

Background

- Synchronization ability develops with age
- Young children can tap along to the beat, but the extent of their synchronization abilities is unclear [1]

- 3-6 year old children prefer medium (vs. low and high) syncopation rhythms for dancing, and subjective ratings suggest they dance more [2]

When freely dancing, do children synchronize to the beat?

Does overall movement or synchronization depend on syncopation or age?

Methods

- 3-6-year-olds (N =) participated from home via Lookit, video recorded

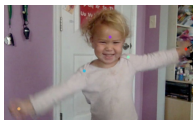
- Participants danced to drumming patterns (2 Hz beat rate) from 2 of 3 syncopation conditions (low, medium and high) [3]

- 4 individual rhythms, each heard twice

- Videos were analyzed using Deeplabcut (DLC) to track body movements



Labels applied to subset of frames



Preprocessing and Analysis

- Label body parts (forehead, hands, shoulders, feet) for a subset of frames of raw videos

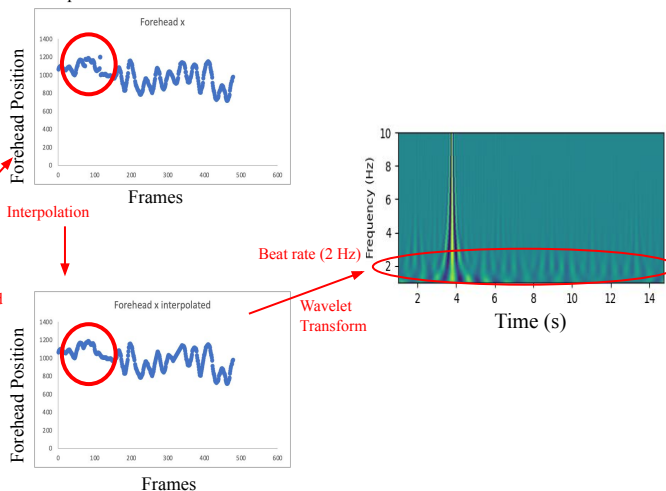
- DeepLabCut (transfer learning with deep neural nets) estimates 2D label positions for remaining frames in each video

- Coordinates with likelihoods <0.95 are corrected with linear interpolation

- Calculate overall movement (average sum displacement over dimensions and trials) in each video (in future will normalize by body size)

- Wavelet (Morlet) transformation provides coefficients for the frequency content in movement for each video frame in each dimension. Movement energy (coefficient²) at the beat rate (2 Hz) is averaged over frames and over trials within syncopation conditions.

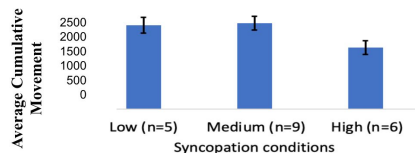
- We will test for effects of syncopation and age on average overall movement and beat-rate (2 Hz) movement power



Preliminary Results (all n.s.)

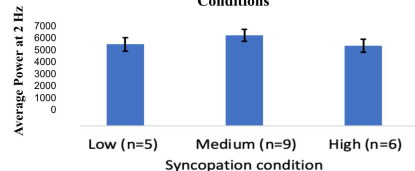
- Mean total movement (forehead) is higher for Low and Medium than High syncopation rhythms

Overall Movement Across Syncopation conditions



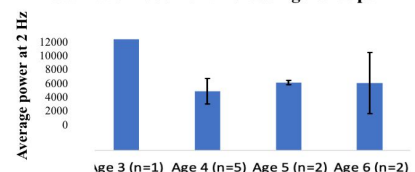
- Movement (forehead) at the beat rate (2 Hz) is greater for Medium than High & Low

Beat-Rate Movement Across Syncopation Conditions



- Beat-rate movement varies with age.

Beat-Rate Movement Across Age Groups



Summary

- We aim to investigate children's dancing while listening to rhythms of varying syncopation

- We are using objective measures to assess overall movement and movement at the beat rate of rhythms.

- Wavelet transforms assess the frequency content in dance movements.

- We are comparing synchronization in terms of the effects of age (3-6 years old) and syncopation (low, medium, and high).

- Data collection is ongoing. These results are preliminary (n = 10).

- We expect the results to reveal new insights into the development of synchronization abilities and the factors that influence synchronization.

References

- [1] Eerola, T., Luck, G., & Toivianien, P. (2006). An investigation of pre-schoolers' corporeal synchronization with music. *ICMPC*.
- [2] Cameron, D.J., Carrillo, C., Caldaron, N., Pсарis, M., & Trainor, L.J. (in revision). The complexity-aesthetics relationship for musical rhythm is more fixed than flexible: evidence from children and expert dancers.
- [3] Witek, M. A. G., Clarke, E. F., Wallentin, M., Kringelback, M. L., & Vuust, P. (2014). Syncopation, Body-movement and Pleasure in Groove Music. *PLOS ONE*, 9(4): e94446.