Abstract

The connection between working memory (WM), development, and N400 amplitude was explored using a Daneman and Carpenter (1980) complex-span task and a Kutas and Hillyard (1980) semantic priming task. The priming task used three types of sentence endings: congruous, moderately incongruous, and strongly incongruous. Children age 8-12 and adults age 18-24 completed both tasks. It was hypothesized that there would be a correlation between N400 amplitude and working memory scores in both ages. It was also hypothesized that strongly incongruous sentences would have larger N400’s than moderate in both children and adults.

The results show a moderate correlation between WM capacity and N400 amplitude in adults, but not in children. Additionally, adults’ N400’s in the strongly incongruous condition were significantly stronger than the moderately incongruous; this was not shown in children.

Methods

Participants

Total: 21 children (8 boys, 13 girls) and 28 adults (8 men, 19 women, 1 genderqueer/other). Children were aged 8-12 (m=10.0, SD=1.0 years), adults were 18-22 (M=20.6, SD=1.3years).

ERP sample: A total of 31 subjects (n=21) were included (15 children, 16 adults). Six adults were not included due to programming errors, additional subjects were excluded based on alpha intrusion, noise level, and accepted number of trials after blink rejections. All participant were seated in a comfortable chair in a darkened, quiet room.

Electrophysiological Recordings

-52-channel tin Electro-cap (Electro-Cap International) based on the standard international 10-20 system.
-Modified refinements: impedances were below 5k-ohms for all subjects.
-Data was recorded using a Synamps Amplifier with Scan 4.2 (2001) software and was digitized at the rate of 250 Hz using a bandpass filter of 1 to 100 Hz.

Results

Working Memory Scale

Adult score: Mean=49.7 (SD=12.8), range: 35 to 59.
Children: Mean=39.2 (SD=6.7), range of: 24 to 52.

Scores were significantly different between children and adults: (t(48)=−27.41, p<.001)

Working Memory Score

Total Working Memory Score

Adult score: Mean=46.3 (SD=6.0), range of 35 to 55.
Children’s Score: Mean=40.8 (SD=7.3), range of 24 to 52.
Scores were significantly different between children and adults: (t(30)=33.59, p<.001).

Discussion

There was a main effect of sentence type for children and adults as expected, based on previous studies (e.g. Atchley et al., 2006).
The trend interaction of WM and N400 amplitude in adults suggests a role of WM in the N400 processes in adults, but not in children.

Adults’ N400’s varied as a function of congruity (strong–moderate–congruous), however, while children showed larger N400’s to strongly and moderately incongruous sentences the N400 did not differ between strongly and moderately incongruous sentences.

This suggests that children have more difficulty releasing from the preceding context of an implausible sentence (e.g. Truewell et al., 1999; Traxler, 2002).

Additionally, increased efficiency in lexical and semantic processing can be seen through changes in the N400 across development.

References

-Please see handout or contact the first author (ebenau@gmail.com).

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