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## A digital resource for navigating extended techniques on bass clarinet

Philip Everall  
*Edith Cowan University*

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# **A Digital Resource for Navigating Extended Techniques on Bass Clarinet.**

This thesis is presented for the degree of  
**Doctor of Philosophy**

**Philip Everall**

Edith Cowan University  
Western Australian Academy of Performing Arts

2016

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## **Abstract**

Extended techniques are integral to the creation and interpretation of works for the bass clarinet. Effects such as multiphonics, microtones, or percussive and air sounds, have become commonplace in repertoire from the twentieth and twenty-first centuries. This PhD dissertation posits that the bass clarinet's affinity for these sounds can be traced back to the instrument's earliest uses, and thus extended techniques should be central to the understanding of the bass clarinet. While there is a large knowledge-base of these techniques, the paradigm of print resources with accompanying music media in which it is catalogued is old-fashioned and inefficient. This project centres around the creation of a digital resource (an iPad application) that allows performers and composers access to this body of information in a format that is portable, powerful, and intuitive. It strives to organise the information in more efficient and useful ways, to present it elegantly, and to facilitate quick and intelligent methods of retrieval. The app can also be used as an educative tool enabling performers and composers to more quickly obtain mastery of this material. The efficacy of the app is demonstrated through a lecture recital and accompanying exegetical discussion explicating the ways that the app can add (or could have added) value in the composition, notation, learning, and performance of the works presented.

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# 1 Introduction

In a matter of only a few decades, the bass clarinet has been transformed from an obscure orchestral voice to a particularly popular instrument in Western art music. This can be explained not only by the fact that there have been a small number of performers dedicated to the instrument, but also by its propensity toward extended techniques. With a working range of over five octaves and a sound palette that includes percussive and articulation effects, alterations to tone colour, and complex sonorities known as multiphonics, the bass clarinet has been enjoyed by many twentieth century and contemporary composers as an impressively versatile instrument.

Historically, conventions for the employment the bass clarinet have been obscure and often conflicting. Notation and transposition, for example, are topics of continued discussion. Since the advent of extended techniques on the bass clarinet, little clarification has been gained despite an ever-growing repertoire. Resources specific to extended techniques for bass clarinet (and soprano clarinet), while created to consolidate knowledge on performance practices, have also presented conflicting information. Also, with advancements in technology and acoustic design of the bass clarinet, some of these resources present information on production and notation of extended techniques that are now out of date.

The aims of the research project are:

1. To clarify the nomenclature and notational practices of extended techniques;
2. To develop a system that enables widespread facile access to specific information on extended techniques;
3. To improve pedagogy of the bass clarinet and facilitate the learning of extended techniques;
4. To enable broader knowledge of the instrument to facilitate the effective use of extended techniques in the creation of new works.

## 1.1 *Personal Background*

These aims came about after career-long reflection on the nature of extended techniques on the bass clarinet. As a professional specialist bass clarinetist with significant

experience in contemporary music, I have performed many new and existing works for bass clarinet in various settings. This has involved playing with ensembles such as *The Schoenberg Ensemble*, *ASKO* ensemble, *Sequitur*, *loadbang*, *The Ebony Band*, and the commissioning, workshopping, and interpretation of many new solo and ensemble works. My training for such a career began at the University of Western Australia (*BMus* 2002), postgraduate study at the Conservatorium van Amsterdam (*Voortgezette Opleiding* 2005) with Harry Sparnaay and Erik van Deuren, and the Manhattan School of Music (*Master of Contemporary Performance Practice* 2009) where my teachers were Michael Lowenstern and David Krakauer.

Throughout my career the preparation of works, particularly the creation of new works, has involved a substantial amount of study and discussion of extended techniques. An ongoing theme in these discussions is, sadly, confusion and frustration. Meetings with composers do not always allow a significant level of collaboration; oftentimes the only contact I will have with a composer (particularly in the case of ensemble works) is in rehearsal, or once the interpretation process is well underway. In such a case, there is seldom time to explore the minutiae of certain effects and try several options for a particular sound or passage. As a result, if there are elements of the writing that are unclear, the burden of finding a solution falls on the performer, often independently of the composer.

This lack of clarity can arise from various sources: the notation is unfamiliar; an effect may be printed that cannot be exactly reproduced; or, as in many cases, a sound taken from a popular resource has been employed in such a way that the player simply cannot execute it according to the composer's wishes. It is in this space that the quality of the interpretation can suffer; the performer may struggle to present the effect as-is, or they may change it to something easier but that does not align with the aesthetic of the work. This situation undermines both artists.

Ideally, in the creation of a new work, my process would be to meet several times with the composer, workshop ideas, discuss the aesthetic they are trying to achieve, and find solutions together. The immediacy in this process is what makes it ideal; the question is asked, the options are assessed, and a solution can be worked out, even if it is

a compromise. In cases where the composer and performer cannot have this face-to-face connection, this immediacy of collaboration is very difficult to synthesise.

## **1.2 Research Question**

This research situates itself in the aforementioned void. In order to address the retrieval of information when face-to-face collaboration is not possible, the following research questions were proposed:

1. How can a digital resource be created to streamline the organisation, presentation, and retrieval of information on extended techniques for the bass clarinet, and to simultaneously be used as an educative tool to enhance the mastery of this material by composers and performers?

As implied by this question, the use of digital technology is central to this project's attempt to create a new way of interacting with extended techniques on the bass clarinet. In addressing this question, this research aims to create a "proof of concept" application that incorporates information in an interactive format.

## **1.3 Project Structure**

1. A dissertation.

The dissertation encompasses a discussion of the historical factors that led to the prevalence of extended techniques, review of current literature, an exegesis of the digital resource, and an exploration of extended techniques in a cross section of repertoire;

2. A new digital resource.

This resource (in the form of an iPad app) incorporates current knowledge and newly researched information on extended techniques in an easy to use, searchable format that allows the audition, audiation, and visualization of effects. The resource will be designed to be useful for performers and composers;

3. A lecture-recital.

The lecture-recital will comprise an introduction to, and discussion of extended techniques on the bass clarinet, and a demonstration of the app. The works performed

will present varying approaches to extended techniques in terms of notation, implementation, and compositional process, and will serve as examples of the resource in the process of creating an interpretation of a work.

#### **1.4 Methodology**

As a practitioner of the disciplines relating to the topic, the methodology of this research incorporates concepts of practice-led research as described by Carole Gray<sup>1</sup>.

...research which is initiated in practice, where questions, problems, challenges are identified and formed by the needs of practice and practitioners; and secondly that the research strategy is carried out through practice, using predominantly methodologies and specific methods familiar to us as practitioners<sup>2</sup>.

At the heart of this project is the concept of collaboration. Collaboration was an integral part of the creation of the app, an essential element in the creation of new works and the interpretation of existing works, and has always been central to the bass clarinet's identity.

In the creation of the app, a collaborative approach was needed. As the principal researcher, a cyclical form of investigation was needed to cultivate forward momentum. From the outset, there were central questions and problems to be addressed: the inadequacy of a print medium; the confusion of some existing notations and practices; and the desire to present extended techniques in a new, unique, and stripped-back way.

Having only a functional knowledge of programming, I was not fully equipped to program the resource myself. Initially this work was to be done, by myself, using software I was familiar with, but the limitations this placed on the potential product were crippling. It was decided to recruit a colleague and friend, Aaron Wyatt, a fantastic musician and skilled programmer, to collaborate with and perform the task of creating a framework for the information to be displayed and interacted with in the form of an iOS app.

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<sup>1</sup> Carole Gray, "Inquiry through Practice: Developing Appropriate Research Strategies.," (1996).

<sup>2</sup> Ibid.

The collaborative relationship between myself and Aaron Wyatt was not one of “programmer and content creator” as one might imagine. Many elements of the resource from a user’s perspective (the author’s) needed to fit the logistics of database and user experience design. An idea for a feature or setting would be imagined by myself and then taken to Aaron for discussion. What might have seemed like a simple task, for example “can we embed a video in this pane here”, could require a significant (and potentially catastrophic) change in the structure of the database (or, in other words: “no”). On the other hand, for example, at the outset I had imagined the task of recording each sound and processing it using an external spectrography program, and saving the images as individual files to be referenced in the database. The response to this was a blunt “Why? We should just program a spectroscope into the app”, a possibility that I had not even considered because of the imagined complexity.

The process required me to learn to think like a programmer; a series of logical steps and instructions that are not necessarily linear. In much the same way that action research is a continuous process of plan – act – observe – reflect, programming involves mental pathways that are reciprocal, interwoven, and constantly referencing each other; not to mention the creative process of the app in which an idea must be thought out, programmed, tested, and then evaluated as useful or otherwise.

In performing this research, there was a constant interaction between myself the performer and myself the researcher, a relationship I had heretofore not acknowledged. The findings uncovered during the process of creating the app are substantiated in a lecture recital in which a demonstration of the app’s features and its potential to streamline the compositional or interpretational process (see chapter 7).

## 2 Historical Background

### 2.1 Historical Sketch of the Bass Clarinet

#### 2.1.1 The Non-Orchestral Bass Clarinet Before 1950

By the end of the first half of the twentieth century, the bass clarinet had established itself as a powerful instrumental force in orchestral and operatic repertoire. Many late Romantic composers used the bass clarinet and its distinctive tone effectively, often to reinforce particular dramatic characterisations. In Wagner's *Tristan und Isolde* (1859), King Mark is accompanied by a sorrowful bass clarinet during "Tatest du's wirklich?"<sup>3</sup>, Richard Strauss represents Sancho Panza's whimsy with the bass clarinet in *Don Quixote* (1897)<sup>4</sup>, and Gustav Mahler paints a picture of serenity: the bass clarinet serenading a herd of cows wandering in the Austrian countryside in his *Sixth Symphony* (1906)<sup>5</sup>.

Outside of the orchestral sphere was a different story. It was not until much later that the bass clarinet was drawn from obscurity by two trend-setting soloists: Josef Horak (b.1931, dec.2005), who played the first full recital on bass clarinet in 1955; and Harry Sparnaay (b.1944), who spent his career building a repertoire of solo and ensemble pieces for bass clarinet. Before this, however, there are a few appearances of bass clarinet in chamber music that are quite significant.

Two short periods in the early twentieth century showed a growing interest in the bass clarinet. Firstly, during the period between 1911 and 1913, the Second Viennese School began to discover the qualities of the instrument and Stravinsky used two bass clarinets in *Le Sacre du Printemps*<sup>6</sup>(1913). Shortly thereafter, between 1924 and 1928, several significant pieces were composed. Janacek's *Mladi* (1924)<sup>7</sup>, a wind sextet of flute, oboe, clarinet, horn, and bassoon plus bass clarinet, and Piet Ketting's *Trio Sonata*

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<sup>3</sup> Richard Wagner, "Tristan Und Isolde," (Leipzig: Breitkopf & Härtel, 1857-59).

<sup>4</sup> Richard Strauss, "Don Quixote," (Munich: Jos. Aibl Verlag, 1897).

<sup>5</sup> Gustav Mahler, "Symphony No. 6," (Leipzig: C.F. Kahnt Nachfolger, 1906).

<sup>6</sup> Igor Stravinsky, "Le Sacre Du Printemps," (Moscow: Muzyka, 1913).

<sup>7</sup> Leos Janacek, "Mladi (Youth)," (Prague: Edition Peters, 1924).

(1924) for flute, bass clarinet and piano<sup>8</sup>: the first small-ensemble piece in which the bass clarinet is given an independent line. Schoenberg also began to use the bass clarinet in smaller works such as his *Serenade op.24* (1924)<sup>9</sup> and *Suite op.29* (1927)<sup>10</sup>. His student and friend, Alban Berg, included bass clarinet in his *Kammerkonzert* (1925)<sup>11</sup> and, a couple of years later, Othmar Schoeck (Swiss lieder composer, Musikmeister of the Gewandhaus Oper and, unfortunately, setter of Nazi-sympathizer texts) penned perhaps the most important work of its time for the instrument: the first bass clarinet *Sonata* in 1928<sup>12</sup>.

There are some other noteworthy compositions of the era that display differing approaches to scoring for the bass clarinet. Pieces such as Stravinsky's *Berceuse du Chat* (1917)<sup>13</sup>, Webern's *6 Songs, Op.14* (1917-22)<sup>14</sup> and *3 Traditional Rhymes, Op. 17* (1924-25)<sup>15</sup> show the bass clarinet as a low continuation of clarinet sonority. Webern seemed fond of the bass clarinet and employed it in several of his chamber works, even using it in place of bassoon in his *Symphony op.21* (1928)<sup>16</sup>.

Schoenberg, however, uses the bass clarinet in a slightly more sophisticated way. In his *Chamber Symphony no 1* (1906)<sup>17</sup> the bass clarinet is no longer just a low clarinet, Schoenberg uses the instrument to reinforce the lines of low woodwind and strings. While nothing new in the orchestral sphere, this piece introduces a more versatile bass clarinet to the chamber repertoire.

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<sup>8</sup> Piet Ketting, "Trio for Flute, Bass Clarinet and Piano," (Amsterdam: Donemus, 1924).

<sup>9</sup> Arnold Schoenberg, "Serenade Op. 24," (Copenhagen: Wilhelm Hansen, 1924).

<sup>10</sup> "Suite Op. 29," (Vienna: Universal Edition, 1927).

<sup>11</sup> Alban Berg, "Kammerkonzert," (Vienna: Universal Edition, 1925).

<sup>12</sup> Othmar Schoeck, "Sonate Für Bassklarinette," (Leipzig: Breitkopf & Härtel, 1928).

<sup>13</sup> Igor Stravinsky, "Berceuses Du Chat," (Geneva: A.D. Henn, 1917).

<sup>14</sup> Anton Webern, "6 Lieder Nach Gedichten Von Georg Trakl, Op. 14," (Vienna: Universal Edition, 1917-22).

<sup>15</sup> "3 Volkstexte, Op.17," (Vienna: Universal Edition, 1924-1925).

<sup>16</sup> "Symphony Op.21," (Kiev: Muzyka 1928 (pub ca.1975)).

<sup>17</sup> Arnold Schoenberg, "Kammersymphonie No. 1," (Vienna: Universal Edition, 1906).



The placement of these works in an historic context raises some questions. Later in the twentieth century it would become commonplace for bass clarinet parts to be written with a particular specialist performer in mind, however, for this time-period there is no record of such a specialist. The technical demands of many of these parts are significant, and with the instrument at such a state of development as it was in this period, it would have been a considerable feat to perform this music.

It would also be interesting to discover what models of instruments were used in the performance of these works. As with soprano clarinets, the system of key-work and bore dimensions differed between German and French instruments. Today, the most common (French) bass clarinet is indebted to Adolphe Sax for many of its design principles<sup>18</sup>. The lineage of the German system bass clarinet (Würlitzer) is more obscure. No doubt, if one were to extrapolate the differences in the two systems today from those in the early twentieth century, the differences in tone quality and agility would be vast.

### **2.1.2 Early Characterisation of the Bass Clarinet**

In his DMA dissertation of 1990, American bass clarinetist Thomas Aber observes that a large proportion of works for the bass clarinet in the nineteenth century use the bass clarinet as a unique theatrical voice<sup>19</sup>. He states that of the fifty-one works that included bass clarinet between 1829 and 1890, twenty-six of these are operas. This in itself is not a surprising discovery, as not only did operas demand the largest variety in instrumental forces in that century, they were also the dominant musical medium. Beyond opera, six of the remaining works are choral or vocal works (with instrumental or orchestral accompaniment), and ten are programmatic orchestral works. Only nine works to use the bass clarinet before 1890 were non-programmatic. The pie-chart in Fig.1 represents Aber's numerical findings.

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<sup>18</sup> Eric Hoeprich, *The Clarinet* (Yale University Press, 2008).

<sup>19</sup> T.C. Aber, *A History of the Bass Clarinet as an Orchestral and Solo Instrument in the Nineteenth and Early Twentieth Centuries and an Annotated Chronological List of Solo Repertoire for the Bass Clarinet from before 1945* (Conservatory of Music. University of Missouri-Kansas City, 1990).

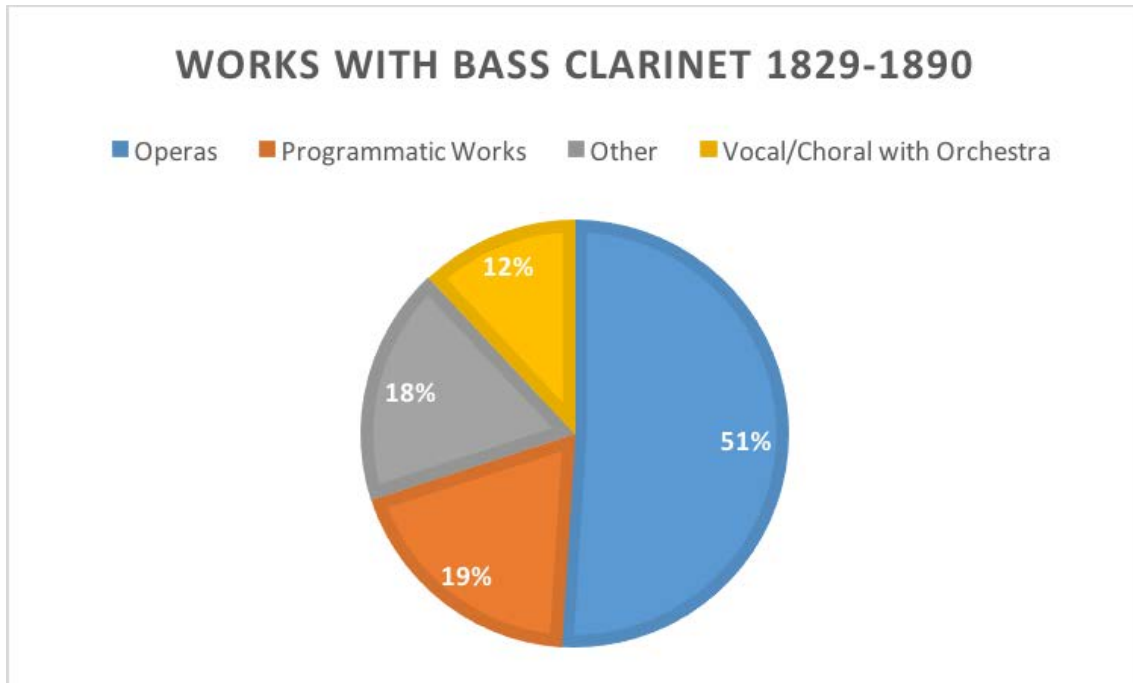


Figure 1 - Bass clarinet presence in works before 1890

From 1891 through to 1920 (a year by which stage, Aber asserts, the bass clarinet had reached a form of musical maturity), the bass clarinet had been employed in a further 139 large scale works. Orchestral music was, of course, *en vogue* at this time, and opera was on the decline. Nevertheless, of these one hundred twenty-three works, twenty-nine were operas, fifteen were choral and vocal works with accompaniment, and ten were incidental or ballet works. Of the eighty-five purely orchestral works, fifty-seven were programmatic. Although this could speak to the fact that programmatic music was a very popular vehicle for musical expression, the bass clarinet's representation in such repertoire is telling. Fig.2 again represents Aber's findings.

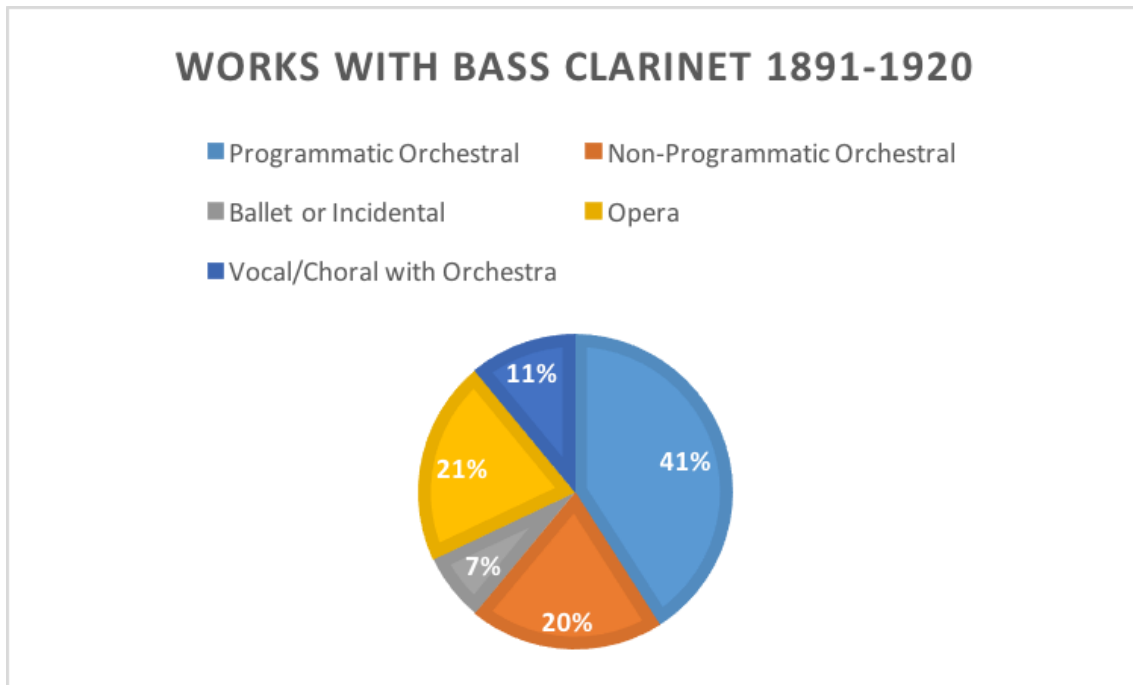


Figure 2 - Bass clarinet presence in works 1891-1921

The most interesting finding is that there was a common thematic element to all but a few of these appearances. This theme (that Aber would later describe as a hindrance to the acceptance of the instrument<sup>20</sup>) could play a pivotal role in the development of a character, an idiomatic writing style and, indeed, tradition in bass clarinet repertoire. Rather than considering the range, playability, place and date of premiere, and even whether or not it was even involved in the premiere (at the premiere of *Lohengrin*, the bass clarinet, cor anglais, and even harp parts were missing due to problems in sourcing instruments and willing players<sup>21</sup>), one must consider the dramatic themes present in these works at the moment the sound of the bass clarinet is introduced. What emerges is that the bass clarinet is linked with themes of death, anguish, and the supernatural.

The most significant uses of the bass clarinet as a dark and sinister instrument, as one might imagine, were in opera. Giacomo Meyerbeer, in his opera *Les Huguenots*<sup>22</sup>, first presents the bass clarinet to the musical world as a serious, somber, and solemn

<sup>20</sup> Ibid., 11

<sup>21</sup> Ibid.

<sup>22</sup> Giacomo Meyerbeer, "Les Huguenots," (Paris: Brandus & Cie., 1836).

voice<sup>23</sup>. In scene two of Act V, an extended bass clarinet solo introduces and then accompanies Marcel's feeling of resignation at the commencement of the Catholic massacre of the Huguenots. This solo, though probably played on a very early (somewhat primitive) version of a bass clarinet made by Buffet, remains one of the great virtuosic moments of the operatic bass clarinet. The expressive qualities of the *piano* opening in the clarion register, the flourish and crescendo from E0 to G3, followed by the hesitation and ultimate descent into the depths of the low chalumeau register expertly display the characteristics of the bass clarinet that composers seek to this day.

In a similar vein, and perhaps inspired by this solo<sup>24</sup>, Richard Wagner showed his fondness for the bass clarinet in a pivotal scene in *Tristan und Isolde*<sup>25</sup>. Though not his first opera to feature the bass clarinet (Wagner first used the bass clarinet in *Tannhäuser* in 1845), the scene in which the low sonorities of the bass clarinet accompany King Mark in the aria *Tatest du's Wirklich?* (Have you indeed?) sits alongside *Les Huguenots* as one of the most gripping and anguished scenes in the repertoire. Much like Act V of *Huguenots*, King Mark's aria sees the bass clarinet begin in the clarion register, but then slowly sink downward in a minor scale, mirroring the King's descent into the realization that his friend has betrayed him; the preparation and suspension in the last four notes of the first phrase an echo of the resolution of the iconic "Tristan Chord". The second phrase is an embellishment of the same, and then the mood crystallizes as the bass clarinet repeats the descending statement an octave lower, exploiting the dark, rich, timbre of the *chalumeau* register.

Once Wagner had helped solidify a role for the bass clarinet as an anchor point in the orchestral woodwind section<sup>26</sup>, many other composers followed suit. Particularly interesting is the fondness for writing descending minor scales, and the interval of a minor 3<sup>rd</sup>, which a large number of composers exploited. Notable passages for the bass

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<sup>23</sup> This is not the first operatic solo for the bass clarinet; a long and virtuosic solo with cadenzas can be found at the beginning of Act II of Mercadante's *Emma di Antiochia*. It seems, though, that most productions of this opera do away with this introduction, replacing it with an offstage *banda* with a fanfare-like passage from the trumpet.

<sup>24</sup> Hoeprich, *The Clarinet.*, 271

<sup>25</sup> Wagner, "Tristan Und Isolde."

<sup>26</sup> Hoeprich, *The Clarinet.*, 272

clarinet in this regard include Tchaikovsky's *Nutcracker Suite*, particularly the eerily charming *Dance of the Sugar-plum Fairies*, Mahler's Symphonies no 1 and 2, and Shostakovich's Symphonies no 7, 8, and 11.

This characterisation remained active into the twentieth century. In 1912, Schoenberg featured the bass clarinet in *Pierrot Lunaire*<sup>27</sup>. While there are no specific "solos" or operatic moments for the bass clarinet, its use is still quite in-line with the negativity and bleakness of former operatic uses. The piece is divided into three sections, relating to three sets of seven poems. In the first section, Pierrot sings about love, religion, and sex; in the second, about violence, crime, and blasphemy; and in the third, his return home to Bergamo. What is apt about the bass clarinet writing is that its first entrance, in the poem "*Valse de Chopin*", immediately following the words *Melancolisch düstrer Walzer* (melancholy, somber waltz). The bass clarinet continues to dominate over the clarinet throughout the second section, after featuring in the poem *Madonna*: a pivotal section of the work where the mood changes sharply into a very serious and dark place, with lyrics such as "Your eternally fresh wounds Resemble eyes, red and open. Step, O Mother of all sorrows, onto the altar of my verses!". Continuing the dark mood, the bass clarinet features in *Night*, *Red Mass*, and *Beheading*, the sections involving perhaps the most somber and chilling moments of the piece.

Throughout the history of the repertoire, this trend to associate the bass clarinet with feelings of anguish, death, and the supernatural has continued. The distinctive tone quality that was linked to this imagery has been cultivated by the decades of performance practice handed down from teacher to student. Popular terms used by pedagogues<sup>28</sup> to describe the sound of the clarinet include "ringing", "golden", "silky", and "clear", whilst the sound concepts of the bass clarinet are often described as "dark", "rich", "woody", and even "spooky". It was common for the bass clarinet to play in minor keys, diminished chords, and other musical clichés that expressed tension and negativity. With this tradition of associating the timbre of the bass clarinet as dark, it is next to impossible to dissociate the instrument's distinct sound from these dramatic connotations.

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<sup>27</sup> Arnold Schoenberg, "*Pierrot Lunaire*," (Vienna: Universal Edition, 1914).

<sup>28</sup> D. Pino, *The Clarinet and Clarinet Playing* (Dover Publications, 1998).

Of course, there are some famous examples of the bass clarinet providing comic relief: Strauss' *Don Quixote*<sup>29</sup> portrays The Knight's trusty side-kick, Sancho Panza, with the bass clarinet. Early in the tone-poem, one hears the amiable gait of Panza's donkey in the lilting nature of the melody, and the wide leaps mimicking the ass' exhortations, contrasted with flowing baritone melismas reflecting what we will eventually recognize as Panza being the voice of reason. The donkey aesthetic is continued, almost note-for-note, in Ferde Grofé's *Grand Canyon Suite* (1931), a movement of which, entitled *On the trail* features a virtuosic bass clarinet solo depicting a donkey careening down a mountain, eventually returning to its normal pace. The grace notes, in a similar fashion to *Don Quixote*, leave little doubt as to the character of the donkey.



Figure 3 - A well-known bass clarinet excerpt from *Don Quixote*

<sup>29</sup> Strauss, "Don Quixote."



Figure 4 - Bass clarinet excerpt from Grofe's *On The Trail*

This characterisation is not limited to Western art music. In fact, one need only to turn to music from theatre, musicals, and film to see the influence the bass clarinet has had. The bass clarinet can be clearly heard introducing “something sinister” in several Broadway and West-End shows, notably *Singin’ in the Rain*<sup>30</sup> and *Wicked*<sup>31</sup>. Many film scores, in a similar manner to opera, include a bass clarinet during moments of anguish, suspense, and intrigue. Even cartoons such as *Scooby-Doo, Where Are You?* and *The Simpsons*, the bass clarinet accompanies clichéd scenes such as the protagonists going somewhere they shouldn’t, under cover of darkness. The quintessential example of this characterisation is the theme music to *Midsomer Murders*, in which a ghostly theremin is accompanied by a rippling bass clarinet ostinato, using the spookiest of intervals; the minor 3<sup>rd</sup>.

Though this is clearly a light-hearted look at a sub-section of popular culture, it’s easy to imagine how a composer or sound designer would approach writing for the bass clarinet. In the same way that someone writing their Fifth Symphony couldn’t help but feel a pull toward the triumphant, nor to a fanfare when writing for a trumpet, a composer writing programmatic music of any kind for a bass clarinet surely must have a dark, spooky feeling of suspense at the back of their mind.

<sup>30</sup> Arthur Freed Nacio Herb Brown, "Singin' in the Rain," (1952).

<sup>31</sup> Steven Schwartz, "Wicked!," (2003).

Through the twentieth century, as music moved away from previous notions of tonality, it became less relevant to express such emotions through the use of tonal musical devices. In terms of musical narrative, since key centres and pitch considerations were (in many cases) less of an influence, a wider range of colours, dynamics, and expressive qualities were more attractive attributes for an instrument to possess. In Western art music in general, there was an increased focus on timbre. Since the bass clarinet, by this stage, was capable of immense range and agility in all of these areas, one could surmise that composers began to appreciate the instrument a lot more. The bass clarinet seemingly became known as one of the more expressive instruments, and thus, composers might extract every last possibility from it. Coupled with the fact that, since pitch-based notions of musical character were becoming less important, composers were looking for a larger palette of sound possibilities to express their ideas, extended techniques and the bass clarinet's propensity toward them became a highly desirable asset. This enabled the bass clarinet to flourish and maintain its badge as a voice associated with serious drama.

### **2.1.3 Bass Clarinet Notation and Bass Clarinet in A**

One of the most interesting and talked about issues with regard to early writing for bass clarinet is its transposition and notation. The bass clarinet in A was never really destined to be. Very few are in existence to this day (leading one to think that there weren't many made in the first place) and are now only available from one maker on special order.

In orchestral music, bass clarinet parts in A are abundant. Mahler, Ravel, R. Strauss, Stravinsky, and Wagner, all wrote parts for bass clarinet in A. This can be explained by the fact that the orchestral bass clarinet was often utilized as a low extension of the clarinet sound. Eric Hoeprich quotes Berlioz (unfortunately without citation):

The bass clarinet is not intended to replace the high clarinets with its upper notes, but to extend their range downward. Yet the effect of doubling the high tones of the clarinet in B flat in the lower octave by the bass clarinet is very beautiful<sup>32</sup>.

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<sup>32</sup> Hoeprich, *The Clarinet*, 272



Composers (or publishers) may have assumed that writing a part in A for the bass clarinet would have been perfectly reasonable: if the performer didn't have the desired instrument, they could simply transpose. The bass clarinetist in chamber music, however, would have required a more delicate and flexible tonal palette than that of an orchestral musician. One would think that a specialist bass clarinet player would be less than impressed with being repeatedly handed parts in A.

While it is easy to assume that the bass clarinet being treated as an extension of the clarinet is the only reason for this confusing issue, there are other factors to consider. More fundamental than the question of transposition is that of standardized notation. For some seemingly inexplicable reason, the bass clarinet has been notated in several ways: treble clef; bass clef; or a mixture of the two. This may not seem out of the ordinary at all, but how this is to be done is slightly confusing<sup>33</sup>.

1. If the piece is notated only in treble clef, the bass clarinetist reads the part as they would a clarinet part. The pitch of the bass clarinet thus sounds a major 9<sup>th</sup> lower than written. This is sometimes referred to as French notation<sup>34</sup>.
2. If the piece uses a mixture of bass and treble clef, the bass clef sections sound a major 2<sup>nd</sup> lower than written, but the performer must play the treble clef sections one octave *higher* than in the French notation to maintain the same major 2<sup>nd</sup> transposition. For those not used to playing bass clarinet, this results in playing treble clef one octave higher than "normal". This is often called German notation<sup>35</sup>.
3. The piece uses bass clef and treble clef; the bass clef sounds a major 2<sup>nd</sup> lower, and treble clef sounds a major 9<sup>th</sup> lower. Sparnaay calls this "half-French, half-German"<sup>36</sup>. Whilst confusing for some, this notation is popular among some doublers and inexperienced players, as this means the fingerings for the treble clef sections are the same as Bb clarinet.

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<sup>33</sup> This topic is discussed in detail in H. Sparnaay, A. Man, and P. Roe, *The Bass Clarinet: A Personal History* (Periferia Sheet Music, 2011), 40

<sup>34</sup> Ibid., 40

<sup>35</sup> Ibid., 42

<sup>36</sup> Ibid., 46

Despite the coexistence of two conflicting transpositions, this system needn't be too confusing. Unfortunately, though, there is an added level of complexity in that some composers do not understand these conventions, and discussions must take place to make sure the bass clarinet is playing in the correct octave. To further muddy the waters, some of the major treatises on orchestration present another conflicting concept: bass clarinet in C. Rimsky-Korsakov writes that there are two common bass clarinets, those of Bb and C.<sup>37</sup>

While the proposed resource deals primarily with works composed after 1950, and therefore some of these conventions are out of fashion, this concept has set a precedent of misinformation regarding the bass clarinet.

#### **2.1.3.1 Pioneering Bass Clarinetists**

##### **2.1.3.2 Josef Horák**

Josef Horák (b. March 24, 1931, Prague, d. November 23, 2005) was a Czech musician who is credited to have given the world's first full bass clarinet recital in 1955.

In his fifty-year career as a bass clarinet soloist, Horák commissioned and performed over 500 works for bass clarinet, many of which for the ensemble "*Due Boemi di Praga*": a duo consisting of Horák on bass clarinet and his wife Emma Kovárnová on Piano.

Whilst maintaining a crucial standing within the historical context of the bass clarinet, Horák was not as renowned for expanding the tonal and textural capabilities of the instrument with extended techniques as he was for premiering contemporary, yet neo-romantic or neo-classical works. This being said, it was a watershed in the bass clarinet's history for Horák to take the bass clarinet to the concert stage as a solo instrument. At the time, parts written for the bass clarinet were limited to a few chamber works and symphonic repertoire. Even the most challenging opera, ballet or symphonic bass clarinet parts would not prepare a player for a solo recital, meaning that this first recital was a significant achievement. The importance in his contribution was not so much creating

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<sup>37</sup> N. Rimsky-Korsakov, M.O. Steinberg, and E. Agate, "*Principles of Orchestration: With Musical Examples Drawn from His Own Works*," no. v. 1-2 (1964).

new sounds and possibilities for the instrument in an “extended” sense, but for the fact that no one had ever performed a full solo recital on the instrument before.

Dubbed by some as “Paganini of the Bass Clarinet”, Josef Horák performed and commissioned new works for the bass clarinet over several decades. Other significant accomplishments include transcriptions of works for other instruments: Paul Hindemith’s *Sonata for Bassoon*<sup>38</sup>; Olivier Messiaen’s *Abime des Oiseaux*<sup>39</sup>; and Bohuslav Martinu’s *Sonatina for Clarinet*<sup>40</sup>; all sanctioned by the composers.

Horak gave his last recital at De Doelen in Rotterdam in October 2005, and passed away three weeks later.

### 2.1.3.3 Eric Dolphy

While primarily an exponent of Jazz, Eric Dolphy was a bass clarinetist who inspired many to take up the instrument. Dolphy was famous among bass clarinetists for his expansion of the bass clarinet’s tonal palette. At a time when the bass clarinet was mainly used in orchestras and bands, Dolphy explored its unusually large range and its ability to create sounds beyond the normal scope of “classical” instruments.

Of particular note are recordings such as “*Out to Lunch!*”<sup>41</sup> the first track of which (entitled “Hat and Beard”) features an improvised solo on bass clarinet by Dolphy that features extreme uses of range and tone colour. In the same solo the listener hears Dolphy producing various multiphonics and percussive techniques. Whether this was pre-meditated or not is difficult to determine, but other bass clarinetists from the time agreed that Dolphy was a highly skilled musician. In a post on a woodwind forum, former National Symphony Orchestra Bass Clarinetist Lawrence Bocaner said the following:

In 1962 I spent a couple of hours in my studio at Howard University playing bass clarinet duos with Eric. What amazed me about him was not only his flawless technique but his terrific sight reading ability - and this was classical stuff!<sup>42</sup>

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<sup>38</sup> P. Hindemith, *Sonata for Bassoon and Piano* (1938) (Associated Music Publishers, 1939).

<sup>39</sup> Olivier Messiaen, “Quatour Pour La Fin Du Temps,” (Paris: Durand & Cie, 1942).

<sup>40</sup> Bohuslav Martinu, “Sonatina for Clarinet and Piano,” (Paris: Chez Alphonse Leduc, 1957).

<sup>41</sup> Eric Dolphy, “Out to Lunch,” (1964).

<sup>42</sup> Lawrence Bocaner, “Message Board Post - Dolphy Duets,” *NewBassClarinetGroup.yahoo.com*, no. 1251 (2006).

#### **2.1.3.4 Harry Sparnaay**

Harry Sparnaay was born in The Netherlands in 1943, and studied clarinet at the Sweelinck Conservatorium with Ru Otto. After completion of his performer's degree, Sparnaay specialized in bass clarinet and began to commission new works for the instrument. At the time, of course, there was very little repertoire for the instrument and so one could say that Sparnaay forged a new path for the instrument. As Josef Horák was dedicated to the extension of the traditional bass clarinet and its inception as a solo instrument, Sparnaay fought to spark a renaissance for the bass clarinet.

In 1972, the same year as the composition of Ferneyhough's *Time and Motion Study I*<sup>43</sup>, Sparnaay won the prestigious *Gaudeamus Prize* for interpretation of contemporary music. This helped him gain some renown, but ultimately Sparnaay had to work tirelessly in commissioning and performing works to have the greater musical community take the instrument seriously. Thanks to Sparnaay's efforts, over 650 pieces have been composed for the bass clarinet. In 2004 Sparnaay was named *Ridder in de Orde van de Nederlandse Leeuw* (Knight in the Order of the Dutch Lion): a Knighthood for his services to Dutch music. In 2012, Sparnaay published his book: *The Bass Clarinet: a Personal History*<sup>44</sup>. This large work is part instructional manual and part memoir, and will be discussed in Chapter 3.

Harry Sparnaay's significant efforts in raising the profile of the bass clarinet as a performer were also matched by his teaching. Since the early 1980s, Sparnaay has taught generations of bass clarinetists, and his students can be found in orchestras, ensembles, and teaching positions all over the world.

#### **2.1.3.5 Michael Lowenstern**

In the tradition of constant investigation into possibilities of sound and performance led by Sparnaay, New York based bass clarinetist Michael Lowenstern has done much to expand the language of the bass clarinet. Whilst pursuing studies at Interlochen Arts Academy and then the Eastman School of Music, Lowenstern began composing virtuosic music for bass clarinet and electronics. While pieces for bass clarinet and sound tracks

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<sup>43</sup> B. Ferneyhough, "Time and Motion Study: I, Solo Bass Clarinet," (Edition Peters, 1977).

<sup>44</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*.

(often cassette tape) were common, Lowenstern took the idea further and built a repertoire focusing on live electronics in a pop/jazz idiom.

The bass clarinet was already a popular instrument in Jazz, and the Classical bass clarinet was well established, but Lowenstern's output began to fuse the two. With a solid conservatory technique using more of a pop language, Lowenstern created a niche sound world that had not been heard before. Through the use of interactive audio processing, the various sounds of the bass clarinet (including extended techniques slap-tonguing, multiphonics and percussive effects) are used to create lush backgrounds to support Lowenstern's improvised solos.

Although the repertoire for bass clarinet already contained pieces using electronic backings, Lowenstern's music has created a new tradition and it is often expected that bass clarinet recitals will include a certain amount of content with electronic interaction. This may seem trivial, but the current expectation that bass clarinetists have at least a basic level of understanding live electronics has completely revolutionized the nature of the instrument and the repertoire being written for it.

#### **2.1.3.6 Henri Bok**

Henri Bok is a Dutch bass clarinetist (born March 9, 1950 in Rotterdam) also devoted to the growth of the bass clarinet repertoire. In addition to being the author of one of the most popular resources on the bass clarinet, Bok is well known as a composer, writing a multitude of pieces for bass clarinet in numerous solo and ensemble settings.

Of particular note is Bok's collaborations with other instrumentalists. He has created duos with such diverse instruments as trombone, accordion, bass oboe, and saxophone. Most notably, Bok's long-standing *Duo Contemporain* with percussionist Miguel Bernat has toured, commissioned, and recorded prolifically throughout the 1980s, 90s, and 2000s.

A highly respected and sought-after educator, Henri Bok was, until very recently, Professor of bass clarinet at the Rotterdam Conservatorium, where he maintained a large studio of international students.

### 2.1.4 Early Occurrences of Extended Techniques

Of the standard group of extended techniques (percussive effects, single sound manipulations, multiple sounds, and articulation effects) none can really be claimed as exclusive to the bass clarinet. This makes finding their earliest occurrences rather difficult. In terms of bass clarinet repertoire, the task is easier, but the actual history of the effects is more complex. Techniques such as circular breathing, for example, pre-date Western art music significantly. While this does not necessarily aid our understanding of the repertoire, knowing the mechanics of these earlier techniques can help with their execution.

Perhaps the most idiomatic extended technique of the bass clarinet is the slap-tongue. Referred to by Rehfeldt as "... an old-time jazz effect..."<sup>45</sup>. The use of slap-tongue in early bass clarinet repertoire is quite common, as the resonance of the instrument makes for an impressive percussive effect. The technique itself however was most likely first used on the saxophone in the early 1920s. Several early jazz saxophonists such as Loren McMurray, Rudy Wiedoeft, and Coleman Hawkins were well known for using slap-tongues. The first published occurrence was in a tune called "Sax-O-Phun" with the subtitle "A Study in Laugh and Slap Tongue" in 1924<sup>46</sup>. A modern typeset version of the score appears in Fig.5.



Figure 5 - *Sax-O-Phun* - one of the earliest notations of slap tongue

<sup>45</sup> P. Rehfeldt, *New Directions for Clarinet* (University of California Press, 1994).

<sup>46</sup> Rudy Wiedoeft, "Sax-O-Phun," (1924).

A little later in 1935, Jean Francaix also notated slap-tongues in a similar way. Towards the end of the final movement of his *Petit Quatuor pour Saxophones*<sup>47</sup> the tenor saxophone part shows the same accents with the marking “*Slap*”.

By the early twentieth century, some types of extended techniques were already being used in works by Richard Strauss, George Gershwin, Arnold Schoenberg, and Bela Bartok, and alterations to tone were beginning to surface. Mahler famously instructed woodwind instruments to play *Schalltrichter auf!* (with the bell in the air), not as a technique to increase volume as often assumed, but to make the sound aggressive and shrill. Flutter-tonguing had been introduced into the orchestra around 1892, with Engelbert Humperdinck asking wind players for the technique to imitate lambs in the opera *Hansel und Gretel* (1892)<sup>48</sup>, Strauss and Mahler following soon after.

The rise of solo works for wind instruments also saw a rise in extended techniques: Luciano Berio requested his flautist play a multiphonic in his *Sequenza I* (1958)<sup>49</sup>, and made significant demands of the trombonist in *Sequenza V*<sup>50</sup>, notating parameters for the independent control of embouchure and fingers.

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<sup>47</sup> Jean Francaix, "Petit Quatuor Pour Saxophones," (Paris: Schott, 1935).

<sup>48</sup> Engelbert Humperdinck, "Hansel Und Gretel," (1892).

<sup>49</sup> Luciano Berio, "Sequenza I " (Suvini-Zerboni 1958; reprint, Universal Edition 2002).

<sup>50</sup> "Sequenza V," (Universal Edition, 1966).

### 3 Review of Current Literature

#### 3.1.1 Bass Clarinet Specific Resources (in Print)

There are comparatively few resources in print that are dedicated to the bass clarinet; in practicality there are only five:

Bok, H. *Nouvelles Techniques De La Clarinette Basse* (1989, 2011)<sup>51</sup>;

Richards, E.M. *The Bass Clarinet of the Twenty-First Century* (1995)<sup>52</sup>;

Sparnaay, H. *The Bass Clarinet: A Personal History*(2012)<sup>53</sup>;

Volta, J.M. *La Clarinette Basse* (1996)<sup>54</sup>;

Watts, S. *Spectral Immersions: A comprehensive guide to the theory and practice of bass clarinet multiphonics* (2016).

Each of these makes a significant contribution to the knowledge base of the field. Bok's offering was for quite some time the only available resource that comprehensively addressed the different extended techniques.

Richards' book is a companion book to his research into extended techniques on the soprano clarinet (and indeed the entire clarinet family), but nevertheless is an important resource in its own right. The book contains many fingerings and notations and as such is less directed towards the acquiring of techniques, but rather their thorough understanding in a theoretical context. For composers, this is a valuable tool.

The very recent book by Harry Sparnaay is more than a manual of techniques. Being the originator and first interpreter of many works and extended techniques, Sparnaay's subtitle is apt: *A personal history*<sup>55</sup>. The introductions to techniques involve

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<sup>51</sup> H. Bok, *New Techniques for the Bass Clarinet*, 2 ed. (Shoepair Music Producitons, 2011; repr., 2nd).

<sup>52</sup> E. Michael Richards, "The Clarinet of the Twenty-First Century - a Sonic Resource Based on Principles of Acoustics," <http://userpages.umbc.edu/~emrich/clarinet21.html>.

<sup>53</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*.

<sup>54</sup> J.M. Volta, *La Clarinette Basse* (International Music Diffusion, 1996).

<sup>55</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*.



personal anecdotes and musings on the production and conception of many performance techniques. Well known for his sense of humour and unashamed confidence, Sparnaay writes in a very familiar, no-holds-barred turn of phrase. This makes the book entertaining to read and removes some of the equability from the subject matter.

Volta's book, whilst a valuable reference and training manual for bass clarinetists, contains no mention of extended techniques, and is aimed more toward the advancing student or newcomer to the bass clarinet.

Perhaps the most important reference to date is the very new resource by Sarah Watts. In *Spectral Immersions*, Watts completely overhauls the current understanding of multiphonics. Spectrography is used extensively to demonstrate the true sounding nature of multiphonics, and many fingerings and possibilities previously unpublished are included. This book also contains études for learning to execute different multiphonics, and culminates in some new works that feature multiphonic possibilities.

This resource is very new, and only came into my possession during the final stages of this project. My project was already well underway, independently of Watts' study. Since discovering this resource, I still believe that this study makes an original contribution that is significantly different from Watts'.

Though meticulously thorough and comprehensive, Watts' resource is an in-depth study of multiphonics only. There is no significant discussion of other extended techniques – nor does there pretend to be so. Where the present study is dedicated to a broader range of topics with a view to simplifying practices and an attempt to revolutionise information retrieval, *Spectral Immersions*, by contrast, is a concentrated effort to uncover heretofore unknown information on one such particular topic.

These resources will be explored and examined in greater detail in Chapter 3.3.

### **3.1.2 Clarinet Resources (in Print)**

There are considerably more resources on extended techniques dedicated primarily to the soprano clarinets, many of which contain chapters on the bass clarinet and/or extended techniques that are very useful:

Rehfeldt, P. *New Directions for Clarinet*<sup>56</sup>;  
 Lawson, C.J. *The Cambridge Companion to the Clarinet*<sup>57</sup>;  
 Heaton, Roger. *The Versatile Clarinet*<sup>58</sup>;  
 Hadcock, P., B. Ronkin, A. Benoit, and M. Burlingame. *The Working Clarinetist: Master Classes with Peter Hadcock*<sup>59</sup>;  
 Gingras, M. *Clarinet Secrets: 52 Performance Strategies for the Advanced Clarinetist*<sup>60</sup>;  
 Garbarino, G. *Metodo Per Clarinetto*<sup>61</sup>.

Another significant resource, Mikko Raasakka's *Exploring the Clarinet*, contains a thorough and illuminating section on the bass clarinet. Though this book has existed for some years now (published in 2011). Primarily concerned with the clarinet, this resource contains guides and examples for producing many contemporary techniques including multiphonics, frullato, and microintervals, and also offers a compendium of Finnish music for clarinet.

While not as accessible or commercially available, there are a multitude of theses, journal articles, and dissertations on the subject of extended techniques that are noteworthy. Likewise, back issues of *The Clarinet*, the American journal of the International Clarinet Association, from as far back as the mid 1970's also contain articles by leading practitioners in extended techniques:

Haddad, Holly Ann. "The History and Comparison of Three Diverse Systems of

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<sup>56</sup> Rehfeldt, *New Directions for Clarinet*.

<sup>57</sup> C.J. Lawson, *The Cambridge Companion to the Clarinet* (Cambridge University Press, 1995).

<sup>58</sup> Roger Heaton, *The Versatile Clarinet* (New York: Routledge, 2006).

<sup>59</sup> P. Hadcock et al., *The Working Clarinetist: Master Classes with Peter Hadcock* (Roncorp, 1999).

<sup>60</sup> M. Gingras, *Clarinet Secrets: 52 Performance Strategies for the Advanced Clarinetist* (Scarecrow Press, 2004).

<sup>61</sup> G. Garbarino, *Metodo Per Clarinetto* (Edizioni Suvini Zerboni, 1978).

Producing Multiphonics on the B-Flat Boehm System Clarinet."<sup>62</sup>  
 Gingras, Michele. "Mastering New Sounds".<sup>63</sup>  
 Heiss, John C. "Colloquy and Review: Some Multiple-Sonorities for Flute, Oboe, Clarinet, and Bassoon".<sup>64</sup>  
 Singer, Lawrence R. "Multiphonic Possibilities of the Clarinet".<sup>65</sup>  
 Farmer, Gerald J. "A Comprehensive View of Clarinet Multiphonics"<sup>66</sup>;  
 Errante, F. Gerard. "Clarinet Multiphonics, Practical Applications (Includes List of Works)"<sup>67</sup>;  
 Rehfeldt, Philip. "Multiphonics for Clarinet"<sup>68</sup>.

The above titles are only a small sample of a large pool of information. Because of the limited number of articles dedicated specifically to the bass clarinet, these and other articles will have their key concepts discussed as examples in Chapter 3.3.

### 3.1.3 Resources for Other Wind Instruments

One of the most well known resources is that of Bruno Bartolozzi. In his *New Sounds for Woodwind*<sup>69</sup>, Bartolozzi catalogues a great many extended techniques for the four primary woodwind instruments: flute, oboe, clarinet, and bassoon. While now considered by some as outdated and problematic, this resource was a tremendous step forward in the cause for contemporary music. The book served as a guide to composers as well as performers and was the first attempt at a logical ordering and taxonomy of extended

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<sup>62</sup> Holly Ann Haddad, "The History and Comparison of Three Diverse Systems of Producing Multiphonics on the B-Flat Boehm System Clarinet" (3367142, The University of Arizona, 2006).

<sup>63</sup> Michele Gingras, "Mastering New Sounds," *Clarinet* 15, no. 2 (1988).

<sup>64</sup> John C. Heiss, "Colloquy and Review: Some Multiple-Sonorities for Flute, Oboe, Clarinet, and Bassoon," *Perspectives of New Music* 7, no. 1 (1968).

<sup>65</sup> Lawrence R. Singer, "Multiphonic Possibilities of the Clarinet," *American Music Teacher* 24, no. 3 (1975).

<sup>66</sup> Gerald J. Farmer, "A Comprehensive View of Clarinet Multiphonics," *Clarinet* 4, no. 2 (1977).

<sup>67</sup> F. Gerard Errante, "Clarinet Multiphonics, Practical Applications (Includes List of Works)," *ibid.* 1976.

<sup>68</sup> Philip Rehfeldt, "Multiphonics for Clarinet," *ibid.* 1, no. 1 (1973).

<sup>69</sup> B. Bartolozzi, "New Sounds for Woodwind," (1967).

techniques. *New Sounds* is problematic in that Bartolozzi suggests that for auxiliary instruments such as bass clarinet, piccolo, and contrabassoon, that the same techniques and fingerings can be extrapolated from the four previously mentioned. This is often not the case as many fingerings for clarinet are not possible on the bass clarinet because of the mechanics of the keywork.

Several publications provide valuable insight into the study of extended techniques. Most notably, *The Other Flute*<sup>70</sup> and *Circular Breathing for the Flutist*<sup>71</sup> are comprehensive texts on their subject matter, and set out the information in a clear and logical way. Cleve's book *Oboe Unbound*<sup>72</sup> contains more written explanations and anecdotal information, but is still a very thorough resource with fingerings and tips on techniques.

#### **3.1.4 Online and Electronic Resources**

The field of online resources regarding extended techniques is ever growing. The expression of the information in an interactive digital world enables quick retrieval and interactivity that print resources lack.

Some new resources specific to clarinet or bass clarinet include the following:

1. *www.clarinet-multiphonics.org*<sup>73</sup>, a Flash-based website that delves into the harmonic theory of multiphonics, and provides a database of fingerings for multiphonics on Bb clarinet. In a well-designed layout, the user can find fingerings for multiphonics arranged by the fundamental pitch of the sound. These fingerings are accompanied by a notation, a sound recording, and a difficulty level expressed in words such as "easy", "difficult", "very difficult", and "OK". This is a very useful resource that also shows animations of how the vibrations of the air-column inside the clarinet is affected by fingerings in order to produce multiphonics.

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<sup>70</sup> R. Dick, *The Other Flute: A Performance Manual of Contemporary Techniques* (Multiple Breath Music Co., 1989).

<sup>71</sup> *Circular Breathing for the Flutist* (Multiple Breath Music Co., 1987).

<sup>72</sup> L.V. Cleve, *Oboe Unbound: Contemporary Techniques* (Scarecrow Press, 2004).

<sup>73</sup> Nicholas del Grazia, "Clarinet Multiphonics," <http://www.clarinet-multiphonics.org/clarinet-multiphonics.html>.

2. [www.earspasm.com](http://www.earspasm.com)<sup>74</sup>, the personal website of Michael Lowenstern has in impressive amount of video content, fingering charts, and blog entries discussing issues relevant to the clarinet, bass clarinet, and music in general. Of particular interest is his video series (also available on YouTube) “So, you want to be a bass clarinet player” in which he discusses and demonstrates numerous techniques for the contemporary bass clarinetist. The site also features downloadable sheet music for his compositions, articulation exercises, and a fingering chart for the altissimo register specific to Selmer bass clarinets.
3. [www.heatherroche.net](http://www.heatherroche.net)<sup>75</sup> is the personal website of contemporary specialist clarinet and bass clarinetist Heather Roche. In the format of a blog, Roche has numerous informative posts dedicated to techniques and concepts of clarinet and bass clarinet playing. The website includes informational posts on extended techniques such as spectral glissando, multiphonics, articulations, and advice to composers on writing new music for the clarinet family. Roche’s website also includes a link to her PhD thesis: *Dialogue and Collaboration in the Creation of New Works for Clarinet*<sup>76</sup>

### 3.1.5 An Overview of Extant Resources

The primary resources addressed in the present study represent the entire body of books in print dedicated to the specific study of extended or modern techniques of the bass clarinet. Other books dealing with specialist topics relating to the instrument exist: Jean-Marc Volta’s *The Bass Clarinet*<sup>77</sup>; *From the Clarinet d’Amour to the Contra Bass: A*

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<sup>74</sup> Michael Lowenstern, "Earspasm.Com," [www.earspasm.com](http://www.earspasm.com)

<sup>75</sup> Heather Roche, [www.heatherroche.net](http://www.heatherroche.net)

<sup>76</sup> "Dialogue and Collaboration in the Creation of New Works for Clarinet." (University of Huddersfield, 2011).

<sup>77</sup> Volta, *La Clarinette Basse*.

*History of the Low Clarinets, 1740-1860*<sup>78</sup>; as well as various journal articles, chapters, and papers. None of these, however, is concerned specifically with extended techniques.

Clarification of a previously mentioned concern is warranted: the term “outdated” has been used in reference to Bartolozzi’s resource, and some other potentially disparaging language has been used in referring to information presented in some resources. This is by no means an affront to the authors of these books who have striven to facilitate widespread understanding of the material; rather, as has also been mentioned, the approach taken by many composers in the first decade of the twenty-first century to the present day has required a more specific approach to the explanation of instrumental capabilities. It is not to say that certain fingerings for microtones are no longer correct, or that instructional methods for circular breathing or slap-tonguing need to be explained differently to a new audience. The information contained in the three main texts remains of great use to both composers and performers, and the present study in no way attempts to undermine this.

One book in this collection of primary resources is peculiar; Sparnaay’s *The Bass Clarinet: a personal history*<sup>79</sup>. Whilst all books in this category provide anecdotal and historical information with reference to works and performances dedicated to or performed by the author, Sparnaay’s book is equal parts historical account and educational resource. This is explicitly stated in the subtitle, *a personal history*, however in the last couple of years (at time of this writing) this book has become a valuable resource for composers and performers. As will be discussed in detail in the ensuing chapter, the main reason for this is Sparnaay’s direct and unapologetic approach to notation and the practice of composers.

The contents of each book are similar to one another, though each author is specific about their approach. All of the books (including secondary literature to be discussed below), except one, give notated examples in written pitch. Bok’s *New techniques* is the only resource to provide examples for multiphonics exclusively in

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<sup>78</sup> A.R. Rice, *From the Clarinet D'amour to the Contra Bass: A History of Large Size Clarinets, 1740-1860* (Oxford University Press, 2009).

<sup>79</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*.

concert pitch, as a courtesy to composers. Other pitched material in Bok's resource are notated in written pitch. All of the books contain information on the following effects:

- Quarter- or micro- tones;
- Air sounds;
- Vocal effects;
- Multiphonics;
- Glissandi (and similar indeterminate-pitch techniques);
- Percussive sounds (key clicks, palm of hand on neck, etc.);

The most glaring omission is that of slap-tongue from Richards' book. Almost every other piece of literature consulted on extended techniques for bass clarinet at least comments on this effect.

The classification of sub-categories differs from book to book. For example, Bok distinctly describes glissando, "*velato*", and vibrato as separate techniques. They are produced, according to his examples and text, in more or less the same way; the same basic technique but of different durations.

Richards, on the other hand, goes into great detail on microtonal execution, suggesting conjunct segments that fall easily under the fingers be used rather than disjunct motion of leaps to and from microtones for fear of the effect not being fully noticed; whilst discussing all species of complex multiphonics as though they are the same sonic phenomenon.

Studying the "other sounds" section in each text is enlightening, as this illuminates the thought process of each author and their overall approach to extended techniques. Rather than identifying author focus by observing in which order the effects are listed in the index, these left-over sounds – perhaps afterthoughts – show what were not priorities to the author. These effects in their respective publications are shown in the following table:

Bok “Other Special Effects”	Sparnaay “Remaining Effects”	Richards “Other Resources”
<ul style="list-style-type: none"> <li>• Teeth on the reed;</li> <li>• Kissing effect;</li> <li>• Mouthpiece alone;</li> <li>• Playing on the neck.</li> </ul>	<ul style="list-style-type: none"> <li>• Mouthpiece only</li> <li>• Mouthpiece and neck only</li> <li>• Without mouthpiece</li> <li>• “Slap-tongue” without mouthpiece</li> <li>• Without neck with flat hand</li> <li>• Velato – Jeu Voilé</li> </ul>	<ul style="list-style-type: none"> <li>• Definite pitch (glissando/portamenti)</li> <li>• Indefinite pitch – percussive</li> <li>• Vocalizing</li> <li>• Air sounds</li> <li>• Speaking</li> </ul>

Table 1 - "other" effects in three sources

Perhaps the most systematic of the three is Richards. Whilst he does not go into great detail about many of the topics, his information is concise and thorough.

It is not particularly surprising that Bok’s and Sparnaay’s indices are very similar; Bok was a student of Sparnaay in the 1970s, and both were actively performing and commissioning during this early period in the instrument’s solo history.

## 3.2 Bass Clarinet Resources

### 3.2.1 New Techniques for the Bass Clarinet

Henri Bok’s *New Techniques for the bass clarinet* is seen as the first major work devoted to the subject of the bass clarinet, and as such has been a go-to resource for composers and performers for nearly thirty years. This practical resource was first published in 1989 in French and English, and a revised version (in English only) was published in 2011 after some years of out of print revision.

The book provides a brief organology and history of the instrument, followed by a discussion of some practical considerations of the instrument. These include the systems of notation: the difference between French and German notation; and a description of the



notations used in the book for tightness of embouchure, and position of the lips on the reed required for certain effects.

It is worth noting that in these preliminary remarks is the section dedicated to circular breathing. Unlike resources which list circular breathing as an extended technique, this skill is only briefly introduced by Bok, with a very basic description of its execution. One might assume that Bok, quite admirably, implies that circular breathing is a fundamental technique of bass clarinet playing, and is necessary for performing new works. That said, the instructions on this technique are preceded by the following advice:

Contemporary music poses some difficult problems in breathing technique. The notion that the ability to sustain a sound depends on the quantity of air breathed in is wrong. On the contrary, a normal breath should be more than adequate to sustain one or several notes for a long period<sup>80</sup>.

It is unclear whether Bok is suggesting that circular breathing is the solution to the “problems” posed by contemporary music, or that the technique should be learnt in spite of proper breath support being the most important factor in maintaining a sound.

From here, *New Techniques* delves into the list of extended techniques, with descriptions and remarks on the following techniques:

1. The high and extreme registers
2. Trills (shakes) and tremolos
3. Harmonics
4. Variations in tone colour
5. Microtones / micro-intervals
6. Multiple sounds or multiphonics
  - a. Multiphonics obtained with traditional fingerings
  - b. Multiphonics obtained by alternative (“false”) fingerings
  - c. Repetitions of multiphonics
  - d. Trills and tremolos of multiphonics
7. Vibrato
8. Frullato (Flatterzunge or Flutter-tonguing)

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<sup>80</sup> Bok, *New Techniques for the Bass Clarinet.*, 40

9. Glissando
  - a. Multiphonic glissando
10. Velato (“Jeu Voile”)
11. Slaptongue
  - a. Slap tongue and multiphonics
12. “Voix Humaine” (Vocal Effects)
13. Aeolian Sounds
14. Percussion on the keys
15. Other special effects
  - a. Teeth on the reed
  - b. Kissing effect
  - c. Mouthpiece alone
  - d. Playing on the neck
16. Combination of different special effects

There are a few occurrences of overlap in the text, whereby a certain effect or technique appears to belong in more than one category. Bok cross-references these quite well, acknowledging the flexible nature of many of the techniques, and the blurred lines between them. Such an example is that of harmonics; the overarching concept of producing partials of the harmonic series on any given note is listed as a separate special effect. Later, in the section on multiphonics, this is again referenced as the first type of multiphonics, “multiphonics using traditional fingerings”, often called *sons fendus* (broken sounds).

Following this main section on extended techniques are two short essays on the history and evolution of the bass clarinet and its repertoire. It appears as though these are compiled from two separate documents (perhaps originally written as stand-alone articles for publication in periodicals such as “*The Clarinet*”), as the two chapters contain some significant overlaps – namely the mention of the evolution of bass clarinet repertoire being owed to Josef Horak’s pioneering work, and the significant commissioning work done by Harry Sparnaay after being awarded the Gaudeamus competition in 1972. The chapter on the evolution of the repertoire focuses on works and composers with whom Bok has worked significantly.

The last section of the book proper is a reproduction of two works for solo bass clarinet: *Sonata Lirica* by David Loeb, and *Mirabella I* by Burkhardt Söll. What is highly perplexing is why these pieces are included; It seems very strange for a book entitled *New Techniques for the Bass Clarinet* to contain not one but two pieces that are almost completely devoid of any new techniques. The repertoire pieces dotted throughout the text as examples of particular effects do so effectively, however in the entirety of these two examples, there is one slap-tongue (near the bottom of the last page of the second piece), but no other techniques such as multiphonics, glissando, or timbral variation. Even more concerning is the fact that the piece including the slap-tongue does so in a way that almost contradicts Bok's own suggestions (see Fig.6). The one note marked "slap tongue" is notated as a definite pitch with a cross through the stem (see Fig.7). Earlier in the piece there appears a series of notes with what would traditionally be described as a *staccatissimo* notation, which is what Bok proposes on page 5 of his book as the preferred notation for slap-tongue.



Figure 6 - Bok's notations for slap-tongue



Figure 7 - A slap-tongue in Loeb's *Mirabella I*



Figure 8 - *Staccatissimi* resembling slap-tongues

Bok's fingering tables are the main strength of the text, and have been a standard resource for decades. In his tables, Bok lists fingerings for eighty-two trills and tremolos, multiple fingerings for the full range of quarter tones and variations in timbre (for each semitone of the tempered scale), 112 multiphonic possibilities, and 62 multiphonic trills. It is important to point out that the tables for multiphonics and multiphonic trills list all the examples in sounding pitch; the fingering tables for microtones and variations in timbre are listed in written pitch. Bok states this only briefly in the introduction to the multiphonic fingering tables, and as such, the potential exists for the reader to overlook this.

With reference to Bartolozzi, Bok identifies two types of multiphonic: the first type being those produced through the use of harmonics above traditional fingerings; and the second, those produced using a special fingering<sup>81</sup>. The fingering table only includes those of the second type, as the first type relates directly to the harmonic series (expressed diagrammatically earlier in Bok's chapter<sup>82</sup>).

The effects for which there are no fingering tables are dealt with swiftly and efficiently. Bok makes no room for unnecessary prose, and describes the effects in their production and perception in very simple, familiar language so as to be understood clearly by performers and composers alike. It is unfortunate that Bok apparently didn't

<sup>81</sup> Ibid., 40

<sup>82</sup> Ibid., 22

employ a native English proofreader; much of the language in English is clumsy, and appears to be direct literal translations from either Dutch or French.<sup>83</sup> A description that is very clear in Dutch may sound slightly less articulate when directly translated into English.

In articulating the “r” the tongue or the throat vibrate. The entrance of air into the instrument depends on the rate of the vibrations produced<sup>84</sup>.

Here, the reader could be left wondering if Bok is implying that the resulting sound is a faster or slower speed of repetitions or iterations of sound, or if he means that a flutter tongue must reach a certain speed or critical mass before the effect is audible. Bok’s text is peppered with such awkward language, but is mostly comprehensible by the reader.

Other such explanations of techniques of this nature, i.e., those not requiring specific fingerings, are similarly concise and generally clear to any reader. The explanation of the glissando effect is at first confusing:

This effect is realized as of a chromatic movement by superficially gliding over the keys in pressure in coordination with the pressure of the lips. To attain this objective, a tone must be raised or lowered by lip only, starting with a semitone then a whole tone, and gradually increasing the intervals.<sup>85</sup>

Though the first sentence eventually becomes clear; the player must raise or lower the keys gradually in a chromatic movement, coordinating with the adjusted lip pressure. The second sentence, however, could suggest to composers that a certain process must be followed when writing a glissando. This is not the case. This sentence is directed at performers wishing to learn the technique, and a composer can choose to write a glissando in any manner they wish.

The text on Glissando continues as an excellent practical guide for both composers and performers:

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<sup>83</sup> The original edition of this text (co-written with Eugene Wendel) is published in both French and English, with both texts printed side by side on the page.

<sup>84</sup> Bok, *New Techniques for the Bass Clarinet*. 62

<sup>85</sup> Ibid. 62

The use of the embouchure alone will produced (sic) limited results and inaccurate pitch. A glissando is more easily accomplished in the high register than the others. A glissando can be played slowly or rapidly; it is therefore necessary to take note of its duration if it is to be played at the correct speed. The difficulty of playing a glissando in the low register sometimes makes it necessary to co-ordinate the embouchure and a slow movement of the key...<sup>86</sup>

With only a short recorded example, this description should be sufficient for any composer or performer to learn enough about the deployment of this effect in a piece of music. This explanation is indicative of much of the information in this book; the information is presented in a way that facilitates an understanding of these techniques from a user's perspective, and offers suggestions on how the effects can be implemented for significant impact.

### **3.2.2 The Bass Clarinet of the Twenty-First Century**

*The Bass Clarinet of the Twenty-first Century* is a companion to a very large research undertaking by Richards, now Professor and Chair of Music at the University of Maryland, Baltimore County. Originally published in 1995, *The Bass Clarinet of the Twenty-First Century* is part six of *The Clarinet of the Twenty-First Century*, an exhaustive online resource for extended techniques. The complete resource features information for soprano, bass, and Eb clarinets.

The most immediately striking feature of the book is its depth of information. Similar to Bok, a large portion of the book is dedicated to fingering tables. Richards' book, however, introduces each topic or effect not just with an explanation of the effect, but a discussion of its use, its execution and, in some cases, suggestions for patterns in which it may prove useful. The book begins with a Table of Contents that shows a comprehensive and well-thought-out structure of the techniques.

The three main chapters of the book<sup>87</sup> are as follows:

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<sup>86</sup> Ibid.

<sup>87</sup> Richards, "The Clarinet of the 21st Century (Web)".

1. Single sounds
  - a. Alternate Fingerings
  - b. Quarter-Tones
  - c. Easy Quarter-Tone Segments
  - d. Easy Microtone Segments
2. Multiple Sounds
  - a. Producing Multiple Sounds
  - b. Chart of Multiple Sounds for Bass Clarinet
3. Other Resources
  - a. Sounds of Definite Pitch:
    - i. Glissando/Portamento
  - b. Sounds of Indefinite Pitch:
    - i. Half-Pitched Percussive Sounds
  - c. Vocalizing Through the Bass Clarinet
  - d. Air Sounds
  - e. Speaking Through the Bass Clarinet

Also helpful, is an index of Tables in the book.

Preceding the first chapter on single sounds is an introduction to Richards' thoughts on extended techniques and the approach many take to learning them. Richards makes clear his opinion, shared by authors of several quotes, that extended techniques are a natural and necessary progression in the development not just of instrumental music, but an instrumentalist's development of their own artistry. He addresses concerns such as a need for standardized notation practices, and an overarching understanding of traditional and extended techniques by composers in order to fully understand an instrument and from there create new works of art<sup>88</sup>. Also, and significantly, Richards acknowledges that some repertoire and its proponents become somewhat stagnant. Richards quotes cellist Siegfried Palm as saying:

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<sup>88</sup> Ibid., iv

...danger lies in the fact that the same interpreters always tend to work with the same composers, busily preparing their works. This results in an exclusivity with is encouraged by the notation, thus misleading the outsider although having nothing to do with the music.<sup>89</sup>

Richards also identifies a few interesting points about the reluctance on the part of the performer toward learning extended techniques. He aptly notes that many performers feel a sense of trepidation in learning new techniques, as they have either little understanding of new music, or feel apathetic toward it. Perhaps, he says, this is because of common adverse attitudes toward the unfamiliar, or because some players see the process of learning a new set of skills as detrimental to the traditional ones they worked so hard to master<sup>90</sup>. In the case of clarinetists, this is not an uncommon feeling, as many of the required adjustments to embouchure, tongue position, and finger technique are in direct opposition to the relaxed-yet-secure methods of tone production that so many teachers encourage. Richards reassures the reader that learning these techniques "... will not destroy traditional skills any more than brushing one's teeth, as long as the player understands the basic concepts of traditional technique".<sup>91</sup>

The book continues with a prelude discussing the general acoustic principles of the bass clarinet, and a theory of finger technique. This theory illuminates not only a fastidious and careful approach to technique in the author's own practice, but a deliberate and thorough guide to how the sequence and layout of examples in the book were conceived. Citing several well-known clarinet educators such as Leon Russianoff, George Townsend, and Paul Drushler, Richards gives examples of how the concepts of minimum motion, avoidance of contrary motion, correspondence of air pressure and embouchure position, and correspondence of twelfths<sup>92</sup> should be not only a consideration in the employment of extended techniques, but also in how the examples and fingering tables are laid out. It appears as though Richards' text is the most thorough in this regard.

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<sup>89</sup> Ibid., i

<sup>90</sup> Ibid., iii

<sup>91</sup> Ibid., iv

<sup>92</sup> Ibid., 6-7



The discussion introducing the chapter on single sounds<sup>93</sup> presents a clear argument on the nature of extended techniques; extended techniques, as the term implies, are extensions of conventional techniques<sup>94</sup>. He goes on to lament the fact that the bass clarinet has physically evolved, thanks to advancements in technology, to become more homogenous in timbre across its range, rather than exploiting the natural acoustic tendencies of the instrument.

The desire of homogeneity of timbre in performance practice is especially baffling when one considers the unique characteristics of the bass clarinet, most obvious in comparisons with other woodwind instruments. It naturally possesses five registers of very different colour, and much greater contrasts than any other wind instrument.<sup>95</sup>

The five registers in question are outlined in the diagram in Fig.9, taken from the book.

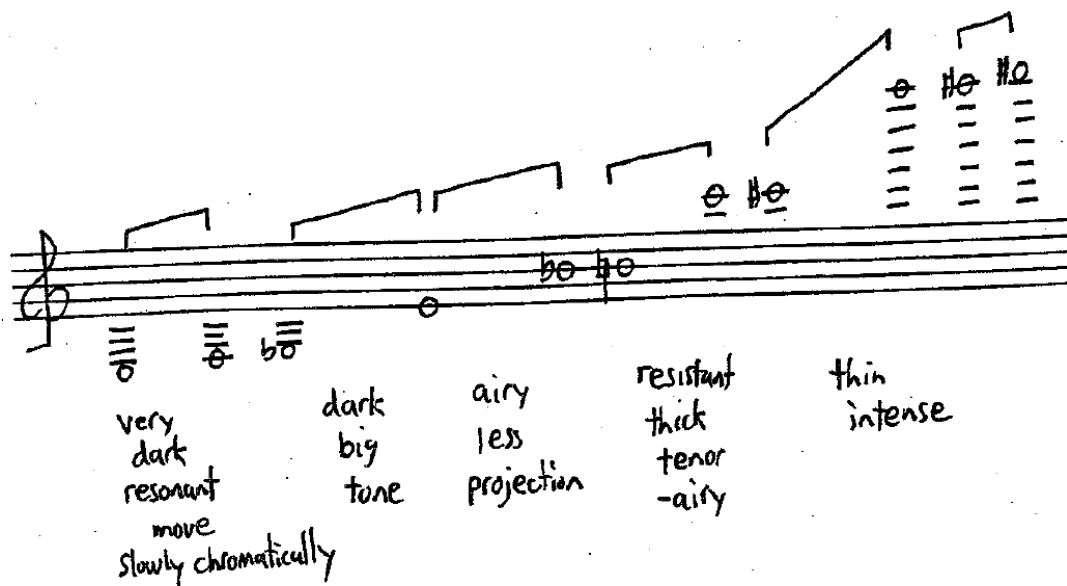


Figure 9 - Richards' five registers

After a discussion of the nature of these registers and the concepts of alternate fingerings, Richards explains his taxonomy for altissimo fingerings. Annotations under each fingering provide information on the nature of the timbre, and suggestions on how it

<sup>93</sup> Ibid., 9

<sup>94</sup> Ibid., 9

<sup>95</sup> Ibid., 10

may behave in execution. This information is highly useful to both performer and composer, as it has the potential to advise the composer on what to expect when using the sound. Table 1 tabulates Richards' list of descriptors and annotations:<sup>96</sup>

**Table 2 - Richards' timbral descriptors**

<b>Line #</b>	<b>Information</b>
I – partial	Partial of fundamental that fingering is based on/fundamental pitch (ie, 5 <sup>th</sup> /C4); (C4m = modification of C4 fundamental fingering)
II – timbre (sometimes two lines)	br = bright, br! = very bright d = dark s = slightly st = stuffy
III – dynamics	<i>ppp</i> to <i>fff</i>
IV – intonation	l = low, h = high, s = slightly
V – articulation	res = resistant; difficult to begin immediately s = slightly
VI – preparation	com = a complex fingering; player must have time to prepare for it; legato connection to it may not be possible sm = smooth connection from another pitch possible sm! = very smooth connection from another pitch possible

At the end of the table of altissimo fingerings, Richards presents fingerings for the quarter tone scale, ascending from A1 to G#5 (written). Throughout the chart, some fingerings are notated with a symbol denoting that they may be either “dark”, “slightly dark”, or “slightly bright” in timbre. The chapter concludes with some segments of the quarter-tone scale comprising fingerings that are easy to execute in rapid succession.

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<sup>96</sup> Ibid., 22

Here Richards makes the point that “conjunct microtonal segments are especially alluring because of their tendency to establish microtonality in a stronger fashion than disjunct motion, which often merely sounds ‘out of tune.’”<sup>97</sup>

In a similar fashion, the chapter on multiple sounds begins with a discussion of the history of multiple sounds, including the aforementioned specific nomenclature, a guide as to how they should be produced (suggesting that they should only require subtle adjustments of lip, jaw, and air pressure), and most importantly, the development of a sound concept for any multiple sound that a performer may need to reproduce reliably. Likewise, an explanation of the taxonomic descriptors is given in the pages preceding the fingering table<sup>98</sup>. These descriptors are significantly more detailed and diverse than those of altissimo fingerings, perhaps absurdly so.

The categories Richards describes are **dynamic range possible, stability, response, timbre, texture, arpeggiation, and technique**. This comprehensive set of characteristics provide highly detailed information on the sound, particularly in the description of texture. Here, Richards mentions two general characteristics that are noteworthy, that “...1) all diads will contain a significant amount of air when played softly, 2) most of the multiple sounds that are not undertones are capable of generating higher partials than indicated in the chart when played very loudly. However, the production and content of these partials are not controllable or reliable.”<sup>99</sup> Richards goes on to explain abbreviations for textural characteristics as follows:

Diad = two pitches (an undertone – lowest pitch is weaker than the highest)

Holl = hollow; high and low pitch (equal strength)

3vc = three voices

mvc = many voices

bal = balance; all pitches of equal intensity

elc = electronic; 3 or more pitches, thin timbres, acoustical beats

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<sup>97</sup> Ibid., 35

<sup>98</sup> A specific description of how the fingering chart is laid out is included in chapter 3.2.3

<sup>99</sup> Richards, "The Clarinet of the 21st Century (Web)", 43

elc! = raucous electronic; changing amplitudes of pitches (similar to electronic, otherwise)

be = acoustical beats; beats caused by out of tune intervals

slbe = slow acoustical beats

mud = muddy; unclear pitches

gent = gentle; dull timbres

M3! = predominant major 3<sup>rd</sup> (10<sup>th</sup>) or triad

Ns = noise in the sound (air)

Sns = some noise in the sound<sup>100</sup>

These, while providing great detail on the behavior of the sound, can make for complicated reading. An example of some multiple sound are expressed thusly<sup>101</sup>:

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<sup>100</sup> Ibid., 43

<sup>101</sup> Ibid., 46

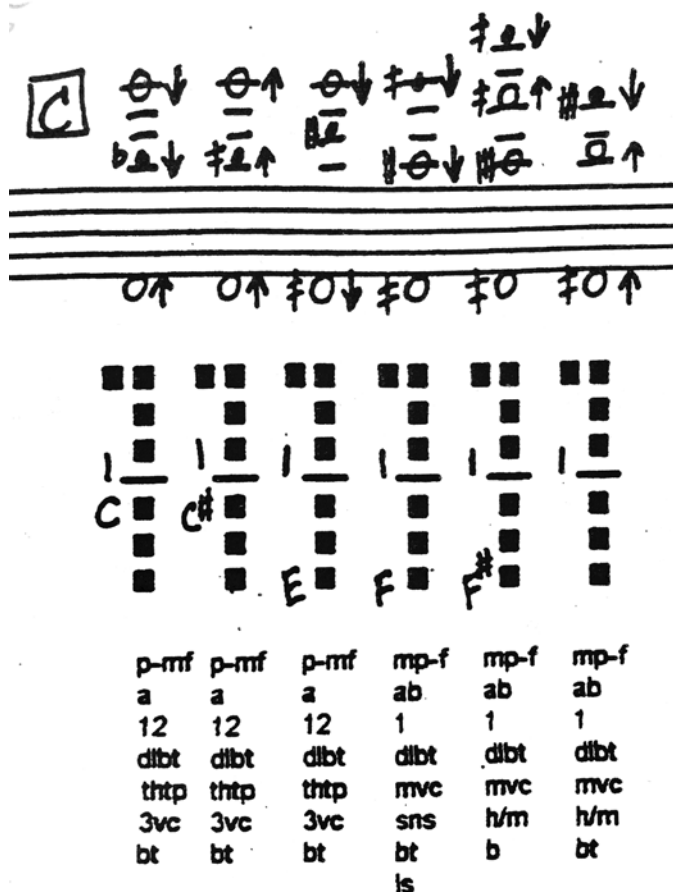


Figure 10 - A group of multiple sounds in section C

The example on the left in Fig.10 therefore has the following characteristics:

- Can be played from *p-mf*;
- Is very stable;
- All sounds begin either simultaneously or within one second, and are fairly easy to produce;
- The lowest pitch is dull;
- The highest pitch is thin;
- Three voices can be distinguished;
- It is easy to begin the sound with either top or bottom pitch.

This is, of course, very helpful to both composer and performer. One must ask, though, is all of this information necessary, especially if one could hear a recorded example?

An interesting feature of the section on multiphonics is how the sounds are listed. Richards states that his intention was to list multiple sounds according to acoustic

properties; that is, the sounds are grouped as combinations of fingerings that share the same “vent hole”. The term vent hole refers to the tone hole or finger hole that is opened, creating an interruption in the air column. In the same way the register key of the bass clarinet interrupts the air column and thus is a vent, any tone hole opened above the lowest continuous closed hole is also considered a vent. For example, in Fig.10, each sound in this group has side-key 1 (the first of four keys played by the index finger of the right hand) open.

f	mf	mf	mp-f	mp-f	f	mf
bc	bc	bc	b	b	bc	bc
34	34	34	23	23	34	34
fttp	fttp	fttp	elc!	elc!	fttp	fttp
elc!	elc!	elc!	elc!	elc!	elc!	elc!
mvc	mvc	mvc			mvc	mvc
b	b	b	b	b	b	bs
ls!	ls!	ls!	ls!	ls!	ls!	tite

Figure 11 - A group of multiple sounds in section A

Fig.11 shows a selection of multiple sounds, the common vent hole being that of the index finger of the right hand. Note that the “vent” is given this quality by the presence of closed tone holes below it.

It is worth noting, too, that all examples in the book are hand written. This occasionally makes deciphering the material somewhat difficult.

After briefly discussing multiphonic trills, a sub-chapter in which Richards suggests some ideas on approaching them, such as using fingerings as a starting point,

and oscillating one or two fingers to achieve an interesting result, the text moves into the Other Resources section. Under *sounds of definite pitch* Richards describes the techniques of glissando/portamento, and then moves swiftly into *sounds of indefinite pitch*. These sections appear more as a description of the effects, with a few examples from repertoire, and are mainly explanatory passages. Richards does, however, go into significant detail on percussive effects, showing resulting pitches from what are commonly referred to as key clicks. A common misconception of key clicks is that the fingering used to provide the key click produces the same pitch as the notated pitch. This is not the case, and Richards lists some particularly effective examples of key clicks<sup>102</sup>.

Finally, air sounds and vocalizing through the instrument is addressed in a good amount of detail, describing which particular vowel and consonant sounds Richards considers effective.

### **3.2.3 The Bass Clarinet: A Personal History**

Harry Sparnaay is known as one of the great pioneers of the bass clarinet, and his eagerly anticipated book was released in early 2012. While Bok, Rehfeldt and others strove to create resources for performers and composers, Sparnaay interweaves a narrative into the book that is engaging and historically important. As one of the most prolific commissioners in the history of the bass clarinet, Sparnaay was ideally suited to chart the development of the repertoire and techniques of the bass clarinet since the late 1960s through his own experiences.

From the outset, Sparnaay makes clear to the reader that the book is as much about his own career as it is the bass clarinet. The first two chapters are particularly personal, telling the story of how Sparnaay came to play bass clarinet, and how his efforts, enthusiasm, and musical tastes dictated the course of his building of the repertoire. Sparnaay notes that when he won the Gaudeamus prize for contemporary music in 1972, *Duo Fusion Moderne* (in which Sparnaay plays with pianist Polo de Haas) could only present six works of the required seven, owing to the fact that there were only six pieces for that combination of instruments!<sup>103</sup>.

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<sup>102</sup> Ibid., 65

<sup>103</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*, 17

A brief chapter on the history of the bass clarinet follows, mainly dealing with the structural development of the instrument, with some remarks on the operatic solos of Meyerbeer for the first bass clarinet, and for *glicibarifono* (a predecessor to the bass clarinet; a bassoon-shaped, single reeded instrument invented by Catterino Catterini of Padova in the early nineteenth century)<sup>104</sup>. While not an exhaustive academic study, there are some interesting tidbits of information, such as the dates of production of modern bass clarinets of Buffet, Selmer, and Boosey and Hawkes.

Beginning the discussion of the practical components of the text is a chapter on notation. As mentioned in Chapter 1, page 12, Sparnaay acknowledges the main systems of notation as French and German, and with a cheeky explanation of the third common system as the “confusing notation”<sup>105</sup>. Sparnaay isn’t shy in stating that for solo repertoire, the German system should be used as it facilitates reading. Having the treble clef as an upward extension of a predominantly “bass clef instrument” enables the performer to read extremes of register without having to decipher large numbers of ledger lines. He does note, however, that when writing a “doubling” part, i.e., a part in which clarinet and bass clarinet both appear, the composer should use the French notation. This allows the performer to switch between instruments freely, using the same fingerings for written pitches. One final notation Sparnaay mentions is what he calls “The Really Bad Notation”<sup>106</sup>. This is a very uncommon notation in which the bass clarinet is notated in bass clef, sounding a major 9<sup>th</sup> lower; Sparnaay notes that he has only come across this a few times in his career, and is usually a result of a composer confusing two different types of notation. Finally, Sparnaay extolls his love of graphic scores, mentioning some pieces with graphic scores that he found particularly fascinating<sup>107</sup>.

Following this is a chapter on range. Rather than simply showing the possible range of the bass clarinet on a staff, Sparnaay goes into great detail on writing in certain ranges, providing examples of effective use of the altissimo register. He also notes the

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<sup>104</sup> Rice, *From the Clarinet D'amour to the Contra Bass: A History of Large Size Clarinets, 1740-1860*.

<sup>105</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*., 46

<sup>106</sup> Ibid., 48

<sup>107</sup> Ibid., 50



existence of “extremely high” notes, but issues a humorous word of warning to performers, “I therefore strongly advise the musician to keep silent about these notes when there is a composer around”<sup>108</sup>.

Particularly interesting are Sparnaay’s thoughts on sitting versus standing to play the bass clarinet. This is not so much a practical guide to posture (though that is a major consideration of the chapter), but rather a statement of the emancipation of the bass clarinet. Stating that “the only, but perhaps the most important similarity between the clarinet and the bass clarinet is by the angle in which the mouthpiece is to be positioned in the mouth<sup>109</sup>”, Sparnaay suggests that the bass clarinet must be thought of as a fundamentally different instrument from the clarinet. This has always been Sparnaay’s *cause célèbre*, that the bass clarinet should be taken seriously as its own entity and not a subservient “doubling instrument”. Following this discussion are some hints on stage presence, and some important notes on tone production and avoiding the desire to spend money on special tools to make playing easier. Though not specifically related to the topic of the present study, Sparnaay’s comments on tone are particularly pertinent, and are fundamental to bass clarinet playing as an art in itself:

A tone comes from within yourself, from your heart. It is actually quite simple: if you cannot produce a beautiful tone with your mouthpiece attached to something as basic as a garden hose, then it is unlikely that the finest materials will help you either. If you work at your long tones over and over again and keep listening with your heart and your soul, you will be repaid with a beautiful tone. Equipment helps but ultimately it comes down to you as a musician to make a wonderful warm tone. And when you have it, you can buy what you want<sup>110</sup>.

A lengthy section on *special techniques/effects* ensues. Rather than an annotated catalogue of effects, Sparnaay interweaves his personal thoughts on the techniques, explaining what he considers effective and non-effective with each. With hints on the physical production of the sounds embedded in text discussing the possible musical contexts and implementation, Sparnaay draws his audience together; not aiming the book

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<sup>108</sup> Ibid., 56

<sup>109</sup> Ibid., 59

<sup>110</sup> Ibid., 64

at either composer or performer alone. Particularly humorous is Sparnaay's trope of "music for the paper shredder<sup>111</sup>"; examples of well-meaning composers who have written extended techniques (particularly multiphonics) after studying examples from books, hoping for magical sounds to be produced in practice the way they are notated on paper. Obviously, Sparnaay is only teasing these composers, as he acknowledges them as beautiful ideas, but pokes fun in order to point out the fact that picking effects from a book is no substitute for working with a musician to get an idea of what works and what doesn't.

Sparnaay's section on extended techniques comprises the following:

- Special techniques/effects
  - a. Slap tongue
  - b. Trills, tremolos and bisbigliando
  - c. Flutter tongue
  - d. Double staccato
  - e. Playing with air
  - f. Vibrato and smorzato
  - g. Teeth on the reed
  - h. Circular breathing
  - i. Glissandi
  - j. Using the voice
  - k. Key sounds
  - l. Playing with tape and other media
  - m. Quarter tones
  - n. Multiphonics
  - o. Remaining effects
  - p. Grace notes
  - q. Reeds

There is no apparent logical system by which the techniques are ordered. The listing begins with effects of articulation, then varying levels of air sounds, but this pattern is disrupted with circular breathing. With so many specific effects, perhaps Sparnaay could

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<sup>111</sup> Ibid., 132

have grouped them into “tonguing/articulation effects”, “embouchure effects”, “air and breath effects”, etc, but instead chooses this organic approach. Whilst this may seem ill-ordered, this actually enables the section to “read” very smoothly. For example, rather than begin with Multiphonics, Sparnaay leaves this until much later in the book. Over the course of the chapter, multiphonics are hinted at in the sections on tremolos, *smorzato*, and playing with air, as if to slowly introduce the reader to the techniques necessary to tackle the examples later in the book.

This approach at once creates engaging reading, and unfolds the narrative of Sparnaay’s career and approach to the bass clarinet and its repertoire in a very thorough and entertaining way. Throughout the book are a multitude of relevant examples, both “good” and “bad”, that provide a basis for a strong understanding of extended techniques as a critical element of the bass clarinet’s identity.

### ***3.3 Current Specific Information on Extended Techniques***

The techniques herein are discussed in no particular order. Owing to the fact that the resource will not be laid out in a linear fashion, there is no intent to prioritize any one technique over another.

- Slap-tongue
- Multiphonics
- Circular breathing
- Microtones
- Altissimo register
- Other pitched effects, and other non-pitched effects
- Alterations to the instrument

For each of these techniques, I will subdivide the information into some or all of the following headings: **explanation, history, execution, special considerations, current information, and current notation.**

### 3.3.1 Slap-tongue

#### 3.3.1.1 Explanation:

The slap tongue is a percussive effect consisting of a relatively loud attack, quick decay, and can be executed with or without a sustained tone immediately following. Through a manipulation of the tongue, the reed is drawn away from the mouthpiece, and suddenly released; the reed rebounding onto the facing of the mouthpiece, resulting in a “slap” or “thud” sound. Parallels can be drawn to “slap bass” or Bartok Pizzicato, the slap in these instances referring to the sound of the string hitting the fingerboard. The slap tongue can be executed with or without pitch, and does not generally have any affect on the duration of a note after the initial attack, i.e., it can begin a long or short note.

#### 3.3.1.2 Execution:

There are two recognized ways to achieve this effect. The first, and best documented, way is what the author would describe as “the suction method”. In order to draw the reed outward from the lay of the mouthpiece, a flat tongue is first depressed onto the reed hard enough to seal the reed onto the mouthpiece. The performer then creates suction inside the mouth, creating a vacuum. As the airstream is engaged, the tongue is brought downward sharply, the suction (between the tongue and reed) forcing the reed with it. When the reed reaches the maximum of its flexibility, it then returns with force, creating the percussive sound as it strikes the mouthpiece. While the key element to this method is the creation of a sufficient vacuum to draw the reed, it should be noted that the vacuum connects the tongue to the reed. Extraneous suction within the oral cavity is not strictly necessary for this effect, as long as the tongue can drag the reed downward. Sparnaay writes that “the vacuum is created with the tongue muscle and **not** with the lungs. Slap tongue is a blowing action and **not** just a matter of suction.”<sup>112</sup>

The second method does not involve suction *per se*. Rather than use suction to drag the reed downward from below, this method involves a slight change in the shape of the tongue to force the reed downward from above. With the same surface area of tongue coming into contact with the reed as the previous method (i.e., more than in normal

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<sup>112</sup> Ibid., 64

playing), the tongue is pushed forward while maintaining this contact. The friction involved, plus a small amount of tongue flesh bulging over the tip of the reed, allows the player to force the reed away from the mouthpiece. The result is the same as the previous example.

The key difference between these two methods is that of preparation. In order to successfully execute the suction method, time must be taken to prepare the mouth for the process of the effect. This, in the vast majority of cases, would involve the suspension of regular airflow, albeit for a brief period. When learning this method, a player must not only master the suction/release part of the effect, but then learn to incorporate this into the context of regular playing. Certain concessions in phrasing and breathing patterns must then be made.

#### **3.3.1.3 Special considerations:**

As a percussive effect, the slap tongue relies on resonance for its efficacy and success. To that end it is recommended, by bass clarinetists, composers, and the authors in question, that it be used mainly when the bass clarinet is playing in its lowest register<sup>113</sup>, or on pitches involving “long” fingerings: those that use fingerings involving both hands. While this is a worthwhile observation, the slap tongue can be executed in any register, but because of the modifications required within the oral cavity, it is difficult to produce a slap tongue and maintain the correct voicing for pitches in the upper clarion and altissimo registers. The actual “slap” sound itself is still audible, and impressively so, regardless of register. An interesting sound can be achieved when attempting to slap tongue in the higher registers; because of the lack of resonance, the resulting sound could be described as a dull thud. This effect could be useful for a composer who wants a percussive sound with no discernible pitch.

Another possibility is the use of the slap tongue with no air. If the airstream is not restarted, the reed can still be made to slap against the mouthpiece. Pitch content can still be perceived (albeit with some difficulty), but the resonance is gained only from the air existing in the bass clarinet at that moment.

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<sup>113</sup> Bok, *New Techniques for the Bass Clarinet.*, 62

#### 3.3.1.4 Current information:

As previously mentioned, each of the existing resources advocate learning to slap tongue via the suction method. It is possible that Bok suggests otherwise, but due to the ambiguity of his language, this is difficult to discern. “A slaptongue is produced by clacking the tongue in releasing it abruptly from the palate, but using the reed instead of the palate of the mouth.”<sup>114</sup>

Bok astutely states that the result is the reed striking the mouthpiece, the clicking sound of which is amplified by the instrument. He then goes on:

With the mouthpiece in playing position in the mouth, the reed is pressed against the tongue which moves from the base towards the tip. Synchronized with an *attacca* pressure of the air, the tongue is abruptly released from the reed. A smacking sound results, due to the impossibility for the reed to begin vibrating normally. If the tongue is moved from the tip to the base of the reed care should be taken to flatten the tongue as much as possible, and it should be very moist... The best result is obtained in the low and medium registers<sup>115</sup>.

Whilst a comprehensive explanation, there are some components of this text that are confusing. Bok doesn't clarify in what manner the tongue moves “from the base towards the tip”; he states that the tongue is eventually “abruptly released” from the reed, but neglects the speed or strength with which the initial movement occurs.

The smacking sound, according to Bok's text, is produced by the “impossibility for the reed to vibrate normally”. Whilst technically true, this is a rather awkward way of stating that it is the action of the reed hitting the mouthpiece and creating a short peak in reed amplitude and resonance that creates the percussive effect.

A contentious point that Bok makes is in his final comment of the description: “the best result is obtained in the low and medium registers”. It is worth noting that Bok is using the word “best” in a purely subjective way. As mentioned in special considerations, due to the physical attributes of the instrument and its key mechanism, the low and middle registers are more resonant by virtue of the fact that the air column is

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<sup>114</sup> Ibid., 62

<sup>115</sup> Ibid., 62

longer. Higher notes are less resonant, and hence less of the natural tone of the instrument is perceived. If, however, a composer wanted the percussive attack of the slap tongue, with little to no perceivable tone, or one with a high-pitched attack and little resonance, a slap tongue notated in the high clarion register would be ideal. Since the slap tongue is a physical effect that can be performed regardless of pitch, its use should be at the discretion of the composer in relation to each pitch and its desired audible material.

Lowenstern provides perhaps the most useful method<sup>116</sup>, breaking down the effect into methodical steps. Having these described and demonstrated in a video format not only brings clarity to the technique, but also shows the viewer how the various steps should sound on their own. In the course of filming, Lowenstern also demonstrates what the effect sounds like when it doesn't work so well.

Neither Rehfeldt nor Sparnaay attempt to describe the technique in anatomical terms. Sparnaay describes the effect very clearly, and makes the important point that the suction is made with the tongue and not with the lungs, but there is no "step-by-step" instruction. Rehfeldt simply describes the effect, and gives a basic introduction as to how it is executed.

Sparnaay is the only author to go into detail about the employment of the slap-tongue. Rather than suggest that it is only useful in the lower register, Sparnaay offers the advice that it can be used across the full range, with only a slight affect to pitch in the extreme registers<sup>117</sup>. He also states that the effect can be particularly useful as what he calls "a kind of 'super accent'" after which the tone can be sustained softly: a point not mentioned in the other texts. Practical considerations comprise a majority of Sparnaay's text on slap tonguing, with Sparnaay acknowledging that speed of repetitions should be considered. Suggesting a maximum tempo of 120bpm, semiquavers are possible to be slap tongued, Sparnaay also recommends that this kind of speed can only be kept up for a short time. "So as a composer if you want your work performed it is probably best not to be overambitious with too much slap-tonguing in your music"<sup>118</sup>.

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<sup>116</sup> Lowenstern, "Earspasm.Com".

<sup>117</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*., 66

<sup>118</sup> Ibid., 67

### 3.3.1.5 Current notation:

The vast majority of sources agree on notation for the slap-tongue. In each case, some kind of note head that represents a percussive effect is used (cross note-heads, crosses through the stem, *spiccato* accents, etc.), though a Bartok Pizzicato is the most common. Other variants include a cross through the stem or a cross note head. Each source makes clear to the composer that whatever notation is used, it should in the first instance be accompanied by the direction "slap-tongue" or "slap".

None of the sources makes the point that composers must be explicit in the description "slap-tongue". If this is worded in a different way, a performer may interpret the instruction as a different effect, such as a key slap, or slapping the neck with the palm of the hand. These are unlikely scenarios, but the possibility remains.

Whilst Ronald Caravan states that "no standard notation has been adopted for this technique, but a wedge-shaped symbol and/or written directions is usually sufficient for the performer to understand the desired effect<sup>119</sup>", Bok and Rehfeldt state that there is a standard, that being a wedge shape above the note. Rehfeldt acknowledges (almost as an aside) that composers have used a wedge above the note to represent a slap tongue, and the same notation coupled with a crossed note-head to represent a slap tongue without the strong presence of pitch<sup>120</sup>. Bok is clearer about this, and suggests that for a slap tongue, a wedge shape accent (*staccatissimo*) should be used, and for an un-pitched slap tongue, the same plus an "x" shaped note-head<sup>121</sup> (columns from left to right have headings: Special Effects; Proposed notations; Other notations used):

Slap tongue without definite tone		slap +
Slap tongue with definite tone		slap +
Slap tongue with approximate tone		slap +

Figure 12 - Bok's notation guide for slap-tongues

<sup>119</sup> Ronald L. Caravan, "Extensions of Technique for Clarinet and Saxophone" (7500578, The University of Rochester, Eastman School of Music, 1974).

<sup>120</sup> Rehfeldt, *New Directions for Clarinet*.

<sup>121</sup> Bok, *New Techniques for the Bass Clarinet*, 62



Kurt Stone, in his book *Music Notation in the Twentieth Century*, suggests that the cross note head be used for "key-slaps"<sup>122</sup>. This furthers the case for using a symbol other than this, yet Stone excludes the slap-tongue from his book altogether. In a book from 1980 this is surprising as the repertoire for bass clarinet, by this stage, was growing in popularity. Bass clarinet aside, this effect had been in use on the Bb clarinet for some time, as well as the saxophone: an instrument excluded entirely from Stone's book.

Howard Risatti's text *New Music Vocabulary*<sup>123</sup> addresses the slap tongue, and is perhaps one of the first to do so. Similar to Bok and Sparnaay's preferred notation, Risatti favours a notation similar to the Bartok Pizzicato symbol<sup>124</sup>.

### **3.3.2 Multiphonics**

Multiphonics are perhaps the most sought-after group of techniques for the bass clarinet. This is testament to the common understanding of other techniques such as slap-tongue, air sounds, and percussive techniques, as these often require less research for a composer, other than to ascertain if a particular performer is comfortable in producing the effect. Multiphonics are also the most complicated of the extended techniques, as there are clearly different groups or categories of sounds within the umbrella term of "multiphonic". Compounding this is the fact that there are also as many different ways of describing these categories or groups of multiphonics, as there are multiphonics themselves; some are categorized by pitch, some by number of audible pitches, some by homogeneity of sound, and some by fingering, etc.

#### **3.3.2.1 Explanation:**

Multiphonic effects, referred to by several different names, can be essentially described as sonorities in which more than one pitch can be perceived. There are various methods of

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<sup>122</sup> Kurt Stone, *Music Notation in the Twentieth Century: A Practical Guidebook* (WW Norton, 1980).

<sup>123</sup> H. Risatti, *New Music Vocabulary: A Guide to Notational Signs for Contemporary Music* (University of Illinois Press, 1976).

<sup>124</sup> *Ibid.*, 151.

production, each with different audible tone qualities. Sharing the name multiphonics are four distinct genera of production, each with their own characteristic timbral considerations. Across these four genera are two families of multiphonics; these are described in the present study as simple and complex.

Simple multiphonics are so named because this family represents the only true “multiphonic” possible on the bass clarinet, that is, the conventional production of a single tone, coupled with another single tone that is sung or hummed by the performer. Occasionally, a third summation or difference tone can be identified, but for practical purposes this family is the only one in which two distinct tones are both produced and clearly identified. This family covers one genus:

- Vocalization of a pitch while playing a different pitch.

Complex multiphonics are named as such because it can be argued that the resulting sound is not made up of equally distinct tones [note that “distinct” tones does not equate to sounds of the same amplitude or prevalence within the sonority.], or tones that are produced independently. In this case, rather than the blanket term “multiphonic”, a term such as “complex sonority” should be used. The family of Complex multiphonics has three genera:

- Use of the embouchure and airstream to emphasize particular partials (*sonsfendus*);
- Employment of non-standard fingerings to achieve complex sonorities (fingered multiphonic);
- A rapid alternation of two fingerings, resulting in a complex sonority (multiphonic trills).

### **3.3.2.2 Execution:**

#### ***3.3.2.2.1 Simple Multiphonics.***

This technique is often difficult for performers new to contemporary music. Above all technical considerations, the performer must play in a manner that is relaxed enough to be able to “disconnect” the use of their vocal cords from regular tone production. As the name would suggest, this involves singing (or perhaps more accurately, humming) into the instrument while concurrently playing pitches in the traditional manner. Vocalized pitches can be just as effective when written either above or below the played note, though some performers will have a preference. The resulting sound is often quite complex, depending on the nearness in frequency of the two pitches. If the tones are within a particular range of each other, difference or summation tones can be perceived in the form of a rasping or distorted sound quality (saturation), or even a third sounding pitch. Another interesting effect is achieved by vocalizing and playing notes that fall within a range of only a few Hz; quite often this results in a rhythmic “beating” in the form of a combination tone.

### **3.3.2.2.2 Complex Multiphonics**

#### **3.3.2.2.2.1 Sons Fendus.**

*Sons Fendus* can be found across a wide array of compositions and styles of bass clarinet playing. Often referred to by different names including harmonic glissandi, harmonics, split-note, *digeridoo* sound, or by directions such as “wild” or “rich in high partials”, *son fendu* literally translates from French as “broken sound” or “split sound”.

The successful execution of *sons fendus* result in two or more clearly discernible pitches: the fundamental, and one or more pitches from the harmonic series thereof. Variations on the technique involve smoothly moving (glissando or portamento) from one partial to another while maintaining the same amplitude. Some composers refer to this as harmonic glissando or spectral glissando.

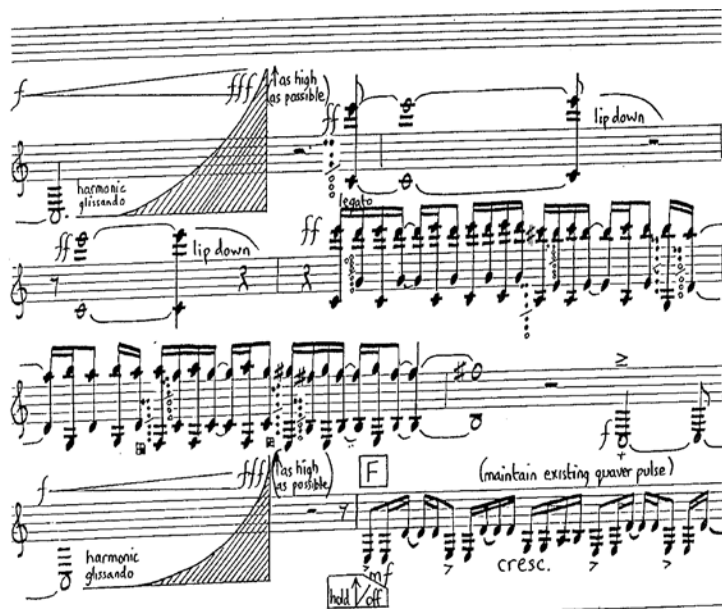


Figure 13 - Harmonic glissandi in Westlake's *Onomatopoeia*<sup>125</sup>

The fundamental of the *son fendeu* is the note produced by a standard fingering, in the case of Fig.13, this is a low C. The audibility of emphasized partials above this pitch is attained by adjustments to the embouchure and air column (speed and direction). Most often, these changes involve the relaxation of the bottom jaw, and a placement of the bottom lip further toward the base of the reed. Once the sound has “cracked”, alteration of pitch in the upper portion of the sound is achieved by changes in jaw pressure (more pressure for higher partials, less pressure for lower), coupled with a complementary adjustment of the air column. In many cases, this means a larger volume of air with a slower speed for lower pitches, and a smaller volume of air with greater speed for higher pitches. These adjustments can be made with the shape of the tongue and inside of the mouth, as well as changes to the angle of the mouthpiece in the mouth.

### 3.3.2.2.3 Non-standard fingerings.

There have been several studies dedicated to the acoustic properties of woodwind instruments specifically relating to multiphonics. For that reason, the present study does not aim to provide any scientific or physical discussion of how this particular type of

<sup>125</sup> Nigel Westlake, "Onomatopoeia - for Bass Clarinet and Digital Delay," (Rimshot Music, 1983).

multiphonic is produced. Rather, a simple overview of the concept is offered, along with suggestions for their practical employment.

Fingerings of any simple or standard notated pitch on the bass clarinet above a written Bb (known as “throat Bb”, sounding a major 2nd below middle C) employ what is known as a speaker key: a key that opens or closes a small hole or combination of holes high up the bore toward the mouthpiece. In common parlance, these keys are called “register keys”, as they are pressed in order to produce the notes of the second (clarion) and third (altissimo) registers. Any advanced clarinettist will tell you, however, that these notes are available to the performer without the use of this key; notes in these higher registers can be attained by changes to the speed and direction of the airstream, known as voicing. With the use of lower fingerings, the clarinettist can reach any odd partial on the harmonic series (odd partials due to the poly-cylindrical bore that is neither cylindrical nor conical). The speaker key, thus, is utilized in order to tune these notes to an equal-tempered scale.

With this in mind, we see the speaker key as a tool for altering the shape of the oscillations within the bore. For regular pitches, this means slightly lengthening or shortening the distance between compression nodes/antinodes, and thus lengthening or shortening the standing wave. An identical process is undertaken for the production of non-standard fingering (NSF) multiphonics, however instead of using the speaker keys close to the mouthpiece, holes further down the bore (such as those operated with the index finger, or side keys) are opened in combination with other tone holes to achieve variously complex wave patterns.

Whilst “complex” in nature, and occasionally unpredictable in execution, the pitches of a NSF multiphonic could potentially be estimated by taking into account the bore measurements, tone-hole placement, and air speed. A fascinating exploration of this potential has been undertaken at the University of Western Sydney by Andrew Botros, John Smith, and Joe Wolfe entailing a detailed computer-driven guide to flute fingerings. It is my fondest hope that such research will eventually be undertaken for the bass

clarinet, but this is beyond the scope of the present study. A complete description of the project<sup>126</sup> and its results can be found in the *Journal of New Music Research*.

As well as a non-standard fingering, this particular genus of multiphonic often requires a change to bottom-jaw pressure and/or the speed/volume of air column. Often, in order for the air column to vibrate in a complex way, the reed must be allowed to vibrate in a particular way.

#### **3.3.2.2.3.1 Rapid alternation of two fingerings**

This particular effect, most often referred to as “multiphonic trill” or “multiphonic tremolo” is less common in extant repertoire than the two aforementioned genera of multiphonics. It is possible that performers are hesitant to explore them as these techniques can appear to be more complicated than they actually are, or composers are unclear on what the actual sonic result is.

There are three sub-genera, or species, of multiphonic trills:

- An alternation between two consonant pitches;
- An alternation between one consonant pitch and a complex fingering (NSF);
- An alternation between two NSFs.

It should be noted that all three species result in a sonority that includes a “third” sound - not necessarily a summation tone or difference tone, but another complex sonority arising from the circumstances. This is what some commentators refer to as “roughness” or “noise”, and will be discussed in this paper as “saturation”, to be defined in Chapter 5.4.


The rapid alternation between two consonant pitches (from standard fingerings) can be coupled with a change in jaw pressure and air speed or direction to produce a sonority similar in nature to the *son fendeu*. This effect is particularly noticeable when alternating between two pitches that have common partials.

Similarly, the alternation between one consonant pitch and a NSF can result in the perception of a third pitch lying higher on the harmonic series of the conventional fingering. In some cases, this pitch becomes more prominent than either of the two

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<sup>126</sup> Andrew Botros, John Smith, and Joe Wolfe, "The Virtual Flute: An Advanced Fingering Guide Generated Via Machine Intelligence," *Journal of New Music Research* 35, no. 3 (2006).

fingered pitches. This technique has been explored in detail by several composers; in some of these cases, the result is an impressive display of tonality, even polyphony, due to the resulting harmonics. Fig.14 and Fig.15 are notations taken from Guus Janssen's *Sprezzatura*<sup>127</sup> which demonstrates this technique beautifully. These sounds, and those mentioned in the previous paragraph, often sound like *sons fendus*, but with significantly reduced saturation.

The lozenges represent pitches resulting from a tremolo between the played note (in normal notation) and the indicated key (1, 2, 3, 4, C or D). The tremolos are played in  tempo.

The key indication is as follows:

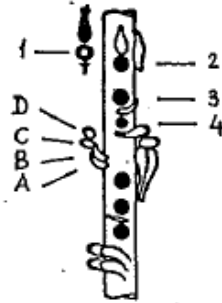


Figure 14 - Fingering key from Janssen's *Sprezzatura*

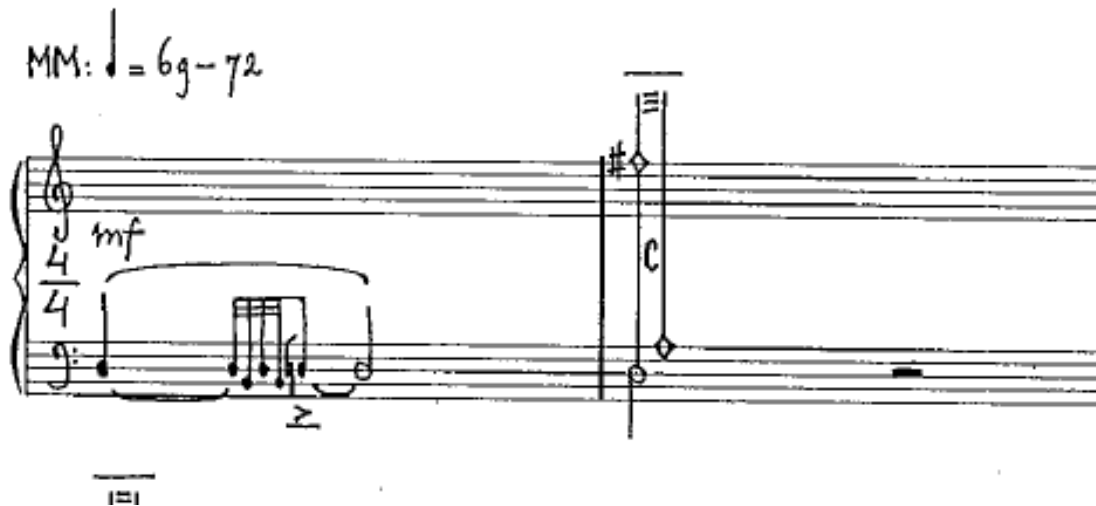


Figure 15 - A multi-phonetic from Janssen's *Sprezzatura*

The third species of this effect appears to be the least common used in repertoire, but enjoys the most exposure in the resources studied in this project. Sparnaay<sup>128</sup>,

<sup>127</sup> Guus Janssen, "Sprezzatura," (Amsterdam: Donemus, 1984).

<sup>128</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*.

Richards<sup>129</sup>, Rehfeldt<sup>130</sup>, and Bok<sup>131</sup> all acknowledge the technique as a very complex one, and that to list every possibility would be a major undertaking. Nevertheless, each of these books lists some possibilities that the author finds interesting. Bok in particular delves into the technique, listing sixty-two multiphonic trills<sup>132</sup>, all of which being examples of this third species. The other authors choose to direct the reader to musical examples. Richards judiciously suggests that multiphonic trills and tremolos are “...a fairly intricate area that is best left to advice from individual players<sup>133</sup>”, but continues to suggest that certain multiphonic classes, according to his own categorization, can be grouped to produce multiphonic trills. Richards lists these classes, but states simply that multiphonics with the same right-hand fingerings but different left-hand fingerings, and those with the same left-hand fingerings but different right-hand fingerings, can be combined to produce multiphonic trills.

### **3.3.2.3 Special considerations:**

The present study aims to address the considerations regarding the execution, notation, and understanding of multiphonics. The central issue in the understanding of multiphonics (and thus the employment thereof) is the balance of tonality and texture. In order for a multiphonic to be utilized effectively, the user (composer or performer) must begin with an understanding of the musical context and the array of sonic possibilities at their disposal.

#### **3.3.2.3.1 Tonality**

Tonal implications are not strictly the realm of the family of simple multiphonics. It can be assumed that the majority of uses of simple multiphonics would be to achieve some kind of tonal objective; the harmonization of two distinct pitches, or the colouring of a

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<sup>129</sup> E.M. Richards, *The Bass Clarinet of the Twenty-First Century* (E & K Publishers, 1995).

<sup>130</sup> Rehfeldt, *New Directions for Clarinet.*, 54

<sup>131</sup> Bok, *New Techniques for the Bass Clarinet.*

<sup>132</sup> Ibid., 54-59

<sup>133</sup> Richards, *The Bass Clarinet of the Twenty-First Century.*, 56



particular pitch with prescribed “noise” with either white noise (breath sounds) or complexity (difference tones between sung and played pitch). Many complex multiphonics have as their basis a harmonic element, and numerous works seek to exploit this. How the pitches within each genus and species of multiphonic interact with one another, therefore, is a key element in their understanding.

In many circumstances, simple multiphonics must be tailored to the voice in question. As previously mentioned, different performers (especially of different genders) will need to sing in different registers; one piece may match the vocal range of a performer particularly well, whereas the same piece could be considered unplayable by her male counterpart. This consideration does not extend only to the vocal range of the performer; the intervallic relationship of the two pitches must be suitable to the voice type. A strong alto voice sung with the bass clarinet playing in the lower reaches of the clarion register would produce a harmonically rich result, but the same clarion range played with a bass-baritone voice sung below may sound hollow and not particularly resonant. The composer, therefore, cannot assume that “singing and playing” would always have a similar tone quality.

Tonal implications pertaining to complex multiphonics are a source of confusion and misinformation. Because of this, there must be accurate information available to all parties so that suitable employment can take place: the concept of notation is integral to this discussion. A fingered multiphonic may have, in certain texts or resources, two, three, or up to five or six pitches listed as parts of its audible makeup. What traditional notation fails to express, however, is the nature of these individual pitches. No fingered multiphonic (to the author’s understanding) produces what could be considered a “chord”. That is, a sonority in which more than one sound appears equally as resonant.

#### **3.3.2.4 Current information:**

It is necessary to note the breadth of literature, particularly journal articles, pertaining to multiphonics for the clarinet. While extended techniques for the clarinet and bass clarinet underwent a parallel evolution, the much more common clarinet was more often the topic of discussion when it came to these sounds. There is little doubt that the major contributors to the body of written information were familiar with the work of pioneers

Harry Sparnaay, Henri Bok, and later Erik van Deuren, Ernesto Molinari, and Rocco Parisi, and in fact, there is less doubt that contributors such as Phil Rehfeldt, Gerald Farmer, and Gerry Errante were also capable bass clarinetists. However, the vast majority of information catalogued in the 1960s, 70's, and 80's concentrated on the clarinet. Fortunately though, much of the most useful information concentrates on the production, employment, and categorization of these effects, which is applicable to both instruments.

Generally speaking, and barring some isolated references, the discussion of singing and playing does not appear in resources for multiphonics. The concentration, therefore, is on complex sonorities. The present study is particularly focused on the categorization thereof.

An important point that every resource brings up is the differences between individual players. Clearly, physical differences in technique, control, and size of lips, preferred angle of mouthpiece, and breath support, contribute greatly to any individual's playing, and this is especially true for multiphonic reproduction. To address this, Rehfeldt explains in an early article that:

Before proceeding, however, it is important to note that with a given reed and mouthpiece multiphonics are possible with virtually all finger combinations available on the instrument. The task has been, therefore, after surveying the present literature, one of selecting only those possibilities with exhibit essentially distinctive pitch characteristics, are generally forthcoming with relative reliability and accuracy, and produceable on a mouthpiece and reed which is equally suited for a performance of the Mozart Concerto<sup>134</sup>.

Bok<sup>135</sup>, Rehfeldt<sup>136</sup>, Errante<sup>137</sup>, all distinguish two clear groups of multiphonics. Bok and Rehfeldt clarify that the first type is produced with a standard fingering and alterations to jaw pressure and air direction (*sons fendus*), but Errante has different criteria. Though the

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<sup>134</sup> Rehfeldt, "Multiphonics for Clarinet."

<sup>135</sup> Bok, *New Techniques for the Bass Clarinet.*, 40

<sup>136</sup> Rehfeldt, "Multiphonics for Clarinet.", 10

<sup>137</sup> F. Gerard Errante, "Clarinet Multiphonics," *ibid.*3, no. 2 (1976).

description he gives of each category is the same, the examples he uses refer to different techniques. From Errante:

Multiphonics are generally divided into two categories: a multiple sound, producing a rather raspy, raucous sonority where not all the pitches can be clearly defined; and, a split tone, usually more gentle in quality, where two distinct pitches may be perceived...

The second type of multiphonic, as mentioned above, is more delicate in nature and generally performed at a lower dynamic level. This “split tone” consists basically of the “undertone” that beginning clarinetists often experience when first learning the upper register<sup>138</sup>.

What Bok and Rehfeldt acknowledge as the first type, and Errante as the second type, are two very different production methods. What Errante is describing is more like what Rehfeldt describes as Category 5<sup>139</sup>; soft dyads produced with a fingering that creates a disturbance, resulting in a subtone and an upper partial closely related to the fingering performed.

According to Rehfeldt, the category produced by fingerings and embouchure changes (i.e., not *sons fendus*) is further divided into sub-categories. These are:

1. All dynamics, flexible
2. Soft attacks, crescendo to mf-f, more resistant
3. Quiet, little or no crescendo
4. Loud, with beats\*
5. Dyads, soft
6. Variable in upper partials, shrill, two or more partials possible.

Rehfeldt’s explanation of Category 4 is as follows:

These multiphonics are similar to those in the first category in that dynamics are generally flexible (basically loud); the quality is full and resonant. The distinguishing feature is that sufficient interference is set up between the various pitch components to cause audible beats. Owing to these pulsating characteristics, this type generally does not sustain to the upper pitch. The speed of the beats can vary considerably from sonority to sonority. On the bass clarinet, a number of

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<sup>138</sup> Ibid.

<sup>139</sup> Rehfeldt, *New Directions for Clarinet.*, 45

fingerings produce slightly beating effects, but none that compares to those found with the soprano instruments. The category has therefore been omitted from the bass clarinet chart. Nearly identical results can be obtained, incidentally, by humming approximately a major or minor second above or below a given pitch<sup>140</sup>.

Clearly, the division into these categories is more to do with the resulting sound than the method used to produce it, though, there must obviously be some similarities with regard to embouchure, air pressure, and in some cases fingerings.

Richards' approach is similar to Sparnaay's, in that the driving force behind the listing of the multiphonics is fingering<sup>141</sup>. Sparnaay<sup>142</sup> begins with what one might call the "home keys": the thumb of the left hand, and the first three fingers of each hand on their respective plateau keys; no fourth finger tier keys, and no side keys, only the index of the left hand is raised. This fingering, for a clarinetist, is a very comfortable fingering and is a logical starting point for an exploration of fingerings. Sparnaay then moves "upward" (with fingering changes that are reminiscent of a chromatic scale) through the various possibilities.

Richards, however, is far more fastidious. The system by which he moves through the possibilities is very clear: every possible fingering involving a common "vent" key (an open tone- or key-hole closer to the source of the vibration of the air column than the lowest closed tone- or key-hole) is systematically listed in each section. Each subsequent section utilizes the adjacent vent key, progressing chromatically upward through the range of the instrument. Not only does this result in groupings of sounds that are similar, but the fingerings required to produce them are, by design, similar as well<sup>143</sup>.

Bartolozzi's resource, though early, shows a very mature approach to multiphonics. An immediate response to Bartolozzi's comments that as the bass clarinet is not specifically dealt with, the fingerings used should be the same as those of the clarinet, might be to disregard the resource for bass clarinet<sup>144</sup>. However, the detail with

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<sup>140</sup>Ibid., 44

<sup>141</sup> Richards, *The Bass Clarinet of the Twenty-First Century*, 41

<sup>142</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History*, 143

<sup>143</sup> Richards, *The Bass Clarinet of the Twenty-First Century*, 41

<sup>144</sup> Bartolozzi, "New Sounds for Woodwind.",

which Bartolozzi describes multiple sounds is a fundamental key to understanding their nature. From the outset Bartolozzi disputes the term, which in 1967 may have been commonplace, “chords”.

It must be immediately stressed that woodwind are not able to produce chords composed entirely of fundamentals, as string instruments can, for example, but groups of sounds of differing quality, which we shall therefore call sound amalgams<sup>145</sup>.

Bartolozzi proceeds to discuss the different amalgams he identifies:

- a) The linking of monophonic and multiphonic sounds;
- b) The production of homogeneous sound amalgams, in which a fundamental is accompanied by harmonics of more or less equal volume;
- c) Sound amalgams which contain sounds of different timbre, the most distinctive type being that in which two sounds are emitted about a semitone apart with, in addition, their respective harmonics<sup>146</sup>.

In print format, it is obviously necessary to clarify and present ideas in a linear way. As such these texts have striven, each in their own way, to allow the user to identify sounds of a certain desired type. Whether this be according to technical demands of fingering, embouchure adjustment, etc, or to timbral or pitch-based considerations, the inevitable perceived hierarchy of certain effects due to their location in the book or written description is an unfortunate consequence. It is hoped that with a completely non-linear resource, a composer may locate sounds according to the characteristics they find desirable, with other relevant information on the sound embedded in the information they receive as a secondary consideration. In doing so, it is hoped that a paradigm can exist that rests on the pursuit of expressing musical ideas rather than picking sounds from a list that might “do”.

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<sup>145</sup> Ibid., 42

<sup>146</sup> Ibid., 45

### 3.3.2.5 Current notation:

From observing an array of works for bass clarinet that employ multiphonics, there emerge roughly six conventions in notation. This is not to reflect the different types of multiphonic production available, discussed previously in this chapter, but rather the approaches to notating any of the various types. For the greater part, these can be described as:

1. Discrete pitches relating to a given fingering (both notated on the page);
2. Discrete pitches given, no fingering reference;
3. No Discrete pitches nor fingerings given, with the direction “multiphonic”;
4. A graphic representation with no fingering;
5. A simple (sung) multiphonic notated on one or two staves, graphic or otherwise;
6. Discrete pitches notated, no fingering reference, and no expectation of being accurately realized.

#### 3.3.2.5.1 *Discrete pitches relating to a specific fingering (both notated).*

There are various examples of pieces that have been worked on or even devised from a collaboration between a bass clarinetist and a composer. Guus Janssen’s *Sprezzatura*<sup>147</sup>, Nathan Davis’ *Dowser*<sup>148</sup> are particularly good examples of this, and it is clear that this level of interaction can produce compositions that address multiphonics effectively within an harmonic context. In each case, the composer has worked with the performer for whom the piece was written, cataloguing several different multiphonic possibilities. These possibilities are set out in a legend at the beginning of the piece, and are given piece-specific labels. In the case of *Sprezzatura*: a trill key is designated a letter: A, B, C, or D which is then printed above a dyad in the score. In the case of *Dowser*, thirteen different multiphonic fingerings are listed at the beginning of the piece with corresponding numbers; during certain sections of the piece, pitches relating to the multiphonics are notated, with the corresponding number typeset below. Whilst neither

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<sup>147</sup> Janssen, “Sprezzatura.”

<sup>148</sup> Nathan Davis, “Dowser : For Bass Clarinet and Live Electronics,” (New York, NY: Nathan Davis, 2007).

piece presents a perfect solution to the notation problem (both require the performer to memorize either a list of fingerings, or to internalize a fingering legend different from most conventions), the approach leaves very little to chance. The multiphonic sounds are represented in the score with appropriate pitches that correspond to a provided fingering. With minimal further techniques (embouchure adjustment, internalizing pitches) the score can be adequately performed, producing the sound that the composer intended with little or no indeterminacy.

#### **3.3.2.5.2 *Discrete pitches given, no fingering reference.***

Particularly effective when considered within the sphere of Spectral music, this approach often refers to multiphonics created by adjustment of embouchure and oral cavity only, thus producing sounds that reflect the harmonic series; i.e., *sons fendus*.

An important consideration when notating this effect is that it should be common practice to provide an introductory note to inform the performer how it should be produced. For a non-specialist bass clarinetist, an unexplained multiphonic notation can lead to confusion. Such a player may spend unnecessary time poring over books and scores trying to find a fingering solution when the fingering should simply be that of the fundamental or lowest pitch.

In situations where a familiar multiphonic using a modified fingering (ie, one which does not produce a standard fundamental pitch, or an NSF) is notated, care must be taken by the composer to notate the fingering as well. There have been several cases in the repertoire where it is expected that the performer either know by rote or research the fingering for themselves. This is by no means ideal, as with the variety in notations and resources, this could be a frustrating pursuit.

#### **3.3.2.5.3 *No Discrete pitches nor fingering with the direction “multiphonic”***

In contrast to the previous executions, there are pieces that approach multiphonics in a completely different way. In Philippe Manoury's *Last*<sup>149</sup> for Bass Clarinet and Marimba,

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<sup>149</sup> Philippe Manoury, "Last : Pour Clarinette Basse Et Marimba (5 Octaves)," (Paris: Durand, 1997).

a multiphonic is notated by the placement of a “Z” through the stem of a given pitch. The direction “multiphonic” is given, coupled with a *sfz* accent seen in Fig.16.

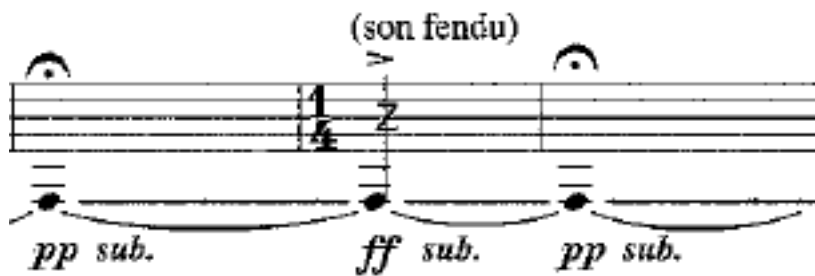


Figure 16 - *Son fendu* in Manoury's *Last*

While this is a completely different approach from the previous, the result can be just as effective. If the given pitch (in this case, a written F) is played with a few small alterations to the embouchure and air supply, a complex sonority (*son fendu*) is achieved. The approximate pitches that result are those of the harmonic series with this written G as the fundamental, with (in most occurrences) the written D one octave and a fifth above as the most prominent, also appearing would be some mid-range “noise” that usually accompanies *sons fendus*.

This is a production in line with category two mentioned above. There are two other possible executions of this type of notation: the performer can choose a multiphonic with which they are already familiar that contains the pitch (as a prominent frequency) on which the multiphonic is based; or the performer can choose any multiphonic that they consider to suit the surrounding pitch material, or textural context of the occurrence. It is common for the latter to be used in many circumstances, whether the sonority is fully notated or not, but with all of the possibilities available to the bass clarinet, there seems little justification for this. It can be quite frustrating to see this notation, as often the composer may have a certain sound quality in mind but this is not communicated to the interpreter.

#### **3.3.2.5.4 A graphic representation with no fingering.**

It has become commonplace to encounter a multiphonic notated in this way, that is, without any (or with very little) indication of pitch. A variant on this, as Bok and



Rehfeldt explain, is the notation of multiphonic “regions”<sup>150</sup>. As stated above, with a variation in embouchure, natural harmonics can be produced. This does not necessarily result in single pitches however, as “blocks” of notes along the harmonic series can be produced, whilst keeping a steady fundamental pitch if desired. In other words, this effect can be attained by employing *sons fendus*. This could be a method of executing the multiphonic requested in Manoury’s *Last*, and indeed is notated in a particular way by Xenakis. For this technique (called “1st type” by Bok, and “Category 7” by Rehfeldt), it is not absolutely necessary for the composer to notate discrete pitches as perhaps a more effective result, texture wise, can be obtained by using a graphic representation.

An example of this effect can be seen more than once in Iannis Xenakis’ *Echange*<sup>151</sup> for bass clarinet and large ensemble. Some sources have referred to this particular sound in Xenakis’ work as harmonic or multiphonic “regions”, due to the ability of the instrumentalist using the technique to choose the register of the higher pitches. Xenakis uses a graphic representation of sorts in the form of a thick striped line along the staff, seen in Fig.17. While there is no fingering given, the instruction “as low as possible” encourages the bass clarinetist to use the same “region” technique, but try as much as they can to keep the pitch very low. In doing so, the performer creates a very disturbed, unstable sound. While there is no actual physical instruction or fingering, every commercially available recording of the piece demonstrates this approach.



Figure 17 - *Son fendeu* from Xenakis' *Echange*

<sup>150</sup> Rehfeldt, *New Directions for Clarinet.*, 46-47

<sup>151</sup> Iannis Xenakis, "Echange," (Paris: Salabert, 1989).

### 3.3.2.5.5 A 'sung' multiphonic notated on one or two staves, graphic or otherwise.

The description here is fairly self-explanatory, but it should be noted that the sung pitches should always be transposed to suit the pitches and register of the bass clarinet. A particularly effective use of this technique can be seen, in Fig.18, in Evan Ziporyn's *Tsmindao Ghmerto*<sup>152</sup>. Sung tones are kept very close (generally within the interval of a perfect fourth) to the played tones, allowing plenty of texture from difference/summation tones. When coupled with tremolos, this effect is magnified, resulting in a very complex sound quality, similar to the use of a distortion effect.

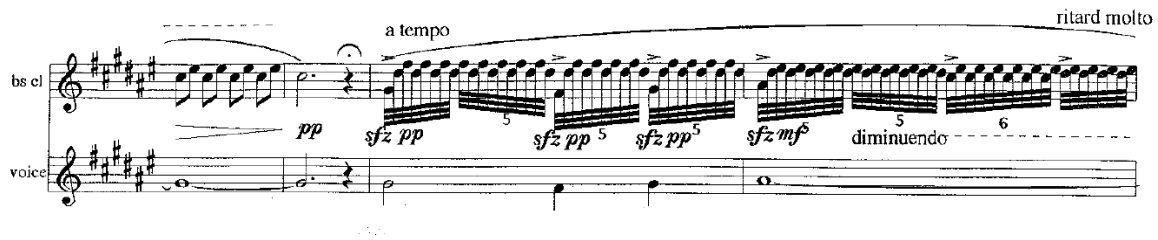


Figure 18 - Sung multiphonics in Ziporyn's *Tsmindao Ghmerto*

To facilitate reading, the sung pitches are on a second staff, avoiding confusion created by placing notes close together. A variant on this technique exists in John Zorn's *Sortilege*<sup>153</sup> for two bass clarinets, wherein an *ossia* staff above a held note contains a curvy line. This is shown in the lower part in Fig.19.

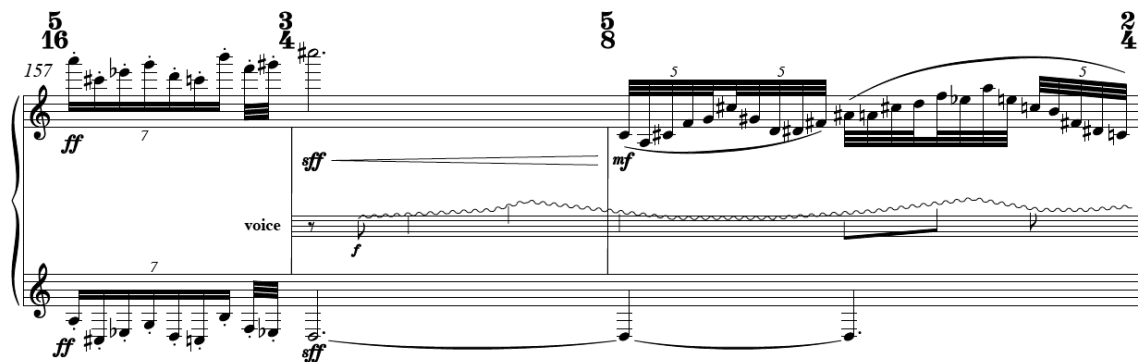


Figure 19 - Sung multiphonic in Zorn's *Sortilege*

This graphical representation leaves the concept of registration open (allowing for a male or female performer), but the similar effect of a “rough” tone quality and the

<sup>152</sup> Evan Ziporyn, "Tsmindao Ghmerto," (Somerville: Airplane Ears Music, 1994).

<sup>153</sup> John Zorn, "Sortilège," (New York: John Zorn, 2002).

resulting difference/summation tones remain effective. It is important to note, though, in these two cases both composers are woodwind players of considerable repute. Ziporyn is a bass clarinetist himself, and Zorn is a saxophonist. Both of these men have built their careers on stretching the limits of their instruments, and are world authorities on the production of extended techniques.

While not a bass clarinetist, but a brass player of note, Vinko Globokar also uses the sung or spoken voice to great effect in his piece *Voix Instrumentalisée*<sup>154</sup>. The bass clarinetist is instructed to play without mouthpiece for the duration of the piece, articulating specified rhythms, fingering (percussively) specified melodies, and “buzzing” like a brass instrument, all while reciting a line of text in French. The text here by Gallileo is significant: “*L’art et la science ne peuvent exister sans la possibilité d’exprimer des idées paradoxales.*” (“Art and science cannot exist without the possibility of expressing paradoxical ideas.”). While very difficult, the notation of the piece could not be clearer. The piece is written on three staves, each dedicated to a particular technique: one for text; one for lip pressure; and one for pitch and fingering information.

### **3.3.2.5.6 Discrete pitches given, not necessarily possible.**

Perhaps the most frustrating of the categories, there are many occurrences of this practice. Unfortunately, this is seen most often in orchestral music, and some composers believe it acceptable to simply write a cluster of notes with no other directions. This could mean a number of things:

- the composer believes that since the bass clarinet can produce multiphonics, then virtually any combination of notes could be possible;
- the composer wishes to have one of the notes sung, and the others produced using either harmonics or a modified fingering; or that
- the composer wants some or all of the notated pitches to be produced by any means.

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<sup>154</sup> V. Globokar, "Voix Instrumentalisée: Für Einen Bassklarinetisten," (Frankfurt, New York: Litolf's Verlag/C.F. Peters, 1975).

Very often, a composer will find in a book such as the Bartolozzi or Rehfeldt a multiphonic possibility that is only applicable to the soprano (Bb/A) clarinet. In any case, this approach does the bass clarinetist a disservice. Without proper guidance (through notation or in a note or legend attached to the piece), the bass clarinetist is thus expected to research the note combination himself. For an experienced contemporary specialist, perhaps this is not such a burden, but in the orchestral realm a composer would be optimistic to assume that the bass clarinetist of an orchestra who is a doubler rather than a specialist would be so well versed. The situation is at its worst when the combination of tones cannot be produced by using any currently known fingering (i.e., one from any of the several books available), nor by harmonic clustering or singing and playing. A performer can exhaust themselves looking for a solution that does not exist, only to find that the composer simply wants a particular tone quality normally attributed to complex sonorities. In this case, it would have been far better to use one of the other categories of notation, perhaps even with a written suggestion above the bar in question.

### **3.3.3 Circular Breathing**

There are many resources in existence dedicated to the production of this technique, and as such this resource will prove to be nothing new with regard to the basic mechanics of circular breathing. That being said, few resources deal with integrating the technique into one's playing. The majority of writings on the subject are an explanation of how the technique is to be produced, but this is only the first hurdle in learning how to circular-breathe. What is needed beyond this point is advice on where to place these breaths, how to practice their seamless integration into playing, and how to "disconnect" the breathing from the operations of the fingers.

The term "circular breathing" is somewhat misleading. The technique could be more accurately described as "cycle" or "cyclic breathing", however these alternatives can invoke as much confusion. The technique in question (henceforth known as "circular breathing") involves the simultaneous actions of exhaling and inhaling. As air is pushed out through the mouth, air is inhaled through the nose at the same time.

Several commentators, including Kynaston<sup>155</sup>, identify the misleading nature of the term "circular" as it is not particularly descriptive of the process (perhaps a pendulum is a better metaphor). Others have noted that the use of the word "breathing" is not entirely accurate; it is not physically possible to "breathe" in and "breathe" out at the same time.

### 3.3.3.1 History

Circular breathing is an ancient technique, used by several cultures for traditional instruments. The *didgeridoo* is perhaps the most famous of these, but folk instruments of Asia and the Middle East such as the *Shawm* (a double reeded woodwind, often with a brass bell, and little to no keywork) and European instruments such as the *duduk* (a double reeded instrument similar to the *shawm*, usually made from apricot or apple wood) also make use of this effect. Quite often this is to mimic the droning capabilities of bagpipes, hurdy-gurdies, and other string instruments, but also as a tradition of long phrases and melodies.

In Western art music, circular breathing was not a particularly necessary pursuit until recent times. From the Renaissance through the Baroque eras, phrases “breathed” in a natural way, giving wind players plenty of cadential opportunities to recoup their air supply. Moving through the Enlightenment, phrases became even easier to navigate for wind players as the aesthetics of the *galant style* encouraged simpler, more *cantabile* lines.

In the Romantic era, however, things became more difficult. The treatment of melodic material often meant that instead of two, four, or eight bar phrases, a musical fragment could be spun out into a much larger idea – and if the composer wanted to exploit the beautiful tone of the clarinet for bars on end, there were no stylistic reasons not to. This led to some difficulties for wind players! Some of the most well known excerpts requested for orchestral auditions for clarinet include the slow movement solos of Schubert’s *Unfinished Symphony*, Rachmaninov’s *Symphony no. 2*, and Beethoven’s *Symphony no. 4*, not because they are technically difficult, but because they are so taxing of the clarinetist’s stamina and ability to play beautifully for extended periods. It is even

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<sup>155</sup> T. Kynaston and T.P. Kynaston, *Circular Breathing: For the Wind Performer* (Alfred Publishing Co., Inc., 1982).

common in some orchestras to play Beethoven's 9<sup>th</sup> Symphony with a section of three clarinets – even though it is scored for two. The third movement contains one of the most sublime clarinet duets ever written, but there is virtually nowhere to breathe! The third clarinet comes in, imperceptibly, playing for a few bars only to cover what must be some very large breaths for the first and second player!

Thus, an expanded capacity for breathing was desirable for woodwind players, and it's not hard to imagine that composers wanted more and more. Eventually in the twentieth century, as presumably more clarinetists learned the skill, composers became specific about asking for phrases or sections of pieces to continue indefinitely without pausing for breath. The only solution to this was for circular breathing to become a standard technique.

#### **3.3.3.2 Execution**

The technique is not a difficult one to master but can be very difficult to put into practice on the instrument. Many performers struggle with this aspect, and so write the technique off as too hard. Some of these have not fully comprehended the fundamentals, and some may miss a crucial aspect of its execution once the instrument is put in place.

Air is taken into the lungs as normal, and the performer plays as normal. Toward the end of the breath, the player must transfer, or rather, hold back, some of the air in their cheeks – puffing them out. At a certain point, the base of the tongue is manipulated back toward the throat and upward to the velum, blocking the air-passage between the throat and the mouth. The action of “pushing” the air is then transferred to the cheek muscles; contracting them to force air out of the mouth past the lips. While this takes place, a breath is taken in through the nose.

#### **3.3.3.3 Special considerations**

The crucial part of this technique is *re-starting* the air with the lungs. These actions must be coordinated and performed quickly to make the entire technique as seamless as possible. Enough air must be inhaled through the nose very quickly, and great control is needed over the cheek muscles to force the existing air out through the mouth at a

consistent rate. Once the air has been pushed out of the mouth and the lungs again full of air, coordinating the newly reapplied air pressure from the lungs with a gradual removal of the tongue from the airway back to its normal playing position. It is with this last part of the technique that most people struggle. Methods outlined by Bok<sup>156</sup> and Sparnaay<sup>157</sup> offer an explanation of the overall concept of the technique, but give no detail on restarting the air. Roger Heaton<sup>158</sup> acknowledges this “bump” when restarting the air, but offers no solution other than persistence. Kynaston<sup>159</sup>, author of perhaps the most comprehensive method on the technique, also acknowledges the possibility of problems in smoothly re-connecting the air from the lungs. Unfortunately, he also offers no specific guidance on fixing this problem beyond “return the air support back to the diaphragm”.

Rehfeldt is the only author to offer physical advice on setup considerations, stating that the setup “... must be capable of briefly sustaining a tone with air support from the cheeks alone. Closer mouthpiece facings are perhaps preferable<sup>160</sup>”. This, however, is in contradiction to a key suggestion of Bok and Sparnaay, who suggest that for contemporary music in general, open facing mouthpieces are generally preferable.

All of the commentators referenced suggest practicing the effect in a comfortable register (usually this would mean the *chalumeau*), and to incorporate the effect with the fingers as soon as possible. Sparnaay, Bok, Rehfeldt, and Kynaston all suggest first learning the effect away from the instrument, and then practicing circular breathing whilst trilling on the instrument; forcing the player to dissociate the act of breathing from what their fingers are doing – contrary to traditional playing.

Circular breathing has become a standard technique for clarinet and bass clarinet players. As such, it should be addressed comprehensively in manuals for performers. For composers however, a general explanation of the technique and some of its shortcomings

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<sup>156</sup> Bok, *New Techniques for the Bass Clarinet.*, 6

<sup>157</sup> Sparnaay, Man, and Roe, *The Bass Clarinet: A Personal History.*

<sup>158</sup> Roger Heaton, "The Contemporary Clarinet," in *Collected Work: The Cambridge Companion to the Clarinet. Pages: 163-183. (An: 1996-05219) (1995).*, 181

<sup>159</sup> Kynaston and Kynaston, *Circular Breathing: For the Wind Performer.*

<sup>160</sup> Rehfeldt, *New Directions for Clarinet.*, 81

and possible problems (for example, being used at loud dynamics or on long held static notes are situations best avoided) is quite sufficient for a composer's understanding.

### **3.3.4 Microtones**

Another technique that has been a part of music making since before history, microtones have been a part of many cultures' musical lexicon since the beginning. Western Art Music, however, has placed itself in a position of ignorance since the adoption of Equal Temperament. This is, of course, a tongue in cheek statement, but Equal Temperament has bred a certain familiarity with our limited tonal palette among the general public. A lack of the inflections and melodic nuances that flourish in the musics of Eastern cultures can be seen as a shame, but for some musicians, it is an opportunity to present microtonal elements as an exotic boost to their compositions.

In the case of the bass clarinet, the quarter-tone is perhaps the easiest entry point into microtonal music. Whilst not the easiest to produce, for reasons to be addressed later in this chapter, quarter-tones are not as difficult to discern in the context of the equal tempered scale than other microtones. Even if a player has no experience with microtonal music, being able to produce a pitch exactly "between" two semitones, with a decent fingering, is not difficult to replicate.

Acoustically, like every instrument, the bass clarinet has at its disposal the natural harmonics that, by their nature, fall outside of the equal tempered scale. The use of these natural harmonic pitchings has been used to good effect by many composers, especially those associated with the Spectral school (Gerard Grisey, Philippe Manoury, Tristan Murail, etc.) since they occur naturally as part of the harmonic spectrum. Quarter-tones, however, can be more "hit-and-miss" in that they require specific fingerings.

Such fingering charts are very popular, and act as a starting point for performers wishing to execute quarter tones. Bok, Sparnaay, Rehfeldt, Alder, Richards, Bartolozzi, and others have all released quarter-tone fingering charts. This has had a strange effect in that there are now so many fingering possibilities for a particular microtone that performers can suffer "analysis paralysis". Fortunately, as most authors state, it is quite simple for a performer to adjust their embouchure and fingerings ever so slightly to manipulate a microtone into being "in tune". The multitude of differences in results for a single fingering from player to player mean that with only one or two different fingering



options for a particular quarter-tone pitch, it is likely that any performer could forge a good result without too much time commitment.

Because of this, sections on quarter-tones in the above resources are usually quite straight forward, and present the fingerings that work best for that particular player. Richards and Sparnaay, however, have some specific hints that offer the composer some very good information on their employment. Richards gives several scenarios in which the use of microtones is particularly effective, namely in groups of consecutive quarter-tone segments. He astutely notes that a quarter tone pitch played more than a few scalar notes away from previous or successive notes can simply sound “wrong”. Thus, the effect of producing quarter-tones is made clear to the listener when played in sequence<sup>161</sup>.

Sparnaay makes a similar statement; that a composer should make the use of microtones very obvious to the listener. In conversation with Sparnaay in 2004, he said to me “If (the quarter tone) is by itself, make sure the sound is different from a normal note; and when they are together, really bring them out and do not apologize – otherwise, it just sounds like a disease...<sup>162</sup>”

### 3.3.5 Altissimo register

Much like quarter-tones, the *altissimo* register is a fairly straight forward technique to document, catalogue, and notate. Pitch-wise, composers need no imagination in coming up with pitches; with the widest range of all woodwind instruments, the bass clarinet is capable of at least five octaves in the hands of a practiced player, and up to a perfect fifth more in some cases. Dynamically, the range of expression in these extreme pitches is limited only by the player, as most performers who would identify as a “specialist” would feel comfortable playing at the softest levels even in the top octave.

It is therefore a matter of fingering choice on the part of the player to determine how successful an altissimo note should be. The charts available, whilst not comprehensive (due to the potential for every conceivable fingering to produce, via harmonics, an altissimo pitch) are sufficient to offer a plentitude of appropriate fingerings. While the composer need have no fear in writing *altissimo* pitches, as wide

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<sup>161</sup> Richards, *The Bass Clarinet of the Twenty-First Century*; *ibid.*,30

<sup>162</sup> In conversation with Harry Sparnaay during a lesson. Amsterdam, 2004.

leaps and running passages are as facile in the extreme register as the most comfortable *chalmereau*. John Zorn makes spectacular use of this artistic freedom, writing blisteringly fast alternations between a low C#, and D over four octaves higher, seen in Fig.20<sup>163</sup>.

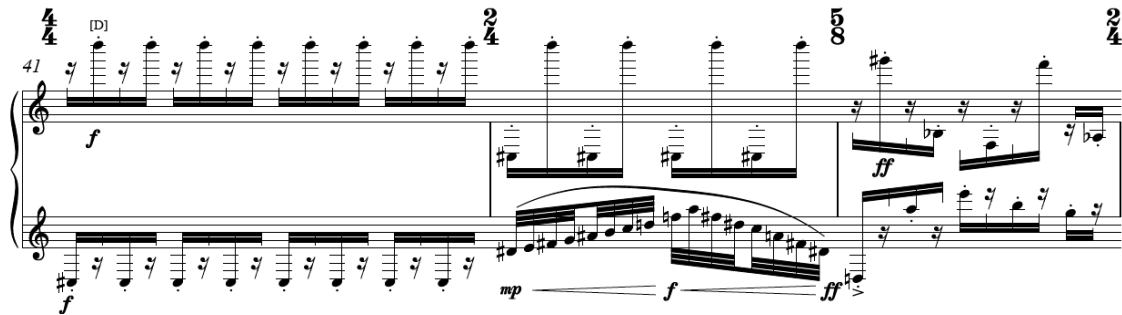


Figure 20 - Extreme register jumps in Zorn's *Sortilège*

The performer, whilst being spoilt for choice as far as fingerings go, should keep in mind that every fingering possibility is in fact a harmonic partial of a lower pitch responding to that fingering. Therefore, understanding which number partial a pitch is in relation to the fingering will give an idea of whether the note will be sharp or flat in an equal temperament context. Fortunately, though, the ability to adjust pitches up or down is particularly prevalent in the higher registers, so as long as performers understand the tendency of the chosen fingering, they can replicate good intonation on each occurrence.

### 3.3.6 Other pitched effects, and other un-pitched effects.

Pitched effects refers to many of the techniques described in the “Other Effects” sections of the resources in common use. These techniques include *Glissando*, *vibrato*, *bisbigliando*, *velato*, *smorzato*, *breath accents* and potentially many more!

As stated in chapter 2, the differences between these techniques can be difficult to discern; Bok suggests that *Glissando* and *velato* are extensions of the same technique, that of a loosening and tightening of either the embouchure in conjunction with an alteration of fingerings to produce a gliding effect. Likewise, *smorzato* and *vibrato* are very similar; an alteration of pitch by loosening or tightening the jaw or throat.

Primarily, the group of un-pitched effects refers to air sounds, percussive effects, such as key slaps, “kissing sound”, neck-slaps, tongue rams, and unpitched vocal

<sup>163</sup> Zorn, "Sortilège."

techniques. In a similar vein to “other pitched effects”, there are a multitude of variants on each technique, and the possibilities are endless.

It is therefore difficult to report on the current state of knowledge of these effects with reference to particular texts, as their definitions are somewhat fluid. Instead, our attention should be directed to the repertoire of the composers who have employed these sounds.

### **3.3.7 Alterations to the Instrument**

Altering the physical instrument in various ways can result in very interesting sounds. Pioneers such as William “Bill” O. Smith on the clarinet, and Matthew Burtner for saxophone and trombone (among others) have created complex and fascinating sound worlds by incorporating different acoustically reflective surfaces (such as tin foil, glass jars, and mutes made of different materials). Smith has also composed extensively for top joint or bottom joint of the clarinet and mouthpiece only, resulting in not only a higher pitch than the full length clarinet, but because of the relative shift of the tone holes to the length of the tube, a vastly different scale than the clarinet.

Other bass clarinet virtuosos have had considerable success in incorporating electronic sounds and processing with live bass clarinet. Michael Lowenstern, in particular, has created a completely new sound world involving subtly processing bass clarinet sounds via looping, live sampling, and mixing with synthesized sounds and beats to great effect.

Sparnaay, Rehfeldt, and other commentators discuss the still blossoming world of bass clarinet and electronics. Since, however, it is of the experienced opinion of this author that electronics is an instrument in itself and both worthy and demanding of considerable dedication and work, the discussion of electronics and physical alterations to the instrument lies beyond the scope of this project.

## **3.4 Concerns with Current Literature**

While there is substantial knowledge in the area of bass clarinet specific extended techniques, there are some aspects of information and its retrieval that are yet to be published.

#### **3.4.1 The Order in Which Fingerings and Effects are Listed**

There is no consistent method for the cataloguing of fingerings, but there are several different practices. These include: listing multiphonics according to their fingerings; listing multiphonics according to their fundamental frequency and; listing multiphonics according to their sound quality or “category”. In any case, in order to find a suitable multiphonic, the user must skim through pages to find an appropriate technique. Added to this is the inherent hierarchy that exists by listing some effects or sounds before others.

#### **3.4.2 Fingering Images**

Graphic fingering diagrams in current resources can be improved upon. Representing keys with letter names is problematic because a) the key names change depending on what register the clarinet is playing in, and b) side keys could be numbered from the top down, or vice versa. Therefore, naming a key “side key a” or “side key 1” could be ambiguous. Whilst there are some practices that are consistent between some authors, there is currently no universally adopted method.

#### **3.4.3 Limitations of Sound Recordings**

While some resources have addressed this (namely online resources such as *clarinetmultiphonics.org*), the majority of sources have accompanying sound examples in a separate format. In the case of Rehfeldt, Bartolozzi and Dick, this is in the form of a 45rpm record! Bok’s book, until very recently, was shipped with an accompanying cassette tape. This is no longer practical for bass clarinetists who wish to find examples quickly.

#### **3.4.4 Live Testing**

Currently, resources rely on the performer to tell if they are executing an effect correctly. In some cases, such as multiphonics, it can be very difficult for the performer’s ear to pick up the minutiae of the particular sound, hindering progress. On this count, Richards

and Watts come close, giving visual representations in the form of still images from a spectroscope. This however does not give the user an idea of what they themselves sound like when attempting the technique.

#### **3.4.5 Cross-Referencing**

Leafing through pages to find possible multiphonics could hardly be considered an effective use of time, especially if the information is needed during a rehearsal or conversation with a composer or conductor. Having the ability to search the resource for multiphonics that include a certain pitch, either as a fundamental, secondary or prominent sonority could be immensely helpful. The ability to then cross-reference this information with other pitches could become invaluable.

## 4 A Rationale for the Proposed Resource

To summarize, as stated in Chapter 1, the aims of the resource are:

- 1) To clarify the nomenclature and notation practices of extended techniques;
- 2) To develop a system that enables widespread and easy access to specific information on extended techniques;
- 3) To improve pedagogy of the bass clarinet and facilitate the learning of extended techniques;
- 4) To enable broader knowledge of the instrument to facilitate the effective use of extended techniques in the creation of new works.

Since much literature already exists on the topic of extended techniques for the bass clarinet, the key element of the proposed resource is its format. Primarily, it exists to facilitate the retrieval of accurate information in a straight forward manner. The functionality is of use for both performers and composers, for the purposes of finding suitable effects and textures for composition, and as a practice tool for bass clarinetists.

### 4.1.1 Format

In the current technological climate, a logical choice for retrieving information of this nature is in the form of mobile application (henceforth known as an “app”). Traditionally, books have been the best medium as a large amount of information can be recorded and sold for a reasonable price. With advancements in low cost transistors, computers offer far more versatility and capability relevant to this kind of information than even five years ago.

At the time of writing the majority of sources on extended techniques, it was impractical to consider a digital format. Books such as the Bok<sup>164</sup> and Rehfeldt<sup>165</sup> consist of pages of information, and an accompanying Cassette tape or 7” Record. Not only have these sound formats been more or less rendered obsolete, the current technology allows authors to incorporate the media of sound and print data (including graphics and video) very easily.

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<sup>164</sup> H. Bok and E. Wendel, *Nouvelles Techniques De La Clarinette Basse* (Editions Salabert, 1989).

<sup>165</sup> Rehfeldt, *New Directions for Clarinet*.

Web based resources are another viable option. This technology enables easy updates to the database, easy bug fixes, and the ability to store data on a remote server. The main drawback to this functionality, however, is that an active internet connection is needed. There is no doubt that in the near future this will be no obstacle, but for the time being, there are difficulties. A key feature of this app is its usability *in situ*. It is conceivable, if not highly likely, that it would be necessary to use the app during a rehearsal or setting in which an active Internet connection is not available.

It is therefore concluded that a mobile app for iPad or smartphone is the most desirable solution. This technology enables all of the features of the resource to function seamlessly in a format that can be accessed anywhere, and allows random access to what is inherently non-linear multimedia based information.

#### **4.1.2 Performer Usability**

As discussed in the literature review, Chapter 3.3, a bass clarinetist will often encounter a confusing or inaccurate notation pertaining to an extended technique. This can be frustrating, but this can be an avenue for further investigation into sound possibilities. It is often the case that performers are able to interact directly with the composer of a piece, either in a rehearsal or via correspondence. There are times, of course, that no contact is possible. In situations like this it can be very difficult to determine the best course of action when a contradictory marking or impossible notation is presented.

Many editions and copies of the available print resources are in circulation, but often these are owned by either libraries or specialist practitioners. With the increased frequency of extended techniques being incorporated into orchestral works, it seems as though there is a current need for bass clarinetists to be well read in terms of their production and notation. Since it is unlikely that bass clarinetists will keep a print resource with them at every rehearsal or appointment at which they are likely to play a piece composed after 1950, having the information on a handheld device could indeed make this a possibility.

A brief example of this: a colleague of mine in an Australian orchestra sent me an email with a photograph of a few bars of music from a new orchestral piece by a well-known composer. As shown in Fig.21 below, in one bar was a chord of three distinct

notes (with diamond shaped note-heads), and the instruction printed below: “raw, penetrating”.

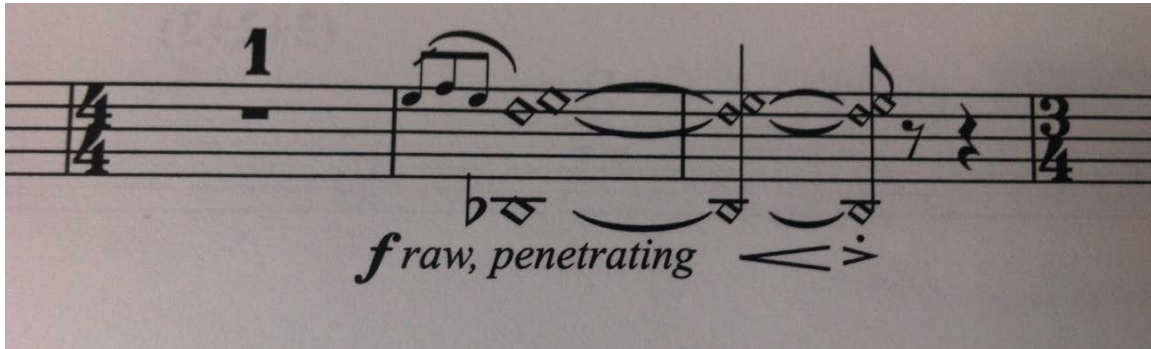


Figure 21 - An "impossible" multiphonic

My colleague had no access to a print resource, an Internet search produced no results, and none of the “standard” fingerings that he knew were of any use. In this case, having access to a digital resource that lists (or provides a searchable list) of multiphonics would not have provided a solution.

#### 4.1.3 Composer Usability

It turns out that the particular multiphonic in Fig.21 is not covered by any available resource, and due to the proximity of the upper notes to the fundamental, it cannot be achieved through the use of overblowing or harmonics. The marking “*raw, penetrating*” enables the performer to understand the desired effect, but this is still insufficient information.

It can be surmised that the notated pitches are not mandatory, and that the composer uses this notation more as a graphic representation than an actual indication of pitch. It is perfectly reasonable for a composer to do so, but this leaves the performer in a quandary. Should he or she try to produce some of the selected notes, maintain the fundamental, try to produce an approximation within a desired range, would a particular category of multiphonic suit better than others? From the performer’s perspective, it may seem that the composer has not researched multiphonics sufficiently.



Realistically, this is a trivial issue, but the ramifications can be substantial. Fig.21 is an excerpt from an orchestral work, and if clarification is needed for the bass clarinet player during a rehearsal, the time wasted in stopping rehearsal and conversing over the particulars can be significant. For this reason, there are few discussions of this nature that take place when rehearsing modern music, and this can lead to a poor product. The app aims to provide enough examples and suggestions to greatly reduce the need for these discussions. With Fig. 21 as an example, a simple legend at the beginning of the work (or a footnote) could read, “multiphonic with steady tone – pitches irrelevant”, “multiphonic of any kind, pitched as low as possible”, or “rough sounding multiphonic, C# to stand out”.

#### **4.1.4 A Tool for Creativity and Practice**

A large portion of the app is dedicated to the production of multiphonics. For various reasons, including the aforementioned confusion and idiosyncrasies of various brands of equipment, multiphonics can be difficult to interpret simply from a notation. Whether the notation is accurate or not, performers can be unsure of the accuracy of their own production. Rather than rely on the input of another person (i.e., the composer, or a colleague) this app serves as a self-contained training resource. The section on multiphonics uses spectrogram technology in the following two settings:

The first case will hopefully hold interest for composers. Being able to see the richness of timbre and areas of higher amplitude across the spectrum will give an insight into which multiphonics would be most suitable for a particular composition or musical idea. This approach has been taken in the latest edition of Richards' *The Clarinet of the 21<sup>st</sup> Century*.<sup>166</sup>

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<sup>166</sup> Richards, "The Clarinet of the 21st Century (Web)".

A spectrogram for the eighth example above shows a tremolo that contains 3rd and 5th partials (gradually enter), along with a sustained pitch with a strong 2nd partial. As these voices and partials enter, the sound increases in complexity.

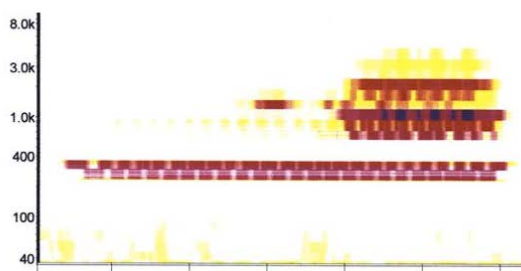


Figure 22 - A Spectrogram image from Richards' web resource

Richards makes good use of this technology (seen in Fig.22), but I believe the result falls short in that the user cannot see a visual representation of their own sound. It is this second aspect that makes the app unique. By having easy access to a spectroscope (via the iPad's inbuilt microphone and speaker), the performer can first see the ideal pattern of the multiphonic, then immediately practice its production with a real time visual reference.

Finally, the aim is to engage the user with a new taxonomy for extended techniques; one that enables description and understanding of the sound without the use of language that may cloud the technique, or steer a composer away from using it (or to use it unnecessarily). Hopefully through doing this, a discussion on extended techniques can take place that discusses only musical ideals and goals, rather than being overly cautious or dismissive of techniques according to their physical production.

## 5 A New Taxonomy for Extended Techniques

At the heart of the present study is a new taxonomy for extended techniques. This taxonomy doesn't seek to go against common understanding of extended techniques, nor does it aim to cast dispersions on well known notation conventions, writings, or resources. It is hoped that this taxonomy will offer a more thorough understanding, and an alternative information paradigm for the utilization of extended techniques.

Through the use of this taxonomy, extended technique users (performers and composers) can sort through and discover sounds according to the sonic qualities they desire. These qualities are expressed as empirically as possible, with little or no use of words that may indicate how a sound is to be produced physically. The reasons for this are twofold: firstly that since all performers are physically different and play instruments that are acoustically different, it is highly likely that what is difficult for one player may not be for another, and this can lead to unreliable results between performances; and secondly that composers may have either no interest in how a sound is physically produced, or may err too far on the side of caution, hesitating to include techniques that a particular performer for whom they are writing may have no troubles with.

As can be seen in the literature review, if authors of compositional guides or manuals are disparaging toward sounds that may be very interesting to some composers to the point of not including them because they are “too difficult”, then the composers may be denied a perfectly achievable artistic vision.

Likewise, previously established technical spectral descriptors such as “noisiness”, “roughness”, and “brightness”, among others, are avoided. As this app is aimed at users across a wide range of experience levels, the present study aims to deliver information in a way that limits any possible influence the naming conventions may carry. For someone not versed in the theories of the Spectral school, the word “rough” may hold a negative connotation, possibly leading to the avoidance of that sound, which, may have been perfectly suitable for their aesthetic purpose.

It is hoped that by describing sounds using the following taxonomy, composers and performers will be afforded realistic expectations of the possibilities of the instrument, and given sufficient information to realize their desired sound and aesthetic.

## **5.1 Dimensions**

Regardless of how a sound is physically produced, temporal and dynamic elements can be described in a consistent manner, namely, through the use of traditional notations. Textural elements of the sound are at risk of being described according to a potential gestural function, therefore subjective terms such as “rough” or “noisy” would be best avoided. Aspects of playability, while necessary in a resource for performers and considerate composers, can likewise be incorporated in a calculated way. Rather than considering sound objects as two-dimensional (pitch and volume) with rhythm as an imposed secondary structure, we must include how the sound behaves over time as an inherent quality. Therefore, each sound needs to be recognized as a four dimensional object. The four dimensions may be measured and labeled independently of one another, but as the sound object exists as a whole, these dimensions constantly interact. The four dimensions are those of

- envelope (temporal aspects)
- frequencies (pitch material)
- amplitudes (volume)
- saturation (textural or timbral elements)

Play-testing and observation of a spectrogram is used to identify the relative presence or behaviour of temporal element in a recorded example, and for the purposes of cataloguing the information, the experiences and recordings of the author are used.

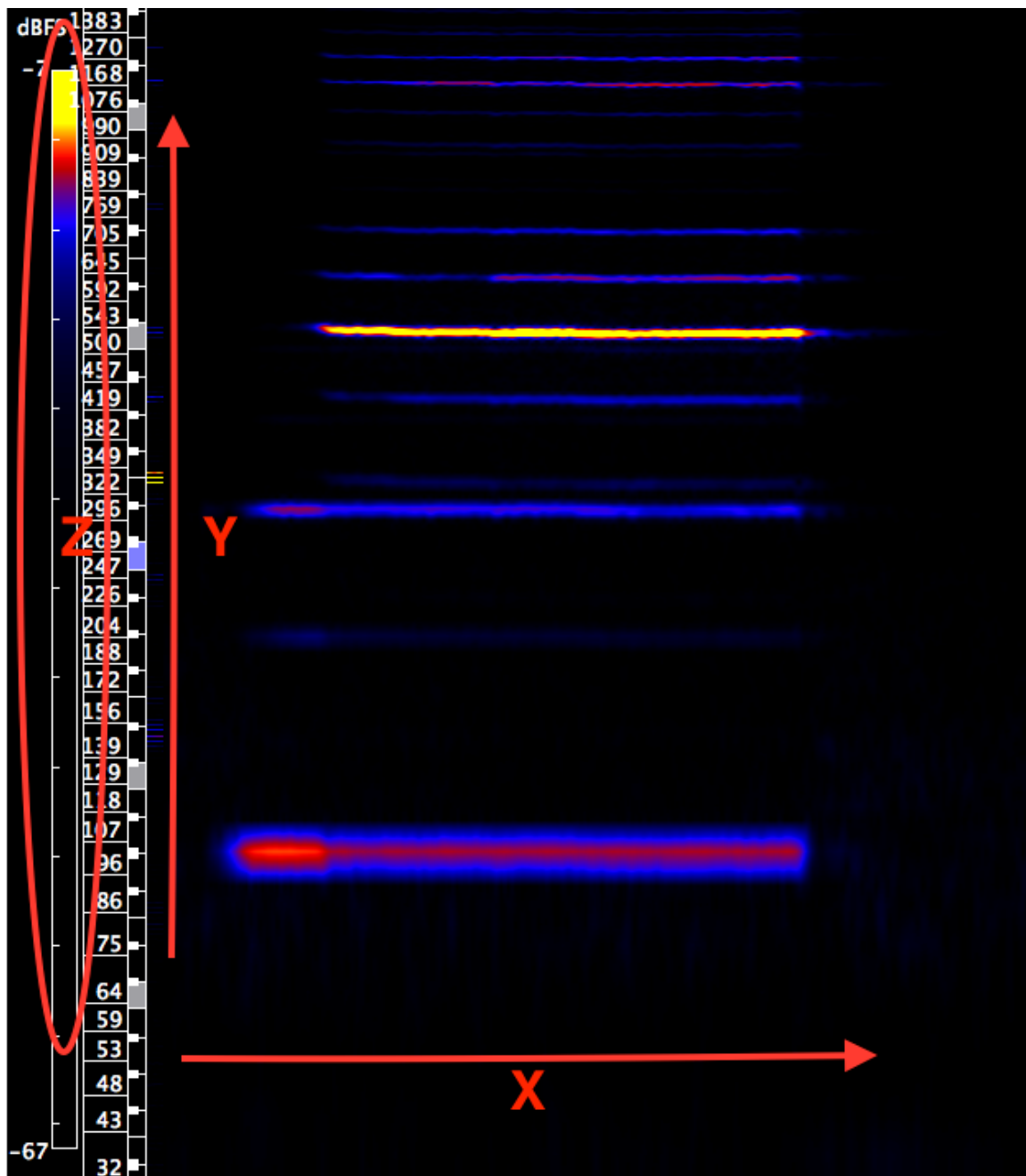


Figure 23 - A spectrogram of a multiphonic recorded by Henri Bok

- The envelope is a representation of the activity on the horizontal (x) axis: how the sound behaves over time. From left to right, the lowest colour line (blue/red in the black space - approximately a concert Ab) appears first, followed by the thinner blue/red line at approximately an Eb one octave and a fifth higher. The last sounds to emerge (in this case nearly 500 milliseconds after the initial attack) are the faint blue lines close to the top of the image.

- On the vertical (y) axis is frequency. As mentioned, the visible lines are representative of where in the pitch-space the sound activity exists.
- Amplitude refers to the relative volumes of each extant frequency. In the case of a spectrogram, the amplitude of a particular frequency is represented by its colour; the closer to white on the spectrum, the higher the relative amplitude. Thus, this quality can be imagined as “emerging” from the background toward the reader (or from black to white). In the above figure, black represents no sound activity, blue is lower amplitude sounds, through purple and red, to yellow as the “loudest” or highest amplitude sounds. According to this scale the pitch with the highest amplitude in the multiphonic in Fig.23 is the one represented by the yellow line: a slightly flat C#. The Z axis in the above diagram is represented in the section on the far left of the diagram (circled).
- The final descriptor is Saturation. This category has not been employed in any current study or catalogue of bass clarinet effects to date, but is of great importance to composers whose process relies on identifying and exploiting the timbre or texture of individual instrumental sounds. Saturation is measured by comparing the number of present frequencies (partials) to that of identifiable pitches.

Of these dimensions, envelope refers to the temporal parameters (discussed in Chapter 5.2), and frequency, amplitude, and saturation refer to timbral parameters (outlined in 5.3)

## ***5.2 Temporal Parameters***

The resource will describe the temporal characteristics of the sound using the ADSR envelope format: Attack; Decay; Sustain; and Release. These characteristics will be expressed as values from 0-10; 0 meaning that zero manipulation of the sound is possible, and 10 meaning maximum manipulation is possible. This concept of numerical values will be discussed more fully as the chapter progresses.

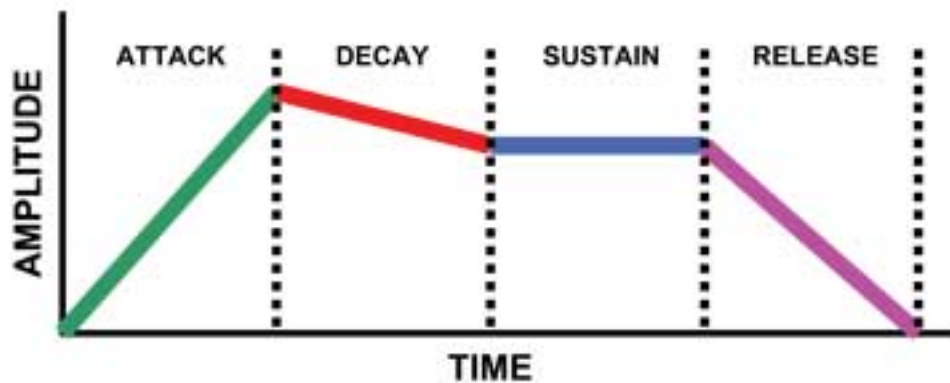


Figure 24 - The ADSR envelope

### 5.2.1 Attack

Attack describes the amplitude activity from the beginning of the sound until it reaches its peak (energy on).

A slow attack is exemplified by a flute beginning a soft note with breath rather than tongue, or the slow drawing of a violin bow across a string, and a fast attack could be the sound of a timpani being struck with a wooden stick.

### 5.2.2 Decay

Decay is the activity from this first peak until the sound reaches a plateau, or its characteristic dynamic (peak energy). For example: a slow decay can be found in a “Viennese accent” on a wind or string instrument, where immediately after a slow attack, the amplitude of the note drops before the main body of the note.

### 5.2.3 Sustain

Sustain describes the “body” of the sound, or the part of the sound that is maintained as opposed to produced (energy maintained). For example, beats two and three of a semibreve played on a trumpet. This part of the sound could be subject to vibrato, crescendi, diminuendi, etc.

#### 5.2.4 Release

Release refers to the moments, however brief, that occur once the physical act of producing the sound has ceased (energy off). An example of a long release would be the remaining resonance produced by a very loud accented short note on a trombone, or a string note played pizzicato. A short release could be exemplified by the dampening of a tam-tam by a percussionist's hand, or an oboist ending the sound by putting their tongue on the reed.

These four sub-elements have become the standard nomenclature for describing the envelope of sound production in analogue and digital synthesis, and the ADSR has the potential to describe the widest array of sound types. Dennis Smalley identifies three distinct phases of the spectromorphology of a sound: onset, continuation, and termination.<sup>167</sup> This has significant merit, despite the decay element not being represented; the assumption being that onset encompasses both attack and decay. The coupling of these two elements can, however, result in the necessity to use a subjective or descriptive term, especially in the multitude of cases where the onset includes a rise and fall of unequal durations. Smalley's three-element approach here is not necessarily problematic, as the ADSR model would suggest that there is always decay in the sound. This is not accurate; a sound can begin, reach its maximal amplitude, and maintain this amplitude until its release. In the present study however, the four-element model is preferred for those cases in which the decay element is significant.

#### 5.2.5 Potential and Flexibility

Rather than describing the physical time taken to form a sound, the values applied to the parameters of Envelope refer to the *potential* time or *flexibility* of the particular temporal and amplitude aspect. For example: a slap-tongue has an inherently strong attack. It is, by definition, not possible to perform a slap-tongue with the attack lasting one second. The attack is short, and therefore inflexible, thus giving the attack element a value of zero (zero flexibility of attack). Some multiphonics are capable of being started at any

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<sup>167</sup> Dennis Smalley, "Spectromorphology: Explaining Sound-Shapes," *Organized Sound* 2, no. 2 (1997).



amplitude, with the further capability of lengthening the attack if desired, to any possible amplitude. This sound would have an attack value of 10 (complete flexibility of attack).

Likewise with decay, sustain, and release, the value from 0 to 10 represents the potential for manipulation by the bass clarinetist, not a fixed temporal value. In the case of sustain, a high value would indicate that the sound could be held at any dynamic and shaped at will; a low value would indicate an inability to control the amplitude over time. It must be noted that this information cannot be gleaned from a visual representation alone. Visually, the multiphonic below appears to exhibit a relatively high attack value (that is, it is able to be manipulated). This is not the case; in the recording of this example, the bass clarinetist attempted to play the effect without significant shape. The appearance of a slow attack would indicate that this effect takes time to develop, and thus, the attack is not readily manipulated. The attack value in this case would be fairly low.

If, on the other hand, the image shows steady colours (consistent amplitude) on all frequencies from the onset, one might assume an attack value of 0. This is not necessarily correct, although it may be. The physicality of the instrument may have imposed that shape, or the bass clarinetist was able to play in such a way comfortably. There is no objective way of interpreting the graphic in this sense, therefore the visual aspect is only a guide to interpreting the numeric information.

In conjunction with the spectrogram image generated from a recording, each sound in the app is play-tested to determine the values of the ADSR envelope. Using these two tools, a value from 0-10 is selected for each sound and entered into the database; 10 allowing maximal flexibility in execution, and 0 allowing no flexibility.

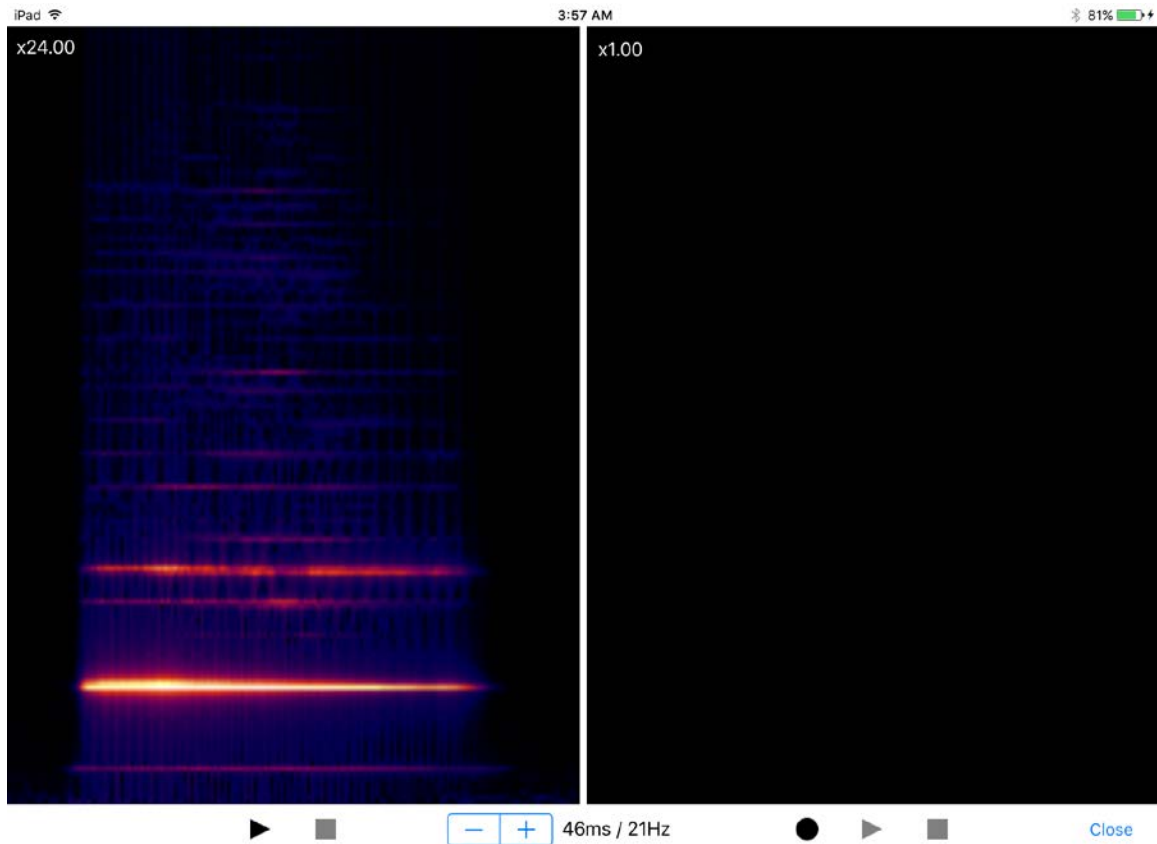


Figure 25 - A spectrogram of a multiphonic

The ADSR values are as follows:

Attack - 9

Decay - 8

Sustain - 10

Release - 10

This particular sound could be started at almost any volume ( $A = 9$ ), then immediately the sound would crack slightly if there was much change in amplitude ( $D = 8$ ), during the body of the sound, crescendi and decrescendi were possible to any dynamic ( $S = 10$ ), and the termination of the note could be tapered or finished with a puff of air ( $R = 10$ ).

Clearly, this level of information cannot be gleaned from the image alone. Rather than a tool for deciphering these temporal parameters, the spectroscope proves useful for identifying the frequency, amplitude, and saturation parameters.

### **5.3 *Timbral Parameters***

#### **5.3.1 Frequency**

Frequency is identified in the present study within the framework of notated pitch; a key element in multiphonics, and relevant to a wide array of compositional genres. Whilst the primary aim of the resource is to facilitate access to the broadest possible scope of information, pitch, in a Western Art Music sense, is the basis of description for extended techniques in current resources.

Sparnaay, Rehfeldt, Mandat, and Read all acknowledge the concept of primary and secondary pitch material in multiphonics whereas Bok lists all audible pitch approximations as clusters. It is interesting to note, however, that Sparnaay prefers not to list secondary pitches, but rather a notation indicating indeterminate pitches between primary pitches, even in some multiphonics where there may be clear pitches audible between the (vertical) extremes of the fundamental and the strong highest audible pitch.

The employment of spectrography offers the hierarchical interpretations of the pitches according to their relative amplitudes. In terms of the resource, all frequencies that register strongly (appear within one or two shades of the maximum) will be listed as primary, and any others that appear distinctly, but at a significantly lower amplitude, are to be listed as secondary.

#### **5.3.2 Amplitude**

Amplitude is less a category than an element common to the other three categories of sound; envelope refers to amplitude over time, frequency refers to the amplitude of the audible pitches present, and saturation is the amplitude of the secondary and tertiary (weak) frequencies. It must be remembered that while the other three elements rely on amplitude, a sound object can be categorized according to its inherent amplitude; this is dictated by the physical properties of the bass clarinet.

### **5.3.3 Saturation**

Saturation describes the amount of sound activity across the harmonic spectrum. If one were to imagine a numerical scale, silence would register 0% saturation, and white or pink noise would register 100%. Saturation is not to be confused with amplitude, as a loud sound is not necessarily saturated. In terms of multiphonics, there are some sounds that have been identified as having one or two discernible pitches; these would return a lower value for saturation than one that has seven or eight discernible pitches. Therefore, saturation is more of a timbral descriptor than a reference to pitch or amplitude.

### **5.4 Measurement Units**

These naming conventions have been selected to express the presence of these elements in numeric values. This may seem inappropriate for descriptions of inherently expressive and therefore subjective qualities, but a reduction to these values can enable them to be searched electronically. In this sense, every aspect of the sound can be measured according to an appropriate scale. This does not necessarily mean standard units of time (ms) or volume (dB), but a numeric representation based on the physical capabilities of the instrument. For example, a sound that can be attacked at any dynamic (therefore having the potential to reach its maximum amplitude immediately) would register an attack value of 10. A sound that can, for physical reasons, only be started softly and then crescendo to maximum amplitude once it is established would register very low on the scale. This measurement, therefore, represents not the characteristics of the sound itself, but how much control the player has over the execution of each aspect of it.

Spectrography is not a fully comprehensive tool in identifying sounds. Strong readings of certain frequencies may indicate characteristics of playability, but ultimately a combination of audible sound, graphic representation, and numeric values together will afford the user most benefit. There will be aspects of some sounds that register on the graphic but not aurally, and characteristic timbral features that do not appear on the spectrogram.

## 6 Resource Creation

The iPad app has been developed over the duration of the project. As with any project of this kind, there are unexpected results or issues that arise that either hinder or help the creative process. In most cases in this project, these “roadblocks” provided an opportunity not only to engage more features or concepts, but also to consider the nature of the information in different ways.

Chapter 6 discusses how the app was programmed, and the information it contains, listed by effect type. Whilst the literature review discussed the sources of the information, this chapter deals more directly with how this information was interpreted and incorporated into the resource.

### 6.1 *Gathering of Information and Database*

Information in the fingered techniques section was taken verbatim from the sources discussed in the literature review. In the app, each effect or sound object taken from a particular source is credited as such with a small notation.

Possibly the largest undertaking of the resource was the systematic cataloguing of multiphonic possibilities. It was hoped that this resource would be the first to explore all feasible fingering possibilities. While it seemed highly unlikely that every possible finger combination could be explored within the time frame, some key points must be remembered:

- There are 32 different keys on the bass clarinet, presumably giving a total of  $2^{32}$  combinations (4,294,967,296 combinations);
- Several of these keys perform the same function (one for the left hand, one for the right), meaning that this number is reduced to  $2^{26}$  or 67,108,864;
- For the majority of situations, each finger can only press one key at a time. This reduces the number further to approximately  $2^{14}$  or 16,384;
- While most keys work independently of others, some fingers only operate “slave” keys. That is, keys that will remain depressed when the one above them is depressed. This further reduces the number to (approximately)  $2^{13}$  or 8192.

- Removing all possible fingerings for traditional notes, microtonal fingerings, and “dead notes” (notes with no discernible pitch content), it is estimated that the number of potential multiphonic fingerings total less than 5000 and;
- The fact that many of these permutations of fingerings will result in pitches or sounds with only miniscule timbral or microtonal pitch differences to others.

At the end of this process, there were far fewer fingering combinations with interesting sonic results than expected. In fact, only a handful of fingerings were not already “in use” by current texts. This is due to the fact that many fingerings using the right or left hand tier keys do so with fingerings involving relatively few fingers higher up on the body of the instrument. This results in, in each case, many fingerings that are acoustically identical but visually different.

#### **6.1.1 Overlap, Uniqueness, and Discrepancies**

With the abundance of information on extended techniques, as well as the transference of knowledge from player to player and indeed the notation of these effects in repertoire, it stands to reason that the current resources will have some effects in common. In the case of multiphonics, some fingerings – particularly those that are not far-removed from fingerings of standard notes – produce results that are very consistent across all makes and models of bass clarinets and setup equipment (reeds, mouthpieces, etc.). In these cases, it is difficult to tell from whence or whom these sounds originate. It may seem that the author whose publishing date is the earliest must be the “owner” of the sound, but that ignores the fact that some of the authors were students of the others. It was therefore necessary to treat each individual effect in each book as its own entity. Fortunately, these cases are few and far between, as for the vast majority of effects, fingerings and their resultant pitches are dissimilar enough to appear unique.

Of the individual fingered effects in the app, there are significantly fewer unique fingerings than there are *entries*. This indicates that there must be a number of fingerings that produce more than one multiphonic or effect. The difference in these sound entities demonstrates a couple of key facts: that subtle differences in embouchure, air pressure, mouthpiece angle, and other physical concerns can produce a wide array of sounds even

with the same fingering; and that many of these sounds have the potential to be manipulated significantly.

While at first glance this is confusing, it gives us an insight into the nature of extended techniques, and rebukes one of the major qualms that performers have with interpreting new music i.e., that some composers write techniques that are “not possible” or “difficult to produce”. What, in some cases, may seem like negligence on the part of the composer for writing effects that are wildly difficult, could actually be a calculated effort to bring out the extremes of subtlety and nuance of the bass clarinet in the hands of a highly skilled craftsman.

In producing a database that draws from several sources yet aims to present a homogenous resource, small discrepancies between these resources appear. These discrepancies do not necessarily cause difficulties in interpreting the information, nor in its potential display. They can, however, give an insight into the process the author undertook in the cataloguing of their material. In identifying these processes, we can identify areas where other resources could have added more detail, and can thus apply them to the present study.

### **6.1.2 Database**

The database for the app was created using a Mozilla Firefox extension called SQLite, a piece of free software powerful enough to handle projects significantly wider in scope than the present study. Similar in some ways to Excel, in that data is entered in a spreadsheet format of columns and rows, SQLite affords the ability to cross reference between lists of data. The desirability of this feature will be discussed in detail later in the chapter.

As mentioned in the previous section, the number of individual sounds is greater than the number of different fingerings used to produce them. It was therefore necessary to build a database that enables fingerings to refer to more than one effect. To this end, the system devised employed two linked databases: one listing unique *FingeringIDs*; cross-referenced with one displaying unique *EntryNumbers*.

### 6.1.2.1 Fingering ID

The concept of how the interactive fingering diagram would work changed several times during the course of the app's creation. The initial intent was to enter each effect, with an image file (fixed) of its respective fingering, into a searchable database. This would require images of every possible fingering to be generated and catalogued, and would allow these to be shown in response to the user's search for certain pitches or attributes. It would not, however, allow the user to "key in" fingerings.

In order to allow the user to enter in a fingering of their own choice, or modify one returned by the search functions, an image representing the key-work of a bass clarinet (Buffet Crampon Prestige model 1193) was created.

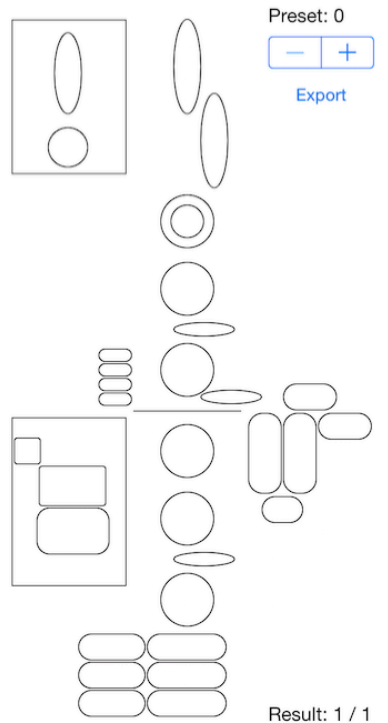


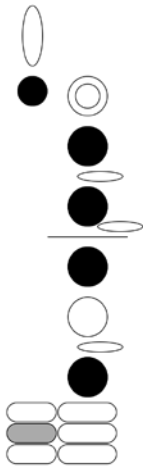
Figure 26 - An example of the fingering diagram

Each key, when pressed on the app, would toggle between black and white – simulating the “open” and “closed” states. An open (white) key will return a value of 0,



and a closed key (black) returns a value of 1. As there are thirty-two<sup>168</sup> keys on the bass clarinet, the number outputted by the diagram is a thirty-two digit binary string.

There are two problems with this method. Firstly, strings consume more processing power and storage space within the app than integers. An analogy to this situation could be the difference between a text file and an image of the same text: the final product may look identical to the user, but text files are much smaller than image files, and thus require less processing power to manipulate and parse. Secondly, there are some cases in which keys need to be pressed down half-way. This is a technique some call “shading”, and is particularly useful in the production of microtones. In Fig.27, the right-hand low E key is shaded.



**Figure 27 - A shaded fingering.**

The first of these concerns was addressed by adding code that converted the outputted string to an integer. When searching for a particular pitch or other attribute, the app will parse all integers within the working range, and return any results as integers that the app would then convert back into a binary string for display on the fingering diagram.

The second concern made matters more complicated. Rather than a binary string, the fact that some keys had to potentially exist in three states (open, closed, and shaded),

<sup>168</sup> The image in fig. 26, as representative of the app, shows thirty-one keys. Note that the two concentric circles toward the top of the diagram represent a key that has a “speaker hole”. This key operates as two separate keys: one with a small hole covered; and one with the small hole open. Thus it operates, in practice, like two separate keys, bringing the total to thirty-two.

meant that the fingerings had to be displayed as a ternary string. Digits in the string were now either 0, 1, or 2 – returning either white, black, or grey. Unfortunately, this was discovered after many of the binary-based integers had been catalogued, causing a rather major “back to the drawing board” moment.

Once these matters had been smoothed out, the list of *fingeringIDs* took shape and grew concurrently with the list of *EntryNumbers*.

#### **6.1.2.2 Entry Numbers**

Each sound or effect is assigned an *EntryNumber*. This is an arbitrary number used to identify each sound. There is no strict pattern to the *EntryNumbers*, they are sequential according to the order in which the effects were extracted from books: first were those in Rehfeldt’s book, second were Bok’s, and so on. As each new sound from a resource was discovered, a new *EntryNumber* was created for it. These entry numbers are unique, and particular to that effect as it appears in the literature; there are separate *EntryNumbers*, for example, for sounds that are may be identical in every way across more than one source, including those that share the same fingering, pitch material, and other metadata.

The Entry contains the following metadata relating to the effect:

- Primary pitches;
- Secondary pitches;
- The above two items, transposed either to or from concert pitch;
- A reference to its location in the literature;
- Any pertinent enharmonic equivalents;
- A spectrogram image;
- A trill *fingeringID* if applicable;
- Secondary, tertiary, and further notation options;
- ADSR information (for multiphonics);
- p-c set information (for multiple sonorities).

#### **6.1.2.3 Data Entry Process**

The entry of information into the database could only accurately be described as laborious. The major contributors to this tedium were peculiarities in the structure of the

database, and some of the inherent issues in outputting the fingering diagram data and inputting it into the database.

As previously mentioned, the employed structure was that of *EntryNumbers* that cross-reference *fingeringIDs*. This means that each of these data had to be unique; no fingering could be indexed more than once in the database, and no entry number could be repeated either. The result was to create two distinct, yet linked, databases: one for *fingeringIDs*; and one for the *EntryNumbers*.

Structure Browse & Search Execute SQL DB Settings									
TABLE: fingeringIndices									
rowid	fingeringID	entry1	entry2	entry3	entry4	entry5	entry6	entry7	entry8
201	834579280302085	153							
202	833731991892642	154	182	188	196				
203	834014421228394	154	182	196					
204	831200586216787	154							
205	834014421229123	155	172	183	189	197			
206	831483015753268	155							
207	831200586217516	155							
208	831190125863584	156	183						
209	826200537385752	157							
210	826953682817097	157							
211	823564528378596	158	175						
212	627854806793917	159							
213	628782291385534	159							
214	831190125866500	159	176	185	191				
215	826967629953973	160							
216	823564528381512	160	177	186					
217	625298993768935	160	178	185					
218	625298993771851	161	178	187					
219	826964143169572	162							
220	617673396383947	162							
221	821073011074922	163							
222	834624608675716	163							
223	850717652052225	163							
224	849844422408934	163							
225	826957169600770	164							
226	826995524229181	164							
227	826988938080868	165	176						
228	826988550660382	165	176						

Figure 28 – A portion of the fingeringID database

Structure Browse & Search Execute SQL DB Settings																
TABLE: fingeringTbl																
entryNum...	pitch	second...	pitch2	second...	notes	PCE_reference	enharm...	enharm...	pitchS	second...	pitch2S	second...	spectro...	trillFing...	second...	thirdNot...
200	A4					Alder										
201	A+4					Alder	B--4									
202	Bb4					Alder	A#4									
203	B-4					Alder	A++4	C--5								
204	B4					Alder	Cb5									
205	B+4					Alder	C-5									
206	C5					Alder	B#4									
207	C+5					Alder	B++4	D--5								
208	C#5					Alder	Db5									
209	D-5					Alder	C++5									
210	Bb-1, F2...	B2			mf-ff qui...	BokM1			Ab-, D#1...	A1			BLOB (Si...			
211	B1, F#2, ...				Very Rel...	BokM2			A0, E1, ...				BLOB (Si...			
212	B-1, C2, ...					BokM3			A-, A#1, ...				BLOB (Si...			
213	C1, E3, ...				mf-ffFair...	BokM4			Bb, D2, ...				BLOB (Si...			
214	D1, Db3, ...					BokM5			C0, Cb2, ...							
215	D+1, A2, ...				Relative...	BokM6			C+0, G1, ...							
216	D+1, A#...					BokM7			C+0, G#...							
217	D1, E3, ...	Bb2				BokM8			C0, D2, ...	Ab1						
218	Eb-1, B2...				Very Rel...	BokM9			Db-0, A1...							
219	E1, C#3	G#2, F#3				BokM10			D0, B1	F#1, E2						
220	D#1, A#...					BokM11			C#0, G#...							
221	D#1, Eb...					BokM12			C#0, Db...							
222	D#u1, B...					BokM13			C#u0, A...							
223	D#u1, A...					BokM14			C#u0, G...							
224	D#u1, B...					BokM15			C#u0, A...							
225	D#u1, G...					BokM16			C#u0, F...							
226	E1, G2, ...					BokM17			D0, F1, B1							
227	E1, G#2...					BokM18			D0, F#1, ...							
228	E1, B1, G...					BokM19			D0, A0, ...							
229	E1, G#2...	A#3				BokM20			D0, F#1, ...	G#2						
230	E-1, Bb ...					BokM21			D-0, G#...							

Figure 29 - A portion of the entryNumber database

As seen in Fig.28, unique *fingeringIDs* (integers) in the second column from the left reference one or more *entryNumbers* in columns three through ten. Fig.29 shows the *EntryNumber* in the left column, and the requisite metadata in ensuing columns.

The entering of data for a single effect is thus a two-phase operation; an entry is recorded (with metadata), which is then linked to a *fingeringID*. The entry number operation is straight forward: a new entry is created for each effect; pitch information (primary and secondary); a reference number (eg: “Bok 23”, “Richards C0.3”) according to its source location; any necessary enharmonics to be listed; etc. are populated into the columns. Finding the *fingeringID* is slightly more difficult.

A test version of the app must be running, which displays a *fingeringID* (string and integer) based on the state of the fingering diagram.

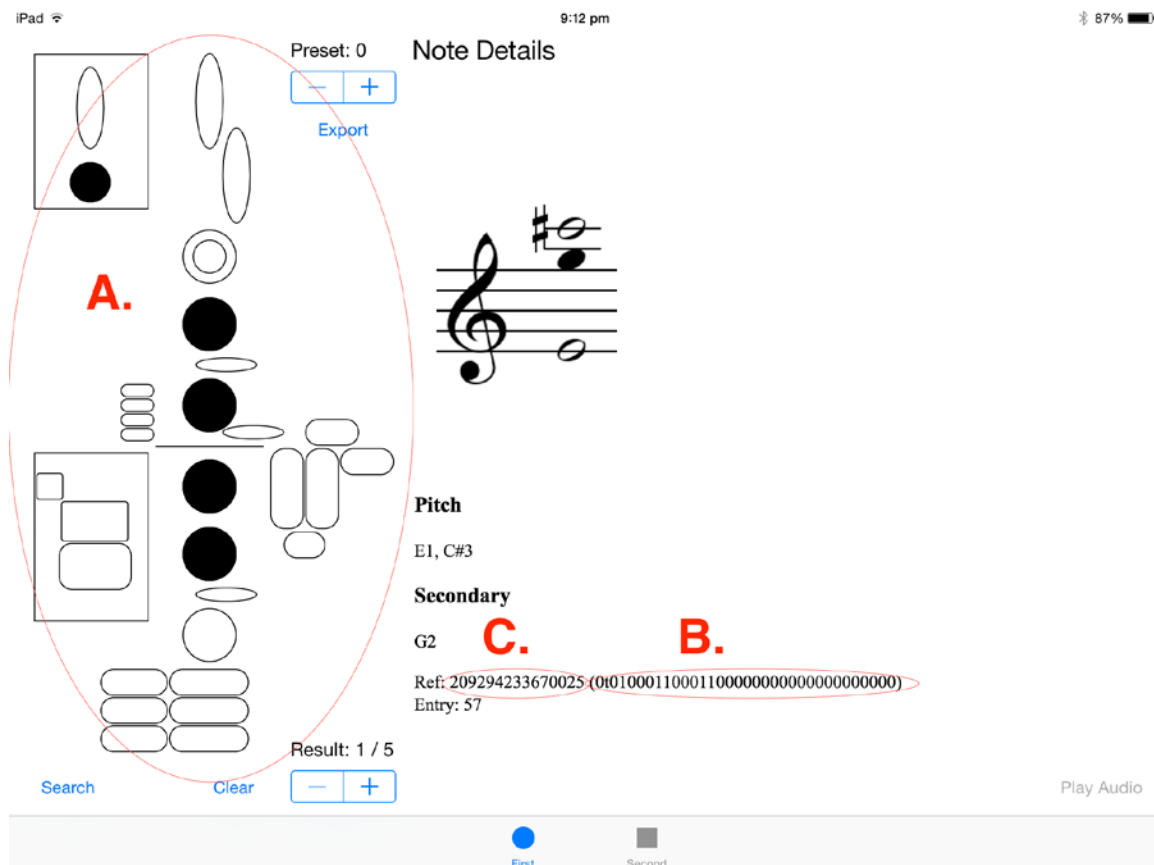


Figure 30 - The fingering diagram displaying a string and integer

In Fig.30, section A. shows the fingering diagram with some keys open, and some closed. B. displays the ternary string representing the image, and C. is the resulting integer. As is clearly seen, the integer is a very large number!

This integer is then entered into the database in the *FingeringID* section. Once this is complete (a simple matter of copy and paste), the corresponding *entryNumber* is entered into the adjoining column.

If, however, the fingering is not unique to that particular entry number (and this was often the case), the database program will return an error message stating that the *ID* in question had already been used. What was then necessary was to find the *fingeringID* in question in the left column, and add the *entryNumber* into the next available column, however, the database software did not give any details as to which entries were linked to the *ID*, nor any kind of indication as to how to locate it. For the first few cases of this, this meant combing through dozens, potentially hundreds, of integers (up to fifteen or sixteen digits in length) trying to find a match.

Fortunately, after a few hundred entries had been catalogued, an updated version of the database could be run on the test app. A change was made to the coding to allow any corresponding entry numbers to be displayed beneath the reference *ID* string and integer (seen in Fig.30). This entry number could be found more readily than the large integer, and the new entry could be added alongside.

### **6.1.3 Generation of Data Pertaining to New Taxonomy**

In an attempt to present the sounds in a manner that removes subjective language and apparent preference for certain effects over others, it was hoped that data according to the proposed taxonomy could be generated digitally. Of course, without the in-depth study of the physical attributes of extended techniques, nor some kind of artificial intelligence, this data needed a certain level of human experience. Whilst significant progress has been made in this area for other instruments, such an undertaking was beyond the scope of this study. The use of recording, spectrography, wave-form images, and other metadata provide certain levels of insight into the nature of these sounds, but for measuring the “playability” aspects (i.e., potential for manipulation of the sound at each temporal stage of the envelope) human experience was needed.

It should be noted that while this resource aims to do away with words such as “difficult” or “unstable”, these descriptions in the source materials were indeed valuable in preparing the database. Much of the information found in the books of Bok, Rehfeldt, Richards, Sparnaay, and Bartolozzi regarding the aspects of playability were accurate to my own experience – it is the purpose of the present study, however, to present the information in a different way.

#### **6.1.3.1 Dimensions**

As mentioned in Chapter 5, the dimensions of sound described in the app are: envelope; frequency; amplitude; and saturation.

In creating the resource, individual recordings had to be made of each sound. These recordings were done in long sessions, and the resulting sound files were edited down into short examples to be added into the database in the form of Mp3 files.

Since the recording process can be arduous, there was no time to contemplate or annotate the relevant taxonomic metadata while in the studio. Thus, much of this information was entered into the database first, with the recordings made later.

The *frequencies* present in each sound are discovered in two complementary ways: recording the sound and studying a spectrogram image; and by physically producing the sound and reverse engineering the sound qualities to identify the elements. The listing of pitches (primary and secondary) in the source material was used as a starting point for the catalogue, being used initially to populate the database. From this point, if any anomalies were found as a result of the recording process, this data could be updated.

A thorough examination of the spectrogram image (and its associated digital data) could also present data of this dimension as concrete frequencies. This data could be very useful for composers whose process involves detailed microtonal analysis or a wish to explore numeric ratios and harmonics.

The information on *amplitude* presented in the app is not intended to act as a recommendation on what dynamics a composer or performer should notate or write. While relative amplitudes of pitches appear on spectrogram images, amplitude as a dimension of the sound is not listed separately as its own data category. To state that a

sound has a certain characteristic amplitude is to suggest that the sound can only exist at that amplitude. This is very seldom the case, as almost all sounds afford the user some control over their volume. Rather, the app describes certain aspects of the sound with relation to their amplitude, and in particular, how much control of the amplitude does the performer have across the duration of the sound.

Thus, the *envelope* data is listed in the database according to their flexibility of amplitude, as discussed in Chapter 4. This data is not able to be generated by the creation of a spectrogram, nor can it be deduced from studying a recording. The envelope categories (attack, decay, sustain, release) needed to be explored individually by the author, and their relative values recorded. This, of course, is a very time-consuming task, but ultimately gives the user a more detailed concept of how the sound can potentially behave over time. A scale from one to ten is used, and each temporal element is examined several times and given a value within this scale; one being “minimal ability to adjust amplitude”, and ten being “maximal ability to adjust amplitude”. These results are recorded in the *EntryNumber* spreadsheet.

*Saturation* is almost exclusively derived from spectrogram images. The process involves determining a weighted average of the colour values of the pixels in the image. As discussed in Chapter 5.1, black pixels in the image represent no sound activity, and white pixels represent maximum activity. Thus, in terms of pixel data, black pixels return a value of 0, and white pixels 10, with each colour (blue, red, yellow, etc.) falling somewhere on that scale. The mean pixel colour of the image is determined, and a (rounded) number is produced. A sound with very few audible pitches (red or yellow lines) would thus return a lower number (sparse) than a number with more audible pitches (dense).

## **6.2 User Experience Structure**

The original intention was to code the information myself using MaxMSP – a platform with which I am familiar and have a fair degree of comfort. It soon became clear that this would severely limit the scope of the project. My chief reason for choosing this platform was one of convenience, and the impression that an app coded in Xcode (the language used – at the time – for developing iOS apps) would be far beyond my skills. However, the skills required for this app are more than reasonable for an experienced coder. Thus,

the decision was made to have a collaborator, Aaron Wyatt, perform this task. This collaborative process will be discussed in Chapter 6.3.

The app itself is in two main sections: non-standard tones; and other extended techniques. The non-standard tones section contains information on the following effects:

- Multiphonics
- Microtones
- Altissimo register

The other extended techniques section is dedicated to:

- Percussive effects
- Flutter-tongue
- Circular breathing
- *Bisbigliando/Velato*
- Air Sounds
- Harmonics

The two-part structure was chosen to represent the kind of information the user will be seeking and how it is sought.

### **6.3 Non-Standard Tones**

The section on non-standard tones is centred around the idea of searching. The user is encouraged to experiment with different searching parameters. The previously mentioned dimensions of sounds are all searchable: envelope, frequency, and saturation; with the element of amplitude being the lens or common element through which we experience differences in the other three.



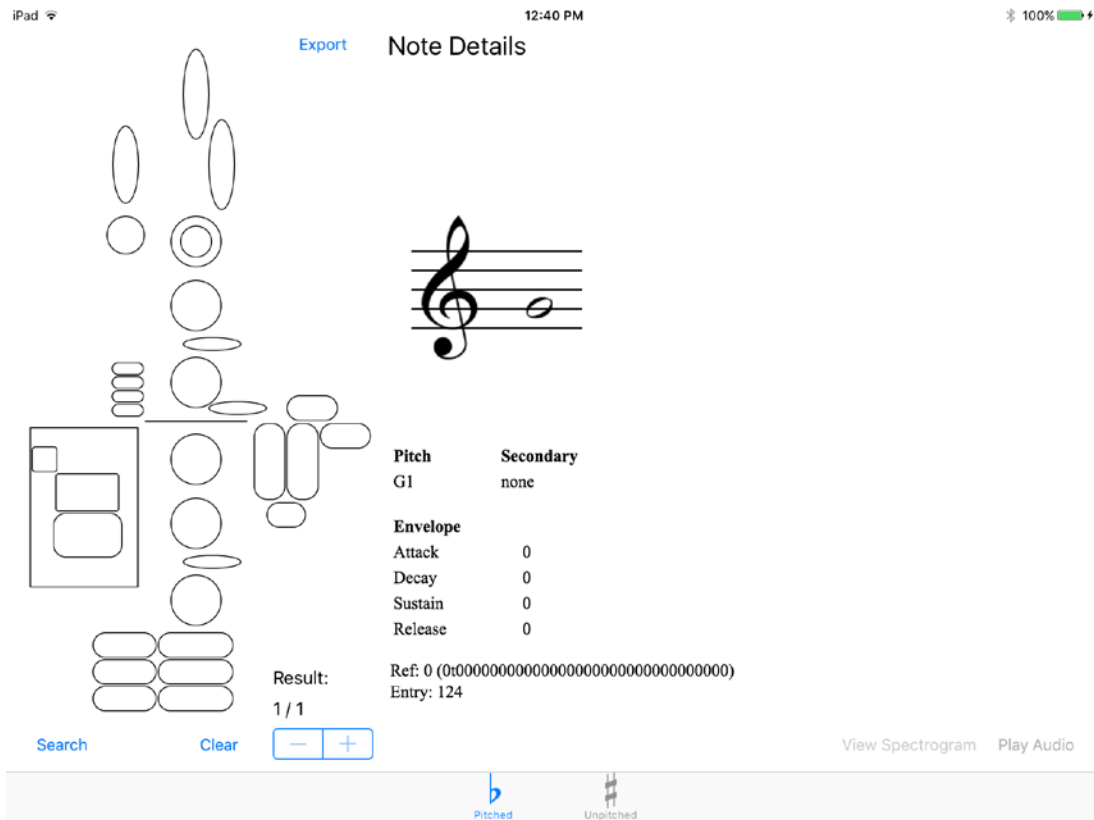


Figure 31 - The "home page" of the non-standard tones section

When the user selects the *search* button, seen in the bottom left hand corner of Fig.31, a search dialogue box will appear (shown in Fig.32).

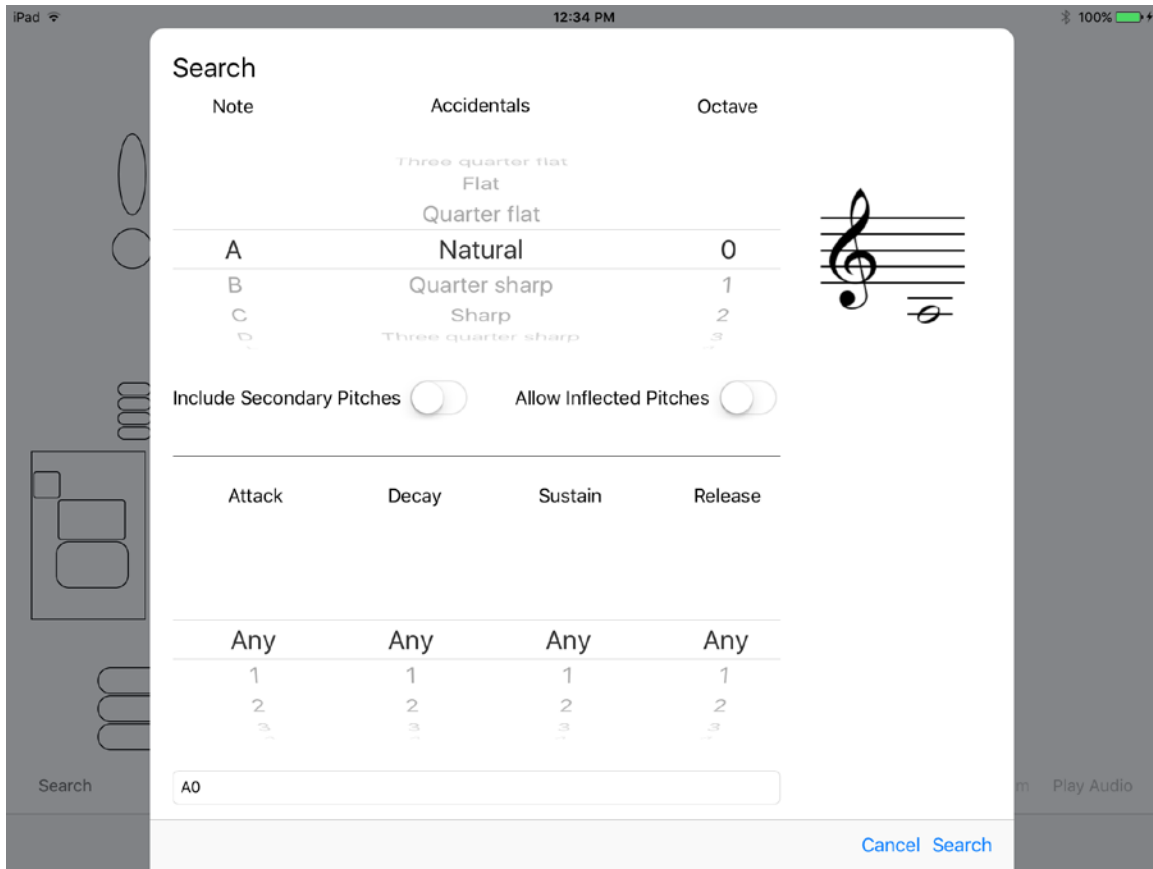


Figure 32 - Search dialogue box.

- Frequencies can be searched by selecting the desired pitches using either the three radial dials (note, accidentals, octave). This search can either include or exclude inflected pitches (notated with arrows) or secondary pitches.
- Envelope can be searched by any one of the four parameters: attack; decay; sustain; release. This way, if, for example, the attack value is not important (the execution doesn't need to be quick), but the ability to manipulate the partials in the main body of the sound is, the user can search for a high sustain value, and leave the other parameters at "any".
- Saturation, in a similar vein, is not searchable but allows the user to identify sounds with similar denseness or sparsity.

The user also has the unique ability to search via fingering, by pressing the buttons on the fingering diagram to see which sounds are available with a given fingering. This is particularly useful for those wishing to experiment with multiphonic

trills: once a desired sound is located, experimenting by “opening” or “closing” (pressing) a key on screen will give the user an idea of what other sounds use similar fingerings.

### 6.3.1 Other Extended Techniques

In contrast to the non-standard tones section, the other extended techniques section is experienced more like a web page.

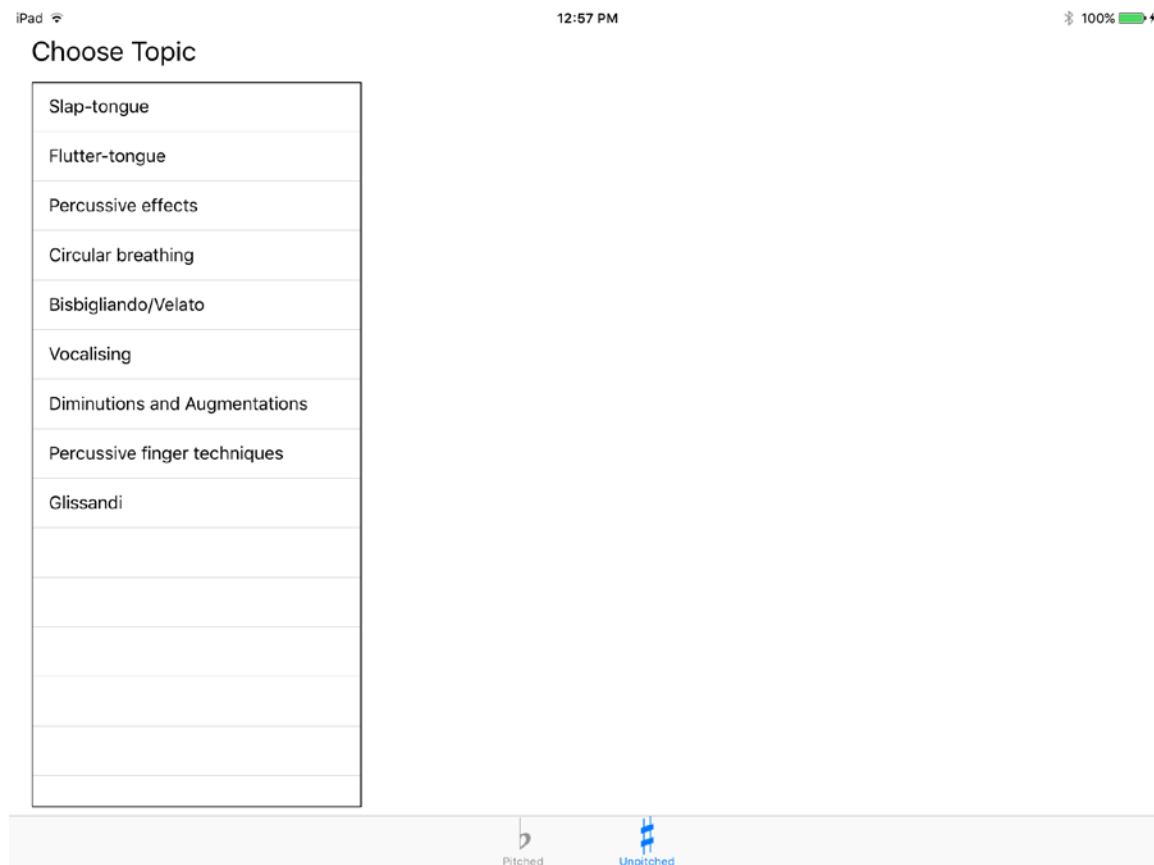


Figure 33 - The home page of the other techniques section

As visible in Fig.33, the user can select the topic they wish to explore. This will bring up an HTML style document with embedded images and links to sound and video files of the techniques in question. This enables the user to experience relevant multimedia with a unique immediacy. The text from these pages is included in the appendix to this thesis.

The user experience of app is dealt with in greater detail in the following chapter, and a partial walk-through is presented in the lecture recital.

## 7 A Demonstration of the iPad app Focusing on a Cross-Section of Bass Clarinet Repertoire

The iPad app offers significant advantages over the current formats of the bass clarinet extended technique knowledge base. It can be used by composers to investigate and select effects for their works with ease, and can even aid in the preparation of scores and parts. For performers there are unique features that enable the user to find solutions to given notations, fingerings, or directions via an intuitive interface, and can be utilized as an aid in practicing these effects.

A public lecture-recital demonstrated these different uses and features in the performance of a selection of well known and new works for bass clarinet. Alongside these performances was a discussion of the history of the bass clarinet, how extended techniques became such an integral part of the bass clarinet's identity, and how the app is the next step in the continued relationship between bass clarinetists, composers, and these special techniques.

The works performed were:

*Sparkle* (1984) – Takayuki Rai

*Onomatopoeia* (1983) – Nigel Westlake

*Voix Instrumentalisee* (1973)– Vinko Globokar

*Bass Clarinet Solitude* (1980) – Joji Yuasa (arr. Harry Sparnaay)

*Dowser* (2007) – Nathan Davis

*Glances* (2009) – Max Giteck Duykers

Each piece was chosen to illuminate a different aspect of the interpretation process. This is not to suggest that every aspect of a new interpretation was covered, nor should it be in the use of a single resource, but rather to show some ways in which the app can be a helpful tool in the creative process. Since each piece shed light on a different aspect of the process, some may be seen as less important than others, and the forthcoming sections may seem more or less comprehensive than others. What this exercise aims to show, however, is to what possible extent this app could be used in the

preparation of a new work, how much of an intervention this app could provide, and how it could make some burdensome practices more streamlined.

### 7.1 *Sparkle* (1989) – Takayuki Rai

Rai's 1989 work *Sparkle* shows a well-researched approach to multiphonics, yet manages to avoid specifying fingerings or particular techniques that might be difficult to some players. Quite often when writing for multiphonics, composers choose effects based on pitch material found in the available resources. The composer may have listened to the accompanying sound recording, and considered the information provided on the timbre and, in the case of some books, ease of production. In many cases, this level of research results in a good outcome; with these factors taken into account, the surrounding musical material can be manipulated to accommodate the multiphonic. Sometimes, of course, there are certain problems; the performer may find that effect difficult, it may produce different pitches, or the volume at which the performer can reliably replicate the sound is not what the composer expected. These can be smoothed out during the collaborative process (in the case of new works), or can be figured out by the performer consulting either the composer or another experienced bass clarinetist who has performed the piece.

Rai takes a different approach, and it is one that is well-supported by the app. The multiphonics in *Sparkle* are notated thusly:

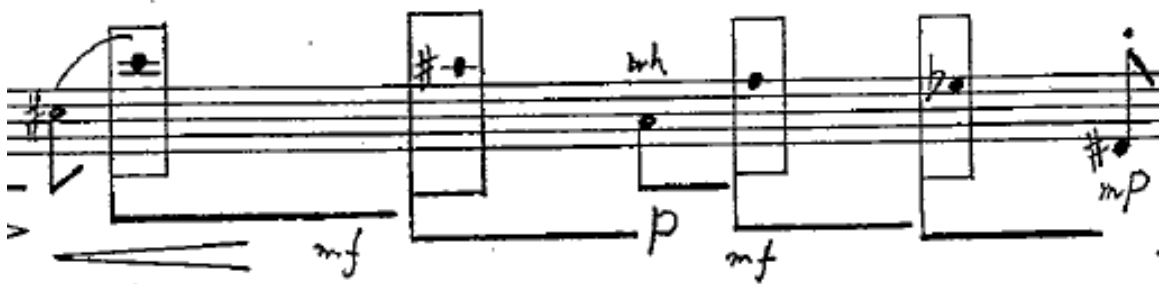


Figure 34 - Takayuki Rai's multiphonic notation in *Sparkle*<sup>169</sup>

<sup>169</sup> Takayuki Rai, "Sparkle: For Bass Clarinet and Tape," (Amsterdam: Donemus, 1989).

The instructions in a legend at the beginning of the work state: “multiphonic sound, play the multiphonic sound which is suitable for the indicated conditions (pitch and dynamics)”. Not only does this allow the performer the opportunity to explore several possible sounds to suit these conditions, giving them the choice to pick sounds with which they might be more comfortable, this approach helps to reassure the composer that the selected sound will contain the elements of the sound which are important to them, whilst giving the performer freedom to experiment within those parameters.

The app is particularly suited to interpreting such a notation. The process used for each multiphonic in the preparation of the lecture performance was the following:

1. Search the fingered section for the desired pitch;
2. Make a note of possible sounds;
3. Observe the envelope data;
4. Shortlist the sounds whose envelope data suited the dynamic and rhythm;
5. Play each one in turn, observing the spectrograms, identifying any major differences;
6. Decide on the sound supporting the most criteria;
7. Export the fingering image;
8. Place image appropriately on PDF copy of part for printing.

This process was then repeated for each different multiphonic in the work. This approach, clearly, is very similar to what a performer would do with a print resource. The main differences lie in the speed with which this can be accomplished, and the ability to search either by pitch or by envelope data.

On several occasions during the preparation of this work, multiphonics were found that appeared to have suitable pitch content. The envelope parameters, however, proved to be a particularly useful tool in the ultimate selection. Quite a few sounds, even some with an attack value of over 6 (representing a fairly high level of possible manipulation of the attack) were found to respond too slowly to be used in these particular circumstances. The ability to simply scroll through all possible search results with a choice of envelope data was extremely helpful.

Another feature of the app that aided in the interpretation of *Sparkle* was the inclusion of pitch-class set prime forms in the multiphonic database. Takayuki Rai claims a personal compositional style derived from both tonal classical music, and processes of atonal serial composition. He says this of his style:

One of the symbolic phenomena of tonality is the hierarchy among the 12 tones of the octave. For instance, in music in C major, the note C appears with greater frequency than other notes. The note G, a fifth above, follows in the hierarchy. I hypothesized that it should be possible to create a potential tonality in the context of an atonal series by forming a hierarchical relationship among 12 tones in an octave<sup>170</sup>.

*Sparkle*, like much of his music, demonstrates this very idea. The musical figures and gestures appear to follow patterns and structures consistent with atonal processes, yet there are very strong harmonic centres. It turns out that the bulk of the musical material is derived from a pitch-class set of 13 notes, with the three notes C, Eb, and F# repeated in the set, and the other pitches - B, C#, D, E, F, G, and G# - are played only once. The interval of a minor third is thus central to the pitch material of this work, as is the “whole-half” octatonic scale. *Sparkle* begins with this set, introduced gradually; the pitches of C, Eb and F# being prominent in the opening measures as the set unfolds. After a short chromatic interlude, the set is presented again, this time in T5 (transposed up a perfect fourth) – with the same C-Eb ostinato, now giving a strong dominant 7<sup>th</sup> pull.

With the knowledge that intervals of a semitone, tone and, particularly, the minor third playing such a central role, the search for multiphonics can take on a new dimension. The inclusion of pitch-class set (prime form) for each multiphonic enables the user to identify similar sets or subsets between multiphonics. This feature is not available as a standalone search, but the information can help the user choose between sounds that have already been identified as potential candidates within a particular musical context.

This feature may be seen as contrary to many of the aims of the app: one major feature of the app, and indeed part of the impetus behind its creation, was to acknowledge that pitch material within a multiphonic is seldom perceived audibly as it appears on

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<sup>170</sup> Rai, T. “Composing Instrumental Parts”. Accessed June 24, 2016. <http://www.t-rai.net/research.html>

paper. As previously discussed, certain pitch material might be identified in a spectrogram but not audibly, or vice versa, and some pitches are clearly audible while others appear as “noise”. The introduction of p-c sets, however, addresses a potential need; while some musicians will only be interested in the timbral aspects addressed by the app, there is no doubt that composers or performers with an interest in pitch material, audible or otherwise, could use this feature as the germ or inspiration for musical material.

## **7.2 *Onomatopoeia* (1983) – Nigel Westlake**

*Onomatopoeia* was written by Nigel Westlake as a very personal reaction to a period of intense study. Westlake had travelled to the Netherlands to study with Dutch bass clarinet virtuoso Harry Sparnaay in 1983. Over a period of three months, Westlake acquired skills in extended techniques and the interpretation of *Avant-garde* works. Upon his return home to Australia, Westlake showcased these techniques in a piece that displayed a much more subtle and delicate approach than the hard-edged European modernist works he had been studying.

The piece, for bass clarinet and digital delay, is scored for bass clarinet and Roland SDE 3000: a standalone delay unit produced in the late 1970s and early 1980s. The Bass Clarinetist operates the delay unit while playing the solo part, controlling the duration and repetitions of the delayed bass clarinet sound. Not to be confused with “looping”, the delay is employed in two modes throughout the piece: the first being *delay* mode and the second being *hold*. *Delay* is the state in which the bass clarinet sound is continuously played back approximately 4.5 seconds after it is initially played. Whereas a loop is a specified length of musical material repeated as an accompaniment, the *delay* creates a sonic background that develops and changes as the musical material changes. After the sound is initially recorded (or more technically, “buffered”), each iteration of the delay is played at a decreased volume, such that each 4.5-second sound parcel fades to nothing after around four repetitions. The *hold* mode is more like looping, in that the sounds that are currently buffered are repeated, with none of the input sound (the live bass clarinet sound) entering the buffer. The result is a sound field of bass clarinet, with the performer “soloing” over the top.



The piece was written almost as a form of catharsis after a particularly intense period. With much of the repertoire Westlake learned in Europe being quite aggressive and obscure, emphasizing the depth and extremities of the bass clarinet's range and timbral palette, this piece is a great departure, dwelling mostly in the more subtle and ethereal sound worlds of which the bass clarinet is capable. To that end, the extended techniques reinforce the tonal, almost modal, nature of the work, and percussive finger and tongue effects are used as rhythmic devices to add momentum to the work. In spite of some more rough and dense textures, the piece remains in a fairly dreamy, gentle, and lyrical sonic environment.

*Onomatopoeia* is in seven sections, each with a different textural character, though forming a rondo form of sorts. Sections **A** and **G** are both “*ad lib*” sections (meaning, in the player's own time), consisting largely of held notes, with the electronics in *delay* mode. Sections **B** and **D** provide a rhythmic and textural backdrop for sections **C** and **E**, which are explorations of the lyrical, melodic upper register, and lower register uses of extended techniques, respectively. Section **F** acts as a recapitulation to the rhythmic and tonal material of Section **B**, and **G** serves as a coda. This structure is outlined in Table 2.

### Table 3 - an outline of *Onomatopoeia*

*Onomatopoeia* is particularly effective in its introduction of extended techniques. As the piece begins and dwells in the unfamiliar upper clarion register for an extended period of time, the moment when the low register (more familiar territory for those accustomed to hearing the bass clarinet) comes as quite a shock. The delicacy with which Westlake unfurls the extended techniques, first percussive sounds, then microtones, slap-tongues, and finally *sons fendus*, presents the sounds as a logical progression or even evolution of the timbre. Coupling this with a gradual increase in the range from a major 2<sup>nd</sup> at the beginning, to the full range (written “as high as possible”), creates a narrative in the piece, escorting the listener through the complete range of registers and timbres of the instrument.

This piece was presented in the recital not specifically to demonstrate the use of the app; rather, it helps support the narrative of the Bass Clarinet’s evolution. That is: at first, a solo voice evoking the ethereal; then an accompanying voice supporting the higher clarinet sound; a strong, low, exciting character; and finally, an agile soloist capable of a wide array of sounds and textures.

The app would be useful, however, in the interpretation of this piece. The section of the app explaining the execution of *sons fendus*, for instance would assist an inexperienced player. Westlake’s score uses a graphic notation (seen in Fig. 35) with the instruction “harmonic gliss.” which is sufficient for anyone with previous exposure to extended techniques.

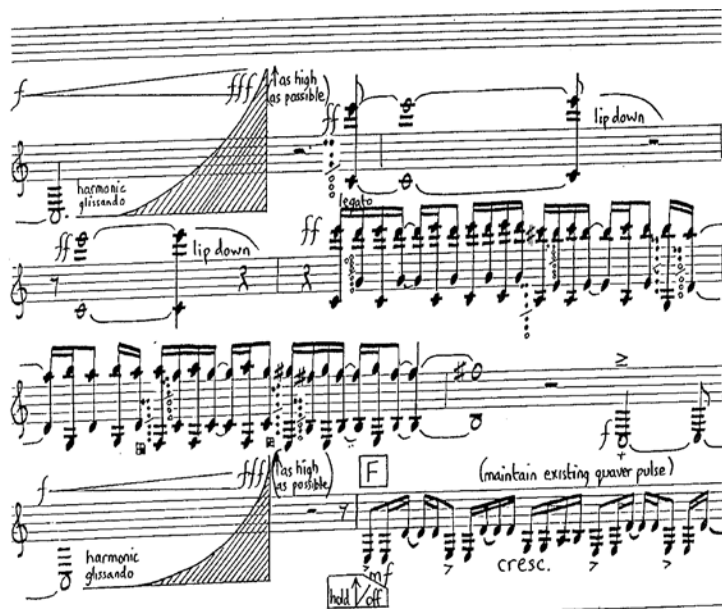


Figure 35 - *Sons fendus* in Westlake's *Onomatopoeia*

Considering the accessibility of the work, if it were published a less experienced interpreter could very well need more information. Likewise, the section on altissimo fingerings offers several alternatives to the fingerings presented in the score. What I have gathered from conversations with Harry Sparnaay and Nigel Westlake is that the piece was written while Westlake was using a 1970s model Buffet or Yamaha Bass Clarinet – the altissimo fingerings for which might not have the same tuning characteristics on a later model instrument.

The piece is a very personal one for Westlake, to the point that he has all but withdrawn it from publication. As it was written as a response to a very intense period in his life, the efforts of some performers to interpret it authentically have fallen short. I consider myself very fortunate to have been given Westlake's permission to perform the work publicly. As demonstrated in the lecture recital, this piece is ideal for introducing an audience into the unique sound world of the bass clarinet.

### 7.3 *Voix Instrumentalisée* (1973) – Vinko Globokar

This piece was presented in the lecture recital as the “polar opposite” of the serene introduction of extended techniques in Westlake’s work. Inspired by the text used in the piece: “*L’art et la science ne peuvent exister sans la possibilité d’exprimer des idées paradoxales*” (art and science cannot exist without the possibility of expressing paradoxical ideas), Globokar demands more from the bass clarinetist than they might normally expect, whilst stripping them of their fundamental physical connection to their instrument – the mouthpiece. The bass clarinetist attempts to speak, sing, or scream this text, sometimes complete, sometimes just the vowels or consonants, sometimes disjointed phonemes, through the instrument, aided and hindered by lip buzzing and key clicking. The result, as the title suggests, is less about the musician bending the instrument to their will, and more about their own voice being distorted, engulfed, and instrumentalized.

Of particular interest in *Voix Instrumentalisée* is the manipulation of air sounds. Globokar employs different combinations of plosives, fricatives, and vowel sounds to create textured sounds quite unlike any others in the repertoire. It is very common to see “air sounds” requested by a composer; more often than not, the composer simply wants the sound of a normal exhalation (normal meaning at the same speed or volume of air as regular pitch) without the reed vibrating. Globokar, however, takes this further and suggests sounds such as *z*, *s*, *n*, *l*, *m*, and *v*. Having these listed and exemplified, as they are in the app, would suggest to a composer that there are many more colours available when employing air sounds than simply exhaling without the reed engaged.

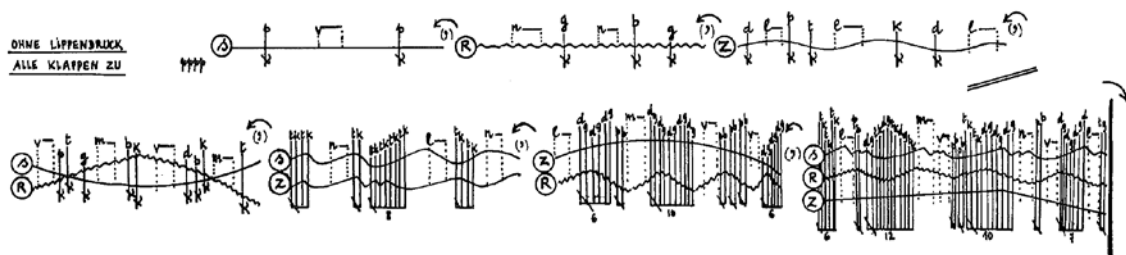


Figure 36 - Section 1 of *Voix Instrumentalisée*

As can be seen in Fig.36 the use of *z*, *s*, and *r* sounds can impress a perception of changes in pitch. With the omission of the mouthpiece, the bass clarinetist can more readily shape the embouchure to raise and lower the pitch of the air sound. Coupled with this, a rising

and falling of the hummed voice provides a strange counterpoint, the *p*, *g*, *k*, *m*, and *n* sounds punctuating the longer lines.

The features listed in the non-fingered section of the app are particularly useful for composers wishing to experiment with a sound palette such as this. The ability to switch between explanations, recorded examples, and suggested notations allow the user to “play” with the ideas of sounds they may have in their head. In previous resources, an author might have only briefly discussed speech and/or air sounds through the instrument; the digital format enables the user to browse several short examples of different sounds to gain a better idea of what sounds they might consider requesting. These include air sounds with different vowel shapes in the mouth, hissing and playing, and mixing air sounds with rapid finger movements (*frullato*). While an experienced performer may not need a resource to interpret the techniques in *Voix Instrumentalisée*, a composer may find inspiration or assistance in preparing a score.

#### **7.4 Solitude (1980) – Joji Yuasa**

Originally written for Bb soprano clarinet, Yuasa’s *Solitude* is a beautiful introspective piece that showcases the subtle nuances of clarinet timbre and the tonal considerations of multiphonics.

The version for bass clarinet was prepared by Harry Sparnaay, and has not been published. Remarkably, in order to play the bass clarinet version, one must obtain a copy from Sparnaay himself. Sparnaay’s version is a printed copy of the original version for Bb clarinet, with the sections involving multiphonics altered with pen or pencil! In conversation with Sparnaay, he mentioned that he had wished to commission Yuasa to write a piece for bass clarinet, but when he found this piece for Bb clarinet, he felt that there was no better piece to be played on bass clarinet. Sparnaay later found that many of the multiphonics were transferable to the bass clarinet, and minimal editing was required.

The startling aspect of the piece is that the clarinet multiphonics translate so well to the bass clarinet. As discussed in previous chapters, extended techniques are very seldom transferable from Bb clarinet to bass clarinet, particularly so in the case of multiphonics. In choosing the particular effects that he has, Sparnaay managed to alter the pitch material yet maintain the aesthetic of the original. The best example of this can be found in a chorale-like section on page 3.

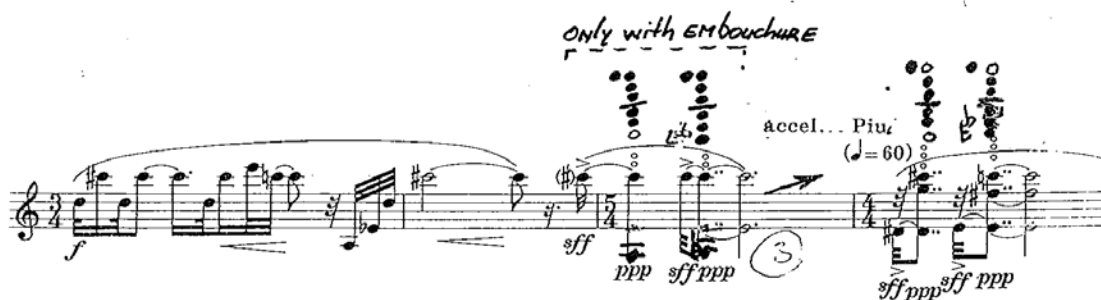


Figure 37 - Multiphonics in *Solitude* altered from the original<sup>171</sup>

At the beginning of the 5/4 bar, we see an adaptation of *sons fendus*, or natural harmonics. In the original Bb clarinet part, the two pitches are E' and C#'''. These two pitches can be produced on the clarinet by using undertones, i.e., the playing of a higher note with a relaxed jaw pressure, resulting in the lower partial of that fundamental fingering emerging. What makes this technique difficult to translate between instruments is that the fingerings for the higher and lower notes on the clarinet are not necessarily the same between the two clarinets. In many cases they are, albeit sounding one octave lower on the bass clarinet. In others, though, the fingerings used for higher, specifically altissimo, notes bear no relation to a fingering in the lower register.

This posed a question to Sparnaay: is it preferable to stick with attempting to recreate all sounds in the piece with octave equivalents; or to aim for sounds that best represented the sound quality of the original, thus maintaining a similar lyrical quality? The answer in this case is: a bit of both.

In the case of the 5/4 bar in Fig. 37, Sparnaay's version asks for the same effect as the original, but with a different sonic result. The fingering suggested by the original notation involves a "cross fingering" which cannot be translated onto the bass clarinet.

<sup>171</sup> page number etc

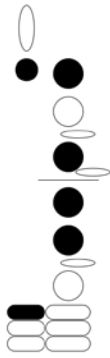


Figure 38 - Cross fingering in *Clarinet Solitude*

In Fig.38, the “open” key on the top joint (operated by the median finger of the left hand) cannot be open while the key below it is closed due to the mechanics of the keywork. Therefore, the fundamental fingering is actually this:

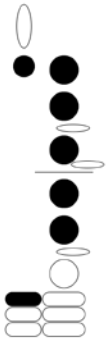


Figure 39 - The above fingering result on bass clarinet

The resulting sound therefore cannot contain the original pitch of E’.

Sparnaay chose, however, to use the same *technique*, rather than use the original pitches. According to the app, there are 34 multiphonic possibilities that contain the C#, many of which also contain the E. Instead Sparnaay could ensure, by using the same technique of under-blowing, that the sound would be produced in the same way as the original, enabling the same articulation and sound behaviours – albeit with different pitches.



This approach of matching technique is seen numerous times throughout Sparnaay's version. There are also some sections where a technique *could* be transferred, but is varied slightly.

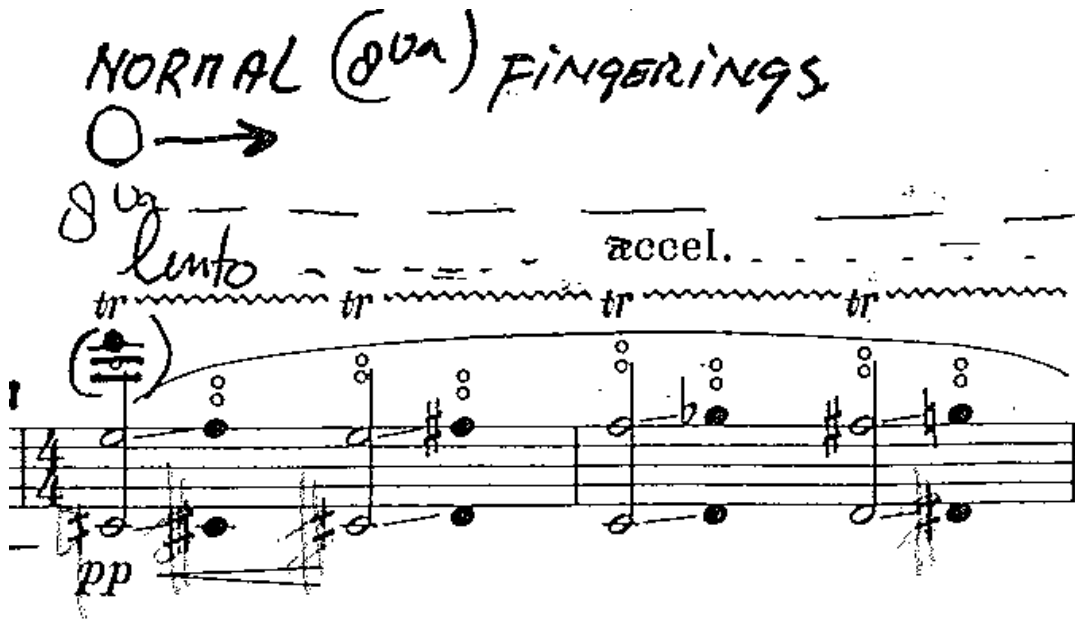


Figure 40 - A section in which the original technique is maintained<sup>172</sup>

Fig.40 shows a passage in which the original is to be performed in the same fashion as Fig.37: to maintain the high notes and allow the lower notes to speak. Here Sparnaay takes the opposite approach. By trilling between the bottom pitches, the higher notes come out one octave higher than written. In this case, the pitch classes are maintained, and the technique is very similar.

There are, also, several techniques which could not be transferred. In these cases Sparnaay had to approximate both playing characteristics and pitch material of the original with fingerings available to him on the bass clarinet.

In all of these cases, it can be assumed that a considerable amount of experimentation was undertaken, alongside an equally considerable amount of searching through printed multiphonic examples. In preparing arrangements or transcriptions, the

<sup>172</sup> Joji Yuasa, "Clarinet Solitude," ed. H. Sparnaay (Berlin: Schott, 1980).

knowledge base provided by the app would be of great value: the ADSR envelope information is useful in choosing techniques that match (or are similar to) the articulation profile existing in an *urtext*; pitch material (*loco*) can be searched and cross-referenced; pitch class set material can also be checked against the original; and, if the original piece is composed for an instrument with which the arranger is familiar, original sounds can be played into the spectrogram generator alongside the bass clarinet possibilities, and their timbral content compared.

### **7.5 Dowser (2007) – Nathan Davis**

Dowser<sup>173</sup> is a hauntingly beautiful work for bass clarinet and electronics composed for the bass clarinetist of the International Contemporary Ensemble (I.C.E.) Joshua Rubin. The title “Dowser” is a very evocative one: the metaphor of a person who uses a kind of intuition to find water is a very apt one for a composer or performer attempting to bring the true nature of the instrument to the surface.

The piece starts very simply, whispering breath tones, singing and playing out of tune to achieve acoustic beats, with very little colour from the electronics. As the music becomes more complex, a sense of searching emerges – the fragile multiphonic sounds slowly becoming more solid and stable. Eventually, the two characters – performer and instrument – reach a standoff, and engage in a kind of distorted *sarabande*. As the natural breathy sounds of the bass clarinet dissolve into multiphonics, a breakthrough is made, and with the help of electronics, the lowest depths of the range are plumbed, with a cackling and maniacal melody, played on the harmonic series belonging to an instrument twice the size.

This search for the “true nature” of an instrument is a common theme in Davis’ works, so much so that in the compositional process for his work *pneApnea*<sup>174</sup> for solo alto flute with electronics began with his acquisition of an alto flute and experimentation. Davis had no experience with the instrument, nor the C flute; what he was attempting in trying to figure out how to play the instrument on his own was to experience what the flute had to offer. Rather than speak with an experienced flautist to find sound possibilities, Davis experienced the raw nature of the instrument, and saw first-hand its

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<sup>173</sup> Davis, “Dowser : For Bass Clarinet and Live Electronics.”

<sup>174</sup> “Pneapnea,” (New York: Nathan Davis, 2007).

most basic, even primal, sound elements. He experienced what the instrument would do if blown in a harsh, untrained manner, or delicately whistled into. Without the burden of knowledge associated with being an experienced practitioner, Davis was able to get a sense of how the *instrument* would react to certain physical conditions, not a performer.

*Dowser* explores these same primal ideas. In this case, Davis did consult a highly trained performer, Joshua Rubin, and asked him to demonstrate some techniques. The use of air, acoustical beats (from singing and playing close intervals), and bent pitches, were already familiar to Davis and are used to create an effective atmosphere for the piece.

Figure 41 - Page 1 of *Dowser* showing acoustical beats, breath sounds, and bent pitches<sup>175</sup>

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<sup>175</sup> "Dowser : For Bass Clarinet and Live Electronics."

The fingered multiphonics, however, were largely new to Davis. In a meeting between Rubin and Davis, a number of multiphonics were selected and put into a list (seen in Fig.42), and the piece began to take shape.

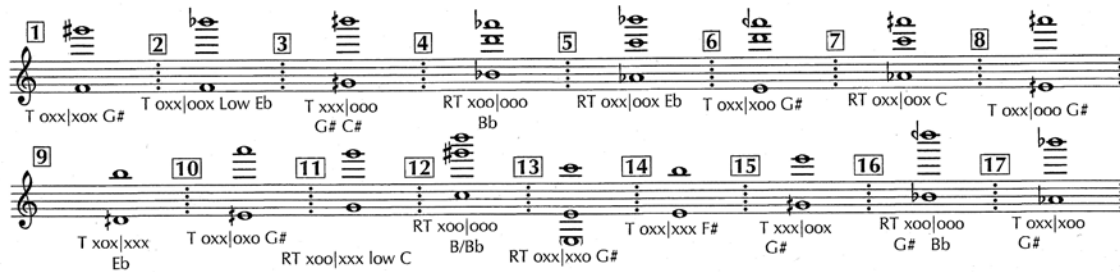


Figure 42 - Fingered multiphonics used in *Dowser*<sup>176</sup>

Some of these multiphonics are the creation of Mr Rubin, and do not appear in this form in the current literature. Some variants are present, for example, Rubin's multiphonic 1 shows the pitches F' and G#'''. The same fingering in the app returns four further results, none of which contains the F'; two contain an E quarter-sharp, and one contains an upward-inflected E (or E plus). This is a shining example of how embouchure, reed and mouthpiece, and instrument setup can affect the sound. There can be no doubt that Joshua Rubin is a highly skilled and regarded player; therefore, the flexibility of these sounds must be addressed in the app.

Rather than list all possible permutations of embouchure pressure and setup (which would return a countless number of results), the user of the app can "test" their production of a multiphonic against the recorded example. The following images show the process of comparing multiphonics using the app.

<sup>176</sup> Ibid.

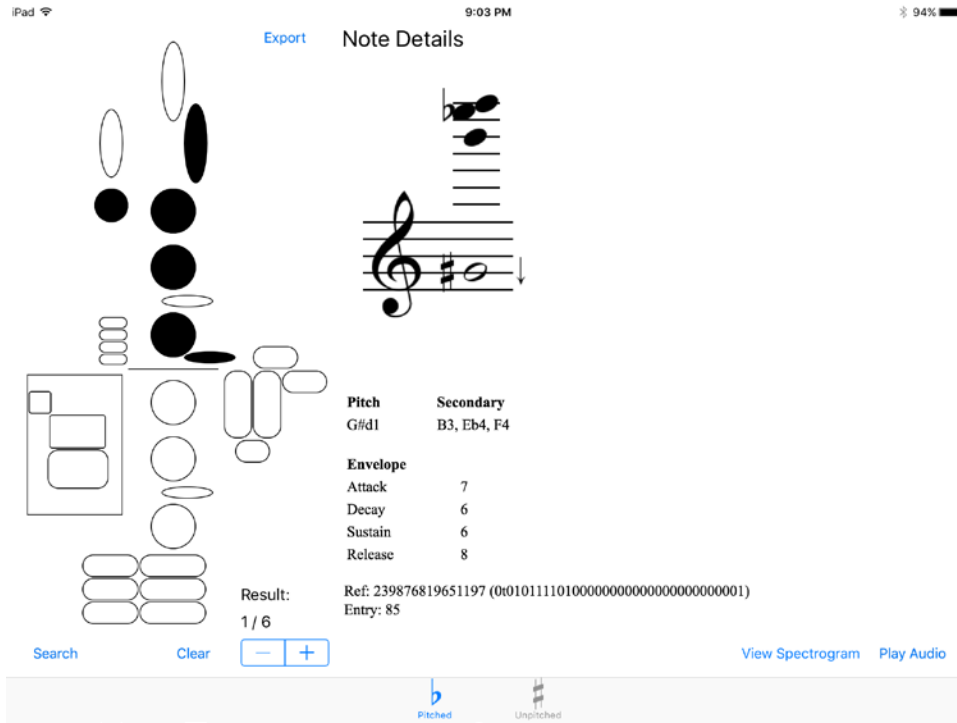


Figure 43 - A result for searching for Rubin's fingering #3

Fig.43 shows one of six resulting sounds from entering the fingering used in Rubin's multiphonic number 3. This result was chosen because the pitch content listed is similar to that in Rubin's example. The envelope descriptors: A-7; D-6; S-6; R-8 suggest a reasonably agile execution. As mentioned in chapter 5.2, the ADSR descriptors represent to what extent the four temporal aspects of the sound can be manipulated as a numeric value out of ten. In this case, an attack value of seven indicates that the sound can be attacked at a wide range of dynamics, decay and sustain slightly less so, and the release can be more flexible (i.e., could be tapered, ended abruptly, etc.).

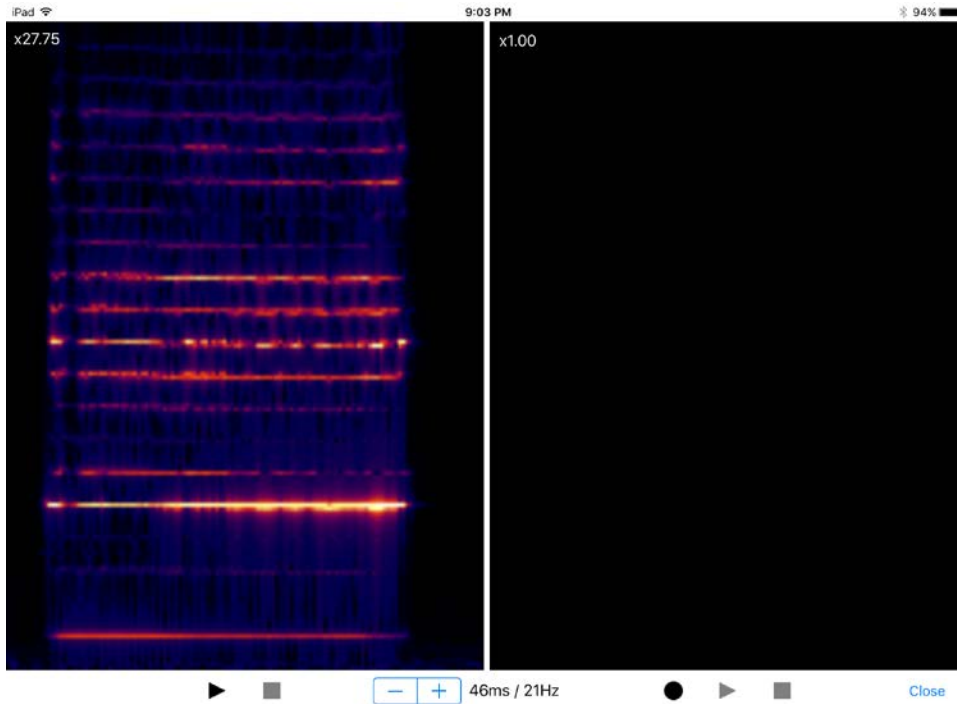


Figure 44 - Spectrogram image of the multiphonic

In Fig.44, the pane on the left shows the spectrogram image for the chosen sound, and by pressing the “play” icon, a sound is played. On the right pane is a space to record five seconds of the user’s own sound, to compare with the recorded example.

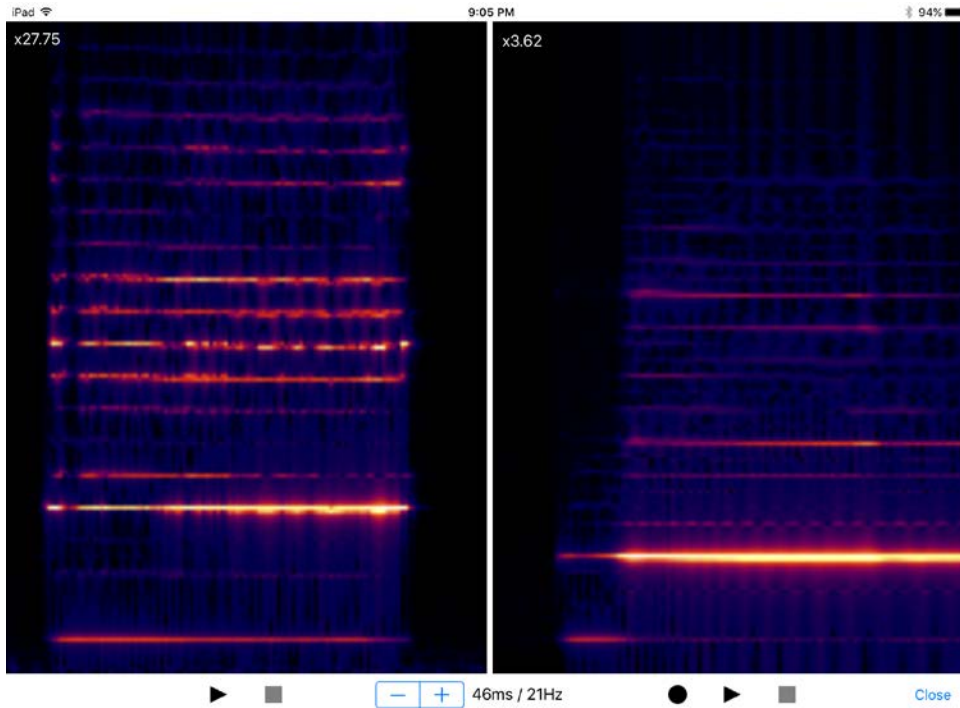


Figure 45 - Recorded and live examples

On the right pane of Fig.45 is a spectrogram of a multiphonic derived from the supplied fingering. It is clear that the pitch material is not the same, but many of the pitches (horizontal lines) are the same; the spectral amplitudes (strength of partials) are not identical.



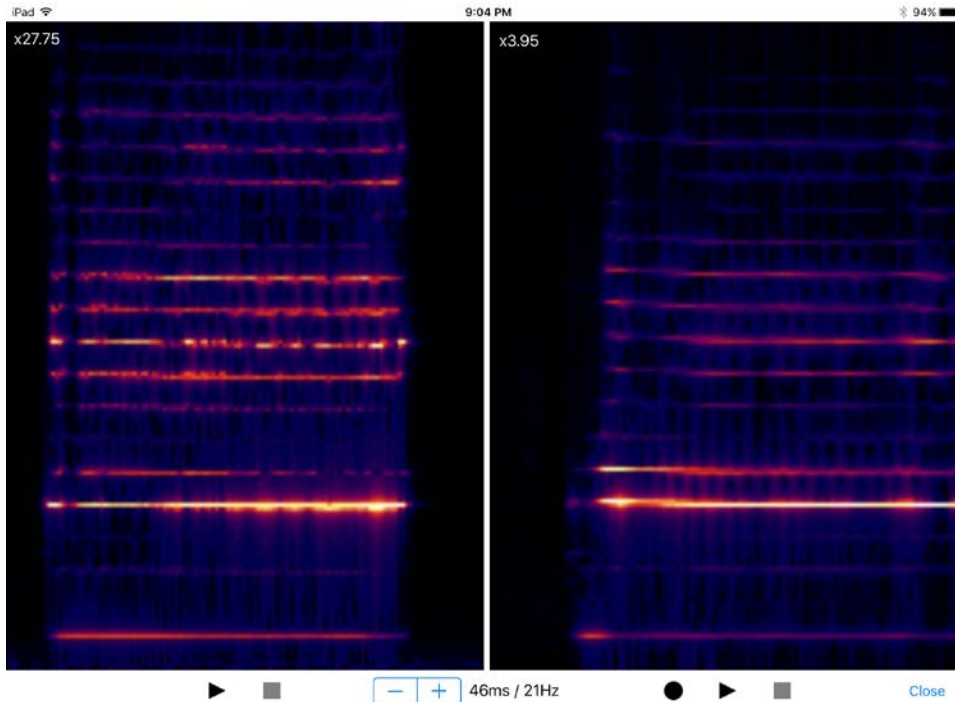


Figure 46 - A closer attempt

Fig.46 shows a much closer attempt at producing the sound. The fingerings for Figs.45 and 46 are the same, but alterations to the embouchure, voicing, and air speed achieve different results.

This unique visual tool provides instant feedback to the user and gives valuable insight into the skill of producing multiphonics reliably. In the course of preparing a new or unfamiliar work, a performer may struggle with consistently reproducing a certain sound. This practice tool allows the user to visualize the sound and work toward its consistent and reliable production.

The legend in Fig.42 leaves no question as to what the multiphonic demands of the piece will be. This page is helpful to the performer as it allows them to isolate the multiphonics, familiarize themselves with them, and practice them before embarking on the interpretation. The fingerings are fairly clear, though the locations of some of the keys in these diagrams can be somewhat confusing.

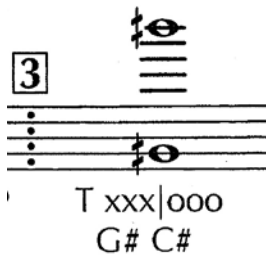


Figure 47 - Multiphonic fingering 3 in *Dowser*

The fingering diagram shown in Fig.47 is slightly awkward; the keys represented by x's are played with the first three fingers of the left hand, and those represented by o's by the right. This would suggest that the image represents a clarinet "lying down" or horizontal, in which case the G# and C# keys would be on the right hand side of the instrument; they are not. The layout of this particular fingering actually looks like that shown in Fig.48:

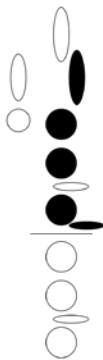
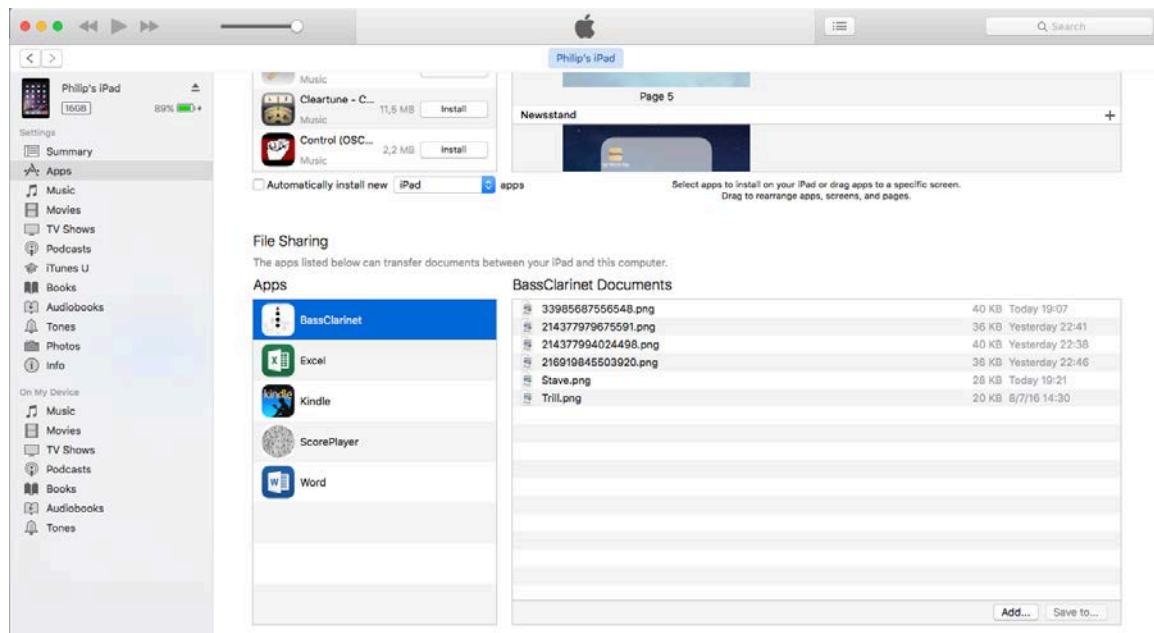


Figure 48 - An image of *Dowser's* multiphonic 3, rendered by the app

For some, this image is more immediately identifiable than the one presented by Davis. This is by no means suggesting that there is anything wrong with the fingerings presented by Davis, but there is room for improvement on his system.

The app offers the user the ability to select a fingering on the screen (either as the result of a search or simply "punched in" into the touch diagram) and export it. After pressing the "export" button, the image is stored in the documents section of the iPad. Once the iPad is connected to a computer with iTunes, the user can view the apps on the

device that enable file sharing, select the BassClarinet app, and view the files recently exported in .png format.



**Figure 49 - Locating exported fingering images from the app**

This might seem trivial, but the ability to generate accurate, clear, and legible fingering diagrams can be incredibly useful for composers and performers alike. Obviously, composers may wish to use this feature in the score creation process, but this is not the limit of this feature. Performers can use this feature to “mark up” existing scores provided they have a digital copy. The image can then be placed on the page according to the performer’s preferences; some like the image below a notation, some above, some adjacent. The potential also exists for composers to distribute individual fingering diagrams with digital copies of scores. That way, the composer can leave it up to the performer to place them as they wish.

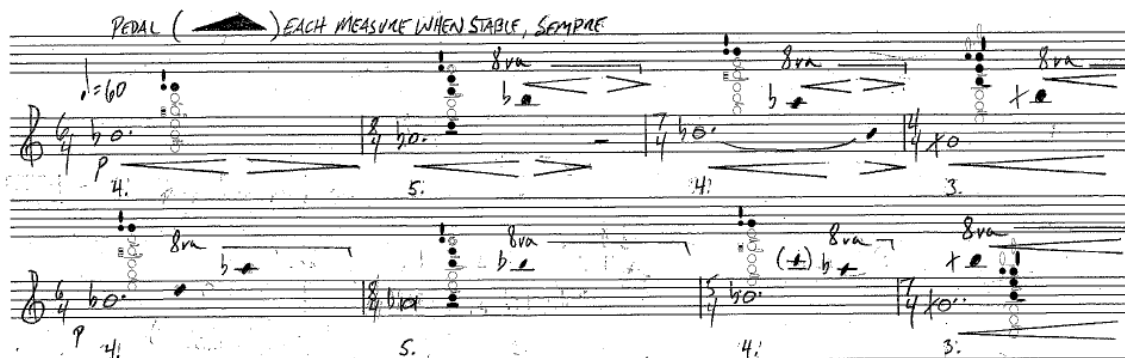


Figure 50 - The author's "marked up" score for *Dowser* used in lecture recital<sup>177</sup>

Fig.50 is a section of the score for *Dowser* with fingering images generated by the app, used in the lecture recital for this project. The images may seem very small, but this was sufficient for the purpose; the images were not needed as a vital source of information during performance, rather a tool to aid the memory.

It should be pointed out that the images are generated on a transparent background, so only the black marks become visible, rather than producing a white square around the image as happens with some visual objects generated for scores. This transparency can be observed here in Fig.51:

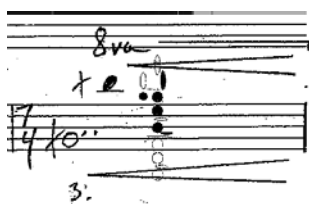


Figure 51 – A close-up image of fingering diagram demonstrating transparency

These images can be resized, rotated, cropped, and otherwise processed in any common image editing software; the ability to quickly generate and share these images is a valuable luxury afforded to the user.

<sup>177</sup> Ibid.

## 7.6 *Glances (2009) – Max Giteck Duykers*

*Glances*, a work for bass clarinet, vibraphone, and piano, was composed over a short period of time in 2008/2009 for my graduation recital from the Manhattan School of Music. The inclusion of this piece in the present study demonstrates the “less is more” approach to notation of extended techniques. The composer writes of this work:

“*Glances*”, for bass clarinet, vibraphone, and piano is a bright, virtuosic piece that I composed for Philip Everall in 2008. I was inspired by the chord progressions of John Coltrane, where root movement occurs in 3rds and 4ths. In this piece, I have verticalized these root pitches into pitch collections, and then linearized those collections into melodies and developing fragments. The two slow sections, or the “glances”, attempt to portray a deeper, darker facet of this dense harmonic world. Here, two pitch collections overlap – one made of two stacked 4ths which “plane” around on different roots, and the melodic scale, made of three stacked fourths. I have been continually excited by these materials because of their possibilities for interwoven consonance and dissonance.<sup>178</sup>

What makes this piece unique among the works chosen is the simplicity with which the composer requests extended techniques. The “glance” sections are introduced with the following direction:

Ad-lib with circular breathing to color the sound: alternate fingerings, finger vibrato, flageolette, throat flutter, trills, etc

This affords the performer significant freedom in interpretation; Duykers suggests the effects that he himself would find appealing, but leaves the final decision with the player. This notation, like much graphic notation, suggests a certain level of creative ownership of the piece.

This direction might seem at odds with the *raison d’être* of the bass clarinet app. One might assume that its purpose is for composers to create scores with a level of specificity and complexity that is demanded by much contemporary music. On the contrary; the app, in many situations, puts the onus on the performer to explore all possible solutions to the questions with which they are confronted. In the case of

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<sup>178</sup> Max Giteck Duykers, “*Glances : For Bass Clarinet, Piano and Vibraphone*,” (Stony Brook, NY: Max Giteck Duykers, 2009).

*Glances*, the performer is subtly instructed to explore as many possibilities as are required to serve the musical purpose.

During the compositional process of *Glances*, Duykers and myself had very little contact. I had played music of his before, and I had seen that his understanding of the tone colour, range, and technical demands were congruent with my own. It came as only a small surprise that Duykers did not speak of specific extended techniques. We did not have a meeting where we explored musical material, I did not show him all the possibilities I knew of for him to arrange in a kaleidoscope of ethereal colours; this was simply a composer acting on his understanding of the instrument, and a performer trusting him. I did, however, expect to see some well-researched extended techniques.

The result, at first, was surprising. When I saw pages of music devoid of extended techniques, I was somewhat taken aback. At the first rehearsal, however, it became clear that in *not* writing specific extended techniques, Duykers elevated those “other” sounds to a loftier plane. It was the dreamy, floating nature of the accompaniment that dictated which sounds I chose for performance – not a strict instruction from the composer. With this approach, each performance of the work could be different. If a performance was to a particularly receptive audience that seemed to have a particularly energetic “vibe”, perhaps I would incorporate some more contrasting material: sudden swells, air sounds, whistles, chirps, even some quite dissonant multiphonics; in a more subdued performance, a simple throat flutter, playing one or two different *sons fendus* that incorporated the notated D''' as a featured pitch, or some finger vibrato would suffice. The musical material in question is shown in Fig.52.

Eerie, sensuous, floating  $\text{♩} = 50$   
 Ad-lib with circular breathing to color the sound: alternate fingerings, finger vibrato, flageolette, throat flutter, trills, etc.

62

Bcl

Vb

Pf

Very delicate, smooth with pedalling

Both slower sections: very delicate, like small murmurs

non troppo

66

Bcl

Vb

Pf

Very delicate, smooth with pedalling, blend with piano like overtones

70

Bcl

Vb

Pf

1-cord L/R

Figure 52 - A page from *Glances* showing the "extended technique" section

What made this approach particularly special was the level of comfort each party in the creative process had toward extended techniques. At the time, I had a significant enough knowledge of extended techniques to be able to find several options *in situ* that would suit the music; Duykers, likewise, understood that there were certain effects that would enhance his vision for the aesthetic, suggested them, but left enough freedom for that palette to be expanded at the whim and experience of the performer.

In order to achieve this level of comfort, both parties must have a thorough working knowledge of extended techniques. They must be familiar with the sounds, but also familiar with the concept of what goes into producing them. In such a piece as *Glances*, it might be completely inappropriate for a composer to notate a series of specific sounds: as the effort required to produce them might add a layer of complexity to the performance that disrupts the flow or mood. In many other circumstances, of course, there are factors in play that necessitate very specific notation.

Ultimately, the contribution made by the app to the preparation of this piece was twofold: firstly, the search multiphonics sharing a similar pitch makeup to the chords can be undertaken, as can a browse through the “other extended techniques” section.



## 8 Conclusion

### 8.1 Results

The initial aims and research question were as follows:

1. To clarify the nomenclature and notational practices of extended techniques;
2. To develop a system that enables widespread facile access to specific information on extended techniques;
3. To improve pedagogy of the bass clarinet and facilitate the learning of extended techniques;
4. To enable broader knowledge of the instrument to facilitate the effective use of extended techniques in the creation of new works.

The research question which was produced to address these aims was:

How can a digital resource be created to streamline the organisation, presentation, and retrieval of information on extended techniques for the bass clarinet, and to simultaneously be used as an educative tool to enhance the mastery of this material by composers and performers?

It is believed that with this resource, some of these aims have been met, or at least have the potential to do so. In terms of the question, the proposed answer was described in Chapters 6 and 7; the description of the creation of the app, then the discussion of its use in the preparation of the lecture recital, citing the included works as examples of possible uses. While the app does need further development to be a commercial viability, the concept (with regard to the lecture recital and chapter 7) could be considered proven.

With regard to aim 1, it is hoped that the app provides numerous options for the notation of extended techniques. The inclusion of traditional pitch notation, as well as the possibility to generate fingerings to be inserted into scores is of particular use. Likewise, the spectroscope function, whilst not necessarily useful as a notation (or perhaps, to some, it is!), offers more detailed information on texture and timbre than other methods of discussion.

The inclusion of videos, texts, sound examples, and the spectroscope “record” function is a large step forward in achieving Aim 3. For the user to have such immediate access (more so than skipping through tracks on a CD accompanying a book), and the ability to compare an image of their own sound to a recorded ideal is heretofore unparalleled.

Finally, the very nature of the product addresses Aim 4. The format allows instant access to the information without the burden or time-cost of shipping, or even carrying heavy books in one’s instrument case!

While not strictly the result of an experiment, it is hoped that by distributing this app to composers and performers of any level of proficiency will make incremental changes and improvements to the ongoing discussion of extended techniques. Hopefully the instructional guides in the “other effects” section will encourage players to practice techniques with which they may have struggled in the past. The section on multiphonics, likewise, might not only help a composer find a sound to suit an existing musical idea, but also to provide inspiration for more of the same.

## ***8.2 Reflections on Collaboration***

Historically, collaboration has been an integral factor in the creation of the repertoire. The efforts of pioneers such as Harry Sparnaay, Henri Bok, Josef Horák, and others in sharing the possibilities of the bass clarinet with composers has not only led to the creation of a vast and rich body of repertoire, it has instilled the idea of collaboration into the minds of the successive generations of bass clarinetists. In much the same way that extended techniques have become an indelible part of the bass clarinet’s identity, an inquisitive nature and passion for working with composers to explore even more musical opportunities for artistry has become a tradition of its own.

As positive a picture of collaboration this study paints, there are of course circumstances in which collaboration breaks down, fails, or is in some way unsuccessful. It is entirely likely in some cases that a discussion between composer and performer on the topic of what is or isn’t possible could be seen by either party as an unfortunate compromise. A composer may demand a particular sound, and a performer may be reluctant to attempt it or find it uncomfortable to include in a performance. The composer

may have taken the sound directly from a print resource, assuming that it was as executable as any other; the performer in turn may have significant difficulties. As mentioned at certain points throughout this paper (Chapter 7 in particular, also Chapter 6), what is easy for one player (or author) may be quite difficult for another. Thus, the language used by an author might benefit from even-handedness. Rather than use words such as “easy to produce” or “difficult”, or even “effective when played loud”, the option of using a more neutral system of ascribing values of flexibility (see Chapters 5.1, 5.2) was chosen. This system, while perhaps confusing at first, or seemingly bland, gives both parties an idea of the quantifiable aspects of what is possible. To a bass clarinetist, these values may boil down to such language as “easy” or “hard”, but when presented to both parties, the numerical system aims to provide a *lingua franca* that neither raises nor lowers expectations on any one sound.

The collaborative process can now evolve a further step with this app. The immediacy and ease with which the user can retrieve information on extended techniques can accelerate conversations between performer and composer. The ability to cross-reference and compare sounds in real time can bridge the gap between the “silent” composer (the printed score) and the interpreter. In situations where a composer has passed away, or is unreachable, the bass clarinetist can physically interact with different sounds and images to serve the composers wishes. Likewise, a composer can interact with the subject matter. In a way, the app acts as a surrogate collaborator for both performer and composer.

### **8.3 Future Updates to the Resource**

There are some aspects of the resource that due to the intricacies of programming were not entirely possible in this iteration. If the app is to be developed according to current app development practices, a few key improvements would be made. These would include:

- The ability to scroll through multiphonics in some kind of linear way, to be able to “audition” the sounds;
- More cross-referencing capacity, to search for sounds within more parameters;

- A more user-friendly interface, perhaps with more description on how certain parts of the NSF section relate to the information;
- Help tabs to explain some of the more obscure features of the app.

These are just some possibilities. With these and continued development, it is hoped that this could even become a commercially viable resource.

#### **8.4 Future Research Opportunities**

This project has paved the way for significant promotion of the knowledge surrounding bass clarinet extended techniques. As this is a proof-of-concept, rather than a stringent app development process, the success of this first step can be seen as a positive indicator of numerous opportunities pertaining to the bass clarinet, and to the use of mobile apps in the creation and interpretation of new music. The potential exists for this platform to be used as a framework for similar resources on other wind instruments. The interaction and tactile nature of an app such as this is an intuitive and powerful tool. Whilst this thesis involves the use of spectrography, a complete and comprehensive resource utilizing existing methods of timbral classification was considered beyond the scope of this project. Once again, the format lends itself to computational processes and could potentially aid in new methods of discussing these ideas. With advancements in notational practices and research into new types of interfaces for musical expression, a multitude of possibilities exist to incorporate this body of knowledge into the creation of new works.

#### **8.5 Final Thoughts**

Looking back, in 1977 Philip Rehfeldt expressed the view that it would be some time before multiphonics could be systemized:

We are still in the pioneering stage with multiphonics, and if the lessons of history can again provide insights, it will be years before we are able to look at them from the standpoint of uniform practices.<sup>179</sup>

However, I would suggest that we have now arrived at that point. The knowledge base surrounding the production, notation and implementation of extended techniques specific

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<sup>179</sup> Philip Rehfeldt, "Some Recent Thoughts on Multiphonics," *Clarinet* 4, no. 3 (1977).

to the bass clarinet is vast. While currently there are several resources dedicated to the subject, none successfully addresses the whole spectrum of related issues: nomenclature, notation, implementation, execution, visualization, and practice methodology. The technology available today, and that which is still being developed, is suited to a new resource that encapsulates all current knowledge in an accessible and relevant format. There exists also the possibility to represent current knowledge within a new flexible taxonomy that can be relevant to all genres of music. With accessible information, such techniques need no longer be considered ‘extended.’ Rather, they constitute an accepted and uniform part of the sound world of the bass clarinet.

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