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Research on the Characteristics and Double-Tone Rules of Chu-Han Chime Bells

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ABSTRACT

In order to explore the acoustic characteristics of chimes and the law of double tones, this paper takes the Chu and Han dynasties (206~202 BC) in this paper, Chimes are used as an example for analysis. Firstly, the characteristics of Chu and Han chimes were collected, the chimes were classified, and their materials and production techniques were studied. Then, the electronic scanner was used to observe the surface of the chime, and the acoustic test software was used to analyze the law of the two tones and draw the sound principle of the chime. The results show that the chimes of the Chu and Han dynasties are mainly shaped with wide mouths and uniform hanging methods, and the chimes are mainly made of bronze, tin and iron, so the pitch is higher. The spacing between chimes varies depending on the shape and size, so it is easy to resonate. In addition, there is a resonance gap between the main drum and the left and right drums of the chime, which prolongs the sound propagation distance of the chime. Therefore, the Chu-Han chime is the culmination of Chinese chime technology, and its acoustic characteristics are reasonable, forming a resonance between the main drum and the left and right drums, and forming a resonance between the chimes, realizing two-way sound, which has an enlightening effect on modern music teaching.

Keywords: Chu and Han Dynasties, Chimes, Acoustic Characteristics, Two-Tone Rules, Music Education Enlightenment.

INTRODUCTION

During the Chu and Han dynasties (206~202 BC), music culture has been developed to a certain extent, especially the development of chimes, which have become an important part of mainstream musical instruments and have been widely used in court etiquette, sacrifices, religious ceremonies, and folk music activities. During this period, because of the important characteristics of chimes, it not only played a certain role in enriching the form of music and art performances at that time, but also showed the life and aesthetic taste of the society at that time. Since the Chu and Han dynasties (206~202 BC) was an important period in ancient China when music culture was more promoted, chimes, as an important part of the music culture at that time, played a role in carrying the connotation of ancient music culture and historical culture (Zhu-Ge, Luo & B. Zhang, 2023). In addition to the profound historical background, the chimes of the Chu and Han dynasties also have great cultural significance. In addition to being an essential musical performance tool, the chimes of the Chu and Han dynasties can reflect social life (Andersen et al., 2023; Chung et al., 2023), aesthetic pursuits, religious beliefs, etc., and are rich in obvious cultural characteristics. Based on the study of the chimes of the Chu and Han dynasties, future generations can understand the pursuit of music art and sound aesthetics in the Chu and Han dynasties and the role of chimes in social life at that time. Moreover, in studying the Chu and Han bells, we can also get a glimpse of the social and spiritual outlook of ancient China, which has great historical and cultural value (Andersen et al., 2023; Stevenson, A., 2023). As we all know, the Chu and Han dynasties were an important period in the history of Chinese music culture, and given the special status of chimes in the Chu and Han dynasties, this paper decided to carry out in-depth research on the acoustic characteristics of chimes in the Chu and Han dynasties, the study of

the two-tone law and the enlightenment to modern music education. After in-depth research, this paper concludes that the acoustic characteristics of chimes in the Chu and Han dynasties are numerous, and through the unique characteristics of bronze materials, as well as the structural design and exquisite carving of chimes, craftsmen can better adjust the timbre of chimes and keep them crisp and beautiful to play (Curtin et al, 2023). At the same time, the two-tone rule was widely used in the Chu and Han dynasties (206~202 BC) to complete the creation and performance of music, so the study of the phenomenon of the two-tone rule in the chimes of the Chu and Han dynasties is also one of the important parts of this paper. Through the study of the two-tone rule, this paper finds that through the application of the two-tone rule, the performers of the Chu and Han dynasties were able to play music rich in rhythm and rhythm by playing chimes of different pitches alternately (Barteit et al., 2023; Rafiei-Ravandi & Smith, 2023), and at the same time, the application of the two-tone rule also had a rich effect on the music culture and various musical elements of the Chu and Han dynasties. Finally, this paper argues that the research on chimes in the Chu and Han dynasties can provide a variety of enlightenments for modern music education, such as improving the aesthetic ability and innovative thinking ability of music education.

LITERATURE REVIEW

The Role of Chu and Han Tian

The Chu and Han Bianzhong is a Chinese Bianzhong, a distinctive musical instrument that reflects the development of ancient bronze casting technology and music theory. It is an important manifestation of the cultural development of the Spring and Autumn Period in China. In depth exploration of the cultural connotations and regional timbre characteristics in Chu and Han Bianzhong is of significant significance for archaeology and Bianzhong, which can enrich the research content of music in the Chu and Han period. From the perspective of cultural relics unearthed from Chu and Han bronze ware, there are relatively few representative objects. It is necessary to excavate the musical connotations and philosophical ideas of music based on the existing qi of Bianzhong. The Chu and Han Bianzhong, which appeared in the Zhou Dynasty and reached its peak in the Chu State, is one of the representative instruments in the Chu and Han Hall. The Bianzhong from the tomb of Zeng Haoyi, with a distance between musical instruments and ritual, is one of the representative instruments in the Chu and Han Hall. There are two types of utensils, mainly used for palace etiquette and important celebrations, especially for sacrificial activities, The Chu and Han Bianzhong, with its complex production process and excellent sound characteristics, and relatively high casting accuracy, is currently a hot research topic both domestically and internationally for modern times.The influence of music has significant value.

The Phonology and Cultural Characteristics in Chu and Han Compilations

The dual tone characteristics in Chu and Han compilations are the main research content of modern music education, so there is an implicit connection between Chu and Han compilations and modern music education. In depth research and excavation of valuable materials, timbres, and other aspects in Chu and Han compilations can provide support for the improvement of modern music education, the clarification of educational content direction, and educational methods. Excavating the educational value in the peak of Chu and Han can provide case support for the development of non cultural heritage and supplement the modern significance of archaeology. From the perspective of modern and archaeology, the characteristics of Chu and Han changes can be discovered. At the same time, the acoustic features, physical principles, and structural principles in Chu and Han compilations also have distinct characteristics, providing support for the optimization of modern musical instruments and the improvement of music education content. Overall, excavation can provide case support for the development of non cultural heritage and supplement the modern significance of archaeology. The dual musical characteristics of Chu and Han bells, The timbre and material structure have significant value characteristics for modern research and the inheritance of ancient Chinese music, which is one of the main contents of modern archaeological research and can enrich archaeology in the Chu and Han dynasties.Insufficient research on music.

RESEARCH METHODS

Methodology

Observe the surface of the chimes with a high-definition microscope to identify the pattern of the chimes, the structure of the bells, and the arrangement of the bells and drums, and find out the reason for their sound. At the same time, the relevant information was searched, the composition and structure of the Chu-Han chimes were collected, and the results were compared. The sound principle of the chime was observed, and the sound process of the chime was drawn with Photoshop. Using the sound collection device, you can obtain the concentration of

the chime sound, as well as the effect of the sound. Observation indicators include the chime's material, shape, and sound mechanism.

RESULTS

Chime Material

Comparing the composition of chimes in the Chu and Han dynasties, the frequency of chimes is studied, and the specific results are shown in Table 1.

Table 1. The Material of the Chime

Type	Material	Vocalization Is High	Transmission Distance	Use
Single Clock	Tin, iron, bronze, brass	Bass	10 meters	vocalization
Bells	On the basis of a single bell, wooden poles, bronze poles and bell bases were added	Treble	20~30 meters	Etiquette, major celebrations

From the results of Table 1, it can be seen that the material of the chime is basically the same, and the material of the chime is added with a wooden rod, a bronze rod and a base to provide conditions for resonance and resonance. The sound distance of a single bell is 10 meters, while the sound of a chime is 20~30 meters, proving that there is a resonance phenomenon in chimes. Materials and empathy. The chimes of the Chu and Han dynasties were made of bronze, which significantly impacted the resonance characteristics of the bells. Specifically, bronze has excellent resonance properties, allowing the chimes to produce crisp, melodious tones when struck. In the process of playing, chimes often produce rhythmic and rhythmic sounds, and show different pitches. For example, when striking chimes of different sizes and shapes, the chimes will emit sounds of varying high and low tones, showing a clear, layered and rhythmic sound. For example, when playing ancient music such as the "Kik Song", the chimes can make a loud sound and play in ensemble with other instruments, such as sheng and se, to create a harmonious and charming classical sound. Moreover, the resonance of the bronze chimes tends to last long and wander back and forth in space, thus showing stronger musical expression in the Chu and Han dynasties (206~202 BC). As an important musical instrument, the design of chimes is often very exquisite, and it is also extremely particular in the selection of materials. Generally speaking, craftsmen will choose better quality bronze raw materials to make chimes, which generally have a high copper content and few impurities, and smelting and forging. The raw bronze is typically melted directly into the furnace and then poured into a prefabricated mold to cast the liquid bronze. This step requires strict temperature and time control to ensure that the bronze can be evenly filled with the mold. Then it's time to hammer and shape, and finish the necessary sanding and polishing (Cook et al., 2023). Finally, the engraving and decoration are completed. During the Chu and Han dynasties (206~202 BC), chimes were generally made of bronze materials, because the acoustic performance of chimes was relatively superior, which could produce bright and crisp timbre. Chimes in the Chu and Han dynasties obtained unique acoustic characteristics through reasonable alloy ratio and exquisite casting technology. For example, the sound produced by bronze chimes is often very crisp and round, and at the same time has a warm texture, which is more sonic penetrating than other metal chimes and can improve the harmonic effect. In addition, the density and elastic modulus of bronze materials also have certain advantages, which can improve the sound wave propagation effect. Generally speaking, the surface of the chimes in the Chu and Han dynasties will be engraved with some specific patterns or words, other decorative elements, etc., which can not only beautify the bells, but also reflect the social culture and aesthetic concepts of the Chu and Han dynasties, followed by the material (Cook et al., 2023). As we all know, the chimes of the Chu and Han dynasties were made of bronze alloys, which were generally made of copper and tin, with a small amount of brass and iron. This is because bronze alloys exhibit greater hardness, are easier to cast, and have stronger resonance properties. Because of the unique material properties of bronze alloy chimes can produce a clear, long-lasting, and pleasant sound. Moreover, the timbre of the chimes can be adjusted according to the size, thickness, shape, etc., so that they can produce different tones, so as to serve the needs of performance activities; in addition, the reason why the chimes of the Chu and Han dynasties used bronze as a material is also an important reason (Desai, 2022; Z. Zhang et al., 2023), that is, the bronze material has durability and can improve the visual effect. Specifically, bronze is not only corrosion-resistant, but also very durable, and over time, bronze often retains its structural integrity and good appearance,

even with time, forming a protective slurry that adds to the bell's sense of history. It can be seen that in the Chu and Han dynasties (206~202 BC), the reason why chimes became an important musical tool at that time and became one of the cultural symbols lies in the exquisite craftsmanship and high-quality and durable characteristics of chimes, in addition, the excellent resonance effect of bronze material is also one of the key factors. For the chimes of the Chu and Han dynasties, whether the casting process complies with the regulations will also affect its acoustic characteristics (Guo et al., 2023). For example, a sophisticated casting process will improve the quality of the internal structure of the chime, making it more uniform and complete, and improving the resonance effect. First, the influence of the casting process on the internal structure of the chime. For example, if the casting process is more sophisticated, the internal structure of the chime can be guaranteed to have a high degree of uniformity and integrity. In the process of casting, the process level is high and the technology is exquisite, so that problems such as porosity or cracks can be avoided to ensure that the bell body of the chime does not contain impurities or voids (Lafleur et al., 2024; B. Zhang et al., 2023). In this way, the propagation and reflection of sound waves in the internal structure of the chimes is increased, making the resonance effect clearer and more durable. Second, the casting process will affect the resonance effect. For example, the exquisite casting process can improve the resonance effect of the chime performance. For example, it can ensure that the timbre of the chimes is long-lasting, clear, and beautiful, and the sound quality performance is improved.

Acoustic Characteristics of Chimes

Comparing the structure of the chime, it can be found that the structure of the chime also resonates with it, giving full play to its acoustic characteristics, as shown in Figure 1.

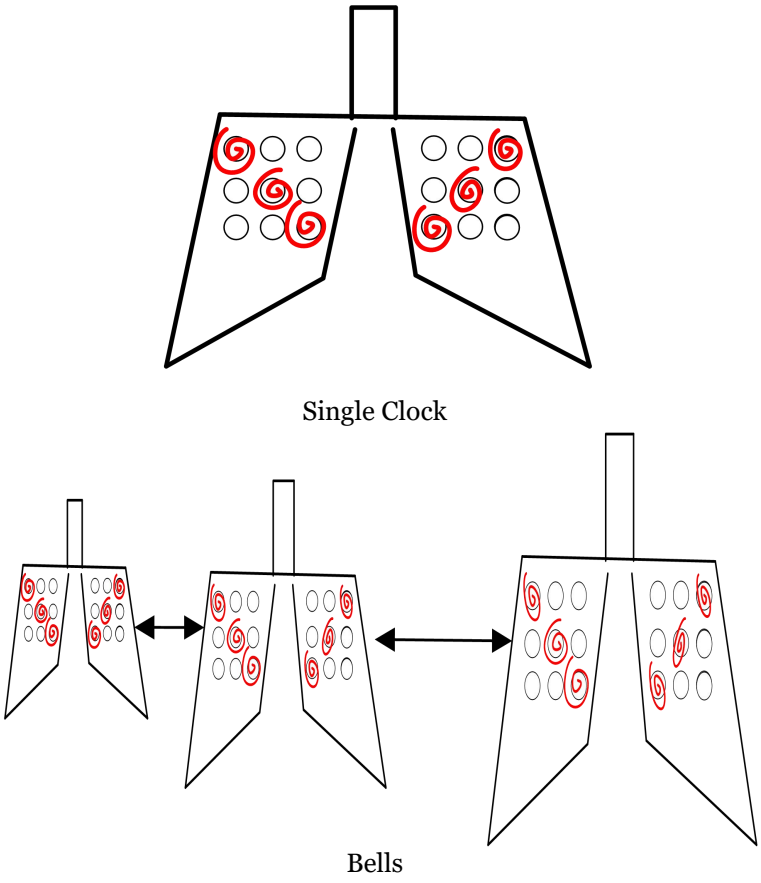
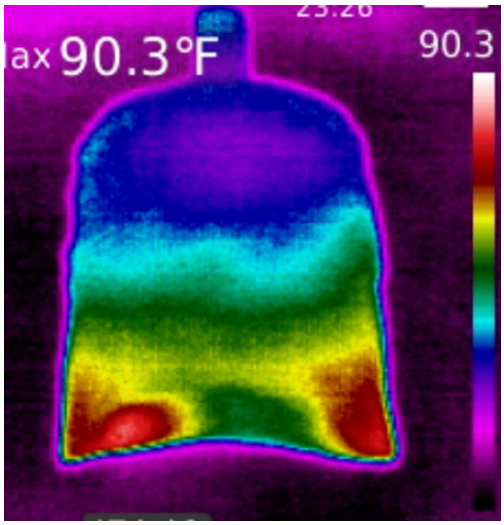


Figure 1. Sounds of Single Bells and Chimes

As can be seen from Figure 1, the single bell sound distance of the chimes is shorter, and the distance between the chimes continues to extend with the shape of the chimes, indicating that there are resonance points between the chimes. The existence of chimes in the Han Dynasty was a high-precision and complex percussion instrument, and the existence of chimes had a certain role in promoting the level of music theory and practice at that time, and had a role in promoting the further development of other types of musical forms and techniques. In the Chu and Han dynasties (206~202 BC), by applying chimes to various social activities, sacrificial activities, and ceremonial occasions, chimes could influence the people's concepts at that time, such as improving their understanding and

awareness of morality, etiquette, aesthetic taste, and other aspects, and then transmitting information (Luo, Zhu-Ge, & B. Zhang, 2023). During the Chu and Han dynasties (206~202 BC), craftsmen would record some important time or praise the merits of the owner's ancestors on the chimes, so the chimes also had the function of recording historical events, expressing political positions and transmitting information to a certain extent, and finally, promoting the national spirit (Merryfield et al., 2023; C. Schwarz et al., 2023). At that time, the bells could not only reflect the deep insight and exploration of the natural world and their own living environment, but also highlight the national feelings and cohesion, and carry forward the national spirit. Chimes in the Chu and Han dynasties have a unique principle of resonance. When the chime is struck, the material near the striking point vibrates, and at the same time, this vibration is quickly transmitted to the whole body of the bell body through sound waves. Because of the excellent elastic modulus and density properties of bronze, the effective propagation of these vibrations will have a resonant effect in the body of the bell. For example, when a bronze instrument chime is struck, the vibrational energy can be transmitted quickly and evenly to the entire bell body, which in turn drives the sound. In the interior of the Chuhan chime, the cavity design can play a resonant role. The air column in the cavity will resonate with external vibrations, which will suppress other frequency components, so that the sound of the chimes will be more pleasant (Metusela et al., 2023) beautiful and fuller. Moreover, when playing classical music, it can also be played with other instruments to achieve better harmonic effects. Generally speaking, the chimes of the Chu and Han dynasties were suspended by metal chains, and the different suspension points and hanging methods would also affect the vibration mode and scope of the chimes. If the right suspension point is chosen, the vibration pattern of the chimes can be guaranteed and the sound will be clearer and longer-lasting. For example, with the right way to hang it, chimes will vibrate better, resulting in a more pleasing and long-lasting sound, which will help improve the performance of the piece. In order to better measure the resonance effect of the chimes and the concentration point of sound, the chimes were scanned by infrared to test their sound position, and the sound collection device was used to test the position of the sound, and the results are shown in Figure 2.



Vocalization Concentration Point

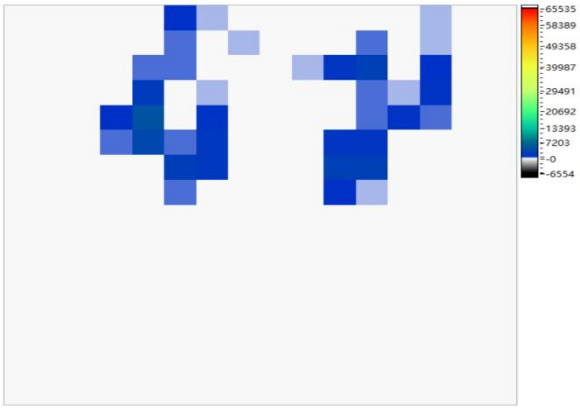
Vocal Position

Figure 2. The Sound Point of the Chime

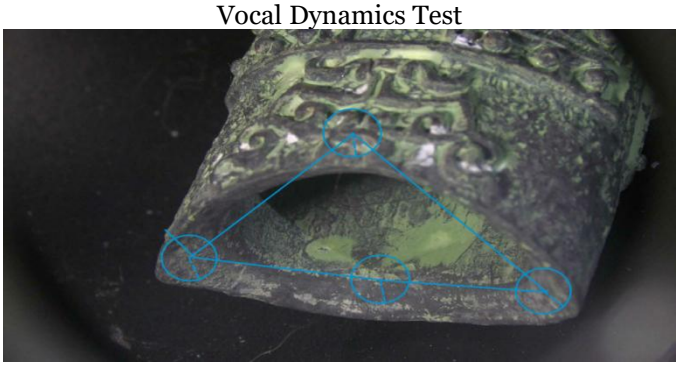
As can be seen from Figure 2, the sound point of the chime is at the left drum, right drum and bell drum position, while the sound point of other positions is on the surface of the chime, indicating that the single bell has its own resonance and there is a resonance between the chimes. In the music culture of the Chu and Han dynasties, chimes have always occupied a key position, which is reflected in five aspects: first, the symbol of social status. During the Chu and Han dynasties (206~202 BC), chimes were a valuable musical instrument that symbolized power and wealth. At that time, chimes were not only one of the musical instruments, but also a symbol of social and political status. For example, having a set of beautifully crafted chimes signifies the prominent status of the family and, secondly, religious and ceremonial functions. The chimes of the Chu and Han dynasties had a core function in various religious ceremonies and national ceremonies at that time. For example, chimes are used in the worship of heaven and earth and ancestors to express respect for gods and ancestors, and their sound is also believed to connect the world and the gods, and then the carrier of cultural inheritance. As we all know, the chimes of the Chu and Han dynasties are not only a classic musical instrument, but also contain a lot of different cultural information, such as its patterns and inscriptions, which can reflect the social culture and historical and philosophical ideas of the Chu and Han dynasties. It is possible to understand the historical background and cultural connotation of the time by studying the various information of the chime and then understanding the music education tools. Chimes also have an extremely high status in music education. Because of its fixed pitch and multi-pitch properties, it is often used to train musical talents and improve their understanding of intonation, musical structure, rhythm, and, finally, their artistic aesthetic value. In the Chu and Han dynasties (206~202 BC), chimes had excellent musical performance and high-level artistic modeling and decorative characteristics. Whether it is the gorgeous decorative patterns and inscriptions full of cultural connotations, or its overall design, they can represent the artistic aesthetic level and aesthetic concept of the Chu and Han dynasties. The pitch and timbre are more varied. The chimes of the Chu and Han dynasties were generally composed of dozens or even hundreds of bells of different sizes and pitches, so each bell could emit two different pitches, generally the main tone and the emblem sound. The two-tone design allows the chimes to emit many harmonious and complex pitches at the same time during the performance, so that the music has a rich sense of layering. For example, the player can create complex chord effects by using the double tone presentation of multiple bells, and by striking each bell at the same time to produce a harmonious sound, thus revealing the different harmonic structures in the music to achieve an aesthetic timbre. In addition, the player can also achieve counterpoint performance through the different pitches of multiple bells, for example, by alternating the bells that can be struck at different pitches, to create a counterpoint melody, so that the melody of the piece is more varied and layered, and then create a more textured sound, and secondly, the combination of harmony and melody. The two-tone phenomenon will allow the chimes to produce sounds similar to harmonic effects during playing. For example, the player can strike bells of different pitches to create rich melodic lines, and based on this, add multi-dimensional harmonic support, based on which they can play a full, beautiful piece of music, and then show the harmonic charm of the chime, and thirdly, the rhythmic and rhythmic characteristics. For example, the performer can use the two-tone rule to change the rhythmic pattern of the piece while maintaining a stable rhythm, and then create different two-tone music by striking each bell, so as to create music with a sense of rhythm and rhythm, and improve the level of performance, increase the variety of music, and improve its interest. In addition, the performer can also use the two-tone law to change the rhythm and rhythm in the chime performance, so that they are interlaced, so as to improve the rhythm of the music, and based on this, change the rhythm mode, so as to improve the interest of the music performance, enrich the level of the chime performance, and fourth, the sound effect and sense of space. Because the structure of the chimes is relatively unique, when the chimes are struck, it can produce a significant resonance effect in the space, and then form a more three-dimensional sound field effect. This stereo field is rich because frequencies and overtones interact, reverberate in the space, and create a sense of profundity. For example, when a player strikes bells of different pitches, the two-tone phenomenon causes the sounds at each frequency to interact with each other and produce a more diverse overtone effect.

The Two-Tone Rule of Chimes

In order to better test the two-tone rule of chimes, a force film instrument was used to test the sound of chimes, and the results are shown in Figure 3.



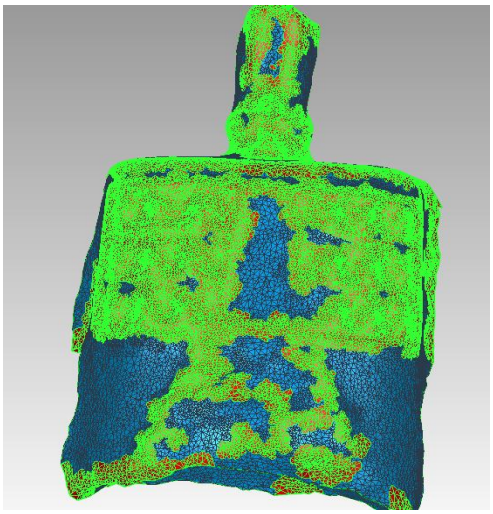
Vocal Dynamics Test



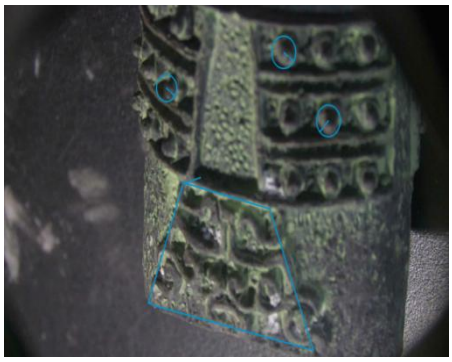
Chime Sound Point

Figure 3. The Sound Effect of the Left and Right Drums of the Chime

As can be seen from Figure 3, the power between the left and right drums of the chime shows a tendency to increase, and the sound effect is the two-tone regular sound, mainly because the single bell itself is low-pitched, and the chime resonance is high-pitched, showing the law of two-tone sounding. The chimes of the Chu and Han dynasties have a unique principle of timbre and resonance. In order to facilitate the understanding and understanding of the chimes of the Chu and Han dynasties, this paper will analyze their unique timbre and resonance principles. First of all, the unique tone. First, make the material. Second, the advantages of morphological design. The design of the shape and size of the chimes in the Spring and Autumn period affected their timbre. In general, chimes are slightly flattened, with a wide base and a narrow top, which helps to spread the sound waves, improving the low-frequency resonance and making the chimes' tone deeper and more melodious. Third, pitch modulation. In the Chu and Han dynasties (206~202 BC), the thickness of the bell wall and the size of the inner cavity of the chimes were carefully adjusted by craftsmen to achieve a good rhythmic effect. Such a fine modulation allows each chime to emit its specific frequency sound waves accurately so the melody can achieve harmony and have a unique timbre. For example, after fine-tuning the diameter of the inner cavity and increasing or decreasing the wall thickness, the craftsmen can precisely control the fundamental frequency sent by each chime; in ancient Chinese music performance, the two-tone rule refers to the fact that in the process of playing an instrument, the instrument can produce two different pitches and express different timbres, thus enriching the expressiveness and connotation of the music performance. In the performance of ancient musical instruments, the application of the two-tone rule was widespread, for example, people in the Chu and Han dynasties would use different combinations of pitches and timbre effects to create musical works full of charm and moving sound effects. Through the clever use of the two-tone rule, the player can create a more profound and rich sound effect, and inject abundant emotions into it to enhance the connotation of the song. In this way, the sound effect and connotation can be blended with each other, so as to enrich the musical works of the Chu and Han dynasties, and improve the appeal and charm of the musical and artistic works of the Chu and Han dynasties. The overall structure of the chimes is shown in Figure 4.



Chime Resonance Area



Chime Resonance Point

Figure 4. Schematic Diagram of the Sound Position of the Chime

In Figure 4, the green part is the treble vocal area, and the blue part is the low vocal area. The blue part is the resonance area of the single clock itself, and the green part is the resonance area between the chime combinations. Among them, the ornamentation of the chimes is the treble resonance point. The chimes of the Chu and Han dynasties have a good structure. The difference in structural design will also affect the acoustic characteristics of the chime. For example, bells of different shapes, sizes, and thicknesses produce different tones and pitches. In addition, the hollow design of the inside of the chime can also create a resonance effect, which in turn affects the final timbre, because the bell body of different shapes, sizes, and thicknesses will produce different vibration patterns. For example, larger and thicker chimes tend to produce a bass-sounding sound, while smaller and thinner chimes produce a high sound. In addition, the cavity inside the chimes will also improve the resonance effect and make the sound of the chimes richer and more persistent (Curtin,et al,2023). It can be seen that under the influence of many factors, the timbre of chimes in the Chu and Han dynasties is often colorful, crisp and moving, especially when playing classical music, it can better meet the timbre needs of ancient music, and then, different hanging methods will also affect the acoustic characteristics of chimes. For example, if different suspension methods are used, chimes may produce different vibration patterns and frequencies when struck, which in turn will affect their timbre and sound quality. The way the suspension is carried can affect the vibration pattern. For example, if the hanging method is different, then the chime body will have different patterns in the process of vibrating, resulting in different timbre and sound quality. The way you hang also affects the vibration frequency. For example, when a chime is struck, it emits different sounds, which are affected by different vibration frequencies and exhibit different acoustic properties. Therefore, changing the vibration frequency of chimes will affect their timbre and sound quality, and thus affect the performance effect of chimes. For example, when the frequency of vibration is adjusted, the sound of chimes can be played richer and clearer to suit the requirements of the performance, and these overtones are intertwined in the space to create a unique resonance and improve the three-dimensionality and richness of the sound field

DISCUSSION

Application of the Acoustic Principles of Traditional Musical Instruments in Teaching

According to the research in this paper, the acoustic characteristics of chimes in the Chu and Han dynasties are diverse, and the artistic display of the ancient two-tone law in the chimes of the Chu and Han dynasties can also reflect the effective promotion of the acoustic principles of traditional musical instruments to the development of music culture. Then, based on this, the relevant research on chimes in the Chu and Han dynasties can also bring some enlightenment to modern music education (Qiao, Yan & Wang, 2024; G.Kim, D.-K. & Jeong, 2024). For example, the application of the acoustic principles of traditional musical instruments in teaching is the embodiment of this inspiration. First, the principle of sound generation and propagation. During the Chu and Han dynasties, sound would be generated after the chimes were struck, and in the process, vibration, resonance, and sound wave propagation phenomena would also occur. In music teaching, teachers can demonstrate the process of sound generation and propagation for music education through the presentation of the performance principle of chimes in the Chu and Han dynasties so that music education can fundamentally understand the basic concepts of acoustics. So, this allows music education to recognize the essence of the overtone series. In the process of teaching, teachers can use the chimes of the Chu and Han dynasties or related video demonstrations to show the overtones for music education and help understand the tuning process of chimes, etc., because chimes can emit multiple frequencies of sounds, and these sounds of different frequencies will be used to construct harmony and melody, so teachers can use the combination of chimes in modern music education to demonstrate the law of double tones. At the same time, it can also help music education complete the method of chord construction and help practice related music theory knowledge. Fourth, the cultivation of music composition and expression ability.

There are also many valuable contents in ancient music theory, such as a variety of creative techniques and expressions, aesthetic concepts, etc., which are of great enlightening significance for modern music education. For example, through the study of ancient music theory, music education can draw rich creative inspiration and help students acquire many different expression skills so that creative ideas and expressions can be expanded. Moreover, music education can also draw on various aesthetic concepts in ancient music theories to improve its own artistic taste and aesthetic level. The development of the two-tone law in the Chu and Han dynasties not only gave the performance at that time many different means of expression, but also profoundly impacted the inheritance and development of music in later generations.

The Sublimation of the Connotation of Modern Music by the Law of Double Tones of Chimes

As we all know, the research on chimes in the Chu and Han dynasties can play a certain role in modern music education. Moreover, the study of chime culture is also conducive to the cultivation of aesthetic taste and creativity in music education. First of all, it can enrich the musical aesthetic experience of music education. First, the diversity of timbre and rhyme can provide some help for music education. The chime of the Chu and Han dynasties is a percussion instrument, which has unique timbre and resonance characteristics, and can play a good role in the music performance process. Through studying and researching chime performance skills, music education can provide a rich musical aesthetic experience and gradually develop the ability to perceive different timbre and rhyme elements. Based on this, the aesthetic ability and core literacy of music education will be comprehensively improved. The sound effect is very harmonious and good (Dandge & Patil, 2024). Chimes in the Chu and Han dynasties can produce harmonious sounds during performance, and based on the use of the two-tone rule, players can create a good harmonic effect by playing different bells alternately. Based on this, music education can feel the beauty of harmony in the performance of chimes, and gradually develop strong musical and acoustic aesthetic ability, and secondly, improve the creativity and artistic expression of music education. First, the diversification of playing techniques. When playing chimes, you need to be able to flexibly use the two-tone pattern and play more moving music through clever combinations of different pitches and rhythms. Based on this, teachers can use chime-based music performance teaching to stimulate creativity in music education and cultivate musical expression skills and expressiveness. Artistic expression and emotional communication. Through the explanation and related demonstrations of the performance skills of chimes in the Chu and Han dynasties, music education can feel the inner emotions from music, and based on the knowledge and understanding of the two-tone law, to demonstrate and play the style, and improve the ability to express musical emotions. Based on this, music education's artistic creation and expressive potential can be stimulated. All in all, chime culture is of great significance in modern music education. It can cultivate the aesthetic taste and creativity of music education and improve the ability of music education to express musicality. In modern music education, teaching chimes in the Chu and Han dynasties can also stimulate the creative thinking of music education, and help music education improve artistic expression and emotional communication ability. Based on this, teachers should pay attention to the introduction of chime culture in music education to integrate it into the aesthetic and artistic education of

music education.

To Enhance the Skills of Modern Music Education

The existence of the two-tone law also had a certain influence on the players' playing skills at that time. For example, in order to improve their own interpretation level, the performer must master the mastery of various pitches and timbre control skills based on this, can promote the performance level and skill level of the performer, and provide a certain impetus for the innovation of instrument performance technology in the Chu and Han dynasties; third, enrich the composition style of the time. For example, composers at that time could create works with different melody and harmony styles by applying the two-tone rule, and at the same time, they could also create more varied and appreciated melodic structures. Fourth, improve the expressiveness and connotation of music. The existence of the two-tone law makes the Chinese national music in the Chu and Han dynasties more profound artistic expression and connotation. For example, through the use of the two-tone rule, the player can play the deep emotion and connotation of the music, thereby enhancing the artistic appeal of the musical work of the time. In addition, the player can also make reasonable use of the two-tone law to create a three-dimensional sound effect in the process of playing the chime. For example, by striking bells of different pitches alternately, the sounds at each frequency can reverberate in the space and create a profound sound effect that adds resonance to the music. The two-tone law also influenced the music theory system of the Chu and Han dynasties. Through the study of the two-tone law, it is found that the two-tone law also had a significant impact on the music theory system of the Chu and Han dynasties, which is manifested in the following aspects: first, enriching the music theory at that time(Williams et al., 2023). The existence of the two-tone law had a rich effect on the music theory system of the Chu and Han dynasties, which made ancient music theory more diverse and complex. For example, judging from the acoustic characteristics of chimes in the Chu and Han dynasties, as well as their pitch, timbre and harmonic performance, the two-tone law provided many new elements and contents for the music theory system at that time. As we all know, applying the two-tone rule made the chimes of the Chu and Han dynasties have a variety of timbres, and can create a unique and multi-timbre through various performance techniques and the reasonable combination of instrument materials. In this way, the Chu and Han dynasties' musical works were enriched, their musical charm was enhanced, and the pitch and interval performance were enhanced. During the performance, the two-tone pattern can reflect different combinations of pitches and intervals. By producing two different pitches at the same time, or two different pitches at different points in time, the performer can create a harmonious, staggered, and counterpoint sound effect, thus enriching the musical expression

CONCLUSION

During the Chu and Han dynasties (206~202 BC), chimes' acoustic characteristics needed to be strengthened. At the same time, the music culture of the Chu and Han dynasties attached great importance to the two-tone rule, and the study of the two-tone law will help future generations to understand better and understand the application of the two-tone law in the Chu and Han dynasties and the music culture at that time. The results show that the main components of the chimes are bronze, brass, iron, tin and lead, and the chimes resonate through wooden and copper rods. A single bell realizes self-resonance and produces low-frequency tones, and chimes resonate with each other to produce high-frequency tones. Among them, wooden rods and copper rods can enhance the resonance effect of chimes, and chime decoration will also enhance the resonance effect of treble. The left and right drums of the chimes resonate and extend the distance of the chimes, so the distance between the chimes increases with the size of the chimes. In addition, the study of chime culture in the Chu and Han dynasties will have a great enlightenment for modern music education, enrich the educational content, improve the education level, deepen the educational connotation, and provide support for the inheritance of the chime culture of the Chu and Han dynasties. In this study, there are difficulties in obtaining chime samples, and some references cannot be effectively obtained, so we will focus on research in the future.

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