

Investigating Auditory-Motor Entrainment in Early Childhood

Mikayla Samuel; Mark A. Schmuckler
Department of Psychology, University of Toronto Scarborough

Introduction



Background

- Synchronization of the auditory and motor systems can occur during the presence of an auditory rhythmic stimuli (Thaut, 2003).
- Auditory-motor entrainment found in spatiotemporal and temporal walking parameters in adults, but not for spatial walking parameters.
- 14- to 24-month-old infants will show modulation in their gait when presented with a single auditory input that was faster than their natural walking cadence (Schmuckler & Paolozza, 2023).

Aim

To explore graduated responses in motor entrainment to fine gradations of change in rhythmic input

Methodology

Baseline Walking condition (1st condition)
Modified Walking conditions (randomized)

Experimental Condition	Participant 1	Participant 2
Baseline Walking (Natural Cadence)	100 steps/min	120 steps/min
Metronome Setting		
75% of Natural Cadence	75 (beats/min)	90 (beats/min)
87.5% of Natural Cadence	87.5 (beats/min)	105 (beats/min)
100% of Natural Cadence	100 (beats/min)	120 (beats/min)
112.5% of Natural Cadence	112.5 (beats/min)	135 (beats/min)
125% of Natural Cadence	125 (beats/min)	150 (beats/min)

Table 1: Example of metronome modifications for two participants

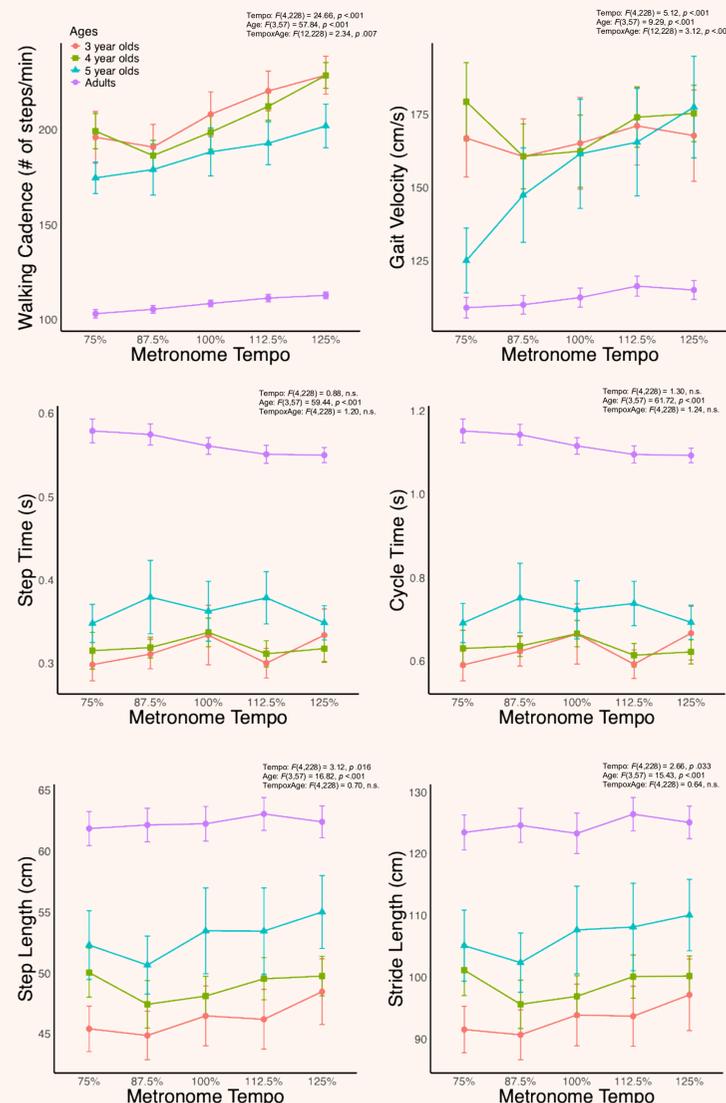
Results

Spatiotemporal
Parameters

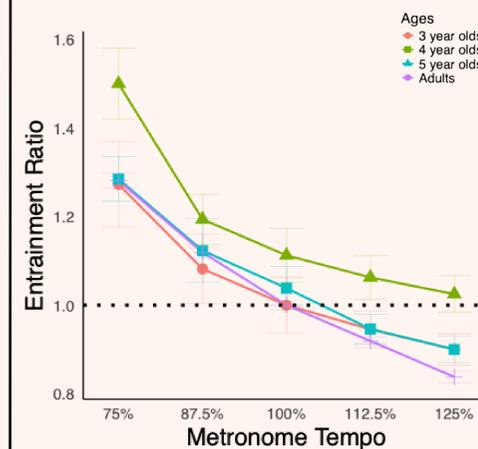
Temporal
Parameters

Spatial
Parameters

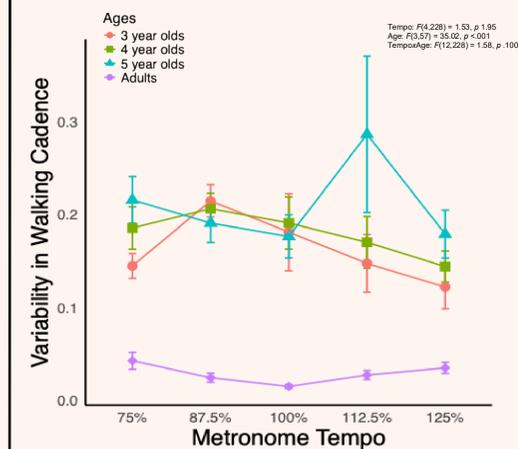
Gait Modulation



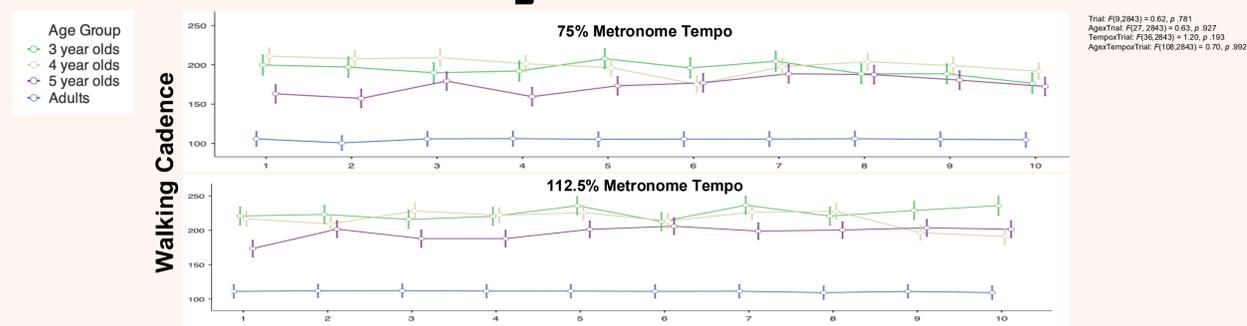
Proportionality of Response



Gait Consistency



Learning Across Trials



Conclusion

Summary

- Evidence of auditory-motor entrainment in early childhood
- Perceptual-motor limits at extreme tempos
- Consistency improves with age
- Automatic process

Future Directions

Persistence of Entrainment

Goal: Test if gait remains entrained without sound

Focus: Insight into the internalization of rhythm based movement

Influence of Ankle Weights

Goal: Test robustness of entrainment under motor load

Focus: Impact of sensorimotor demand on rhythmic gait adaptation

Contact info

mikayla.samuel@mail.utoronto.ca
utsc.utoronto.ca/labs/infant/

References

- Ghai, S., Ghai, I., & Effenberg, A. O. (2017). Effect of rhythmic auditory cueing on gait in cerebral palsy: A systematic review and meta-analysis. *Neuropsychiatric Disease and Treatment, Volume 14*, 43-59.. <https://doi.org/10.2147/NDT.S148053>
- Thaut, M. H. (2003). Neural basis of rhythmic timing networks in the human brain. *Annals of the New York Academy of Sciences, 999*(1), 364-373.
- Thaut, M. H., & Abiru, M. (2010). Rhythmic auditory stimulation in rehabilitation of movement disorders: a review of current research. *Music Perception, 27*(4), 263-269.