

## Selected flute percussive techniques and their impact on Sound Emission and Articulation

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**Abstract:** *Through auditory analysis and advanced methods of sound analysis was possible to understand and explain the selected effects of the contemporary percussive flute technics in the modification of the diaphragm support, throat and embouchure, articulation, and the respective sound and musical results. The research has been conducted systematically with the aim to deepen the theoretical knowledge and practical skills of the students, learn the types of percussive effects and their symbols, and add them to their daily studies. For this purpose, different compositions and excerpts of compositions employing various types of contemporary percussive effects have been selected and applied to resolve effectively various problems in sound production in the interpretation of contemporary music, as well as music of other historical eras.*

Key-words: *flute, pedagogy, sonority, articulation, percussive techniques*

### 1. Introduction

Sound and articulation are some of the most important qualities of wind instruments because they express the individuality and identity of each musician. Therefore, these qualities belong to the most implemented and developed contents during the learning process of the instrument. The use of contemporary techniques as a way to improve sound skills is currently quite common. In the case of the flute, but also in the case of other wind instruments, the effectiveness of including simultaneous singing when playing, the use of harmonics, multiphonics, glissandos and flattezung was proved. This work proposes the inclusion of selected percussive techniques and observes their impact on the development of sound and articulation in a pedagogical context.

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## 2. State of the Art

The pioneer in the implementation of percussive flute sounds was Edgard Varèse, author of the solo piece *Density 21.5*, written in 1936 and revised in 1946. This composer used the percussive sounds created by striking keys in combination with natural sound.

The development of percussive techniques was based not only on imitation of percussion instruments or strings (*pizzicato*), but it was linked to the development of electronic concrete music, which began to spread between the late 1940s and early 1950s. It was integrated in the world of musical sound, with fragments of natural and industrial sounds, which included ambient sounds or noises. These fragments were recorded and later transformed in studios and then incorporated in electroacoustic compositions. The movement of concrete music contributed considerably to the search for new sounds in musical instruments and, logically, motivated the production of similar sounds. The percussive sounds created in acoustic instruments ended up corresponding to pre-recorded and/or transformed sounds. These were implemented, especially by mixed electroacoustic music, from certain sound materials. There is a vast repertoire, solo or with various combinations of instruments, where the use of percussive effects can be found. The conscious and correct production of these effects can result in several benefits in the production of the flute sound.

As our research project focuses on the development of sound quality, we have selected only the percussive effects that have a closer connection with the embouchure, such as lip *pizzicato*, tongue *pizzicato* and tongue ram. The benefits of these techniques have not yet been explored in a profound and scientific manner.

## 2. Objectives

The main objective of this research is to create new pedagogical strategies and practical resources, at the higher musical level, to improve the placement of the lips, and their relaxation, and to observe the benefits of applying techniques with the use of residual air, so that students have an adequate evolutionary learning process, taking into account their difficulties and development stages. Therefore, the objective is that these exercises have a theoretical basis, but that they are also adaptable to the student's individual learning process.

### 3. Methodology

The methodology used was based on the experimental empirical method, through the analysis of scores, observation, and listening and critique of sound results. Pedagogical activities with the aim of testing various types of percussive techniques were divided into individual work and group laboratory work. In the individual work, as an example of the piece covered, we mention the Prokofjev's Sonata for flute and piano. The result of this application was not just a clearer articulation.



Fig. 1. Application of pizzicatos and tongue-rams

<https://soundcloud.com/monikastreitova/the-impact-of-pizzicati-on-staccato>

<https://soundcloud.com/monikastreitova/the-impact-of-tongue-ram-on-high-flute-register>

With the regular utilization of lip pizzicato and tongue-ram the student also improved the sound quality and the sound became clearer with greater projection. "The systematization of results included sound analysis. During the laboratory sessions, experimental work and other activities that included the evaluation of results, particular importance was given to the systematic listening of recordings made by the students" (Streitová 2020, 3).

Aurally more conclusive in the group of three students was the application of lip pizzicato and tongueram. These proved to have a greater immediate impact on the sound quality of the low register, whose projection on the flute is generally very fragile. We can compare in the images the sound spectrum before, during and after the use of proposed types of percussion techniques. To obtain the following graphic results, a sound analysis tool, Spectrogram n°16 by Richard Horne was used.

### 5. Pizzicato



Fig. 2. *Pizzicato Symbol*

### 5.1. Execution of lip pizzicato

There are two types of pizzicato - lip pizzicato and tongue pizzicato and each has specific benefits. Lip pizzicato involves the use of residual air and is performed through a specific movement of the lips which, when approaching and then moving away, pronounce the phoneme “p”, opening just enough to let out the residual air, with an attack that gives the column of air the correct orientation and enough intensity to hit the edge of the flute head and produce the sound. Learning this technique requires some training in lip flexibility, especially in the upper lip. A small movement of this lip is responsible for the formation of the mouth opening and for the correct orientation of the air that reaches the flute edge when producing the sound.

The muscle that is responsible for the movement of the upper lip, the orbicularis oris, is at the same time the most important in the anatomy of the human face, so it is beneficial to train its functioning.

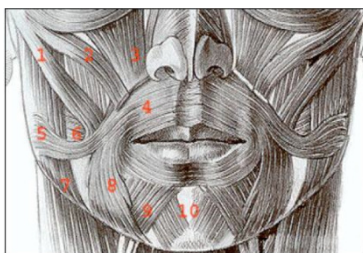


Fig.3. *Anatomy of the lips Dr. Arquero Clinic's website*

[http://www.clinicaarquero.com/pt/07\\_labios\\_anatomia.htm](http://www.clinicaarquero.com/pt/07_labios_anatomia.htm)

*“The most important muscle is the orbicularis oris of the lips (4), which closes the oral sphincter and provides labial competence. The levator labii superioris muscles are: the levator labii superioris (3), the zygomatic major (1), and the zygomatic minor (2). Other muscles that act in the lips are the triangularis of the lips (8), the risorius (5), the buccinator (6). In the lower lip, the lifting and protrusion of the central part are produced by the mentonian muscles (10), the lowering is produced by the quadratus mandibular muscles (9) that arise in the lower edge of the mandible”*

We used an image from Lubomír Kantor's book: *Skolahrynapricnouflétu* to explain to students the movements of the muscles in creating the embouchure and opening between the lips, which can be trained by practicing the lip pizzicato technique. Here we can see very clearly how the student must concentrate on the lip adjustment process before creating the classic sound.

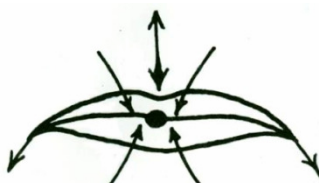


Fig. 4. Image from the book, "*Skolahrynapricnouflétu*" by Lubomír Kantor.

## 5.2. Execution of tongue pizzicato

Tongue pizzicato is a technique that also consists of using residual air, just like lip pizzicato, but it generally has a greater sound projection. Their symbols are the same and are used in passages where greater sound projection is required.

This percussive sound is created by the contact of the tip of the tongue with the upper palate, more specifically with a specific point behind the teeth. The tip of the tongue withdraws quickly because of the residual air tension, as if imitating the "t" phoneme. During this process the throat is completely closed. The resulting sound approximates the pizzicato sound produced by string instruments.

### 5.2.1. Lip pizzicato and tongue pizzicato application

#### Comparison of results

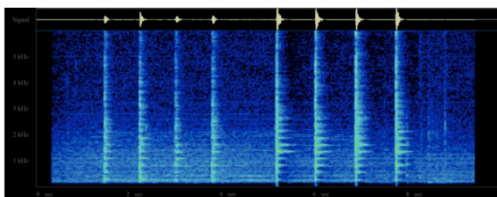


Fig. 5. Spectrogram image. In a first phase, the example demonstrates the execution of lip pizzicato (the first four attacks), then four attacks of tongue pizzicato follow.

<https://soundcloud.com/monikastreitova/the-comparison-between-lip-and-tongue-pizzicato>

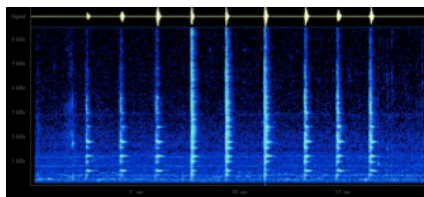


Fig. 6. Spectrogram image. The first three attacks were performed with natural sound, the second three with tongue pizzicato, and the last three with natural sound.

<https://soundcloud.com/monikastreitova/the-impact-of-tongue-pizzicato>

### 5.2.2. Discussion of results

First, we tried to conclude, through the collection of graphic registers and sound registers, if tongue pizzicato really has a greater sound projection than lip pizzicato.

The graphic registers and the sound registers demonstrated that tongue pizzicato results in a more intense and concrete attack. This technique was then applied to compare the sound quality between the production of three natural sound attacks in D4 tone and three natural sound attacks after the execution of three attacks with slap tongue. The application of this technique led to a significant change in sound quality, as the natural sound attacks, produced after the application of this technique, displayed a greater concentration of sound. In the last three attacks with natural sound, a change could be noticed, the attacks were more concrete and defined after the execution of tongue pizzicato. "Contemporary composers used that technique as a starting point for the pizzicato sound, by eliminating the air stream" (Vanoveren 2020, 8).

### 5.2.3. Interpretation of results

The controlled application of this technique and its systematic use makes it possible to discern the point behind the teeth where the tip of the tongue should be placed to create a classic sound attack. As the beginning of the sound on the flute predetermines the quality of its continuity, it is very important to pay particular attention to the quality of the tongue attack. "The sound be begun with a light attack caused with the withdrawal of the tip of the tongue from the hole" (Woltsenlogel 1995, 21).



Fig. 7. *Placing and removing the tongue while creating the sound attack. Image from the book "Skolahrynapřícnouflétnu" by Lubomír Kantor*

As in the execution of tongue pizzicato, the air coming from the lungs is not involved and the student can concentrate only on the correct execution of the tongue movement. A correct learning and application of this technique can help to minimize the limitations in staccato performance, especially in the low flute register. The use of this contemporary technique demonstrated conclusive results throughout our research project. We also concluded that this can be applied to the teaching of younger students who are still trying to establish basic sound attack habits. We focused our attention on developing the student's sound and on a quality attack and developed some warm-up exercises and exercises/excerpts from the pieces, where we replaced the notes with pizzicatos to improve the attack and developed some warm-up exercises and exercises/excerpts from the pieces, where we replaced the notes with pizzicatos to improve the attack.

## 6. Tongue ram



Fig. 8. *TongueramSymbol*



Fig. 9. *Positioning of mouth in tongue ram*

### 6.1. Tongue ram execution

The sound of the tongue ram technique is also based on the use of residual air. The tongue has a different position here from the tongue pizzicato position, as the lips completely enclose the mouth of the flute, and the tongue is placed directly in the opening. Then, the tongue is removed, maintaining a very high air pressure in the instrument, which produces a hollow sound, typical of the height of a major seventh below the fingering performed.

There are some limitations in the production speed of the repetitions of this technique, as the process of creating the effect described above is time consuming and requires a controlled speed. Pierre Yves Artaud, in his book *Present Day Flutes*, tells us that “It is possible to perform several T. R. one after the other. However, on account of the movement of the tongue, the maximum speed cannot go much above the quarter note = 240” (1986, 117).

### 6.1.1 Application of tongue ram –comparison of results

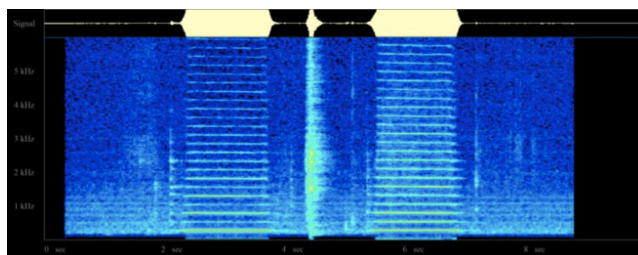


Fig. 10. The following is spectrogram image of the application of the tongue ram technique, proving the sound result in the execution of the C4 tone in natural sound, before and after the use of tongue ram.

<https://soundcloud.com/monikastreitova/c4-tongue-ram-c4>

## 7. Discussion of results

We decided to compare the results of performing the C4 tone in natural sound, before and after using tongue ram, to see how the use of this technique can benefit the sound spectrum. The graphic results and the sound results of the three students are conclusive in terms of the change in the quality of the spectrum –the sound, in addition to becoming cleaner and more focused, displayed, after using the technique, a greater presence of high harmonics due to the conscious work of the oral cavity and greater support for the diaphragm.

## 8. Interpretation of results

In order to perform this technique well and effectively, it is necessary to learn to contract the diaphragm very quickly, while withdrawing the tongue from the opening of the flute. In this movement, the abdominal muscles are involved, and they are essential in the process of rapid breathing. The tongue ram uses only the air stored in the oral cavity because after the diaphragm is contracted, which expels the residual air, the throat closes. As we have seen, this technique greatly



benefits the execution of tones in the first octave, where it is necessary to further fortify the diaphragm, or the training of staccato excerpts in the first octave, in order to obtain a clear, concrete and full-sounding attack.

Furthermore, the fact that the position of the mouth must be radically changed when performing this technique means that it can be a good exercise to find the right position of the lips more quickly after using tongue ram or to perform this technique at various speeds. Although it is recommended that composers use this technique within the quarter-note beat = 240, it is always beneficial to learn to play tongue ram at even faster speeds.

By learning this technique, students who have a less projected sonority in the first octave can gain, in a short time, a greater awareness of the functioning of the immediate connection of the diaphragm. This results in the development of sound quality in the low register, which is what occurs in the case of the limited flute. An effect very similar to the application of the tongue ram technique was previously proved with the application of the jet whistle technique.

Percussive techniques teaching application:

Type of percussive technique	Technical result	Application in non-contemporary flute repertory
Lip pizzicato	Lip flexibility, especially in the upper lip. Fortification of the lips	A small movement of this lip is responsible for the formation of the mouth opening and for the correct orientation of the air that reaches the flute edge when producing the sound in flute repertory of all historical styles. Provides lip flexibility throughout the solo recital
Pizzicato with the tongue	Correct execution of the tongue colocation and its movement	More concrete and defined attack in all flute repertory
Tongue Ram	Immediate connection of the diaphragm. Synchronization between tongue movement and relaxed throat	Benefits the sound spectrum, causes development of sound quality in the low and high register.

Table 1. *A comparative table of possible results obtained through the application of selected percussive techniques*

## 8. Conclusions

It has been proved that selected types of percussive effects, found in contemporary works, can be useful in the development of the classical attack

domain and flute sonority. This is because the student, through the production of different percussive effects, can be more conscious of the control of the whole physical apparatus involved in the production of articulation.

For a correct and beneficial application of selected percussive effects, adequate supervision of students is essential to correctly convey the notions and the learning of what can be translated into a correct and adequate sound emission source. This enables the students to achieve a conscious interpretation, respecting the style and historical context of the repertory.

## 9. Acknowledgements

I would like to express my very great appreciation to my first flute teacher, Lubomír Kantor (in memoriam) for their book “Skolahrynapricnouflétnu”, that brings the correct and clear approach of all the contents in the flute learning. His constructive suggestions were very valuable during my development as a young musician. His willingness to give their time so generously was fundamental for my development as a person and as a musician.

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