

Reading Guide: Phillips-Silver, et al.

RG 4: Dean Gladish, Sarah Burckle, Katherine Jackson

Bibliographic Information

Phillips-Silver, J., et al. (2011). Born to dance but beat deaf: A new form of congenital amusia. *Neuropsychologia* 49 (5): 919-969. <https://doi.org/10.1016/j.neuropsychologia.2011.02.002>.

Reading Type/Profile

Journal article, from an international and world-renowned journal on neuroscience that publishes theoretical and experimental studies on human cognition, neuroplasticity, music's impact on memory, and the origin of different musical artifacts within the brain. Published in 2011.

Author Background

Phillips-Silver is a postdoctoral researcher at Georgetown University Medical Center, who has a PhD in auditory development and music perception. Her primary research interests are entrainment in music, beat-deafness, and early childhood development of executive skills within the brain (source: Georgetown University, "Laboratory of Integrative Neuroscience: Jessica Phillips-Silver" <https://linc.georgetown.edu/jessica-phillips-silver>). Petri Toiviainen is an academy professor in the music department of the University of Jyväskylä whose interests lie in pattern recognition, music psychology, and music cognition (source: ResearchGate, "Petri Toiviainen | PhD" https://www.researchgate.net/profile/Petri_Toiviainen). Nathalie Gosselin is an assistant professor of neuropsychology who studies the effects of music within both typical and atypical individuals (source: Brams, "Nathalie Gosselin, PhD, Neuropsychologist", <https://www.brams.org/en/membres/nathalie-gosselin/>). Likewise, Isabelle Peretz is a PhD in experimental psychology who has focused extensively on how neural structures, heredity, and language impact musical potential (source: Brams, "Isabelle Peretz, PhD", <https://www.brams.org/en/membres/isabelle-peretz/>).

Abstract/Summary

This chapter focuses on a specific and novel case study – the university student Mathieu, who is documented to have congenital amusia. Congenital amusia, or beat deafness, is best described as the general inability of the brain to keep track of and reproduce the beat in music. This experimental study identifies beat deafness via a synchronization setup. The primary focus of this study is on a sample of ordinary people who are able to move in rhythm to music and identify when a dancer is unable to do so. The primary emphasis of this study is on identifying or eliminating possible correlations between beat deafness and different factors. These factors include participants' ability to move in synchrony with a Merengue-style song with or without visual aid. Phase-locking analysis revealed that Mathieu could not bounce or tap in time with music despite his consistent discrimination of pitch and changes in tune. The conclusion of this

research is that congenital amusia is a form of musical pitch processing that is distinct from pitch deafness.

Important Details

Beat Deafness is something that is identifiable early in human development; people express spontaneous responses to music early on, and this behavior is characteristic of human propensity to communicate. Phillips-Silver suggests that such dance behavior derives from the impact of evolution, which encourages group synchrony and cohesion for the sake of survival and sexual selection. Furthermore, she alludes to the fact that beat deafness is relatively rare among the general population. It is thought to be a form of musical pitch disorder.

The experimenters sought to employ two methods for making sure that Mathieu's inability to maintain the beat was not due to the methodology. So, participants were asked to bounce up and down as well as tap their fingers (which requires fine motor skills). Mathieu matched the beat neither in *tempo* (which is defined by the matching of each period of rhythmic movement with the given musical beat period) nor in *phase* (which is described as synchrony between the onset of rhythmic movements and the onset of the musical beats).

In this case study, Mathieu failed the *meter test* – he could not reliably distinguish between different time signatures in music. While he also failed to bounce in rhythm to the Merengue song, this abnormality was not present when a metronome or bouncing experimenter were provided. He was also able to maintain regularity of tempo in the absence of outside perception. This indicates that beat deafness is not correlated with a deficit in visual imitation.

Phillips-Silver also notes that such synchronization impairment is generalizable to many different musical genres and tempos. Familiarity seems to be essential for the beat-deaf, as Mathieu was able to synchronize with the most popular musical excerpts. Furthermore, beat-deaf individuals seem to exhibit a partial inability to adapt to temporal stimulus change; in the case study, Mathieu was only able to determine tempo changes greater than 10%. The authors suggest that congenital amusia is the result of a failure of perception as well as sensorimotor integration (a failure of different systems of the brain to integrate sensory stimuli and perform a motor function as a response).

Temporal ventriloquism is described as the brain's propensity to compensate for disparities between auditory and visual cues that roughly occur at the same time. For example, Mathieu did not perceive smaller asynchronies between body motion and musical beat.

The results of the experiments suggest that the two systems responsible for pitch and time in music function independently of one another. Beat deafness does not necessitate pitch or tune deafness. Our results corroborate the evidence for pitch and time having a different and distinct neurobiological origin in processing music. Phillips-Silver cites lesion studies that indicate selective impairments in rhythm discrimination that exclude pitch processing. Thus, these elements are likely independent.

For Further Reading

Elsevier B.V. *Neuropsychologia*. Copyright 2018, from <https://www.journals.elsevier.com/neuropsychologia/>

Accessible at <https://www.ncbi.nlm.nih.gov/labs/journals/neuropsychologia/>.

This journal contains a plethora of articles on reactions to musical stimuli and the roots of musical memory.

Goodale, M. A., & Milner, A. D. (1992). Separate visual pathways for perception and action. *Trends in Neuroscience*, 15 (1), 20-25: http://www.cnbc.cmu.edu/braingroup/papers/goodale_milner_1992.pdf

This paper clarifies the notion of dorsal and ventral pathways and their implication in action versus perception.

Phillips-Silver, J. (2013). Amusic does not mean unmusical: Beat perception and synchronization ability despite pitch deafness. *Cognitive Neuropsychology*, 30 (5), 311-331. <https://doi.org/10.1080/02643294.2013.863183>.

A Phillips-Silver article that explores the dissociation between pitch- and beat-deafness.

Sacks, O. (2007). *Musicophilia: Tales of music and the brain* (Vol. 1). New York: Alfred A. Knopf.

A good book about the philosophy of music as well as forms of amusia.