Are "non-human sounds/music" lesser than human music? A comparison from a biological and musicological perspective

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Abstract. The complexity and variation of sound emission by members of the animal kingdom, primarily produced by the orders Passeriformes (songbirds), Cetacea (whales), but also reported in species belonging to the Exopterygota (insects) and Carnivora (mammals), has attracted human attention since the Middle Ages, where birds' calls were used in compositions of that time. However, the focus of this paper will be on sound productions of birds and whales, as recent scientific and musicological research concentrates on these two animals.

1. Towards a definition of the terms "music", "sound" and "noise"

The discussion of a cross-disciplinary matter, such as "non-human sounds/music" and "human music" must entail a definition of the terms "music" and "sound". According to Ian Cross (1998: 207), musicology is based on "immanentist" thinking, which ignores scientific evidence that may contribute to *Musikwissenschaft*. The notion of an irrational animal and its sole response to inbuilt natural instinct can be traced back as far as the Middle Ages (Leach 2007: 11). Beasts are

degraded to "inanimate objects", whose sounds must not be dignified with the term 'music', as music is a trait which can only be ascribed to humans (Leach 2007: 20; Peretz 2006: 1; Trehub 2003: 670).

From a zoological point of view, however, animals are regarded as "musicians", who display musical sensibility and use ornamentation or instruments to deliver their musical compositions (Jellis 1977; Bottoni *et al.* 2003). Birds may sing for pleasure and enjoyment, as sound signals may have evolved not just for the purpose of reproduction and survival (Hartshorne 1973; Jellis 1977).

Wieland Ziegenrücker (1997: 9) defines music as an "artistic expression of man"[1]. Music may be "organized sound" comprising sound phenomena and serialization (Metzger, Pepper 1997: 55). However, according to *The New Penguin Dictionary of Music*, music is "an arrangement of, or the art of combining or putting together, sounds that please the ear", which does not explicitly exclude animals as the "sound producers" (Jacobs 1977: 277). Furthermore, *The New Grove Dictionary of Music and Musicians* acknowledges that

> […] presenting the word 'music' as an entry in a dictionary of music may imply either an authoritative definition or a properly comprehensive treatment of the concept of music […] in all senses. That last would require discussion from many vantage points, including the [...] biological, […] along with the musical in the widest sense. Whether music is human-specific or whether other species have music has been an issue for musicologists; and so also is the question whether the works of certain 20th-century composers may be included on equal terms with music based on common practice.[2]

In fact, Mark Robin Campbell (1992: 83, 88, 90) argues that John Cage's composition *4'33"* cannot be regarded as music, as silence does not permit auditory movement, which comprises rhythm, tonality and

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[1] "*Musik ist eine künstlerische Lebensäußerung des Menschen*" in the German original.

[2] http://www.grovemusic.com/index.html?authstatuscode=202

harmony, although the author acknowledges that it may be a "musical notion". By contrast, Heinz-Klaus Metzger and Ian Pepper suggest John Cage's compositions may be "liberated music", despite Cage's ignorance for musical harmony resulting in tones not corresponding to each other. Further, the authors refer to the piano as "sound source" instead of "musical instrument" (Branden 1997: 80; Metzger and Pepper 1997: 53). The dictionary defines "sound" as "meaningless noise", whereas "noise" may be a "sound of any kind or a nonharmonius or discordant group of sounds"[3]. Considering the difficulty to reach a unitary definition of "music" and "sound" within musicology, some authors avoid the distinction altogether and suggest "musical sound" may be non-human, but that the term music is reserved for human intention or organisation. The title of this paper has been chosen in order to avoid these problems, which may result from the implications of these distinct terms. Therefore the emission of sound by animals, if discussed from both a scientific and musicological perspective, will be referred to as 'non-human sound/music' in order to represent both views. [4]

2. Natural sciences *versus* musicology

When dealing with non-human sounds/music it is crucial to be aware of the different methodologies in the respective research areas, their advantages and limitations. The natural sciences heavily rely on the formulation of null hypotheses, the acceptance or rejection of which depends on the statistical significance of data, upon which any further argumentation is based. By contrast, musicological discourse requires informed judgment of opinions, which is supported by evidence from

[3] http://www.thefreedictionary.com/sound

[4] According to Philip Tagg's *Towards a definition of Music*, available at http://www.tagg.org/teaching/musdef.pdf

similar studies. Frank X. Mauceri (1997: 194) notes that music theory, a branch of musicology as listed in the *Dtv Atlas Musik*, "manifests itself in equipment, methods, and expectations" (Michels, Ulrich 1977: 13). The crucial difference to the natural sciences is that the validity of these "expectations" is not dependent on statistical values. These two approaches illustrate the apparent opposition of these two disciplines, which raises the question, whether science and musicology are incompatible with regard to the respective analyses. Linda Phyllis Austern (2001: 52) notes that people in earlier times were "fascinated by […] the traditionally opposite shores of art and nature". A brief introduction to the origins of music may shed light on whether this "incompatibility" can be ascribed to the nature of the disciplines or the changing attitudes of scientists and musicologists over time.

3. Origins of music

Music in the Middle Ages comprised ethical, political and mathematical topics, of which the latter category contributed to establishing "ratios" in compositions. Authors of treatises of that time discussed music in a scientific manner, which included the analysis of the position of pitches or the size of intervals. Following Pythagoras' discovery of the harmonic ratios of tones, music and nature complemented each other (Leach 2007: 16).

A picture by Francesco Corbelletti from 1650 supports beliefs of theorists of the mid-seventeenth century who suggested that "birdsong can tell us where music came from" (Clark, Rehding 2001: 5). The graphic visualisation of the pitches uttered by several bird species does not only aptly capture the complementing aspects of the worlds of science and art, but also reflects the origins of music. However, the end of the 16th century marked a split of the nature of music through the influence of the "modern world" (Chua 2001: 19). While one division comprised scientific, objective and external truth and facts, its

juxtaposition was concerned with human, subjective and internal meaning and values (Figure 1).

According to Daniel K. L. Chua (2001: 19) this shift occurred through the transfer of music from the medieval quadrivium, the "science of music", to the rhetorical arts of the trivium. Music had become an acoustic fact that was easily controllable by scientific experiments, thus it was in opposition to the power of human nature. The 18th century stimulated a change in direction, which may have been initiated by Wolfgang Caspar Printz's remark (Head 1997: 9) in the *Kurtzgefaßtes musicalisches Lexicon* that birdsong serves as a model for imitation and reproduction. However, the split nature of music, that was characteristic of the 16th century, bears striking resemblance to the separate entities *Naturwissenschaft* and *Musikwissenschaft* today.

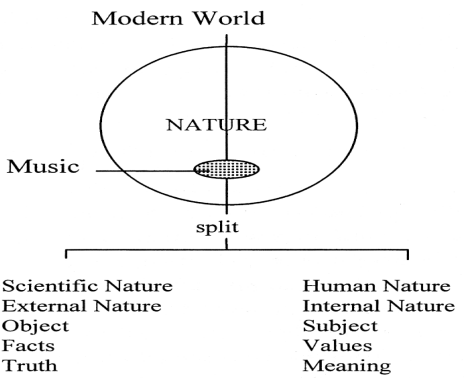

Figure 1. The split of music through the influence of the modern world [Reproduced with permission from Daniel K. L. Chua (2001: 19)]

According to Siegfried Nadel (1930: 533–536), the origin of music falls into three categories: music developed out of sexual instincts of man and animal, speech or human activity. Music and the "natural world" were in fact related and co-existed for some time. Johann Joachim Quantz (2001) considers a picture by François-Hubert Drouais, which

shows a parrot and a flautist and appears as the title page of the second edition of his treatise *On Playing the Flute*, as an appropriate representation of the contents of the book (Quantz 2001). A painting by Jan Breughel, *Allegory of Hearing*, shows a collection of musical objects and animals that embody the sciences. The stag in the middle of the picture representing "music" in ancient times thus indicates an early connection between music and zoology (Austern 2001: 52). The original co-existence of music(ology) and the natural sciences could not be exemplified better than by placing a bird on top of a score and displaying a representative jumble of material from both disciplines as in the painting *The Yarmouth Collection* by an anonymous Dutch artist (Austern 2001: 52).

The latest attempt to re-unite science and musicology takes shape in the form of zoomusicology, a term that was coined by François Bernard Mâche in 1983 in his *Music, Myth and Nature* (Martinelli 2004: 1). Although a search in the online encyclopaedia *Article World*[5] does not show any entries for this discipline and a journal dedicated to zoomusicology is currently non-existent, several articles related to this emerging research area can be accessed electronically. Sporadic essays appear in *Contemporary Music Review*, *SEED* (*Semiotics, Evolution, Energy, and Development*), *Sign Systems Studies*, *Quaderni di Musica/Realtà* and *Kulturos Barai*. The aim of zoomusicology is to combine aspects of both zoology and musicology and the investigation of an "aesthetic use of sound communication among animals", which may be a response to the two contrary opinions on non-human sounds, which are defended by the respective fields (Martinelli 2005: 3). Dario Martinelli, one of the pioneers in this area, defines the term in his own words and illustrates what is to be gained from zoomusicological contributions: "In zoomusicology, nobody would ever say that electric guitars are played also by frogs, or that penguins buy CDs. But, if we consider the biological dimensions of what we call music, taking

[5] http://www.articleworld.org/

account of causes, effects and side effects, then the work becomes realistic and useful" (Martinelli 2001: 2).

4. Zoological and zoomusicological evidence for non-human music

The rigid separation of the "inferior" bird or whale song and the "superior", sophisticated human music seems to be unjustified taking into account the different biological functions of species-specific song (that is, human music is produced for enjoyment, non-human sounds/ music have a function in survival) and the environment to which it is adapted. Rosemary Jellis (1977: 204) states in her book that "The acoustic proportions of natural surroundings can't be measured with the precision of those of a concert hall". Despite the musicological view that animals do not produce music as such, musicology acknowledges that animals are susceptible to its impact due to irrationality and lack of judgement. However, from a zoological perspective this view may be difficult to uphold given the wealth of experimental evidence.

The common raven, *Corvus corax*, which is a species that is capable of producing a range of calls, frequently engages in "tactical deception". Scientific literature mentions the bird's outstanding intelligence and possession of "insight" (Bugnyar, Heinrich 2006: 369; Dally *et al.* 2005: 1262; Drack 1995: 21). This is demonstrated by the raven's active engagement in deliberate "misleading" of conspecifics in order to avoid loss of cached food items to others. Ravens are capable of anticipating the behaviour of competitors, which is a pre-condition for deception (Heinrich 1999: 118). Joanna Dally and others (2005: 1261) suggest corvids judge whether or not another observant Western scrub-jay (*Aphelocoma californica*) pays attention to the caching event and can discriminate between the two. This clearly demonstrates that biological evidence does not support the view of the "irrational" animal. Furthermore, Dario Martinelli (2005) views animals as creatures which

"are well known for the regularity and humanly intelligibility of their pitch". He adds that "orcas include several *points of relaxation* […] in their most complex elaborations" (Martinelli 2005: 12).

As previously mentioned, another musicological view is that "inanimate objects" are incapable of producing music. According to Wieland Ziegenrücker (1997: 9), music developed out of emotion and knowledge, which are qualities "an object" clearly cannot possess. However, another study reveals that an African grey parrot (*Psittacus erithacus*) demonstrates understanding of frequencies and complex cognitive competence in response to a musical stimulus (a scale played on the keyboard). The notes from C to F played by the experimenter led to an original response by the parrot, instead of a mere parrot-like imitation, which included the filling in of missing notes to complete the scale (from E to D), followed by the bird's own variation (from B to G)(Bottoni *et al.* 2003: 136).

Several reasons may be put forward in support of the parrot's ability to master the musical code, which rule out the possibility of arbitrary choice of notes with regard to the utterance of the last three ascending notes.

The musical training sessions prior to the start of the experiment involved exposing the bird to both the stimulus (that is, an ascending scale) and an opposite response (that is, a descending scale) in a random musical solfeggio manner (Bottoni *et al.* 2003: 135). Since the parrot was positively reinforced to participate in the experiment, her response may have been influenced by the expectations and demonstrations of the scientists, which would indicate an imprecise experimental design rather than no understanding of the music on the parrot's side. The fact that the notes sung by the bird included a greater number of pitches that were dependent on previous utterances and different frequencies would not only suggest originality but also transposition abilities. This is supported by an additional study on frequency discrimination and the concept of rhythm conducted with the same parrot that compared the bird's responses to melodies played

by an electric piano (Bottoni *et al*. 2006: 85). In 83% of the cases the bird sang entirely new themes, while the remaining 17% were similar to the musical stimulus. This demonstrates the parrot's general musical ability to continue a melody in the same fashion, but also shows a preference for variation in 83% of the cases. In this trial the bird started a sequence with a learnt motif, but then experimented with the insertion of new notes, which may account for the ascent of the latter three notes in the first study from 2003. Since the parrot also displayed preferences for particular pitches, such as C, F and G sharp, it is interesting to note that in her response in the previous experiment some of the least favourite notes were sung (D and E out of D, E and A) in order to complete the scale-like phrase. This illustrates that pitches were not chosen according to preference, but involved awareness of the music.

The notion of musicality in birds is reinforced by the findings of the present study which revealed the ability for rhythmic regularity in this species (Bottoni *et al*. 2006: 82).

Further evidence that suggests the parrot's response can be termed musical variation comes from Luis F. Baptista and Robin A. Keister (2005: 432), who mention that birds attempt to avoid monotony in their songs. Musical excellence in composers is not demonstrated by constant repetition of scale-like passages but by variation on a theme. Should not the same criteria be applied to non-human singers in order to judge their musical ability effectively?

Musician wrens (*Cyphorhinus aradus*) are known to produce variations on a theme before returning to the original melody. In an experiment with blackbirds (*Turdus merula*), the "avian musician" copied some of the pitches played to him on a concert traverse flute. However, the authors report that "he would then go off on his own warbles and trills" (Baptista, Keister 2005: 435).

Some further examples show that variation and development of songs is the rule rather than the exception in the animal kingdom. Joan Hall-Craggs (1962: 278) found an increase in complexity of

birdsong with time. Several distinct musical phrases with varying length uttered by blackbirds (*Turdus merula*) were practised in different combinations to reach a final version, which contained elements from previous musical fragments as well as new ones. In a study on two populations of humpback whales (*Megaptera novaeangliae*) from two locations (Gabon and Brazil) in the Western and Eastern South Atlantic Ocean, the length and choice of themes varied with each song cycle (Darling, Sousa-Lima 2005: 561). As some whales continuously evolve song patterns over a period of time, the production of whale utterances is a process of improvement and development, which is comparable to human compositions in progress. Especially during the mating season whales may recycle melodies from previous years and add new musical material to them (McVay, Payne 1971: 591).

Contrary to the musicological notion of the non-existence of musical animals, Isabelle Peretz (2006: 9) notes that the processing of pitches may be one element that is responsible for musical behaviour, which she refers to as "domain-specific" element. This domain-specificity may arise from learning. W. Tecumseh Fitch (2006: 184) suggests that vocal learning and its resulting potential cultural transmission in the form of dialects may demonstrate an analogy between human music and bird song. Vocal learning in both birds and whales is reported in species, such as the common raven (*Corvus corax*), Indian hill mynah (*Garcula religiosa*) and viduine widow bird (*Viduine macroura*), the latter of which engages in natural mimicry. As a parasitizing bird species on estrilid finches (Estrildidae, for example *Estrilda caerulescens*) the imitation of the calls of the host species may increase survival (Nicolai 1974: 93–98).

The successful reproduction of song must involve excellent learning and memorization capacities in the viduine widow bird. However, the most outstanding avian example of pitch production comes from the Ryukyu robin (*Erithacus komadori*; Hartshorne 1973: 244).

The bird does not only use ornamentation such as trills and dynamics (diminuendo), but also articulation (for example, staccatos). In

fact, from a performance practice view, it was considered bad taste in the early 18th century to perform a piece without variation (Ledbetter 2001: 25). Today the art of free embellishing experiences a revival and has inspired a number of musicological articles on the matter. The use of ornamentation to vary song in some bird species seems to "go without saying" and may have led to such a variety of themes that they may have inspired a number of well-known composers. Olivier Messiaen included songs from 260 avian species in his compositions, one of which (*Reveil des oiseaux*) depicts the nightingale's (*Luscinia megarhynchos*) song. Likewise, Wolfgang Amadeus Mozart used elements of starling (*Sturnus vulgaris*) song in his *Divertimento K. 522* (Baptista, Keister 2005: 427–428).

However, examples for vocal learning can also be found among cetaceans, in which it aids the transmission of calls between conspecifics (Miller, Bain 2000: 626; Loyer 2006). In two studies it was suggested that vocal variation in coda[6] dialects between clans results from social learning (Weilgart, Whitehead 1997: 283; Rendell, Whitehead 2003: 229). Luke. E. Rendell and Hal Whitehead (2003: 229) proposed that culture may be the driving force behind this variation in dialects. In whales, variation obeys the laws of a codified set of rules, which, according to Dario Martinelli (2005: 9), is comparable to modern compositional endeavours. If demonstration of learning and culture are the criteria against which an analogy of human music and bird/whale song can be measured, these zoological examples should provide sufficient evidence for the musical awareness in animals. The recent emergence of contemporary repertory for birds and orchestra (Peter Neuber's *Sinfonie des Waldes*) and for a computer-based instrument derived from cetacean clicks (Shinji Kanki's PCM0355+53) suggests that composers and performers have long recognized the musical capacities of animals (Erkut 2003: 1).

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6 coda = patterned series of clicks

5. Conclusion

The evaluation of non-human sounds/music should always take into account that potential problems with its analysis are not just associated with a musicological approach, but also with animal behaviour and zoomusicology. Particularly the latter two disciplines may be affected by anthropomorphism, which does not allow objective judgement of animals and their behaviour. As Dario Martinelli (2001: 7) points out this is a problem that concerns all human sciences, not just the zoomusicological field. He argues that this emerging research area aims to provide evidence for potential analogies between animal and human music in order to eliminate the notion that human experiences are merely transferred (Martinelli 2001: 7). While some of the literature suggests animals possess musical tendencies, phylogenetical evidence challenges these assumptions. From an evolutionary point of view, bird song and human music are analogous but not homologous at best, as musicality did not arise in any other species (Cross, Morley 2002; Jellis 1977). This apparent discrepancy within the same discipline may be resolved by future zoomusicological research. It also may shed light on the question whether animal sounds are greatly elaborated signals or indeed can be regarded as music.

Another point of controversy is the utilization of instruments in non-human creatures. A musical instrument is defined as "an object other than the organs of the body used for the production of musical sound by the application of mechanical energy […] or electrical impulses" (Jacobs 1977: 198). Therefore the use of the beak, tail or wings in certain birds may not qualify as "instrumental use" according to this definition. Zoological argumentation should be strictly adhering to the musicological definitions when providing evidence for or against issues of a zoomusicological nature. The contributions of both, the sciences and musicology, demonstrate that only a combination of the two disciplines will lead to an integral analysis of non-human sounds/music. As Isabelle Peretz (2006: 26) put it in her article: "There's every

reason to welcome advances in the biological foundations of musical behaviour but to be cautious in interpreting the evidence".

To conclude, I would like to refer to the aforementioned suggestions that John Cage's compositions can be considered "liberated music" and that silence is a musical notion (Metzger, Pepper 1997: 58). If a piece comprises four minutes and thirty three seconds of no rhythm, tonality or harmony, which are essential elements of music, then an avian or cetacean arrangement of notes, that does contain one or more of these categories, clearly deserves to be recognized as a very own and distinct form of music.

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Являются ли «звуки/музыка животного мира» менее ценными, чем музыка людей? Сравнение с биологической и музыкологической точки зрения

Сложность звуковых конфигураций, которые способны издавать представители животного мира — прежде всего певчие птицы (Passeriformes) и киты (Cetacea), но и некоторые виды насекомых (Exopterygota) и млекопитающих (Carnivora), — привлекали внимание людей уже начиная со Средневековья, когда мотивы птичьего пения стали использовать в музыкальных произведениях. Данная статья сосредоточивается в основном на творчестве птиц и китов, так как современные исследования в биологии и музыкологии рассматривают прежде всего эти виды.

Kas “mitte-inimliikide” helid/ muusika on vähem väärtuslik kui inimeste oma? Võrdlus bioloogilisest ja musikoloogilisest vaatepunktist

Loomariigi esindajate, peamiselt laululindude (Passeriformes) ja vaalade (Cetacea), aga ka mõnede putukaliikide (Exopterygota) ja imetajate (Carnivora) tekitatavate helide keerukus on inimeste tähelepanu köitnud juba keskajast peale, mil linnulaulu motiive kasutati muusikateostes. Käesolev artikkel keskendub peamiselt lindude ja vaalade heliloomingule, kuivõrd viimase aja teaduslikud ja musikoloogilised uurimistööd keskenduvad peamiselt neile kahele loomale.