

**Collaboration in practice:
developing a repertoire of
extended techniques for the
Kingma System alto and bass flute**

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Abstract

This doctoral research explores the benefits of the Kingma System as applied to the alto and bass flute. It demonstrates each instrument's potential for the use of extended techniques and the way in which these techniques are applied to the repertoire. The research takes place within the context of my own personal practice as a recitalist and chamber musician, and is represented through recordings of a selection of the repertoire and a website for each instrument, as well as a written commentary.

The discussion of repertoire focuses on case studies selected from over 75 works composed for me using these Kingma System instruments. These case studies are presented through recordings, as well as in a detailed discussion of the use of specific aspects of the instruments' capabilities, including multiphonics, microtonality, alternate fingerings, tone colour, articulation and other extended techniques. The approaches of different composers regarding the notation of these techniques within the repertoire are also explored, and the practical information arising from these case studies is presented as a reference guide for composers and performers in website form. These websites can be found at www.altoflute.co.uk and www.bassflute.co.uk, and include multimedia demonstrations, fingering charts and notational examples. Much of this information is being made available for the first time, and includes the most extensive published selection of multiphonics and trill fingerings for the alto and bass flute. This is also the first survey of extended techniques that is specifically dedicated to instruments enabled by the Kingma System.

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Preface

This project was made possible through the financial assistance of the Arts and Humanities Research Council and the Royal College of Music, to whom I am extremely grateful. Thanks are due to Professor Colin Lawson, Director of the RCM, to former Director of Programmes and Research, Professor Amanda Glauert, and to Dr Natasha Loges, Assistant Head of Programmes.

I would like to thank David Burnand, without whose vision this project would not have existed, technical supervisor Nick Romero for his assistance with the websites and practical supervisors and mentors Robert Dick and Wissam Boustany. Thanks are also due to the staff of the RCM Studios, and in particular Stephen Harrington and Ben Wiffen for their professionalism and for being such a pleasure to work with.

My thanks go to all the composers who have explored the potential of the Kingma System, without whom this project would not have been possible, especially Claes Biehl, Coreen Morsink and Scott Wilson who made extra efforts to make sure any materials lost in the fire were replaced. My thanks also to the members of *rarescale* for their open-minded willingness to try new repertoire, and particularly to electronics player and composer in residence Michael Oliva, who has been an inspirational collaborator, duo-partner and trusted friend throughout the Kingma System journey.

This project owes more than a debt of gratitude to the creator of the Kingma System, Eva Kingma, for her wonderful instruments, friendship and support over the years. Thanks also to flute makers Bickford Brannen and Lev Levit for their support during this project.

I would like to thank my parents, Derek and Judy Rees, for their endless encouragement, help and support, and my grandfather, David Wynne Rees, for being a constant inspiration. Last, but by no means least, special thanks to Colin Pilgrim for always being there when I needed him, especially in the tough times.

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Conventions

Throughout this thesis, the following conventions apply:

Where appropriate, all pitches referred to in this thesis use Helmholtz notation of written (not sounding) pitch, as outlined below:

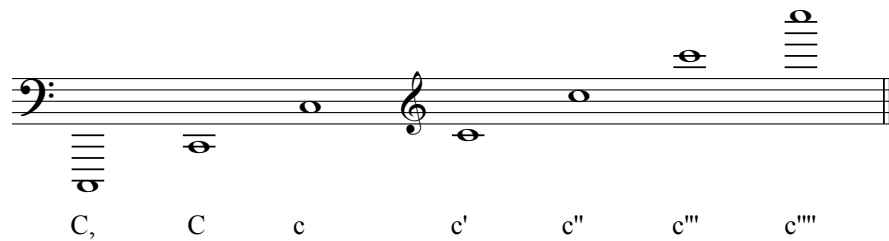


Figure i: Helmholtz Pitch Notation

The names of flute keys refer to the pitches created when that key is closed – i.e. the F key refers to the key which, when closed, produces a written F. Kingma System keywork is referred to in the same terminology as is used by the maker, so for example the D up key is the key used to produce D quarter sharp. The keys of the Kingma System C flute are shown in the diagram below. Although there are some variations in key positioning with the alto and bass flute, the general principals it demonstrates apply to each instrument.

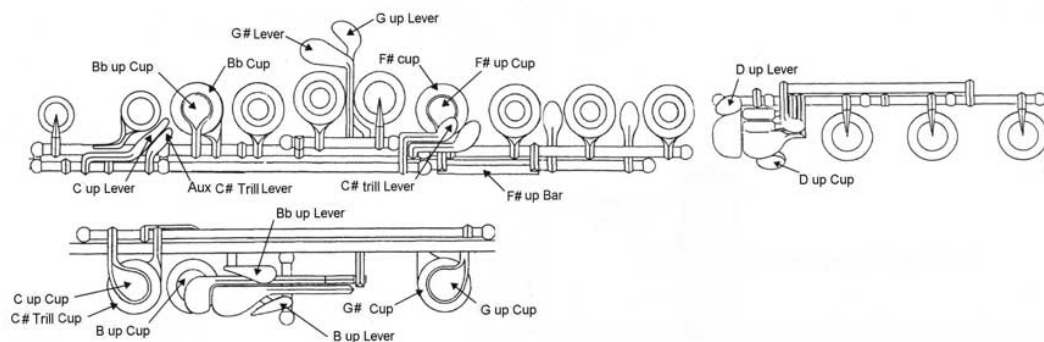


Figure ii: Key layout of a Kingma System C Flute ©Eva Kingma and reproduced with permission.

The Kingma System® is a registered trademark.

1. A revolution in contemporary flute design: the Kingma System

The Kingma System, developed by Dutch flute maker Eva Kingma in the 1980s, is arguably the most innovative and significant transformation of the flute's mechanism since the work of Theobald Boehm in the 19th century, and has the potential to become the design standard for new flutes. This doctoral research explores the benefits of the Kingma System, as applied to the alto and bass flute, examined through both the available techniques and their practical application within the repertoire. The work takes place within the context of my own personal practice as a performer, both as a soloist and as a member of the contemporary chamber ensemble, *rare-scale*, which was founded in 2003 to promote repertoire for the alto and bass flute.

The thesis is presented through three elements. Recordings of a selection of the repertoire, with works chosen for their ability to demonstrate different aspects of the instrument's technical capabilities, are presented on CD. The technical capabilities of each of the instruments are explained and outlined on two websites, at www.altoflute.co.uk and www.bassflute.co.uk, created as a reference tool for composers and performers. This information is presented in website form to enable the inclusion of multimedia material, as well as to allow the content to be quickly updated and to be easily accessible internationally. These practical aspects of the research are accompanied by this written commentary, which discusses the ways in which the techniques presented on the websites are incorporated into the repertoire.

Repertoire worked on throughout this project was performed, both in the UK and abroad, recorded, and a selection of the works were published in London by Tetractys for wider dissemination.

Case Studies: A summary

Since commissioning the first full Kingma System alto flute in 2000, I have worked with a range of composers in order to develop repertoire for the instrument. This project was expanded in 2007 to take into account the creation of the first upright Kingma System bass flute. During that time, I have received over 75 works written specifically for Kingma System flutes, and several hundred works for standard alto and bass flute. The aim of these collaborations was to create a repertoire for the future, as well as for performers today. The potential of the instruments to play accurate microtones has resulted in a number of works with electronics, and it has been interesting to compare different approaches to microtonal composition, as well as to the synchronisation of live music with electronic sounds.

The recordings included in this submission provide example performances of a selection of this repertoire, and were recorded at the RCM Studios. In addition, Murail's *Unanswered Questions* is included here to demonstrate how the Kingma System's fingerings may be applied to existing repertoire.

These case studies, listed below, appear here as a practical demonstration of the application of the techniques and particular capabilities of Kingma System low flutes. Each of the pieces, apart from the example by Murail, was composed for me, and detailed discussions of the instruments, their capabilities and limitations and my own preferences as a performer took place with the composer during the process of their creation. Each of the pieces was subject to a series of revisions during the rehearsal process to refine the writing and to ensure practical efficacy, and provided an opportunity to explore aspects of technique available on the Kingma System that perhaps had not been used elsewhere. As such, these challenging works combine to give an overview of the enhanced possibilities provided by the Kingma System, and serve the purpose of showcasing the System as applied to the alto and bass flute. A number of the composers included here –

Christian Baldini, Claes Biehl, Dan Di Maggio, Michael Oliva and Scott Wilson – had written solo or chamber works for me previously and therefore already had some experience of writing for low flutes, the Kingma System and my own personal preferences and limitations as a performer. Coreen Morsink's piece was written as part of a collaboration project for a conference, and we had no prior knowledge of each other's work.¹ Marc Tweedie wrote his piece after attending *rarescale's* Summer School for composers, where he was able to experience Kingma System low flutes at first hand. The composers range from advanced students (Biehl, Morsink and Tweedie wrote these works during their PhD studies) to mid-career professional composers, and this selection of composers also covers a variety of nationalities.

The CD track listing is as follows:

Disc 1

[1 & 2] Tristan Murail – *Unanswered Questions (1995)*

Versions for open-hole alto flute (following the composer's instructions in the score) [track 1] and Kingma System alto flute [track 2]

Recorded 22 July 2011 - Ben Wiffen, engineer

[3] Claes Biehl – *evocazione del mare (2009)*

For Kingma System bass flute and electronics

Recorded 8 June 2009 - Claes Biehl, producer - Michael Oliva, engineer

[4] Scott Wilson - *Vortically (2009)*

For Kingma System bass flute and electronics

Recorded 12 May 2011 - Nick Romero, producer - Stephen Harrington, engineer

¹ This work was composed as part of the Royal Musical Association Collaboration in Music Study Day at the University of Leeds on 23 October 2010. The timetable for the collaboration was set according to the terms of the study day, and began at the end of May 2010. The first performance took place at the Study Day in October 2010.

[5] Coreen Morsink – *Andromache’s recitativo, aria and subtext* (2010)

Version for Kingma System alto flute

Recorded 19 May 2011 - Nick Romero, producer - Stephen Harrington, engineer

[6] Dan Di Maggio – *Same Old Monsters* (2009)

For Kingma System bass flute and electronics

Recorded 5 May 2011 - Nick Romero, producer - Stephen Harrington, engineer

[7] Christian Baldini – *Kingma and the Duke* (2013)

For Kingma System bass flute

Recorded 26 February 2013 - Stephen Harrington, engineer

[8] Marc Tweedie – *Zoli* (2009)

For Kingma System bass flute

Recorded 19 May 2011 - Nick Romero, producer - Stephen Harrington, engineer

[9] Michael Oliva – *Apparition and Release* (2005)

For Kingma System alto flute and electronics

Recorded 29 June 2005 - Produced and engineered by Michael Oliva

Released on rarescale records rr001, rarescale plays Michael Oliva

©2008

[10] Michael Oliva – *Bereft Adrift* (2007)

For Kingma System bass flute and electronics

Recorded 2008 - Produced and engineered by Michael Oliva

Released on rarescale records rr001, rarescale plays Michael Oliva

©2008

Disc 2

[11] Michael Oliva – *Les Heures Bleues (2013)*

For Kingma System alto flute

Recorded 1 October 2013 - Produced and engineered by Michael Oliva

This repertoire, developed throughout my own relationships with composers, inevitably reflects my own strengths and preferences as a performer. For example, pieces are often written with my sound, approach to interpretation and technical abilities in mind, and the extended techniques used will undoubtedly be biased towards those within my capabilities. For example, none of the pieces written for me require circular breathing as a vital part of the work, since this is a technique that I have not yet mastered on low flutes. However, despite this, and perhaps in some ways because of this, my own technical and musical abilities have been vastly extended through the creation of this repertoire. I often ask composers for musical and technical challenges, and the virtuoso nature of some of the works has arisen directly out of an intention to stretch my abilities. Different composers' approaches to microtonality have deepened my interest in this area of composition in particular, and my knowledge has increased exponentially since my first time playing a Kingma System alto flute, when I had never heard a complete quartertone scale before. In the 14 years since then, I have become much more technically proficient with the necessary changes to hand positions and my agility has increased significantly; this too is reflected in the repertoire. Heather Roche states that "An individual repertoire has become increasingly important to performers of contemporary music, a repertoire of new music that reflects their own tastes, collaborations and unique abilities."² This reflects my own personal experience, especially in relation to the repertoire for low flutes which tends to develop around individual performers. It perhaps arises from a change in focus between the prevalence of the composer-performer and the current preference for composition as an

² Roche, Heather, *Dialogue and Collaboration in the Creation of New Works for Clarinet* (Doctoral Thesis, University of Huddersfield, September 2011), 91

independent discipline. Within this climate, having a broad collection of pieces which are tailor-made for a particular performer is not all that unusual.

Websites

The two websites, which form a core part of this project, can be found at www.altoflute.co.uk and www.bassflute.co.uk. These sites function as a guide to composers interested in writing for these instruments, as well as for performers interested in playing them. As such, they cover the technical aspects that have arisen as a result of the creation and performance of the works heard on the CD, including multiphonics, timbral variations, microtones, trills, articulations and other extended techniques, as detailed in the site map shown in Fig. 1 below. The websites are developed from a concept previously produced on CD ROM,³ incorporating multimedia to provide audio and video examples, notational charts and extensive fingering charts for a wide range of extended and standard techniques.

³ Rees, Carla and Burnand, David, *Composing for Quarter Tone Alto Flute*, (London: Royal College of Music, 2003) CD ROM.

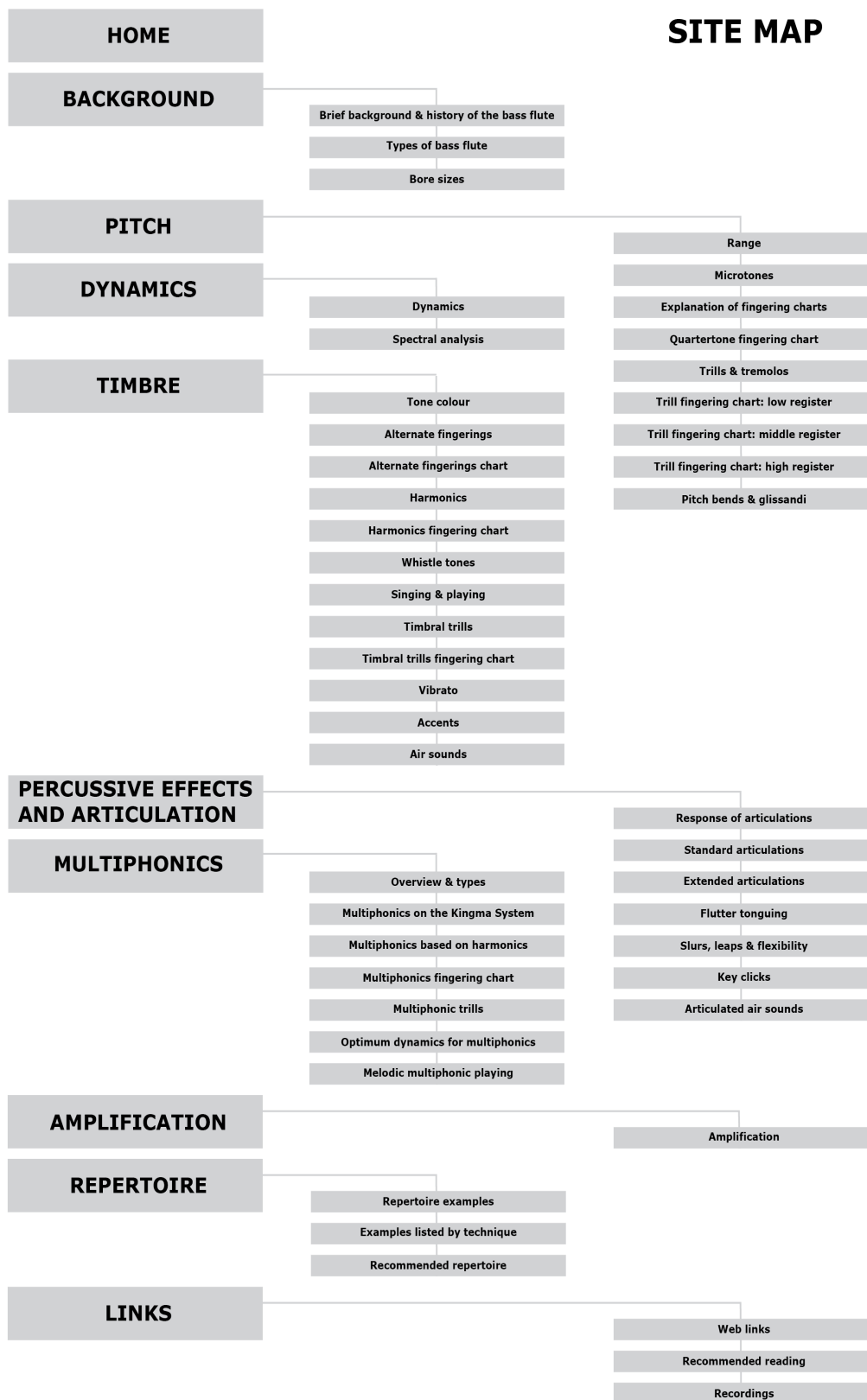


Figure 1: Site map to show organisational structure of each of the websites

The websites contain a wide range of information, from fundamental areas such as each instrument's history, range, standard articulations, harmonics and response, to advanced extended techniques, such as the provision of fingerings for a large selection of multiphonics, microtonal trills and alternate fingerings. Repertoire examples are also provided for each instrument, for further exploration of a range of styles and the practical application of the techniques discussed. The information included within the websites was compiled and developed through a series of collaborations with composers, as well as through my own individual exploration of the instruments, and as such, this work is fully integrated within my own professional work with the ensemble *rarescale* and beyond. The websites are aimed primarily towards composers, and the information presented will also be of use to performers. The websites are not intended to function as a tutor for contemporary techniques, as this is covered in detail elsewhere, for example by Pierre-Yves Artaud, Robert Dick and Carin Levine.⁴ Instead, the websites focus on the practical application of these techniques. For composers, they present a catalogue of available techniques with all the information required to incorporate these techniques into a score, including fingerings, optimum dynamics and notational examples. For the performer, the websites serve as a reference tool, offering a selection of practical solutions to the performance of extended techniques, primarily in the form of tried and tested fingerings for microtones, multiphonics, trills, timbral trills, alternate fingerings and multiphonic trills. Since many of these include the use of keys which only exist on Kingma System flutes, this information is not available elsewhere. The websites also offer performers a range of repertoire

⁴ The three most widely recognised manuals of extended flute techniques are Artaud, Pierre-Yves, *Flûtes au Présent* (Paris: Billaudot, 1995); Dick, Robert, *The Other Flute – A Performance Manual of Contemporary Techniques*, 2nd Edition (New York: Multiple Breath Music, 1989) and Levine, Carin and Mitropoulos-Bott, Christina, *The Techniques of Flute Playing Volume 1: Flute* (Kassel: Bärenreiter 2002). These manuals are primarily aimed towards flute players and offer advice regarding the execution of each of the presented techniques.

suggestions for both Kingma System and closed-hole instruments, and links to further resources, including recordings.

The need for detailed information regarding the application of the Kingma System to the alto and bass flute can be seen through an increase in interest in the development of repertoire for these instruments in recent years. The ensemble, *rarescale*, of which I am Artistic Director, was founded in 2003 with a view to creating and promoting recital repertoire for low flutes within a chamber music context. Since the ensemble's formation, we have held an open call for scores, inviting composers of all ages and nationalities to submit works using the alto or bass flute, as well as two international composition competitions, in 2004 and 2013. During this time, we have received over 750 new works, with approximately 10 per cent of these focussing on Kingma System instruments.

In the case of Kingma System alto and bass flutes, composers are often writing for instruments they have never heard live, or even seen. For example, within the repertoire presented on the CD, two of the composers were based in Europe and one in the United States.⁵ It is not always practical for composers to travel in order to experience the instruments at first hand. In order to compose effectively for them, composers need to develop an understanding of the physical demands of the instruments for the performer, as well as the idiosyncratic responses from the instruments themselves. The technical capabilities and response of the bass flute are particularly difficult for uninitiated composers to predict, since the size of the instrument creates a number of inherent challenges for the player, and the sheer volume of air required for the instrument's operation can be a limiting factor in certain areas. While the alto flute has become more widely owned by

⁵ Coreen Morsink, composer of *Andromache*, is resident in Greece, and the collaboration included one face-to-face meeting on the day of the first performance. Dan Di Maggio, who wrote *Same Old Monsters* is based in Italy, and we met for the first time in this collaboration at the recording session of his piece. One further example is *Kingma and the Duke* by Christian Baldini, who lives in California. We had one face-to-face meeting at the beginning of the collaborative process.

players in recent years, and therefore more accessible to composers, the bass flute remains something of a rarity, and specialist players are in short supply. This further increases the necessity for a resource such as the websites created as a part of this research, which can clarify certain areas of technique and provide reliable and accurate information on a range of sounds, from basic techniques to contemporary effects. The use of the bass flute will be discussed in more detail through the works of Christian Baldini, Michael Oliva, Marc Tweedie and Scott Wilson.

Without any reference material available, composers are dependent on the performer to provide information about these instruments, and many common issues, such as understanding the Kingma System's potential for multiphonics or microtonal agility, recur within the works received. In general, without access to specific information, it is my experience that composers write relatively conservatively for the instruments, for example by limiting their use of multiphonics to those which can be played easily on the open hole C flute. The pieces which make most extensive use of the Kingma System's capabilities, such as those included as examples in this research, are those that have been written in close discussion with the performer. For the capabilities of these instruments to be fully exploited, there is a need to make detailed information available to composers, in a format that is unambiguous, editable to allow revisions and additions as knowledge increases, and as comprehensive as possible. Using this as a starting point, this project seeks to clearly document the capabilities of Kingma System alto and bass flutes, combining theory and practice to enhance and expand current knowledge, and developing working methods that may be applied in the future to the study of other instruments.

This written commentary seeks to bring together these elements, addressing the technical and interpretational aspects of this repertoire within the context of my own practice as a performer specialising in music for low flutes.

The Kingma System

Dutch flute maker Eva Kingma (b. 1956) is widely regarded as the world leader in alto and bass flute design, and her innovative work includes improvements to the sound quality and response of the headjoint. She began to develop the Kingma System in the late 1980s, initially in collaboration with her uncle, Dirk Kuiper. The starting point for the design was an order for an alto flute with open holes from Dutch flute player Jos Zwaanenburg's in 1987.⁶ The size of the alto flute meant that an open-hole version was possible with some design modifications from a standard instrument. However, a 1989 order for an open-hole bass flute for Robert Dick revealed that, with a bigger instrument, the finger stretches required were excessive. Kingma's solution to the problem was to develop a 'key-on-key' system, which enabled the small central holes, i.e. the open holes that are usually covered by the fingers, to be covered instead by smaller keys, operated through the use of levers. This has since developed into the Kingma System, which modifies the standard Boehm flute to provide extra venting on each key, enabling a full range of quartertones, in addition to a wider range of multiphonic and timbral possibilities.

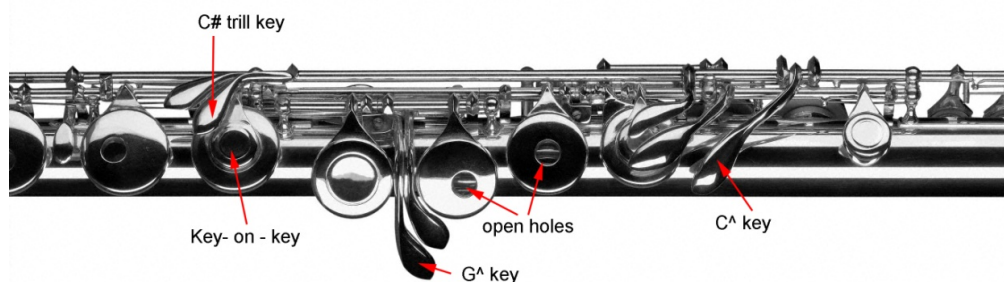


Figure 2: Kingma System alto flute. Photograph ©Eva Kingma 2000

The Kingma System is based on a standard Boehm flute, with five open holes and an additional C sharp trill key. It has, in addition, six extra keys, using the key-on-key design, providing levers to open and close small holes in the centre of the keys that are not operated directly by the fingers. The system is slightly modified for each size of flute to cater

⁶ For a timeline of the Kingma Flute Company history see <http://www.kingmaflutes.com/mySite/index-1.html> (accessed 21 March 2013)

for the additional stretches between tone holes, so the bass flute has fewer open holes and more key-on-key keys than the alto flute. An animated version of the system, showing the additions to the standard Boehm flute, can be seen on the Kingma website.⁷

The extra keys are positioned in such a way that they never interfere with traditional playing, yet can be easily reached when needed. This means that a Kingma System instrument may be used for all repertoire, not just pieces specifically written for its enhanced capabilities. The fingering system is logical, and works on the basis of sharpening a standard pitch through opening a small hole in the centre of the key to produce the quartertone above; thus F quarter sharp is produced by opening the small hole in the centre of the F key and A quarter sharp is produced by opening the small hole in the centre of the A key.

The first prototype Kingma System alto flute was made for John Fonville in 1991.⁸ A full Kingma System alto flute was made for me in 2000 and a revolutionary upright bass flute with the full Kingma System was completed for me in 2007.⁹ In 1993 the Brannen-Kingma C flute was launched, and in 2007 Sankyo started to produce their own model of Kingma System C flutes, with the extra keywork available as an option on student level flutes. A third manufacturer, the Levit Flute Company, began producing Kingma System C flutes in 2012. It was announced in August 2009 that a new collaborative project, between Eva Kingma and Bickford and Laura Brannen would start production of a new model of standard-system (closed-hole) Kingma and Brannen alto flutes, with open-hole and full Kingma System models to follow.¹⁰

⁷ http://www.kingmaflutes.com/documenten/anim1/Kingmasys_anim.html
(accessed 22 August 2009)

⁸ <http://www.kingmaflutes.com/mySite/index-1.html> (accessed 21 March 2013)

⁹ The upright bass flute is made in a vertical alignment, so that instead of the player holding the instrument horizontally, the instrument can be rested on the floor by means of a cello-style spike.

¹⁰ *Exhibitor Showcase: Introduction of the new Kingma/Brannen Alto Flute*, National Flute Association Convention, New York 15 August 2009; Rees, Carla *The Kingma & Brannen Alto Flute: a Collaborative Model* *Flutist Quarterly*, the journal of the National Flute Association of America Volume XXXVII No 1 Fall 2011, 34-37

The open-hole version was launched in 2011 and the first full Kingma System model was completed in May 2013.

My own interest in the Kingma System stems from the desire to create an interesting and varied repertoire for the alto flute suitable for the recital platform. My decision to focus my attentions as a performer onto the alto flute were based purely on the instrument's sound rather than on its repertoire; at that time, in the late 1990s, very little published repertoire was available, and what little I could find tended towards the extremes of either simple, tonal melodic writing or complex atonality which presented musical and technical challenges that were beyond me at the time. Since Boehm's first alto flute was made in the late 1850s,¹¹ there was no historical development of repertoire through the ages, and although Boehm had made some arrangements of popular repertoire to play himself on the alto flute, these, too, were unpublished until relatively recently.¹²

As a student of both the flute and composition, I encouraged composer colleagues to write for the alto flute, and found that they were keen to incorporate the instrument, with its distinctive and previously largely underused tone, into their works. However, it quickly became clear that the alto flute's closed holes presented a major obstacle to writing within a contemporary idiom. Many of the flute's extended techniques, which had become an important part of the instrument's versatility since Robert Dick's systematic research in the 1970s, could not be achieved

¹¹ Further information regarding the history of the alto flute can be found at <http://www.altoflute.co.uk/01-background/history.html>

¹² Boehm's descendant, and curator of the Theobald-Boehm-Archiv, Ludwig Böhm, told me that he had seen a letter of 16 February 1862, offering the arrangements to Franz Philipp Schott for publication. Schott refused, because, at that time, the alto flute was not widely known. Boehm gave two volumes of the arrangements, in the hand of a copyist, to his last pupil, James Wilkins, who relocated to Cuba. After Wilkins' death, his widow gave the arrangements to Dayton C Miller, and they now reside in the Miller Collection at the Library of Congress in Washington DC. A complete edition of Boehm's works, including the arrangements for alto flute, was prepared by Ludwig Böhm and Raymond Meylan in 2012. (Telephone conversation with Ludwig Böhm, 8 February 2014)

on a closed-hole instrument.¹³ These limitations quickly became the source of much frustration, both for me as a performer and for the composers I was working with. For an explanation of the types of alto flute currently available (closed-hole, open-hole and Kingma System), and the major differences between them, see

<http://www.altoflute.co.uk/01-background/types.html>

The application of the Kingma System to the alto flute has solved these problems, as well as providing additional versatility that elevates the technical capabilities of the instrument beyond what can be achieved on a standard open-hole flute. However, alongside these possibilities comes the challenge of composing for an instrument which is still rare, and, in many cases, located in a distant geographical location from the composer. Especially in the case of the bass flute, which experience shows is particularly difficult to write for effectively, composers require contact time with the instrument and its player in order to avoid problematic issues. A commercial argument is also often made, especially by established composers, that writing for instruments as rare as these means limited opportunities for performance and minimal sales through publishing. This comes at a time when making a living from full-time composition is the domain of just a few, and while premieres are not uncommon, second performances are often harder to come by. Within the context of a specialist ensemble such as *rarescale*, some of the works written for us have received numerous performances in the UK and abroad, such as Michael Oliva's *Apparition and Release*, which has had more than thirty performances since it was written in 2005. While Kingma System repertoire is unlikely to sell a high volume of copies for mainstream publishers, specialist publisher Tetractys has a number of Kingma System works in its catalogue and

¹³ Robert Dick was a pioneer in the exploration and development of extended techniques for flute. His research is documented most fully in his work *The Other Flute* Dick, Robert, *The Other Flute – A Performance Manual of Contemporary Techniques*, 1st Edition (New York: Oxford University Press, 1975), and in the revised 2nd Edition (New York: Multiple Breath Music, 1989)

the availability of this repertoire may help to encourage other players to invest in Kingma System instruments.

A number of notable contemporary music performers choose not to use the Kingma System. Their reasons are outlined in Deborah Fether's 2005 dissertation:¹⁴

Robert Aitken, for example, felt that such flutes are not worth the financial investment for the limited repertoire which one can play on them. Other flautists feel that some of the advances in technical abilities brought about by these flutes are in fact possible on the Boehm flute, and it is, as Detta Danford described, such challenges which add to the calibre of a player.

These arguments demonstrate, in my view, a fundamental misunderstanding of the nature of the Kingma System. In my own practice, I use Kingma System instruments for all repertoire, not just those involving contemporary techniques, and I am not alone in doing so. The vast array of alternative fingerings and improved intonation makes these instruments ideal for the whole historical span of the repertoire, and these fingerings can even be used to play in the multitude of different tuning systems used before equal temperament. All of the technical challenges posed by the Boehm flute can be mastered on the Kingma System flute, and the player is required to handle extra keys and new types of hand movement to produce the additional multiphonics and microtones that these instruments offer. Although certain techniques, such as accurate quartertones are achieved more easily on a Kingma System instrument than a Boehm flute, the additional technical capabilities in turn stimulate further technical development of the player. My own experience is that my technical and aural abilities have developed substantially as a result of these extended capabilities, and I have no doubt that my calibre as a

¹⁴ Fether, Deborah, *A Discussion of Contemporary Flute Design and the Issues Surrounding These Developments*, (MMus Dissertation, Goldsmiths College, University of London, 2005), 46-48

player has increased specifically because of facing challenges which would not have been achievable on a Boehm flute.

For me, the Kingma System offers the opportunity to develop the virtuoso contemporary repertoire for my instruments, and this repertoire is created alongside my own development as a performer. Some of these pieces are later made into versions for standard Boehm flutes, and although many compromises have to be made to accommodate the closed holes, particularly in the areas of multiphonics and microtones, it is often found that a composer's open-minded approach when writing for the Kingma System develops further possibilities for the technical development of the Boehm flute. By removing the limitations imposed by closed-hole instruments, composers are at liberty to write for the flute in new ways, using new compositional languages and exploring a different range of possible techniques. Once these ideas are refined in the form of a new work, adaptation for standard Boehm system flutes stimulates a creative approach to instrumental technique. This then challenges those making the transcription to consider ways in which similar sounds may be produced on a more limited system.

In the case of Coreen Morsink's *Andromache*, it was found that some of the ideas being incorporated into a version for standard alto flute were more challenging for the instrument than they might have been had Morsink begun the compositional process with that instrument in mind. Morsink says:

Had I started writing this piece for [closed-hole] alto flute it wouldn't have been so adventurous...It's not that different, and not the end of the world to lose a few quartertones – I think the basic ideas still remain.¹⁵

For any composer, the idea of developing a standard instrument version is appealing, as it has the potential to bring their music into the

¹⁵ Coreen Morsink, email to Carla Rees, 30 July 2011

domain of many more players. However, it may be found in doing so that the technical complexity of performing an already difficult piece on an instrument with unfamiliar and problematic fingerings may result in only a small handful of players having the ability, or indeed the willingness, to approach the challenges it presents.

Literature Review

Resource books featuring both the alto and bass flute have been published in recent years including Pear and Browns-Evans' *The Alto Flute Companion*, Irene Maddox's brief *An Artist's Guide to Alto and Bass Flute* and Christine Potter's more comprehensive *Alto and Bass Flute Resource Book*.¹⁶ Repertoire lists dealing specifically with these instruments include Potter and Rees's online repertoire catalogue and Peter Munster's recently published repertoire list for auxiliary members of the flute family.¹⁷ In acknowledgement of a surge of interest in the lower members of the flute family, the National Flute Association of America included the formation of a Low Flutes Committee in its organisational structure in 2010, and the committee has since published a list of recommended repertoire for alto flute at all levels, from beginner to professional in 2011, and a similar list for bass flute was added in 2012.¹⁸

The Kingma System has been documented through journal articles and dissertations, including research projects at New York University in the

¹⁶ Pear, John and Brown-Evans, Glyn, *The Alto Flute Companion* (Manchester: Ephemerae, 1999); Andersen, Mark and Maddox, Irene, *An Artists' Guide to Alto and Bass Flute* (North Carolina: Pan Publications, 1983); Potter, Christine, *Alto and Bass Flute Resource Book* (New Hampshire: Falls House Press, 2005)

¹⁷ Potter, Christine and Rees, Carla, <http://www.chrispotterflute.com/altobass-resources/alto-and-bass-flute-repertoire/> (2000); Munster, Peter Van, *Repertoire Catalogue for Piccolo, Alto and Bass Flute* (Rome: Riverberi Sonari 2004) and an updated online supplement <http://www.petervanmunster.nl/page3.php> (accessed 27 May 2013)

¹⁸ <http://www.nfaonline.org/Stage-and-Studio/Low-Flutes/Low-Flutes-Selected-Alto-Repertoire.asp> (accessed 21 March 2013), <http://www.nfaonline.org/Stage-and-Studio/Low-Flutes/Low-Flutes-Selected-Bass-Repertoire.asp> (accessed 21 March 2013)

USA and at Goldsmiths College, University of London in the UK.¹⁹ Journal articles have been published by Anne LaBerge, Françoise Ducos, and Patricia Nagle and myself, and an article by Karen Bijsterveld and Marten Schiulp was published in the journal *Social Studies of Science*.²⁰

Although there are a number of comprehensive published guides to extended flute techniques, resources concerning techniques specific to the Kingma System alto and bass flutes are scarce. Dick's *The Other Flute* was first published in 1975, and is widely considered to be the definitive guide to the modern flute, giving information on the full range of extended techniques.²¹ The majority of the book's content is made up of fingering charts, including for microtones, alternate fingerings organized by timbre, and multiphonics. This is a comprehensive and well-produced resource, which is invaluable to flute players and composers. In regard to the alto and bass flute, he says:

The alto and bass flutes share a common, major problem for composers that is not an issue with the concert flute. Concert flutes are incredibly well standardized in bore size and are very similar in tone hole sizes and scales, piccolos, alto and bass flutes are not. These instruments vary in acoustically meaningful ways from maker to maker...Thus it is both impractical and unwise to assume that the various sonorities described in this book will transpose consistently to the...lower flutes.²²

Dick's comments accurately suggest that a website focusing on alto and bass flutes in general would result in a range of information that would

¹⁹ Shiung, Cindy Ying *The Brannen-Cooper Kingma System Flute: A resource Thesaurus of Multiphonic Production Capability* (PhD Thesis, New York University 2008); Fether, Deborah, *A Discussion of Contemporary Flute Design and the Issues Surrounding These Developments*, (MMus Dissertation, Goldsmiths College, University of London, 2005)

²⁰ La Berge, Anne, 'The Oston-Brannen Kingma System Flute', *Flutist Quarterly* No 20.4 Summer 1995, 88-90; Ducos, Françoise and Nagle, Patricia, 'A la recherche d'une flûte d'avenir: Le système Kingma', *Traversière*, Journal of the French Flute Society, No 74 Jan 2003, 46-51; Rees, Carla, 'Eva Kingma and the Quarter-Tone Flute', *Pan, Journal of the British Flute Society*, December 2007, 23-29, reprinted in *Flöte Aktuell*, Germany, April 2008 and *Falaut*, Italy, December 2008; Bijsterveld, Karin and Schulp, Marten, 'Breaking into a World of Perfection: Innovation in Today's Classical Musical Instruments', *Social Studies of Science* 34/5, October 2004, 649-674

²¹ op cit.

²² *ibid.* 7

not necessarily be applicable to all makes of instrument. By focusing the websites of this study to the Kingma System, and specifying the bore sizes of the instruments used in its creation, a level of consistency can be created to ensure that each fingering provided can be reliably reproduced on the instrument in question. Dick's comments also stress the need to test the fingerings given in both his and other similar resources for their accuracy on alto and bass flutes.

Carin Levine and Christina Mitropoulos-Bott's two-volume work, *The Techniques of Flute Playing*.²³ includes a volume with detailed resources for the alto and bass flute. Published in 2004, the existence of the second volume suggests that the consistency in response between makers has become more standardized than at the time of Robert Dick's book. However, Levine states:

For this book, instruments with closed holes and without a B footjoint ...were utilized. Alto and bass flutes are also available with open holes, however, since these exhibit such wide variations in construction, no generally applicable fingerings can be suggested. On the basis of the fingerings provided here for closed-hole flutes, each flutist should take the opportunity to discover new fingerings for himself.²⁴

Pierre-Yves Artaud gives 283 fingerings for multiphonics on the alto flute and 266 for the bass flute, largely based on harmonics as a result of the instrument's closed holes.²⁵ The most recent text on contemporary flute techniques, Tilmann Dehnhard's 2013 publication, *The New Flute* includes some video demonstrations on contrabass flute, but is otherwise entirely focussed on the C flute.²⁶ Hiroshi Koizumi's *Technique for Contemporary Flute Music* includes indications of which of the given techniques and fingerings may be produced on alto and bass

²³ Levine, Carin and Mitropoulos-Bott, Christina, *The Techniques of Flute Playing Volume 1: Flute and Volume II: Piccolo, Alto and Bass Flute* (Kassel: Bärenreiter, 2002 & 2004)

²⁴ *ibid.* vol 2, 8

²⁵ Artaud, Pierre-Yves, *Flûtes au Présent* (Paris: Billaudot, 1995), 80-110

²⁶ Dehnhard, Tilmann, *The New Flute* (Vienna: Universal Edition, 2013)

flute, and makes a distinction between bass flutes with and without trill keys.²⁷

None of these resources make reference to the Kingma System, since most of them predate its development, and perhaps more importantly, none of the resources that apply to the alto and bass flute reveal the bore size of the instruments used for testing.²⁸

Online multimedia resources

Given the paucity of printed material relating to the Kingma System, online resources can prove indispensable, and reflect the way in which practitioners seek information regarding specialist information. In general terms, technology has undoubtedly played a part in the dissemination of knowledge of instrumental techniques, and a number of online resources have emerged for the flute and other instruments. Orchestras and ensembles such as the Philharmonia and Psappha have developed information related to the instruments of the orchestra, but these are brief and serve more to educate the public than to give a detailed guide for practitioners.²⁹

In the case of other instruments, two resources in particular present detailed information for performers and composers. Both incorporate multimedia elements, such as video demonstrations, and cover a range of extended techniques. Christopher Redgate, who worked with instrument maker Howarth's to design the quartertone oboe, describes a number of extended techniques for his instrument, but although the information is comprehensive, the site is difficult to navigate and lacks

²⁷ Koizumi, Hiroshi, *Technique for contemporary flute music for players and composers* (Japan: Scott, 1996)

²⁸ The instrument's bore size has an impact on the balance of upper partials within the sound, which can in turn alter the pitch and balance of multiphonics in particular.

²⁹

http://www.philharmonia.co.uk/thesoundexchange/the_orchestra/instruments/flutes/extended_techniques/ (accessed 30 January 2013) and <http://www.compositionlab.co.uk/learn-about/woodwind/what-is-that-sound/flute--extended-techniques.aspx> (accessed 30 January 2013)

clarity in presentation.³⁰ Ellen Fallowfield and Thomas Resch's *Cello Map* is an ongoing project to document contemporary techniques for the cello.³¹ The *Cello Map* project links actions to sounds, provides acoustical information and contains clear diagrams and imaginative graphics. Other resources, such as those for clarinet,³² saxophone³³ and vibraphone³⁴ extended techniques are less comprehensive and difficult to navigate, with low quality graphics.

A selection of flute players have published information online regarding extended techniques at various levels of detail, including Helen Bledsloe, Larry Krantz, John McMurtery, Mats Moller, Wil Offermans and Matthias Ziegler.³⁵ They focus on the C flute, providing useful information for flute players on the production of the techniques described. Gergely Itzész's *Flouble* resource focuses on multiphonic fingerings for the C flute and provides a comprehensive, but somewhat difficult to understand, method of finding fingerings.³⁶

Again, none of these resources make mention of the Kingma System, including Matthias Ziegler's, who is heavily involved in testing and working with Eva Kingma's flutes.³⁷ The information provided on all of these sites is of a general, practical nature, explaining how each technique is produced but with the exception of Mats Möller's

³⁰ <http://www.21stcenturyoboe.com/> (accessed 21 March 2013)

³¹ www.cellomap.com (accessed 21 March 2013)

³² <http://userpages.umbc.edu/~emrich/clarinet21> by E. Michael Richards (accessed 23 March 2013)

³³ http://004500e.netsolhost.com/saxophone_extended_technique.htm author unknown (accessed 23 March 2013)

³⁴ http://www.malletjazz.com/lessons/ext_tech.html by James Walker (accessed 23 March 2013)

<http://helenbledsoe.com/?cat=4> (accessed 30 January 2013)

³⁵ <http://helenbledsoe.com/?cat=4> (accessed 30 January 2013),

<http://www.larrykrantz.com/et/et.htm> (accessed 30 January 2013),

http://www.johnmcmurtery.com/index.php?option=com_content&view=section&id=1&Itemid=8 (accessed 30 January 2013),

<http://www.sfz.se/flutetech/> (accessed 30 January 2013),

<http://www.forthecontemporaryflutist.com/> (accessed 30 January 2013),

<http://www.matthias-ziegler.ch/english/klangwelten/index.html> (accessed 30 January 2013)

³⁶ <http://www.flouble.com> (accessed 28 May 2013)

³⁷ Although video demonstrations of the Kingma System by Matthias Ziegler can be found on the Kingma Flutes website at

<http://www.kingmaflutes.com/mySite/kswhat.html> (accessed 4 May 2013)

quartertone fingering chart, none provide fingerings for any of the sounds discussed.

A small number of multimedia resources for Kingma System instruments do exist, however, created by flute makers to demonstrate their products. These include Matthias Ziegler's collection of videos on the Kingma website and a DVD featuring Robert Dick made by Brannen Brothers Flute Company in 2005.³⁸ Although providing some useful background information regarding the instruments, none of these Kingma-specific resources provide a comprehensive guide to extended techniques on these instruments.

These resources demonstrate that in making information available online, the level of presentation and the organization of the material is of paramount importance if the information is to be helpful to a wide range of users. The target audience is an important consideration, and the website must be well designed and easy to navigate. The most successful of these resources, in terms of navigability, are less text-heavy, relying more on demonstration. They also have clearly presented menus on each page, allowing the user to move between pages easily and quickly.

As a result of this survey of existing resources, care was taken in the organisation of material within the websites created for this project. Each of the websites was constructed using the same organisational structure, accessible through the home pages. A link was inserted in the site's header, to allow the user to switch between instruments from each page of the resource. This structure allows each instrument to have its own self-contained resource, without the need for the user to

³⁸ <http://www.kingmaflutes.com/mySite/kswhat.html> (accessed 21 March 2013), Dick, Robert *The Brannen-Cooper Kingma System Flute* (Boston: Brannen Brothers Flutemakers, 2005)

refer elsewhere for explanations of underlying premises.³⁹ Since the method of production and fingerings for these techniques are the same on each instrument, there is inevitably some duplication of material between the alto and bass flute websites. However, separation of the instruments in this way allows the presentation of instrument-specific material without confusion, and allows potential for the two sites to diversify further in later versions if required.

Players and Repertoire

Repertoire for alto and bass flutes, and for the extended capabilities of the Kingma System, is developing primarily around the few specialist players working in this field, with composers relying on direct contact with these players in order to use the full capabilities of the system. The table below shows a selection of players of Kingma System flutes of all sizes, outlining the way they incorporate the instruments into their work.

³⁹ Thereby avoiding the problem of Levine (2004) which refers the reader to another volume of the resource for explanations of the techniques.

Name	Location	Work Summary
Bledsoe, Helen	Germany	Performer in Musikfabrik, Köln Contemporary techniques repertoire list ⁴⁰
Boustany, Wissam	UK	Recitalist and orchestral player Use of alternative fingerings in conventional repertoire Commissioning of new works for C flute
Dick, Robert	USA	Using Kingma System since 1996 Worked in development of Brannen-Kingma C flute Modifications to Kingma design for his own use Composition of own works Pioneer in the development of flute contemporary techniques Brannen-Kingma DVD ⁴¹
Fonville, John	USA	Early involvement with Kingma System Book of exercises for microtonal flute ⁴² Uses quartertone instruments from Piccolo to Bass
Fredrickson, Marion Garver	USA	Low Flutes Specialist Full range of Kingma System instruments Former student of John Fonville
La Berge, Anne	Netherlands	Composer/improviser Use of electronics
Pahud, Emanuel	Germany	Principal flute of Berlin Philharmonic Orchestra Concerto soloist Use of alternative fingerings in conventional repertoire Development of contemporary repertoire
Rees, Carla	UK	Alto and bass flute specialist and recitalist Artistic Director of <i>rarescale</i> Development of contemporary repertoire
Ziegler, Matthias	Switzerland	Current Kingma collaborator Low flute specialist and composer Work with electronics, including amplification of internal air stream
Zwaanenburg, Jos	Netherlands	First player to commission open-hole alto and bass flutes. Academic positions in UK and Netherlands Development of contemporary repertoire

Figure 3: Kingma System flute players

⁴⁰ <http://www.helenbledsoe.com/erep.html> (accessed 23 August 2009)

⁴¹ op. cit. Dick (2005)

⁴² Fonville, John, *Quarter Tone Exercises For Flute* (San Diego: JonFon Publications, 1995)

Alongside my own work on alto and bass flute, other notable specialist low flute players include Christian Le Délézir (France: alto flute), Roberto Fabbriciani (Italy: notable particularly for his work in the development of the hyperbass flute), Marion Garver Fredrickson (USA: bass and contrabass flute), Christine Potter (USA: alto and bass flute), Peter Sheridan (Australia: bass and contrabass flute), Matthias Ziegler (Switzerland: alto, bass and contrabass flute) and Jos Zwaanenburg (Netherlands: alto and bass flute).

With both the alto and bass flute, a wide range of models is currently available, from reasonably-priced starter instruments, such as those made by London-based flute shop *Just Flutes*, to custom-made models in precious metals.⁴³ Many professional flute players, whether working in orchestras or as soloists, have had some experience with the alto flute, and it is becoming increasingly common for these players to own their own instruments, rather than to rely on borrowing one when required. A survey of musician's diary service listings shows that of a total of 101 flute players listed, 66 of these play alto flute. The bass flute is still somewhat more of a rarity, although that too is becoming more prevalent, with 21 of the diary service players listing the instrument in their doublings.⁴⁴

There has also been a surge in repertoire in recent years, with a growing selection of published works available. A 2013 search of Sound and Music's online catalogue showed 465 solo or ensemble pieces for alto flute, with 78% of these works written since 1980.⁴⁵ The same can be seen with the bass flute; the collection holds 86 works in its database, and 93% of these works were composed since 1980. My own personal repertoire collection includes 136 pieces for solo alto flute and

⁴³ A survey of the Just Flutes website, www.justflutes.com on 28 May 2013 shows that alto flutes range in price from £875 to £9995, and bass flutes from £1495 to £5741. A full Kingma System instrument in 2012 cost in the region of £14000.

⁴⁴ Data from <http://www.morgensternsdiaryservice.com> and <http://www.maslink.co.uk/> (accessed 28 May 2013)

⁴⁵ <http://www.soundandmusic.org/thecollection/> (accessed 17 May 2013)

46 pieces for solo bass flute. Their dates of composition are shown below:

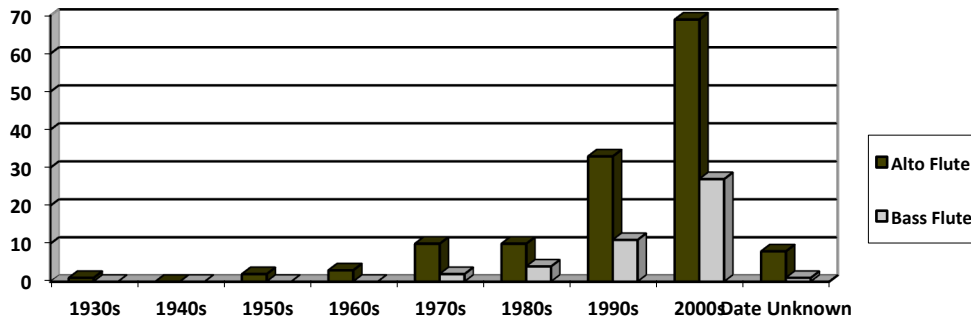


Figure 4: Dates of composition of solo repertoire for alto and bass flute in my own collection

It is clear from this survey that low flutes are rapidly becoming an increasingly established part of the flute family, and that composers have an interest in writing for them. The implementation of the Kingma System on these instruments has had a pivotal role in the expansion and development of the repertoire and available techniques. In the chapters that follow, different technical aspects of these instruments are explored in some detail, illustrated through examples from the case study repertoire.

2. Quartertones and Microtonality

One of the most significant assets of the Kingma System, which sets it apart from the Boehm system flute and indeed most other instruments, is the ability to produce correctly tuned quartertones with an even tone colour for almost all of the range. For a video demonstration of a quartertone scale, see

<http://www.altoflute.co.uk/02-pitch/microtones.html>

Accurate quartertones on the flute are produced by opening the small hole in the centre of a key while holding down the key's rim. A standard Boehm system flute with five open holes can therefore produce five accurate quartertones, with even tone quality, while a closed hole alto flute cannot produce any. When an opening in the centre of the key is not available, microtones are produced through a range of complex fingerings which are often limited in tone colour, dynamic range, or pitch accuracy. In addition, these fingerings are often difficult to negotiate in fast passages and require a considerable amount of practice time to master. Some composers, such as Stockhausen, make a feature of these sounds, and the unusual tone colours they produce. A notable example of this can be found in the 1991 work *Xi*, where he specifies that:

numerous microtonal pitches having special fingerings are used. With regard to the future development of instruments: it is important to realize that on present instruments each of these microtonal pitches has its own timbre and that the choice of these pitches is also a choice of their special timbres. *Xi* for alto flute or flute should, therefore, always be played on an instrument like those in use in 1991 (which have this characteristic). Kathinka Pasveer, who assisted in the choice of the pitches and timbres and their related fingerings, plays a closed-hole alto flute manufactured by *Wm. S Haynes* (Boston, USA) in 1986 and a closed-hole flute also made by *Wm. S Haynes* in 1983.¹

¹ Stockhausen, *Xi* Werk Nr 3 ex 55 (Kürten: Stockhausen Verlag, 1992)

The key-on-key mechanism of the Kingma System means that each key effectively has an open hole, sometimes operated by levers, thereby allowing for accurate quartertones for the full range of the instrument. Apart from a very small number of awkward note combinations (see <http://www.altoflute.co.uk/02-pitch/microtones.html#agility>), quartertones can be played quickly, evenly and in tune, with no perceived change in tone quality or dynamic response from the surrounding pitches. For performers of Stockhausen, and other repertoire that requires alterations of tone colour, all of the microtonal fingerings available to the player of the Boehm System flute remain possible. It thus becomes a matter of choice for the player which type of sounds to produce in the contexts of different repertoire.

While the Kingma System's keywork provides an accurate quartertone scale, the instrument is similarly versatile with smaller microtonal intervals. The additional keywork and venting provides almost unlimited possibilities for fingering combinations, which can be combined with pitch bends and subtle changes of intonation from the air stream and embouchure, to allow for a versatile and accurate range of microtonal pitches.

Murail's *Unanswered Questions*

In some cases, therefore, the use of Kingma System fingerings can enhance the performance of existing works, written for a standard open-hole C flute. Murail's *Unanswered Questions* is an interesting example of this, and Tracks 1 and 2 of the CD provide performances of the work in two different versions. Both are played on a Kingma System alto flute, but Track 1 uses only the fingerings given by Murail in the score (i.e. making use of the open holes that would be present on the C flute). Track 2 makes full use of the Kingma System mechanism, as described below.

Written in 1995, this five minute solo work makes use of quartertones throughout. Murail is known for his use of spectral techniques, which

use computer modelling to define a microtonal language from the harmonic spectrum of a particular sound. When 'translated' into instrumental music, the pitches are often 'rounded' to the nearest quartertone to make them practically viable for the instrument in question. Murail's choice of harmony takes the five available open holes into account, using only a small selection of microtonal pitches, and focusing them on the middle and high registers of the flute, where he makes considered use of harmonics to widen the scope of available quartertones. In places, however, compromises of fingering are necessary to reach the required pitches. By using a Kingma System instrument, these compromises can be removed, and even-sounding quartertones can be produced throughout the piece.

However, when performing on Kingma System flutes, it is important to decide if the alterations in tone colour are part of the composer's intention for the piece or simply a by-product of a set of compromises. In the case of Murail, the logical way to answer this was to ask his views on the matter:

...I play quartertone system flutes (C flute, alto flute and bass flute) by Eva Kingma, which have keys to give accurate quartertones across the whole range of the instruments. I am preparing for a performance in April of *Unanswered Questions* for solo flute. I have a couple of questions. Firstly, would you object to the piece being played on alto flute? Secondly, as a general question for your music, do you specifically want the difference in tone colour from the quartertone fingerings in the score, or can I use the fingerings my flutes provide without any alteration to the tone colour?²

The response was unequivocal:

I don't object to the alto flute. I certainly do not want the difference in color due to quartertone fingerings, and would prefer everybody to be playing on quarter-tone instruments...³

² Email from Carla Rees to Tristan Murail, 17 March 2009

³ Email from Tristan Murail to Carla Rees, 20 March 2009

Performance Practice

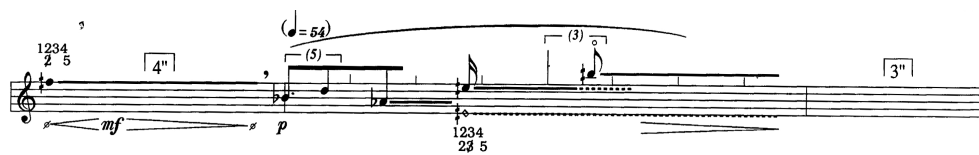
Converting the piece for performance on a Kingma System instrument poses a number of challenges, as the player must decide which elements of the piece's construction emerge from solving problems of pitch production, and which elements exist for the purposes of musical expression. These challenges could be solved in a number of ways, including asking the advice of the composer, but this is not always a viable possibility, and in this case I found that an approach which involves close examination of the score served as a useful model for other repertoire, as well as enhancing my theoretical understanding of the work.

Precise pitch control is an important consideration in the choice of fingering used. As the partials generated through Spectral techniques are rarely exact quartertones, the question here is whether the fingerings represent the required pitches, with notation rounded to the nearest quartertone for ease of reading, or whether the notated quartertones are the target pitches and the fingerings given are the closest pitch solution for those notes. In approaching this work, I decided to find fingerings that matched the notated quartertones as closely as possible. This is, in part, due to Murail's answer regarding even sounding quartertones, and in part due to the pitch material of the opening phrase. As we will see, the first notes of the piece use stable quartertone fingerings, which can be played in tune and with matching tone colour. These pitches remain important throughout the piece, giving a focus for the stability of intonation whenever they occur. It therefore makes sense to attempt to create a version of this piece with even, in tune quartertones throughout.

A full list of the quartertone fingerings used in the Kingma System version of this piece is shown in Appendix 1.

Quarternotes produced through the use of harmonics

Murail demonstrates a thorough understanding of the flute's capacity for quartertones in this piece, through his careful use of harmonics. The work's opening phrase, shown in Example 1, below, uses three quartertones. f quarter sharp" and e quarter sharp" are produced using the flute's open holes and are standard, reliable fingerings with no alteration to tone colour. b quarter sharp" can be produced through the overblowing of an e quarter sharp' fingering to its second harmonic, with little change to the timbral quality. The dotted lines in the score indicate the composer's intention for a gentle glissando from the first to the second harmonic, with some multiphonic overlap at the point where the highest note is introduced. Here, the initial e quarter sharp" is an octave higher than the fundamental but not marked as a harmonic in the score as this is the standard method of producing second octave pitches on the flute.

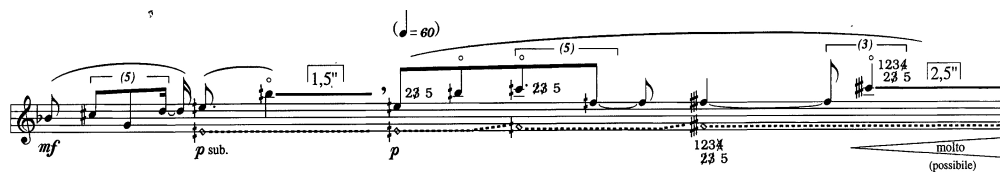


Example 1: Page 1 line 1 of Murail's *Unanswered Questions*, showing the use of harmonics. ©2001 Editions Henry Lemoine [Tracks 1 & 2]

This opening phrase is an important feature of the work, forming the main theme and recurring frequently in different keys and slightly different rhythmic formations.

The use of harmonics in other parts of the piece is more ambiguous, as it is not always clear whether Murail uses harmonics for their particular timbre, or to solve certain problems of quartertone fingerings. For example, the multiphonic indication at the opening suggests more than a mere compositional solution to a problem of pitch, so although a good b quarter sharp" is available on the Kingma System, the loss of the multiphonic renders it inappropriate in this place. However, later in the work, additional harmonics are included within the phrase, including

notes such as C quarter sharp, which does not have a reliable fingering on an open-hole flute, and is most easily produced as a harmonic.



The image shows a musical score for a flute. It features a single staff with a treble clef and a key signature of one sharp (F#). The score includes various dynamics: *mf*, *p sub.*, *p*, and *molto* (possible). Fingering instructions are provided throughout, including (5), 1,5, 2,3 5, 1,2,3 4 2,3 5, and 1,2,3 4 2,3 5. A tempo marking of quarter note = 60 is present. The score ends with a fermata over a note.

Example 2: Page 2 line 2 of Murail's *Unanswered Questions*, showing further use of harmonics. ©2001 Editions Henry Lemoine [Track 1 2:09; Track 2 1:49]

This raises an important consideration in the performance of a Kingma System version of the piece; should all of the harmonics be retained as written, or should some of them be replaced with more reliable fingerings? The use of harmonics on non-quartertone pitches indicates that they are an important part of the timbral world of the piece and should therefore be treated as expressive material rather than just the solution to a problem.

Quartertone Fingerings

Throughout the piece, Murail provides fingerings for the quartertone pitches in the score. These are generally clearly explained, although there are some omissions, and produce the required pitches, although often cause alterations of intonation and tone colour. These are a clear area where Kingma System fingerings can improve performance of the piece.

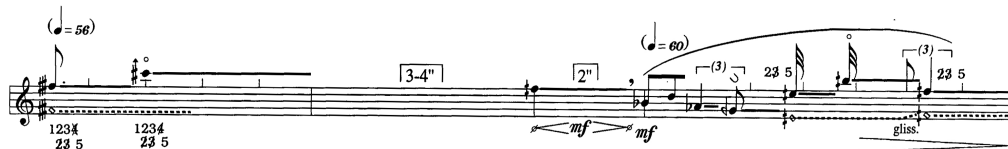
At the end of line 2, an alternate harmonic fingering is provided for c quarter sharp". This note could be produced as a harmonic from the standard fingering for f quarter sharp', as used in the work's opening phrase. The alternate given here makes the fundamental an eighth tone flatter, and its harmonic sounds closer in pitch to c" than the notated quartertone higher. It is conceivable that this fingering is given to facilitate the glissando from the previous note, but a smooth glissando could also be achieved with the standard fingering, although less easily. Two other possible explanations are possible; that the given fingering is

a typographical error, or that Murail wanted a flatter pitch than the notated quartertone at this point. As explained above, the rationale for this version was to produce even, in tune quartertones as far as possible throughout the piece. In this case, it was decided to create this note using a harmonic on the standard fingering for f quarter sharp' for more accurate intonation.

Certain pitches, such as F three quarters sharp and C three quarters sharp, have no reliable fingering on an open hole flute. These pitches have to be formed using either alternate fingerings or pitch bends. The alternate fingering given for f three quarters sharp" which first appears at the beginning of line 3 on page 1 is a quartertone sharp, and sounds as g". It can be made to sound in tune by bending the pitch down, but not without losing tone quality. Another fingering is provided for f three quarters sharp" on the third line of page two, and this is even sharper, producing a note around 10 cents higher than g". These are examples where using Kingma System fingerings is a clear advantage, producing the correct pitch with a good tone.

c three quarters sharp" is a particularly problematic pitch in this piece. There is no effective fingering for this pitch on an open-hole flute, as a c sharp is produced with the tube completely open and no closed keys except for the right hand little finger to help stabilize the instrument, so the only way to secure a higher pitch would be to add extra venting to the flute, as exists on the Kingma System. Here, it is suggested the note is approached in various ways:

1. As a harmonic of f three quarters sharp' (which in itself is a compromise fingering), although here the pitch is indicated as an arrow above c sharp'', in recognition of the pitch problems inherent in the production of the note:



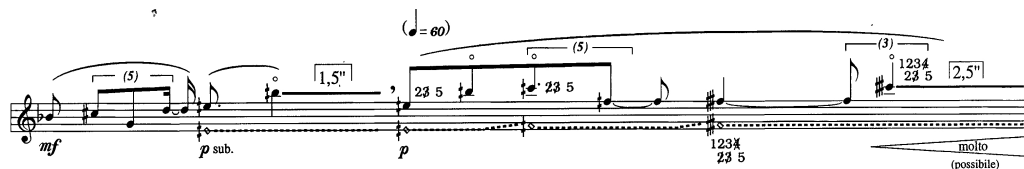
Example 3: c three quarters sharp'' as a harmonic of f three quarters sharp' - page 1 line 3 ©2001 Editions Henry Lemoine [Track 1 0:57; Track 2 0:47]

2. As a harmonic of g', with the flute rolled in to lower the pitch from the resulting d''. Here the pitch is also notated with a diminuendo, which perhaps demonstrates Murail's understanding that by rolling the flute in, the instrument's dynamic range becomes limited.⁴



Example 4: c three quarters sharp'' as a harmonic of g' - page 1 line 4 ©2001 Editions Henry Lemoine [Track 1 1:24; Track 2 1:12]

3. And finally, as a harmonic of f three quarters sharp', as in the first example, but notated as an exact quartertone:



Example 5: c three quarters sharp'' as a harmonic of f three quarters sharp' notated as a quartertone - page 2 line 2 ©2001 Editions Henry Lemoine [Track 1 2:10; Track 2 1:48]

⁴ See <http://altoflute.co.uk/02-pitch/pitch-bends-and-glissandi.html>

Each of the three fingerings given above is timbrally distinct and the different approaches are therefore inconsistent in terms of both intonation and tone quality. The first fingering is extremely diffuse in tone, difficult to produce and a quartertone flat. Since the production of the note itself is unstable, requiring the flute's headjoint to be slightly turned in towards the player, there is very little flexibility of pitch, and an upwards pitch bend from a standard c sharp" fingering would provide a closer pitch match. The second fingering is more effective, as the harmonic d'" has enough flexibility to allow a downward pitch bend of a quartertone, but the tone becomes uncentred as the flute's headjoint is rolled in towards the player. The final solution presented here uses the same fingering as the first, but with altered pitch notation. The *molto crescendo (possibile)* marking suggests perhaps that the composer recognizes the lack of dynamic control available using this fingering.

On the Kingma System, c three quarters sharp" is produced by fingering a c sharp" and adding the C sharp up lever. The pitch is stable and the tone quality matches the timbre of the surrounding pitches. In consideration of Murail's extensive use of harmonics in *Unanswered Questions*, it is also worthy of note that c three quarters sharp" may be produced as a harmonic from f three quarters sharp'. On the Kingma System alto flute, this note can be produced through fingering an f sharp' and adding the F sharp up key, again with reliable intonation and even sound quality. This means that the harmonic can be clearly produced and an appropriate choice of fingerings can be made according to the surrounding context and the use of harmonics in a particular passage.

As mentioned above, there are some omissions in Murail's fingerings. No instruction is given for b quarter flat', appearing on the first line of the second page. Similarly, c quarter sharp', on the third line of the

same page, has no given fingering. The fingerings given for these notes by Dick is:⁵

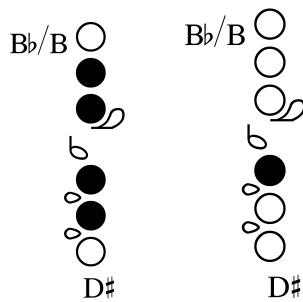


Figure 5: Fingerings for b quarter flat' and c quarter sharp'

Both of these fingerings have a diffuse tone. b quarter flat' can only be played at quiet dynamics, as it easily breaks into a multiphonic. Again, using a standard Kingma System fingering in these cases retains expressive control and tone quality.

The fingering given for g three quarters sharp'' in page 2, line 3, can be made to be accurately in tune, but with a diffuse timbre [Track 1 2:43]. The given fingering for a quarter sharp''' is an attempt to flatten the standard fingering for b flat''' but has more effect on timbre than pitch. In an already loud passage, sharpness is likely in this register, and there is not enough pitch flexibility to allow for flattening the note by a quartertone.

A reasonably good fingering is provided for b quarter sharp'. This note is slightly sharp and the tone becomes increasingly diffuse as the dynamic increases. The Kingma System fingering has greater expressive potential and would therefore be preferable.

g three quarters sharp''' is an unstable note which is sharp and diffuse using the fingering provided. The Kingma System fingering is more easily controlled in terms of sound, and the pitch is flatter.

⁵ op. cit. 60

Some of the quartertone fingerings provided by Murail work very well. For example, d quarter sharp” at the end of the first page uses a fingering which essentially gives additional venting, through the use of the first trill key, to a harmonic on g’. The pitch is accurate, and although there is some minor timbral variation to the sound, within the dynamic context that this is used here, the fingering is effective. On the Kingma System, the standard fingering is perhaps a more instinctive solution, but either would work well in this instance. Further examples of this are the fingerings for e quarter sharp”, d three quarters sharp”, and the final a quarter sharp”, which is a different fingering from that presented earlier in the piece, perhaps to take into account the quiet dynamic. In this context, the fingering given provides more stability than the standard Kingma System fingering, and would be preferable.

Pitch bends

Pitch bend indications are given for pitches which cannot be created in any other way. In this sense, they are not actually pitch bends, but rather a change of the flute’s position, as would occur in the execution of a pitch bend. The transition itself from one pitch to another is not needed within this context, but the end point of the bend produces the physical playing position required to produce the indicated pitch. This is not an ideal way of producing quartertones, since the rolled-in position of the headjoint is different for each note, and each individual position has to be remembered by the player, as well as reached quickly in performance. Any moving of the flute’s position interrupts the airflow, and a smooth transition cannot be achieved without a glissando effect. This means that the legato of the phrase is lost, and time is needed on either side of the note to move into position and back again. The alteration to the air angle also results in a deadening of the flute’s tone, as the upper partials are removed from the sound. Dynamic control becomes limited, and the sound projects less.

Used as the fundamental for a harmonic, g is presented in this way in the fourth line of the first page, with the suggestion that g' should be bent downwards by a quartertone, through the use of the 'turn-in' symbol shown in the example below:



Example 6: Page 1 line 4 of Murail's *Unanswered Questions* showing a pitch bend for g quarter flat' ©2001 Editions Henry Lemoine [Track 1 1:24; Track 2 1:12]

As discussed above, the legato nature of the phrase would have to be broken in order for the rolled in position to be reached, and it is likely that the rhythmic flow of the phrase would also be interrupted. In this case, the use of Kingma System fingerings is ideal, and has been applied with each reiteration of this pitch in both the low and middle registers.

Pitch bend indications are given elsewhere in the piece, for pitches which cannot be created in any other way, such as on the b quarter sharps near the end of the piece:



Example 7: Page 3 line 5 showing a pitch bend for b quarter sharp ©2001 Editions Henry Lemoine [Track 1 5:18; Track 2 4:39]

The Kingma System does not have quartertone keys below low D, as these notes are all produced using the same finger, and additional keywork in this area of the instrument would be impractical. As a result of this, even a Kingma System realisation of this work would require a compromise here.

Conclusion

The appended recordings of Murail's *Unanswered Questions* demonstrate the difference between the two versions. The fingering combinations required to play the piece on a standard flute are more awkward than the corresponding Kingma System fingerings. In addition to these simplifications of finger technique, the Kingma System fingerings are also, in the majority of cases, more responsive and easier to control at a wider range of dynamic levels, with an improvement in intonation and an even tone quality. In the few cases where the given alternative fingerings are equally good as, or an improvement on the standard Kingma System fingerings, the player can choose which fingering to use based on the surrounding context and personal preference.

In recording the work using each of the fingering systems, it was found that the comparative ease of the Kingma System fingerings, combined with the ease of sound production and evenness of tone, had an overall effect on the performance that went beyond the creation of equally tempered quartertones. The overall direction, flow and phrasing of the piece seemed much less inhibited using these fingerings, and as a result I found a greater connection with the musical structure of the work. In fact, the Kingma System recording is quicker overall, and has, to my mind, a more convincing sense of direction. This is in the most part due to the changes of position required for the non-Kingma fingerings, including techniques such as pitch bends, which take the instrument away from its standard playing position. It is also perhaps helpful to note that many pieces intended for C flute are often slightly slower when performed on the alto flute, as a result of the larger instrument's slower response.

This example shows how advancements in instrument-making technology can further enhance the performance of established repertoire, with the additional keywork of the Kingma System opening the scope for wider expressive potential during performance. The even

quartertones allow for the use of a smooth airflow, which does not have to be altered to accommodate less responsive fingerings. As a result, the intensity of the dynamics can be increased, and expressive devices such as vibrato and changes in tone colour may be applied at will. This is just one example of how the Kingma System can be used to improve the performance of works originally written for an older form of instrument, and the approach described here may be equally applied elsewhere, taking into account appropriate performance practice concerns.

By understanding how the Kingma System can be used to solve compositional problems as demonstrated in this case, the nature of the new possibilities it affords to contemporary composers becomes clear. Murail's piece deals with relatively simple concepts, such as producing even-sounding microtonal pitches, but the examples below demonstrate the further microtonal capabilities of the Kingma System and how they can be implemented within successful and practically viable compositions.

Other microtonal applications

The modern flute is an equally tempered instrument, and as such, music requiring the equal division of semitones to produce even quartertones is most common within its microtonal repertoire. Works based on non-Western scales frequently make use of pitches approximated to the nearest quartertone, for practical considerations, although alternative fingerings can often be used to approach more precise tunings and the Kingma System is particularly helpful in this regard. Examples of works for flute using Arabic or other non-Western scales include Patrick Nunn's *Maqamat* and *Night Scene* by David Burnand,⁶ the first two pieces to be composed specifically for my Kingma System alto flute. With both works, it was found that in some places the quartertones had to be slightly 'detuned', in a similar way as an orchestral player might

⁶ Nunn, Patrick – *Maqamat* for solo Kingma System alto flute (2002), Burnand, David - *Night Scene* for Kingma System alto flute and electronics (2001)

alter the tuning of the third of a chord, in order to emphasise and enhance the expressive effect of the quartertone.

Using a pre-existing scale structure such as these allows the composer an opportunity to explore a microtonal language within a traditional, tonally-centred framework; modulations and transpositions can be used without the necessity of complex calculations, and my experience performing these works indicates that generalist audiences find this kind of microtonal language relatively unchallenging; both pieces have proved popular with audiences, both in the UK and abroad. Used as examples in the early stages of my own Kingma System practice, both pieces have served as useful models for other composers.

Morsink

Aligned with the use of Arabic scales is the use of Ancient Greek tuning systems based on the *genera*. Composers who have used this approach include Daniel Kessner, in his work *microimages*, written for C flute but frequently also played on the Kingma System alto flute, and Coreen Morsink, in her solo alto flute piece, *Andromache's Recitativo, Aria and Subtext*, which was written specifically with the Kingma System in mind [Track 5]. Here, Morsink sets a text by Euripedes (in an English translation by Phillip Vellacott) and makes use of the *genera* system which was extant at Euripedes' time (c 484-407 BC). This system is centred around four note tetrachord structures which have fixed outer intervals of a perfect fourth, and inner pitches which are flexible and include quarter- and third- tones. Morsink's score includes pitch values in cents to allow the player to understand the intervals numerically.

The *Recitativo* and *Aria* sections use equally tempered quartertones, and different forms of genera are used to represent different characters in the plot. This idea continues into the *Subtext*, where each of the three characters shows their true emotion through a different tetrachord:

Character	Location	Genus	Tetrachord intervals
Andromache	bars 70-95 Track 5: 4:17	Hemiolic chromatic	75 + 75 + 350 cents
Hermione	bars 96-112 Track 5: 5:07	Soft diatonic	100 + 150 + 250 cents
Thetis	bars 113- 122 Track 5: 6:10	Soft chromatic	66.6 + 66.6 + 366.6 cents

Figure 6: Tetrachord intervals and their relationship with character in the Subtext of *Andromache's Recitativo, Aria and Subtext* by Coreen Morsink

The flexibility inherent in the traditional tetrachord structures facilitates Morsink to choose pitch sets which are well-suited to the technical considerations of the Kingma System flute, avoiding particularly difficult fingering combinations while still maintaining a viable microtonal language. The development of the microtonal language in this piece was therefore also influenced by practical factors, and, as can be seen from the changes made in the early stages of the piece's composition, the construction of the pitch material was directly influenced by a close collaboration between composer and performer.

The first sketch, written on 2 June 2010, shown in Example 8 below, contains the first seven bars of the piece, and uses a combination of scales based on tetrachords, based around the enharmonic genus. The piece begins on F, to allow enough space within the range to allow a

perfect fourth on either side of the tonal centre. The Kingma System flute does not have quartertone keys below D quarter sharp, as there are not enough fingers available to operate extra keys on this part of the instrument. To accommodate this, the idea was to use a lower tetrachord, which did not contain quartertones, and a higher one which did:



Figure 7: Tetrachords used in first sketch of *Andromache*

Example 8: First sketch of *Andromache*, 2 June 2010

As the fingering diagram below shows, the quartertone movement from *f* to *f* quarter sharp' in bars 6 and 7 requires a sliding movement of the first finger of the right hand, to open the centre hole of the key. This is difficult to execute at speed without creating a glissando.

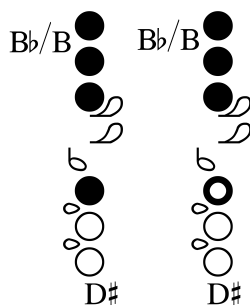


Figure 8: Fingerings for *f* and *f* quarter sharp', showing the necessary movement of the first finger of the right hand.

A second sketch of the work was created on 19 June 2010, after the composer had received detailed information about the Kingma System. A number of obvious changes have been made which set the whole piece on a strong practical grounding, based on the information given. The overall pitch has been raised by a semitone, giving a new starting note of f sharp'. The figure below shows the new tetrachord arrangement for the piece:



Figure 9: Tetrachords used in the second sketch of Andromache

Here, tetrachords are placed on either side of the opening f sharp', and quartertones are used in each tetrachord. The choice of quartertones is well suited to the Kingma System, since both f three quarters sharp' and c three quarters sharp'' are achieved through the use of lever keys, rather than sliding movements. As these levers open and close the relevant keys in one decisive movement, it means that the microtonal pitch changes can be executed with greater clarity and at faster speeds.

quasi recitativo flessibile

mf *<f>pp* *mp* *p* *mp* *f*

My home! Thebe, the loveliest city in all Asia. I left my home; and with me came a golden hoard of treasures for my dowry.

7 a tempo *p* *mp* *>pp*

Then we reached the royal Palace of Priam;

11 *tr*

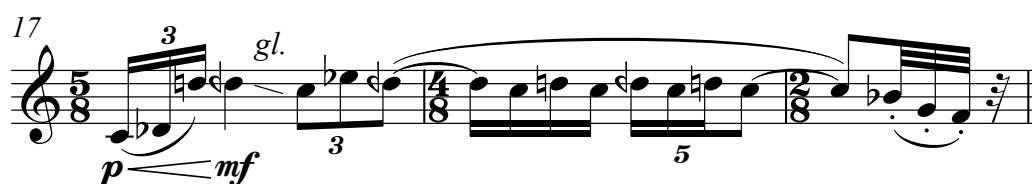
there I became Hector's wife, To bear him true sons. My name is Andromache.

Example 9: Andromache - Second sketch, 19 June 2010. Bars 1-14, with new starting note of f sharp'

The new pitch centre of the work as a whole allows for quartertone trills, such as between f sharp' and the quartertone above, and a range of tremolos, as seen in bars 13 and 14 of the example above, which are all practical on the instrument. This example demonstrates how by making slight adjustments to accommodate the practicalities of Kingma System fingerings, a composer can gain a level of compositional freedom which allows them to fully explore a microtonal language. This is an important consideration for Kingma System repertoire, and one which I had not previously considered, since although the instrument is made in equal temperament, the finger movements required for different notes are not always the same. In positioning the material to suit the agility of these finger movements carefully, a greater freedom is developed.

Tweedie

Other microtonal usages influenced by tradition include Marc Tweedie's *Zoli* for solo bass flute [Track 8], where material inspired by Bulgarian folk music incorporates the use of microtones for colouristic effects. Microtonal trills are frequently employed during the piece, and form the basis of the melodic microtonal writing; the first instance of this is in bars 17 and 18, where the d quarter flat" alternates with c" and d natural" in what is effectively a slowed down double trill.



Example 10: Bars 17-19 of *Zoli* by Marc Tweedie, showing a slowed down double trill effect in bar 17-18 [Track 8 1:05]

The same effect, with alternations between quartertones and standard pitches, can be seen in bar 44. As the quartertone movement begins to develop it moves from trills, first seen in section 1, to slowed down trills, first seen in section 2, to melodic microtonal lines, which begin to emerge in section 3. By section 4, the microtones become fully

entrenched in the melodic language of the piece. In the final, short section, which is seven bars long, microtones make up almost half of the pitched material.

Biehl

Various other approaches to microtonal writing appear in the flute's repertoire. Murail's spectral, harmonics-based language has prepared the way for post-spectral composers such as Claes Biehl and Michael Oliva, who have developed their instrumental writing through the use of Kingma System flutes.

A particular breakthrough in my own understanding of the microtonal capabilities of the Kingma System flute came through working with Claes Biehl on his piece for bass flute and electronics, *evocazione del mare* [Track 3]. Biehl's compositional style is based on the use of spectral aggregates to determine the pitches used. Frequency shifting is applied to the harmonic fields of the work, which develops very quickly into a complex microtonal language. The nature of this microtonal language lends itself well to the Kingma System bass flute, and enabled us to further explore the potential of this instrument.

The microtonal pitches generated through frequency shifting in this piece do not conform to equal temperament. The practice of many composers in this situation would be to incorporate these pitches into the electronic part while using a more simplified language for the acoustic instruments to take into account their practical capabilities.⁷ However, during the early stages of the composition process, the following question was posed by the composer:

Would it be possible to 'remember' the way/position required to produce certain microtones (e.g. the B flat lowered by a sixth-tone in measure 2) in order to directly perform that note

⁷ For example, in the works of Grisey and Murail, spectrally generated microtonal pitches are often rounded up or down to the nearest quartertone. This can be seen in ensemble works such as *Ethers* (1978) by Murail and *Quatres Chants pour franchir le seuil* (1997-8) by Grisey

without glissing up or down from a standard fingering (e.g. as suggested in measure 7)?⁸

In order to avoid compromises of pitch, we decided to attempt to find ways to allow the live instrumental line to tune exactly to the required microtonal pitches, notated in the score as a fixed number of cents above or below a regular pitch. In this system, a semitone is divided into 100 cents, so a quartertone is represented by 50 cents, a third-tone by 66.6 cents and so on. These cents were always written in relation to standard (non-quartertone) pitches, with + and – signs used to show direction, as well as arrows incorporated into the accidentals. In this way, glissandi and stand-alone pitches could be specified at a greater degree of accuracy and the underlying harmony could be maintained in the live instrumental writing.

Example 11 below demonstrates the notation of a specific microtonal pitch, reached through a pitch bend, to raise the d sharp” by 27 cents.

Example 11: Bars 17-18 of *evocazione del mare* by Claes Biehl, showing a glissando to a specific microtonal pitch in bar 18 [Track 3 0:48]

⁸ Email from Claes Biehl, 5 November 2008

Example 12 shows a d' raised by 29 cents, approached from an e'', where the player is required to find the exact microtonal pitch of the d' at the moment it is first sounded.

Example 12: Bars 97-98 showing d' +29 cents in bar 98 [Track 3 5:02]

The accurate achievement of such specific intonation in performance depends on two factors. Firstly, the player needs to be able to hear accurately the required pitch and secondly, the player needs to be able to develop a detailed enough control of intonation to be able to reproduce the required pitch consistently and precisely.

To address the issue of pitch recognition, the required pitches were recreated electronically and provided on CD for reference for use during practice. This enabled the performer to develop a sense of the pitch both in isolation and in the context of its surrounding harmony. Comparisons could be made during practice between the note produced on the bass flute and the intonation of the pre-recorded note, allowing for increased awareness of accuracy. In live performance, the process of being able to hear the level of microtonal inflection required is assisted through careful listening to the electronics part. Each of the microtonal pitches in the bass flute part correspond to harmonies in the electronics, and can be tuned accordingly, as one would tune any note in a chord during standard ensemble playing. It is therefore important that the player can hear the electronics part clearly during performance, and the positioning of the speakers can have an important

role in this.⁹ It is also important that the performer has developed sufficient understanding of the underlying microtonal harmony to be able to hear whether the pitches played are intended to be consonant or dissonant against the electronic material.

In terms of controlling the intonation itself, the additional keys of the Kingma System allow the player to access an accurate fingering for the nearest quartertone to the required pitch. As with all flutes, it is generally more effective to modify pitches downwards from standard fingerings than upwards, so unless specific pitches meant it was illogical to do so, a general principle was developed to begin with a basic fingering a quartertone above the microtonal pitch in question.¹⁰ Alternative fingerings could then be created, achieving a slight flattening of pitch with the addition of extra keys along the length of the tube. In each of the instances in the score, a modified fingering was found which was as close as possible to the required pitch, and fine adjustments were made through the use of normal tuning methods, including subtle changes to the angle and speed of the air stream, and small pitch bends.

Although pitch bends can provide a flexibility of pitch ranging from a small microtonal interval to a minor third, depending on the fingering used, there are disadvantages associated with this technique when a precise level of accuracy is required.¹¹ Specifically, the technique requires moving the flute away from normal playing position, by varying amounts according to the amount of pitch change required.

⁹ In the context of a solo instrument with electronics, we have found in performance that the use of monitor speakers can interfere with the clarity of the overall sound, and as a result this is a practice we prefer to avoid within the context of *rarescale* performances. Instead the solo performer is positioned in the centre of the stage with the speakers placed to the sides and slightly behind the performer, so that the stereo mix may be heard clearly during performance. A diagram of this stage position can be seen at <http://www.altoflute.co.uk/07-amplification/amplification.html>

¹⁰ Exceptions to this include examples where the microtonal modification required was a few cents above a standard quartertone pitch and could be produced with a small change of air angle and/or air speed from the quartertone below.

¹¹ See website section on pitch bends for a detailed explanation:
<http://www.bassflute.co.uk/02-pitch/pitch-bends-and-glissandi.html>

These movements can only be judged by feel, rather than through any exact placement, and so reproducing consistent pitches each time by this method alone is likely to be unreliable. Any significant movement away from standard playing position creates a thinning of the tone quality and a reduction in expressive control and dynamic, which is not well suited to an expressive melodic line. The movements themselves take time, especially on the bass flute, which has a large lip plate, and must be reset to normal playing position after the note has been sounded. This physical movement can interrupt the flow of a melodic line, and slurs are not possible without the pitch bend being heard as a transition from the previous note. By keeping the use of pitch bends to a minimum and exploiting the additional fingering capabilities of the Kingma System, the execution of precise microtonal intonation could benefit from increased reliability and consistency.

The exact specification of microtonal pitches in this way represents an important step forward in terms of providing freedom of harmonic language, both within the context of this piece and beyond, as well as developing greater knowledge of the capabilities of the Kingma System instrument.¹² The development of this technique demonstrates an example of how a theoretical approach on the part of the composer can be developed into greater practical knowledge, in this case in an aspect of playing that is unlikely to have arisen without the repertoire to support it.

Oliva

The available quartertones on the Kingma System are of significant interest to British composer Michael Oliva. As a composer of music for electronics, the availability of a wide range of microtonal pitches on a live instrument has given wider scope for the development of integrated harmonic systems which take their basis from a combination of spectralism and an extension of Romantic chromaticism. Oliva's

¹² It is a method which has since been adopted by other composers, most notably Michael Oliva in his song cycle *Dover Beach* (2010)

harmonic thinking includes concepts such as *harmonic disorientation*; creating consonant chords which are in fact composed of microtonal pitches based on the upper partials of the underlying harmonic series.

In his 2005 work, *Apparition and Release* [Track 9], Oliva explores the perception of microtonality through altered forms of large intervals, and maximizes expression through the use of microtonally extended thirds and sixths. These wide intervals form an integral part of the melodic line, creating a sense of consonance with the surrounding electronics and blurring the listener's perception of which pitches are quartertones and which are semitones. Very often it is the non-microtonal pitches which seem dissonant with the surrounding context, and the shifting microtonal centres give the music a sense of tonality, in spite of its complex harmonic language. The twisting lines of the alto flute part are woven around the underlying harmony, allowing microtonal suspensions to be heard in the closing bars.

Oliva's music is influenced by the music of Scriabin and the French Romantics, and harmony plays an important role in his compositional design. Cadences based on the German sixth are important features of *Apparition and Release*, with neutral thirds, created from the quartertone that falls between major and minor thirds, giving additional colour.

Although the piece uses equally tempered quartertones across the range of the alto flute, Oliva's electronics sounds includes the use of virtual string modelling, and specifically:

models of very large, taut glass strings bowed forcefully *sul ponticello*. This of course creates a very rich mix of high harmonics, many of which have their own special just intonation. For me, combining equally tuned quartertones with just intonations is not an issue – I feel these fine distinctions are lost in the practical experience of live performance, where Carla should be allowed to respond naturally to what she is

hearing and interpret the music. The flute is after all not a keyboard instrument...¹³

In the 2007 work for bass flute and electronics, *Bereft Adrift* [Track 10], Oliva uses melodic quartertones for colouration of a line, and the composer cites influence from listening to Koran recitations on the Islam Channel. Although such pitch inflections can be found here, particularly when moving by step, the microtonal focus lies with the potential for a rich, post-Romantic harmony.

The image shows two staves of musical notation. The top staff is labeled 'B. Fl.' and contains a melodic line starting at bar 31. It features a quarter rest, followed by a quarter note with a flat, then a quarter note with a natural, and a triplet of quarter notes with naturals. The bottom staff is labeled 'Lx.' and shows a chord with a circled '10' below it, indicating a microtonal interval.

Example 13: Bars 31-33 of *Bereft Adrift* by Michael Oliva, showing stepwise movement of microtones [Track 10 1:24]

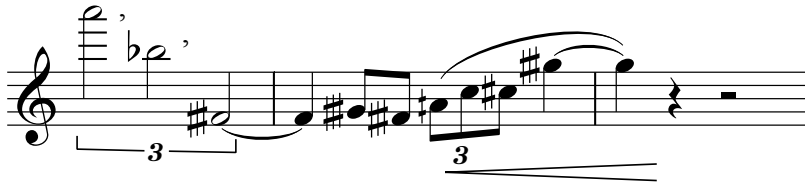
As we have seen, the composer's main interest in the use of microtones is through the development of harmonic systems. Specifically, the piece makes use of what Oliva calls the *ultraminor*, a minor chord which has the minor third flattened by a quartertone. The opening piano chord in the electronic part is a B flat ultraminor chord.

The image shows a single staff of musical notation with a treble clef. It contains a chord with a flat sign and a circled '8' below it, representing the B flat ultraminor chord.

Figure 10: B flat ultraminor chord

¹³ Michael Oliva – Grove Forum lecture at the Royal College of Music in 2005

Other intervals, which are particularly important to the harmonic construction of this piece, include neutral thirds and sixths (i.e. using the quartertone between major and minor) and fifths which are widened by a quartertone.



Example 14: Bars 85-87 of *Bereft Adrift*, showing a widened 5th between the last two pitches of bar 86 [Track 10 4:07]

Bereft Adrift is based on the fundamentals of B flat, B quarter flat and B, and the harmonic series that are derived from them. Oliva makes particular use of the seventh harmonic, which forms an interval with the fundamental of 31 cents lower than a minor seventh, and the eleventh harmonic, which is 49 cents lower than a tritone.¹⁴

Baldini

As we shall see in Chapter 3, multiphonics, with their naturally occurring microtones, are also aligned with spectral compositional methods, and multiphonics of various kinds have appeared frequently in the flute's repertoire since they were first catalogued by Robert Dick in 1975.¹⁵ The enhanced multiphonic capabilities of the Kingma System, discussed further at <http://www.altoflute.co.uk/06-multiphonics/multiphonics.html> provide a useful starting point in the microtonal construction of a number of works, most notably two works written in 2013, Michael Oliva's *Les Heures Bleues* and Christian Baldini's *Kingma and the Duke*.¹⁶

¹⁴ For an explanation of the seventh harmonic, see <http://www.phy.mtu.edu/~suits/badnote.html> (accessed 19 March 2013)

¹⁵ Dick, Robert *The Other Flute*, (New York: Oxford University Press, 1975)

¹⁶ Both published by Tetractys. For more information on the use of multiphonics in *Les Heures Bleues* see chapter 3.

Kingma and the Duke [Track 7] is structured around what the composer calls “two Ethos”,¹⁷ described as:

- a) “a well defined, rhythmic, energetic, somewhat rigid and secure monophonic world”
- b) “a more tentative, introspective, flexible and almost frail reality in the multiphonics realm”¹⁸

The microtones serve as a link between these two *Ethos*, arising from the multiphonics,¹⁹ and link with the hectic monophonic material through their inclusion in the melodic line. Chromatic quartertone movement features in the early part of the piece, and becomes one of the main elements of the final bars, with greater energy and a sense of hectic forward direction. Baldini makes good use of the instrument’s potential for quartertones, and his understanding of the fingering system meant that the majority of the writing was practically viable from the outset. For the most part, rapid quartertone movement is avoided, and any minor areas of awkwardness were quickly resolved.

Example 15: Bars 45-49 of an early version of *Kingma and the Duke* by Christian Baldini, showing difficult fingering combinations in bar 49

Example 15, above, shows one example of a difficult microtonal fingering combination. In bar 49, the movement between e quarter flat” and d” requires the central hole of the D key to be covered for the central note of the group of three, which can only be done in a sliding movement. This is a relatively slow action with a weak finger, the fourth finger of the right hand, at the same time as the fifth finger of the same hand is lifted off the D sharp key. Even without the bass flute, it can be felt that this is a difficult movement for the hand and unlikely to be

¹⁷ Email from Christian Baldini to Carla Rees, 25 February 2013

¹⁸ *ibid.*

¹⁹ For a full explanation of the use of multiphonics in this piece, see Chapter 3.

achievable at speed. After some experimentation, we decided to replace the e quarter flats” with d quarter sharps”. This would still give a microtonal inflection to the line, but would eliminate the movement of the right hand fourth finger altogether, and requires just a movement of the fifth finger, which is much more practical to execute at speed.



Example 16: Bars 48-49 in final version of the score, with e quarter flats” replaced with d quarter sharps” [Track 7 3:05]

The tempo at the very end of the piece is somewhat limited by the inclusion of microtonal pitches and the instrument’s overall response, but the notional tempo of crotchet=152+ gives a sense of the music pushing to its limits and urges the player to play as fast as possible. In practice, this will be executed at a slower tempo than indicated, but with the aim of capturing the energetic atmosphere suggested by the tempo marking.



Example 17: Closing section of Kingma and the Duke, bars 71-76 [Track 7 4:26]

Conclusion

These examples clearly demonstrate that the Kingma System enables a number of varying approaches to microtonal writing. Each of these approaches provides different challenges to the performer, and requires the development of both a technical command of the additional keys of the Kingma System, and a good aural awareness to enable the correct intonation of the required pitches. These case study works have therefore helped to define the limitations and capabilities of the Kingma System instruments and my ability to play them. In many of the pieces described above, a new approach to microtonal writing could be developed as a result of the collaboration, allowing for more adventurous writing and in some cases, such as with Claes Biehl, a departure into what was, for him, an entirely new, more precise, microtonal language.

With their naturally occurring microtones, multiphonics, discussed in the next chapter, are for many composers an extension of melodic microtonal writing. Here, we will see how the possibilities of the Kingma System expand the expressive and harmonic potential of these sounds on the alto and bass flute.

3. Multiphonics

The additional venting of the Kingma System allows for an extended range of multiphonic possibilities, which have not yet been fully explored. The possibilities are, in fact, too numerous to be comprehensively documented; a Kingma System flute with B footjoint has 27 keys, compared to a closed-hole instrument with B footjoint, which has just 15 keys. I estimate that the number of fingering combinations on a Kingma System instrument is approximately 200,000, compared with around 40,000 combinations on a Boehm flute.¹ Each fingering will have some form of multiphonic capability, from a simple two note multiphonic formed from two adjacent notes in the harmonic series, to a more complex combination of three or four notes. The three main types of multiphonic possible on the flute, achieved from overblowing low register pitches, underblowing high register pitches, and the use of special fingerings, are explained at <http://www.altoflute.co.uk/06-multiphonics/multiphonics.html>.

Since a comprehensive survey of all possible fingerings is unrealistic within the scope of this project, I decided to focus on a selection of well-tested fingerings which could be relied upon with consistency. As such, the websites contain fingerings for a selection of multiphonics, with the potential to add many further examples in the future.

The websites currently include 190 multiphonic examples for each instrument, arranged by low pitch, seen at <http://www.bassflute.co.uk/06-multiphonics/multiphonics-fingering-chart.html> and <http://altoflute.co.uk/06-multiphonics/multiphonics-fingering-chart.html>. Suggestions of the optimum dynamic level for each multiphonic are given, and the dynamic levels were kept relative to each other in the recorded examples to allow composers to hear the differences between each sound. The fingerings for these multiphonics came from a range of sources. Levine's list of multiphonics for C flute,

¹ <http://www.phys.unsw.edu.au/music/flute/virtual/main.html> (accessed 23 March 2013) - although this resource does not make it clear if this refers to a flute with open or closed holes.

alto and bass flute were tested on both alto and bass flute, and any differences in sound and response were noted.² Additional fingerings were developed through experimentations with the Kingma System, and through collaborative work with composers on both alto and bass flute, for example, with Claes Biehl in *evocazione del mare* for bass flute and electronics, or in the preparation of a Kingma System version of Saariaho's *Oi Kuu* for bass flute and cello. Fingerings originally discovered on the bass flute could be easily adapted to the alto flute, and vice versa, although the balance of pitches was found to be subtly different between the two instruments as a result of differences in the response of harmonics on each instrument.³

In addition to this multiphonics fingering chart, the websites also include a chart outlining possible multiphonics created from harmonics fingerings, offering a further 157 tested multiphonic combinations. <http://www.bassflute.co.uk/06-multiphonics/multiphonics-based-on-harmonics.html>



Figure 11: Examples of multiphonics produced from harmonics. The fundamental shown on the left of each example defines the fingering to be used.

²Levine, Carin and Mitropoulos-Bott, Christina, *The Techniques of Flute Playing Volume I: Flute* (Kassel: Bärenreiter 2002) 76-138

³ A spectral analysis of a c' played on bass, alto and C flute can be seen at <http://www.altoflute.co.uk/03-dynamics/spectral-analysis.html> It can be clearly seen that the third harmonic on the C flute is stronger than the fundamental, and that the upper partials are significantly weaker on the bass flute.

The additional venting provided through the extra keys of the Kingma System allows multiphonic intervals to be moved chromatically within the flute's range. A chain of 12 multiphonics of the same interval, moving by semitone, is shown in both notation and an audio example at <http://www.bassflute.co.uk/06-multiphonics/multiphonics-on-kingma.html>



Figure 12: Chromatic sequence of multiphonics

In my experience of performing multiphonics within different musical contexts, I have found that it is important for composers to provide fingerings as a guide with scores, rather than relying on players having access to the same fingering charts and manuals that the composer used when compiling the piece. For example, Saariaho's *NoaNoa* gives numerical references for the multiphonics fingerings, which can only be found if the player possesses Artaud's *Flûtes au Présent*. This may not be immediately available; at the time I was learning the piece, the book was out of print. This is particularly important in the context of the Kingma System, where fingerings are often devised by individual players and are not universally available in a published form.

The application of multiphonics within the repertoire for low flutes requires careful consideration, since, even if the player has the correct technique to produce the sound, and has undertaken the required preparation, a number of factors may still cause the multiphonic to fail. On the C flute, a standard bore size is used for all instruments, and the positioning of keys is relatively uniform across different makes. However, this is not the case on low flutes. Bore sizes, although becoming more similar in recent years, can vary depending on the maker and date of manufacture; alto flutes have been made at bore sizes ranging from 21mm to 26mm. Additionally, the configuration of

the keys can be different from one maker to another, with ergonomic considerations sometimes taking priority over the acoustically correct placement of tone holes. The addition of any combination of open holes and footjoint extensions to low F sharp can also alter the response of the multiphonics, as can the enormous variations in headjoint design. As a result of this, it is difficult for composers to be certain that a multiphonic that works successfully on one instrument will be equally possible on another. The repertoire created during this research is specifically written for small bore Kingma System alto and bass flutes, and the specifics of these instruments are described on the homepages of the websites. Any fingerings that are outlined here should transfer to other similar instruments without issue, and can serve as a starting point for instruments with different bore sizes and key configurations.

Biehl

A significant collaborative exploration of multiphonics on the Kingma System bass flute took place during the compositional process of *evocazione del mare* by Biehl. Initially, Biehl selected multiphonics from a list of C flute multiphonics by Carin Levine, based on interval and pitch preferences.⁴ This in itself is something that cannot be reliably achieved with non-Kingma System low flutes, since the lack of open holes presents a limitation to many of the given C flute fingerings. These fingerings were tested to ensure accuracy and reliability on this particular bass flute, and any differences in dynamic response and pitch were taken into account in the composition. During this testing process, it was found that many of the multiphonics had a tendency towards instability, at least in the earliest stages of preparation. This was due to a number of factors, but most notably came from attempts to play outside of the optimum dynamic range for each sound, as well as my own lack of experience with these particular multiphonics. However, Biehl formed a preference for multiphonics that emerged from the lowest pitched note, and this became a feature of the piece.

⁴ op cit.

Multiphonics were carefully scored to allow a smooth transition from a single pitch to the full multiphonic over the duration of a sustained note, as shown in the example below, and dynamics were chosen accordingly to match the natural response of the instrument.

Example 18: Gradually emerging multiphonics in bars 39-43 of Biehl's *evocazione del mare*. [Track 3 2:00]

evocazione del mare has a strictly organised structure, based on an Ulam series on the number 19, with some sections just a few seconds in duration.⁵ For practicality of synchronisation in performance, the electronics part is divided into a series of short cues, but nevertheless, the composer wanted to maintain a strict rhythmic approach throughout the piece to ensure the structural relationships remained in tact. Biehl's approach to the multiphonic writing allowed for the fingering position to be reached separately from any modifications of the air stream required for the full multiphonic to sound. This meant that any latency in the instrument's response could be accommodated within the planned duration of the note and thus provided better control of overall rhythmic accuracy. Fingerings were clearly provided at the appropriate points in the score, for reference in both the learning process and performance.

The strict structural framework, as well as the requirement to synchronise exactly with the electronics meant that precise rhythmic

⁵ For further details about Stanislaw Ulam, see http://www.lanl.gov/history/people/S_Ulam.shtml (accessed 12 March 2013). For an explanation of the Ulam Sequence, see Weisstein, Eric W. *CRC Concise Encyclopedia of Mathematics, Second Edition* (Florida: Chapman & Hall/CRC, 2003), 3097

playing became an important aspect of the bass flute part. Slow to respond whistle tones at the end of the piece were eventually replaced by multiphonics for greater impact and more accurate rhythmic placement. The additional multiphonics were chosen to highlight certain pitches within the harmonic framework. As the composer says:

I used the multiphonics to enhance the harmonic material featured in the electronics as both entities share certain pitches. This way the harmonic progressions (frequency shifts leading back to the main aggregate) became much clearer and thus the final section much more effective.⁶

Elsewhere in the piece, Biehl required multiphonics which could not be found in Levine's list for C flute, allowing the development of specific fingerings for the Kingma System which could not be reproduced on a standard instrument. For example, the harmony in bar 54 required a multiphonic of b'' and f''', as shown below:

The image shows a musical score for a bass flute part, specifically bars 53 through 57. The notation is in treble clef. Above the staff, there are two boxes: one containing 'Bb - key' and another containing 'F# - key', with a box containing the letter 'M' below them. The score features several trills, indicated by '3' over a group of notes. Dynamic markings are placed below the staff: *pp*, *mp*, *p*, *p < mp > p*, *pp*, and *p < mp > p < mp*. The notes are connected by slurs and some have accents.

Example 19: multiphonic of b''/f''' in bars 53-57 of *evocazione del mare*. [Track 3 2:49]

As explained in the website at <http://www.bassflute.co.uk/06-multiphonics/multiphonics.html>, multiphonics on the flute are created in one of three ways; overblowing to allow adjacent pitches in the harmonic series to be heard simultaneously, underblowing high register pitches to allow a lower pitch to be heard, or through the use of special fingerings. This b''/f''' tritone appeared initially to be impossible; the two pitches come from different harmonic series, and underblowing an f''' does not produce the required b'' below.

⁶ Claes Biehl, email to Carla Rees, 13 March 2013

Investigations of standard resources did not provide any pre-existing fingerings for this combination of notes. After some experimentation, a solution was finally found using the specific capabilities of the Kingma System. The standard fingering for b flat'' could be used to produce both b flat'' and f'', since both notes exist in the same harmonic series. By pressing the B up key, the b flat'' rose in pitch by a semitone, while the f'' remained unchanged, thereby creating the accurate pitches with reliable sound production.

This provides a valuable example of how the capabilities of Kingma System instruments can be explored through collaboration. I have found continuously while working with these instruments that since Kingma System method books, studies and other practice material has not yet been written, the most concrete way for me to develop further skills is through the challenges that arise within the repertoire. A composer's requirement for a particular interval, harmonic language or type of sound provides an opportunity to combine investigations of the additional keys with the application of existing knowledge in order to solve a specific practical problem. It is perhaps indicative of my overall approach as a performer that I actively seek out these challenges, and request many of the composers that I work with to begin by writing what they would like to hear and to make revisions later in the process only if a suitable practical solution cannot be found within the time available. The resultant works, including many of those included as examples here, provide an enhanced knowledge of the instruments, and also serve to increase my technical and musical abilities as a performer and interpreter.

Di Maggio

This kind of challenge-based approach was taken in Dan di Maggio's work for bass flute and electronics, *Same Old Monsters* [Track 6]. Here, the multiphonics were initially written with an approximate sound in mind, to show the kind of harmony required and the dominant pitches. When searching for practical solutions, it is important for the player to

ascertain which elements of the multiphonics are most significant to the composer and to the piece – the intervals, the highest pitches, the lowest pitches or the timbral quality of the multiphonics. In this case, the musical material required strong sounding multiphonics, with the upper notes providing a melodic line in most cases. Fingerings were found to create the closest possible practical match to the composer’s initial sketches, and the score was eventually renotated to accommodate the sounding pitches of the new fingerings. Example 20 below shows the development of the multiphonics in one of the phrases:



Example 20a: Development of multiphonics in bars 23-25 of *Same Old Monsters* by Dan Di Maggio. This stave shows the first version, with impractical note combinations outlining the desired harmonies



Example 20b: Development of multiphonics in bars 23-25 of *Same Old Monsters* by Dan Di Maggio. This stave shows final version of the piece with practically viable multiphonics. [Track 6 3:02]

To suit the nature of the material, wide-interval multiphonics, as well as those based on harmonics, were used most. These types of multiphonics are generally more stable at loud dynamics, and would not become lost in the balance with the electronics.

Three multiphonics are included which use special fingerings, as shown below:

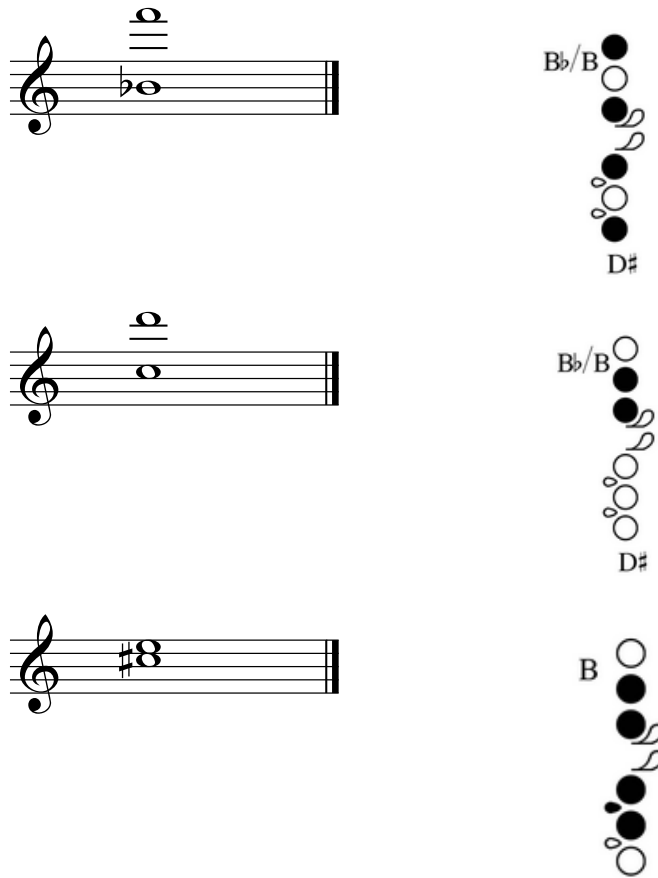


Figure 13: Multiphonics using special fingerings in *Same Old Monsters*

All of the other multiphonics in the piece can be produced using harmonics, overblowing the lowest note of the multiphonic as appropriate. There are two multiphonics which require the fundamental to be sounded with a non-adjacent partial in the series; these are notated in the score without the intermediate partials, although it is likely that in practice these will be heard when the multiphonic is produced in this way. By keeping the notation as the composer originally intended, an opportunity is provided for subsequent performers to find alternative ways of producing these multiphonics, as well as to give an indication of the dominant pitches within the multiphonic.

Baldini

Christian Baldini makes extensive use of bass flute multiphonics in *Kingma and the Duke* [Track 7]. Here, the multiphonics are at the centre of the work's genesis, as the main element of *Ethos B*, and the instigator of the piece's microtonal language. In contrast with the strength of sound required in Di Maggio's piece, Baldini's *Ethos B* material is calm and flexible, with soft dynamics. To achieve this, many of the chosen multiphonics use small intervals with a gentle timbre. Having previously worked with Biehl on *evocazione del mare*, I was able to demonstrate to Baldini the effectiveness of gradually emerging multiphonics. Here the concept was developed one stage further, with a multiphonic emerging from an air sound, allowing Baldini to make particular use of the area between sound and silence. This is described in detail in Chapter 8.

As a guide to composition, Baldini was provided with fingerings for 80 multiphonics that were in the process of being tested for the website. Any differences in pitch, dynamic and response between the bass and the alto flute were being explored, both in isolated instances and within the context of repertoire, and a number of discoveries were made in the process of this collaboration.

The b'/c'' multiphonic in bars 6-9 was found also to contain an f sharp' in the recordings sent to the composer. Writing on 23 February 2013, Baldini says:

I really like this. I will leave it in the score as it is for now, and then...I'll probably just add the F sharp in the score if you think this is consistently the case. I like it.⁷ [Track 7 0:29]

The multiphonic in bar 12 of the first draft was found to be a quieter dynamic than originally anticipated, but Baldini was happy that this was in keeping with the atmosphere of the piece at this point. [Track 7 1:05]

⁷ Email to Carla Rees, 23 February 2013

One other multiphonic, in bar 33, was found to be unreliable. Although theoretically possible, even with the correct change in the angle and speed of the air, finding an even balance between the two pitches was difficult and the overall sound was extremely quiet, to the point of being almost inaudible. It was decided that the likelihood of making this work in context, even with more time to practice, was small, and replacing it with a different multiphonic was the best solution. The selected replacement has a reliable sound with a bigger dynamic range, and the dominant pitch (e'' natural) was able to remain, heard against a second pitch which was a quartertone away, although in this case displaced by an octave.

The image displays two staves of musical notation for a multiphonic in bar 33. The top staff, labeled 'Original', shows a complex multiphonic with a dominant pitch and a second pitch a quartertone away. The bottom staff, labeled 'Revised', shows a different multiphonic with a dominant pitch and a second pitch a quartertone away, but displaced by an octave.

Example 21: Bar 33 of *Kingma and the Duke* by Christian Baldini, with the multiphonic shown in original and revised forms. [Track 7 2:24]

These discoveries in terms of pitch and dynamic response demonstrate the need for clear documentation of multiphonics specifically for each instrument, rather than relying on the fingerings to respond the same way on instruments of different sizes. Baldini's use of these sounds also explores their expressive capabilities, and the success of the piece owes much to the collaborative explorations of the natural response of the bass flute to the written sounds, allowing us to extend the use of multiphonics within a range of expressive musical gestures. This undoubtedly also broadened my experience as a performer; although I was well aware of the timbral and dynamic differences between multiphonics, working on this piece helped me to develop my own expressive range within the limits of each of the sounds.

Oliva

Michael Oliva is a composer with a good deal of experience in writing for low flutes, as a result of our on-going collaboration, which has spanned nearly fifteen years. While his use of the instruments is largely built around the expressive use of their microtonal capabilities, there are a few examples in his works where multiphonics form an important aspect of the musical language.

The nature of the sound of low flutes, with strong lower partials and a bore size which is designed to favour the low register, means that hints of additional pitches can sometimes be heard as a part of the overall tone quality. In the 2005 work, *Apparition and Release*, the multiphonics in bars 119-125 arose as a result of expressive playing at a very quiet dynamic. In an early rehearsal, Oliva asked requested a 'spooky' sound at this point. Initially, this was achieved with an airy tone, which produced the desired effect, but it was found that in keeping the dynamic extremely soft, the final e quarter flat" of the phrase was often accidentally underblown to achieve a multiphonic. Oliva found that this enhanced the overall timbre and created a good blend with the surrounding harmony, and it was subsequently decided to take this approach with the whole phrase, producing multiphonic octaves from harmonics for the first two notes:



Example 22: Multiphonics in bars 119-125 of *Apparition and Release* by Michael Oliva [Track 9 5:21]

In *Bereft Adrift*, Oliva demonstrates a more planned approach to the use of multiphonics, although the piece's structure is built almost entirely around another multiphonic discovery. At the time the piece was being written, Oliva and I were exploring improvisation using gesture-based electronics systems and live instruments. As an improviser, I have

often found that particular sounds and intervals become a regular part of my musical language. One such sound is the rich multiphonic created by overblowing the lowest note of the instrument, b, sounding the fundamental and the first four partials simultaneously. Having heard this sound a number of times, Oliva was keen to incorporate it into a piece. As a spectral composer, the harmonic series often features in his music as one of the main building blocks of his harmonic system. We spent some time looking at ways to modify this fingering to produce other multiphonic pitches that could work in conjunction with the overblown b. A significant breakthrough was made when it was found that by venting the small hole in the A key, a second multiphonic, referred to by an abbreviated description of its fingering as *low B half A*⁸ could be created using the notes b, f', b', g'' and d sharp''. Furthermore, by sliding the A key shut while holding this multiphonic, the chord could be made to resolve onto the harmonic series from b. This was to form one of the main sound sets of the piece, with the 'low B half A' multiphonic heard and developed through the piece, resolving finally onto the b harmonic in bar 106 as the climactic moment of the piece:

The image shows a musical score for two parts: B. Fl. (Bass Flute) and Lx. (Lip). The B. Fl. part begins at bar 103 with a dynamic marking of *p*. It features a multiphonic chord that evolves over time, with a 'slide to cover full A key' instruction. The Lx. part has a circled 24 and 25 below it, indicating specific moments in the performance.

Example 23: 'Low B half A' multiphonic resolving to the harmonic series on b in bars 104-107 of *Bereft Adrift* by Michael Oliva [Track 10 4:58]

Like Biehl, Oliva's multiphonic writing is practical, allowing the pitches to be added and removed one at a time, as can also be seen in the example above.⁹ This is easier to execute for the player than a

⁸ i.e. the fingering is as for b, but with the small central hole in the A key uncovered.

⁹ Oliva's notation shows only the addition of the upper pitches; it is implied that all the available pitches between the upper note and the fundamental will also sound, due to the method of production of the multiphonic.

simultaneous sounding of several pitches, as the exact air angle for each note can be found one by one, giving a smooth harmonic sweep through the pitches while maintaining previously sounded notes. As well as being practical, however, the use of this technique in this piece provides extra emotional impact to the climax. Here, the sounding of the five note multiphonic from low b is simultaneous, giving additional strength to the resolution from the previous multiphonic. The writing here is failsafe; the previous multiphonic is built up note by note, allowing the player to stabilize the embouchure position before the key is gradually covered to produce the resolution. This kind of multiphonic treatment demonstrates a true understanding of the method of production of these sounds, which can only be developed through working closely with a player.

A further exploration of multiphonics can be seen in Oliva's most recent work for solo alto flute, *Les Heures Bleues*, composed in 2013. This is Oliva's first work which does not include electronics, and the requirement to write for a single instrumental line presented Oliva with new challenges. Here, multiphonics are used to present harmony, and are often combined with trills to provide textural movement. Oliva's work is strongly influenced by Debussy and Scriabin, and this can be seen here in both the expressive range of the work and the harmonic language.

Oliva chose the multiphonics from those provided on the alto flute website, with specific harmonic requirements in mind. Many of the multiphonics provide a structural framework for the harmony as the piece develops. For example, the opening 9 bars are formed almost entirely from two multiphonic combinations:

Example 24: Use of multiphonics in the opening bars of *Les Heures Bleues* by Michael Oliva. Bars 1-9 [Track 11]

Throughout the piece, Oliva makes use of fingering combinations which require the fingers to move from ordinary playing positions. This opens up further multiphonic note combinations, but can sometimes be problematic on low flutes as a result of awkward hand positions and large stretches for the fingers. In the example above, the multiphonic in bars 5-6 requires all of the right hand keys to be held down, in addition to the second trill key. On a C flute, this can be practically realised with the hands in the normal position, with either the third or fourth finger leaning on the trill key. However, on the alto flute, the increased distances between the keys means that it is impractical to reach the trill key while still covering the open holes.¹⁰ The solution is to place the second and third fingers on the F and E keys, as normal, and then use the fourth finger to operate the trill key. The fifth finger then has to move much further along the flute than normal to cover the open hole on the D key. The player also has to turn the flute slightly outwards to change the air angle, so the hand position becomes even more awkward. Although this seemed practically difficult in the early stages

¹⁰ This is one example of a situation where a closed hole instrument would be more practical, since without the necessity to cover an open hole in the key, the finger positions would be more flexible. However, this fingering also requires the open hole of the A key (LH2) to remain open, so would not be possible on a closed-hole alto flute.

of learning the piece, with practice the hand movements have become more reliable and quicker to execute. However, these departures from standard hand positions can place considerable strain on the hands and arms, especially in conjunction with balancing the weight of a heavy instrument, and cannot be maintained for long periods of time.

Similar hand position changes are also required in some of the multiphonic trills, for example in bar 10, where two right hand keys, the second trill key and the D key, have to be held down while two other keys, the F key and the first trill key, are trilled.



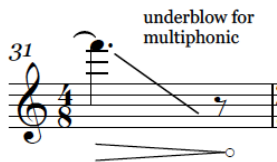
Example 25: Multiphonic trill in bars 10 and 11 of *Les Heures Bleues* by Michael Oliva. The fingering of this trill requires the right hand little finger to operate a different key from normal. [Track 11 0:45]

Flute players are taught from the early stages of playing that a specific finger operates a particular key. Sometimes a single finger might operate more than one key, but hand positions are essentially fixed and it is considered ‘wrong’ to use the right hand little finger to operate anything other than the footjoint keys, as is required in the examples above. However, the Kingma System encourages a change of attitude in this respect. Rather than relying on the fingers moving up and down, many of the fingering combinations require a sideways movement of the fingers, sliding to cover open holes or changing position to enable the hand to reach the additional keys. This is something that players are quickly able to adapt to, and although the sliding movements are inherently slower than the traditional method of closing keys, particularly on low flutes where the distances between keys is larger, it encourages the player to think more flexibly about hand positions, and ultimately to find solutions such as those outlined above.¹¹

¹¹ For further applications of the use of flexible hand positions, see Chapter 4.

Tweedie

Another of the case studies which makes frequent use of multiphonics is Marc Tweedie's *Zoli*. Here, he uses two of the three types of multiphonics. Upper register fingerings are underblown to allow lower pitches to emerge, as can be seen bars 31, 61 and 76. The first of these can be seen in the example below.



Example 26: Underblown multiphonic in bar 31 of *Zoli* for solo bass flute by Marc Tweedie [Track 8 2:01]

Primarily in the penultimate section of the piece, Tweedie introduces low register pitches which are overblown to produce additional upper partials from the harmonic series, such as in bars 27, 73 and 82-4. The third type of multiphonics, using special fingerings, is not used in this work.

Example 27: Bars 79-84 of *Zoli* showing multiphonics produced through overblowing a fundamental. [Track 8 5:27]

As seen in many of the other repertoire examples, in this piece multiphonics are always notated to emerge gradually from the original sound, ensuring that the stability of the melodic line is never interrupted. Multiphonics are also often connected with a dynamic change, either a crescendo or diminuendo as the pitches emerge, and as such are used with a sense of drama. Most notably, the overblown multiphonics in the penultimate section form important events within the climactic moments. The inclusion of over- and underblown multiphonics suggests their use as a form of expression, emerging through an increase or decrease in the air flow, and these multiphonics

serve to emphasise the folk-music elements of the piece's concept through their impurity. They are used for timbral contrast, possessing a 'raw', organic quality, which lends itself well to the expressive nature of the piece. It is almost as if Tweedie is aiming for an uncontrolled use of the air to produce the multiphonics, with the player blowing too hard in the louder sections and not hard enough in the softer sections; of course this is a simplification of how these sounds are produced, but the dramatic effect remains.

Tweedie shows an understanding of the response time required to enable the multiphonics to sound by the addition of the following note in the score's glossary of techniques:

More or less time may be taken over these depending on performance factors such as reverb in the concert space and breath of the performer.¹²

Conclusion

In summary, all of the repertoire examples shown here demonstrate the natural incorporation of multiphonics into the flute's expressive language, with the additional keys of the Kingma System providing wider possibilities for the composer in terms of harmonic capabilities. In Oliva's *Les Heures Bleues*, for example, he uses the Kingma System's capabilities almost entirely just in terms of the additional multiphonics it provides. In the example by Dan Di Maggio, use of the Kingma System allowed practical solutions for the multiphonics which were the close matches to the harmonies originally imagined. The works by Christian Baldini and Claes Biehl are technically challenging and make full use of the Kingma System's scope, and the broad range of multiphonics used forms an important part of the compositional language. These collaborations have resulted in a much increased repertoire of multiphonic fingerings on Kingma System flutes, and there is scope for

¹² Marc Tweedie, *Zoli* (London: Tetractys, 2012)

further exploration still of this important area of the instrument's capability.

The Kingma System is frequently referred to as a quartertone flute, as a result of its groundbreaking developments in this area. However, it can be seen already through the extended range of multiphonics that the System's potential extends further than just its improved capability for quartertones. In the chapters that follow, the use of further aspects of the Kingma System will be explored, demonstrating the breadth of the impact of this innovative design.

4. Alternate fingerings, Flexible Hand Positions and Timbral Trills

During the course of this research the concept of alternate fingerings took on a new perspective. Traditionally, alternate fingerings are used to create subtle variations of timbre, so that, for example, a trill can be made between two notes of the same pitch. A wealth of composers, including those writing in diverse compositional styles, such as Takemitsu and Ferneyhough, has used alternative fingerings in this way.¹ However, upon close examination of documented flute alternative fingerings, it was found that the majority of these fingerings have microtonal pitch inflections as well as timbral changes.² In general use, this is not problematic, and sometimes a microtonal pitch inflection creates a greater effect within the context it is used. However, when considering these fingerings within the context of an essentially microtonal instrument, any pitch changes that approximate quartertones or clearly distinctive smaller microtonal increments can no longer be included as alternate fingerings.

New solutions had to be found where pitch changes were kept to a minimum, while maintaining some timbral contrast. The alternate fingering charts in the websites, seen at <http://www.altoflute.co.uk/04-timbre/alternate-fingerings.html> and on the corresponding page of the bass flute site, give at least one fingering possibility for each pitch. The additional venting of the Kingma System allows for a wider variety of fingering combinations, and undoubtedly, more true alternate fingerings will be found in time.

However, in some repertoire, what a composer expects in the use of alternative fingerings is in fact a microtonal pitch inflection rather than purely an alteration of the tone. This gives a more exaggerated alteration than one based on timbre alone, and as we have seen, in music written for a Boehm System flute, the use of microtonal

¹ See Takemitsu (1930-1996) *Toward the Sea* for alto flute and guitar (Schott) and Ferneyhough (b.1943) *Sisyphus Redux* (2010) for solo alto flute (Peters).

² Such as those listed in Dick and Levine.

fingerings frequently results in alterations of both timbre and dynamic. With the Kingma System, it is possible to define these timbral changes through careful pitch notation and the provision of a suitable fingering. There is potential for a wider exploration of the numerous fingering combinations of the Kingma System to provide detailed fingerings for 'microtonal segments'³ which could be used in these contexts, giving the composer greater control over the pitch differentiation and the tone quality required.

When performing pre-existing works from the flute's repertoire on Kingma System instruments, this raises an important question of interpretation. The player must decide when to maintain the pitch and change only the timbre of the note, and when it might be more appropriate to use microtonal pitch inflections. Ultimately, this may perhaps even vary from moment to moment within an individual piece, based on the musical contexts required, but there are often cases where use of Kingma System fingerings might provide a better result than those provided for the Boehm system flute.

We have already seen in Murail's *Unanswered Questions* that given fingerings can be replaced with Kingma System fingerings to good musical effect. In the case of Murail, the aesthetic of the composer was to create even-sounding quartertones throughout. However, other composers use a mixture of timbral changes and microtonality, and deciding which approach to take is not always so straightforward. One such example is Daniel Kessner's *Micro-images* for solo flute, written in 2003-4.⁴ I premiered this work in 2004 on a Kingma System alto flute, although the piece was written so that it could be played 'on an open-hole flute with a low B or an instrument otherwise equipped to produce the required microtones'.⁵ Kessner provides detailed fingerings to enable the player to reproduce quartertones on a Boehm system flute,

³ As seen in Robert Dick's *The Other Flute*, 62-69

⁴ Published by Theodore Front.

⁵ Txt taken from the performance notes in the score

and a number of these unintentionally result in alterations of tone colour. However, there are also many circumstances during the work where an intended alteration of colour (but not always pitch) is indicated through the use of alternate fingerings and harmonics. Since Kessner is himself a flute player, and conveys many details in the score, my own preference is to use his given alternate fingerings where it is clear that a variation in colour is required (for example, for the whole of the *Nanalogue* movement, where small microtonal pitch increments feature alongside timbral variations), and to use standard Kingma System fingerings for the quartertones. This approach means that the timbral changes can be separated from the microtonal language, giving them greater emphasis within the expressive communication of the work. Decisions such as this can be encountered throughout the repertoire, and allow players of the Kingma System greater choice over how to present the fine details of a composer's work. Explorations of non-Kingma System specific repertoire such as this leads to a greater understanding of the potential of the Kingma System, which can then be exploited by composers writing music specifically for these instruments.

Adagio; ♩ = 52 ca.

The musical score shows a melodic line in the upper staff and a corresponding line of notes and fingerings in the lower staff. The upper staff begins with a *pp* dynamic and a *poco* marking. The lower staff includes fingerings such as *-L1*, *T (only)*, and *-L1 T ord.*, along with *+12* markings indicating specific fingerings for alterations of tone colour.

Example 28: Opening of the *Nanalogue* movement from Kessner's *Micro-images*. The lower staff shows the fingerings to be used for alterations of tone colour.

Flexible Hand Positions

One further technical issue regarding the use of alternate fingerings came to light while working on Claes Biehl's *evocazione del mare*. The nature of the Kingma System, especially when applied to the bass flute where more of the open holes are replaced by additional keys, is that

each finger is required to control the operation of several keys. In most cases, this does not present much of a problem, and the player can quickly adapt to the additional dexterity required. During the course of these collaborations, the composers were made aware of any restrictions of movement between particular notes and, when these are taken into account, the instrument can be used with a sense of versatility. In the case of *evocazione del mare*, I found that certain note combinations became easier to execute with the adoption of a less fixed hand position. This allowed for greater hand movement so that large stretches could be reached more readily. However, one fingering combination required an even more flexible approach. In bar 139, shown below, the bass flute part contains rapid movement from f quarter sharp” to c three quarters sharp’:

Example 29: Bars 138-139 of *evocazione del mare*, showing awkward fingering combinations in bar 139 [Track 3 7:13]

In this combination of notes, the left hand is required to move from all keys down to all open, which in itself is unproblematic. However, at the same time, the first finger of the right hand has to move a considerable distance from the outside rim of the F key to the C sharp up lever, which is located further up the body of the instrument. This requires a considerable movement for the entire hand, which takes time to execute and cannot be achieved smoothly in a slur, as is required here. The two notes alternate in this example, and the initial reaction was that this would have to be re-scored. As we have seen, flute players are taught from the beginning that each key is operated by a corresponding finger⁶ and alterations are never made. However, within the context of

⁶ For example, the first finger of the left hand plays B, the second plays A, the third plays G, and so on.

certain multiphonics on low flutes, modifications are made to allow additional access to some keys.⁷ By using this principle as an example, a workable solution was found. The rim of the f' key could be operated by the second finger of the right hand instead of the first, leaving the first free for the C sharp up lever, and moving the hand into a position which makes both keys accessible at the same time. The short rest before the notes are sounded was used to move the hand into the new position. It was found that moving back was faster than finding the new position, since the hand is more used to that posture, and so the transition could easily be made in the space between the two slurs at the beginning of bar 140.

This fluid approach to hand positions is an important aspect of Kingma System technique. The sliding motion required to hold down the outer part of the key while opening the central hole means that fixed hand positions are limiting to overall agility, and the player must develop an ability to break away from the static hand positions of conventional flute playing if they are to explore the full potential of the Kingma System's agility.

Timbral Trills

The Kingma System allows for a wider variety of timbral trills than the open-hole C flute, and a significantly greater range of timbral trill fingerings than a standard closed-hole alto or bass flute would provide. The fingering charts provided in the websites give at least one example for each pitch, including quartertones, with the exception only of the instrument's lowest pitches for which there are no alternate fingerings. These can be seen at <http://altoflute.co.uk/04-timbre/timbral-trills-fingering-chart.html> and on the corresponding pages of the bass flute website at <http://www.bassflute.co.uk/04-timbre/timbral-trills-fingering-chart.html>. As with alternate fingerings, solutions were located for each pitch which had minimal microtonal inflection. Since a

⁷ As seen in the example of Michael Oliva's *Les Heures Bleues*, described in Chapter 3.

range of quartertone trill fingerings is given elsewhere in the website, it is important that as far as possible, these timbral trill fingerings should alter the timbre of the note only, providing the textural effect of movement in a long note. Timbral trills have been used in this way to good effect in the music of composers such as Michael Oliva, Claes Biehl and Scott Wilson.

5. Notation

Notation is of paramount importance in the communication of the composer's intentions and approach. The notation of extended techniques appears to develop on an instrument-by-instrument basis, as a result of specialist treatises by individual performers. In the case of the flute, Robert Dick's method of notation has become the adopted standard, as a result of its clarity and logic.¹ Despite this however, there are sometimes alternative notations used for individual sounds and it is not uncommon for a glossary to appear at the beginning of a score for clarity. When writing for a new instrument, such as the Kingma System flute, it can take time for standardised notations to develop for the new technical possibilities that arise through collaborations between composer and performer, as composers sometimes find a range of solutions for the notational problems that arise.

The score of Marc Tweedie's *Zoli* is highly detailed, and makes use of a number of extended techniques. The notations used are clear, following standard conventions wherever possible. Precise instructions are given in the score through the use of text descriptions, such as 'overblow for multiphonic' and 'air + tone'. In addition, the notations used, and the techniques they refer to, are clearly described in a glossary at the beginning of the score. This is an excellent practice which avoids confusion and ensures that the composer's intentions can be met by the performer.

The use of instrument-specific notation can cause confusion at times. Whenever a composer uses a method of notation associated with a different instrument within a score, the results can sometimes be

¹ In an email to the Flute Listserv email discussion group on 19 March 2000, Robert Dick writes "I'm also happy to report that the international Conference in New Musical Notation (I believe in 1979 but I'm not absolutely sure of the date) adopted most of my notations as standard. One of the ongoing problems with contemporary works is the plethora of notations for the same sounds and the use of different systems to notate fingerings. It is natural, of course, that unification is a process that takes time – it took several centuries for standard notation to settle into its form and its going to take a few more decades for the notations of extended techniques to do the same." <http://www.larrykrantz.com/multphon.htm> (accessed 19 May 2013)

incongruous, although usually understood. For example, in a recent workshop with undergraduate composers at Royal Holloway University of London,² a timbral trill was notated as a long note with the performance direction 'wa-wa effect'. Although this is an unusual term to use within the context of flute music, the composer's intention for a timbral trill was understood.

It is inevitable that with any technical advancements in the design of an instrument that result in the extension of that instrument's capabilities, new approaches to notation must be explored and developed to express these capabilities. Within this doctoral research, different methods of notation can be seen, especially in the area of microtones, where composers are often limited by the capabilities of their choice of notation software. The notational examples provided in each section of the alto and bass flute websites aim to provide samples of the most common forms of notation for each of the given techniques, based on practical experience across a wide range of compositional approaches. These are further expanded through suggested repertoire examples which direct composers to practical applications of these examples. See <http://www.altoflute.co.uk/08-repertoire/repertoire-examples.html> and <http://www.bassflute.co.uk/08-repertoire/repertoire-examples.html>.

Quarternote Notation

As previously described, quartertones on the Kingma System are produced from sharpening the semitone below, i.e. an A quarter sharp is produced by modifying the fingering for A, a D quarter sharp is produced by modifying the fingering for D, and so on. For this reason, quartertones notated in sharps are much quicker to read and interpret than those written in flats. For example, to play an E quarter flat, the player must first enharmonically translate the note to D three quarters sharp, before working out that a modification of D sharp is required to

² 8 February 2013

produce the note. Of course, with experience and practice this procedure becomes much quicker, but even after more than a decade of using the Kingma System, I still find my sightreading abilities are more refined when reading sharps in complex repertoire. For this reason, when working directly with composers I often advise them to notate in sharps wherever possible. This poses inevitable issues of harmonic 'spellings' and a balance must be made between practical efficacy and theoretical accuracy.

For this reason, in *Andromache's Recitative, Aria and Subtext*, Morsink has notated quartertones as sharps throughout the piece. This made the music easier to learn quickly, which was an important consideration with the amount of time available for this particular project. Morsink also uses a system of accidentals applying only to the note they precede. This is common practice in some contemporary repertoire and any initial confusion, caused as a result of being accustomed to the more traditional convention of accidentals continuing until the end of a bar, were quickly overcome.

At a time when the majority of scores are presented to performers in a computer-typeset form, limitations of notational software can have an impact on the notation of microtones. In the case of Michael Oliva, the original versions of his scores are notated using *Logic*, which is computer software used for recording and creating electronic music. As this is essentially a sequencer, using MIDI to input the score, rather than a dedicated music notation programme, there are some limitations in the presentation of the score. Most notably, there are no standard symbols for quartertones. Instead, an arrow is placed over the accidental to indicate that the pitch should be raised by a quartertone. Although this is not standard quartertone notation, it is quite common for quartertones to be shown in this way and was found to be a practical solution when writing for the Kingma System, since it allows the player to think in terms of upwards modifications of a standard pitch. From the earliest works in Oliva's portfolio of pieces for low

flutes, this was found to be the most effective method of notation given the constraints of the software used. However, this notation is also used by other composers to indicate a smaller microtonal pitch increment than a quartertone, and clarification is needed to ensure the correct communication of exactly what is required. For this reason, in preparation for publishing, the MIDI files were imported into *Sibelius* notation software and these accidentals were replaced with more standard quartertone symbols.

Another form of quartertone notation can be seen in Baldini's *Kingma and the Duke*, where standard conventions are used throughout, except for the notation of quartertones. Baldini uses sharp or flat signs with a figure 4 at the top to indicate a quartertone sharp or flat. These symbols are used before a standard note (no additional accidental) or before a sharp or flat (with an additional accidental before the main note). As can be seen in the example below, they are also slightly smaller than standard accidentals.

Example 30: Quartertone notation in *Kingma and the Duke* by Christian Baldini. Bars 57-59 [Track 7 3:29]

This method, too, is not uncommon, but this was the first time I had encountered it, and it initially caused some confusion, especially when reading quickly and in the early stages of learning the piece. If we take the first example from the extract above, the symbol means that the first *f'* should sound a quartertone higher. However, the player, who has been trained to deal with accidentals, reads the sharp sign first, followed by the 4, so the thought process is 'sharp>quartertone', which can sometimes be erroneously interpreted as a quartertone higher than a sharp – in this context, *f* three quarters sharp", which, as we have seen in the works of Michael Oliva, can be notated as a sharp sign with an

upwards arrow. Furthermore, given that the Kingma System works on sharpening standard fingerings, I found that this method of notation resulted in constantly thinking of raising the note by a semitone and then reducing the interval down to a quartertone, rather than working upwards from the original note, because of reading the sharp sign first. I found it was possible to become accustomed to this method of notation, but it took time and was not immediately instinctive. Within the context of this piece, it meant that there were several misreadings in the early stages of playing the work, and I found myself adding 'respellings' of the accidentals to the score in many cases.

Notation of Multiphonics

Multiphonics on the flute can be performed either simultaneously, as is required in the music of Robert Dick, or the notes can be introduced one by one and allowed to fluctuate, as can be seen in many of the case study works. In *Vortically*, Wilson takes a practical approach to the notation of multiphonics. Often based on overblowing octaves through the use of harmonics, he has adopted a method of writing brackets around non-melodic notes, as shown in the example below at rehearsal letter C:

The image shows a musical score for flute, starting at measure 40. The score is in 5/4 time and changes to 6/4 time at measure 41. At measure 42, there is a rehearsal letter 'C' in a box. The tempo is marked as quarter note = 90. The music features multiphonics, with notes grouped by brackets. Dynamics range from *p* (piano) to *mf* (mezzo-forte). A timpani part is indicated with '(timb) trmm' and a wavy line. The phrase 'More atmospheric' is written above the multiphonics. A triplet of eighth notes is marked with a '3' and a bracket.

Example 31: Brackets to show transitions within multiphonic pitches, bars 40-43 of *Vortically* by Scott Wilson. [Track 4 2:35]

The brackets give an indication of pitches emerging as the multiphonic is produced. The overblowing needed to produce these sounds, and the overall response of the instrument, means that precise rhythmic control over the emergence of the different pitches is difficult, although not impossible. By giving a clear indication of the melodic direction, the player can adapt the air stream in order to ensure the reliability of these pitches, while creating a smooth transition between the pitches.

This notation indicates that the transition itself is an important aspect of the bass flute line, and that nothing is sacrificed musically to allow the transition to take place organically at the instrument's natural speed of response. Wilson says:

I realized that I like the fragility of those transitions, which after all are sonically interesting non-linearities in the response of the instrument, and that it was musically advantageous to explore them, rather than attempt to smooth them out as if the instrument was completely homogenous in its response. I suppose that's a rather more 'Eastern' than Western conception of the instrument. Shakuhachi is the obvious parallel, with the obsession with the break, but for me it's more conceptual than imitative.³

In some cases, this technique is used to create an uninterrupted transition between octaves, with the low notes sounding first and the player gradually bringing in the higher register, sounding both together and then focusing on the higher pitched notes:



Example 32: Transitions of multiphonics, bars 174-175 of *Vortically* [Track 4 10:04]

Markings such as this are extremely useful to the performer in terms of presenting a clear picture of the composer's intentions. When a player sees a multiphonic, the aim is usually to present a well-balanced sound. However, it is possible to change the balance of the notes within the multiphonic, within the limits of each individual combination in terms of the instrument's response, through a combination of minor changes to the air speed, air angle and internal resonance.⁴

³ Scott Wilson email to Carla Rees, 19 March 2013

⁴ For a full description of multiphonics, see the website section: <http://www.bassflute.co.uk/06-multiphonics/multiphonics.html> and Dick, Robert *Tone Development through extended techniques* (New York: Multiple Breath Music Company, 1986), 36

Within the context of a collaboration, certain details of notation can sometimes become superfluous if a work is intended for a particular performer who is familiar with an individual composer's approach. For example, the versions of Michael Oliva's scores used for the first performances contain very little in terms of marks of expression beyond the most basic of dynamics and articulations. An interpretation of the work develops as part of our collaboration, and having worked together for more than a decade, a number of these details can be taken as read, without the necessity to include them within the score. Performance directions are added during the rehearsal process as a result of the composer-performer dialogue, and articulations and subtleties of dynamics and tone colour are, by and large, left to the discretion of the performer. This is acceptable within the confines of the collaboration, and is not uncommon - for example, some of Nono's bass flute writing for Roberto Fabbriciani is lacking in many notational details - but presents a problem if other performers are to access the true nature of the music within their own interpretations. For this reason, the published versions of Oliva's scores are presented in a performers' edition, which I created through analysing my own approach to the music in concert and studio recordings and adding expressive notation accordingly.

It can be seen from these explorations of notation that any evolution in an instrument's design, which enables the development of playing new techniques, in turn stimulates developments in other areas. The notation of these techniques is one clear area where existing methods have to be modified and extended in order to suitably express the composer's language. In turn, it follows that notational software may also require an expansion of its capabilities in order to serve the composers effectively.

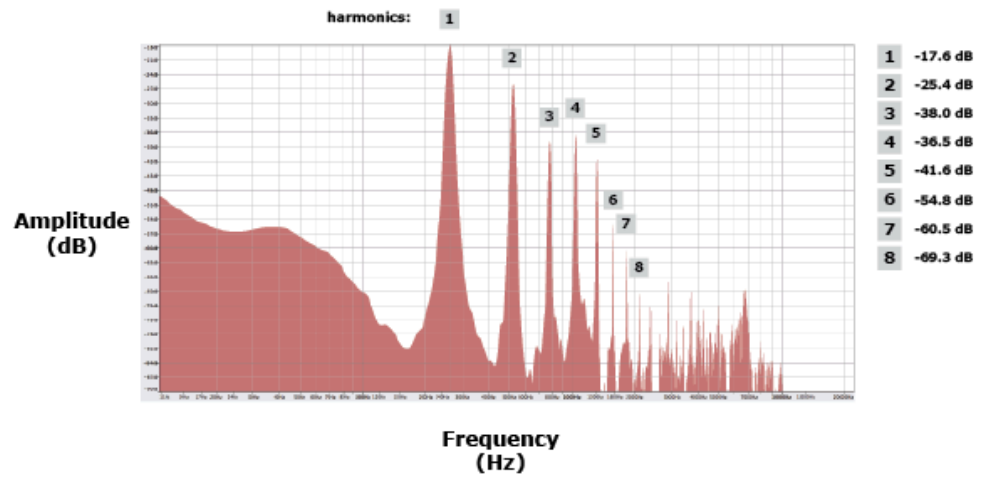
6. Tone Colour/Timbre

Some interesting observations regarding dynamics, tone colour and projection were made during the course of this research. On the C flute, to play louder, an increased volume of air must be used. Often, however, this is accompanied by an increase in the air speed, which causes the pitch to rise. Although this can be controlled in several ways, for example by increasing the size of the embouchure's aperture,¹ players often compensate for this sharpness through other means, such as an alteration of embouchure position to change the angle the air hits the sounding edge. However, this technique does not lend itself well to the alto or bass flute. If the air stream becomes too fast, the volume of sound does not increase, but instead overblows to an upper partial, losing control of tone. Sharpness in pitch also occurs, but it is more common for the pitch to be lost altogether, with no alteration in dynamic. In order to play *forte*, the player must develop the technique of increasing the volume of air without any resultant increase in air speed.

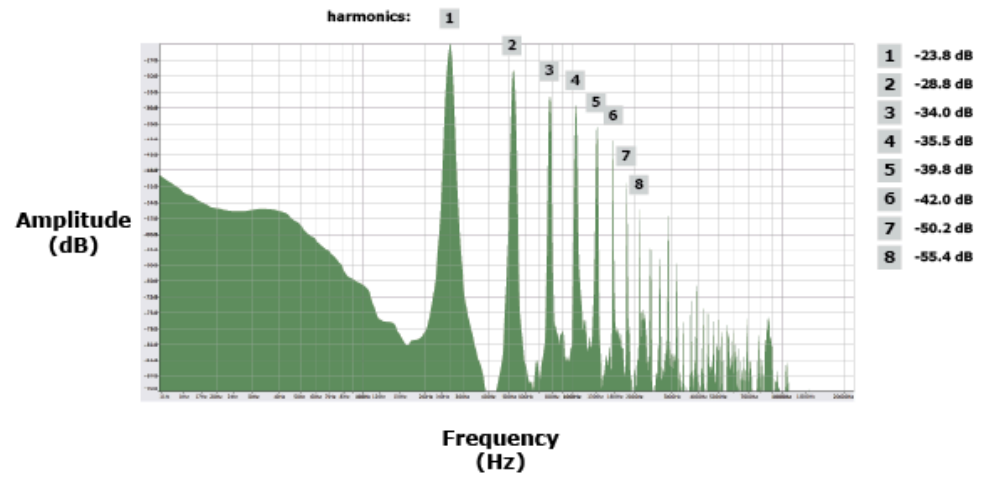
To help composers and performers understand the difference in tone quality between the members of the flute family, a spectral analysis of sounding *c'*, played at *mf* on C flute, alto flute and bass flute is provided on the website at <http://www.altoflute.co.uk/03-dynamics/spectral-analysis.html>. This was produced in *Audacity* and clearly shows the different arrangement of partials within each sound. The bass flute has strong lower partials, and the harmonics fall away quickly in a steep curve. The alto flute shows the same pattern but in a less extreme fall-off of partials, while on the C flute, the third harmonic is stronger than the fundamental, and there is more strength in the upper partials.

¹ A wider aperture reduces the air pressure and therefore allows a greater volume of air to travel at lower speeds.

Bass flute



Alto flute



C flute

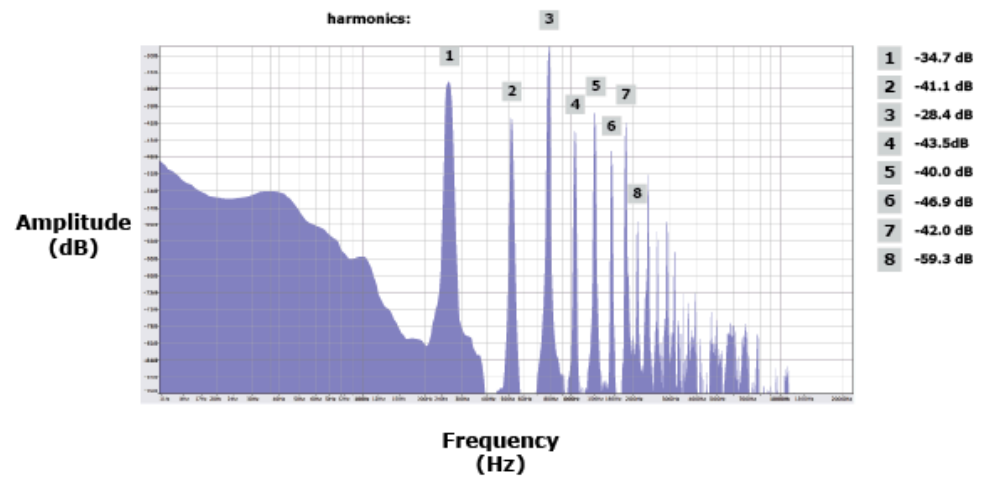


Figure 14: Spectral analysis of 'c' on bass flute, alto flute and C flute

The dynamic curve of alto and bass flutes is not the same as the C flute. Although all three instruments get louder towards the upper register, on low flutes the lack of high partials in the sound means that these pitches do not project as well as the lower notes, and much of the loudness of the sound comes from air noise, rather than the sound of the flute itself. To assist with projection, the skilled low flutes player may use tone colour to emphasise the existing higher partials. This is achieved through a combination of embouchure position and mouth shape. Evidence exists in support of this, even on the C flute, and the type of tone used by the player undoubtedly has an effect on the projection of the sound. Trevor Wye hints at this in his *Practice Book for the Flute, Volume 1*, thus:

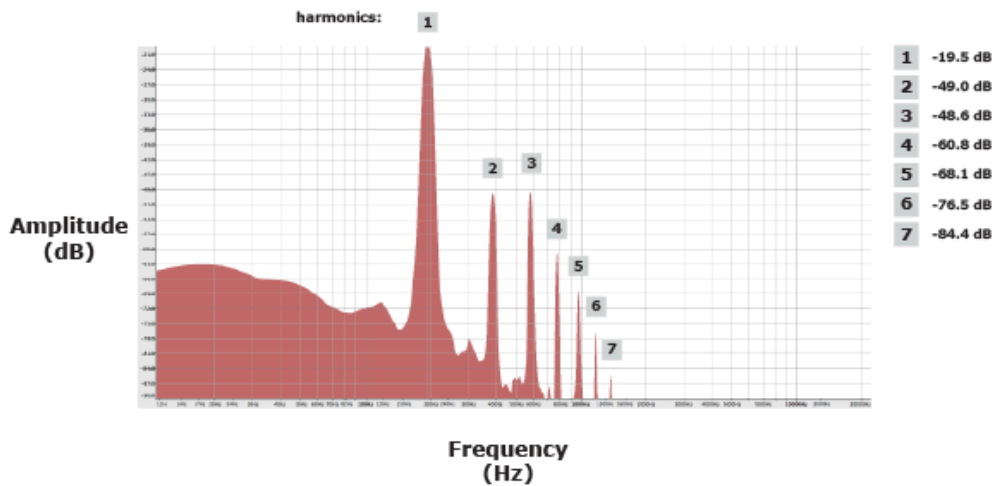
Play this first exercise A with a full, strong, rich, dark 'purple' tone. Try not to turn the head of the flute inwards to do this. It is better to play this exercise loudly.... now play exercise B with a hollow, 'open', gentle 'yellow' tone, more like the recorder in colour. Play more softly than A. ²

It is interesting to note the link between the type of sound suggested and the optimum dynamic for practice. Clearly, these tone colours can be developed to be applied to any dynamic level, with greater or lesser effect, but there is a natural tendency for certain tone colours to align with specific dynamics.

² Trevor Wye, *Practice Book for the Flute, Volume 1, Tone* (London: Novello 1980, reprinted 2005), 24

A spectral analysis of notes at each dynamic extreme, *ppp* and *fff* on alto and bass flute is also given on the respective websites at <http://www.altoflute.co.uk/03-dynamics/spectral-analysis.html> and <http://www.bassflute.co.uk/03-dynamics/spectral-analysis.html#bass>. The crescendo is produced, in part, through changes of tone colour, and the relative increase in upper partials is clearly visible on the analysis charts. The increase in strength of extreme high pitches, especially on the bass flute suggests an increase of air noise within the sound.

ppp



fff

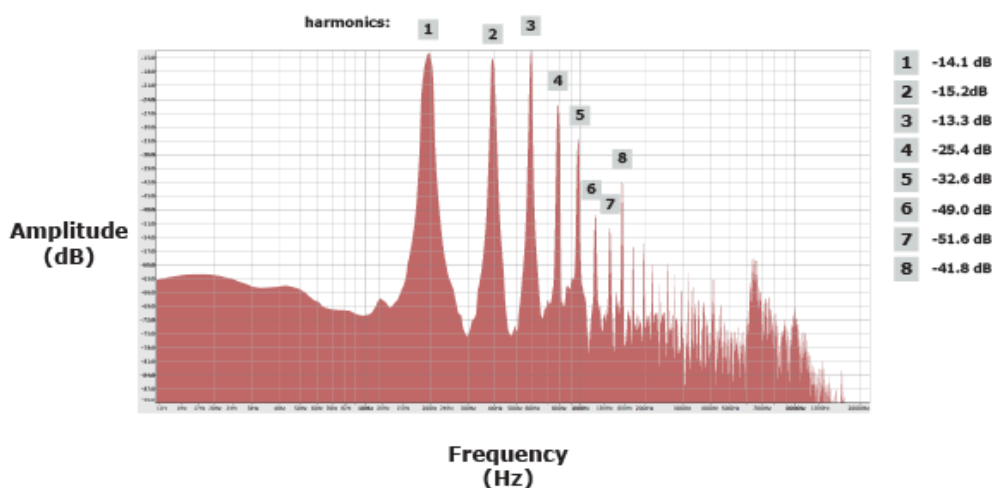


Figure 15: Spectral analysis of bass flute *g'* at *ppp* and *fff* showing an increase in the upper partials with an increase in dynamic.

My own personal experience is that the upright design of the Kingma System bass flute used in this project also allows for a wider dynamic range than many other bass flutes are able to provide. The upright design allows the instrument to be centred in front of the body, rather than being held to the right hand side, with significant weight and difficult stretches for the arms. This provides an important postural improvement for the player, allowing for more available energy while playing, and more efficient use of the player's air capacity. Combined, these create an improved tone and greater power, which can be exploited in the repertoire, for example through the expressivity of the bass flute's line in Michael Oliva's *Bereft Adrift* or the detailed performance instructions in works such as Claes Biehl's *evocazione del mare* and Scott Wilson's *Vortically*.

As we have already seen, the application of tone colour on low flutes extends beyond creating an alteration of timbre for subtlety of phrasing. This is a fascinating area of study, and one which will benefit from further research as a dedicated project. The creation of different timbral variations in the sound is surprisingly undocumented, but the perception remains that tone colour is produced almost entirely from changing the vowel shape inside the mouth. Southworth states:

Most languages involve the use of five vowel sounds: a-e-i-o-u. Increasing your awareness of these vowel sounds, and integrating them into your own playing, will greatly improve your tone production. It is these vowel shapes, along with air speed and direction, which give your sound its colour.³

She continues:

If we put our vowels in order of the most open to the most closed, we get: o-u-a-i-e. In order for these vowels to be more successful, like singers, we have to lengthen the sounds to: oh-oo-ah-ay-ee.⁴

³ Clare Southworth, *The Expression of Colour* (London: Just Flutes Edition 2008), 4

⁴ *ibid.* 4

Southworth's explanation of why the use of vowel shapes changes the sound of the flute tone relates to harmonics, with the vowel shapes resonating different numbers of upper partials in the sound.

We have seen that this concept of changing harmonics has a useful implication for lower pitched members of the flute family. However, it is conceivable that, on low flutes, the difference in the distribution of harmonics within the basic sound, and the relative weakness of the upper partials, means that fewer variations in tone are possible through the use of vowel shapes alone. In addition, the wider air stream used to play lower pitched flutes means that the subtle changes in mouth shape through this technique have a reduced effect on the instrument's sound. It follows that this is even more apparent on the bass flute than on the alto flute. However, the overall range of colour available on the alto and bass flute is much wider than that of the C flute, with soft, mellow tones particularly easy to produce due to the larger size of the instrument.

To test the theory that tone colours are produced differently on low flutes than on the C flute, phrases were played using different formations of the mouth and the embouchure. It was discovered that by changing the vowel shape in the mouth alone, very little change in timbre could be detected. However, if this was combined with a change in the focus of the air stream by widening or compressing the embouchure's aperture, a much more effective change in tone was perceived. The muscles of the embouchure can provide fine control for the air stream, and a bright, edgy sound, which is rich in harmonics, is produced by compressing the air stream, while at the other end of the tone colour spectrum, an open, hollow sound with fewer partials is created through a more open aperture. In the website, four main types of tone colour are identified, named as *full*, *hollow*, *bright* and *airy*, as seen at <http://www.altoflute.co.uk/04-timbre/tone-colour.html>. The full tone uses maximum internal resonance but without a highly compressed embouchure, whereas the bright tone increases the harmonics in the sound through focus of the airstream. At the opposite

end of the range, an airy sound has an open aperture and therefore less focus, and a hollow sound is similar but with more internal resonance. Giving any sort of name to these types of timbre is difficult, since the descriptions are necessarily subjective, and different listeners are likely to choose different descriptors for each sound. However, the multimedia nature of the alto and bass flute websites allows composers and performers to hear each of the sounds in conjunction with their descriptions to avoid any misunderstanding or misinterpretation.

A further note of caution was added to the websites regarding the notation of tone colour. While it is possible for composers to dictate the type of sound the player uses for specific notes, certain contemporary techniques can only be produced through the use of a particular internal mouth and embouchure position. For example, this is particularly true of multiphonics, as well as singing and playing. In these situations, a composer's request for a particular sound type may interfere with the production of the technique, and it is therefore advisable to leave matters of tone colour to the performer.

Harmonics

Harmonics are frequently encountered in flute repertoire, as a timbral alteration which is less penetrating than a standard note, and were first used for the modern flute in the mid 19th century.⁵ However, they are less commonly used for in repertoire for alto and bass flute, and much more difficult to control, especially in the high register. This is, in part, due to the speed and volume of air that has to be maintained while playing low flutes.⁶ It is also inevitably connected with the lack of strength of the upper partials in the instrument's tone. The difference in tone between a harmonic and a standard fingering in the high register of the bass flute is considerably less significant than on the C flute, and since harmonics fingerings are naturally flatter than more conventional fingerings, it is common practice for some players to replace standard

⁵ Franz Doppler 1821-1883 used harmonics in his *Fantaisie Pastorale Hongroise* op. 26

⁶ i.e. a large volume of air at relatively slow speeds, compared to the C flute.

fingerings with harmonic fingerings to help control intonation.⁷ Harmonics are demonstrated in comparison with standard fingerings for the same note at <http://www.bassflute.co.uk/04-timbre/harmonics.html>

The problem of harmonics was encountered when working with Scott Wilson on *Vortically*, for bass flute and electronics. Harmonics are notated in the score, for example, at rehearsal letter J, and remain there in the final version.

The image shows a musical score for a bass flute part. It is in treble clef with a 3/4 time signature. The tempo is marked as quarter note = 84. The dynamic is marked as *mf*. The score starts at rehearsal letter J, bar 205. The music consists of several measures with notes and rests, including a section marked 'Ethereal' and another with a 'tr' (trill) marking.

Example 33: Bars 205-210 showing the use of harmonics in *Vortically* [Track 4 11:21]

However, in performance, harmonics were never used. Since no significant alteration in tone was found, a harmonics-like effect was produced by using standard fingerings and playing with a slightly more open tone colour than usual. Wilson was happy with the resultant sound, and the phrases were much easier to control in performance than they would otherwise have been. It was decided to leave the harmonics markings in the score, so that the player would understand the tone quality required at this point in the piece, and it would then be left to the discretion of the performer to decide how best to produce that sound.

Harmonics fingering charts are given on the websites, for example at <http://www.bassflute.co.uk/04-timbre/harmonics-fingering-chart.html> taking into account differences of response and available pitches on

⁷ Helen Bledsoe, flute player in German contemporary music ensemble, *Musikfabrik* says, 'Harmonic fingerings are also very useful when playing alto or bass flute in the third octave, as the normal third octave fingerings are inevitably too sharp' <http://www.helenbledsoe.com/ETWorkshop.pdf> (accessed 15 March 2013)

each flute. An indication of response and a workable dynamic range is also provided.

Vibrato

The use of vibrato in flute playing is a matter of taste, with players taking a personal approach regarding the amplitude and speed of the vibrato. Leonard Garrison's lecture, *Visualizing Vibrato*, demonstrates an analysis of vibrato in recordings of a range of flute players, including James Galway and Marcel Moyse and shows that, on the flute, vibrato is mostly controlled through variations in air speed, effecting pitch, volume and timbre.⁸ His research shows that average vibrato speeds in flute players range from 5 Hz to 8-9 Hz, equating to semiquaver speeds ranging from 75 to 120 crotchet beats per minute. Amplitudes also vary from around 20 to 80 cents.⁹ ¹⁰ My own performing experience has shown that, on low flutes, a gentle vibrato is most effective, and that a fast or wide vibrato can quickly interfere with the overall tone quality, as a result of changes to the air speed. Additionally, vibrato is naturally linked to the dynamic, and the use of a larger volume of air for loud dynamics can result in a wider, more obvious vibrato. The websites provide details of the application of vibrato to music for low flutes, highlighting the connection between vibrato and dynamics. Notational examples are given showing the specification of varying speeds of vibrato, as well as the indication of a vibrato-less sound. This can be seen at <http://www.altoflute.co.uk/04-timbre/vibrato.html>.

Use of the High Register

The relatively large bore of low flutes gives them a distinctive tone colour in the high register, particularly from written e''' upwards. This area of the instrument's tessitura can be highly expressive if written for idiomatically, but it is not without problems. The large bore size of the

⁸ Garrison, Leonard *Visualizing Vibrato* lecture, presented at the British Flute Society Convention, 17 August 2012, Royal Northern College of Music, Manchester

⁹ op cit. information taken from copy of *Powerpoint* presentation, sent by email to Carla Rees on 15 June 2011.

¹⁰ This perhaps also suggests that the use of vibrato within microtonal music should also be carefully considered if accurate microtonal pitches are to be maintained.

bass flute can infringe on the reliability of the high register, even on a small-bore instrument, as a result of weak upper partials. Intonation is difficult to control at the top of the instrument's range, partly due to the curved headjoint, with pitch bends less effective than on lower pitched notes, giving the player less overall flexibility of pitch. There is also more audible air in the high register tone of a bass flute than at lower pitches, and air pitched in the lower octaves can often be heard in the overall sound. All of these elements combine to create a unique tone quality, which can be extremely expressive if written for in a sympathetic way.

In Wilson's *Vortically*, this idiosyncratic sound has been used as a virtue, with short sections at higher pitches used to create a lyrical contrast with the lower, more percussive material.

Example 34: Bars 26-36 of *Vortically* showing use of high register to contrast with lower pitched material [Track 4 1:57]

However, during the compositional process, some modifications were made to the use of the high register. An overblown g quarter sharp” in bar 63 was removed, as the effort required to make this note sound detracted from the glissando effect which was intended to be the main focus of this melodic gesture. Microtonal pitch bends, intended as inflections, were removed in bar 128, as it was found that there was

little capacity for alteration of pitch through this method in the high register, and using keys to create the pitch changes would have been too intrusive for the effect required here.

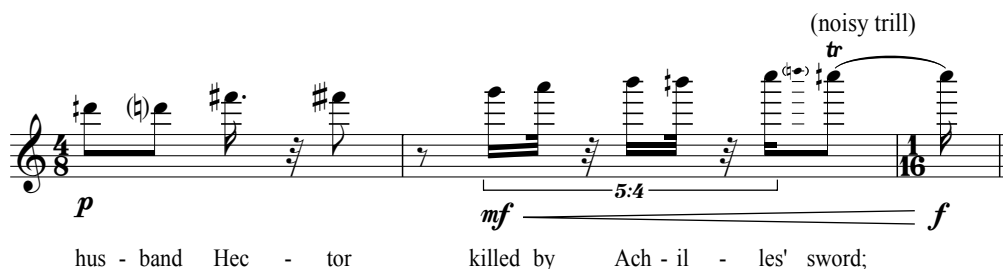
Oliva, too, makes use of the distinctive tone colour of the high register of the bass flute in some of the most expressive moments of *Bereft Adrift*:



Example 35: Use of the high register in bars 92-96 of *Bereft Adrift* by Michael Oliva [Track 10 4:27]

This use is perhaps similar to the expressive nature of the opening bassoon melody in Stravinsky's *The Rite of Spring*, and contrasts successfully with Oliva's use of the extreme low range, which includes a pitch bend to a semitone lower than the instrument's lowest note.

Another example of use of the high register, this time on alto flute, appears in Morsink's *Andromache*. Although at times the music reaches the extreme limits of the instrument's register, it does so only at the most emotionally dramatic points, where the composer specifically requires a sound which is rough, earthy and slightly out of control. For example, in bar 24, where the text reads *killed by Achilles' sword*, the flute ascends to a trill on c quarter sharp". Each occurrence of these high pitches is followed immediately by a rest, to allow the player some recovery time from the fast expulsion of air which is needed to perform the previous phrase.



Example 36: Bars 22-24 of *Andromache*, showing use of extreme high register pitches [Track 5 1:13]

As we have seen, the use of register is an important factor in composition for low flutes. A C flute is made with an average bore size to suit all registers, and players strive for evenness of tone across the instrument's three octave range. This is not the case with low flutes, as a larger bore is used to enable a rich low register, desired as a characteristic part of the instrument's sound. Although developments in instrument making, not least in regard to the Kingma System, have allowed these instruments more flexibility in the upper parts of the range, a difference in timbre between octaves still remains. The examples shown here demonstrate that, once they gain a clear understanding of the nature of the instrument, composers are able to exploit these changes of tone colour to expressive effect.

7. Articulation

While the basic methods of articulation remain fundamentally unchanged by the type of key system a flute has, some practical considerations arise as a result of the additional keywork, extended range and microtonality of the Kingma System. Extended articulations often occur in contemporary flute repertoire, and the adaptation of these techniques for low flutes has been refined as a result of working on this case study repertoire.

The website chapters on Percussive Effects and Articulation, at <http://altoflute.co.uk/05-percussive-effects-and-articulation/response-of-articulations.html> and <http://bassflute.co.uk/05-percussive-effects-and-articulation/response-of-articulations.html> define and demonstrate standard forms of articulation, such as single, double and triple tonguing, alongside more extended forms, such as ribattimento, flutter tonguing and pizzicato, as applied to the alto and bass flute. Percussive sounds, such as tongue rams, articulated air sounds and key clicks are explored, and information is also provided regarding slurs. On a standard system flute, slurs are rarely problematic, except perhaps for some wide intervals or when a fast transition is required between two adjacent notes in the harmonic series in the high register. However, in the course of working on this case study repertoire, it was found that there are two situations where slurs require careful consideration.

The first is a practical issue, arising as a result of the key positions. On a Kingma System instrument, G quarter sharp and G sharp are both played using lever keys operated by the left hand little finger. To move from one to the other, one key must be released before the other can be pressed. In releasing the key, a G natural is sounded, unless the airflow is stopped. This means that these notes cannot be slurred without hearing a G natural, however briefly, between the other two notes. The action of articulating the second of this pair of notes is enough to stop the air and move cleanly from one to the other. The same is true of the transition between G quarter sharp and G three quarters sharp.

The second problem arises due to the finger actions required to play quartertones. As previously explained, some of the quartertones are produced by sliding the fingers sideways, uncovering the open holes in the centre of the key. If these notes are slurred, and particularly if the finger action is slow, the resultant effect is a glissando. Even when moving relatively quickly, this can compromise the clarity of the execution of microtonal passagework. This is particularly a problem on low flutes, as a result of the relatively large distances the fingers need to move in order to completely open the central hole of the key. By asking the player to articulate these pitches, the airflow is stopped and a clear transition can be created between one note and the next.

Short Attacks

Other problems of articulation come as a result of the size of the instruments and their inherent response times. Short articulation is difficult to achieve on low flutes, especially so on the bass flute, and composers are often surprised by the lack of a strong attack. This is demonstrated on the bass flute website at

<http://www.bassflute.co.uk/05-percussive-effects-and-articulation/response-of-articulations.html>

An example of this is the opening of Scott Wilson's *Vortically*, where a strong attack was required on individual notes in the low register.

Mysterious yet intense ♩ = 54

Example 37: Key clicks in bars 1-5 of the first version of *Vortically*

The opening gesture, as shown in the first version of the score, above, was initially conceived for key clicks only, and was intended to sound like a 'thump', with much energy and a strong attack. However, it was found that, even with amplification, the resultant volume of the attack

in performance fell a long way short of the composer's expectations. A pitched note was added to the key click, to give a stronger sense of pitch and to allow articulation to give further emphasis to the opening sound.



Example 38: Revised version of bars 1-5 of *Vortically* with sounding pitches added to key clicks [Track 4 0:01]

Despite this modification, however, the sound was still not as strong as the composer had intended. This lack of strong attack, and the expectation of composers that a larger instrument is capable of producing a louder sound, continues to be a common problem with the bass flute. Volume on the flute comes from the amount of air used, and an individual player has physical limits regarding how much air can be produced. With any flute, one of the main resonance chambers of the sound comes from the player's body, as soundwaves re-enter the mouth after the air stream is split on the far edge of the flute's embouchure hole.¹ It follows that the size of the player's resonant cavities remains the same, no matter what size of flute they are playing, so the instrument's volume cannot increase exponentially with the size of the instrument.

On the bass flute, single notes, such as at the opening of *Vortically*, are slow to respond, especially in the low register, as a result of the distance the air has to travel. Any leaks in the keys or even minor misplacements of the fingers can result in the sound disappearing altogether. Although percussive articulations, such as tongue pizzicato,²

¹ Robert Dick's *Throat Tuning* concept is based on this knowledge, developing a way for players to maximize internal resonance to strengthen the flute's tone. See the section on singing and playing in Chapter 8 for a full explanation of this.

² See the website section on percussive articulations for an explanation: <http://www.bassflute.co.uk/05-percussive-effects-and-articulation/articulated-air-sounds.html>

can be used for a more definite attack, the sound is still relatively quiet, even with amplification.

A further problem with short articulation on this size of instrument is that the tongue has to move more gently than it would on a smaller member of the flute family, so that it does not disrupt the slow-moving airflow too forcefully and cause the note to overblow. The instrument's slow response with staccato notes also means that in the context of the opening of *Vortically*, placing the sound exactly in time with the corresponding electronic part is extremely difficult to master. In performance, this required much anticipation, and took some time to control.

In the final version of the piece, these short percussive notes were kept at the original pitch for the opening, but revised to sound an octave higher when they recur at bar 130, 131 and 135.

The musical score for Example 39 consists of two systems. The first system covers bars 125 to 130, and the second system covers bars 131 to 135. Each system has two staves: B. Fl. (Bass Flute) and EA (Electronic Array). The B. Fl. staff uses a treble clef and various time signatures (4/4, 2/4, 3/4, 5/4, 7/4). The EA staff uses a bass clef and the same time signatures. The B. Fl. part includes dynamic markings such as *ppp*, *p*, *mp*, *pp*, *mp*, and *f possible*. The EA part includes notes labeled F4, F5, F6, F7, and F8. The B. Fl. part starts with an '(emerging)' marking and includes dynamic markings like *ppp*, *p*, *mp*, *pp*, *mp*, and *f possible*. The EA part has notes labeled F6, F7, and F8. The B. Fl. part has notes labeled *p*, *mp*, *f possible*, *p*, *mf*, *mp*, *f*, and *f possible*.

Example 39: Bars 125-135 from final version of *Vortically*, showing the opening figure sounding an octave higher in bars 130, 131 and 135 [Track 4 7:19]

The problem of response has to be taken into account by both the player, through anticipation, and the composer, through careful scoring. Particularly when the instrument is cold, there is latency between the player blowing and the production of the sound, making rhythmic

playing difficult. A further example of this can be seen in Robert Fokkens' *Cycling to Langa*, which builds textures around two staccato quavers at the bottom of the bass flute's range.³ These quavers are recorded and played back through a looping system. Accurate rhythmic placement of these notes is crucial to the structure of the entire piece, but practically, this was found to be extremely difficult to achieve, and a version using pre-recorded sound files was found to be the only solution to a convincing performance.

Soft Tonguing and Ribattimento

As with standard forms of single, double and triple tonguing, both soft tonguing and ribattimento can be practically applied to the alto and bass flute. Soft tonguing is rarely specified within a score, and players on the C flute will often choose this technique for a gentle attack at quiet dynamics. While this technique is equally effective on low flutes, I have found within my own practice that the lack of natural attack on these instruments suits quiet dynamics particularly well, and starting a note completely unarticulated is often much more stable than on the C flute.

Ribattimento amounts to articulation which changes speed, usually from slow to fast and back again, and often from single to double tonguing. Ribattimento notation indicates the speed of articulation through the use of arrows, but the use of feathered beaming is equally possible, and perhaps preferable, as this allows the composer fine control over the exact number of repetitions a note has. See <http://bassflute.co.uk/05-percussive-effects-and-articulation/extended-articulations.html> for an audio example of this technique on the bass flute.

³ Robert Fokkens, *Cycling to Langa* (2008) for Kingma System bass flute and electronics

Percussive Articulations

While researching percussive articulations, an important issue of nomenclature arose regarding the term ‘slap tonguing’. Slap tonguing, in the sense that the term is most widely used, refers to a reed instrument technique, where the tongue hits against the reed for a dramatic, percussive effect.⁴ Since the flute does not possess a reed, the technique does not apply in the same way, and the term has been used to describe a range of percussive tongue effects, including tongue rams. In the course of this research, current usage of the term ‘slap-tonguing’ has been found to be variable, and the different definitions available can cause confusion. Since the term is misleading when applied to the flute, a need exists for greater consistency in the naming of these percussive articulations within the repertoire.

Mats Möller, in his web resource on flute contemporary techniques, describes it thus:

Slap tongue is a flute technique which sounds very close to the pizzicato of string instruments. It is produced by puffing short tones with the tongue, without any air pressure from the lungs.⁵

A further web resource, Kyungmi Lee’s *Extended Techniques for Flute*, gives a definition of “articulating harshly without air pressure from the lungs (with closed throat)”.⁶ In Dean Stallard’s online article, he describes the sound as a similar action of the tongue to “spitting rice”, producing an:

⁴ Slap tonguing is defined by Alyn Shipton in *The New Grove Dictionary of Jazz*, 2nd edition, as ‘A technique used in playing single-reed wind instruments. Using the length of the tongue, slightly arched, the player presses hard against the reed, at the same time sucking so as to create a vacuum between reed and tongue; he then draws the tongue sharply away so that the vacuum is broken and the reed is released, producing a dull slapping sound. The technique may be used alone, in which case the pitch of the note being fingered is only faintly heard (this is particularly effective in a low register), or to give a loud percussive attack to notes blown in the usual way.’

<http://www.oxfordmusiconline.com/subscriber/article/grove/music/J413100?q=slap+tongue&search=quick&pos=1&start=1#firsthit> (accessed 24 March 2013)

⁵ Mats Möller, *New Sounds for Flute* <http://www.sfz.se/flutetech/04.htm> (accessed 23rd July 2011)

⁶ <http://pcm.peabody.jhu.edu/~klee/sem/sem3/>

explosive articulation that sounds the note you are fingering, although it will be rich in upper harmonics and difficult to distinguish which octave you are playing. Right after the note there should also be a slight residual tone that helps give the effect of an exact pitch.⁷

These explanations seem to be in agreement, but through consultation of further resources the problem becomes more complicated. In another web resource on extended techniques, John McMurtery states:

This effect is produced by fingering a specific pitch and producing a hard “T” with the tongue (the throat must be closed to avoid extra expulsion of air).⁸

This appears to be a similar description to those above, (although with the tongue hitting the roof of the mouth instead of between the lips) but this definition comes under the heading of ‘Tongue Pizzicato’.

None of the three main extended techniques texts by Dick, Artaud and Levine mention slap tonguing in their arsenal of techniques, but all of them make reference to various forms of pizzicato. Dick makes the important distinction that tongue pizzicato uses *the opposite action of the tongue* to that used in tongue-rams (tongue-stops, as he calls them).⁹ This emphasises that in a tongue pizzicato sound, the tongue is brought into the mouth from a starting position between the lips, whereas in a tongue-ram, the sound is produced from the tongue being thrust forwards. To mirror Dean Stallard’s explanation (of slap tonguing), he goes on to say:

Tongue-pizzicato is related to traditional French style articulation, in which the tongue is inserted into the lip opening. Then withdrawn to articulate single pitches, but the motion and lip compression used in tongue-pizzicati are much greater.¹⁰

⁷ Dean Stallard, <http://fluteped.com/articles/Flutewise/special%20effects3.pdf> (accessed 23rd July 2011)

⁸ John McMurtery, Extended Techniques for Flute: Percussive Effects <http://cnx.org/content/m14069/latest/> (accessed 23 July 2011)

⁹ op.cit. 139

¹⁰ ibid.

From this, it seems clear that, in fact slap tonguing and tongue pizzicato are viewed as the same technique. However, like McMurtery, Artaud and Levine take a slightly different approach, suggesting a tongue position on the roof of the mouth rather than between the lips, as suggested by Dick:

tongue the palette (TE) without blowing any air. ¹¹

Levine also suggests a more airy timbre, and perhaps more akin to the explosive air sound suggested by Ferneyhough in his flute works:

The tip of the tongue lies firmly on the roof of the mouth and then, *supported by a strong air stream*, is explosively thrown to the bottom.¹²

To add to the confusion, all of the notational examples in all of the resources cited are identical, suggesting an accent-shaped note head, whether this is defined as slap tongue or tongue pizzicato, and whether the tongue is supported by air or with the throat closed.

For the purposes of clarity in the websites created as part of this project, precise definitions and sound examples are provided for each of the techniques, clarifying that slap tonguing and tongue pizzicato are related in nomenclature, and also creating a distinction between tongue pizzicato, with the tongue between the lips, and other articulated air sounds, where the tongue makes contact with the roof of the mouth and different consonants are used to give strong articulations to air sounds. This can be found at <http://www.bassflute.co.uk/05-percussive-effects-and-articulation/extended-articulations.html>, with an extensive selection of audio examples of articulated air sounds at <http://www.bassflute.co.uk/05-percussive-effects-and-articulation/articulated-air-sounds.html>

¹¹ op. cit. 116

¹² op. cit. 25

Tongue Rams

Tongue rams, demonstrated and explained at <http://www.bassflute.co.uk/05-percussive-effects-and-articulation/extended-articulations.html#tonguerams>, can be highly effective on low flutes, and are used with careful consideration in Baldini's *Kingma and the Duke*. Owing to the size of the instrument, the movement required for the player to reach the embouchure position for a tongue ram is considerable and takes some time to negotiate. In Baldini's piece, each of the tongue rams has space around it for the player to reset the tongue position and all are positioned in the instrument's low register, where the pitch can be clearly heard. The tongue rams are used alongside pizzicato notes to give sudden pitched attacks, which belong to both of the two *Ethos*.

12

→ only air

Very agitated ♩=126

→ mostly air

like an anxious clock, ticking fast tongue ram

p < *mp* > *f* > *mp* < > *f*

Example 40: Bars 12-18 of *Kingma and the Duke*, showing tongue rams in bars 17-18 [Track 7 1:05]

In Marc Tweedie's solo bass flute piece, *Zoli*, tongue rams are also used for a sudden percussive attack to interrupt the melodic line. In each occurrence they are written with sufficient space around them to take into account the required movement from standard playing position, demonstrating a good awareness of the practical constraints of this technique. Tongue rams are also spaced apart through the use of relatively long note values (usually a quaver), to allow the tongue position to be reset after each one.

72

overblow for multiphonic

air + tone flz.

underblow for multiphonic

HT HT

p as poss. *fff* *p* as poss. *cresc.* *mf*

Example 41: Bars 72-78 of *Zoli* by Marc Tweedie, showing tongue rams (marked HT in the score) [Track 8 5:00]

Articulated Air Sounds

Articulated air sounds have been widely used in repertoire for alto and bass flute, including in examples by Lorenz Dangel and Claes Biehl.¹³ In bars 7-34 of *evocazione del mare*, Biehl makes extensive use of articulated air sounds, created by speaking a range of consonants over the flute's headjoint.¹⁴ The notation of these posed an unexpected issue of pronunciation; Biehl had particular sounds in mind, which did not always translate well on paper. One such example of this is the 'tse' sound, which he intended to sound as 'ch', as in 'chair', or tʃ in the International Phonetic Alphabet. Issues of language and phonetics are important here; certain sound formations might be written in a way that makes sense in one language but are less clear in another. Biehl is German, so for him, this sound was produced with 'tse', whereas an English speaker might find 'ch' easier to understand. This highlights the need for each composer to add clearly defined glossaries to their scores, so that when not working in person with a performer, effects such as this are not open to misinterpretation.

Kajia Saariaho's notation of speaking and playing, seen in works such as *NoaNoa* (1992) is an extension of this technique.¹⁵ For clarity, all consonants provided in the examples in the websites are provided using the International Phonetic Alphabet, as shown below:

¹³ Lorenz Dangel, *Soundtracking* (2004) for Kingma System alto flute and electronics and Claes Biehl, *evocazione del mare* (2008-9) for Kingma System bass flute and electronics.

¹⁴ For a full explanation and demonstration of these sounds, see the website section on articulated air sounds: <http://www.bassflute.co.uk/05-percussive-effects-and-articulation/articulated-air-sounds.html>

¹⁵ Kajia Saariaho, *Noa Noa* (London: ChesterNovello 1992) for flute and electronics

Alto Flute Examples:	Bass Flute Examples:
t [t ^h]	teh [tɛ ^h]
sh [ʃ]	tah [tɑ ^h]
k [k ^h]	toh [tɔ ^h]
sssha [ʃ:a]	t [t ^h]
p [p ^h]	ti [ti]
ch [tʃ]	che [tʃɛ]
f [f]	ke [kɛ]
cho [tʃɔ]	ka [kɑ]
	cha [tʃɑ]
	ch [tʃ]
	cho [tʃɔ]
	peh [pɛ ^h]
	se [sɛ]
	shhh [ʃ:]
	p [p ^h]
	f [f]

Figure 16: Articulated air sounds expressed using the International Phonetic Alphabet

A further practical issue associated with articulated air sounds is the handling of the transition from normal methods of playing. While working on *evocazione del mare*, it was found that, due to the staccato nature of the percussive air sounds, it was not possible to create a smooth transition from one to the other, as the composer had notated. The example from bar 12 below shows the written articulations, with notes slurred in pairs. The percussive sounds are themselves a form of articulation, so the slurs from the previous note are incongruous.

The musical notation for Example 42 shows a single staff with a treble clef and a key signature of one flat. The bar number '12' is at the beginning. The first measure contains a half note with a slur and the dynamic *sfzp*. The second measure contains a quarter note with a slur and the dynamic *p*. The third measure contains a quarter note with a slur and the dynamic *sfz*, followed by a triplet of eighth notes with a slur and the dynamic *p sfz*. The fourth measure contains a quarter note with a slur and the dynamic *sim.*, followed by a triplet of eighth notes with a slur and the dynamic *sim.*. Above the notes, there are slurs and articulations: 'flz' above the first note, '3' above the triplet in the second measure, '3' above the triplet in the third measure, 'tah' above the first note of the triplet in the third measure, '3' above the triplet in the fourth measure, 'kah' above the first note of the triplet in the fourth measure, and '3' above the triplet in the fifth measure, with 'teh' above the first note of the triplet in the fifth measure. There are also asterisks (*) above some notes in the triplet in the fourth measure.

Example 42: Bar 12 of *evocazione del mare* - transition from normal pitched sounds to percussive sounds – from first version of the score

In the second version of the score, created on 12th February 2009, key clicks were added to increase definition on the articulated sounds, and the consonant of the first percussive sound was changed from 'tah' to 'pah' for a more explosive effect, as shown below.

The musical notation for Example 43 is identical to Example 42, but with some changes in articulation. The first measure is the same. The second measure is the same. The third measure is the same. The fourth measure is the same. The fifth measure is the same. Above the notes, there are slurs and articulations: 'flz' above the first note, '3' above the triplet in the second measure, '3' above the triplet in the third measure, 'pah' above the first note of the triplet in the third measure, '3' above the triplet in the fourth measure, 'kah' above the first note of the triplet in the fourth measure, and '3' above the triplet in the fifth measure, with 'teh' above the first note of the triplet in the fifth measure. There are also asterisks (*) above some notes in the triplet in the fourth measure. Additionally, there are plus signs (+) above the first notes of the triplets in the third, fourth, and fifth measures.

Example 43: Bar 12 of *evocazione del mare* - transition from normal pitched sounds to percussive sounds – from final version of the score [Track 3 0:33]

While the slurs are still redundant from a practical perspective, they remain in the score to communicate the phrasing.

Flutter Tonguing

Flutter tonguing can be produced by the tongue or the uvular, and players make a specific choice over which form to use, based on their personal preference and abilities. For those who can execute flutter

tonguing with the tongue, this is usually the preference, but the tongue can sometimes impede the formation of the embouchure in the low register and cause the sound to be airy. With both forms of flutter tonguing, tension can be developed in the throat, often made worse with fatigue, which can make sound production in the low register even more difficult for some players during a performance. Modifications to the tongue position have been found to improve the response of flutter tonguing on low flutes, and on the bass flute particularly, I found that flutter tonguing was much more effective when produced with the tongue than the uvular. The websites include examples of different kinds of articulated and unarticulated flutter tonguing, as well as explanations of combining flutter tonguing with air and percussive sounds. These are found at <http://www.bassflute.co.uk/05-percussive-effects-and-articulation/flutter-tonguing.html>

Tweedie demonstrates good idiomatic use of flutter tonguing for the bass flute by specifying a combination of air and pitch for low register flutter tongued notes, as seen in the example below. Flutter tonguing in the extremes of the flute's low register, even on the C flute, can be problematic. The use of air sounds in this range, particularly at the very end of the piece, is both practically and musically effective, providing an echo of the full-toned microtonal chromaticism of the fourth section of the piece.

The image shows two staves of musical notation for Example 44. The first staff starts at bar 79 and ends at bar 85. It features a variety of dynamics: *p*, *sfz*, *sub.p*, *mf*, *sfz*, *pp cresc.*, *f*, and *pp*. Articulations include accents, slurs, and a '5' fingering. A performance instruction reads: 'gradually add multiphonics on given fundamental while increasing volume'. The second staff starts at bar 86 and ends at bar 92. It includes dynamics like *pp as poss.*, *p*, and *ppp*. Performance instructions include 'flz.', 'norm.', 'flz.', 'norm.', 'flz. air + tone', and 'sim.'. The notation includes triplets, slurs, and a '5' fingering.

Example 44: Use of flutter tonguing in the final section of *Zoli*, bars 79 to 92

It can be seen, then, that although the methods of articulation per se are not specific to the Kingma System, the application of these techniques to repertoire for low flutes has resulted in a greater understanding of both the limits and capabilities of these instruments. Any differences in the response or effectiveness of these articulations, in comparison with the C flute, have been documented on the websites. The case study works have also helped to highlight areas for my own development, for example in learning how to adapt my existing knowledge of forms of articulation in order to gain the most effective results on low flutes. I believe also that in writing for Kingma System flutes, the composers have approached the instruments with an open mind and sense of adventurousness, perhaps incorporating techniques that they may not otherwise have used.

8. Extended techniques

Flute extended techniques of all kinds may be applied to the alto or bass flute with some differences in response. The Kingma System allows for a greater flexibility of many of these techniques, and it has been suggested by notable players such as Matthias Ziegler, as well as by Eva Kingma herself, that the additional venting that forms an integral part of the instrument's design provides significant improvements to the response and tone. The upright design of the bass flute, and the careful consideration of ergonomic hand positions on both the bass and the alto, gives greater finger flexibility than on standard instruments, and in addition to this, Eva Kingma's improvements to the design of the headjoint makes the response of these instruments much more immediate than any other alto and bass flute that I have played. All of these advantages combine to produce a wide range of extended techniques which can be incorporated sensitively into the repertoire. However, although the Kingma System assists in certain areas, some techniques, when explored during the course of this research were found to be less effective on low flutes than on the C flute. These discoveries were extremely helpful in enabling me to define the limits of the instruments, and by communicating this information with composers the repertoire could become more idiomatically suited to the alto and bass flute.

Whistle tones

Whistle tones are quiet sounds created by a slow air stream breaking against the edge at the far side of the flute's embouchure hole. They are difficult to control, but can be produced as stable pitches or as fluctuations moving through different partials from any given fingering. As the response time of whistle tones can be slow, rhythmic playing is difficult to achieve successfully. A more detailed explanation and audio examples can be found at <http://www.altoflute.co.uk/04-timbre/whistle-tones.html>

Whistle tones are rare in low flute repertoire. There were several instances during the course of this project where whistle tones were removed from scores during the collaborative process due to their sound being less present than the composer imagined. For example, they were used in the early versions of Biehl's *evocazione del mare*, but were removed after the premiere and replaced by multiphonics, to produce greater rhythmic accuracy and better balance with the electronics. The same is true in the case of *Andromache* by Coreen Morsink, where the whistle tones were removed once the composer heard them in the context of the surrounding material. Particularly on the bass flute, they are weak, and difficult to hear, and often lower in pitch than the composer expects.

Marc Tweedie's work, *Zoli*, provides one of only a few instances of the successful use of whistle tones in the bass flute's repertoire, seen in bars 32 and 45.

The image shows a musical score for two staves. The top staff is in treble clef with a 4/8 time signature. Bar 31 contains a single note with a dot above it. A line points from the text 'underblow for multiphonic' to this note. Bar 32 contains a single note with a wavy line above it, labeled 'w.t.'. Below the staves, there are two dynamic markings: a hairpin opening to the left and a 'ppp' marking, followed by a hairpin closing to the right.

Example 45: Bars 31-32 of *Zoli*, showing whistle tones in bar 32 [Track 8 2:02]

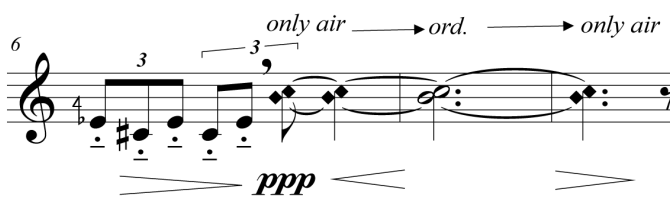
In the example above, the whistle tones are allowed to fluctuate through the range of available notes from each fingering. On the concert flute, the high-pitched nature of these sounds helps them to be heard clearly. However, on the bass flute, although effective, the pitch range and relative lack of strength in the high partials means that they are less easily audible. In a sound-proofed recording studio or concert venue, the whistle tones could be heard without any difficulty, but it was found in other performance spaces, such as Shoreditch Church, where this piece was premiered, that external noise could easily prevent them from being heard. For this reason, where possible, the whistle tones are amplified in performance.

Tweedie's use of whistle tones allows space for the sounds to respond, and they are allowed to die away naturally within the duration of the note. Even with the space given in the score, I found in performance that a greater amount of time is needed for whistle tones to be sounded, and registered by the audience. The nature of the sound is unlike any other flute tone, and when heard in isolated instances such as this, it can be helpful to take a little more time over them than notated. Within the context of Tweedie's work, a *rubato* approach, which can be altered to suit the acoustic of the performance space, is encouraged by the composer, and fits the overall style of the music.

Air sounds

A wide range of air sounds can be created on the flute, and the large tube of the alto and bass flute means that these sounds can be particularly effective, although they cannot be sustained for long, especially at loud dynamics. The rapid air exchange and frequent breaths can be fatiguing for the player, and I have often found that dizziness occurs in the early stages of working on pieces with frequent use of air sounds. The websites provide five audio examples on each instrument, demonstrating a range of possible air sounds, including the transition from air to pitch and jet whistles.
<http://www.altoflute.co.uk/04-timbre/air-sounds.html>

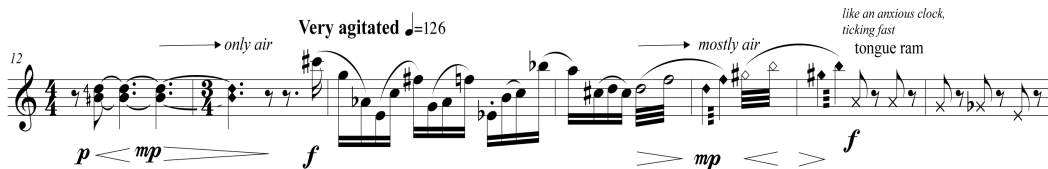
Air is an important element of bass flute playing, since the instrument uses a large amount of air to produce a sound and has an inherently unfocussed timbre. Incorporating air sounds into a piece in the way that Baldini has in *Kingma and the Duke* helps to give a sense of organic development to the piece, and further extends the bass flute's timbral and dynamic range. Here, the air sounds interact with both of the two *Ethos*, joining the microtones as a link between the two. They are often combined with multiphonics, allowing the pitches to emerge from silence and air.



Example 46: Bar 6 of Baldini's *Kingma and the Duke*, showing conjunction of multiphonics with air sounds [Track 7 0:25]

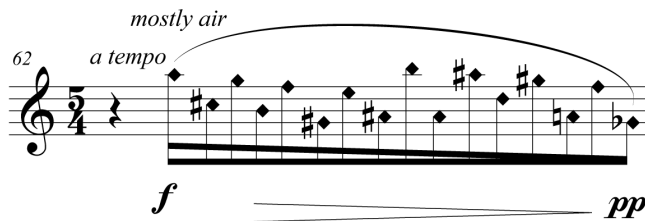
This is not a technique which occurs particularly often in bass flute repertoire; it is much more usual for air sounds to emerge into a single pitch. The multiphonic pitches can be hinted at during the air phase, although one of the pitches naturally dominates. However, Baldini uses this idea on a naturally soft multiphonic, seen in the example above, to excellent effect.

Baldini takes the same approach with tremolos, which are allowed to become mostly air.



Example 47: Bars 12-18 of *Kingma and the Duke*, showing conjunction of tremolos with air [Track 7 1:05]

Air sounds permeate the hectic material of *Ethos A* through frequent use of fast moving pitches heard as mostly air.



Example 48: Bar 62 showing fast moving air sounds [Track 7 3:41]

The indication to use *mostly air* is an important distinction, and demonstrates an understanding of the instrument. Pure air sounds are only truly effective in the low register; above that, the audible pitch drops to either the lowest register (in the second octave, where fingerings are repeated from the first octave but air speed is increased in normal playing to produce the octave higher) or to the pitch of the flute's open tube (in the third octave, where fingerings are usually modifications of a harmonic fingering to correct intonation), depending on the fingering used. By defining *mostly air*, Baldini is allowing the player to maintain the required pitch with a hint of the played note while developing a different timbre overall.

Jet Whistles

Like whistle tones, jet whistles are less convincing on alto and bass flute than on the C flute. This is a result of a lack of volume in the high partials and the amount of air required at extremely high speeds. My experience is that several composers have removed them from their scores after hearing them played. One of the few surviving examples of this technique within the alto flute's repertoire is David Bennett Thomas' solo work, *Carla* (2012).¹ The original notation of the jet whistle is shown below, with a *forte* dynamic and the arrow going upwards.

15 *mp* *f* *f* *f*

slightly overblow accents flz. *quickly* *Jet* *more forceful*

Example 49: Jet whistle in *Carla* by David Bennett Thomas from score version of 7 April 2012, bar 15

After hearing a recording of the premiere performance,² in preparation of a studio recording, the composer wrote:

The jet can be a little longer if you'd like. I changed the dynamic to *mp* and put in a *cresc* and *dim*, and made an arrow up and an arrow down.³

15 *mp* *f* *mp* *f*

slightly overblow accents flz. *quickly* *Jet* *more forceful*

Example 50: Jet whistle in *Carla* by David Bennett Thomas from revised version of score following the premiere, bar 15

¹ Published by Tetractys, London

² The premiere took place in a *rarescale* Premiere Series concert at Shoreditch Church, London, on 1 June 2012. For the studio recording of the work, see <https://www.youtube.com/watch?v=2ivWYet8gR0>

³ Email to Carla Rees from David Bennett Thomas, 5 June 2012

The new notation reflects the effect of the sound in performance, and it was explained to Thomas that the duration of the sound was dictated by the amount of available air.

Following the use of complex audible breaths in works such as Lorenz Dangel's *Soundtracking* (2004) for alto flute and electronics, a section was added to each of the websites to warn composers about the potential difficulties of incorporating breathing sounds into their music, seen at <http://www.altoflute.co.uk/04-timbre/air-sounds.html#breathingsounds>. Deliberately noisy breathing requires a tightening of the throat, which is the opposite of the breathing technique employed by players to insure they inhale enough air to play. As such, these are two activities which do not blend well, especially in the context of performance on low flutes. It is suggested in the website that complex breathing sounds can be pre-recorded for incorporation into an electronics part, to avoid the over-exertion of the player during a live performance.

Singing and playing

The advice given in the website section on singing and playing simultaneously, seen at <http://www.altoflute.co.uk/04-timbre/singing-and-playing.html>, has been largely developed through the practical experience of working in collaboration with composers, with guidance notes created to help to ensure successful incorporation of this technique into repertoire. Singing and playing can be difficult to master on low flutes. Taking into account that the majority of flute players are untrained singers, accurate intonation and voice control in complex passages can be problematic.

When playing the flute, and particularly the lower members of the flute family, internal resonance in the body of the player is an important factor in overall sound quality. As the internationally recognized French flute player Michel Debost says:

The volume of air where you are playing resonates, but so do all the cavities inside your body: chest, mouth, throat, sinuses, even bones. They contribute to give each of us a distinctive sound.⁴

When a sound is made on the flute, some of the vibrations created from the splitting of the airstream against the embouchure hole of the instrument re-enter the player's mouth, while others travel along the tube of the flute.⁵ The instrument itself does not offer much resonance of the air stream, and the player's head, chest and throat provide the main resonant chambers. A technique known as *throat tuning* can be employed in flute playing, which involves setting the throat to the position that would be used to sing the pitch that is being played, in any octave which most conveniently suits the player's vocal range. In this way, the resonant spaces can be moulded to match the sounding pitches of the instrument, with resultant improvements in the tone quality.⁶

In terms of singing and playing simultaneously, the simplest form of the technique to execute is therefore when both parts are in unison or octaves, so that the voice can be set in the same position for both the sung note and the instrument's pitch. However, the further the voice is required to move away from the played pitch, the more interference is created between the flute and the voice. If the voice is required to sing, for example, an *f sharp*, while the flute plays a *c*, the same throat position cannot be used for each pitch, and the pitch of the voice must dominate over the optimum position for the played note. This can result in a reduction of tone quality, as well as internal conflicts of resonance

⁴ Debost, Michel *The Simple Flute from A to Z* New York, OUP 2002, 204

⁵ For a detailed survey of the physics of the flute, see <http://www.phys.unsw.edu.au/music/flute/> (accessed 13 March 2013)

⁶ Dick, Robert *Tone Development through Extended Techniques* (New York: Multiple Breath Music, 1986), 9

which can make accurate pitching extremely challenging. Additionally, vowel formants in the mouth are used to assist the blend between the flute sound and the sung pitch. However, conflicts can also occur between the mouth position of a note played in the low register against a higher pitched sung note. For example, a low register note on the bass flute requires a particular air angle and embouchure position in order to sound, and singing a high pitched note at the same time may alter these positions due to the mouth shape required, resulting in the played note's failure to sound.

Vocal range relative to the pitch of the instrument also causes an alteration of the overall effect. On the C flute, both male and female voices can sing at the same pitch as, or below, the flute's low register, strengthening the fundamental and blending well with the flute's tone. To some extent, this is also true of the alto flute, although it is unlikely that a female voice will be able to extend much below the instrument's range. On the bass flute, however, a female voice will be unable to reach the pitch of the low register, and therefore cannot add to the fundamental of the sound. By singing an octave above the fundamental, the female voice will only match the even harmonics of the played note, resulting in an altered timbre and less of a blended sound.^{7 8}

The sung and played parts may work independently of each other and do not require rhythmic unison, although any articulation used affects both parts simultaneously. An example of this is the third movement of

⁷ This was explained in an email on 14 March 2013 by Joe Wolfe of the Physics department of the University of New South Wales, hosts of the flute acoustics website at <http://www.phys.unsw.edu.au/jw/fluteacoustics.html> (accessed 24 March 2013)

⁸ In an email to Carla Rees on 1 April 2013, Robert Dick writes: "Singing above the played note tends to kick the flute into the octave of the voice. The second partial is very strong in the flute tone in normal playing, very close in strength to the fundamental. When reinforced with the voice, the second partial is way stronger than the fundamental."

David Lefkowitz's *Four Mythical Creatures* for solo alto flute, which incorporates a vocal line for almost the whole movement. The sustained notes cannot remain uninterrupted while the other part is articulated.

Example 51: Singing and playing in David Lefkowitz's *Four Mythical Creatures* (2005) Movement 3 bars 1-6

Although I have had some previous experience of singing in choirs, my own vocal range is limited and relatively low for a female voice. Perhaps as a result of undesirable throat tension when singing, I also find singing and playing extremely tiring to maintain for long periods, and often experience a sore throat when practicing the technique for a long time. Perhaps as a result of my own deficiencies in this area, singing and playing does not feature particularly prominently within the case study repertoire, except for a few notable examples, such as Biel's *evocazione del mare*.

Here, the technique is used to form an important change in the timbre of the bass flute's sound, and to achieve the effect of two distinct lines for the flute and the voice, providing harmony. Time was taken during the initial meetings to discover which pitch ranges were most effective for my voice, and care was taken in the scoring to minimise overexertion. It was decided to keep the vocal range within that of the bass flute, as shown below.

Figure 17: Vocal range at sounding pitch in *evocazione del mare*

Sung notes were chosen which were based on consonant intervals (thirds and fourths) from the played pitches for both the comfort of the voice and to avoid interference. Pitching the notes initially can be difficult, but a two beat rest before the vocal entry provides time to find the required note. Reflecting the work's harmonic language, the voice is required to sing accurate quartertones, a task which is undoubtedly daunting to the untrained singer. This is an issue which was carefully considered by the composer, and the sung quartertones always follow the same pitch played on the instrument, so the pitches can be matched. Biehl often allows the played note to be sounded shortly before the sung pitch, to help with intonation and to provide moments of respite for the voice, and pitches often alternate between the two parts. The example below demonstrates how the bass flute leads the voice to help with the accurate pitching of sung microtones:

12

146 Voice (sounds as written)

149

gliss., rhythm quasi ad lib.

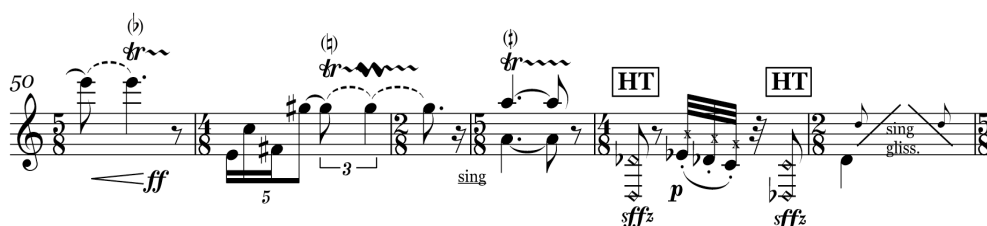
42

43

Example 52: Singing and playing, bars 146-152 of *evocazione del mare* [Track 3 7:39]

I found in the process of preparing this piece for performance that the preparation of each sung pitch in this way enabled accurate intonation, and also helped to clarify the effect of the resonance on the flute's sound. My skills in singing and playing simultaneously improved dramatically as a result of working on this piece, and the ability to sing quartertones within this context also helped my overall microtonal pitch awareness.

Tweedie, too, makes careful use of singing and playing techniques, using them sparingly and for a particular effect. For example, in bar 53, an A is sung an octave lower than the bass flute, to support a microtonal trill. The sung pitch is a sounding a, and as such would lie safely within the vocal range of the majority of male and female voices.



Example 53: Bars 50-55 of *Zoli*, showing singing and playing in bar 53 and a vocal glissando in bar 55 [Track 8 3:32]

Vocal glissandi

Another technique used by both Tweedie and Biehl is the vocal glissando, heard against a stable sounding pitch. This technique, demonstrated at <http://www.altoflute.co.uk/04-timbre/singing-and-playing.html> - *gliss*, has been used successfully within repertoire for the C flute, but appears not to have been previously applied to the bass flute in published repertoire.⁹ The effect is an interesting one, as difference tones can be heard moving in contrary motion to the voice.

⁹ The first use of this technique within the flute's repertoire is thought to have been in Robert Dick's 1973 work, *Afterlight* for solo flute. (New York: Multiple Breath Music, 1985)

The example below demonstrates the notation and application of vocal glissandi in *evocazione del mare*. In this instance, two glissandi are employed, with the voice beginning in unison with a high register played pitch,¹⁰ before descending and ascending and reaching the unison once more at the end of the note's duration. The effect is tiring, since the voice is required to sound notes high in the range, but these are the last vocal sounds in the piece, and each iteration is interspersed with percussive sounds which provide some respite.

153

tah
teh
pah
tsh keh

sim.
f
mf
mf
sfz

44 45

Example 54: Vocal glissandi, bars 153-155 of *evocazione del mare* [Track 3 7:55]

Tweedie uses the opposite vocal direction, asking first for an upwards glissando. In this example, the female voice is sounded at a higher pitch than the bass flute, but the moving nature of the vocal line and the difference tones created ensures an effective use of the technique.

50

ff
5
3
sing
HT
p
HT
sing
gliss.
sfz
sfz

Example 55: Bars 50-55 of *Zoli* showing singing and playing in bar 53 and a vocal glissando in bar 55 [Track 8 3:32]

¹⁰ This technique works best if the voice is sounded an octave higher than written, ie in unison with the bass flute.

Key clicks

Key clicks are effective on both the alto and bass flute, as the larger keys make more sound than the smaller keys of the C flute, and the instrument's tube acts as a resonator. Different types of key clicks are explained and demonstrated, on the website at <http://www.altoflute.co.uk/05-percussive-effects-and-articulation/key-clicks.html>, including the use of a striker key, key click drumming and covered key clicks. Key clicks with sounded pitch, as used by Varèse in *Density 21.5* are also explained. Information is provided about the speed of striker response, the potential to combine key clicks with percussive articulations and the ideal pitch range for the technique.

On the Kingma System, key clicks can be produced on the quartertone pitches, and particularly when using a striker key to produce the sound, there is no loss of volume created by opening the central holes in the keys to produce these pitches. The dynamic range of quartertone key clicks follows that of the rest of instrument, namely that when more keys are closed, the effect is stronger.

Within the repertoire, key clicks are often used to strengthen the attack than can be produced just with the tongue, such as those discussed at the opening of Wilson's *Vortically*. In Tweedie's *Zoli*, they are used alongside sounded notes to give an extra percussive attack in a three note low register motif which first appears in bar 5. They also appear in the middle register in bars 25 and 36, adding clarity and attack to each of the notes. In bar 36, this provides an interesting contrast with the accents and staccatissimo attacks of the previous bar.

The image shows a musical score for three bars. Bar 35 is in 2/8 time and contains a triplet of eighth notes marked *sffz*. Bar 36 is in 5/8 time and contains a quarter note marked *mf* followed by a quarter note marked *f*. Bar 37 is in 4/8 time and contains a quarter note marked *f*. A hairpin symbol is present at the end of bar 37.

Example 56: Bars 35-37 of *Zoli* showing key clicks in bar 36 [Track 7 2:21]

Pitch bends and glissandi

Explanations and examples of glissandi, pitch bends and fall-offs can be found at <http://www.altoflute.co.uk/02-pitch/pitch-bends-and-glissandi.html>. True glissandi are difficult to achieve on the flute, and although the additional open holes of the Kingma System are helpful in this regard, the size of the keys on low flutes makes them a little less effective than on the C flute.¹¹ Occurrences of glissandi are rare within the repertoire, and are often replaced with either pitch bends for small intervals or rapid chromatic or diatonic scales for larger intervals.

It was found, through working on Michael Oliva's *Incline* (2009) for two alto flutes and electronics, that in the case of pitch bends, very little pitch differentiation was available in the high register. Overall, a greater range of pitch is available on notes which do not use many closed keys, so that the flute's tube is at its shortest. Notes which require the full length of the tube, such as b' are less flexible, with smaller pitch differentiation available. Pitch bends were also been found to reduce control of dynamic and tone quality, becoming weaker and thinner in tone the further the pitch varies from the starting note.

The upright design of the Kingma System bass flute used in this project is generally advantageous in terms of ergonomics and performance practicalities. However, in certain circumstances, the instrument's connection with the floor requires some additional negotiation for the player. One such example is in the case of pitch bends, where the angle of the flute is required to change against the player's mouth, rolling inwards or outwards, according to the direction of pitch change required. This rolling motion is also amplified through a movement of the player's head and jaw. Having the instrument anchored to the floor, by means of a spike, limits the flexibility of physical movement. As a result of this the range of pitch differentiation on the vertical bass flute is very slightly diminished from that of the horizontal instrument. The

¹¹ especially where open holes are replaced by key-on-key mechanisms.

instrument can be lifted for a full range of pitch alteration, but greater time is required for the change of player position, and a note to this effect is included on the website. Video demonstrations of pitch bends were recorded to include two camera angles, to allow the composer to see the amount of movement required. These can be seen at <http://www.bassflute.co.uk/02-pitsch/pitch-bends-and-glissandi.html>

Trills

The extended techniques used in *Zoli* primarily give a sense of movement to the music. There are very few sustained long notes within the piece which are not subjected to some form of movement device. Trills of different kinds make frequent appearances throughout the piece, and other techniques such as flutter tonguing and multiphonics ensure that a static state is only reached during the silences. The use of trills includes standard trills, incorporating both microtonal and standard pitches, changing speed trills, such as in bar 51 and double trills, as seen in bar 58.

Example 57: Bars 50-62 of *Zoli*, showing different types of trills [Track 8 3:32]

Over 400 trill fingerings are provided on each of the websites, organised by register, beginning at <http://www.altoflute.co.uk/02-pitch/low-register-trill-fingering.html>. For ease of navigation, fingerings are arranged according to the lowest note of the trill, and intervals of up to a perfect fifth, including quartertone trills are shown. These fingerings were devised through a combination of prior

knowledge, examples from the repertoire and trial and error with the instrument.

An important consideration in the effectiveness of extended techniques lies in the ability of the player, and I am aware that each of the techniques described above, and particularly those that are somewhat problematic, may be more successful in the hands of a different player, while perhaps other techniques may in turn be less convincing. At a time when method books for these techniques are scarce, a player's ability develops through practice and experience in relation to the repertoire. For this reason, it is inevitable that skills in these techniques develop differently between players. Physical factors, such as lung size, mouth shape and muscle strength may also play a part in the success of some of these techniques. For example, a player with large lungs and strong abdominal muscles is likely to be more successful at producing a jet whistle than one with a smaller facility for the fast expulsion of large amounts of air. However, these differences also need to be considered alongside the acoustical properties of the instruments in order to form an opinion on their efficacy. In the case of a jet whistle, we have learned elsewhere in this research that the upper partials are lacking in the bass flute's sound. Since these form an essential part of the properties of a jet whistle, it is unlikely that this technique could ever be as effective on a bass flute as on a C flute.

In the course of this survey of extended techniques on Kingma System flutes, I have made practical observations based on my own ability at the time of exploration, combined with the knowledge gained from the academic aspects of this research. The case study pieces were written with my playing in mind, so it is perhaps inevitable that the composers would choose to include techniques that I can execute well in performance. My playing has developed significantly as a result of working on this repertoire, and it is likely that any future collaborations will build on this further. The websites can then be updated to reflect any future developments in the execution of these techniques.

Conclusion

Through the course of this doctoral research, it has become clear that the application of the Kingma System to the alto and bass flute has resulted in a vast range of extended technical and expressive possibilities which have begun to be incorporated into a new repertoire written specifically for these instruments.

The case studies presented in this research have succeeded in placing these technical enhancements into a practical musical context, exploring how they can be applied to different compositional languages to good effect. In addition, these works have assisted in outlining areas of limitation, which may go some way towards informing future developments of the Kingma System, such as the ergonomic placement of keys to allow easier access to certain combinations of notes. The dialogue between composer, performer and instrument maker is an important one in the development of musical instruments for the twenty-first century, and the lessons learnt in this project will undoubtedly help to shape a number of areas of low flute design.

The importance of collaboration in this process should not be underestimated, since frequently the imagination of a non-flute playing composer results in a new approach which may not have been considered a possibility with a traditional way of thinking. Performers, during their training, are conditioned to approach their instrument in a particular way, and their experience of what is possible on the instrument is built around a lifetime's knowledge of technique, and the limitations of an instrument. In the context of the flute, an example of this is the fixed hand positions that are taught from the very first lessons, with each finger having its own assigned keys which move up and down. This training teaches that there is a 'correct' hand position, which allows for flexibility of up-and-down movement of the fingers, and several other 'incorrect' positions, which are 'wrong' for a number of reasons including balance, posture or flexibility. However, playing the Kingma System requires changeable hand positions, to allow for the

sliding motion of uncovering the central hole of a key, and certain multiphonic fingering combinations require keys to be operated by different fingers than those traditionally used. This in itself forces the player to adapt their in-built approach to their instrument, and encourages new ways of thinking. In turn, composers approach instruments without the preconceptions that develop through learning to play them, and are likely to be interested more in the sound that can be produced, than the technique of how that sound is made. In the collaborative process, if a composer requires a particular sonority or technique, the player then has to find ways to produce it. In this way, the composer's ideas stimulate new techniques, fuelled by the player's broader approach to technique as a result of playing a new design of instrument. My personal experience is that I have extended my playing technique in many new directions as a result of this collaborative process.

Claes Biehl's *evocazione del mare* provides an excellent example of how techniques may be developed through the collaboration between composer and performer, fuelled by the discovery of new possibilities of an innovative instrument. The piece provides a considerable challenge to the performer, and yet all of the wide ranging techniques involved are both practical and reliable, as a result of thorough testing in rehearsal and the composer's willingness to make further revisions once the piece had been fully tested through public performance. The process of creating this work has led to the development of several concepts which have since been used in other repertoire, such as the development of an approach to specific microtonal pitches and a method for creating unknown multiphonics fingerings. Both of these concepts demonstrate a greater exploration of the Kingma System which has arisen directly through finding practical solutions to the theoretical problems posed by the composer.

The development of Biehl's piece has provided a template for a number of working processes that may be applied elsewhere. These include

methods of providing pitch references for singing and playing simultaneously, ways of approaching the discovery of new multiphonic fingerings and the idea of exploring alterations of standard finger positions to allow difficult fingering combinations to be more easily executed. In addition, we discovered that certain sounds, such as whistle tones and multiphonics, can have extended response times that interfere with the rhythmic flow of the music within a particular context, and that any spoken elements of a piece require clearly defined pronunciation guides to avoid misunderstandings between composer and performer.

The process of working on these case study pieces, from their early stages to the premiere performances and beyond, has had a pronounced effect on my own playing and technique. The opportunity to develop repertoire with electronics has provided an exploration of new techniques within the framework of a strictly rhythmic musical context, and all of the works discussed here have helped me to develop a range of musical skills as a direct result of the challenges presented. In particular, I have found that performing microtonal music has improved my skills for listening and intonation, and the fine control of microtonal intervals is a new skill which I had previously never encountered. The extensive use of articulated air sounds, particularly in Claes Biehl's *evocazione del mare*, has assisted with the development of greater co-ordination between extended articulations and finger technique, both within this work and beyond. The physical demands of many of these works, in terms of breathing and stamina, provided training for the development of greater physical strength, to the extent that the dizziness experienced in early performances of several of these works is no longer an issue. This undoubtedly impacts on my ability to perform other, similarly challenging works, and prepares the way for new physical challenges to be created through further collaborative work. Working with extended techniques in challenging ways has been extremely beneficial in terms of embouchure control, and the intellectual and physical challenges presented, and overcome, in these

works have contributed towards a higher standard of playing, a greater level of self-criticism and a determination to succeed.

Important considerations with these composer-led developments in playing technique are the quality of the composition, and the eventual achievability of the music's demands. Both *evocazione del mare* and *Vortically*, were, at the time of composition, at the limits of my technical capabilities, but even within the short space of time between initially working on the pieces and the present, the music has become more manageable and less challenging, as a result of improvements in my playing technique, driven by the demands of performing these works. These works are of sufficient interest and compositional quality that they are likely to become standard works (albeit difficult ones) for Kingma System bass flute. Biehl's piece has already received seven performances and may well be adopted by other players once the Kingma System becomes more widely available on the bass flute. Pieces such as this, which push the boundaries of technique and language, also create space for works of a less challenging nature within an instrument's repertoire, and broaden the scope of music available to players. Some examples of this within the C flute repertoire are Berio's *Sequenza* and Boulez's *Sonatine*, both of which were deemed to be virtually unplayable at the time of composition but are now standard twentieth-century works, and are no longer the sole domain of a few determined players.

The creation of the websites has given me an increased understanding of the physical processes involved in flute playing, as a direct result of needing to find ways to describe and convincingly document each of the techniques. I developed a large number of new fingerings, particularly for trills and alternate fingerings which can now be incorporated into the repertoire, and which can be further expanded as the repertoire develops further. Having tried and tested information available to composers anywhere in the world means that the application of these

techniques has become more reliable, and collaborations can begin from a starting point that is more advanced than the provision of orchestration book descriptions of the instrument. It is my hope that future collaborations will further enhance this knowledge and contribute to revisions and additions to the websites which, in turn, will lead to greater developments in the repertoire for Kingma System alto and bass flute.

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Appendix 1: Fingering choices used in the Kingma System version of Murail's *Unanswered Questions*

Page/Line	Note	Pitch	Murail version	Kingma version
1/1	1	f ¼#''	open holes	unchanged
	5	e ¼#'	open holes	unchanged
	6	b ¼#''	harmonic using open holes	unchanged
1/2	1	f ¼#''	open holes	unchanged
	5	e ¼#'	open holes	unchanged
	6	b ¼#''	harmonic using open holes	unchanged
	7	e ¼#'	open holes	unchanged
	8	b ¼#''	harmonic using open holes	unchanged
	9	c ¼#'''	harmonic using alternate fingering	changed to harmonic using open holes (f ¼#')
1/3	1	f ¾#''	alternate fingering	changed to standard Kingma System fingering
	2	c ¾#'''	harmonic using alternate fingering	changed to harmonic using standard Kingma System fingering
	3	f ¼#''	open holes	unchanged
	7	g ¼b'	pitch bend down from g'	changed to standard Kingma System fingering
	8	e ¼#	open holes	unchanged
	9	b ¼#''	harmonic using open holes	unchanged
	10	f ¼#''	open holes	unchanged
1/4	1	e ¼#'	open holes	unchanged
	2	b ¼#''	harmonic using open holes	unchanged
	3	c ¼#'''	harmonic using open holes	unchanged
	5	c ¾#'''	pitch bend from harmonic on g'	changed to harmonic using standard Kingma System fingering
	7	d ¼#'''	alternate fingering	unchanged or standard Kingma System fingering – both work well

2/1	1-3	f ¼#''	open holes	unchanged
	4	b ¼b'	no fingering given; assume alternate fingering or pitch bend	changed to standard Kingma System fingering
	7	g ¼b''	pitch bend down from g''	changed to standard Kingma System fingering
	10	f ¾#'	pitch bend down from g'	changed to standard Kingma System fingering
	12	e ¼#'	open holes	unchanged
2/2	5	e ¼#'	open holes	unchanged
	6	b ¼#''	harmonic using open holes	unchanged
	7	e ¼#'	open holes	unchanged
	8	b ¼#''	harmonic using open holes	unchanged
	9	c ¼#'''	harmonic using alternate fingering	changed to harmonic using standard Kingma System fingering
	10	f ¼#''	open holes using alternate fingering	changed to standard Kingma System fingering
	11	f ¾#''	alternate fingering	changed to standard Kingma System fingering
	12	c ¾#'''	harmonic using alternate fingering	changed to harmonic using standard Kingma System fingering
2/3	2	e ¼#'''	alternate fingering	unchanged or standard Kingma System fingering – both work well
	3	f ¼#''	open holes	unchanged
	4	c ¼#'''	harmonic using open holes	unchanged
	5	f ¾#''	alternate fingering	changed to standard Kingma System fingering
	7	g ¾#''	alternate fingering	changed to standard Kingma System fingering
	8	a ¼#'''	alternate fingering	changed to standard Kingma System fingering
	10	e ¼#'''	alternate fingering	unchanged or standard Kingma System fingering – both work well
	14	c ¼#''	no fingering given; assume alternate	changed to standard Kingma System

			fingering or pitch bend	fingering
	16	f ¼#''	open holes	unchanged
2/4	3	f ¾#'	pitch bend down from g'	changed to standard Kingma System fingering
	5	e ¼#'''	open holes	unchanged
	6	b ¼#'	alternate fingering	changed to standard Kingma System fingering
	10	f ¾#''	pitch bend down from g''	changed to standard Kingma System fingering
	16	b ¼#''	harmonic from open holes	unchanged
	22	d ¾#'''	alternate fingering	unchanged or standard Kingma System fingering – both work well
2/5	2	e ¼#'''	alternate fingering	unchanged or standard Kingma System fingering – both work well
	3	a ¼#'''	alternate fingering	changed to standard Kingma System fingering
	5	e ¼#'''	alternate fingering	unchanged or standard Kingma System fingering – both work well
	9	g ¾#'''	alternate fingering	changed to standard Kingma System fingering
	10	f ¾#'	pitch bend down from g'	changed to standard Kingma System fingering
	14	g ¾#'''	alternate fingering	changed to standard Kingma System fingering
3/1	2	f ¾#'	pitch bend down from g'	changed to standard Kingma System fingering
	8	g ¾#'''	alternate fingering	changed to standard Kingma System fingering
3/2	5	b ¼#''	harmonic from open holes	unchanged
	6	f ¼#''	open holes using alternate fingering	changed to standard Kingma System fingering
	7	g ¾#'''	alternate fingering	changed to standard Kingma System fingering

3/3	1	g $\frac{3}{4}\#''''$	alternate fingering	changed to standard Kingma System fingering
	3	f $\frac{1}{4}\#''$	open holes	unchanged
	4	g $\frac{3}{4}\#''''$	alternate fingering	changed to standard Kingma System fingering
3/4	4	g $\frac{3}{4}\#''''$	alternate fingering	changed to standard Kingma System fingering
	6	b $\frac{1}{4}\#$	pitch bend down from c'	unchanged
	7	f $\frac{1}{4}\#''$	open holes	unchanged
3/5	1	g $\frac{3}{4}\#''''$	alternate fingering	changed to standard Kingma System fingering
	2	b $\frac{1}{4}\#$	pitch bend down from c'	unchanged
	3	f $\frac{1}{4}\#''$	open holes	unchanged
3/6	1	a $\frac{1}{4}\#''''$	alternate fingering	unchanged

Appendix 2: list of Kingma System repertoire

The chart below shows a list of repertoire composed for or premiered by Carla Rees using Kingma system flutes

Composer	Title	Date	Instrumentation	Duration	Premiere
Baldini, Christian	Kingma and the Duke	2013	bfl	5'00	2013 rarescale 10 th Anniversary Competition, RCM London
Biehl, Claes	evocazione del mare	2008-09	bfl, eam	9'00	2009 UK Microfest 3
Biehl, Claes	der himmel ist ein nomade	2011-12	fl, db, eam, 3 actors, video	80'00	2012 Krefeld Germany
Biehl, Claes	sphères, déformées	2009	afl, gtr, eam	11'00	2010 Shoreditch Church, London
Bloom, Darren	Solo for quartertone alto flute	2005	afl		2005 rarescale premiere series, London
Boden, Mark	Into the Flames	2010	afl	10'00	
Burnand, David	Night Scene	2001	afl, eam	8'15	2001 RCM
Burnand, David	For Tarkovsky	2008	bfl, eam, vid	12'00	2008 rarescale 5 th Anniversary concert, London
Chambers, Mark	...glass darkly...	2006	afl, pno, eam		2007 rarescale premiere series, London
Cotton, Sophie	All her life	2010	bfl	5'00	2012 rarescale premiere series, London
Czaplowski, Philip	Elegia	2007	afl		2007 Barber Institute, Birmingham
Dangel, Lorenz	Sound tracking	2004	afl, eam	8'00	2004 rarescale competition RCM
Fokkens, Robert	Cycling to Langa	2008	bfl, eam		2008 rarescale premiere series, London
Fokkens, Robert	Inyoka Etshanini	2007	afl (or bfl), vln, vcl		2007 rarescale premiere series, London
Fokkens, Robert	Tracing Lines	2006	afl vcl		2006 rarescale premiere series, London
Fokkens, Robert	Two Songs on texts by ibn al-'Arabi	2007	sop, afl		2007 rarescale premiere series, London
Foo, Jean Y	The Clinging	2010	sop, afl		
Giorgetti, Daniel	Mantra	2006	afl, eam		2006 rarescale premiere series, London
Giorgetti, Daniel	Panic and Echoes		afl, pno		rarescale premiere series, London

Gourlay, Karen	Dreamscape	2006	afl, gtr	6'00	2006 rarescale premiere series, London
Gourlay, Karen	The Only Lonely one	2003	afl		2004 rarescale competition RCM
Hebb, Rosie	Looking Back	2012	fl		2012 Arcomis Colston Hall Bristol
Hexel, Vasco	Mantra	2007	afl, eam	5'00	2007 New Wind Festival, London
Hodgkinson, Tim	The Hum of Destruction Whirrs Through the national cackle of love and produce	2007	afl, gtr, eam	17'00	2007 HCMF
Jen, Chen-Hui	As a dying haze	2011	afl		2011 UCSD, USA
Kessner, Daniel	Micro-images	2003-04	afl (or fl)	9'00	2004 rarescale premiere series, London
Kessner, Daniel	Music in uncommon modes	2010	bfl, gtr, shak	17'00	planned for 2015, Eglise St Merry, Paris, France
Kessner, Daniel	Tous les matins (quartertone version)	2007	afl or bfl	9'00	2007 UK Microfest 3
Kilpatrick, Steve	Falling out of cars	2010	afl, gtr, eam		
Kwiatkowska, Daria	In the Dark Basket of my Belly	2009	afl, pno		2009 rarescale premiere series, London
LeFanu, Nicola	A Phoenix for Carla	2013	afl/fl d'am	12'00	2013 Hoxton Hall, London - Spitalfields Festival
Lefkowitz, David	Mythical Creatures	2005	afl/bfl		2006 rarescale premiere series, London
Maggio, Dandi	Same Old Monsters	2009	bfl, eam	9'10	2013 Nonclassical, The Macbeth, Hoxton, London
McBirnie, Andrew	The Moon by Night	2003	afl eam		2003, The Warehouse, London
McBirnie, Andrew	The Sun by Day	2008	fl, pno		2005 rarescale 5 th anniversary
Mendez San Juan, Camilo	Tropical Textures I	2009	afl		
Miller, Scott	Anterior/Interior	2011	afl (or fl), eam	8'10	2011 rarescale premiere series, London
Miller, Scott	Lovely Little Monster	2009-10	afl, eam		2011 St Cloud University USA
Molloy, Ryan	Seamsur II	2011	fl		2011 rarescale premiere series, London
Morsink, Coreen	Andromache	2010	afl	7'30	2011 Leeds University
Neal, Adam Scott	Simoom	2011	afl, eam	6'00	

Nunn, Patrick	into my burning veins a poison	2003	afl, pno, eam		2004 rarescale competition RCM
Nunn, Patrick	Maqamat	2002	afl		2003 rarescale premiere series, London
O'hara, Yuko	Sa-Ku-Ra	2009	2 afl	6'00	
Oliva, Michael	Apparition and Release	2005	afl, eam	10'00	2005 New York Flute Club
Oliva, Michael	Bereft Adrift	2007	bfl, eam	5'55	2007 rarescale premiere series, London
Oliva, Michael	Dover Beach	2010	sop, afl, bcl, eam	23'00	2010 rarescale premieres series, London
Oliva, Michael	His Anxiety	2005	afl, pno, eam	7'50	2005 rarescale premiere series, London
Oliva, Michael	Les Heures Bleues	2013	afl	7'15	2013 Harlaxton Manor, Lincs
Oliva, Michael	Night Crossing	2005	afl, ca, bcl eam	5'00	2005 rarescale premiere series, London
Oliva, Michael	Nocturne	2010	afl, pno, eam	9'30	2008 rarescale premiere series, London
Oliva, Michael	Rain Drive	2007	bfl, grt, eam	10'00	2007 San Francisco
Oliva, Michael	The Girl Who Liked to be Thrown Around	2006	sop, afl, eam, video	45'00	2006 An Tuireann Arts Centre, Skye
Pentreath, Rosie	The Music of What Happens	2012	fl	3'40	
Redfern, Nick	Gallery of Solitude	2009	afl, pno		
Redhead, Lauren	...and then it becomes its own darkness	2007	bfl, eam		2007 HCMF, St Pauls Hall, Huddersfield
Rhys, Paul	Blue Rondo	2003	afl, pno		2004 rarescale competition RCM
Skuse, Amble	Sligachan	2012	sop, afl, eam	5'00	2012 rarescale premiere series, London
Spitzbergen, Joshua	A Study and Reflection Upon the Present State of Existence, of Which I Breathe In and out and In	2011	afl		2011 UCSD, USA
Sudol, Jacob	Wind in Spring	2011	afl, eam	21'00	2011 UCSD, USA
Tinkle, Adam	For Quartertone Bass Flute	2011	bfl		2011 UCSD, USA
Thow, John	Dulcis Aurea	2007	afl	10'00	2007 rarescale premiere series, London
Thow, John	Puva Puva	2001	afl	5'00	2001 GSMD, London

Tweedie, Marc	Zoli	2009	bfl	6'30	2009 rarescale premiere series, London
Welch, Adam	Breathe silence, respire	2011	afl		2011 UCSD, USA
Wilson, Ian	Khalwat	2011	fl, string quartet		2011 University College Cork
Wilson, Ian	The Linnet Sings her note so pleasing	2010	bfl, eam	10'00	2010 Dundalk Institute of Technology
Wilson, Ian	Spillaert's Beach	2008	afl or bfl, gtr		
Wilson, Scott	Fluxion	2006	afl, pno, eam		2006 rarescale premiere series, London
Wilson, Scott	rarescale (re)introduction	2011	fl		2011 rarescale premiere series, London
Wilson, Scott	Vortically	2009	bfl, eam	13'00	2010 George Cadbury Hall, Birmingham
Winters, Elizabeth	Ghost Dances	2009	afl, gtr	9'00	2009 All Saints Arts Centre, London
Winters, Elizabeth	White Bird Blackbird	2011	afl	7'30	2012 Women of the World Festival, Christ Church Spitalfields, London
Wu, Yiheng	Solo for alto flute	2010-11	afl		2011 UCSD, USA
Yeats, Marc	Have heard this dialogue of one	2003	afl	12'00	2003 An Tuireann Arts Centre, Skye
Yeats, Marc	Strange and artificial echoes	2012	afl	22'00	2013 rarescale 10 th Anniversary Competition, RCM, London
Young, Ruth	Never Bite the Hand that Feeds	2003	afl, pno	8'00	2004 Trinity College of Music, London