

# The N170 as a Biomarker of Response to Pivotal Response Treatment in Children With Autism Spectrum Disorder

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## Background

- Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by primary difficulties in social function
- The N170 is a face-sensitive event-related potential (ERP) recorded over occipitotemporal scalp regions
- Previous research consistently shows that individuals with ASD have delayed N170 latencies to upright faces in ASD, suggesting potential as a biomarker applicable to ASD
- There is a lack of research examining whether the N170 is reflective of response to treatment, an important potential context of use for biomarkers
- Pivotal Response Treatment (PRT) is an empirically-validated behavioral treatment for ASD

## OBJECTIVE

- Analyze the N170 as a potential index of treatment response in ASD

## HYPOTHESIS

- N170 latency will decrease in response to faces after PRT treatment

## Methods

### Participants

- Clinical and EEG data were collected from 7 children with ASD, 4 to 6 years of age, receiving PRT (Table 1)
  - 3 participants served as waitlist controls
  - 5 participants completed a follow-up EEG 16 weeks after PRT completion
- Participants received a 16 week course of PRT for 8 hours per week

	Mean	SD
Age	5.6	0.91
ADOS	17.9	6.5
DAS-II	112.3	11.4

Table 1. Participant demographic data.

### Experimental Paradigm

- 70 distinct computer-generated, dynamic, grayscale faces with neutral and fearful affect
- Participants viewed 146 trials in random sequence

### Trial Structure

- Central fixation crosshair followed by a static face with either a neutral or fearful expression
- Then the face changed expression from neutral to fearful or fearful to neutral (Figure 1)

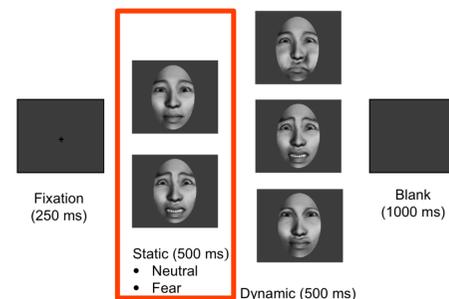


Figure 1. Experimental paradigm & trial structure. ERP data segmented to the static face (red box).

### EEG Data Acquisition and Collection

- EEG collected using a 128-channel HydroCel Geodesic Sensor Net
- Recorded at 500 Hz

## Methods

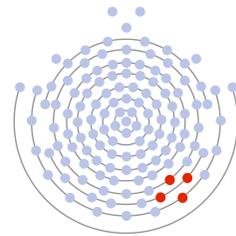


Figure 2. N170 electrode recording sites.

### ERP Analysis

- ERP data segmented to the onset of static face presentation within larger dynamic face paradigm
- Data was averaged across selected occipitotemporal electrodes (Figure 2)
- N170 peak latency was compared across fear and neutral stimuli at four time points:
  - Pre- and post-treatment
  - 16 weeks prior to treatment and 16 weeks after treatment completion

### Statistical Analysis

- N170 latency analyzed using repeated measures ANOVA
- 2 within-subjects factors
  - Treatment (Pre/Post) & Emotion (Fear/Neutral)
- Correlations to determine relationship between changes in N170 latency and ASD symptomatology

## Results

- Analyses revealed a main effect of treatment [ $F(1,6)=11.34, p=0.02$ ]
  - Reduced N170 latency after treatment
  - Observed for both neutral ( $p=0.02$ ) and fearful ( $p=0.03$ ) face stimuli

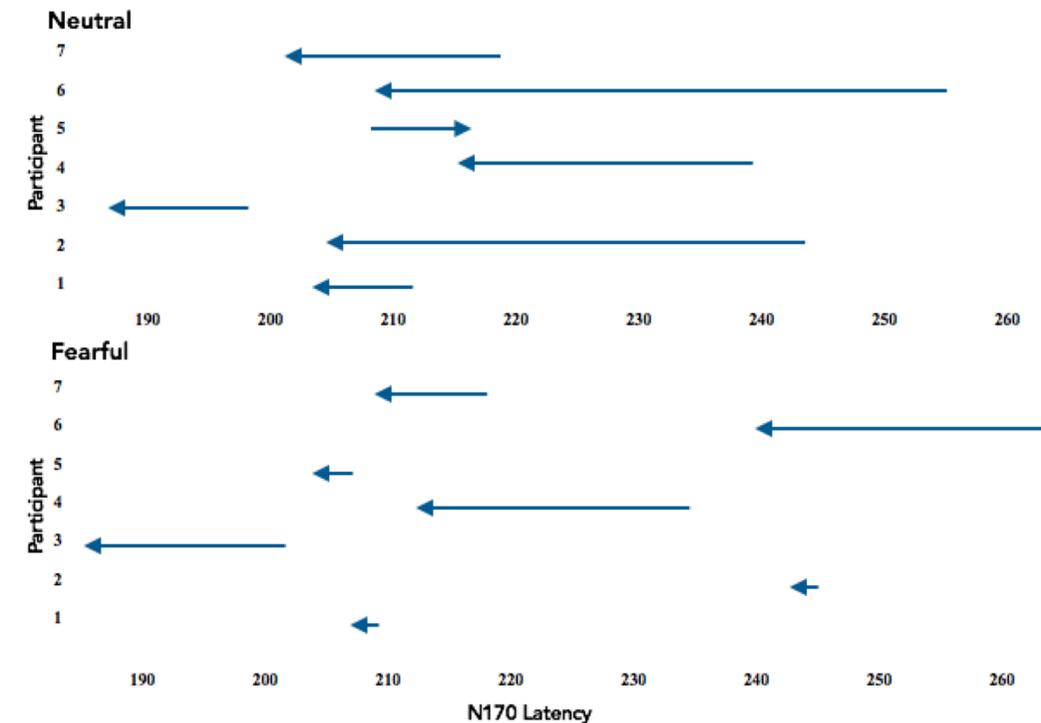


Figure 3. Individual changes in N170 latency before (base of arrow) and after (arrowhead) 16-weeks of PRT. Panel A shows differential responses to neutral faces, and Panel B displays responses to fearful faces.

## Results

- Participants' N170 latency prior to PRT significantly correlated with treatment-associated change in latency for neutral faces ( $r=-.873, p=0.01$ )
  - Participants who initially showed more atypical (slower) neural response to faces showed the most dramatic improvements in face-processing efficiency during treatment

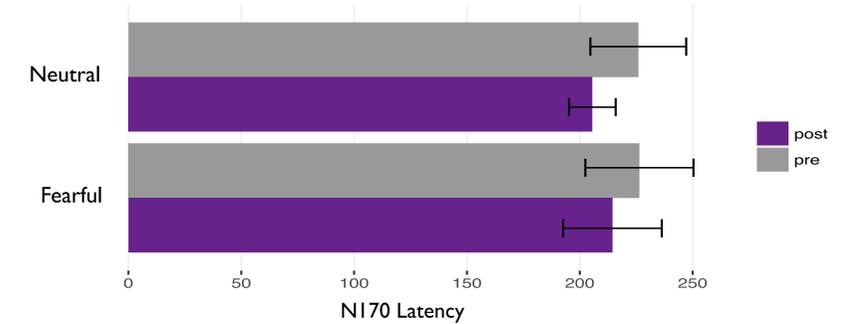


Figure 4. Group changes in N170 latency in response to 16-weeks of PRT. Average latency for neutral faces reduced from 225 ms to 205 ms. Average latency for fearful faces reduced from 226 ms to 214 ms.

- There was no significant change in N170 latency 16 weeks before PRT onset in the waitlist controls
- Reduced N170 latency was maintained 16 weeks after the end of PRT
- No significant correlation between change in N170 latency and clinical improvement were observed

## Conclusions

- PRT results in improved face processing efficiency, as indicated by significant reductions in N170 latency
- This study provides initial evidence of the effectiveness of the face-sensitive N170 as a potential index of treatment response in ASD
- N170 latency may denote a potential stratum within ASD (e.g., individuals displaying the most delayed latencies) more likely to respond to behavioral interventions targeting social function
- Not all participants showed a decreased N170 latency after PRT
  - The N170 may not universally reflect changes elicited by all ASD treatments, just as all treatments do not universally improve ASD symptomatology
- Main limitation of the current study is its small sample size
  - Future research should apply current methodology in a larger sample
- Future research should examine correlations between change in N170 latency and specific facets of clinical improvement

## Acknowledgements

- McPartland Lab, Yale Child Study Center, New Haven, CT [mcp-lab.org](http://mcp-lab.org)
- Funding sources: NIMH R01 MH100173, NIMH K23 MH086785, NIMH R21 MH091309, CTSA Grant Number UL1 RR024139, Allied World, Harris Professorship at the Yale Child Study Center, Deitz Family

