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Theory of mind and high abilities, EEG analysis

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Introduction
Theory of Mind (ToM) refers to the ability to understand and represent both one's own mental states and those of others, enabling the process of mentalizing (Happé et al., 2017). This study posits that individuals with high cognitive abilities may exhibit distinct neural processing patterns during ToM tasks, reflecting a potentially more efficient or elaborate engagement of brain regions associated with social cognition. By employing electroencephalography (EEG) to examine brain activity in individuals with varying intelligence levels during a ToM task, this research aims to shed light on the neural correlates of intelligence-related differences in social cognitive processing, contributing to a more nuanced understanding of the intersection between cognitive ability and social understanding.
Objective
To explore whether brain processing, measured through electroencephalography (EEG), differs according to intelligence levels during Theory of Mind (ToM) tasks. The study compares individuals with high cognitive abilities and those with a normal IQ.
Method
EEG measures were used to analyze brain processing. Participants were classified into two groups using the MATRICES-TAI test: 36 university students, 18 with high cognitive abilities and 18 with normal IQ, aged between 18 and 55 years. EEG data were obtained through a reduced version of the Yoni Task to measure responses to ToM stimuli. A time-frequency analysis has been carried out
Results
The study identified differences in brain activity across cognitive, affective, and physical conditions. Cognitive Condition: Differences were observed in beta and gamma frequency bands (23-32 Hz, 36-40 Hz) in prefrontal and frontocentral regions, particularly around 100-300 ms. Affective Condition: Theta (6-7 Hz) and beta (16-29 Hz) frequency differences were detected in anterior regions, particularly around 100-200 ms. Physical Condition: Differences were present in gamma (36-40 Hz) and alpha (9-12 Hz) activity, particularly at 250-550 ms.
Conclusions
The findings highlight differences in brain activity and connectivity across cognitive, affective, and physical conditions.
- Differences in high-frequency activity were found in cognitive tasks.
- Differences in theta and beta frequencies were observed in affective conditions.
- Variability in gamma and alpha activity was present in physical conditions.

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