



Event-related potential memory effects are influenced by individual differences in children's episodic memory performance

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Introduction

Memory abilities improve during childhood:

1. Increased ability to identify previously encountered items as old
2. Increased ability to correctly reject novel items
3. Increased ability to recall contextual details associated with events (Baker-Ward et al., 1993; Drummey & Newcombe, 2002; Lindsay, Johnson, & Kwon, 1991; Lloyd, Doydum, & Newcombe, 2009; Riggins, Miller, Bauer, Georgieff, & Nelson, 2009)

Previous event-related potential (ERPs) studies of recognition memory:

- Adults:
 - **FN400 component** is maximal over mid-frontal scalp and is a correlate of familiarity. The FN400 has been shown to be more negative for new stimuli than old stimuli (Friedman 1990; Friedman & Johnson, 2000).
 - The **parietal old/new effect** has been illustrated where old items elicit a larger late positive component (LPC) over parietal scalp in the interval between 400-800 ms than do new stimuli. Findings illustrate that it is closely associated with recollection and its amplitude is related to retrieval success (Friedman & Johnson, 2000).
 - Curran (2000) illustrated that the FN400, which is associated with familiarity, was less negative to new-unrelated than old and new-related items. The parietal old/new ERP effect was more positive to old items than new-related and new-unrelated items (Curran, 2000).
- Children:
 - The **negative component** (Nc) in children peaks between 400-800 and is more negative for unexpected events potentially suggesting it may be sensitive to the process of familiarity (Courshesne, Ganz, & Norcia, 1981; Karrer & Ackles, 1987).
 - Riggins, Rollins & Graham (2013) recently found a recollection effect in the late time window (positive slow wave at 800-1,500 ms post stimulus).

Goals

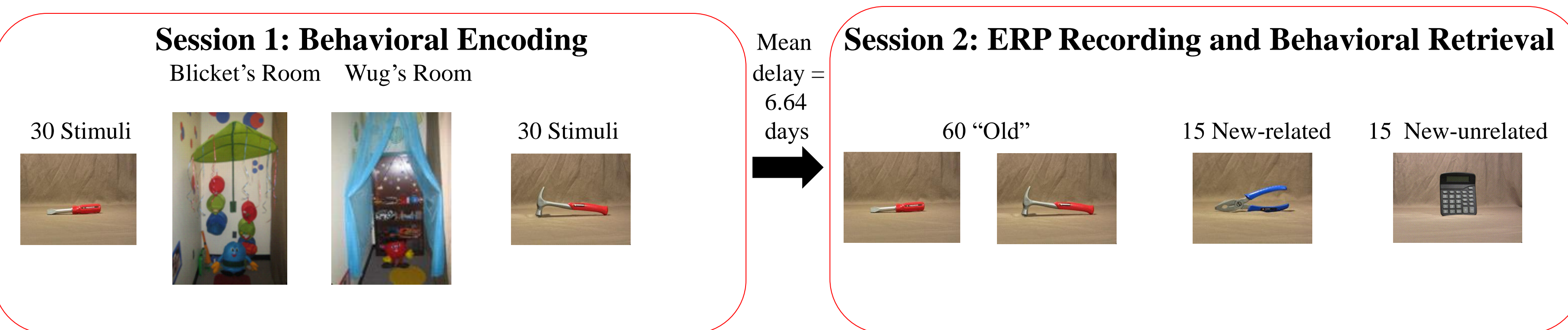
1. Examine ERPs associated with previously seen items (i.e., old), new items that were perceptually or semantically related to old items (i.e., new-related items), and new-unrelated items,
2. Determine whether individual differences in memory influence this response
3. Investigate whether differences on the CBCL characterize these groups.

Method

Participants

-30 (17 females, 13 males, mean age= 5.63 years, range 5.04-6.43 years) participants visited the lab twice.

Figure 1



-CBCL (Child Behavior Checklist/ 1.5-5 years old): a parent-report measure that includes 99 items that describe specific kinds of behavioral, emotional and social problems that characterize preschool children.

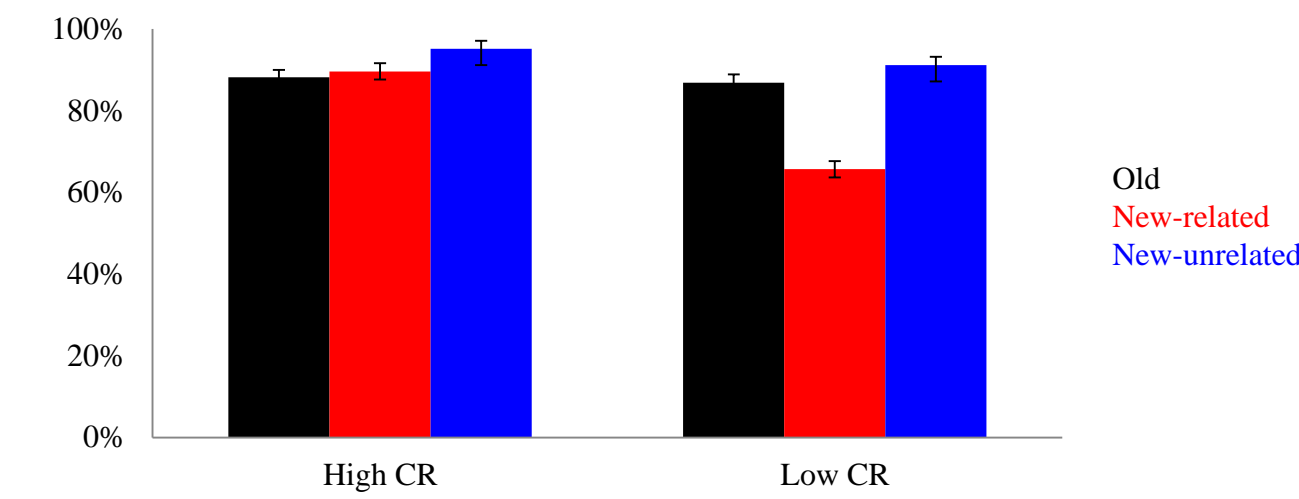


Procedure:

- The University of Maryland Institutional Review Board approved this procedure prior to data collection.
- Session 1: Behavioral Task
- Session 2: Children completed a passive ERP session and a memory task (see Figure 1)
 - ERP: EEG was recorded from 64 electrodes, left and right mastoids, and 2 vertical and 2 horizontal electrooculogram (EOG) channels using active Ag-AgCl electrodes (BioSemi Active 2). ERPs were collected while children were shown pictures of the original items they interacted with during the previous session and novel items (each item was shown twice for a total of 180 trials). Children completed two separate blocks, each including the 60 original items and 30 novel items, totaling 180 trials. The order of item presentation was randomly selected by E-Prime presentation software (Psychology Software Tools, Pittsburgh, PA).

Results

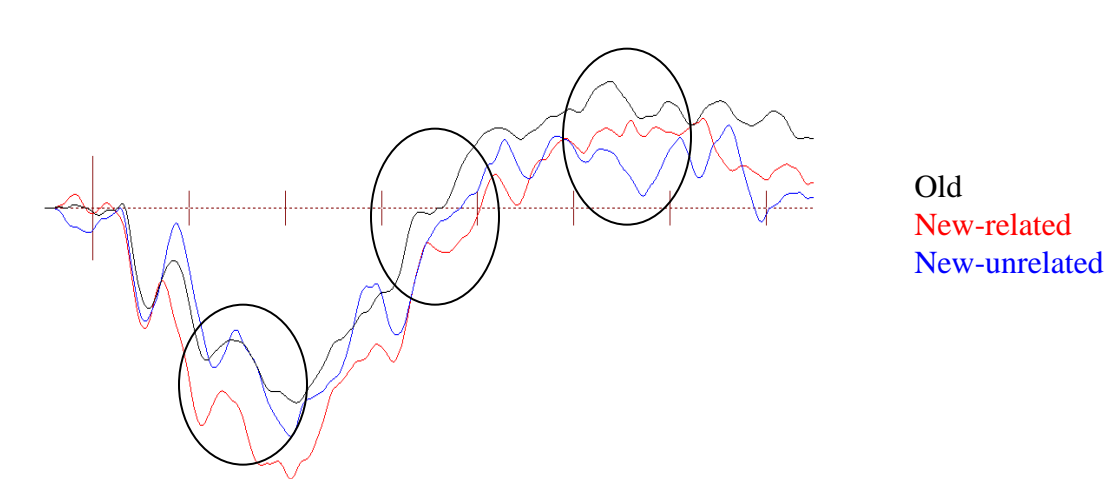
Behavioral Results



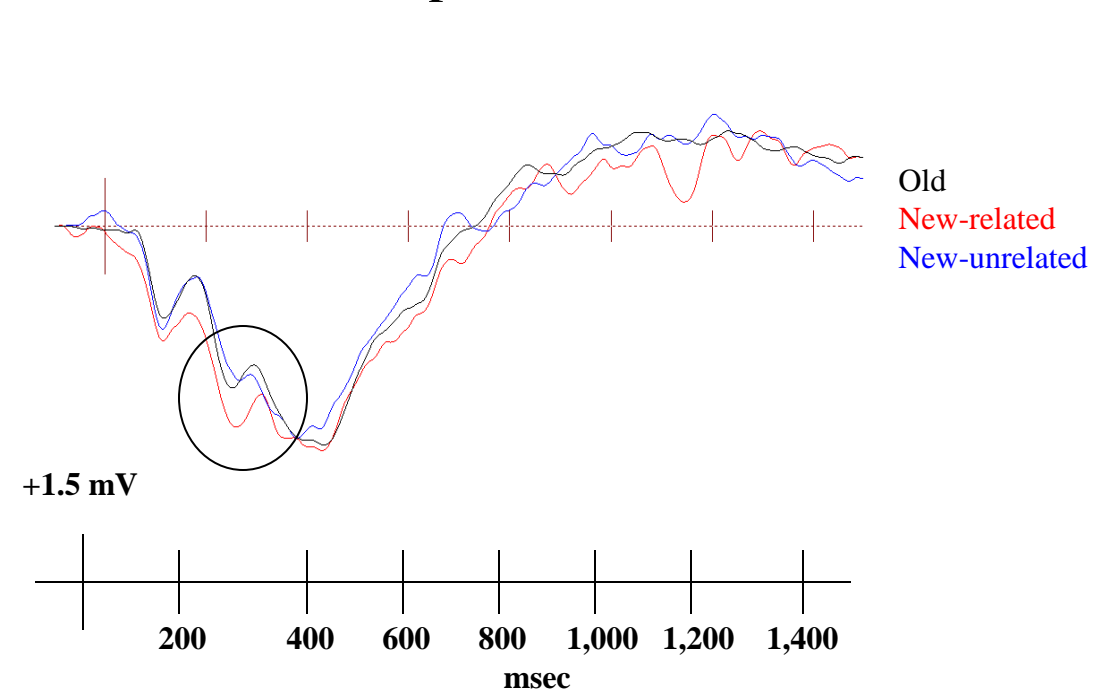
No differences between high and low CR groups on CBCL subscale

Subscale	N (High CR)	N (Low CR)	t-value	p-value
Emotional Reactive	11	16	-1.356	.19
Anxiety/ Depressed	13	16	-.248	.80
Somatic complaints	13	15	.874	.39
Withdrawn	13	16	.251	.80
Sleep Problems	13	16	1.041	.30
Attention Problems	12	16	-.140	.89
Aggressive Behavior	13	16	-.984	.33
Internalizing	11	15	-.508	.61
Externalizing	12	16	-.886	.38
Other Problems	10	11	.029	.98
Affective problems	13	15	.890	.38
Anxiety problems	13	16	-.244	.80
Pervasive Developmental Problems	12	15	.774	.45
Attention Deficit/Hyperactivity Problems	12	16	-1.045	.31
Oppositional Defiant Problems	13	16	-1.320	.20

High CR Group at Cz Lead



Low CR Group at Cz Lead



Approach

- Mean amplitude was analyzed across conditions for 5 times windows at 9 leads (F3, Fz, F4, C3, Cz, C4, P3, Pz, P4).

Overall ERP effect:

- 250-400 ms window. Analysis of mean amplitude 250-400 ms post-stimulus onset revealed a main effect of Condition, $F(2, 56) = 3.18, p = .05$.

ERP effects as a function of performance:

- 250-400 ms. Consistent with results above, there a main effect of Condition, $F(2, 58) = 3.16, p = .05$.
- 600-800 ms. Analysis of mean amplitude 600-800 ms showed a Condition x Group interaction, $F(2, 56) = 4.92, p < .05$, and a Group x Condition x Coronal Plane interaction, $F(4, 112) = 2.50, p < .05$.
- 1000-1200 ms. Analysis of mean amplitude showed a main effect of Condition, $F(2, 56) = 3.46, p < .05$, and a Condition x Group interaction, $F(2, 56) = 6.44, p < .05$.

Discussion

- Children performed well on recognition tasks (Drummey & Newcombe, 2002; Marshall et al., 2002). Further, children were more likely to correctly reject new-unrelated items than new-related items (Lindsay et al., 1991).

- All children elicited ERPs to old items that were less negative compared to new-related items with new-unrelated items in between. Because the Nc reflects allocation of attention (Courshesne, Ganz, & Norcia, 1981; Karrer & Ackles, 1987), children may have allocated more attention for new-related items in order to differentiate them from old items.

- In the high correct rejection group, ERPs elicited to old items were greater than new-unrelated with new-related in between for the 600-800 ms and 1,000-1,200 ms time windows. Previous research in children has illustrated a recollection effect in later time windows than adults (Riggins et al., 2013). The high CR group may be using the process of recollection to remember contextual details associated with old items in order to correctly reject new-related items.

References and Acknowledgments

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