

The Nature of the Electrophysiological Response Associated with Recollection in Preschool Children



Introduction

- Dual process models of memory suggest that memory for contextual details surrounding an item occurs via recollection (Yonelinas, 2002).
- Recollection may be a threshold process or alternatively, recollection may be graded with the magnitude of the effect increasing as more contextual details are retrieved. Findings from the adult literature are beginning to support the latter hypothesis (Vilberg, Moosavi, & Rugg, 2006; Woroch & Gonsalves, 2010).
- Studies are beginning to show that recollection and familiarity are dissociable during childhood, and that recollection develops through this period (e.g., Ghetti & Angelini, 2008; Cycowicz et al., 2003; Riggins, et al., 2009).
- The goal of the present study is to examine the nature of ERP responses generated to recollected items.

Methods

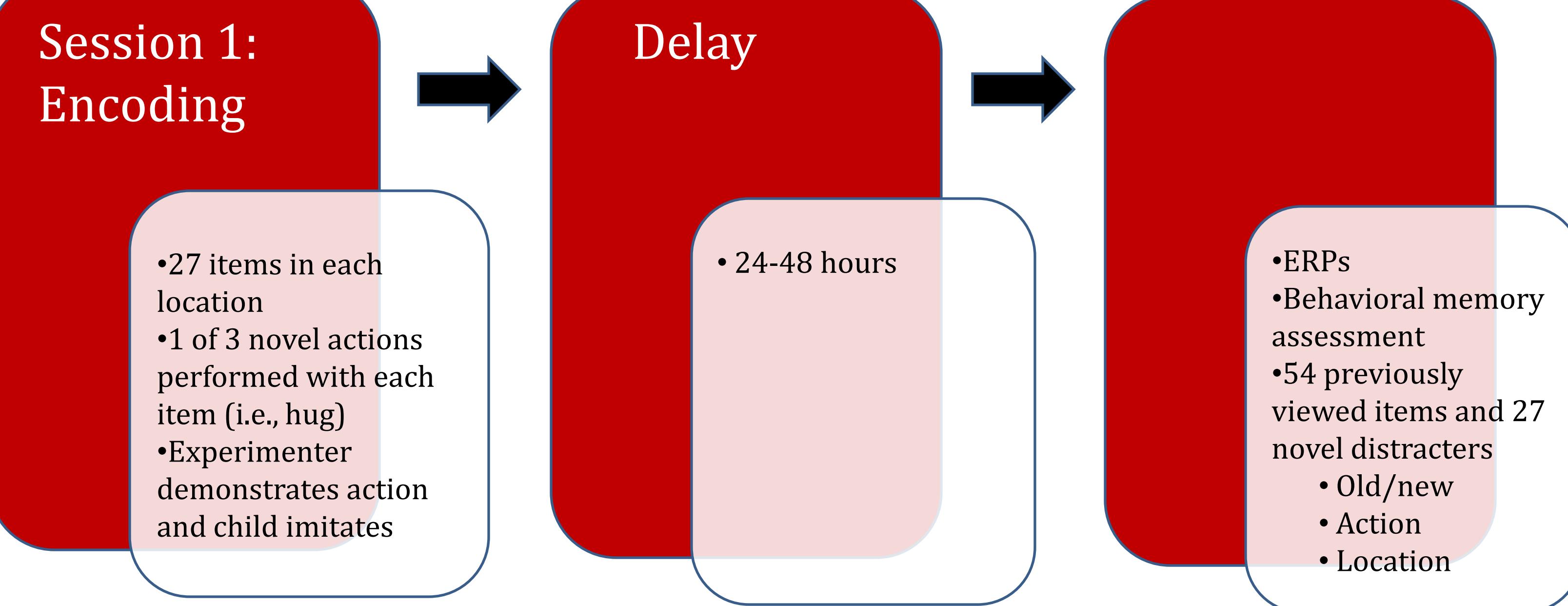
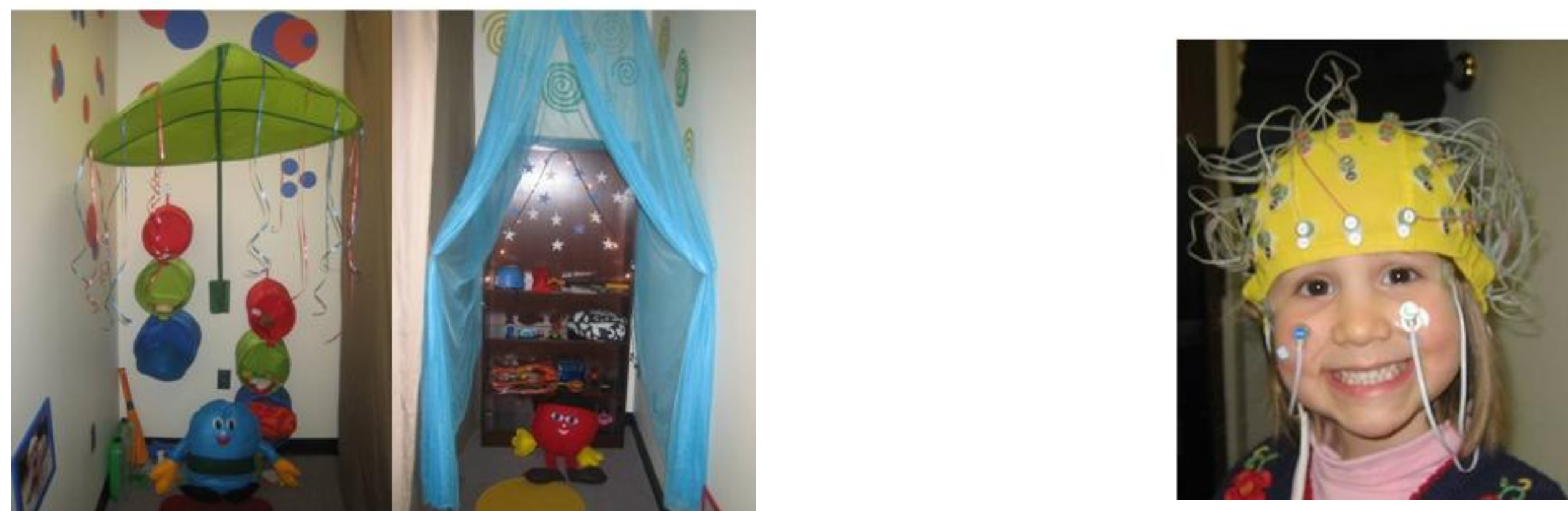
Participants

- Behavioral and ERP data was collected from 36 4-year-old children (16 boys and 20 girls, mean age = 4.29 .16 years, range = 4.02-4.57). Data analyses included 12 children (6 boys and 8 girls) with complete behavioral performance and a minimum of 10 ERP trials per condition.

Behavioral Assessment

- Visits (Figure 1) occurred at the Neurocognitive Development Lab at the University of Maryland.

Figure 1



Event-Related Potentials (ERPs)

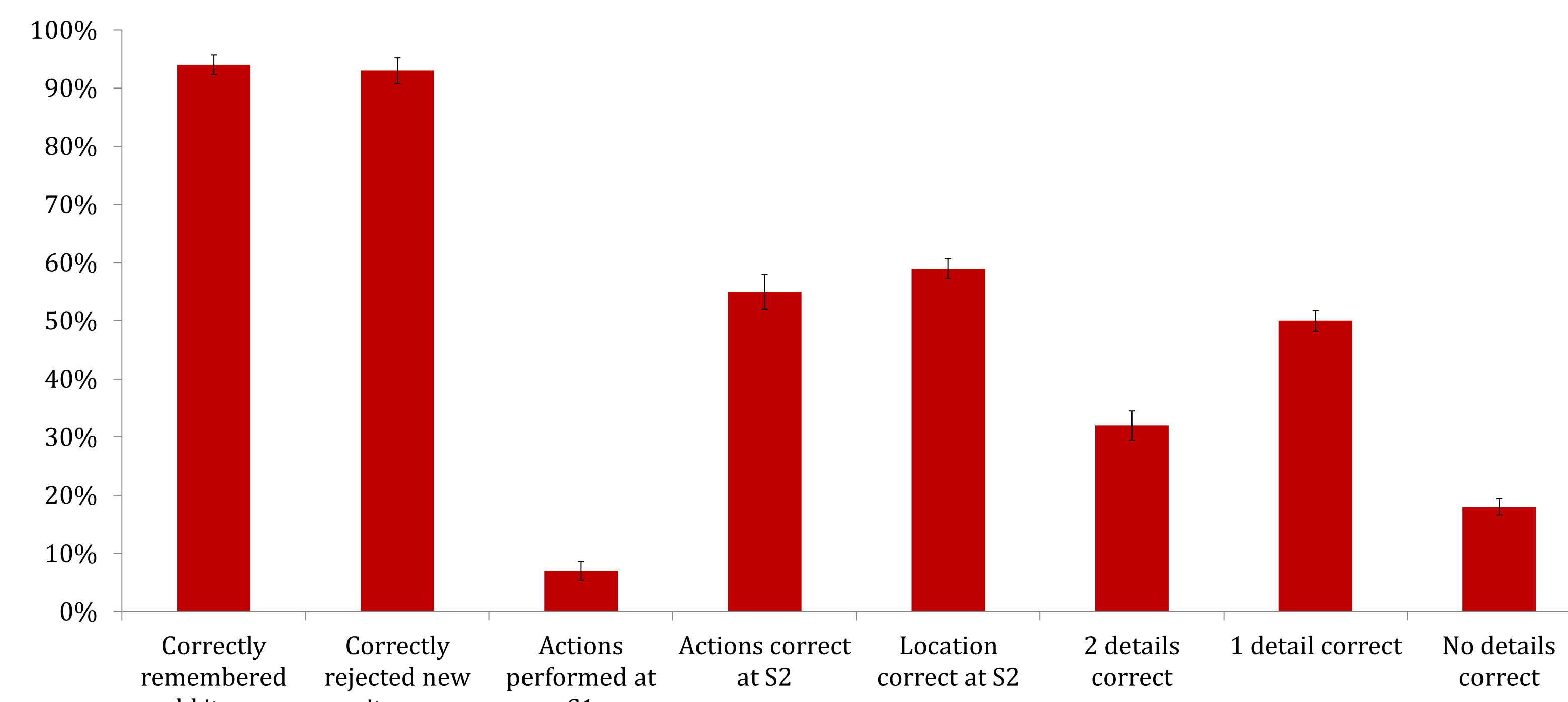
- EEG was recorded with a sampling rate of 512 Hz (BioSemi Active 2) from 64 active Ag-AgCl scalp electrodes and two vertical and two horizontal electrooculogram (EOG) channels (see Figure 1)
- EEG data were re-referenced offline to an average reference configuration using Brain Electrical Source Analysis (BESA) software (MEGIS Software GmbH, Gräfelting, Germany).
- Ocular artifacts were corrected applying the Ille, Berg, & Scherg (2002) algorithm.
- Trials were hand-edited to remove movement related artifact
- Data were high and low pass filtered at 0.1 Hz and 80 Hz, respectively (filtered at 30Hz for visual presentation)
- Trials were epoched with a 100ms baseline and continued 1500ms poststimulus onset. Stimuli were presented for 500ms. Three analysis windows were selected: 300-600 ms, 600-900 ms, 900-1200ms.
- ERPs were sorted based on memory performance on the behavioral paradigm. Conditions included 2 details correctly recalled, 1 detail correctly recalled, and correctly rejected new items.

Results

Behavioral Data (Figure 2)

- Overall, children performed well on the task remembering a large percentage of items and their associated details as well as correctly rejecting new items.
- T-tests revealed that children as a group successfully remembered the action ($t(13) = 7.28, p < .05$) and location ($t(13) = 5.63, p < .05$) details significantly more than chance. Binomial sign tests revealed that children were more accurate at remembering the action detail than the location detail ($p < .05$).

Figure 2
Behavioral Performance



ERPs

- Mean ERP amplitudes were assessed using repeated measures ANOVAs at midline (Fz, FCz, Cz, CPz, Pz) and lateral (F1, F2, F3, F4, F5, F6, FC1, FC2, FC3, FC4, FC5, FC6, C1, C2, C3, C4, C5, C6, CP1, CP2, CP3, CP4, CP5, CP6, P1, P2, P3, P4, P5, and P6) electrode sites.
- 2 details vs. 1 detail vs. correctly rejected new items
 - For the 600-900ms and 900-1200ms time window, no significant main effect or interaction with condition was present for the midline or lateral leads.
 - 300-600ms (see Figure 3 and Figure 4) a main effect of condition occurred at Fz, $F(2,26) = 9.5, p < .01$. ERPs generated to items remembered with 1 (-8.49) or 2 (-7.62) contextual details were more negative in average amplitude than correctly rejected new items (-5.58; see Figure 3).

Figure 3

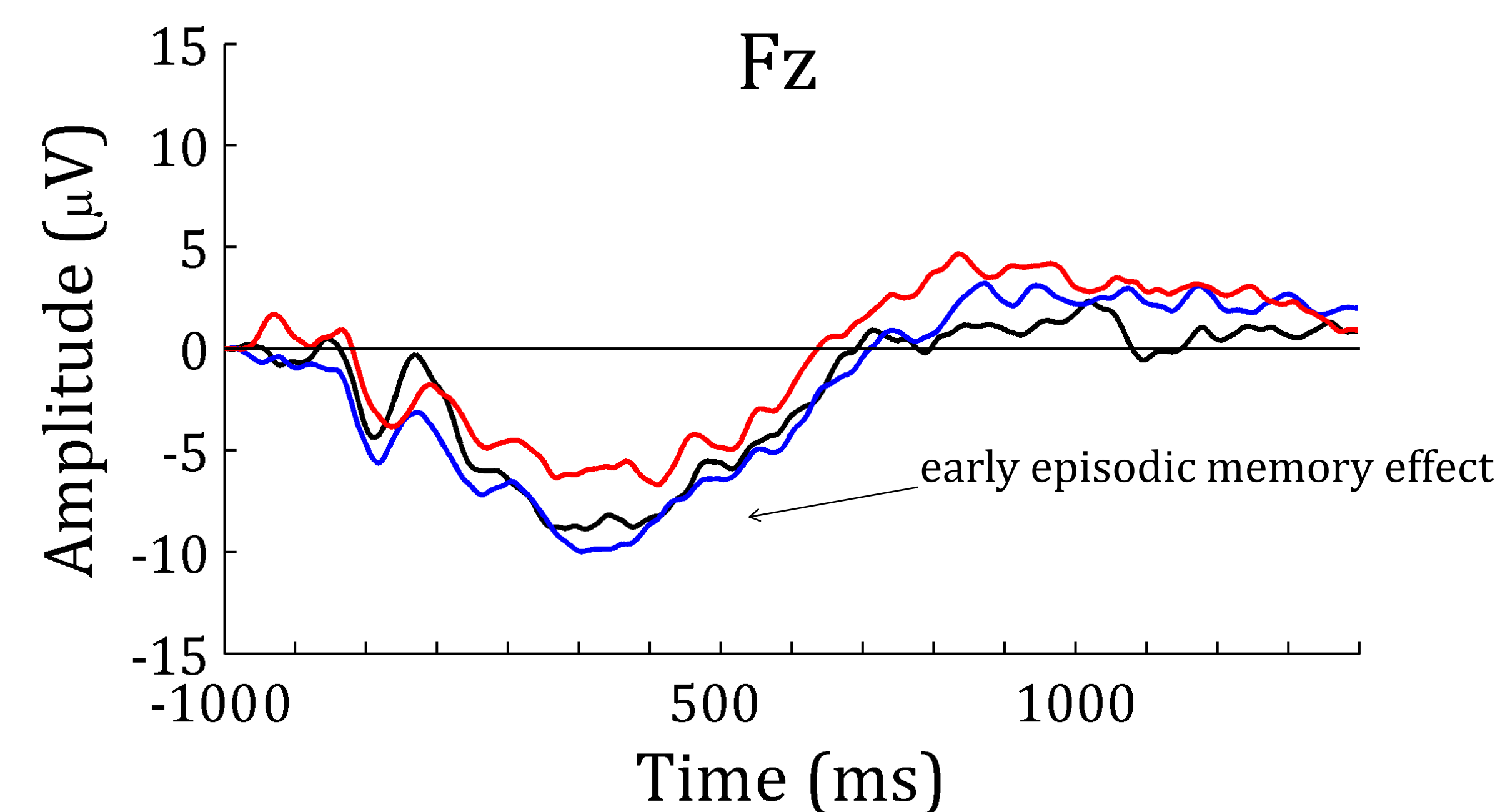
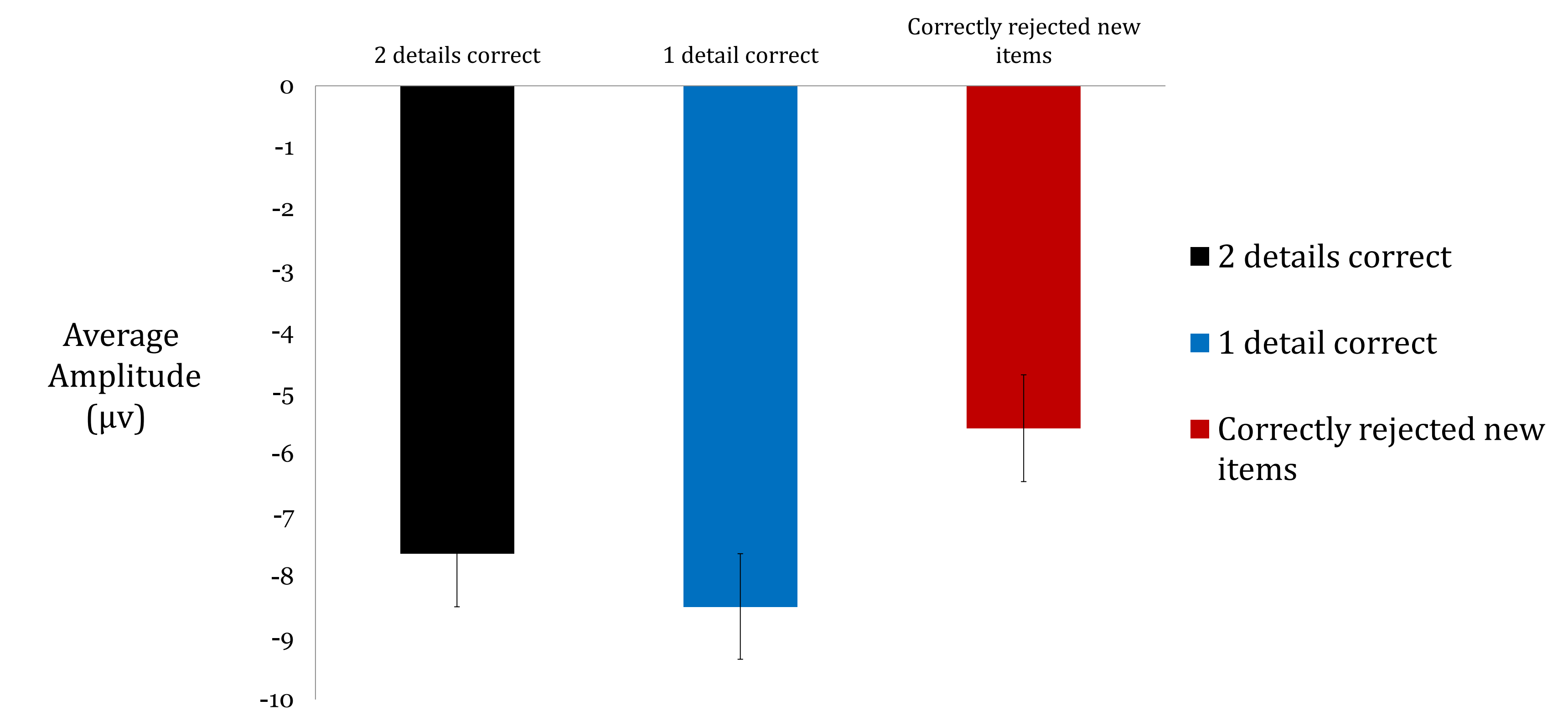


Figure 3. Grand average ERP waveforms illustrating the difference between recollected and correctly rejected items at lead Fz.

Figure 4



Discussion

- The current effect overlaps and is similar to the Nc component in infants
 - The Nc is a negative peaked component assessed in infancy that reflects attentional processing (Nelson & Collins, 1991) and is modulated by memory (Carver, Bauer, & Nelson, 2001).
 - Similar to infant studies, the ERP response differed for old and new items. This effect was not influenced by the number of contextual details retrieved, suggesting a threshold process.
- Limitations
 - The current sample size and variability in the 2 detail recollection condition are limitations of the current study. Data collection is ongoing and includes 3 to 6-year-old children.

Acknowledgements

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References

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