Published in final edited form as:

Behav Brain Sci. ; 44: e97. doi:10.1017/S0140525X20001466.

Progress without exclusion in the search for an evolutionary basis of music

DL Bowling¹, M Hoeschele^{2,3}, JC Dunn^{3,4,5}

¹Department of Psychiatry and Behavioral Science, Stanford School of Medicine, 1201 Welch Rd. Mail code 5485, Stanford, CA 94306, USA.

²Acoustic Research Institute, Austrian Academy of Sciences, Wohllebengasse 12-14, 1040 Vienna, Austria

³Department of Cognitive Biology, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria

⁴Behavioral Ecology Research Group, Anglia Ruskin University, East Rd. Cambridge, CB1 1PT, UK

⁵Biological Anthropology, University of Cambridge, Henry Wellcome Building, Fitzwilliam St, Cambridge, CB2 1QH, UK.

Abstract

Mehr et al.'s hypothesis that the origins of music lie in credible signaling emerges here as a strong contender to explain early adaptive functions of music. Its integration with evolutionary biology and its specificity mark important contributions. However, much of the paper is dedicated to the exclusion of popular alternative hypotheses, which we argue is unjustified and premature.

Human musicality poses a longstanding evolutionary puzzle (Darwin, 1871), and Savage et al. and Mehr et al. provide much needed updates. Their perspectives consolidate and refine ideas from the past two decades of research, marking an important milestone (cf. Brown et al., 2000). We focus on Mehr et al., which argues that music's origins lie in credibly signaling coalition quality and parental attention. These adaptive hypotheses are formulated within the well-established framework of signaling theory in evolutionary biology, and build upon comparative evidence for musical behavior in non-human animals. We find tremendous value in the breadth and specificity of this work, but flaws in its dismissal of alternative hypotheses show that the historical genesis of music remains unclear, if indeed there is a principal one.

Mehr et al. dismiss the music and social bonding (MSB) hypothesis on three counts. The first derives from the premise that primate sociality evolved under predation pressure associated with diurnal foraging. Mehr et al. imply that this ultimate-level pressure renders superfluous any fitness benefits that accrue from variation in group social dynamics. This

Telephone: +1 650 725 8009 (DLB), dbowling@stanford.edu.

CONFLICTS OF INTEREST: None

Home Page: <https://profiles.stanford.edu/daniel-bowling>; <https://tinyurl.com/marisahoeschele>; <https://aru.ac.uk/people/jacob-c-dunn>.

falsely equates the selection pressures that drive the evolution of social (versus solitary) living, with those that drive the evolution of social behavior within a group. We are not aware of any evidence that ties variation in the social group dynamics to differences in fitness, but differences in fitness between groups are self-evident, and we see no cause for assuming that environmental and/or genetic shifts that facilitate social bonding cannot have profound consequences in this context.

Mehr et al.'s second argument against MSB is that it conflates ultimate and proximate levels of explanation by connecting music's function to the neurobiology of social reward (Machin & Dunbar, 2011; Savage et al., 2020; Tarr et al., 2014). They correctly point out that music causing social bonding today (behaviorally or neurobiologically) is not evidence that it evolved to do so. This recalls Gould & Lewontin (1979)'s critique of adaptationism. Current function tells us little about evolutionary process, particularly in complex aspects of human behavior/cognition (like musicality), where exaptations are expected to comprise "a mountain to the adaptive molehill" (Gould, 1991). However, we object to the implication that this fundamental issue uniquely undercuts MSB. Mehr et al.'s own adaptive hypotheses derive the majority of their empirical support from current functions of musical behavior (in war, intimidation, territoriality, alliance-forging, and infant directed song). We are all trapped by the present, and inappropriate evidentiary standards for identifying adaptations are not specific to any particular theory (Andrews et al., 2002; Williams, 1966).

Mehr et al.'s third argument against MSB is that music is poorly designed to coordinate groups. They derive this counterfactual from the notion that language is a superior facilitator of coordinated collective action, offering the example of a coxswain's use of language rather than music to coordinate rowing as support. This reflects a mistaken imposition of the modern distinction between music and language onto their evolutionary foundations. Language (or its primary behavioral manifestation speech) exists on a continuum with music and many intermediates (public oratory, poetry, rap, chant, etc.). Features that are held in common across this continuum (e.g., auditory-vocal channel is default, highly ordered, infinitely generative, fundamentally social) exceed those which may be considered unique to either pole (e.g., music's spectrotemporal regularity, speech's explicit referentiality). From this perspective, the coxswain's rhythmic calls to "row!" appear more musical than linguistic. Their support to coordination in particular seem musical, as temporal regularity characterizes music more than speech (Brown & Jordania, 2013; Dauer, 1983). By contrast, more linguistic features (like the meaning of the word "row") are inessential; a nonsense word or a drum beat (the norm in Chinese dragon boat racing) works just fine. Undoubtedly, speech is superior for coordinating rational thought and planning, but music, and the more musical aspects of speech, clearly support temporal and emotional coordination (Filippi et al., 2019). The MSB hypothesis is not undone by language.

Finally, Mehr et al. dismiss the mate quality hypothesis (Darwin, 1871). The crux of their argument is that if music evolved via sexual selection in a substantive way, human musicality would be sexually dimorphic, which they argue it is not. There are a number of problems here. One is that it contradicts the author's earlier acknowledgement that current function does not imply original function. Another is that sexual selection does not always produce sexual dimorphism (Darwin, 1871; Hooper & Miller, 2008; Jones & Ratterman,

2009). Another is that sexual selection has almost certainly shaped the evolution of primate loud calls, which Mehr et al. identify as musical precursors (Delgado, 2006; Dunn et al., 2015). But a more pressing problem is the claim that there are no sex differences in human musicality relevant to this argument. This seems premature given how few studies have addressed the issue directly, particularly when considering the difficulty of separating predisposition from experience at this level (a point which Mehr et al. also acknowledge). The authors assertion that musical behavior is invariant across the human lifespan is also suspect. Musical preferences emerge as a critical part of self-identity during adolescence, musical performances peaks in young adulthood when courtship is most intense, and musical tastes support strong assortative mating (Miller, 2000; North & Hargreaves, 1999). Lastly, it should be noted that humans are more sexually dimorphic in voice frequency than any other ape (Puts et al., 2016). Male and female singing voices fall roughly an octave apart (Titze, 2000), which has potential implications for the aesthetics of chorusing (Bowling & Purves, 2015; Hoeschele, 2017).

In sum, we find Mehr et al.'s proposed hypothesis of music evolution to be extremely valuable for its integration with evolutionary biology, breadth, and specificity, but we see no present reason to rule out any of the other hypotheses discussed above as (co-)functional drivers of human musicality.

Acknowledgments

FUNDING STATEMENT: DLB is supported by NIMH grant K01-MH122730-01; JCD is supported by Royal Society grant RSG\R1\180340.

REFERENCES

- Andrews PW, Gangestad SW, & Mathew D (2002). Adaptationism - How to carry out an exaptationist program. *Behavioral and Brain Sciences*, 25(4), 489–504. 10.1017/S0140525X02000092
- Bowling DL, & Purves D (2015). A biological rationale for musical consonance. *Proceedings of the National Academy of Sciences*, 112(36), 11155–11160. 10.1073/pnas.1505768112
- Brown S, & Jordania J (2013). Universals in the world's musics. *Psychology of Music*, 41(2), 229–248. 10.1177/0305735611425896
- Brown S, Merker B, & Wallin NL (Eds.). (2000). *The origins of music*. MIT Press.
- Darwin C (1871). *The descent of man and selection in relation to sex*. John Murray.
- Dauer RM (1983). Stress-timing and syllable-timing reanalyzed. *Journal of Phonetics*, 11(1), 51–62.
- Delgado RA (2006). Sexual selection in the loud calls of male primates: Signal content and function. *International Journal of Primatology*, 27(1), 5–25. 10.1007/s10764005-9001-4
- Dunn JC, Halenar LB, Davies TG, Cristobal-Azkarate J, Reby D, Sykes D, Dengg S, Fitch WT, & Knapp LA (2015). Evolutionary trade-off between vocal tract and testes dimensions in howler monkeys. *Current Biology*, 25(21), 2839–2844. 10.1016/j.cub.2015.09.029 [PubMed: 26592343]
- Filippi P, Hoeschele M, Spierings M, & Bowling DL (2019). Temporal modulation in speech, music, and animal vocal communication: evidence of conserved function. *Annals of the New York Academy of Sciences*, 1453, 99–113. 10.1111/nyas.14228 [PubMed: 31482571]
- Gould SJ (1991). Exaptation: A Crucial Tool for an Evolutionary Psychology. *Journal of Social Issues*, 47(3), 43–65. 10.1111/j.1540-4560.1991.tb01822.x
- Hoeschele M (2017). Animal Pitch Perception: Melodies and Harmonies. *Comparative Cognition & Behavior Reviews*, 12, 5–18. 10.3819/CCBR.2017.120002 [PubMed: 28649291]
- Hooper PL, & Miller GF (2008). Mutual mate choice can drive costly signaling even under perfect monogamy. *Adaptive Behavior*, 16(1), 53–70. 10.1177/1059712307087283

- Jones AG, & Ratterman NL (2009). Mate choice and sexual selection: What have we learned since darwin? *In the Light of Evolution*, 3, 169–190. 10.17226/12692
- Machin A, & Dunbar R (2011). The brain opioid theory of social attachment: a review of the evidence. *Behaviour*, 148(9), 985–1025. 10.1163/000579511X596624
- Mehr SA, Krasnow MM, Bryant GA, & Hagan EH (2020). Origins of music in credible signaling. *Brain and Behavioral Sciences*.
- Miller G (2000). Evolution of human music through sexual selection. In Brown S, Merker B, & Wallin C (Eds.), *The origins of music* (pp. 329–360). The MIT Press.
- North AC, & Hargreaves DJ (1999). Music and Adolescent Identity. *Music Education Research*, 1(1), 75–92. 10.1080/1461380990010107
- Puts DA, Hill AK, Bailey DH, Walker RS, Rendall D, Wheatley JR, Welling LLM, Dawood K, Cárdenas R, Burriss RP, Jablonski NG, Shriver MD, Weiss D, Lameira AR, Apicella CL, Owren MJ, Barelli C, Glenn ME, & Ramos-Fernandez G (2016). Sexual selection on male vocal fundamental frequency in humans and other anthropoids. *Proceedings of the Royal Society B: Biological Sciences*, 283(1829), 0–7. 10.1098/rspb.2015.2830
- Savage PE, Loui P, Tarr B, Schachner A, Glowacki L, Mithen S, & Fitch WT (2020). Savagem PE Loui P Tarr B Schachner A Glowacki L Mithen S Fitch WT *Behavioral and Brain Sciences*.
- Tarr B, Launay J, & Dunbar R (2014). Music and social bonding: “self-other” merging and neurohormonal mechanisms. *Frontiers in Psychology*, 5(September), 1096. [PubMed: 25324805]
- Titze IR (2000). *Principles of voice production*. National Center for Voice and Speech.
- Williams GC (1966). *Adaptation and natural selection: a critique of some current evolutionary thought*. Princeton University Press.