Linguistic And Non-Linguistic Semantic Processing In Individuals With Autism Spectrum Disorders: An ERP Study

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Introduction

Language deficits in autism
• Autism spectrum disorders (ASDs) are characterized by widespread language impairments [1].
• Language deficits may stem from difficulties with semantic integration: the ability to integrate the meanings of pieces of information and arrive at a holistic understanding [2].

The N400 and semantic processing
• The N400 event-related potential (ERP) is thought to index semantic processing.
• N400 amplitude is reduced when stimuli are easier to integrate semantically with their preceding context compared to stimuli that are difficult to integrate [3].

Semantic processing in individuals with ASD
• In individuals with ASD, the N400 effect (i.e., the modulation of N400 amplitude by semantic relatedness) in response to linguistic stimuli is reduced or absent compared to typically-developing (TD) individuals [4,5], suggesting impaired semantic integration during language processing.
• However, visuo-semantic processing of non-verbal stimuli is not impaired [4,6].
• This could suggest semantic processing impairments only for language, but such a modality-specific deficit has not been satisfactorily established.

The current study
• We established whether semantic processing deficits in individuals with ASD are restricted to the linguistic domain.
• Compared within-modality semantic priming of linguistic stimuli (written words) and non-linguistic stimuli (pictures) in adults with ASD and TD adults.

Results: Pictures

TD vs. ASD: Unrelated-related difference waves

Discussion

Non-linguistic semantic processing
• Both groups showed an N400 effect for picture pairs.
• Suggests non-linguistic semantic processing is not impaired in individuals with ASD.

Linguistic semantic processing
• Both groups showed an N400 effect for words from 400-800 ms, indicating successful semantic processing of language.
• However, there were group differences in the timing and topography of the N400 effect.
• N300 component
  • An N300 occurred from 300-500 ms over frontal scalp for the TD group but not the ASD group.
  • The N300 is proposed to reflect expectancy processes in semantic priming [7].
• N400RP (right-lateralized N400) component
  • An N400RP occurred from 400-700 ms over parietal scalp for the ASD group but not the TD group.
  • The N400RP is proposed to reflect a semantic matching strategy [7].
• This suggests an expectancy-based strategy for the TD group (N300), but a more controlled post-lexical integration strategy for the ASD group (N400RP).

Results: Words

TD vs. ASD: Unrelated-related difference waves

Conclusions

• Intact semantic processing of picture stimuli between groups suggests that individuals with ASD do not have difficulties with non-linguistic semantic processing, as predicted.
• In contrast to previous findings, the ASD group did show an N400 effect in response to linguistic stimuli, suggesting intact semantic processing of language.
• Subtle differences in the timing and topography of the N400 effect suggest different processing strategies between the groups:
  • TD individuals utilize a more expectancy-based strategy.
  • Individuals with ASD employ a more controlled post-lexical integration strategy.
• These differences could be related to the explicit nature of the semantic priming task or to the adult populations we tested.

References