

Time on my hands: Examination of overlapping rhythmic synchronization mechanisms across sensory modalities

Chloe Mondok & Martin Wiener

Department of Psychology, George Mason University



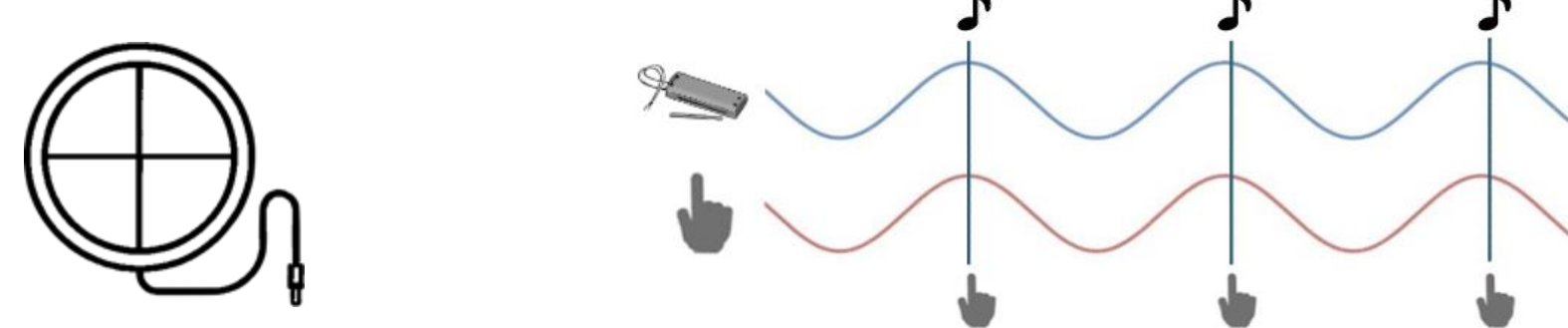
Background

- Range of optimal sensorimotor synchronization frequencies across modalities
- Synchronization performance depends on modality suitable processing styles (Hove et al., 2013)
 - Discrete auditory stimuli (ie. distinct beats)
 - Continuous visual stimuli (ie. movement)
- Optimal oscillations vary across the literature
 - Context dependent

Experiment 1 Methodology

Experiment 1: In-Phase Tapping

- $n = 30$
- Auditory and visual metronome blocks consisting of 168 trials each
 - Auditory: 100 ms woodblock tone
 - Visual: white circle moving vertically between two horizontal white lines
- Frequency range: .5 to 3 Hz
- Participants were instructed to tap in time on a drum pad to stimuli beats then maintain tempo after stimuli disappeared



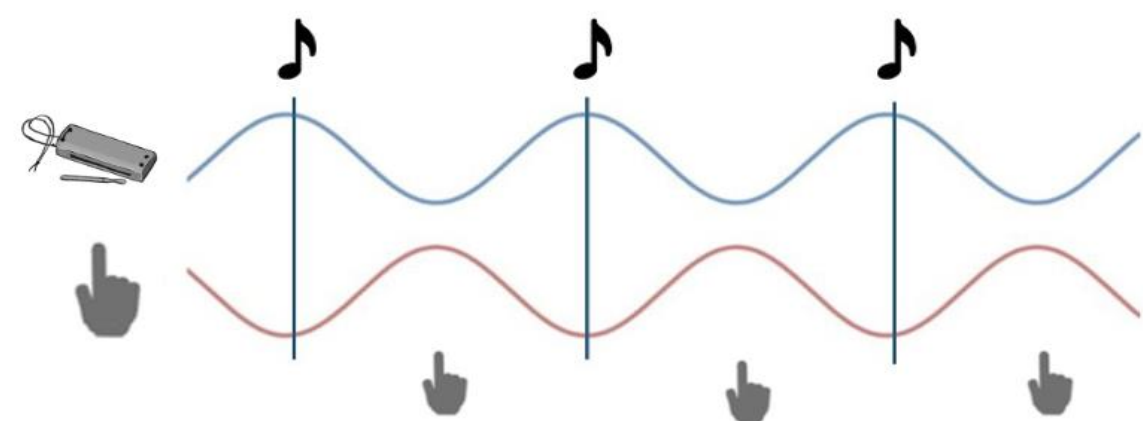
- Synchronization-Continuation paradigm** (based on Kaya & Henry, 2022):
 - Synchronization: Tap to the beat for 5 taps
 - Continuation: Continuing tapping at the same pace in absence of stimuli for 7 taps



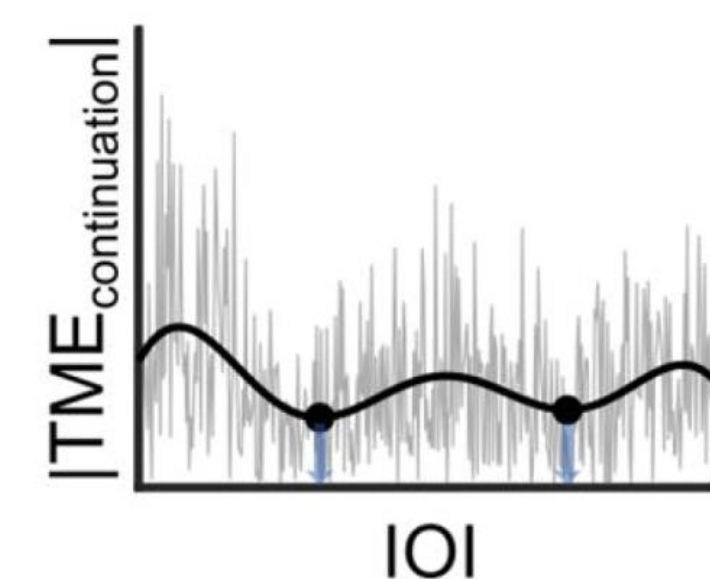
Experiment 2 Methodology

Experiment 2: Out-of-Phase Tapping

- $n = 22$
- Participants were instructed to tap in between stimuli beats then maintain tempo after stimuli disappeared
- Same Synchronization-Continuation paradigm



Example from Kaya & Henry, 2022

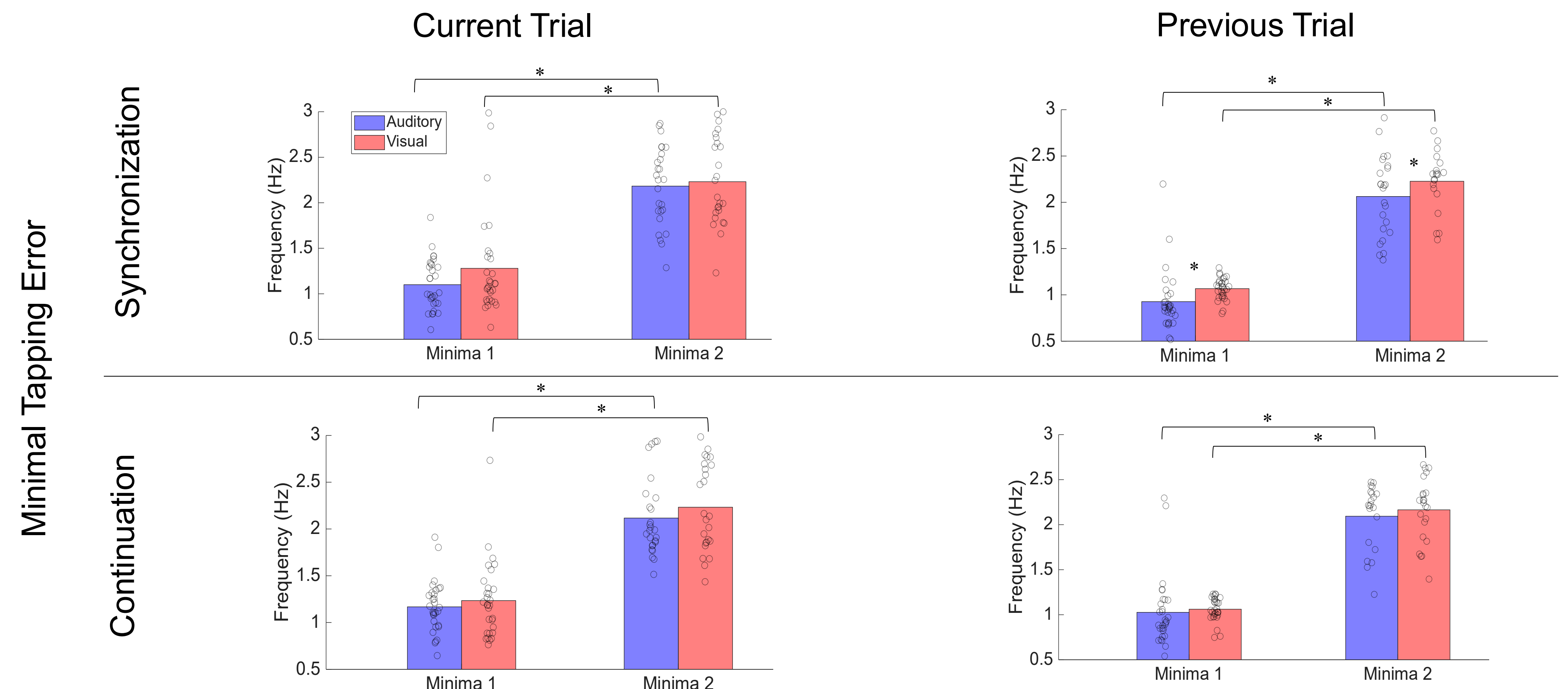


- Fit with sum of sines
- Find 2-3 local minima associated with minimal tapping error
 - Best tapping performance

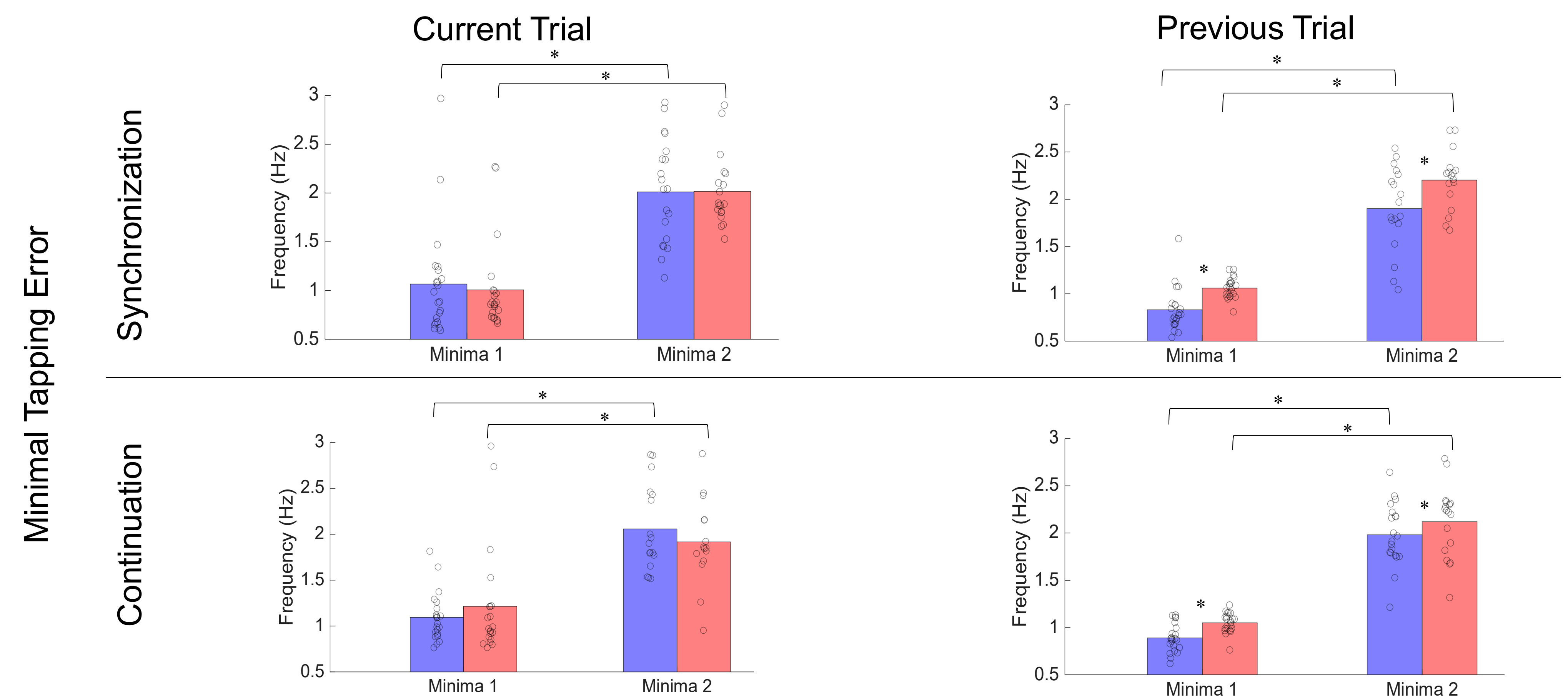
Conclusions

- No significant difference in minima between auditory and visual modalities
 - Auditory and visual temporal processing utilize overlapping synchronization mechanisms
 - ~1 Hz and ~2 Hz
- Significantly different yet harmonic minima for both auditory and visual modalities
- Previous trial significantly shifted minima leftward (~.8 Hz and ~1.9 Hz)
- No significant difference for visual and auditory across synchronization or syncopation or difficulty

Experiment 1 Results



Experiment 2 Results



Key References

- Hove, M. J., Fairhurst, M. T., Kotz, S. A., & Keller, P. E. (2013). Synchronizing with auditory and visual rhythms: An fmri assessment of modality differences and modality appropriateness. *NeuroImage*, 67, 313–321. <https://doi.org/10.1016/j.neuroimage.2012.11.032>
- Kaya, E., & Henry, M. J. (2022). Reliable estimation of internal oscillator properties from a novel, fast-paced tapping paradigm. *Scientific Reports*, 12(1). <https://doi.org/10.1038/s41598-022-24453-6>
- Zalta, A., Petkoski, S. & Morillon, B. Natural rhythms of periodic temporal attention. *Nat. Commun.* 11, 1051 (2020).

Scan here for a copy of the poster!

