Microtonality and the Recorder 1961 – 2013:
Repertoire, Tone Colour and Performance

By

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Contents

CD

Track	**Title**	**Composer**	**Performer(s)**
1	*Winds of Heaven*[1]	C. Fox	Peter Hannan
2	*Whale Song*[2]	D. Bousted	Bennetts/Bowman
3	*The Voyage*[4]	M. Wolters	* see below
4	*Dialogue* (Mvt. 1)[3]	P. Bowman	K. Bennetts
5	*Dialogue* (Mvt. 2)[3]	P. Bowman	K. Bennetts
6	*Dialogue* (Mvt. 3)[3]	P. Bowman	K. Bennetts
7	*Midsummer Night's Dream*[4]	M. Wolters	Bennetts/Bowman/ Purkis

8	*Measure for Measure*[4]	M. Wolters	“ “ “
9	*Macbeth*[4]	M. Wolters	“ “ “
10	*Romeo and Juliette*[4]	M. Wolters	“ “ “
11	*Hamlet*[4]	M. Wolters	“ “ “
12	*Antony and Cleopatra*[4]	M. Wolters	“ “ “
13	*King Lear*[4]	M. Wolters	“ “ “
14	*She Stays*[4]	M. Wolters	Bennetts/ Bowman
15	*My Own Stepsong*[4]	M. Wolters	Bennetts/Bowman/ Purkis/Fumiko

The Voyage Performers
Mezzo-Soprano: Suzi Purkis
Solo recorder: Michelle Holloway
Double bass: Sebastiano Dessanay
Microtonal Recorders: Kathryn Bennetts/Peter Bowman
Ensemble Recorders: Sarah Langdon, Clare Murphy, Kate Rose, Charlotte Hiller, Ben Rose, Maryanne Coughlan, Kathryn Harris, Emily Bannister.
Conductor: Dan Watson

Notes;

1. CD Recording SRI Classics SRI 001 (1989)
2. Recorded Live at St. Gregory’s, Canterbury, 28 October 2013
3. Recorded at Canterbury Christ Church University 21 October 2013. Recorded by Dr Matt Wright.
4. CD Recording Birmingham Record Company CD1 (2013)

ABSTRACT

This thesis investigates the development of the recorder's microtonal repertoire from 1961 through to 2013. The artistic impulses for the use of microtones are discussed and selected pieces studied and performed. An investigation is also undertaken into the relationship between pitch, dynamic, and tone colour. This leads to the development of a method for objectively identifying the changes in tone colour that result from using various microtonal fingerings.

Very little substantial research has been undertaken into the recorder's contemporary repertoire, and even less so with regard to its engagement with microtones. The skills for producing the expressive effects of dynamic and tone colour, and thus microtones, were known in the early 16th century, lost, and then revived during the period of musical experimentation in post-war Europe. The application of this knowledge, however, has remained limited. This thesis addresses these shortcomings.

Following consideration of intonation and interpretation in Chapter 2 a survey of writings analyzing changes in tone colour and dynamic, and the relationship between them, is undertaken in Chapter 3. These include a number of foreign language texts, whilst others appear in American journals, or conference papers not generally available to the British reader. They highlight the tendency for writers to discuss tone colour and dynamic in vague and subjective terms, and in relation to the performance of early music but rarely in the context of contemporary music. This strand of my inquiry is brought to fruition in Chapter 5, where research leading to the development of a method for identifying and quantifying changes in tone colour, through the application of different fingerings, is applied for the first time.

The results of an investigation into the evolution of microtonal repertoire composed since the 1960s are recorded in Chapter 4. Different compositional approaches to both instrument and microtonality are reflected in my choice of seven pieces, plus my own composition, that are the subject of detailed study in Chapter 6. The analyses of the pieces discussed in this thesis, and the contexts in which they were composed, represent a significant step forward in the understanding of the instrument and the use of microtones in compositions of the period. My thesis concludes with a live performance in which a selection of microtonal pieces is presented. This serves as a demonstration and confirmation of the principles discussed in this thesis, drawing together the threads of my research, and applying the insights gained in the course of this study.

Chapter 1

Introduction

This work is a study of the nature, and extent, of microtonal repertoire for the recorder, and the art and technique of realising it in performance. My credentials for undertaking this work include thirty years teaching and performing, in both early and contemporary music fields, nationally and internationally, at all levels. I have published anthologies of repertoire, articles on technique and interpretation, and have acted as a consultant for recorder to a leading UK music examination board. My current position is that of a performer attempting to discover the background to the development of microtonality, the aesthetic impulses that led to its adoption by players and composers, and the extent of its incorporation into the repertoire. Microtonality has the potential to add colour to the recorder player's expressive range, not only by virtue of its extended chromaticism, but also because microtonal fingerings alter the structure of the sound itself, resulting in the availability to both player and composer of a greater variety of tone colours.

The recorder is designed and voiced such that fingerings for pitches outside the normal twelve-tone chromatic range produce tones with a variety of subtly different tone qualities. I refer to them as tone colours. The noun 'colour' is derived from the Greek word *Khroma (*χρώμα*)* for which the adjective, 'chromatic', is equivalent to the Greek *Khromatikos (*χρωματικός*)* – the root is the same, and a strong connection exists, therefore, between 'colour' and 'chromatic'. It is not related either conceptually or etymologically to the 18th- and 19th-century ornamental vocal style of 'coloratura', which has its roots in the Italian *colorare* (colouring). Rather, 'colour' here refers to instrumental tone colour, and it seems to me to be an area of expressive potential, and a natural extension of players' advanced technical skills, that performers aim to engage with a repertoire that tends towards a more colourful, i.e. chromatic, musical environment. The application of different types of colour being addressed here are, on one hand, those changes in tone quality (colour) produced in performance, by an instrumentalist, through choice of fingering, the addition of vibrato and variety of articulation, and on the other, elements of timbre and texture brought to the performance by the composer, mainly through directions for the use of chromaticism or in the case of microtonality, 'ultra-chromaticism'. This can be achieved through the use of microtonal intervals or other compositional techniques such as multiphonics, glissando, simultaneous singing and playing, etc. The first is discussed in Chapter 3, *Tone Colour and Dynamics on the Recorder*, the second in Chapter 4, *Microtonality and the Recorder*.

The special link between these two elements of a 'colourful' performance on the recorder is a technical one: one of the techniques commonly employed by the recorder player to produce dynamic variety in performance is, essentially, the same as that used for the production of microtones. That is, the fingerings used to produce a range of dynamic levels for each pitch are slightly adjusted to produce the microtones. The two aspects of performance are, for the recorder player, inextricably linked. This study of microtonality on the recorder, therefore, is by necessity also a study of tone colour on the recorder – not as a primary element of the research but as an inevitable by-product of it – the fingerings used to produce the microtones alter the tone colour compared to that of surrounding diatonic and chromatic pitches, where they occur as elements of the 12-tone equal-tempered tuning system. Musical colour will, therefore, be a focus of attention as I investigate the development of microtonality on the recorder, and aspects of performance practice in microtonal music. Finally, I include a chronologically arranged detailed study and analysis of seven significant microtonal works, plus a composition of my own. I undertook the compositional work as part of this thesis because the pieces to be studied, which in every case add something of significance to the *oeuvre*, do not express what I, as a performer and teacher, felt specifically needed to be said about the instrument and microtonality. I consider that it too adds something of significance to the recorder's microtonal repertoire.

One of the aspects of performance with which the performer must remain particularly flexible is analysis, since this is the first step in developing an interpretative approach to each of the pieces (Cook 1994, 1). This, and the application of different analytical methods will be discussed in Chapter 2 with the aim of developing an approach appropriate to each piece. Elements of performance considered particularly relevant to this thesis are also considered in Chapter 2. The first of these in importance is intonation, and my aim will be to determine an approach to its application in the various different microtonal environments of the pieces discussed in detail in Chapter 6. Secondly, my study of the pieces will reveal a variety of different aesthetic approaches to composition, microtonality, and to the recorder. This indicates that a single analytical approach or method would not be sufficiently flexible to reveal the intricacies of all the musical styles encountered. Furthermore, this thesis contains the first thorough analysis of the recorder's microtonal repertoire, and for this reason a certain amount of flexibility of approach will be required in order to ensure that all microtonal and musical situations are adequately covered. As this kind of detailed study of contemporary microtonal music for the recorder has not, to my knowledge, previously been undertaken, future performers and analysts will have at their disposal a point of departure from which they can develop their own methods.

The pieces to be studied have been carefully selected for their variety of approaches to both instrument and microtonality, thus facilitating a comparison between them. A broad approach to analysis will be adopted in which both formal and hermeneutic methods will be employed. A formal study of the structure and compositional method of a piece will aid the understanding of the musical processes involved in the creation of the work. Hermeneutics, on the other hand, 'emphasizes meaning and context rather than structure or technique' (Whittall), and covers the more elusive, dynamic aspects of the creation of a work and its interpretation. This dual analytical approach, allowing a comparison between the 'musical and the extra-musical' (Bent and Pople) aspects of the pieces, will enable the development of a clear understanding of each by placing them in a broader historical, cultural, artistic and aesthetic context.

Intonation is the one aspect of performance over which the performer has ultimate control and can exert a high degree of creativity. In considering an approach to intonation three aspects of interpretation will be seen to be prominent: first, the performer's aural skill when pitching small intervals, second, the instrument's flexibility of pitch and tone colour to deal creatively with expressive intonation according to the aesthetic demands of individual pieces, and finally, the instrument's sensitivity to breath pressure and the consequences of this for pitch and expression.

The recorder has at its disposal an almost unlimited flexibility of pitch and this has to be weighed against the sensitivity of the ear according to the different microtonal and musical environments that will be encountered, some of which will tolerate little or no intonational deviation. This raises difficult philosophical questions concerning the validity of engaging in microtonal music in which the smallness of the intervals may approach the limits of both the instrument and the player to reproduce them with sufficient accuracy to give a performance that conforms to the composer's instructions. The performer's decision to engage with challenging interpretational situations, particularly aspects of intonation, indicates a willingness to deal flexibly and creatively with the composers' instructions. The argument in favour of expressive tuning (Kanno 2003, 36) will be discussed particularly with regard to the contexts in which it is applied.

Making decisions regarding the kind of analysis that will offer the most rewarding appreciation of the music is the start of a process that leads to the development of an interpretation. Understanding something of how the music was composed can be decisive in this process. Selecting fingerings and therefore making decisions regarding an approach to intonation, dynamic and tone colour must also be confronted and decisions made. How the performer embarks on this process will be discussed in Chapter 2.

Chapter 3 focusses on the technical aspects of producing microtones, beginning with a survey of writings on tone colour on the recorder - the first time it is discussed in this thesis, hinting at its potential role as an expressive device, particularly in contemporary music. I define the term and briefly discuss its role in performance and precis the writings of early treatises, beginning with Ganassi's *Fontegara* (1535) and finishing with Quantz's *Versuch eine Anweisung die Flöte traversiere zu spielen [On Playing the Flute]* (1752) before undertaking a short survey of the work of two authors from the twentieth century, Rowland-Jones and Wells, who discuss the expressive potential of varying tone colour in the performance of early music. Tone colour will be discussed in the context of contemporary music performance too but the primary aim of this chapter is to investigate research undertaken into the structure of the sound itself and specifically the effect of different fingerings on the quality of the sound. Other methods of varying tone colour are also discussed, namely breath speed and size of the oral cavity. In all, the writings of thirteen contemporary authors are considered for their contributions to our understanding of varying tone colour in performance. However, much of this material has been published in either German, Dutch or in American journals and has not been generally available in the United Kingdom until now. The authors' backgrounds range from performers through to instrument makers and a museum curator, which is an indication of their diversity of intentions and approaches to the subject. My survey aims to clarify these diverse positions and establish a solid basis for my own investigation in Chapter 5.

The discussion in Chapter 4 on the evolution of microtonal repertoire for the recorder will include a review of the aesthetic trends that led to the development of the use of microtones in European music generally. I will continue by surveying the works, players, and composers that contributed significantly to the development of a microtonal idiom for the recorder and those pieces that have become established as major works in the recorder's microtonal canon. My investigation acknowledges the increasing use of texture as a formal and expressive device in the repertoire and, as an extension, of the burgeoning but as yet underdeveloped use of tone colour.

Dynamic fingerings can be seen as a template for the development of secure microtonal fingerings. This proposition will lead in Chapter 5 to an investigation into concomitant changes in tone colour. The analysis of changes in sound structure resulting from changes in fingering, the first study of its kind, is preceded by a review of the theory of sound and the human perception of it so that a comprehensive reassessment of our perception, initially of loudness, later of tone colour, can be made in as objective a way as possible.

The results will be used to identify a correlation between dynamic and tone colour using different fingerings. Changes in tone colour on the recorder are audible but often subtle. Differences in tone brightness and tone colour are regularly used by composers of electronic music and others who synthetically create instrumental sounds on computers (Manning). This allows easy comparison between, for example, different families of instruments. A new method of measuring changes in tone colour within one instrumental family, namely the recorder, is now necessary and one will be developed that can aid identification of subtle changes due to slight variations in fingering alone. This will be accomplished by comparing the tone colours of selected diatonic and chromatic fingerings.

The spectra of the different pitches will be analysed and a comparison made of the relative loudness of the fundamental and its upper partials. A selection of nineteen different pitches will be made from across the recorder's four registers. Accurate measurements will show changes in the sound's structure, which will be indicative of differences in tone colour resulting from the use of the different fingerings used to produce the various microtonal intervals. A rigorous reading of the sound analyses will be used to develop a method for producing a reliable numeric value for the relationship between the fundamental partial and the upper partials. The resultant tone colour ratio for each fingering will allow a clear and accurate comparison of the tone colours of different pitches.

The recorder's microtonal repertoire will be explored in Chapter 6 through detailed analyses of the eight pieces noted above, all of which have been carefully selected for stylistic variety of microtonal usage. The presentation of these analyses in chronological order will offer an insight into trends as well as into modes of microtonal usage. The study will also indicate the variety of aesthetic backgrounds of the composers and aesthetic influences on the repertoire. This approach offers a broad understanding of all aspects of each of the pieces and will allow me to interpret each with sufficient understanding to convey the composers' intentions as faithfully as possible, yet allowing sufficient artistic freedom to be able to place my unique stamp on the performance of each. At the same time the selection of pieces ensures that the range of compositional styles and musical genres is sufficient to give a broadly insightful overview of the recorder's microtonal repertoire.

I have given microtonal fingerings at appropriate points in the text as a means of explanation and clarification. They are included with the caveat that they were accurate on my instrument on the day I wrote them. Other players, instruments and even my own fingerings on other days may produce different results. For the same reason, I feel it inappropriate to include a microtonal fingering chart, either for comparison with existing charts, of which there are many, or for a sense of completeness of the thesis; readers who are interested in following this course will be able to take sufficient information from the text, particularly Chapter 5, to discover their own fingerings.

Throughout this thesis pitches are notated thus:

c^1 c^2 c^3 c^4

Fingerings are given with '0' indicating the left hand thumb followed by the left hand fingers (1, 2, 3) and the right hand fingers (4, 5, 6, 7). Half-holes are indicated by a slash through the relevant number (eg. ~~6~~) with partial shading indicated by a small downwards arrow (eg. 6↓) and a slight leaking of the hole by an upwards arrow (eg. 6↑):

Chapter 2

Elements of Performance
Intonation[1] and Interpretation

It is curious that an ancient instrument, one that during different eras has played a significant role in the performance of western music is, more than one hundred years after its 'renaissance' around the turn of the twentieth century, still undervalued in the United Kingdom for its expressive and sonic potential. Despite having 'attracted a skilled body of professionals' the image persisted in the public eye through much of the twentieth century that it was 'a widely popular educational and amateur instrument' (Lasocki) and not one that inspired exciting musical experimentation or sonic exploration. Two developments in western classical music during the second half of the twentieth century, however, contributed to the broadening of the understanding of the instrument's capabilities, at least among some protagonists: the first was the advent of post-war experimentalism, not only in terms of exploring a previously unknown sound-world but also as a means of discovering new instrumental techniques; much of this was instigated in continental Europe. The second was the research undertaken into early music performance. It is research through which we have come to understand expressive techniques, such as those described by Ganassi (1535) and Cardano (1546), and discussed in more detail in Chapter 4 of this thesis, that had been known for centuries, then lost. However, knowledge of these techniques is essential to gaining an understanding of the musical essence of the instrument.

[1] According to Douglas Leedy (with Bruce Haynes) in Groves Music Online, Intonation is 'the treatment of musical pitch in performance. It is usually thought of as the acoustical and artistic accuracy of pitch in singing or playing, but it has an indispensable role in musical expression through the deliberate inflection of pitch to shade and colour melody, to create excitement or tension, or as a means of characterizing a particular repertory or style of performance.' In atonal microtonal music it is clear that there is no particular hierarchy of notes and therefore little leeway for melodic or intervallic adjustments to accommodate expression and intervallic purity.

Composers who decide to write for the recorder, therefore, must also come to grips with its technical and musical idiosyncrasies before putting pen to paper, as an understanding of these will to a large degree determine a work's success in performance. The compositional concept or idea must, I suggest, be aligned with the technique and expressive capabilities of the instrument. Notwithstanding this, many composers set out to stretch, and indeed enjoy stretching, the interpretative skills of the player, and exploring less well-known or unfamiliar areas of instrumental technique. During the final quarter of the twentieth century this included an exploration of microtonality. The extent to which this development effected performance practice in general, and microtonal music in particular, specifically regarding intonation, will be the subject of the first part of this chapter. In the second part different approaches to analysis are discussed with the aim of aiding performers in their search for an analytical method appropriate to each of the pieces.

There are four possible media available for the performance of microtonal music in the Western European tradition:

1) Computers – composers can employ any tuning system, including the various forms of irregular tuning e.g. mean tone tuning, or an equal tempered system from the many that are in common use e.g. 19-, 31-, 43-, 72-tone, or any other equal temperament system. With computers, composers can rely on absolute accuracy of intonation.
2) Specially built and tuned instruments, notably percussion, such as those favoured by James Wood (1986, 328-329). Like computers, these can be designed and tuned to accommodate any tuning system and are intonationally reliable in performance.
3) Acoustic instruments that have been adapted or redesigned to accommodate new tuning systems. Examples include the 19- and 24-tet trumpets of Stephen Altoft and

Lee Ferguson (Bousted), microtonal guitars (Organic Design), and the 19-tet tenor recorder designed by Lewis Jones (see Chapter 4).

4) Traditional acoustic instruments whereby players adapt their techniques to accommodate the composer's tuning requirements. Microtonal music played on traditional acoustic instruments is generally restricted to tuning systems based on the regular division of the twelve-tone equal tempered system (12-tet). These include 18-tet (third-tones), 24-tet (quarter-tones), 36-tet (sixth-tones), 48-tet (eighth-tones) and others.

The pieces included for study here all fall in to the fourth category – microtonal music played on traditional acoustic instruments – with composers writing pieces in 18-, 24- or 48-tet or a mixture of any two of these. The challenges for the performer of becoming not only familiar with, but an expert in the accurate performance of such small intervals, in other words, intonation, will be one point of focus in this chapter. The other will be centered on forming the bases of interpretations for each of the eight pieces to be studied. Intonation and the interpretation of the idea or concept itself upon which the composer's work is based are, therefore, the elements of performance that are specific to this thesis and will form the basis of the discussion in this chapter.

For the performing instrumentalist, the differences between the four media are that they offer varying degrees of interpretive input to the performance. For the creative recorder player, the first two serve only to reinforce the deep personal need to play an active role in the re-creation of music and thus participate in a truly live performance as opposed to one that is wholly or partially mechanical, in which the composers' ideas are realised without the aid of an intermediary. Writing in support of the "mechanical" realization of his music, Wood argued in 1986 that with the 'growing availability of electronic sound sources' and 'an infinite number of possible octave subdivisions' available, it is not surprising that the composer most readily turns to the electronic medium 'to realise his microtonal music'. 'Hence', he writes, 'the evolution of acoustic microtonal instruments has faltered before entering its adolescence'.

> Many would argue that a more realistic future for acoustic microtonal music lies in writing for instruments that do not have to be specially built such as strings, wind, brass, and voices, thereby employing the finer ear and technique that many of today's musicians can boast. It is, however, precisely these conventional instruments, which in practical terms are incapable of consistently accurate realisation of micro-intervals because of the subjectivity involved. Again following the example of the pioneers of microtonality, if we want to achieve any degree of precision, we have to build special instruments. (Wood 1986, 328-329).

Whilst Wood concedes no flexibility of tuning, Donald Bousted, in discussing the implications of his microtonal works for recorder in his Doctoral Thesis, appears to take a more conciliatory approach. He states that his microtonal works for recorder have 'led to the necessary exploration of two key points', the first of which leads him to pose a question pertinent to the present discussion: 'what is it realistically possible to achieve in the performance of microtones on acoustic instruments?' (Bousted 2001b, i). Bousted is here referring to intonation but it is not clear to what extent intonation can influence the expressivity of a performance of his music, nor indeed, whether strict adherence to the appropriate equal-tempered tuning system is what is required. Bousted's compositions use microtones in varied but particular ways – for example in *Study No.2* from *Five Microtonal Studies*, where they occur as 'integrated structural pitches' so that accuracy of intonation becomes an element of the performance of his music that is critical to how the music is perceived (*ibid.* 17). In Bousted's *Whale Song*, the microtones play a structural role, but the overriding aural experience is of varying texture[2] and colour. Many of his works, particularly those from the last three years of the 1990s, are, however, to some extent atonal and, thus lacking a strong tonal centre, the performer is forced to consider all tones of equal importance. Voice leading therefore plays a diminished role in his music and whilst there is some room for colouring and note-shaping with, for example, vibrato, it is a technique that in his music is generally not encouraged. Did Bousted expect a high degree of intonational accuracy in the performance of his music? He devoted chapter three of his thesis to '*An Empirical Study of Quarter-Tone Intonation*', a substantial part of which is further devoted to his *AudioSculpt*[3] analysis of Bennetts' and Bowman's recorded performance of *Curve* from *Journey Among Travellers* (1998), to which Bousted himself was a contributor in the role of producer. The results of this are supported by subsequent controlled tests (also played by Bennetts and Bowman). The purpose of these analyses was to investigate the intonational accuracy of the performance but had the by-product of revealing an interesting aspect of the recorder's sound. His investigation supported observations by Benade that, rather than producing a single steady pitch, the sound resembles 'what is, effectively, a bandwidth of sound'. Benade, for example, 'described the bandwidth of a violin tone':

> The fact that each partial of a string tone is spread over a bandwidth of about 20 cents means that there is a diffuseness to the string tone which has enormous implications for the musician (Benade 1976, 549).

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[2] By texture, I understand a texture based not on a harmonic dissonance/consonance relationship but degrees of dissonance, often with multiphonics.

[3] AudioSculpt: Sound analysis and manipulation software produced by IRCAM

‘Notably, however, the “bandwidth” of the recorder tone, even with vibrato, is substantially less than 20 cents, in fact, generally, it is around half this amount’ (Bousted 2001b, 30). Bousted’s investigation into *Curve* and the separate controlled tests, noted above, indicated a bandwidth of approximately eight cents across the range for a tone without vibrato - a bandwidth ‘created by, seemingly, irrational deviations from the core pitch, in one direction or the other’ (*ibid*. 30). Bousted showed ‘that this [compared] roughly to an average bandwidth sampled from notes in *Curve*, where vibrato forms a natural part of the colouring of the note, of approximately 10-12 cents’ (*ibid*. 30). He proposed that, played with the use of a ‘colouring’ vibrato combined with the characteristic bandwidth of the instrumental tone, it would be ‘not unreasonable to suggest that the [AudioSculpt] results, having been [averaged out and] calculated to arrive at one reading for each note, are accurate [to] plus or minus 1 cent, and that this reading corresponds very closely to the heard result’ (Bousted 2001b, 30-31). Regardless of the human ear’s ability to detect such small deviations in pitch, the relatively narrow bandwidth of the recorder’s sound, compared to that of the violin, will certainly have important implications for the performance of microtonal music on the recorder, as will be discussed below. However, Bousted’s results describe more accurately the size of the imperceptible rapid variations in pitch rather than its ability to accurately and consistently sound a definitive pitch. The ‘irrational deviations from the core pitch’ of the fundamental partial contributes to the production of a broad bandwidth (compared to a pure sine wave) and this may be one element in determining the characteristic timbre of the instrument but, as Bousted’s figures indicate, has little influence on how we perceive the pitch of the tone. The small, very rapid and unpredictable fluctuations in pitch of the fundamental partial do not alter the auditor’s perception of the overall pitch, which, like the addition of a controlled vibrato, is perceived as the average of all pitches present in the tone.

Returning now to the comment by Benade regarding the broad bandwidth of the violin's sound, he continues by describing the implications referred to above:

> On the one hand it allows larger tuning errors to be made in ensemble playing before the discrepancies become unacceptable, and on the other it permits the composer to write a wide variety of chords having many degrees of consonance and dissonance. […] The diffuse string sound explains to a large degree the greater versatility of the string quartet as compared with a wind ensemble. The skilled wind group can produce on demand chords of oily smoothness or dissonances of astonishing harshness, neither of which are attainable to the same degree by stringed instruments. But the tendency of the wind ensemble to push consonance and dissonance towards their extremes means that the subtleties of the middle ground must inevitably be neglected, and this is just the region where the string ensemble is unsurpassed (Benade 1976, 549).

The clear implication for wind ensembles is that they are potentially a more expressive unit than the string ensemble, at least in terms of the application of variable intonation. If that is the case, how much more room for intonational expression has the recorder ensemble, with its yet narrower band-width, relatively purer tone, and consequent ability to define consonance and dissonance with the utmost clarity? During his neo-classical period (broadly 1920-1940), Stravinsky had composed for the clarity of wind instruments when he wrote music with particular prominence given to winds. In accordance with the 'anti-romantic' aesthetic (Griffiths 1994, 67), prevalent among progressive composers of the time, this neo-classical music had an element of objectivity, and of irony. It emphasized austerity and clarity of texture (*ibid*. 67), eschewing the 'bombast' and 'sentimentality' of the romantics (*ibid. 63*). Although Stravinsky's music from that period is, stylistically, vastly different from the music of the turn of the twenty-first century, the aesthetic values that we may enjoy along with Stravinsky might indeed include objectivity, clarity of line, and texture, but there is no irony. Instead, the intensity of the listening experience, the exploration of subtley different but nonetheless rich, colourful textures, places a different emphasis on this phenomonen, in accordance with our own current aesthetic preferences. To pursue this line of argument, the discussion must now take account of variable, or expressive tuning, that I will now turn my attention.

Mieko Kanno, in a wide-ranging discussion of playing in tune on the violin, proposes four types of expressive tuning: harmonic, melodic, corrective, and colouristic. She develops an argument for the exploitation of the tension between pitch and intonation in performance, as well as making a distinction between the two: describing pitch as ‘an abstract commodity’, and intonation as ‘a practical topic’ (Kanno 2003, 36). How does this relate to the recorder? Benade’s comments infer that recorder players would have substantially less leeway in matters of tuning and intonation than do string players. This becomes critical when the player is engaged in performing certain kinds of microtonal music. Limiting the player’s ability to incorporate ‘flexible tuning’ into performances of structural microtonal music, depending on the style and usage of the microtones, consequently limits the player’s potential for expressive playing. For the recorder player, intonation has always been a double-edged sword whereby the relatively pure sound ensures that inaccuracies are clearly audible (and immediately punished!) but also allows that great subtlety, expression, and purity are possible. Returning now to Bousted’s music, the atonal nature of *Study No. 2* from *Five Quarter-tone Pieces* implies, as Kanno puts it in discussing Schoenberg’s atonal *Fantasy* for violin and piano (which makes some use of microtones), the ‘freezing of directional thinking that dictates intonational mapping’ produces, she concludes, a performance which demands non-directional thinking, in which the notes are played ‘with relatively equal intensity and amplitude, each note with *tenuto*, to characterize the passage as a static series of loosely connected but disjointed notes'. She continues by questioning 'whether such an interpretation would be perceived musically as expressive as one might anticipate' (Kanno 2003, 41). Can the same conclusions be drawn for Bousted's *Study No. 2*? One recognizes in the score similar amounts of disjunct movement and degrees of atonality, so the answer must be that asking similar questions with regard to the performance of Bousted's *Study*, is legitimate, in the context of preparation for a performance of the piece.

> What emerges from the above examination of Schoenberg's *Fantasy* is that the musical material cries out for expressive tuning. It is the advantage of the instruments with unfixed tuning systems that intonation can be employed to help articulate musical expression. Not making use of this invaluable facility is to reduce the artistic range of the instrumental playing (Kanno 2003, 42).

Thus, when considering intonation in performance, the type of intonation employed by performers can unreservedly said to be dependent on context, and the performer's ability to develop a contextually suitable interpretation. In contrast to Bousted's *Study*, the remaining pieces to be considered display varying degrees of tonal gravity, and generally more extensive use of conjunct movement, more sense of melodic direction, thus allowing for more intonational manoeuverability in performance.

Of the categories of expressive tuning noted by Kanno, she observes that 'the emergence of non-diatonic music diminished the effectiveness of harmonic and melodic tunings but increased the critical power of corrective and colouristic tunings'. She invokes the statement of Schoenberg that 'the tone becomes perceptible by virtue of tone colour[4], of which one dimension is pitch. Tone colour is, thus, the main topic, pitch a subdivision.

[4] Kanno correctly observes that tone colour changes according to the harmonic structure of a sound.

Pitch is nothing else but tone colour measured in one direction' (Schoenberg quoted in Kanno 2003, 42).

I will show, in Chapter 5, that the choice of fingering on the recorder equates to a choice of both tone colour and pitch. Within the limits of the instrument's capabilities, the player has considerable control over both. Interestingly, few of the pieces studied here take account of the potential for the recorder player to employ the instrument's expressive potential with regard to tone colour, which remains just one element, and a little-known one at that, of the expressive potential of microtonality, or indeed, any –tonality, on the recorder.

As we will see in Chapter 6, composers have taken a great variety of different approaches to writing microtonally for the instrument and it is to the analysis, understanding and interpretation of these compositional intentions that I will now turn my attention. According to Cook, analysis can explain peoples' 'experience [of listening to music] in terms of the totality of their perception, conscious and unconscious' (Cook 1994, 221). There are many routes to the development of a musical interpretation and many constituent elements of an analysis. No two pieces will be analysed in the same way although elements of the analytical process will be similar for some pieces where appropriate – as with intonation, the type of analysis employed will depend on the musical context. The pieces selected for study here all bring something new and different to the recorder's microtonal repertoire. As might be expected, the pluralism of late twentieth- and early twenty-first century art music is quite accurately, though not comprehensively, reflected in my choices – no two works share the same musical style, or indeed approach, to microtonal usage. What then is the artistic impetus that unites them, or defines them individually? How does one determine the important structural and motivic elements that define each one, and what can be gained from undertaking such an exercise?

Musical analysis falls into two broad categories: formal analysis, which concerns structural elements of the music, and hermeneutic analysis, which is concerned with the music's aesthetic content, and might include consideration of the historical, social and expressive context in which the music was composed (Bent and Pople; Bent). At the formal level, the primary purpose of analysis should be to aid the performer's understanding of how the music has been constructed - which elements are most important to the structure of the work, and which elements less so. Other formal elements to be subjected to analytical scrutiny include motifs, rhythm, harmony and melody. With an understanding of the hierarchy of all these structural elements the performer is more able to make decisions about the performance and consequently present a more convincing interpretation of the formal elements of the work. Since these are established by the composer and notated in the score, it is the aesthetic elements that inform the personal 'authenticity' of the performance because these are the elements of the work that are more or less clearly defined by the performer.

The aim of an examination of the aesthetic context in which the music was composed, including the historical, social, and expressive contexts mentioned above, should be to reveal insights into the musical content of the piece not covered by formal analysis, thus adding further depth to the interpretation. This is reflected in my studies of the pieces in Chapter 6. In this respect, 'temporality' and 'shape' have been identified as two elements that form the core of a performer's analysis of a piece (Rink 2002, 39). Stefan Reid elaborates and suggests that 'musical interpretations are communicated through the expressive parameters of timing, dynamics, articulation and timbre, among others' (Reid 2002, 106). Rink defines the kind of analysis undertaken by performers as 'an integral part of the performing process', continuing 'that is, "considered study of the score with particular attention to contextual functions and [the] means of projecting them" (Rink 2002, 36), 'rather than a rigorous academic technique' (Reid 2002, 108). According to Rink such an analysis might include: identifying formal divisions and basic tonal plan; graphing the tempo; graphing dynamics; analyzing melodic shape and constituent motifs/ideas (paradigmatic analysis); preparing a rhythmic reduction; re-notating the music.

Analysts have attempted to develop universal and integrated methods. Primary among these is the work by John Rink (2002), whose focus on analysis for performers has highlighted what he describes as 'two principal categories:

(1) analysis prior to, and possibly serving as the basis of, a given performance
(2) analysis of the performance itself.

The first of these, whether rigorous or more pragmatic in nature, is potentially *prescriptive* with regard to performance, whereas the second type of analysis is *descriptive*'. Rink focuses on the first of the above, as a means of developing an understanding of the music, as part of a preparation for developing an interpretation and performance. In general, he supports a more pragmatic approach to analysis (Rink 2002, 37-39).

More theoretical approaches support an holistic kind of analysis and include one based on the principles of generative linguistics. In this theory sets of rules that are hierarchically organized are followed to produce a recognizably sensible piece of music. Expression in performance, according to this theory, results from 'systematic patterns of deviation from the “neutral” information given in a score’ (Clarke 1995, 22). Clarke rejects this theory on the grounds that no account is taken of un-notated music, and notes in addition that expressive markings in the score, such as those relating to changes in tempo and dynamic, if observed without deviation, would, according to this theory, produce an inexpressive performance.

A theory of musical expression, based on integrated energy flux, attempts to synthesize ‘the various contributions of all components of expression (tempo, dynamics, articulation, timbre, vibrato), since each creates fluctuations in integrated energy’ (*ibid.* 24). These are modeled as ‘a series of filters operating at different time scales and producing a hierarchy of integrated energy profiles’ (*ibid.* 24). The theory ‘takes account of abstract structural characteristics only to the extent that these are expressed through changes in [for example] tempo and dynamics, and for that reason alone it cannot be a complete theory’ (*ibid.* 24). Clarke notes the controversial nature of mapping structure into expression, pointing out that ‘some have argued in particular for the importance of dramatic characterization as a factor in expressive performance’ (*ibid.* 24). He continues by pointing out the ‘tricky relationship between structure and character or narrative’ and questions ‘whether grafting on a component of mood, character, drama or narrative is the way to resolve this difficulty’ (*ibid*. 26).

Clarke suggests a more inclusive framework, and proposes that ‘semiotics is the discipline best able to achieve this, even though it is by no means a panacea’ with which to resolve the shortcomings of other forms of analysis (Clarke 1995, 26). His ideas are based on those of the American philosopher C. S. Peirce (1839-1914) whose work with semiotics led him to understand three kinds of sign: Index, Icon, and Symbol. Clarke gives a detailed account of how this information can be applied to expression in performance and, as an illustration, used ‘the performer’s use of tempo variation to convey phrase structure in music’ (*ibid.* 27) in performances of 19th century piano music, particularly that by Chopin, to make his argument.

Tarasti’s *A Theory of Musical Semiotics* develops semiotic musical analysis with the intention of developing a theory ‘to relate to the musical reality in all its complexity’ (Tarasti 1994, xiv). He is, he writes, a ‘researcher who takes into account the circumstances and context in which the examination proceeds’ and his analyses ‘make free use of some aspects of the model and leave others aside, according to what the music demands’ (*ibid*. xv). In his chapter *A Semiotic Approach to the Study of Musical Performance*, Tarasti’s analysis of twelve performances by singers, and ten by string players, of Faure’s *Après un rêve*, identifies eight ‘pertinent parameters of analysis of the musical enunciation (he defines ‘Enunciation’ as ‘the act of producing a phrase or an entire “text”; in music, the act of writing, performing, listening, and interpreting a musical work’ (*ibid.* 303)). These are: Tempo; Instrumentality/Speech-likeness of the voice (Timbre); Vibrato; Breathing (Phrasing); Dynamic Change (Dynamic); Glissandi; Phenomenal Qualities (Articulation); Global Form (*ibid.* 204-208).

A particular feature of the analytical methods described above is that the various authors apply them primarily to eighteenth- and nineteenth century music. Only Tarasti delves with his analyses in to early twentieth century music styles, briefly discussing impressionism (Debussy) and aspects of the works of the minimalists (Cage, Reich, Pärt). A section titled *Musique pauvre* [*Poor Music*] hints at his regret for the tendency of post-modern music to refer back to earlier musical styles and forms, thus indicating his frustration at the display of a paucity of invention, (Tarasti 1994, 280-281).

This rather gloomy assessment of contemporary music, indicates an apparent unwillingness of writers to discuss, and analyse, music of the late twentieth and early twenty-first centuries. Performers of music of that period are left very much to their own devices when it comes to finding a way of understanding and interpreting the music they perform. With this in mind, I will approach the task of developing interpretations of microtonal recorder music with a great sense of anticipation and excitement. Whatever musical secrets are revealed will, in any event, shed light on what, for many recorder players, remains a deeply mysterious, even threatening, aspect of our repertoire.

Let us now turn to one of the technical aspects of producing microtones on the recorder. A fundamental principle for the production of accurate microtones is that, depending on the context, dedicated fingerings are used for each pitch. Because of the design of the instrument, different fingerings produce variations in the structure of the sounds. These structural variations are responsible for the subtle differences in tone colour that result from changing fingering. This fact is well known, and the application of this knowledge, and techniques, plays a significant role in the production of accurate intonation and the interpretive process. To my knowledge no comprehensive investigation into the phenomenon has yet been undertaken, so to better understand the implications for tone colour of using microtonal fingerings, I will review the research published to date with regard to the performance of both early and contemporary music in Chapter 3. In Chapter 4, I will undertake a survey of the use of microtonality in the repertoire in order to understand the extent and mode of usage.

Chapter 3

Tone Colour and Dynamics on the Recorder

I concluded Chapter 2 with the observation that different fingerings produce variations in the harmonic structure of sounds. This effect is responsible for the subtle differences in tone colour that result from changing fingering. The use of microtonal fingerings, therefore, has the potential to affect both pitch and tone colour, and this, accompanied by a suitable introduction to the science of acoustics, will be the subject of a detailed discussion in Chapter 5. Now, I will introduce a third element into the equation: dynamics. Dynamic fingerings on the recorder depend for their effect upon changes in breath pressure – microtonal fingerings, on the other hand, depend for theirs upon constant breath pressure. In all cases the tone colour will be unique to the pitch and effect required, that is, either microtonal or dynamic. The specific relationship between microtonality and both tone colour and dynamic will, as mentioned ablove, be explored in Chapter 5. In this chapter I will undertake a survey of writings on tone colour and dynamic, in order to determine the nature of the relationship between them. I will begin by clarifying my understanding of both timbre and tone colour and identifying the difference between them.

The definition of timbre given by Backus (1970, 94) is: ‘the characteristic of a tone that can distinguish it from others of the same frequency and loudness’. This definition is often used to identify the tonal qualities of different instruments, voices, and vocal sounds such as vowels. For my purposes, a more refined definition must be found since the comparisons I shall make in Chapter 5 are concerned with the subtle differences between the tone quality of the sustained portion of a stationary note executed with various different fingerings. In addition to timbre referring to the difference in tone quality between sounds from different sources, Halmrast *et al.* (2010, 183-187) cite changes in tone quality over time as the significant element that defines our concept of timbre (Halmrast *et al.* 2010, 183-187). These changes can be observed in the sound envelope and include the attack, sustain, and decay phases of the sound. Further elements that cause significant changes in our perception of the timbre of a sound, those controlled by the performer, include the use of breath vibrato, finger vibrato, and articulation. Where these techniques are not under discussion I will use the more restricted term ‘tone colour’ to define the different tone qualities. Where the discussion focuses on the more inclusive and broader understanding of sound in a musical context with all elements of the sound envelope present and where time is a factor, then the term used will be timbre.

‘When we hear music we do not hear sound only; we hear something *in* the sound, something which moves with a force of its own’ (Scruton 1997, 19-20). Scruton is referring to the relationship between different sounds and their organisation in the musical work and, improvised works aside, one must be clear that this aspect of music is firmly in the composer’s realm of creative activity. It is equally clear that sound does not move of its own accord and that the perception of the movement of sound due to harmonic or melodic tension may in any case be culturally or historically determined (Norton 1984; Blacking 1995, 54-59). Scruton (1997, 19-20) further identifies tone colour as the ‘character of sounds’ and in most cases this falls into the performer’s field of activity. ‘Most cases’ because some composers from the early 18th century to the present have included instructions for changing the timbre in some particular way, usually by the addition of vibrato but also through the use of crescendo and diminuendo. Prominent examples include the works of Pierre Danican-Philidor (1681-1731) who is very specific in his use of *flattement* (finger vibrato) as a structural device, to highlight significant gestures as well as points of melodic and harmonic tension (Bowman 1999, 14-20). The perception of tension[1] due to contrast, movement or changes in timbral character, however, may be another matter. The use of timbral variety may be twofold: firstly as an orchestral technique used to colour or highlight contrasting passages. Timbral contrasts adopted a significant role in the late nineteenth and early twentieth centuries at the hands of those composers most engaged in the breakdown of diatonic harmony and the development of tonal harmony, for example Debussy, Schönberg and Webern. The development of electronic instruments during the 1920s and the extensive and highly influential experimentation with computers after 1945 is partially responsible for a positive re-evaluation of the importance of timbre as an element in western music (Kreitner *et al.*). Secondly, timbral variety may result from a technique employed by instrumentalists to colour or shape the sound of individual notes or phrases. It is this meaning of timbre that will be the focus of my attention in this chapter.

Much of what we now know of recorder playing techniques arose out of earlier research into renaissance and baroque performance practices. Of particular relevance to this discussion are the techniques described in the sixteenth century by Ganassi (and others) who were influenced by Pietro Bembo's (1470-1547) *Prose della volgar lingua* (1525). Although not a musician, Bembo's study of language usage in poetry was influential in establishing the aesthetic of the early madrigal (Haar, a). Ganassi's interest lay in achieving the imitation of the human voice

[1] Tension: mental or emotional strain or stress; situation or condition of hostility, suspense or uneasiness (Collins English Dictionary 1986, *Tension*). Research into the perception of tension in music has revealed few insights; Fredrickson and Coggiola in their 2003 study reported the findings of a study by Fredrickson and Johnson (1996) that showed 'small, but not significant, differences in perceptions of tension' amongst a selection of musicians and non-musicians due to the application of varying degrees of rubato in performances of the Mozart Horn Concerto whilst other studies (Burnsed & Sochinski, 1995; Burnsed, 1998, and Misenhelter, 2001) compared "dynamic maps" that music majors produced while listening to the first movement of Beethoven's Symphony No. 7 to non-music majors' perceived tension responses for that selection. Due to the many similarities it was suggested that, at least in this piece of Western art music, dynamics might play a key role in determining perceptions of tension' (Fredrickson and Coggiola, 2003, 261-262). A study by Fredrickson (2001) on a group of 60 musicians and non-musicians in which timbre played a significant role produced inconclusive results but the author reported that 'exerting specific experimental controls on timbre and dynamics may yield interesting results' (Fredrickson 2001, 64).

in musical performance, which was in accordance with the humanist study of rhetoric and poetics prevalent at the time (Haar, b). The techniques discussed by Ganassi and later writers highlight the importance played by the use and variation of tone colour in music of the period.

The first treatise specifically written for the recorder was Sylvestro Ganassi's *Opera Intitulata Fontegara* (1535). It gives us an insight into professional standards, describing but giving little information regarding context for the application of an astonishingly well-developed technique and expressive style of playing. This was founded on imitation of the human voice and achieved by good breath control, alternative fingerings, a wide variety of tonguing syllables, and extensive use of graces and complex diminutions. Varying the tone colour is an integral part of Ganassi's understanding of the performance of music. He writes that instrumentalists should imitate the dynamic range, variety of tonal colours, vowel sounds and subtle expressive nuance of the human voice (Ganassi 1959, 9, 89). He also gives instructions for leaking and shading holes for tonal colour, and trill fingerings for a variety of characters: narrow trills (a minor second and a whole tone) for the expression of sweet, gentle character, and wide trills (minor/major third) for the expression of lively characters. The width of the interval is variable: 'the interval may fluctuate, a little more or a little less' (*ibid*. 87-88).

> We should endeavour to learn from [the human voice] and to imitate it. …it is possible with some players to perceive, as it were, words to their music; thus one may truly say that with this instrument [the recorder] only the form of the human body is absent, just as in a fine picture, only the breath is lacking. This should convince you that the aim of the recorder player is to imitate as closely as possible all the capabilities of the human voice. For this it is able to do. (Ganassi, 1959, 9).

Further treatises followed, including Hieronymus Cardanus (*De Musica*, *c*1546) who described aspects of recorder playing including controlling intonation by closing the bell hole, partially shading the bell to change the pitch, varying the position of the tongue in the mouth to improve and colour the notes, and creating a kind of vibrato by repercussively bending back the tongue. Assessing the relative attributes of all the instruments, Cardanus praises those that are capable of playing the very small interval of the diesis[2] as the most excellent. He continues: 'Since instruments that are blown are similar to the human voice, they are superior to those that are struck…' (Cardanus 1973, 55). Other often-quoted writers, Sebastian Virdung, (1511) and Martin Agricola (1528), say little about performance; Agricola advised that graces (*Mordanten*), which make the melody *subtil*, must be learnt from a professional (*Pfeiffer*). Ercole Bottrigari (1594) noted that expert wind players, including those of the recorder, were skilful at playing in tune through breath control and shading the finger-holes. Bartolomeo Bismantova, a wind player in *Reggio nell' Emilia* and Ferrara, insisted in his *Compendio musicale* (1677) that all wind instruments should be played 'in a singing manner and not otherwise' and with 'breath control in order that good intonation be maintained, and that there be a perfect co-ordination between tongue, fingers and breath' (Bismantova, quoted in Castellani 1977, 81-83).

Quantz's *On Playing The Flute* (1752) devotes a chapter to tone production in flute playing. The most pleasing tone quality, according to Quantz, 'is that which more nearly resembles a contralto than a soprano, or which imitates the chest tones of the human voice'. He cites 'a clear, penetrating, thick, round, masculine, and withal pleasing sound' as that which flautists should aim to acquire by imitating the human voice and by copying the tone quality of the flautists who know how to produce such a tone. 'Much depends upon the flute itself, and whether its tone has the necessary similarity to the human voice' (Quantz 1966, 50). The qualities that give singers preference over instrumentalists include 'the voice itself and

[2] An interval roughly equivalent to 50 cents i.e. a quarter-tone.

words'. The 'chief requirements of a good singer (specifically regarding tone) include, therefore, the ability to produce a portamento and to make a *messe di voce*. He must have good pronunciation, clear diction ('enunciate words distinctly'), clear and distinct vowel sounds, and the ability to 'raise and moderate' the voice, 'introducing light and shadow', according to the character of the piece (*ibid.* 300-301).

The years 1600-1750 make up the period from which the recorder's core repertoire is drawn and is the musical environment in which many recorder players' understanding of musical expression is formed. Yet renaissance writers were more forthcoming in their attitude to tone colour, indeed early treatises frequently urged recorder players to shade or leak air from the finger-holes to imitate the changing expression or tone colour of the words of the singer.
In the French repertoire of the early eighteenth century instructions for the use of *flattement* (finger vibrato) are occasionally found. Dynamic indications in baroque music are rare and where they occur are restricted to simple *piano* and *forte*, meaning gentle and strong respectively, reflecting a particular character rather than a dynamic level as understood in the nineteenth century orchestral sense of the term. Tone colour in early music remains for many players, therefore, a rather vague notion of tonal character, which may be thought of in terms of gentle or strong playing, may concern the use of vibrato, including *flattement*, and shading and leaking air out of holes to alter the tone colour and the use of wide and narrow trills depending on the character of the music.

Twentieth-century teaching literature makes numerous references to the use in early music of tone colour. A survey of some of these writings will shed some light on how this important element of tone quality has been employed in the performance of both early and contemporary music. The following texts have been selected for the quality of their references pertaining to the use of tone colour as an expressive device. They focus primarily on the technique of using various fingerings[3] for tonal variety, excluding, for the purposes of this study, breath (vibrato, dynamic) and tonguing. They range from purely technical accounts of how this can be achieved, to the musical contexts in which such techniques can musically be applied – some texts apply themselves both to the process and its application whereas others deliberately confine themselves to one or the other. These have, of course, varied over time, depending not only on prevailing aesthetic considerations but also on the technical and musical demands of the repertoire and the technical skill and knowledge of the writer. No attempt has been made therefore, either to justify the inclusion or exclusion of any particular author or to comment on their aesthetic preferences or relative skill levels with the instrument. The only criterion for inclusion is that the text makes a contribution to our understanding of either the techniques or their application, preferably both.

The first of two of the more in-depth accounts of tone colour variation in the performance of early music (1500-1750) written in the twentieth-century include 'A Short History of Partial Venting' by Anthony Rowland-Jones (1995, 48–50). Rowland-Jones gives a brief account of the use of partial venting in early, mainly renaissance, music for dynamic, intonation, and expressive purposes. He refers to an article in *American Recorder* by Scott Reiss 'Pitch Control: Shading and Leaking' (Reiss 1987, 136-139)[4], the title of which, according to Rowland-Jones, provides a definition of 'partial venting' but cites the additional benefit of giving 'variety of timbre', and notes that the technique of 'slide-fingering' on the smaller-holed baroque instrument is more difficult to manage 'especially as the change in tone quality at the first moment of leakage is more abrupt with baroque [instrument] bore design. He

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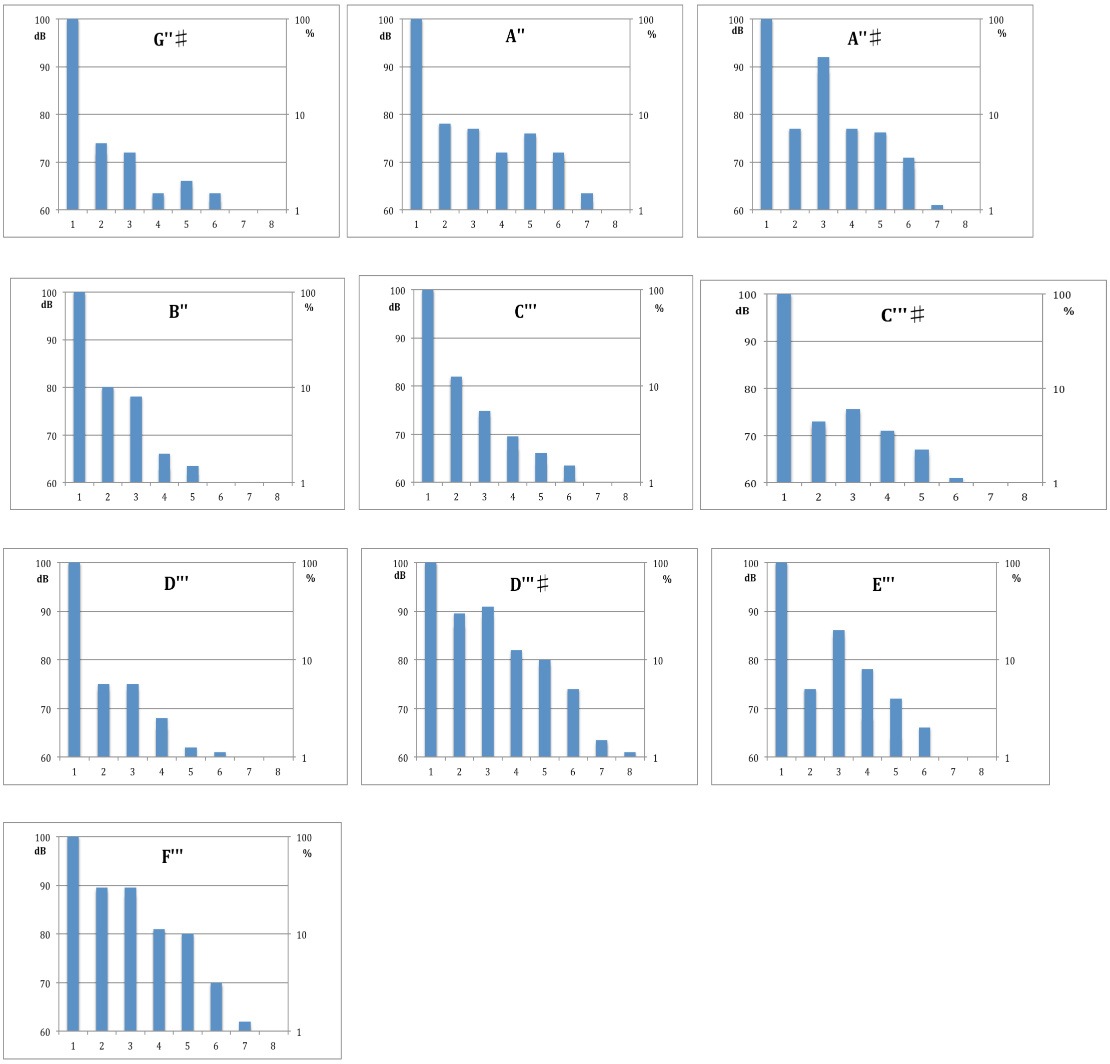
[3] The exception to this is the inclusion of Laurin's paper, which explores changes in tonal colour through varying the size of the vocal tract, using standard fingerings.

[4] The year of publication given in Rowland-Jones' article, 1976, is incorrect – the article actually appeared in *American Recorder* in 1987 and was reproduced in *The Recorder Education Journal* No.12, 2006

makes reference to the writings of Ganassi and Cardano but offers no explanation of the expressive potential of tonal variety. He claims 'partial venting is a *sine qua non* of *avant-garde* music' and cites three pieces, Lechner's *Varianti* (1976), Linde's *Music for a Bird* (1968), and Casken's *Thymehaze* (1979) as examples of its usage to produce *flattements* and glissandos. The second article, by Peter Wells, discusses the use of alternative fingerings in three early music contexts: for tone colour; for affect; for tuning. Reflecting Ganassi's writing, he describes the effects of using different trill fingerings for producing different colours, for example narrow intervals for soft characters through to wide interval trills for a brilliant affect and concludes that key colour and mood can be enhanced by 'consideration of the tone colour available from the use of different fingerings'. Examples given include creating a diminuendo, echo effects including producing tones with a 'distant' (shaded) quality. He concluded by proposing the use of different fingerings, in order to achieve particular effects, [that] can be produced by using more than just breath pressure 'to create specific timbres or strengths of sound' (Wells 2001, 8-11).

Twentieth-century writers have also employed technology and analysis in order to explore the nature of tone colour on the recorder. Arndt von Lüpke's *Untersuchung an Blockflöten [Research into Recorders]*, (1940, also cited in Martin 1994, 11, 16-17) published the results of an analysis of the harmonic content of the recorder's sound over two octaves, see Figure 3-1, below, which shows a version of Lüpke's analysis based on my own reading of his charts. Lüpke's original charts can be found in Appendix 17. The decibel scale has been simplified for ease of reading by converting Lüpke's negative loudness values to positive readings based on a maximum loudness of 100dB.

Figure 3-1. Shows Lüpke's analysis of the harmonic content of the recorder's sound over two octaves. The strength of the upper partials is measured in relationship to the strength of the fundamental. The left vertical scale has been altered from Lüpke's original for ease of reading; see Appendix 17.



Martin claimed that Lüpke's 'investigation of the recorder, in a modern sense, was the first'. He recorded that Lüpke's conclusions regarding the structure of the sound included that 'in comparison with almost all other instruments the tone is lacking in harmonics'. As can be read from Lüpke's analysis shown in Figure 3-1, above, 'the third harmonic is in general stronger than the second. The number and strength of the overtones decreases as one progresses up the scale to a certain limit at which the recorder becomes over-blown, at which point the harmonics suddenly become strong and remain so for the remainder of the scale'. He noted that 'the sound pressure rises steadily through the lower octave and then falls at the beginning of the second octave' and 'the measured strength of the second harmonic relative to the fundamental depends strongly on whether the note is cross-fingered or not' (Lüpke 1940, cited in Martin 1994, 11). Whilst Lüpke's analysis appears to be strong, particularly for the time it was written, it should be noted that advances in instrument design and manufacture suggest that the instrument used by Lüpke would not satisfy the needs of players in the late twentieth- or early twenty-first centuries. Martin also questions the validity of the results due to the suspect positioning of the microphone 'near a second harmonic minimum', which resulted in a variable strength second harmonic, depending on blowing pressure. Lüpke gives no indication of the recorder[5] or fingerings used so any estimate of tone quality or colour is not possible. The style of presentation of the results renders comparison with results of my own analysis (see Chapter 5) impractical. Furthermore, in Lüpke's tests, an 'artificially blown' recorder was used for the production of the notes, whereas my performance-based research requires an approach more aligned to the performing experience.

The publication of Michael Vetter's *Il Flauto Dolce ed Acerbo [The Sweet and Sour Flute]* (1969) established his reputation 'as an explorer of the outer limits of the recorder's technique and repertoire'. He extended the instrument's range and opened up a new tonal palette (Thomson 1971, 317).

> There are above all two characteristics of the instrument just described - hardly anyone can connect their image of the recorder with that of the ideal instrument of the time: its diverse variability, which offers a large range of sounds and colours, and the equally unique direct sound combinations with the human voice on the other[6] (Vetter 1968, 468).

[5] It is not clear whether a baroque-style instrument, an original instrument, or a German-fingered instrument of the period was used. All three varieties of instrument could be expected to produce quite different results.
[6] "Zwei Eigenschaften sind es vor allem, die das eben beschriebene Instrument, das wohl kaum noch jemand mit seinen Vorstellungen von der Blockflöte in Verbindung bringen kann, zu dem idealen Instrument des Zeitstils machen:

This is how, one year before the publication of his major work, *Il Flauto Dolce ed Acerbo* (1969), Michael Vetter described his view of the recorder and its place in contemporary music of the 1960s. 'The title of his book celebrates the transformation of the recorder, by means of new techniques, into a "new instrument which combines and mixes the characteristics of the '*flauto dolce*' with that of the '*flauto acerbo*' in a natural way"'. It consists largely 'of fingering charts – for regular notes, flageolet tones, and multiphonics in the open, closed, and covered registers' (Griscom and Lasocki 2003, 378). Vetter's book exemplifies the exploratory nature of art music during the immediate post-war years.

Linde Höffer von Winterfeld's *Griffkombinationen und Klangfarben auf der Blockflöte [Fingering Combinations and Tone Colour on the Recorder]* (1976), describes a system for determining dynamic and tone-colour fingerings based on two techniques: firstly whether the thumb-hole is closed, open or half open and, as an extension, the partial venting of the first finger hole. The second element is the principle of adding fingers, which increases the length of the vibrating air column, thus lowering the pitch and, conversely, subtracting fingers, thus shortening the length of the air column and raising the pitch. The use of forked fingering combinations and different blowing intensities allows for all diatonic and chromatic tones to be produced over the whole range of the instrument with a wide range of dynamic and tonal colours. Although systematic in her approach to developing fingering combinations and, to a limited extent, dynamic fingerings, tonal colourings are systematised under Höffer von Winterfeld's method only in as far as they are dependent on dynamic (Höffer von Winterfeld 1976, 77-80).

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seine vielseitige Variabilität, welche über eine ebenso reiche Skala von Klang- wie von Geräuschfarben verfügt, und die ebenso einzigartigen unmittlebaren Klangkombinationsmöglichkeiten mit der menschlichen Stimme andererseits. ..."

The first study of the recorder's tonal characteristics to consider shape and size of the oral cavity is Christoph Mühle's *Untersuchung über die Resonanzeigenschaften der Blockflöte [Research into the Resonance Characteristics of the Recorder]* (1979). Due to the difficulty of accurately reproducing the results he employs a mechanical blowing device in order to maintain constant 'breath pressure' and to avoid variations in blowing due to technique and in particular variations in temperature and moisture in the windway. Three shapes were constructed to test the differences in the structure of the sound due to the different 'mouth' shapes: cube; pipe; sphere. Figure 3-2 shows the results in graph form for an F treble recorder. The vertical axis shows the relative pressure level (dB) and the horizontal axis the results for the first 15 partials:

Figure 3-2

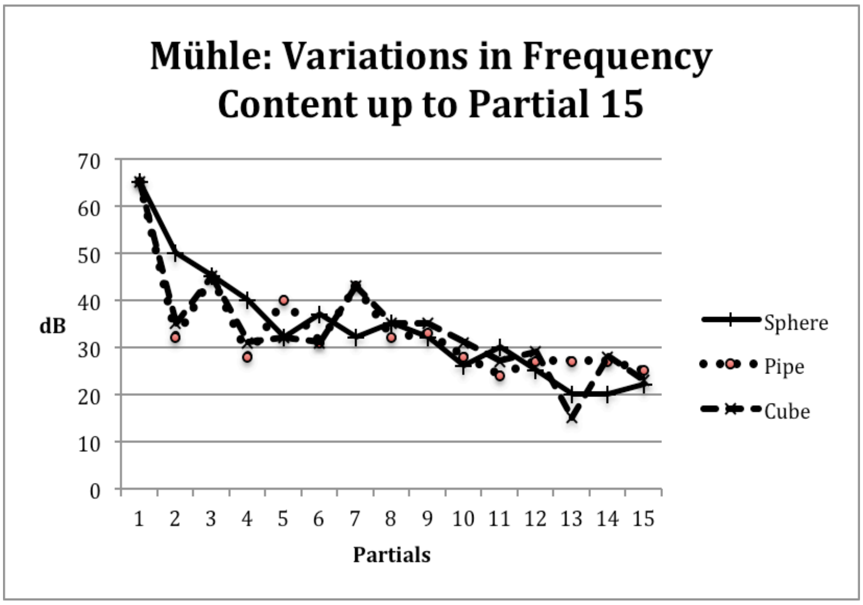
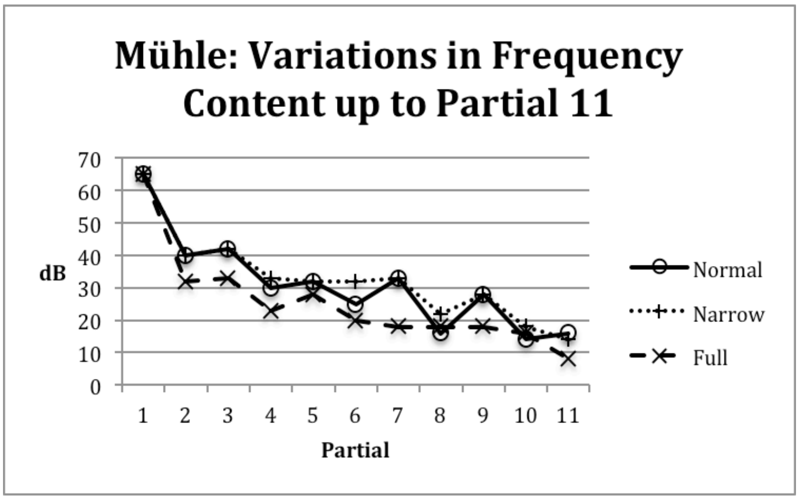


Figure 3-2 shows that the sphere-shape mouth produces the most consistent results. 'When blowing the recorder, the resonating space of the recorder is coupled with the oral cavity. This coupling can influence the frequencies and the sound of the recorder's tone'

(Mühle 1979, 36). Figure 3-3 shows the variations in the frequency content (dB) up to the 11th partial of three differently shaped mouth spaces: normal; narrow and full.

Figure 3-3



As with the results for artificial mouth shapes shown in Figure 3-2, above, Figure 3-3 confirms that the full (round) mouth shape produces the most consistent results. Noteworthy are the slight but consistently higher sound pressure levels with the ‘narrow’ mouth shape. This aspect of tone colour change is discussed in more detail below.

The application of vibrato is the focus of Elisabeth Delker’s *Ansätze zur Untersuchung dynamischer Ausdrucksmöglichkeiten auf der Blockflöte [Approaches to Researching the Dynamic Potential of the Recorder]* (1984). She sets out to determine the extent to which the player can influence tone colour with regard to dynamic. Her aim is to prove the value of vibrato as a medium for varying tone colour and dynamic and to show the close relationship between these. Reference is made to the spectra over the two-octave range of the recorder (f^1 – f^3) (Lüpke 1940, 40; quoted in Delker 1984, 11) in order to demonstrate the role of the relationship between fundamental and the upper partials in determining tone colour. In

Lüpke's investigation a mechanical blowing machine was used to reduce variations in blowing across the range, and from player to player, to provide an objective assessment of an instrument's tuning. The upper frequencies of a note are dependent on the frequency of the fundamental. They clearly show that the sounds of the different fundamental tones vary across the range of the instrument. Furthermore, the tone will appear lighter or sharper depending on the number and intensity of its upper partials. Notes that are deficient in upper partials, on the other hand, have a dark or soft timbre. Delker identifies the characteristic content of the upper partials of a note as the main feature that enables identification of different instruments by their tone colours, regardless of pitch or dynamic level. The recorder's sound is relatively rich in upper partials yet their proportion in relation to the fundamental is much smaller than that of brass instruments, whereby the recorder is inferior in dynamic range and richness of tone. The position and frequency of amplitude peaks plus the effect of particularly prominent or strong individual partials also influence the tone colour of an instrument. Such amplitude peaks are known as 'formants' and have the effect of producing tone colours similar to those of various vowel sounds. Delker identifies different instruments as possessing tone colours uniquely similar to the tone colour of certain vowels. From Lüpke's spectra she notes that the recorder has, across its range, an irregular sound envelope, and that the upper partials play only a small role in determining the tone colour – the sound is dominated by the fundamental. From this Delker concludes that the tone colour of the recorder is determined by the frequency of the instrument's fundamental note and the individual pitches across its range. The recorder's spectra indicate the presence of no frequency peaks and thus no formants. It's sound has been compared to that of the human voice and is noted for its ability to imitate it (see page 30). Her explanation for this apparent contradiction is that individual notes on the recorder can be associated with the colour of particular vowel sounds – the irregular overtone spectrum declares its presence by virtue of the change in tone colour as heard in rising and falling semitone passages. This, Delker explains, is the reason why those who are very familiar with the sound of the recorder can determine the pitch of a note on hearing its tone colour.

According to Delker, factors that influence tone colour include the shape of the mouth (for which the author draws on the research of Mühle, see above), sound pressure level (dynamic), and the use of vibrato. Increasing dynamic level by blowing harder can increase the intensity of both the fundamental and the upper partials by a small amount. Delker points out that the increase in breath pressure will result in a rise in pitch. A comparison between the spectrum of a straight note and the same note with regular vibrato shows a significant increase in the strength of the fundamental and the strength and number of upper partials, particularly the second partial whose intensity, in her experiment, rose above that of the fundamental, an unusual situation for the recorder, which indicated a 'significant lightening of the sound'. She concludes that the enriching of the tone colour through the use of vibrato corresponds to a change with regard to the assessment of dynamic level, but not pitch. The musical concept of dynamic refers not only to loudness, but also to the attack at the beginning of the note as well as other aspects of the note such as stillness and movement (vibrato), harmonic structure and consequently changes in tone colour. Therefore, a rise in dynamic level is not necessarily the same as a rise in sound level. One can say the opposite – that the sound spectrum provides information about the loudness of the sound. The remainder of Delker's booklet consists of an argument in favour of the wider use of vibrato as an expressive device. A shortcoming of Delker's research is that she bases her assessment of the recorder's sound structure on Lüpke's research from 1940, see above (Delker 1984).

Johannes Fischer, in his performer oriented *Die dynamische Blockflöte [The Dynamic Recorder]* (1990), lists 306 dynamic and quarter-tonal fingerings over a range of three octaves. He offers two fingerings for each chromatic note where possible within each of the dynamic rubrics given (*f*, *mf*, *p*, *pp*, *ppp*). The second fingering at each dynamic level, where given, offers variety in the form of a more muted tone quality (Fischer 1990, 38-43).

Fischer makes three assertions regarding the correlation between dynamic level and fingerings: first, ‘simply stated, the dynamic of a good recorder continually rises from the lowest note to the highest’; second, depending on the number of open holes, ‘the more open holes, the louder the instrument will sound’, and third, depending on the position of the open holes, ‘the more closed holes below an open hole, the softer the instrument will sound’.

Can we deduce from this that tone colour on the recorder is limited by a direct relationship between fingering and dynamic, which, by extension, includes changes in tessitura and breath pressure? Fischer seems clear that there is a direct link between all three. He extols the virtue of dynamic consistency over the instrument’s range. The extent to which any evenness of tone is successfully achieved may correspondingly determine the extent to which tone colour varies when players employ alternative fingerings for dynamic or indeed microtonal purposes. That is, consistency of dynamic and tone might be achieved across the normal chromatic range at the expense of tone quality on dynamic or alternative fingerings used for any other purpose. Following this logic, consistency of tone colour across a range of microtonal fingerings may be achieved only by the development of dedicated tone colour fingerings.

Regarding the technique of varying the size of the oral cavity to vary tonal colour, which can be applied to any note on the instrument, Fischer writes that ‘the size of the oral cavity will have an effect on the sound spectrum of the recorder. Therefore, a small oral cavity strengthens the overtones whereby the tone sounds more robust and is perceived as louder. A large oral cavity on the other hand suppresses the overtones somewhat, causing the tone to sound duller and consequently softer.'[7]

Gerhard Braun, in his foreword to *Die Dynamische Blockflöte*, praises Fischer for his work 'with fingerings in numerous series of experiments through which he has discovered dynamic possibilities that have substantially expanded the instrument's sound spectrum'. Fischer's numerous references to tone colour and the publication of two tone-colour fingerings for each different dynamic level, within the context of his exploration of dynamic possibilities, may be interpreted as an attempt to liberate the recorder's potential for colour from the bounds of its dynamic limitations.

In the first of the English language texts not limited to early music performance practice to be surveyed, Eve O' Kelly, in her influential *The Recorder Today* (1990), mentions timbre very briefly in Chapter 7, *Modern* [playing] *Techniques*. She describes playing the same note with different fingerings as having 'the effect of changing the composition of the group of [upper] harmonics [which accompanies the fundamental] and hence the timbre of the sound'. The text is accompanied by a pair of examples taken from the repertoire[8] in which sets of repeated notes are played alternately with fingerings selected to highlight different tone colours. Under the heading *Non-Standard Fingerings* O'Kelly refers to a system whereby fingerings belong 'to one of three 'registers', based on the discovery that the recorder behaves in a different manner acoustically when the end-hole is obstructed either partially or wholly'. 'The three registers are designated as follows: the normal or 'open' register when the end-hole is open and the wave formation within the pipe is that of a cylinder open at both ends; the 'closed'

[7] *Die Weite der Mundhöhle hat Auswirkung auf das Klangspektrum der Flöte. Demnach verstärkt eine enge Mundhöhle die die Obertöne, wodurch der Ton kerniger und somit lauter erscheint. Eine weite Mundhöhle hingegen unterdrückt die Obertöne eher, wodurch der Klang matter und infolgedessen leiser wirkt.*

[8] Hans-Martin Linde, *Music for a Bird*, no. 4 (1968); Werner Heider, *Katalog* (1968).

register when the end-hole is tightly stopped, and the 'covered' register when the end-hole is obstructed but not sealed' (O'Kelly 1990, 84-85). This system is the same as one described by Rechberger who gives fingerings and examples for their use (Rechberger, 1987, 25) and has strong similarities to that described by Höffer von Winterfeld with the difference that Winterfeld describes the additional technique of partially venting finger-hole 1, which, according to her results, opens up many more possibilities. The variations in tonal colour thus produced seem to be very subtle but unfortunately measurable data were not included in the article. The appendix to O'Kelly's book includes fingerings, taken from an unpublished paper by Hermann Rechberger (1987), for timbral variation over a range of an octave and a seventh (c^2-b^4).

Rose's (1996) argument for the use of 'colour[9] fingerings' is set out in his article *In Living Colour!* (Rose 1996, 12-15). It revolves around his understanding of their purpose as primarily one of adding dynamic variety. The use of alternate fingerings, he argues, can be justified in two ways: the first is based on the fact that the fingerings produce notes that are either sharp or flat and that breath pressure must be changed accordingly to bring them in tune. The change of breath pressure alters the dynamic level of the note, thus basing their use primarily on the intention of changing the dynamic. The resultant change in tone colour occurs as a consequence of that, rather than tone colour change being the primary intention of using a fingering dedicated to that purpose. The second justification given by Rose is based on clarity of phrasing and to exemplify this he provides fingerings in the score of *Longing* (1995) by Olga Gorelli (1920-2006). The fingerings are based on dynamic, almost exclusively in the direction of *piano* and *pianissimo*, which in all cases produce a softening or dulling of the tone quality. They are used to begin and end phrases quietly and in one case to finish a phrase with

[9] American spellings have been changed to conform to standard British English.

a surprisingly effective *piano* on a high f^3 (using the fingering θ 14568) following a brief crescendo. This is an interesting study, limited, however, to the idea of tone colour being a function of dynamic, without considering the possibility of tone colour on the recorder as a primary musical objective or expressive device.

Dan Laurin's English language article *Shaping The Sound* (Laurin 1999, 13-17), describes a method of obtaining tonal variety based not on varying fingerings[10] but on changing the size of the vocal tract. In conjunction with acousticians and technicians at the School of Physics, University of New South Wales, Laurin carried out experiments to test his hypothesis that a change in the size and shape of the vocal tract has a considerable impact on sound quality i.e. *timbre*. He proceeded to produce opposing *timbres* on notes in different registers so that different breath pressures and fingerings could be accounted for when analyzing timbral changes. Each note was recorded three times and the results fed into a computer for spectral analysis. Laurin describes the two different *timbres* as 'thick' and 'thin'. He describes as 'thick' the sound that is produced with a relaxed palate and relatively small oral cavity whereas the 'thin' sound is produced with the palate kept as high as possible, creating a relatively large oral cavity. A reading of the published spectrograms produces the following estimates of timbral difference between the 'thick' and 'thin' sounds and are calculated in the same way as my own experiments, details of which can be found in Appendix 2 (see Figs. 3-4 and 3-5). They are based on the assumption of the use of standard fingerings and a 'normal' *mf* dynamic. According to Laurin the results between the 'thick' and 'thin' *timbres* were consistent throughout the range and across a variety of fingerings. The experiment was initially carried out using a plastic Yamaha alto (A440) and the results later verified on a hand-made alto by Morgan.

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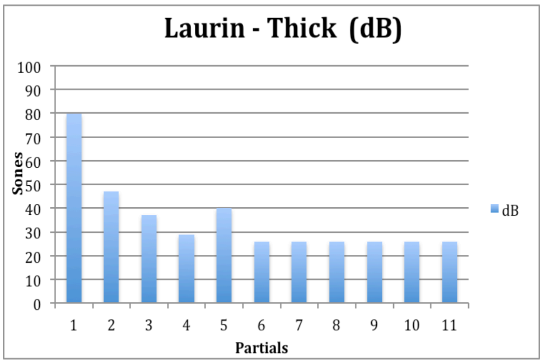
[10] No mention of the effect on tone colour of different fingerings is made by Laurin in his article.

Figure 3-4.

Sprectral graph for Laurin's 'thick' timbre Loudness graph for Laurin's 'thick' timbre

Loudness In Sones	Tone Colour Ratio (F/H)
21.7	0.919



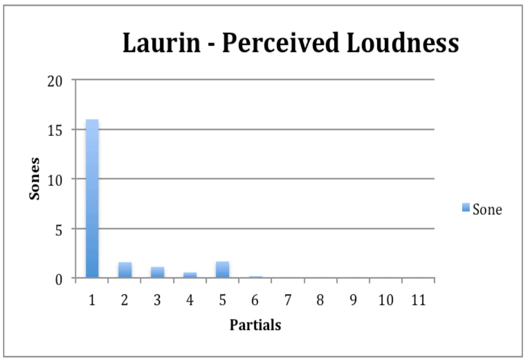
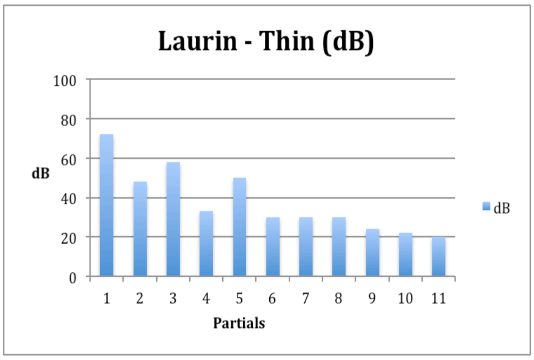
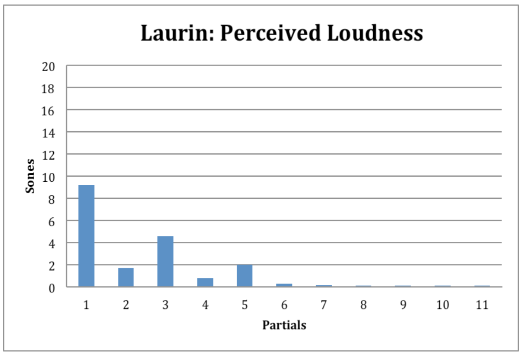


Figure 3-5.

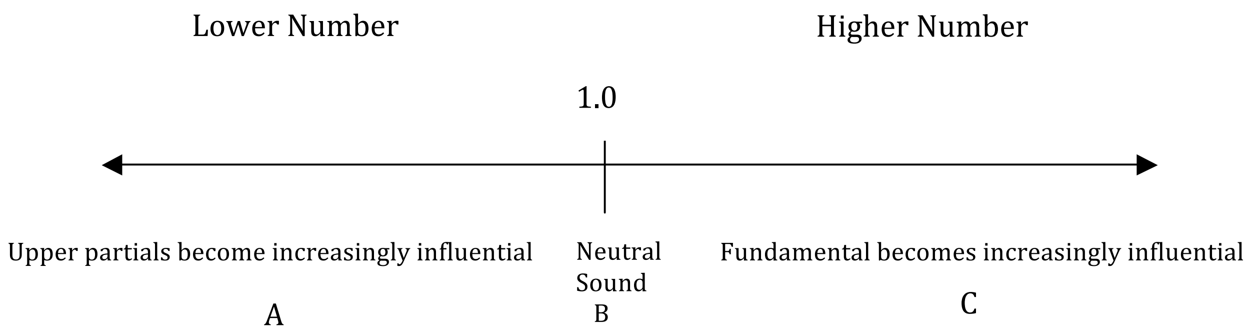
Sprectral graph for Laurin's 'thin' timbre Loudness graph for Laurin's 'thin' timbre

Loudness In Sones	Tone Colour Ratio (F/H)
19.2	2.8





Tone Colour Ratio



According to my analysis, Laurin's 'thick' *timbre*, with a high tone colour ratio of 2.8, is overwhelmingly dominated by the fundamental and displays a consistently high level broad-band signal; the 'thin' *timbre*, with a tone colour ratio of 0.919 has higher spectral peaks on the third and fifth partials and its tone colour falls into the neutral range of my tone colour ratio. The spectral and loudness graphs indicate notes with similar dynamic levels but two very distinct tonal colours.

Walter van Hauwe, in the introduction to breathing technique in Volume 1 of *The Modern Recorder Player* (1984), asserts 'that to achieve a rich, colourful and personal sound a proper and effective breathing system is indispensable'. A principle of Hauwe's teaching, reiterated in the introduction of *The Modern Recorder Player*, is that he aims 'not to [teach] the interpretation of old or modern music [but to] concentrate on the less subjective aspects of recorder playing: essentially the technique, and how that technique can be used in a musical way'. This approach manifests itself, for example, when, discussing vibrato in Volume 2, he suggests:

> that a performer will gain an enormous wealth of expression if he is able not only to play and master his instrument, but, on top of that, is able to express and communicate his own personal sound, without being limited by his chosen instrument. Vibrato is but one of the ingredients which help to shape this secret sound.

In volume 3, under the heading *The Illusion of Dynamics*, Hauwe asserts that the use of dynamics (crescendo, decrescendo) and vibrato are ways of colouring the notes (Hauwe 1992, 19). He later states that alternative fingerings have three purposes: dynamics; convenience (mainly for executing trills); varying 'the colour of the notes' (Hauwe 1992, 21-30). However, he rejects out of hand the idea that the size or shape of the mouth cavity alone can influence tone quality. 'It is a mistake to think that a large and open mouth will provide nice resonance'. Any changes are, he says, down 'to the speed of the airstream'. 'A faster airstream gives a "faster" and a "thinner" sound, a slow one a "slower" and "fatter" tone.' Whilst it is not discussed in anything other than passing terms in Hauwe's volumes he is nonetheless comprehensive in his approach to the techniques available for varying tone colour. It is clear that he considers changes in dynamic, the use of vibrato, changes of fingering and careful use of breath can all produce subtle but effective changes in tone quality and colour.

Floor van Rijn, in an article entitled *Klankkleur van blokfluiten [Tone Colour of Recorders]* in the Dutch language *De Bouwbrief* (Rijn 2004, 6-9), compares the sound qualities of a variety of recorders made from different materials, wood and plastic, and publishes spectra for five instruments, three from rosewood, one from maple and one from plastic. Verbal descriptions of the generic tone quality of several wood types are given, for example, maple is described as having a 'soft, light sound', pear as being 'warm, soft, strong fundamental' European boxwood as being 'refined, mildly loud, rich in upper partials'. She concludes that the material from which the instrument is made influences the timbre and that the number of overtones present in wooden and plastic recorders indicates a clear distinction between the two. There is no comment regarding the extent to which the tone colours of the instruments as described are influenced by the material from which they are made nor is there any correlation made between the instrument design and size (descant, tenor and bass instruments were examined) and the published spectra. Rijn's experiments included tones blown by wind machine as well as by mouth, the results are interesting, showing greater variation in tone colour from the machine-blown tones, indicating the moderating role of the player.

Recorder maker Philippe Bolton uses his article *XVIIth Century Recorder Fingerings* (Bolton 2005, 7-12) to compare two instruments from the sixteenth and seventeenth centuries and different ends of Europe, Italy and The Netherlands respectively, to argue a case for using each instrument with an appropriate repertoire. He claims that a copy of a mid-seventeenth century recorder by the Dutch maker Haka has a richer sound than a copy of an earlier sixteenth century Ganassi style instrument. To this end, and via a brief explanation of the fundamental vibrating modes of open-ended flutes and recorders, plus the derivation of the different registers and fingerings, he presents a series of comparative spectrograms for a range of notes on the two instruments. We are not told the provenance of the instruments or details of their design, voicing or tuning. Nevertheless, the spectrograms show subtle but sufficient differences in their spectra to conclude that on some notes at least the tone quality of the two instruments would be different and certainly sufficiently so to warrant using each for a specific repertoire – Bolton suggests the Haka for mid seventeenth century music and the Ganassi for sixteenth century Italian repertoire. The article is rare for its use of spectrograms but unfortunately these lack sufficient detail either of the frequency of the notes tested or the sound pressure levels of the partials to draw any concrete conclusions regarding measurable differences in tone colour between the instruments.

Dutch researcher Rob van Acht[11] published the results of his investigation into the tonal qualities and sound structure of Dutch woodwind instruments made between 1670 and 1820 in the conference proceedings of the *Institute of Acoustics*, 1997. He proposed that the results of this work, published in various journals and conference proceedings in Dutch, German, English and French, show that on the instruments tested, including recorders and in particular an original Dutch instrument by Engelbert Terton (1676-1752), the 'prominence of the odd overtones in the spectrum of the note a^1' of the instrument 'resulted in a rounder, darker tone colour (Acht 1997, 533-540, quoted in Griscom and Lasocki 2003, 116-117). Other instruments are tested too, but the Terton is the only one for which results are available. Only four notes were tested, which severely limited the scope of the investigation. Lasocki observes some inconsistency in the results between the spectra and the text (Lasocki 2010, 24). This and the varied language used by Acht to describe the tone quality: 'rich, full, slightly hollow' (Acht 1997, 537) and 'a colourful overtone structure [which] results in a round and dark tone colour' (Acht 1999, 33-52, quoted in Griscom and Lasocki 2003, 116) indicates the need for more detailed research.

Two clear approaches to investigating tone colour on the recorder have emerged in this survey: on one hand there are those whose interest is in evaluating the instrument. These investigators use either mechanical blowing methods to produce the tones to be analysed or analyse a limited number of tones blown by the researchers themselves. On the other hand are those whose primary interest is in determining what is possible regarding variations of tone colour in performance. These researchers take a more subjective approach to the assessment of the results – consequently, they themselves blow the tones, and more of them, to be

[11] Rob van Acht: curator of the musical instrument collection at the Gemeentemuseum, Den Haag at the time his research was undertaken.

analysed. It might be expected that this approach would result in a more subjective assessment of the perceived results than the mechanical blowers but this is not the case as both sets of researchers rely on words to describe their findings. Of the twelve articles reviewed six were published in foreign language journals, five German, one Dutch. They tend to highlight the more structural elements of the recorder's sound, with only Fischer's work leaning more towards the performer's perception of dynamic and tone colour. Of the English language writers Rowland-Jones and Wells are comprehensive in their reference to renaissance and baroque authors with Wells focussing more heavily on variety of tone colour. Vetter and Hauwe provide in-depth technical information for varying dynamic, tone colour and timbre with no account of how the techniques might be applied. Laurin's research, whilst interesting, is limited to an analysis of one note only with an accompanying spectrogramme and subjective description. Rose gives the most detailed account from the performer's perspective of how dynamic variety might be applied whilst Bolton's technical description of the different sounds of two instruments, as noted above, lacks sufficient detail to draw any firm conclusions.

Many factors play a role in an instrument's dynamic and tonal quality including choice of fingerings used and instrument design. Players of renaissance and baroque style instruments may have at their disposal a variety of tonal colours across the range of their instruments, using inconsistencies of tonal colour and intonation (including, for example, in instruments tuned to any of the unequally tempered tuning systems) as an expressive device to add variety to their performances. An example of this kind of historically informed performance practice can be found, in extreme cases, in the use of historic trill fingerings from the eighteenth century which 'may sound strange or simply out of tune, but with familiarity and a certain tempering of the intonation with the breath, it soon becomes clear that the old fingerings produce a distinctive and attractive colouring' (Davis 2010, 78). The use of such trill fingerings, which is restricted to a few notes in the middle of the instrument's range, are therefore mixed in with otherwise satisfactorily in-tune trills, depending on the requirements of the music to be played (Hotteterre 1707, trans. Lasocki 1984).

Bolton's insistence on using instruments whose range and tonal colour is historically appropriate to the period of music being played exemplifies the divergence of opinion regarding what a recorder is and what it should sound like. The evenness of dynamic and thus tone quality across the recorder's range that is promoted by Fischer adheres to a twentieth century concept of the recorder as a twelve-tone equal tempered contemporary musical instrument. It is therefore not surprising that little of substance and objectivity has been written during the twentieth century about varying tone colour on the instrument; the assumption of many players is that each instrument has its own unique tone qualities (Davis 2010, 76-80) and the matter need be discussed no further. This alone adds strength to my argument for a more considered and objective approach to the subject.

The relationship between dynamic and tone colour, mentioned and accepted by Winterfeld and Rose, is more successfully and adventurously dealt with by Fischer, who, whilst acknowledging its existence, is still able to give two differently coloured fingerings for each dynamic level across a substantial range of notes, thus managing to separate the two elements. His inclusion of quarter-tone fingerings confirms his interest in an equally tempered tuning system with consistent dynamic and tonal colour for standard fingerings. Indeed, it is the approach to fingering used in the *Quarter-Tone Recorder Manual* (Bennetts et al 1998) in which the aim of finding consistent dynamic and tonal colour across quarter-tone fingerings covering a range of two octaves and a sixth was a major influence on the authors in the selection of fingerings. Delker also argues cogently for a strong relationship between tone colour and dynamic but concludes that the best method for introducing dynamic and tonal variety into one's playing is by the addition of vibrato.

Rose is the only writer surveyed to give clear instructions for the use of fingerings for tonal colour. The tonal variation is, in all examples given by Rose, towards the *veiled* end of the tone colour range and the *piano* end of the dynamic range but the application is directed towards 'improving the musical result' and he stresses that 'the musical context should be the most important factor in determining one's approach to colour fingerings.' He acknowledges the changing use of colour fingerings from 'novel resources' in the 1960s, to be used 'as objective sound resources that could produce momentary surprises'[12] through to 'general tools of expression' via 'well integrated and expressive use of colour fingerings' in the traditionally oriented non-European music of the 1970s[13]. In the 1980s recorder players turned their hands to adapting the best solo repertoire for 'modern wind instruments', which forced them to find 'creative reinterpretations' because these works were written for instruments that had the 'very capabilities that pushed the recorder into obscurity'[14] during the eighteenth and nineteenth centuries. More recently[15], he writes, some players 'have come full circle, applying these methods with state-of-the-art sophistication to add expression to their performances of historical music and conservative twentieth-century works'. His selection of a stylistically conservative piece, to which he adds colour fingerings to clarify phrasing, is an example of how these fingerings can effectively be used, primarily in their role of introducing dynamic variety, but without treating separately the element of tone colour (Rose 1996, 12-15).

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12 Rose cites no particular repertoire but one can find examples of this approach in Linde's *Music for a Bird* (1968), Andriessen's *Sweet* (1964) and DuBois' *Muziek* (1961).

13 Rose may be thinking here of pieces influenced by traditional Japanese shakuhachi music: Masumoto's *Pastorale* (1973), Shinohara's *Fragmente* (1968), Hirose's *Meditation* (1975) and Ishii's *Black Intention* (1975), for example.

14 Stockhausen's *In Freundschaft* (1977) is a good example. It was adapted for recorder by Geesche Geddert in 1984.

15 Rose's article was published in 1996.

Hauwe acknowledges the relationship between dynamic and tone colour when he writes that the use of dynamic is a way of colouring the notes but considers varying the colour of notes as a purpose of using alternative fingerings quite separate from dynamic. He clearly does not exclude the possibility that tone colour can be varied without altering the dynamic. (Hauwe 1992, 21).

Three writers address the claim that variety of tone colour may be a function of oral cavity shape and size. Whilst this technique does not strictly fall within the parameters of this survey it is nevertheless included because it is a system completely independent of fingerings and if verified would work over the instrument's entire range.

Laurin is the most enthusiastic advocate of the technique and the spectrograms he published give a clear and measureable difference in tone quality for the note recorded, c^3. According to his description a 'thick' sound is produced using a relaxed palate, with 'relatively less space in the oral cavity', though not consistently so, since in order to maintain what he describes as 'a nice musical recorder sound' he lifts the palate higher for the higher notes. The 'thick' sound is produced when he mimics 'the letter 'a', as in the word 'cat'' and could be described as a tone dominated by the fundamental with relatively weak upper partials and the presence of a broad-band signal. It produces the louder of the two tones. Laurin produces what he calls a 'thin' sound by keeping the palate 'as high as possible' […] 'regardless of register'. The 'thin' timbre is characterised by more prominent upper partials and reduced noise or broad-band signal. To produce this tone colour, he 'mimics a giant yawn while playing.' It can be described as having a bright tone quality with a good balance between the fundamental and its upper partials. It is the quieter of the two tones. The researchers who conducted the experiment hypothesised that 'the vocal tract position for the 'thick' sound sets up turbulence in the windway. This means that more pressure is required to get the same air flow.' The faster air flow would account for the louder sound of the 'thick' tone colour. Laurin did not consider in his article the effects different fingerings have on tone colour.

Fischer is also an enthusiastic supporter of varying oral cavity size in order to vary tone colour and has clearly been influenced by the findings of Mühle. He gives no measurable information but describes the technique, noting that a small oral cavity causes the sound to be perceived as louder. A large oral cavity on the other hand softens the sound. Hauwe rejects the theory that oral cavity size alone can influence tone quality. It is, he proposes, simply as a result of air speed into the windway that the tone quality changes. The relationship in Laurin's findings between oral cavity size, air speed, and pitch is not correlated either by Mühle, Fischer, or Hauwe but it is an area of technique that would benefit from some detailed research.
Table 3-1 shows the results of Laurin's experiment and compares these with the hypotheses of Hauwe, Fischer, and Mühle. Parentheses indicate my own suggestions so that an easier and more complete comparison can be made.

Table 3-1

Author	**Oral cavity size**	**Tone Colour**	**Air Speed**	**Overtones**	**Dynamic**
Laurin	Large	Thin	Slower	Stronger	Quieter
	Small	Thick	Faster	Weaker	Louder
Fischer	Large	Dull	(slower)	Weaker	Softer
	Small	Robust	(faster)	Stronger	Louder
Hauwe	(-)	Fat	Slow	(weaker)	(softer)
	(-)	Thin	Fast	(stronger)	(louder)
Mühle	Large (Round)	(-)	(slower)	Weaker	Softer
	Small (Pipe)	(-)	(faster)	Stronger	Louder

From Table 3-1 we can conclude that Hauwe, Mühle and Fischer are largely in agreement: a faster air flow produces a stronger, louder sound which, on this basis alone, will produce a sound richer in upper partials ie. Indicating that timbre varies with dynamic level (see also Campbell and Greated 1998, 145). Laurin's result shows a faster airflow producing a louder sound that is weaker in upper partials but with a large component of broad-band signal (noise) caused by turbulence. Turbulence is a normally unwanted attribute of the air flow during its passage down the windway during playing, causing the tone 'to become unacceptably diffuse and breathy' (Loretto 2003, 50). Its presence is controlled by the way the maker voices the instrument and is not easily introduced by the player (Martin 1994, 31).

> The mouth and windway together form a Helmholz resonator[16] which, by varying the mouth volume, can be brought into tune with one or other of the sound components. The small coupling between the mouth-windway and the bore may change the bore resonances slightly if the mouth resonance falls near one of them, and this may slightly alter harmonic content or the willingness of some notes to overblow. […] 'For treble and tenor [recorders] the resonances may fall in the same range as the instrument, and may affect articulation, overblowing and tone. However […], any tone changes are likely to be more apparent to the player than to his audience. (Martin 1994, 85-86).

Laurin's claim that he can clearly and audibly change the tone colour is at odds with the evidence available to date (Laurin 1999, 15). It is worth noting that his published results apply to one note only, a c^3, and that during the experiment the microphone was attached by a 'lightweight frame fixed to the recorder itself so as to keep the relative orientation constant' (*ibid.* 14). The close proximity of the microphone to the sound source will also have given a

16 Helmholtz Resonator: An enclosed volume communicating with the atmosphere through a relatively small aperture or neck. Such a cavity has the property of resonating over a narrow range of frequencies. The resonant oscillation of the air in an empty milk bottle is a good example. You can hear the resonant oscillation of the air in the bottle when you blow across the top. The theory for this was developed by H. L. F. Helmholtz (1821-94) (Grove Music Online, accessed 15 April 2011).

player's-ear perspective on proceedings, possibly exaggerating the resulting effect of the colour change as seen on the spectrogram.

There has been an on-going dispute between teachers and players about the validity of claims regarding tone colour change due to oral cavity size. This is an indication that the effect is not as obvious as some may think and that any change in tone colour effected in this way is likely to be too subtle for most audiences. That the use of vibrato, articulation, dynamic and fingerings can reliably be shown to affect tone colour is not in dispute and for most players will be sufficient. If oral cavity size can affect tone colour it may simply be the result of an individual's unique mouth shape, resonant qualities, and the effect may therefore not be reproducible by other players.

In conclusion, it is now clear that a certain amount of confusion exists where the discussion concerns tone colour and dynamic. This confusion has its basis on one hand from the widespread use of the term 'alternative fingering', which implies the production of a given pitch through the use of a non-standard fingering regardless of the consequent change in tone colour, and on the other from the widespread use of subjective descriptions of the effects on colour and dynamic of using different fingerings. Where the non-standard fingering is used to produce dynamic variety the necessary change in breath pressure will itself impact on the tone colour. There has, therefore, been very little published research into the structure of the recorder's sound and consequently its tonal characteristics, and it is this that will be the topic for discussion in Chapter 5. I must be quick to take the opportunity to reiterate that this study is not intended to be comprehensive or in any way conclusive or definitive. It is hoped, however, that the research undertaken in Chapter 5 will clarify important structural aspects of the instrument's sound, and act as a stimulus for further research. However, one of the potential consequences of changing fingering is a change in pitch – it is the consequence of this technique that results in the production of microtonal intervals. This will be the subject of Chapter 4.

Chapter 4

Microtonality and the Recorder

> It would be hard to find another musical epoch in which every aspect of musical technique and aesthetics has been subjected to such radical discussion and dispute as in our own. (Bartolozzi 1967, 1)

The exploration of microtonality on the recorder began in the first half of the 16th century. Written records from the time confirm that over four hundred years ago recorder players had the necessary technical flexibility and aural skills to play intervals smaller than a semitone. Sylvestro Ganassi, in his *Fontegara* of 1535, declared that the recorder is capable of imitating the human voice in all its shades of expression and that the player achieves this by varying breath pressure 'and shading the tone by means of suitable fingering' (Ganassi 1535, 9). Hieronymus Cardanus confirms Ganassi's assertion and expands on it by giving instructions for producing the microinterval of a diesis for expressive and tuning purposes – to meet the demands of the mean-tone tuning system in use at the time (Cardanus 1546, 64). The widespread acceptance during the eighteenth century of twelve-tone equal temperament tuning precluded the necessity of changing pitch in performance. The increasing expressive demands placed on instrumentalists during the eighteenth century and the growth of interest in the symphony led to a concomitant increase in the loudness of instruments along with demands for greater dynamic contrasts. At the level of professional music making the recorder gradually fell into disuse until its renaissance at the turn of the twentieth century (Macmillan 2008, 18-20). Around the same time a small number of musicians began exploring micro-tonality in determined but distinctive ways. Hába, Carrillo, Wyschnegradsky and Partch are the most commonly cited microtonal pioneers. I will begin by briefly investigating the sources of their inspiration in an attempt to find a common cause which can be said to have led to microtonality for acoustic instruments as we now understand it.

Czech composer Alois Hába (1893-1973) wrote his first microtonal piece, *Suite* for string orchestra, in 1921. His main inspiration was the microtonal inflection he had heard as a child in Moravian folk music. During the 1920s he was engaged in projects to make microtonal instruments including quarter-tone pianos, quarter- and sixth-tone harmoniums, a quarter-tone clarinet and later a quarter-tone trumpet and guitar (Vysloužil).

Mexican composer Julián Carrillo (1875-1965) wrote his first microtonal piece in quarter-tones for string quartet in 1895 (Wood 1986, 328). During his career he explored 16th-tones and designed a simple notation system suitable for microtonal music. In 1930 he formed the *Orquesta Sonido 13* (Orchestra of the 13th Sound), which was capable of playing exclusively in microtones. He, too, was engaged in the design of microtonal instruments – the metamorphosing piano, capable of playing in 14th-, 15th-, and 16th-tones. Fifteen were built and the instrument was shown at the 1958 Exposition in Brussels (Benjamin, a).

Charles Ives' (1874-1954) output indicates a tendency for experimentation and this included an interest in microtonality. An article published in 1925 mentioned his *Three Quarter-tone Pieces* (1924) - three short pieces for two pianos, one tuned a quarter-tone sharp (Ives 1925, 31).

Bela Bartók's *Sonata for Solo Violin* (1944) contains a passage in the fourth movement that uses quarter-tones but Yehudi Menuhin, who commissioned and premiered the work, was reluctant to perform the piece. The quarter-tones had a colouring function, were not structural, and could be omitted (Bartok, quoted in Mac Erlaine 2009, 12).

Ivan Wyschnegradsky (1893-1979) was a committed microtonalist whose scheme for ‘ultrachromatic’ synthesis included works for strings which employed quarter-, sixth-, and twelfth-tones. During the 1920s he had a quarter-tone piano built and later designed an adjustable piano that could play in quarter-, sixth-, and twelfth-tones. He left many microtonal works, a substantial number of which included works for piano (Criton).

Mieko Kanno asserted that at the turn of the twentieth century the performance skills of violinists attained a level whereby the artistry of the player ‘dictated the musical experience’ and that ‘the practice of expressive intonation was certainly part of that movement and there were instances in which the sensibilities of intonation produced a new kind of pitch’. She cites violinists ‘like Ysaÿe and Enescu’ as embracing ‘the new vocabulary of quarter-tones and micro-tones’ in their compositions and notes that ‘it was during this period that composers began writing micro-tones’ (Kanno 2003, 43). The most prominent microtonalist of the mid-twentieth century was American composer Harry Partch (1901-1974). According to Wood he was ‘perhaps the most important figure in the evolution of microtonal instruments in that he created a complete family of string, keyboard and percussion instruments, all tuned to his 43-note scale’ (Wood 1986, 328). From the disparate approaches of these regularly cited pioneering figures there remains little evidence of a genuine, concerted aesthetic shift among composers towards acoustic microtonal composition.

The post-war period of experimentalism and an interest in the exotic, typically manifested in European music as an interest in Asian music, art and religion, led by Messiaen, Stockhausen, and Boulez, came at a time, therefore, when microtonal composition for acoustic instruments seemed to have run its course. However, it is difficult to imagine that performers and composers of instrumental music were not inspired, or at least influenced by the potential offered by the new electronic media – primarily the tape recorder, which was commercially available from 1947 (Weber). Electrical instruments such as the *ondes martenot*, which Messiaen had used to great effect in *The Turangalîla Symphony* (1946-48), highlighted the extent of the continuing exploration of new sounds and timbres – an aesthetic in accordance with that of many microtonal composers (Werntz 2001, 172). The medium of electronic music via the tape recorder appeared to offer composers the greatest possibilities. Edgard Varèse's *Poème électronique* (1957-58) is 'one of the few great works of music on tape' (Griffiths 1994, 147). It was composed for the Philips Pavilion at the 1958 Brussels Exhibition and combined the familiar sounds of bells and a woman's voice with shimmering, swirling and occasionally frightening new 'electronic' sounds. Interest in electronic music quickly spread during the immediate post-war period and centres of activity established themselves primarily in Paris, where Pierre Schaeffer (1910-1995) founded the concept of *musique concrète* (1948), and Cologne where Karlheinz Stockhausen (1928-2007) took a position at the *Studio für Elektronische Musik* at *Nordwestdeutscher Rundfunk*, Cologne, in 1953 (Toop) and worked to create 'pure' electronic music whilst continuing to compose instrumental music (Griffiths 1994, 147-149).

From the beginning of the 1960s both composers and adventurous recorder players had become more willing to expand the recorder's repertoire and develop its tonal range and expressive potential. This included an exploration of microtonality more as a by-product of the general aesthetic trend to explore new sounds and timbres than for the sake of microtonality itself. Although the creative impulse for new recorder sounds was not universal, there were enough high quality players of international status whose enthusiasm for the instrument and the genre was sufficient to have a significant impact on the instrument's status in the contemporary art music of the time.

The instrument's repertoire of the second half of the twentieth century can be identified as an indicator of the extent to which the use of microtonality had spread into the playing techniques of performers and should take precedence over both academic writings and technical manuals as a guide to its acceptance into the musical milieu. A study of selected works from the period will therefore give a clear indication of the extent to which composers have incorporated the microtonal aesthetic into their work. This manifests itself in the variety of different aesthetic stances composers have taken, which in turn is reflected in the variety of musical styles that will be studied in Chapter 6 of this thesis. For the time being, a broader consideration of the extent of microtonal usage will be sufficient, in order to lay down a firm foundation for the more detailed study to follow and to understand the context in which the pieces to be studied in detail appeared.

I have categorised microtonal repertoire (apart from that based on just intonation, none of which appears in this study) according to how composers have added new pitches to their existing twelve-note, equal-tempered vocabulary. My system is an adaptation and extension of the one devised by Werntz (2001). The new pitches are usually obtained in one of the following three ways:

1) 'Through the construction of microtonal clusters and masses of sound' (Werntz 2001, 171). In recorder playing this is achieved through multiphonics – the recorder does not overblow to produce pure harmonics - multiphonics often produce microtonal deviations, particularly in the upper reaches of the chord.

2) 'Through simple inflection or bending of the basic pitches in a scalar, or twelve-note idiom'.
3) 'Through full expansion of the twelve-note chromatic by the creation of a new, more minute equal-tempered chromatic, in which all intervals are treated as equally distinct, and potentially functional' (Werntz 2001, 171-172).

The following table, Table 4-1, is a list in chronological order of published works and writings on microtonality, and pieces that contain microtonal intervals, or that I consider significant in the development of a microtonal repertoire. The category of usage is based on those given above, with the addition of a further category – 'E', which represents material, pieces and books that encourage exploration of the instrument that may have led to the use of microtones.

Table 4-1.

Year	**Author/Composer**	**Title**	**Features**	**Cat. Of Usage**
1961	Bois, Rob du	*Muziek voor Altblokfluit*	Extends contemporary techniques to new levels including extreme dynamics (*ppp*), glissando, and indeterminate pitches by raising breath pressure	E
1964	Andriessen, Louis	*Sweet*	dynamic range (*ppp – sffz*), extreme tonguing, extended range to c^4	E
1966	Berio, Luciano	*Gesti*	Co-ordination of primary techniques dismantled to produce unpredictable sounds	E
1968	Linde, Hans-Martin	*Music for a Bird*	Extreme dynamic range (*ppp – sfz*), increased note range to c^4 glissando, multiphonics	E
1968	Shinohara, Makoto	*Fragmente* (see below)	First notated microtones in recorder repertoire	2
1969	Vetter, Michael	*Il Flauto Dolce ed Acerbo*	Explored hundreds of different fingerings for dynamic and timbral variety	E

1971	Linde, Hans-Martin	*Amarilli mia bella – Homage à Johann Jacob van Eyck*	Linde's first use of notated microtones for melodic inflection	E
1972-74	Andriessen, Louis	*Melodie*	Some notated quarter-tones, as colour set against simple Right-hand piano part	2
1975	Masumoto, Kikuko	*Pastorale*	Microtones for colour	2
1979	Casken, John	*Thymehaze* (see below)	Microtones for colour	2
1983-84	Fox, Christopher	*Winds of Heaven* (see Chapter 6)	Microtones in combination with electronic and vocal effects for timbral variety	1 & 2
1990	Fischer, Johannes	*Die Dynamische Blockflöte* (see below)	110 dedicated dynamic and microtonal fingerings	E
1991	Maki Ishii	*Tenor-recorder Piece (east • green • spring)*	Microtones for inflection	2
1992	Hauwe, Walter van	*The Modern Recorder Player, Vol. 3* (see below)	Devoted to contemporary music techniques including hundreds of dynamic fingering	E
1992	Spahlinger, Matthias	*Nah, Getrennt* (see below)	Explores the relationship between fingering, breath, pitch, and dynamic to produce precisely notated 16th-tones	3
1992-94	Zahnhausen, Markus	*Lux Aeterna* (see Chapter 6)	Explores timbral and tonal variety; includes an extended quarter-tonal passage	2
1993	Isang Yun	*Chinese Pictures*	Microtones for colour	2
1994	LeFanu, Nicola	*Dawn's Dove* (see Chapter 6)	Microtones included in notated ornamental flourishes	2
1994	Lumsdaine, David	*Metamorphosis at Mullet Creek* (see Chapter 6)	Microtones used as ornament and device to suggest physical movement	2
1995-96	Bousted, Donald	*A Journey Among Travellers*	Extended nine-movement work with structural quarter-tones	3
1997	Bousted, Donald	*Five Quarter-Tone Pieces* (see Chapter 6)	Experimental quarter-tone pieces to be played on modern 'harmonic' instruments (T, A)	3
1997	Hashiramoto, Masaru	*Krishna*	Microtones for colour	2
1998	Bennetts *et al.*	*The Quarter-tone Recorder Manual*	Introduces and describes dedicated quarter-tone fingers over two octaves and a sixth, with exercises	
1998	Bousted, Donald	*Whale Song* (see Chapter 6)	Sophisticated quarter- and eighth-tone writing. Extensive use of texture as expressive devise	3
1995-99	Wolters, Michael	*She Stays*	Extensive use of quarter-tones in a minimalist style piece	2

2000-12	Wolters, Michael	*My Own Step-song*	Quarter-tonal ‘concept’ piece	2
2001	Jones, Lewis	Two 19-tone equal-temperament tenor recorders. Designed by Jones, made by Jones and Armitage	An interesting project. Jones wrote a duet which was performed on the instruments by Jones and Barnes	E
2005	Wolters, Michael	*Kathryn und Peter durchqueren die Antarktis*	An extended ‘concept’ piece entirely in eighth-tones	3
2012	Wolters, Michael	*7 Shakespeare Songs*	Quarter- and third-tones for colour	2
2012	Wolters, Michael	*The Voyage* (see Chapter 6)	Third-tones set in a tonal environment	2
2013	Bowman, Peter	*Dialogue for One Recorder Player* (see Chapter 6)	Structural use of quarter-tones	2 & 3

The introduction into the repertoire during the 1960s of various ‘advanced’ or ‘avant-garde’ techniques, including glissando and extreme dynamics, awakened awareness among players to the potential for, among other things, the exploration of new fingerings and the discovery of the possibilities for microtonal intervals. By the beginning of the last decade of the 20th century microtonal music on the recorder had arrived at a point of considerable sophistication. It had evolved gradually throughout the second half of the twentieth century, beginning from a state of experimentation driven by the curiosity of a small number of recorder pioneers whose passion for the instrument drove them to break out of the ordinary and merely pleasant to develop new means of expression for the recorder, based on elements other than melody and harmony. The musical concept that lay at the root of the search for new sounds is texture and has been relevant for musicians wishing to discuss and understand their art, according to Dunsby, since the beginning of the twentieth century, when it emerged ‘as a feature of the critical vocabulary spawned by post-tonal music’ (Dunsby 1989, 47). Adventurous recorder players of the mid-twentieth century gained advanced knowledge of their instrument through enquiry and exploration. They collaborated with composers to produce new works in order to ensure, as far as possible, the instrument’s survival by the provision of high quality, relevant, modern music. In this context the decade 1960-1970 was seminal for the recorder. There was a clear trend by players and composers to extend the range of techniques employed in new recorder music. Players of exceptional technical facility and musicianship were responsible for the development of a new repertoire that engaged with the aesthetic of post-war experimentalism. Despite this, the use of specifically notated microtones during this period was relatively infrequent.

Michael Vetter was a significant contributor to experimental mid-twentieth century recorder repertoire. *Il Flauto Dolce ed Acerbo* (1969), consists of 'fingering charts – for regular notes, flageolet tones, and multiphonics in the open, closed and covered registers' as well as 'discussions of embouchure, articulation, breathing, vibrato and dynamics'. It is 'the magnum opus by one of the two main pioneers of avant-garde recorder music' (Griscom & Lasocki 2003, 378). O'Kelly refers to Frans Brüggen (b. 1934) as 'the most influential player of the twentieth century' (O'Kelly 1995, 157) and as Griscom and Lasocki's book is dedicated to Brüggen it does not seem unreasonable to assume that he is the other 'main pioneer of avant-garde recorder music' referred to in their text (Griscom & Lasocki 2003, v).

Brüggen commissioned or was otherwise influential in the composition of new works during the sixties including *Muziek voor Altblokfluit* (1961) by Rob du Bois (b. 1934), *Sweet* (1964) by Louis Andriessen (b.1939), and Luciano Berio's *Gesti* (1966). All three pieces demand a virtuosic technique and employ several 'extended' techniques including, significantly, glissando and extreme dynamics. *Gesti* alone stands out for its uncompromising willingness to challenge the main elements of technique – blowing, tonguing, fingering – and dismantle the coordination between them to produce a piece consisting, at the beginning, of unpredictable sounds. As the piece progresses the techniques gradually re-coordinate. However, one piece in particular was important for its introduction of microtones into the repertoire – Shinohara's *Fragmente* (Fragments, 1968), which was written for, and in collaboration with, Brüggen. Of the fourteen fragments, numbers 4, 6, 7, and 13 include micro-intervals, see Figures 4-1 and 4-2, below. *Fragmente* was a *tour de force* in the development of modern recorder technique and remains a seminal work in the recorder's twentieth century repertoire. It is a work that has been widely recorded and performed and can be thought of as significant in the canon of twentieth century concert repertoire. It consists of fourteen short 'fragments' that effectively show-case the two traditional musical and technical strengths of the recorder – articulation and melody, and then develops them into a thorough exploration of the recorder's technical capabilities. These include wide, fast leaping passages, a variety of articulations, multi-phonics, and broad melodic passages, four of which employ quarter-tonal intervals to varying degrees. Although the individual fragments are essentially tonal, thorough knowledge of alternative and dedicated microtonal fingerings is required for an accurate performance of *Fragmente*. Fragment 4, for example, consists of short glissandos originating from diatonic, chromatic, or microtonally altered versions of those pitches. Effective control of the glissandos is essential for consistency of pitch and tone and to achieve this they are best executed not by changes in breath pressure but by sliding the finger(s) on and off the holes to produce an even and smooth glissando (see Example 4-1, below). Fragment 6 is a highly ornamented single note – g-quarter-sharp, with melismatic quarter-tonal intervals weaving either side of the main note within the range g-quarter-sharp - a quarter-tone high a♭ above, down to f♯ below. The accuracy of the execution of the quarter-tonal intervals and a smooth, consistent tongued-legato is essential. Fragment 7, like Fragment 4, consists of glissandos originating from diatonic, chromatic and microtonal pitches, but this time the tones are sustained. Fragment 13 (see Example 4-2, below) consists of three short microtonal glissandos, one long, followed by a brief recall of Fragment 6, before two final shorter glissandos.

Example 4-1, Shinohara's *Fragmente*, showing three of the fragments that use quarter-tones: numbers 4, 6 and 7:

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Example 4-2, Shinohara *Fragmente*, Fragment 13

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Other players active in performing new works during the sixties included Hans-Martin Linde (b. 1930) and Michael Vetter. The works that were written for Vetter, including Jürg Baur's (1918-2010) *Incontri* (Encounters, 1960) and *Mutazioni* (1962), made extensive use of an extended dynamic range and glissando whilst Bois' *Pastoral IV* (1964), like *Mutazioni* also includes multiphonics (O'Kelly 1995, 152-166) but no notated microtones. Vetter's influential *Il Flauto Dolce ed Acerbo*, however, has largely been superseded due to developments in recorder design that rendered many of his fingerings irrelevant for players of instruments made during the 1970s and 1980s, following the introduction to the market of sophisticated baroque and renaissance copies and, during the 1990s, redesigned 'modern' instruments that became available. Nevertheless, it remains an important historical document because it pointed out possibilities and showed the way for the future development of the repertoire.

Linde is probably best known for his *Music for a Bird* (1968), which, like the early works for recorder by Andriessen and Bois, makes extensive use of a wide dynamic range and glissando. *Music for a Bird* has remained influential because of its continued widespread use for both study and performance among students. It was in a later work, *Amarilli mia bella* –

Hommage à Johann Jacob van Eyck (1971), see Example 4-3, that Linde first employed notated microtones on a small scale, for colouration and melodic inflection, and which were achieved primarily by changes in breath pressure but which also indicated the possibility of developing dedicated microtonal fingerings.

Example 4-3, Linde's *Amarilli mia bella*, showing a short passage containing microtonal inflections, created with a combination of changes in breath pressure, and by altering fingering:

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By the 1970s Frans Brüggen had already established a reputation as a musician of extraordinary talent (Ehrlich 1993, 449-452). Together with his students Walter van Hauwe (b. 1948) and Kees Boeke (b. 1950) Brüggen formed 'the controversial, experimental blockflute-ensemble *Sour Cream*' in 1972 (Recorder Department Amsterdam Conservatory), which 'did much to update the "safe" image of the recorder through the originality and wit of their performances (O'Kelly, 1990, 120). This important aspect of the recorder, by which I mean the extent to which it is perceived as a 'real' instrument by members of the wider musical community, led both to its broader acceptance and an acknowledgement of its role in contemporary music, including among audiences and particularly composers. However, because of its inability to compete dynamically with mainstream instruments, the recorder has no seat in the symphony orchestra, nor a place in the standard jazz or wind band. It is an instrument that is undoubtedly on the periphery of mainstream contemporary music-making, a situation that adventurous and ambitious recorder players see as a distinct advantage - an opportunity to operate freely outside conventional contemporary classical or art music practices.

Whilst developments in recorder technique and repertoire were advancing rapidly on the continent of Europe, in the UK, sceptical recorder players and an even more sceptical public were far more resistant to the artistic and musical value not just of microtonality but also of the desire to explore new means of expression on the recorder. The development of new repertoire for the recorder, and the presence of advanced players eager to explore it, was restricted in the UK by the conservative attitudes of some prominent players and teachers of the older generation. Their attitudes were informed by the dominance and conservatism of a strong amateur movement and of the Dolmetsch family, whose influence over the recorder-playing community was, in turn, pervasive. For example, Edgar Hunt's (1909-2006), *A Practical Method for the Recorder* (1935) had to be submitted by the publisher to Arnold Dolmetsch and Robert Donnington, then Secretary of the Dolmetsch Foundation, for revision prior to publication (Hunt 2002, 126-127). Reflecting on the recorder's post-war development in *The Recorder and its Music* (1962, rev. 2002), Hunt presented a surprisingly Anglo-centric view of developments in the recorder world, particularly in Chapter 8, *The Recorder Today,* where his treatment of late twentieth-century recorder music failed to mention the pioneering work that was, and continued to be, undertaken by Linde, Braun, Brüggen, Hauwe, and Fischer. There is no mention of microtonality (*ibid.* 135-155).

Carl Dolmetsch (1911-1997) was active in the U.K. and abroad during the middle part of the century. He is widely regarded in England as a pioneer and promoter of new music during the twentieth century. He commissioned fifty-one new works between 1939 and 1987 that were premièred at London's Wigmore Hall on an almost annual basis – interrupted by the war in the years 1940 – 1946; and also in 1948 and 1951 there were no new works premièred. A further twenty-seven works were composed for him during this period that were not premièred at the Wigmore Hall (Mayes 2008, 18-20). Despite his desire for new repertoire his musical taste as well as his perception of the taste of his audiences remained conservative – the new works commissioned by him were almost entirely in a neo-classical style, and certainly contained none of the exploratory instrumental techniques that composers on the continent were employing – microtones were emphatically excluded, as the following extract from Dolmetsch's letter in 1972 to the composer Martin Dalby shows:

> As you know, I do not want a pastiche of early music in any sense. At the same time the work must make an immediate appeal to the audience at first hearing …
> Although I told you that third and quarter tones are possible on the recorder, on further reflection I would prefer to adhere to the standard twelve semitones, since we have a difficult enough task as it is to convince people that the recorder can be played in tune. Nor do I want any avant-garde gimmicks alien to the character of the instrument – to my mind an affront to its innate dignity (Dolmetsch 1972, 1).

On the Continent, Hans-Martin Linde in *The Recorder Player's Handbook* (1962, rev. 1991) took a more positive and engaging view of the recorder's developing role in contemporary music-making:

> The adoption of the recorder by the avant-garde in the 1960s brought with it a considerable enlargement of the instrument's traditional range of expression. […] Players and composers alike now helped bring about a significant expansion of the range of possible sounds. [Michael Vetter] saw the recorder as 'a new instrument: its

> qualities as a "*flauto dolce*" combine and intermingle naturally with those of a "*flauto acerbo*", but at other times they stand in clear contrast with them, giving rise to clashes of tone-colour that are more extreme than those naturally available to almost any other instrument.' The very simplicity of the recorder's construction means that its tonal range can be enormously extended. […] Chromatic notes and micro-intervals were introduced, systematic sets of *piano* and *forte* fingerings were devised, and, altogether, a wholly new armoury of techniques was built up in a process of constant experimentation (Linde 1991, 127-128).

Linde's emphasis on the role of tone colour in the recorder's expressive armoury is noteworthy. Various techniques of tone production including multiphonics, simultaneous singing and playing, glissando, extreme pitch range, and extreme articulation, were extensively deployed, for example, in *Music for a Bird*.

Although few microtonal works had appeared in the years immediately following *Fragmente*, there are some composed during the 1970s that are worthy of comment, for example, Casken's *Thymehaze* (1979), dedicated to English recorder player Alan Davis, was published as part of Brüggen's *The Modern Recorder Series* by music publisher Schott and thus adopted into the canon of contemporary repertoire. Its microtonal use is inflective with the majority of microtonal intervals being produced by increasing or decreasing breath pressure to raise or lower the pitch one-quarter-tone higher or lower as required, although the c^2 to c-quarter-sharp^2 glissando requires sliding finger 3 (θ123 to θ12~~3~~) to raise the pitch, see Examples 4-4a and 4-4b.

Example 4-4a, Casken, *Thymehaze*, showing breath-produced quarter-tones:

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Example 4-4b, Casken, Thymehaze, showing finger-controlled quarter-tones:

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From the mid-seventies onwards Japanese composers wrote works for the recorder that included quarter-tones including the following two pieces from either end of that period: Masumoto's *Pastorale* (1975) and Hashiramoto's *Krishna* (1997), which uses finger techniques to produce the quarter-tones, see Example 4-5. Several works in a similar vein appeared throughout this period including, significantly, Ishii's *Tenor Recorder Piece (east • green • spring)* and Isang Yun's *Chinese Pictures* (1993), both of which have been adopted into the canon of contemporary recorder music. These pieces were heavily influenced by traditional Japanese and Asian music and the microtonal usage is primarily for colouration. Notation in these pieces varies between specific quarter-tones with fingerings (*Krishna* and *Chinese Pictures*) and the non-specific inflection by changes in breath pressure (*Pastorale*):

Example 4-5, Hashiramoto, *Krishna*, showing fingered quarter-tones in lines one and three whilst the c-quarter-flat[1] of the second line (note Hashiramoto's unusual notation) appears to require a reduction in breath pressure:

Example 4-6, Isang Yun, *Chinese Pictures*, *1 The Visitor of the Idyll*. The microtonal use is limited to simple melodic inflection. Note the unusual notation for the microtones:

⌒ = raised one quarter-tone; ‿ = lowered one quarter-tone.

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Masumoto's *Pastorale* calls for indeterminate pitching of tones up to one semi-tone higher or lower than the notated pitch, see Example 4-7a:

Example 4-7a, Masumoto, *Pastorale*, showing a passage of tones blown 'shakuhachi' fashion to produce a breathy tone of indeterminate pitch:

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Example 4-7b, Masumoto, *Pastorale*, showing a microtonal passage indicated by the use of arrows to indicate the direction, up or down, of the pitch deviation by up to a semitone:

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Between 1984 and 1992, Walter van Hauwe published the three volumes of *The Modern Recorder Player*. Volume 3 (1992) is devoted to contemporary music techniques and in it he published a range of dynamic fingerings for notes over a range of three octaves and a sixth ($b\flat^{1}$-$g\sharp^{4}$ - 484 fingerings in all). He points out that the most common micro-intervals include 'the third of a tone, the quarter-tone (and the three-quarter-tone), the sixth-tone and the twelfth-tone'. His table should provide, he writes, 'enough information to find out the different fingerings required to produce all these very fine nuances'. He warns about the 'huge effect changes in air pressure can have on these pitches, both in a positive way (colouring) and a negative way (i.e. unstable pitch). So it is essential to check constantly that your airstream really is steady'. Hauwe acknowledges that it is possible to play micro-intervals 'by just leaking holes' but observes that this is the hard way of achieving those pitches 'especially when particular micro-intervals come back more than once. It is better to play safe by giving each note its own fingering' (Hauwe 1992, 23-31).

Christopher Fox derives the microtonal pitches of the second part of *Winds of Heaven* (1983-84) from composer-specified fingering patterns which produced pitches that are standard quarter-tones, although the audible outcome does not have the same clarity of pitch as the more tonal pieces due to the simultaneous vocalisation and multi-phonics. The effect is a piece of two strongly contrasting textures: the first part consists of chorale-like polyphonic glissandos whilst the second imitates the sound-world of the didjeridoo.

The same texture-inspired techniques that influenced Hans-Martin Linde in the late 1960s have also played a significant role in the later works of some German composers, notably Gerhard Braun (b. 1932), whose *Five Meditations* (1992), *Flauto Aperto* (1996/97), *Albumblätter* (1997), and *Tempi passati* (1999) make extensive use of multi-phonics, flutter-tonguing, labium vibrato, alternative fingerings, articulation and tonguing effects, flageolet tones, and combined vocal and instrumental sounds to great effect. Braun prefaces *Flauto aperto* by writing that 'even the "modest" descant recorder has come to qualify for a new status as regards expression and colour quality previously thought incapable of being elicited from what used to be considered as a mere "child's instrument"' (Braun 1998, 3).

Eve O'Kelly includes a short paragraph on microtones in *Chapter 7, Modern Techniques,* of *The Recorder Today* (1990). She cites three works that include microtones, *Encounter* (1973) by (Walter Hekster, 1937-2012), *Fragmente* (1968) by Makoto Shinohara (b. 1931), and *Thymehaze* (1979) by John Casken, (b. 1949). She states that microtones can be produced by 'modifying standard fingerings' and continues to describe three further techniques for producing microtonal intervals: the first method she notes is to use the fingers to 'fractionally open or close one or more finger-holes of the standard fingering'. Likewise 'occasionally it is necessary to add or subtract fully open or closed finger-holes' (O'Kelly 1990, 88). The second involves increasing or decreasing the breath pressure 'to effect microtonal changes in pitch' with standard fingerings (*ibid*. 89). The third employs the use of non-standard fingerings to ensure accuracy of pitch (*ibid*. 89).

The contrast between the attitudes taken in Linde's and Braun's writings compared to those of O'Kelly may lie in the fact that Linde and Braun were themselves professionally involved in the developmental process, being active at the highest level as composers, performers and teachers whereas O'Kelly was, at the time of writing her book, involved neither as a performer nor composer and, like Hunt, was possibly unaware of the role of texture in mid to late twentieth century music in continental Europe. O'Kelly appears to have been a distant observer, having been active as director of Ireland's Contemporary Music Centre between 1990 and 2010 (O'Kelly).

The different attitude towards repertoire development in the UK and in Europe could hardly be more marked. Dutch composer Roderik de Man (b. 1941) wrote sixteen significant works for prominent recorder players between 1986 and 2012. These included works for Walter van Hauwe, the quartet *Brisk*, and most recently, Jorge Isaac (b. 1974), with whom he has collaborated to contribute a number of significant new electro-acoustic works to the repertoire (Man 2010). He said in an interview in 2010 with Hauwe:

> People who play the recorder are almost by definition adventurous musicians. Probably because of the limitations of existing literature for recorder. As a consequence, it forces them to look far beyond their own boundaries. That is what I call useful, and unfortunately, that is a quality many instrumentalists with a great body of literature, such as string players, often lack.
> (Man 2010).

Johannes Fischer's *Die dynamische Blockflöte* further exemplifies the movement towards a more flexible, even adventurous, approach to selection of fingerings on the recorder with 110 dedicated dynamic and quarter-tonal fingerings over a range of three octaves and a major seventh (Fischer 1990, 38-43). The *Quarter-Tone Recorder Manual* (Bennetts *et al* 1998) set out specifically to develop a system of dedicated fingerings for the production of quarter-tones on the treble recorder over the range of two octaves and a sixth. It took account of tonal variety by ensuring that the fingerings published in the *Manual* focussed in the first instance on accuracy of tuning and an even, secure tone over the full microtonal range. A further consideration of the authors in the selection of microtonal fingerings was ease of reading and playing. The fingerings evolved from alternative fingerings, which used a consistently logical approach whereby all or most of the fingers of the right hand are employed as tuning fingers. The intention of the authors was that their method could also be developed and applied to the other degrees of micro-tonality and other sizes of the recorder family.

Twenty-four years after *Fragmente*, in 1992, Matthias Spahlinger composed *Nah, Getrennt* [*Near, Separate*]. It is a piece that demands precise technical control of breath, fingers, tongue, as well as refined aural skills - it is also a piece that blurs the borders between music and pure technical facility. Dedicated to Gerhard Braun, for solo alto recorder, *Nah, Getrennt* is in two sections; the first explores the relationships between fingering, breath, pitch and dynamic – static fingerings combined with extreme changes of breath pressure result in dramatic changes in pitch and dynamic. The second section consists of close micro-intervals, all contained within the interval of a minor third, played 'as fast as possible'. The piece's musical content is derived from the technical processes devised by the composer. Spahlinger, formerly a recorder player, was able to test the accuracy of the fingerings himself and had personal contact with Gerhard Braun, for whom the piece was written (Braun 1994, 297). It was described by Braun as 'probably one of the most physically and psychologically strenuous pieces for recorder of our time'[1] (*ibid*, 294). The piece lasts for almost thirty minutes. It is notated in a tablature form in which fingerings

[1] 'wohl eines der physisch und psychisch anstrengendsten Blockflötenstücke der Gegenwart'

for each pitch are given – the pitches equate to sixteenth-tones. Instructions are also given both for very imprecise, as well as unstable pitches, including production of 'shadow tones[2]', and using a constant fingering whilst varying breath pressure to change pitch. Fingering and pitch determine the dynamic level. One sixteenth of a tone is equivalent to 12.5 cents in twelve-tone equal temperament tuning. The small size of the microtonal intervals raises questions of discernibility. A study on absolute pitch published in the *Psychological Bulletin* in 1993 concluded that 'treating tones separated by less than a semitone as distinct pitches runs counter to musical practice and training' (Takeuchi and Hulse 1993, 347). Moore, however, posits that a difference in pitch of 3Hz at the nominal test frequency of 1000Hz 'can be detected' (Moore) – this is equivalent to approximately 5 cents at this frequency, a figure that is in accordance with a generally accepted just noticeable difference in pitch of 5 – 6 cents (Loeffler 2006, 6). The one-sixteenth-tone intervals should therefore be perfectly audible. The rapid, unbroken micro-intervals of the second section, however, test the powers of concentration of listener and player as well as placing extreme demands on the player's technique. It pushes the recorder in many ways to its limits (Braun 1994, 294). Sixteenth-tone equal temperament is not one of the standard recognised systems that microtonal composers have worked with, such as 19-, 24-, 31- and 43-tone equal temperament. The 16-tone system used in *Nah, Getrennt* is derived from fingering patterns devised by the composer, see Examples 4-8a and 4-8b.

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[2] The very quiet, rustling or windy lower pitch of a multi-phonic - produced by overblowing a more or less unstable fingering.

Example 4-8a, the opening of Spahlinger's *Nah, getrennt*

Example 4-8b, the closing passage of *Nah, getrennt*

Donald Bousted's *A Journey Among Travellers* is a set of nine duets that together form a substantial body of quarter-tonal music whose total performance time is around twenty-six minutes. His music is at times lyrical, colourful and often rhythmically impelling. Like *Nah, Getrennt*, *Journey* is a piece that demands virtuosic technical ability from both players, and represents the culmination of several years' collaboration between the composer and recorder players Kathryn Bennetts and Peter Bowman. The musical style, however, is very different from that of *Nah, Getrennt* by virtue of the variety of musical characters and styles contained within the set. The microtonal usage also varies from piece to piece so that a range of musical styles and characters are explored: complex rhythms, glissandos, and quarter-tones colour the note a^2 in *Colours* (see Example 4-9); *High* explores the extreme high register of the recorder's quarter-tonal range in combination with a highly complex metrical structure; *Sonata* is a 'light-hearted version of an 18th century sonata using common major and minor scales organised quarter-tonally' that adds an element of lyricism to the set; texture becomes the prominent element in *Double*, 'where two lines in close juxtaposition make an apparent "band" of sound' and in *Still*, where glissandos and flutter-tongue add textural variety; various rhythmic, textural, and melodic ideas are explored in *Racket* (see Example 4-10), often through imitation between the players (Bousted 1998). Bousted uses microtonality in a conventional manner: he employs scales but the scales are often structurally microtonal i.e. the microtonal intervals are built in to the scale. Texture, too, plays a role in his music as does rhythm - often complex and, at times, conventional melodic motives, all of which mitigate against the occasional strangeness of his quarter-tonal sound world.

Example 4-9, The opening of *Colours*, from Bousted's *A Journey Among Travellers*

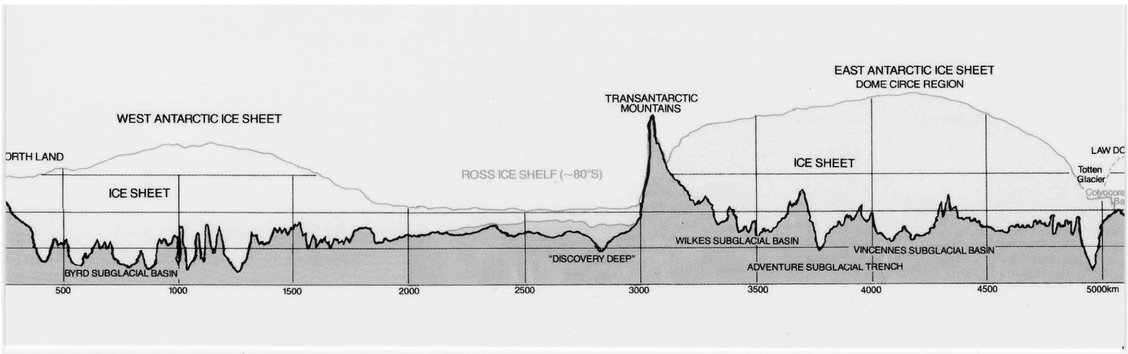
Example 4-10, Racket from Bousted's *A Journey Among Travellers*

Bousted's exploration of texture in *Whale Song* (1998) is a radical departure from his earlier conventional style of writing for the recorder. As well as employing contemporary playing techniques such as vocalisation and multiphonics on renaissance style instruments, Bousted varies the musical texture by contrasting dense polyphonic styles of writing with intensely rhythmic homophonic passages. Additionally, quarter-tones are set in contrast with intense passages of eighth-tone writing to produce a most sophisticated and intriguing piece, which is discussed in detail in Chapter 6.

Research was being undertaken around the same time by David Armitage and Lewis Jones at London Metropolitan University (previously London Guildhall University). Jones designed, and subsequently he and Armitage built two prototype 19-tone equal-temperament tenor recorders in 1999. They were modelled on a late renaissance tenor recorder, without keys, but the concept was subsequently developed in 2001 to produce instruments with keys. Recorder players Bennetts and Bowman worked with the instruments over several months but found that the positioning of the keys was awkward and the duo was unable to perform with them. To my knowledge the instruments have only had limited public appearances since.

A cluster of five microtonal works by Michael Wolters (b. 1971) composed between 1995 and 2012 displays a noteworthy variety of approaches to both the instrument and to microtonal writing. Within Wolters' largely tonal sound world the composer has found room for a piece (*My Own Step-song*) whose pitches are determined by the removing and adding of fingers one-at-a-time to the instrument in a process-driven compositional method not dissimilar to that employed by Fox in *Winds of Heaven* and Spahlinger in *Nah, getrennt*. *Kathryn und Peter durchqueren die Antarktis* (Kathryn and Peter Cross the Antarctic) is a concept piece, originally a radio opera, based on the story of Robert Scott's 1912 failed attempt to be the first man to reach the South Pole (see Example 4-11). The music is a duet for treble and tenor recorders, the composition of which is based on a cross-section of the route taken by Scott's party. The relative levels of the bedrock and the overlaying ice sheet determined the pitches, which are entirely in eighth-tones, see Example 4-12, (25 cents in the 12-tone equal-tempered tuning system).

Example 4-11, Wolters, *Kathryn und Peter durchqueren die Antarktis*, cross section of the 5064km route taken by Robert Scott and his party:



Example 4-12, Wolters, *Kathryn und Peter durchqueren die Antarktis*, part of the route crossing the Transantarctic Mountains (3000 – 3129km):

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Wolters' *The Voyage*, a mini opera commissioned for the 2012 Cultural Olympics, sets two solo recorders playing in third-tones against an eight-member recorder ensemble plus soprano voice, solo recorder, which doubles the voice, and double bass, who play in a largely tonal environment. The third-tones at different times support and comment on the dramatic action within the opera, thus playing a significant expressive role in the piece.

Writing five years after publication of *The Recorder Today*, O'Kelly, in *The Cambridge Companion to the Recorder* (1995), places extended techniques in four categories, 1) Non-standard Fingerings – which she defines as any sound created by finger combinations outside the accepted pattern (this may be interpreted as including microtones but they are at no stage mentioned specifically); 2) Articulation; 3) Vibrato; 4) Special Effects. The curious lack of reference to microtones, possibly reflecting a lack of interest in the subject by the author compared to comments in her earlier work, albeit limited, seems a significant omission considering the fact that the nineties have since proved to have been a period of intense interest in them, with major works such as Fischer's *Die Dynamische Blockflöte* (1990), Spahlinger's *Nah, getrennt* (1992), and in the latter half of the decade, Bousted's numerous compositions (see above). Despite acknowledging that the recorder's contemporary repertoire has numerically far outstripped that of previous centuries, she remains sceptical about its quality and concludes that 'the modern recorder repertoire contains few real masterpieces; good music, certainly, but little that is comparable with those composed for mainstream instruments' (O'Kelly 1995, 165). O'Kelly provides no evidence in support of this statement. Furthermore, her 'controversial' 'cynicism, and questions, about the recorder's ability to survive into the twenty-first century ... particularly in the light of recent innovations by Maarten Helder and others' was noted in a review by Marie Ritter in *The Recorder Magazine* (1996, 25-26). Whilst her neglect of the role of American players in the twentieth century recorder revival was noted in a review of the book by Mark Davenport in *American Recorder* (1996, 36-38), hinting at her limited awareness of developments around the world. On the other hand, if Man's comment, above, on the value of composing for the recorder is not testament enough to how composers often view and treat the instrument, then the impressive list of renowned composers who have written substantial works for the instrument should convince the sceptical of the high regard in which the contemporary recorder and its players are held[3]. A number of these and other composers have been inspired, others commissioned by players, to explore the expressive potential of the instrument and the use of microtones has played no small role in the development of the recorder's repertoire.

I have shown that the extended technical skills necessary for playing microtones in different musical styles are well established. Research undertaken in Chapter 3 indicates that the tonal consequences of using different i.e. microtonal, fingerings are little understood or recognised. More research into this aspect of technique will enable greater awareness of tone colour as an expressive device. It is with this in mind that I will continue the study of tone colour begun in Chapter 3 and investigate this little-explored aspect of recorder technique in more detail. It will be necessary first to undertake a review of acoustic theory, in particular to understand our perception of loudness and tone colour, so that an assessment of these two important qualities of sound can be made as objectively and accurately as possible.

[3] An incomplete list of professional composers known to the author who have taken the trouble to write for the recorder: Andriessen, Louis; Ayres, Richard; Berio, Luciano; Bryars, Gavin; Casken, John; Donatoni, Franco; Fox, Christopher; Gilbert, Anthony; Henze, Hans Werner; Heppener, Robert; Hindemith, Paul; Maki Ishii; Jo Kondo; Ligeti, György; Lumsdaine, David, LeFanu, Nicola; Man, Roderik de; McCabe, John; Rubbra, Edmund.

Chapter 5

Investigation into Tone-Colour Variations

Using Dynamic and Microtonal fingerings

In this chapter I will investigate the extent to which microtonal fingerings can produce changes in tone colour and how these can then be used for expressive purposes. It is a chapter concerned mainly with technique but before I begin it is necessary to determine what I mean by the term tone colour; what are the elements in the sound that cause it to change and, most importantly, what are the physical and psychological means by which we perceive it?

As discussed in Chapter 3 the concept of altering tone colour and dynamic on the recorder has its origins in the instrumental treatises dedicated to the recorder in the first half of the sixteenth century. The re-emergence of the instrument in the twentieth century was accompanied by a rediscovery of early repertoire, the reinvention of old playing techniques, the commissioning of new works, and the invention and application of new techniques in accordance with the requirements of the new repertoire. An important aspect of these rediscoveries was the increased use of non-standard or alternative fingerings for the purpose of adding an element of dynamic variety to the performer's armoury of expressive techniques. This usage was typically limited to performing ends of phrases *piano* – phrase shaping - though *forte* playing was also employed and described by Hauwe in 1992 (Hauwe 1992, 20). Both these techniques are typically discussed in teaching literature without reference to the consequent changes in tone colour. The application of alternative fingerings, therefore, had the primary purpose of altering the dynamics of individual notes or a short phrase and any fingering used for that purpose thus becomes a dynamic fingering – either *piano* or *forte*.

Raising or lowering breath pressure and then adjusting the fingering in order to maintain pitch is the preferred method of achieving dynamic variety on the recorder (Hauwe 1992, 19-32). Dedicated microtonal fingerings are distinct from dynamic fingerings in that breath pressure remains consistent throughout the phrase with no technical concessions to either pitch or dynamic. The advent of dedicated microtonal fingerings coincided with the increased awareness, and gradual introduction into the repertoire, of microtonal intervals from the 1970s onwards. The subsequent realisation of the potential for their use thus became more widely recognised within the performing community. The true distinction between dynamic and microtonal fingerings is the use to which they are put: a fingering is little more than an indication of a technical possibility with musical potential until it has a role conferred upon it. With the technical guidelines for dynamic variety and microtonality now established the player is able to add a further possibility to the performer's list of available expressive devices: variety of tone colour. We can now also discuss both dynamic and microtonal fingerings with regard to consistency or otherwise of tone colour as well as the potential for the development of dedicated tone-colour fingerings.

The purpose of this chapter, therefore, is to determine the extent, if any, of change in tone colour through the use of microtonal fingerings and to increase our understanding of the recorder's potential for tonal variety as an expressive device. The recorder has dynamic and tonal limitations compared to modern orchestral instruments and, therefore, a further aim of this study is to aid the performer in the selection of microtonal and dynamic fingerings with the intention of relating practice to perception by evaluating the subtle changes in tone colour as precisely as possible.

The investigation will analyse variations in tone colour between standard diatonic pitches and adjacent quarter-tone pitches on two modern alto recorders by the application of dedicated microtonal fingerings at a constant *mezzo-forte* dynamic.

The investigation will take the following format: I will observe variations in tone colour of different quarter-tone fingerings over a range of notes on a modern style alto recorder. A second recorder will be used as a control to confirm the generic response of the first instrument. I will analyse the spectra of the recorded tones by comparing the relative perceived loudnesses of the fundamentals with those of their upper partials. This information will then be used to determine the presence or otherwise of variations in tone colour based on the ratios derived from an analysis of the relative strengths of the fundamental and the overtones. The resulting tone-colour ratio will be in the form of a simple ratio F/H, where F = the perceived loudness of the fundamental and H = the perceived loudness of the upper partials combined.

First, let us consider some of the pertinent physical aspects of sound and how the human ear perceives it.

> The human ear is a highly sensitive receptor. It achieves this through a lever system in the middle ear that transfers vibrations from the eardrum to the inner ear. Different frequencies preferentially produce motion of different parts of the basilar membrane[1], so that different fibres of the auditory nerve receive the greatest stimulation. [...]

---

[1] Basilar membrane: that part of the auditory system 'whose vibrations determine what we hear. The *Organ of Corti* rides loosely on the inner part of this membrane and contains more than 20,000 hair cells. Different hairs are disturbed when different parts of the basilar membrane move, and they initiate signals on the individual fibres of the auditory nerve' (Hall 1990, 92).

> Our sound perceptions depend just as much on the action of the brain as they do on the physiology of the inner ear. Unfortunately, our understanding of how the brain transforms and interprets information about sound is still rather rudimentary (Hall 1990, 92-93).

Sound waves are generated by vibratory motion in musical instruments which causes 'a disturbance of the air' in the form 'of longitudinal waves carrying energy outward from their source' (Hall 1990, 5), which are 'transmitted as tiny pressure changes in the air' (Taylor and Campbell). They 'are described in terms of their wavelength and amplitude' (Hall 1990, 14) and from them it is possible to determine the frequency of the sound, measured in hertz (Hz), and perceived loudness, for which I will calculate a value in sones[2]. The sound waves produced by the recorder are complex periodic waves that consist of a number of simple sine waves. The frequencies of the sine waves belong to an harmonic series whose frequency is that of the series fundamental (Campbell and Greated 1987, 16-21).

Each of the individual component sine waves of the complex sound wave can be analysed for amplitude and frequency by a method devised in 1822 by French mathematician Joseph Fourier (1768-1830). The analysis produces the *Fourier components* from which can be derived the frequency and amplitude of each of the component sine waves. The frequencies are whole number multiples of the fundamental frequency and are known as the first, second, third, etc. harmonics. The strengths of the individual harmonics is represented in the form of a *harmonic spectrum*; a set of vertical bars, each labelled according to its harmonic number and with its height proportional to its amplitude (Campbell and Greated 1987, 19-20).

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[2] The standardized unit of perceived loudness. It is discussed in detail on pages 98-103.

The period (P) of a wave ‘is the length of time it takes to complete its basic pattern, and its frequency f = 1/P is how many times per second that whole pattern repeats’ (Hall 1990, 131). Frequency, from which our perception of pitch is derived, is a physical quantity that can accurately be measured; loudness is a psychological quality and difficult to measure. The psychological attribute of a steady sound’s loudness is produced mainly by the physical attribute of intensity, which is a measure of the energy transmitted by the sound wave (Hall 1990, 108). Intensity is measured in decibels[3] (dB), a non-linear scale whereby the decibel is defined as ‘10 × the logarithm of ratio of the energy of [a] sound to the energy of the faintest discernable sound’. The decibel scale does not take account of the fact that the ear is not equally sensitive at all frequencies; it ‘measures the physical signal, not a perceptual experience’ (Tan *et al.* 2010, 35).

‘The human ear responds to pressure variations, as do most microphones’ and accordingly it is ‘preferable to talk about the pressure changes caused by a sound wave rather than the displacement of the air’ (Campbell and Greated 1998, 26). The sound pressure level (SPL) can be used to relate measurable decibel levels to musical dynamic levels. However, the subjective nature of this exercise leads to difficulties of measurement. For example, the recorder’s limited dynamic range, roughly *piano – forte*, affords the player a different perception of dynamic range to that of other instrumentalists and orchestral ensembles and this has led to different interpretations of loudness as shown in Table 5-1, below:

[3] Decibel – a unit for comparing two […] power levels, equal to one tenth of a bel. (Collins English Dictionary 1986)

Table 5-1.

Pressure Level (dB)	**Loudness (Sone)**	**Backus (1970, 83)**	**Campbell & Greated (1987, 107)**	**Hall (1990, 77)**	**Treble Recorder F^2 (von Huene)[4]**
100	64	*fff*	*fff*	*fff*	
90	32	-	*ff*	*ff*	*ff*
80	16	*f*	*f*	*f*	
70	8	-	*mf*	*mf/mp*	*mp*
60	4	*p*	*mp*	*p*	
50	2	-	*p*	*pp*	
40	1	*ppp*	*pp*	*ppp*	
30	0.5	-	*ppp*	-	

This comparative chart reflects more the dynamic range of a symphony orchestra than that of single instruments that 'are in many cases simply incapable of even a 40 dB dynamic range' (Hall 1990, 77).

> Patterson[5] suggests that woodwind players especially may exhibit as little as 10 dB difference between their loudest and softest playing. […] The listener will make some allowance for the instrument's capabilities; whatever greatest extremes are reached probably will be considered at least *pp* and *ff*, even if only 10 or 15 dB apart.
> The player can also convey dynamic impressions in other ways, such as phrasing and articulation or visual clues (Hall 1990, 77).

The highly subjective perception of dynamic is illustrated by the differences between two authoritative texts that were discussed in Chapter 3: Hauwe (1992, 23-30) lists standard fingered chromatic notes providing a full range of dynamic levels using dynamic fingerings of

[4] The loudness of this typical middle-range note is taken from the author's measurements for common *forte* and *piano* fingerings with the microphone places at a distance from the labium of 50cm.
[5] Patterson, Blake, *Scientific American* (November 1974), 78.

ppp – fff, whereas Fischer (1990, 37-43) allocates a *mf* dynamic to standard chromatic fingerings across all registers. Fischer's dynamic range for the recorder covers *ppp – f*.

Perceived Loudness levels vary depending on a combination of both frequency and sound pressure as detected by the ear. The human ear is generally thought to be most sensitive to frequencies in the range 1 – 4 kHz[6] for sound pressure levels in the range 40 – 100 dB and tones that fall within this range are perceived as louder than those of equal intensity that occur in other frequency ranges (Backus 1970, 86). A number of other important physical processes that affect our perception of loudness take place in the middle and inner ear, converting fluctuations in air pressure into 'electrical nerve impulses for processing by the brain. It is the basilar membrane whose vibrations determine what we hear'.

> The organ of corti rides loosely on the inner part of this membrane and contains more than 20,000 hair cells. Different hair cells are disturbed when different parts of the basilar membrane move, and these initiate signals on the individual fibres of the auditory nerve […] before being presented to the auditory cortex […] for conscious interpretation.' (Hall 1990, 92-93).

I will return to the matter of psychoacoustic response to sound a little later. First I will consider ways in which the perceived loudness of tones can be objectively measured. Establishing perceived loudness levels is an important step in this study on the path to determining tone colour.

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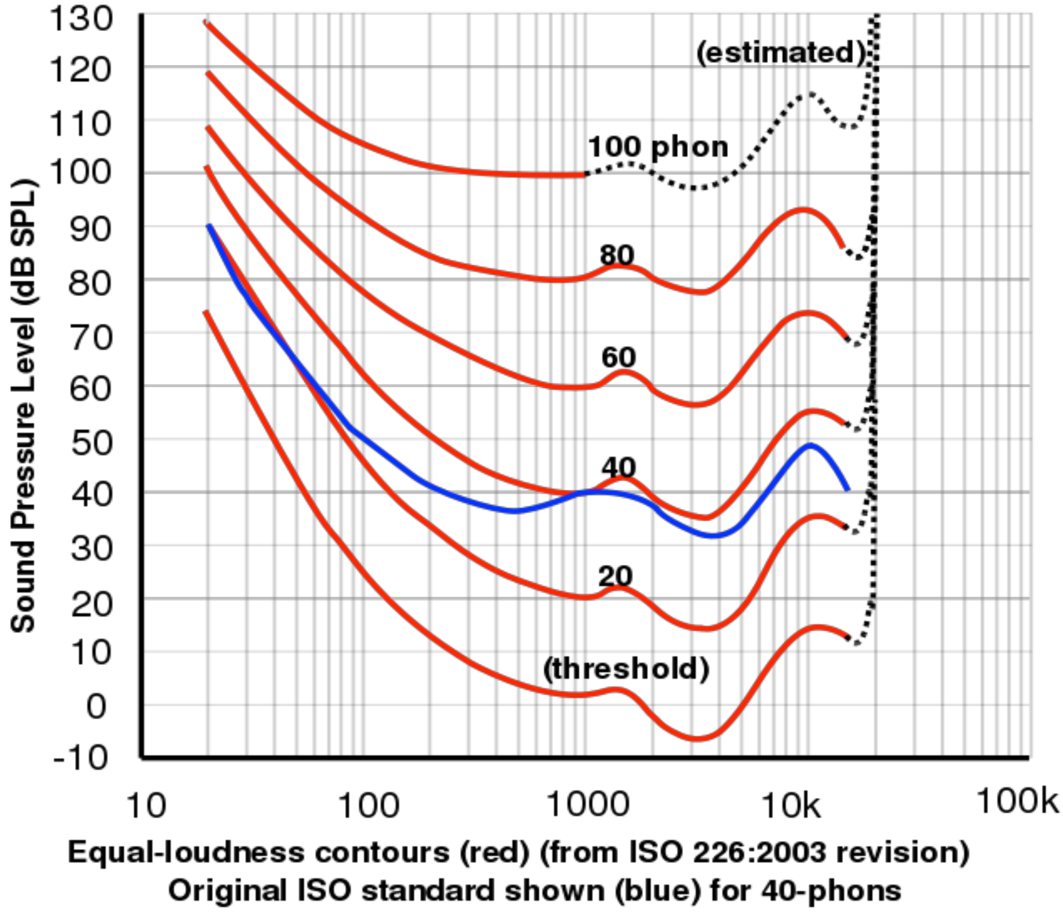
[6] According to Hall, however ' we are most sensitive to sounds with frequencies of approximately 2 to 5 kHz' (Hall 1990, 94).

We can determine perceived loudness in two stages: from frequency and intensity we can read a loudness level in *phons*[7] from a chart of contours of equal loudness first devised by Fletcher and Munson in 1933. The *phon* was first used in 1925/26[8] by the German physicist Heinrich Barkhausen (1881-1956). It is a measurement of perceived equal loudness levels and is the result of studies of thresholds of audibility that has led to the production of contours of equal loudness levels. Equal loudness level contours were devised to show variations in the ear's sensitivity at different frequencies and pressures. Curves of equal loudness were developed by Fletcher and Munson at the Bell Laboratories in 1933 (University of New South Wales), modified by Robinson and Dadson in 1956 and further revised in 2003 by the International Organisation for Standardisation (ISO). For my analysis the frequencies (given in Hz) and sound pressure levels (in decibels) of the notes recorded were noted and a value for phons interpolated using the equal loudness contours of the Fletcher-Munson graph, Figure 5-1 below:

[7] Phon – a unit of loudness level (LL) measured subjectively. A pure tone with an intensity level of 40 dB at a frequency of 1 kHz will, by definition have a loudness level of 40 phon. Likewise, pure tones at frequency 1 kHz with PLs of 20, 40 and 60 dB etc. will have loudness levels of 20, 40, and 60 phons respectively. Readings are adjusted to accommodate the ear's ability to hear at varying frequencies and sound intensity levels (Campbell and Greated 1998)

[8] Different sources give different dates.

Figure 5-1: H. Fletcher and W. A. Munson, Loudness, its definition, measurement and calculation, Journal of the Acoustic Society of America 1933, 5, 82-108



Phons and decibels are defined as having the same value at a frequency of 1000 Hz so at this frequency a tone of SPL 40 dB has a loudness level (LL) of 40 phons and a tone of SPL 60 dB a LL of 60 phons. The contours of the graph show that the loudness level of a pure tone varies according to pitch and also that the ear is particularly sensitive within the common musical dynamic range *ppp* (approximately 40 dB) – *fff* (100 dB). The ear's sensitivity diminishes outside this range. This can be seen from the Fletcher-Munson graph, above, where it can be read that a note of frequency 500 Hz and 62 dB SPL has a loudness level of 60 phons whereas a note of frequency 100 Hz must be played with an SPL of about 78 dB to be perceived as having the same loudness, i.e. 60 phons. Tables 5-2a, 5-2b and 5-2c, below, show this for a range of frequencies. A doubling of sound intensity produces an increase in loudness of 3 dB so the 16 dB increase cited in the example above would require a forty-fold increase in SPL in order to be perceived as having the same loudness[9] (Campbell and Greated 1998, 108). The equal loudness contours of the graph show lines of 'constant loudness level' (*ibid,* 113).

The second of the subjective measures of loudness to be considered is the *sone*. The sone scale of perceived comparative loudness allows comparison of the relative loudness of two pure (sinusoidal) tones (Stevens 1936, 405-416 and Stevens 1955, 815-829). It is, therefore, an estimate of how loud an auditor might perceive sounds relative to one another within a complex sound. The development of the sone as a measure of perceived loudness is the result of

> a large number of laboratory tests in which people were asked to adjust the intensity of one pure tone until they judged it to be "half the loudness" of another tone of the same pitch and fixed intensity. These tests showed that, despite large individual variations, there seemed to be a consensus that the loudness of a pure tone was halved when its loudness level dropped by 10 phons (Stevens 1936, 1955; quoted in Campbell and Greated 1998, 115).

'By convention, a loudness of 1 sone is defined to be that of a 1000 Hz sine wave at 40 dB sound level and all others are compared to that' (Hall 1990, 100-101). A tone perceived as twice as loud has a loudness of 2 sones and is equivalent to 50 phons. From phons the corresponding loudness in sones is calculated to produce a loudness spectrum in sones (Campbell and Greated 1998, 148). The relationship between loudness level in phons (Lp) and loudness in sones (Ls) is defined as:

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[9] $10 \log_{10}(2) = 10 \times 0.3 = 3$dB; $10 \log_{10}(40) = 10 \times 1.60 = 16$dB (Campbell and Greated 1998, 108).

$Ls = 2^{(Lp - 40)/10}$ (Loy 2006, 170) (Formula 1)

Table 5-2a shows the relationship between decibels, phons and sones for a tone of frequency 1000 Hz, 500 Hz (Table 5-2b) and 100 Hz (Table 5-2c):

Table 5-2a: 1000 Hz

Sound Pressure Level (dB)	Phons (from the chart of equal loudness contours)	Sones
100	100	64
90	90	32
80	80	16
70	70	8
60	60	4
50	50	2
40	40	1
30	30	0.5

Table 5-2b: 500 Hz

Sound Pressure Level (dB)	Phons (from the chart of equal loudness contours)	Sones
100	100	64
90	90	32
81	80	16
71	70	8
62	60	4
52	50	2
42	40	1
33	30	0.5

Table 5-2c: 100 Hz

Sound Pressure Level (dB)	Phons (from the chart of equal loudness contours)	Sones
106	100	64
98	90	32
92	80	16
85	70	8
78	60	4
70	50	2
63	40	1
54	30	0.5

Table 5-2a shows that every 10 dB increase in sound pressure level ('that is, every multiplication of intensity by 10') results in a doubling of the loudness in sones. This accounts for the phenomenon whereby, for example, 'a group of 10 people all singing the same note will sound about twice as loud as a soloist, and a chorus of 100', (producing a sound intensity of 60 dB), 'twice again as loud; that is, four times as loud as the soloist' (Hall 1990, 101). The sone scale of loudness, therefore, is linear, and can be used for describing what is otherwise a subjective and difficult characteristic quality of sound, and it becomes a very useful tool for describing numerically the loudness of individual sinusoidal elements. Because of its linear nature, loudnesses in sones can be added together to give an overall loudness for the tone (Benade 1976, 235). Furthermore, the sone has become widely accepted as a subjective measure of loudness (Benade 1976, 231-233; Backus 1970, 89; Hall 1990, 103-107; Campbell and Greated 1998, 115): for example, a study in which two methods of calculating values for the spectral centroid in order to determine perceived timbral brightness were compared for two loudness levels – loud and soft. The loudness levels in the results were recorded in sones (Schubert and Wolfe 2006, 820).

Hall shows (see page 96, above), that our perception of the loudness of complex sounds depends on disturbances to the tiny hair cells on the basilar membrane. Following Benade, I also noted on page 105 that the perceived loudness levels of individual partials can be added together to give a total loudness. However, before we can proceed we must consider the effects of two phenomena that can influence our perception of loudness: masking and critical bands.

> If [two sinusoids are] close together in frequency, they both disturb more or less the same region of the basilar membrane; but if far apart they stimulate two regions independently – that is, there is little overlap of the two response curves. The range of frequencies whose response curves overlap is called a critical band' (Hall 1990, 282-283).

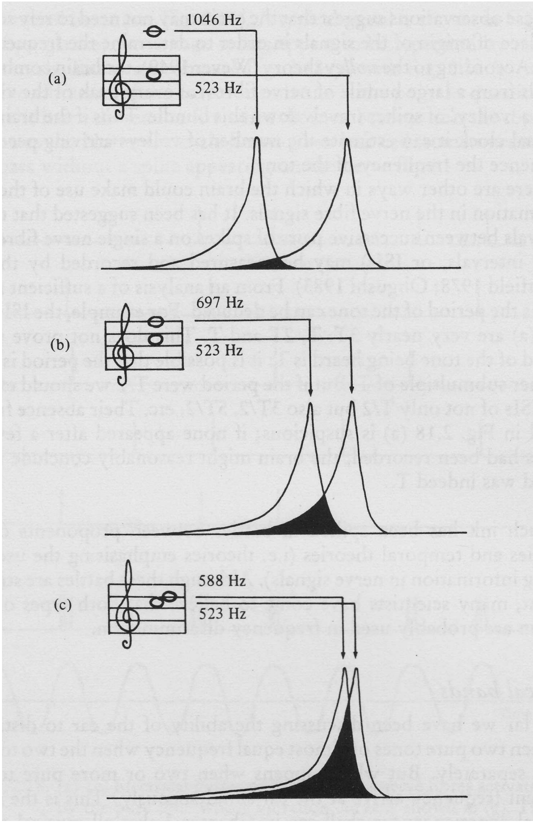
It is critical to my argument that the very best possible estimate of perceived loudness is obtained for use in the calculation of tone colour. I will consider at some length the relevance of including critical bands and masking in my calculations to determine perceived loudness. The conclusion of all this may be that masking need not be taken into consideration for the first 5 or 6 partials. Furthermore, for the upper partials I could follow an ISO recommendation. However, I think it important to consider all the possibilities and show that difficult questions regarding critical bands and masking have been considered and answered in full.

The extent of the influence of critical band width and the effects of masking must now be incorporated into my calculations in order to estimate as accurately as possible the perceived loudness of a tone. I will consider these in some detail, as an accurate as possible estimate of the perceived loudness of different parts of the spectrum will be important to my assessment of tone colour.

> Critical bands represent regions within which neighbouring basilar membrane fibres have sufficiently similar motions that they do not send independent information streams to the brain. They severely limit our ability to discriminate between signals whose frequencies are within approximately 15% of one another, including neighbouring harmonics above roughly the seventh (Hall 1990, 394).

The mechanism, known as masking, by which critical bands affect our ability to distinguish between two simultaneously heard pure tones of almost equal frequency, is demonstrated by Campbell and Greated through comparison of three intervals; an octave, a fourth and a second (see Figure 5-2, below). The amplitude envelopes of each pair of tones (for simplicity, only the upper halves of the envelopes are drawn) are shown with the overlapping portions of each pair shaded. The shaded area is small where the tones are an octave apart. 'This means that the excitation of the hair cells [on the basilar membrane] due to one tone will be almost unaffected by the presence of the other tone. The situation changes when the frequency separation of the tones is reduced; where the interval is reduced to a fourth, the area of overlap has grown. When the separation is reduced to a tone the amplitude envelopes overlap almost completely, implying a strong interaction between the two sounds' see Figure 5-2.

Figure 5-2, Showing Overlap of Amplitude Envelopes
From: Campbell and Greated *The Musician's Guide to Acoustics* 1998, 58.



Campbell and Greated proposed a method for determining critical band width based on finding the centre frequency between two tones, reading a critical band width for that frequency from a chart and then calculating whether the frequency separation of the two tones is more or less than the critical band width.

From Figure 5-2, above, for two tones of frequencies 523 Hz and 1046 Hz the centre frequency is 1/2(523 + 1046) = 784.5 Hz and the frequency separation is 1046 − 523 = 523 Hz. From curve (a) in Figure 5-3, below, we read that the critical band width for a tone of 784.5 Hz is about 150 Hz. The separation, 523 Hz, is much greater than the critical band width and the two tones 'are thus well outside a critical band' (Campbell and

Greated 1998, 60). From Figure 5-2(c) for two tones forming the interval of a second, the calculation proceeds as follows:

For two tones of frequency 588 Hz and 523 Hz

Centre frequency = 1/2 × (588 + 523) = 555.5 Hz

Frequency separation = 588 – 523 = 65 Hz

From Figure 5-3(a) the critical band width of the central frequency of 555.5 Hz = ca. 125 Hz

The critical band width is much greater than the frequency separation (125 > 65) indicating that their frequencies lie within one critical band, thus firing almost the same set of hair cells on the basilar membrane, resulting in 'strong interaction between the two sounds' (Campbell and Greated 1998, 58-59). See Figure 5-3, below:

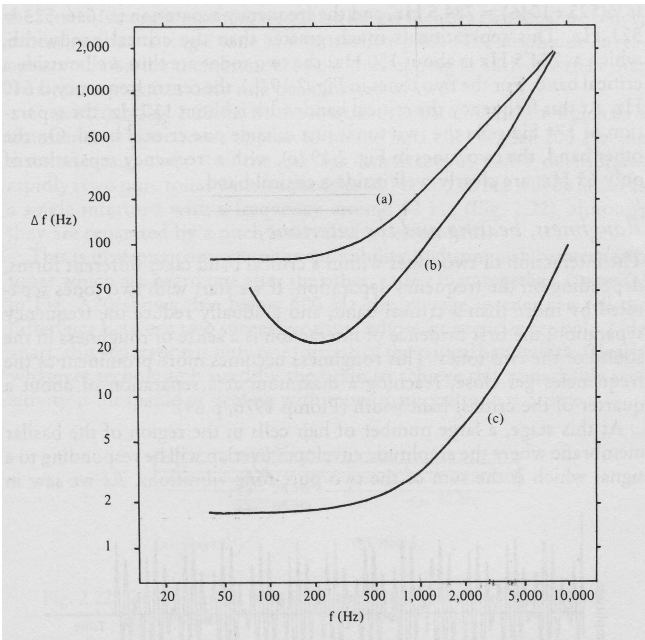


Figure 5-3 (a) Critical bandwidth. From Zwicker et al. (1957), p.556, Figure12
(b) Minimum Frequency separation for which two simultaneous pure tones can still be distinguished. From Plomp (1964), p.1634, Fig. 10
(c) Minimum detectable sudden change in the frequency of a pure tone. Calculated from Eqn. 4 in Nelson et al. (1983), for SL = 80 dB.
From: Campbell and Greated, The Musician's Guide to Acoustics 1998, 59

Campbell and Greated later show that the width of the critical band can be indicated by a vertical bar (Figure 5-4). 'Up to the 6th harmonic, the bars do not overlap; each harmonic is in a separate critical band, and should be distinguishable from its neighbours. Above the 6th harmonic the separation between adjacent harmonics is less than a minor third, which is the critical bandwidth in this region of pitch; the bars overlap, and the corresponding pitches become difficult to distinguish.'

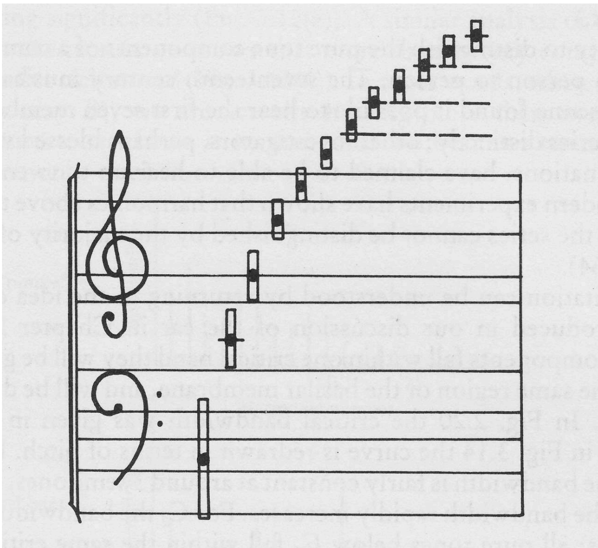


Figure 5-4. The first twelve harmonics of C_3, shown as black circles on the stretched stave.
The width of the critical band around each harmonic is indicated by a vertical bar.
From: The Musician's Guide to Acoustics, Campbell and Greated 1998, 84

Whilst I have shown that Hall's and Campbell and Greated's estimates of critical bandwidth are largely in agreement (see pages 103 – 106), research by Moore (2002), whose work with interference effects on the basilar membrane develops the idea further, has resulted in the production of a formula for calculating what he calls the *equivalent rectangular bandwidth* (ERB). 'The ERB increases with increasing centre frequency [and] in humans, […] can be estimated from masking experiments. Its value in Hz, for normally hearing people, is given approximately by the following equation: ERB = $24.7(4.37F + 1)$, where F is the centre frequency in kHz. For centre frequencies above 2 kHz, the ERB is *ca.* 12% of the centre frequency' (Moore 2002, 839-840). From Campbell and Greated's example, above, where a centre frequency of 784.5 Hz has a critical band width of approximately 150 Hz (see page 105), Moore's formula estimates a critical band width of:

$$\begin{aligned} \text{ERB} &= 24.7(4.37 \times 0.7845 + 1) \\ &= 24.7(4.43) \\ &= 109.4 \text{ Hz} \end{aligned}$$

Moore's estimate of 12% for frequencies above 2 kHz also suggests a narrower bandwidth of 390 Hz, for a centre frequency of 3250 Hz (that is the centre frequency between the 6th and 7th partials of a 500 Hz fundamental) compared to an estimate based on Hall's chart (Hall 1990, 383) of approximately 500 Hz and even more so set against the reading of approximately 700 Hz from Campbell and Greated's chart (Fig. 5-3, above).

A comparison between Hall's and Campbell and Greated's method of calculating critical band width shows insignificant differences, Campbell and Greated's method producing results which err slightly in favour of assuming interference, especially at higher frequencies. Moore's results suggest a critical band width with much less potential for masking. However, it is worth noting again that, as my calculations on pages 108 and 109 indicate, it is not just the critical bandwidth but the relationship between the critical band width and the frequency separation of the two intervals that determines whether or not masking will occur. The number of upper partials to be included in any calculations for determining perceived loudness on the recorder will be limited to the fundamental plus those higher partials that fall outside a critical band; 'for fundamental frequencies up to 500 Hz, the third, fourth and fifth harmonics when present are especially important. They are often even more important than the fundamental itself, which can be completely absent without changing the perceived pitch' (Hall 1990, 394). From my research, it is likely, therefore, that there will be a significant masking effect from the 6th partial upwards and this follows limits suggested by Campbell and Greated (1998, 84).

Benade has undertaken experiments comparing sounds made up of harmonically related noise partials[10] with sounds made up of harmonically related sinusoidal components. The results indicate that the masking in the critical bands of the noise partials reduces the difference in loudness between the two sounds to just 7 per cent, where the noise partials are the louder of the two. This loudness difference is due to the effects of masking, and furthermore, these effects 'are drastically reduced when one listens to them in a room' but 'narrow-band noise signals mask each other in very much the same way whether we listen to them via earphones or in a room' (Benade 1976, 242-244). Furthermore, Benade endorses the International Organisation for Standardisation's (ISO) Recommendation 532, which states that 'the critical bandwidths for sounds above 280 Hz are conventionalised as being 1/3 of an octave (4 semitones, an interval of a major third)' (*ibid.* 237). Benade suggests that when listening in a room, 'we are led to consider the following formula for the total loudness S_{tsp} in sones produced by a sound constructed of sinusoidal partials having loudnesses S_1, S_2, S_3, ….: $S_{tsp} = S_1 + S_2 + S_3 + \ldots\ldots$ sones'. This indicates that masking need, therefore, not be taken into consideration when assessing the perceived loudness of a tone heard in a room (*ibid.* 242).

It is now necessary to consider how best to calculate the tone colour variations between standard diatonic and microtonal fingerings on the recorder. This study will focus on differentiating between instrumental sounds whose tone colours are likely at best to be

[10] According to Benade's definition these are 'sets of narrow-band noises whose centre frequencies are harmonically related'.

perceived as subtle by other than the most experienced auditor (see pages 97-99). I will attempt to develop a system for accurately identifying tone colour that can easily be related to perception and that is consistent, logical, and clear. This will be preceded by a discussion of attempts to identify the elements of a sound that determine its tone colour. We will discover that there is a small amount of agreement and much discussion about the extent of the role of each element of the tone. It will also be seen that much of the emphasis of research into instrumental timbre is focussed on identifying differences between families of instruments. My research on the other hand relates to the subtle differences between instruments belonging to the same family – the recorder - and will, therefore, need to be able to identify differences of a very subtle nature.

Campbell and Greated (1998), Hall (1990), Backus (1970), Tan *et al* (2010), and McAdams (2001) agree that the three characteristics of a sound that enable us to identify it are loudness, pitch and tone colour, or timbre. Loudness and pitch are one-dimensional elements but tone colour and timbre are complex and multi-dimensional. The factors in determining timbre, for example, are numerous and varied: Carl E. Seashore, writing in 1936, defined the three elements that determine the characteristic forms of timbre: '(1) the height of fundamental pitch, (2) the relative loudness, and (3) the dominant regions in which the overtones seem to cluster. Such regions are called formants. The number and location of these formants distinguish one vowel from another' (Seashore 1936, 26).

Backus asserts that 'it is the number, frequency and amplitude of the individual partial tones that determine the quality of a given complex tone' (Bachus 1970, 95). The periodic nature of steady tone notes is responsible for producing their characteristic wave form which in turn is a manifestation of the pattern of partials that make up the tone. However, instruments are not consistent throughout their range; ‘the spectra of tones in the high ranges will be quite different to those in the low, and even adjacent tones in the scale of the instrument will frequently show considerable differences in harmonic structure’ (*ibid*. 102). Despite this, we can identify which instrument is producing the tones. This is because ‘there are other aspects of the tone as important as the spectrum in identifying the instrument producing it’ (*ibid.* 102); the initial transient, the decay transient, and the presence of vibrato are briefly discussed in this context by Backus. He also identifies the presence of formants in a tone’s structure as possibly playing a role in identifying the tonal characteristics of individual instruments. A formant is ‘a region or regions in which harmonics are prominent, regardless of the frequency of the fundamental.’ […] ‘According to this theory, the number and positions of the formants determine the tone quality of an instrument. This is true for the human voice’ (*ibid.* 103) but ‘for musical instruments the situation is not clear’. ‘There seems to be no agreement as to whether or not formants exist in most musical instruments’[11] (*ibid.* 104). Hall suggests that ‘it is at least theoretically possible that we may someday succeed in describing four specific aspects of timbre (or three or five – it is not all that certain)’ (Hall, 1990, 392). Campbell and Greated acknowledge that the initial attack is ‘an important feature of an instrument’s characteristic sound’ (Campbell and Greated, 1998 142), and continue by identifying wave form and harmonic spectra as equally important contributory elements. Tan *et al* (2010, 13) concur: in complex tones ‘the interplay amongst their component frequencies leads to a quality of sound referred to as timbre’.

A method often used for determining tonal brightness involves calculating the spectral centroid. It has been used to determine the centre of mass of the spectrum (i.e. the midpoint of the spectral energy distribution), and has also been used as an aid to ‘determining degrees of

[11] My investigation indicates a complete absence of formants in the recorder’s sound structure.

blend' in orchestration (Sandell 1995, 209) or to give an indication of the 'brightness' of the sound (McAdams 2001, 165). The results are often used to synthetically recreate original instrumental sounds. Such syntheses are undertaken by investigating the harmonic spectra of different tones and, for example, comparing their spectral envelopes[12], which provide a pictorial description of the sound. This method of identifying timbral differences is limited to comparison between families of instruments because, and this is particularly true of the recorder, the method of tone production is always the same, or at least very similar, across the range of the instrument. An advantage of using the spectral centroid is that it is represented by a numerical value. However, focussing on the brightness of a tone may present difficulties for an instrument like the recorder whose tone, due to the relative strength of its fundamental tone compared to the upper partials is not, as I will show, characteristically bright. Perception of brightness is at least partially dependent on pitch – higher pitched instruments sound brighter. When comparing the recorder's low register with high register notes anomalies may arise due to the greater presence of strong upper partials in low register notes, thus producing figures that indicate a bright tone colour, and the absence of upper partials in the high register, producing figures indicating a relatively low tonal brightness (Schubert and Wolfe 2006, 820). Perception of brightness, therefore, would, in the case of the recorder, seem to be an unreliable correlation to tone colour.

Campbell and Greated also discuss the role of the psychological perception of sound in terms of verbal descriptions which 'relate to different aspects of the timbre: we might have a "dark, smooth" sound, a "dark, rough" sound, a "bright, smooth" sound, or a "bright, rough" sound' (Campbell and Greated 1998, 149). They acknowledge the possibility of up to 28 pairs of different aspects of timbre but list just twelve and then refer to 'sophisticated statistical

[12] Spectrum Envelope: A drawn line 'connecting the upper ends of the vertical bars representing harmonic amplitudes' (Campbell and Greated 1998, 148)

methods [which] have suggested that 3 or 4 scales should be enough to specify most steady-state musical timbres with a fair degree of accuracy' (*ibid.* 149). They also make reference to a study by Bismarck (1974) that indicated the significance participants placed on the dull-sharp scale.

The tristimulus diagram devised by Campbell and Greated for measuring timbre is an acknowledgement of the multi-dimensionality of this element of sound perception. They took as their model the ability of the eye to define colour.

> The eye contains three different types of cone receptors, each type sensitive to a different part of the visible spectrum: one set responds predominantly to red light, another responds to green, while a third responds to blue. When light corresponding to a mixture of different wavelengths is received by the eye, the brain is able to judge the spectral distribution of the light by comparing the signals from the three types of receptor. A colour can therefore be defined by three numbers, representing the relative strengths of the components in the red, green and blue regions respectively. The success of this analysis is confirmed by colour television, in which red, green, and blue pictures are presented together on the screen, and accepted as full colour by the brain (Campbell and Greated 1998, 150).

The authors refer to work undertaken by Pollard and Jansson (1982) which suggests that the properties 'of a spectrum envelope can likewise be reduced to three numbers representing the effective loudness of three regions of the spectrum' (*ibid*. 150). These regions are first, the fundamental, the second region consists of partials 2, 3 and 4, and finally the third region, the remaining higher partials. The loudness, which must take account of masking in the second and third regions, is calculated in sones, which in harmonic complex tones are, as I have discussed on page 102, above, summative. The tristimulus diagram measures timbre by calculating the relationship between the upper and lower partials of a steady-state sound and placing the quotient of the two terms on a two-dimensional triangle. The tristimulus diagram shows differences between the timbral qualities of different families of instruments – the tonal differences between different fingerings played on the recorder, however, will be found to be too subtle for this method. The two dimensions suggested by the authors are the medium and higher partials but, as we will see, the structure of the recorder's sound is particular in that it consists of an overwhelmingly strong fundamental plus a series of upper partials of variable but comparatively weak strength. It is therefore appropriate that the assessment of tone colour on the recorder should include the loudness of the fundamental.

McAdams undertook a sophisticated study employing multidimensional scaling techniques 'to derive a time-space model to determine the components of the mental representation of musical timbre'. He identified a three-dimensional model based on attack time, spectral centroid, and spectral irregularity (McAdams 1999, 85-102).

The knowledge gained in pursuit of an understanding of the workings of the human perception of loudness will now be used in the practical pursuit of a method for determining the tone colour of a selection of steady state tones on the recorder. I undertook in Chapter 3 an investigation into research specific to the recorder that has been published in this field and discovered the widespread reliance on subjective description and confusion about the tonal consequences of different fingerings. It is this aspect of technique that I hope now to clarify.

Brightness and loudness are two characteristics of tone quality that, as I have shown, are difficult to quantify. However, much work has been done in the field of describing loudness in objective terms and particularly in the field of determining perceived loudness. With this in mind, and as aural perception is highly subjective, a number of researchers have found it useful to convert the purely objective decibel scale into a measure more closely related to our perception of loudness. For it is indeed the *loudness* of the tones selected that will be the focus of attention here and in particular an analysis will be undertaken of the relationship of the constituent elements of the sounds – the partials – to one another. As has been discussed (see pages 112-114), it is this relationship that makes a significant contribution to defining the tonal characteristics of the sound. For this reason a process is undertaken in which the raw data retrieved from the Sound Description Interchange Format (SDIF, see page 123) is first analysed to produce an harmonic spectrum, and then converted to measurements more closely aligned to our subjective perception of the loudness of the individual partials.

The loudness in sones for individual partials can be added together to give a value for the perceived loudness for the tone as a whole as well as a value for the total perceived loudness of the upper partials, thus allowing a comparison with the perceived loudness of the fundamental (Backus 1970, 88-89). It is this comparison that produces a ratio that I will use to describe the tone colour of the note. A fully worked example of my method can be found in Appendix 2. The bar chart, Figure 5-6, below, shows a reading in sones for each of the eleven partials analysed of an f^2, using fingering 02. This gives as realistic as possible an indication of the quality of sound actually perceived. The loudness of the fundamental can be compared to the loudness of the other partials combined, and a tone colour ratio subsequently calculated.

Figure 5-5. Bar chart showing the spectrum for f^2.

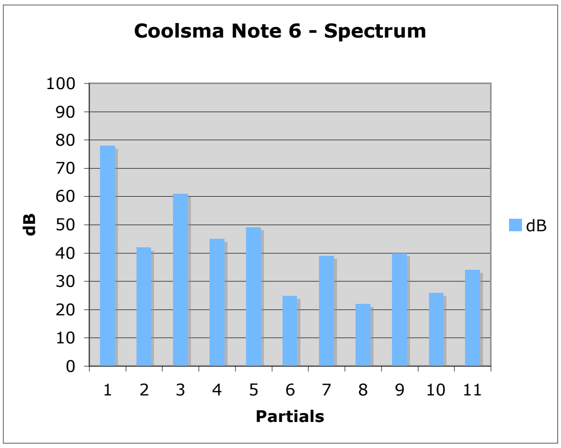
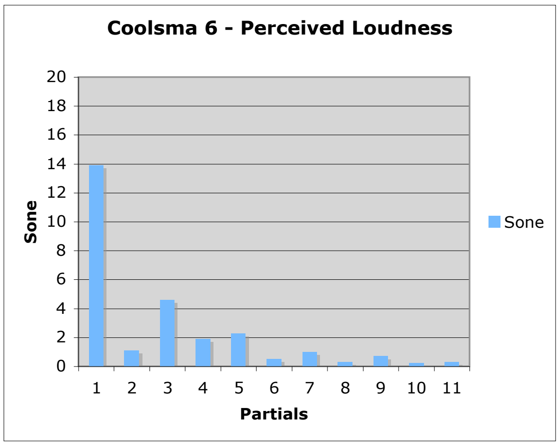


Figure 5-6. Bar chart showing the perceived loudness, in sones, of each of the partials for f^2.



The measurable partials seen in the spectrum, Figure 5-5 above, are clearly not present to the same extent in Figure 5-6, which more closely reflects the typical auditor's perception of the sound. As can be observed, the upper partials disappear as they increasingly fall outside the normal hearing range whereas the lower partials, particularly the fundamental, feature prominently.

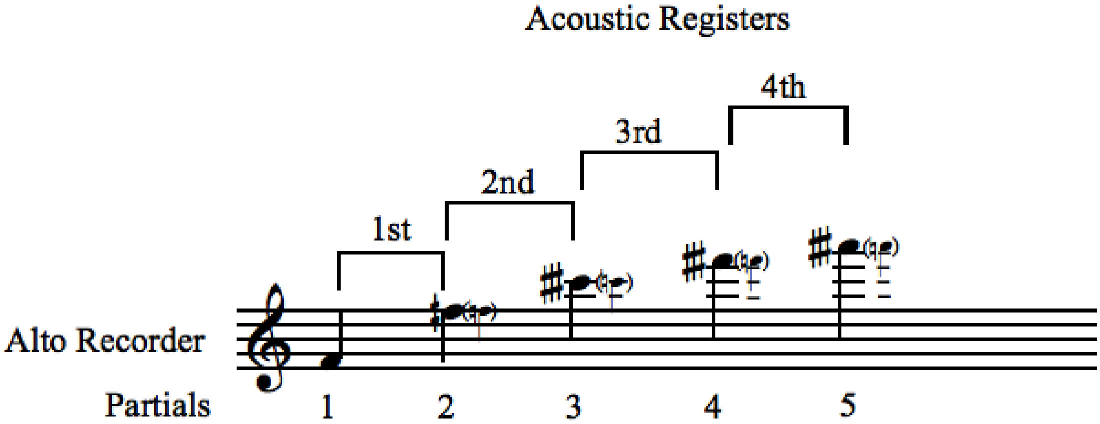
For this study a recording was made in an acoustically deadened studio in the music department at the Broadstairs Campus of Canterbury Christ Church University. The sample rate was 44.1 kHz. Two similar microphones were placed at 0° (12 o'clock) at varying distances from the player: the primary microphone was a Rode model NTK placed at 500mm from the sound source. The close proximity of the microphone to the sound source is consistent with Benade's assertion that an arrangement whereby the microphone is 'placed next to the first open tone hole' […] 'allows us to record a sound similar to the one our hearing mechanism puts together as we move around in a room' (Benade 1976, 244). The Frequency Response Graph for this microphone can be found in Appendix 1. A second microphone, an AKG Perception model 170, was placed at a distance of 1000mm from the sound source and was used as a control to ensure consistency of response. The main instrument used was a modern style handmade Coolsma alto in European boxwood pitched at A=442 which is a professional level instrument. A second instrument, a Yamaha conservatoire standard alto, also in European boxwood in a modern style, was used as a control to ensure consistency of response to the tests. Appendix 2 provides details of the methods used to calculate the perceived loudness and tone colour ratios of the notes tested. A comparison between the two instruments can be found in Appendices 3 and 4. Samples of notes across the instruments' range were recorded: low, middle and high registers (see pages 120-121).

Nineteen steady-state tones were recorded in order to focus on the intrinsic qualities of the tone, independent of initial transients, vibrato, or other factors added by the player. Each note was played three times in order to verify that there were no chance variations in performance and that the tones measured were stable and well-defined (Benade 1976, 245). The instruments were warmed for a few minutes before playing and then each note was recorded. Diatonic pitches with quarter-tone steps above and below, based on variations of basic and dynamic fingerings, were used to record the effect on the tone colour of adding or subtracting fingers.

Recordings were made of a selection of notes across the instrument's range and were played with breath pressure appropriate to the production of a steady, clean, musical tone. A number of writers, including Martin, Mühle and Rijn, have used blowing or wind machines to establish the differences in breath pressure required to produce in-tune notes at each of the registers and to ensure consistency of blowing. Indeed, Dutch recorder maker Jan Bouterse has suggested that the wind machine produces results in which 'the differences between instruments (for instance tenor recorders) became apparent' whereas 'playing the instruments 'on the mouth' gave hardly (any) variations in the results' (Bouterse 2012). This suggests that the player makes small adjustments to breath pressure to compensate for differences in dynamic and tone quality. Such outcomes are of little interest to this paper, which is not concerned with testing instruments. My concern is with performance practice and I will therefore focus less on the mechanical aspects of tone production and more on the outcome in terms of expression and the player's response to the demands of the music.

Acoustically, the recorder overblows to produce harmonic intervals that tend to be too sharp. However, the intervals it does produce give the instrument its range of four registers, extending to g^3, although most instruments will play a fourth higher than this – up to c^3, often extending to d^3 and even e^3. In Figure 5-7, true harmonic partials are notated in brackets:

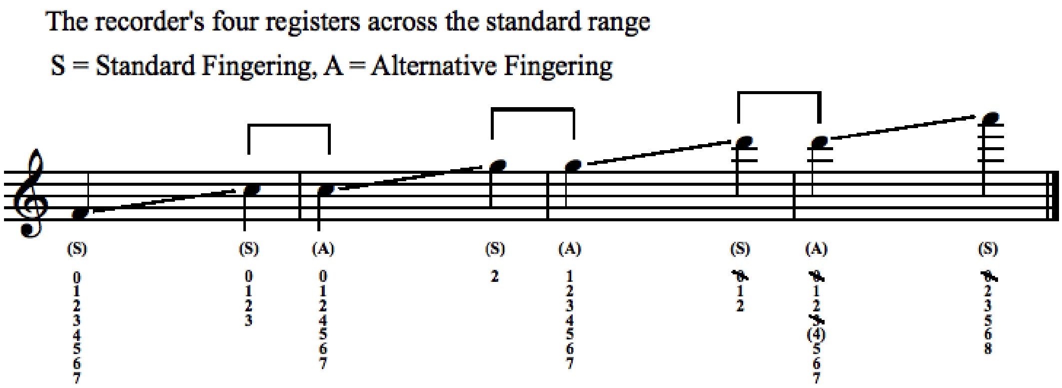
Figure 5-7



By using this system to research the recorder's registers it can be observed that the fingerings, all based on that necessary for producing the instrument's lowest note, rely on using delicately judged breath pressures particular to each note, making the use of consistent and steadily increasing breath pressure across the range impractical. Pitching the notes accurately using this method creates an unnecessary difficulty. A more practical idea would be to use a system for determining microtonal fingerings that readily relates to standard alternative fingerings, where the determination of fingerings follows a logical pattern and where breath pressure is not unnecessarily harsh and the high notes are easy to produce.

From Figure 5-8 below we see that the recorder's registers can also be determined by fingering patterns. The system used to develop quarter-tone fingerings for the *Quarter-Tone Recorder Manual* (Bennetts et al, 1998 VII) and which can be used as the basis for the further development of microtonal fingerings is this:

Figure 5-8



This also reveals the division of the recorder's range into four registers or modes: each register, except the first, is defined by the use of an alternative fingering as a starting point in which all the fingers of the right hand are covering their finger-holes – the first octave begins on the lowest note, f^1, for which all holes are fully covered. These fingers then slide off the recorder one-by-one in a glissando-like manner causing the pitch to rise until only the thumb and three left hand fingers remain (0123 = c^2 – this and other cross-over notes are indicated by the square bracket above the staff in the illustration above) and produce a strong chromatic pitch (standard fingering), at which point the next register is engaged by the use, again, of a dynamic fingering that uses all of the right hand fingers which are, once more, subtracted glissando-like until the next register is reached and so on. In this way the foundation of every possible dynamic and microtonal fingering can easily be established. Based on this approach to determining fingerings I selected notes from each of the four registers shown in Figure 5-8, above, in order to give a representation of the potential for tonal variety with each of the selected microtonal fingerings but restricted myself to a common and easily obtainable selection of notes with a known potential for tonal variety of dynamic fingerings. These can be seen in Appendix 1, page 329.

A software package[13] was used to undertake a Fast Fourier Transform (FFT) analysis. This produces a sonogram, which gives a visual display of the energy distribution, and a *Sound Description Interchange Format* (SDIF) analysis that outputs data for time, frequency, amplitude and phase. The sonogram was used to identify a suitable point in the sound sample at which the analysis could be made. This was done by aurally and visually inspecting the sonogram for representative tone quality and stability and then by identifying the same point in time in the SDIF output for details of frequency and amplitude. From this information readings were calculated for each of the partials present in the sound using a formula that describes the sound pressure levels in decibels (dB):

[13] AudioSculpt, from IRCAM (vers 3.0b9) using the following settings:
Analysis Type: FFT
FFT Size: 1 x 2084 Bins
adaptive oversampling: 8x
Sound Thresholds: 0dB - -96dB
Window Size: 2048
Samples: 0.04644 sec.
Window Type: Blackman

Sound Pressure Level$_{dB}$ (SPL) = $20 \times \log_{10} (A_1/A_0)$ (Campbell and Greated 1998, 110)

(Formula 2)

Where SPL$_{dB}$ is given in decibels (dB)

A_1 = the amplitude of the partial in newtons per metre squared (N/m^2)

$A_0 = 0.00002\ N/m^2$ = the lower threshold of hearing

The results of my analysis are presented in three forms: a harmonic spectrum, in the form of a bar chart; a bar chart showing perceived relative loudness (sones) of the individual partials; a collated table recording fingerings, dynamic, sones and tone colour ratio. These can be found in Appendices 3 and 4, from page 329.

The harmonic spectrum shows the SPLs (dB) for each of the first eleven partials[14], see Figure 5-9, below. This is a measurable snapshot of the sound at a given point in time and is frequently used for the analysis of timbral differences between instrumental and vocal sounds, and for the synthesis of computer generated musical sounds. As noted above, the decibel scale is an objective measurement and does not take into account the sensitivity of the human ear (see page 98). For that reason the harmonic spectrum, whilst presenting a useful visual guide to the structure of the sound, does not give an accurate representation of the relative strengths of the different elements of the sound as perceived by the auditor.

[14] At three octaves and a minor third above the fundamental, say f^1 on an alto recorder, this partial has a frequency of approximately 3850 Hz and at such low SPLs and with masking from lower, stronger partials, perceived loudness levels of 1 sone or less, it is in practice inaudible and was therefore set as the upper limit for this analysis.

Figure 5-9, showing the sprectum for the note f^2, fingered 02

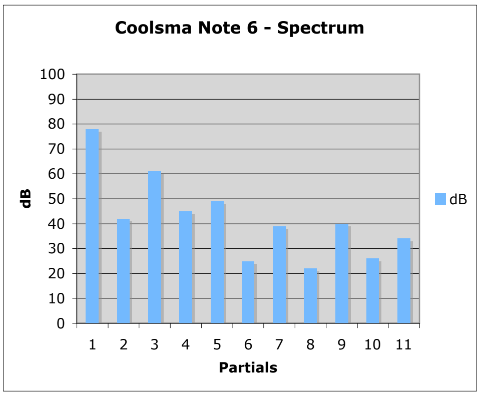
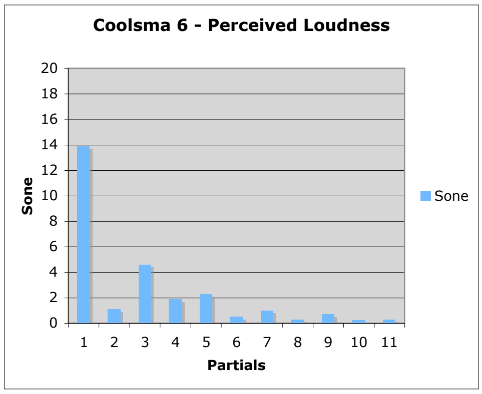


Figure 5-10, showing the chart of perceived loundess in sones for the first 11 partials of f^2



With information for sound pressure levels (decibels), equal loudness level curves (measured in phons), and perceived comparative loudness (sones), it is possible firstly to produce a harmonic spectrum of the sound showing all partials up to the 11th and, subsequently, a bar chart showing the perceived loudness in sones of each of the partials, see Figure 5-10, above. The effects of masking will be taken into consideration too, though the extent to which upper partials are masked will depend on the frequency of the fundamental and the extent to which upper partials are present. The spectra will be assessed on an individual basis. Finally, the relationship between the loudness of the fundamental and all the upper partials together can be calculated, giving an indication of the variations in tone colour between different tones, fingerings and dynamics.

The effects of masking must now be taken into consideration. I have shown that there is little real agreement between authors regarding the extent to which the effects of masking influence the overall loudness of the tone and indeed exactly which of the sinusoidal tones are the maskers and which are the masked. All writers agree that sones are additive and that no masking occurs in the region of the first five or six partials (Benade 1976, 548). For the upper partials I will adopt the ISO recommendation that a critical band width of four semitones applies to all partials from the sixth upwards, that it is difficult to distinguish between partials in this region and the effects of masking will therefore be present. The criteria that I will apply to determine the loudness of each tone are as follows: first, the loudness in sones of each of the first five upper partials[15] will, following Benade and Campbell and Greated, see pages 107-109, be added together to give a total loudness of the sound for that region. Second, the recorder's tone characteristically displays weak even partials and stronger odd partials. Where any partial from the sixth and above is weaker than the nearest lower partial it will inevitably be masked by that partial. If a partial has a loudness substantially less than 1 sone it will be ignored, as loudnesses of this level are, in a practical situation, inaudible.

The tone colour will be calculated on the basis of the relationship of the calculated loudness of partials two and above (H) to the loudness of the fundamental (F). An analysis of the charts in Appendix 5 reveals that the loudness of the upper partials across the range increases at a flatter rate than does the overall loudness. The upper partials are also more consistent, with fewer deviations from the steady rate of increase than can be seen in the increase in overall loudness across the range (see Figures. 5-11a, 5-11b, 5-11c). The relationships between the upper partials and the fundamental are therefore indicative of the variations in tone colour across the range of notes tested. The charts show that the upper partials play a greater role in the sound of the lower register notes than in the high register notes, where the fundamental is generally dominant. The ratio F/H represents the tone colour ratio for each note[16]. This ratio will be calculated on the same basis for each note tested so a direct comparison of the tone colours of each note will be possible.

[15] The recorder's spectrum typically indicates strong odd partials and relatively weak even partials. For this reason the sixth partial will inevitably be masked by the, often, substantially stronger fifth and lower partials and for the purposes of this research will be relegated to the upper partials.
[16] See page 93.

Figure 5-11a

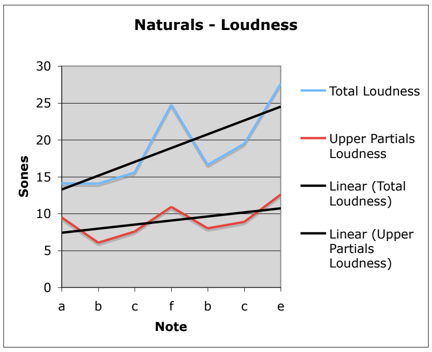


Figure 5-11b

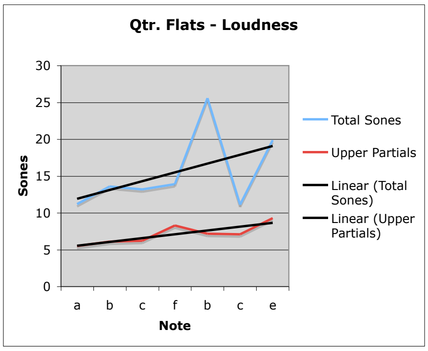
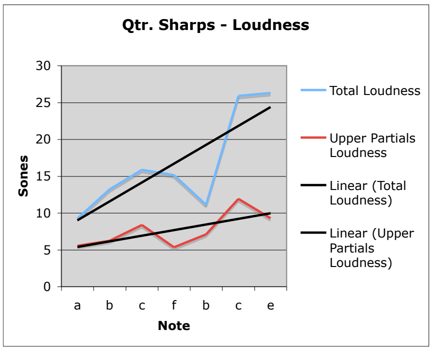


Figure 5-11c



The collated charts in Appendices 3 and 4 record all the relevant data for an accurate comparative analysis of the various tone colours: Instrument and Note Name; Fingering; Dynamic; Sones; Tone Colour Ratio. The tone colour ratio for each note allows a comparison between notes for tone colour and categorises them according to whether the ratio is more or less than one: ratios less than 1.0 indicate a note whose upper partials are increasingly dominant; notes with ratios greater than 1.0 are characterised by a sound which is increasingly dominated by the fundamental.

This investigation was undertaken using a modern alto recorder[17] with regard to loudness and tone colour across a selection of natural and quarter-tone notes from each of the recorder's registers. From the first register I have analysed the notes a^1, b^1 and c^2; from the second the note f^2; from the third the notes b^2 and c^3 and from the fourth the note e^3. Each of these notes offers good possibilities for the production of microtonal degrees by varing the fingerings without altering breath pressure. The results are used to identify characteristics of the instrument with regard to tone colour and loudness across the range of notes tested. From this it will be possible to determine the typical characteristics of the instrument, as far as possible within the limited scope of this investigation, and reject more eccentric results, should they occur, as being idiosyncratic. Initial results indicate a relationship between dynamic and tone colour. More specifically, dynamic was shown to correlate directly to the strength of the fundamental compared to the upper partials.

Figure 5-12 shows a comparison of both loudness and tone colour for the instrument across the range tested. An increase in loudness from the lowest notes to the highest might be expected and indeed this is very clearly shown. The dotted line joining the lowest and highest notes in the chart indicates a constant steady rise in loudness between these two points. This allows us to gauge whether the instrument adheres to a consistent increase in loudness. The modern style alto instrument in F indicates a change in loudness between the lowest and highest notes tested of approximately 15 sones, roughly equivalent to the dynamic range from a low of *mezzo-forte* to a gentle *fortissimo*. However, major deviations from this at f-natural^2, b-quarter-flat^2 and b-quarter-sharp^2/c-quarter-flat^3 indicate a characteristic either of the style of instrument or of the fingerings used and it is this that will now be examined in detail. The lower line represents a trend line for the tone colour of the instrument across the range of

[17] Professional level handmade treble recorder in European boxwood by Coolsma.

notes tested. This shows a high degree of consistency in relation to loudness[18], indicating that this particular instrument behaves in a predictable fashion to the application of various different fingerings.

Figure 5-12.

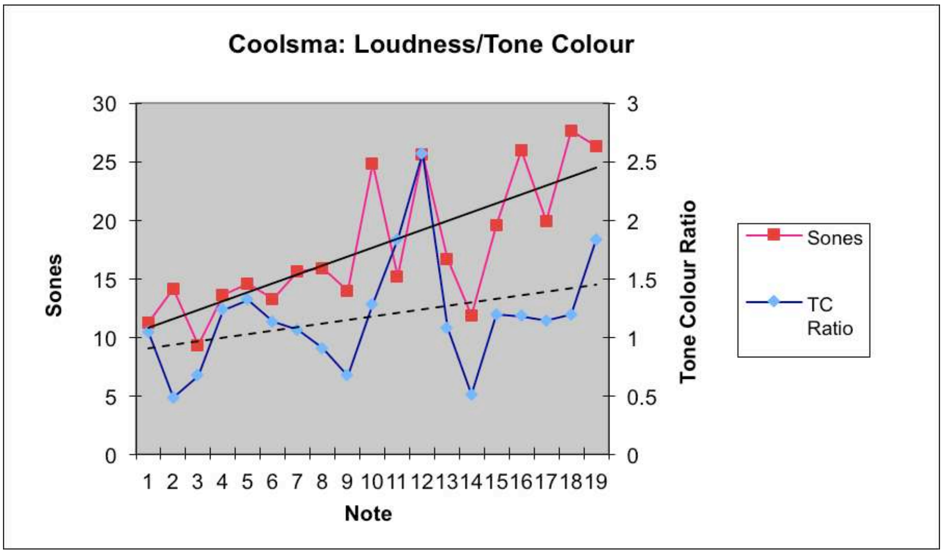


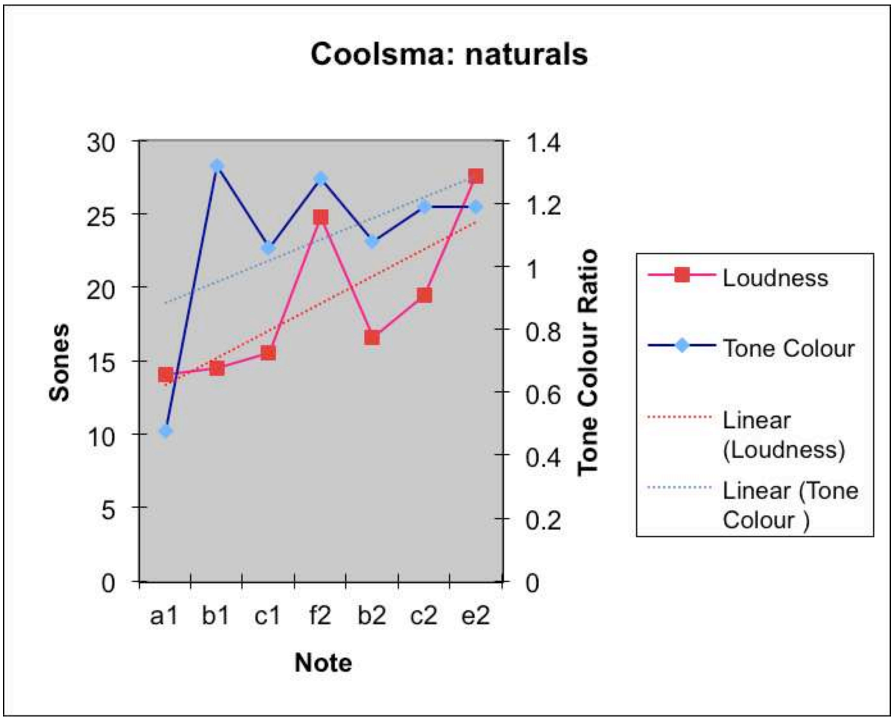
Table 5-3 identifies the pitches of the 19 notes charted in Figure 5-12, above.

Note No.	Note Name	Note No.	Note Name
1	a-quarter-flat^{1}	11	f-quarter-sharp^{2}
2	a-natural^{1}	12	b-quarter-flat^{2}
3	a-quarter-sharp^{1}	13	b-natural^{2}
4	b-quarter-flat^{1}	14	b-quarter-sharp^{2}/ c-quarter-flat^{3}
5	b-natural^{1}	15	c-natural^{3}
6	b-quarter-sharp^{1}/ c-quarter-flat^{2}	16	c-quarter-sharp^{3}
7	c-natural^{2}	17	e-quarter-flat^{3}
8	c-quarter-sharp^{2}	18	e-natural^{3}
9	f-quarter-flat^{2}	19	e-quarter-sharp^{3}/ f-quarter-flat^{3}
10	f-natural^{2}		

18 High values for tone colour indicate notes dominated by the fundamental, which is itself an indicator of loudness.

The relationship between dynamic and tone colour is a feature of the writings examined in Chapter 3 with only Fischer attempting to find a way of varying tone colour without altering the dynamic. My research indicated that the instrument tested responded in a consistent way to the application of different fingerings, both diatonic and microtonal. Noteworthy in Figure 5-12 is the peak in the tone colour ratio at note 12 (b-quarter-flat^2), indicating the increased influence in the sound of the fundamental where the dynamic is also uncharacteristically high. The high dynamic level at note 10 (f-natural^2) also indicates an upward trend for tone colour at this point. Conversely the value for the tone colour ratio dips, indicating an increase in the influence of the upper partials in the sound, where the dynamic is noticeably low, for example at note 14, b-quarter-sharp^2/c-quarter-flat^2, and note 9, f-quarter-flat^2 (see also Appendices 3, page 329, and 4, page 332, for source information). This movement indicates a direct correlation between dynamic and tone colour for the fingerings used. Figure 5-13a shows the tone colour and dynamic for the 'natural' fingerings.

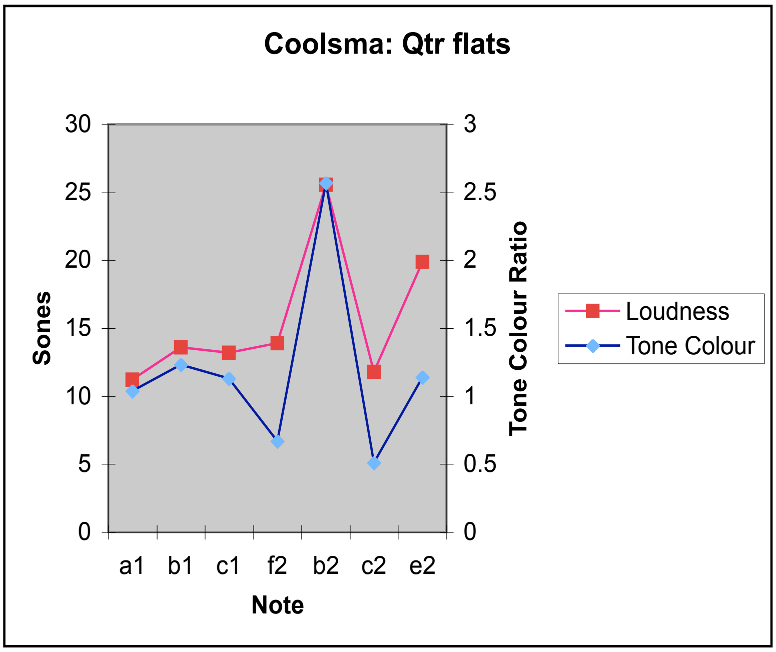
Figure 5-13a



From Figure 5-13a, above, it could be argued that the instrument maker has elected to design his instrument based on consistency of tone colour over regularity of dynamic increase and despite irregularities, the trend line for tone colour is indeed slightly flatter here. An alternative hypothesis is that the dynamic is simply a product of a combination of the natural acoustic properties of the instrument and the standard fingering used. Inspection of the spectra for $f\natural^{2}$ of the instrument (Appendix 5, page 341) reveals a strong fundamental and prominent third and fifth partials with slightly suppressed even partials: two, four and six. The louder sound of the $f\natural^{2}$ compared to surrounding notes – 64% louder than the f-quarter-sharp^{2}; a 59% increase over the dynamic level of the $c\natural^{1}$ and 49% louder than $b\natural^{2}$ - can be explained by the absence of fingers on the instrument whose influence, as we shall discover, is that of suppressing the fundamental and slightly raising the upper partials, thus producing a softer, more veiled tonal quality that is more heavily influenced by the upper partials. The standard fingering of 02 therefore produces a robust sound, with the presence of a relatively much stronger fundamental indicating a somewhat duller sound. This will be indicated in the modestly high numeric value of the tone colour ratio of 1.28.

The quarter-tone fingerings produce interesting results: Figure 5-13b shows the quarter-tone flat fingerings for the seven notes tested. Here we observe the diminishing influence of the upper partials in the tone colour at exactly the point where volume is loudest – at b-quarter-flat^{2}.

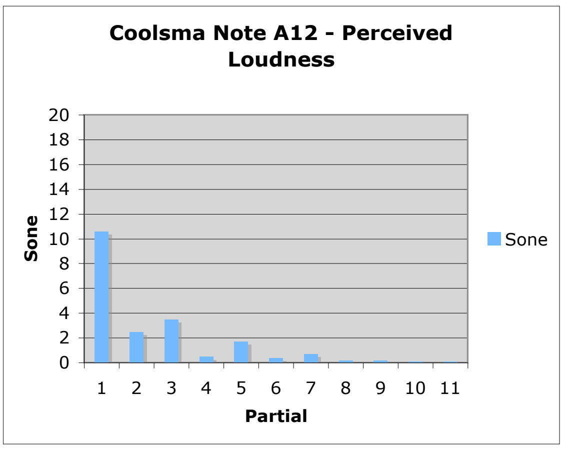
Figure 5-13b



The reasons for this can only be understood after we have compared this note with other similarly fingered notes. If we begin with the core fingering θ123 (c♮^{3}) we observe a tone with a strong fundamental and the presence of upper partials up to the seventh. The note is relatively loud, 19.5 sones, with a neutral tone colour ratio of 1.19 (Figure 5-14).

Figure 5-14 – c♮^{3}, fingered θ123

Perceived Loudness (Sones)	Tone Colour Ratio (F/H)
19.5	1.19



By adding finger 6 to give a fingering of θ123~~6~~ (b-quarter-sharp^2/c-quartert-flat^3) we can observe a substantial reduction in the strength of the fundamental and only minimal changes in the combined strength of the upper partials, see Figure 5-15c. The resulting sound is relatively quiet with a tone quality heavily influenced by the domineering presence of upper partials. The addition of finger 5 to the core fingering of θ123 produces a b♮^{2} (θ1235), which has a loudness and tone colour ratio similar to that of the c♮ a semitone higher, see Figure 5-15b. Swapping finger 5 for fingers 4 and ~~6~~ (θ1234~~6~~ = b-quarter-flat^2) causes an increase of 114%[19] in the strength of the fundamental above that of the b-quarter-sharp^2 and a tone that is overwhelmingly dominated by it, see Figure 5-15a. This pattern can most clearly be observed in a visual comparison of the three notes. Figures 5-15a, 5-15b and 5-15c show the note, the fingering, the loudness (sones), tone colour ratio, perceived loudness chart, and sound wave for three notes with core left-hand fingering θ123. It highlights changes in tone colour and dynamic when this core fingering is altered by the addition of various right-hand fingers.

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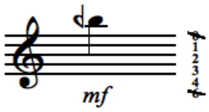
[19] (18.4-8.6)/8.6 x 100 = 114%

Figures 5-15a, 5-15b, 5-15c. The effect of different RH fingers to the core fingering θ123:

Figure 5-15a:
Fingering θ1234~~6~~

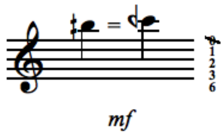


Loudness In Sones	Tone Colour Ratio (F/H)
25.56	2.57

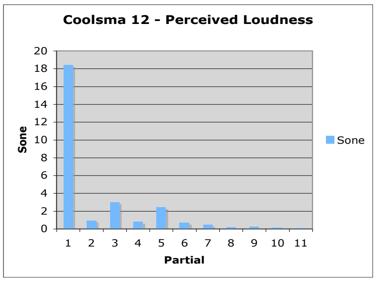
Figure 5-15b:
Fingering θ1235

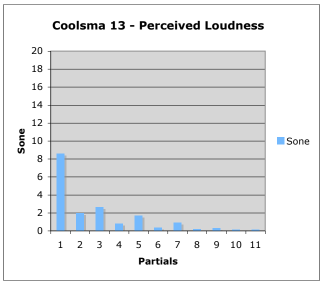
Loudness In Sones	Tone Colour Ratio(F/H)
16.60	1.08

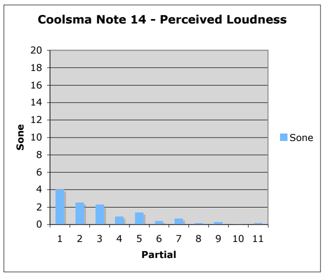
Figure 5-15c:
Fingering θ123~~6~~

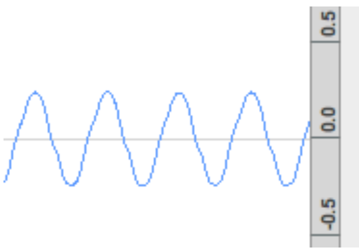


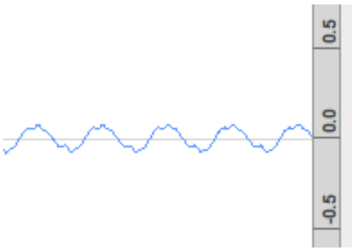
Loudness In Sones	Tone Colour Ratio (F/H)
11.80	0.51

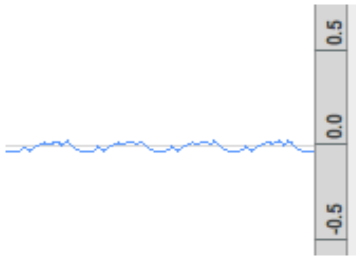








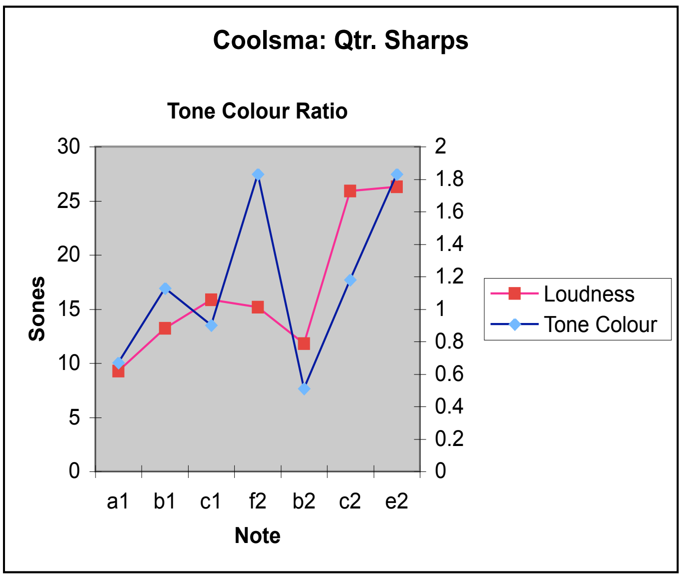




From Figure 5-15, we clearly see the influence of different right-hand fingering patterns on the sound waves, which visually describe the different effects. Reading from left to right, the almost pure sine wave of the b-quarter-flat[2] indicates a sound dominated by the fundamental with little influence from the upper partials. The sound wave of the b♮[2] clearly shows the influence of the upper partials in a softer sound – both dynamically and tonally, which blends well with the diatonic notes either side of it. The sharply reduced amplitude of the sound wave of the b-quarter-sharp[2] is indicative of the reduced dynamic level whilst the strong influence of the upper partials in the tone colour can be seen in the irregular shape of the wave. The tone colour ratios shown for each note highlight the tonal differences between them – a satisfying progression in tonal variety is produced when moving chromatically step-wise up or down between them but a comparison between diatonic notes either side of them shows the strength of the difference, for example between b-quarter-sharp[2] (11.80 sones/TC ratio 0.51) and c♮[3] (19.5 sones/TC ratio 1.19).

From this I conclude that closing hole 4 in combination with hole 3 produces a tone with a stronger than usual fundamental. A possible alternative for b-quarter-flat[2] is θ12356 but this produces a less reliable note with a somewhat scratchy tone. The addition of further fingers, e.g. 6 for b♭, which is more reliable, reduces the strength of the fundamental, causing an increase in prominence of the upper partials. Figure 5-15c, above, shows a dramatic drop in loudness and tone colour for b-quarter-sharp[2] (θ1236) compared to the previous note, see Figure 5-16 below.

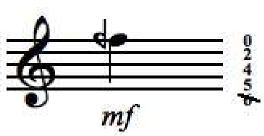
Figure 5-16



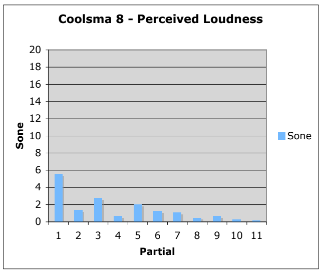
Similar effects can be observed with variations on the core fingering 02 ($f\natural^2$) but notice here the dramatic differences in tone colour and dynamic, i.e. responses to quarter-sharp and quarter-flat fingerings compared to those for b^2 shown in Figure 15, above:

Figure 5-17a, b and c. The effect of different RH fingers to the core fingering 02:

Figure 5-17a:
Fingering 0245~~6~~



Loudness In Sones	Tone Colour Ratio (F/H)
13.9	0.67



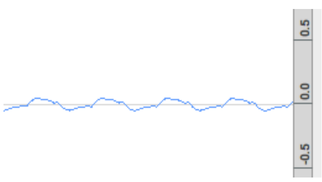
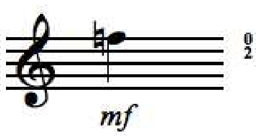
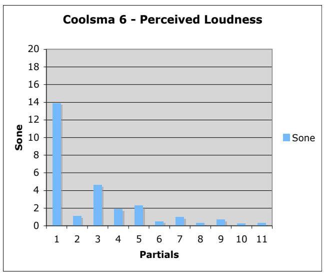


Figure 5-17b:
Fingering 02



Loudness In Sones	Tone Colour Ratio (F/H)
24.80	1.28



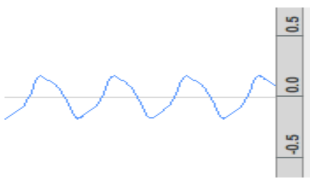
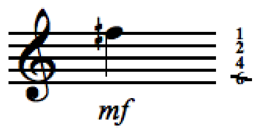
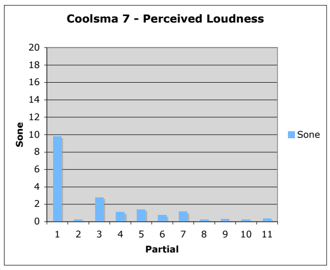
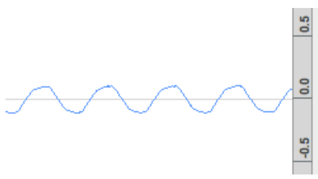


Figure 5-17c:
Fingering 124~~6~~



Loudness In Sones	Tone Colour Ratio (F/H)
15.15	1.83





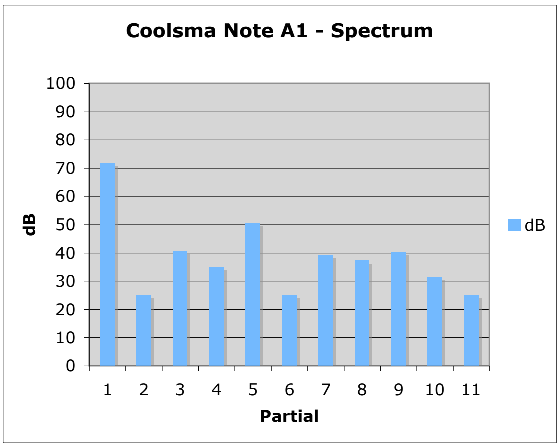
The core fingering produces a tone with a strong fundamental and the presence of some upper partials. This is indicated by a tone colour ratio of 1.28 highlighting the domination of the fundamental without it overwhelming the upper partials, and a high loudness of 24.80 sones. The addition of right-hand fingers 45~~6~~ for the f-quarter-flat^{2} produces a muted sound with a tone colour dominated by upper partials and a quiet loudness. The f-quarter-sharp^{2} has a loudness consistent with its surrounding notes (with the exception of f♮^{2}) but, with little input into the tone colour of the upper partials, it has a tone colour ratio indicating dominance by the fundamental, see Figure 17, above. The three waveforms clearly show the difference between the notes in terms of loudness (amplitude of the wave) and tone colour (regularity of form).

The aim of this research was to identify and evaluate changes in tone colour and dynamic due to the use of microtonal fingerings. At this point it is possible to propose some conclusions: the recorder's spectrum displays typical characteristics of a partially open pipe i.e. the even partials are suppressed but not absent. The sound of standard chromatic notes is generally based on a strong fundamental with influential upper partials which, on a well-designed instrument, will produce a fundamental to upper partial ratio of between 0.8 and 1.2.
The use of two fingers or more of the right hand will have an impact on the tone colour ratio, causing a reduction in strength of the fundamental and a corresponding rise in the strength of the upper partials, e.g. compare Coolsma notes 1 and 2, Figures 5-18 and 5-19, over.

Figure 5-18

Loudness In Sones
14.50

Tone Colour Ratio (F/H)
1.32



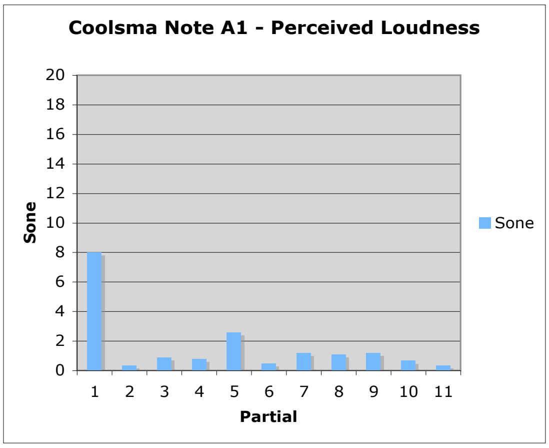
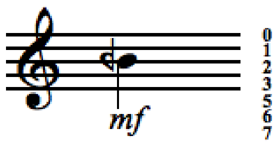
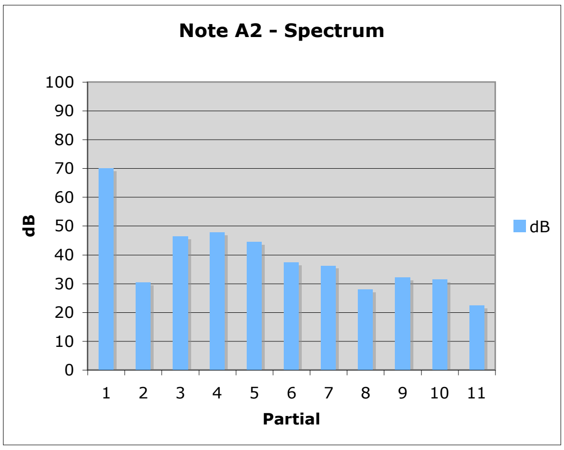


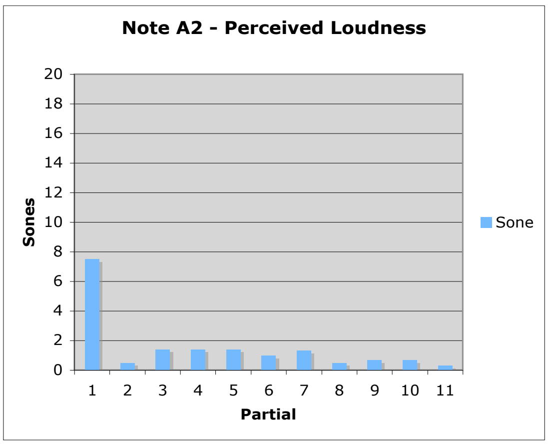
Figure 5-19



Loudness In Sones
13.6

Tone Colour Ratio (F/H)
1.23



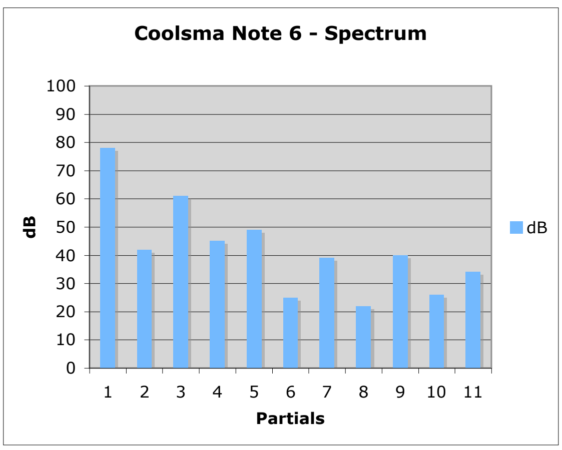


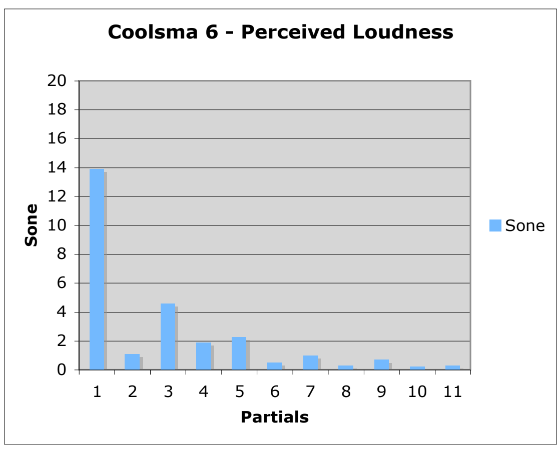
Here, the change in loudness and tone colour is observable but slight: 14.5 – 13.6 sones and tone colour ratio from 1.32 – 1.23 respectively. An alternative to fingering 0123567 is 01234, where finger 4 replaces fingers 567, but the result is a raw, brash sound, out of character with surrounding notes and so is not used. This shows that where fingers 3 and 4 are used together, the sound can be softened by the addition of an extra finger, eg, 012345 for a$\natural^1$. Where finger 3 is not used, for example in upper register fingerings for c-quarter-sharp^3, e$\natural^2$ and e-quarter-sharp^3, the loudness is uncharacteristically high. The fingering ~~0~~1245~~6~~ (e-quarter-flat^3), however, reduces the loudness to a level more in keeping with surrounding notes.

Note that this effect will be more pronounced if the right-hand fingers are deployed after an open hole e.g. compare f$\natural^2$ (Figure 5-20):

Figure 5-20

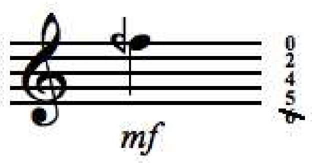
Loudness In Sones	Tone Colour Ratio (F/H)
24.80	1.28



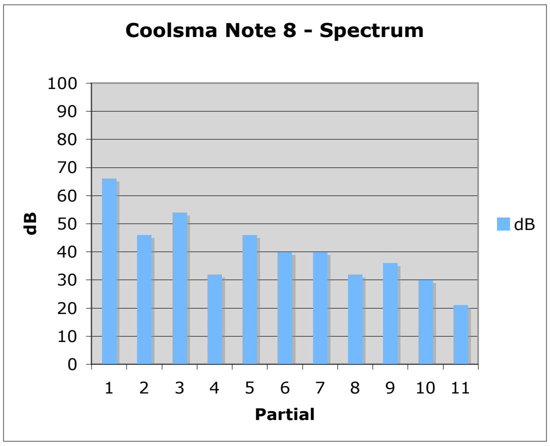


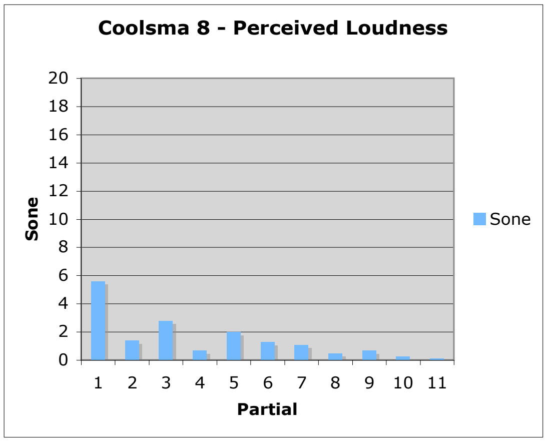
with f-quarter-flat[2] (Figure 5-21) for which the finger 3 is not used:

Figure 5-21



Loudness In Sones	Tone Colour Ratio (F/H)
13.9	0.67





With no finger 3, the use of RH finger 4, on its own or in combination with other right hand fingers, has a dramatic effect on the tone colour, strengthening the fundamental and raising the loudness level. A well made instrument will have a degree of 'flexibility' – an ability to maintain its pitch despite modest changes in breath pressure. Small changes in breath pressure, however, are not sufficient to produce noticeable differences in dynamic level. The player must therefore employ other techniques to give the impression of dynamic variety. These include the application of different types of vibrato and effective use of varying degrees of articulation. Nevertheless, these subtle degrees of dynamic variety should be applied with care, for the inappropriate use of any technique will result in an inappropriate interpretation.

The recorders tested, like many baroque copies and modern instruments, are designed to produce the best results when played in a tonal environment – they are not designed to play a full two-and-a-half octaves of microtonal intervals. This can be seen very clearly in Figure 5-11a, page 127, which shows the relatively even values of tone colour across the diatonic notes tested. The deviations in both tone colour and dynamic for microtonal notes indicate a relationship between them that suggests that a different choice of fingering will smooth out irregularities of either dynamic or tone colour, but not both – some compromise will inevitably have to be made. This will have to be the subject of further research, however.

The purpose of this investigation was to determine the degrees of dynamic and tonal variety possible on the recorder using standard microtonal fingering techniques. Fischer and Hauwe have shown that a greater degree of dynamic variety is possible by leaking the thumb-hole, finger hole 1, and making use of the bell end. Rather than employ extreme techniques, my aim is to raise awareness of the potential for dynamic and tonal variety using fingerings that should be within the grasp of any proficient player. Moreover, I have shown that tonal variety and dynamic are to a large degree mutually dependent but not exclusively so. Players will always have to use additional techniques to give the impression of dynamic and tonal variety. This raises the further question of interpretation and in particular that of the player's relationship to his instrument. The recorder was praised in the eighteenth century for its ability to play in tune in any key (Mattheson[20], quoted in Hunt 2002, 70). This suggests that makers aimed to produce instruments with a fair amount of consistency of intonation, tone and dynamic across all registers. Where instruments are subject to irregular variation in this respect it is clear that players will become slaves to the instrument's foibles, the player adjusting as necessary 'in accordance with his sense of pitch' (Linde 1991, 35). When playing

[20] Johann Mattheson (1681-1764)

in a strictly equal tempered tuning system, for example, in contemporary microtonal pieces, it would seem to be preferable to have an instrument with truly consistent intonation, tone quality and dynamic so that the player can be the master of the performance. This places considerable responsibility on performers to develop techniques that extend the instrument's expressive qualities, working from a stable foundation.

Chapter 6

Discussion and Analysis of a Selection of Twentieth Century Microtonal Works

Introduction

As an introduction to my study of selected microtonal repertoire for the recorder I will briefly investigate the broad impulses behind each of the pieces before outlining my approach to their selection and study. A short introduction to each piece then follows.

The drive by performers to create new recorder repertoire continued unabated through the latter part of the twentieth century, encouraged in part by the waves of players passing through the Dutch conservatories. In order to display their musicianship and technical skills, and to make a statement concerning the recorder's validity as a contemporary music instrument, some players took existing works for orchestral instruments and arranged them for recorder. This, they hoped, would encourage composers to consider writing for the recorder. Japanese recorder player Tosiya Suzuki (b.1961) is one such player. Suzuki worked with English composer Brian Ferneyhough (b. 1943) and arranged some of his highly complex and microtonal solo works for recorder. These included *Carceri d'Invenzione IIb*, arranged for tenor recorder (1986/1997), *Unity Capsule*, arranged for tenor recorder (1976/2002), and *Superscriptio*, *for Solo Piccolo*, arranged for descant recorder (1982/1998) (Suzuki).

Walter van Hauwe[21] had discussed in 1990 the importance of new works in the recorder's repertoire by composers who do not play the instrument. He argued that the extraordinarily high standard of 'certain players and ensembles' active during the 1970s-80s inspired

[21] Walter van Hauwe is a leading performer writer and thinker on recorder pedagogy. He was Professor of recorder at the Amsterdam Conservatory for around 30 years and his students include many amongst the third generation (taking Brüggen as generation 1) of leading professional ensembles and soloists.

composers who, unfamiliar with the recorder and unencumbered by previous knowledge of the possibilities and limitations of the instrument, were able to write without concern (*rücksichtslos*), causing the leading players of the time to consider their instrument in a new way. He further argued that this had a positive effect on teaching and hence on the following generation of young professionals (Hauwe, 1990, 128-131)[22].

Collaborations between composers and leading performers have produced many works during the second half of the twentieth century which have since been absorbed into the recorder's contemporary concert repertoire due to the performances of Frans Brüggen and Hauwe himself (O'Kelly 1990, 62). Several works discussed in this study involved collaboration between player(s) and composer and it can be shown that where close collaboration between players and composers has existed difficulties arising in the preparation of the work for performance were met by the experienced performer by either seeking a workable performance solution, thus advancing understanding, knowledge and instrumental technique or, having ascertained that no viable solution is possible, discussing with the composer ways in which the composition can be practically altered. During the period under discussion a further important factor played a role – that of instrument selection. The development of Maarten Helder's harmonic tenor recorder in 1995, which, like other wind instruments, but not traditional recorders, overblows to produce pure harmonic intervals. It played an important role in influencing the development of new repertoire, of which Bousted's *Five Quarter-tone Pieces* is an example. However, unlike recent developments in the design of some orchestral wind instruments, for example the quarter-tone *Kingma* system flutes (Kingma), Helder's addition of keys was not intended to aid the production or performance of

[22] Van Hauwe was himself at the forefront of repertoire and pedagogic development during the final quarter of the twentieth century. He was a student of Brüggen and an enthusiastic protagonist of contemporary music who commissioned numerous new works that have since been incorporated into the standard concert repertoire (O'Kelly 1990).

microtones. Another development in instrument selection is the use of renaissance-style instruments (see Bousted's *Whale Song*, page 250). The use of renaissance-style instruments was not restricted to recorders: viol consort *Fretwork,* for example, have numerous contemporary works in their repertoire, including some by prominent British composers (Boothby). Composer Christopher Fox has also written new works for early music ensembles including *The Science of Freedom* (1990), *A Glimpse of Sion's Glory* (1992), *Notes From a Cold Front* (1996-1998) (Fox). Thus not only are new instrumental sounds explored and techniques developed but compositional approaches to the recorder also benefit. It follows that a further implication of Hauwe's theory is that in circumstances where the composer and player are the same person, there is a risk that the long-term value of the works may be limited by the personal knowledge and preferences of playing the instrument of the musician concerned. The urgent sense of exploration implicitly present during the preparation for performance of significant new works by a composer who does not have intimate knowledge of the instrument will, to a large extent, be absent. This cannot, of course, be true in all cases; Hans-Martin Linde's enduring *Music for A Bird* (1968) and Michael Vetter's recently reissued book *Il Flauto Dolce ed Acerbo* (1969 and 1999), which indirectly inspired so many composers to explore the instrument, are testament to the adventurous nature of some contemporary recorder composer-instrumentalists. Furthermore, the constant level of interest in these and other works that, as Hauwe predicted, have now largely left the concert platform, is nevertheless supported by their retention as significant works in recorder pedagogy.

During the twenty years following Hauwe's statement the predicted explosion of technical achievement among serious students of the recorder (Hauwe 1990, 128-131) has been matched only by a simultaneous diminishing of performance opportunities (Hauwe 1995, 75) that, in turn, has led to an enhanced broadening of the careers of recorder professionals. This process progressed at such a rapid pace and with such breadth of outlook and training, brought on by the very process described by Hauwe as well as the necessity of carving out a career in a constantly evolving music industry, that the roles of composer, performer, teacher etc. by necessity have merged to create many more rounded musicians, similar to those of the seventeenth and eighteenth centuries whose work with the recorder as composers, players and in some cases instrument makers is so well known today: Hotteterre, Paisible, Pepusch, members of the Bassano family, Loeillet, van Eyck etc. Of today's musicians one thinks of Matthias Maute, Benjamin Thorn, Pete Rose, Alan Davis, Karel van Steenhoven, Paul Leenhouts and from the older generation, Gerhard Braun and Hans-Martin Linde.

Specialist recorder players composed two of the pieces included here: *Lux Aeterna* by Markus Zahnhausen, and *Dialogue for one Recorder Player* by Peter Bowman. All of the remaining pieces were composed either in collaboration with or for specific players. We can say, therefore, that through contact with their collaborating players, composers have access to high quality and detailed information about the instrument. This should encourage composers to work within the bounds of the technical possibilities set out for them by the players, without necessarily restricting their creative imaginations.

Discussions and analyses of a selection of eight works that include microtones form the bulk of this chapter. Pieces were selected for inclusion on the basis of the following criteria: they should be either published or recorded, preferably both, and are commercially available; they should be technically within the grasp of most professional players and students; the pieces should make use of microtones in a variety of interesting ways that, it is hoped, will stimulate players and composers to consider for their own use the broad range of musical and technical possibilities available within the genre.

An analysis of each of the pieces, undertaken with the performer in mind, is preceded by a study of the context in which the work arose. This includes the composer's background in composition, his aesthetic preferences, and the circumstances under which the composition was undertaken. Where possible, comparison is made with the composer's works for similar instrumentation, for example, solo instrument, written around the same time. It is hoped that this information will offer an insight into the composer's style and into any particular adjustments to this in his compositions for recorder that characterize his approach to the instrument.

The only piece that was well known to me prior to beginning this study was Bousted's *Whale Song,* a piece unique in his oeuvre for three reasons: its use of renaissance style instruments, its application of timbre for structural and expressive purposes, its varied use of microtones. I quickly established that all the other composers approached both instrument and microtonality in uniquely different ways and that much could be learned about both through intensive study. And yet much remains unsaid. Thus my own piece was composed out of a desire to express something different with the recorder, redefine its relationship with microtones, and its expressive potential, that I had not observed in the other pieces. These, I hasten to add, are not deficient in any way but my particular relationship with the instrument and its repertoire, both old and new, offered me the opportunity to make an 'insider's' contribution to the discussion.

The microtonal pieces for recorder to be studied in this chapter are listed here in chronological order of composition:

1. *Winds of Heaven* (1983-84)	Christopher Fox (b. 1955)
2. *Lux Aeterna* (1992-94)	Markus Zahnhausen (b.1965)
3. *Dawn's Dove* (1994)	Nicola LeFanu (b.1947)
4. *Metamorphosis at Mullet Creek* (1994)	David Lumsdaine (b.1931)
5. *No.2 from Five Quarter-tone Pieces* (1997)	Donald Bousted (b.1957)
6. *Whale Song* (1998)	Donald Bousted (b.1957)
7. *The Voyage* (2012)	Michael Wolters (b.1971)
8. *Dialogue for One Recorder Player* (2013)	Peter Bowman (b.1952)

I will continue now by briefly previewing my interpretations of the eight pieces discussed in this chapter that will also involve a very brief outline of my approach to the analysis of each of the pieces.

Fox's *Winds of Heaven* is defined more by textural contrast than the use of clear rhythmic or melodic motives. The constantly evolving and continuous glissandos of the first part are set against the repetitive and densely textured nature of the second. A semiotic analysis of Bousted's *Study No. 2*, on the other hand, reveals insights in to the formal structure of the piece as well as its motivic construction through paradigmatic analysis. Lumsdaine's *Metamorphosis at Mullet Creek* and LeFanu's *Dawn's Dove* likewise reveal some of their formal secrets by the application of a semiotic analysis. Broad tonal analyses can also be beneficially applied to several of the pieces including Zahnhausen's *Lux Aeterna*, LeFanu's *Dawn's Dove*, and Lumsdaines' *Metamorphosis at Mullet Creek*. This brief survey and the more detailed description of the pieces given later in the chapter, highlight the fact that no single analytical method can provide sufficient information for an informed interpretation to take place. Rather, it offers an initial insight into the variety of musical styles included in this dissertation.

Two of the pieces, *Winds of Heaven* and *Whale Song* stand out as examples of the exploration of texture in music. The microtonality of the former adopts a subsidiary role to the vocal and electronic effects that define its sound world in the respective sections. *Whale Song* also makes extensive use of vocal effects but microtonality also plays a significant role with the closely wrought eighth-tone melodies contrasting with robust multi-phonic and vocalized passages played on the bass recorder. Nevertheless it is the exploration of different textures, in other words sound-worlds of varying textural density that defines these two pieces. Zahnhausen's *Lux Aeterna* also undertakes a thorough exploration of timbre, indeed, 'the decisive element in its performance' he writes in the programme note, 'is the painstaking calibration of the four levels of timbre: "flauto traverso", harmonics, whistling, and "ordinario"'. Furthermore, he notes that the piece 'was primarily conceived for the acoustic properties of a relatively large church interior with correspondingly long reverberation times' (Zahnhausen 1995b, 6). *Dawn's Dove* and *Metamorphosis at Mullett Creek*, like *Whale Song* give clear indications through their titles of the influence of the natural world in the creation of these pieces. *Metamorphosis* is the most closely linked of the three to nature, with the readily identifiable songs of particular birds and the creation of a sound-world that is reminiscent of Lumsdaine's own landscape recordings of the Australian bush. The use of microtonality and dynamic here is unique amongst the set of eight pieces for its representation of movement and distance from the observer. *Dawn's Dove* is less naturalistic and more abstract in its approach to bird song and more overt in its reference, through the title, to peace and friendship. *Whale Song*, is an 'aural study of imagination and innocence' which sets out 'to utilize the microtonal possibilities of renaissance instruments' (recorders) (Bousted 2004).

Whilst it does not set out to imitate the song of a whale, it is, as far as one can ascertain from available recordings, at least reminiscent of it. *Study No. 2* from Bousted's *Five Quarter-tonal Pieces* is an exploration of the instrument. It stretches the traditional tenor recorder beyond its normal chromatic range – c^1 – d^3 (O'Kelly 1990, 25) both within the compass, in terms of microtones, and by extending the microtonal range of two octaves and a sixth (c^1 – a^3). Wolters' *The Voyage* is an exploration of a very different and gentler kind – it explores the potential offered by combining different temperaments. In the context of a mainly tonal background two recorders playing in eighteen-tone equal temperament (18-tet = third-tones) are set against an eight-strong recorder ensemble with double bass accompaniment. A further descant recorder doubles the vocal line. The double bass plays pizzicato throughout and was included to perform 'the role of something that doesn't make sense' (Wolters 2013b) but it also serves as a reference to the baroque-style bass line. My own piece, *Dialogue for One Recorder Player*, is also an exploration of a kind. It sets out to highlight the recorder's expressive strengths. These range from forceful, rhythmic playing through a dense passage in eighth-tones in the second movement to a vibrant, rhythmic and microtonally subtle final movement. All eight pieces therefore share the notion of exploration, a desire to discover the potential of the recorder in all its facets and with the use of varying amounts and degrees of microtonality.

Winds of Heaven for amplified Tenor Recorder and Tape Delay (12 seconds)

(1983/84)

Christopher Fox (b. 1955)

Canadian recorder player and composer Peter Hannan (b.1953), who Fox considers a 'special musician' (Fox 2009b, 25), commissioned *Winds of Heaven*. It is the only solo piece for recorder by Fox; two other pieces of his include a recorder in an ensemble - *Notes From a Cold Front* (1996-1998) for the early music ensemble *Sirinu* and *Missa Est* (1983) for the *Landini Consort*. Many of Fox's compositions include either amplification, live electronics, tape, or a combination of these. Hannan has performed with real-time live electronics and his own compositions have included works with alternative tuning systems (Hatch 2013). *Winds of Heaven* is in two parts, which 'may be played successively or separately' (Fox 1984). The first part is an electro-acoustic piece that calls for amplified tenor recorder and tape delay of twelve seconds. The delay is to disappear by the sixth repeat. The second part is for amplified tenor recorder in which the composer's pre-determined fingering patterns are performed accompanied by constant vocal sounds and accented multiphonics.

Christopher Fox's music 'combines a love of pure sound and a distancing of the self from the creative process, in a manner that recalls both Cage[23] and Feldman[24], with a more European concentration upon sophistication and intricacy of form.' (Pace and Saunders).

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[23] John Cage (1912-1992): A leading composer of the twentieth century avant-garde and influential in the development of minimalism, Cage's early interest in Asian aesthetics and later Zen Buddhism led him to an exploration of the aesthetics of silence and later the application of chance operations to the compositional process. (Bryars, Gavin xiii, 2009)

[24] Morton Feldman: Feldman's aesthetic was influenced in the early 1950s by New York-based abstract artists Mark Rothko, Jackson Pollock, Franz Kline and Philip Guston. Towards the end of his life his music typically displayed an interest in minimalism (influenced by Cage) and the use of abstract gestures. (Steven Johnson. "Feldman, Morton." *Grove Music Online*. *Oxford Music Online*. Oxford University Press. Web. 29 Jan. 2013. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/09435>.)

His work has been influenced by both serialism, which introduced him ‘to systematic ways of thinking about composing’, and minimalism, which aroused his interest in ‘audible systems and processes’. Other traditions to which he in some way belongs include ‘experimentalism, minimalism, Dada[25], European modernism (particularly in its tendency to abstraction), northern-ness[26] and social democracy.’ (Fox 2006).

The evolution of a concept is also an important element in Fox’s compositional process. He only begins a work when he reaches the point where he has ‘a sense of what it will be like to hear the whole piece. If structure and process are there in particular pieces it is because that is what I heard’ (Fox 2009a, 261). Interviewed in 2006 about one of his *Generic Pieces* (1999 – 2001), Fox explained both his relationship with the performer and Cage’s influence in his compositional methods. In this piece, the performer chooses six fingerings that produce unstable sounds. He ‘composed the sorts of patterns that these sounds are grouped into, so actually my [Fox’s] control of the overall flow of the piece is pretty much absolute. If there’s a debt to Cage and indeterminacy - and in my music there usually is - it’s more to do with [my] fondness for prescribing actions rather than sounds in notation’ (Fox 2013).

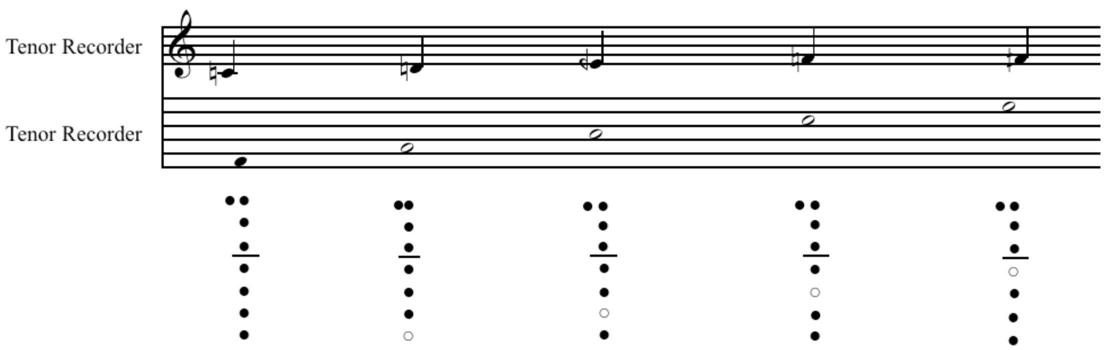
The extent to which these interests and influences have been brought to bear in the composition of *Winds of Heaven* will be explored in the following pages, before I discuss technical aspects of a performance of the piece.

[25] The Pears Cyclopaedia defines Dadaism as ‘an hysterical and nihilistic precursor of surrealism resulting from the shock produced by the first world war. Beginning in Zurich about 1915, it spread to other continental cities such as Berlin and Paris, dying out in 1922.’ (Pears *s.v.* ‘Dadaism’ 1991-1992, L32). The Oxford English Dictionary takes a more benevolent view of the movement, defining it as: ‘an early 20th-century movement in the arts which mocked conventions and emphasized the illogical and absurd’ (Oxford English Dictionary *s.v.* ‘Dadaism’ 2002, 204).
[26] Fox was born in York.

An important and recurring feature of Fox's compositional method is the development of processes (Fox 2009b, 7 – 26). This implies that the development of the musical content and consequently the musical structure by mechanical or mathematical means is, at least to some extent, inherent in the development and application of processes to musical composition – indeed Fox states that [musical] material should not be separated from structures and processes (Fox 2009a, 261). Yet the composer appears to be distancing himself from the creative act by employing chance or random operations in the compositional process. His influence over the realisation of the work may appear to be diminished further by factors beyond his control. This loosening of control in favour of the performer, resulting in an apparent democratisation of the creation and realisation of a work may, however, be an illusion. Fox, in determining the material of the piece has, according to his own definition, 'absolute control over the structure and flow' and this would appear to be the case for performances of *Winds of Heaven*. It is also certainly true that elements of the realisation of *Winds of Heaven* are left to the performer, including the instruction to vocalise in the second part, and the execution of dynamic changes, which should be exploited 'to vary the overtones produced by each fingering' (Fox 1984), thus allowing the addition of a varied layer of colour to the sound world. Whilst the fingerings given by Fox for part two should produce stable pitches, the composer nevertheless adds an element of indeterminacy by allowing the performer to add varying and irregular dynamics at prescribed places – the harmonic content of the multiphonics will vary depending on the instrument used, the strength of the player's articulation, and the extent to which the tone is overblown, but there are limits, determined by the instrument, to the variety that can be achieved. Breathing in this part is left to the player – no breathing places are marked in the score and indeed none are apparent. The second part also carries the instruction for the player to 'vocalise at bottom of voice', which, with an absence of further instructions, indicates indeterminate pitching. This will of course also vary between players. The extent of the player's influence on the re-creation of the piece seems to be arbitrary, depending on the natural pitch of the voice, and the instrument used, leaving little room for genuine creative input.

Fingerings given for the second part (see Figure 6-1) are secure and correspond to a high degree to the following, including the two microtonal, pitches:

Figure 6-1. Part Two, the prescribed fingerings and their corresponding pitches



Non-mensural time-space notation is used in the first part and phrases are clearly defined. The score is divided into twelve-second segments to match the tape delay – phrases at the beginning coincide with the segments but these soon vary in length and the resulting overlapping mix of glissando-ing quarter-tonal and chromatic pitches produces a build-up of cacophonous but ever-changing sound, which should, nonetheless, be predictable. This is determined by the precise timing of the tape delay and a strict adherence to the timings and movements of the player, who must vary his orientation to the microphone, moving either to the left, right, or centre, with the aim of producing a predictable sound of varying pitch distribution and texture. The overriding concept of *Winds of Heaven* is that of contrasting textures: in the first part a rich sound world of varying textural density, whilst that of the minimalism-influenced second part is dependent on a set of predetermined fingerings that produce a variety of mainly microtonal intervals whose clarity inevitably will be compromised by the addition of low vocal sounds and varying strength overtones at the player's discretion. The rhythmic patterns of this part are, in principle, similar to that which Fox describes in later works such as *Everything You Need to Know* (2000-2002), *Canonic Breaks* (2001 – 2003), and *Iridescence* (2005):

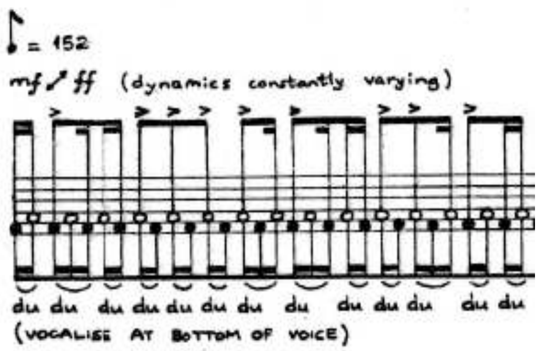
> I liked the level of complexity that self-similarity produced in [Tom Johnson's] rhythmic and melodic construction – one's ear can detect some sort of rule-based pattern-making but the patterns resist immediate aural analysis, which seemed to me to offer some kind of halfway point between chance operations and minimalist systems. […] Like Tom Johnson I use it as a technique to produce rhythmic and melodic proliferation, usually starting with a group of two elements and then finding a simple formula to make the relationship between them proliferate (Fox 2009a, 263).

The rhythmic patterns in part two of *Winds of Change* indicate some resemblance with the system of self-similarity described by Fox, above, and may be an indication that an almost identical system was developing in his own work some eighteen years earlier, though in *Winds of Heaven*, identifiable repeating rhythmic patterns are elusive. Using the semiquaver as one rhythmic unit (quaver = 2 etc.), the opening of the second part has the following rhythmic patterns[27], the vertical lines indicate the groupings (slurs). See also Example 6-1, below:

[27] Fox used this method of describing the rhythmic patterns in his *Iridescence* (2005), (Fox 2009a, 263-264) though the overall rhythmic organisation in that piece is substantially different to that of *Winds of Heaven*.

Example 6-1, The opening of *Winds of Heaven*, Part 2, showing rhythmic and slurred groupings:

| 2 | 3 2 | 2 | 2 | 2 | 3 | 3 2 | 2 | 3 | 2 2 etc.



The piece concludes with:

| 3 3 | 2 2 | 3 2 2 | 3 2 2 | 2 2 | 3 3 2 | 3 | 2 2 3 | 2 2.

At a higher level, the accents indicated in the score fall into the following patterns at the beginning:

2 5 2 2 2 3 5 2 3 10 6 2 2 3 etc.

and finish with:

6 2 2 3 11 4 8 3 7 2 2.

At the highest level, where the pitches are defined by the prescribed fingerings, each of the twenty-five different patterns of notes in groups of two, three, four or five pitches, occurs 24 or 25 times, depending on whether a note or notes overlap where the pattern changes.

Here one detects the influence in Fox's works of minimalism, evidenced by subtly changing patterns and a complex rhythmic texture that works simultaneously at three levels. The tonal material, represented by the individual pitches, is muddied by the addition of the player's vocalization and the intermittent presence of overtones due to the irregularly overblown accents. Fox's love of rich, texturally dense sounds is evident throughout the piece, as is his 'fondness for prescribing actions rather than sounds in notation' (see pages 152-153, above). The strictly composer-regulated phrasing and tape delay of part one determine the dense texture as much as do the pitches themselves. In part two, the process of performing the prescribed sequences of fingerings is inherently more important than the pitches they produce, which are simply a by-product of the prescribed fingering patterns. Processes are therefore in evidence throughout the piece, leaving no doubt that the composer's 'control of the overall flow of the piece is pretty much absolute' (*ibid.*) and the extent of the player's influence over the performance therefore limited. This will be discussed in detail a little later, but first I will address the composer's use of microtonality.

Microtonality has been an intermittent feature of Fox's work since the early 1980s. He composed *Winds of Heaven* soon after 'an encounter in 1982 with the music of Scelsi, Grisey, Murail, and Radulescu[28] at the *Darmstadt Ferienkurse*'. This 'resulted in a group of works from 1983 that use microtones in different ways: *Reeling* (in which he was 'primarily interested in the registral distribution of the pitches and used microtones simply to avoid the occurrence of familiar intervallic relationships'), *Etwas Lebhaft* (in which

[28] Scelsi's works influenced Radulescu, Grisey and Murail, particularly their concentration on 'gradual timbral transformations'. He was one of a group of avant-garde composers from the 1960s who 'had begun to explore the inner life of sounds, writing music which focussed on small fluctuations within sustained sonic bands' (Christopher Fox and David Osmond-Smith. "Scelsi, Giacinto." *Grove Music Online*. *Oxford Music Online*. Oxford University Press; Accessed 27 Jan. 2013. http://www.oxfordmusiconline.com/subscriber/article/grove/music/24720).

'quarter-tone inflections are heard against the background of repeated equal-tempered chords in the piano') and *Threnos'* (which 'is written entirely in quarter-tones around recurrent pitch centres, with the melismatic character of much Middle Eastern vocal music as a model') (Fox 2003, 124). Later works derived their microtonal intervals in a variety of ways: inflection (*chant suspendu*, 1997–8), overtone derived (*BLANK*, 2002), or based on the harmoniad[29] (*Chromascope*, 2005) (Pace and Saunders). Despite this Fox does not consider himself 'a "microtonal" composer': his microtonal works demonstrate no 'consistent adoption of one of the many microtonal ideologies available but rather [represent] an exploration of a range of different tonal resources' (Fox, 2003, 123).

Winds of Heaven uses microtonality in two different ways: the first part consists of short, simple melodic phrases consisting of two to five intervals that are heavily inflected with glissandos and microtones. With the twelve-second delay the phrases overlap and accumulate over time to produce clusters of varying textural density. The microtones – all quarter-tonal intervals, are clearly notated using standard quarter-sharp and quarter-flat signs respectively[30]. In some instances these can be pitched by using dedicated microtonal fingerings or achieved by using alternative fingerings, or by 'leaking' or 'shading' holes; in any case all can be accurately played. Part two consists of sequences of composer-determined fingerings (actions by the player) that produce a mixture of diatonic and microtonal intervals. This part uses tablature notation: a six line staff – five spaces, from which the player is able to identify the fingering to be used. Each fingering produces a definite pitch (see Figure 6-1, above) but the fingerings and the sequences of patterns into

[29] Harmoniad – based on the concept of "compound tones" - a generative principle devised by composer Tom Johnson (b. 1939) and used by Fox to produce connected pitch centres. The technique was also used in the composition of *Everything You Need to Know* (1999-2001), *Catalogue irraisoné* (1999-2001) and some of his Generic Compositions (1999-2001) (Fox 2003, 134-137).

[30] 𝄲 and 𝄳

which the composer has placed them are what define the movement. The instruction to accent (sharply overblown note, with a *sforzando* articulation) produces a slightly different multi-phonic (set of upper partials) from each of the fingerings. This combined with the broad pitch-bands of the low tessitura vocal sounds inevitably obscures the small intervals of a tone, three-quarter-tone, and quarter-tone.

Winds of Heaven places significant demands on the performer: a high level of understanding and proficiency with alternative and dynamic fingerings; exceptional breath control; knowledge of microtonal fingerings is required in the first part. In the second part, sufficient finger dexterity to deal with rapid and unusual finger combinations and the ability to maintain a constant, even, and uninterrupted flow of semiquavers during which breaths may be 'snatched on the second (semiquaver) of ♪ groups' (Fox 1984) for something approaching 7 minutes are the main physical demands made on the player. If the core ideal of the player's interpretation is an accurate representation of the composer's intentions then we can conclude that the closer we can come to understanding those intentions, the better we can establish the basis of a successful or at least an accurate interpretation.

I have established that the core of the compositional method of *Winds of Heaven* lies in the first instance in the composer's concept of the piece and secondly in a compositional style in which processes play an important role. In order to realize the piece, the performer has to enter the mind-set of the composer and thus prepare for a performance on the composer's terms; to what extent, therefore, can *Winds of Heaven* be interpreted?

The Oxford English Dictionary defines 'process' (noun) as 'a series of actions taken towards achieving a particular end', and secondly, as 'a natural series of changes' (OED, *s.v.* ‘process’). The processes inherent in a performance of part two of *Winds* can be clearly seen in the score (see Example 6-2):

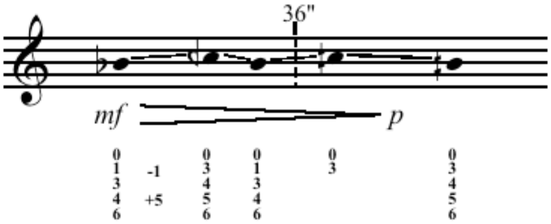
Example 6-2, the first page of the score of Part Two

There are three indications that, for the composer, the process itself is at least as important as the heard outcome in this movement: first, the tablature notation of the second part indicates fingerings only, and makes no reference to pitch; second, the vocalization and articulation indicate the grouping of the semiquavers into 2, 3, 4 or 5 places an emphasis in the piece on texture and rhythm, and finally, the composer's instruction regarding breathing is that this 'is left to the player. If possible breath should only be snatched on the second (semiquaver) of ♪ groups'. This suggests that priority is given to the constant flow of semiquavers over any indication of phrasing or the player's need to breathe. Hannan, in his CD programme notes, notes that 'the second part of the piece calls for simultaneous vocalizing and playing found in Australian didjeridoo music'. However, the composer does not ask for the piece to be played with circular breathing, as is necessary for playing the continuous drone of the didjeridoo.

The structure, flow, and phrasing are tightly controlled by the composer – in the first part the main factor is the rigid twelve-second tape delay; in the second part the relentless flow of semiquavers would appear to allow for no deviation of tempo – no rubato, no flexibility of phrasing. To ensure that there is something left for the performer to contribute to the performance of *Winds of Heaven* outside a purely mechanical re-production I will now address the technical difficulties of the piece with regard to the player making a musical contribution to the performance. I will begin by discussing pitch.

The glissandos of the first part, as noted above, are nearly all achievable by using standard quarter-tone fingerings or well-known alternatives but a few unusual combinations occur and one or two are problematic. It is to these that I will now turn my attention. The opening g♯^{1} - c^2 glissando is standard but the c^2 – b-quarter-flat^1 (at time 0’00”-0’12”) is more comfortably achieved by not using the standard fingering for b-quarter-flat^1 but by moving from c^2 (0 2) and adding fingers 3 and 4 which gives a perfectly in-tune b-quarter-flat^1. The d-quarter-sharp^2 in the middle of the phrase at 24” can be achieved with no finger-hole covered – from here fingers can be added in the order 0 2 3 4 5 to produce a *mp* a-quarter-sharp^1. The glissando across 36” provides a more interesting challenge: the b♭^{1} is fingered normally (0 1 3 4 6), c-quarter-flat^2 by simultaneously sliding finger 1 off and sliding finger 5 on. From there it is relatively straightforward to get to c-quarter-sharp^2 (0 3) and b-quarter-sharp^1 (0 3 4 5 6), see Example 6-3.

Example 6-3



Leaking hole 5, and then shading it again, can achieve the glissando e♭^{1}-f♮^{1}-e-quarter-sharp^1 at 2’-24”. The a-quarter-flat^2 – c-quarter-flat^2 glissando at 3’- 0” – 3’-12” requires a different fingering from the a-quarter-flat^2 of the previous glissando because of the register break between a^2 and b^2, but from the new fingering (θ 1 2 ~~3~~ 4 5 6 7) c-quarter-flat^3 is readily obtainable. The c-quarter-sharp^3 at 5’ – 12” can be obtained by fingering c^3 (θ 1 4 5) and carefully leaking hole 1.

The fingerings given in the tablature of the second part produce reliably accurate pitches as shown in Figure 6-1, above. These fall within the range of a quarter-tone sharp perfect fourth (c^1 – f-quarter-sharp^1). The largest interval within this range is a tone (c^1 – d^1) and the smallest an interval of a quarter-tone (f♮^{1} - f -quarter-sharp^1).

The tenor recorder tone is susceptible to splitting in the low register if care is not taken to control breath pressure. Changing breath pressure to suit dynamic requirements and vocalization at the bottom of the voice muddies, if not obfuscates, the pitches due to the inevitable presence of multiphonic sounds. However, the sequence of fingering patterns must be adhered to, so one is left with a low-pitched vocal noise combined with mid- to high-pitched overtones (multiphonics) of indistinct pitch with (apparently) irregular accents. The focus of the piece thus becomes one of rhythmic interest over a drone of varying textural density – depending on whether the group consists of 2, 3, 4 or 5 pitches.

Breathing and phrasing are treated differently in each of the two parts of *Winds of Heaven*. Both are clearly indicated in the first part by virtue of the notation but 'audible breaths' are also marked, particularly towards the end of the part. The player has some flexibility with regard to lengths of phrases as long as their durations fit into the scheme of the twelve-second delay with a maximum of six repeats. The second part has no phrasing indications or instructions. Here, the player must choose breathing places within the bounds of the composer's instructions, as mentioned above. He has to make an interpretative decision regarding whether to use rubato or not, in order to manage the breaths in a musical way. However, too much of this kind of use of rubato, even if well controlled and subtly varied and executed, is likely to become predictable and tedious. If imitation of the didgeridoo was the composer's intention then the use of circular breathing, a norm for the drone effect of didgeridoo playing, could be expected, though the composer has not indicated this, rather, 'breathing is left to the player' (Fox 1984). Both player and composer have to accept that this second part pushes the instrument and the player to their practical and technical limits. It is certainly true that vocalization is not uncommon in contemporary recorder repertoire, although it is rarely as sustained as in *Winds of Heaven*. The additional burden on the instrument of working in the lowest part of its register at varying and often high breath pressures, and at a rapid tempo is likely to cause jumping of the sound into uncontrollable multi-phonics. This will also impact on the clarity of the accents, therefore endangering the rhythmic clarity of the piece.

The set-up for the electro-acoustic first part – including a twelve second delay which should disappear by the sixth repeat, will require a personal computer loaded with suitable software such as *MAX MSP* or *Ableton Live*[31]. Comparison with recent developments in digital signal processing software and fast laptop computers have rendered reel-to-reel tape machines such as that required by the composer as cumbersome and in any case difficult to obtain. The composer also provides instructions for the player to position himself at different times to the left, right, or directly in front of the microphone 'in order to produce audible changes in the level of the amplified recorder sound' (Fox 1984). However, my experience of performing this piece suggests that a typical omnidirectional microphone, operating in an amplified environment, offers little perceptible change in sound levels apart from that occurring naturally from the rise and fall of pitch through different registers of

[31] *MAX MSP* by Cycling74 or *Ableton Live* by Ableton.

the instrument, regardless of how far to the left or right one turns in performance. An indication of the composer's intention with this movement can be seen from the score, where the first and final phrases – 0'00"-0'12" and 5'24"-5'36", show the rising and falling pitch corresponding to a similar rise and fall in dynamic level. Thus the physical movements of the player may be considered as an indication and reinforcement of the waxing and waning of the sound as the pitch and dynamic rise and fall. They thus add a theatrical or gestural element to the performance.

The challenge of the second part is to produce a convincing drone effect. The composer's instruction, however, is for 'snatched' breaths (Fox 1984), which will interrupt the drone and is thus likely to disturb the flow of this part and remains a musical and technical issue for the performer of some magnitude. Hannan's own recording of this part of *Winds*, whilst producing a very satisfactory sound with effective rhythmic variety is less successful in the manner in which the flow of the sound is interrupted due to the noisily snatched breaths (CD, track 1). The vocalization on the other hand adds an effective texture to the piece's sound world whilst the rhythm of the accented multiphonics lends a light-hearted 'jazzy' feel.

Lux Aeterna (1992-1994)

Markus Zahnhausen (b. 1965)

Markus Zahnhausen is one of a new generation of musicians whose activities include most aspects of the modern professional musician's portfolio. He is a composer, performer, teacher, editor, publisher, and has worked as a music journalist and critic for radio and magazines (Zahnhausen 1998a, 178). He therefore brings a wide range of musical experiences to bear in the creation of new repertoire for the recorder and his experience suggests a relatively broad range of interests, indeed he has written orchestral works, an oratorio, choral and chamber music as well as numerous works for recorder. He has achieved recognition for his compositions in the form of stipends and prizes (Zahnhausen) indicating a wide engagement with and acceptance by the music industry in general. It can be argued that this not only adds an aura of credibility to his works for recorder within the broader musical community but also to a large extent sets him aside from what has been called the recorder ghetto (Meynaud 1997, 6-8), a derogatory expression that emerged during the second half of the twentieth century due primarily to the overwhelming number and influence of players whose sole interest lay in early music compared to those seeking professional recognition for their work within the field of new music.

The development and success of the recorder's repertoire during the twentieth- and early twenty-first centuries can indeed be traced and linked to the improved knowledge and performance skills of influential players – a process that began with Brüggen and Linde in the 1960s and continues to this day. Zahnhausen's role as a composer-player in this is a continuation of a process that was first outlined in *The Recorder Today* (O'Kelly 1990, 11-19).

As a professional performer, Zahnhausen's knowledge of the instrument has enabled him to exploit its expressive and technical potential whilst his broader understanding of the milieu in which he composes, gained, for example, from his experience in journalism, places his music in a more central, or at least, a less peripheral position in contemporary music (and indeed contemporary *recorder* music) than much repertoire which seeks nothing more than to satisfy the needs of the market of amateur players rather than communicate the expression of deeper and more abstract musical ideas of the quality likely to satisfy the needs of contemporary music audiences and professional performers. For it is this, the creation of high quality contemporary repertoire, that many professional players see as being so important for the future of the recorder and which forms the basis of both Hauwe's and Zahnhausen's divergent approaches to the creation of new repertoire.

Zahnhausen brings his technical expertise on the recorder and his musical preferences to his compositions in a variety of ways that ultimately find their expression through the stylistic and musical variety of his works, each one a new development of his compositional style and technique as well as having something new to express, for he claims 'to repeat oneself is, for me, very inartistic'[32] (Zahnhausen 1998a, 186). His twenty-four works for recorder (twelve published) include eighteen unaccompanied solos, one unaccompanied duet for recorder and transverse flute, two for recorder, voice and other instrument(s), one for recorder and string orchestra (*The Awakening of Pan*, 2006), one for four recorders and string orchestra, one for string orchestra and four recorders (*Sviréli*, 2001), and one for recorder quartet. The titles of a number of the pieces indicate a strong interest in music of the past as well as with song (his output includes 7 works for voice and instrument(s) as well as an *a capella* motet) and include titles such as *Carmina Romana* (composed 1997) (using texts of ancient Roman poets),

[32] *'Sich zu wiederholen ist für mich etwas sehr Unkünstlerisches.'*

Klangreden (composed 1986)[33], *Lux Aeterna* (composed 1992-1994)[34] and *Ikona* (Icon) (composed 2006).

A strong didactic intent underpins a number of his earlier pieces: he refers to his *Sieben Stücke für Altblockflöte* (composed 1989-90) as being a 'sort of *haute école*[35] for recorder playing in which the advanced player can work on fingering, breathing and tonguing, and also on contemporary techniques such as multiphonics, glissandos, noise effects and so on.' (Zahnhausen 1991, 3). The didactic intent of the *Jahreszeichen* cycle is acknowledged in the programme notes accompanying the scores (Zahnhausen 1992a-d). Later pieces such as *Lyrische Szenen*, *Lux Aeterna* and *Horns of Elfland* (composed 1999) include sufficient instructive notes to the player, including fingerings, to indicate the continuing presence of a didactic intent there too, though this is not openly stated. A number of pieces are also imbued with romantic ideals: a connection with nature is evident, for example, in his *Jahreszeichen* (*The Seasons*) (composed 1989-1991) and *Lyrische Szenen* (*Lyrical Scenes*) (composed 1992). He describes *Jahreszeichen* as 'mood paintings' based on evocative poetic titles inspired by landscape and the natural world whilst the pieces of *Lyrische Szenen* 'are to be regarded as standing squarely in the romantic tradition.' (Zahnhausen 1997, III). *Horns of Elfland*, a piece 'inspired by the poetic imagery' (Zahnhausen 2003, 3) of Alfred, Lord Tennyson's (1809-1892) *The Splendour Falls on Castle Walls* that makes extensive use of rubato, silence and extremely quiet dynamics (referring to the 'echoes' of the poem) through the use of flageolet tones to evoke an atmospheric and reverential tribute to Benjamin Britten who set words from the same poem for the third movement, *Nocturne*, of his *Serenade for Tenor, Horn and Strings* (1943).

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33 The title *Klangreden* is a reference to the baroque 'sound speech' aesthetic.
34 The title is taken from the incipit of the Requiem Mass of the Roman Catholic church and is discussed in detail below.
35 High School

The overwhelming preference for solo pieces in Zahnhausen's oeuvre is derived from his desire to compensate for the instrument's complete lack of opportunities for virtuosic display through great music similar to that found in the nineteenth century repertoire of the piano, violin, and other standard orchestral instruments (Zahnhausen 1998a, 178). Allied with his passion for contemporary music his solution has been to write his own virtuosic solo repertoire.

An indication of Zahnhausen's aesthetic preferences thus established, it may now be instructive briefly to investigate his dislikes, for, as Hauwe suggests, one must accept the potential for an artistically restricted approach in the works of the specialist performer-composer whose prime concerns during the compositional process may be personal technical preferences rather than artistic ideals and which, as Hauwe less kindly implies, thus brings limitations to bear on his instrumental compositions. This is almost certainly the case with Zahnhausen who, for example, has a number of times publicly expressed his dislike of extended techniques, abstract noises and other tricks of some avant-garde music, which 'seem all too often to be an alibi for an intellectual and emotional vacuum'[36] (Zahnhausen 1998a, 184), as well as expressing an intense distaste of the new complex style that became prominent during the 1970 and 80s. He noted in particular Spahlinger's *Nah Getrennt* (1992) (see Chapter 4, p. 79), which the commissioner, Gerhard Braun, described as 'probably one of the most physically and psychologically strenuous pieces for recorder of our time' (Braun 1994, 294) as 'simply too much'[37] for the listener (Zahnhausen 1998a, 177-189). His rejection of the avant-garde aesthetic, whilst at odds with Hauwe's more adventurous and at times confrontational approach,[38] is not, however, a denial of the importance that period played in

[36] 'die nur allzu häufig ein Alibi für das gedankliche und emotionale Vakuum […] zu sein scheinen'
[37] '*schlichtweg eine Zumutung*'
[38] An example of this is his approach to technique as exemplified in his *The Modern Recorder Player* (Schott Ed 12150, 12361 and 12270).

the twentieth-century *renaissance* of the recorder and the development of playing techniques and new repertoire (Zahnhausen 1997, III). Rather, he would prefer to take stock of the situation in which the recorder finds itself and point to new ways of improving the image of the instrument (Zahnhausen 1998a, 177). He wants nothing more 'than to write *natural*, idiomatic music for the recorder.'[39] (Zahnhausen 1998a, 184). The thread, he says, that 'binds all my works together is perhaps my attitude to the recorder itself, the love of its specific sound, of its absolutely unalterable lyrical quality.'[40] (*ibid.* 186). In this sense Zahnhausen sees himself as a trendsetter, a late twentieth-century modernist who has escaped the bonds of highly complex, difficult music (for both player and listener) and the self-conscious virtuosity that is so often associated with the instrument, and Hauwe's attitude to contemporary repertoire in order to find a new way forward. Rather, for Zahnhausen 'music should […] touch the heart'[41] (*ibid.* 185).

Zahnhausen's conservative, romantic leanings in his approach to compositional content and style are balanced by a desire to find new means of expression on his instrument. As Jann Pasler puts it 'neo-romantic has become synonymous with neo-conservative post-modernism' (Pasler). This fusion of backward-looking conservatism and forward-looking post-modernism sums up the complex set of influences at work in contemporary recorder music, a situation discussed in 1983 by Hans-Martin Linde in his article *Neue Musik für alte Instrumente*[42] in which he discusses the tension produced by the confrontation of the old and the new – 'a delightful tension'[43] (Linde 1983, 395-404).

[39] '… wollte ich nicht anders, als *natürliche*, idiomatische Musik für die Blockflöte zu schreiben.'
[40] *'Der rote Faden, der alle meine Werke verbindet, ist vielleicht meine Einstellung zum Instrument Blockflöte, die Liebe zu ihrem spezifischen Klang, zu ihre absolut unverwechselbaren lyrischen Qualität.'*
[41] '*Musik soll* […] *das Herz Rühren*'
[42] *New Music for Old Instruments*
[43] eine reizvolle Spannung

Zahnhausen completed *Lux Aeterna* in 1994. He was 29 years old and his enthusiasm for the instrument and its repertoire combined with a youthful idealism are evident in this work. He began composing *Lux Aeterna* in 1992. It was initially intended as a movement, a 'universal memorial piece', as part of his fantasy-cycle *Lyrische Szenen* but felt it would be more suitable as a stand-alone piece and was subsequently revised and completed in 1994 (Zahnhausen, 3 June 2010).

> Peter,
> Lux aeterna was originally part of my solo cycle *Lyrische Szenen*, composed in 1992. As I got aware that Lux aeterna would match better as a stand-alone piece, I revised it for final publication in 1994. So, originally it was not a memorial piece for Jens Rohwer, rather a 'universal' memorial piece.
> When I heard of Rohwer's death in 1994, I decided to dedicate the piece to his memory. Rohwer was – in my humble opinion – one of Germany's most original composers of the older generation. We had personal contact but he was not a teacher of mine. I have recorded his marvellous Sonata for harpsichord and treble recorder for the Bavarian Radio.
> That's all in brief, I think.
> Best,
> Markus (3/6/2010)

The three fantasias that make up the cycle *Lyrische Szenen* are: *Pastoral*[44], *Traumspiel (Recollection of a Fantasia by G. P. Telemann)* [45] and *Nostalgischer Waltzer*[46]. They 'owe something to the solo fantasias of Georg Philipp Telemann' and 'are similar in nature' though 'quite different in character' to *Lux Aeterna*, 'being intrinisically united by the element of

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[44] Dedicated to Andrew Mayes: amateur player and editor of the English *Recorder Magazine* from September 1993-Autumn 2005.
[45] Dedicated to Dan Laurin, a Swedish recorder player.
[46] Dedicated to Markus Bartholomé, a student of Zahnhausen between 1995-2000. Although *Lyrische Szenen* was composed in 1992 it was not published until 1997, hence Zahnhausen's opportunity to dedicate *Nostalgischer Walzer* to his student retrospectively.

lyricism and an instrumental poetry completely idiomatic to the instrument.' (Zahnhausen 1997, III). Due to the composer's use of altering agogic accentuation and tempo rubato 'all three fantasias should be regarded as standing squarely in the romantic tradition.' (*ibid*.). The poetic titles and Zahnhausen's subjective response to their imagery as well as his emphasis on the importance of 'timbre' or tonal colour in performance are clear and ample testament to the presence of the element of lyrical romanticism in his music as noted above. This is all the more significant for his performance instruction in the *Jahreszeichen* cycle that concert halls with excessively dry or reverberant acoustics should be avoided (Zahnhausen 1992a-d).

The inspiration for *Lux Aeterna*, on the other hand, was the desire simply to write a piece for performance in a church with significant acoustic properties including long reverberation times (Zahnhausen, 1995b, 6). Unusually for Zahnhausen's works extensive use is made in *Lux Aeterna* of extended instrumental techniques including playing by blowing across finger holes and using a transverse flute embouchure, producing flageolet tones, whistling, and microtones, the musical purpose being to explore the recorder's sound world: 'it should be completely new, an 'outrageous' piece of music in the truest sense of the word'[47] (Zahnhausen 1998a, 185) but the effect should nevertheless be to produce a piece of music that is 'still, simple and beautiful' (Zahnhausen 1995a, 4). *Lux Aeterna* carries the dedication "*Für Dan Laurin, Jens Rohwer in memorium*"[48]. In order to present a thorough analysis of Zahnhausen's *Lux Aeterna* it will be necessary first to investigate the origin and meaning of the piece, and the context in which it was performed. We will then be able to examine the extent to which the composer was influenced by the original and how he may have incorporated these ideas into his own composition.

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[47] *'…es sollte ein ganz neues, im wahrsten Sinne des Wortes unerhörtes Stück Musik werden.'*

[48] Jens Rohwer (1914-1994) was a German music teacher and composer – 'unique among contemporary German composers' (Zahnhausen 1995a, 4).

Lux Aeterna is a communion antiphon and is part of the *Requiem Mass* (*Missæ Defunctorum*). The text for the communion of the Requiem Mass was confirmed by the Council of Trent (1545-1563) and is taken from the apocalyptic Old Testament fourth book of 4 Esdras, 35 and 34 (Anon 1962, 118):

Lux æterna luceat eis,	May everlasting light shine upon
Domine,	them, O Lord,
cum sanctis tuis in æternum,	with your Saints forever,
quia pius es.	for you are kind.
Requiem æternam dona eis,	Grant them eternal rest, O Lord,
Domine;	and may everlasting light shine upon
et lux perpetua luceat eis ;	them.
cum Sanctis tuis in æternum,	with your Saints forever,
quia pius es.	for you are merciful.

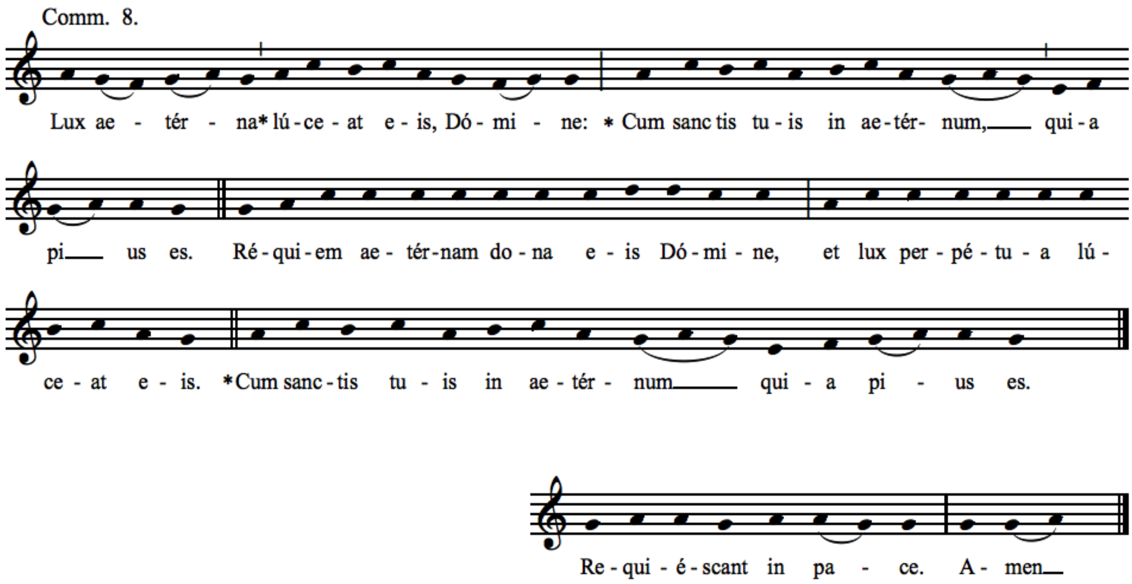
It is one of several books considered by Jews and protestants not to be of canonical value and was therefore omitted from approved versions of the Jewish and protestant bibles but admitted in Rome as being of some value and therefore partially included in Catholic versions (Anon 1991a).

It is thought that the communion in [its current] form dates back to the fourth century though the earliest Mass for the dead can be dated to the second century (Karp). The earliest sources for the chant melodies date from the tenth-twelfth centuries. The original melodies for the *Lux Aeterna* were commonly in the plagal versions of either the sixth or eighth modes (hypolydian or hypomixolydian respectively) and these were also sometimes transposed. Furthermore, the communion melodies indicated a ‘high incidence of modal instability’ (McKinnon), however, during the twelfth century modal ambiguity had increasingly been rejected as not being faithful to the original divinely inspired chants as noted by Saint Gregory and ‘modally ambiguous chants were emended in order to remove uncertainty’. (Hiley, 1990, 133).

There have been a number of attempts to modernise Gregorian chants, including the *Lux Aeterna*: initially following the 1546 Council of Trent; and then in 1582 Giovanni Guidetti published the first post Tridentine chant book "*Directorum chori ad usum sacrosanctae basilicae vaticonae et aliarum cathedralium et collegiatarum ecclesiarum*" (Lockwood and Crawford). A further version, edited by Franz Xaver Haberl (1840-1910) in Regensburg in 1871, was rejected in 1903. A commission was established in 1904 to prepare a new edition and this work resulted in the *Graduale Romanum* 1908 (Haberl 2010, 225-289 and Dyer).

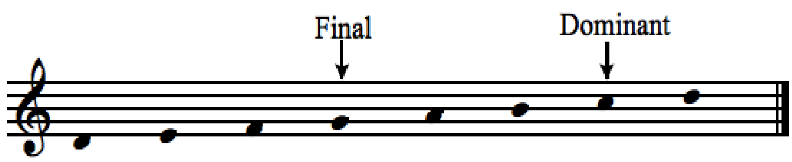
Example 6-3a, Facsimile of The Chant for *Lux Aeterna*, still in use within the Roman Catholic church's Requiem Mass according to the 1908 *Graduale Romanum* (Ordinarium Missae, page 88*)

Example 6-3b, The Chant for Lux Aeterna, still in use within the Roman Catholic Church's Requiem Mass according to Graduale Romanum 1908 – on modern staff



The *Lux Aeterna* is composed in the eighth church mode within the range D-D, has the final note G and is, therefore, in the plagal Hypomixolydian mode. It is in two sections, the antiphon *Lux Aeterna* and the verse *Requiem Aeternam* (see Examples 6-3a and 6-3b, above). It has existed in this form since at least the time of the *Missale Romanum* of 1474 (Harper 1991, 126). The dominant note, also called the tenor, in this case C, is so called because it acts as the reciting tone of the mode and is also a melodic pivot or the tone around which the melody centres, see Example 6-4 (Powers and Wiering).

Example 6-4, The Eighth Mode, Hypomixolydian:



The significant feature of the officially adopted version of the chant melody is the range, primarily restricted to the notes between the fourth and seventh degrees of the scale, G-C. It is further characterised by the consistent use of stepwise movement with occasional skips between the fifth and seventh degrees of the scale (A-C) with the melody just twice descending the minor third G-E. The use of larger intervals is slightly extended in the 1871 Ratisbon version with a rising perfect fourth occurring on the *Cum Sanctis* (twice) and a rising major third, F-A, also occurring twice on the *quia pius es*. However, it is the later version, taken from the 1908 and later editions of the *Graduale Romanum* that has prevailed within the church that I have used as the prototype for the present study.

The officially adopted 1908 version of the chant melody appears to show little evidence of the 'modal ambiguities' referred to by McKinnon and Hiley, above. On the contrary, the melody appears stable and supportive of the text by reaching its upper extent just once, leading up and on to the word *Domine* whilst the stabilising and central role of the dominant note, C, is confirmed by its persistent use on the words *æternam* and *perpétua*. Cadential patterns make consistent use of a falling second, including in the varied second phrase, *lúceat eis Domine*, which in this case is extended with a low F inflection before the repeated final note. The pattern of tones within the mode includes two semitone steps and use of these is restricted to two occurrences of E-F, both times on *quia pius es* and several uses, generally in a repeated pattern, of the interval B-C, thus highlighting the strength and confirming the importance within the piece of the dominant or chant tone C.

Zahnhausen's *Lux Aeterna* has C and G as tonal centres of gravity, where G is used in the role of a dominant, reflecting the important dominant and final notes of the Hypomixolydian mode. It is in three parts, A (bars 1 – 58), B (bars 59 – 96) and C (bars 97 – 127). Part A can further be sub-divided into five shorter passages (A1; A2; A1a: A2a; A3), each of which can be defined by the tempo and characteristic sound production techniques employed. Section B is largely microtonal whilst section C is both musically and, in its use of instrumental techniques, the most conventional. The three-part form has elements that are characteristic of classical sonata form: it consists of an exposition (with two subjects; bars 1-39); a development, bars 59-96; a recapitulation, bars 97-127.

The opening passage, A1, marked *pp dolente, quasi da lontano*[49] (see Example 6-5) is performed by blowing across a finger hole, in the manner of playing the transverse flute. The sound thus produced is *pianissimo*, breathy and ethereal. The melody is restricted to just three notes in this section: C, D and E♭, suggesting the key of C minor. The piece begins with a bar of silence in 3/4-time and each short, quiet phrase that follows is in a similar way separated from its neighbours by a three-beat silence. The silences, accompanied by the reverberation of the large acoustic envisaged by the composer, arguably create a reverential atmosphere and a sense of expectation and thus intensify the listening experience as well as adding a sense of occasion, spirituality, contemplation, and because of their irregular nature in the context of the phrases, uncertainty to the performance: throughout sections A and B the time signature regularly alternates between 3/4 and 4/4 causing the melodic patterns to be subjected to constantly varying ‘agogic accentuation’ (Zahnhausen 1995a, 6). The length and frequency of the silences gradually decreases through the first section, are minimal in the second section and absent throughout the third until the silence surrounding the final note. Thus the sense of rhythmic uncertainty diminishes through the piece until stability is finally established with the meter settling into a regular 3/1 from bar 112 to the end.

[49] sorrowful, as if from a distance

Example 6-5, *Lux Aeterna*, Section A1

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Material from this section is used again from bar 26, at the beginning of A1a, but in a shorter version just 9 bars long. Here the layout of the phrases is similar to that in A1 but the material is rhythmically offset compared with section A1 in addition to which the silences are foreshortened in bars 33 and 34 prior to a short repeat of material in the dominant key from A2, at bar 15. As with section A1, this material too is re-used in an abridged version from bars 35 – 39 (section A2a). The final section, A3, calls for the player to whistle and uses material from previous sections. See Table 6-1, below, for an outline of the structure and development of the section.

Table 6-1, showing the development of the first part of *Lux Aeterna* through sections A1 – A3

Section	**Tone Production Method**	**Tempo**	**Performance Instruction**	**Length (bars)**	**Features**
A1	Flute	♩ = ca. 66	*pp dolente, quasi da lontano*	1-14	Key = C minor Regular three-beat rests between phrases. Phrases are short, comprising 1, 2 or 3 notes. Character = ethereal
A2	Flageolet	♩ = ca. 76	*ppp e simplice*	15-25	Key = G major Occasional single-beat rests; longer phrases, up to 14 beats Character = brighter, with more ‘presence’

A1a	Flute	♩ = ca. 66	*pp dolente*	26-34	Key = C minor Rests between phrases becoming shorter Character = ethereal
A2a	Flageolet	♩ = ca. 76	*ppp e simplice*	35-39	Key = G major The final E hints at a change of tonality Character = brighter
A5	Whistle	♩ = ca. 84	*pp*	40-54	Key = Mixed, alternating between C minor and G major. The whistling and the mixed tonalities suggests a reconciliation and may represent the introduction of a human/physical element.
B	Microtonal	♩ = ca. 96 – ca. 176	*pp poco a poco crescendo ed accelerando*	59-96	Tonal centres C and G Microtonality and constant accelerando lends a sense of melodic instability
C	Ordinary	Minim = varies ca. 60-ca.84	*f Cantando espressivo e sonoro*	97-127	Rhythmically, melodically and tonally the most stable section. Strong sense of modality in final 14 bars.

Section B continues without a pause, separated by a one-bar rest from the end of Section A. Whereas the section A created uncertainty and instability through the use of constantly changing rhythmic patterns, distant, ethereal, thin and wispy sounds, section B creates a similar effect through the intermittent use of microtonal intervals and hesitant shifts in tonality. Other features are, again, the limited tonal range - for all except the last three bars this is restricted to a diminished octave, a constantly increasing tempo, which begins at ♩ = ca. 96 and finishes with ♩ = 176, nearly double the original tempo. Tonally, it begins with a short scalic passage in C minor that uses new melodic material covering the interval of a fourth and finishes in G at bar 96, having first been subjected to several transpositions; up a minor third at bars 66 – 68 and returning to C at bar 69. A pivot at bar 71 takes us in to D minor and then, hesitantly, to a central section tonally centred around G, bars 73 - 79, where it lingers uncertainly until returning to C minor at bar 83. The same minor third transposition at bar 86 is a variation of material heard in bars 66 – 69 but this time there are hints of G before returning to C at bar 93 prior to the final descent to G. The melodic movement is mainly stepwise though use is made of falling minor thirds (bars 64 and 84). The range of the melodies also often covers the interval of a minor third, for example bars 60 – 61 and bars 66 – 67. As the extent of the microtonal usage increases through the section the step-wise intervals become increasingly frequent and small, with extensive use of quarter-tones. This process begins with the introduction of d-quarter-flat and then b-quarter-sharp in bar 68 and, with the exception of bar 85, continues unabated until bar 88. The steady accelerando throughout the section and the increasingly frequent occurrence of quarter-tone intervals correspondingly increases the sense of instability through to the final descending phrase, bars 93 – 96.

The final section (C) is melodically and rhythmically the most regular of the three. It takes material directly from section A2 but places it in a new metric context. In this section the alternating 3/4 - 4/4 bars settle in to a regular pattern of extended passages in either triple or duple time (3/1 or 2/1), the exclusive use of semibreves and minims up to bar 114, and thereafter of breves and semibreves, in triple time, accompanies the introduction of a modal feel to the work, particularly at bar 107 where the opening G major/E minor passage moves towards an E♭-B♭-F modality based on the two corresponding diatonic tetrachords, which are made explicit at bar 114. Thereafter follows an extended passage that emphasises the modal origins of the concept for the piece, which ends on an F-C plagal cadence.

The following microtonal accidentals are used in Zahnhausen's *Lux Aeterna*.

Quarter-tone sharp = 𝄲 Quarter-tone flat = 𝄳

Threequarter-tone sharp = ♯ Threequarter-tone flat = ♭

These are inconsistent with either of the systems recommended by Stone (Stone 1980, 67-69), Risatti (Risatti 1975, 16-17) or Karkoschka (Karkoschka 1972, 2-3) though in these latter cases the quarter-tone sharp and quarter-tone flat signs are employed in separate systems by different composers for microtonal inflections in tonal music. Zahnhausen's choice of signs indicates a surprising absence of consistency of systematic approach within the piece. According to the system chosen for the quarter-tones the three-quarter-tone flat might more logically have been indicated by the addition of an arrow to the regular quarter-flat sign[50] which, although not widely in use has, according to Risatti, been used by Mauricio Kagel (b.1931-d.2008) (1953), Azio Corghi (b.1937) (1967) and Paul Méfano (b.1937) (1968).

The same signs have been used in *Winterbilder* and *Sommerklänge* of *Jahreszeichen* though the use of microtones in these pieces is limited to incidental occurrence as part of a short passage of multiphonics, e.g. in *No. 2, Weisse Weiten* from *Winter Bilder*, see Example 6-6. The most prominent note in each of the multiphonics is in bar 20 the c♯ and in bar 21 the e♭ and f♮ respectively:

Example 6-6, bars 19-22 from *Weisse Weiten*

50 That is, ♭

and for motivic colouration as part of an extended chromatic passage in *No. 1, Der Tag erwacht* from *Sommerklänge*, see Example 6-7.

Example 6-7, bars 27-34 from *Der Tag erwacht*

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The general increase in breath pressure through the passage above plays no role in the execution of the microtones in the following passage, which requires the use of accurate dedicated fingerings for the b-quarter-flat in both registers.

Sieben Stücke für Altblockflöte (Zahnhausen 1991, 3) uses different signs for the quarter-tones; sharp = †, three-quarters sharp = ♯, and flat = ♭. Usage is similar to that found in the two movements from *Jahreszeichen* (see p. 178) i.e. a combination of multiphonics based on a microtonally chromatic rising scale which, in turn, incidentally produces high-pitched microtonal notes and microtones as a result of altering the breath pressure in bar 105 though it is unclear whether this could actually accurately be achieved as part of a breath glissando incorporating a trill without the use of a complex combination of fingerings including shading with left hand finger three (see Example 6-8). There is evidence to suggest that the composer has chosen here a rather complicated notation to indicate a slow, simple vibrato (glissando) in combination with a trill on C-sharp:

Example 6-8, bars 99-105 from No.6 *Hommage à D. SCH.* From *Sieben Stücke für Altblockflöte*

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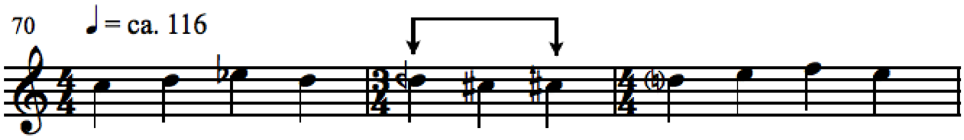
The rather primitive approach to the production of microtones shown in the example above is in contrast to the more sophisticated and extensive use of microtones in *Lux Aeterna*. Here their role is both as a central melodic feature of the work and as a structural element within the central section and that makes this piece unique in Zahnhausen's output. A significant feature of his microtonality in *Lux Aeterna* is his structural use of enharmonic equivalents at points in the passage that suggest modulation. For example, the use in bar 71 instructs the performer in the direction of melodic movement and indicates a point of tonal modulation, in this case from C minor to D minor: down towards the c♯ from the first beat d-quarter-flat and up from the third beat c-three-quarters-sharp towards the d♮ at the beginning of the following bar as shown in Example 6-9, below.

Example 6-9, bars 70 – 72

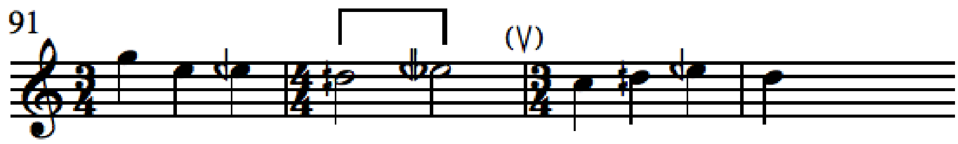


Example 6-10 shows how the movement towards the dominant key, G, hesitates, initially by the use of a semitone fall away from the microtonally sharpened leading note and secondly by the addition of a rest before the G, thus weakening movement towards the dominant tonality, which is further destabilised by the use of microtonal deviations from the G immediately before and after the hiatus at the third beat of bar 76. The use of enharmonic equivalents, indicated by the bracket in Example 6-10, either side of the hiatus again highlights, at least on paper, the instability of the movement between tonalities and hints, in this case with the a-threequarters-flat[2], at the future direction the modulations may take; here it presages the movement down towards C, which is finally reached seven bars later, at bar 83.

Example 6-10, bars 75 – 77

The final phrase begins at bar 93 and is preceded by a third enharmonic equivalent – the d-quarter-sharp – e-three-quarters-flat (see Example 6-11, below). Unlike the other two occurrences here we find the end of a phrase. The two notes are clearly intended to be played separately and, since the possibility of a breath is indicated after the second of the pair, the player must not assume to have been given any instruction regarding forwards movement; the phrase ends and a new start is indicated.

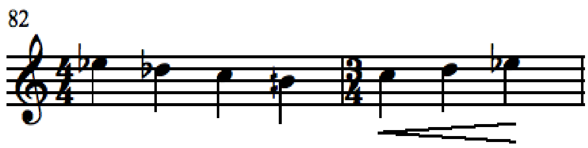
Example 6-11, showing a third use of the enharmonic equivalent



Section B finally comes to rest on G at bar 96 following an extended descending passage that begins in bar 90, with the B♭, the highest note encountered in the piece thus far.

The use of b-quarter-sharp leading in to c (see Example 6-12, below) may be seen to highlight tonal modulation pivots in the same way as the enharmonics in Examples 6-9, 6-10 and 6-11, above. The quarter-tonal raising of the leading note strengthens the melodic move to C: it occurs twice, at bars 68 – 70 and across bars 82 – 83:

Example 6-12 shows the use of the raised leading note in C



The movement towards the dominant G, on the other hand, is teasingly withheld by quarter-tonally flattening a previously sharpened leading note, so that the melodic movement is away from the G, and also by the insertion of rests, breaths or by microtonally altering the home note. Example 6-13 shows a variety of playful ways in which the G is repeatedly withheld in the central section, bars 69 – 81. Note the descending quarter-tonal scale, bar 76, leading out of the passage, eventually to arrive in C at bar 83:

Example 6-13

It has been shown that Zahnhausen's use of microtonality in this section highlights important structural points and heightens the sense of melodic movement and instability. Example 6-14 shows the main centres of tonal gravity as the middle section progresses.

Example 6-14. Highlighting the tonal centres of gravity (shown in boxes) in the central microtonal section.

Considerable emphasis is placed in all of Zahnhausen's works on tonal quality or timbre. In *Jahreszeichen*, for example, he advises the performer on the acoustic properties of the performance space as an aid to enriching tone quality and expects advanced and professional players to be familiar with a range of 'dynamic' fingerings with which it is possible to achieve dynamic and timbral variety. A relatively straightforward example of this kind of usage can be seen in the second movement, *Blätter im Wind*, from *Jahreszeichen*, *Herbstmusik* (see Example 6-15, below) where the use of a *piano* fingering will produce a somewhat quieter and timbrally softer or more muffled tone. However, this kind of specifically notated usage is rare. More common in his works is his recommendation that the performer use 'recorders with so-called "low" tuning (A 415)' because of their 'considerably greater sonority and softer range of timbres' (Zahnhausen 1992a, 11). A similar note appears in *Lyrische Szenen* (Zahnhausen, 1997, III), see Example 6-15. This perceived difference in sonority might be due to little more than the effect of the lower pitch or it may be an entirely subjective assessment of a particular instrument or of the instruments of a particular maker or makers. Whether such a difference can be quantified is assessed in Chapter 5 of this study.

Example 6-15, *Blätter im Wind*, from *Jahreszeichen*, *Herbstmusik*

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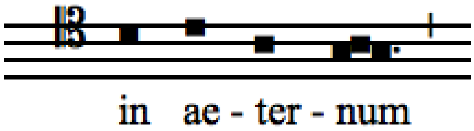
Thorough knowledge of the use of fingerings such as the one used in the example above is essential for determining dedicated microtonal fingerings of the kind and accuracy necessary for the successful performance of microtonality in works like *Lux Aeterna*. Once familiarity with the fingerings has been acquired they can readily be applied to the straightforward melodic context of *Lux Aeterna*. Zahnhausen's suggested fingerings produce notes with a consistently bright, open tone with the exception of the fingering for G-quarter-sharp/A-three-quarters-flat, which due to the number of holes covered (123456~~7~~), produces a softer, darker, slightly 'muffled' sound. It is not clear whether this 'darker' timbre is intended or not but it certainly has the feeling of wanting to return to the dominant note G rather than continue rising in pitch, away from the dominant. Should a timbre more in keeping with that of the rest of the movement be desired, a suitable alternative in the context of the surrounding fingerings in order to produce a consistent bright and open tonal quality across the range of notes used might be to remain in the first register by using the fingering - - - - 5 6 - . (the use of fingers 3 and 4 in Zahnhausen's fingering sends the instrument into the second register).

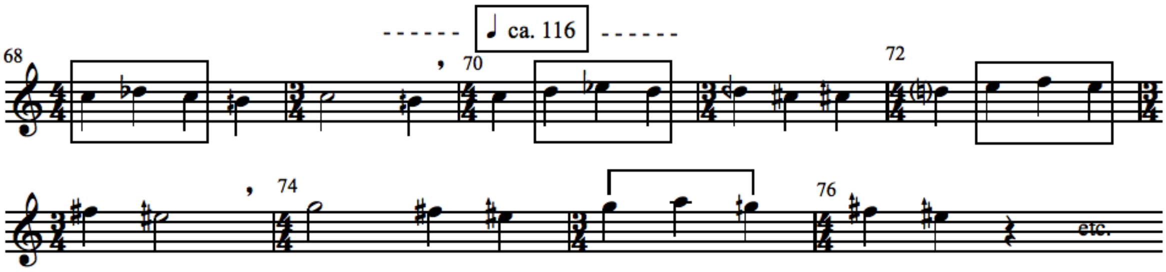
Original Gregorian chant melodies, including *Lux Aeterna*, varied from place to place and changed over time (Hiley 1990, 120-142) and part of the purpose of this study and an important element in the performer's role of interpreting the piece is to determine the extent to which Zahnhausen has incorporated elements of the original chant melodies in his piece. This information will form the foundation on which a considered interpretation may be based. The clearly defined phrases of the chant melody are determined by the underlying text and supported by consistent use of the falling second at cadences and the mode's final note, G. A comparison, for example, of the twice-occurring G-A-G rocking motif on the syllable '*num*' in *aetérnum* in the original chant (see Examples 6-16a, 6-16b), with similarly phrased motifs in Zahnhausen's piece (see Example 6-17) reveals just three occasions where Zahnhausen uses the motif, albeit with the smaller semitone interval. Bar 75 includes a microtonally modified version of the same motif (see Example 6-17):

Example 6-16a, from the original Gregorian chant *Lux Aeterna*



Example 6-16b, from *Lux Aeterna* in a modern transcription

Example 6-17, bars 68 – 76 from Zahnhausen's *Lux Aeterna*



Zahnhausen's *Lux Aeterna*, like the original chant melody, makes extensive use of stepwise melodic movement, indeed, it is a defining characteristic of the piece but in all other respects this is a contemporary instrumental composition with few references either to the modal nature or the vocal roots of the original chant. Indeed, Zahnhausen's use of rhythmic instability as noted above (see page 174) and the extensive use of microtones in the central section are in direct contrast to the modal and melodic stability of the chant melody. Despite his 'love of [the recorder's] specific sound, of its absolutely unalterable lyrical quality' (Zahnhausen 1998a, 186), he makes extensive use of extended instrumental techniques including tonally unstable microtonality, the production of ethereal sounding flageolet tones, transverse flute sound production techniques and whistling, thus removing his composition a step further in intent from the sung source material and conceptual inspiration for the piece whilst simultaneously invoking the recorder's expanded tonal and dynamic possibilities through the use of unconventional playing techniques as its *raison d'être*. Indeed, it is the performer's skill with 'the painstaking dynamic calibration of the four levels of timbre: 'flauto traverso', harmonics, whistling, and 'ordinario'', Zahnhausen writes, that is 'the decisive element in performances of *Lux Aeterna*' (Zahnhausen 1995b, 6).

The lyrical qualities of the recorder, so highly valued by the composer, are here secondary to dynamic and timbral variety. However, dynamic control over the flageolet and flute passages is naturally limited by the techniques themselves leaving one element of performance - the ablility to sustain the melody, to find the instrument's lyricism through these passages - that is likely to prove the greatest *musical* challenge for the performer. Only the final passage of the first section (A3 in the score, see Appendix 9, page 357), which is to be whistled, offers the player the opportunity to demonstrate dynamic variety, not through the recorder but in his whistling skills. How is the performer to reconcile these apparent contradictions? This more 'human' element of the performance, the whistling, 'mediate[s] timbrally between the 'flauto traverso' notes or [sic][51] harmonics and the subsequent *ordinario* notes.' (Zahnhausen, 1995b, 5) and suggests one stage in the move from the purely ethereal to the physical world in a way that suggests a reconciliation of the two and a 'coming to life', an interpretation that is supported by the gradual increase in tempo through the section and indeed the gradual establishment of rhythmic and tonal stability as the piece progresses.

Section B (see Appendix 9) is technically more straightforward - once familiarity with the nine microtonal fingerings is established (see the microtonal fingerings that are given in the accompanying notes to the score) and the performer has the skill to play a melodic line convincingly with all that entails – breath control, sensitivity to phrasing - no further technical

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[51] '…sollen klanglich vermittelnd zwischen den "Querflöten"- bzw. Flageolet-Tönen und den ordinario-Tönen wirken.' Bzw. (=beziehungsweise) here means "and" or "likewise". A more accurate translation would read '… should mediate timbrally between the "flauto traverso" notes and likewise between the harmonics and the subsequent ordinario notes.'

difficulties are presented. The few dynamic markings are in accordance with the natural rise and fall of the melodic lines and the same is true of the final section (C). It is clear that the composer has composed the dynamic and timbral variety into the piece leaving little in the second and third sections to challenge the performer technically. Instrumentally, there are in the first section two technical challenges: the production of flageolet tones and a transverse flute embouchure as the method for note production and, in contrast to much nineteenth century music, the virtuosity of these is understated – there are no displays of instrumental bravura. This is in direct contrast to Hauwe's, as Zahnhausen might see it, more extravert approach to performance.

One may have reservations about Zahnhausen's inconsistencies in his use of microtonal signs, his attitude towards and use of unconventional playing techniques including calling on the player to whistle and to blow across finger holes in order to produce tones with a transverse flute embouchure, nevertheless the result is an effective and in some ways challenging piece.

Dawn's Dove (1994)

Nicola LeFanu (b. 1947)

Nicola LeFanu's most important early musical influence was the composer Elizabeth Maconchy (1907-1994) - her mother. Other early influences include some of the most important composers of the early-mid twentieth century including Witold Lutoslawski (1913-1994), Anton Webern (1883-1945), Leoš Janáček (1854-1928), Alban Berg (1885-1935), Peter Maxwell Davies (b.1934) and Harrison Birtwistle (b. 1934). She qualifies their influence, however, as being of a 'quite low-level' and of a 'conceptual' nature, concerning the 'shape and grammar of a piece' and in particular not to do with the 'sound-world' due to her own musical language already being 'sufficiently formed' at that time (LeFanu 2006, 125-126).

LeFanu's works include six operas of which three were written during the decade when Dawn's Dove was composed: *The Green Children* (1990), *Blood Wedding* (1992) and *The Wildman* (1995). Her total output amounts to around ninety works of which over forty involve voice or voices with or without instrumental accompaniment. She considers herself 'as predominantly a vocal composer' despite having composed 'just as much instrumental [as vocal] music' (*ibid.* 130). Her style, therefore, is primarily melodic: lines, she explains, may be expressive 'in terms of contour, shape, tension', and can generate different textures, 'outline register and carry the harmonic implications of a piece. This is particularly true of my music, where registral space and harmony are all-important: often my starting point'(*ibid.* 130). Melodic lines, therefore, can play a structural role in her music.

Typical also of Nicola LeFanu's works 'are pieces that avoid goal-orientation' (*ibid.*) which 'owes a great deal to Eastern modes of thought and mirrors the composer's increasing interest in Tao'[52] (Hall 1979, 202). It is a compositional style that has also been associated with the feminist movement in music (Macarthur 2007, 57) though there is no evidence in any of her writing that sex or gender issues have influenced her compositions. LeFanu founded the UK based *Women in Music* organisation in 1987 with the socio-political purpose 'of [the] active promotion of the work of women composers' (Halstead 1997, 160). Her compositions, however, are much more about 'expressing human feelings', a fusion of the intellectual and the emotional, than engaging with political or social concerns (LeFanu 2006, 129).

LeFanu's interest in Zen Buddhism has been a major influence in her music. The two people who particularly encouraged this interest were her teacher the Korean-American composer Earl Kim (1920-1998), who introduced an Asian influence and from whom she learnt about 'economy of expression' which, she says, 'leads to a tremendous intensity' (LeFanu 2006, 126) and her husband, the composer David Lumsdaine, with whom she has had a close working relationship since the early 1970s (see *Metamorphosis at Mullet Creek*, page 212). According to Hall (2003, 63), Lumsdaine has been a devotee of Zen since 1973 or 1974. LeFanu's own interest in Zen was aroused in the late 1970s by which time she was already aware of 'the idea [in Asian art] of capturing something in a single brushstroke', a reference to the practice, derived from calligraphy, of rapidly and spontaneously executing poetic, sweeping lines, apparently with a minimum of thought or effort on the part of the artist, which

[52] Hall may be confusing Taoism and Zen. LeFanu has expressed her interest in Zen in a number of articles and interviews and her reference to brush work in Asian art appears to confirm this (see illustration 6-1, page 191). The two belief-systems are similar: Taoism is 'a mystical religion recommending doing nothing and resisting nothing.' […] it encourages 'virtue, compassion, humility and non-violence.' Zen, on the other hand, is not a religion but encourages the individual development of inner understanding. 'The student must learn to act spontaneously, without thinking and without self-consciousness or hesitation.' (*Pears Cyclopaedia* 1991-92, J51-56)

Illustration 6-1. ‘Orchid’ by Yamada Kensai (1911-1974)
From ‘Zen Brushwork’ by Tanchu Terayama (trans. Judge T. and Stevens J.)
2009, Tokyo, Japan

nevertheless express grace, movement and also tell us something of the spiritual relationship between the artist and his subject (Gombrich 1988, 102-112). LeFanu values music's power 'to take us out of ourselves, the "here and now" of daily physical tasks is translated into a "here and now" of the spirit' and is not only a reflection of her passionate, indeed spiritual engagement with the music of south-east Asia (LeFanu 1980, 28) but a further indication of the influence of Zen Buddhism on her work. She explains how this has manifested itself in her music through the economic use of material in, for example, her *Seven Inventions and a Passacaglia* (2000) (previously *A Little Sketchbook for Piano Duet*) (LeFanu 2007) by using 'elliptical forms, vivid images that make their point without needing elaboration, and which are coherent because of the larger harmonic field lying behind the individually characterized miniatures.' (LeFanu 2006, 131), see Example 6-18:

Example 6-18, from LeFanu, *Seven Inventions and a Passacaglia for Piano Duet, No. 4 A splashy toccata, obsessed with repeated notes*

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One of a set of eight miniatures, *No. 4 A splashy toccata, obsessed with repeated notes*, is an aptly named miniature of just 55 bars demonstrating LeFanu's use of tightly focussed writing that succinctly captures the essence of the piece.

Discussing her song cycle *The Same Day Dawns* (1974), LeFanu reiterated her admiration for 'the concentration of Chinese and Japanese art: an art apparently simple, yet rich in implicit meanings. A few brush strokes can conjure up a magical landscape for us. It was towards this economy and intensity that I aspired' (LeFanu 1974). It is a piece that uses 'texts drawn from Tamil, Chinese, and Indian poems. The work is a cycle of very short, atmospheric songs that reflect the mood and color of the words with a conciseness reminiscent of oriental art.' (Roma 1991, 184). This idea manifests itself in the recorder's repertoire, for example, in the work of Ryohei Hirose (b.1930) and in particular his quartet *Lamentation* (1975) where 'the composer's aim was to create the effect of an ink painting. This he does through the juxtaposition of continuous versus discrete sounds, light versus shade. The ever-changing forms and aspects of grief are conveyed with great intensity and expressiveness' (O'Kelly 1990, 122).

Dawn's Dove is a short piece, sixty bars long, for solo treble recorder loosely based on the birdsong of a dawn chorus. It is not, she writes, 'a literal birdsong' but hopes that it 'captures the spirit of a jubilant dawn chorus - as well as the softer sounds of a dove, which does not get up as early as other birds!' (LeFanu 1994). Describing her music, Nicola LeFanu said in 2009 it is 'sometimes like Guinness' and 'sometimes like champagne' (LeFanu 2009, 11). The writing in *Dawn's Dove* can be shown to be typical of the composer's essentially broad and elegant melodic style contrasted with moments of melodic intensity and rich ornamentation, some of which in *Dawn's Dove* is 'coloured' with the use of microtonality.

Symbolism, and in particular that relating to birds, plays a role too: ‘generally speaking, birds […] are symbols of thought, of imagination and of the swiftness of spiritual processes and relationships’ (Cirlot 1962, 28). The subject of this piece, the dove, traditionally symbolises peace, marital constancy, faithfulness, gentleness, freedom and, in Christianity, the Holy Spirit and transcendence (Coleman, 1913). Numerous references to birds have occurred in the recorder’s repertoire since the early sixteenth century (Lander). The specific depiction of the dove is rare, however, there is a reference to it in Benjamin Britten’s *Noye’s Fludde* (1957) and the third movement of Jacques Hotteterre’s *Premiére Suitte de Piéces* (Op.4, No.1, 1712), marked *Rondeau Tendre*, *Gracieusement*, called *Les Tourterelles*[53] (The Turtle Doves) (Mather 1973, 40). This lack of references to the dove in the recorder’s repertoire would seem to be at odds with the traditional symbolism of the recorder in music and art: love, death, the spiritual, birdsong, pastoral, supernatural and Eros (Rowland-Jones 2002, 7; 2008, 7; 2009, 137; 2010, 4; Griscom and Lasocki 2003, 28-29). Indeed, since the two traditionally share a number of symbolic associations, it would be reasonable to think such a combination might be more commonly found in the recorder’s repertoire. In *Dawn’s Dove*, it seems that some, at least, of this shared symbolism is realised: friendship, faithfulness, gentleness and birdsong.

Dawn’s Dove was dedicated to English composer Anthony Gilbert and premiered at a concert to celebrate his 60th birthday. Gilbert is a long-term friend and colleague of LeFanu and her husband David Lumsdaine. LeFanu acknowledges in her programme note a quote which occurs early in the second section (bars 27-43, see Example 6-19, below) of *Dawn’s Dove*, from a piece, *Towards Asavari* (1978), by Gilbert: ‘At the end of that work, there is a trumpet solo which outlines the Indian raga on which the piece is based (see Appendix 16). My quote alludes to that.’ (LeFanu 1994), see Example 6-20.

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[53] The origin of this nickname is unknown; it does not appear in the original publication of 1712 (Paris) but a subsequent edition from the same year carries the sobriquet and additional ornamentation.

Example 6-19, *Dawn's Dove*, b 27-43

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Example 6-20, from Gilbert's *Towards Asavari*

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The quotation is not an exact one but is nonetheless significant both as a gesture of friendship to *Dawn's Dove's* dedicatee and structurally for its position within the work. This will be discussed in more detail below. LeFanu, however, short-circuits the listener's curiosity and the problem of identification by naming Gilbert's work in her programme note (the presence of which in all likelihood would otherwise have remained unnoticed) and thus simultaneously identifies her motive for using it; she concedes to the simple attraction of the 'pleasure of allusion' (Whittall 2003, 5). Taking pleasure in quoting from a work of a long-term friend in this way implies admiration for the work and signifies the strength of the close and long-standing friendship between three composers: Lumsdaine, LeFanu and Gilbert. Lumsdaine has Indian ancestry and his own music has, to a small extent, been influenced by Indian music; indeed in *My Sister's Song* (1974), dedicated to 'Nicola' [LeFanu], he uses texts that are translations of Tamil love songs and ancient Mesopotamian poems (Hall 2003, 108).

Gilbert's own interest in Indian music is manifested in two works from the late seventies, *The Chakravaka-Bird* (1977) and *Towards Asâvari*. Both pieces are based on the theme of longing and fulfilment (Glover). Furthermore, the influence of birdsong, rhythmically and harmonically, in both of Gilbert's pieces (Gilbert 1984, 42-43) (Lumsdaine's interest in bird song is discussed on page 212 of this thesis), further confirms the shared interests among the three composers.

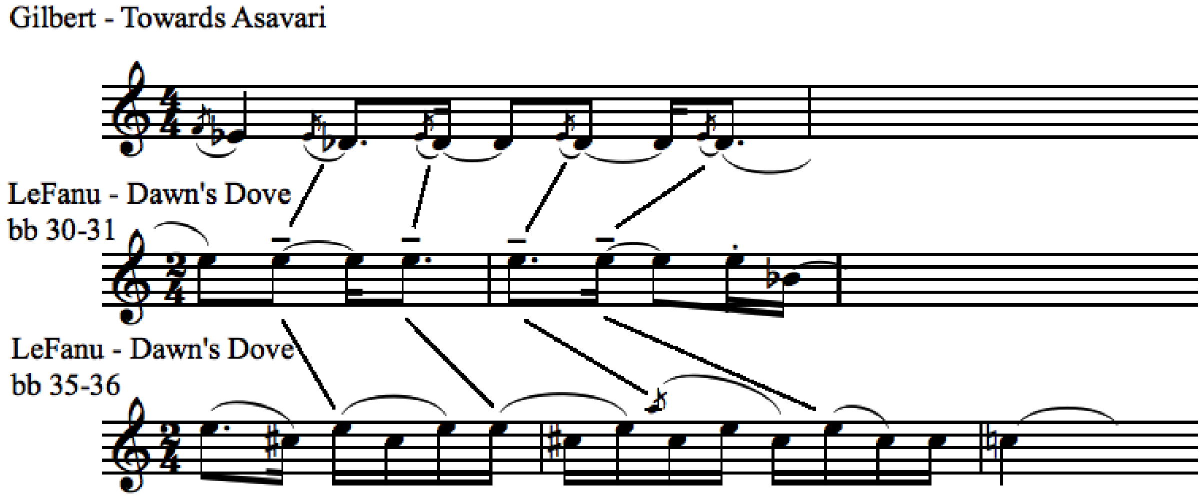
Gilbert's use of the rhythm of birdsong employs what he calls the 'principle of cyclicity […] to maximise the time interval between repetitions of a given phrase', which, he continues, 'is a feature of types of Indian classical music' (*ibid*.). Gilbert's 'cyclicity' refers not to the large scale cyclic forms familiar in western music but to his use of melodic and rhythmic cells or ostinati, which he calls 'mantras', 'akin to that of birdsong' that 'are repeated by individual instruments at measured intervals'. Harmonically, he refers to the 'very slowly changing harmonic backgrounds that [he] had begun to borrow from Indian and Indonesian musics' and the presence of which he implies in his observance of ambient noise during trips into the Australian bush to record birdsong (*ibid*. 36).

> ‘It is impossible not to listen to the land, when the “paddocks thrum with cicadas, crickets, birdwings. Up from the creek comes the chirr of frogs” (Winton 2003, 86, quoted in Richards 2007,7).
>
> It is a “great all-embracing sound […] a layered music, dense but deeply flowing, that was clippered insects rubbing their legs together, bird-notes, grass-stems chaffing and fretting in the breeze’ (Malouf 1999, 11, quoted in Richards 2007, 7).

It is an approach to the development of a harmonic sound-world that resonates in the music of LeFanu and Lumsdaine too. The influence of birdsong and traditional Indian music on all three composers is, therefore, strong.

In *Dawn’s Dove*, LeFanu employs Gilbert’s material to suit her own musical purpose, see Example 6-21; the raga *Asavari* is traditionally played mid-morning, after the dawn chorus and at the time when the dove, as LeFanu writes, makes its late appearance. The use and placing of the raga, at the beginning of the second half of the piece, is symbolic not only of the timing of the dove’s appearance, later than the other birds, but also strengthens the narrative element of the piece, an aspect that will be discussed in more detail below.

Example 6-21, showing Lefanu's quote from *Towards Asavari* and her variation of it.



A further prominent element in *Dawn's Dove* that reflects the composer's approach to the subject matter is her repeated use of traditional weak or feminine cadences. These symbolise the perceived 'gentleness' of the dove and in most cases this is reinforced by their occurrence as part of falling, sighing appoggiatura-like figures. Example 6-22 shows a sequence of three such cadences, each with a different outcome, at bars 39, 41 and 43. In bar 39 the cadential B♭ briefly continues with a new version of the main repeated-note motif, ending with a rising question-like figure in bar 41. The cadence at bar 43 marks the end of the central section, before the accelerating microtonal flourish that leads into the quicker passage that follows.

Example 6-22, showing three examples of feminine cadences in *Dawn's Dove*

There are numerous similar examples of all three different uses of the traditional feminine cadence: for example as the beginning of a new idea (bars 29-30); the rising, questioning figures of bars 11 and 12 and the falling weak ending of the repeated two-bar phrase of bars 49-50, to highlight just a few. It is an idea which LeFanu uses very effectively to exemplify the gentleness of her subject in this piece.

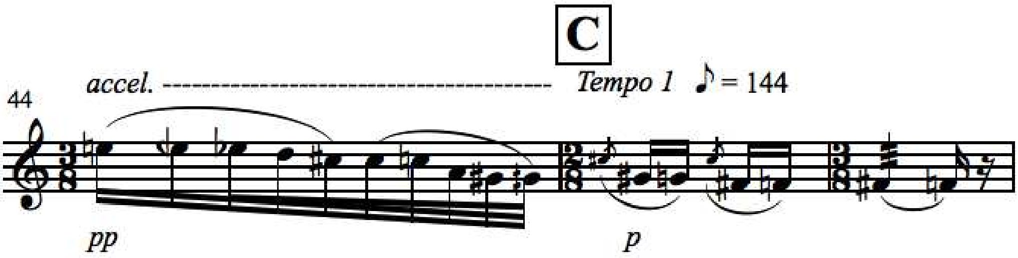
Dawn's Dove begins with a fanfare-like opening that uses material similar to that at the beginning of the epilogue to her opera *The Wildman* (1995). In the opera it signifies the dawn (LeFanu 1994). The piece thus begins in a lively manner with the first early-morning call (see Example 6-26, page 200, below) immediately followed by a contrasting short, leaping answer in bar four. A colourful A♭-B♭ trill in bar five announces the beginning of the cacophonous dawn chorus which continues to a climax, full of colourful microtonal inflections, around bars 22-23, before the falling scalic figure in the later part of bar 23 through to bar 25 prepares the listener for the arrival of the quieter dove, beginning at B (bar 27) and continuing through to bar 43. This cacophony is interrupted just once, in bars 16-17, by an early appearance of gentle cooing, represented by flutter-tongued c♯s. Bar 44 replicates the falling scale of bar 24 but this time with an accelerando leading to a return of the original tempo at C (bar 45) which includes lively ornamental acciaccaturas and a return of the rhythmic leaping motive of bar 4 mixed with a broader melodic passage from bar 50. The piece ends with a coda from D (bar 53) that combines the slower tempo of the central dove's passage, bars 27-43, with elements from the livelier first section. The piece ends calmly with three gently fluttered F^1s, reminiscent of Benjamin Britten's portrayal of the dove in *Noye's Fludde*, and the return of the leaping fifth motif previously heard in bar 4 and again in bars 16-17, see Example 6-23.

Example 6-23, from Benjamin Britten's *Noye's Fludde*, showing the use of flutter-tonguing to portray The Dove.

Dawn's Dove is in four continuous sections, the structure corresponding to the narrative flow. The fanfare-like opening, section A (bars 1 – 26), a middle section B, marked '*Steadier*', bars 27 – 44, provides a more reflective passage and a contrast to the "*jubilation*" of the richly ornamented first section. The original faster tempo returns at C (bars 45 – 51) with brief references to the opening section before the piece concludes with a coda, indicated by a return to the steadier tempo at D (bars 52 – 60). The slower central section B is flanked at the end of the first fast section (bars 24-26), see Example 6-24, and the start of the second fast section (bars 44-47), Example 6-25, by similar material in the form of a composed *rallentando* and *accelerando* that lead in and out of it at bars 24 and 44 respectively.

Example 6-24, showing a composed *rallentando* leading into the slower middle section:

Example 6-25, showing the accelerando back to the first tempo at C:



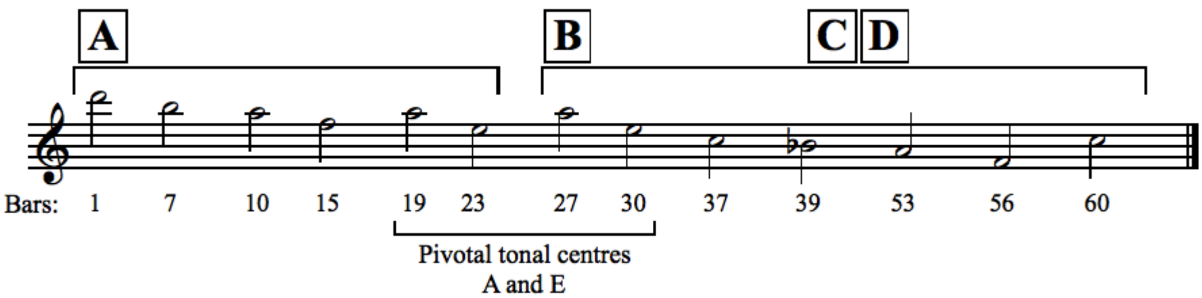
The structure of the piece is defined by a recurring repeated-note motif at different pitches, rhythms and tempi throughout the piece that serves as the central motif, defines the tonal centres and gives the piece its coherence, see Example 6-26, below. The opening bars establish the main motifs: the repeated notes of bars 1-2, the recurring motif that establishes the tonal centres of the piece, and the rhythmic motif of bar 4 which recurs throughout the piece. Initially it is made up of the interval of a perfect fifth, only heard again briefly in bars 16-17, where the c♯ and g♯ hint strongly at the A tonality which follows soon after, at bar 19, an event which is itself, again, presaged by the c♯ acciaccatura, and again in the last bar. Its first appearance presents us with the two notes that will represent the main tonal centres of the piece, A and E:

Example 6-26, bars 1-4

A third rhythmic motif, this time syncopated, occurs from bar 30, the dotted quaver-semiquaver figure which forms the quote from Anthony Gilbert's *Towards Asavari*. It comes roughly halfway through the piece, at bar 29, soon after the beginning of the second section at B (see Example 6-19, page 194, above).

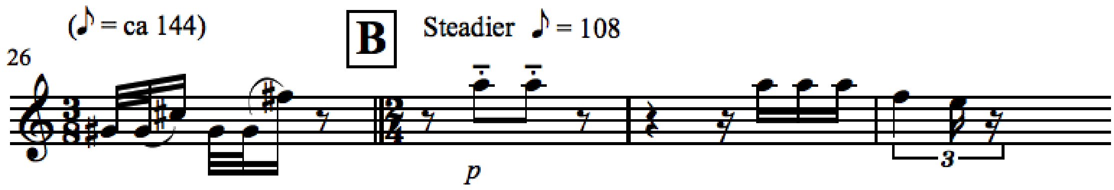
Two tonal centres, A and E, are structurally pivotal as they frame the change from the dawn chorus, beginning at A, to the appearance of the dove at B and are further highlighted by the addition of microtonal colouring, (see pages 206-207 for a discussion on LeFanu's use of microtones) and Examples 6-24 and 6-25, above, though other tonalities are encountered in the course of the piece that serve as pivots for facilitating movement between tonalities, see Figure 6-2.

Figure 6-2, Tonal Centres in *Dawn's Dove* in order of occurrence.



The harmonic content is mainly modal – there is little use of tonic-dominant or leading-note relationships and where such relationships occur they are softened by the insertion of silences, see Example 6-27. This produces a vague sense of diatonic stability and exemplifies the avoidance of goal-orientation in LeFanu's music.

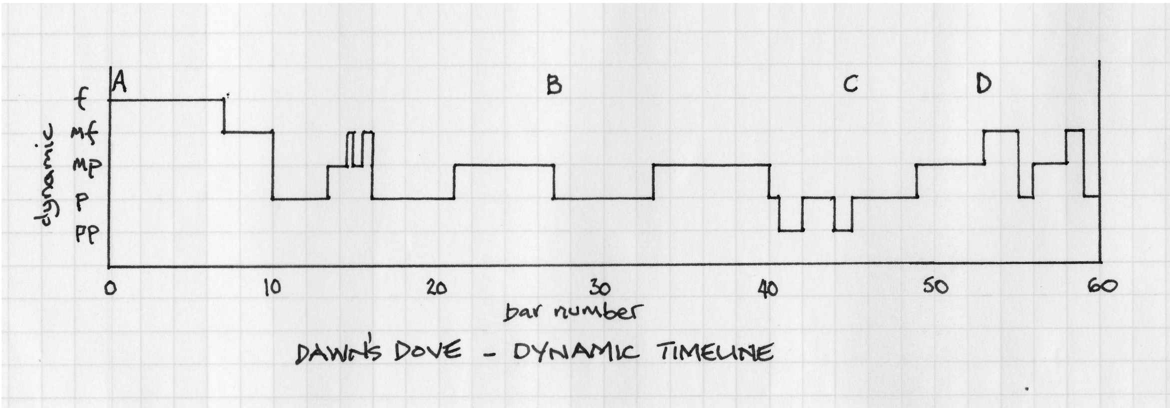
Example 6-27, showing softening of a leading-note relationship g♯-a by the use of silence across bars 26 and 27



The composer's dynamic instructions range from *forte* (bar 1) to *pianissimo* (bar 41) and are broadly in keeping with the recorder's accepted potential dynamic range, normally defined by tessitura i.e. high = loud; low = soft. Middle register writing carries a normal dynamic of *mezzo forte* and the composer adheres to this pattern. Exceptions, such as the *mezzo piano* in bar 21, can be played using *piano* fingerings, giving consistency of tone through the bar as all notes can be fingered using the same fundamental 'long' fingering pattern[54]. The *decrescendo* from bar 40-41 can similarly be achieved by decreasing breath pressure and using *piano* fingerings: 012346~~7~~ in bar 40 and 012346 in bar 41. The piece begins *forte* but by bar 10 has settled down to a stable *mezzo piano/piano* where it remains until the coda, at D, at which point more marked fluctuations in dynamic range reflect the return of material from earlier in the piece. The dynamic time-line, Figure 6-3, below, shows an essentially stable dynamic with mild fluctuations representing the composer's use of answering calls and contrasting characterisations. The opening *forte*, bars 1-2, may be interpreted as a gesture to capture the listener's attention:

[54] See *LeFanu's Use of Microtones*, below, for more detail.

Figure 6-3, Dynamic timeline of *Dawn's Dove*



Apart from slurs and phrasing instructions, which occur throughout the piece, LeFanu uses minimal instructions for tonguing but where they occur they highlight key tonal centres, thus also defining the pivotal centre of the tonal structure (see Figure 6-2, above). Example 6-28 shows LeFanu's use of articulation including the staccato Es in bar 23, the portamento As in bar 27 (at B), the tenuto Es in bars 30, 31 and 34 and finally the tenuto B♭s in bars 39-41.

Rhythm is also a concern of articulation and it is therefore worth noting that the only syncopation in the piece, bars 30-31, repeated in the varied version, bars 35-36, highlights the reference to Gilbert's *Towards Asavari*.

Example 6-28, Articulation instructions highlighting important structural elements in the central passage of *Dawn's Dove*

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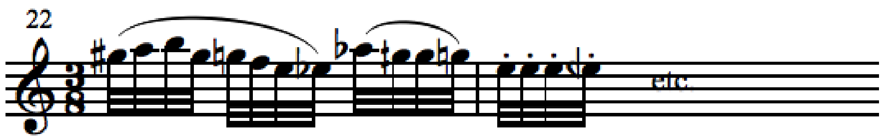
The opening figure, repeated d^{3}s, is unmarked even though this passage, fanfare-like in character, demands clear, strong articulation. The omission of tonguing instructions at this point thus highlights the significance of tongued articulations on figures where they are given. Anomalies do occur, however, and it is to these that I will now address my attention.

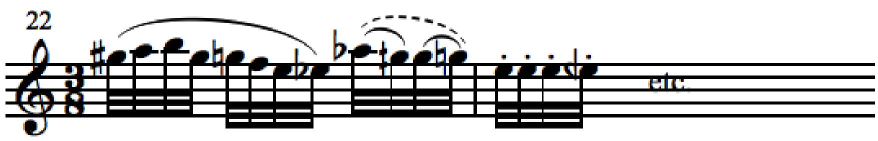
A problem arises, for example, in bar 22, where a slur is shown over two repeated g-quarter-sharps, which clearly cannot be slurred, see Example 6-29:

Example 6-29, *Dawn's Dove*, bar 22



These must in fact be phrasing marks and this raises questions about some of the other 'slurs' indicated in the score, particularly where they are shown over passages of broad melodic lines, possibly indicating unusual phrasing which may, in performance, be more effectively executed using tongued legato or slurring in pairs whilst retaining the integrity of the phrasing pattern given, see Example 6-30:

Example 6-30, showing an alternative articulation



Example 6-31, Phrasing indications may be interpreted as slurs:

In Example 6-31 two short phrases are shown, indicated by the dotted lines. The phrases are identical apart from a minor variation of bar 50. LeFanu's apparently unusual bar-by-bar phrasing may in fact not be phrasing but either slurring, or, alternatively, nothing more than an indication that the acciaccaturas should be tongued. A similar situation arises in bars 25 and 45, marking the slur shown on the third beat of bar 22 (Example 6-30, above) thus indicating an anomaly in a piece that otherwise displays consistent use of articulation markings. A similar situation arises in bars 24 and 44 where the two repeated notes, d♭ and c♯ respectively, are clearly separated by slurs; see Examples 6-24 and 6-25, above.

LeFanu began using microtones in her music in the mid sixties though it was not until her saxophone quartet (1985[55]) that she 'explored a thorough-going microtonal harmony' (LeFanu 2006, 132). She first used microtones in *Preludio* for chamber orchestra, which she wrote as a student in 1967-8 and again in 1969 in a vocal work. Following that the first really extensive use of microtones was in *Moon over Western Ridge Mootwingee* (1985) (Lefanu, 2010). More works employing microtonality followed intermittently: *Lament* (1988), the *Concerto for Alto Saxophone and String Orchestra* (1990), *Ervallagh* for alto saxophone (1993), see Example 6-32, and *Dawn's Dove* (1994). A more recent work employing microtones is *Mira Clas Tenebras* (2002).

[55] There is some confusion regarding the composition dates of this and a number of other of LeFanu's works, depending on the information source. For consistency I will use the earlier date.

Example 6-32, The opening passage from LeFanu's *Ervallagh* in which the composer makes much more extensive use of microtonal inflection than is found in *Dawn's Dove*:

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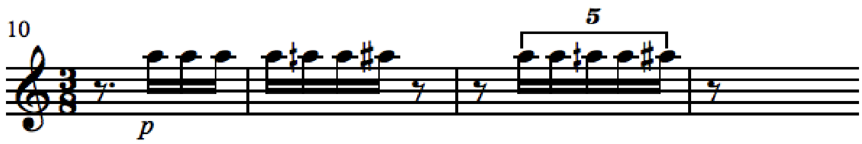
Microtonal usage in *Dawn's Dove* is primarily ornamental and indeed restricted mainly to ornamenting important structural elements - the tonal centres A and E, without the microtones themselves forming part of the structure of the piece. Microtonal usage is therefore restricted in the middle register to a-quarter-sharp in the middle and lower registers and e-quarter-flat. There are two other uses of microtones: g-quarter-sharps which occur once in the middle and twice in the lower register, and c-quarter-sharp, found twice in the first octave (lower register). In none of these later instances do the microtones occur in the context of the repeated note motif and their function is therefore considered to be passing colour and not of structural significance even though those notes form the interval of a perfect fifth and are the only two notes in the piece apart from A and E that are microtonally inflected.

A closer study of the context in which the microtonality occurs reveals that the repeated semiquaver motif on A is always rising and the repeated E motif always falling. For the rising scalic passage the sequence a♮ - a-quarter-sharp - a♯ is consistently used, creating a tense, questioning motif; the falling pattern always follows the pattern e♮ - e-quarter-flat - e♭, see Examples 6-33 and 6-34, below:

Example 6-33, *Dawn's Dove*, bars 10-13



Example 6-34, *Dawn's Dove*, bars 23-25

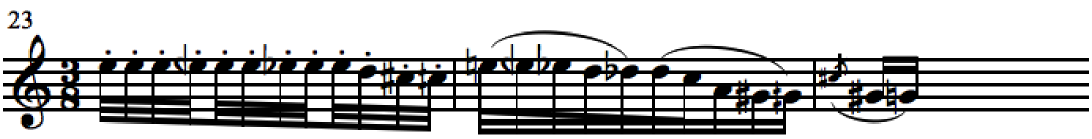
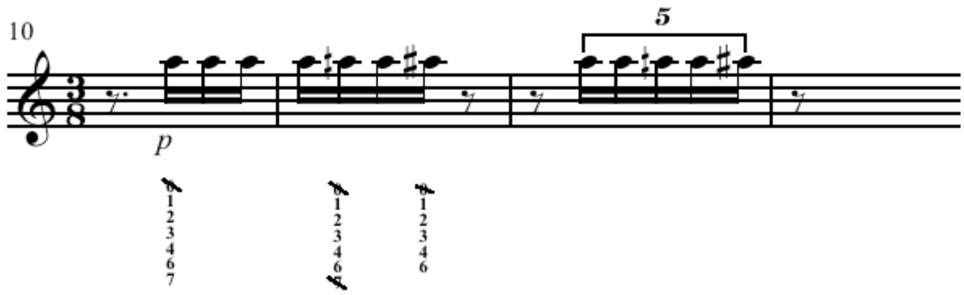
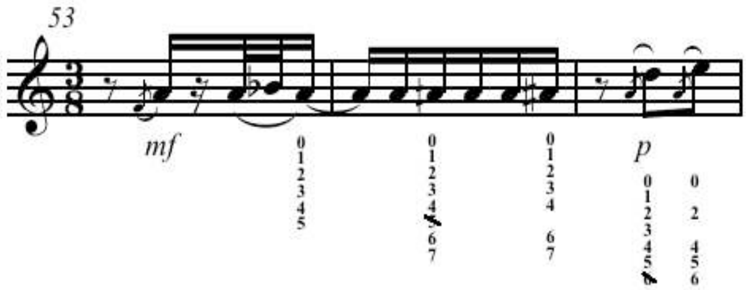
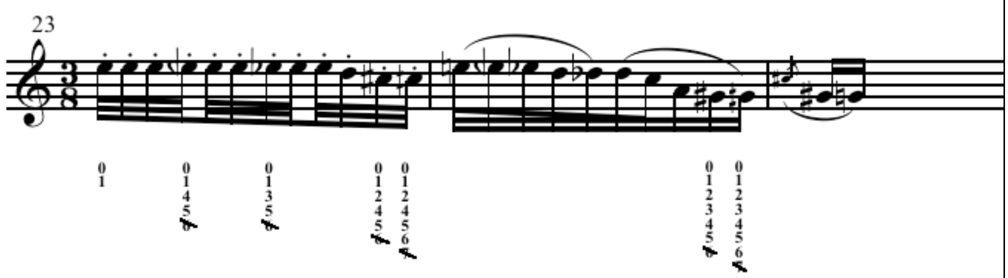


Table 6-2 showing fingerings for the microtones in *Dawn's Dove*:

Bars 11 and 21	From a^2 to a-quarter-sharp^2. The composer asks for the a^2 to be played *piano* and *mezzo piano* respectively, inviting the use of the alternative (*piano*) fingering θ123467 which can then be adjusted to θ12346~~7~~ in order to accurately produce the a-quarter-sharp^2. The a♯/ b♭ follows quite simply with θ12346. 
Bar 54	The use of a-quarter-sharp^1 is slightly more problematic for the player as it is marked to be played *mezzo forte* and can only be accurately produced with the technique of half-holing by adding half of finger 5 from a♯^{1}: 01234 ~~5~~ 67, producing a much less robust sound than the *mf* required. This may be overcome with timing and more robust tonguing. 
Bars 23-24 and bar 44 Bar 24	e-quarter-flat^2 occurs initially in bars 23-24, later in bar 44. The context is the same each time, e♮^{2} (01) being flattened with the addition of fingers 45~~6~~ to produce e-quarter-flat^2. The following e♭^{2} (0135~~6~~) is easily produced from the quarter-tonal fingering. As with a-quarter-flat^2 and e-quarter-flat^2 the occurrence of g-quarter-sharp^1 and c-quarter-sharp^2 is here restricted to the context of passing chromatic colouration.  g-quarter-sharp^1 occurs in bar 24 as the final note in a short chromatic passage prior to a c♯^{1} at the beginning of bar 25. g♯^{1} (012345~~6~~) can be flattened to produce the g-quarter-sharp^1 by the addition of finger 7 (012345~~6~~7). The following c♯^{1} is fingered by the simple removal of finger 3 and 7 to produce 01245~~6~~.
Bar 22	g-quarter-sharp^2 occurs in bar 22 following an a♭^{2} (23456). It can be produced from there with the addition of fingers 1 and ~~7~~ to give 123456~~7~~.

	
Bars 23 and 52	c-quarter-sharp^{1} occurs twice, in bars 23 and 52, and can be fingered both times with 0124567 This method offers an elegant method for shaping the phrase to end on a *piano* d^{2} 

Although *Dawn's Dove* does not attempt an accurate representation of birdsong, it does, in a more general sense, attempt to capture the spirit of a dawn chorus through extensive use of the rapid repeated-note motif and leaping acciaccaturas, which range in interval from a semitone to a major ninth. Both these devices plus the rapid ornamental passages lend the piece its 'jubilant' character. This is balanced by extensive use of weak cadences, sighing figures (bars 25, 29, 43, 46 and 50) and several falling microtonal chromatic scalic passages that add tonal colour and a feeling of gentleness and melancholy to the piece. The frequent use of acciaccaturas over minor and diminished intervals (bb. 8, 9, 13, 14, 19, 36 and 48) reinforces this occasionally melancholic character.

The dove's appearance is central to the piece, literally and metaphorically, and its presence through the middle section, C, marked *steadier*, is important in preventing the piece from becoming a mere catalogue of bird-like figures; rather it lends the piece its soul and becomes its spiritual *raison d'etre*. If, as the composer suggests, the dove makes its first appearance at this point can we then assume the flutter-tonguing in bars 16-17 represents a more generic kind of avian warbling? It seems unlikely and Britten's similar use of flutter-tonguing to portray the dove in *Noye's Fludde*, as noted in Figure 6-23, above (page 200), would be a convincing enough precedent to assume the dove's presence outside of the central section (bars 27-43) and this is indeed announced by flutter-tonguing in bars 16 – 17 and, additionally, at the beginning and end of the last section, in bars 46 and finally bars 57 – 60.

The dynamic markings in the piece are consistent with the (limited) dynamic range of the recorder (see Figure 6-3, Dynamic Timeline of *Dawn's Dove*, above and compare this with Zahnhausen's treatment of the instrument in *Lux Aeterna*, page 163) and the varied use of tonguing, articulation and dynamic fingerings that would normally be available to advanced players.

The tempo of the first and third sections, quaver = ca. 144, is quick and if inflexibly adhered to would produce a performance lacking in precisely the 'joyous' character the composer is seeking to reproduce. Therefore, a certain amount of flexibility in dealing with individual figures and silences will be essential for a successful performance. The use of notated silences of varying lengths; triplets and quintuplets and the occasional move between 3/8- and 2/4-time imply a certain amount of freedom in performance – as though the composer is fitting specific figures into an otherwise predetermined rhythmic and temporal framework in order to imply the apparent randomness of bird song, though this is not otherwise indicated in the score. For example, a flexible approach to the repeated note motif, where precise, regular repetitions would produce a rather static, mechanical performance as opposed to one which uses a subtle rubato plus varying articulation and tonguing to give a sense of movement and life. As LeFanu's interest in Zen Buddhism would suggest, any performance of the piece requires in equal amounts a sense of stillness and freedom, spontaneity, intensity and expression, each in turn relating respectively to: the use of silence; fluent execution of ornamental passages; sensitive performance of passages of repeated notes and rising microtonal passages; and finally, careful use of timing and judging of phrasing. Clarity of articulation throughout the piece and adherence to dynamic instructions is, as always, essential.

This is a piece, with its calls and birdsongs of various lengths, articulations and expressions, which demands a rhetorical approach to its interpretation. The clear execution of the various articulations: staccato, tenuto, portamento and slurring, is ideally suited to the recorder's expressive capabilities, principally its sensitivity to variety of articulations. There are opportunities for note-shaping, use of vibrato to produce warm sounds and sensitive use of silence. It is idiomatically written for the recorder on a subject that is in keeping with its traditional symbolic associations and in this way draws on the instrument's strengths and makes clear links with its past role in baroque and renaissance music.

Metamorphosis at Mullet Creek (1994)

David Lumsdaine (b.1931)

Australian born composer David Lumsdaine has lived in the UK since 1953. Despite this his music continues to reflect images of his childhood and experiences from his more recent frequent journeys home (Hall 2003, 15, 62). *Metamorphosis at Mullet Creek*[56] was conceived as a result of one of these visits and takes an Australian landscape and local birdsong as its points of departure. But, says the composer, his music is not about these things, rather, ‘these things are where my music came from’ (Lumsdaine quoted in Hall 1992, 329). Thus, from the raw material Lumsdaine develops musical ideas, motifs and fragments that form the basis of his piece. The continuing strong influence on Lumsdaine’s music of landscape and its natural environment (*ibid*. 329) manifests itself in others of his works from the early-mid 1990s including *Norfolk Songbook* (1993) and *Curlew in the Mist* (1993), both of which are similarly concerned with landscape, though in these cases the landscapes are English and Irish respectively but, like *Metamorphosis*, they employ microtonality both as a descriptive tool and to represent birdsong and other fauna. Other works composed during this period include *Soundscapes 1–6* (1990–95), commissioned by the Australian Broadcasting Commission and consisting of edited recorded birdsong and his *6 Postcard Pieces* for piano. For the former, the composer edited recorded birdsong to produce music for which he credits the birds with the composition (Gilbert).

Significant for this thesis among Lumsdaine’s output during this period is *Cambewarra Mountain* (1992), a composition of edited birdsong existing only in CD format. It was

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[56] Mullet Creek is a small tributary of the Hawkesbury River that flows into Broken Bay and thence the Tasman Sea, on the Central Coast of New South Wales, about 60 kilometers north of Sydney. It is an area of dense unspoiled bushland that includes a number of Nature Reserves and National Parks including Brisbane Water National Park, which borders Mullet Creek on both banks. It is this landscape and its bird life that is the inspiration for *Metamorphosis at Mullet Creek*.

recorded in 1989 at different times of the day and night in ten locations around Cambewarra Mountain, near Nowra, southern New South Wales (Lumsdaine, 1995). It is the edited version of ‘many hours’ recording natural sound from which, as Lumsdaine continues, ‘a piece of music emerges’ (*ibid.*), in this case, in nine movements with titles reflecting the period of day or night during which the recordings were made e.g. *Nocturne*, *After Sunrise* etc. (*ibid*.). Editing recorded natural birdsong to create a piece of music of arguably symphonic proportions is indicative of Lumsdaine’s deep empathy with the natural world. The piece lasts approximately 70 minutes and its structure is defined by the time of day and location of the various recording sessions. Regarding this technique Lumsdaine says that they ‘are recordings of a very active listening which we may say has gone on *outside* my head. In the making and editing of these recordings I’m organising my listening; that’s to say, I’m composing it’ (Lumsdaine 1996, quoted in Boyd 2007, 29).

The conceptual transfer of the recorded natural sound world as captured, for example, on the recording *Cambewarra Mountain* to the composition of a note-based miniature such as *Metamorphosis at Mullet Creek* in which the environmental sounds – primarily birdsong, but also other wildlife sounds such as frogs and crickets as well as silence, are represented in a score, is evidence of the extent to which Lumsdaine has absorbed the soundscape of the Australian bush into his musical language. Indeed, the representation of the Australian landscape in all its diversity has become, for many Australian artists, musicians and authors, something of a quest to establish a spiritual relationship with the natural environment that is so important to them (Richards 2007, 1-10). The titles of so many of Lumsdaine’s works, including *Kangaroo Hunt*, *Empty Sky – Mootwingee, Salvation Creek with Eagle, Shoalhaven, Kelly Ground* and *Cambewarra*, indicate that they are ‘more than evocative of Australian places and experiences; they suggest that Lumsdaine’s creative identity may, in some sense be tied to the land' (Schultz 1991, 95). Schultz further suggests that 'it is possible to argue that a distinctive handling of time is a characteristic of much of Lumsdaine's music and that this, in turn, is derived from the composer's focus on the land.' (*ibid.*).

Lumsdaine's spiritual relationship with the land is reflected in his works through his desire to transcend both time and landscape and this has been an important influence in his compositions. For Lumsdaine 'transcending' in this context means escaping what he calls the linearity of music in order to observe and explore a landscape, its textures and sounds from different perspectives (Lumsdaine 1993, 70-77).

> A painter works on the surface of a canvas. Similarly a performer must work in time, taking one breath after another, and, […] the seconds tick by. But one of the most magical things about painting for me is that, when you stand in front of a painting, you see the surface, but then the surface disappears. The painting transcends its surface. And any kind of rich music, for me, has to transcend that ticking. Time – whatever time is – is the material of music. It's the material of all rhythmic ideas; it's the basis of all pitch ideas. Time – our perception of time. And the whole point for me is to transcend it. (*ibid.* 71)

More specifically, transcending time for Lumsdaine means becoming 'lost in the natural time, the seasonal time, the time the sun takes to cross that patch of sky over there. Time is measured in the way light and shadows change, the way the moon sinks down behind those hills, the way the stars develop in the sky.' (Lumsdaine and Hall 1992, 330).

Olivier Messiaen (1908-1992) had previously adopted a similar approach to time and bird song in his *Quatuor pour la fin du temps* (1940) in which, in his programme note to the third movement, *Abyss of the Birds,* he notes ‘The abyss is Time with its sadness, its weariness. The birds are the opposite to Time; they are our desire for light, for stars, for rainbows, and for jubilant songs.’ (Messiaen 1940 quoted in Samuel 1986). Lumsdaine’s reference to ‘natural time’ (light, stars etc.) resonates sympathetically with Messiaen’s own spiritual relationship, ultimately manifested as belief in God, with birdsong and the natural world.

Anne Boyd in her chapter *Landscape, Spirit and Music* discusses how Lumsdaine along with fellow Australian composers Ross Edwards and Peter Sculthorpe, has ‘drawn upon birdsong’ so that birds ‘become spiritual messengers linking human music and landscape in an indissoluble relationship’ (Boyd 2007, 32). The relationship thus established, Lumsdaine affects the, for him, spiritual transcendence of landscape in *Metamorphosis* by metaphorically moving about within it, observing it from different angles and different perspectives through his varied use of silence, dynamics and the use of microtonal intervals to impart a sense of movement, space and distance.

A further spiritual influence in Lumsdaine’s music that supports his transcendental goal is his interest in Zen Buddhism. It is an approach that is reminiscent of the influence of ‘eastern modes of thought’ on the music of Nicola LeFanu and in particular the avoidance of goal orientation in her music noted in my discussion of *Dawn’s Dove* (see page 189). Lumsdaine defines Zen in his paper *Towards a Zen Music* as being ‘a pointer to a way of life, a mode of seeing, hearing, and feeling, which exists now as I/you write/read these words.’ (Lumsdaine, 1983). He uses typically nebulous Zen language in describing his music as ‘essentially […] inconsequential. There are no transitions or mergings. It is not going anywhere, nothing becomes anything else. On the contrary, everything is everything else.’ (Lumsdaine and Hall

1992, 331). Lumsdaine expands on his general understanding, in a more spiritual sense, of transcendental in his 1983 paper *Towards a Zen Music*:

> '"Transcendental" […] is possibly the nearest word we have to describe the Zen experience but it won't do if we try to puff it up or expect something in particular from it. I remember the story of a man who practiced archery on the edge of the open cliff, back turned to the drop, heels over the edge – How about listening to music in such a way? Some such position is obviously the best for composing!
>
> > No thought, no reflection, no analysis,
> > No cultivation, no intention;
> > Let it settle itself. (Tilopa, quoted in Lumsdaine, 1983)
> > Listen!" (Lumsdaine, 1983)

'The most important thing in music for me is the silences.' The edge-of-cliff metaphor is particularly relevant to Lumsdaine's use of silence in *Metamorphosis*: He continues by discussing in his 1993 interview with Andrew Ford his use of silence and the transformation of gestures where he describes with unnerving accuracy the techniques that he would use one year later in the composition of *Metamorphosis*:

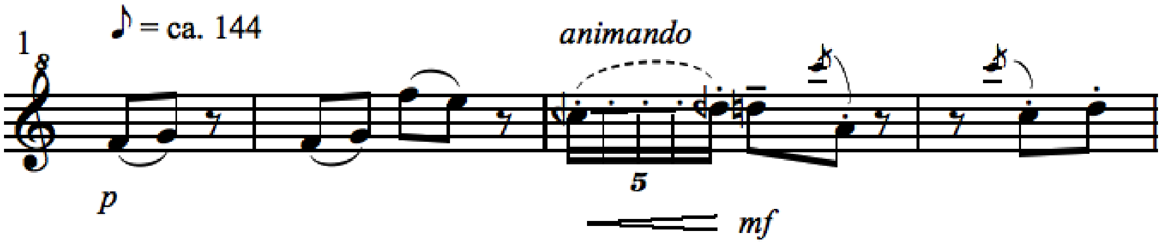
> 'You understand a particular gesture; there's a break – something else; and then you have a transformation of that original gesture. Those transformations overlay one another, they take you back. The first gesture had to be the right length in order physically to imbed itself in your experience, and now it's waiting there – there's nothing lost – it's waiting there for you to pick it up when it comes around again and you understand the transformation on top of that. Likewise, the other transformations throughout a work; they will also be creating dimensions going this way, dimensions going that way, which will also be non-linear. We can only hear them in a linear fashion; we can only understand them in a non-linear fashion. That's not a contradiction for me.

> […] I'm talking about memory; I'm talking about eternity and timelessness. If you live in the moment, all time is there.' (Lumsdaine 1993, 72).

Considering his preference for composing slowly (*ibid*. 73) it seems likely that ideas for Metamorphosis were forming in his mind as much as a year in advance of it actually reaching completion.

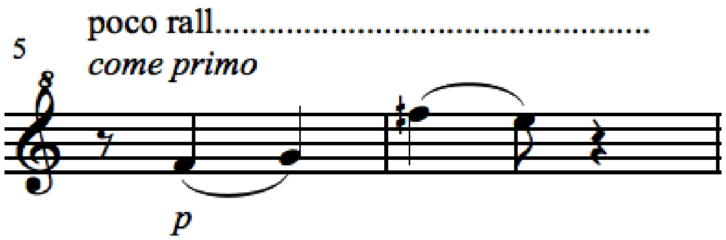
Metamorphosis is in two parts, each consisting of two sections (see Appendix 11, page 363): the first half consists of a short section in the form of an introduction, letters A – B (bars 1 - 6), followed by the second section from letter B – C (bars 7-27); the second half is unbarred and consists of a first section (letter **D** – **G**) and a coda (letter **G** to the finish). The tonality is essentially uncomplicated and apart from the latter section of the second half, from the introduction of a call, the opening of which is reminiscent of the Spotted Nightjar (*Eurostropodus argus*) (Chapman), at letter **F**, is conventional and stable. After letter **F** the tonality remains unremarkable but the rate of change quickens through to the end.

Example 6-33, The opening bars of *Metamorphosis*



The introduction fixes the tonal centres as F and D (see Example 6-33, above), with neither predominating, as well as establishing the motivic material based on the intervals of the rising major second and falling minor second. Both are presented in augmentation with the falling motif additionally heard in a microtonally varied form (bars 5 and 6), see Example 6-34, below.

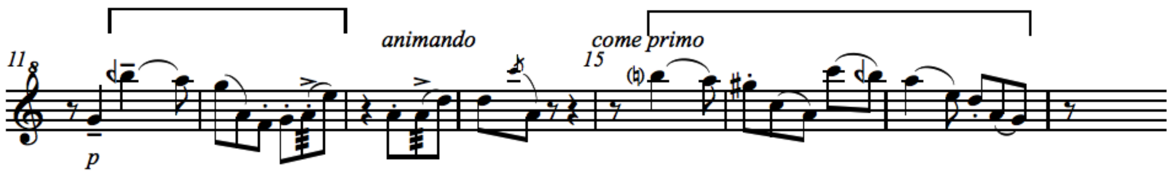
Example 6-34, *Metamorphosis*, bars 5-6



This is the first transformation of material in the piece and establishes a pattern for the development of other fragments and ideas throughout *Metamorphosis*.

As the uncertain tonality suggests, the first section begins falteringly – not in the fashion of a joyous dawn chorus but hesitantly, in the manner of a slow awakening. It contains variations of the rising and falling motifs. There are two fragments of melodic material; a short phrase in bars 11-12 that is extended and coloured by microtonal inflection in bars 15-17 and then interrupted by three bars of birdcall fragments (bars 18-20) that are repeated in a varied form at the end of the section (bars 25-26).

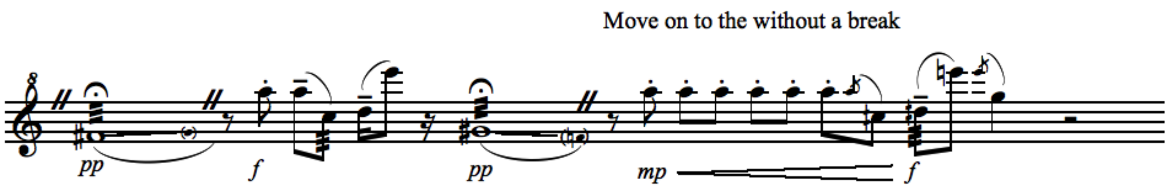
Example 6-35, bars 11-17



The second half, beginning at letter **D**, after bar 28, is unmeasured and more fragmentary, using fewer calls but repeating them, often in a varied form and making extensive use of silence. It begins with a change of tonal centre to C and a brighter, more decisive character through the use of light, rhythmic articulation patterns and wide leaps. This change of character also heralds the onset of a passage of sustained birdcall interspersed with silences. The composer invites us to listen carefully. The intensity of the passage is enhanced by the irregular pattern and length of alternating calls and silences.

At **F** a call closely resembling that of the spotted nightjar is introduced, implying the onset of dusk (Examples 6-46a and 6-46b, page 227-228, below) and the piece moves quickly through G then D, hinted at by the inclusion of fluttered F♯ and F♮s and repeated As (see Example 6-36, below), finally to end in G. The piece ends with a short coda that introduces a repeated-note motif, heard twice, but separated by a single call reminiscent of that of the Grey Shrike Thrush.

Example 6-36



It is unclear exactly to what the *Metamorphosis* of the title refers. There may be four explanations: first, the abrupt change of character at the beginning of the second half.
The second, at letter **F**, about half-way through the second half, when a call reminiscent of the nocturnal Spotted Nightjar heralds a change of tonal centre and to a more subdued atmosphere; its slowly rising microtonal call is in stark contrast to the lively leaping figures of the first part of the half. Thirdly, calls, gestures and melodic passages are repeated, varied and transformed. It is a pattern that is established from bar 1 (see Examples 6-37 and 6-38) and

continues throughout the piece. For example, a call is heard twice in a transformed version at letter **E**, see Example 6-37. These calls are separated by silence:

Example 6-37

Example 6-38, below, shows the opening gesture of bars 1-2 and its transformation and extension from bar 21.

Example 6-38.

A further, fourth, metamorphosis alluded to in the title but not found in the music refers to Lumsdaine's boating companion that day in 1979 on Mullet Creek – British composer Anthony Gilbert, who according to Michael Hall 'identified himself with the flora and fauna of Australia for the first time.' (Hall 2003, 94).

Birdsong is not restricted to the twelve notes of western musical scales. Microtonality presents composers with the possibility of representing birdsong with more realism than the diatonic scale allows. Composers use microtones, whether precise or undetermined, in an effort to capture a realistic representation of birdsong. Messiaen transformed birdsong from an ornament to an element of musical style, drawing particularly on its complex rhythmic ostinatos, textures, varied melodic contours, and approximating birds' microtonal intervals with the 12 chromatic pitch classes. (Johnson 1995, 249-265).

Studies have shown that birds display a high degree of flexibility both in the pitch range and variety of their calls (Taylor, 2008; Gilbert, 1984, 4-9). As evidence of this Gilbert has also shown that specific patterns in the rhythm and pitch of individual species and indeed all birds resident in any given location may emerge and so it remains uncertain whether globally definitive calls in terms of both parameters could be established. Birds' extensive use of portamenti and glissandi (Gilbert, 1984, 4-9) further confuses the issue of pitch.

Lumsdaine's use of microtonality is varied: in *Norfolk Songbook* it is used in an evocative and even humourous way to describe, in *The World Oozing*, a walk through water-logged ground, in the third song of the collection (Example 6-39), and again in number 8, *Rainbow Dance*, this time to evoke a shimmering, watery atmosphere (see Example 6-40).

Example 6-39, From *The World Oozing*, bb24-29

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Example 6-40, From *Rainbow Dance* bb 1-7

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More in keeping with the concept of *Metamorphosis* i.e. landscape and birdsong, however, Lumsdaine has also used various degrees of microtonality in *Curlew in the Mist*, on the one hand to describe with some accuracy the call of the curlew and on the other to evoke a 'mobile, fleeting, wild' atmosphere through the use of undetermined microtonal intervals, see Example 6-41 (Lumsdaine 1993b).

Example 6-41 From: *Curlew in the Mist*; notation of undetermined microtonal intervals, the crosses on the stems 'to indicate mobile and approximate tunings' (*ibid.*).

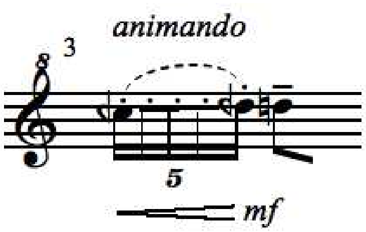
Lumsdaine's Microtonal Notation conforms to standard quarter-tone flat and quarter-tone sharp signs in common usage[57]. Some non-specific microtones, where they occur, are notated as a tongued glissando. This latter, non-specific, notation presents a challenge to the performer, for whom the important question is to decide between informed and intelligent random selection of pitches and the 'fundamentally uninformed and careless' approach noted by Dunsby (Dunsby). How one should approach the unnotated pitches that Lumsdaine occasionally uses to depict calls in *Metamorphosis* will be discussed below.

[57] = quarter-tone flat; = quarter-tone sharp.

Lumsdaine's use of imprecise notation in *Metamorphosis*, on the other hand, similar to that in *Curlew in the Mist* (see Example 6-41), can also be interpreted as indicative of a mobile and fleeting moment, of movement and changing perspective, thus, in Lumsdaine's words, exploring the landscape and adding to the creation of an uncertain or mysterious atmosphere.

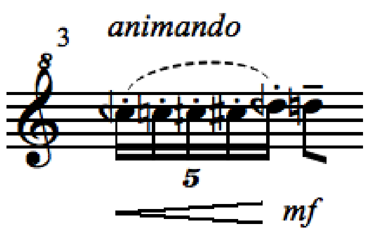
Microtonality is used in *Metamorphosis* in four different ways: as colourful scalic and melodic ornaments: these occur in the first section, bars 3, 7, and 24. The first two provide a sense of movement (marked *animando*) within fragments (Examples 6-42a and 6-42b), in both cases leading to a 'call' where the first ends as abruptly as it began whilst the second continues into a slightly longer multiple 'call'. The second is also an extension, or variation, on the opening motif. The requirements of the undefined microtones, notated as a tongued glissando in Example 6-42a, below, would, in the context of the microtonality used elsewhere in *Metamorphosis*, appear to be the four equal tempered quarter-tone intervals between c-quarter-flat^2 and d-quarter-flat^2.

Example 6-42a



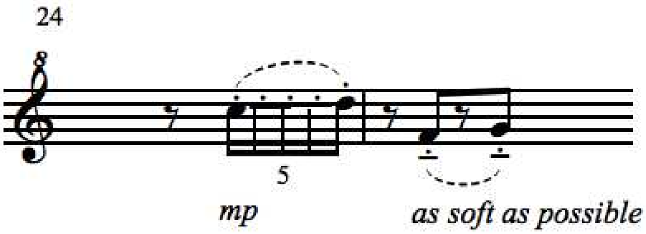
May be performed....

Example 6-42b

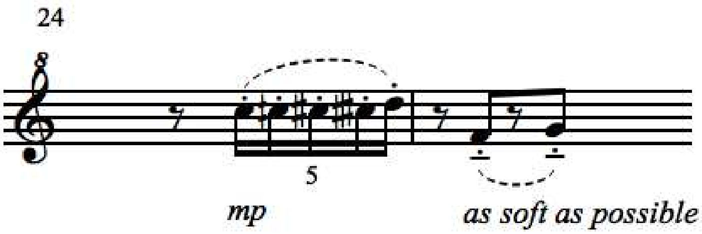


The third (Examples 6-43a and 6-43b) stands alone as a 'call' fragment (bar 24), an interjection, also re-calling the two previous instances of microtonal scale before a reminiscent repeat of the opening motif, this time at a slower tempo and as an echo, with a rest between the f^1 and the g^1. Here, the same solution would apply to the microtonal scale c^2-d^2 (Example 6-43a, the notated version, and 6-43b, as it might be performed):

Example 6-43a

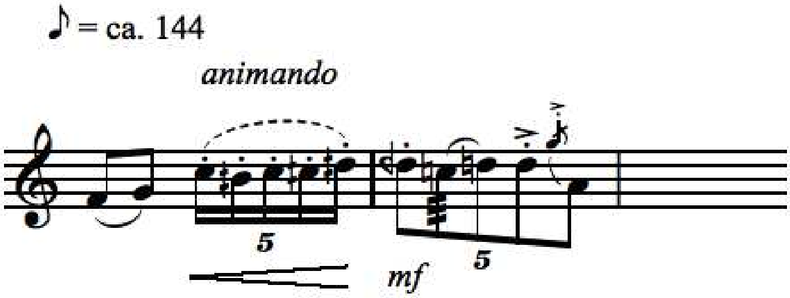


Example 6-43b



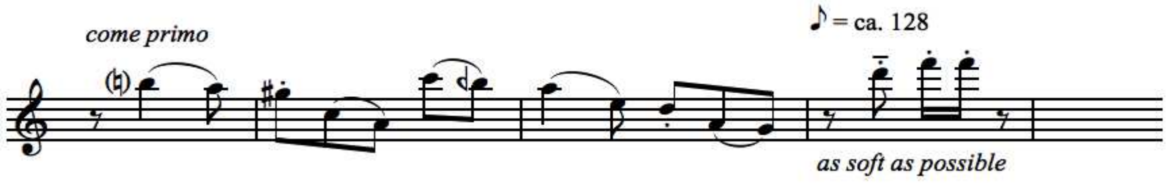
The strictly notated call at the end of bar 7 is a combination of the opening rising and falling motifs in a microtonally inflected form (Example 6-44):

Example 6-44 – bars 7-8



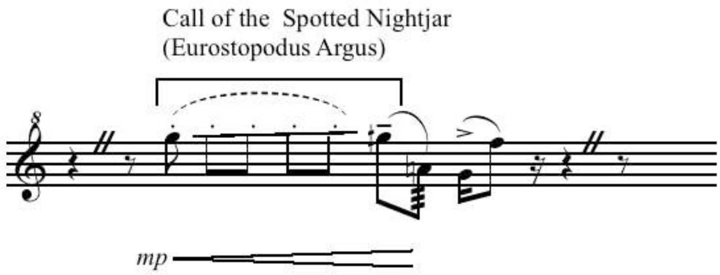
Microtonality is used in broad melodic lines as deviations from the main tonal centres to add both colour and a feeling of depth, distance, movement and a sense of mystery to the soundscape, see Example 6-45.

Example 6-45



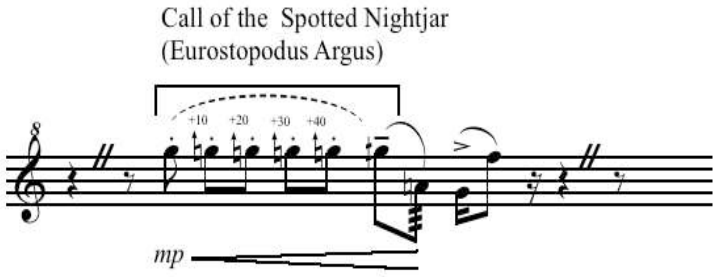
Thirdly, Lumsdaine uses microtonality as a representation of birdsong: a birdcall makes two appearances at letter **F**, about two-thirds of the way through the second section that closely recalls the Spotted Nightjar. Notated in quavers, each of the four tones would, if played equally, be at an interval of 10 cents from the two either side of it, although this is not accurately notated, the composer instead leaving the player to decide the precise interval (g^2-g-quarter-tone-sharp^2). See Example 6-46a, below.

Example 6-46a



Example 6-46b as the call might be performed, showing the same passage with intervals notated in increments of ten cents, making up the 50 cents of an equal-tempered quartertone interval:

Example 6-46b.



A fragment of call (Example 6-47) persists through the second part, giving coherence and establishing it as a soloist, albeit a distant one, amongst a background chorus of numerous closer, calls.

Example 6-47

Finally, Lumsdaine makes use of wide microtonal intervals. The examples above relate to stepwise or skipped microtonal intervals. Lumsdaine also uses larger intervals both melodically and in leaps. Microtonally inflected wide intervals are also frequently used in the second half. In the following passage, bars 8-12, see Example 6-48, the intervals of the quarter-flat major ninth, quarter-sharp minor seventh and quarter-flat major tenth (Bennetts et al. 1998) may suggest uncertainty, mystery, movement and distance from the observer.

Example 6-48.

The consistent use of a microtonally inflected wide interval such as the repeated interjections that recall the call of the Grey Shrike Thrush may represent an attempt at the accurate notation of the bird's call, see Example 6-47, above. In contrast to the ornamental step-wise passages that dominate the first half the wider microtonal intervals of the second half suggest movement, perspective and mystery.

In Example 6-49, below, the minor seventh is occasionally microtonally inflected. Microtonally inflected octaves and other intervals are also introduced.

Example 6-49

Lumsdaine uses microtonally shifting melodies and microtonally inflected wider intervals, therefore, as a descriptive tool and to evoke a sense of movement within the landscape and realism within his composition.

Metamorphosis is written for solo sopranino recorder. The sopranino is the highest pitched member of the recorder family in common use and has a standard range of two octaves and one note (f^2-g^4). Lumsdaine asks a range of two octaves (f^2-f^4) for his piece. Characteristics of the sopranino are its high pitch, a bright, clear tone and quick response. However, it generally lacks the depth of tone of the more widely used treble (alto) instrument and the spacing and size of the finger-holes on the smaller instrument may be too problematic for some players to accurately manage the microtonal passages. The high calls in bars 18, 20, 25 and 26, to be played *as soft as possible*, will prove particularly difficult at the instrument's high pitch. The alternative of using a *piano* fingering and covering the bell end will not be an option for most players with such a small instrument due to the distance from instrument to knee (see Example 6-47). Nevertheless, Lumsdaine has composed a piece that is idiosyncratically written for the instrument. It presents the player with technical and musical challenges that range from obtaining accuracy of microtonal passages to dynamic variety that will demand imagination and flexibility of technique. A wide variety of articulations are required to effectively characterise and contrast broad melodic passages with lighter bird calls. In so far as these challenges can be met *Metamorphosis* is an important addition to the recorder's solo repertoire.

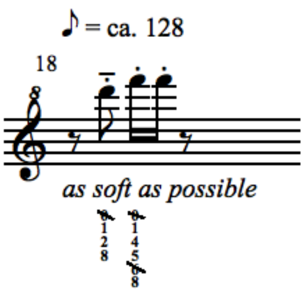
The technical difficulties are not insurmountable by a player of advanced technical ability and the musical challenges presented by Lumsdaine's use of silence is a rare opportunity to explore this expressive medium in an otherwise conventional note-based repertoire. Technical limitations of the instrument will influence the extent of expressive nuance, dynamic variety and also the performer's approach to the problem of microtonality and the level of accuracy he achieves. Furthermore, some birds are able to produce a variety of timbrally rich sounds. The sopranino recorder, as noted above, lacks this depth of tone. Although the pitch of the sopranino closely reflects that of much birdsong, it lacks the quality and warmth of tone necessary for a colourful and tonally varied performance. For this reason I prefer to place the sopranino recorder to one side and take up the treble for performances of *Metamorphosis at*

Mullet Creek – all fingerings and technical comments therefore assume use of the treble (alto) recorder. In taking this approach I reflect an attitude to both their instrument and its repertoire that is not entirely untypical of recorder players. Precedents have been set, for example, by Zahnhausen, in *Lux Aeterna* (see page 163) for alto recorder (tenor or voice flute *ad lib*.) noting in the remarks on performance that the piece was 'conceived for the acoustical properties of a relatively large church interior with correspondingly long reverberation times' (Zahnhausen 1995b, 6). Instruments may, additionally, be pitched at A440, A415 or A392, depending on the performer's preference. He makes similar suggestions for performances his of *Lyrische Szenen* (1992). Hauwe takes a similar approach to the performance of Isang Yun's *Chinesische Bilder für Blockflöte* (1993). Yun does not specify the type of recorder to be used - the foreword to the published score suggests the use of different recorders for each of the four pieces, based on Hauwe's premiére of the work in which he used tenor, bass, descant and Ganassi style alto in G for each of the 'pictures', depending on his interpretation of the tonal requirements of each. It seems reasonable to suggest that the determining factor here is the performer's preference of tone quality depending on the performance space, his interpretational requirements, or other factors of personal taste. My own decision regarding the instrument to be used, as well as taking tone quality into consideration, must also take account of more practical issues. These are discussed below.

In the case of the call shown in Examples 6-42a, 6-42b, 6-43a and 6-43b, above, it can be shown that for an accurate performance, discrete fingerings should be used for all five microtonal intervals even though the instruction for those in bars 3 and 24 is to perform a tongued glissando. The first call begins on c-quarter-flat^1, a note impossible to obtain with any fingering other than by beginning with a flattened c^1, i.e. using the standard fingering (0123) and adding a finger or fingers of the right hand to obtain the correct pitch. It follows that the player must then rise through c-natural^2 and then either continue fingering discreet pitches or begin a tongued glissando up to the d-quarter-flat^2. The former seems to this player a more coherent and logical approach whilst the latter appears to represent the contrary point of view. Furthermore, the composer's "*animando*" instruction indicates the use of clear, accurate fingering and tonguing. The solution to performing the call in bar 7 (Example 6-44) requires nothing less than discrete fingerings throughout, in particular the intervals c-quarter-sharp^2 to d-quarter-sharp^2 and d-quarter-sharp^2 to d-quarter-flat^2 being unreliable for accuracy using quasi glissando techniques. The calls shown in Examples 6-42a, 6-42b, 6-43a and 6-43b can readily be produced by use of a tongued glissando, beginning as it does on c^1, which can be played using the fingering 0124567 and then glissando-ing up to the d^1. This in no way implies that it should be the solution of choice, only that it is a possibility. A technically more accurate solution would be to discreetly finger each note, thus producing a quarter-tone scale, see Examples 6-43a and 6-43b. The composer's "***mp***" need not be compromised and would simply indicate the use of gentler tonguing. Curiously, this figure is not marked *animando*, However, where the composer does ask for an *animando* character – one is reminded of the 'mobile, fleeting, wild' atmosphere required for *Curlew in the Mist*, - then the player is confronted with a decision regarding the extent to which 'mobile, fleeting, wild' can be portrayed without loss of clarity of execution and to this end possible solutions are suggested in Examples 6-42a, 6-42b, 6-43a, 6-43b, 6-46a and 6-46b, above. Examples 6-46a and 6-46b, above, present a technically similar situation though in this case the smaller intervals demand much greater accuracy from the player if a true representation of reality is to be achieved. The normal noticeable pitch difference is thought to be about 5 cents so the 10-cent intervals required to produce the five equally spaced tones accurately should produce no problems for the trained musician.

Microtonal fingerings on the recorder produce tones with a weaker fundamental and fewer upper partials than the standard fingerings of normal chromatic notes (see Chapter 5). Recorders are designed to produce strong and even tones with, as I have shown in Chapter 5, increasingly standardised fingerings over a chromatic range of two and a half octaves. Microtonal notes, often making use of 'long' fingerings, produce, therefore, a quieter, more 'veiled' sound. A sense of distance from the observer may be achieved in this piece, in part, by taking advantage of this technique. For example, the call in bar 18 and repeated in bars 20, 25 and 26 (the Spotted Pardalote – *pardalotus punctatus*), may be performed 'on the knee', as follows (Example 6-50):

Example 6-50



> Wie in der Sprache gehört der Gegensatz von Tönen und Nicht-Tönen zum Prinzip "Musik". Dabei kann das Nicht-Tönende in unterschiedlicher Form und unterschiedlicher Bedeutung in Erscheinung treten. Zunächst scheint es die Kontrastfolie für Klang und Geräusch zu sein. Pausen und Stille vermitteln, in Klang, in Musik integriert, bestimmte Ausdruckswerte, Spannungs- und Affektgehalte. Der Gegensatz von tönen und Schweigen, Klang und Nicht-Klang birgt eine ungeheure Faszination in sich, ebendiesen Kontrast wiederum als konstitutives Moment von Musik kreativ zu nutzen[58]. (Betz, 1997, 237)

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58 The contrast between sound and silence is just as important an element in music as it is in speech. In music silence can present itself in various forms and with various meanings. Initially it appears to be a counterfoil to sound and noise. Rests and silences in sound, integrated into music, convey particular expressive qualities, degrees of tension and affective content. The contrast in speech between sound and silence, noise and quiet, holds a tremendous fascination for using this very same contrast as a creative element in music. (Translation by Peter Bowman)

Lumsdaine's theatrical use of silence epitomises his approach to the composition of this piece and indeed to his understanding of landscape, birdsong and even his philosophy of life and music. In an improvised live performance on the 'stage' of *Mullet Creek* the composer invites us into his world to listen to and explore the beloved landscape of his childhood. He implores us to engage with his silent world and to be dazzled by the beauty of the fauna and its sounds. But we must listen carefully …

The calm opening is interrupted by short passages of animated birdcall. At bar 9 the microtonally inflected melody suggests a passage depicting the listener moving around the landscape – calls interrupt, we listen carefully – silence. By the end of the passage birdcall surrounds us. The frequency of the solo call at the beginning of the second half diminishes as the piece progresses, establishing the call in the listener's memory and with it an expectation that it will continue to recur. The *piano* instruction indicates, however, that the bird is already at some distance from the listener and the decreasing frequency with which it is heard indicates that it finally moves out of ear-shot. The silence surrounding the call increases too as the section progresses, reinforcing the perception of distance. Lumsdaine refers to this technique as 'continuity through discontinuity' (Lumsdaine 1993a, 70-77) an expression the composer used to describe the interpretation of silences and phrases in *Curlew in the Mist*. Here, Lumsdaine explains that each phrase is to be considered as a fresh start: 'Play each of these disparate phrases as though you were beginning a new *piece*, rather than a new *phrase*.' He gives the player similar instructions in *Metamorphosis*: 'The rests indicate the metric character of each call, and every call exists in a different time-frame. Listen outside, between the fragments' (to the silences) and 'break continuity of pulse between calls.' The 'discontinuity' - the silences, effectively isolate each individual call fragment so that attention is focussed solely on that call (listen to the here and now!). The composer surrounds fragmentary calls and responses with unmetered silence thus creating a sense of time and place in which the here and now of the individual call fragments when they are heard is more important than what went before or what follows. Michael Hall (2003) suggests that the 'continuity' is created by the repetition of calls in which the listener's memory plays an important role by creating an expectation of what may follow based on what has already been heard. In this way time appears, for the listener, to stand still; we forget *our* time and listen to the *natural time* of Lumsdaine's world. The 'continuity' referred to earlier is the listener's memory of what has come before and his anticipation of what might come next.

The theatrical aspect of the piece may be enhanced through the distant, slightly muffled sounds produced by the use of microtonal fingerings which suggest not only a quiet sound but also one that is in some way hidden or at some distance, that the bird can just be heard but not seen – off stage, as it were.

The extent of each silence and the precise timing of each call is at the discretion of the performer, adding an element of improvisation to the performance. Understanding Lumsdaine's use of silence, therefore, is the key to an effective, rhetorical and theatrical performance as the composer invites the audience to listen.

No. 2 from *Five Quarter-Tone Pieces* (1997)

Donald Bousted (b. 1957)

The *Five Quarter-Tone Pieces for Solo Recorder* (for Alto or Tenor) were considered by Bousted to be among his 'most ingenious creations' and 'were aimed at the most adventurous soloist' (Bousted 2002b, 102). They use the full microtonal range of the alto recorder: two octaves and a major sixth although numbers 2 and 4 are specifically written for the tenor recorder. They are technically demanding. They were composed in the middle of the period 1995-2000 when the composer was intensely engaged in creating microtonal works for the recorder; 1998 was also the year that the *Quarter-Tone Recorder Manual* was published, one year after *A Journey Among Travellers* was completed and the year before *Whale Song* was composed. Bousted's period of engagement with the recorder was undertaken in close collaboration with recorder players Kathryn Bennetts and Peter Bowman but he also worked with the French player Philippe Renard, for whom he composed *The Evolution of Line* for amplified solo tenor recorder in 1997, his first work specifically composed for that instrument. Renard's interest lay at that time primarily in electro-acoustic music and the larger instrument would have been more appropriate for use in these circumstances due to the greater presence of upper partials compared to the higher pitched members of the recorder family.

Much of the discussion regarding *Study No. 2* that follows is concerned with highlighting the difficulties of performing it on a baroque style tenor recorder of the type commonly in use at the time of composition. However, I consider it an important work in the recorder's microtonal oeuvre and include it in this thesis for two reasons: firstly on the grounds of optimism, that is that it anticipates a time when recorder players would have access to modern style instruments capable of playing the microtonal range demanded by this piece. Secondly, and perhaps more importantly, its inclusion is significant because it is the only piece that uses microtones as integrated structural elements. It is a truly structurally microtonal work[59], which alone is sufficient reason for its inclusion.

The tenor recorder had become the focus of attention for many players and composers during the last decade of the twentieth century. It became popular during a period when there was a search among players for a 'modern' recorder that would be compatible in mixed instrument contemporary music ensembles. But this was just one of the strands in instrument development that was taking place at the time. The discovery, in the nineteen-seventies, and later development and reproduction by various makers, of a fragment of a renaissance G-alto in the Kunsthistorisches Museum Vienna (catalogue number C 8522) led to the production of an instrument that, as a by-product, fulfilled many of the perceived needs of the modern recorder player – strong lower register, clear, bright high register, dynamic flexibility, and a range, based on the fingering chart given in Ganassi's treatise *La Fontegara*, in the region of two-and-a-half octaves. The *Harmonic Tenor* of recorder maker Maarten Helder was developed out of a similar desire – to find a modern recorder with the sound, range and dynamic flexibility necessary for contemporary music. It gave impetus to the desire among some professionals to develop the tenor as the main ensemble and solo instrument of the recorder family. Its convenient pitch (lowest note is middle C) and range of two-and-a-half octaves makes it particularly suitable for playing with other instrumentalists. Bousted's interest in the tenor recorder was thus aroused, initially following discussions with Bennetts and Bowman, and by more radical developments in

59 A piece composed using a scale or set of notes based on microtonal intervals.

recorder design taking place on the continent, notably France, where recorder maker Maarten Helder had his workshop, and later in Fulda, Germany, where he developed a relationship with recorder manufacturer Mollenhauer. Two of Bousted's earlier works, originally for flute, were later revised for the tenor - *Two Responses to Silence* (1985 rev. 1998) for solo tenor recorder (pub. Orpheus) and *Dla ba 'n de da* (1986 rev. 2001-2) also for solo tenor recorder. Later, he worked with English recorder player Rachel Barnes who had become an advocate of the Helder *Harmonic Tenor Recorder*. The tenor thus became more popular as a solo instrument, even before the development of the harmonic instrument. It was anticipated, not least by Bousted, that interest in the new contemporary recorder would grow, that players would be attracted to its expanded range and increased expressive potential, and that new works would be composed for it.

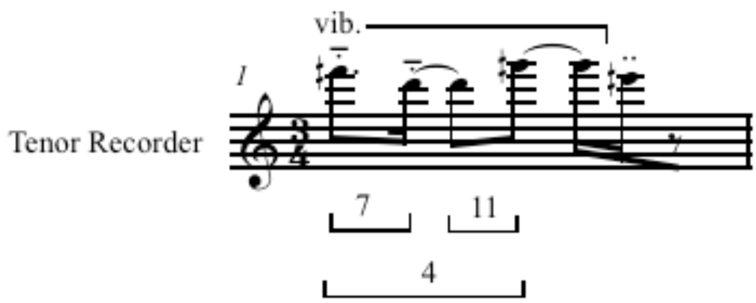
Up until the late 1990s Bousted's compositions for recorder, encouraged by Bennetts and Bowman, were restricted to the use of the alto instrument. This restriction of instrument was the result of a reaction to the works for recorder of some British composers who employed different sized recorders in a single work as a means of creating musical variety. For the Bennetts-Bowman duo the challenge to composers was to create variety *musically* and not merely by asking players to swap instruments. One such work, an extended duet composed for the Bennetts-Bowman Duo, is *A Journey Among Travellers* (1995-1996). It is a collection of nine miniatures in which each piece focuses musically and technically on specific compositional objectives and musical concepts. The *Five Quarter-Tone Pieces*, on the other hand, explore the technique of the recorder and microtonality in a broader musical and technical context and employ a specific compositional technique to achieve this - motivic transformation, which Bousted declares 'is evident [in *Five Quarter-Tone*

Pieces] as a means to create structural binding and variation'. Regarding his use of motive as a structural element, Bousted acknowledges the influence of Arnold Schoenberg's *Fundamentals of Musical Composition* (1967) (Bousted 2002a, 9-11).

The piece selected for study here, the second of the set, is intended for tenor recorder and carries the composer's instruction '*Intense*'. It is one of just two in the set for tenor and is the only one of the five composed in the *pointillist* style. By definition, therefore, it distinguishes itself from the remaining four pieces by making greater use of leaps, silences, and by highlighting structural elements with the addition of flutter tonguing, vibrato, finger slaps, and playing notes with a distinct 'chiff' at the point of attack.

Study No. 2 is structurally microtonal and in three sections: the first (bars 1- 28) establishes the main motivic material: the three-note leaping passage that defines the piece. The main motive of the piece is stated in bar 1 and its importance is highlighted by the use of vibrato (see Example 6-51, below). The end of the section is announced by three bars of silence – bars 29-31, followed by section 2 (bars 32-78) which begins with the opening motive transposed, augmented and in retrograde form (see Example 6-52). Section 3 (bars 79-107) is marked *Intense; Reflective.*

Example 6-51, showing the opening motive with the number of quarter-tone interval steps between tones:



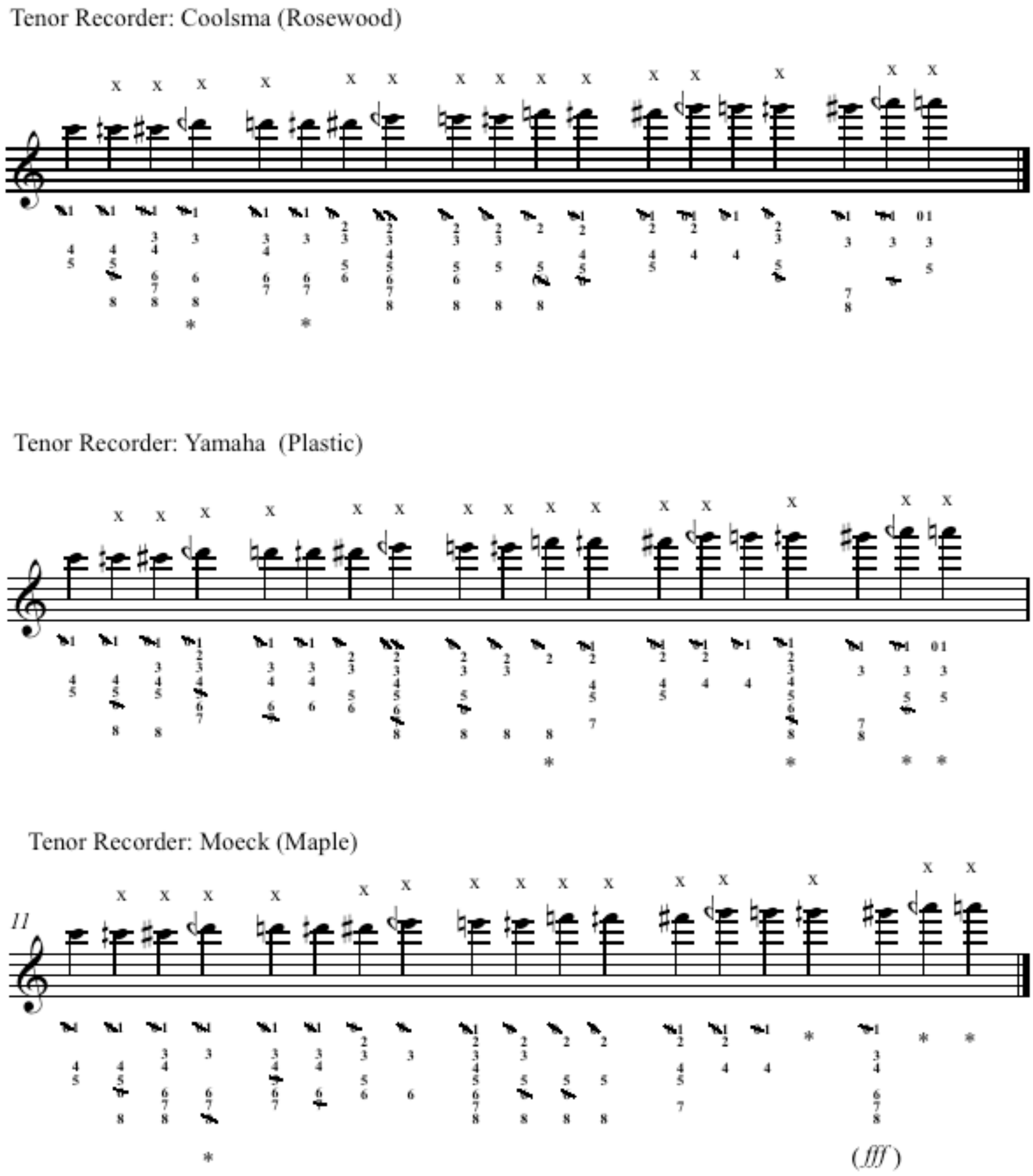
The second section begins with a transposed, augmented, and retrograde form of the initial motive. It runs from bars 32-78. Example 6-52 shows bars 32-34, where the initial motive is transposed down ¾-tone, augmented and in retrograde form:

Example 6-52.

The final section, bars 79-107, marked *Intense; Reflective*, consists primarily of falling patterns. Indeed the overall shape of the section shows a progression from the very highest range at the beginning of the section to the very lowest at the end.

Five Quarter-Tone Pieces was written seven years after the publication of Johannes Fischer's *Die Dynamische Blockflöte* (Moeck 1990), which showed that a range above the alto recorder's lowest F of three octaves was possible. The availability of recorder maker Maarten Helder's *Harmonic Tenor Recorder* from around 1995 (Bowman 1995, 126-127), which offered a range of over three octaves encouraged composers and players to explore the very highest register of the instrument. Until this time, even the most adventurous players considered the range to be two octaves and a sixth. Bousted, however, did not specifically call for the use of the *Helder Tenor* until 2003 when he composed *In Preparation for HelderTenor recorder, 4 spatially separated CD systems, domestic percussion and live art performance*. It was written for Rachael Barnes and recorded by her in 2007 for the double CD/DVD *The End of the Beginning* (2007). The range required for the second of the *Five Quarter-Tone Pieces* is two octaves and a sixth (c^1-a^4). A number of the third register notes on the tenor require closing the bell-end and this alone is likely to restrict performances to players who not only can physically fulfill that requirement but also possess an instrument that will play the notes clearly and reliably. Example 6-53 shows the third register of the tenor with those pitches that occur in the second of the *Five Quarter-Tone Pieces* marked with an 'X'. The fingering chart below shows that many of these notes require the bell-end hole (hole 8) to be covered. This is normally achieved by placing the bell-end firmly on the thigh although the length of the instrument will make this manoeuvre impossible for the majority of players. The alternative cross-legged seating position may instead allow the player to make use of the calf muscle to cover the end hole. Fingerings for the third register of three tenor recorders are given – one student plastic instrument, a professional model from rosewood, and one of maple. Fingerings in the table marked with an asterisk (*) are unstable, excessively raspy, noisy, or unreliable. The choice of student model plastic instruments as an alternative to a high quality wooden instrument should not be dismissed as unsuitable as these instruments often produce more reliable results, with greater clarity of tone, in the highest register:

Example 6-53
Showing the third register of the tenor with those pitches that occur in the second of the *Five Quarter-Tone Pieces* marked with an 'X'



A further implication for performers of the use of such high notes is that, due to the design of the instrument, many of the fingerings produce weak and unstable sounds (marked with an asterisk '*' in the example above). Were performances of the piece on all instruments to be compared we would find some inconsistency of tone strength and colour. Whilst in general one can say that the highest register is loud and the very lowest is soft, there are sufficient exceptions to that rule, particularly in the highest register, for composers and players to take note and proceed with caution. This feature is particularly prominent in the final section, which begins on an a^4 and steadily falls down to a $c\sharp^1$. The notable feature of this section is the tessitura and, dynamic range notwithstanding, the section is successful because of that. Exceptions to this familiar pattern occur, for example, at bar 76, where the g-quarter-flat^2, which is one of the instrument's least stable notes, carries the instruction to play *mf* - surely an indication of the composer's musical desire rather than his expectation of what can realistically be achieved in performance. The plastic Yamaha instrument comes with a split key for the c^1/c-sharp^1, which renders performance of the c-quarter-sharp^1 impossible and some of the microtonal third register notes similarly problematic.

The extreme demands that this piece places on the traditional baroque-style tenor recorder and the player would, for a successful performance, require an exceptional instrument and exceptional control and understanding of that instrument. Furthermore, the ability of an instrument to reliably play in a register for which it was not designed may produce many variations of tone quality and pitch accuracy depending on the maker, quality, and flexibility of both the individual instrument and the player. Using the alto recorder's fingerings (transposed down a perfect fourth) as a model for the tenor is insufficiently rigorous for the production of microtones requiring a high degree of accuracy. The fingerings given in Example 6-53, above, have been developed for each of the instruments shown and a number of differences can be observed, making it difficult to provide definitive notes for interpretation and performance. Difficulties typically arise where the dynamic instruction cannot be fulfilled due to the particular strengths and weaknesses of individual instruments. The *mf* $a\flat^2$ in bar 8 presents the first difficulty for the player of the Coolsma tenor, it being one of that instrument's weakest notes. The difficulty is further compounded by the *pp* f^1 in the following bar, which leads on to a d^1 semi-breve with *diminuendo* in bar 10. The dynamic relationship between the notes of the phrase must be maintained but with the $a\flat^2$ possible at best at a *piano* dynamic level, pressure is placed on the player to reduce the remaining dynamic levels by two steps, to *ppp* and *pppp* respectively. However, since from Table 5-1, page 96 of Chapter 5 of this thesis, we read that dynamic level *ppp*, at SPL 40dB or 30dB, is either at or below the practical threshold of hearing, we realize that some compromise must be made and thus it is possible by carefully controlling the leaking of hole 5 in the performance of f-quarter-flat^1 (fingering = 01234~~5~~67) to raise the pitch and blow less to compensate and thus produce a note at dynamic level *pp*, which still leaves room for a *diminuendo* on the d^1. Example 6-54, below shows the proposed new dynamic levels in parentheses:

Example 6-54

This piece can be regarded as an experimental composition and is an indication of the extent to which the composer had been prepared to explore the full range of the instrument. It seems likely, however, that Bousted understood the limitations of the tenor recorders in use at the time of composition – copies or models of instruments based on baroque models - and that the instrument he wrote for had not yet been fully developed but was in his sights, in the process of development and, as it were, on the horizon. The *Study No. 2* was premièred by Rachel Barnes who found the Helder Harmonic Tenor unreliable:

> I premiered 1, 2 and 3. Only 2 is for tenor - I performed this on a standard (non-Helder) instrument. The Helder instrument I own has never been able to play the very high pitches consistently successfully. Movement 2 was much easier to perform on my Aulos and my knee!
> It could be possible that the high quarter-tone pitches are possible on newer models: I bought mine ages ago, when they were the 'new' thing!
> (Barnes 2014, private correspondence)

Whale Song (1998)

Donald Bousted (b. 1957)

Composer Donald Bousted asserted that 'in every sense the recorder is an instrument with developing potential and, increasingly, excellent players who will help it to fulfill a central role in the music of the 21st century'[60] (Bousted 2001a, 141).

> 'In *Whale Song* I set out to utilise the microtonal possibilities of renaissance instruments. It explores quarter-tones throughout its nine-minute duration and uses eighth-tones in the central section. The title comes from the prize-winning children's story "The Whales' Song" (Sheldon and Blythe, 1990). *Whale Song* is not a programmatic retelling of the story but rather an aural study of imagination and innocence' (Bousted 2004, programme note).

An article by Bousted in *The Recorder Magazine* of Winter 2001, *An Instrument for the 21st Century?* which was one of a series of six written following the completion of his Doctoral research, asserted that the recorder will be 'a relevant, powerful and vital instrument in the 21st century' and that 'in a profound way the recorder speaks of "renewal"'. Encouraged by the success of *Journey Among Travellers*, the positive reception of Bennetts' and Bowman's CD recording (1998), and the *Quarter-tone Recorder Manual* (1997), Bousted purposefully set about realizing his vision of the recorder by writing increasingly virtuosic works that extended the recorder's expressive and microtonal potential. *Whale Song* was composed two years after the completion of *Journey*, and at a time when he was intensively engaged in this process. During the period 1990-2000 he composed 15 substantial new works for the instrument, including ten between 1995 and 2000. Many of these pieces, including *Whale Song*, make extensive use of microtones and other extended techniques. Between 2001 and

[60] Developments in recorder design during the twentieth century are discussed in Chapter 4.

2005 a further five pieces appeared, all requiring accompanying CD, including one, *Les Multiphoniques* (2003), which indicates an increasing awareness and use by Bousted of the technique of producing multiphonics and particularly of texture as a structural and expressive device in his compositions for recorder.

Whale Song (CD track 2) is a duet for two recorder players that explores the timbral and microtonal possibilities of the instrument. The composer makes extensive use of microtonality (quarter- and eighth-tones) as well as significant use of multiphonics[61], simultaneous singing and playing, glissando, wide vibrato, and flutter-tonguing to produce a varied piece which includes passages of contrasting textural density as well as microtonal and rhythmic complexity. It was composed in collaboration with recorder players Kathryn Bennetts and Peter Bowman and written at the players' request for alto, tenor and bass renaissance-style instruments. It is his only composition for recorders that employs this style of instrument. This instrumentation presented new opportunities and new challenges: the players' facility with microtones on standard baroque-style instruments had been established with the publication of *The Quarter-Tone Recorder Manual* and the recording of the composer's *A Journey Among Travellers*. Renaissance instruments typically have a range of one octave and a sixth. The instruments' specific sound qualities and fingering characteristics suggested that restricting the microtonal range to the middle register would be the place to begin an exploration of the microtonal potential of these instruments, particularly since eighth-tones were employed here by the composer for the first time in his output. Renaissance instruments had become popular among recorder players and composers for their bright, open and robust tone, which also have advantages of dynamic range over standard baroque style instruments. *The Catalogue of Contemporary Blockflute Music* (*Stichting Blokfluit*) lists 62 pieces for renaissance

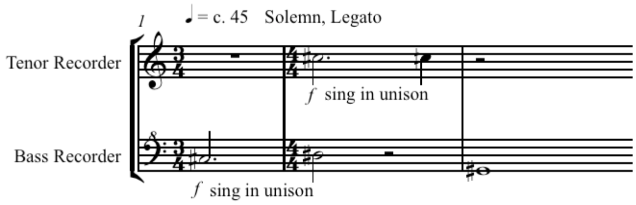
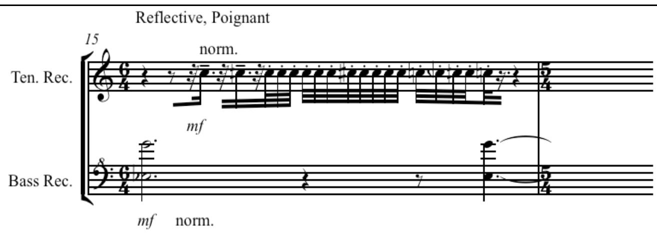
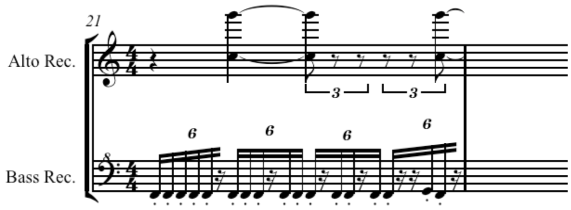
[61] A multiphonic typically consists of two prominent pitches. However, either of these can be unstable and are also generally accompanied by white noise, making pitch identification sometimes problematic.

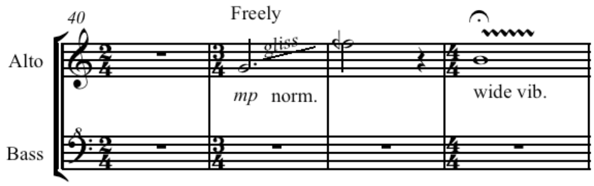
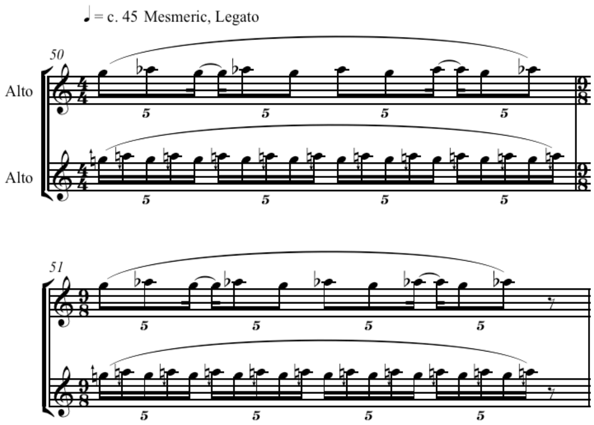
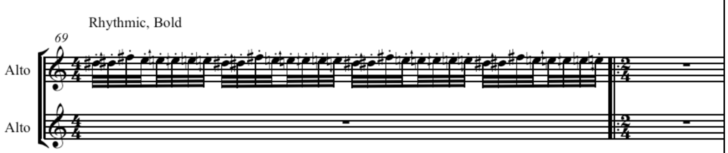
instrument(s), the majority composed between 1985 and 2000 (*Anon.*). During the 1990s many players considered the renaissance 'Ganassi' style instrument the prototype of a new modern recorder, uniquely suitable for the performance of contemporary recorder music. Australian recorder maker Fred Morgan was working in collaboration with Walter van Hauwe to develop the 'Ganassi' instrument with this goal in mind before the project was cut short by Morgan's death in 1999.

My analysis of *Whale Song* will compare and contrast the musical material that constitutes each of the nine sections of the piece. Indeed the piece is heavily dependent on contrast between passages for its primary effect. I will show that the relationships between the sections are complex and operate at motivic, rhythmic, and textural levels. Following initial brief motivic and rhythmic analyses, which will be linear in approach, it will be necessary also to study some passages simultaneously from different perspectives in order to understand fully the relationships and structural significance of each. The main part of the analysis, that focusing on texture will, however, not be linear but vertical, viewed as though circling around it from above, observing the different musical textures and the techniques that produce them. It is the study of the contrasting textures of the piece, between the extremes of homophony on one hand and polyphony on the other, and how these are created by the application of various microtonal motifs that forms the central part of this analysis.

Table 6-3, Motivic analysis of *Whale Song*

Whale Song is in nine short, continuous sections:

Sec-tion	Description	Material	Techniques
1	Bars 1-14 *Solemn, Legato* chorale-like introduction for bass and tenor.		Quarter-tones, Simultaneous singing and playing
2a 2b	Bars 15-20 *Reflective, Poignant* introduces multiphonics, in the bass. Against the chordal background the alto plays a mixture of repeated and quickly alternating quarter-tone intervals in demi-semiquavers. At bar 21, the roles are reversed. There is a change in tonal centre at the beginning of the passage from a broad C based tonality through F, G, D, and E		Multiphonics, Quarter-tones
3	Bars 27-39 A slightly quicker tempo that begins with solo alto in a rhythmic passage of quarter-tone semi-quaver sextuplets. The rhythmic pattern is loosely imitated by the bass at one bar, until the passage is		Multiphonics, Quarter-tones

	interrupted by the alto in bar 30 with two new chords which announce a new tonality and rhythmic pattern in the bass. This in turn is taken up by the alto until in bar 36 a short four-bar unison passage, the first in the piece to this point, leads in to section 4.		
4	Bars 40-49 *Freely* an eight-bar, quasi-improvised passage for solo alto that leads in to a further short unison passage.		Glissando, wide vibrato, quarter-tones
5	Bars 50-68 *Mesmeric, Legato* the central section uses mixture of eighth- and quarter-tones at the same slow tempo as Section 1. This section is characterized by syncopated rhythms, shifting beats and intervals of a semitone or less. The motifs are predominantly rising.		Quarter-tones, Eighth-tones
6	Bars 69-74 *Rhythmic, Bold* The alto leads with two bars of tongued chromatic demi-		Quarter-tones, Eighth-tones; Simultaneous singing and playing.

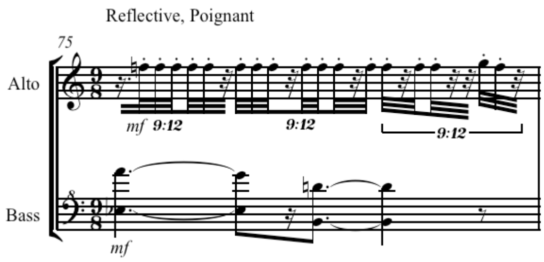
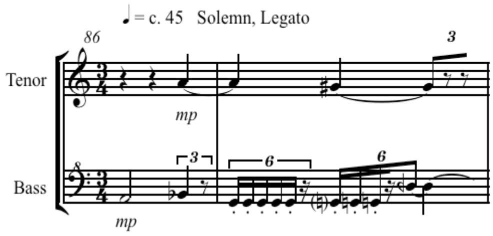
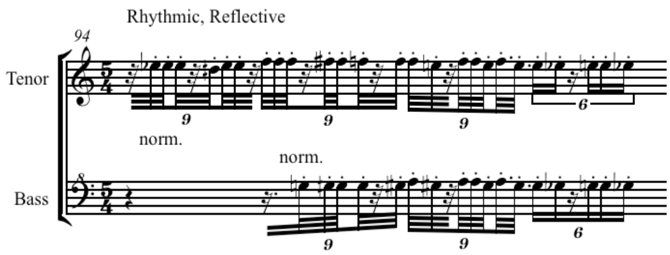
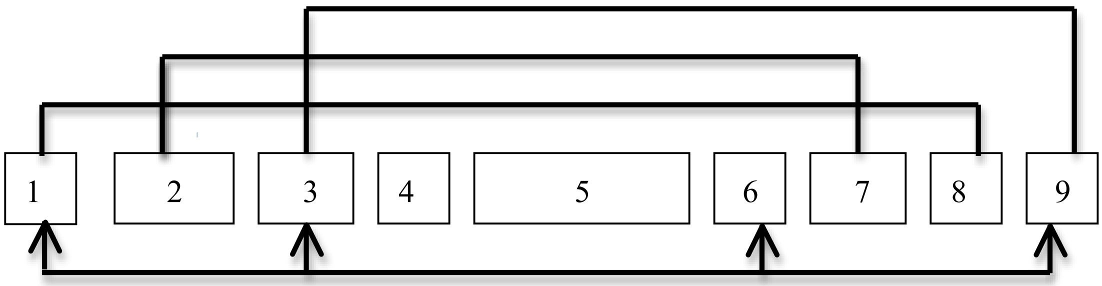
	semiquavers in a ten-times repeated pattern before microtonal transpositions in both parts prior to a brief *accelerando* which leads in to Section 7		
7	Bars 75-85 *Reflective, Poignant* reminiscent of Section 2. It has chords in the bass and rapid repeated notes interspersed with quarter- and eighth-tone intervals in the alto part, in a demi-semiquaver passage that lasts ten bars.		Multiphonics, Quarter-tones, Eighth-tones in alto.
8	Bars 86-93 *Solemn, Legato* similar to the chorale of section 1.		Quarter-tones
9	Bars 94-99 *Rhythmic, Reflective* Reminiscent of a classical coda, section 9 consists of quick, shifting rhythms and like section 3, is loosely imitative until the parts come together for the final 3 bars.		Quarter-tones, Simultaneous singing and playing, Flutter-tonguing

Table 6-3, above, shows the primary structural organisation of *Whale Song*. At the surface level it is based on contrasting textural relationships between the various sections. For my analysis I refer to this as the third or highest architectonic level. Within each section multiphonic chords and microtonal passages create contrasting passages of timbral tension and release. I refer to this as the second architectonic level. I begin, however, with a brief motivic analysis and will refer to this as the first architectonic level of the work. The rhythmic and textural elements that constitute the higher architectonic levels will be studied in detail later in this chapter.

The composer makes persistent use of a fast repeated note motif in Sections 2, 3, 6, 7, and 9, which add rhythmic tension and are, additionally, constantly hovering in an uncertain melodic sound world of shifting quarter- and eighth-tone intervals. A tense backdrop is thus established onto which the addition of densely textured multiphonic chords (Sections 2 and 7) and imitative duet playing in Section 3, is set against alternating parallel duo and solo passages in Sections 6 and 9. Many of the duet passages are played in chromatically (microtonally) altered parallel fourths and fifths. The central fifth section, the gentlest in character, uses close, mainly microtonal, intervals and subtly shifting rhythms to create an intense fluid passage – the longest in the piece. In the following diagram (Figure 6-4), brackets show my suggestions for the motivic relationship between sections and these will be discussed below:

Figure 6-4



Sections 1 and 8 are both marked *Solemn, Legato* and share a slow tempo of ♩ = c.45, as well as low instrumentation (tenor and bass). They are both stylistically reminiscent of an eighteenth century chorale and employ both imitation and counterpoint. Example 6-55 shows Section 1, bars 3-6 in which the material initially heard in the tenor part (bars 3-5) is imitated by the bass in diminution at the interval of a fifth below (bar 6):

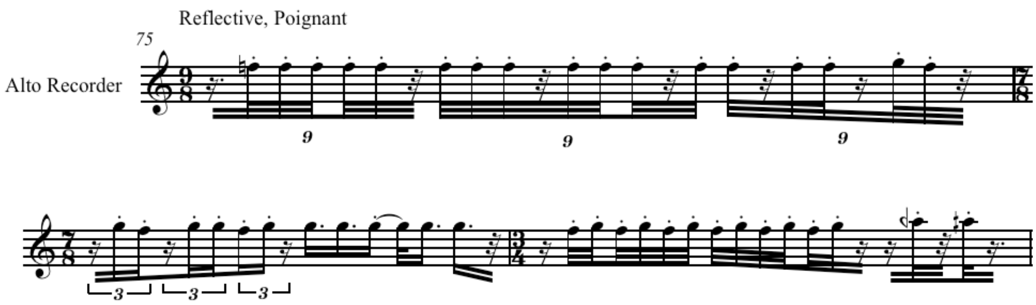
Example 6-55. The square brackets show the imitation in diminution between the parts in Section 1:

Sections 2 and 7 are marked *Reflective, Poignant,* and are linked by virtue of the use of multiphonics (see Table 6-3, above) and similarities between the repeated F motif at bar 21 in section 2b (see Example 6-56, below):

Example 6-56

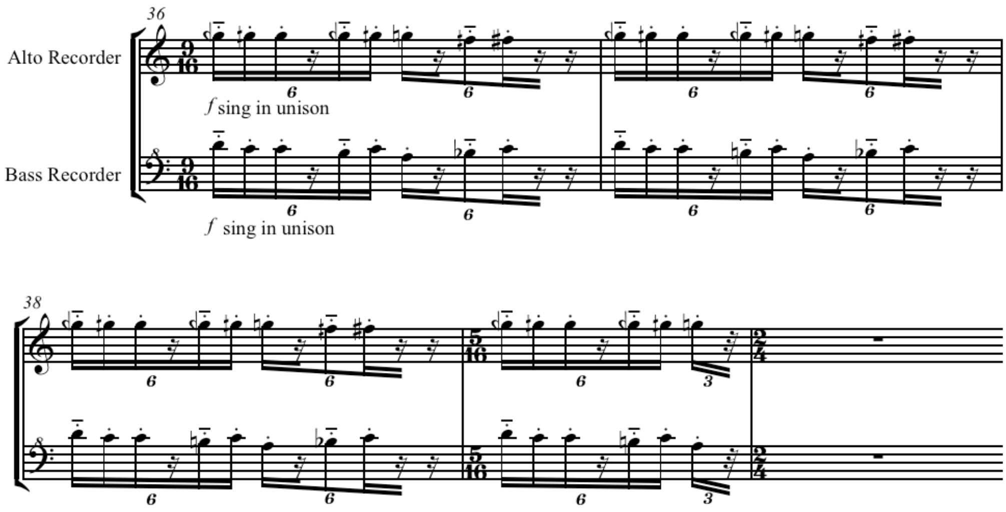
and bar 75 in Section 7, see Example 6-57:

Example 6-57



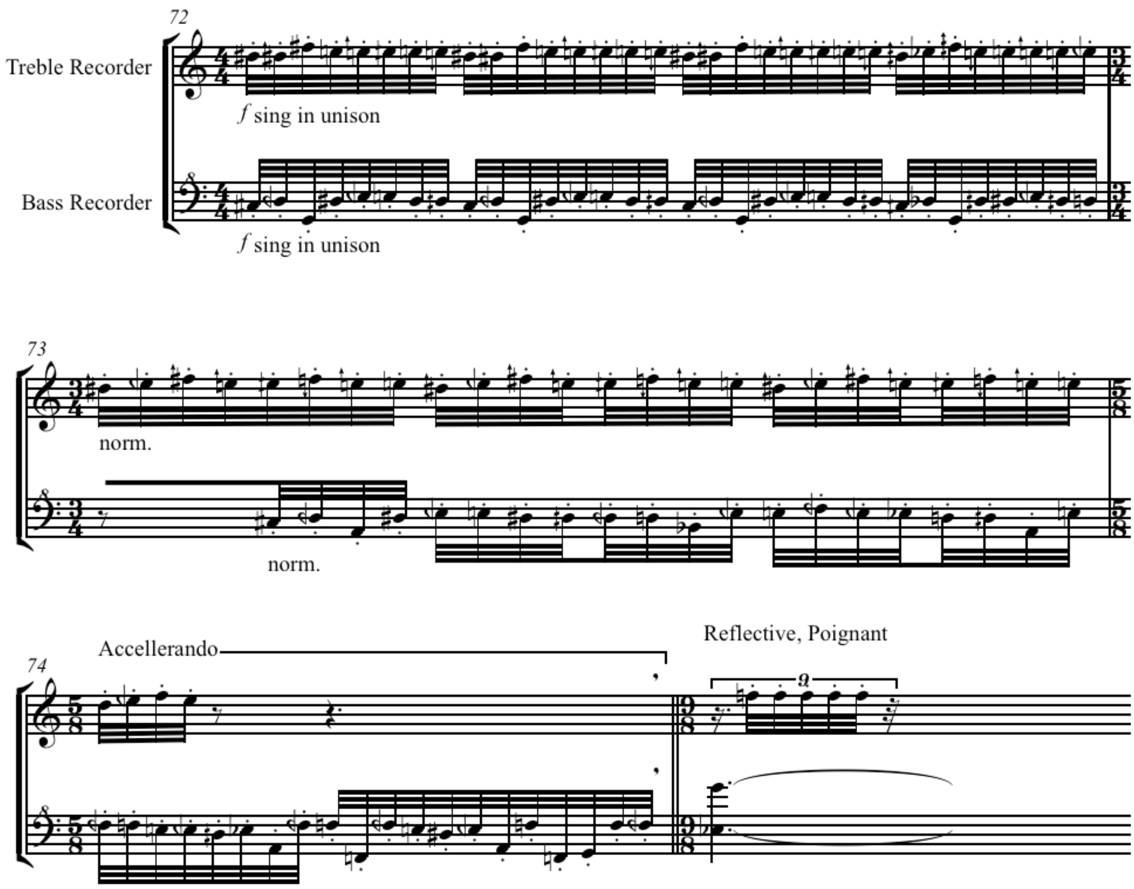
Section 1 begins with simultaneous singing and playing through the first short section (bars 1 -14). Its slow tempo, mainly conjunct movement and vocalized execution renders it reminiscent of an eighteenth century chorale. The passages of simultaneous singing and playing at the ends of Sections 3 (bars 36-39), 6 (bar 72), and 9 (bars 97-99) are, in contrast, rhythmically strong and timbrally dense. Each is constructed differently, so that the timbral contrast between passages is highlighted: Example 6-58 shows bars 36-39 followed by two beats of silence before the alto's quasi improvised solo passage.

Example 6-58, Section 3 (bars 36-39)



Example 6-59 shows the short, four-beat sung passage followed by a further two bars of normal playing, which leads straight in to Section 7 at bar 75.

Example 6-59, Section 6:



Example 6-60 shows the final passage of the piece; rhythmic, robust and timbrally dense, the piece ends in a questioning manner with both incomplete rising motif and a diminished fifth.

Example 6-60, Section 9 (bars 97-99):

These elements define the structure of the piece at a motivic level but there are further elements that add structural coherence – rhythm and texture. The first of these that I shall discuss is rhythm. Bousted's music was influenced by Cooper and Meyer's book *The Rhythmic Structure of Music* (Bousted 2002a, 10). The authors base their understanding of rhythm on five basic rhythmic groupings 'traditionally associated with prosody'. In the following examples ∪ = upbeat; and − = downbeat: the Iamb: (∪ −), the Anapest: (∪ ∪ −), trochee: (− ∪), dactyl: (− ∪ ∪), amphibrach: (∪ − ∪).

Cooper and Meyer discuss the organization of the rhythmic structure of music into three architectonic levels: the *primary rhythmic level* consists of 'a strong beat and one or more weak beats grouped together'. […] 'When groups on the *primary rhythmic level* are themselves organized into longer, compound patterns, *superior rhythmic levels* are created' (Cooper and Meyer 1966, 6). Bousted explains: 'I have used this approach in much of my music over the past 10 years[62] but perhaps the most elaborate evocation of it, in terms of multi-movement design, was in my quarter-tonal nine-movement duo, *A Journey Among*

[62] Bousted was writing in 2002

Travellers'[63]. In order to understand Bousted's use of rhythmic structuring in *Whale Song,* I will first look at his explanation of its use in *Journey Among Travellers.* He defined the three architectonic levels in *A Journey Among Travellers* in this way: 'the first concentrates on the relationships of adjacent groups of movements […], the second defines the next important set of groupings and, finally, the most fundamental stress pattern is revealed as an iambic grouping (or downbeat, followed by upbeat – the upbeat is stressed to show that it has emphasis, although the second group remains the downbeat…)'[64].

Bousted's rhythmic analysis of *A Journey Among Travellers*, based on Cooper and Meyer's ideas, was made retrospectively[65], during the writing of his Doctoral Thesis (Bousted 2001b, 6) but his music continued to be influenced by the ideas promoted by Cooper and Meyer after the composition of *A Journey Among Travellers* (1995-1996).

The parameters Cooper and Meyer use for determining rhythmic elements at an architectonic level include pitch, intensity, timbre, texture, harmony as well as duration. They compare the organization of rhythm and meter – groups of individual tones 'into motives, motives into phrases and phrases into periods' with the structural elements of prose: 'letters are combined into words, words into sentences, sentences into paragraphs…'. 'As a piece of music unfolds, its rhythmic structure is perceived not as a series of discrete independent units strung together in a mechanical, additive way like beads but as an organic process, in which smaller rhythmic motives, while possessing a shape and structure of their own, also function as integral parts of a larger rhythmic organization' (Cooper and Meyer, 1966, 1-2).

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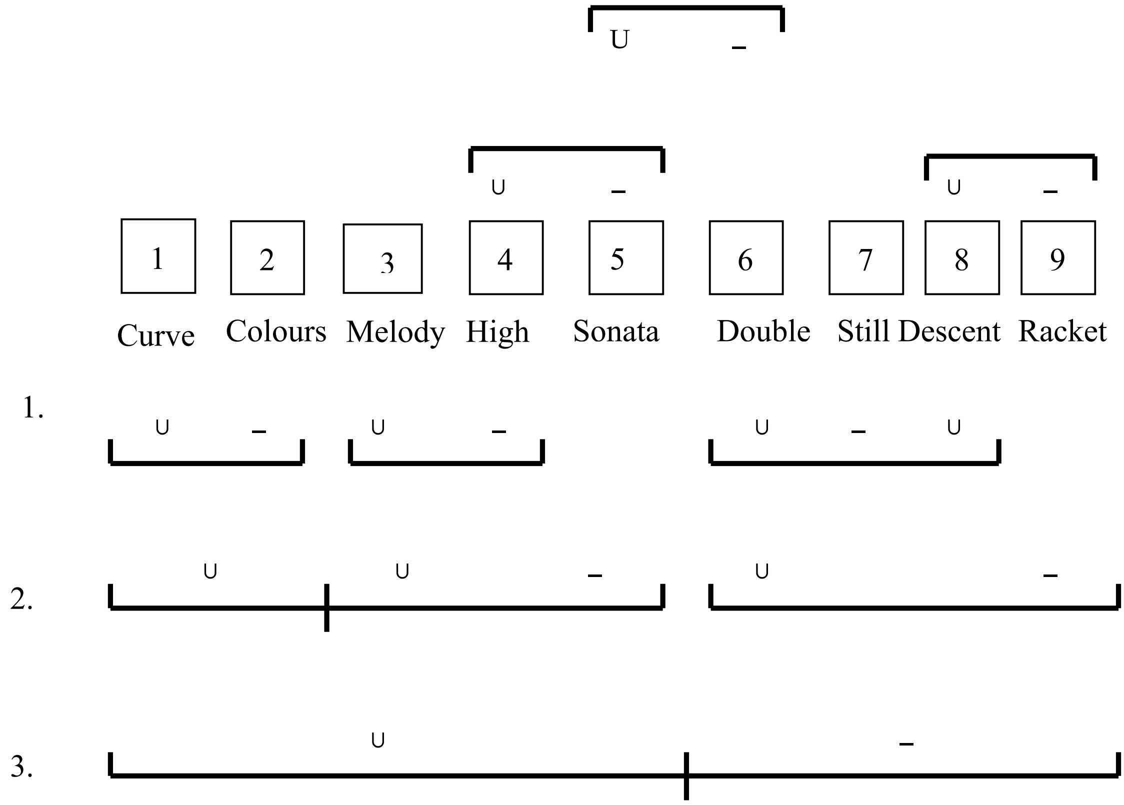
[63] Composed 1995-1996

[64] This appears to contradict Cooper and Meyer who show quite clearly that they understand the iamb as an upbeat followed by a downbeat (Copper and Meyer 1966, 6).

[65] The initial instruction from the composer was that the movements could be performed separately and in any order but this statement was withdrawn and the order of the movements finally established.

Figure 6-5: Structural relationships between the individual movements of *A Journey Among Travellers* (and the three architectonic levels proposed by Bousted (Bousted 2002a,11)).

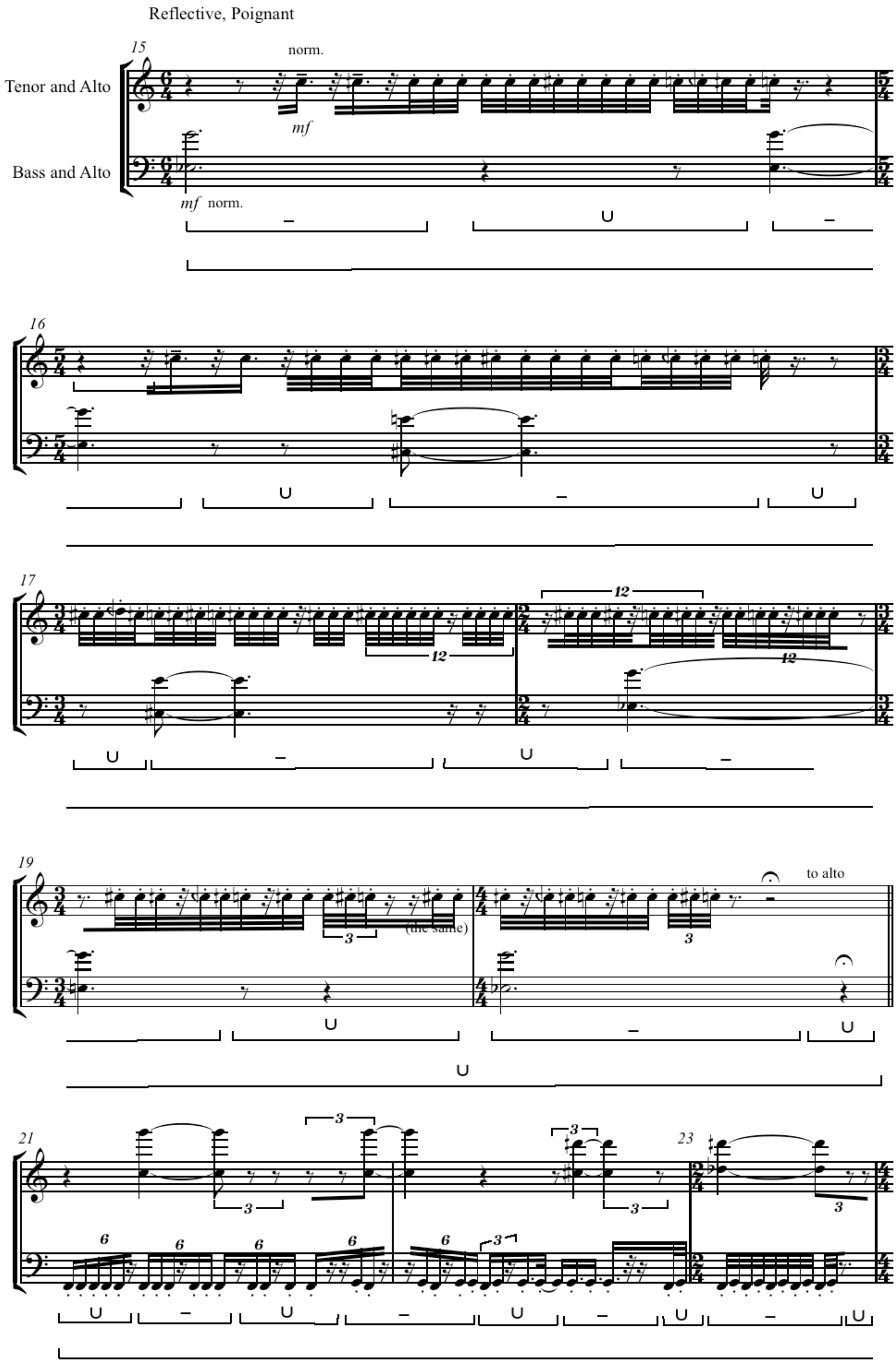


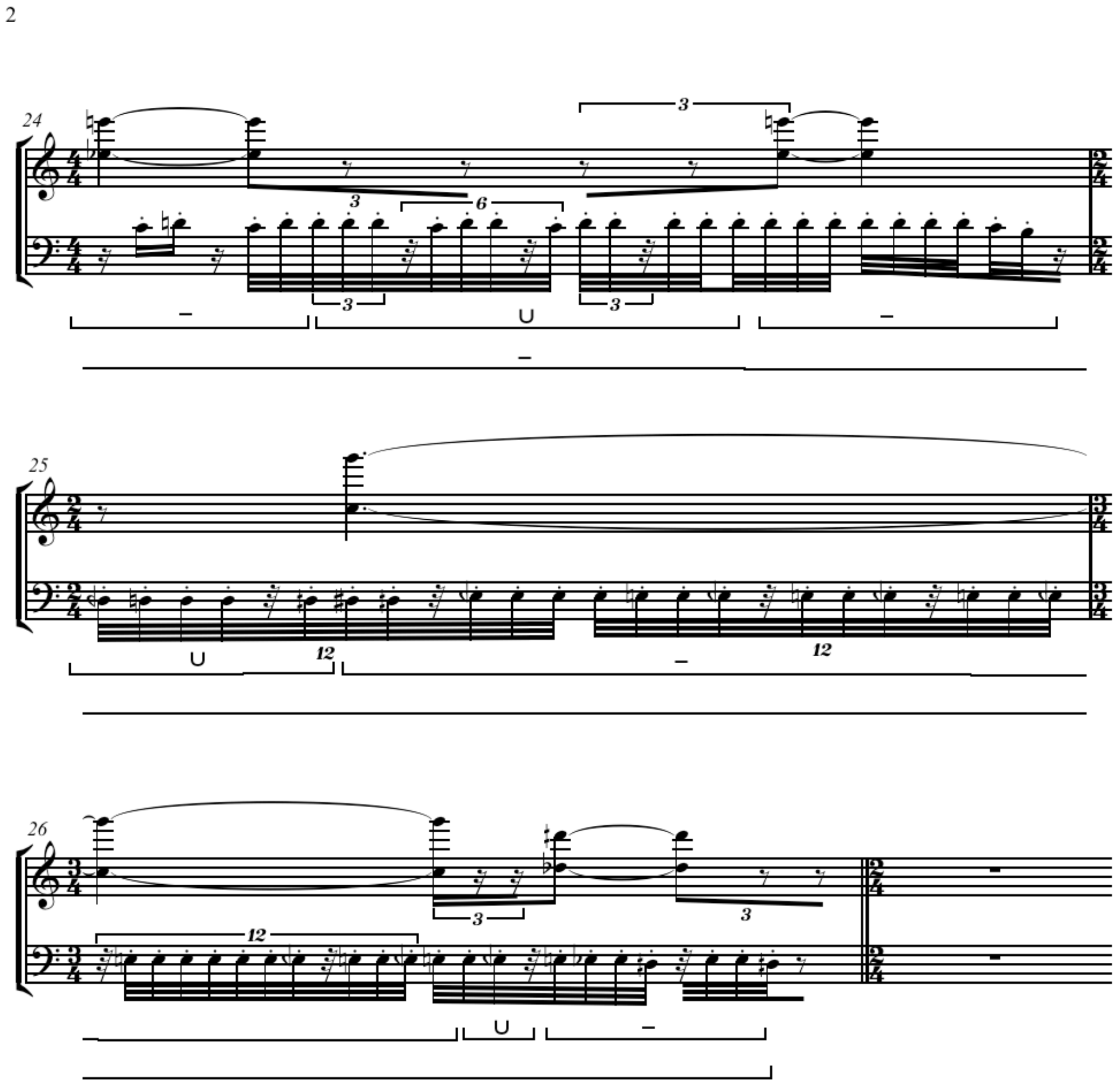
‘The different stresses are created by the nature of the material: the upwardly rising, accelerating patterns of *Curve* impose a downward stress to *Colours* (which is reinforced by the static quality of this movement). The pattern repeats with *Melody* and *High* whose very high (and relatively loud) pitches determine that it is heard as a down, rather than an upbeat. *Sonata*, like *Racket*, stands alone at the lowest rhythmic level but, significantly, becomes accented on the next highest level: both these pieces are given a structural intensity due to their, somewhat light-hearted, referencing to other styles (*Sonata* to the 18th century one-movement sonata form and *Racket* to a ragtime dance). The realization of the highest architectonic level is justified by the slightly more substantial, more intense, last four works.’

(Bousted 2002a, 10)

Let us look at section 2 of *Whale Song* to investigate the extent to which, if any, Bousted has incorporated Cooper and Meyer's ideas regarding rhythmic structure at the secondary architectonic level. As the composer himself observes 'while discussions about whether such sections are indeed upbeats or downbeats could easily lead to full-scale debate, for the composer, the precise outcome is not really vital so long as the sense of rhythmic structure is felt in principle' (Bousted 2002a, 11). My proposed organization of the rhythmic patterns, below, is the first stage in developing an interpretation of the work and is by no means intended to be definitive (Example 6-61, below).

Example 6-61, The Rhythmic Structure of Section 2 of *Whale Song*

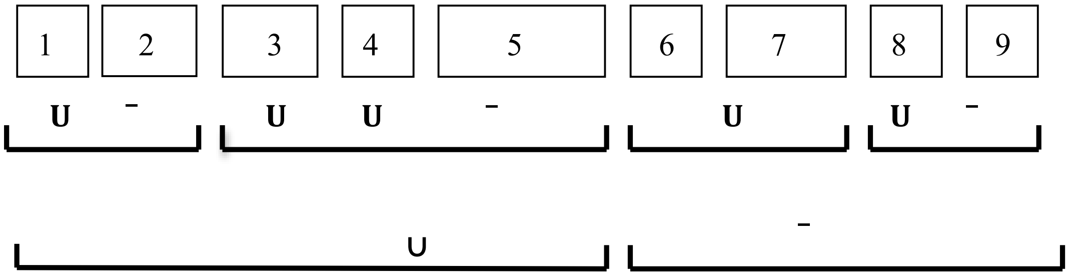




Example 6-61 shows Section 2a opening with a solo multiphonic chord E♭-G♮ in the bass. The alto enters just before the second beat with a C♮ and plays quick repeated notes in the pitch range D-quarter-flat – C–quarter-flat with the central pitch C-quarter-sharp, which between bars 15-20 is also the most frequently recurring pitch. The chords in the bass alternate between two appearances of E♭-G♮, each a dotted minim in duration, followed by C♯-E♮, twice, each a minim long and again two appearances of E♭-G♮, each a dotted minim in duration. If we consider pitch, intensity, timbre, texture, harmony and duration as the primary indicators of stress (see Cooper and Meyer, above) then the relatively, loud, long and coarsely textured E♭-G♮ multiphonic can be considered strong and therefore becomes a downbeat at the beginning of the section. The repeated, solo, demi-semiquavers between the chords, consisting of vacillating quarter- and eighth-tones, are less intense, lower in pitch, and therefore present a passage of relatively weaker stress. They therefore become upbeats. A change in tonality is marked by a role reversal, the alto now playing the multiphonic chords accompanied by repeated F demi-semiquavers in the bass. G is gradually introduced at bar 22, D at bar 24, E in bar 25 through 26 until the bass finally settles on a D-quarter-sharp. A harmonic resolution is indicated by the C-G chord and the E♮s in the bass, before the final D♭-D-quarter-sharp chord in the alto raises the tension prior to the beginning of Section 3. The chords are shorter and change more quickly here, reflecting the evolving harmonies implied by the bass and adding strength to the passage. At the second structural level Section 2a is considered an upbeat and Section 2b a downbeat.

At the third architectonic level, the individual sections of *Whale Song* that I have identified can be shown to form a series of related strong and weak passages – passages that are defined by their individual textures in such a way that at a high architectonic level textural contrast is sufficiently strong for such a comparison to be made. The first section is for tenor and bass and is slow moving. The low tessitura and flowing chorale style suggests a relatively weak passage. Section 2a begins with a robust and long multiphonic and this is repeated insistently through to Section 2b where the introduction of the alto raises the tessitura and the rate at which the multiphonics occur. Section 2b can thus be judged as stronger than Section 2a. Section 3 follows almost immediately with a solo passage of repeated sextuplet semiquavers in the alto part. The bass entry at bar 28 a fifth and then a sixth lower lends the passage sonority up to bar 36 where a four-bar passage of unison singing and playing finish the section in a robust manner. Thus Section 3 can be seen as weak (upbeat) compared to Section 2, with the last four bars strong (down beat) leading in to Section 4. The soloistic character of Section 4, with smooth glissandi and wide vibratos, is relatively gentle; even the final two bars, a brief rising ‘question’ motif for the two altos reinforces the upbeat character of the section. The central passage of the piece, Section 5, is played on two altos in an almost uninterrupted flow of rhythmic counterpoint. The section is composed in eighth-tones, which lends an extra textural dimension. At eighteen bars, it is by far the longest section in *Whale Song* thus justifying its role as the central and strongest passage. Section 6 flows straight on from Section 5. It begins with a four-beat solo passage for the alto consisting of mixed quarter- and eighth-tones followed by a two-beat silence and then a three-beat repetition of the opening passage of the section. The following parallel passage of unison singing and playing in microtonally altered octaves and ninths precedes Section 7, in which extensive use is made of multiphonics in the bass therefore making it reminiscent of the strong Section 2. Section 8 is separated from the preceding section by a two-beat silence. It is, as in Section 1, in the style of a chorale, and is for tenor and bass. The tessitura is low, the tempo slow and the character ‘*solemn*’. It is in this sense a gentle section and therefore acts as an upbeat. Bar 87 includes a brief reference in the bass to Section 2b. The final section is a robust passage of rapid repeating demi-semiquavers whose rate of microtonal change is slower and more repetitive than earlier passages. A relatively strong sense of stability pervades the passage. The final three bars are played and sung in parallel at the intervals of chromatically and microtonally altered fourths and fifths.

Figure 6-6, shows a graphic representation of the rhythmic structure of *Whale Song* at the third and fourth levels:



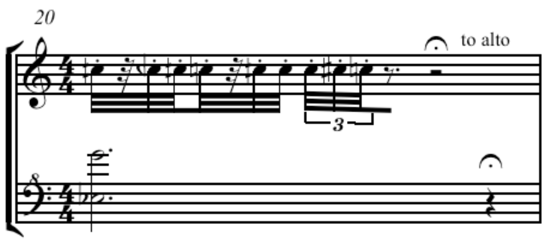
The third element that adds structural cohesion to *Whale Song* is texture. Indeed this a piece whose primary musical element is texture; texture and textural contrast provide a third layer at which the piece's structure coheres. The texture in *Whale Song* is varied in four ways:
First, varying use of microtonality, second, by the use of simultaneous singing and playing (sections 1, 3, 6 and 9), thirdly by the use of multiphonics (sections 2 and 7), and finally by varying rhythmic counterpoint (section 5).

All of these devices have the effect of altering the texture to different degrees and I will discuss each in turn with a view to showing that Bousted uses contrasting textures to define the structure of *Whale Song* at both the surface and fundamental levels.

Microtonality is present throughout the piece and used with a variety of compositional and playing techniques that in combination have the primary effect of varying the texture. Bousted uses microtones in *Whale Song* primarily in a way that gives the impression of a dense band of sound that is centred around a particular pitch, which itself may be microtonal. The pitch centre is in most cases nonetheless difficult to identify due to the constant and quick-fire microtonal hovering in intervals of a semi- or quarter-tone around it, above and below. In Section 2a, bars 15-20, the central tone, C-quarter-sharp, teases the ear by never quite settling at the correct 'in-tune' pitch, thus creating an unstable, coarse texture. It operates as an almost-but-not-quite in-tune root of the E♭-G♮ multiphonic and similarly hovers around the C♯ of the C♯-E♮ multiphonic. Perhaps the most noteworthy use of microtonality is the simultaneous playing of eighth- and quarter-tones, and singing (the final bars of sections three, six, and nine). The ability to pitch the voice as accurately as the instrument when playing microtonal intervals impacts on the interpretation of these passages. The dynamic and timbre of the voice also play a role too, by either masking or reinforcing the instrumental sound.

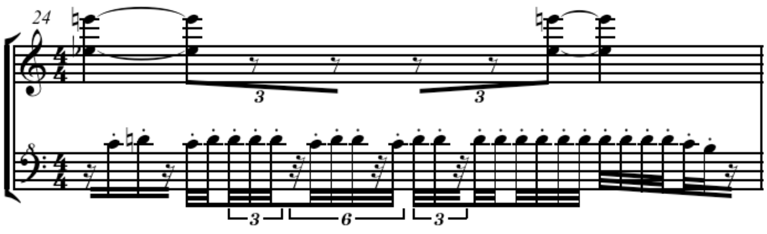
Multiphonics dominate the sound world of Sections 2 and 7, with every possible combination of uses explored. Here the accompanying microtonal passages add textural depth and melodic colour. When accompanying a multiphonic chord the microtonal passages 'hover' around one of the pitch centres of the chord or suggest a missing element. At Section 1, bar 20, the alto briefly hints at a complete C minor chord (see Example 6-62):

Example 6-62



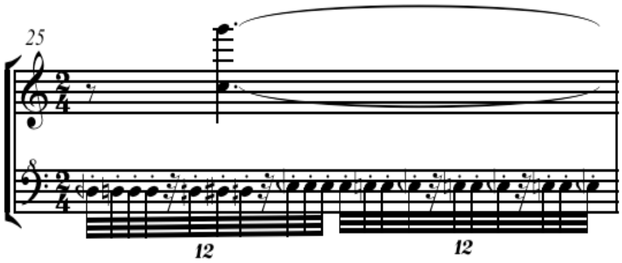
At Section 2, bar 24, the Ds in the bass provide sufficient dissonance with the alto E♭/E♮ chord to enrich the texture and contrast with the lightly textured solo Ds in the middle of the bar (see Example 6-63):

Example 6-63



The rising microtonal scale in the bass of bar 25 adds dissonance, colour and tension to the passage (see Example 6-64):

Example 6-64



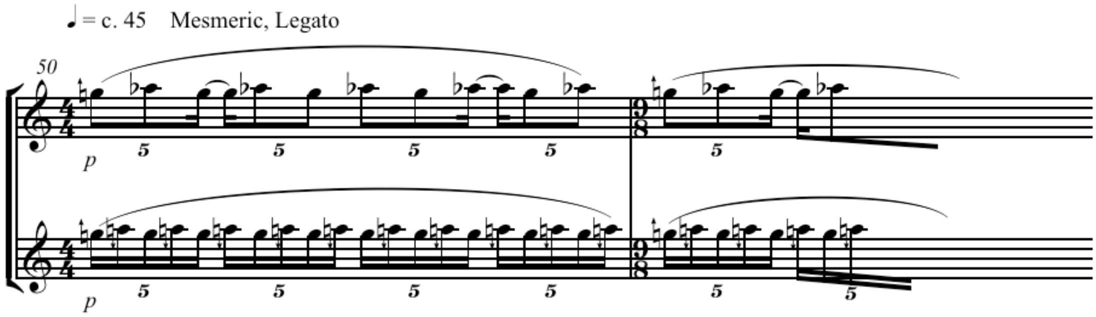
Section 7 uses similar techniques but with the addition of eighth-tones. Quarter- and eighth-tone fast-moving passages, including two sustained passages of rising microtonal scales, indicate an increase in textural density and tension (see Example 6-65):

Example 6-65

A passage of microtonal transpositions in Section 6, bars 72 – 74, are simultaneous but various: the parts begin the passage a 9th apart at bar 72, beat 1, but at beat 4 the alto is transposed down an eighth-tone whilst the bass goes down a quarter-tone making the interval between the parts an eighth-tone sharp major ninth. The alto is again transposed up a quarter-tone whilst the bass, following half a beat of silence, goes up a quarter-tone at bar 73. Bar 73, beat 3, is transposed up a minor third from the start of the passage so that the parts are now an eighth-sharp major seventh apart at bar 72, beat 3, and at the beginning of bar 74 they are an eighth-tone sharp augmented sixth apart.

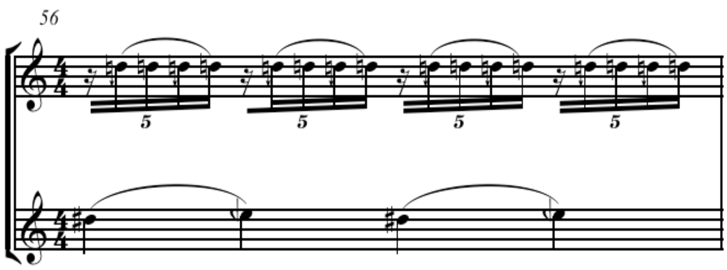
Eighth-tones are first introduced in Section 5 (bar 50), marked *Mesmeric, Legato*. The use of alternating small intervals in both parts in combination with syncopated rhythmic motifs and clear, regular phrasing creates a gentle rhythmic fluidity at the beginning of the section. This is offset by the coarse texture of the passage due to the dissonance and the repeated and rather mournful character of the rising motif, which is a feature of the section (see Example 6-66).

Example 6-66



At bar 56 the bass establishes the rising motif with a quarter-tone. The motif occurs later in eighth-tones (see Example 6-67, below):

Example 6-67



The rich, broad band of sound produced by the human voice combined with simultaneous playing of Section 1 produces an other-worldly sound. Within this sound-world there exists further potential for variety provided by the combination of male and female voice (see cd recording, track 2) and intervals ranging from perfect fourths, quarter-sharp perfect fourths, quarter-sharp perfect fifths, quarter-sharp augmented fifths, a quarter-flat perfect twelfth and a major sixth. The simultaneous singing and playing passage in Section 6, bar 72, consists of fast-moving, quickly articulated demi-semiquavers in eighth-tones (alto) and quarter-tones in the bass. This passage adds a kind of coarse density in which precision or accuracy of pitch gives way to two broad bands of sound moving in parallel over large intervals, ranging from major and minor ninths to microtonally augmented octaves. The indistinct aural experience of this passage belies the composer's characteristically precise notation (see Example 6-60, page 256). The repeated low Gs in the bass suggest the presence of a pedal point and indeed the G briefly coincides three times with an F♯ in the alto part, hinting at an harmonic relationship between the parts, before the upper part moves down an eighth-tone at beat 4, and then up a quarter-tone in bar 74, at which point the G-Pedal moves to an A. The twice-repeated F and then finally G in the bass (bar 74) presage the E♭-G-F♮ of the opening of section 7 at bar 75 (see Example 6-59, above). The final passage of the piece, bars 97-99, is a simultaneously sung and played parallel passage which features the tri-tone in both its diminished fifth and augmented fourth forms. Here, the strong rhythmic motif is repeated twice in its full form and finally left incomplete on the third hearing. The relative strength and rhythmic clarity of these bars is in strong contrast to earlier similarly executed passages.

The multiphonics, which are a significant feature of two sections of *Whale Song*, are fundamental to the piece and were the result of the composer listening to various multiphonic possibilities suggested by the players and then selecting those sounds that best suited his purpose. The search in the score for a hierarchy within the sequence of multiphonic chords reveals little other than subtle degrees of dissonance between chords of no obvious harmonic relationship. What becomes apparent in performance, however, is that the broad band of sound (white noise) produced by the over-blowing to some extent veils the components of the chords and produces a thickly textured sound which, when combined with the band of quarter-tonal demi-semi- and semi-quavers produces a sound in which the individual components are shrouded to an even greater extent. The two chords that repeat through Section 2a appear harmonically unrelated, creating a sense of stability as they oscillate through the passage. The section begins and ends with the more consonant of the two. Tension between the stable bass part, which is palindromic, and the microtonal upper part remains constant throughout the section. The rate of harmonic and melodic change increases in Section 2b (bars 21-26). The alto takes up the role of playing the multiphonics whilst the bass takes over the repeated semiquavers with low Fs, which then move quickly through to G. One bar (b24) of stable high Ds follows before shifting down an octave to hover around D, actually beginning with D-quarter-flat before steadily rising quarter-tonally through bars 25-26 up to E before finally settling on a D-quarter-sharp. The section finishes on the most dissonant chord of the section. The role of the quick moving, mainly microtonal, notes appears to be one of either adding instability to otherwise harmonically stable multiphonic chords, for example bar 25, or adding to the tension and density of the texture by the use of insistent repeated dissonant notes to the existing dissonant multiphonics, see for example bar 24.

Example 6-68, showing multiphonics used in Section 2

Section 2 Multiphonics:

Example 6-69 shows the Section 2 Note Set extrapolated from the multiphonic chords shown above:

Example 6-70 shows multiphonics as they occur:

Example 6-71 shows Section 2 multiphonics in a hierarchy according to dissonance, beginning with the most consonant on the left:

The multiphonics in section 7 remain in the bass throughout and although fewer in number, the rate of change is quicker than in Section 2. The accompanying demi-semi- and semi-quavers are also faster and an accelerando effect is reinforced by the use of nonuplets at the beginning of the section, increasing to dodecatuplets for bar 79, before returning at bar 81 to the original note rate with sextuplets at ♩ = 69. The quicker tempo increases the rate of change of the multiphonics, thus giving the impression of a steady accelerando in the bass whilst the alto appears to enter a slow ritardando as it moves at bar 81 from sextuplets, through four semiquavers and finally to one crotchet per beat. In this passage we find a faster rate of change of the multiphonics, a microtonally rising melodic line in the alto, and more dissonance in the juxtaposition of the multiphonics against the fast moving demi-semi- and semi-quavers. This raises the textural density and the level of tension through the section until the end, at bar 84, where the passage resolves on the final chord - the least dissonant of the section. Although only four multiphonic chords are used, greater variety of texture and dissonance results in this section from the juxtaposition of up to six different demi- and semi-quaver pitch groups against one multiphonic. Section 7 (bars 75-85) has more rhythmic and melodic movement, as well as a denser texture than section 2.

Example 6-72, below, showing Section 7 Multiphonics:

Example 6-73, below, shows the section 7 Note Set extrapolated from the multiphonic chords shown above:

Example 6-74, below, shows the multiphonic chords and the accompanying notes in the alto part. These are circled where the pitch varies microtonally through the beat:

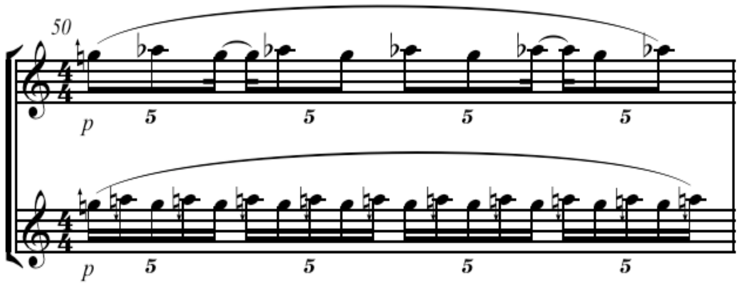
Example 6-75, below, shows section 7 chords assembled according to hierarchy of dissonance – most consonant on the left. Again, the microtonally varying notes are circled:

Example 6-75

Carrying the instruction *Rhythmic, Bold*, Section 6 stands alone in the nine sections of *Whale Song* as having a singularly strong rhythmic pulse. The motif that begins with D♯ in the alto part is repeated seven times before the bass joins in and leaves little room for doubt about its rhythmic nature. In all, the rhythmic motif is repeated uninterrupted sixteen times through the section. It contrasts strongly with the fluidity of Section 5 and the syncopations and asymmetrical meters of Section 7. Section 8 is characterized by lyrical passages and syncopation. Section 9, *Reflective, Poignant*, treats rhythm more hesitantly until the flutter-tonguing of the alto precedes the strongly rhythmic final three bars in a joyous passage of simultaneous singing and playing. Section 3 also treats its rhythmic motif hesitantly until bar 36, when the rhythmic motif is firmly established, and both parts engage in simultaneous singing and playing for a final short passage. The central Section 5 treats rhythm in a more varied and complex manner. Marked *Mesmeric, Legato*, it makes use of shifting rhythmic motifs and syncopation to create a passage of considerable textural and rhythmic fluidity:

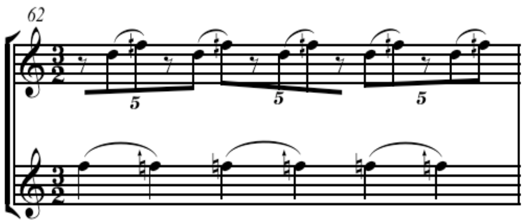
Example 6-76 (bar 50, see also Example 6-58, page 255), showing the parts rhythmically synchronized at the beginning of the section, the close microtonal intervals producing a light but rich texture:

Example 6-76



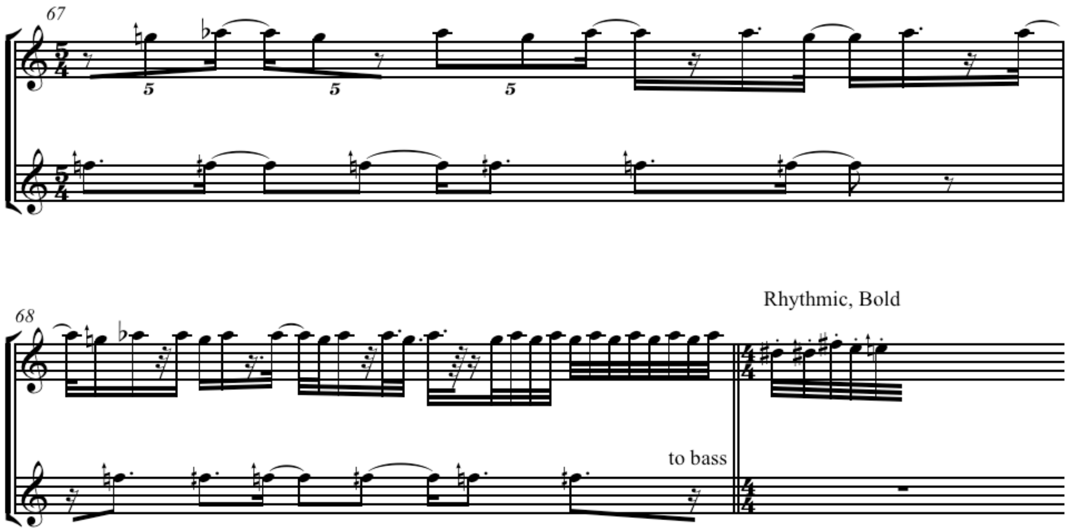
The rhythmic material evolves through the section, at times entering into lightly textured rhythmic counterpoint, for example, at bar 62:

Example 6-77, Section 5, bar 62



The final accelerando and textural crescendo through bars 67-68 leads directly into the solo passage that begins section 6 at bar 69 (see Example 6-78, below):

Example 6-78, Section 5, bars 67-68:

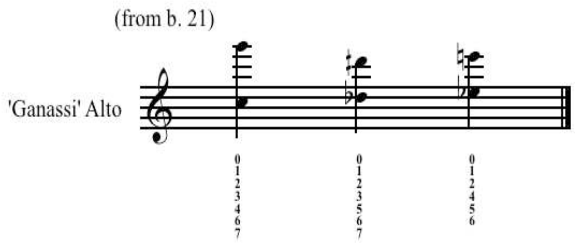


The use of microtonal intervals - quarter-tones and eighth-tones, adds melodic fluidity to the section.

Whale Song is a difficult and complex work that requires a high degree of rhythmic precision, finger dexterity, breath control and the ability to pitch sung notes accurately in quarter- and eighth-tones. Furthermore, the piece is to be played on renaissance style instruments.

I will now discuss the instruments and the suitability of these for playing complex microtonal music. With the exception of some (for the late renaissance period) extravagantly chromatic madrigals by Gesualdo (c.1560-1613) early in the seventeenth century, most renaissance music was composed within the framework of the eight modes commonly in use during the sixteenth century. In this context the use of chromatic notes was restricted in the repertory to accommodating the correct execution of cadential patterns, whether composed or added by the performer according to the rules of *musica ficta* (Bent and Silbiger). Instruments were used for dance music or to accompany singers performing madrigals. The publication of the first recorder-specific treatise by Silvestro Ganassi in 1534 and the subsequent publication of collections of *ricercare* by Virgilliano, Bassano etc., saw the development of a solo instrumental repertoire, which nevertheless remained conservative with respect to the modal compositional framework. Exploring chromaticism and indeed microtonality on instruments not intended for that purpose therefore presents the players with some challenges. Modern copies of renaissance tenor recorders often include a key to facilitate playing the lowest note and the bass employs keys for the same purpose. This makes playing microtones with fingerings that use keys impractical, though not impossible. The normal usable range of renaissance recorders is one octave and a sixth though in practice the reliable microtonal range, using secure dedicated fingerings, is restricted to the octave between the fifth and twelfth notes: on most instruments 0123 to θ123. Thus the decision was made by the players for microtones to be restricted to the central register for *Whale Song*. There is a second caveat regarding the use of renaissance style instruments for contemporary music: they were not designed to play multiphonics – the technique would have been alien to the aesthetic of the period, which valued the ideals of beauty, naturalism, and clarity (Burkholder *et al* 2006, 148-154). Furthermore, recorders do not overblow to produce in-tune upper partials, and some deviation from standard pitches should be expected. Reliable fingerings for the multiphonics, therefore, also had to be determined for the alto and bass. Some variation in the instruments' responses to multiphonic fingerings may result in the need to apply more or less breath pressure as well as stronger or weaker articulations, thus resulting in inconsistencies in dynamic and accent (tonguing) as well as slight deviations from the notated pitch. The published score includes the following suggested fingerings (Bousted, 2003, 1)[66]:

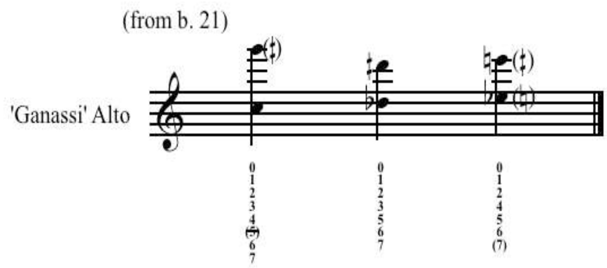
Example 6-79, Showing suggested multiphonic fingerings from the published score. Errors in pitches and fingerings below are due in part to the players not being consulted during the preparation of the published score:



Example 6-80, the composer's proposed fingerings – accidentals in brackets to the right of the note-heads indicate more accurately the pitches obtained, even using the amended fingerings shown:

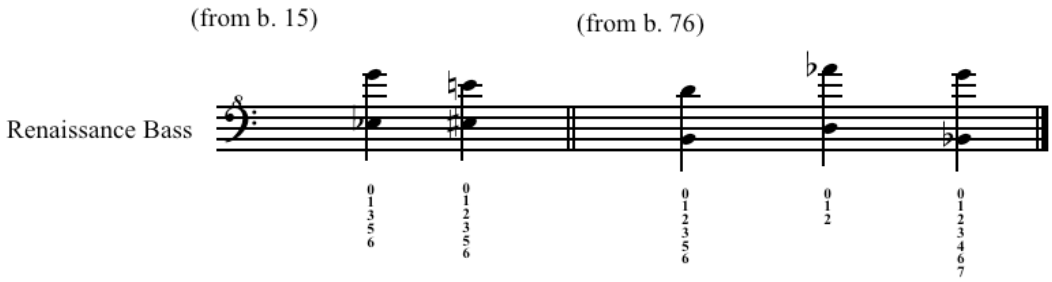
[66] Note an error in the published score: the first chord should read C-G

Example 6-80



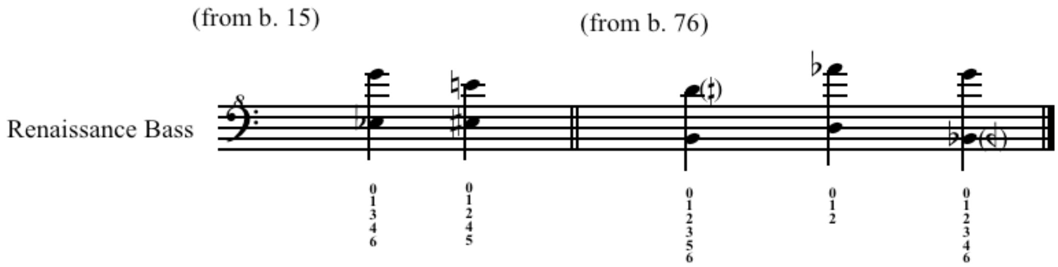
The fingerings for multiphonics produced by the Moeck renaissance bass from the published score are incorrect for three of the five pitches noted (see Example 6-81, below):

Example 6-81



The correct version with accurate pitches, see Example 6-82:

Example 6-82



Variations in texture in *Whale Song*, are heavily dependent on context: the density of microtonal passages, the use of multiphonics, simultaneous singing and playing. Instances of this include passages where the textures of the multiphonics, for example, play a more significant role than the precise pitches. Accurate pitching can be blurred by the white noise and other incidental pitches that result from the production of the multiphonic chord. The same is true for simultaneous sung and played passages which indicate, superficially at least, the high expectations placed by the composer on the performers' ability accurately to play and sing intervals as small as 25 cents. The broad band of sound produced by this kind of playing, regardless of vocal accuracy, blurs the perception of the pitching, especially in passages such as section 3 bars 36-39, where the parts operate at intervals ranging from a quarter-flat perfect fourth to a quarter-flat minor sixth. When compared to lightly textured eighth-tone passages in section five this inevitably raises questions regarding the composer's attitude to accurate pitching of microtones. The light texture and rhythmic complexity of the eighth-tones in Section 5 require a high degree of attention to the detail of pitch accuracy and consistency of tone colour in order to achieve the required *mesmeric* and *legato* effect. This is in direct contrast to the repeated sung and played motif in Section 3 and a similar passage at the end of Section 9. The far more densely textured passage in Section 6, bar 72, in which the parts are broadly parallel at intervals varying between a major ninth, a seven-eighths sharp octave and a three-eighths sharp octave, relies, precisely on the variable, tiny intervals to reinforce the broad breadth of the band of sound and hence the dense texture.

I have shown that in *Whale Song* texture takes precedence over pitch, rhythm or melody as the primary musical element of the piece. It is particularly dense in Sections 3, 6 and to some extent Section 7, where the slowly rising microtonal scale plays a more significant role in conjunction with the multiphonic chords. The contrast with Section 5 becomes stronger when seen in this light. It is due to an investigation into the techniques of performing *Whale Song* that it is possible to appreciate the degrees of subtle variety of rhythm, at all architectonic levels, as well as the richness of textural variety that lend the piece its unique character. It is, as Bousted asserts, 'an aural study of imagination and innocence', which explores the use and application of some contemporary instrumental techniques in a unique way but if 'innocence' means 'artless', 'harmless' or 'ignorant'[67] then this is not an aural study in 'innocence'. Rather, it is an aurally challenging and well-crafted work that deliberately sets out to extend the recorder's sound-world and its expressive potential, that encapsulates the composer's concept of the recorder as 'a relevant, powerful and vital instrument in the 21st century'. Bousted's idea that 'the recorder is an instrument with developing potential' may refer to developments that were taking place during the 1990s and which I discussed in detail in my analysis of *Study No. 2* from *Five Quarter-Tone Pieces* (pages 236-245). This is one aspect of the instrument's potential development. The other depends rather on the imagination of composers and the skill of players to explore and actually realize the true potential of this ancient instrument even when it is stretched beyond its originally conceived limits.

[67] Roget's Thesaurus, Fourth Edition, page 1028

The Voyage (2012)

Michael Wolters (b. 1971)

The Voyage (CD track 3) is a twelve-minute long mini-opera commissioned by the PRS[68] for Music Foundation for the Cultural Olympiad (New Music 20x12). The music is by Michael Wolters, the libretto by James Yarker[69]. The piece is scored for mezzo-soprano, diatonic recorder, two microtonal recorders[70] and an eight-piece recorder ensemble consisting of two descant recorders, two treble recorders, two tenor recorders, two bass recorders plus a double bass.

The Voyage is a piece rich in satirical references, irony and word-painting, that "concerns the constructed nature of nationality and focuses on a mythological figure who travels overseas to face trials in the hope of returning a hero" (Yarker 2012, 5). For the first performance the audience was placed on a mobile platform of banked seating that moved on castors. During the third section of the opera (*Journey*) it was rolled back from the stage to reveal an ocean (blue netting). When the seating was fully retracted, the netting was again removed, this time to reveal running tracks. During Section 7, the *Race* (bars 252-289), the audience platform was rolled back along the running track, following the athlete to the finish line. The narrative is linear with dialogue and commentary. It is the story of an adopted child who is trained to represent his adoptive country at an international competitive athletics festival. The libretto leads us through his physical and emotional journey until the point in the race where he trips and falls. His mother comes to his aid but both are literally and metaphorically 'run over' by the audience as the seating is rolled

[68] Formerly the Performing Rights Society
[69] James Yarker: theatre director and writer for Stan's Café (founded 1991), Birmingham
[70] Standard baroque style treble and tenor recorders played with dedicated fingerings to produce the third-tones as necessary.

back towards the stage and over the mother and fallen athlete (the libretto is curiously silent on this element of the narrative). Another athlete continues to win the race and is hailed a hero whilst the original athlete is forgotten.

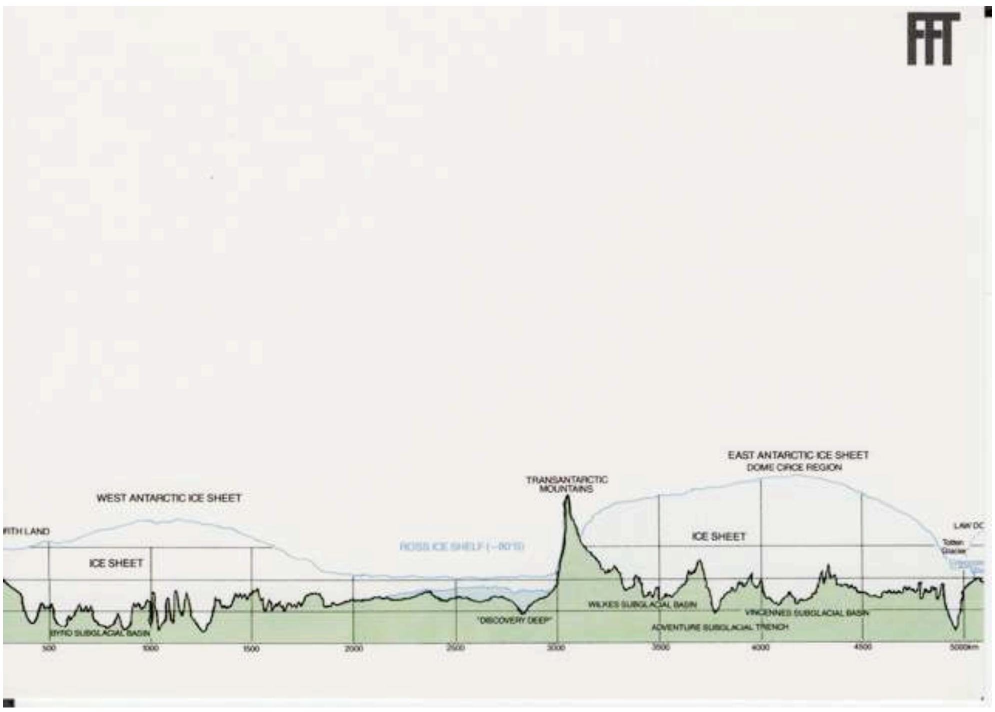
Michael Wolters is a conceptual composer. His background is in theatre and he is a founding member of the theatre group *New Guide to Opera* for which he has composed several works for recorder including the fifty-minute long eighth-tone piece for the radio play and subsequent opera *Kathryn und Peter durchqueren die Antarktis* (*Kathryn and Peter Cross Antarctica*, 2003/2004).

> New Guide to Opera conceives, produces and assembles art projects in which connections are made between scientific and everyday materials, experiences, knowledge and strategies for action as well as musical and tonal expression. The projects are not bound to particular artistic forms or genres and move between action, concert, opera, radio play, music- and performance-theatre. Normally, opera guides serve to familiarize audiences with musical action in opera. New Guide to Opera reverses this process and makes it its job to seek out musical rules, structures, and systems in places and contexts outside opera houses and use these for the conception and realization of their own artistic schemes[71] (New Guide to Opera).

[71] New Guide to Opera konzipiert, produziert und versammelt Kunst-projekte, in denen wissenschaftliche und alltagsbezogene Materialien, Erfahrungen und Kenntnisse zu musikalischen und klanglichen Ausdrucks- und Handlungsstrategien in Beziehung gesetzt. Die Projekte sind keiner künstlerischen Ausdrucksform oder einem Genre verpflichtet und wechseln zwischen Aktion, Konzert, Oper, Hörstück, Musik- und Performancetheater.
Für gewöhnlich dienen Opernführer dazu, Menschen mit musikalischen Handlungen in Opern vertraut zu machen. New Guide to Opera kehrt diesen Prozess um und macht es sich zur Aufgabe, nach musikalischen Regeln, Strukturen und Systemen an Orten und in Kontexten jenseits von Opernhäusern zu suchen und diese konsequent für die Konzeption und Realisierung eigener künstlerischer Handlungen zu nutzen. (…)
Entwickelt hat sich New Guide to Opera seit 1996 aus der Zusammenarbeit von Michael Wolters und Marcus Droß. Die zumeist auf orts- und kontextspezifischen Beobachtungen und Recherchen basierenden Projekte entstehen in enger Kollaboration mit einem internationalen Netzwerk von Gästen und Gastgebern aus den Bereichen Kunst, Medien und Wissenschaft. Projekte aus dem New Guide to Opera wurden mehrfach ausgezeichnet. Das Team setzt sich aktuell aus Marcus Droß, Christoph Rodatz, Anabel Sarabi und Michael Wolters zusammen.

‘In most of Wolters' works the structures and sonic material are site and context-specific to the nature and circumstances of each commission, often combining elements of music, theatre and performance art. He has a particularly close collaborative relationship with the German theatre producer Marcus Droß’ (Wolters). Other microtonal works for recorder by Wolters include *She Stays* (1997) for two alto recorders, *Suggestions for Improvement* (2000), *My own Step-Song* (2000-2012) for two recorders, harpsichord and voice, and *Seven Shakespeare Songs* (2012) for two recorders and voice. As a conceptualist, Wolters carefully follows the logic of his ‘conception’ to produce the structure and pitches of his scores. The concept, for example, for *Kathryn und Peter durchqueren die Antarktis* is a cross-section through Antarctica along the route taken by Robert Scott’s expedition to the south pole in 1911/1912. The pitches (eighth-tones) are determined by the relative contours of the bedrock and the overlying ice sheet.

Figure 6-7, showing the cross-section of Antarctica along the route taken by Scott’s expedition to the South Pole of 1911-1912.



Example 6-83 shows a page from the score for *Kathryn und Peter durchqueren die Antarktis* showing the cross-section at the distance from the beginning of Scott's journey of between 3,000km and 3,500km; the Transantarctic Mountains.

Example 6-83

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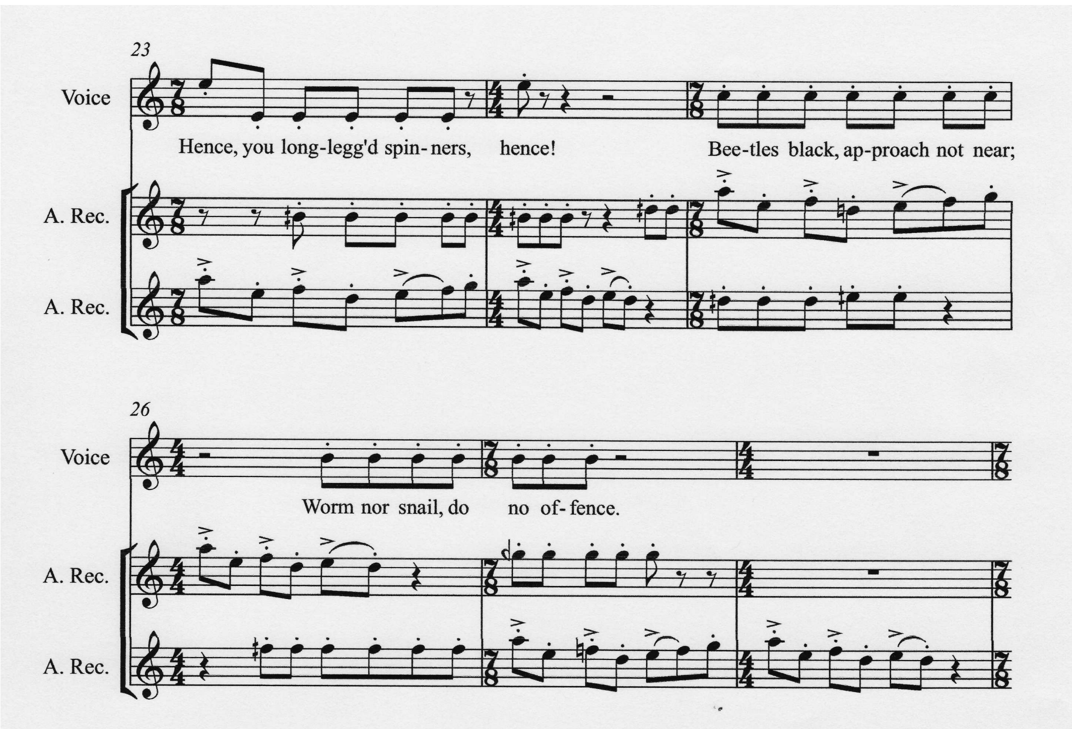
My Own Step-Song (CD track 15) is similarly composed on a conceptual basis – concerned with openings. It is based on a short story by Franz Kafka, *An Everyday Occurrence*: *The Enduring of it a Matter of Everyday Heroism.* It is a tale of two men whose efforts to meet to conclude a business deal are surreally thwarted. Scored for voice, harpsichord and two recorders, the piece begins with all four players failing to 'connect' with each other. The recorders, for example, begin playing with all holes covered, thus producing a series of apparently unrelated pitches. Gradually, holes are opened (fingerings given by the composer and taken from the fingering chart included in the *Quarter-tone Recorder Manual* (1998)) until the final notes of the piece, when all holes are open and a plaintive quarter-tonal melody emerges. The process employed produces diatonic pitches with random and varying degrees of changes in dynamic and tone colour as well as quarter-tone pitches across the instruments' range. The result is a piece as *Kafkaesque* and bizarrely theatrical as the story that inspired it. *My Own Step-Song* was composed at a time when Wolters produced no scores, only parts (see Example 6-84, over).

Example 6-84, showing a partial score - the recorder parts for the first bars of *My own step-song*. The voice and harpsichord parts are each printed separately.

Wolters' first composition involving third-tones was *Seven Shakespeare Songs* (2011), (CD tracks 7 – 13) for two recorders and voice. Of the seven short songs numbers 1 (*Midsummer Night's Dream*) and 3 (*Macbeth*) use quarter-tones but number 2 (*Measure for Measure*) uses third-tones. The composer noted in an interview that 'I have heard music in third-tones but when you are writing it, it is really hard to imagine, and I don't want to imagine it either. I like combining quite poppy, minimal music with third-tones' (Wolters, 2012).

The *Seven Shakespeare Songs* appear to have been Wolters' first attempt at employing third tones and indeed possibly a trial for the bigger work, *The Voyage*, that would follow. The microtones in *Seven Shakespeare Songs* serve a mainly colouristic function but they also support the libretto. Example 6-85 shows a short passage from *Midsummer Night's Dream* with the robustly defensive character of the libretto supported by a staccato-tongued passage of repeated notes with some simple but strident quarter-tonal dissonance:

Example 6-85



The use of third-tones in *Measure for Measure* is more varied (see Example 6-86). The cantabile character of this song includes elements of counterpoint and is provided with a more open textured accompaniment, which is less strident but nonetheless dissonant and mournful enough to add to the pathos of the piece.

Example 6-86

In *The Voyage*, the instruments (and voice) are used in a manner similar to that of a baroque concerto grosso in which the larger of two groups of players (the ‘ripieno’ or ‘concerto grosso’) compliments a smaller group of soloists (the ‘concertino’)” (Talbot). Stylistically, the piece is at times reminiscent of a baroque instrumental gigue. The ensemble for *The Voyage* falls into four groups: two solo groups consisting of the voice and accompanying (doubling) solo recorder and the solo (microtonal) recorders; the second group is the ensemble; the third, the double bass. We can hypothesize that each instrumental group and the vocalist supports a different player in the drama – the protagonist and his mother (vocalist and supporting solo recorder); independent commentators - the microtonal recorders, which at different times both support and comment on the dramatic action; the recorder ensemble, which by virtue of its rhetorical nature, may be seen to represent the public; and finally the string bass, which does not fully engage with the dramatic events until the race and final *Epilogue* (bars 253-288 and 290-314). The double bass performs the role in the ensemble ‘of something that doesn’t make sense’ (Wolters 2013) it thus simultaneously acknowledges and satirizes the role played by the bass in baroque music. The individual nature of each of the ensemble elements can be interpreted as a metaphor for the various interest groups involved in such events, which at no time act in a concerted manner until the race itself.

The solo microtonal recorder parts reinforce the varied nature of the ensemble. They consist at different times of passages that use third-tones, and passages in which diatonic playing is required, meaning that the piece is at times simultaneously in two different temperaments; 12-tone-equal-temperament (12-tet) and 18-tet. The microtonal recorders act rhetorically as a counterpoint to the dramatic events as they affect the protagonists. Microtonal passages at different times comment on and support the narrative: through sometimes engaging in a dialogue with either the 'ripieno' or the soprano; sometimes commenting on or reflecting the character of the text (struggle, unsettled, active, calm, etc.), often through the use of word-painting. Microtonal passages, for example, highlight anxiety on the part of the protagonists and increase the dramatic impact.

The recorder ensemble provides harmonic support and textural variety: variable but generally dense in section 1; very light in section 2 but enriched by the short third-tone interjections; light at the beginning of section 3 but enriched as the section progresses by the increasingly active and harmonically independent double bass, and the continuing microtonal interjections.

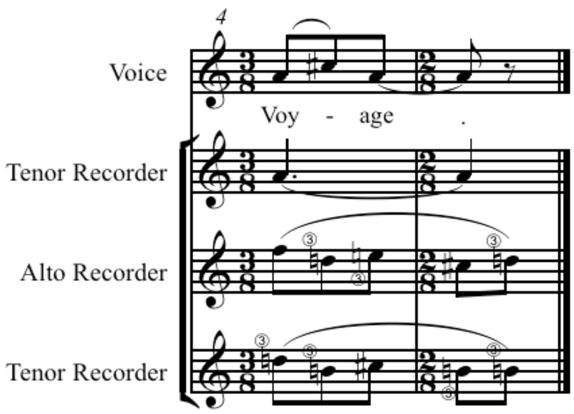
Wolters composed *The Voyage* in four sections: *Introduction*; *The Journey*; *The Get Set* and *Race*; *Epilogue* (Wolters 2013b). Study of the libretto, however, suggests that a different approach may be taken and that the piece can be understood to be in eight sections based on the dramatic and musical content of each. My description is based, therefore, on the format described by the libretto: section 1, Introduction, bars 1-67; Section 2: Prior to the Journey (Recitative - Anxious mother), bars 68-82; Section 3: The Journey – dialogue (Part 1), bars 83-113; Section 4: The Journey - dialogue (part 2), bars 114-171; Section 5: (Commentary), bars 172-251; Section 6: The Get Set (bar 252); Section 7: The Race; bars 252-289; Section 8: Epilogue. The libretto is given for each section, where one exists, followed by a description of the musical content with notes and examples of significant features where appropriate.

Section 1: Introduction; bars 1-67

Libretto: *The Voyage. He will be a hero. After the Voyage. Now he is nothing, Then he will be someone. After the voyage. The Voyage.*

The piece begins with a rhythmic opening in A major. The texture is dense. The microtonal recorders enter at bar 4, where at the word "Voyage" the voice is accompanied by a discordant motif in third-tones (Example 6-87).

Example 6-87.



At bar 13 the solo recorders play slow rising scale passages in third-tones and engage in a 'dialogue' with the voice. The dyad F-C♯-F in the double bass (bars 19-20) establishes the material for the passage, which evolves in the recorder ensemble in a minimalist-style progression through the dyads C♯-F; C♯-G; D-G; D-G♯ and A-D before arriving on a B♭-major chord at bar 56. The double bass persists with evolving three-times-repeated fragments of F-minor scale (bars 21-48) followed by a further repetition in C (bars 49-55). A ten-bar repeat of the introductory passage in B♭ (bar 56) leads to a link in the form of a descending third-tone scale in the double bass, to the second section.

Example 6-88, The opening bars of *The Voyage* showing the entry of the microtonal recorders at bar 4:

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Example 6-89, showing the dense texture and the entry of third-tones, bars 26-31:

Section 2: Prior to the Journey (Anxious mother); bars 68-82

Libretto: *Have you packed your lance? Have you packed your jeans? Do you have your pants? How about your hammer? Have you got your spikes? Show me your raincoat. Where in there's your toothbrush? Have you packed your shield? Do you have your helmet? Have you got your passport? Have you had your jabs? How about your…*

This section is characterized by a light texture and the simple accompaniment of the recorder ensemble. There is a repeated three-bar harmonic progression (F-C^{maj7}-Amin) in the manner of a ground bass throughout the section. The humourous anachronisms of the text are reflected in the simultaneous tremolo and syncopated falling third-tone scale passages of the solo recorders, possibly reflecting the athlete's humiliation at being hounded by an anxious mother (e.g. bars 76-77, below). These are in dialogue with the soprano (Example 6-90).

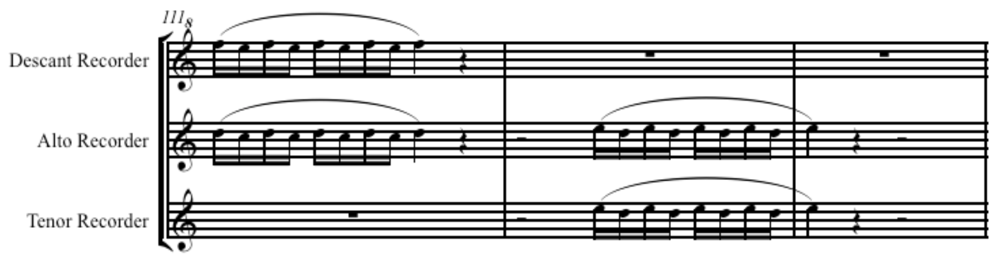
Example 6-90

Section 3: The Journey – dialogue (Part 1); bars 83-113

Libretto: *So young, So ready. I don't want you to go. I must go, you know It's all I've ever wanted. All you've ever worked for. All I've ever worked for. All you've ever wanted. It's the one thing I'm good for. It's all you've ever dreamed of. Today I'm just nobody Tomorrow you'll be golden.*

The positive nature of the libretto is reflected in the lightly textured accompaniment: the voice is accompanied and supported by the solo recorders through some polychordal passages (e.g. b 87) whilst some more rhetorical passages hint at the dialogue between mother and the athlete. The Double bass plays a fourteen-bar long 'ground bass', which is repeated twelve times. At the start it supports the voice and solo recorders (C major) in a short polychordal passage with the recorder ensemble (f/d/b♭) (bars 87-88). No use is made of microtones in this section. The introduction of the 'flattering' motif (see Section 4, below) in the solo recorder parts can be seen in bar 111 (Example 6-91):

Example 6-91

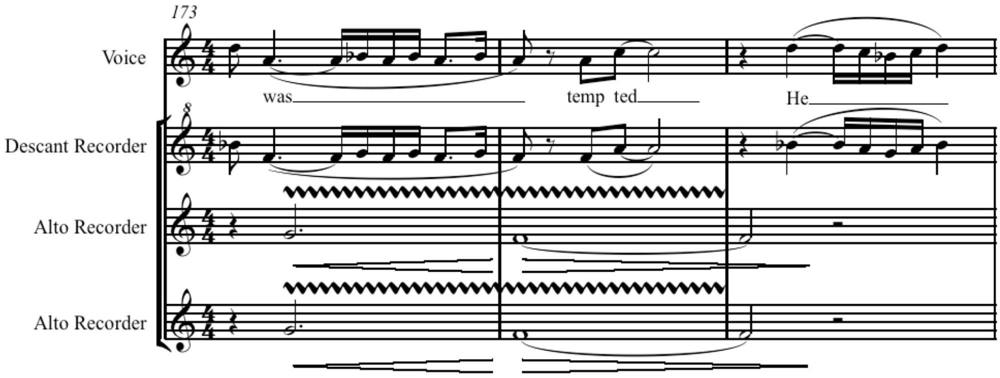


Section 4: The Journey – dialogue (part 2); bars 114-171

Libretto: *I love you. I know. I'll miss you. You won't. I will. It's not long. It's far. I'm ready. Be safe. I'll try. Be fast. I will. You will be strong. You will be brave. You will be pure. You will be true. You will be fast, fast, fast, fast. Sail far, sail fair, sail straight. Good luck, come back, I love you.*

This section includes more extensive use of the 'flattery' motif. The introduction of wide vibrato in solo recorder parts highlights the emotional elements of the story. Microtones are reintroduced to accompany the libretto on 'strong', 'brave', 'pure', 'true' and 'fast' (bars 132-141). A brief instrumental interlude, (bars 173-175) includes overblowing and swelling of long vibrated notes for microtonal effect and word-painting on "tempted" (Example 6-92).

Example 6-92



Section 5: Commentary; bars 172-251

Libretto: *He was tempted. He was tainted. He was vaunted. He was feted. And he ran. He was washed up. He was wound up. He was held up. He was messed up. And he ran. He came from over the seas. He was picked up and adopted. He was a cared-for child. He had a child. And he ran.*
He was spotted. He was coached. He was hugged. He was picked. And he ran.
And he laughed, And he stretched, And he lifted, And he fasted, And he chased, And he wretched, And he pressed, And he squatted, And he did all the things they ever asked him to. Until in the end they called him theirs.
He was a monk. He was a warrior. He was a man. And he ran, and he ran, and he ran, Until.

Example 6-93, over, bars 173-175, showing a polychordal passage highlighted by the use of wide vibrato in the solo recorders. This passage also makes use of overblowing to produce smaller micro-intervals, thus adding movement and tension to the passage as it moves through bar 173. The double bass maintains its harmonic independence with its passage in C major against the g minor/d minor of the ensemble and the g minor/F major of the voice and its accompanying recorder.

Example 6-93.

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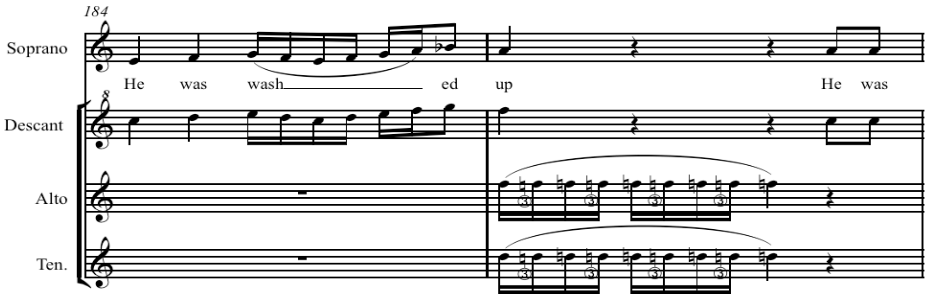
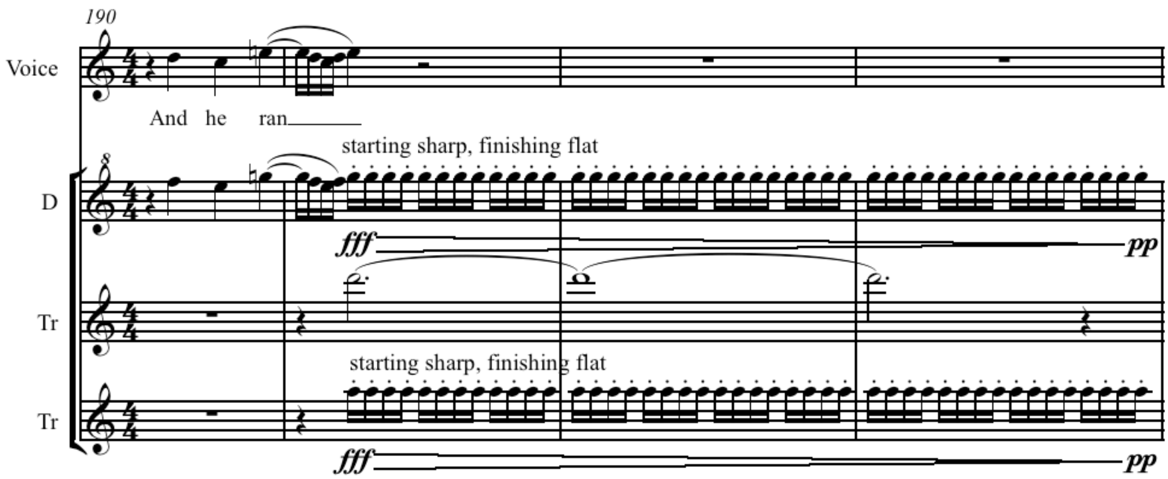
Some use is made of wide vibrato on 'tempted' and third-tones leading into 'feted'. The 'flattery' motif is also used to support the movement of 'ran'. There is humorous use of third-tones on 'washed up' in bars 184-185 (Example 6-94).

Example 6-94



The composer makes use of wide vibrato and fast repeated notes, with a diminuendo, on 'ran'. The semiquaver passages begin by being overblown to produce a sharp a^2 followed by a diminuendo to finish the passage quiet and flat, bars 191-193 (see Example 6-95).

Example 6-95



There is intermittent use of third-tones to accompany and in dialogue with significant words: ‘seas’; ‘adopted’; ‘child’ and ‘ran’. Finally, unison third-tones, a-third-sharp[2], accompany the voice at the end, before *The Get Set* at bar 252.

Section 6: *The Get Set* (bar 252); Section 7: *The Race*; (bars 252-289).

Section 8: *Epilogue*; bars 290-314

Libretto: *So it is, so it is. People. Now hail your champion. All hail your great bright hero. He fought the lion And he slew the dragon. He sailed through storms, Defeated the waves. All hail our champion. Once he was a dwarf, Now he’s a giant. Soon free to air. Now you can kiss me. Come to my cloud.*

Microtonality in *The Voyage* is restricted mainly to the two ‘microtonal’ treble recorders although the double bass has a short scale passage in third tones at bars 65-67, which facilitates the transition from Section one to Section 2. As discussed above, microtonality – third-tones – in *The Voyage* both supports the drama and acts as a rhetorical counterfoil to the protagonists. The dramatic effect is achieved by word painting and by virtue of the degrees of dissonance created by the juxtaposition of 18-tone equal temperament against 12-tone equal temperament. Brief polychordal passages are generally neutral in this respect due to the composer’s arrangement of the parts – large intervals diminish the effect of the dissonant intervals, ensuring the introduction of colour to the performance rather than strident dissonance. Passages include dissonances that occur on dramatically significant words, thus highlighting their impact, include ‘tempted’ and ‘ran’: see for example, Example 6-92 and 6-93, above (‘tempted’ – wide vibrato) and Example 6-95 (‘ran’ – semiquaver passage). The wide vibrato, for example, can be interpreted as reflecting the ‘wavering’ of the protagonist, as he is ‘tempted’ (bar 174).

The microtonal recorders are set against the tonality of the ensemble and are therefore free to enjoy the rebellious character of such passages. Such dissonance as in bars 4 and 5 of the opening, and the passage towards the central 'Journey' section (bars 226-251) of long held third-tones, are typical. One feels in this passage the tension of the protagonist rebelling against those who pay for and supervise his training and, ultimately, who want to own him. The third-tones therefore have a significant impact on the dramatic effect of the piece – they express the excitement, trepidation, and fear of the young athlete. This brings into focus the issue of tone colour, since a number of the fingerings, due to the essential nature of the instrument, produce muted sounds. The parts can, therefore, be played such that their effect is as strong as possible – allowing the tone quality of the microtonal pitches to contrast with the more open sound of the other recorders in the ensemble, and using clear strong tonguing and an appropriate amount of vibrato to enliven and indeed heighten the tonal differences where necessary.

Musically, *The Voyage* reflects, as Wolters noted in an interview in 2012, his liking for composing 'quite poppy, minimal music with third-tones' (see page 286). The generally light-hearted nature of the music is at odds with both the story line, which includes two metaphorical 'deaths', and the inclusion of discordant third-tones. Furthermore there is sufficient evidence of satirical comment regarding notions of nationality, the role of both the press and a morbidly curious public, to warrant serious reflection on these and other facets of sporting heroism. The inclusion of two recorders playing in third-tones is a comment on an underlying and perhaps slightly sinister aspect of major sporting events such as the Olympic Games, which can raise serious social and philosophical questions.

***Dialogue for one Recorder Player* (2013)**

Peter Bowman (b. 1952)

My own composition has presented an opportunity for me, as a performer of microtonal music, to demonstrate ways in which the instrument's range of expression can be extended, primarily, though not exclusively, through the varied use of microtonal intervals. The first movement employs two strata of sound – one diatonic and rhythmic, the other microtonal and melodic – in a dialogue of intense and varied rhythmic activity. The third movement places subtle microtonal shifts in a tonal environment and uses repetitive rhythmic patterns in 5/4 to create a melodically and rhythmically varied sound world. Only the second movement of this piece is entirely dependent for its expressive content on small intervals – eighth tones.

Dialogue for one Recorder Player (CD tracks 4 – 6) is a work that takes an approach to the recorder's expressive capability that I believe only one other work in this study touches on: Michael Wolters' *The Voyage* (see page 280). It explores the contrasts between motivic material that consist of diatonic and chromatic intervals, and material that makes extensive use of microtonal intervals. Furthermore, the different modes of material (microtonal/diatonic) are in some passages mixed, not only to effect contrast but also through this contrast to highlight microtonality and its interaction with chromatic and diatonic intervals as an expressive device. The piece is thus composed in a contemporary musical idiom that does not deviate too far from what I consider a challenging but acceptable sound-world for professional players and students aiming to work professionally with the recorder. It corresponds to what I perceive to be an appropriate, even necessary, extension of the recorder's expressive capabilities.

My approach to writing *Dialogue for one Recorder Player* is, therefore, informed by three considerations - two technical and one compositional: first, that microtonal and diatonic intervals are consistently and freely mixed throughout; the motivic and therefore structural material is a mixture of the two, second, that tone colour can be controlled; its variation in performance is not dependent on the idiosyncrasies of the instrument but on the skill of the performer, and finally, that microtonal music need not be unduly complex.

These considerations inform the form and style of motives used as well as the level of the work's technical difficulty. It could also play an important role in developing a rationale for microtonal writing for the recorder in the future.

The influences on the composition of *Dialogue for one Recorder Player* are the direct result of my performance and teaching work with the instrument over the past thirty-five years. *Dialogue for one Recorder Player* contains a strong didactic element and has the (possibly somewhat optimistic) goal of demystifying microtonal playing on the instrument - highlighting its strengths as a percussive instrument without losing sight of what Zahnhausen refers to as its 'absolutely unalterable lyrical quality' (see page 167). A significant rhetorical element is present in the work that draws its inspiration from the baroque aesthetic of *Klangrede*[72] and is manifest at two levels: at a basic level in the contrasting diatonic and microtonal passages of the first movement. A dialogue takes place between the insistent, forceful rhythmic motives, initially in the high register, and the middle to low register microtonal flourishes. At a higher level, *Dialogue for one Recorder Player* can be appreciated as a dialogue between the recorder's following two technical and musical strengths: it highlights the recorder's ability to play forcefully and

[72] The aesthetic of *Klangrede* – literally 'sound speech', is a musical rhetorical device that dominated the seventeenth and eighteenth centuries.

rhythmically, on one hand by using leaping motives – the recorder is capable of quick and easy movement between registers, and on the other hand by making extensive use, particularly in the first movement, of repeated-note motives. Secondly, it acknowledges the instrument's ability to play in broad melodic lines, including using micro-intervals. In the second movement this is manifested through the use of quarter- and eighth-tones.

Example 6-96, showing the opening bars of *Dialogue* and the contrasting rhythmic (diatonic) and melodic (microtonal) material:

The use of the different motives in the piece is, on the other hand, also designed to challenge preconceptions and to show the recorder in its different guises: firstly, as a percussive instrument through the use of strong articulation and repeated-note motives, and secondly to confirm the recorder's role as purveyor of broad melodic passages in a microtonal idiom.

Conceived in three movements, the motivic material for the outer movements consists of two pitch collections, the first of which is the basis of the first part of each movement:

Example 6-97, Pitch Collection A

The second pitch collection for the first movement is an inverted and microtonally altered version of the first (see Examples 6-98 and 6-99):

Example 6-98, Pitch Collection B:

This material is itself inverted, revolving around F♮, to produce a third collection of pitches:

Example 6-99, Pitch Collection C:

The first movement begins with the two sets of motivic material separated by register; the first, pitch collection A, provides the material for the insistent rhythmic motive and initially occupies the highest register. This material is set against a microtonal second collection, B, that serves as an ornamental counterfoil and initially inhabits the low and middle registers. As the movement progresses these two sets of motivic material merge and then reverse the registers that they inhabit – the high register is, at the end, taken over by the microtonal flourishes whilst the diatonic first set settles in the mid to low registers. A striking change in tone colour occurs at bar 22, see Example 6-100, with the introduction of f-quarter-flat[2], the point where the motivic materials begin to change roles.

Example 6-100

A middle section, *Agitated*, consisting of a twelve-bar rhythmically broken passage (bars 39-50), was composed using the microtonal collection B, shown above (Example 6-98) and collection C (Example 6-99). The musical-rhetorical purpose of this rhythmically disjointed passage is to balance and contrast the robust rhythmic outer sections of this movement. The third section of this movement, bars 51-86, uses much of the material from the opening section but is more compact and intense, with greater use made of shorter note values resulting in quicker rhythmic movement.

Example 6-101 Showing tessitura inversion of the motivic material

The second movement employs all the pitches of pitch collections A and B (Examples 6-97 and 6-98, above). The complete collection, pitch collection D, is shown in Example 6-102, below:

Example 6-102: Pitch Collection D

The latter part of the movement, from bar 26, uses a transposed version – up a perfect fourth, which becomes pitch collection E:

Example 6-103: Pitch Collection E.

The aim of this movement is to contrast the two rhythmically robust outer movements with a closely woven melodic line. The movement is in three sections: section 1, bars 1 – 12; section 2 is metrically free and extended (bar 13); the third section uses transposed material from the first 12 bars (pitch collection E, see Example 6-103, above). The first twelve bars consist of an outline melody (see Example 6-102), which is decorated with ornamental microtonal diminutions. The close intervals and frequent falling motives of the diminutions, using mainly quartertone intervals, give the piece a mournful character, which is balanced by the rising shape of the melodic outline of bars 1 - 12:

Example 6-104, showing the outline melody of bars 1-12 before resolving on the f^2 at the beginning of the extended bar 13:

The central, unmeasured, section is an exploration of dynamics and micro-intervals – quarter- and eighth-tones, between e^2 and f♯^{2}, see Pitch Collection F, Example 6-107, below. The diatonic pitches d^2 – g^2 each have standard fingerings that employ only fingers of the left hand, resulting in what I consider one of the more 'colourless' regions of the instrument's registers. A tone-colour ratio of 1.28 for the central tone, f^2 (standard fingering = 02 - see Chapter 5, and Appendix 5, page 339), indicates the strong influence on the tone's structure of the fundamental partial. The redeeming feature, indeed strength, of this central register, however, is the wealth of different fingerings available for each tone, which in turn provide an opportunity to explore tonal contrast both for the main note, f^2 and which, by virtue of the various fingerings, can also be used to produce microtonal intervals.

The motivic material for this central section is derived from the microtonal compression of Beethoven's *Ode to Joy*, transposed for my purposes into D♭ major (Example 6-105) to accommodate the pitch range the study needs to cover whilst maintaining f♮^{2} as the central pitch:

Example 6-105

My motive for using such a well-known melody was two-fold: firstly, I enjoyed the irony of juxtaposing the extreme mournfulness of the eighth-tone melody with the famously joyous ode – it was a temptation that I found too difficult to resist. Second, the strong tonality of the *Ode to Joy* should offer some sense of a tonal centre, even in this extreme microtonal setting. The melody is composed from the first five notes of the D♭major scale, shown in Example 6-106, below:

Example 6-106.

The second pitch collection is in quarter- and eighth-tones, based on the compression of the familiar major scale pattern of tones and semi-tones down to quarter- and eighth-tones respectively, centered around f^2, the five-note scale fragment becomes pitch collection F:

Example 6-107: Pitch Collection F.

Example 6-108, below, shows the source melody compressed into quarter- and eighth-tones. This is in itself a useful exercise for exploring the microtonal range around f^2:

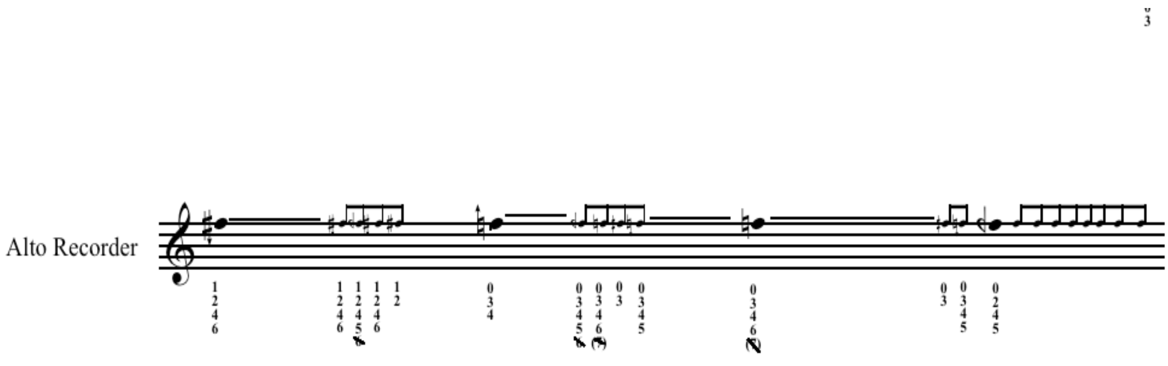
Example 6-108.

Ode To Joy (Compressed)

The structure and rise and fall of the melody are clearly audible when played in this microtonal environment but in order to disguise the origins of the material the rhythm is removed and the melody freely ornamented. The intervallic structure of the study retains the tonality of a major scale, despite being on a highly compressed level, thus facilitating maintenance of the listener's bearings in an otherwise unfamiliar aural environment.
The central section is itself in two parts: the first deals with the ornamentation of the melody using mainly eighth-tones whereas the final part explores some of the dynamic and tonal possibilities.

Compensating for the flat or sharp fingerings by blowing more or less to produce dynamic variety is not the goal here, however. The fingerings for the pitches given in Example 6-108, above, should produce accurate pitches if played with consistently even breath pressure, depending on the instrument being used. As I have shown in Chapter 5, tone colour is affected primarily by the fingerings used – with either or both fingers 3 and 4 absent, the more fingers of the right hand that are employed, the more veiled the tone. My aim with this study is to use the interplay of close microtonal pitches to provide the 'colour' and for this reason dynamic range is kept to a minimum. Melodic lines are allowed to follow their natural flow, rise, and fall, without undue use of changes in dynamic. Any colour produced during performance of the piece arises from the interplay of microtonal intervals, not timbrally diverse or wayward fingerings. This indicates that timbral consistency is not only possible but also desirable in the performance of microtonal music. Indeed, the fingerings given in the score are based on core left-hand fingerings (02, 03, 12) to which right-hand fingers provide the deviations from core pitches, which thus give the microtonal intervals, and, where appropriate, the dynamic variety. From this starting point, the player can control tone colour, he does not become a slave to the tonal idiosyncrasies of his instrument but can control them. Thus tone colour becomes an expressive tool, see Example 6-109.

Example 6-109 showing part of the un-barred middle section of movement 2

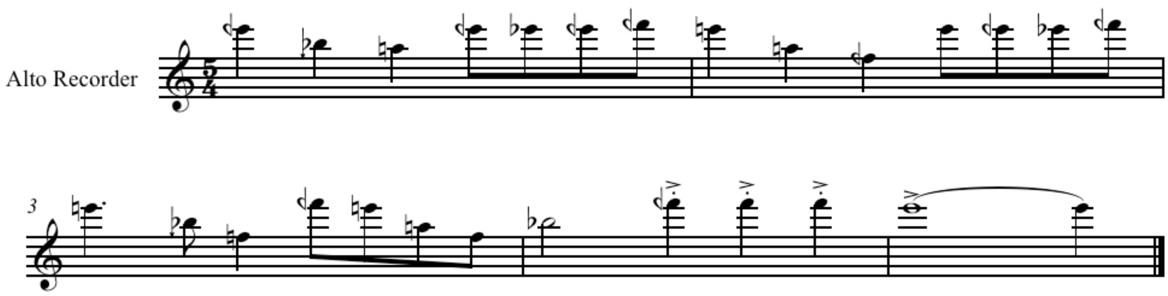


The final section of the central part of movement 2, the last two lines, deals with dynamic change. In each case the lines begin with a core fingering, 1 2 and 0 2 respectively, to which right-hand fingers are added to lower the pitch and, with the aid of decreasing breath pressure, soften the tone colour, see Example 6-110.

Example 6-110, showing the use of different fingering to achieve an extreme *piano* dynamic:

This two-sided approach to dynamic highlights the findings of the research undertaken in Chapter 5 that tone colour and dynamic are directly linked. The core left-hand fingerings used for both parts of the study and the use of right-hand fingers to introduce subtle changes in pitch and tone colour highlight the instrument's dynamic and tonal flexibility. Bars 15 – 23 lay out the complete motivic material (see Example 6-98, Pitch Collection B, page 303), much of which is taken from the opening four bars of the movement, albeit transposed up a perfect fourth for the final nine-bar passage see Example 6-111.

Example 6-111, showing the final 5 bars of the second movement. The repeated note motive of the penultimate bar is reminiscent of the first movement.



The third movement employs pitch collection A (Example 6-97, above), and a version of the initial material in its ‘normal’ form transposed up a perfect fourth (pitch collection G):

Example 6-112. Pitch collection G

The movement is in the form of a set of short rhythmic and tonal variations. Each set consists of four rhythmic variations - the material is microtonally altered one set at a time as the movement progresses, see Examples 6-113a and 6-113b.

Example 6-113a, showing the first two bars of the 3rd movement:

Example 6-113b showing the first microtonal and chromatic shifts from bar 17:

Bars 1 – 16 employ the unaltered diatonic material but thereafter, in bars 17 – 48, two notes are altered in each variation, one chromatically, one microtonally, until at bar 33 the motivic material has become that shown in Example 6-114, below:

Example 6-114, Pitch Collection A, altered

The closely interwoven micro-intervals exaggerate the chromaticism of the passage; the mournful character here is in stark contrast to the repeated-note motive heard in the first movement and to the bold rhythmic leaps at the beginning of the third movement, which begins diatonically. A process of waxing and waning microtonality continues through extensive use of quarter-tones in the central section of the movement (bars 49 – 80) until the diatonic passage triumphs in the final bars 113 – 128.

The steady chromatic descent of the first notes of each variation, from c^2 through to e-flat^2 exemplifies the ‘colouring’ of each of the passages, though because of the large intervals involved, major and minor 9ths, these may not be as readily perceived by the unschooled listener as the more colourful and striking quarter- and three quarter-tone intervals that occur later in each of the variations. The continued use of unaltered diatonic intervals also maintains an environment within which the microtonal intervals can be more readily perceived as colourful ornamentation.

A central section from bars 49 – 80 continues the chromatic ‘compression’ of the material but at a quicker rate than in the first 48 bars, until at bar 81 the original rhythmic theme returns using pitch collection G, (see Example 6-112, above). This material is also subjected to microtonal compression, honing in on f^2 until the final variation (bars 113-128) at which point the pitch collection has become pitch collection H (see Example 6-115:

Example 6-115: Pitch Collection H

At this stage the note that plays the central role in the entire piece finally becomes apparent and indeed is prominent through the last sixteen bars.

The recorder's limited capacity for dynamic variety is compensated for by the use in this piece of gesture, of varying articulation, note-length, and tessitura. The use of these technical devices to provide variety of expression is common in baroque music and is employed again here. The varying rhythmic motives add interest to the movement as shifts in stress, indicated primarily by varying note lengths, rhythmic movement and articulatory energy. This is a piece that draws heavily on stylistic elements of baroque music – dialogue, rhythm, and melody, but not conventional form or tonality, and uses them in a way that offers familiarity in an unfamiliar microtonal and expressive environment.

Conclusion to Chapter 6

A brief summary of the microtonal content and application in the eight pieces is appropriate at this time.

Winds of Heaven is a piece in two parts, both of which explore texture, but in different ways: the first part asks for a 12-second tape delay which repeats six-times. The build-up of layers of glissandos results in a varied but richly textured sound world. The challenging second part is more drone-like - a monotonal vocal drone, rhythmically punctuated by short accented multiphonics, accompanies the microtonal recorder part. Throughout the piece, precise pitched microtones play a subsidiary role to the textural effects produced. The central section of Bousted's *Whale Song* (bars 50-68, played on Ganassi-style renaissance alto recorders), on the other hand, is entirely dependent on the finely interwoven and rhythmically mesmeric eighth-tone melodies for its textural effect. This is in contrast to the outer passages, which variously employ multiphonics and vocalization to produce bold, dense textures. Zahnhausen's *Lux Aeterna* is concerned primarily with tone colour and uses different methods of tone production to produce these. The central microtonal section plays a significant role as an expressive and tonal link between the ethereal sound world of the opening and the calm final section (Zahnhausen 1999, 9). LeFanu's *Dawn's Dove* uses quarter-tones in an ornamental, chromatic and conventional way whereas the microtonal inflections used by Lumsdaine in *Metamorphosis at Mullet Creek* recall bird song as well as suggest movement and distance. Bousted is technically uncompromising in his approach to both instrument and material in his *Microtonal Study No. 2*. It was written for the Harmonic Tenor recorder, which with a range of over three octaves, will cover the pitch range demanded by Bousted, though it remains unclear whether that includes the full quarter-tonal range. The effects produced by the two recorders playing in third-tones in Michael Wolters' mini opera *The Voyage* produces some interesting textures, varying from open and full to quite taught sounds, but never quite as strident as one might have expected from, for example, quarter- or eighth-tones. My own piece, *Dialogue for One Recorder Player*, explores the tonal variety of the instrument through the use of extremes of range (first movement), tessitura, dynamic, and eighth-tones (second movement), and quarter-tones set against a tonal background (third movement). Taken across all eight pieces, the variety of musical applications of microtonality is, even in this small selection of pieces, quite extensive and clearly indicates the expressive potential for the aspects of the recorder's technical capability relating to texture and tonal variety, which my work indicates to be the creative impulse that supports the use of microtones in the majority of pieces studied.

Chapter 7

Conclusion

I undertook an investigation in this thesis into microtonality on the recorder and the extent of its use in the repertoire. My contributions to this little-explored musical genre are my research, my performances and my composition.

My research brought together diverse pieces and writings on aspects of the recorder's technique and tone production in a way that documented and contextualised the growth of the recorder's microtonal repertoire during the period 1961-2013. It located the recorder's microtonal technical and musical roots in the 16th century, thus drawing very clear technical, though not aesthetic, links between the recorder's traditional repertoire and developments in microtonal techniques during the second half of the twentieth century. These culminated in a group of works that exhibit a high degree of sophistication in their use of the recorder and the variety of their utilizations of microtonality. I identified variation of tone colour as an intrinsic and welcome companion to microtonal fingerings. My research into this aspect of sound resulted in contributions to the way we understand and measure the perception of both loudness and tone colour. Furthermore, my research indicates that, on the recorder, these two elements of sound are linked.

As a performance-based research project my attention initially focussed on two elements of musical activity: performance and analysis, in order to determine how the recorder player might approach this repertoire to develop an interpretation. Analysis is the first step and to this end I took a two-pronged approach: first, was a hermeneutic analysis, which includes a study of the aesthetic elements of the piece - historical, cultural, and reflection on my own aesthetic disposition in preparing pieces for performance. Secondly, the formal analysis throws a clear light on elements of the compositional method that allowed me to reach an understanding of each piece's structure.

The evolution of microtonal repertoire can be observed in a survey of writings and pieces that were significant in the development of a microtonal idiom for the recorder. This was presented in Chapter 4. It indicated a gradual shift over time from a primarily inflective use of microtones in a tonal environment during the late 1960s through to the use during the mid-1990s of an expanded version of twelve-tone equal temperament that employed smaller micro-intervals of equal functionality. The impulse towards greater use of microtones was, in the early stages, player-led, as those who understood the recorder best encouraged adventurous composers to engage with the instrument. Towards the end of the 20th century greater awareness of the instrument's potential saw an increased willingness amongst recorder-experienced composers to explore and expand its microtonal capabilities yet further. Most of the significant developments in recorder repertoire and technique took place in mainland Europe. Influential were Frans Brüggen, Walter van Hauwe, Hans-Martin Linde and, in the 1990s Gerhard Braun who increasingly introduced texture into the repertoire as a structural and expressive device. Braun's works plus Fischer's *Die Dynamische Blockflöte* were indicative of a trend towards greater awareness of the recorder's potential for subtle tonal as well as dynamic variety as expressive devices. Significant pieces in this trend include Spahlinger's *Nah, getrennt* and Bousted's *Whale Song*. My own piece, *Dialogue for One Recorder Player*, attempts to continue to raise awareness of all aspects of the recorder's expressive potential – microtonally, rhythmically and melodically.

In Chapter 3 an investigation into tone colour on the recorder began with a discussion of the aesthetic impulses and techniques in use during the 16th – 18th centuries. Two aspects of performance practice were at play during that period: the aesthetic desire for expression by imitating the human voice with all its potential for subtle variation of tone, and the need to adapt to the tuning system in operation at any given time and in any context. The equal tempered tuning system was not in use so recorder players developed techniques for adjusting their intonation by selecting different fingerings or by leaking or shading open finger holes. This research was undertaken in order to gain some understanding of the implications of this for the performance of both old and new music in the 20th century. Investigations into recent writings on tone colour, and in particular the harmonic structure of sound and how this could be varied in performance revealed some insights first into the structure of the sound, with some consistency among the findings of several writers, and second, into how this information can be applied in performance. Diverging opinions indicated the danger of relying on subjective findings instead of presenting scientifically quantifiable data. A number of writers touched on the relationship between dynamic and tone colour. Despite some convergence of opinion on this matter, no single writer categorically either confirmed or denied a close relationship between the two. The controversial debate over the influence of oral cavity size on tone colour continues but on this issue opinions remain polarised. My research indicated that this little-understood area of technique would benefit from further rigorous investigation.

The investigation in Chapter 5 into the physical and acoustic aspects of the recorder continued the work of writers discussed earlier in Chapter 3, including Fischer, Laurin, Höffer von Winterfeld, Mühle, Rijn, Acht, and Bolton, though in a more extensive and detailed way. My research into the background of the development of microtonality on the recorder highlighted an element of technique that had previously been discussed but only sporadically – that of tone colour. The correlation between varying fingerings for microtonal pitches, dynamic, and tone colour, led me to undertake an in-depth study of the recorder's acoustic properties, particularly with regard to tone colour. The result of this research is a contribution of some significance to the understanding of the acoustic properties of the recorder's sound. A major element was the development of a, for the recorder, unique numerical classification of the perceived loudness and, importantly, the tone colour of the nineteen different fingerings tested. It established a method for investigating both tone colour and dynamic on the instrument that may be further developed in the future. The results of my investigation were presented in the form of a full spectral analysis of nineteen different pitches from across the instrument's four registers. I included measurements of the perceived loudness in sones and a numerical value for the tone colour of each pitch based on a method that I developed specifically for the instrument. For six of the pitches, which are produced using two sets of related fingerings, the sound waves were also reproduced in the text, in order to give a clear visual indication of the tonal differences between the pitches. The subtle aural differences resulting from the use of different fingerings are thus rendered clear. The use of these was intended to aid the understanding of the acoustic processes involved in tone production and fingering selection, and thus serves an educational purpose. My research contributes to gaining a clearer understanding of the implications for the sound structure and consequently, tone quality, of altered fingerings. It represents a significant contribution to our understanding of the influence of various fingerings on both dynamic and tone colour and supersedes earlier studies of the recorder's sound from both a practical and acoustic perspective. It clarifies and redefines our understanding of tone colour on the instrument.

Microtonal music raises a matter of significance - the question of accuracy of intonation. The subject was discussed in Chapter 2 where my research indicated that this interpretative element of primary importance relates to the creative use of tuning or, as Kanno calls it, 'expressive tuning' (Kanno 2003, 35-52). In the musical world of micro-intervals, where small deviations of pitch could alter the microtonal environment, precision can take on different meanings, musical or technical, depending on context. After some discussion I concluded that different musical styles permit different attitudes to intonational accuracy. Atonal music, often lacking both a strong tonal centre and traditional harmonic movement, presents more philosophical difficulties for the performer. Without the guiding principles of melodic and harmonic hierarchies, all pitches function as equals in a manner that deprives the performer of his *raison d'etre* for phrase- and note-shaping, and thus of contributing to performance in a creative way.

Whereas microtonal music that is intended to be played on traditional acoustic instruments is based on the regular division of the twelve-tone equal tempered tuning system, the works discussed in this thesis of composers such as LeFanu, Lumsdaine and to a certain extent Fox have been influenced by various indigenous musics, which do not employ the western tuning system. Although this may not have influenced the modes of microtonality used in their pieces, the aesthetic influences can be clearly observed. The pieces in which textural variety plays a significant role allow more latitude of intonation, it being the density, roughness, lightness or other aspects of the tonal quality that determines the character of the music. The second part of Fox's *Winds of Heaven* is a good example of a situation in which intonation is secondary to the textural 'roughness' of the piece, in this case imitating the sound of a didjeridoo. 'Rough' and 'smooth' are adjectives normally associated with dissonance and consonance respectively in tonal music but in the context of late twentieth century textural passages the intonational precision becomes subservient to the effects of the textural density. Returning to the question of the use of expressive tuning in atonal music, one can turn to Kanno's plea for an approach to intonation that 'exploits the tension between pitch and intonation' to achieve a musically expressive performance. The composer is likely to have taken elements of tension into account during the compositional process and thus the remaining tension exists primarily between the composer's ideal and the performer's interpretation and realisation. The performer must strike the difficult balance between adherence to the composer's instructions (as understood by the performer) and his desire to create an expressive living performance. It is this aspect of analysis, the hermeneutic, that offers the performer the opportunity to place his personal stamp on the performance. This was particularly true for the two works by Bousted, whose divergent approaches to both the recorder and the application of microtonality reinforce my view that pieces must be assessed on an individual basis, regardless of composer or compositional style.

An analysis and discussion, the first of its kind, of the selected microtonal pieces followed in Chapter 6. It highlighted the diversity of musical styles, microtonal usages, and their evolution in Europe between 1961 and 2013. The manner in which microtones were incorporated into the recorder's repertoire was explored through detailed studies of the pieces, each of which employed microtones to a different extent and with a different aesthetic intention. The studies included both formal and hermeneutic analyses of each of the pieces. These indicated the variety of compositional styles, aesthetic impulses, and extent to which microtones had been incorporated into the selected pieces. For all of the composers it was the first time their work for recorder had been subjected to independent detailed analysis. This represents a significant contribution to the understanding of contemporary recorder repertoire and of the application of microtonality in a variety of musical contexts. Additionally, the works by three of the composers, Fox, LeFanu and Lumsdaine, were their first for solo recorder and therefore my research offered a rare opportunity to compare their compositions with those for other instruments. Six of the pieces were composed in collaboration with specialist recorder players - active recorder players composed the remaining two. For myself, the act of composing is clearly separated from that of performing; new pieces, whether from my own pen or not, all have to be studied and learned with the same careful approach. Composer and performer Markus Zahnhausen, in private conversation, has expressed similar sentiments with regard to learning his own pieces. Perhaps in these two cases a more acute awareness of technical limitations and possibilities may inform the compositional process more fully but, with the exception of Bousted's *Study No. 2*, there is little evidence here or elsewhere of composers stretching the instrument's technique beyond known limits. Indeed, the same composer's *Whale Song* is a perfect example of the extraordinary sounds that can be achieved with a thorough understanding of both the instrument's and players' capabilities.

My studies of the repertoire further indicated that composers such as Fox (*Winds of Heaven*) and Bousted (*No. 2 from Five Quarter-tone Pieces*) sometimes use the instrument in a way that allows little opportunity for the player to have the freedom to enjoy making sounds and shaping them to his own satisfaction. This is surprising in an age when the improvisatory skills of musicians are highly valued and 'note-based' musicians, a derogatory term applied in some circles to musicians considered to be in some way inferior, less valued. The implication that performers wanting to play an active role in the reproduction of a composer's work – wanting to play with the material and ideas given to him in a creative way – appears, in the eyes of some composers, to be an undesirable element in the performance of their music. Lumsdaine, on the other hand, expects no less than a committed artistic input from the player in the performance of *Metamorphosis at Mullet Creek*, particularly with regard to timing.

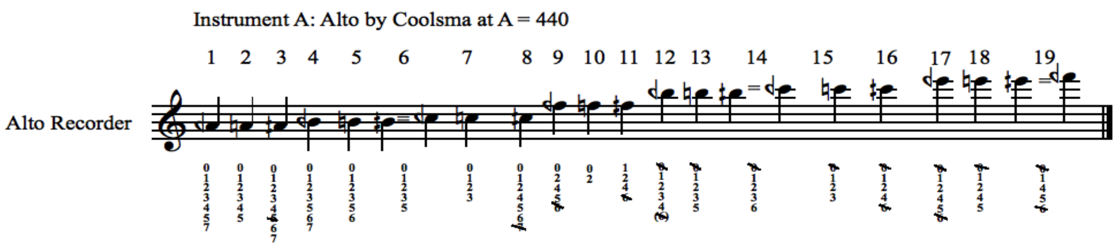
My study of the eight pieces indicates, therefore, a diverse range of approaches and attitudes by the composers to the performance of their pieces. In the same vein, no single analytical method or style of interpretation will be suitable for more than one piece, each being artistically and musically unique. My research into various different approaches to formal analysis in Chapter 2 identified several which might be beneficial in different circumstances: motivic analysis, rhythmic analysis, harmonic- and melodic analyses. These can be taken together under the heading of paradigmatic analysis and operate at the small-scale level. I also employed a semiotic approach for the analysis at the large-scale level where appropriate. My research indicates that taken together this dual approach provides a flexible method of analysis of a variety of styles of music and is particularly suitable for a rounded understanding of a piece for interpretation and performance.

A number of philosophical concerns have been addressed in the course of this thesis, primarily regarding the validity of playing small intervals on an instrument that is notorious for its dependence on secure breath pressure for accurate intonation. Quarter-tones can be accurately played with security using dedicated fingerings; third- and eighth-tones are somewhat more reliant on subtle variations, leakings or shadings of the more secure fingerings. My research indicated that approaches to intonation may be context dependent. For the performer, having made the decision regarding a strategy, it remains for him and his audience to face challenges of audibility where adjustments of less than an eighth of a tone (25 cents) are concerned. This means that in selecting repertoire, he must have clear ideas about the compositional and expressive intent behind the use of small intervals and ensure that this is clearly realised in performance, whether it be speed (*Dawn's Dove*), movement (*Metamorphosis at Mullet Creek*), texture (*Winds of Heaven* and *Whale Song*), subtle changes in tone colour (*Dialogue for One Recorder Player* and *Lux Aeterna*), expression and word painting (*The Voyage*), or as a musical and technical extension of the recorder's capabilities (*Study No. 2*). The approach to intonation will be as different as are the musical and expressive demands of each piece. With clarity of intent, performances become stronger and composers more willing to explore the potential of this medium.

This research has revealed a continuous development in the range and sophistication of the recorder's expressive tools. Microtonality has developed from inflective glissandos through to Wolters' placing of third-tones against a tonal background and Bousted's use of microtonal pitch class sets. My research has indicated a growth in the use of texture as both a structural and expressive device. Above all, however, this study has highlighted the musical evolution of the recorder's repertoire from the experimentalism of the avant-garde through to the sophisticated use of the recorder and of microtonality in various styles by composers whose confidence and individuality are themselves expressions of early twenty-first century music.

Appendix 1

Notes Analysed

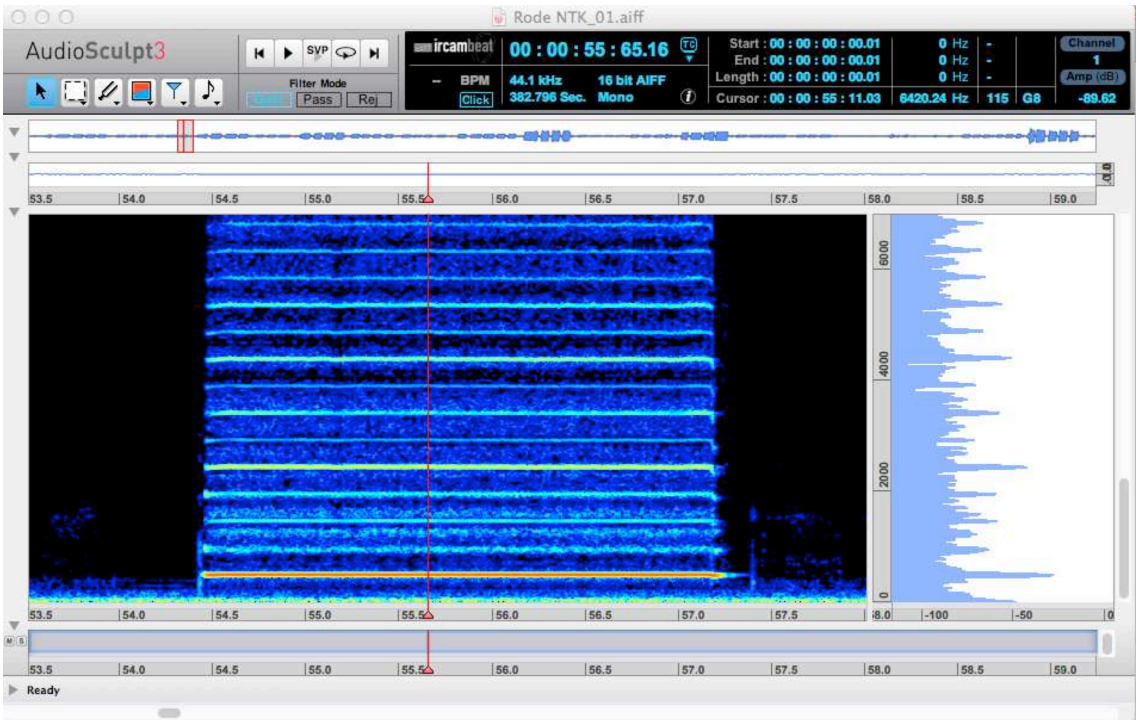


Appendix 2

Method of Tone Colour Analysis

I will detail here the method used to calculate the loudness and tone colour ratios for nineteen pitches on each of two instruments. A recording of the pitches was subjected to spectral analysis using a commercially available software package[73] which produced a sonogram – a visual representation of the sound (see Figure 1, below), and a Sound Description Interchange Format (SDIF) output (see Figure 2, below). Both provided information that enabled the calculation of sound pressure levels (dB) for each of the frequencies of the pure sine waves that are the constituent elements of the instrument's sound, as detected during the spectral analysis.

Figure 1 shows the sonogram of the pitch produced on the control instrument using the fingering 01235. The strength of each of the partials is indicated by the brightness of the horizontal lines on the sonogram. The window at the right of the frame shows the structure of the sound in elevation, with the strong fundamental, the highest peak, at the bottom.



[73] AudioSculpt, see Chapter 5, page 120.

The sonogram, Figure 1, is a visual representation of the constituent elements of the sound - the fundamental and its upper partials. It is an indication of the energy distribution within the sound; the strength of each of the partials is indicated by the colour of the horizontal lines – the brighter the colour, the greater the sound pressure level. Placing the cursor over each line gives a reading for the sound pressure level at that point.

Figure 2, shows the SDIF output for a snapshot of the sound corresponding to the point where the vertical red line crosses the sonogram in Figure 1, above.

55.620113	487.861389	0.045619
55.620113	940.816284	0.000631
55.620113	1463.170776	0.001287
55.620113	1951.551392	0.000957
55.620113	2439.002930	0.008365
55.620113	3416.657227	0.001706
55.620113	4390.680176	0.002998
55.620113	4878.783691	0.000514
55.620113	5366.594727	0.001804

Figure 2 shows three columns of information. These are from left to right:

time (seconds); frequency (Hz); amplitude (N/m^2).

At time = 55.620113 seconds the fundamental frequency was 487.861 Hz and the amplitude 0.045619 N/m^2. An inspection of the sonogram clearly indicates the strong partials, 1, 5, and 9, with bright, clearly defined horizontal lines. Other partials with a noticeable presence include 3 and 7. The even partials 2, 4, 6, 8, 10, plus 11, are noticeably more diffuse and clearly of a less robust nature. This interpretation is confirmed by the figures in the SDIF output, shown in Figure 2 and reproduced in Table 1, below. This shows in the columns from left to right, the number of the partial, the frequencies of each of the partials in Hz, the natural harmonic frequency of the partial, the arbitrary reference level (Max. dB), sound pressure level (dB), loudness level (phons), perceived comparative loudness (sones), and finally the tone colour ratio. The frequencies in parentheses were weak and are absent from the SDIF output. Figures for those frequencies given here were the result of approximate readings taken from the sonogram. For the second partial at time 55.62 seconds it is possible to interpolate a reading of approximately -67 dB. Subtracting this from the predetermined arbitrary reference level of 96 dB produces an estimated SPL of 29 dB.

Table 1.

Partial	**Hz**	**Nat. Hz**	**Max dB**	**dB**	**Phon**	**Sone**	**Total Sones**	**Ratio**
1	488	488	96	67.2	65	5.7	5.7	0.452380952
2	(940)	976	96	29	29	0.5	0.5	
3	1463	1464	96	36.2	34	0.7	0.7	
4	1952	1952	96	33.6	33	0.6	0.6	
5	2439	2440	96	52.4	54	2.6	2.6	
6	(2928)	2928	96	26	30	0.5	0	
7	3417	3416	96	38.6	43	1.2	1.2	
8	(3904)	3904	96	24	30	0.5	0	
9	4391	4392	96	43.5	44	1.3	1.3	
10	4879	4880	96	28.2	30	0.5	0	
11	5367	5368	96	39.1	38	0.9	0	0.547619048
TOTAL							6.9	12.6
F/H Ratio								**0.826086957**

The calculations used to derive the phon and sone values for each sinusoid are as follows:

From the SDIF output, Figure 2:

Obtain sound pressure levels (SPL) for each sinusoid (formula 2, page 120).

SPL (dB) = $20 \times \log_{10}(A_1/A_0)$

Where A_1 = the amplitude of the partial in N/m^2

and $A_0 = 0.00002\ N/m^2$ (the lower threshold of hearing)

For a sinusoid of 488 Hz with amplitude $0.045619\ N/m^2$

SPL (dB) = $20 \times \log_{10}(0.045619/0.00002)$

$= 20 \times 3.358$

$= 67.2$ dB

From the Fletcher and Munson contours of equal loudness chart (page 100), for SPL 67.2 and frequency 488 Hz: read loudness level (Lp) = 65 phons.

From Formula 1, page 100, convert phons to sones:

Ls (Loudness in sones) = $2^{(Lp - 40)/10}$

$Ls = 2^{2.5}$

Ls = 5.7 sones

The loudness of the fundamental in the above example, 5.7 sones, is added to the total loudness of the upper partials, 6.9 sones, giving a total loudness for the tone of 12.6 sones. However, my interest lies primarily in the relationship between the fundamental and the upper partials, so by applying the simple formula F/H, a ratio for the tone colour can be calculated:

F = 5.7 sones;

H = 6.9 sones

5.7/6.9 = 0.826

The tone colour ratio for this note is 0.83 (see Appendix 4, note 6, page 333). This same procedure was applied to every note analysed in order to produce the loudness and colour ratios for each of the tones given in Appendices 3 and 4.

Appendix 3

Results of Analysis
Coolsma Modern Alto in Boxwood A440

Note	Fingering	Dynamic	Sones	Tone Colour Ratio (F/H)
1 a𝄳^{1}	0123457	mf	11.2	1.04
2 a♮^{1}	012345	mf	14.1	0.48
3 a𝄲^{1}	01234~~5~~67	mf	9.25	0.67
4 b𝄳^{1}	0123567	mf	13.6	1.23
5 b♮^{1}	012356	mf	14.50	1.32
6 b𝄲^{1}	01235	mf	13.2	1.13
6 c𝄳^{2}	01235	mf	13.2	1.13

7 c♮^{2}	0123	mf	15.56	1.06
8 c𝄲^{2}	012456~~7~~	mf	15.87	0.90
9 f𝄳^{2}	0245~~6~~	mf	13.9	0.67
10 f♮^{2}	02	mf	24.8	1.28
11 f𝄲^{2}	124~~6~~	mf	15.15	1.83
12 b𝄳^{2}	~~0~~1234(~~6~~)	mf	25.56	2.57
13 b♮^{2}	~~0~~1235	mf	16.6	1.08
14 b𝄲^{2}	~~0~~1236	mf	11.8	0.51
14 c𝄳^{3}	~~0~~1236	mf	11.8	0.51
15 c♮^{3}	~~0~~123	mf	19.5	1.19

16 c𝄲^{3}	~~0~~124~~6~~	mf	25.9	1.18
17 e𝄳^{3}	~~0~~1245~~6~~	mf	19.9	1.14
18 e♮^{3}	~~0~~1245	mf	27.6	1.19
19 e𝄲^{3}/f𝄳^{3}	~~0~~145~~6~~	mf	26.3	1.83

Tone Colour
Ratio

Lower Number — Higher Number

1.0

← Upper partials become increasingly influential — Neutral Sound — Fundamental becomes increasingly influential →

Appendix 4

Results of Analysis
Control instrument: Yamaha modern alto in boxwood A440

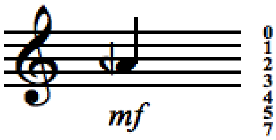
Note	Fingering	Dynamic	Sones	Tone Colour Ratio (F/H)
1 a𝄳^{1}	0123457	mf	11.3	1.13
2 a♮^{1}	012345	mf	13.9	0.76
3 a𝄲^{1}	01234~~5~~67	mf	9.35	0.43
4 b𝄳^{1}	0123567	mf	11.0	0.83
5 b♮^{1}	012356	mf	14.0	1.33
6 b𝄲^{1}	01235	mf	12.6	0.83
6 c𝄳^{1}	01235	mf	12.6	0.83
7 c♮^{1}	0123	mf	21.4	0.84

8 c𝄲^{1}	012456~~7~~	mf	15.2	0.6
9 f𝄳^{2}	02456	mf	15.1	1.13
10 f♮^{2}	02	mf	25.3	0.92
11 f𝄲^{2}	1246	mf	16.46	1.27
12 b𝄳^{2}	~~0~~1234(~~6~~)	mf	24.27	3.13
13 b♮^{2}	~~0~~1235	mf	20.1	1.28
14 b𝄲^{2}	~~0~~1236	mf	13.54	0.57
14 c𝄳^{2}	~~0~~1236	mf	13.54	0.57
15 c♮^{2}	~~0~~123	mf	15.9	1.0
16 c𝄲^{2}	~~0~~124~~6~~	mf	29.9	1.15

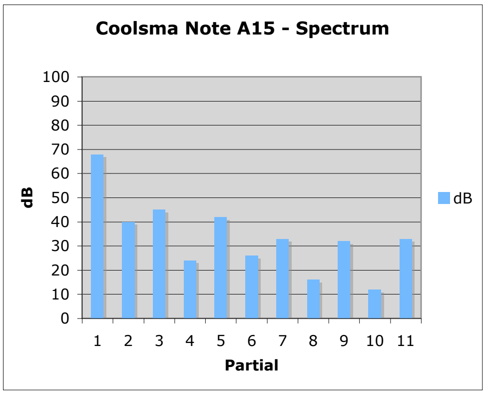
17 e𝄳^{2}	~~0~~12456~~6~~	mf	18.0	0.91
18 e♮^{2}	~~0~~1245	mf	18.6	0.86
19 e𝄲^{2}/f𝄳^{3}	~~0~~1456~~6~~	mf	26.0	1.6

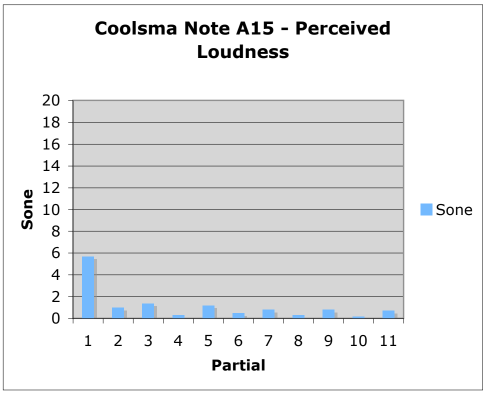
Appendix 5

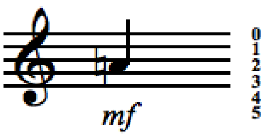
Coolsma Alto



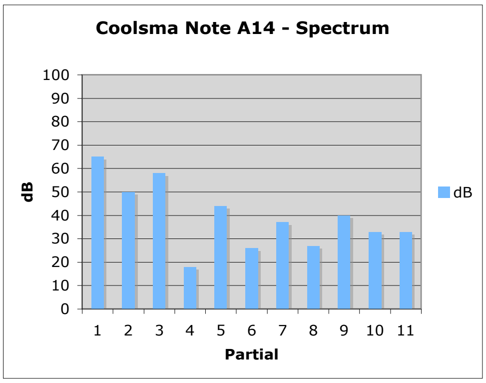
Loudness In Sones	Tone Colour Ratio (F/H)
11.20	1.04

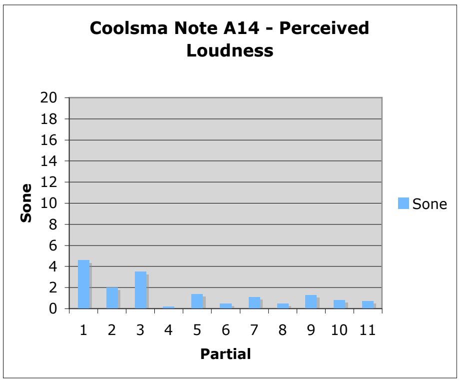


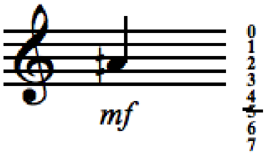




Loudness In Sones	Tone Colour Ratio (F/H)
14.1	0.48

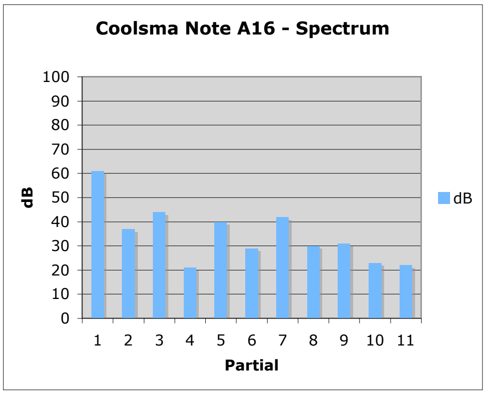


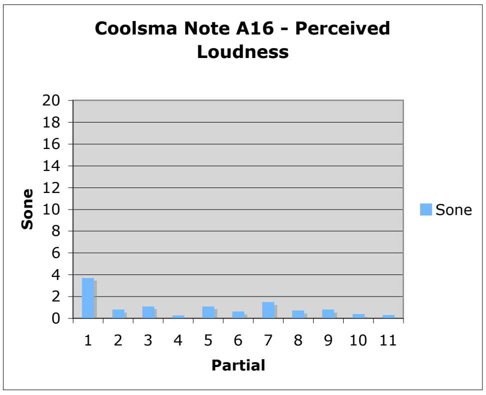


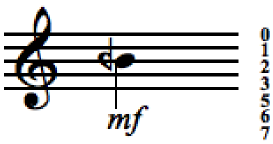


Loudness In Sones
9.25

Tone Colour Ratio (F/H)
0.67

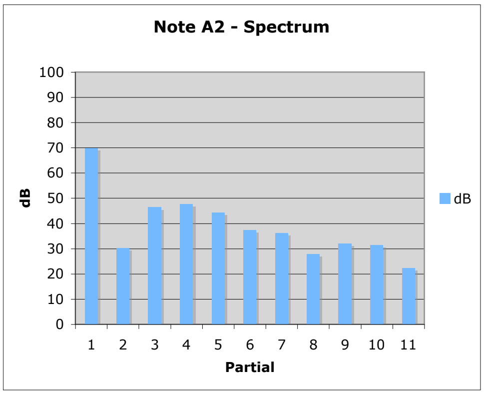


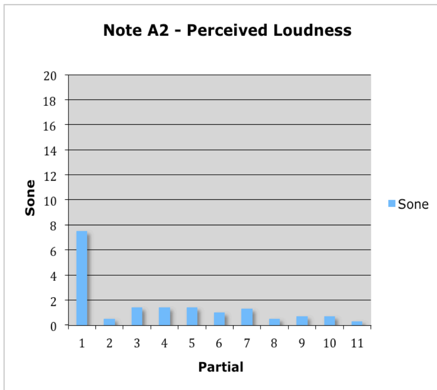


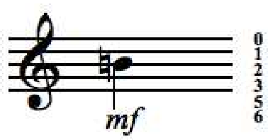


Loudness In Sones
13.6

Tone Colour Ratio (F/H)
1.23

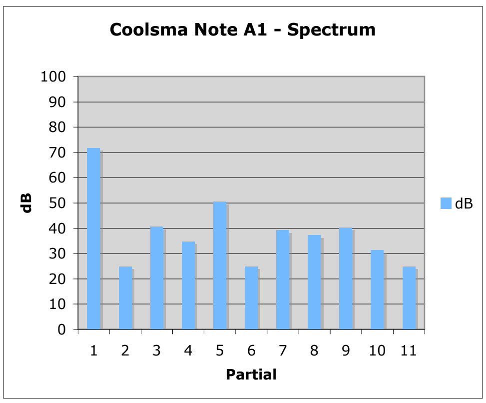


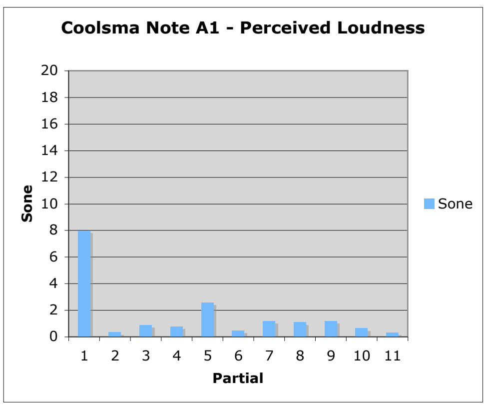


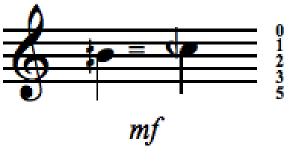


Loudness In Sones
14.50

Tone Colour Ratio (F/H)
1.32

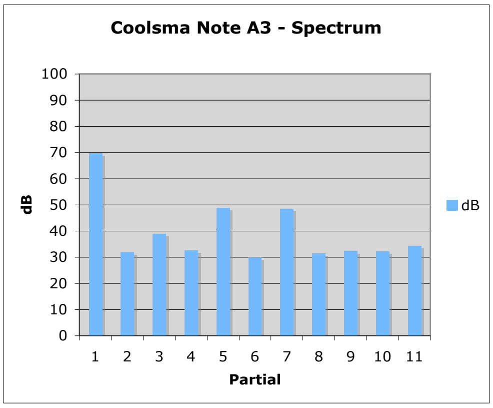


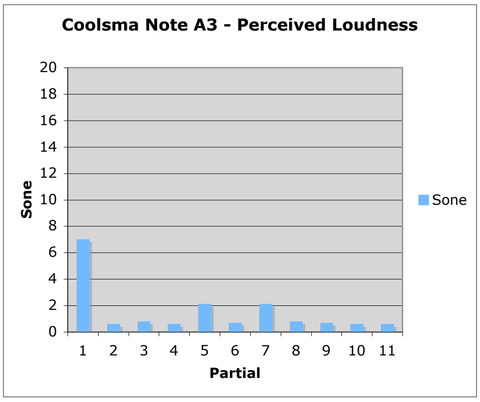


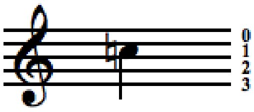


Loudness In Sones 13.2

Tone Colour Ratio (F/H) 1.13

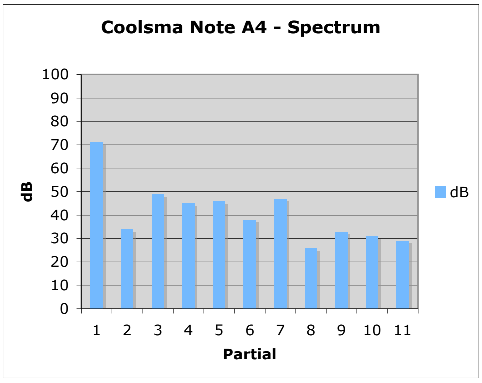


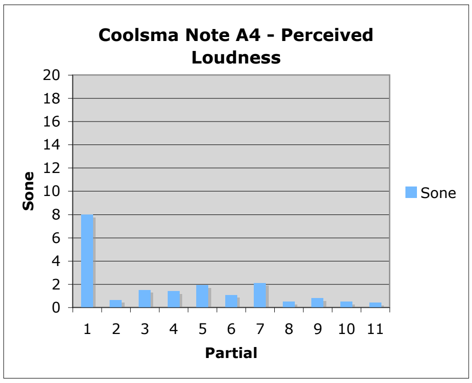


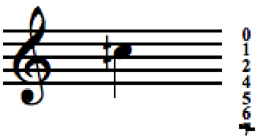


Loudness In Sones 15.56

Tone Colour Ratio (F/H) 1.06

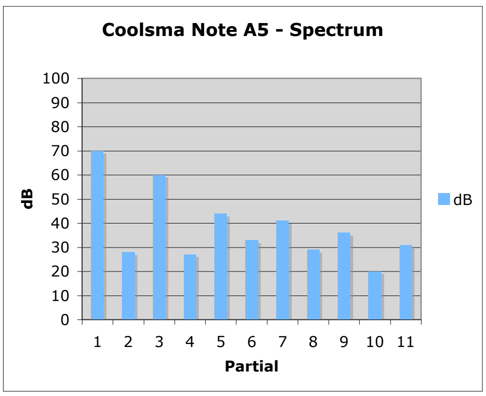


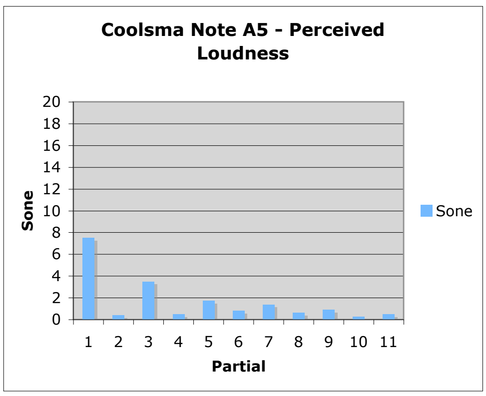


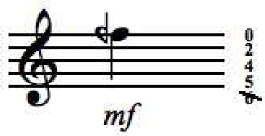


Loudness In Sones 15.87

Tone Colour Ratio (F/H) 0.90

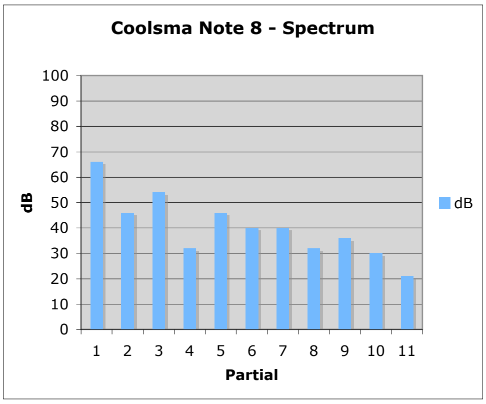


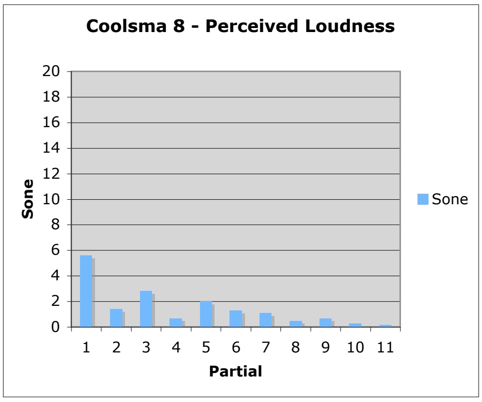


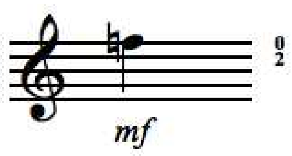


Loudness In Sones
13.9

Tone Colour Ratio (F/H)
0.67

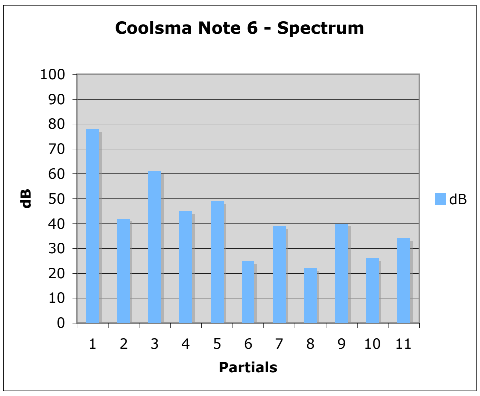


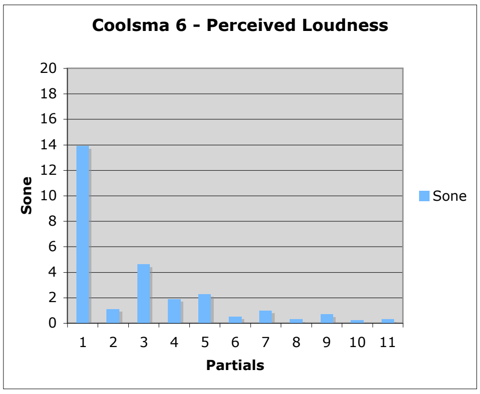


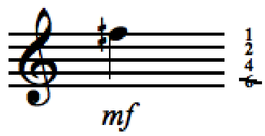


Loudness In Sones
24.80

Tone Colour Ratio (F/H)
1.28

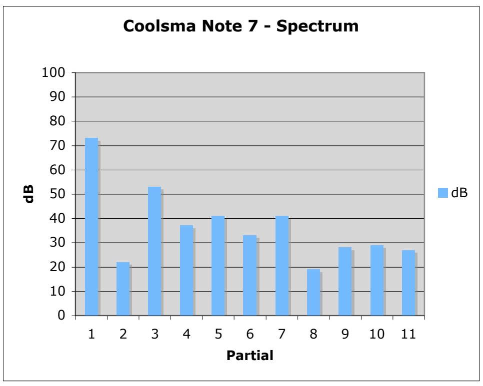


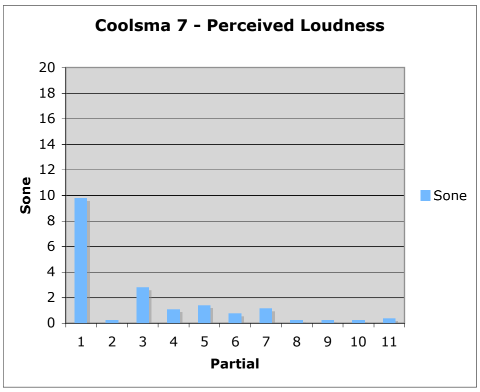


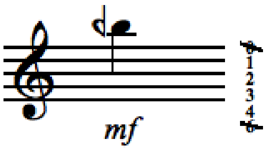


Loudness In Sones
15.15

Tone Colour Ratio (F/H)
1.83

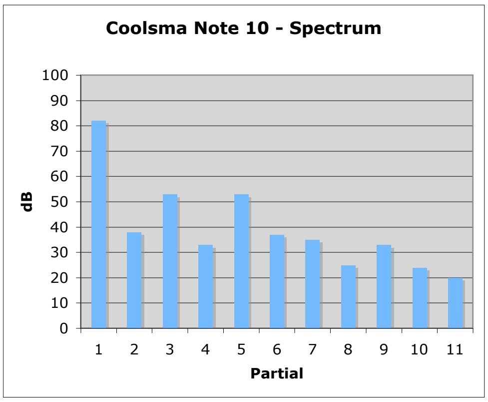


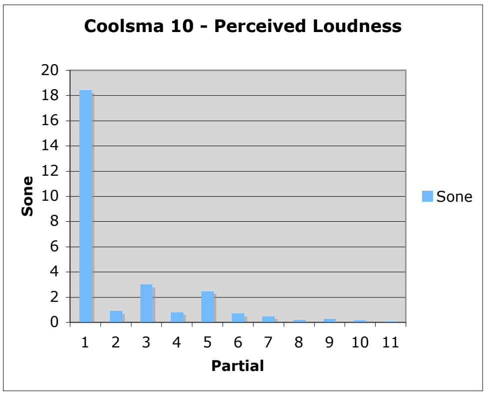


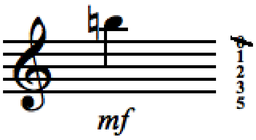


Loudness In Sones 25.56

Tone Colour Ratio (F/H) 2.57

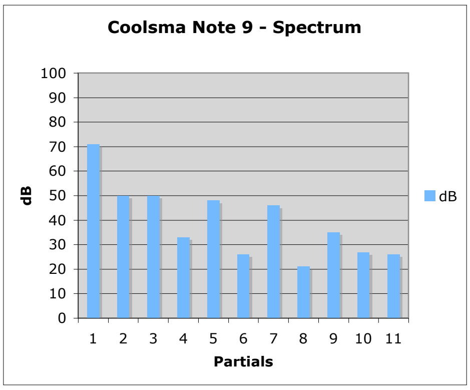


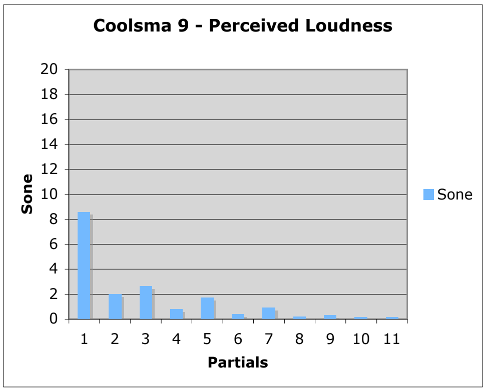


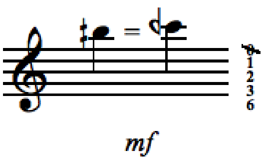


Loudness In Sones 16.60

Tone Colour Ratio (F/H) 1.08

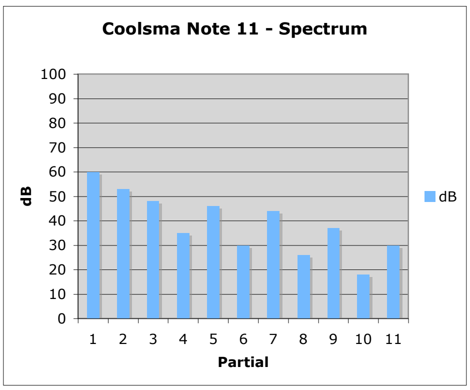


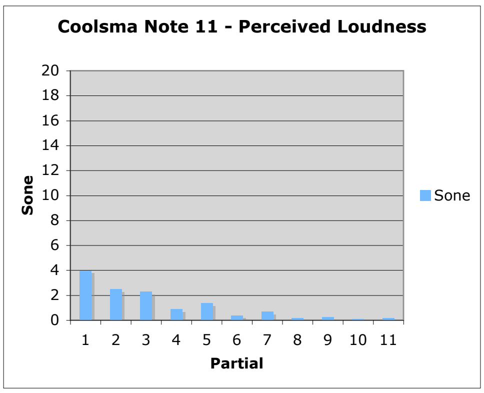


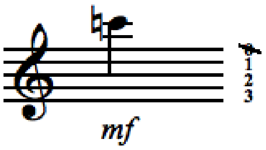


Loudness In Sones 11.80

Tone Colour Ratio (F/H) 0.51

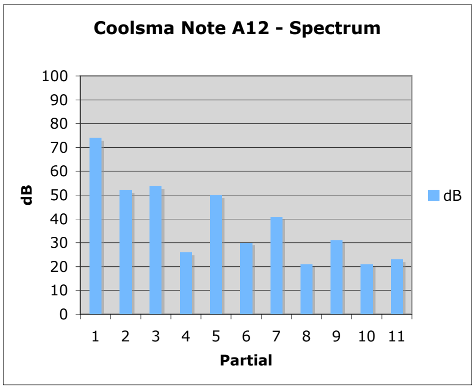


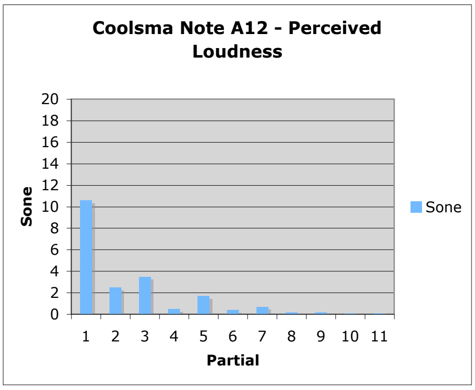


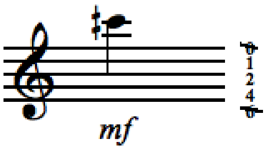


Loudness In Sones
19.5

Tone Colour Ratio (F/H)
1.19

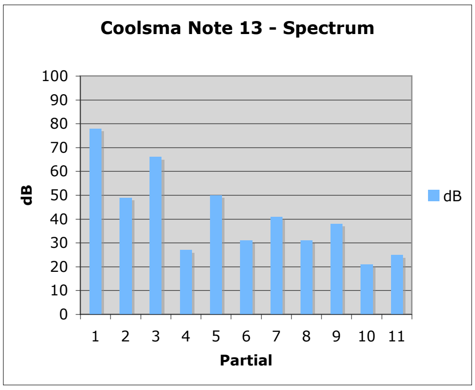


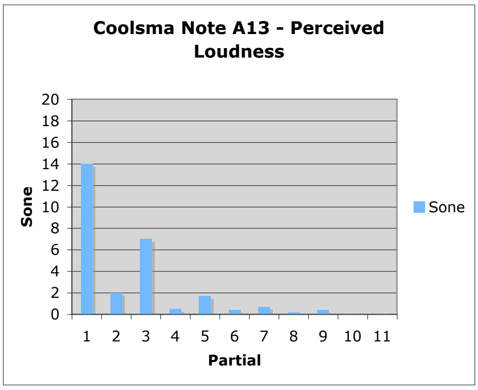


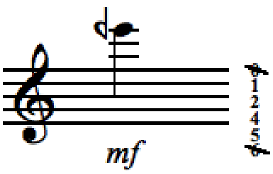


Loudness In Sones
25.9

Tone Colour Ratio (F/H)
1.18

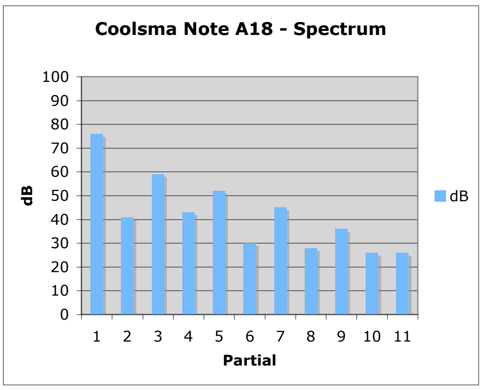


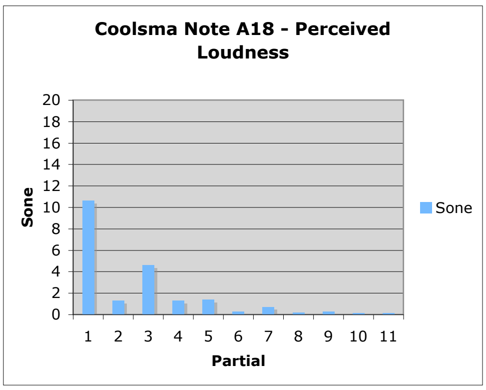


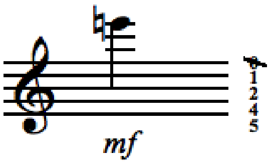


Loudness In Sones
19.9

Tone Colour Ratio (F/H)
1.14

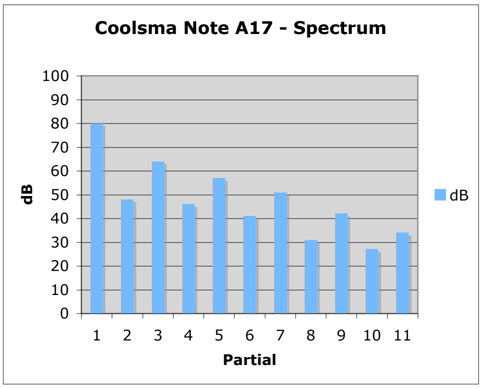


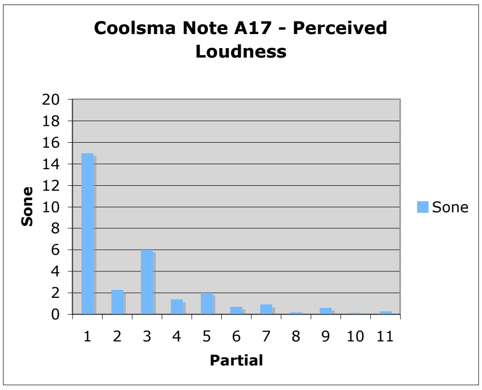


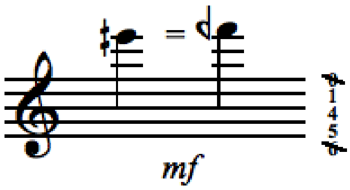


Loudness In Sones
27.60

Tone Colour Ratio (F/H)
1.19





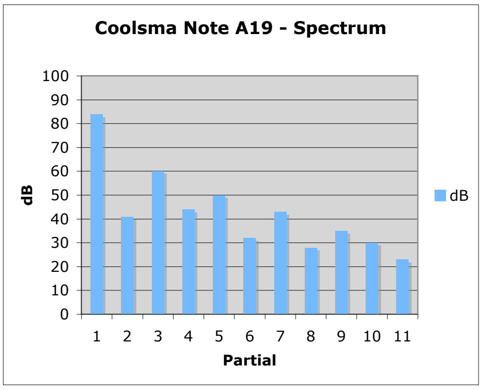


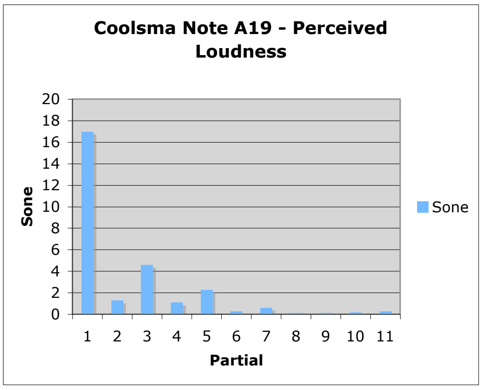
Loudness In Sones

26.30

Tone Colour Ratio (F/H)

1.83



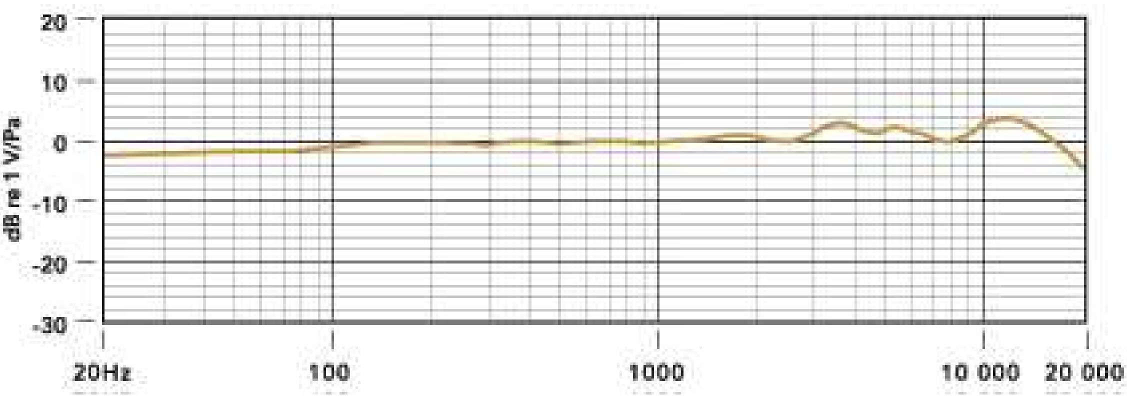


Appendix 6

Rode NTK Condenser Microphone

Cardioid Polar Pattern

Frequency Response:



Appendix 7

Comparison of Instruments used in this Investigation: Coolsma-Yamaha

Two instruments were selected for this investigation for their speed and evenness of response, and accuracy of intonation: modern style trebles by Coolsma and Yamaha. The designs are based on the familiar baroque style recorder but both are voiced by the manufacturers such that they produce a bright, even tone across the range. Fingerings on both instruments are consistent with the standard baroque fingerings for the full chromatic range and they also respond in a familiar way to microtonal fingerings. The instruments are broadly consistent in their responses but also indicate some divergence in the loudness and tone colour responses to the tones tested in this investigation. The graphs, Figures 1a, 1b, 2a and 2b, below, indicate responses for loudness and tone colour. They have a compressed horizontal scale due to the limited number of pitches chosen for investigation and the irregularity of the intervals between selected pitches. Nevertheless, the contours of the lines indicate consistency of response for the various degrees of the pitches - natural, quarter-flat, and quarter-sharp for each instrument. The graphs facilitate easy comparison both between the responses of different pitches on each instrument and between the instruments themselves for both loudness and tone colour.

The patterns of loudness and tone colour resulting from the use of established fingerings for b^2 and c^3 gives the first indication of differences between the Coolsma, used as the primary instrument for my investigation, and the control instrument – an alto by Yamaha. The Coolsma indicates widely diverse responses of loudness for both pitches whereas the Yamaha indicates more consistency between the natural and quarter-flat degrees of the pitch but a somewhat wayward response from the quarter-sharp. There are also deviations from established patterns when we reach the fourth register and the highest notes tested here – e^3. Figures 1a and 1b give a comparison of loudness between instruments. Here we find strong similarities between e-quarter-flat^3 and e-quarter-sharp^3 but a substantial divergence between the instruments is indicated for e-natural^3.

Figure 1a.

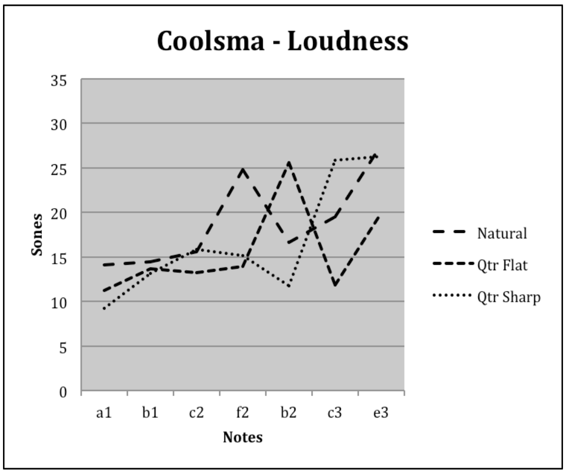
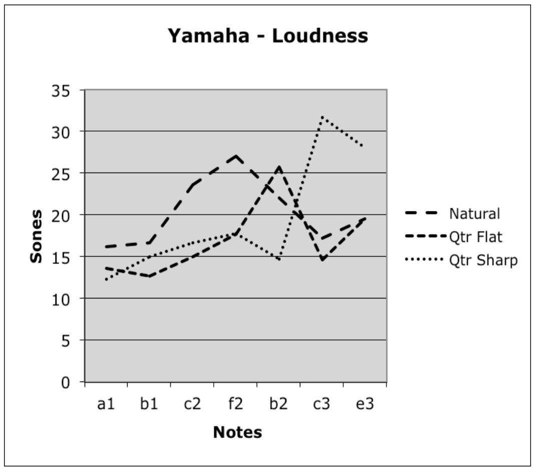


Figure 1b.



Figures 2a and 2b indicate a similar divergence in tone quality but in this case it is the e^3-quarter-sharp that is prominent. Note that when reading figures for tone colour, the higher numbers indicate tones increasingly dominated by the fundamental – lower numbers indicate tones increasingly dominated by the upper partials. A tone colour ratio of 1.0 can be considered a tone with a neutral tone colour. An example of a range of pitches with consistent tone colour is that shown by the line for the Coolsma naturals, see Figure 2a, below. Other degrees of the pitches tested are considerably less consistent on both instruments.

Figure 2a.

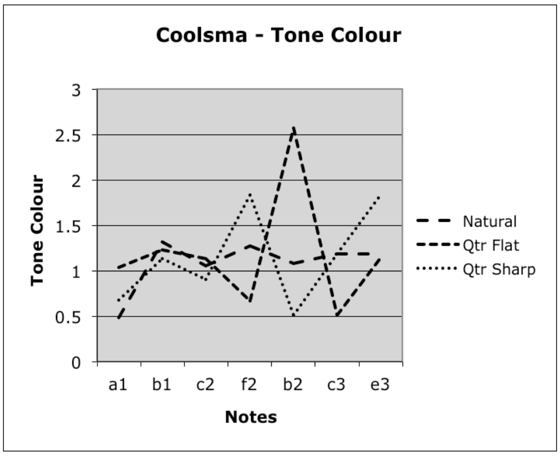
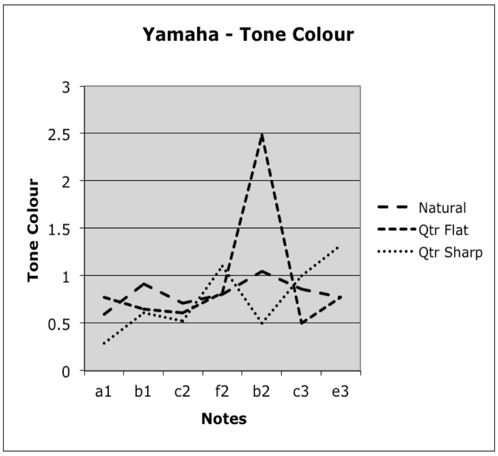
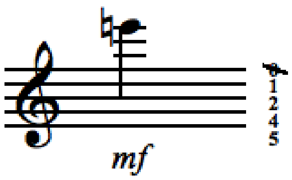


Figure 2b.



The differences between the two instruments is highlighted by the spectra and loudness bar charts for the e^3-natural, which are markedly different for each instrument, see Figures 3a, 3b, 4a, 4b:

Loudness and tone colour for the Coolsma



Loudness In Sones	Tone Colour Ratio (F/H)
27.60	1.19

Figure 3a

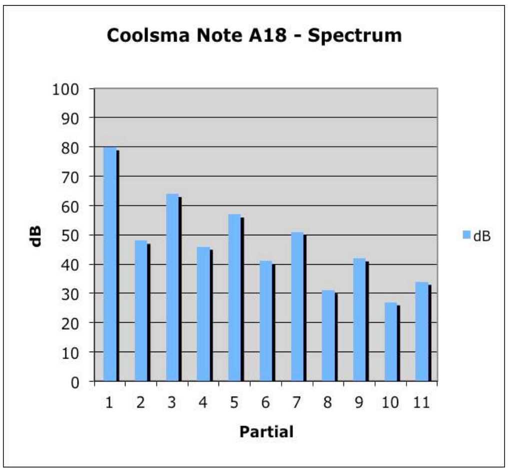
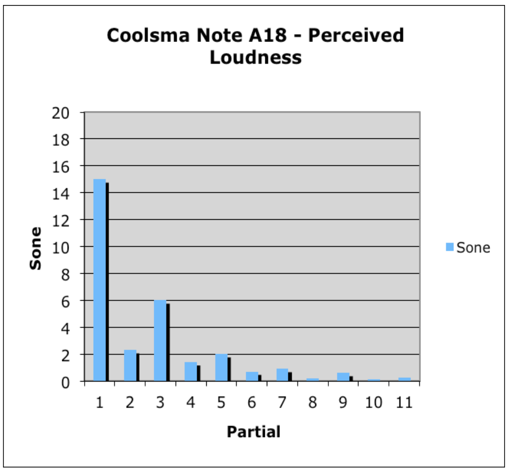
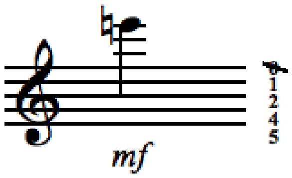


Figure 3b





Loudness and tone colour for the Yamaha

Loudness In Sones	**Tone Colour Ratio (F/H)**
18.60	0.86

Figure 4a

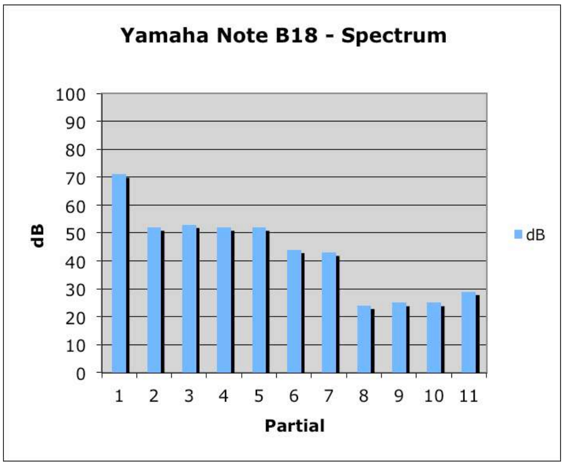
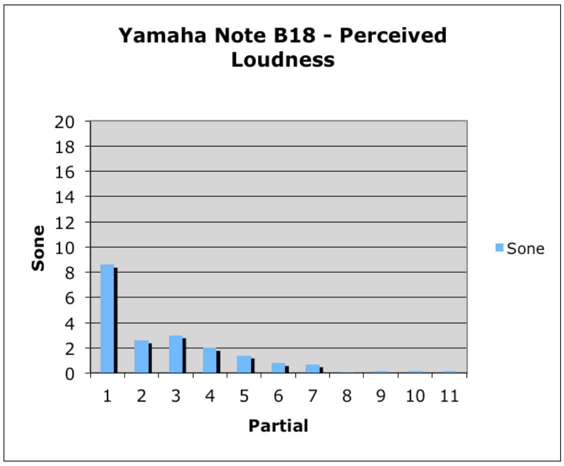


Figure 4b



The Yamaha spectrum shows a slightly suppressed fundamental for all three degrees of e^{3} compared to the Coolsma (see Appendix 3, page 330) but the Coolsma's upper partials fall into a clear pattern of strong odd and clearly suppressed even partials, whereas the Yamaha's upper partials are slightly less strong and present a relatively 'flatter' contour, the even partials being barely suppressed (see Figures 3a and 4a, above, and Appendix 4, page 333). This raises questions about identifying tone colour by reference to the contour of the spectrum or indeed the loudness chart. O'Kelly's assertion (1990, 28) that 'the number and composition [of the upper harmonics] is responsible for the characteristic timbre of the instrument' is only half of the explanation of the recorder's unique tone quality. I have shown that not only are tone and loudness closely related (see Chapter 5, page 137) but that both depend to a large extent on the strength of the fundamental relative to the upper partials. The Yamaha has a quiet but bright tone because the fundamental is weak and the sound is dominated by the upper partials. It is less loud than the Coolsma because for two of the notes its fundamental is weaker. The Coolsma, on the other hand, has a spectrum where the odd-numbered partials are clearly stronger than the even-numbered ones but the fundamental is stronger so the instrument is louder and one therefore perceives it as sounding brighter. On the other hand the tone is more evenly balanced by virtue of the ratio of the upper partials to the fundamental being nearer to unity.

The lower notes b^1 and c^2 and their microtonal neighbours display a satisfying degree of uniformity with regard to tone colour but are divergent with regard to loudness at c^2 (see Figures 1a and 1b) where the Yamaha indicates loudnesses of 12.6 sones, 21.4 sones and 15.2 sones for c-quarter-flat^1, -natural and –quarter-sharp respectively. Despite this, the tendencies noted for the higher octave notes b^2 and c^3, where the left hand fingers provide the core fingering and the additional right hand fingers control pitch and tone colour, still holds true, albeit to a far less dramatic extent – in the higher register, the use of finger 4 has a clear and dramatic effect on the loudness of the tone. Table 1, below, shows an extract from Appendices 3 and 4, showing a comparison of loudness and tone colour measurements for the Yamaha and Coolsma recorders for b^2 and c^3. Note the influence of finger 4 on the loudness of b-quarter-flat^2 and c-quarter-sharp^3.

Table 1

Note	Fingering	Dynamic	**Loudness (Sones)/ Tone Colour Ratio** Yamaha	**Loudness (Sones)/ Tone Colour Ratio** Coolsma
b-quarter-flat^2	~~0~~1234(~~6~~)	*mf*	24.27/3.13	25.56/2.57
b-natural^2	~~0~~1235	*mf*	20.1/1.28	16.6/1.08
b-quarter-sharp^2	~~0~~1236	*mf*	13.54/0.57	11.8/0.51
c-quarter-flat^3	~~0~~1236	*mf*	13.54/0.57	11.8/0.51
c-natural^3	~~0~~123	*mf*	15.9/1.0	19.5/1.19
c-quarter-sharp^3	~~0~~1246	*mf*	29.9/1.15	25.9/1.18

In the lower register, the core fingering, 0123 produces a c^2 and is modified by the addition of right hand fingers 5 (b-quarter-sharp^1), 5 and 6 (b-natural^1) and finally 5, 6 and 7 (b-quarter-flat^1), which slightly alters the strength of the fundamental and consequently its relationship with the upper partials. For the Yamaha the b-natural^1 has the strongest fundamental followed by the b-quarter-sharp^1 (01235) and finally the b-quarter-flat^1 (123567) whereas a strong b-natural^1 is followed on the Coolsma by the b-quarter-flat^1 and then the b-quarter-sharp^1, with only slight differences between them (see Appendices 3 and 4). The Yamaha's tone is most clearly influenced by the fingering changes whilst the Coolsma is the more stable of the two, indicating more consistency of both loudness and tone colour in this range.

The addition of finger 7 to 012356 to produce the b-quarter-flat^1 (0123567) produces a subtle but noticeable reduction in the strength of the fundamental on both instruments, producing a softer and somewhat veiled tone. An alternative to this fingering, 01234, produces a coarse, loud tone whose colour and loudness are not consistent with the surrounding notes and was therefore rejected as a standard microtonal fingering (this fingering was tested aurally and rejected for this more detailed study).

The difference between b♮^{1} and c♮^{2} is more marked on the Yamaha but the graphs indicate that both instruments behave in a similar way to fingers added to the core fingering 0123 – the b-natural^1 (fingered 012356) produces alsmost identical results for tone colour and loudness on both instruments. Compared to this, the addition of finger 5 alone (c-quarter-flat^1) causes a significant drop in the strength of the fundamental and a corresponding increase in the influence of the upper partials to the Yamaha's tone colour, the overall strength of the upper partials being only slightly affected. The c-quarter-sharp^2 (0123567) has a substantially more veiled tone colour on both instruments, although the Yamaha indicates a more extreme response.

The other pitch that has been central to my investigation is f^2. Loudness levels are similarly high on both instruments for f-natural^2 with the Coolsma indicating a tone colour more heavily influenced by the fundamental. With respect to tone colour, the instruments respond in different ways for the quarter-sharp and quarter-flat degrees, although both are substantially less loud than the natural. The results indicate slightly more influence of the fundamental on the Yamaha whereas the Coolsma indicates a substantial increase in the influence of the fundamental on the f-quarter-sharp^2 and, with a tone colour ratio of 0.67, a significant increase in the influence of the upper partials for the f-quarter-flat^2, see Table 2, below.

Table 2, extracted from Appendices 3 and 4, showing a comparison of loudness and tone colour measurements for the Yamaha and Coolsma recorders on f♮^{2} and neighbouring quarter-tone pitches:

Note	**Fingering**	**Dynamic**	**Loudness (Sones)/ Tone Colour Ratio Yamaha**	**Loudness (Sones)/ Tone Colour Ratio Coolsma**
f-quarter-flat^2	02456	*mf*	15.1/1.13	13.9/0.67
f-natural^2	02	*mf*	25.3/0.92	24.8/1.28
f-quarter-sharp^2	1246	*mf*	16.46/1.27	15.15/1.83

We are now able to make a more general comparison between the two instruments. Figures 5a and 5b, below, compare instruments respectively for average tone colour and loudness. It is to be expected that on an unkeyed instrument like the recorder the instrument makers would aim to optimise evenness of tone and loudness across the chromatic range of the instrument. We can conclude that attempting to produce microtones on a copy or modern version of an eighteenth century instrument that was barely intended for use in chromatic music is stretching its capabilities to the limit. Nevertheless, I have shown that such instruments are capable of doing just that, without significant loss of loudness or tone colour. Figure 5a shows that, on average, the Coolsma plays with a very even response to tone colour across the microtonal range tested. The Yamaha is less consistent, indicating a substantial decrease in the influence of the fundamental across the microtonal intervals quarter-flat to quarter-sharp and a corresponding increase in the influence of the upper partials to the tone colour. This has the general effect of reducing the loudness and producing a more veiled tone colour. The loudness chart, Figure 5b, indicates that, on average, the instruments produce their optimum loudness on the natural degree of the note.

Figure 5a.

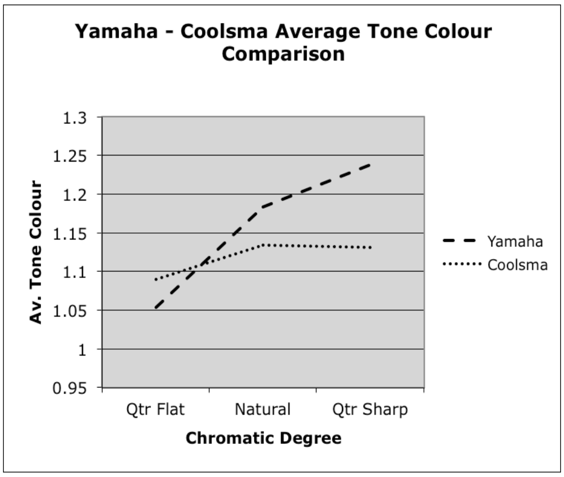
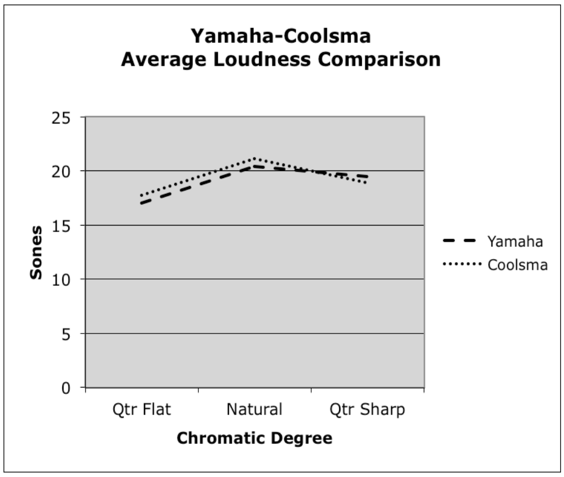


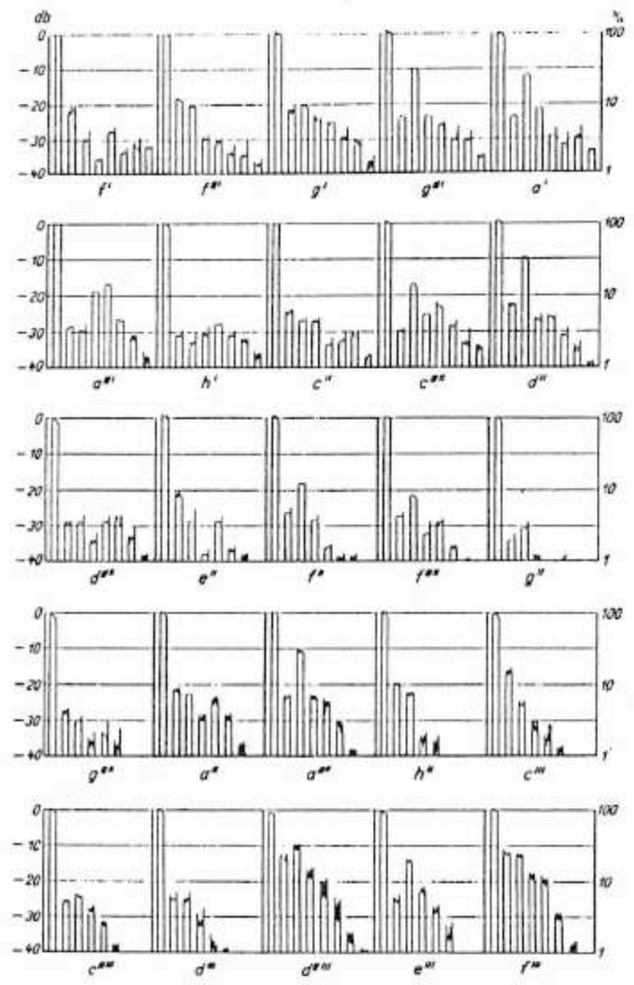
Figure 5b.



From Figure 5a, the Coolsma tends towards a more neutral or balanced tone colour whereas the Yamaha is more heavily influenced by the fundamental for the quarter-flat tones and has a tone that becomes increasingly dominated by the upper partials through the natural and quarter-sharp tones. The instruments have similar loudness curves, both peaking on the natural degree. The Coolsma is in general the slightly louder of the two.

Appendix 8

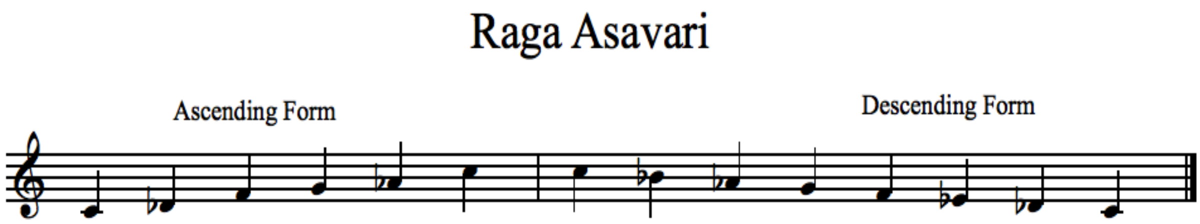
Arndt von Lüpke's Analysis of the notes of a Treble Recorder made in 1940.



Appendix 9

Raga Asavari

Raga Asavari is a raga of North Indian (Hindustani) origin – Kashmir. It is the last of a group of five ragas traditionally played during the first quarter of the day. It's general character is 'very expressive and tender.' (Daniélou 1968, 165). The Ascending version consists of Sa, ri, ma, pa, dha, (C, d-flat, f, g, A-flat, C^1) The descending version is: Sa^1, ni, dha, pa, ma, ga and ri. (C^1, b-flat, a-flat, g, f, e-flat, d-flat, c).



Appendix 10

Winds of Heaven by Christopher Fox

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Appendix 11

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Appendix 12

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Appendix 13

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Appendix 14

Microtonal Study No. 2
From 5 *Quarter-Tone Pieces* (1997)
By Donald Bousted (b. 1957)

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Appendix 15

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Appendix 16

DIALOGUE
for one recorder player
in three movements

Peter Bowman

1.


Robust

2


♩ = ca. 50
Slow, freely
gliss.
vib.
mf
pp
p
mf
pp
mf
p
al niente
a tempo
p
mf

3


53
57
61
65
69
73
77
81
85
89
93
97
101

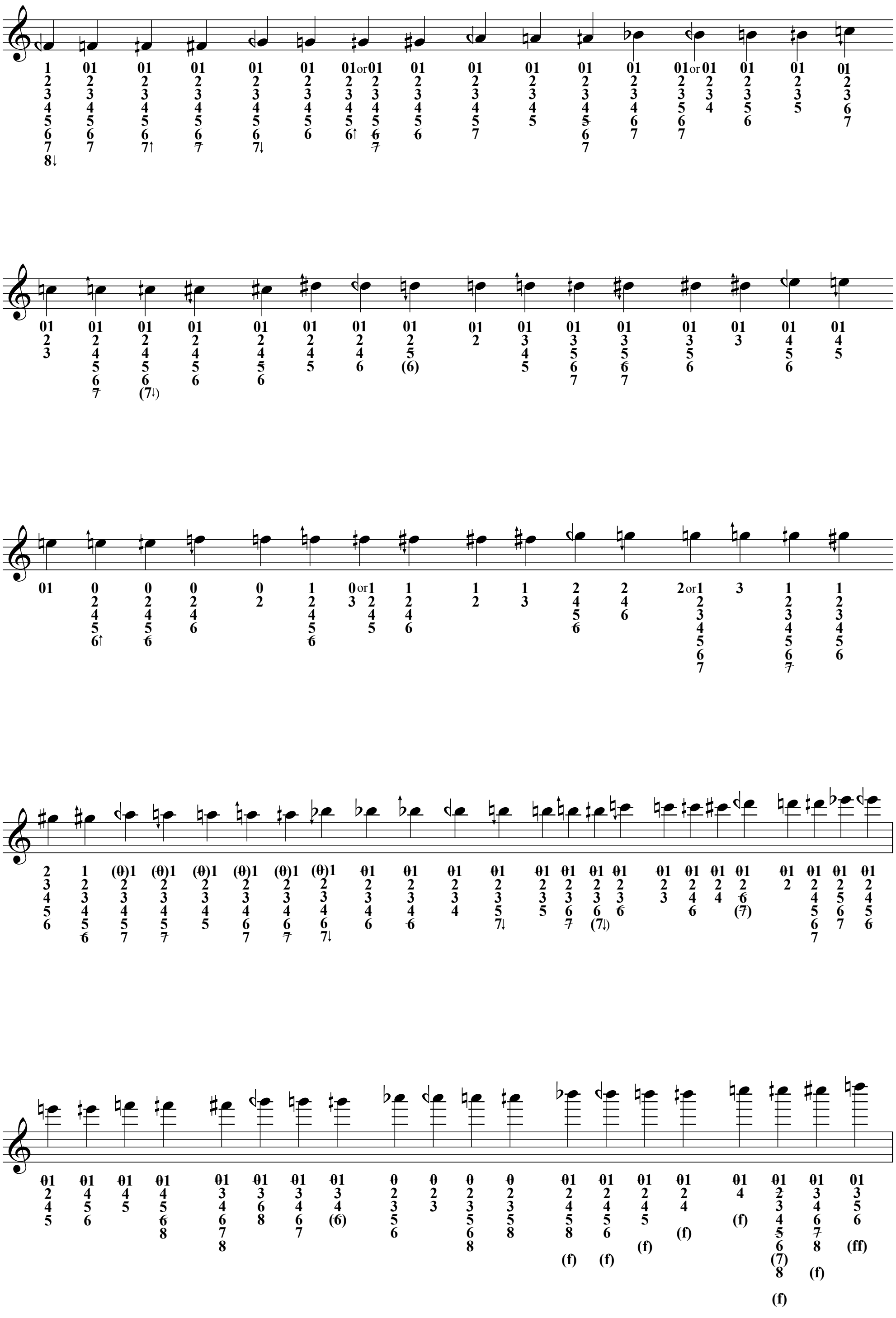

3
105
109
113
117
121
125

Appendix 17

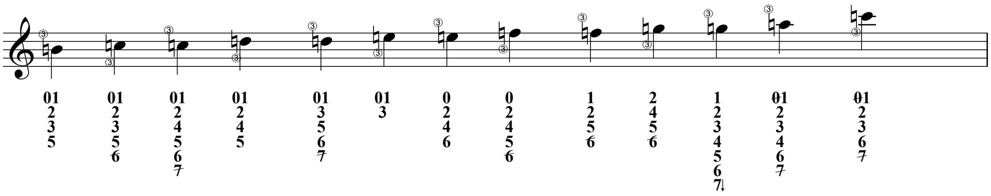
Microtonal Fingering Charts and Accidentals used in their Compilation

Natural	♮
Eighth-tone sharp	♮↑
Quarter-tone Sharp	𝄲
Third-tone sharp	③♮
Semitone sharp	♯
Semitone flat	♭
Third-tone flat	♮③
Quarter-tone flat	𝄳
Eighth-tone flat	♮↓

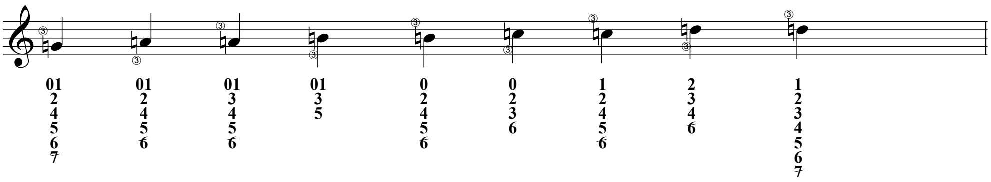
Treble Recorder
Quarter- and Eighth-tone Fingerings



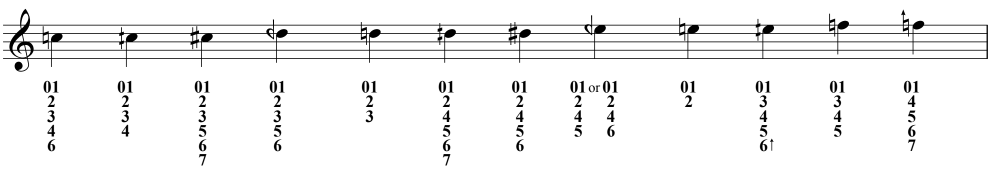
Treble Recorder
Third-tone Fingerings

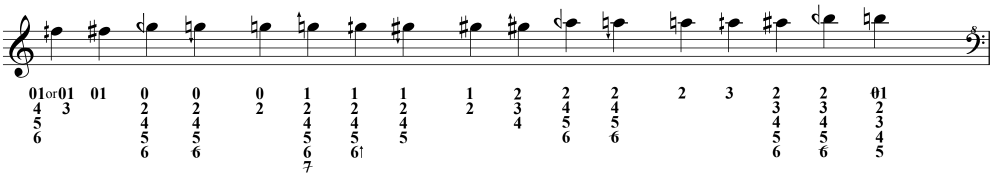


Tenor Recorder
Third-tones Fingerings

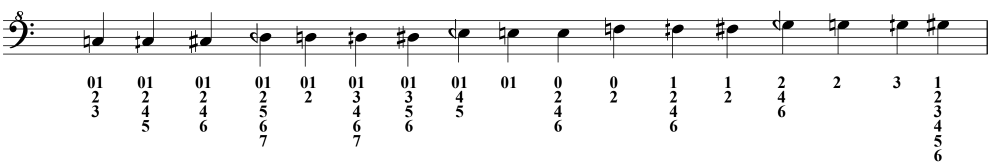


Renaissance Style Treble Recorder in G (after Ganassi)
Quarter- and Eighth-tone Fingerings





Renaissance Style Bass Recorder in F
Quarter-tone Fingerings



BIBLIOGRAPHY

Acht, R van (1997). 'The Sound Quality of Dutch Wind Instruments from the Baroque Period: The Project (1)'. *Proceedings of the Institute of Acoustics*. Volume 19, Part 5. 533-540.

Acht, R van. (1999). Quoted in Griscom and Lasocki 2003, 115-117.

Adorno, T.W. (1956). *Dissonanzen.* Göttingen: Vandenhoek & Ruprecht (1963).

Adorno, T.W. (1963). *Quasi una Fantasia*. London (1998): Verso.

Agawu, V.K. (1991). *Playing with Signs - A Semiotic Interpretation of Classic Music*. Princeton, New Jersey: Princeton University Press.

Anon. 'Modern'. Stichting Blokfluit. Online. <www.blokfluit.org/modern/>. (Accessed 12 April 2014).

Anon. (1962). *Missale Romanum*. Roman Catholic Church. Online. <www.globalchant.org>. (Accessed 18 March 2014).

Anon. (1991a). 'Apocrypha'. *Pears Cyclopaedia*. Ed. Cook, C. London: Pelham Books Ltd.

Anon. (1991b). 'Dadaism'. *Pears Cyclopaedia.* Ed. Cook, C. London: Pelham Books Ltd.

Anon. (1991c). 'Zen'. *Pears Cyclopaedia.* Ed. Cook, C. London: Pelham Books Ltd.

Anon. (1991d). 'Taoism'. *Pears Cyclopaedia.* Ed. Cook, C. London: Pelham Books Ltd.

Anon. (2002). '*Process'*. *Oxford English Dictionary*. Ed. Soanes, C. Oxford: Oxford University Press.

Backus, J. (1970). *The Acoustical Foundations of Music*. London: John Murray.

Balzano, G.J. (1986) 'What Are Musical Pitch and Timbre?' *Music Perception: An Interdisciplinary Journal*, Vol. 3, No. 3, University of California Press. 297-314.

Barnes, R. (2014). *Bousted's 'Five Quarter-Tone Pieces'.* Private email. 8 January 2014.

Bartel, D. (1982). *Handbuch der Musikalischen Figurenlehre*. Laaber, Regensburg: Laaber-Verlag.

Bartolozzi, B. (1967). *New Sounds for Woodwind*. London: Oxford University Press.

Beard, D. and K. Gloag. (2005). 'Feminism'. *Musicology, The Key Concepts*, Oxford: Routledge. 63-65.

Benade, A.H. (1976). *Fundamentals of Musical Acoustics*. London/New York: Oxford University Press/Dover Publications.

Benjamin, G.R. (a). 'Carrillo, Julián'. *Grove Music Online*. Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/05018>. (Accessed 25 April 2013).

Benjamin, G.R. (b). Philosophy of Art. Encyclopædia Britannica. *Encyclopædia Britannica Online*. Encyclopædia Britannica Inc. Online. <http://original.search.eb.com/eb/article-36265>. (Accessed 14 Aug 2011).

Bennetts, K., D. Bousted, and P. Bowman (1998). *The Quarter-tone Recorder Manual*. Celle: Moeck Verlag.

Bent, I.D. 'Hermeneutics'. *Grove Music Online*. Oxford Music Online. Oxford University Press. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/12871>. (Accessed 2 August 2013).

Bent, I.D. and A. Pople. 'Analysis'. *Grove Music Online*. Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/41862pg1>. (Accessed August 27 2011).

Bent, M. and A. Silbiger. 'Musica Ficta'. *Grove Music Online*. Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/19406>. (Accessed 28 Jun. 2012).

Betz, M. (1997) 'Das Stumme in der Musik'. *Sine musica nulla vita*, (Ed. Delius, N.) Celle: Moeck verlag. 237-256.

Blacking, J. (1995) 'The Problem of Musical Description'. *Music Culture and Experience*, (Ed. Bohlman, P. and Nettl, B.). Chicago: University of Chicago Press. 54-72.

Recorder Department Amsterdam Conservatory. Conservatorium van Amsterdam. BLOK History. <http://www.visisonor.info/BLOKfiles/history.htm>. (Accessed 21 December 2013).

Bolton, P. (2005). 'XVIIth Century Recorder Fingerings'. *Recorder Magazine*, 25/1, Hebden Bridge, UK: Peacock Press. 7-12.

Boothby, R. 'Contemporary'. Online. <http://www.fretwork.co.uk/contemporary/>. (Accessed 17 June 2014).

Bosgraaf, E. (2008) 'Dynamik auf der Blockflöte, Illusion oder Wirklichkeit?'. *Tibia*, Vol. 33, 4/2008, Celle, Germany: Moeck Musikinstrumente + Verlag. 253-262.

Bousted, D. 'Collaborations'. Online. <http://www.donaldbousted.co.uk/collaborations.html>. (Accessed 17 April 2014).

Bousted, D. (1998). Liner note to *A Journey Among Travellers*. Bennetts, K and Bowman, P. QTR CD07-98. London: QTR Recordings.

Bousted, D. (2001a). ‘An Instrument for the 21st Century?’. *Recorder Magazine*, Vol 21a, No.4, Scout Bottom Farm, Mytholmroyd, Hebden Bridge, W. Yorks. HX7 5JS: Peacock Press. 141-145.

--- (2001b). *Rhythmic, Diatonic and Microtonal Structures in Musical Composition: Method and Notation (Compositions 1993-1998)*. PhD Dissertation . University of Huddersfield.

--- (2002a). ‘Musical Elements Coming Together’. *The Recorder Magazine*, 22/1, Scout Bottom Farm, Mytholmroyd, Hebden Bridge: Peacock Press. 9-11.

--- (2002b). ‘Microtonality, the Recorder and the Quarter-Tone Recorder Manual’. *The Recorder Magazine*, 22/3, Mytholmroyd, Hebden Bridge, UK: Peacock Press. 99-102.

--- (2004). *Concert Programme*. Bennetts, K. and Bowman, P. 2 April 2004. Tudely Church, Tonbridge.

Bouterse, J. (2012). ‘Recorders – Research’. Personal Communication (E-mail). 20 January 2012.

Bowman, P. (1995). ‘The Birth of a Truly Contemporary Recorder’. *The Recorder Magazine*. Vol 15/1. Mytholmroyd, Hebden Bridge, UK.: Peacock Press. 126.

--- (1999). Ornaments in the Duets of Pierre Danican-Philidor. *Recorder Education Journal*, 5/1999, Cook Music Library, School of Music, Indiana University, 1201 E. 3rd Street, Bloomington IN 47405-7006, USA: American Recorder Teachers’ Association and The European Recorder Teachers’ Association (UK). 14-20.

--- (2006). The Reluctant Tongue. *Recorder Education Journal*, REJ 12. Cook Music Library, School of Music, Indiana University, 1201 E. 3rd Street, Bloomington IN 47405-7006, USA: American Recorder Teachers’ Association and The European Recorder Teachers’ Association (UK). 17-20.

Boyd, A. (2007). ‘Landscape, Spirit and Music’. *The Soundscapes of Australia*. Ed. Richards, F. Aldershot: Ashgate. 11-33.

Braun, G. (1994). Im Grenzbereich - Einige Anmerkungen zu Mathias Spahlingers “nah, getrennt” für Altblockflöte solo. *TIBIA*, 4/1994, Celle, Germany: Moeck Verlag. 294-298.

Brindley, G. (1969). A Method for Analysing Woodwind Cross-Fingerings. *The Galpin Society Journal*, Vol. 22. The Galpin Society. 40-46.

Bryars, G. (2009). ‘Foreword’. *The Ashgate Research Companion to Experimental Music*, Saunders, J. Farnham, Surrey: Ashgate Publishing Limited. xiii.

Burkholder, J.P., D.J. Grout, C.V. Palisca. (2006). *A History of Western Music*. New York/London: W. W. Norton and Company.

Butt, J. (2002). *Playing with History*. Cambridge: Canbridge University Press.

Campbell, M. and C. Greated. (1998). *The Musician's Guide to Acoustics*. New York: Oxford University Press.

Campbell, M. and C. Greated. 'Loudness'. *Grove Music Online*. Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/17030>. (Accessed 3 February 2012).

Cardanus, H. (1546). 'On Recorders, their Shape and Secrets'. *Writings on Music*. Trans. Miller, C.A. (1973). USA: American Institute of Musicology, p.62-71.

Cardew, C. (1961). 'Notation – Interpretation etc.'. *Tempo*, No. 58, Cambridge University Press. 21-33.

Castellani, M. (1977). 'The Regola per suonare il Flauto Italiano by Bartolomeo Bismantova (1677)'. *The Galpin Society Journal Vol. 30 (May 1977)*. 76-85.

Cirlot, J.E. (1962). *A Dictionary of Symbols*. London: Routledge.

Clarke, E. (1995). 'Expression in Performance: Generativity, Perception and Semiosis'. *The Practice of Performance, Studies in Musical Interpretation*. Ed. Rink, J. Cambridge: Cambridge University Press. 21-54.

Coker, W. (1972). *Music and Meaning*: *a Theoretical introduction to Musical Aesthetics*. London: The Free Press (Collier-Macmillan).

Cole, H. (1974). *Sounds and Signs - Aspects of Musical Notation*. London: Oxford University Press.

Coleman, C. (1913). 'Birds in Symbolism'. *Catholic Encyclopedia (1913)*. Online. <www.Catholic_Encyclopedia_(1913)/Birds_(In_Symbolism)> . (Accessed 31 march 2014).

Collins English Dictionary. *s.v.* 'Tension'. 2nd Edition 1986.

Cook, N. (1994). *A Guide to Musical Analysis*. Oxford: Oxford University Press.

Cook, N. (1998). *Music (A Very Short Introduction)*. Oxford: Oxford University Press.

Cooper, G. and L. Meyer. (1966). *The Rhythmic Structure of Music*. Chigago: Phoenix Books. 1-11

Cope, D. (1997). *Techniques of the Contemporary Composer*. USA: Schirmer.

Criton, P. 'Vyschnegradsky, Ivan Aleksandrovich'. *Oxford Music Online*. Oxford University Press.
<http://www.oxfordmusiconline.com/subscriber/article/grove/music/29509>.
(Accessed 26 April 2013).

Daniélou, A. (1968). *The Ragas of Northern Indian Music*. London: Barrie and Rockliff.

Davenport, M. (1996). 'Book Review'. *American Recorder*, XXXVII no. 2, Littleton USA: American Recorder Society Inc. 36-38.

Davis, A. (2010). 'Thoughts on Authenticity'. *Recorder Magazine*, 30/3, Hebden Bridge, UK: Burbidge. 76-80.

Delker, E. (1984). *Ansätze zur Untersuchung dynamischer Ausdrucksmöglichkeiten auf der Blockflöte*. *EM 4028*. Celle: Moeck Verlag.

Dessy, R. (1999). 'What New Experiments, Modeling, and Simulation are Telling us about Real Recorders'. *American Recorder*, XXXX no. 2, Littleton, USA: American Recorder Society Inc. 8-10.

Dipert, R.D. (1980). 'Composer's Intentions: an Examination of their Relevance for Performance'. *Musical Quarterly*, 66/2. London: Oxford University Press. 205-218.

Dolmetsch, C. (1972). Letter to Martin Dalby. 7 September 1972.

Dufourt, H. (2010). *Contemporary Music - Theoretical and Philosophical Perspectives*. Ed. Paddison, M. and Deliège, I. Farnham, England: Ashgate.

Dumoulin, H. (2007). *Zen Enlightenment, Origins and Meaning*. London: Shambhala.

Dunsby, J. 'Performance'. *Grove Music Online*. Oxford Music Online. <http://www.oxfordmusiconline.com:80/subscriber/article/grove/music/43819>. (Accessed 25 November 2009).

Dunsby, J. (1989). 'Considerations of Texture'. *Music and Letters*, 70/1, Oxford: Oxford University Press. 46-57.

Dyer, J. 'Roman Catholic Church Music.' *Grove Music Online*. Oxford Music Online. Oxford University Press. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/46758>. (Accessed 31 March 2014).

Ehrlich, R. (1993). 'Frans Brüggen oder die Vermarktung eines Star-Musikers'. *Tibia*, 18/2, Celle, Germany: Moeck Verlag. 449-452.

Emmerson, S. and D. Smalley. 'Electro-acoustic music'. *Grove Music Online*. Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/08695>. (Accessed August 27 2011).

Fales, C. (2002). 'The Paradox of Timbre'. *Ethnomusicology: Journal of the Society for Ethnomusicology*, Vol. 46, No. 1, University of Illinois Press. 56-95.

Fischer, J. (1990). *Die Dynamische Blockflöte*. Celle, Germany: Moeck Verlag.

Fox, C. (2003). 'Hybrid Temperaments and Structural Harmony: A Personal History'.

Contemporary Music Review, 22, 1/2, Oxford: Routledge. 123.

--- (2006). 'More Heat, More Light: Christopher Fox in Conversation'. *Tempo*. Vol. 60, No. 236, (April 2006). Cambridge: Cambridge University Press, 13-19.

--- (2009a). 'Christopher Fox in Interview with James Saunders'. *The Ashgate Research Companion to Experimental Music*, Ed. Saunders, J. Farnham, Surrey: Ashgate Publishing Limited. 261-270.

--- (2009b). 'Why Experimental? Why me?'. *The Ashgate Research Companion to Experimental Music*, Ed. Saunders, J. Farnham, Surrey: Ashgate Publishing Limited. 7-26.

--- (2013). Private email message, 24 October 2013.

Fox, C. 'Catalogue of Works'. Online. <http://www.foxedition.co.uk/Fox_Edition_works.pdf>. (Accessed 1 February 2015).

Fox, C. and D. Osmond-Smith. 'Scelsi, Giacinto'. *Grove Music Online*. Oxford Music Online, Oxford University Press. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/24720>. (Accessed 27 January 2013).

Fredrickson, W.E. (2001). 'The Effect of Performance Medium on Perception of Musical Tension'. *Bulletin of the Council for Research in Music Education*, University of Illinois Press. 60-64.

Fredrickson, W.E. and J.C. Coggiola. (2003). 'A Comparison of Music Majors' and Non-majors' Perceptions of Tension for Two Selections of Jazz Music'. *Journal of Research in Music Education*, 51/3, The National Association for Music Education. 259-270.

Fritsch, J. (2006). 'Allgemeine Harmonik, Tonsysteme, Mikrotonalität - ein geschichtlicher Überblick'. *Orientierungen - Wege im Pluralismus der Gegenwartsmusik*, Hiekel, J.P. Mainz: Schott Music. 107-122.

Gabrielsson, A. (1985). 'Interplay between Analysis and Synthesis in Studies of Music Performance and Music Experience'. *Music Perception*, Vol. 3/1, University of California Press. 83.

Galfrido, F. (1440). *Promptorium Parvulorum Sive Clericorum*. London: Sumptibus Societatis Camdenensis. 425-426

Ganassi, S. (1535). *Opera Intitulata Fontegara*. Translated by Peter, H. (1959). Berlin: Lienau.

Georgiades, T. (1974). *Music And Language (The Rise of Western Music as Exemplified in Settings of the Mass)*. Heidelberg (Cambridge): Springer Verlag (Cambridge University Press).

Gilbert, A. 'Lumsdaine, David'. *Oxford Music Online.* Grove Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/17164>.

(Accessed 25 November 2009).

Gilbert, A. (1984). *Birdsong - Some Technical Pointers for the Composer*. MMus (Dissertation). University of Leeds.

Glover, J.M. ‘Anthony Gilbert, Unclassified Composer’. Online. <www.anthonygilbert.net/essay.html>. (Accessed 31 March 2014).

Gombrich, E.H. (1984). *The Sense of Order - a study in the psychology of decorative art*. Oxford: Phaidon.

Gombrich, E.H. (1988). *The Story of Art*. Oxford: Phaidon.

Greated, C. ‘Comma’. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/06186>. (Accessed 6 April 2010).

Griffiths, P., M. Lindley and I. Zannos. ‘Microtone’. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/18616>. (Accessed 16 September 2013).

Griffiths, P. (1994). *Modern Music, A Concise History*. New York: Thames and Hudson Inc.

Griscom, R. and D. Lasocki. (2003). *The Recorder, A Research and Information Guide*. New York: Routledge.

Gritten, A. and E. King. (2006). *Gesture and Music*. Aldershot: Ashgate.

Haar, J. a. ‘Bembo, Pietro’. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/02625>. (Accessed 10 May 2013).

Haar, J. b. ‘Humanism’. *Grove Music Online*. Oxford Universtity Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/40601>. (Accessed 19 June 2011).

Haberl, D. (2010). ‘”Labore et Constantia” - Das Leitmotiv im Leben von Franz Xaver Haberl. Ein Beitrag zu seinem 100. Todestag’. *Beiträge zur Geschichte des Bistums Regensburg*, Bd. 44, Regensburg: Bistums Regensburg.

Hall, D.E. (1990). *Musical Acoustics*. Pacific Grove, USA: Brooks/Cole Publishing.

Hall, M. (1979). ‘LeFanu and “Deva”.’ *The Musical Times*, 120, No. 1633, Musical Times Publications Ltd. 202-203.

Hall, M. (1992). ‘The Country of my Childhood. The Australian Composer David Lumsdaine “Needs to be an Exile”’. *The Music Times*, 133, No. 1793. 329-331.

Hall, M. (2003). *Between Two Worlds, The Music of David Lumsdaine*. Todmorden, UK: Arc Music.

Halmrast, T., K. Guettler, R. Bader, and R.I. Godøy. (2010). 'Gesture and Timbre'. *Musical Gestures - Sound, Movement, and Meaning*, Godøy, R.I. and Leman, M. New York: Routledge. 183-211.

Halstead, J. (1997). *The Woman Composer*. Aldershot: Ashgate.
Hamilton, A. (2009). 'The Sound of Music'. *Sounds and Perception - New Philosophical Essays*, Nudds, M. and O'Callaghan, C. Oxford: Oxford University Press, p.146-182.

Hanslick, E. (1957). *The Beautiful in Music*. Indianapolis: Bobbs-Merrill.

Harley, M.A. 'Birdsong'. *Grove Music Online*. Oxford UNiversity Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/03123>. (Accessed 16 September 2013).

Harper, J. (1991). *The Form and Orders of Western Liturgy from the Tenth to the Eighteenth Century*. Oxford: Clarenden Press.

Haskell, H. (1996). *The Early Music Revival, A History*. London: Dover Publications Inc.

Hatch, P. (2013). *Peter Hannan*. Online. <www.thecanadianencyclopedia.ca/en/article/peter-hannan-emc>. (Accessed 21 March 2014).

Hauwe, W.v. (1984). *The Modern Recorder Player*. *1*. London: Schott.

--- (1990). Plädoyer für eine Akzentverschiebung im Blockflötenunterricht. *Tibia*, 15, No. 2, Celle, Germany: Moeck Verlag. 128-131.

--- (1992). *The Modern Recorder Player*. *Volume 3*. London: Schott.

--- (1995). 'The Recorder in Crisis? A View from the Dutch Conservatory'. *Recorder Education Journal*, 2, Durham NC27707, USA: American Recorder Teachers' Association. 75-77.

Hechler, I. (1997). *'Von Vogel- und Flötenstimmen'*. *Sine Musica Nulla Vita*. Ed. Delius, N. Celle: Moeck Verlag. 119-131

Hiley, D. and J. McKinnon, (ed.). (1990). 'Plainchant Transfigured: Innovation and Reformation through the Ages'. *Antiquity and the Middle Ages*. London: Macmillan Press. 120-142.

Höffer von Winterfeld, L. (1976). 'Griffkombinationen und Klangfarben auf der Blockflöte'. *Tibia*, 2/76, Celle, Germany: Moeck Verlag. 77–80.

Hooper, M. (2009). 'Reconfigurations in the Facture of Lumsdaine's *Cambewarra*:

Re-experiencing a Territory'. *Sixth Biennial International Conference on Music Since 1900*. 183-212.

Hotteterre, J.J. (1707). *Principes de la Flute Traversiere, ou Flute d'Allemagne, de la Flute a bec, ou Flute douce et du Hautbois*. Translated by Lasocki, D. (1984). London: Barrie and Jenkins.

Hughs, E. (1915). 'Musical Memory in Piano Playing and Piano Study'. *Musical Quarterly*, 1 - 1915, 592-603.

Hunt, E. (2002). *The Recorder and its Music*. Hebden Bridge: Peacock Press.

Ives, C. (1925). Some "Quarter-tone" Impressions. *Franco-American Music Society Bulletin*, New York: Pro-Musica Quarterly. 24-32.

Johnson, R.S. (1995). Birdsong. *The Messiaen Companion*, Hill, P. London: Faber and Faber.

Kanno, M. (2003). Thoughts on How to Play in Tune. *Contemporary Music Review*, 22/1-2, Routledge. 35-52.

Karkoschka, E. (1972). *Notation in New Music*. London: Universal Edition UE 26902.

Karp, T. 'Requiem Mass, Chant', *Grove Music Online*. Oxford University Press: Oxford Music Online.
<http://www.oxfordmusiconline.com/subscriber/article/grove/music/43221>.
(Accessed 26 March 2014).

Keller, H. (1973). *Phrasing and Articulation*. Norton (USA): Norton & Co. Inc.

Keown, D. (1996). *Buddhism - A very short introduction*. Oxford: Oxford University Press.

Kingma. *Eva Kingma Flute Maker*. <http://www.kingmaflutes.com>. (Accessed 1 February 2015).

Kivy, P. (1980). *The Corded Shell*. Princeton: Princeton University Press.

Kivy, P. (1997). *Authenticities*. New York: Cornell University Press.

Kottick, E.L. (1974). *Tone and Intonation on the Recorder*. New York: McGinnis and Marx.

Kraft, D. (2000). *Birdsong in the Music of Olivier Messiaen*. PhD Dissertation . Middlesex University.

Kreitner, K., M. Térey-Smith, J. Westrup, D.K. Holoman, G.W. Hopkins, P. Griffiths, J.A. Conrad. 'Instrumentation and Orchestration'. *Grove Music Online*. Oxford University Press: Oxford Music Online.
<http://www.oxfordmusiconline.com/subscriber/article/grove/music/20404>.
(Accessed 14 June 2011).

Lander, N.S. Recorder Home Page: '*History*'. Online. <http://www.recorderhomepage.net/history/>. (Accessed April 15 2014).

Lasocki, D. (2010). The Recorder in Print: 2008. *American Recorder*, L1:3, St. Louis: American Recorder Society. 14-24.

Lasocki, D. 'Recorder'. *Grove Music Online*. Oxford University Press: Oxford Music Online. <www.oxfordmusiconline.com/subscriber/article/grove/music/23022>. (Accessed 27 January 2015).

Laurin, D. (1999). 'Shaping the Sound'. *American Recorder*, Vol. XXXX, No. 4, Littleton, USA: American recorder Society. 13-17.

Leedy, D. and B. Haynes. 'Intonation'. *Grove Music Online*. Oxford University Press: Oxford Music Online. <www.oxfordmusiconline.com/subscriber/article/grove/music/53762>. (Accessed 7 April 2013).

LeFanu, N. (1974). Nicola LeFanu. *The Same Day Dawns*. Programme Note. Online. <http://www.musicsalesclassical.com/composer/work/904/8019>. (Accessed 15 April 2014).

--- (1980). 'West and East'. *The Musical Times*, Vol.121 No.1643, Hove: Musical Times Publications Ltd. 28-29.

--- (1994). Nicola LeFanu. *Dawn's Dove*. Programme Note. Online. <http://www.musicsalesclassical.com/composer/work/904/1233>. (Accessed 15 April 2014).

--- (2006). Nicola LeFanu. *Making Music in Britain - interviews with those behind the notes*, Ed. Haddon, E. Aldershot UK: Ashgate. 125.

--- (2009). 'The Guest Artist Q&A'. *New Notes*, 03/09, London: SPNM, Sound and Music. 11.

--- (2010). *RE: A Travelling Spirit*. Private email message

Lehrmann, A.C., J.A. Sloboda, R.H. Woody. (2007). 'The Performer'. *Psychology for Musicians - Understanding and Acquiring the Skills*. New York: Oxford University Press. 165-184.

Linde, H-M. (1983). 'Neue Musik für Alte Instrumente'. *zum 50jährigen Jubiläum der Schola Cantorum Basiliensis*, Reidemeister, P. & Gutmann, V. Winterthur, Switzerland: AMADEUS-Verlag. 395-404.

Linde, H-M. (1991). *The Recorder Player's Handbook*. London: Schott.

Lippman, E.A. (1990). *Musical Aesthetics, a Historical Reader, Vol. 3 (The Twentieth Century).* New York; Pendragon Press.

Lockwood, L. and D. Crawford. 'Giovanni Guidetti'. *Grove Music Online*. Oxford University Press: Oxford Music Online. <www.oxfordmusiconline.com/subscriber/article/grove/music/11959?q=Giovanni+Guidetti>. (Accessed 12 July 2010).

Loeffler, B.D. (2006). *Instrument Timbres and Pitch Estimation in Polyphonic Music*. Master of Science Dissertation . Georgia Institute of Technology.

Loretto, A. (2003). Double Chamfers. *Recorder Magazine*, 23/2, Hebden Bridge, UK: Peacock Press. 50.

Loy, G. (2006). *Musimathics, The Fundamental Foundations of Music. 1*. London: MIT Press.

Loy, G. (2007). *Musimathics, The Mathematical Foundations of Music. 2*. London: MIT Press.

Lumsdaine, D. (1983). *Towards a Zen Music.* Lecture Notes. Unpublished.

Lumsdaine, D. and M. Hall. (1992). 'The Country of My Childhood. The Australian Composer David Lumsdaine "Needs to Be an Exile", Aspects of Australian Music'. *The Musical Times*, Vol. 133, No. 1793, Hove: Musical Times Publications Ltd. 329-331.

Lumsdaine, D. (1993a). Composer to Composer. Ed. Ford, A. London: Quartet Books Ltd. 70-77.

--- (1995). Liner notes to *Cambewarra Mountain*. Tall Poppies Records. CD TP083.

--- (2006). David Lumsdaine Biography. Sydney: Australian Music Centre. <www.australianmusiccentre.com.au/artist/lumsdaine-david>. (Accessed 13th August 2009).

--- (2007). Quoted in Boyd. Landscape, Spirit and Music – An Australian Story. In *The Soundscapes of Australia – Music, Place and Spirituality*. Ed. Richards, F. Aldershot, UK. Ashgate. 11 – 33.

--- (2010). 'Towards a Zen Music'. Email. Private Correspondence. 27 January 2010

--- Composer Biography. Sydney: The Australian Music Centre. <http//:www.australianmusiccentre.com.au/artist/lumsdaine-david>. (Accessed 14 April 2014).

Lüpke, A. v. (1940). 'Untersuchungen an Blockflöten'. *Akustische Zeitschrift 5*, Leipzig: S. Hirzel.

Mac Erlaine, S. (2009). *Microtonality as an Expressive Device: An Approach for the Contemporary Saxophonist*. Master of Music Dissertation . Dublin Institute of Technology.

Macarthur, S. (2007). 'Women, Spirituality, Landscape'. *The Soundscapes of Australia:*

Music, Place and Spirituality, Ed. Richards, F. Aldershot: Ashgate. 51-74.

Macmillan, D. (2008). *The Recorder in the Nineteenth Century*. Mytholmroyd, West Yorkshire: Ruxbury Publications.

Magill, P.C. and L. Jacobson. (1978). 'A Comparison of the Singing Formant in the Voices of Professional and Student Singers'. *Journal of Research in Music Education*, Vol. 26, No. 4, National Association for Music Education/SAGE. 456-469.

Malouf, D. (1999). *Fly Away Peter*. In *The Soundscapes of Australia* Ed. Fiona Richards, Sydney and London: Vintage.

Man, R. d. (2010). Interview with Walter van Hauwe. Online. <http://www.youtube.com/watch?v=iW2DCIyfycc>. (Accessed 19 March 2014).

Man, R. d. Works. Online. <www.roderikdeman.com/works>. (Accessed 19 March 2014).

Manning, P. 'Computers and music'. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/40583>. (Accessed 4 September 2013).

Martin, J. (1994). *The Acoustics of the Recorder*. Celle, Germany: Moeck Verlag.

Marvin, B. Online. <http://bobmarvinrecorders.wordpress.com/>. (Accessed April 11 2011).

Mather, B.B. (1973). *Interpretation of French Music From 1675-1775*. New York: McGinnis & Marx.

Mauser, S. (2007). 'Mikrowelten'. *Orientierungen (Wege im Pluralismus der Gegenwartsmusik*, Ed.Hiekel, J.P. Mainz: Schott, p.100-103.

Mayer Brown, H. and S. Sadie. (1989). *Performance Practice, Music Before 1600*. Basingstoke: MacMillan Press.

Mayes, A. (2008). *Aspects of performance practice in works for recorder composed for Carl Dolmetsch between 1939 and 1989*. PhD Dissertation. Birmingham City University.

McAdams, S. (1999). 'Perspectives on the Contribution of Timbre to Musical Structure'. *Computer music Journal*, 23;3, Paris, France: IRCAM. 85-102.

McAdams, S. (2001). 'Recognition of Sound Sources and Events'. *Thinking in Sound, The Cognitive Psychology of Human Audition*, McAdams, S. and Bigand, E. Oxford: Oxford University Press. 146-198.

McKinnon, J. 'Communion'. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/06199>.

(Accessed 31 March 2014).

Medley, D. (1995). ‘Recorders and Reeds; 4 Foot and 8 Foot Pitch’. *The Recorder Magazine*, 16/1, Hebden Bridge: Peacock Press. 16-18.

Merritt, R. (1993). *Early Music and the Aesthetics of Ezra Pound*. New York: The Edwin Mellen Press.

Messiaen, O. (1940). ‘My Birds’. Quoted in *Olivier Messiaen, Music and Color.* (1986*).* Samuel, C. Portland, Oregon: Amadeus Press. 95.

Metzer, D. (2003). *Quotation and Cultural Meaning in Twentieth-Century Music*. Cambridge: Cambridge University Press. 1-15

Meynaud, M. (1997). ‘Ein Cross-Interview’. *Windkanal*, 3/1997, Fulda, Germany: Mollenhauer. 6-8.

Mitchell, D. (1963). *The Language of Modern Music*. London: Faber & Faber.

Montoya, K. (2003). ‘Song and Wind (Effective Breathing and Tone Production for Singers and Woodwind Players)’. *Recorder Education Journal*, REJ 9, 2003. 8-13.

Moore, B.C.J. (2002). ‘Interference Effects and Phase Sensitivity in Hearing’. *The Royal Society*, Cambridge: University of Cambridge. 833-855.

Moore, B.C.J. ‘Hearing and psychoacoustics’. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/42531>. (Accessed 26 Feb. 2013).

Morris, T. (2006). *What do Buddhists Believe?* London: Granta.

Mühle, C. (1979). *Untersuchung Über die Resonanzeigenschaften der Blockflöte*. Frankfurt/Main: Verlag das Musikinstrument.

Nattiez, J-J. (1990). *Music and Discourse - Toward a Semiology of Music*. Princeton, New Jersey: Princeton University Press.

New Guide To Opera. “NGtO”. Online. <www.newguidetoopera.de.>. (Accessed 10 April 2014).

Norton, R. (1984). *Tonality in Western Culture*. Philadelphia: Pennsylvania State University.

O’Hagan, P. (2003). *Aspects of British Music of the 1990s*. Aldershot: Ashgate.

O’ Kelly, E. (1990). *The Recorder Today*. Cambridge UK: Cambridge University Press.

O’Kelly, E. (1995). ‘The Recorder Revival ii: The Twentieth Century and its Repertoire’.

The Cambridge Companion to the Recorder, Thompson, J.M. & Rowland-Jones, A. Cambridge: Cambridge University Press. 152-166.

O'Kelly, E. *Biography*. Online. <http://eveokelly.com/biography>. (Accessed September 2013).

Organic Design. 'Gallery of Microtonal Guitars'. Online. <http://www.organicdesign.org/peterson/instruments.html>. (Accessed 17 April 2014).

Oxford English Dictionary. *s.v.* 'Dadaism' (2002).

Pace, I. and J. Saunders. 'Fox, Christopher'. *Groves Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/48595?q=Fox%2C+Christopher&search=quick&pos=1&_start=1#firsthit>. (Accessed June 2013).

Paperback Oxford English Dictionary (2002). *s.v.* '*Process*'. New York: Oxford University Press.

Pasler, J. 'Neo-Romantic'. *Groves Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/40720>. (Accessed 27 March 2014).

Pears Cyclopaedia. *s.v.* 'Dadaism' (1991-1992). L32

Powers, H. and F. Wiering. 'Hypomixolydian'. *Grove Music Online*. Oxford Music Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/13664>. (Accessed March 27 2014).

Quantz, J.J. (1752). *On Playing the Flute*. Ed. Reilly, E. R. (1966). New York: Schirmer Books (Faber & Faber).

Rechberger, H. (1987). *Die Blockflöte in der zeitgenössischen Musik*. Online. <http://sonopt.pp.fi/>. (Accessed 27 March 2014).

Reid, S. (2002). 'Preparing for Performance'. *Musical Performance, A Guide to Understanding*. Ed. Rink, J. Cambridge: Cambridge University Press. 102-112.

Reiss, S. (1987). 'Pitch Control: Shading and Leaking'. *American Recorder*, 28/4, American Recorder Society. 136-139.

--- (2005). 'Articulation: The Key to Expressive Playing'. *Recorder Education Journal*, REJ 11, 2005. American Recorder Teachers' Association. 5-11.

--- (2006). 'Pitch Control: Shading and Leaking'. *Recorder Education Journal*, REJ 12. 2006. American Recorder Teachers' Association. 2-5.

Richards, F. (2007). ‘Introduction: Spirit of Place, Spiritual Journeys’. *The Soundscapes of Australia*, Ed.Richards, F. Aldershot, UK: Ashgate. 1-10.

Rijn, F.v. (2004). ‘Klankkleur van blokfluiten (Tone Colour of Recorders)’. *De Bouwbrief*, No.114, Arnhem. Netherlands: Huismuziek. 6-9.

Rink, J. (2002). ‘Analysis and (or?) performance’. *Musical Performance a Guide to Understanding*. Ed. Rink, J. Cambridge: Cambridge University Press. 35-58.

Risatti, H. (1975). *New Music Vocabulary*. Chicago: University of Illinois Press.

Ritter, M. (1996). ‘Books’ *The Recorder Magazine*, xvi/2, Hebden Bridge, UK: Peacock Press. 25-26.

Roma, C. (1991). ‘Contemporary British Composers’. *Women and Music: A History*, Ed. Pendle, K. Bloomington USA: Indiana University Press.

Rose, P. (1996). ‘In Living Color!’ *American Recorder*, 37/2, Littleton, USA: American Recorder Society. 12-15.

Rowland-Jones, A. (1995). ‘A Short History of Partial Venting’. *Recorder Magazine*, xv/2, Hebden Bridge, UK: Peacock Press. 48-50.

--- (2002). ‘The Recorder in the Art of Titian’. *American Recorder*, XLIII, No.2, Littleton: American Recorder Society. 7-13.

--- (2008). ‘The Background to Lully’s Use of Recorder Symbolism’. *American Recorder*, XLVIV, No. 1, St. Louis: American Recorder Society. 7-15.

--- (2009). ‘Thank You, M. Lully (Part 1)’. *The Recorder Magazine*, Vol.29, No.4, Hebden Bridge, UK: Peacock Press. 137.

--- (2010). ‘Thank you, M. Lully (Part 2)’. *The Recorder Magazine*, Vol.30, No.1, Hebden Bridge, UK: Peacock Press. 4-5.

Rüdiger, W. (2003). ‘Musical Breathing in the Eighteenth Century’. *Recorder Education Journal*, REJ 9, 2003. 2-7.

Sandell, G.J. (1995). ‘Roles for Spectral Centroid and Other Factors in Determining “Blended” Instrument Pairings in Orchestration’. *Music Perception: An Interdisciplinary Journal*, 13/2, University of California Press. 209-246.

Schoenberg, A., G. Strang, G. (ed.). (1967). *Fundamentals of Musical Composition*. London: Faber and Faber.

Schubert, E. and J. Wolfe. (2006). ‘Does Timbral Brightness Scale with Frequency and Spectral Centroid?’. *Acta Acustica United with Acustica*, Vol. 92, S. Hirzel Verlag Stuttgart, Germany: The Journal of the European Acoustics Association (EAA). 820 – 825.

Schultz, A. (1991). 'Identity and Memory: Temporality in the Music of David Lumsdaine'. *Studies in Music*, Vol. 25, 95-101.

Scruton, R. (1997). *The Aesthetics of Music*. New York: Oxford University Press.

Scruton, R. (2009). *Understanding Music, Philosophy and Interpretation*. London: Continuum UK.

Seashore, C.E. (1936). 'The Psychology of Music III. The Quality of Tone: (1) Timbre'. *Music Educator's Journal*, 23/1, MENC: The National Association for Music Education. 24-26.

Sheldon, D. and G. Blythe. (1990). *The Whales' Song*. London: Red Fox Books.

Steenhoven, K.v. (1992). 'Das Ricercar. Virtuose Improvisation und kreative Übemethode'. *Tibia*, 1/1992, Celle, Germany: Moeck Verlag. 1-9.

Stegemöller, E.L., E. Skoe, T. Nicol, C.M. Warrier, N. Kraus. (2008). 'Music Training and Vocal Production of Speech and Song'. *Music Perception: An Interdisciplinary Journal*, Vol. 25, No. 5, University of California Press. 419-428.

Steinkopf, O. (1983). *Zur Akustik der Blasinstrumente*. Celle, Germany: Moeck Verlag.

Stevens, S.S. (1936). 'A Scale for the Measurement of a Psychological Magnitude: Loudness'. *Psychological Review*, Vol. 43/5, American Psychological Association. 405-416.

Stevens, S.S. (1955). 'The Measurement of Loudness'. *The Journal of the Acoustical Society of America*, Volume 27, No.5, Acoustical Society of America. 815-829.

Stichting Blokfluit. *Catalogue of Contemporary Blockflute Music*. Online. <www.blokfluit.org>. (Accessed 4 May 2012).

Stockhausen, K. (1997). 'Das Porträt: Karlheinz Stockhausen in Gespräch mit Kathinka Pasveer'. *Tibia*, 2/1997, Celle, Germany: Moeck Verlag. 420-427.

Stone, K. (1980). *Music Notation in the Twentieth Century: a Practical guidebook*. New York: W. W. Norton. 67-69

Straus, J.N. (2005). *Introduction to Post-Tonal Theory*. Upper Saddle River, New Jersey: Pearson/Prentice Hall.

Stravinsky, I. (1939). *Poetics of music in the form of six lessons*. Harvard University Press.

Sundberg, J. (1977). 'The Acoustics of the Singing Voice'. *Scientific American*, March, 82.

Suzuki, T. 'Repertoire'. Online. <www.tosiyasuzuki.com>.
(Accessed 21 March 2014).

Takeuchi, A.H. and S.H. Hulse. (1993). 'Absolute Pitch'. *Psychological Bulletin*, Vol. 113. No. 2, The American Psychological Association. 345-361.

Talbot, M. "Concerto". *Grove Music Online. Oxford Music Online.* Oxford University Press. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/40737>. (Accessed 10 April 2014).

Tan, S-L. P. Pfordresher, R. Harré. (2010). *Psychology of Music - From Sound to Significance*. Hove, UK: Psychology Press. 31-51

Tarasti, E. (1994). *A Theory of Musical Semiotics*. Bloomingtom/Indianapolis: Indiana University Press.

Tarling, J. (2004). *The Weapons of Rhetoric*. St. Albans: Corda Music Publications.

Taruskin, R. (1988). 'The Pastness of the Present and the Presence of the Past'. *Authenticity and Early Music*, Ed. Kenyon, N. New York: Oxford University Press, p.137-207.

Taruskin, R. (1995). *Text and Act, Essays on Music and Performance*. New York: Oxford University Press.

Taylor, C. and M. Campbell. 'Sound'. *Grove Music Online*. Oxford Music Press: Oxford Music Online.
<http://www.oxfordmusiconline.com/subscriber/article/grove/music/26289>.
(Accessed 20 March 2014).

Taylor, H. (2008). 'Decoding the Song of the Pied Butcherbird: an initial survey'. *12-2008*. Online. <http://www.sibetrans.com/trans/index.htm>. TRANS-Transcultural Music Review 12 (article 13). (Accessed 26 November 2009).

Thompson, J.M. (1971). 'Michael Vetter: profile by J. M. Thompson'. *Recorder and Music Magazine*. London: Schott Music. 317-320.

Toop, R. 'Stockhausen, Karlheinz'. *Grove Music Online*. Oxford University Press: Oxford Music Online.
<http://www.oxfordmusiconline.com/subscriber/article/grove/music/26808>
(Accessed 27 April 2013).

Turner, J. (2010). 'LeFanu and Lumsdaine'. E-Mail correspondence. 7 September 2010.

Universtity of New South Wales. Online.
<www.animations.physics.unsw.edu.au/jw/dB.htm>.
(Accessed 20 March 2014).

Vetter, M. (1968). Apropos Blockflöte. *Melos, Zeitschrift für Neue Musik*, 35/12, Switzerland. 461-468.

Visisonor. Online. <http://www.visisonor.net/BlockfluteFestival/Bios_VanHauwe.htm>. (Accessed 18 March 2014).

Vysloužil, J. 'Hába, Alois'. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/12113>. (Accessed 28 April 2013).

Weber, J.F. 'Recorded sound'. *Grove Music Online*. Oxford University Press: Oxford Music Online. <http://www.oxfordmusiconline.com/subscriber/article/grove/music/26294>. (Accessed 27 April 2013).

Welch, C. (1911). *Lectures on the Recorder in Relation to Literature*. London: Oxford University Press. 1-22

Wells, P. (2001). 'Giving the Fingers II: Fingering for Expressive Purposes in the Music of the Baroque'. *Recorder Magazine*, 21/1, Hebden Bridge, UK: Peacock Press. 8-11.

Werntz, J. (2001). 'Adding Pitches: Some New Thoughts, Ten Years after Perspectives of New Music's "Forum: Microtonality Today"'. *Perspectives of New Music*, 39/2, Perspectives of New Music. 159-210.

Whittall, A. *'hermeneutics'.* The Oxford Companion to Music. *Ed. Alison Latham.* Oxford Music Online*. Oxford University Press.* <http://www.oxfordmusiconline.com/subscriber/article/opr/t114/e3224>. (Accessed 23 Jan. 2015).

Whittall, A. (2003). 'James Dillon, Thomas Adès, and the Pleasure of Allusion'. *Aspects of British Music of the 1990s*, Ed. O'Hagan, P. Aldershot, UK: Ashgate Publishing Ltd. 5.

Winton, T. (2003). *Dirt Music (Quoted in In The Soundscapes of Australia Ed. Fiona Richards, 2007)*. Sydney: Picador.

Wolters, M. 'Michael Wolters'. *British Music Collection*. Online. <http://soundandmusic.org/thecollection/node/13273>. (Accessed 11 April 2014).

--- (2012). PRS for Music Foundation. Interview. Online. <http://www.prsformusicfoundation.com/Partnerships/Flagship-Programmes/New-Music-20x12>. (Accessed 11 April 2014).

--- (2013). Liner note to *Kathryn and Peter Play the Recorder*. Compact disc. Birmingham Record Company, CD1.

Wood, J. (1986). 'Microtonality: aesthetics and practicality'. *The Musical Times*, 127/1719, Musical Times Publications Ltd. 328-330.

Yarker, J. (2012). 'The Voyage'. *New Music 20x12 programme note*. South Bank Centre. Sunday 15 July 2012. Confirmed in private communication by email with the author.

Zahnhausen, M. (1995a). ‘Markus Zahnhausen in Conversation with Andrew Mayes’. *The Recorder Magazine*, Vol.15, No.1, Hebden Bridge UK: Peacock Press. 3-6.

--- (1998a). ‘Markus Zahnhausen, Blockflötist und Komponist, im Gespräch mit Brigitte Schmaus’. *Tibia*, 23/3, Celle, Germany: Moeck verlag. 177-189.

--- (1997). *Lyrische Szenen*. Programme Note, 8-9.

--- (2010). ‘Kontakt Homepage’. Private Email correspondence. 3 June 2010.

--- *Auszeichnungen*. Online. <www.zahnhausen.com/>. (Accessed 22 March 2014).

RECORDINGS

Bousted, D. *A Journey Among Travellers*. Bennetts, K. and P. Bowman. 1998. QTR CD07-98. London: QTR Recordings.

Bousted, D. *Whale Song*. Bennetts, K and P. Bowman. 2013. QTR CD13-09. London: QTR (Unpublished).

Bowman, P. *Dialogue for One Recorder Player*. Kathryn Bennetts. 2013. QTR CD13-09. London: QTR.

Chapman, G. Spotted Nightjar (*Eurostropodus argus*).
<www.graemechapman.com.au/library/sounds.php?c=346&p=55>.
(Accessed 15th March 2014).

Fox, C. *Winds of Heaven - Part 1*. Hannan, Peter. 1989. SRI 001. Toronto: SRI Classics, SRI 001.

Fox, C. *Winds of Heaven - Part 2*. Hannan, Peter. 1989. SRI 001. Toronto: SRI Classics, SRI 001.

LeFanu, N. *Reflections*. MSV CD92064. 2005. Doddington, Cambridgeshire: Métier Records.

Lumsdaine, D. (2010a). *White Dawn*. MSV 28519 A. Doddington, Cambridgeshire: Métier Records

Lumsdaine, D. (2010b). *White Dawn*. MSV 28519 B. Doddington, Cambridgeshire: Métier Records.

Varèse, E. (1957). *Poème électronique*. Online.
<http://www.medienkunstnetz.de/refmovie.php?mov=7&play=audio>.
(Accessed 5 May 2014).

Wolters, M. (2013a). *Kathryn and Peter Play the Recorder*. Bennetts, K, Bowman, P. Birmingham Record Company, CD1, CD2.

Zahnhausen, M. *Lux Aeterna; Lyrische Szenen; Jahreszeichen*. Laurin, S. (1999). CD-1013. Djursholm, Sweden: Grammofon AB BIS.

SCORES

Bartók, B. (1944). *Sonata for Solo Violin*. Urtext Edition. (1994). New York: Boosey and Hawkes.

Berio, L. (1966). *Gesti.* London: Universal. U.E. 15627.

Bousted, D. (1995). *A Journey Among Travellers.* London: Composer Press.

Bousted, D. (1997). *Five Quarter-Tone Pieces for solo alto and tenor recorders*: Unpublished

Bousted, D. (2003). *Whale Song.* Armidale, Australia: Orpheus Music. OMP100.

Bowman, P. (2013). *Dialogue for One Recorder Player*. Unpublished Score

Braun, G. (1992). *Five Meditations for Tenor recorder.* Vienna: Universal Edition UE 18750.

Braun, G. (1996/1998). *Flauto aperto*. Wilhelmshafen: Heinrichshofen Verlag N2429.

Braun, G. (1997). *Albumblätter.* Celle: Moeck Verlag ED1584.

Braun, G. (1999). *Tempi passati - 8 letzte Stücke.* Wilhelmshaven: Heinrichshofen.

Britten, B. (1958). *The Dove,* from Noye's Fludde. Ed. Bennetts, K, Bowman, P. AB 2846. London: ABRSM.

Casken, J. (1979). *Thymehaze.* London: Schott. S & Co. 7072.

Ferneyhough, B. (1982). *Superscriptio*. London: Edition Peters 7289a.

Fox, C. (1984). *Winds of Heaven.* The Fox Edition. Online. <http://www.foxedition.co.uk/>. (Accessed 27 march 2014).

Hába, A. (1921). *Quartet for Strings*. Vienna: Universal Edition. U.E. 6418.

Hashiramoto, M. (1992). *Krishna.* Münster: Mieroprint. EM 1103.

Ishii, M. (1991). *Tenor-Recorder Piece - east•green•spring.* Celle: Moeck. EM 1551.

Ives, C. (1924). *Three Quarter-tone Pieces for two Pianos (One tuned ¼-tone sharp)*.New York: C. F. Peters, (1968); ed. by George G. Pappastavrou.

LeFanu, N. (1974). *The Same Day Dawns.* London: Novello.

LeFanu, N. (1993). *Ervallagh.* London: Novello.

LeFanu, N. (1994). *Dawn's Dove.* London: Novello.

LeFanu, N. (2007). *Seven Inventions and a Passacaglia.* London: Edition Peters. EP 71208.

Linde, H-M. (1968). *Music For a Bird.* London: Schott. OFB 48.

Lumsdaine, D. (1992). *A Norfolk Songbook.* York: University of York Music Press.

Lumsdaine, D. (1993b). *Curlew in the Mist.* York: University of York Music Press.

Lumsdaine, D. (1994). *Metamorphosis At Mullet Creek.* Manchester: Forsyth.

Masumoto, K. (1975). *Pastorale for Recorder Solo.* Tokyo: Zen-On Music Co., Ltd. R-105.

Shinohara, M. (1968). *Fragmente.* London: Schott. S & Co. 6929.

Wolters, M. (2013b). *The Voyage*. Unpublished Score.

Wolters, M. (2004). *Kathryn und Peter Durchqueren die Antarktis.* Unpublished Score.

Wolters, M. (2000). *She Stays*. Unpublished Score.

Wolters, M. (1998). *My Own Step Song*. Unpublished Score.

Wolters, M. (2012). *7 Shakespeare Songs*. Unpublished Score

Yun, I. (1993). *Chinese Pictures*. Berlin: Boosey & Hawkes, 1746.

Zahnhausen, M. (1991). *Sieben Stücke für Altblockflöte.* München, Germany: Doblinger 04 457

Zahnhausen, M. (1992a). 'Frühlingsmusik'. *Jahreszeichen.* Wolfenbüttel, Germany: Möseler-Verlag M22.439.

Zahnhausen, M. (1992b). 'Sommerklänge'. *Jahreszeichen.* Wolfenbüttel, Germany: Möseler-Verlag M22.442.

Zahnhausen, M. (1992c). 'Herbstmusik'. *Jahreszeichen.* Wolfenbüttel, Germany: Möseler-Verlag M22.439.

Zahnhausen, M. (1992d). 'Winterbilde'. *Jahreszeichen.* Wolfenbüttel, Germany: Möseler-Verlag M22.440.

Zahnhausen, M. (1995b). *Lux Aeterna*. Wolfenbüttel, Germany: Möseler Verlag M22.448

Zahnhausen, M. (1997). *Lyrische Szenen.* Wolfenbüttel, Germany: Möseler Verlag. M22.601.

Zahnhausen, M. (2003). *Horns of Elfland.* Mainz: Schott Music. OFB198