



Neural Basis of Information Transfer in Autism Spectrum Disorder: A Pilot Study

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Introduction

- Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder affecting sensorimotor, cognitive, and socio-communicative abilities throughout the lifespan.
- Social deficits observed in ASD are linked to impairments in brain systems that support theory of mind, which requires recruitment of sensorimotor simulation systems.
- While there is extensive behavioral research on theory of mind in ASD (Baron-Cohen et al., 1997), comparison of sensorimotor simulation systems in ASD has not been carried out.
- Understanding the neural underpinnings of successful number processing in ASD can help develop targeted interventions for recruitment of the same sensorimotor networks in other domains, including emotion recognition from facial and body expressions.

Methods

Participants

- A group of 20 ASD diagnosed participants (ASD) and a group of 20 neurotypical participants (TD) will be recruited to participate in the study from the students at the University of Alabama and UA-ACTS program.
- The study received approval from the University of Alabama's IRB.

Procedure

- Participants will complete a mismatch task validating Arabic Numbers (1-4), Finger Numeral configurations (FinNum - numbers 1-4), Facial Expressions (Face - disgust, joy, sadness, surprise) and Social Gestures (FinSoc - like, dislike, perfect, and punch).
- 32-electrode system was used for EEGs recording.
- Participants will complete 12 blocks of 80 trials taking about 50 minutes.

Methods cont.

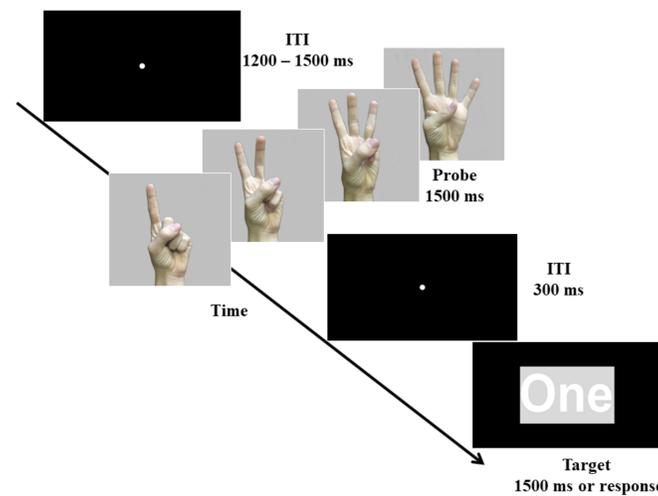


Figure 1. Experimental progression for Finger Numerical Configurations trial showing gestures for 1-4 numbers and validation for 1.

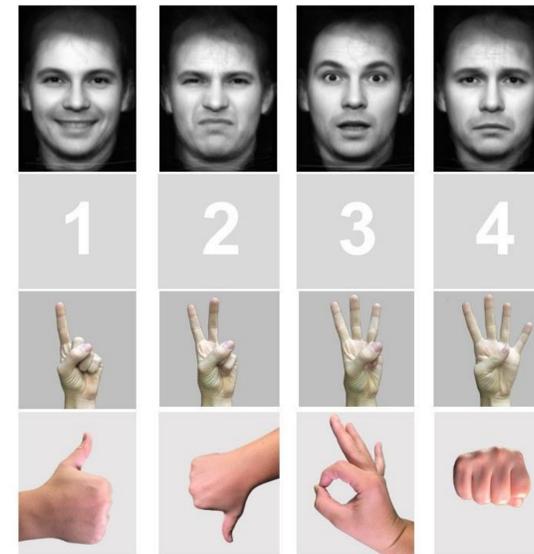


Figure 2. Stimulus for each category: Face (Joy, Disgust, Surprise, Sad), Arabic (1-4), Finger Numerical Configurations (1-4), and Social Gesture (Like, Dislike, Perfect, Punch).

Pilot Results

- Preliminary results are based on data from 5 neurotypical pilot participants.
- Average target-locked event-related potentials (ERPs) were created for Match and Mismatch trials for each of the four conditions.

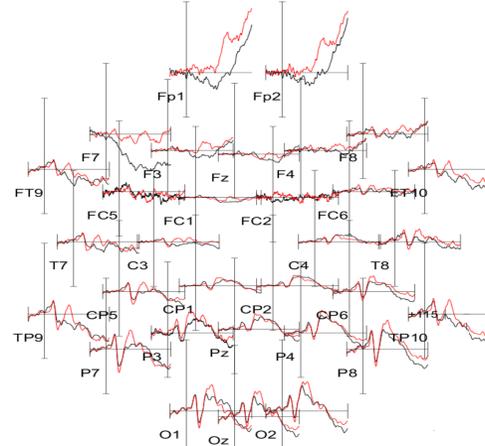


Figure 3. Average ERPs showing FinNum condition for all 32 electrodes.

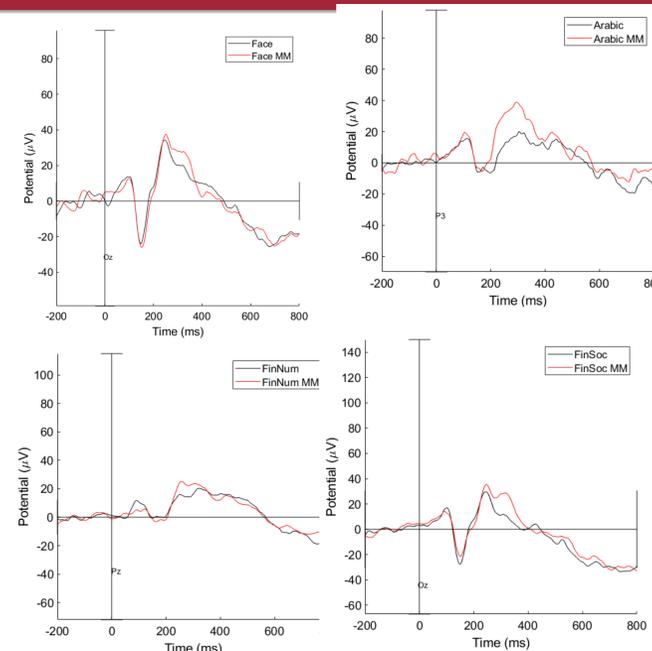


Figure 4. Average ERPs showing a) Face condition for Oz electrode, b) Arabic condition for P3 electrode c) FinNum condition for Pz electrode, and d) FinSoc for Oz

Future Directions

Data analysis will be performed between groups (TD, ASD) in the following ERP components:

P1/N1 (ERP peak occurring 50-150ms)

- N1 is sensitive to processing body parts (Taylor, Roberts, Downing, & Thierry, 2010).
- N1 is relevant for assessing effects of numerical gestures (Soylu, Rivera, Anchan, & Shannon, 2019).

N170 (150-200ms)

- Marks processes involved in recognition and identification of facial information (Bentin et al., 1996, Nelson and McCleery, 2008)
- Children with ASD had shown longer N170 latencies than TD (Wagner et. al, 2013).

P3b (250-400ms)

- Deficits in sensory processing and attention to task-relevant information exist in visual and auditory domains for the ASD group (Kemner et al. 1999).
- P3b amplitude was smaller in a group of participants with ASD when processing auditory (Courchesne et al. 1989) and visual stimulus (Verbaten et al. 1991).

N400 (250-450ms)

- The spatial distribution of the N400 varies between an ASD group and controls when processing semantically incongruous sentences (Braeutigam, Swithenby, & Bailey, 2008).

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