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COMPARATIVE COGNITION & BEHAVIOR REVIEWS

Preface to the Special Issue on Animal Music Perception

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Music is found around the world in all human cultures, no matter how isolated. Although its function is still debated (Fitch, 2005; Honing, Cate, Peretz, & Trehub, 2015; Justus & Hutsler, 2005; Masataka, 2009), music clearly plays an important role in human life. The fact that music is ubiquitous suggests that music is part of our biology.

The biological study of music has recently gained momentum. Only three years ago, Henkjan Honing put together a workshop at the Lorentz Center with people from many different disciplines around the world, all of whom were interested in the question, What makes us musical animals? (See Lorentz Center, 2014)

Twenty-three key researchers from psychology, biology, music, neuroscience, anthropology, and computer science came together to discuss the problem of how we can approach studying the biology of music. From there, we wrote a special issue for *Philosophical Transactions of the Royal Society B: Biological Sciences* (see introduction; Honing et al., 2015).

My aim within this workshop and special issue was to present the goals and challenges when using a comparative approach to study the biology of music (see Hoeschele, Merchant, Kikuchi, Hattori, & ten Cate, 2015). Comparative biomusicology is still a relatively new area of study, with only a handful of studies having occurred prior to the 2000s. In comparative biomusicology, we try to understand the evolution of music by considering the factors of our musical faculty that are relevant to other species. Because human musical systems have, of course, grown immensely because of cultural evolution, we focus on musicality rather than music itself. Musicality refers to the traits, or core abilities and behaviors, that constitute our natural ability to produce and perceive music. Are aspects of human musicality found in other species? Are they widespread? Or do they depend on specific phylogenetic or biological niche factors?

Recently, a lot of attention has been placed on rhythm perception and production in animals. Especially since Aniruddh Patel's (Patel, Iversen, Bregman, & Schulz, 2009) study on Snowball, the dancing cockatoo and his ability to track and move to the beat in music, there has been much focus on rhythmic entrainment across the animal kingdom. Fantastic recent neural research in primates has been produced (see Merchant & Bartolo, 2017, for review), and a recent special issue on the evolution of rhythm cognition had quite a few comparative contributions as well (Benichov, Globerson, & Tchernichovski, 2016; Dufour, Pasquaretta, Gayet, & Sterck, 2017; Gamba et al., 2016; Hartbauer & Römer, 2016; Hoeschele & Bowling, 2016; Norton & Scharff, 2016; Ravignani, Fitch, Hanke, & Heinrich, 2016; Rouse, Cook, Large, & Reichmuth, 2016; Spierings & Cate, 2016; Ten Cate, Spierings, Hubert, & Honing, 2016).

However, there has been relatively less excitement and focus on pitch perception across species in recent years. One of the goals of the Lorentz workshop was to outline human musical universals that are ripe for study from a biological perspective. For example, besides beat perception and metrical encoding of rhythm, Honing et al. (2015) pointed out that relative pitch and tonal encoding of pitch are potentially basic components of musicality. Other relevant candidates might be octave generalization (Crickmore, 2003) and consonance (Cook & Fujisawa, 2006). All of these pitch-related issues are

the focus of the current issue and are explained and discussed in detail with reference to cross-species work in the following four articles.

This special issue is especially timely given a recent article in *Nature* (McDermott, Schultz, Undurraga, & Godoy, 2016) that pushed the interpretation that much of human appreciation for particular pitch relationships is based in cultural evolution rather than any innate predispositions. This has stirred up much debate among researchers because, as with any nature/nurture debate, there is evidence supporting both the role of nature and nurture in our acoustic preferences. This entanglement is further made complicated by increasing globalization and the difficulty finding people who are truly culturally isolated from one another. Studying other species can hopefully add another perspective to help untangle these issues.

Our goal with this issue is to bring attention to the study of pitch perception across species in order to both stimulate further comparative research and also force us to rethink what we know about humans. Much of the work we have done suggests that the music-theoretical view of human pitch perception may be at odds with how both humans and other animals perceive sound. We ask readers of this special issue to keep two questions in mind:

1. Are humans unique in their approach to pitch perception?
2. Can we use the results of experimental non-human animal work to enhance the study of human pitch perception?

In conclusion, because pitch plays such an important role in human music (see Burns, 1999) and appears to be a relevant factor in the core universals of music (see Honing et al., 2015), we hope that our discussion of pitch can work parallel to the work being conducted on rhythm to shed light on the evolution of music."

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References

Benichov, J. I., Globerson, E., & Tchernichovski, O. (2016). Finding the beat: From socially coordinated vocalizations in songbirds to rhythmic entrainment in humans. *Frontiers in Human Neuroscience, 10*, 1–7. http://doi.org/10.3389/fnhum.2016.00255

Burns, E. M. (1999). Intervals, scales, and tuning. In D. Deutsch (Ed.), *The Psychology of Music* (Second, pp. 215–264). San Diego: Academic Press.

Cook, N. D., & Fujisawa, T. X. (2006). The psychophysics of harmony perception: Harmony is a three-tone phenomenon. *Empirical Musicology Review*, *1*, 106–126.

Crickmore, L. (2003). A re-valuation of the ancient science of harmonics. *Psychology of Music, 31*(4). http://doi.org/10.1177/03057356030314004

Dufour, V., Pasquaretta, C., Gayet, P., & Sterck, E. H. M. (2017). The extraordinary nature of Barney's drumming : A complementary study of ordinary noise making in chimpanzees. *Frontiers in Neuroscience*, *11*. http://doi.org/10.3389/fnins.2017.00002

Fitch, W. T. (2005). The evolution of music in comparative perspective. *Annals of the New York Academy of Sciences*, *1060*, 29–49. http://doi.org/10.1196/annals.1360.004

Gamba, M., Torti, V., Estienne, V., Randrianarison, R. M., Valente, D., Rovara, P., … Giacoma, C. (2016). The Indris have got rhythm! Timing and pitch variation of a primate song examined between sexes and age classes. *Frontiers in Neuroscience*, *10*. http://doi.org/10.3389/fnins.2016.00249

Hartbauer, M., & Römer, H. (2016). Rhythm generation and rhythm perception in insects: The evolution of synchronous choruses. *Frontiers in Neuroscience*, *10*, 1–15. http://doi.org/10.3389/fnins.2016.00223

Hoeschele, M., & Bowling, D. L. (2016). Sex differences in rhythmic preferences in the Budgerigar (*Melopsittacus undulatus*): A comparative study with humans. *Frontiers in Psychology, 7*, 1–10. http://doi.org/10.3389/fpsyg.2016.01543

Hoeschele, M., Merchant, H., Kikuchi, Y., Hattori, Y., & ten Cate, C. (2015). Searching for the origins of musicality across species. *Philosophical Transactions of the Royal Society B*, *370*, 20140094.

Honing, H., Cate, C., Peretz, I., & Trehub, S. E. (2015). Without it no music: Cognition , biology and evolution of musicality. *Philosophical Transactions of the Royal Society B*, *370*, 20140088.

Justus, T., & Hutsler, J. J. (2005). Assessing innateness and domain specificity. *Music Perception*, 1–28.

Lorentz Center. (n.d.). What makes us musical animals? Cognition, biology and the origins of musicality. Retrieved from http://lorentzcenter.nl/lc/web/2014/628/info.php3?wsid=628&venue=Snellius

Masataka, N. (2009). The origins of language and the evolution of music: A comparative perspective. *Physics of Life Reviews*, *6*, 11–22. http://doi.org/10.1016/j.plrev.2008.08.003

McDermott, J. H., Schultz, A. F., Undurraga, E. A., & Godoy, R. A. (2016). Indifference to dissonance in native Amazonians reveals cultural variation in music perception. *Nature*, *25*, 21–25. http://doi.org/10.1038/nature18635

Merchant, H., & Bartolo, R. (2017). Primate beta oscillations and rhythmic behaviors. *Journal of Neural Transmission*. http://doi.org/10.1007/s00702-017-1716-9

Norton, P., & Scharff, C. (2016). "Bird song metronomics": Isochronous organization of zebra finch song rhythm. *Frontiers in Neuroscience*, *10*, 97–99. http://doi.org/10.3389/fnins.2016.00309

Patel, A. D., Iversen, J. R., Bregman, M. R., & Schulz, I. (2009). Experimental evidence for synchronization to a musical beat in a nonhuman animal. *Current Biology: CB*, *19*, 827–830. http://doi.org/10.1016/j.cub.2009.03.038

Ravignani, A., Fitch, W. T., Hanke, F. D., & Heinrich, T. (2016). What pinnipeds have to say about human speech, music, and the evolution of rhythm. *Frontiers in Neuroscience*, *10*, 1–9. http://doi.org/10.3389/fnins.2016.00274

Rouse, A. A., Cook, P. F., Large, E. W., & Reichmuth, C. (2016). Beat keeping in a sea lion as coupled oscillation: Implications for comparative understanding of human rhythm. *Frontiers in Neuroscience*, *10*, 1–12. http://doi.org/10.3389/fnins.2016.00257

Spierings, M. J., & Cate, C. (2016). Zebra finches as a model species to understand the roots of rhythm. *Frontiers in Neuroscience*, *10*, 1–3. http://doi.org/10.3389/fnins.2016.00345

Ten Cate, C., Spierings, M., Hubert, J., & Honing, H. (2016). Can birds perceive rhythmic patterns? A review and experiments on a songbird and a parrot species. *Frontiers in Psychology*, *7*, 1–14. http://doi.org/10.3389/fpsyg.2016.00730