

Chinese Art of Playing the Bamboo Flute: the Differences in Acoustic Parameters When Performing Music of Contemporary Chinese Composers and the Influence of the National Compositional Tradition

Arte Chinesa de Tocar Flauta de Bambu: as Diferenças dos Parâmetros Acústicos na Execução da Música de Compositores Chineses Contemporâneos e a Influência da Tradição Composicional Nacional

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Abstract: The evolution of a global musical culture may be influenced by local changes, which are described by the characteristic features of the performed musical compositions. With this in mind, the paper's primary goal is to identify the special aspects of the Chinese art of playing the bamboo flute, while taking into account the acoustic parameters in the performance of contemporary Chinese composers and their influence on national compositional traditions. The sociometric rating index applied herein helped to determine that Feng Zicun (2.94) and Guo Wenjing (2.71) have the highest values for harmonious bamboo flute performance, as compared to other Chinese performers and composers - Liu Guan Yue and Zhang Chuanhao. This process is attributed to the fact that Feng Zicun was one of the first to use the bamboo flute as a solo instrument, which was made possible by changing the tempo of playing. Guo Wenjing's music-making process is based on a variety of timbres, as well as a combination of traditional intonation and contemporary forms. After studying the ways in which famous performers and composers

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play the flute, the authors argue that the most important things in the uniqueness of acoustic performance include the breathing pattern (3.05), trills (2.87), changes in pitch and volume (2.40), and overtones (1.92). Respondents, on the other hand, considered the breathing pattern (2.37), pitch changes (2.19), and staccato (1.59) to be the most significant indicators. The differences are attributed to the complexity of the discussed elements, which requires respondents to be more involved in the bamboo flute playing process. The findings suggested that contemporary bamboo flute approaches (59%) have an advantage over traditional approaches (41%). The paper's practical implications are attributed to the application of elements affecting the quality of sound in the context of teaching to play the bamboo flute. Further studies might address the positive and negative influence of European traditions of flute playing in Chinese culture.

Keywords: Expressiveness of the sound. Tempo of performance. Trills. Vibrating flow. Vibrato.

Resumo: A evolução de uma cultura musical global pode ser influenciada por mudanças locais, que são descritas pelas características das composições musicais executadas. Com isso em mente, o objetivo principal do artigo é identificar os aspectos especiais da arte chinesa de tocar a flauta de bambu, levando em consideração os parâmetros acústicos na performance de compositores chineses contemporâneos e sua influência nas tradições composicionais nacionais. O índice de classificação sociométrica aqui aplicado ajudou a determinar que Feng Zicun (2,94) e Guo Wenqing (2,71) apresentam os maiores valores para execução harmoniosa de flauta, em comparação com outros compositores chineses - Ren Tongxian, Liu Guang Yue e Zhang Chuanhao. Este processo é atribuído ao fato de Feng Zicun ter sido um dos primeiros a utilizar a flauta como instrumento solo, o que foi possível através da alteração do ritmo de execução. O processo de fazer música de Guo Wenqing é baseado em uma variedade de timbres, bem como uma combinação de entonação tradicional e formas contemporâneas. Depois de estudar as maneiras pelas quais compositores famosos tocam flauta, os autores argumentam que as coisas mais importantes na singularidade

da performance acústica incluem o padrão de respiração (3,05), trinados (2,87), mudanças no tom e volume (2,40) e harmônicos (1,92). Os entrevistados, por outro lado, consideraram o padrão respiratório (2,37), as mudanças de tom (2,19) e o staccato (1,59) como os indicadores mais significativos. As diferenças são atribuídas à complexidade dos elementos discutidos, o que exige que os respondentes estejam mais envolvidos no processo de tocar flauta. Os resultados sugeriram que as abordagens contemporâneas de flauta (59%) têm uma vantagem sobre as abordagens tradicionais (41%). As implicações práticas do artigo são atribuídas à aplicação de elementos que afetam a qualidade do som no contexto do ensino da flauta. Outros estudos podem abordar a influência positiva e negativa das tradições europeias de tocar flauta na cultura chinesa.

Palavras-chave: Expressividade do som. Ritmo de execução. Trinados. Fluxo vibratório. Vibrato.

Submetido em: 30 de junho de 2022

Aceito em: 2 de Agosto de 2022

Introduction

The Chinese musical culture has more than 20 musical instruments, which include stringed, keyboard, wind, and percussion instruments (PAUW, 2017). The bamboo flute is the most common among Chinese wind instruments, conveying harmony and lyrical timbre (RUST *et al.*, 2022). These processes resulted in a situation where playing the bamboo flute became one of the most common parts of Chinese musical academic culture (KELLER and COSTA, 2018).

The long period of evolution of the contemporary bamboo flute has affected the differences in musical techniques, which are described by innovative and traditional approaches (YANG *et al.*, 2015). Traditional bamboo flute playing approaches consist of playing a sound, with the corners of the musician's mouth forming a smile to produce low-pitched sounds. In order to produce high-pitched sounds, the lips should be pulled forward (QI *et al.*, 2020). One common contemporary approach to bamboo flute playing is to minimize the longitudinal movements of the lips as well as their forward extension (JI, 2021; TANG, 2021). The main emphasis should be on the breathing pattern as well as maintaining the rhythm (SU and JIANG, 2021). This approach will help to ensure that airflow and sound power are consistent and render a natural sound (GAO, 2021).

The bamboo flute is also one of the main instruments of Chinese opera, which has led to its expanding role in other ensemble performances that contribute to the flute's sounding range (MAGNUSSON, 2021). Another traditional principle of the bamboo flute sound is based on blowing a stream of air into the tube, which helps to create a vibrating flow (NOBLE and MCADAMS, 2020). Such a process produces a rustling sound. There are many varieties of Chinese bamboo flutes, depending on the region, musical technique, structure, etc. (NOBLE and MCADAMS, 2020):

- Xiao is a longitudinal bamboo Chinese flute that is used in solo performance. The Xiao rhythm is described by warmth and tenderness in the upper register;

- Dizi has a transverse structure with 6 holes for air intake and tuning. Dizi produces a subtle sound, which conveys the phenomena of nature or the person's inner world;

- Sheng makes it possible to play several sounds at the same time, which have a wide range. When playing sounds, Sheng is described by vivid expressiveness, clarity, and precision in the middle-pitched and low-pitched sounds.

Playing the Chinese Bamboo flute, regardless of its type, requires learning the rhythm, tone, and style of playing the melody, with subsequent learning of the characteristic features of each type of instrument (MARTIN, 2017). When playing the bamboo flute, the Chinese scale (pentatonic scale), which arises during performance, as a result of combining several harmonies, needs to be taken into consideration (WANG and LUO, 2022). This approach helps to maintain the beauty of the sound and preserve national traditions and timbre, regardless of the bamboo flute type (LIU *et al.*, 2021). An accurate rendering of the sheet music, which is directly attributed to the Chinese people's lifestyles, is important to the preservation of Chinese culture (YANG, 2019).

Literature review

Bamboo flute technique influences the expressiveness and emotionality of the sound. Vibrato, tremolo, trill, flutter-tonguing, portamento, and glissando are the most important for expressiveness. Music dispersion techniques make it possible to control the volume of the sound (WANG *et al.*, 2022). The Chinese bamboo Xiao flute is one of the most ancient and widespread musical instruments, as it is used in both traditional and contemporary music. Xiao conveys the sound's artistic merit with a deep and melodic sound. While playing the Xiao, a pentatonic

scale is developed, producing a delicate sound. When it comes to traditional music, Xiao is used with 6 holes; 6-7 holes are used in case of contemporary music (JI, 2021). Despite its thousand years history, the bamboo flute is described by imperfect tuning, pitch range, and high notes that affect acoustic changes. Acoustic impedance should be used to deal with these inaccuracies. To do this, consider numerical optimization, focusing on the tone holes. This approach promotes better high note tuning, harmonic blending of sounds (LAN and WALTHAM, 2016).

When playing the bamboo flute, one of the techniques involves sight-reading of unknown notes. The distance between the securing of the note and the hand position affects the duration of the melody. Such a process also affects shape recognition, the working memory and thinking speed. Sight-reading skills help to maintain the tempo of the performance. Development of mental skills affects the difficulty of playing music, which in turn influences the quality of performance (ROSEMANN *et al.*, 2016). A bamboo flute player learns the differences in the sheet music, which affects the sound's specific nature. The amount of air should be increased to develop a high-pitched sound. Air valve control helps to equalize distorted sounds. The strength of air inhalation affects the intensity of the overtones. Taking a deep breath contributes to loud overtones. Sound quality is also achieved by playing low notes with less intensity, and by playing high notes with muted sounds (WANG, 2021). Khлуй is a traditional musical instrument that is used in solo performance. The quality of the sound depends not only on the playing technique, but also on the bamboo flute material. Vibration and melisma are used to produce sounds. Continuous melodic lines, applied in the opposite motion, are used during the playing (CHITNAONT *et al.*, 2018).

Increased air pressure while playing the bamboo flute contributes to a higher pitch, making it possible to vary the amplitude for the same notes. A quality sound requires visualization and analysis of a piece of music and identification of tones and fingering. While playing, the variation in timbre contributes to a warm, sharp

sound (HAN and LEE, 2016). The aesthetic performance with a bamboo flute depends on cultural context, creative conventions, compositional rules, and genre. Semiotic analysis revealed that the bamboo flute's optimal acoustic sound is influenced by the culture of a particular country. This is because the musical culture, which is described by high-pitched sounds (Chinese), requires the opening of vowels, their long sound (DUBNOV *et al.*, 2016). The bamboo flute's pitch may be recognized with computer simulation of sounds. Analyzing a musical note helps to identify the features of musical sounds that are created through pitch, loudness, duration, spatiality, and timbre. The ease with which melodies are played depends on the passages, and the higher register helps to render the nature's sounds (SHELKE and CHITRE, 2015). Melody, rhythm, and harmony are the most universal elements when playing the bamboo flute. Depressive emotions and sadness are best conveyed by the bamboo flute. To do this, sounds should be played with the lower note 'C' of the first octave. The glissando technique should be used for transition from one sound to another. This element is achieved by maintaining the tone by holding the tone hole (WU *et al.*, 2014).

Available studies emphasize primarily the expressiveness and vividness of the sound, which is achieved through air control without detailing the musical instruments.

Problem statement

The long period of development of the Chinese bamboo flute has shown its importance in the performance of long folk tunes, jovial pieces and gentle melodies. Still, the introduction of the Western concert bamboo flute into Chinese culture has contributed to a change in musical techniques that seek to preserve various traditional musical techniques. The use of classical repertoire while playing the bamboo flute helps to maintain aesthetic preferences and technical skills. Introduction of the European approach to bamboo flute instruction caused the need for new technologies for

playing the bamboo flute. Chinese Bamboo Flute playing developed under the influence of the Chinese musicians who comply with musical intonation and tonality. The paper primarily addresses the features of the Chinese art of bamboo flute playing, keeping in mind the differences in acoustic parameters in the performance of music written by contemporary Chinese composers, and their influence on the national compositional tradition.

The objectives of the study were as follows:

- identify contemporary and traditional bamboo flute techniques following the analysis of the pieces written by Chinese composers, based on the sociometric rating;
- identify the elements affecting the difference in bamboo flute technique, as well as determine their significance among the authors and the respondents;
- identify preferences in bamboo flute playing techniques by comparing traditional and contemporary approaches.

Methodology

Research design

The first step of the study involved a comparison of traditional and Chinese bamboo flute music and approaches to its performance (DIETRICH, 2017). Helping to identify the most significant elements for this study, the comparison addressed traditional and contemporary Chinese composers who performed melodies for the bamboo flute. The most famous performers and composers (Feng Zicun, Liu Guan Yue, Zhang Chuanhao, Guo Wening), in which the creativity vector addressed to the bamboo flute, were chosen for the study. These composers were chosen for the experiment because they are Chinese composers specifically on the bamboo flute. A sociometric rating index based on algebraic summation of scores was used to determine the significance of

these composers' music and to determine bamboo flute musical techniques. The sociometric rating index depends on the positive and negative impact of various items - the musical culture in this case (CLARK, 2018).

$$I_s = \frac{\sum(q_p + q_n)}{N-1}, (1)$$

q_p - a conventional estimate of the element's positive effect;

q_n - a conventional negative estimate of the element's positive effect;

N - number of indicators.

Based on the Chinese composers' music, the next step involved identification of elements that influence the bamboo flute performance approaches. The following musical elements were chosen for the study:

- breathing pattern;
- change in the pitch and volume of the sound;
- overtones;
- trills;
- staccato.

Their significance was compared using the sociometric rating index similar to the previous step of the study. The instruments' significance was determined by comparing the parameters provided by the paper's authors and the respondents who took part in the study. Respondents' answers (provided to the authors' email within 36 hours) were used to calculate the sociometric rating index.

The findings suggested discrepancies in the data, which has been instrumental in the use of the Shapiro-Wilk test to compare them (GIBBS, 2021).

$$W = \frac{(\sum_{i=1}^n a_i x_{(i)})^2}{(\sum_{i=1}^n x_i - \bar{x})^2}. \quad (2)$$

where $x_{(i)}$ is the smallest conventional parameter;

\bar{x} - is the average conventional number;

a_i - is the statistical order coefficient.

The final step of the study involved determining the advantages of bamboo flute techniques - traditional or contemporary, as well as the features of the bamboo flute's influence on music, which centered around the sentimentality of sound, symbolism, expressiveness, artistic meaningfulness, and manifestation of musical language. Responses were given by respondents according to the Chaddock scale, which provides for scoring a specific item, allowing for a calculation according to the sociometric rating index (DIETRICH, 2017). The outcomes were lumped into one group, which helped to identify the more important elements.

Sample

A total of 138 respondents from Shenyang Conservatory of Music participated in the study. The sample of study participants was designed to include fourth-year university bamboo flute majors. This is because fourth year students have the theoretical knowledge and hands-on experience of playing the bamboo flute, performance techniques, as well as an idea of the sound variation. Initially, 148 students were scheduled to participate in the study. However, 10 persons refused to take the study due to time constraints, as the study was conducted during additional classes. All respondents were made aware of the steps of the study and provided documented consents to participate.

Statistical processing

Data were processed using Maple, because this program facilitates calculations of varying complexities, and also facilitates data visualization through graphs and charts.

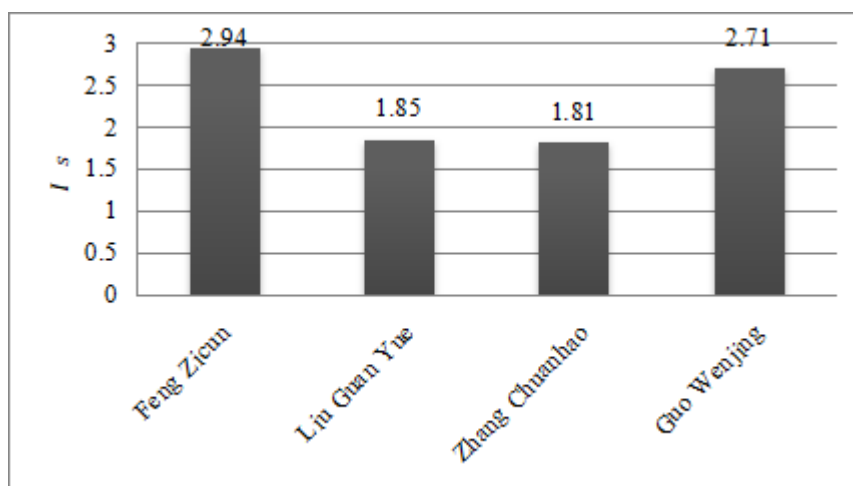
Ethical issues

The ethical issues pertaining to the paper were observed by complying with the Guidelines for Research Ethics in Science and Technology (NORWEGIAN NATIONAL COMMITTEE FOR RESEARCH ETHICS IN SCIENCE AND TECHNOLOGY, 2016). The ethical provisions preserved the respondents' rights and also provided them with a list of responsibilities during the study.

Research limitations

The study is exposed to the limitation in terms of examining the influence of traditional and contemporary features of Chinese bamboo flute playing, excluding comparisons with the Western concert bamboo flute. Such limitations can be addressed in further studies, as the paper discusses the composers' music, helping to identify the most significant elements affecting the acoustic parameters.

Figure 1 - Influence of Chinese composers and performers on the development of bamboo flute playing techniques



Results

The Chinese art of bamboo flute playing has been shaped by the composers and performers who represent contemporary and traditional Chinese culture. With this in mind, the paper initially identified Chinese composers and Chinese performers who influenced the bamboo flute playing technique. The emphasis on sociometry helped to identify composers with the greatest influence on the development of bamboo flute techniques (Figure 1).

The sociometric rating index showed that Feng Zicun (2.94), the bamboo flute player at the Chinese Orchestra of the Central Song and Dance Troupe, performs a major role in preservation of traditional musical techniques. Feng Zicun used the Er Ren Tai performance style, based on the interaction of lips, tongue, fingers, and the breathing pattern. Performer and composer helped in the bamboo flute's recognition as a solo instrument. His performance techniques are based on variations in tempo, as well as improvising the same melodies with different tempos, and his musical technique resorts to loud playing, using staccato and vibrato. Guo Wenjing (2.71) is the second most important composer. Performing bamboo flute melodies according to own technique is described by a timbre palette that conveys traditional and operatic acoustic parameters. His music preserves linguistic and musical intonation combined with contemporary forms. Composer Guo Wenjing's music is performed with variations of registers that are described by Judy - high, low, medium texture. Judy is based on the continuous breathing techniques as well as repetition of sounds. Performer Liu Guan Yue (1.85) is also one of the most famous Chinese bamboo flute players who performed in China and other countries. He used portamento, arpeggio and vibrato techniques to imitate bird sounds. Liu Guan Yue's style of playing is light and simple, helping to preserve folk traditions.

The second category of composers has less influence on the preservation of bamboo flute techniques. Composer and performer Zhang Chuanhao (1.81) is a contemporary bamboo

flute player whose style combines traditional and contemporary elements. The music combines drama and tension. Timbre makes music more expressive and rich.

The differences in performing the bamboo flute's acoustic sound as a result of contemporary and traditional musical techniques depend on the geographical location, the conveyed emotions, the instrument's design and material. In order to identify the elements that affect the bamboo flute performance approaches, the paper provided a detailed analysis based on the features of performances by Chinese composers. The significance of these elements for the personalized performance was determined using the sociometric rating index according to formula 1. The Shapiro-Wilk test (Table 1) was also used to compare items with each other in terms of significance.

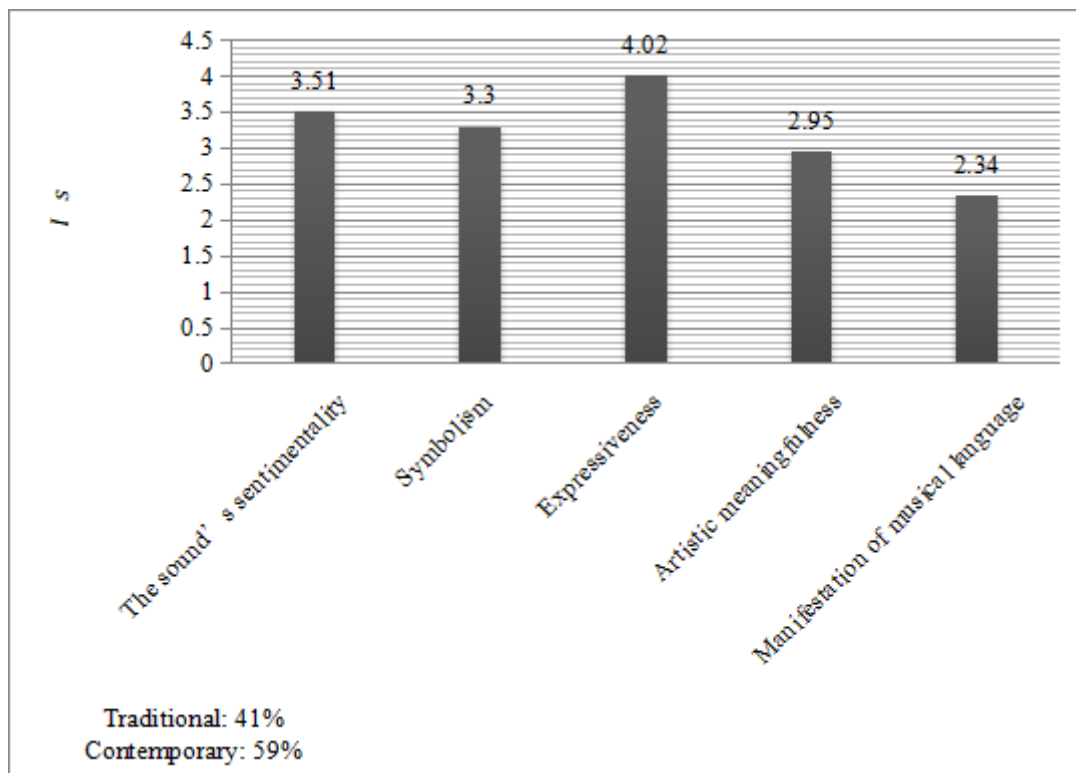
Table 1 - Elements affecting the acoustic sound of contemporary and traditional performance techniques

Music elements	Sociometric rating index		Shapiro-Wilk test
	Authors of the paper	Respondents	
Breathing pattern	3.05	2.37	0.853
Change in the pitch and volume of the sound	2.40	2.19	0.812
Overtones	1.92	1.08	0.744
Trills	2.87	1.62	0.809
Staccato	1.89	1.59	0.320

The authors (3.05) and respondents (2.37) believe that the breathing pattern is an important element of the unique acoustic sound, because its proper placement affects the purity of the tone, loudness and pitch. This process takes place as a result of controlling the orbicularis oris muscle and tongue. When playing the bamboo flute, the first thing to do is to maintain the blended breathing pattern (shallow breathing and diaphragmatic breathing), which engages the lower back muscles and abdominal muscles that affect the strength of the sound. During the blended breathing pattern, the diaphragm is lowered and the controlled

exhalation becomes even, which produces the sound. When playing traditional bamboo flute, the finger directly touches the tone hole. When playing contemporary instruments, the sound is

Figure 2 - Example of a trill during a fast sound switch



produced by means of the hole through the valve, which affects the performance tonality.

The authors consider trills (2.87) to be the second most important necessary element for the authors. Their feature set is based on the smooth distribution of the two tones, which helps to create musical embellishments and melismas. A trill produced while playing the bamboo flute controls the pitch and sustainability of the sounds, making it possible to switch from one sound to another as quickly as possible (Figure 2).

Changes in pitch and volume also affect the musical technique (respondents consider vibrato to be the second most important element (2.19)), as it is typical for vibrato to use more air at the

initial stage, which affects the duration of the sound. The amount of air affects the steady and even rhythmic sound, as well as the quickness of the sound. The use of vibrato during the alternation of long and short notes makes up the contemporary performance pattern, with the transition from one pace to another being slow and smooth. The importance of vibrato is also about the fact that while playing the bamboo flute, vibrato contributes to the development of new timbre qualities that affect the warmth and emotionality of the performance. The use of vibrato depends on the characteristic features of the piece of music and affects the expressiveness of the sound.

Overtone is more typical for traditional music than of contemporary music, affecting the performance's dynamic pattern. In this case, the high notes are played a little quieter, and the low notes are played a little louder. Such approach affects the expressiveness of the sound, which is achieved through lip power and controlled breathing pattern. Overtone makes the sound clear. With traditional bamboo flute playing technique, the overtones have the same dynamic pattern, making it impossible to produce sounds of different pitches. This is accomplished with controlled air flow from the diaphragm to the lips. Despite the complexity of this approach, overtones affect the sound's purity.

Staccato affects the imitation of the sounds with the breathing pattern and tongue movements. Staccato influences the vividness and volume of the sound, which is possible with one, two or three

Figure 3 - The bamboo flute's significance for musical culture



sounds. Staccato affects the slowness, moderation, mobility of the sound. When using the double staccato technique, two strokes are applied during the airflow with the tip of the tongue and the

back of the tongue. Double staccato imitates tu-cu, re-re and mi-mi sounds, which affects the double articulation.

The paper discussed how the bamboo flute influences musical culture, also determining which musical techniques (contemporary or traditional) make the performance vibrant. The findings are shown in Figure 3.

The respondents believe that the bamboo flute's importance is more about expressiveness (4.02), as it helps to distinguish certain musical elements from others (timbre, tone, pitch, duration) with a soft sound. The sound's sentimentality (3.51) is achieved by performing muted sounds, which creates relevant acoustic parameters. The lowest value is attributed to the manifestation of musical language (2.34), which is due to the ability to perform melodies from the note to the first octave to the note to the fourth octave. Respondents also believe that contemporary performance techniques (59%) are better in conveying pure sound and preserving the uniqueness of Chinese acoustic parameters, and involve improvisation practices. Based on the techniques of Feng Zicun, Liu Gua Yue, bamboo flute techniques may be learned taking into account the correct breathing pattern, arpeggio, and vibrato techniques. Traditional performance techniques (41%) are unique, but they rely on more complex approaches of applying overtones, trills, which requires a strong proficiency to perform pure notes.

Discussion

The sociometric rating index applied herein helped to determine that Feng Zicun (2.94) and Guo Wenjing (2.71) have the highest values for harmonious bamboo flute performance, as compared to other Chinese performers and composers - Liu Guan Yue and Zhang Chuanhao. This process is attributed to the fact that Feng Zicun was one of the first to use the bamboo flute as a solo instrument, which was made possible by changing the tempo of playing. Guo Wenjing's music-making process is based on a variety of timbres, as well as a combination of traditional

intonation and contemporary forms. After studying the ways in which famous performers and composers play the flute, the authors argue that the most important things in the uniqueness of acoustic performance include the breathing pattern (3.05), trills (2.87), changes in pitch and volume (2.40), and overtones (1.92). Respondents, on the other hand, considered the breathing pattern (2.37), pitch changes (2.19), and staccato (1.59) to be the most significant indicators.

Bamboo flute playing approaches depend on musical characteristic features (frequency, amplitude, duration, tone) and more local musical parameters - timbre, pitch. The quality of acoustic perception of melodies is affected by resonance, repetition and vibration. Quiet sound results from little intensity of harmony and frequency of sound (CARDOSO FRANCO, 2019). The cantus firmus technique used while playing the bamboo flute fosters an aesthetic performance of music. This technique is based on the premise that, while rendering tonality, one should use polyphony at different levels, which is achieved by resorting to rough archaisms (humming, natural intervals). Raw intervals promote musical self-expression during performance (LI *et al.*, 2019). The musical technique affects the expressiveness of musical performance, which is different in the cases of live and isolated performances. This is because a live performance is accompanied by the introduction of improvised approaches to producing the sounds. Contemporary performance techniques resort to musical techniques that are based on breathing-in pattern and creating noisy sounds. Such approaches are achieved using bamboo flute notation (WANG *et al.*, 2019). The study also identifies that musical techniques contribute to changes in sound and affect expression, detailing the benefits of breathing patterns, overtones, vibrato, trills, and staccato for the bamboo flute's acoustic parameters.

The bamboo flute's acoustic parameters, which affect the sound quality, can be studied with modal analysis and information technology. The bamboo flute is one of the most important musical instruments that represents the culture of the people and is used

in ensemble and orchestra. Therefore, bamboo flute techniques are constantly improving, contributing to a more vivid and vibrant sound. One such musical technique is to cover the holes with a finger, alternating the loose holes, which produces a higher or lower tone (PENG and GENG, 2017). The Chinese bamboo flute is among the most common instruments, conveying the symbolic sounds. Xiao began to be used not only in traditional, but also in original music, helping to preserve cultural traditions. This type of bamboo flute resorts to the pentatonic scale, as well as a change in tone with each tone row. The advantages of the bamboo Xiao flute are attributed to the breadth of its acoustic parameters, which are based on the frequency of vibration, the volume of the sound and its intensity. While playing the bamboo flute, the musician should stabilize the mental state through psychophysiological parameters, more specifically the breathing pattern. The acoustic capabilities of the bamboo Xiao flute are described by a soft, silky sound as well as a slow playing tempo (JI, 2021). For cultural preservation purposes within the context of the bamboo flute sound, attention should be paid to the timbre, which is achieved by means of an adjustable whistle. With whistle and fingering, the position of semitones is achieved, allowing melodies to be played in different tones and scales. An adjustable whistle promotes airflow that creates a rustling sound. Controlled whistling results from having a large amount of air inhaled and slowly exhaled. Furthermore, the sound quality depends on the technique of putting the bamboo flute to the lips. When playing the sounds, the lips should be closed regardless of position, and the size of the opening should vary depending on the sound's position (KAWAMURA *et al.*, 2018). This paper specifies that the setting of the breathing pattern affects the sound's quality and strength.

The musical transformation of the notes improves approaches to playing the bamboo flute. A combination of various sounds that reach high, medium and low thresholds should be used to enhance the sound. When the jaw and lips are in the same position, a smooth transition from one pitch to the other takes place, affecting

the sound quality and intonation switching. Rhythmic movements contribute to the expressiveness of the sound (LI, 2021).

Available literature focuses primarily on the change in timbre and intonation during bamboo flute performance. This paper reviewed the musical techniques of the Chinese composers, which helped to identify the elements of greatest importance when changing the musical technique.

Conclusions

Using a sociometric rating index, the paper revealed the following sequence of the Chinese performers and composers playing the most significant roles in preserving the bamboo flute playing art: Feng Zicun (2.94), Guo Wenjing (2.71), Liu Guan Yue (1.85), Zhang Chuanhao (1.81). Feng Zicun and Guo Wenjing are the most influential performers and composers as they resort to unique musical techniques with tempo control. Guo Wenjing, Zhang Chuanhao, emphasizing the breathing pattern and combining contemporary and traditional approaches to performance.

Centering around the specific features of playing the Chinese performers and composers' music, the paper identified the elements that affect the bamboo flute's acoustic parameters. The sociometric rating index, estimated relying on the authors' responses, showcased that the breathing pattern (3.05) and trills (2.87) were the most important for clarity of sound. This is because the breathing pattern impacts all elements, whereas inaccuracies in the setting of the breathing pattern lead to false notes. The trills are important because they control the pitch. Respondents believe that the breathing pattern (2.37), changing pitch and volume (2.19), were more important than the factors presented by the authors because they contributed to the long sound. According to the authors, staccato has the least importance (1.89), because it affects the sound imitation, which requires, first of all, setting the proper breathing pattern and fingers while playing.

The paper's practical implications are attributed to the possibility of applying the findings to improve the sound quality. Further studies might compare Chinese and foreign bamboo flute techniques that affect acoustic parameters.

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