Implicit Semantic Processing of Linguistic and Non-Linguistic Stimuli in Adults with Autism Spectrum Disorder

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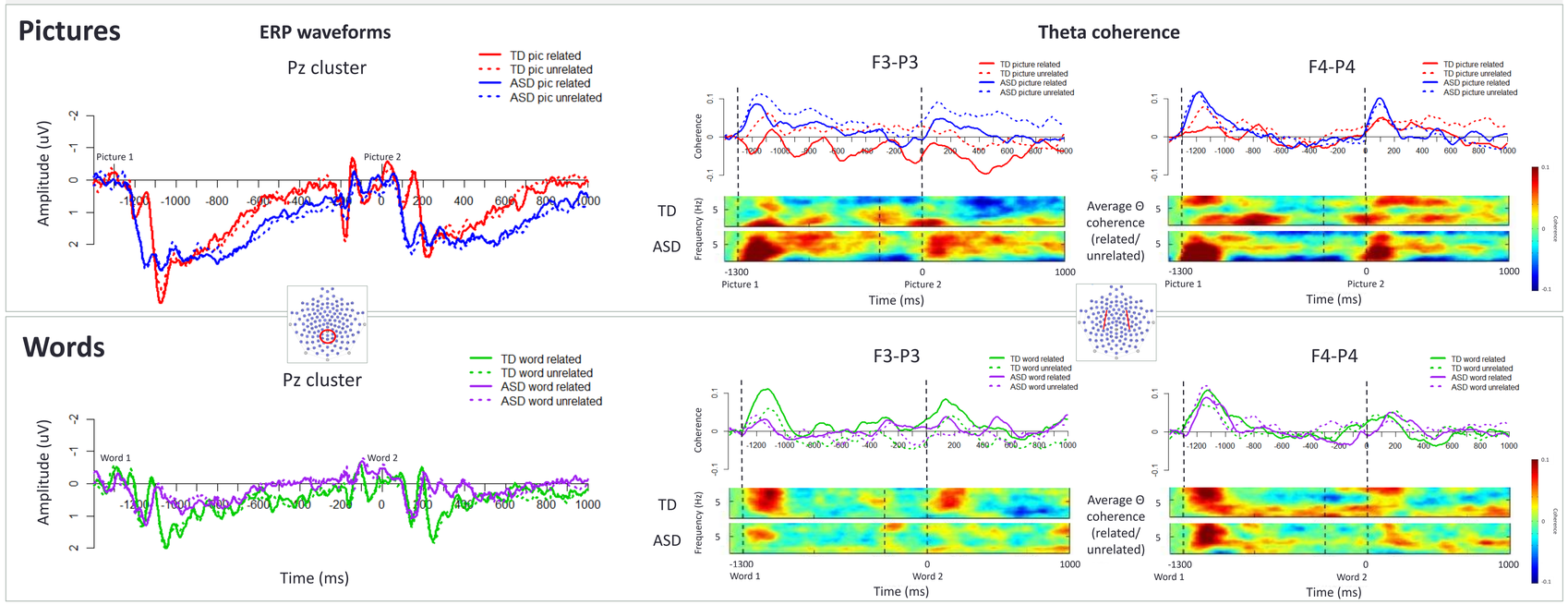
BACKGROUND

- Autism Spectrum Disorder (ASD) affects approximately 1 in 68 children in the United States [1].
- Language impairments are common in ASD, particularly in higher-level functions like reading comprehension [2].
- Impairments in *semantic integration*, or the ability to integrate meanings of various pieces of information to arrive at a holistic understanding, may underlie language difficulties [3].
- In semantic priming tasks, the amplitude of the N400 ERP component is reduced when a prime and target are semantically related (e.g. dog-CAT), and thus easier to integrate, compared to unrelated stimuli (e.g. rock-CAT) [4]. The N400 effect (the amplitude difference between unrelated and related conditions) is an established index of semantic integration.
- Some studies have shown that non-linguistic semantic processing is not impaired in individuals with ASD [5,6], suggesting generally intact semantic processing but a language-specific deficit in semantic integration.
- However, these previous studies tested children and adolescents; whether language-specific deficits in semantic integration persist into adulthood is unknown.
- This study examines whether semantic integration of language, as assessed by the N400 effect, is impaired in adults with ASD.

RESULTS

- No significant group*congruency interactions, indicating groups did not differ in N400 responses.
- Significant group*modality*site*hemisphere interactions from 300-500 ms and 700-900 ms (all *p*'s < 0.05): Larger positive amplitude for pictures (over both related and unrelated conditions) in ASD group compared to TD group at Pz cluster.
- Spectral analyses of EEG coherence, a metric of neural connectivity, in the theta band (thought to index semantic processing [7]) showed greater theta coherence for ASD group in response to pictures, greater coherence for TD group in response to words.



METHODS

Participants

- 8 adults with ASD (M = 21 years old); 6 male, 2 female.
- 8 typically-developing (TD) participants (M = 22 years old); 5 male, 3 female.
- Groups matched on age, receptive vocabulary, and verbal/non-verbal IQ (all *p*'s > 0.47).

Stimuli and Procedure

- Participants viewed pairs of pictures or pairs of words that were semantically related or unrelated (100 pairs per trial type).
- Participants monitored for "catch trials" (16% of stimuli) in which a smiley face (picture blocks) or consonant string (word blocks) were presented, and were instructed to hit a button when they saw the catch stimulus. Catch stimuli were not included in analyses.

EEG Data Acquisition, Preprocessing, and Analysis

- EEG data recorded at 500 Hz using a 128-channel Geodesics Sensor net and NetStation 5.3.
- Data bandpass filtered from 0.1-50 Hz and segmented into epochs time-locked to the onset of the first stimulus.
- Time-frequency analysis of theta band (3.5-7 Hz); Morlet wavelet of 2 cycles with expanding factor of 0.5 and Hanning taper.

	Pre-trial fixation 200 ms	**Stimulus 1** 1000 ms	**Inter-stimulus fixation** 200 ms	**Stimulus 2** 1000 ms	**Inter-trial interval** 1000-1400 ms
Picture, related	+		+		+
Picture, unrelated	+		+		+
Picture, catch trial	+		+		+
Word, related	+	cat	+	dog	+
Word, unrelated	+	frog	+	clock	+
Word, catch trial	+	XPLKW	+	bread	+

CONCLUSIONS

- There were no significant effects of relatedness in either group, suggesting that the implicit task may be too subtle to elicit N400 effects. These results are preliminary and we are still collecting more data, so this may change with a larger sample size and more power.
- In measures of ERP amplitude and theta-band coherence, the ASD group showed a greater neural response to pictures whereas the TD group showed greater neural response to words.
- The enhanced responsivity to pictures in the ASD group could explain why visual processing is intact in this population.

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