

The beat goes on: Children's sensorimotor synchronization to music in a home paradigm

Catherine Tan¹, Areeba Qureshi², Haley E. Kragness² & Laura K. Cirelli²

¹Faculty of Music, University of Toronto Department of Psychology, ²University of Toronto Scarborough

Background

- Sensorimotor synchronization involves matching movement to an external source, like a musical beat (Monier & Droit-Volet, 2019)
- Adult-like synchronization to music involves entraining to a regular beat and anticipating the next beat in a sequence
- Adults show better tapping synchronization to music that encourages movement ("groovy" music) (Janata et al., 2012)
- Though sensorimotor synchronization is slow to develop, previous research has shown that children's free dancing is affected by musical groove (Kragness et al., 2022)

- Do children's early free dancing abilities relate to their later sensorimotor synchronization abilities?

- Can we study children's sensorimotor synchronization in settings beyond the lab?

Method

Participants

- 78 children (M age = 4.74, SD = 1.20; minimum age = 3.01 years, maximum age = 6.98 years) who had previously participated in a home free dancing study (Kragness et al., 2022) were asked to participate approximately 1 year later

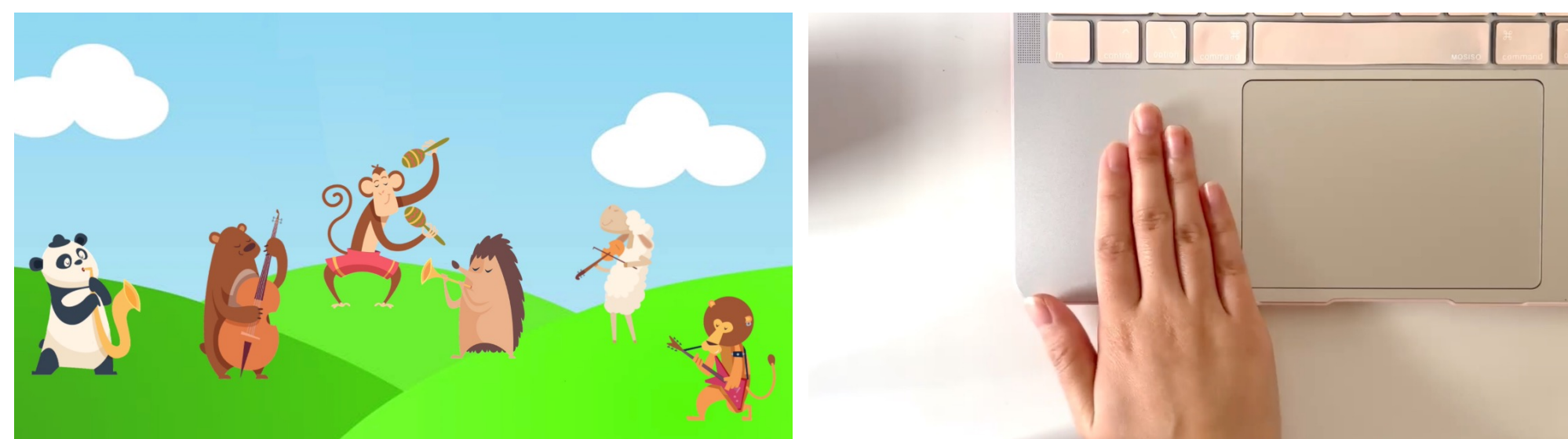
Stimuli

- All excerpts were 1 minute in duration and had different tempos and groove ratings (Janata et al., 2012)
- Excerpts were presented in a **musical** trial and a **woodblock** trial that reflected the underlying beat in the music trial

	Low Groove	High Groove
120 bpm	Bryter Layter Nick Drake	Bad Tune Earth, Wind, and Fire
170 bpm	Ray Dawn Balloon Trey Anastasio	In the Mood The Glenn Miller Band

Procedure

- Participants were recruited to perform as "drummer for the TEMPO Band". They were instructed to tap along to each stimulus by tapping on their laptop in their own homes
- Their audio was recorded, and their taps were extracted and analyzed using digital signal processing (Anglada-Tort et al., 2022)



Contact: Catherine Tan
catherinetan.tan@mail.utoronto.ca
UofT BMus Music Education '23
TEMPO Lab, University of Toronto Scarborough

Preliminary Results (n=44, for analysis n=16)

Planned analyses with a full sample

- We will examine effects of tempo and groove on children's tapping ability

Trial Type on Tapping Performance

Anticipation vs. reaction (mean tapping asynchrony)

- Asynchronies at 0 suggest they are tapping *on* the beat. Negative asynchrony indicates they are tapping *ahead* of the beat (anticipating), and positive asynchrony indicates they are tapping *behind* the beat (reacting)

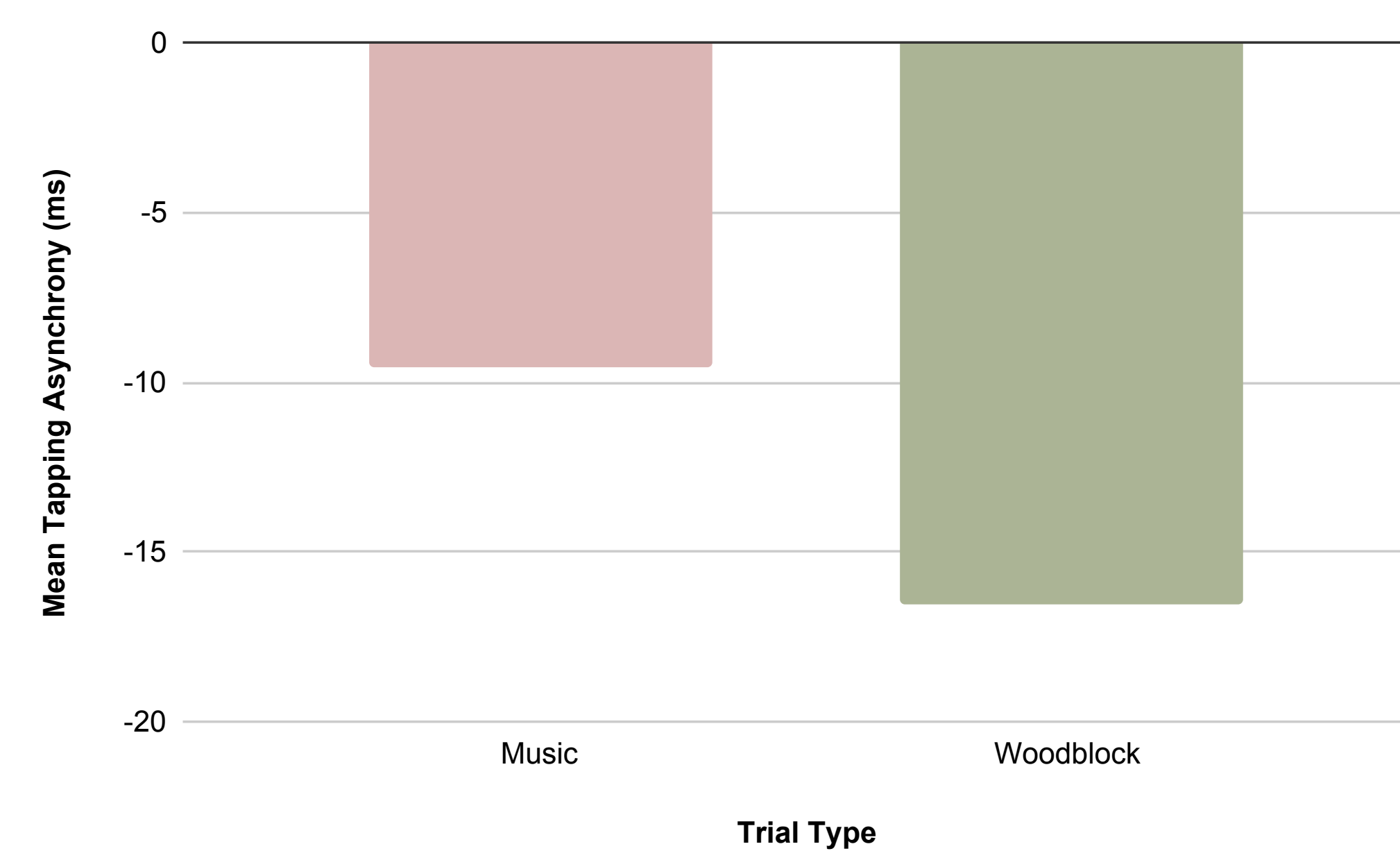


Figure 1. Participants' mean asynchronies were negative on average, and more negative for woodblock trials than music trials

Tapping consistency (SD of tapping asynchrony)

- Lower standard deviation (SD) indicates more consistency in their tapping asynchrony.

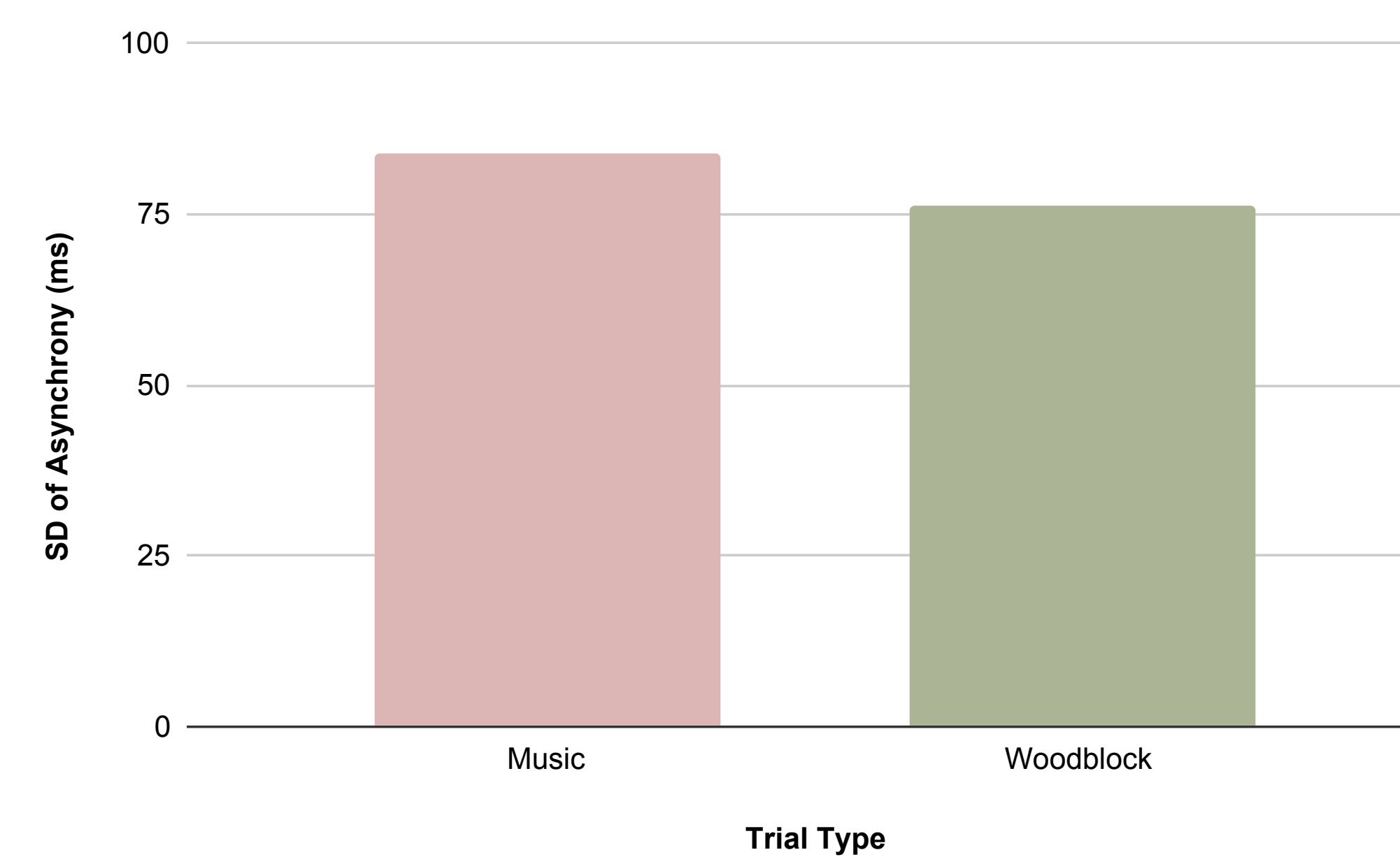


Figure 2. Overall, tapping was more consistent in the woodblock trials than the music trials.

Home Free Dancing vs. Tapping Performance

Metrical correspondence refers to the proportion of movements that were performed within $\pm 10\%$ of the excerpt beat rate. A higher metrical correspondence score means that the tempo of their movement was more related to that of the musical excerpt.

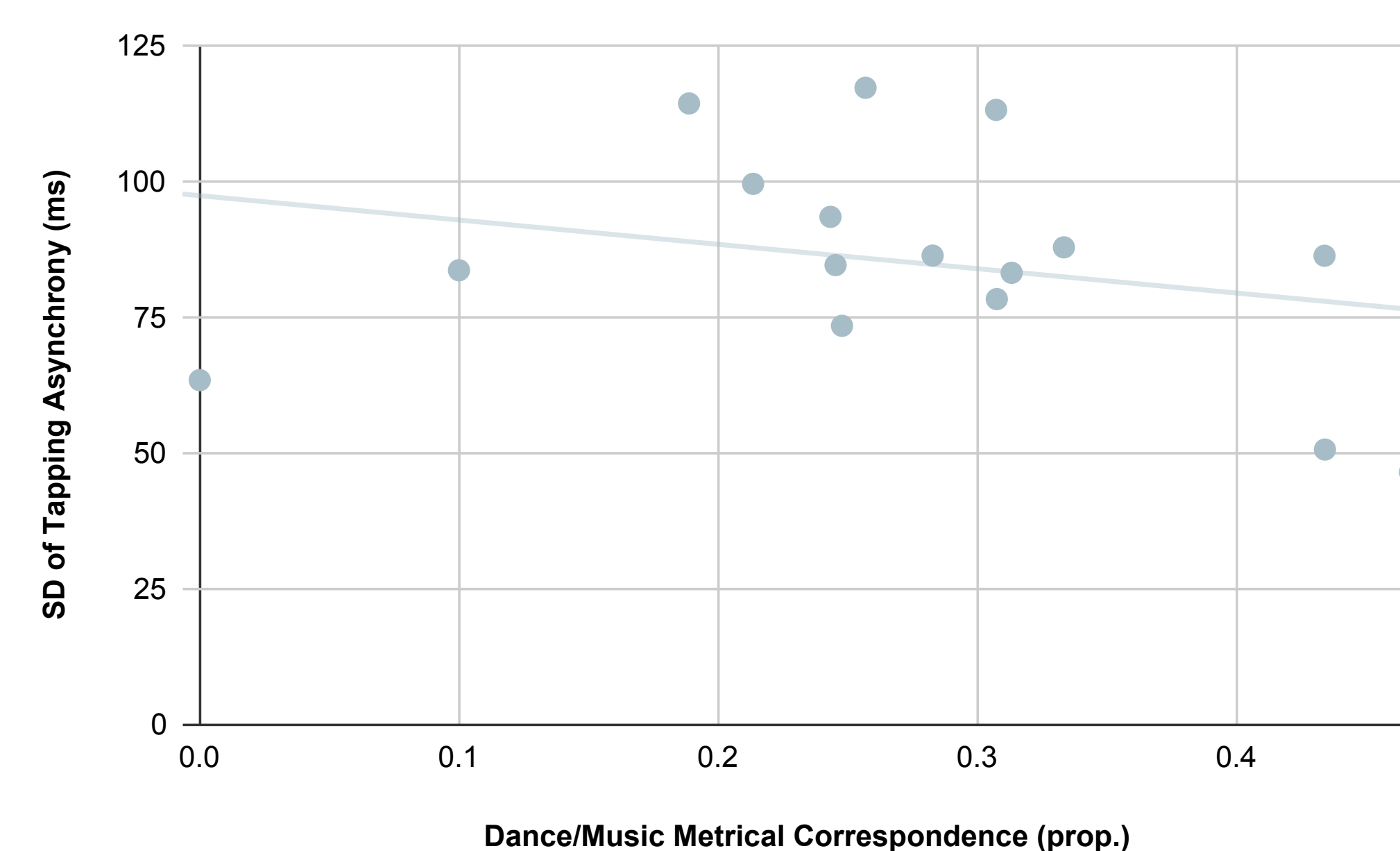
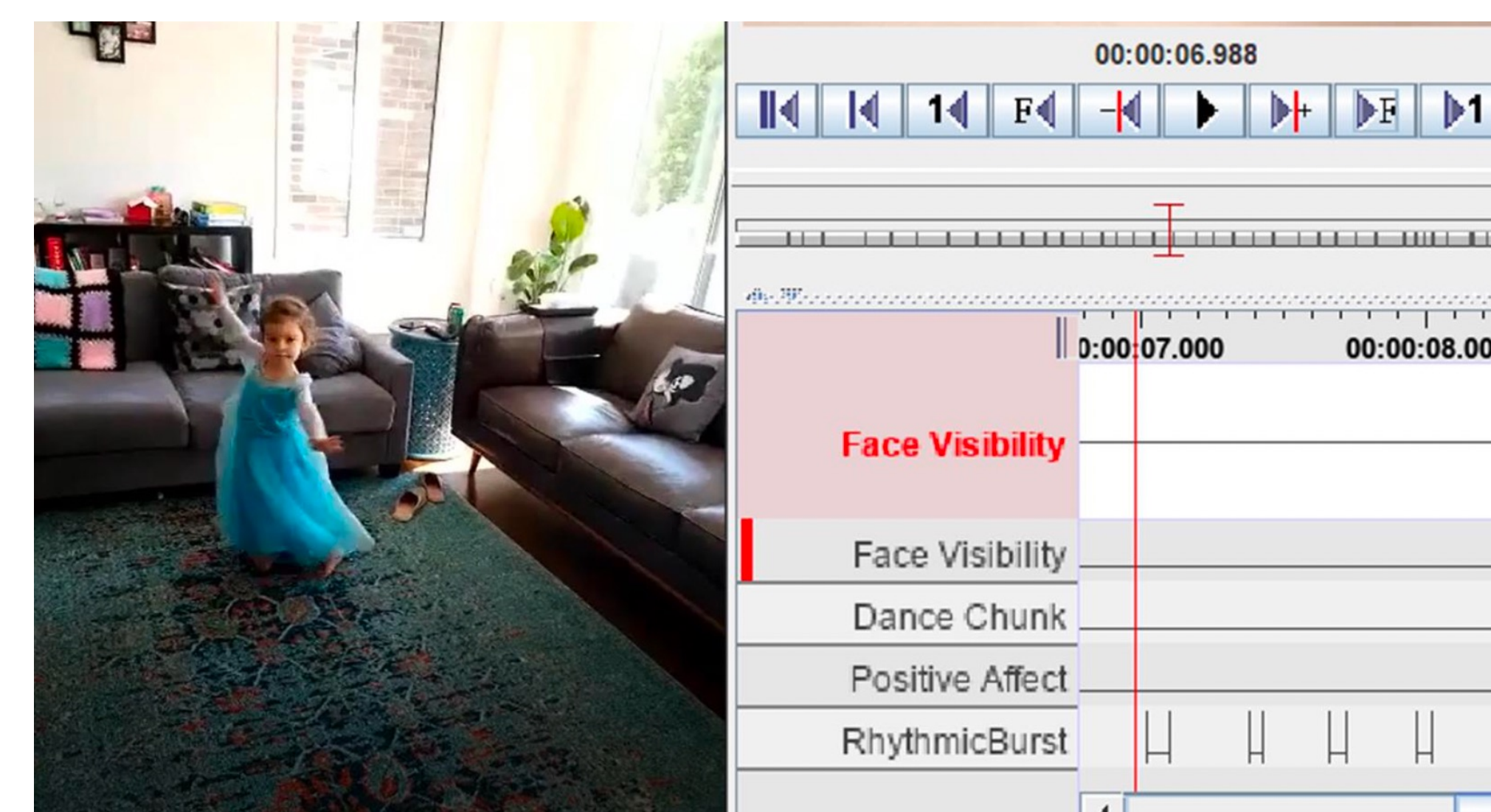


Figure 3. Participants' who had more metrical correspondence in dancing also tapped more consistently ($r = -0.26$)

- Parents recorded their child dancing, at home, to the 4 musical excerpts
- Videos were coded for face visibility, smiling, dancing, and onset of each event in a burst of rhythmic activity



Discussion

- We were able to test children's sensorimotor synchronization in the comfort of their own homes using technologies that are found in most North American homes
- Preliminary results suggest that acoustic features (music vs. woodblock) influence children's sensorimotor synchronization performance
 - Perhaps the simplicity of the woodblock is less distracting, facilitating more consistent tapping and the anticipation of tapping
- Temporal correspondence in home free dancing also predicts tapping performance one year later

Limitations

- Testing in participants' homes led to uncontrolled circumstances that may have influenced our data. For example:
 - Distractions in participants' testing environment
 - Variability in families' hardware and browser capabilities
 - Children's ability to follow the instructions and attention maintenance

Future Directions

- What influences does emotional aspects, acoustic features and tempo differences in music have on children's sensorimotor synchronization performance? How could a home experiment test this?
- How do socio-cultural differences, differences in dance experiences, language, and enculturation influence children's beat synchronization?
- Does groove influence children's beat alignment?

References

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Dr. Haley E. Kragness is now affiliated with Bucknell University.