

Mapping the sound world of the flute: towards a new classification of standard and extended techniques

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Abstract

In the last decades, some literature has been published about extended techniques, and composers have made them part of the contemporary music language. However, the classification of extended techniques in these writings is often arbitrary, based on the way they have been discovered and used. In this contribution, a new way of classifying flute playing techniques is proposed, with the aim of grouping them according to their role in sound production and to the gestural parameters that are involved for each of them. First, a definition of the concept of extended technique is given. An overview of publications since the 1960s will show the existing classifications; then types of musical gesture according to Cadoz and Wanderley (2000) and a classification of extended techniques based on the musical instrument classification system by Hornbostel and Sachs (1914) will be applied to the flute, with a description of the articulators involved in the flute sound production.

Keywords: contemporary music, flute, extended techniques, classification, gesture

Introduction

In the search for new sounds, flutists and composers started about fifty years ago to explore new ways of playing the flute. These new ways of playing – also named *extended techniques* – have since been well integrated in the sound world of the instrument. In the last decades, some literature has been published containing general explanations of these techniques, and composers have made them part of the contemporary music language.

However, the techniques described in these writings are generally classified in a rather arbitrary way, according to a nomenclature that has been developed through exploration processes and repeated use in musical composition. In this context, it can be difficult to access a complete and detailed portrait of the actual existing techniques. In this paper, we will propose a new way of classifying flute playing techniques based on types of musical gestures as described by Cadoz and Wanderley (2000) and on the musical instrument classification system by Hornbostel and Sachs (1914).

First, an overview of existing publications about extended techniques since the 1960s will be given, listing the principal categories of flute extended techniques established by their authors. Then, three categories of extended techniques will be given, according to the type of musical gesture: excitation, selection and

modification. For excitation gestures, an application of the musical instrument classification system by Hornbostel and Sachs (1914) is proposed. Finally, for a better understanding of the selection and modification gestures, the articulators involved in the sound production gesture will be listed with a description of their role.

Methods

The standard way of playing the flute consists of using the instrument as an edge-blown aerophone (by blowing against the edge of the embouchure hole in order to produce an oscillation of the air flow). The flutist also usually chooses fingerings that correspond to pitches on the tempered scale and tries to keep the best possible homogeneity in tone, in all registers and dynamics.

An extended technique could be defined as a way of playing a musical instrument that goes beyond or that is not part of the standard instrumental technique. For instance, in the case of flute playing, an extended technique can be an alternative way of producing a sound vibration with the instrument, the use of uncommon articulations and/or alternative fingerings, a technique that breaks the tone homogeneity of the instrument, or a way of playing that results in pitches that are not part of the equal temperament.

Overview of existing literature

The publication of articles and books about extended techniques began nearly fifty years ago, with John C. Heiss and his article “*For the Flute: A List of Double-Stops, Triple-Stops, Quadruple-Stops, and Shakes*” (Heiss, 1966). As the title says, this article investigates *multiple sound* techniques (which will be called multiphonics later). This exploration is also the main subject of Bruno Bartolozzi’s book *New Sounds for Woodwinds* (Bartolozzi, 1967) and Heiss’s second article, “*Some Multiple-Sonorities for Flute, Oboe, Clarinet, and Bassoon*” (Heiss, 1968).

In the 1970s, authors begin to be more exhaustive in their writings and to explore other kinds of playing techniques. John C. Heiss, in a third article named “*The Flute: New Sounds*” (Heiss, 1972), explores various ways of producing new sounds on the instrument: key slaps, trumpet sounds, low harmonics, whistle tones, noise elements in the sounds, and so on. Authors Lawrence Singer, Harvey Sollberger, Sheridan Stokes and Richard Condon are also known for having written about extended techniques for flute and woodwinds (Toff, 1986, p. 213-223).

Thomas Howell’s book *The Avant-Garde Flute* “is intended as a source of information which would help flutists and composers make what seems [to the author] a necessary connection between composition and performance” (Howell, 1974, p. V) and give the reader very detailed information about flute acoustics and various sound effects on the instrument. Howell seems to emphasize timbre changes in flute sound and describes techniques such as alternate fingerings, pitch bend, whistle tones, colored noise, blowing like brass and singing with the flute. In Germany, Martin Gümbel publishes in the same year *Neue Spieltechniken in der Querflöten-Musik nach 1950* (Gümbel, 1974), in which he presents extended techniques more as musical gestures than as sound effects.

One year after, Robert Dick writes the first edition of his well-known book *The Other Flute*, which has become a reference for most contemporary flutists and composers. According to the second edition (published in 1987), there are three kinds of extended techniques: single sounds and tone coloration, multiphonics, and other resources, such as fluttertongu-

ing, jet whistles and percussive sounds (Dick, 1987).

In the 1990s, flutist and conductor Pierre-André Valade adopts a new approach by describing extended techniques used in solo flute works by 15 composers; there are two main categories: percussive modes (*modes percussifs*) and sound processing (*traitement du son*) (Valade, 1990). Pierre-Yves Artaud and Gérard Geay’s treatise *Flûtes au présent* presents new playing techniques as an extension of standard flute technique: he focuses on alterations of timbre and pitch, lists other kinds of sound (*autres sonorités*) and gives a detailed fingering chart for multiphonics and *glissandi* (Artaud and Geay, 1995).

More recent publications include a book by Carin Levine and Christina Mitropoulos-Bott – *The Techniques of Flute Playing* (Levine and Mitropoulos-Bott, 2002) – and informational websites by flutists who are specialized in contemporary music: for instance, Matthias Ziegler (2016), Helen Bledsoe (2016) and Rogier de Pijper (2016). Since extended techniques have become standard in the repertoire, the aim here is to give performers and composers pedagogical tools and clear explanations on the realization of each technique. Hence the categorization is more based on aspects of instrumental technique than on the resulting sound. In this regard, websites allow authors to use demonstration videos in order to reinforce their explanations.

Types of musical gestures and techniques

According to Cadoz and Wanderley, there are three types of instrumental gestures. The *excitation gesture* “is the one that provides the energy that will eventually be present in the perceived phenomena”. The *modification gesture* “is related to the modification of the instrument’s properties” and “affects the relation between the excitation gesture and the sound”. Then, the *selection gesture* “consists of a choice among multiple similar elements in an instrument” (Cadoz and Wanderley, 2000, pp. 79-80).

These categories have been applied to the flute by Cléo Palacio-Quintin (2012), who explains that some gestures, such as the choice of a specific fingering, can be considered either as a selection gesture (from the flutist’s point of view, who actually chooses the fingering) or as a modification gesture (according to acous-

tics, because two different fingerings will modify the length and structure of the resonating tube). Considering this, we will follow the instrumentalist's point of view and techniques will be taken as selection gestures if they imply a choice *before* sound production begins, and as modification gestures if they are used in order to modify already existing sound parameters.

Starting from these three categories, we will define three types of extended techniques. The first type corresponds to the excitation gesture and thus concerns extended techniques that are related to the sound production mode, which consists of two aspects: the vibrator and the resonator. In other words, it is the way of producing the oscillation that brings the necessary mechanical energy for a sound production, and the kind of resonance that results from activating the air column contained in the pipe (Guillaume, 2006, p. 55). Tongue rams, trumpet sounds and key clicks are possible examples of this first category of extended techniques.

Techniques of the second type take place independently of the sound production mode and can be related to a selection gesture. They are ways of modifying sound parameters that the flutist chooses before the sound production begins. Since modifying duration and intensity of sounds is already a part of the standard instrumental technique, extended techniques of this type will usually have an influence either on pitch, on timbre, or on both of them. For instance, the use of alternative fingerings or timbres belongs to this category.

The third type corresponds to the modification gesture and consists of sound modulations and periodical or aperiodical alterations of a continuous sound. This can be an alteration of pitch, intensity and/or duration, and techniques belonging to this category distinguish themselves from those of the second category by happening during the sound phenomena and by having a constant or repetitive character. A good example would be vibrato, in all its possible variations.

Several instruments in one single flute

While playing, the structure of the instrument itself undergoes very few changes: this happens only if the flutist decides to tune his or her instrument differently (a kind of *scordatura*) or if he or she plays with separate

parts of the instrument. But there are several ways of producing a sound vibration on the flute, which corresponds to distinct – often extended – playing techniques. In this regard, the flute can be considered as a multiple instrument, and a special application of the musical instrument classification system by Hornbostel and Sachs (1914) can be an interesting tool to get a portrait of most ways of bringing the instrument into vibration.

As mentioned, techniques that are related to the sound production mode correspond to an excitation gesture. This gesture can be either continuous or instantaneous (Cadoz and Wanderley, 2000, p. 80); both are possible on the flute. Continuous gestures correspond to most cases where the flute is used as an aerophone (when an airstream brings the instrument into resonance); instantaneous gestures usually correspond to the cases where the instrument is used as an idiophone (when the sounds result from a stimulation of the material itself, with its stiffness and elasticity) (Hornbostel and Sachs, 1914, p. 9-18) or as a resonator.

Articulators involved in sound production

For a classification of selection and modification gestures, the concept of *articulator* is used here as an extension of a common notion in phonetics. According to the Collins Dictionary¹, an articulator is “any vocal organ that takes part in the production of a speech sound”. In our case, this idea is transferred to the flute; the articulators are all parts of the body whose gestures are determinant in flute sound production and modulation.

As for the voice, most ways of producing a sound on the flute require an airstream, which comes from the lungs, and is controlled through a common action of thorax, abdomen and diaphragm muscles. This airstream passes through the larynx and the mouth, and the degree of tension and the position of vocal articulators (vocal folds, tongue, soft palate, lower jaw) have a direct influence on the sound quality. Then, the airflow is controlled by the lips, which can be considered separately in the context of flute playing, as they are responsible of embouchure control (speed, angle and width of the airflow). Finally, gestures

¹ Collins dictionary online, Articulator. Found at URL < <http://www.collinsdictionary.com/dictionary/english/articulator> >, on May 8th, 2016.

from the hands and fingers are directly related to important aspects of sound production, such as the position and the angle of the instrument on the chin, and, of course, the fingerings used.

Results

Classification of excitation gestures

If the flute is mainly used as an aerophone, there are several ways of bringing the instrument into resonance, which can be associated to different kinds of musical instruments. The following classification of excitation gestures is based on categories and subcategories of musical instruments as defined by Hornbostel and Sachs (1914) in their classification system. All numbers in brackets correspond to the Dewey Decimal Classification used by the two authors.

Continuous excitation gestures

When used as an aerophone (4), the flute is mostly a wind instrument and a non-free aerophone (42), which means that the vibrating air is contained within the instrument. In this case, there are two possible subcategories: the flute as an edge-blown aerophone (an actual flute) without duct (421), or the flute as a trumpet (423).

For most standard techniques, as for normal tone, multiphonics, aeolian sounds and whistle tones, the instrument, an actual transverse flute, can be defined as a single open side-blown flute with fingerholes (421.121.12). In some cases, for instance when the instrument is played without the headjoint, the flute becomes an open single end-blown flute with fingerholes (421.111.12). Then, the flutist can also set the air in motion with his or her vibrating lips. In this other special case (usually called “trumpet sounds” or “trombone sounds” by authors and composers), the instrument becomes a side-blown tubular trumpet (423.122), that can also be related to the keyed trumpets subcategory (423.21).

Finally, there are special cases where the flute belongs to other subcategories, or even none of them. Consequently, the technique consisting of setting the air in motion with a vibration of the tongue in the embouchure role could be a special case of the side-blown trumpet. Jet whistles, which consist of blowing directly in the embouchure hole, also belong to

the aerophone family, but are rather difficult to classify. In this case, we could mention the unclassified aerophones (43)² category.

Instantaneous excitation gestures

In the case of tongue rams (which consist of blowing directly into the embouchure hole and then obstruct the hole with the tongue), the flute becomes a plosive aerophone (413), which playing mode corresponds to an instantaneous excitation gesture: the sound is caused by a single compression and release of air.

Other instantaneous excitation gestures lead to define the flute as a struck idiophone (11). For instance, when used with key slaps, the flute becomes an individual percussion tube (111.231), and part of the percussion idiophones subcategory (111.2).

The flute as a resonator

When techniques such as *pizzicati*, tongue rams without obturation of the tongue or articulations without blowing are used, the excitation gesture takes place outside of the instrument. In those cases, the flute is used as a resonator that amplifies the excitation gesture.

Classification of selection gestures

As mentioned, selection gestures are those where the musician has to choose between several similar elements and will be related to choices made before the sound production begins. With extended techniques, these choices are related to parameters such as pitch and timbre, which are often interdependent. There are two ways of playing on those parameters: by choosing a special fingering, and by choosing a specific embouchure.

Alternative fingering can be chosen to play natural harmonics or get specific spectral qualities (which result in an unusually bright or muted tone, for instance) or to play according to an extratonal or microtonal scale. Embouchure position includes control of parameters such as the angle of the airstream, the degree of covering of the embouchure, and the lip

² Mentioned only in the Wikipedia article on Hornbostel and Sachs's classification system, not in the original article. See Wikipedia, *Hornbostel-Sachs*, at URL < https://en.wikipedia.org/wiki/Hornbostel%E2%80%93Sachs#Struck_idiophones_.2811.29 > on May 8th, 2016.

aperture. All of those will have an influence on pitch and timbre.

Then, when the flute is played as an edge-blown aerophone, the choice of a specific fingering and/or a specific embouchure position will determine if the flutist plays a normal tone, a multiphonic, an aeolian sound or a whistle tone.

Classification of modification gesture

Fingerings and embouchure position can also be changed while playing. In this case, they become parametrical modification gestures, such as when playing glissandi or pitch bends. But most modification gestures will induce a modulation or an alteration—periodical or aperiodical— of the sound. This includes a simultaneous use of the voice and all kinds of modulations.

The usual vibrato, which is similar to the one we hear in the singing voice, is a result of a coordinated action of the diaphragm, the thorax and the abdomen muscles and happens in the glottis cavity (Gärtner, 1981, p. 59). It can be exaggerated and modulated through a control of the diaphragm and the abdominal muscles, or through an exaggeration of the larynx contractions. *Smorzato* is another kind of modulation that can be related to vibrato. It happens through a common action of the lips and the inferior jaw. Pitch, intensity and timbre are modulated through a modification of lip aperture.

The tongue can also induce a modulation in sound quality, by oscillating in the mouth, and while playing with *fluttersong*. Finally, a fingering change during sound production, such as when playing with *bisbigliando*, will also be considered as a modification gesture.

Discussion

A classification of extended and standard playing techniques on the flute based on the type of musical gesture and on the different ways of playing the flute as an instrument is useful to get a better understanding of factors influencing sound production and sound quality. The relationship between playing techniques and their acoustics and the resulting sound becomes also clearer.

But there are some limitations that come with this classification. First, a flute played with some extended techniques will become a

new musical instrument that is hard to describe and classify with the system defined by Hornbostel and Sachs. A good example of this is the jet whistle technique: there is probably no musical instrument that has been invented to be played with this very technique.

Then, the distinction between selection and modification gestures is not always clear, depending on the point of view. We could argue that gestures must be considered from a more holistic point of view. Some gestures associated with specific techniques seem include all kind of gestures: excitation, selection and modification. Also, articulators that modify sound parameters are often used in a common action and cannot always be considered as separate factors of change in sound quality.

Conclusion

Despite its imperfections, this classification based on existing systems such as the musical instrument classification system by Hornbostel and Sachs (1914) and the definition of musical gestures by Cadoz and Wanderley (2000) can find several applications. For instance, it could be used in instrumental pedagogy when teaching extended techniques, in acoustics for a modeling of extended techniques or in studies concerning musical notation in contemporary music.

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