

Does music-based cuing improve motor performance in children with ASD?

A proposed motion capture study

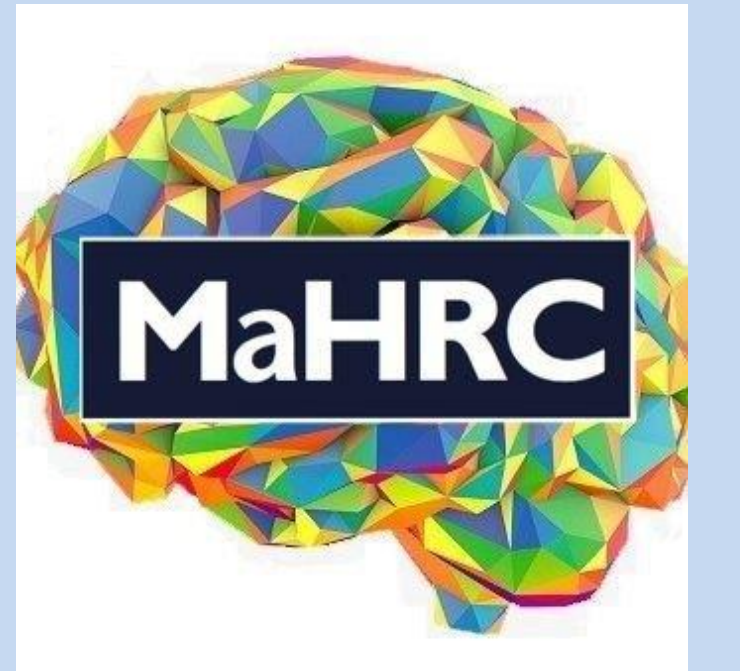
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BACKGROUND

- The current diagnostic criteria for autism spectrum disorder (ASD) incorporate sensory differences and repetitive behavior/motor movements, but not underlying motor dysfunction.
- Accurate sensory information guides movement, therefore, disordered sensory input leads to inaccurate motor output.
- Treatment for ASD symptoms targets behavior and language development, while underlying motor dysfunction often goes unaddressed.
- Studies suggest music as an effective tool to address motor dysfunction as autistic individuals show increased sensitivity for music, undisturbed rhythm synchronization capacity, and intact auditory-motor pathways.
- Music improves social communication and auditory-motor connectivity in autistic children. Yet, using music to facilitate controlled motor performance in children with autism is not well studied.

PROJECT AIMS

- 1) To determine if children with ASD show improved motor performance while executing a simple upper motor task given silence or rhythmic auditory stimuli.
- 2) If motor performance given an auditory stimulus is improved, a following aim is to determine which stimulus was more effective; the simple (metronome) or complex (structured music).

REFERENCES

- (1) American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.
- (2) Fabbri-Destro, M., Cattaneo, L., Boria, S., & Rizzolatti, G. (2009). Planning actions in autism. *Experimental Brain Research*, 192(3), 521–525.
- (3) Sharda, M., Tuerk, C., Chowdhury, R., Jamey, K., Foster, N., Custo-Blanch, M., Tan, M., Nadig, A., & Hyde, K. (2018). Music improves social communication and auditory-motor connectivity in children with autism. *Translational Psychiatry*, 8(1), 231–13.

EXPERIMENTAL DESIGN

PARTICIPANTS

- Children diagnosed with ASD
- Ages 6-12 y/o
- Right-handed
- n = 30

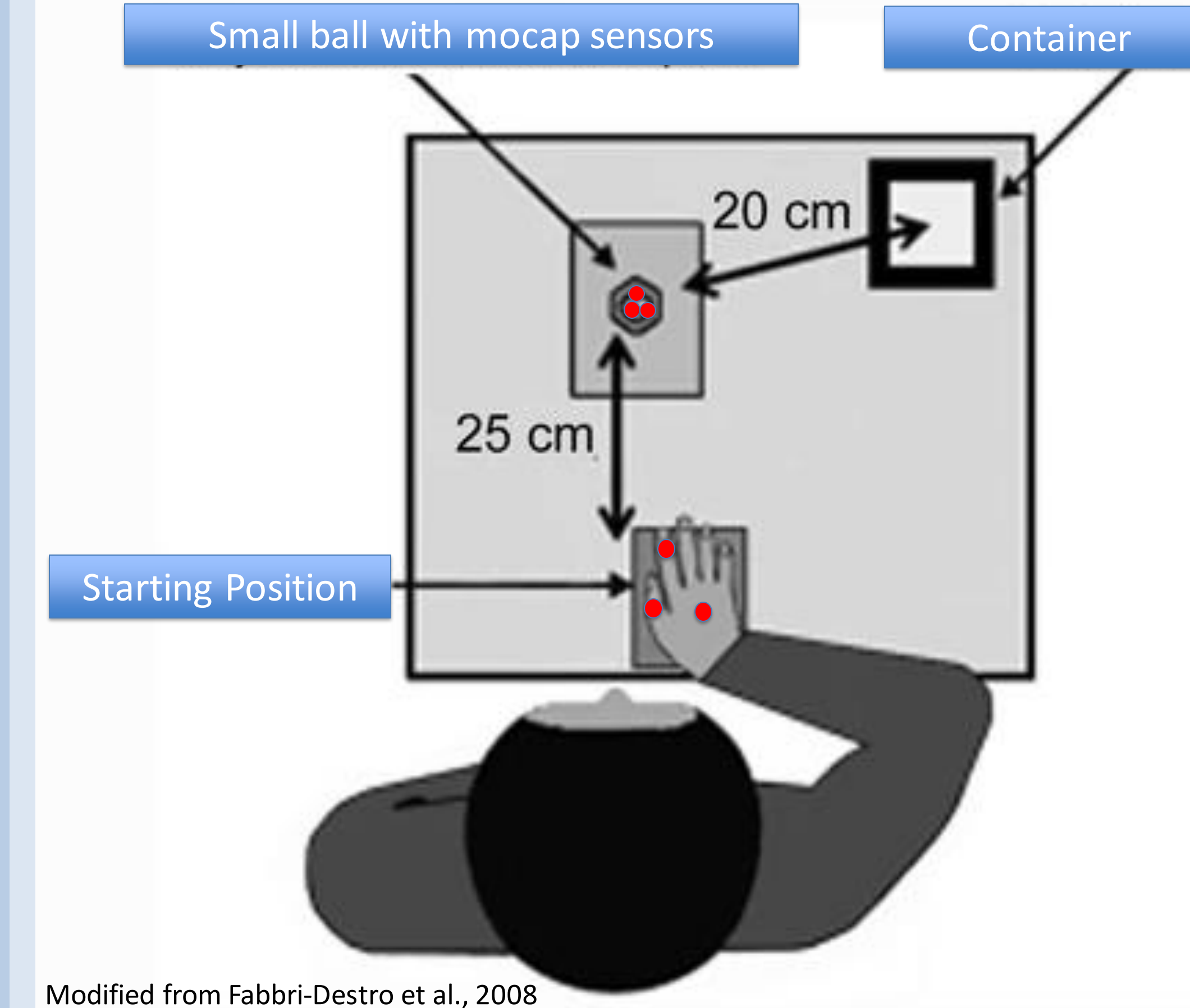
MATERIALS

- Vicon Motion Capture System & markers
- iPhone w/ Metronome app and cued music
- Bluetooth speaker

CONDITIONS

- 1) Self-paced (SP)
- 2) Metronome Beat @ 120bpm (MB)
- 3) Structured Music @ ~ 120 bpm (SM)

TASK



- 10 trials per condition, 30 total trials
- Counterbalanced
- Sampled at 300 hz

Procedure

- 1) Reflective markers will be adhered to middle of the right hand, right pointer finger, and right thumb as well as the object to be transported (ball)
- 2) Participant begins in the home position (pictured)
- 3) Verbal cue of “4, 3, 2, 1, GO”
- 4) When cued, the participant will reach to pick up the ball and drop it in the container
- 5) Reset to home position for next trial

DATA

OUTCOME MEASURES

- Initiation of movement:
 - Measured from the time the verbal cue “GO” is given until the sensors on hand reach 30 mm/sec
- Time measured for each two movements:
 - Trajectory phase measured from hand (T1) to ball (T2)
 - Transport phase from ball (T3*) to container (T4)

(*T3 will begin once the sensors on the ball reach 30 mm/sec, which will also indicate the T2 time point)

ANALYSIS

Data will be collected from coordinates of the object, hand, thumb, and forefinger via VICON motion capture systems and will be analyzed applying a repeated measures ANOVA with three levels (self-paced, metronome, music) for each of the dependent variables (time of initiation, trajectory phase, transport phase).

EXPECTED OUTCOME

- Participants will demonstrate quicker initiation of movement during MB and/or SM than SP
- Participants will show less movement variability during the MB and/or SM than SP.

IMPLICATIONS

- The results are important to advise the clinical use of specific auditory stimuli to facilitate improved initiation of movement and controlled motor performance in autistic individuals.
- Furthermore, the results of this study may give insight into how children with ASD may program single motor acts independently from one another with and without cued rhythmic auditory stimuli.