Title: Effect of music intervention on infants' brainstem encoding of speech

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Study Protocol

The objective of the proposed music intervention is to standardize the procedures in which the intervention is carried out such that 1) it matches the music intervention in our previous study and that 2) it can be replicated in the future to include new outcome measures.

The data from this intervention will be compared to a control group and we hypothesize that the intervention group will exhibit enhanced post-intervention measurement at 11 months of age in comparison to the control group.

Families with healthy infants with no family history of hearing, speech and communication disorders will be recruited at 7 months of age to participate in the longitudinal music intervention study (Aim 2) that will last for about 4 months. At recruitment, infants with 3 or more ear infections and infants who have already been/ have had participated in infant music classes will be excluded.

Infants will complete a pre-intervention brainstem measures at 7 months of age upon enrolling in the study: the frequency-following response measure (FFR). Participants will have to complete the measurement to proceed to the intervention phase.

The music intervention starts at 9 months of age if the participants completed the pre-intervention measurement at 7 months of age. The 12-session intervention (15 minutes per session) is intended to last for a 4-week period with 3 sessions/week. It can last for as long as 5 weeks if some sessions are missed. Participants have to complete all sessions to be eligible for post-intervention measurements. During each session, a facilitator will guide the caregivers to interact with infants by synchronizing infants' movement to musical beats. At 9 months of age, families will start the 12-session intervention in a controlled laboratory space. In the initial session, caregivers will be given a brief orientation to intervention, including introducing them to the musical toys they will be using during the sessions with their infants and the lab environment. They will also be trained technics through which they can synchronize the infant's movements to the experimenter's movements, such as clapping hand, tapping feet. The remaining sessions will be scheduled in groups of 2-3 infant/parent dyads. In each session, a music CD with 15 minutes of selected children's music will be played and a musically trained experimenter will facilitate the sessions to engage the infants and parents to move to musical beats, using different musical toys, such as infant drums and maracas. Parents will be instructed to not to repeat any of these activities outside of the lab setting for the period of the study. Upon finishing the intervention, infants will repeat the FFR measurement at 11 months of age.

Statistical Design and Powers

Our *a priori* power analysis is based on two previous studies in our lab that delivered similar foreign language or music intervention during the same period in development with behavioral/electrophysiological outcome measures post intervention [7,24]. In both studies, the comparisons were only at post-intervention between the intervention group and the control group. In the language intervention study, the intervention group exhibited higher consonant discrimination (M=65.7, SE=2.4) then control (M=56.7, SE=2.3) and in the music intervention, the main effect of intervention in the ANOVA model had an effect size η^2 of 0.12. Using the G*Power software, it shows that to detect a similar between group effect, a total of 40 subjects at a level significance level of 0.05 will yield power above 0.90.