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CHAPTER 1

Introduction, parameters, and guidelines

1.1 Introduction

My first contact with the bass clarinet was in 1964, through jazz legend Eric Dolphy. I was 14 years old when I heard Dolphy, who had just died in a Berlin hospital, on the radio. His bass clarinet improvisations in *Epistrophy* (1964) contained a lot of sonic extravaganza or, in other words, extended techniques. Dolphy used the bass clarinet to its full potential, expanding its ambitus and vocabulary.

Therefore, it seems fair to say that I have been embedded in 'new sounds for woodwind' (the title of Italian composer Bruno Bartolozzi's famous book) ever since I became involved with the bass clarinet. My conservatoire studies with bass clarinet specialist Harry Sparnaay added to my fascination for the sonic potential of the instrument. When I started my own career, there were basically two paths to choose from: try to become an orchestral player, or choose a solo and chamber music career, which for a bass clarinettist automatically meant specialising in contemporary music. Duo Contemporain, the duo I started in 1980, which combined bass clarinet (and saxophone) with tuned percussion instruments (marimba and vibraphone),[1] depended solely on new pieces being written. After 20 years of existence several hundreds of pieces were at the duo's disposal.

Many composers prescribed extended techniques which meant a lot of research had to be done on techniques such as multiphonics, microtonality, and timbral variations. This personal data collection led me to write my book *New Techniques for the Bass Clarinet*, which was published in 1989 by Salabert, Paris. As mentioned, many pieces written for Duo Contemporain contained microtonality, in most cases quartertones. However, it was only when duo Hevans, the ensemble with British tenor saxophonist Eleri Ann Evans, was formed in 2006 that I developed a real fascination for microtonal playing on the bass clarinet. Evans and I share a passion for this extended technique and

[1] Evert le Mair was the percussionist of the ensemble during the first ten years. He was succeeded by Miquel Bernat.

wanted to demonstrate that several forms of microtonality are indeed possible on our single reed closed-key instruments.

A pivotal year for my microtonal research was 2014: I was invited by the Huygens-Fokker Foundation to play a concert at Muziekgebouw aan 't IJ, Amsterdam, in their organ series, together with Evans. This meant that in order to be able to play together with the 31-tone Fokker organ, we had to try to find fingering patterns for this uneven division of the tone, matching our instruments' 31-tone pitches with the organ's.

As a composer I have become more and more interested in microtonal writing and have been able to apply my growing microtonal knowledge as a performer directly to my work as a composer. The juxtaposition of contrasting microtonal systems became a clear artistic goal in my recent compositions. When writing pieces for duo Hevans, another artistic motive was the merging of the two different instruments in the context of small microtonal intervals, such as eighth-tones and 31-tones.

Highly motivated to find out as much as I could regarding the microtonal possibilities of the bass clarinet by adapting fingering patterns, I also wanted to explore another kind of microtonality, one which is 'rooted' in the instrument. The acoustics of the bass clarinet, the way overtones are produced on top of roots according to the natural harmonic series, made me aware of the 'inherent' microtonality of the instrument and the additional microtonal options it offers.

My research covers the aforementioned microtonal areas and will discuss and develop the microtonal challenges and opportunities the bass clarinet has to offer. Focussing on the different aspects of the microtonal realms I wanted to explore, and dividing the general aims of my research into subsections, I formulated the following research questions:

- Which information concerning microtonal possibilities on the bass clarinet is currently available and is this information correct?
- Is it possible to play (more) precise quartertones, eighth-tones, and 31-tones on the bass clarinet, and if possible, which fingering patterns can be established to do so?
- Is it possible to use the root-overtone system in order to expand the microtonal language of the bass clarinet and are there ways to microtonally alter the root-overtone pitches?

The research questions have been applied to a standard, unmodified bass clarinet (that is without any modifications done to the keywork). The material I used for this research comprise a Henri Selmer Paris Privilege bass clarinet (low C model), a Bok-Wiseman carbon-fibre bell, a crystal Pomarico mouthpiece model HB, a Silverstein ligature, and D'Addario Reserve reeds (strength 3.5).

All measurements were done using a Peterson Strobe tuner.

This research is practice-based and undertaken from my intertwined perspectives as a performer, composer, and improviser. It is therefore focussed on the musical and artistic aspects of microtonality. More microtonal possibilities on the bass clarinet will enrich the creative processes of bass clarinettists, composers, and other instrumentalists. The research is aimed at these fellow artists in the first instance, but with the hope that the output of creative products will reach out to audiences which are open to new experiences.

1.2 Parameters of the instrument

The bass clarinet is a single reed instrument belonging to the woodwinds, more particularly to the clarinet family. Clarinet tubes are cylindrical, unlike saxophones, which have a conical bore. Whilst many woodwind instruments, including saxophones, flutes, and oboes, over-blow at the octave, clarinets over-blow at the twelfth.

Bass clarinets come in two versions: one has E♭ as its lowest note, the other the C a minor third below this (both pitch names are transposed in B♭). As much of its core repertoire has been written for an instrument with low C, this research concerns the long bass clarinet, as it is sometimes called.

1.2.1 Transposition and music notation systems

The bass clarinet is a transposing instrument in the key of B♭. This means that the written pitch and the sounding pitch are different.

The transposition of written music for this instrument is either a major ninth or a major second higher than the sounding pitch. The exact transposition depends on the form of notation used, as bass clarinet music can be notated using three different systems.

The most common notational systems are referred to as ‘French notation’ and ‘German notation’. In French notation only the treble clef is used. The transposition in French notation is a major ninth: a note sounds a major ninth below the written pitch. The player simply reads the written pitch, as all the transposition which ensures that the correct pitches and octaves are played, has already been completed in the written score.

In German notation both the bass clef and the treble clef are used. The transposition is a major second, meaning that a note sounds a major second below the written pitch. In this notation system there is a difference between music written in the bass clef and music written in the treble clef. In the bass clef the player simply reads the written pitches, whereas in the treble clef the player is required to transpose notes up one octave.

Figure 1: Téhéricsen (2016) an extract from *Progression Bureaucratique* written in French notation

Figure 2: The same extract (Figure 1) written in German notation

Figure 1 is an extract from *Progression Bureaucratique* (2016) by French composer Fabien Téhéricsen, a composition which uses the French notation system. If this extract were to be written in the treble clef, but using German notation, the result would be Figure 2. This is because the player would automatically transpose the written pitch up one octave. Figures 1 and 2 therefore give the same sonic results although two different notation systems have been used.

Bass clarinet notation became yet more ambiguous with the advent of what is commonly known as Russian notation. This notation system acquired its name because Russian composer Igor Stravinsky used it in *Le Sacre du Printemps*. The Russian notation system combines elements of the two pre-existing notation systems: German and French. In the Russian notation system, music is written in both the bass clef and the treble clef. Despite using both clefs, as does German notation, the player is not required to transpose any notes. The player simply reads the written pitches, as all the transposition needed to ensure that the correct pitches and octaves are played, has already been completed in the written score. It can therefore be said that notes written in the bass clef use German notation and notes written in the treble clef use French notation. This combination of notational systems does however mean that notes written in the bass clef will sound a major second lower than the written pitch, and notes written in the treble clef will sound a major ninth lower than the written pitch, an aspect which can be disconcerting for the player when scores move between the bass and treble clefs. Sparnaay spoke of the French, the German, and the "confusing notation":

> In this notation (half French and half German), the bass clarinet sounds an octave + maj. [major, HB] second lower in the treble clef ("French notation") and in the bass clef only a major second lower ("German notation"). This will cause major confusion particularly when this is not mentioned in the score. (2011, pp.46-47)

The bewilderment caused by the different notation systems is therefore further magnified as composers do not always specify which system they are using. Knowledge of which notation system has been used is absolutely crucial in order to allow players to differentiate between the requirements of German and Russian notation.

One argument for using French notation, and for making it the preferred notation system, is uniformity. Music written for all saxophones and the vast majority of clarinets is only ever notated in the treble clef. The bass and contra-bass clarinets are the exceptions to this rule. As French notation treats the bass clarinet in the same manner as the other single reed instruments, it facilitates reading when players have to swap between different single reed instruments. Instrumental 'doubling' is still a frequent practice, especially in North American recording and film music studios. As American saxophonist Larry Teal remarks, "most saxophone players are expected to play clarinet, and from a commercial angle this is practically a necessity" (1963, p.96). The main reason to be in favour of the French notation, however, is that this notation diminishes the chance that music will be misread or misunderstood, leaving a player without any doubt as to which notes or octaves to play from a written score.

Some composers, such as Dutch composer and composition teacher Joep Straesser, have argued that writing notes in the higher register require too many leger lines when using the French notation system. However, the use of the 8va sign considerably decreases the number of leger lines required, thereby making life easier for both composers and performers. It is common practice to use the 8va sign for any pitches written more than five leger lines above the stave.

So, unless otherwise stated in the text, French notation will be used for the remainder of this work.

1.2.2 The ambitus

Whilst many twentieth century orchestration manuals have recommended not to write higher than F4-A4 (Adler, 1982; Blatter, 1997; Forsyth, 1937; Piston, 1955), the bass clarinet's build allows for an immense richness in overtones. This provides the instrument with a large ambitus of almost five octaves (Figure 3).

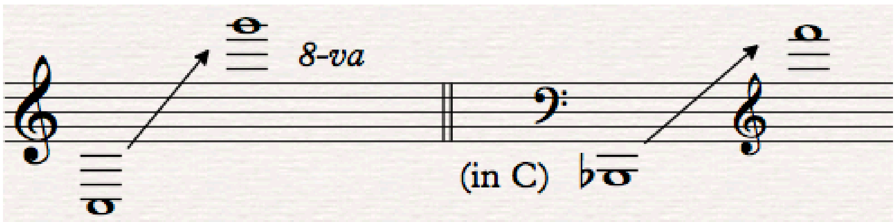

Figure 3: The bass clarinet ambitus in B♭ and in C

The pitch G5, notated in Figure 3, can be considered a reliable guideline for composers as the highest note to be used. From my many years of teaching I have found that the majority of bass clarinet specialists will not encounter considerable problems in playing the pitches up to this point, although ‘speed limits’ may apply: the complicated nature of fingering patterns and sudden changes in lower lip positions restrict the tempo at which sequences can be played. The remainder of the fifth octave, though, is risky and prone to instability. For this reason, the focus of this study has remained within the range C1-G5.

Video 1: The ambitus of the bass clarinet

1.2.3 Build systems: Oehler, Boehm, and ‘Reform’ Boehm

Oehler-system (sometimes called Albert-system) and Boehm-system clarinets are the two main clarinet builds encountered today. “Although Boehm-system clarinets are the most common, clarinettists in Germany and Austria play on Oehler-system clarinets, and there is a considerable difference in the design of the keywork and bore of the two types” (Hoeprich, 2008, p.4). A third system, the ‘Reform’ Boehm-system, which is a combination of the Oehler-system bore and mouthpiece and the Boehm-system keywork is “especially popular today in the Netherlands” (Hoeprich, 2008, p.5). The same three build systems are also found in bass clarinets. Inventor and instrument maker Adolphe Sax contributed largely to the Boehm-system bass clarinet. Both the Oehler-system and the ‘Reform’ Boehm-system bass clarinets are almost exclusively used by orchestral players, and it is quite exceptional to find bass clarinet soloists using these systems, especially in contemporary music.[2]

[2] There are exceptions, of course, such as German (bass) clarinettist Volker Hemken.

Figure 4: The Oehler-system bass clarinet (left) and the Boehm-system bass clarinet (right)

Figure 5: Necks and mouthpieces: Oehler-system bass clarinet (bottom) and Boehm-system bass clarinet (top)

This research will focus on the microtonal possibilities of the Boehm-system bass clarinet. Compared to its Boehm-system counterpart, the Oehler or Albert system, which is commonly known as the ‘German’ bass clarinet, has fewer dynamic possibilities. This is due to its bore being much narrower and its much smaller mouthpiece (about the size of an alto saxophone mouthpiece). The keywork on the ‘German’ bass clarinet also makes extended techniques, including microtonality, harder or even impossible to produce, as there is a less ergonomic placement of the keys used for the lowest third of the range, and there are fewer alternative keys.

1.2.4 Roots and overtones

With an ambitus of almost five octaves, the anatomy of the bass clarinet can be clearly delineated into two sections: that where notes are sounded using the roots or fundamentals, and that where notes are sounded using overtones of these roots.

The lowest octave plus the next minor seventh comprise all the roots of the bass clarinet, C1-B♭2, each played using a different fingering pattern. Although overtones are often associated with high or altissimo registers, the first overtone encountered on the instrument is B2. This pitch is an overtone of the root E1. It sounds a twelfth higher than the root and is overblown with the help of the register key (key number 18). From B2 up all notes are overtones and their fingerings are based upon root fingering patterns. Figure 6 illustrates the overtone series based on E1.

Figure 6: The overtone series of the bass clarinet based on the root E1

Whilst all the notes seen in Figure 6 are overtones of the root E1, they are not necessarily played as an overtone of the root fingering pattern for E1. As Figure 7 shows, the second overtone, G♯3, can also be produced as the first overtone of root C♯2, with the help of the register key, and the third overtone, D4, can be played as the second overtone of root B♭1.[3]

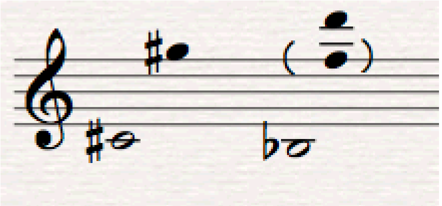

Figure 7: G♯3 based on root C♯2 and D4 based on root B♭1

For most of the notes which are played as overtones it is possible to use a number of different fingering patterns in order to produce the note. These fingering patterns are based upon the different roots which include the required pitch in their overtone series. This phenomenon is especially prevalent for the notes C♯4 and higher. For example, using different roots and overtones could provide up to 17 different fingering patterns to play C♯5 (Bok, 2011, p.11).

Video 2: Basics of the root-overtone system

The root-overtone system of the bass clarinet is of particular interest when studying its microtonal possibilities. As can be heard in Video 2, there are small microtonal pitch differences that occur when using different root fingering patterns for shared overtones. This will be the subject of Chapter 5 'The inherent microtonality of the bass clarinet'.

[3] When speaking about overtones, also in the video, the numbers given refer to the overtones which can be produced on a bass clarinet. For example, "B2, the first overtone we come across on the instrument, based on root E1" is the first overtone which it is possible to sound on the bass clarinet. This is officially called the second overtone, or the third harmonic.

1.2.5 The ‘break’

All clarinets share this feared area, and for many clarinettists going ‘over the break’ poses problems. The passage between B♭2 and B2, the exact place of the transition from roots to overtones, can cause a break in the sound continuum.

American hornist Alfred Blatter writes that “in spite of concern to the contrary, crossing the break B♭ to B is no problem” (1997, p.108). Whilst I believe that Blatter is correct, it is also important to state that the performer has to employ the right technical skills to ensure that moving across the break is not problematic. The player must not only move the fingers, but also change the position of the lower lip by bringing it forward slightly, and accompany this with a contraction of the muscles which control the diaphragm. It is a matter of awareness: players have to realize that they are entering the first overtone zone.[4] This issue is illustrated in Video 3.

Video 3: Technical aspects of going ‘over the break’

1.2.6 The lowest fifth

In the lowest fifth of the instrument, between C1 and G1, the keys are not subject to independent movement. Keys for the lower notes close the pads for any of the other notes between the desired pitch and G1. With the exception of key number 7 (F♯1), all keys close shut (rather than open), and each causes a semi-tonal change (lowering) of the pitch.

In contrast with the rich possibilities for different fingering patterns in the overtone region, the lowest fifth of the instrument is a complicated area, simply because the keywork offers such very limited possibilities for microtonal manipulation. This means that the only options for microtonal playing in this range of the instrument are embouchure manipulation or half-closing keys.

Video 4: The (im)possibilities of the bass clarinet’s lowest fifth

[4] Blatter characterized ‘throat’ tones as “quite pale and almost ‘fuzzy’ in quality” (1997, p.107).

1.3 Guidelines for the performer

1.3.1 The embouchure

A relaxed and flexible embouchure is needed in order to produce a 'rounded' and 'open' sound. This allows more freedom for the reed to vibrate, therefore allowing the overtones present in the note to sound more prominently. This is an important asset for a full sound quality.

A tight embouchure dampens the lower and middle overtones, and stresses the highest particles. This form of embouchure, which was in fashion in the beginning and middle of the twentieth century, especially in Germany and Austria, results in a metallic sound quality. Still, despite this, many sources appear to advocate a tight embouchure by using terms such as "firm", "pushing" (Doyle, 2012-2013, p.60), "pressure", or "compression" (Porter, 1973, p.17), when explaining its necessary qualities.

1.3.1.1 The lower lip: pressure versus position

When writing my book *New Techniques for the Bass Clarinet* in 1989, I followed Bartolozzi's ideas (1982, p.9) and included symbols for various states of embouchure pressure. These were: "relaxed embouchure", "relatively relaxed embouchure", "very relaxed embouchure", "tight embouchure", "relatively tight embouchure", and "very tight embouchure" (Bok, 2011, p.3). I used these symbols in the fingering pattern charts whenever a certain amount of pressure was needed to obtain the desired result.

Many years of performing and teaching have led me to totally change my point of view. I now believe that the lower lip should have very little pressure at all times, but should, instead, take different positions on the reed according to the register or the overtone zone. The most important constituent part of the embouchure is the lower lip, and the movability of the lower lip is crucial for sonority, pitch control, and intonation.

Although, of course, sufficient pressure is required from the lips in order to form the embouchure and to keep it closed and in position when blowing, these are the only, very slight amounts of pressure, which might occur. The main factor in obtaining the desired pitch throughout the whole ambitus of the instrument is controlling lower lip positions.

Notes for which open fingering patterns can be used are good examples to illustrate the notion of lip position.

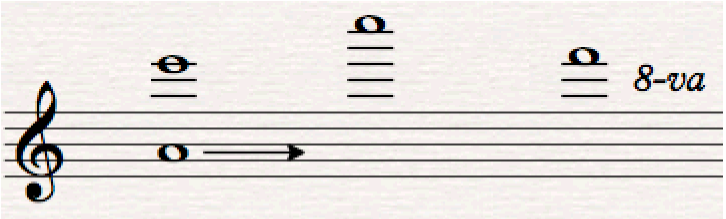

Figure 8: Four different pitches using the fingering pattern for A2

The four notes in Figure 8, A2, E4, C5, and F5, can all be played by moving/re-positioning the lower lip when using the same fingering pattern. Pitch A2 is played using a root fingering pattern, as it falls within the lowest octave plus a minor seventh of the bass clarinet. It is played by opening key 17 with the left hand index finger. The embouchure is in its natural, basic position, referred to here as position 1. The next note in the sequence seen in Figure 8 is the first overtone (or the third harmonic) of A2. In order to play E4, it is necessary to move the lower lip slightly forward (position 2). The same process is followed to generate C5 (position 3), and finally F5 (position 4). The lower lip position changes whilst the fingering pattern remains the same for all four notes.

Video 5: Lower lip positions

Practising the different lower lip positions helps to develop muscle memory, thereby enabling the bass clarinettist to produce any note from the above sequence easily and quickly.

Notes played in the overtone registers often make use of key 18 (the register key), but this is not strictly necessary. As has been demonstrated, overtone production largely depends on the correct position of the lower lip. This means that, with a correct lower lip position, notes in the overtone register can be played without using the register key.

1.3.1.2 Different forms of embouchure manipulation

Despite my belief that it is changes to lower lip position and not to lower lip pressure which allow players to reach different notes of the overtone series, there are occasions when it is necessary to make other changes to the basic embouchure, or to combine a change in lower lip position with another form of embouchure manipulation. These changes enable the player to achieve certain effects or extended techniques.

One of these techniques is vibrato. “Given the fact that vibrato is currently an essential part of sound production for the other woodwinds, it might seem difficult to avoid on the clarinet” (Hoeprich, 2008, p.233). However, despite its use on other instruments in the western music tradition, the clarinet is the only woodwind instrument for which vibrato does not form part of its current playing technique practice. Whilst vibrato is not generally used by clarinet players in German-speaking countries (Hoeprich, 2008, p.169), in Eastern and Southern Europe vibrato is often used as an expressive device. Czech bass clarinettist Josef Horák, for example, took the use of vibrato one step further, and made constant and consistent use of it in his playing.

Vibrato is obtained through embouchure manipulation. By slightly moving the lower lip and lower jaw in a vertical direction, microtonal inflections are created. The speed of the vibrato can be altered, suddenly or gradually; a musical element often encountered in contemporary scores.

In section 1.3.1.1 changes in lower lip position were shown to enable the player to produce different notes from an overtone series based on A2 (Figure 8). Further embouchure manipulation, putting the lower lip in an ‘in between’ position, that is, between position 1 and 2, allows the performer to play a multiphonic, or multiple sound, of the overtones based on a single root fingering pattern. This is called a ‘type 1’ multiphonic.[5]

It is also embouchure manipulation, by moving the lower lip forward or back, going along the different positions or ending up in the middle of two positions, which allows the performer to sound different overtones more prominently whilst continuously playing a multiphonic, and to glide/gliss between the different overtones.

[5] I introduced the term ‘type 1’ multiphonic (and similarly ‘type 2’ multiphonic) in my book *New Techniques for the Bass Clarinet*, but it is now a generally accepted term (for example, see Watts, 2015).

Finally, embouchure manipulation aids in the production of ‘type 2’ multiphonics,[6] multiphonics produced by special fingerings. To generate this type of multiphonic the embouchure is commonly required to relax to a greater extent and to make minuscule changes in lower lip position.

Gliding or glissandi, as demonstrated in Video 6, can also be applied to individual notes (monophonic sounds): the embouchure can be manipulated to lower the pitch of a note. This generates lip glissandi or portamenti. Smorzando is yet another example of embouchure manipulation. A quick and regular embouchure movement will create the smorzando’s characteristic ‘wa-wa’ sound.

This section has highlighted the fact that the embouchure must be manipulated to enable the player to generate many different notes or effects on the instrument. Whilst small lip adjustments allow the player to improve the intonation of any note, embouchure manipulation is of the utmost importance for microtonal playing.

Due to the acoustic design of the bass clarinet, which determines the inherent characteristics of the instrument’s harmonic series, all notes of the overtone series are microtonally varied from equal temperament tuning. It has already been shown that changes in lip position allow the playing of different notes from the overtone series. However, it is also embouchure manipulation which allows notes to be sounded from irregular fingering patterns, as illustrated in Figure 10.

For example, the fingering pattern in Figure 9 is based upon the standard fingering pattern for G3, but by closing RHK3 using the right hand ring finger (Figure 10), the G3 would be raised to a G𝄲3 (31-tone).

[6] See footnote 5.

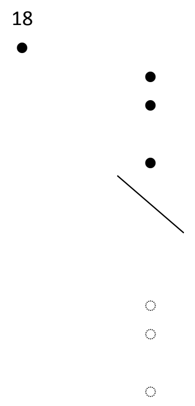

Figure 9: Standard fingering pattern for G3

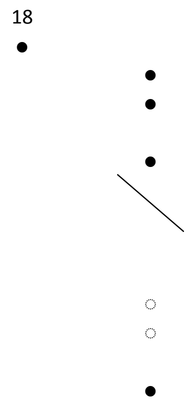

Figure 10: Fingering pattern for G𝄲3 (31-tone)

If the position of the lower lip is not correct, and the basic embouchure is not manipulated in the correct way, the microtonal note will not sound or will squeak (Video 6). Such changes to lower lip position and manipulations of the embouchure can be minute, or extreme, in the case of microtonal work.

The various forms of embouchure manipulation spoken about—vibrato, glissando, portamento, smorzando—can also be applied to microtonal fingering patterns. For example, a glide or gliss can be applied from one (fingered) microtone to the next. In areas where the keywork does not allow for variations to fingering patterns, and in the root register of the instrument, one of the available options for microtonal adjustments is embouchure manipulation (lipping notes down). Such microtonal (mini) glissandi/portamenti work well in this register, including on the lowest note of the instrument, C1, which can be brought down in pitch by relaxing the lower lip.

Although the lack of precision that some of the techniques allow for, means that these options are not valid where strict microtonal practice (such as quartertone or 31-tone divisions) is required, they do allow some forms of microtonality where it is not possible to apply other techniques.

Video 6: Forms of embouchure manipulation

1.3.2 Breathing and blowing

As British brass player and dental surgeon Maurice Porter writes, “trained musicians learn how to control, within certain limits, the degree of pressure and the rate of flow of breath as well as the rate of inspiration and expiration” (1973, p. 71). Whilst it might seem self-evident that ‘wind’ players need maximum control of the air they blow through their instrument in order to make it sound, one of the phenomena I have come across most frequently when teaching, is that performers change their air flow unnecessarily. For example, when they tackle difficult technical passages, they simply ‘forget to blow’. The players are then confronted with dips in the sound and an unstable sonic result.

When playing a wind instrument the air should always be in motion and the air flow should be controlled. As American oboist James Lakin writes, “the quality of the resulting sound depends, in large part, upon the degree of control which he [the wind instrumentalist, HB] is able to exert upon the expiratory mechanism” (2012-2013, p.30). The way in which air is blown through the instrument is an important variable in sound control and sound production. It is the key to a stable and flexible bass clarinet sound.

A lot has been said about the subject of air support, and the role of the diaphragm and the abdominal muscles. In his 1983 interview with music critic Kevin Kelly, American tubist Arnold Jacobs said:

> First of all, the term support raises questions in itself. Many people make the mistake of assuming that muscle contraction is what gives support. The blowing of the breath should be the support, not tension in the muscles of the body, but the movement of air as required by the embouchure or the reed. (1999, p.8)

Whilst Kelly neglects to acknowledge that there must be some movement of the relevant muscles in order to breathe in and blow out, Lakin has stated that “the performer needs to be able to affect the maximum amount of control over the muscles of expiration” (2012-2013, p.31). As a performer and teacher, I have seen that an abdominal movement whereby the sides of the body, just under the ribcage, expand during the intake of breath, supplies the right support for playing the bass clarinet. Contrary to Kelly, I believe that some level of tension in the abdominal muscle is required and provides the control needed for a stable sound production, but this tension is not of the diaphragm muscle itself. As British saxophonist John Harle writes, the diaphragm “has no conscious function in playing. It is a reflex muscle that reacts automatically to the expansion and contraction of your lungs and the movements of your abdominal wall muscle” (2017, p.149). It is fair to say that efficient and effective breathing and blowing profit from a fruitful collaboration between the lungs and the chest muscles. American vocal artist Fred Newman summarises this as follows: “They [the lungs, HB] have no ability to move or inflate themselves, but, as we breathe, they are filled with air by the contraction and relaxation of our chest muscles” (2004, p.2).

To conclude, several medical studies (for instance, Coirault, Chemla, and Lecarpentier, 1999, or Cossette, Monaco, Aliverti, and Macklem, 2008) have looked into the working and the role of the diaphragm muscle in more detail. The latter group of scientists researched breath support during professional flute playing, and at the end of their study tentatively put forward the following definition:

> Flute breath support is a mechanism to avoid the recruitment of expiratory muscles in order to decrease lung volume during playing so that they can best exert fine control over the mouth pressure modulations required for high quality playing without being encumbered

> by other tasks. This is achieved by inspiratory muscle recruitment as demonstrated by their greater electrical activation which keeps the rib cage expanded, lung volumes higher and the expiratory muscles relatively relaxed. (Cossette, Monaco, Aliverti, and Macklem, 2008, p.194)

The manner in which air is inhaled is also of considerable relevance. Observing single reed players, I have noticed that many breathe in through the corners of the mouth. This kind of 'sideways' inhalation has some disadvantages. Firstly, it is noisy, because of the small gaps in the embouchure through which the air must be taken into the body. Due to the same problem, it also takes time to breathe in using this method. The main issue, though, is that due to the noisy and slow intake of air, breathing in using this method can be shallow, that is, not using the full capacity of the lungs. An additional problem is that due to the constant contact between the lower lip and the reed/mouthpiece, it enhances a rigid embouchure.

My preferred method of taking in air is to lower the chin/jaw and breathe in 'downwards', thus allowing a deep and quick breath and each time relaxing the embouchure by disconnecting the lower lip from the reed/mouthpiece combination.

A few other factors lead to good air support on wind instruments. It is important to keep the shoulders down, in their natural position. Raising the shoulders by even just a small amount causes tension in the upper body, making it more difficult to expand the area under the ribcage to the same degree. It is also important to keep both feet on the ground. This ensures a stable base. A lack of balance, caused by 'dancing feet', can inhibit the intake of breath. This is partly because the body is required to use its energy elsewhere: if the player's weight is not centred, muscle tension is required in order to avoid falling over. This constrains the ability to expand the area under the ribcage for inhalation. The entire body of the performer should remain in balance and as relaxed as possible at all times, with the exception of the muscles which supply the air support necessary for a full and stable sound. Respecting and adopting the discussed breathing techniques will enable the bass clarinet player to optimise air management and control.

The 'air column' is the length of vibrating air in the instrument during sound production (Fuks and Fadle, 2002, p. 311). Whilst larger instruments such as the bass clarinet generally require a greater amount of airflow to create pressure waves that travel along the air column toward its end and are then reflected back to the reed, the air requirements also vary from one musical situation to the other. Changes to the amount of air and the manner in which the air is blown into the instrument can be demanded by different dynamic levels. Control of the air speed should be coupled with the right amount of air pressure. For example, in order to play louder dynamics, especially at the higher end (***ff*-*fffff***), not only is more air required, but it should also be blown through the instrument at a faster speed, usually referred to as ‘fast air’.

Whilst scientific studies of the air pressure needed to play different notes have been divided[7] (Fritz, Farner, and Kergomard, 2004; Fuks and Sundberg, 1996; Parncutt and McPherson, 2002) partly due to the complex and difficult to define and measure amalgamation of factors which result in a note sounding from a woodwind instrument, my research has been undertaken from the point of view of a player. Therefore, despite divided scientific opinion, as a player it seems obvious that air must be managed and controlled in order to play in the different registers of the instrument. For example, C1, the lowest note on the bass clarinet, is played with all the (tone) holes closed—this means that there is a greater interaction taking place between the reed and the standing waves in the air column—whereas a note such as G2 requires less air, as no keys are pressed and so fewer tone holes are closed. Perhaps not as evident is that in order to obtain good results in the fourth and fifth octaves of the bass clarinet, the air pressure should be diminished: “La pression de l’air contenu dans la bouche doit être nettement plus faible dans l’aigu et le suraigu que dans le grave” (Marchi, 1994, p.6).[8]

Air speed and air flow can be varied in order to assist performance. Much of this will be done intuitively: for example, when playing crescendo and decrescendo the speed of the air is changed by the performer accordingly in order to achieve the correct change in dynamic level.

A varied air speed can be an important tool to manage differences in dynamics, to aid legato playing, to avoid dips in the sound in the case of large register jumps, and to play accents. Air speed and air flow can also be adapted in order to obtain different effects. For example, if slow air is used to play C1 at a soft dynamic (***p*-*ppppp***) the note can be sustained for quite a long time using a

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[7] There are differing points of view, for example, with regard to the question if the lower register has a higher acoustic pressure than the higher register for a given mouth pressure.

[8] “The air pressure contained in the mouth should be clearly lower in the high and altissimo registers than in the low” (Marchi, 1994, p.6).

single breath. Air control is vital for microtonal playing, in order to aid the often subtle embouchure manipulations.

1.3.3 Articulation

According to American clarinettist Phillip Rehfeldt, “articulation on wind instruments is primarily a concern of attack and release. With the clarinet, as with other wind instruments, this is controlled largely by an action of the tongue” (2003, p.10). Most of the different forms of articulation used on single reed instruments are accomplished by a tongue action.

> The tip of the tongue, at the flat surface, on the top, touches the reed, momentarily damping its vibration, causing the tone to be initiated (and sometimes terminated) in a manner consistent with the stylistic requirements of the passage. The force of the release of the tongue on the reed, coupled with the amount of blowing, determines whether the attack is loud and forceful, soft and legato, or somewhere between. (Rehfeldt, 2003, p.10)

I believe that Rehfeldt’s descriptions of ‘loud and forceful’ and ‘soft and legato’ to describe different types of attack are slightly confusing. As is his combination of two elements of playing: the force of the tongue on the reed and the amount of blowing. Whilst they are necessarily combined in order to play a wind instrument, the two factors must also be considered for their individual effects on the whole playing process.

The term ‘forceful’ can be used to refer to a style of playing, as can the term ‘legato’, although this latter term is the only one of the four which denotes a specific form of articulation. The other two terms he uses, ‘loud’ and ‘soft’, are typically used to express dynamic levels. Because ‘soft’ may also be used to refer to the manner in which the tongue articulates, replacing ‘loud’ with the word ‘hard’ might serve to clarify his remarks, as this can also be used to refer to the manner in which the tongue articulates.

In this way, a ‘legato’ attack may be ‘loud and forceful’, or hard and forceful. It could equally be played as a soft and forceful articulation (where soft indicates the dynamic level), or soft and loud articulation (where loud indicates the dynamic level). Therefore, the following discussion about different forms of articulation will endeavour to separate points about force, style, and dynamic level.

1.3.3.1 Position and part of the tongue

The position of the tongue, and the part of the tongue which touches the reed, both have an influence on the types of articulation which can be played. For instance, if a short, unaccented note is required at a low dynamic level, then it would be illogical to place a large section of the tongue against the reed. Therefore, in the following discussions, the different articulations involving tongue action will be considered, for the part of the tongue they use and the position the tongue forms for the articulation.

1.3.3.2 Staccato

Staccato is a short articulation whereby the tip of the tongue is placed very high up closing off the space between the tip of the reed and the tip of the mouthpiece. The player inhales, puts the tongue in this position, closing off the tiny opening, then opens quickly, allowing air to move through the instrument, and closes off again.

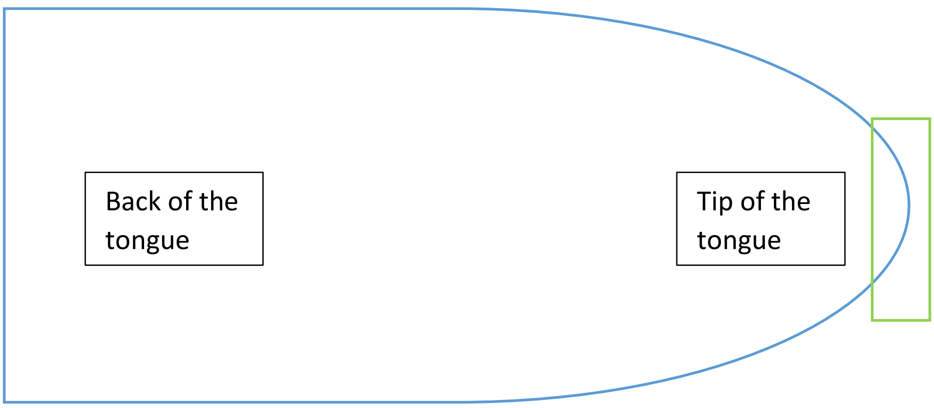

Figure 11: Diagram highlighting (in green) the part of the tongue used for staccato playing

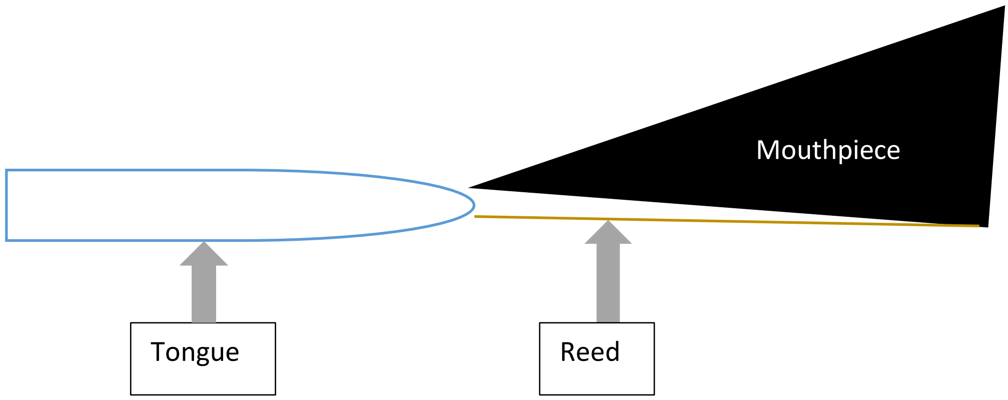

Figure 12: Diagram of the position of the tongue (against the reed) used for staccato articulation

The result is a short ‘tat’ sound. As Rehfeldt writes, “with more rapid, perhaps staccato, passages, the space between the pitches is determined by the amount of time that the tongue remains on the reed at its return for the next attack-called ‘closing off’” (2003, p.10). A series of staccatos would therefore give ‘tat tat tat tat’ as a result. Many performers will play a series of staccatos, but neglect to end the series with a closed position. This leaves the note ‘open’, giving the result ‘tatatata’, which makes the last staccato note sound longer. Since the brain tends to remember most recent events the best, the overall impression of a passage will be less staccato, or it could even be perceived as portato articulation, if the tongue is not replaced on the reed at the end of the last note.

French clarinettist Michel Pellegrino writes that: “playing staccato in the higher register is quite hard on the bass clarinet” (2009, p.9). Indeed the correct technique must be mastered, however, the examples he gives have C4 as their highest pitch. This means that most of the written notes are situated in the third octave, a register of the instrument which should not be problematic for staccato playing.

Figure 13: Pellegrino (2009, p.9), example of playing staccato in the higher register

Bringing Pellegrino's example up one octave, that is, into the fourth octave, would make it more of a challenge for staccato playing, since the tongue action could interfere with the lower lip position needed to sound altissimo notes.[9]

1.3.3.3 Portato and legato

To quote Rehfeldt again: "Wind players are taught to articulate (or 'tongue') all pitches which are not tied or slurred" (2003, p.10). However, at the start of a slurred passage the tongue *is* used to clearly time the sequence and starting a legato passage with 'air only' is not recommended.

The articulation at the start of a legato passage and the execution of portato notes is identical: the tip of the tongue is placed slightly further down on the reed than in the case of staccato.

[9] Video 7 will show the details of the altissimo/staccato combination.

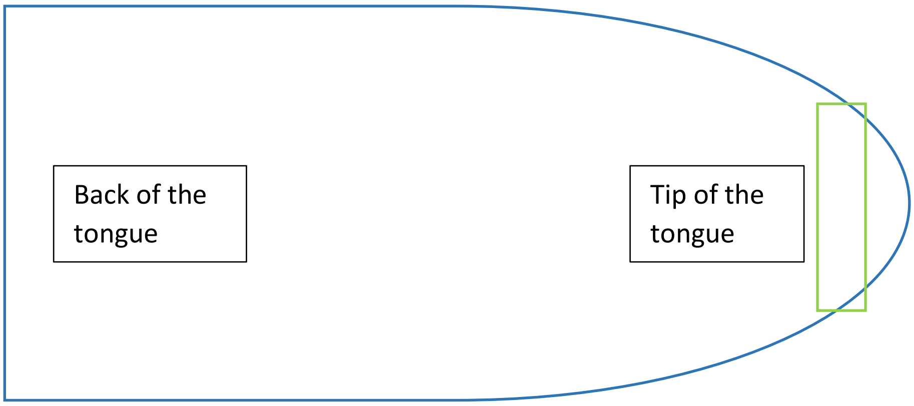

Figure 14: Diagram highlighting (in green) the part of the tongue used for portato and legato playing

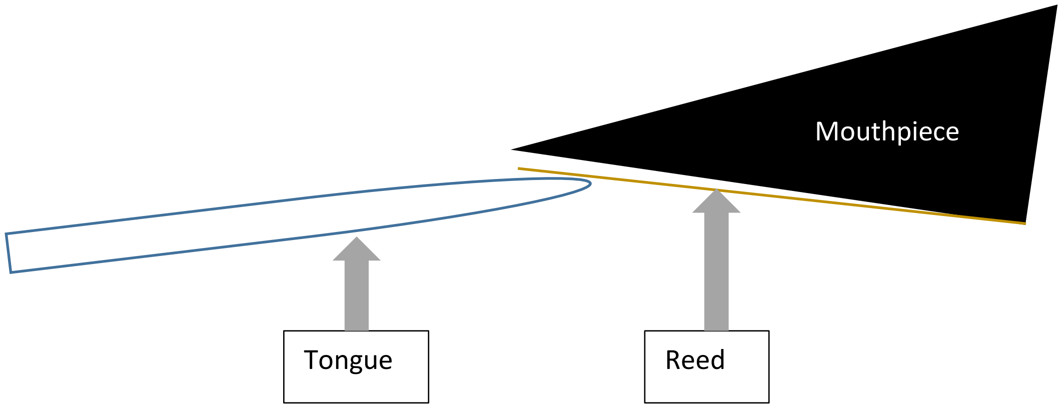

Figure 15: Diagram of the position of the tongue used for portato and legato articulation.

The result is a ‘da’ sound, more mellow than the crisp ‘tat’ sound of the staccato. With a single portato the note is left ‘open’ at the end, that is, not closed off by the tongue, simply stopping the air to stop the note. The same procedure applies to a series of portati. The last note is left open: ‘dadadada’. This is a crucial difference with staccato playing, where every note is closed off by the tongue.

1.3.3.4 Half-tonguing

'Half-tonguing' is a term usually employed to denote a form of articulation used in jazz, for which a greater portion of the tongue comes into contact with the reed. More tongue is used, and the tongue touches the reed midway (half way down the vamp of the reed, hence the terminology), so that a smoother and more relaxed articulation can be achieved. The result is a 'dud' type of sound. It could be characterized as a 'laid back' form of articulation. As opposed to portato playing, the tongue returns to the reed at the end of every note, but this is not done as completely or as precisely as in staccato playing.

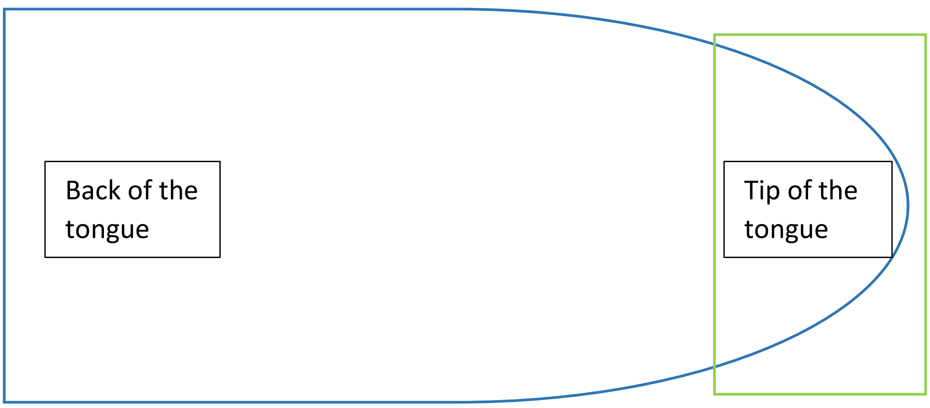

Figure 16: Diagram highlighting (in green) the part of the tongue used for half-tonguing

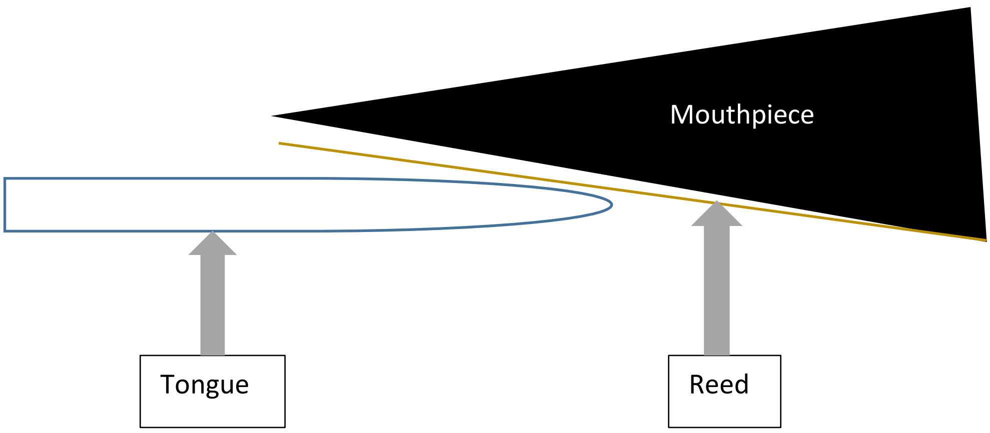

Figure 17: Diagram of the position of the tongue used for half tonguing

1.3.3.5 Slap tonguing

Slap tonguing is the next step in articulation.

> Using the tongue to press the reed against the mouthpiece is the preparation point of playing a slap-tongue….The tongue then pulls the reed away from the mouthpiece and, when the reed and the tongue part contact, the reed moves back towards the mouthpiece. (Evans, 2016, p.72)

Although Evans is a saxophone specialist, the described technique works the same on all single reeds. Even more tongue is used than in the case of half tonguing, and the tongue is pushed flat against the reed. As the tongue starts to move away from the reed, a small 'vacuum' is created. This vacuum causes the reed to move further away from the mouthpiece, together with the tongue. When the contact between the tongue and the reed is broken, a brusque, percussive sound is produced.

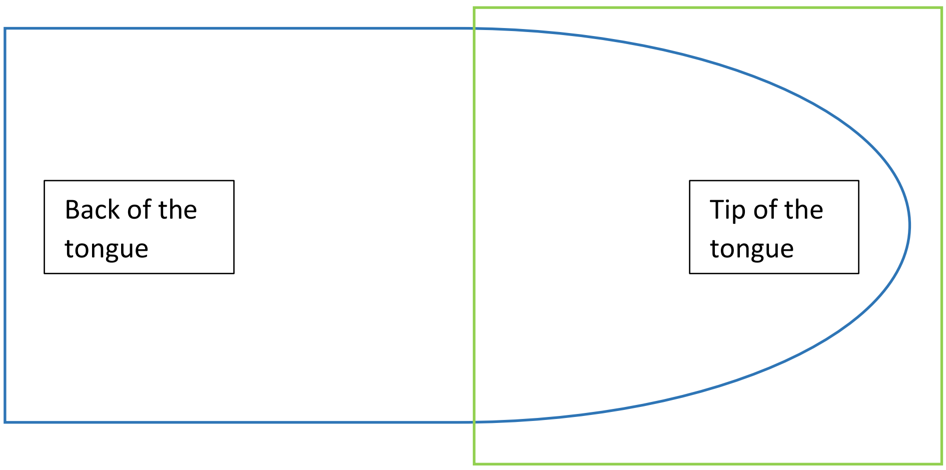

Figure 18: Diagram highlighting (in green) the part of the tongue used for slap-tonguing

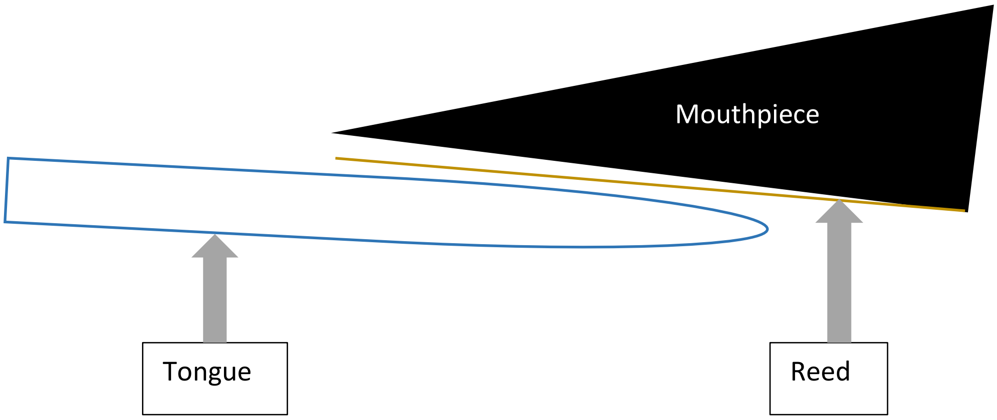

Figure 19: Diagram of the position of the tongue on the reed used for slap-tonguing

Since a tongue action is needed for the production of each individual slap tongue, it is impossible to play a sequence of slap tongues legato, a point which composers should take into account.

Whilst it is very important to realize that slap tongue is a 'dry', percussive effect in which no air is physically blown into the instrument, air can be added immediately after the slap tongue is sounded. The amount of air added to the slap tongue can be varied, so that the result can be more, or less, 'dry' and percussive.

As Evans justly remarks, "as there is no air blown through the saxophone in secco slap-tonguing, the force with which the reed moves away from the tongue is relative to the dynamic level of the sound produced" (2016, p.73).

This technique works well on bass clarinet, particularly in the low and medium registers (Bok, 2011, p.62; Rehfeldt, 2003, p.65)[10], but also functions in its higher regions. Experimenting at the time of writing *New Techniques for the Bass Clarinet*, I discovered that "from the 3rd register on it often occurs that while playing a slap tongue a multiphonic is obtained (1st type) [type 1, HB]. This supplementary 'effect' produces an extremely pleasant sound" (Bok, 2011, p.63).

A special kind of slap tongue has to be mentioned, the so-called 'open slap'. The same, basic slap tongue technique applies, but as soon as the slap sounds, the player opens the mouth, which creates a distorted sound, a barking

[10] Roughly between C1 and C3.

sound. To be more precise: “At the point when the tongue is removed from the reed, the lower jaw is dropped and the mouth opened: due to opening the mouth, this form of articulation can only be played as a short sound” (Evans, 2016, p.74).

<u>1.3.3.6 Air only</u>

‘Air only’ is the exception to the articulation rule: here the tone is started by blowing air into the instrument, either making the reed vibrate or not. In the latter case the result is an aeolian sound with possible pitch variations caused by pressing or releasing keys.

The main disadvantage of using air only in order to make the reed vibrate is a lack of precision: the timing of the resultant pitch is hard to control and often the note ‘speaks’ too late. Therefore, starting a note without the help of the tongue, is a rare phenomenon.

However, playing low notes on the bass clarinet, at very soft dynamics, could benefit from this kind of articulation. There are also occasions when the quasi imperceptible appearance of the sound could add to the musical expression.

<u>1.3.3.7 Articulation and microtonality</u>

All the different forms of articulation that have been discussed here can be applied to microtonal playing, with greater or lesser success. Staccato playing can be difficult, but ‘air only’ can allow the player to sound pitches using microtonal fingering patterns, that would be nigh impossible to play using any form of tongue articulations.

With closed slap tonguing, it can be difficult to sound the desired pitch, which could result, as we have seen above, in a multiphonic, that is, the desired pitch plus overtone(s) sounding simultaneously. Open slap tonguing causes microtonally modified pitches to sound for each fingering pattern used. As Swiss saxophonist Marcus Weiss and Italian composer Giorgio Netti indicate: “Because the embouchure is opened to produce the open slap, the vibrating tube is shortened by approximately the length of the mouthpiece. The sounding pitch does not correspond to the fingered tone but is somewhat higher" (2010, p.143).

Video 7: Different forms of articulation

1.4 Summary and conclusions

The information provided in this chapter is not, at first glance, specific to microtonal playing on the bass clarinet, but the techniques detailed here and in Videos 1-7 are aspects of playing which all require further development and refinement in order to be able to play microtonal music.

An understanding of the root-overtone system and the way the bass clarinet overblows, producing the upper partials which constitute the instrument's harmonic series, is crucial for the creation and production of the inherent microtonality of the bass clarinet, the subject of Chapter 5.

My explanation and demonstration that the lowest fifth of the instrument offers very little in terms of special (unconventional) fingerings lead to a better understanding of the absence of microtonal options in this area (C1 to G1) and its first overtone zone (B2 to D3).

Showing how to manipulate the embouchure, and how to use the correct lower lip positions, paves the way for the right amount of flexibility needed for successful microtonal playing.

Proper breathing, the right air management, and abdominal muscle control are all essential for a good sound and an efficient technique, elements which are truly indispensable with regard to microtonal performance.

Finally, a closer look at all the different forms of articulation enhances the desired microtonal results, which depend on a more refined application of articulation techniques.

The next chapter will look at the history of the bass clarinet and its repertoire, demonstrating the influence that the evolution of the instrument and its keywork has had on the microtonal possibilities of the bass clarinet models currently in use.