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PROCEEDINGS

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Zoomusicology Research in Serbia

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Abstract

Zoomusicology studies musical aspects of animal sound patterns and their aesthetic qualities. Applied Zoomusicology was the optional subject for MA and PhD students at the Faculty of Music in Belgrade from 2011 to 2017. The aim of this paper is to offer an overview of zoomusicology research in Serbia, resulting in 30 seminar papers and eight articles that have been published in Serbia and abroad during the last decade. Studying similarities between humans' and animals' communication systems and finding music elements of the animal sound patterns which correspond with music elements in Serbian folk songs and dances indicate the origin of music and language. Notating and analyzing animal sound patterns have strong pedagogical implications, enabling understanding of basic music elements. In the field of psychology and sociology, the role of nonverbal communication of apes, cats, dogs, and birds, and facial expression as a result of the effect of music on emotional expression in humans and animals has been considered. To understand evolutionary and ontogenetic development of rhythm in humans, the investigation of the rhythmic abilities of the great apes was conducted.

Introduction

In this paper, I presented an overview of my zoomusicology research in Serbia during the last decade. Zoomusicology studies musical aspects of animal sounds (Mâche, 1992). It also considers the aesthetic use of sound communication among animals (Martineli, 2008), or the human valorization and analysis of the aesthetic qualities of non-human animal sound (Taylor, 2017). There are some common features between animal sounds and human music, such as organization and form, repetition and variation, intervals and scales, rhythm and tempo, sounds and timbres (Martinelli, 2008). An understanding of those basic musical parametershas been achieved through the use of familiar animal sound patterns in initial music education (Petrović, 2009a, 2009b). The similarity of musical parameters, especially metric and rhythmic ones, in human and animal sound patterns indicates that humans imitated animals and introduced their sounds into their songs and dances (Petrović & Ljubinković, 2010, 2011). I was also researching the role of some animals in nonverbal communication (Petrović et al., 2014) in order to show gestures and facial expression as a result of the effect of music on emotional expression in humans and animals (Petrović, 2012). I was studying similarities between humans' and animals' communication systems in order to indicate the origin of music and language (Petrović, 2014, 2017). Finally, I did the experimental research with preschoolers and apes trying to find out whether rhythmic patterns they produce are inborn characteristics or experience (Petrović et al., 2017). Because of my particular interest in the rhythmic abilities of humans and animals, I decided to present this research in more detail in this article. The belief that animals can produce rhythm using purpose-built instruments is the fact that the ability to synchronize action or sound production to a regularly produced external pulse, or the so-called rhythmic entrainment, is not just a uniquely human ability, but also an animal (Patel, Iversen, Bregman, & Schulz, 2009).

Zoomusicology Research

My first zoomusicology research, presented at the second conference Changing Face of Music Education in Tallinn in 2009, refers to the application of animal sound patterns in music education for beginners. The aim was to use the familiar animal sounds as a tool for children understanding basic music elements through listening, analyzing and notating. For example, a nightingale's pattern brings a clear meter and rhythm (Figure 1).

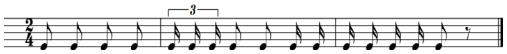

Figure 1. The combination of eights and sixteens in the 2/4 nightingale's sound pattern (Petrović, 2009b).

Or, a cow's mew (Figure 2) and wolf's howling (Figure 3) could be presented with the analog notation pointing to the melodic contour and dynamics:

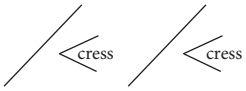

Figure 2. Analog presentation of the cow's mew (Petrović, 2009b).

Figure 3. Analog presentation of the wolf's howling (Petrović, 2009b).

However, in some animal sound patterns, we may recognize tonality. It is the case with one of the dove's patterns, where we hear the relation between tonic, dominant and the second scale degree (Figure 4).

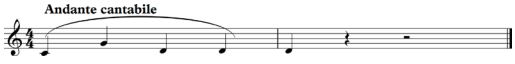

Figure 4. The implication of tonality in a dove's sound pattern (Petrović & Ljubinković, 2011).

This type of cadenza on the second scale degree is a typical cadenza in many Serbian folk songs. Therefore I did the empirical research about music elements of animal sound patterns that were found in Serbian folk songs and dances. I presented the results at the 10th Conference on Interdisciplinary Musicology in Sheffield in 2010 (Petrović & Ljubinković, 2010, 2011). The aim was to show similarities between humans' and animals' communication systems through the human's imitation of animal sound patterns in Serbian folk music. For example, the contagious heterophony (Brown, 2012) could be heard in wolves howling, but also in Serbian traditional singing "ojkanje", where one person starts singing and then the rest of a group continuous. Or, the rhythm of a horse's gallop (Figure 5) is recognizable in a Serbian traditional dance "Nemo Glamočko kolo" (Figure 6).

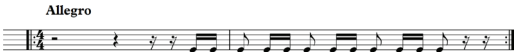

Figure 5. The rhythmic pattern of the horse's gallop (Petrović & Ljubinković, 2011).

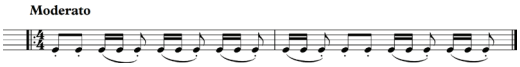

Figure 6. Serbian folk dance "Nemo Glamočko kolo" (Petrović & Ljubinković, 2011).

A dove's 5/8 meter is typical for many different Serbian folk songs and dances, while a dove's syncopated rhythm is similar to those in some Serbian folk songs and dances. Rooster's dotted rhythm is heard in Serbian traditional dance "Vlaško kolo", and crane's augmented fourth is a melodic pattern of Serbian traditional music as a part of the Balkan scale. Metric change from 6/8 to 3/4 and vice versa the cardinal makes while singing, can also be a metric base of some Serbian songs.

In 2011, I introduced Applied Zoomusicology as an elective subject for the MA and PhD students of different departments at the Faculty of Music in Belgrade. The results are 30 seminar papers on different topics. Students wrote about sound and gestural communication within different types of animals, such as *birds* (Emotional aspects of music communication in owls; Elements of dance in birds of paradise, cranes, and peacocks; The possibility of applying birds musical patterns in music pedagogy in Sarajevo; Birds as inspiration: "The Blackbird" by Olivier Messiaen; Zoomusicology aspect of music research and place identity of birds in Einojuhani Rautavaara music); *honey bee* (Honey bee and the Bible – communication through symbols; Factors of identities of Apis-mellifera through the sound communication in human surrounding), *mammals* (Musical elephants: How did we get to it?; Equus Caballus: basic steps and rhythmic patterns; Can apes produce rhythm on children's percussion instruments?; Sound communication of wolves in the pack; Gesture communication in apes), etc.

In 2011, at the 14th Pedagogical forum of performing arts in Belgrade, I presented the results of the research dealing with the effect of music on humans and apes emotional expressions (Petrović, 2012). There were three groups of participants: 1) babies (less than 7th months); 2) people with mental disorders and 3) chimpanzees from the Belgrade's zoo. They wereall listening to the eight different types of music: 1) pentatonic; 2) Serbian orthodox music; 3) Serbian folk song; 4) Bach's Air on G; 5) Mozart's Symphony 40 in g minor 1st movement the first theme; 6) House music; 7) Metal music, and 8) Music from the movie "Schindler's list". Their face and body reactions were recorded by the camera. The results show facial expression and gesture as the effect of music on emotional expression in humans and animals.

At the 5th International symposium of music pedagogues in Pula, Croatia, in 2017, I presented the exploratory research on whether rhythmic patterns of humans and chimpanzees are inborn characteristics or experience (Petrović et al., 2017). The research was conducted in May and June 2016, at the Preschool institution "Čika Jova Zmaj" Belgrade, Music school "Dr. Vojislav Vučković" Belgrade and Belgrade's Zoo.

The aim was to: 1) determine similarities and differences in preschoolers and chimpanzees rhythm reproduction, and 2) investigate if those patterns reflect the inborn characteristics or the experience.

The sample was a) *Children*: (153) boys (56) and girls (64), and b) *Chimpanzees*: (5) female (4) and male (1). The children sample was a) *Preschoolers*: (120) age 3–4 (48) and 5–6 (72), and b) *Music prekindergarten*: age 6–8 (33) boys (12) and girls (21).

The task given to children was to perform any kind of rhythm on claves without preparation. Children were tested individually to avoid imitation. Chimpanzees were given specially designed instruments – two plastic hollow tubes 30 centimeters long and 5 centimeters in diameter. These were made of simple materials that cannot harm the animals and were resistant to animals' strength. Both children's and chimpanzees' performances were recorded by the camera Practica DVC 14.1 HDMI.

Results showed that preschoolers frequently performed only the pulse and the gradual introduction of rhythmic substance increased with age. Without clear accents, a pulse cannot express emotions, and it is only the rhythm that can express the emotional state of a performer. However, preschoolers rarely performed rhythmic patterns, but with an increase in age, the rhythm performance of duple meter and 2 eights 1 quarter rhythmic pattern as the most frequent one appeared. It was expected that children in music prekindergarten would perform rhythmic patterns more frequently. Finally, chimpanzees did not perform any rhythm on the given instruments but have shown they enjoyed playing with the instruments and connecting tubes/sticks, just like some preschoolers.

However, only one male chimpanzee named Jova performed the rhythm, not with the sticks but with his body. The body movement was the consequence of his emotional state that was caused by the social context provoked by the zoo visitors. The form of his rhythmic pattern has two parts: 1) he stands in one place and produces rhythm with his legs alternately hitting the floor, 2) he moves in a circle and diagonally, and speeding the tempo causes the change of rhythm – from equal eights into the dotted rhythm.

Interestingly enough is that Barney, the chimpanzee from one of the Netherland's zoo, also produces a similar rhythm to Jova. He drums with his hands on the metal barrel found in his surroundings. Because the tempo was fast, Barney, just as Jova, changes eights into the dotted rhythm. Both of the chimpanzees create a kind of form, instead of Jova's two parts, Barney performed eleven sequences. The fast tempo in both chimpanzees was similar to human's manual rhythmic reproduction (Dufour, Poulin, Curé, & Sterck, 2015).

The results show that all three categories of participants performed isochrony, dotted rhythm, syncopations, and eight/quarter combinations. What we may consider as inborn characteristics are: pulse performance, isochrony, and fast tempo. The result of experience may be one-bar or two-bars rhythmic patterns, triple meter, and complex rhythm. Researching

chimpanzees' rhythmic abilities would help to discover the biological basis of rhythmic reproduction. The base of the rhythmic behavior of preschoolers and chimpanzees is a biological predisposition to perform and understand the rhythm.

Zoomusicology in Music Education

Animal sound patterns might be integrated into music education. For example, a dove's rhythmic patterns could be used to teach short-long rhythm in syncopated, dotted and 5/8 rhythm (Figure 7).

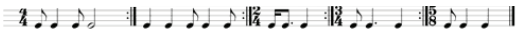

Figure 7. Short-long rhythm in dove's rhythmic patterns.

When teaching syncopated rhythm we can use a dove's syncopated rhythmic pattern. It can be recorded and introduced in education as an accompaniment to the song "Sunce nam se krajom krade" (Figure 8).

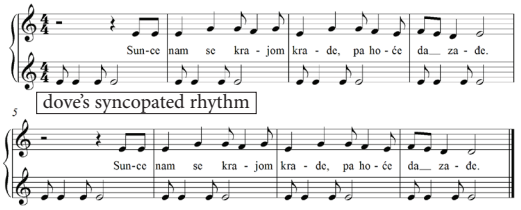

Figure 8. Dove's continual syncopated rhythm in the lower voice within the song "Sunce nam se krajom krade".

The dotted rhythm is very recognizable when listening to the rooster's rhythmic pattern. Therefore, introducing a dotted rhythm in music education is possible through a rooster's pattern. In the song "Sedela sam za mašinom šila sam" we introduce a typical rooster's pattern four times, namely after each two bars of the following eight-bar musical sentence (Figure 9).

A dove's 5/8 meter may be used three times within the song "Ej gidi Stojne ubava**"** as the important structural bond at the beginning, in the middle (between first and the second four bars of the eight-bar sentence) and at the end of the song (Figure 10).

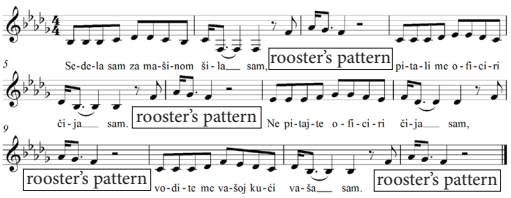

Figure 9. A rooster's dotted rhythmic pattern within the song "Sedela sam za mašinom šila sam".

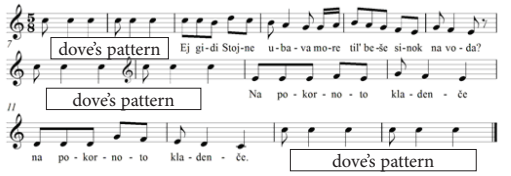

Figure 10. A dove's 5/8 metric pattern within the same metric song "Ej gidi Stojne ubava".

Conclusion

Zoomusicology studies music-like aspects of sound communication among non-human animals and their possible aesthetic qualities. The aim of this article is an overview of zoomusicology research undertaken during the last decade in Serbia, both by myself and my students and colleagues. In most of the seminar papers written for the elective subject Applied Zoomusicology, students dealt with the musical and pedagogical aspects of birdsong and mammals sound patterns.

The central topic of my research is to find common features of animal sounds and human music. Like human music, numerous animal patterns most often have isochrony (seal, canary, horse) and duple meter (dove, nightingale), while the iambic meter is most likely conditioned by inspiration (rooster, dove, owl). However, we can also find non-isochrony (owl, cardinal, peacock). Humans and animals sounds share syncopated rhythm (dove) and dotted rhythm (rooster, owl). What is perhaps most surprising is that animals have a sense of tonal centre (frog, dove, duck). Method for describing and notating animal sound patterns have strong pedagogical implications, enabling understanding of basic music elements.

Studying similarities between humans' and animals' communication systems indicate mu-

sic and language origin. Most aspects of human speech acoustics, physiology, and neural control are similar to animals. Interestingly enough is that laryngeal descent is not uniquely human, but it serves to elongate the vocal tract, allowing callers to exaggerate their body size by decreasing vocal tract resonant frequencies in humans, birds, and mammals.

Since antiquity, humans have imitated sounds from their environment, especially those of animals. In Serbian folk songs and dances, animal sound patterns were incorporated for ritual purposes by direct imitation. Serbs imitated small melodic ranges of many animal species, drones, and heterophony of wolves howling, ending on the second scale degree of a turtledove singing, the interval of the augmented fourth of a crane, galloping rhythm of a horse and dotted rhythm of a rooster.

The role of some animals in non-verbal communication has also been considered. Namely, the musculature of humans and chimpanzees is very similar, just like their facial expression, reflecting similarity in expressing basic emotions. Facial expression in humans and chimpanzees depends on emotional state and social context. Listening to the same music causes a similar expression of emotion in humans and chimpanzees. This suggests that the musical experience is of evolutionary origin and that music can evoke primordial emotions in modern man.

In human and animal communication systems there is a link between sound quality and emotion. Animal sound communication is an expression of the functional aspects of their behavior, emotional state, and rarely an aesthetic expression. Animals most commonly use vocal and gestural communication, while mating season, as a warning sign given to other animals, to mark territory or to identify within species.

To understand evolutionary and ontogenetic development of rhythm in humans, it is inevitable to investigate the rhythmic abilities of the great apes, because they are the only species, apart from humans, having inborn percussion behavior. The particular interest in human and animal rhythmic abilities prompted me to present the 2017 experimental study which deals with preschoolers and apes rhythmic expression on children's percussion instruments, aiming to search for the evolution of rhythm as inborn characteristics or experience.

All the published articles carry the reader through a series of disciplines – music education, cognitive and evolutionary musicology, music theory, aesthetics, and cognitive psychology. The interdisciplinarity of zoomusicology opens new perspectives on music origin, musicianship, and music education.

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