

The transfer effect of musical ability to intelligence and reading: A longitudinal study on Mandarin-speaking primary school children

Ivan Yifan Zou

State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, China

Disciplinary background A. In the discipline of music education, how musical training can benefit other non-musical cognitive domains has been a perennial theme among music educators, music pedagogist, and education policymakers. Despite its importance, the mechanism of the musical transfer effect is still shrouded in mystery. According to Swaminathan & Schellenberg (2019), not only are the results of the current literature on the transfer effect of musical ability contradicting, but the definition of musical training is also loosely defined.

Disciplinary background B. In the discipline of linguistics, it has been hypothesized that tonal language speakers tend to have a finer perception of pitch variation so that it can be transferred to the domain of music, which also relies heavily on pitch variation. According to this hypothesis, tonal language speakers should have a higher prevalence of perfect pitch possessors and a lower prevalence of amusic patients. Except for this hypothesis, the direction of language-to-music transfer is still insufficiently investigated when compared to the music-to-language transfer. Moreover, there is virtually no literature on the language-to-music transfer when a longitudinal approach is adopted.

Abstract

In the discipline of linguistics, it has been hypothesized that tonal language speakers tend to have a finer perception of pitch variation so that it can be transferred to the domain of music, which also relies heavily on pitch variation. According to this hypothesis, tonal language speakers should have a higher prevalence of perfect pitch possessors and a lower prevalence of amusic patients. Except for this hypothesis, the direction of language-to-music transfer is still insufficiently investigated when compared to the music-to-language transfer. Moreover, there is virtually no literature on the language-to-music transfer when a longitudinal approach is adopted.

Explaining the mechanism of cross-domain transfer between musical ability and other cognitive domains is crucial for us to understand both the pedagogical and therapeutic significance of music in the early development of children. Despite its importance, current literature still lacks convincing evidence to address how and under what conditions musical abilities can benefit other cognitive domains. In this study, we studied the reciprocal associations between music ability and two other non-musical cognitive domains — intelligence and reading in 71 typically developing Chinese children from ages 9 to 11 using a longitudinal design. According to the common practice in the previous literature, we broke down musical abilities into pitch and rhythm perception; intelligence into IQ and working memory (WM); reading ability into phonological awareness (PA), lexical tone perception (LTP), rapid automatized naming (RAN), character recognition (CR), and reading fluency (RF). For the transfer effect between music and reading, the cross-lagged analysis indicated that the link is only robust between the two musical abilities and LTP. Specifically, both music pitch and beat perception abilities at age 9 could predict LTP at age 11. Interestingly, LTP at age 9 also predicted pitch perception at age 11, which is a language-to-music transfer, a direction not often mentioned in the previous study. We also did mediation effect analysis to examine whether there were indirect routes between any two domains when no direct transfer could be found. Mediation analysis revealed that rhythm perception ability at 9 could predict CR and RF via RAN, whereas pitch perception ability predicted PA via IQ. For the transfer effect between music and intelligence, correlation test showed

that IQ at 11 years old can only be predicted by pitch perception ability at 9 years old, whereas WM at 11 years old can be predicted both by pitch and rhythm perception ability at 9 years old. But since PA was also shown to be able to predict IQ and WM, we controlled PA in the regression analysis to find that pitch (but not rhythm) could still independently predict IQ (but not WM).

Interdisciplinary implications. This study combines the knowledge at least from three fields: musicology, linguistics, and education in the purpose of understanding how musical abilities can transfer to the other two cognitive domains — intelligence and reading, and vice versa. Overall, the main findings in the current study highlighted the importance of pitch rather than rhythm in this transfer effect since the perception ability of pitch can independently predict IQ, LTP, and PA (via IQ). Moreover, this study also provides a profile of non-Western participants who speak tonal languages. Since there is no shortage of literature on how tonal language speakers might have a better musical pitch perception ability, this study can be viewed as providing yet another developmental perspective on this line of research.

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