Children's Brains and Socioeconomic Status: A Selective-Attention ERP Study

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Introduction

Children's cognitive abilities, such as attention, are associated with their socioeconomic status (SES) (Noble, Norman, & Farah, 2005). Many everyday activities that children carry out at school, at home, and in the community require selective attention – i.e., attending to relevant information while ignoring irrelevant and distracting information. Although studies have shown that behavioural measures of cognitive functions are linked to SES and that attention-related brain responses can be recorded from children (Berman & Friedman, 1995), little is known about the relationships between the neural responses underlying selective attention and SES in children. The present study is a first attempt at verifying whether such relationships exist.

Methods

Thirty-four children (aged 11-12) volunteered from two schools in distinct SES areas. Individual SES was matched to school area using a composite measure of neighborhood, parents' occupation, income and education. Children were then confirmed as belonging to a high or low SES group based on norms established by Statistics Canada.

Electroencephalography (EEG) at F3, F4, Fz, FC3, FC4, Cz, Pz, VEOG sites was recorded during 2 blocks (either for 8- or 12-kHz tones) each consisting of 30 (10%) *target-duration (either 100 or 250 ms) tones*, 30 (10%) *unattended target-duration* tones with same the duration as target-duration tones but not frequency, 120 (40%) *attended non-target duration tones* with the same frequency as target tones but not duration, and 120 (40%) *unattended non-target duration tones* with different frequency and duration as target tones.

Children listened to the tones randomly presented at an inter-stimulus interval of 1 second and were asked to press a button to target tones as accurately and as fast as possible. Reaction time and accuracy were measured from responses.

Each participant's EEG was epoched and averaged for each stimulus type. Event-related potential (ERP) differences between *attended non-target-duration tones* and *unattended non-target-duration tones* were calculated. Amplitudes of the attention-related Nd (difference negativity) wave were calculated as the maximum negative deflection between 100-400 ms in the ERP difference waveforms.

Results

Reaction times, accuracies, and false alarms were not significantly different between low (616 ms, 76%, 3%) and high (579 ms, 73%, 3%) SES children. The Nd amplitudes; however, were more negative for high SES (-3.2 μV ± 0.3 S.E.) than low SES (-2.4 μV ± 0.3 S.E.) children ($p<.05$).

Discussion

This is the first evidence that the Nd brain response, which reflects selective-attention, is related to SES. Because behavioural results were similar between SES groups, the group differences in Nd amplitudes could indicate that our behavioural results were insensitive to finding attentional differences between SES groups or that children with low SES are utilizing other neurocognitive systems to maintain similar performances as compared to children with high SES. In on-going studies, we are currently investigating which of these two possibilities is the correct one.

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References

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