

REPLY TO SCHELLENBERG:

# Is there more to auditory plasticity than meets the ear?

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In our article (1) on nature-vs.-nurture effects of auditory plasticity, we challenge long-held assumptions on the neural benefits of musical training by showing that inherent auditory skills might account for *de novo* enhancements in speech processing. Our study revealed that formal music experience is unnecessary to enhance the brain's encoding and perception of complex sounds.

Although Schellenberg (2) commends our approach to unravel innate vs. environmental mechanisms, he criticizes claims that music training engenders additional benefits to speech perception. His chief complaint stems from our comparison of neural advantages in nonmusicians to (previously collected) data from a group of musicians, which implied that training boosts speech processing beyond preexisting differences in auditory function. We argue this criticism misses the primary objective of our study, which was not intended to provide a reductionist account of the plasticity associated with musicianship (cf. refs. 3 and 4). Rather, we focused on neural enhancements that occur absent any training. Our inclusion of a supplemental musician group was simply to replicate putative musician advantages in speech processing (5, 6). While understanding mechanistic differences between “musical sleepers” (high-aptitude nonmusicians) and musicians is important for future work, merely identifying these individuals highlights more important implications of our study: (i) inherent perceptual abilities differentiate people previously considered to be homogenous nonmusicians, producing brain activity that mirrors those attributed to formal music training; and (ii) the need to consider preexisting factors before claiming that music activities engender neuroplastic benefits.

As previously suggested (1, 3, 7), individuals with music training may differ from their peers on latent perceptual (1), cognitive (3, 8), personality (3), or other social factors [e.g., socioeconomic status (SES)] (2).

Receptive music aptitude also varies across the population, irrespective of music lessons (Fig. 1) (1, 9). Our data imply that the very reason why musical training and speech perception associations are not always replicable (10) may be due to differences in unmeasured aptitude even among musicians, which seems to concur with Schellenberg (2).

However, contrary to Schellenberg's (2) assertions, both self-reported [ $t(26) = -1.93$ ,  $P = 0.064$ ] and parental education [ $t(26) = 0.90$ ,  $P = 0.38$ ] were matched between our musician and nonmusician cohorts. Critically, these groups' neural enhancements were observed under passive listening without attention to speech. Moreover, there is no evidence (11) that (and it is difficult to see how) personality traits would influence auditory brainstem potentials, as indexed by our frequency-following responses (1). These points strongly argue against cognitive or SES explanations of our findings.

Lastly, we share Schellenberg's (2) skepticism that evidence of plasticity from music interventions is fuzzy, given the predominantly cross-sectional nature of existing studies. While we await the accumulation of additional evidence, recent randomized, active-control-group studies on music enrichment programs have reported treatment effects following 1 to 2 y of music training (5, 6), including the very same neural-perceptual enhancements for speech reported in our experiments (1). Although we are cautiously optimistic of such effects, it is clear that Mother Nature has endowed some people with highly adept auditory systems that offer similar speech–language benefits as taking years of music lessons.

### Acknowledgments

Funding was provided by the NIH National Institute on Deafness and Other Communication Disorders Grant R01DC016267 (to G.M.B.).

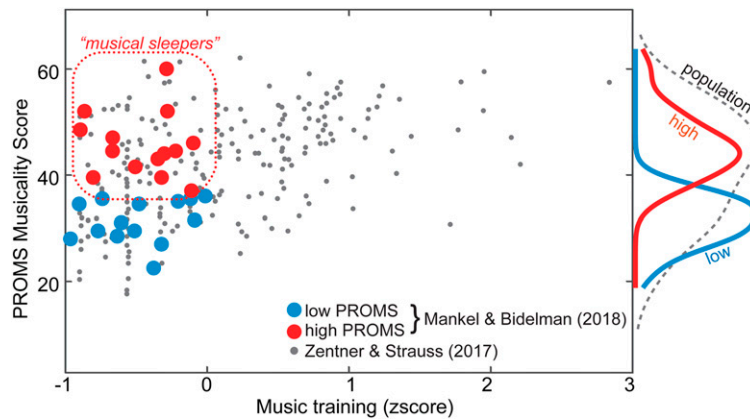
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The authors declare no conflict of interest.

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**Fig. 1. Musicality is modulated by innate and experience-dependent factors. Among the population, receptive auditory skills vary along a continuum. Points toward the upper right corner would be considered musicians. While music aptitude covaries with training (9), our study (1) identified nonmusicians without training (musical sleepers) with inherently good listening skills and neural processing of speech. PROMS, Profile of Music Perception Skills.**

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