Age-related neural differences in memory: an ERP study
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Introduction

- Episodic memory is known to be well-developed in adults and less mature in younger children.
- The differences in underlying neural mechanisms across development supporting this ability is less understood.
- An early neural response appearing early that is negative and maximal over frontal-central leads differentiates between items that are correctly remembered as new versus correctly remembered as old.

Purpose of Current Study:
To examine developmental differences in the neural mechanisms, specifically early frontal negativity, supporting memory recall across development.

Method

Participants
- 95 3- to 6-year-old children (M_age=4.73, SD_age=1.06)
- 17 young adults (M_age=20.63, SD_age=2.09)

Encoding:
- Familiarized to 54 toys

Retrieval:
- 1) Viewed 54 old toys and 27 new toys while brain activity was recorded
- 2) Sorted toys as old “played with” or new “not played with”

Procedure
- Memory paradigm with encoding and retrieval phase.
- EEG recorded during passive viewing with a sampling rate of 512 Hz (BioSemi Active 2) from 64 active Ag-AgCl scalp electrodes and two vertical and two horizontal electrooculogram (EOG) channels.
- ERP data utilized an average reference and was included if participants provided a minimum of 20 trials per condition.
- Electrodes analyzed (9 total): F3, Fz, F4; C3, Cz, C4; P3, Pz, P4

Measures
- Memory measuring using: proportion of correctly identified new items (New) and proportion of correctly identified old items (Old)
- Early frontal negativity examined between 350 – 550 milliseconds (ms)

Results: ERPs

Early frontal activity (350–550 ms) was more negative for trials where participants correctly identified an item as “New” compared to trials when an item was correctly labeled as “Old” for all participants.

Children; n= 95
- Early negative activity averaged across all electrodes showed more negative amplitudes for new compared to old items.

Adults; n= 17
- New and Old items only reliably in the right hemisphere.

Results: Behavior

No behavioral difference between adults and children.

Discussion

- Behavioral performance did not differ between adults and kids.
- Suggests that the ability to recognize items is relatively well-developed in early childhood.
- Neural activity in both adults and kids indexed different recruitment of resources for old versus new items.
- Consistent with previous research (Riggins, Rolls, & Graham, 2013), early frontal activity was more negative when a new was correctly identified, versus when an old item was correctly identified.
- Effect was widespread in kids and localized to right hemisphere in adults, consistent with past research (Riggins, Rolls, & Graham, 2013).

Suggests that although behaviorally adults and kids are able to complete this task, the way the brain supports this ability continues to change into adulthood.

References

- Riggins, Rolls, & Graham (2013). Developmental Neuropsychology.

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