Exploring Early Visual ERP Effects and Spectral Power Dynamics in Numerosity Perception

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1. Introduction and Summary:

This study investigates the presence of early visual ERP effects in spectral power signals (theta, alpha, beta, and gamma bands) during the perception of numerosity, size, and spacing. The research was conducted at the CoDeNeuro Lab, where we collected and analyzed EEG data using MATLAB.

The main goal was to examine the reliability of ERP and spectral power signals in response to experimental conditions related to numerosity, size, and spacing. By understanding the neural mechanisms underlying numerosity perception, it is aimed to contribute to the growing field of computational neuroscience and the development of more effective cognitive models for information processing.

2. Materials and Methods:

ERP Analysis:

- A MATLAB script was developed using EEGLAB to perform ERP analysis on EEG data.
- This script included the following steps: loading individual subject datasets, averaging across trials, applying bin operations, filtering ERP data, creating grand averages across subjects, and plotting waveforms for specific channels and trial types.

Spectral Power Analysis:

- A MATLAB code was developed to process and analyze EEG data for multiple subjects, extract ERSP measures, and analyze frequency bands of interest (theta, alpha, beta, and gamma) in response to different experimental conditions.
- The code employed the Fourier Transform, filtering data into different frequency bands, and analyzing ERSP measures under different conditions related to numerosity, size, and spacing.

3. Results:

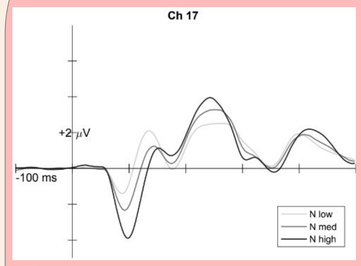

Figure 1. Channel 17 ERP.

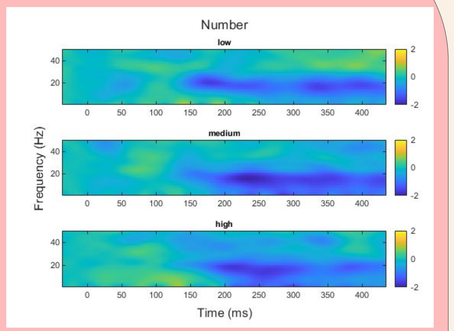

Figure 2. Number Heat Map.

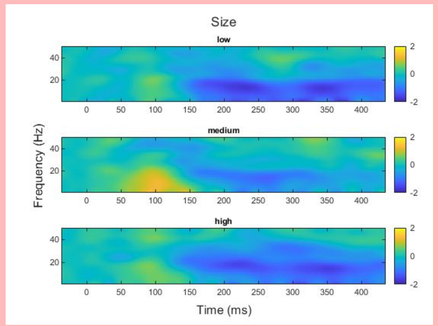

Figure 3. Size Heat Map.

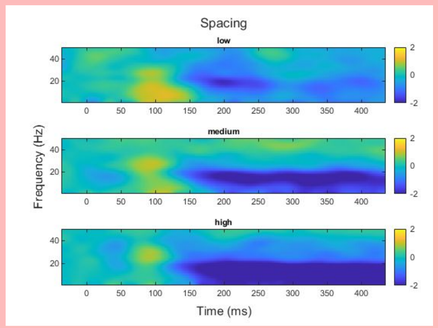

Figure 4. Spacing Heat Map.

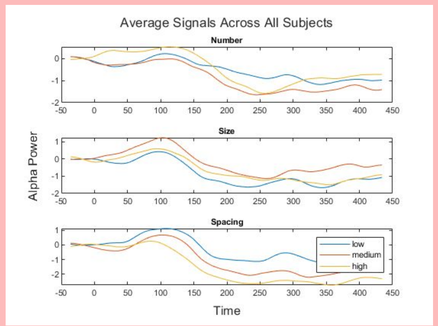

Figure 5. Average Alpha Line Graph Across All Subjects.

3. Results (cont.)

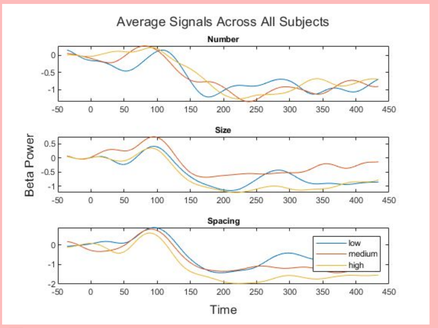

Figure 6. Average Beta Line Graph Across All Subjects.

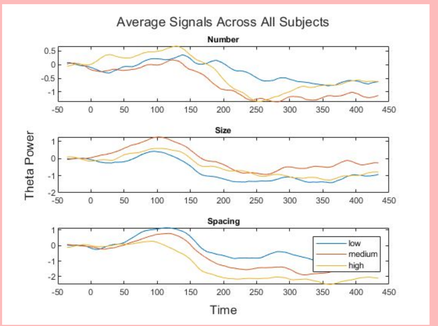

Figure 7. Average Theta Line Graph Across All Subjects.

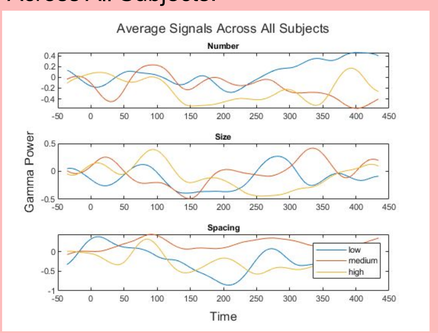

Figure 8. Average Gamma Line Graph Across All Subjects.

4. Conclusions:

The findings from this study indicate the presence of early visual ERP effects in spectral power signals during the perception of numerosity, size, and spacing. These results contribute to our understanding of the neural mechanisms underlying numerosity perception and highlight the potential of ERP and spectral power analysis in investigating cognitive processes. Further research is necessary to confirm these findings and explore their implications for the field of computational neuroscience.