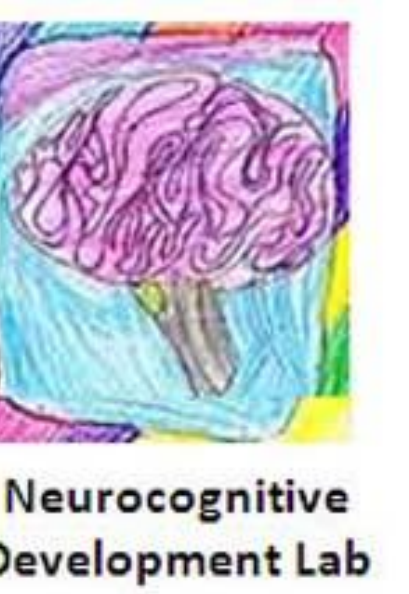


The Nature of the Electrophysiological Response Associated with Recollection in Preschool Children

Leslie Rollins and Tracy Riggins
University of Maryland, College Park



Introduction

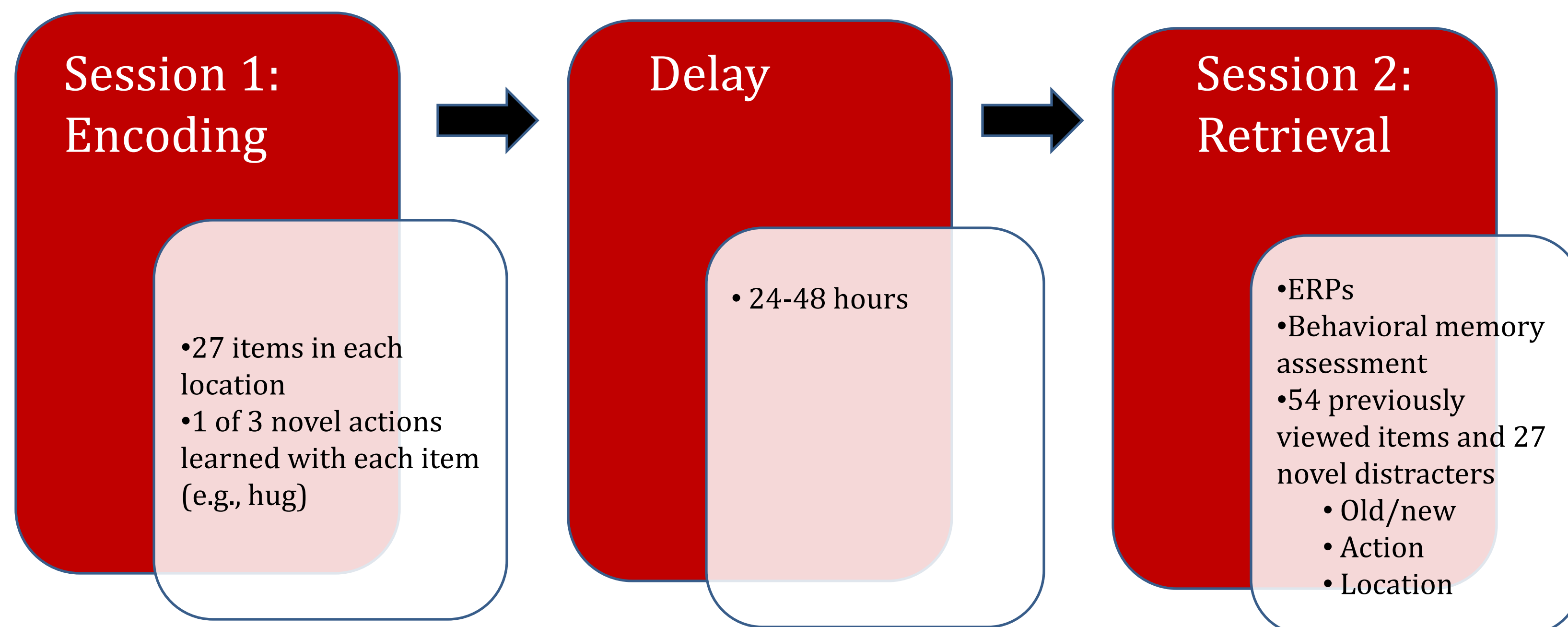
- Dual process models of memory suggest that memory for contextual details surrounding an item occurs via recollection (Yonelinas, 2002).
- Recollection may be a threshold process or alternatively, recollection may be graded with the magnitude of the effect increasing as more contextual details are retrieved. A previous finding from the adult literature suggested that earlier-onsetting effects 300-500ms reflected old/new processing whereas later effects 500-800ms were modulated by recollection strength (Vilberg, Moosavi, & Rugg, 2006).
- Studies are just beginning to show that recollection and familiarity are dissociable during childhood, as recollection develops through this period (e.g., Ghetti & Angelini, 2008; Cychowicz et al., 2003; Riggins, et al., 2009).
- The goal of the present study was to examine the nature of ERP responses generated to recollected items.

Methods

Participants

- Behavioral and ERP data were collected from 34 4-year-old children (16 boys and 18 girls, mean age = 4.29 .16 years, range = 4.02-4.57). Data analyses included 12 children (5 boys and 7 girls) with complete behavioral performance and a minimum of 10 ERP trials per condition.

Behavioral Assessment

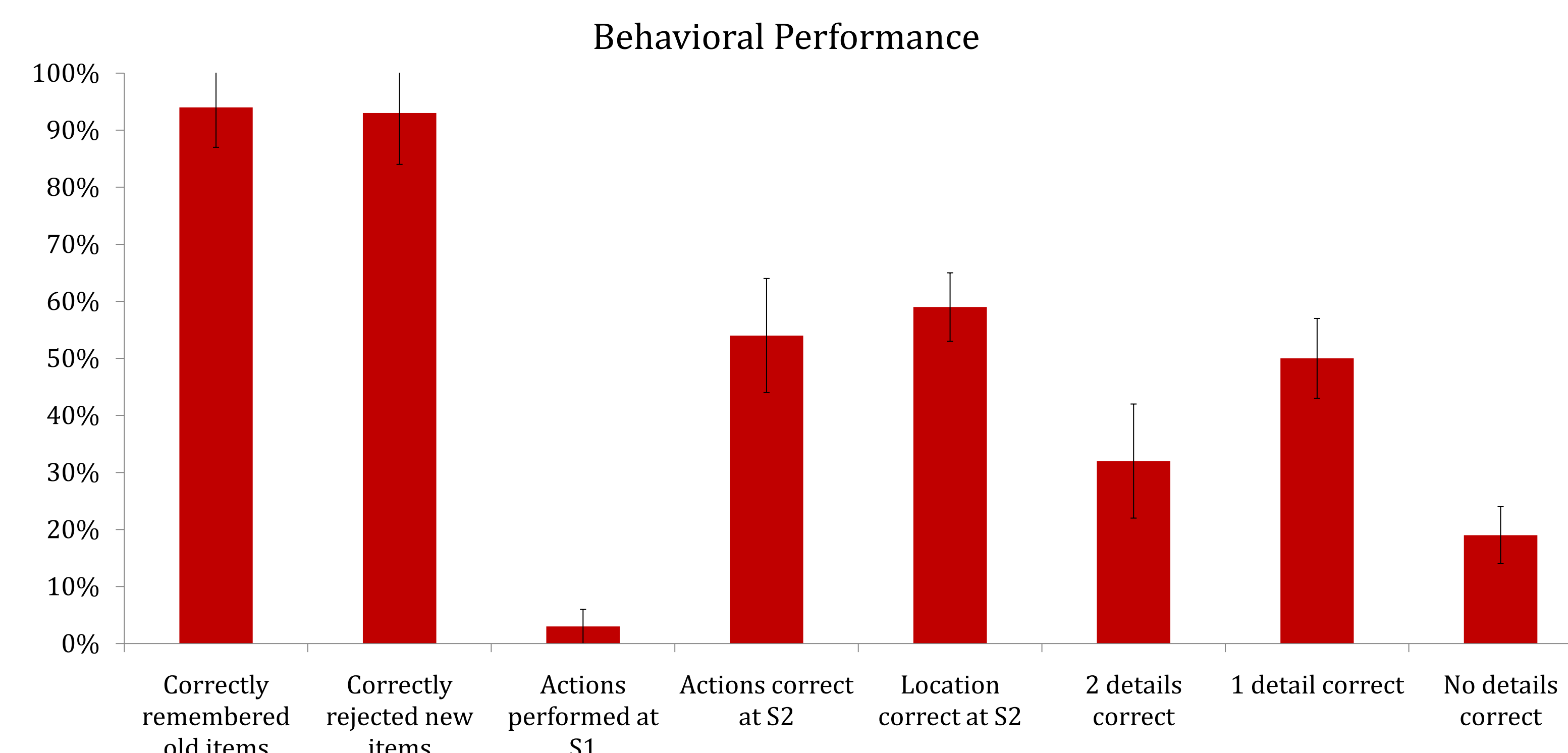


Event-Related Potentials (ERPs)

- 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.
- 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.
- Trials were epoched with a 100ms baseline and continued during stimulus presentation for 1500ms at three epochs: 300-600 ms, 600-900 ms, 900-1500ms.
- ERPs were sorted based on memory performance on the behavioral paradigm. Conditions and their associated trial numbers included 2 details correctly recalled ($M=25$ 14), 1 detail correctly recalled ($M=38$ 16), and correctly rejected new items ($M=38$ 14).

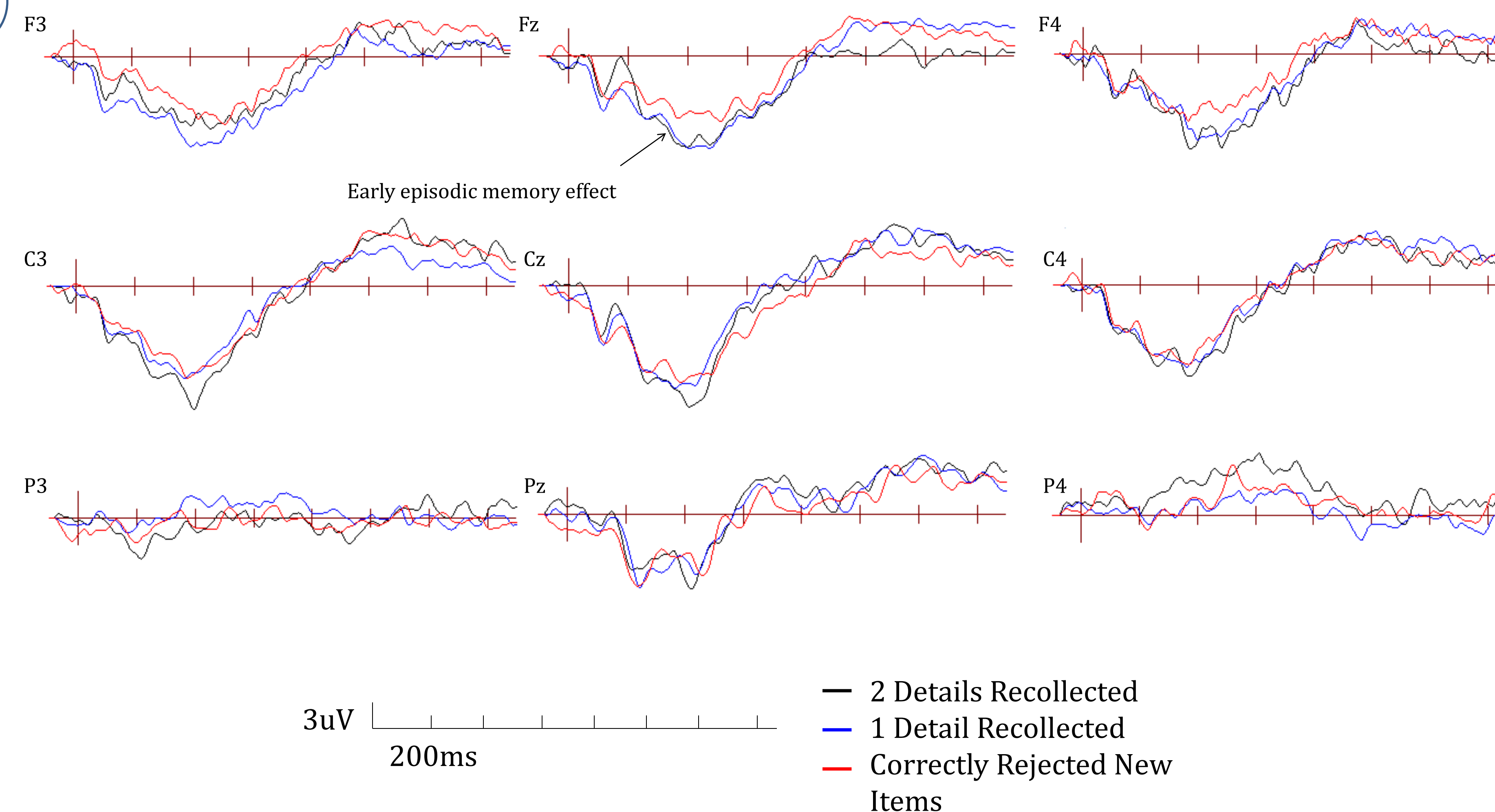
Behavioral Data

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

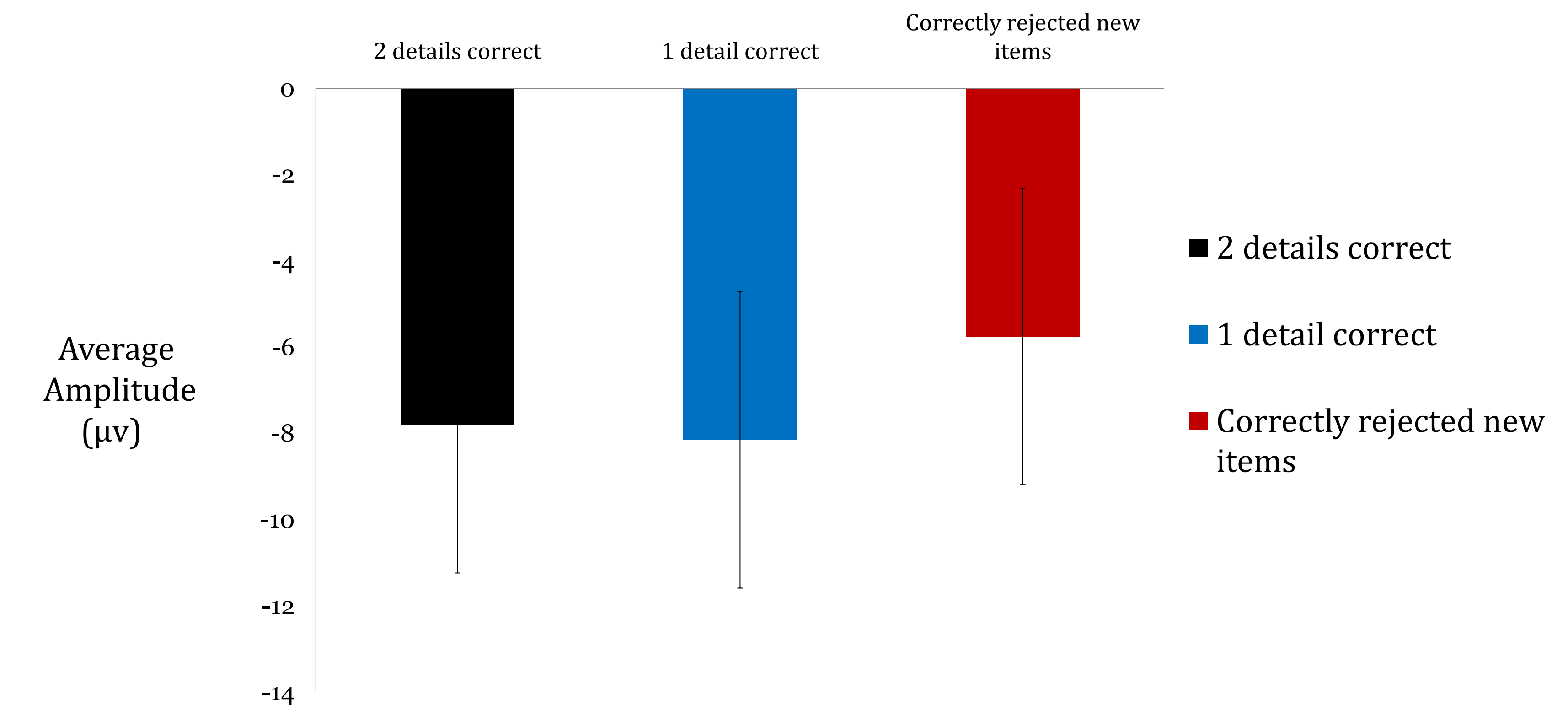


ERPs

- Mean ERP amplitudes were assessed using repeated measures ANOVAs at midline (AFz, Fz, FCz, Cz, CPz, Pz) and lateral (F3/F4, C3/C4, P3/P4) electrode sites
- For the 300-600ms window there was a main effect of condition at Fz, $F(2,22) = 7.68, p < .01$. ERPs generated to items remembered with 1 (-8.14 μ V) or 2 (-7.80 μ V) contextual details were more negative in average amplitude than correctly rejected new items (-5.75 μ V).
- For the 600-900ms and 900-1500ms time window, no significant main effects or interactions with condition were present.



*Waveforms were filtered at .1Hz and 30Hz for presentation



Discussion

- The early negative-going response differed for old and new items but was not influenced by the number of contextual details retrieved. The timing of this effect is consistent with findings from the adult literature showing old/new effects 300-500ms poststimulus onset that were not influenced by recollection confidence (Villberg et al., 2006).
- However, this study did not find a graded recollection effect at retrieval as reported in the adult literature (Villberg et al., 2006).
 - This may be to the limited sample size and large variability in the 2 detail recollection condition due to the fewer number of trials contributing to this condition.
 - Graded recollection may not emerge until later in development when children more accurately recall contextual details.
 - Data collection is ongoing to determine the reliability of these findings.

Acknowledgements

Thank you to the families that participated in this research study and to members of the Neurocognitive Development Lab for assistance with data collection and analysis. Support for this research was provided by NICHD (R03HD067425).

References

- Carver, L.J., Bauer, P.J., Nelson, C.A. (2000). Associations between infant brain activity and recall memory. *Developmental Science*, 3(2), 234-246. doi:10.1111/1467-7687.00116
- Cychowicz, Y. M., Friedman, D., & Duff, M. (2003). Pictures and their colors: What do children remember? *Journal of Cognitive Neuroscience*, 15(5), 759-768. doi:10.1162/089992903322307465
- DeBoer, T., Scott, L. S., & Nelson, C. A. (2005). Event-related potentials in developmental populations. In Todd Handy (Ed.), *Methodological Handbook for Research Using Event-related Potentials* (pp. 263-297). Cambridge, MA: The MIT Press.
- Ghetti, S., & Angelini, L. The development of recollection and familiarity in childhood and adolescence: Evidence from the dual-process signal detection model. *Child Development*, 79(2), 339-358. doi:10.1111/j.1467-8624.2007.01129.x
- Ille, N., Patrick, B., & Scherg, M. (2002). Artifact correction of the ongoing EEG using spatial filters based on artifact and brain signal topographies. *Journal of Clinical Neurophysiology*, 19(2), 113-124. doi:10.1097/00004691-200203000-00002
- Nelson, C.A., Collins, P.F. (1991). Event-related potential and looking-time analysis of infants' responses to familiar and novel events: implications for visual recognition memory. *Developmental Psychology*, 27(1), 50-58. doi:10.1037//0012-1649.27.1.50
- Riggins, T., Miller, N. C., Bauer, P. J., Georgieff, M. K., & Nelson, C. A. (2009). Electrophysiological indices of memory for temporal order in early childhood: Implications for the development of recollection. *Developmental Science*, 12(2), 209-219. doi:10.1111/j.1467-7687.2008.00757.x
- Villberg, K. L., Moosavi, R. F., & Rugg, M. D. 2006. The relationship between electrophysiological correlates of recollection and amount of information retrieved. *Brain Research*, 1122, 161-170. doi:10.1016/j.brainres.2006.09.023
- Yonelinas, A. P. (2002). The nature of recollection and familiarity: A review of 30 years of research. *Journal of Memory and Language*, 46, 441-517. doi:10.1006/jmla.2002.2864