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Quarter-tones, Glissandi and their Benefits in Flute Embouchure and Tuning

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Abstract: *For the elaboration of this article, different compositions and exercises employing quarter tones and glissandi have been selected and applied to effectively resolve various problems in sound production in contemporary, as well as classical music. The objective was to prove that there was a better control of the changes between the flute registers after the application of quarter tones and glissandi. Beyond that, greater control of the tuning and development of the ability to react quickly in the process of correction during a concert was observed with this pedagogical approach. The research has been conducted systematically with the aim to deepen the theoretical knowledge and practical skills of the students, learn contemporary flute techniques and add them to their daily studies.*

Keywords: *flute pedagogy, contemporary music, quarter tones, glissandi*

1. Introduction

The ability to interpret contemporary music has nowadays become increasingly indispensable and is part of the qualification of a professional musician. This requires a more comprehensive knowledge from an instrumentalist, broader technical requirements and very special care with the character and timbre of the sound produced. Consequently, in the case of the flute, it requires special care with the position of the embouchure in the realisation of rapid changes in dynamics, changes between extreme registers and changes in the timbre of the sound. These technical and dynamic requirements demand an extraordinary flexibility of the embouchure and of all the parts of the human body which collaborate in sound production. The regular and careful use of glissando quarter tones is one of the methods which contributes to achieving the desired flexibility. We focused on the contextualisation of these techniques, providing a description of the sound production, as well as its pedagogical application, demonstrating the possible results of this process.

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2. Objectives

Frantisek Malotín (2000, 53) says that "the fundamental thing in creating a correct embouchure is relaxation, naturalness and the release of all the psychological blocks which act on the body. Only after actual relaxation has been achieved can action be taken." Consequently, the objective was to carry out the process of applying quarter tones and glissandi in a pedagogical context and to achieve greater relaxation and flexibility of the embouchure, usable not only in the execution of contemporary repertoires, but others as well.

In this sense, we specifically sought to contemplate the changes between flute registers, tuning control and the ability to quickly correct them during a concert. The psychological and physical pressures, the environment, temperature and possibly the tuning of the piano or other instruments, create challenges for flutists in the context of public performances. The student must learn to master several tools to know how to react in these situations.

3. Methodology

In addition to documentary research, the methodology is based on direct observation, analysing how the two selected techniques were applied from a pedagogical point of view, as well as the result of the approach. During the application of the techniques, they also memorise the psychomotor processes. These are responsible for all the movements which express a human being's psychological activity and actively collaborate in psychological processes. Psychomotor processes influence the use of techniques, namely in learning different forms of the embouchure, which stimulate the creation and establishment of new habits. In turn, these habits are capable of being retroactively reflected in the creation of classical sound in a remarkably positive way. The following three phases are defined for the development of the embouchure and its new habits:

1. In the first phase, a set of conditions and capabilities will enable the performance of various functions of the movement (lip shapes and configuration of the muscles which work to create the embouchure - genetically inherited physical conditions). These are formed by habits learned and fixed during study to create the classic sound.
2. In the second phase, new skills are developed through experiments with contemporary techniques. The flutist can better control and master all the microscopic movements important for the execution of new sounds and know

how to repeat and imagine them before executing them (imagine the position of the desired embouchure and adopt it immediately depending on the final sound wanted).

3. In the third phase, the set of new embouchure habits become a rich source in the creation of a variety of timbres, whose choice is directed and guided by the performer's imagination and enables an effective, immediate, intuitive application of the sound the student wants to give the musical material – the score.

4. State of the Art

After the book, *New Sounds for Woodwinds* by Bruno Bartolozzi (1967), was published, dedicated to expanded techniques and which included all woodwind instruments, the reference book, *Present Day Flutes* by Pierre-Yves Artaud appeared in 1980, which was dedicated solely to flutes. This publication contains complete tables and diagrams for different effects (multiphonics, glissandi, various types of vibrato, etc.) and a compilation of the symbols used up to that point, with the main purpose of interpreting contemporary music as authentically as possible. This publication would become one of the most important technical references to this day, both for its theoretical and technical content, as well as for the examples presented of various works which constituted the repertoire to which the techniques were applied. Carin Levine, in her book, *The Techniques of Flute Playing* (Levine 2002), continues Artaud's work, expanding it and adding examples of more recent works and other techniques found in works especially dedicated to the author. The systematic works presented by these authors focus essentially on methodologies and the application of expanded techniques in contemporary music. For example, P. Y. Artaud systematically explains all the new techniques and proposes ways of interpreting the new music. Carin Levine follows some of the paths proposed by Artaud. Mathuz, to whom this project is closest, uses new execution techniques to interpret historical works. His six studies for flute (Akkord) often quote small excerpts from works from earlier periods. The relationship between the embouchure and technical flexibility has been one of the subjects most explored by the American, Robert Dick. In his book, *About Tone Development Through Extended Techniques* (Dick 1987), he presents, among others, practical exercises for performing multiphonics and other techniques which can help to better relax the embouchure and throat. He went on to contribute more to the development of the flute embouchure through new techniques. Ine Vanoeveren, in her book, *The immediate and long term effects of practicing extended flute*

techniques on the overall performance qualities in standard flute repertoire (Vanoeveren 2020) consideres: “Making glissandi with the lips improves the flexibility of the embouchure. This will help to play pianissimo and fortissimo notes in tune.” The goal of our contribution to this theme is, since the beginning of our investigation in 2011[2], to systematise these processes of developing the sound of the expanded techniques, to facilitate their application in a pedagogical context and in the interpretation of the concrete classical flute repertoire.

5. Historical context

The use of quarter tones in the modern flute is linked to the musical movement of the 20th century which was inspired by non-European musical cultures based on semitones, such as the music of Indonesia and India, and by appropriating from these, it was reflected on classical instrumental music. Some pioneer composers are Alois Hába, Giacinto Scelsi, La Monte Young and Krzysztof Penderecki, among others. This movement developed fully in the 1970s. However, already in the 16th century, the Italian composer, Nicola Vicentino, built an instrument with thirty-six keys for the octave. References to quarter tones can also be found in the 17th century, mentioned by Marin Mersenne in the book, *Harmonie Universelle*. These were special notes used to enrich tonal melodies. In the 1980s, the Dutch construction company, Eva Kingma, explored a mechanism on a flute which made it possible to play quarter tones. This would eventually be explored by great interpreters, such as Robert Dick, Anne La Berge and Mathias Ziegler. This innovation came to be built into all types of flutes, from the C flute to the bass flute. However, it ended up not being more extensively used by a wider community of performers, despite some composers having already contributed to the repertoire of this new flute.

The glissando technique first appeared on keyboard and string instruments. However, its practice also became common in voice, electric guitar and wind instruments. However, on the flute, it is not possible to play a glissando similar to the clarinet glissando in George Gershwin's piece, “Rhapsody in Blue”, even using a head built by Robert Dick, "the glissando headjoint", which enables the production of a longer glissando. The execution of glissando with the traditional embouchure of a modern flute is limited to the extension of a minor third. The key glissando, which is longer and requires special fingerings, is not as continuous as the ones associated with the instruments mentioned above.

[2] Monika Streitová: *A influência das técnicas contemporâneas na sonoridade da flauta (2011)*

6. Quarter tone symbols

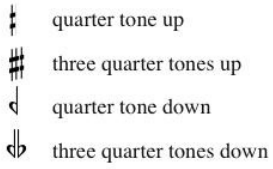


Fig. 1. *Quarter tone symbols. Preface of Luminiscence for flute by P. Bachratá*

6. 1. Execution of quarter tones

There are two possible ways of playing quarter tones. One with the embouchure and the other with special fingerings which can be found in the expanded techniques manuals. In this article, which focuses on the embouchure and its development, we focus only on the application of quarter tones performed through the different embouchure positions. As is known, quarter tones created in this way are usually used in slower passages. In faster passages, it is necessary to learn the alternate fingerings, as rapid changes of embouchure positions are unusable. Pierre Yves Artaud, in his book, *Present Day Flutes*, established four embouchure positions in the execution of natural sound from "very closed to very open" (Artaud, 1986, p. 9). In playing quarter tones through different embouchure positions, the flute student can learn to fix all these positions and produce a better-quality sound, despite these providing different conditions for the direction of the air column against the mouthpiece edge.

6. 2. Quarter tone application

Modes of application of quarter tones

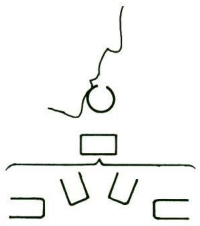


Fig. 2. *Four embouchure positions. Image from the book, Present Day Flutes, by Pierre Yves Artaud*

In a group of 1st and 2nd year university students of Transverse Flute, we applied the learning of quarter tones through excerpts of pieces, where there were slow passages and passages which did not require special fingerings. The study pieces were namely compositions for solo flute: "*Palimpsestos"* by Álvaro Salazar, "*Hudba k vernisázi"* by Ivan Parík and "*Luminiscencia"* by Petra Bachratá.

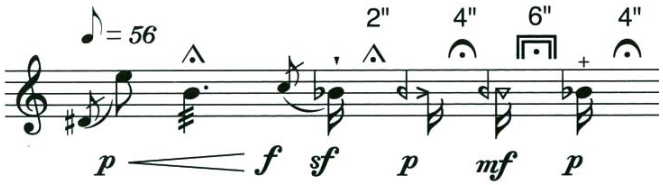


Fig. 3. *Excerpt from the piece, "Palimpsests" by Álvaro Salazar - the pauses of two and four seconds allow the proper preparation of the embouchure to produce quarter tones.*

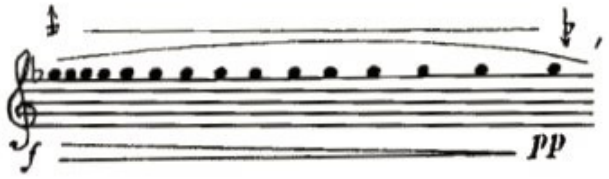


Fig. 4. *Excerpt from the piece, "Hudba k vernisázi" by Ivan Parík - repetition of aextreme high point of playing glissando to the extreme low point of playing. glissando.*

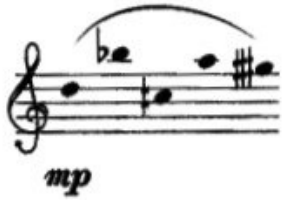


Fig. 5. *Excerpt from the piece, "Luminiscencia" by Petra Bachratá - production of the quarter tones in the sequence of distant intervals in legato and a fluent form*

After careful learning of these excerpts, some excerpts from classical flute repertoire pieces were also used, such as the Concerto in D and G major by Mozart and the Sonatas by J. S. Bach. The students experimented with playing the flute whilst it was turned inwards or outwards in order to maintain a stable sound quality, despite changing the angle of the exhaled air flow. The aim was to be able to react with agility to possible changes and to correct the tuning during a concert.

After measurements, several researchers have verified numerous interval oscillations during a public presentation, such as shortening the intervals of half tones and widening the others, in the ascending and descending sequences (Henriques 2007). “Tuning is extremely flexible and corresponds to an adjustment made at each moment on each note. .... The type of tuning used on non-fixed tuned instruments during a musical performance depends on several factors related to the musical context. The tuning is highly dependent on whether the instrument is played solo or not, and specifically, whether it is accompanied by the piano.” (Henriques 2007). For the musician to have the ability to immediately correct the tuning at certain times without having to resort to adjusting the flute head, they need to invest time in developing the flexibility of the embouchure.

6. 3. Benefits of using quarter tones

As already mentioned, by learning to create quality sound, despite the changes in direction of the exhaled air against the edge of the flute, students also gain a new sensitivity in the embouchure, as well as develop hearing and tuning sensitivity. “The tuning of wind instruments is closely linked with the embouchure technique, which offers the performer a broad area to compensate for the imperfections in the instrument's tuning.” (Syrovy 2008). As a harmonic instrument, the flute has, in general, some more sensitive notes, such as Do 5 and Re 6, among others, which require special attention. In addition, each instrument brand has different characteristics. Syrovy presents us with the tuning curve obtained through the measurement carried out on the Yamaha flute.

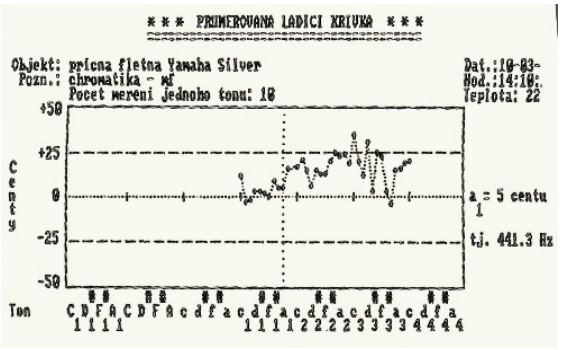


Fig. 6. *The transverse flute tuning curve. Syrovy, Václav, Hudební akustika*

P. Y. Artaud in his book, *Flutes au presente,* states that: "We have incessantly come up against difficult problems concerning the perception of the relative value of intervals. Where exactly is the border line between a wide major sixth and a narrow minor seventh? As often as not, it is the musical context which permits us to the case of a catalogue, our perception is tributary of many physiological and technical factors" (Artaud 1986, 7). In the pedagogical application, our sole purpose was not only achieving perfection in the execution of quarter tones, but also taking advantage of new experiences to develop the interpretation of contemporary, as well as classical repertoires. Throughout the pedagogical application, the following benefits were confirmed in the application of learning quarter tones, in addition to the ability to improve performance within the contemporary repertoire:

Technical result	Application in non-contemporary flute repertoire
Ability to create various embouchure positions.	Development of lip flexibility.
Better perception of the sound result and significant tuning changes when performing various embouchure positions.	Ability to improve tuning within the context of a classical repertoire.
Maintenance of sound quality, despite changes in embouchure position.	Ability to quickly react to pitch changes during a concert, caused by room temperature or instrument heating.
Greater control of the direction of the air column.	Ability to create the most stable sound with dynamic differences.

Table 1. *Benefits of the application of quarter tones*

7. Glissando symbols

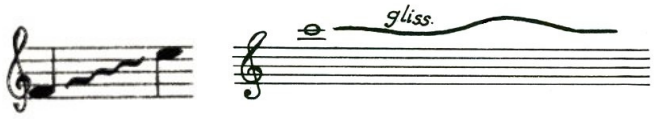


Fig. 7. *Two types of glissando - glissando whose execution requires special fingerings and glissando whose execution requires turning the flute inwards or outwards.*

7. 1. Execution of glissandi

According to Grove Music Online (Grove, 2001), glissando is a term generally used to describe a passage played quickly with a gliding motion. Playing glissandi on the flute, like quarter tones, occurs in two different ways. One with the embouchure and the other with special fingerings. Here, too, we focused on the application of the use of glissandi through different embouchure positions which Robert Dick calls "bending" in his book, *Tone Development Through Extended Techniques* (Dick, 1987, p. 25).

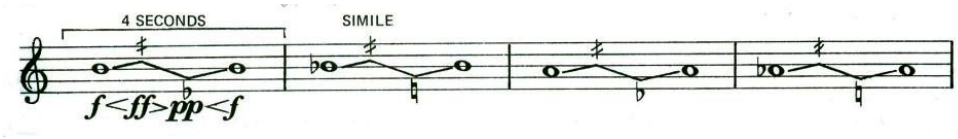


Fig. 8. *Exercise with the "bending" technique. Image from the book, Tone Development Through Extended Techniques by Robert Dick.*

This glissando mode does not allow a glissando of great length, as in the case of the clarinet. However, we had the opportunity to prove that this significantly benefits embouchure flexibility. The glissando is performed by turning the flute inwards or outwards. In this process, it is very important to control the quality of the sound produced, as changes in the angle of the air column direction make sound production difficult. The sound produced by the extreme positions "the timbre changes first a color somewhat resembling that of wooden flutes, then to a very dark, even smothered quality." (Ibid)

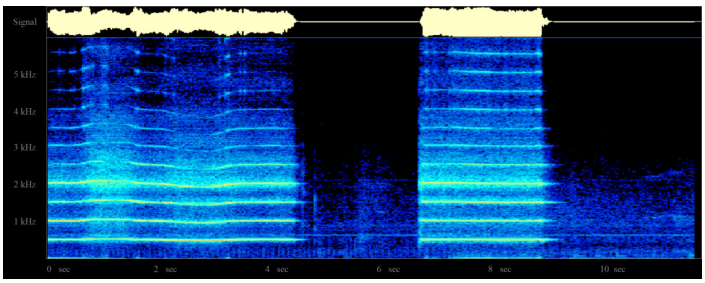


Fig. 9. *First bar of Robert Dick's exercise*

The spectrogram by Richard Horne demonstrates the sound changes in the ascending and descending glissando (at the 1st and 3rd second). At the extreme points of ascent and descent, there is a blurred sound. The attack and the quality of the natural sound produced immediately afterwards reveals a spectrum enriched by the superior harmonics. This experience proves the benefit of using glissando to achieve a more focused sound, with a fuller spectrum.

7. 2. Application of glissandi

Learning methods to use glissandi

The application of glissandi was carried out in this project in two different ways: As an auxiliary exercise to learning effective quarter tone playing and as a method of learning to control sound production under different conditions, i.e., in extreme positions of the flute head. During the application of the techniques, we tried to obtain, through the execution of glissando, a greater flexibility of the upper lip, as it must be able to follow the flute's rotation movement. With the application of glissando, the students also trained the mobility of the lower lip, as this together with the movements of the chin accompanies the entire process. A properly relaxed chin consequently results in many benefits to the resonance of the oral cavity and throat. The exhaled air jet.becomes more concentrated and focused and is reflected in a better production of natural sound.

7. 3. Benefits of using glissandi

The benefits of playing glissandi which contribute to improving the control of the air column direction in the performance of a classical tone in all flute registers, are considerable and are described in the table 2.

The production of glissandi significantly helps the student to achieve excellent control in the passage between the various flute registers, where they have to react by changing the direction of the air column in a natural and flexible way, using strong, but relaxed lips. It also helps to develop the ability to perform greater jumps in quality sound without causing excessive embouchure fatigue.

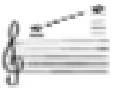
Flute register	**Embouchure position**	**Glissando phase**
Low register 	Embouchure position with the flute turned inwards	Extreme low point of glissando execution.
Medium register 	Normal playing position for classic sound.	Normal playing position for classic sound.
High register 	Embouchure position with the flute turned outwards.	Extreme high point of glissando execution.

Table 2. *Flute registers versus glissando phases*

8. Conclusion

Throughout the course of the laboratory work, it was possible to aurally recognise the influence of the chosen techniques by listening to selected and systematically applied excerpts. Sound changes were also recorded using the software, Spectrogram Version 16, A Product of Visualization Software LLC by Richard Horne. We concluded that the application of quarter tones and glissandi in the pedagogical process is an impactful tool, and we recommend that students be introduced to it from an early age.

Acknowledgments

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