P3-E-125

Putting 'effort' in a usable way: Using eye movements and pupillometry to uncover the role of focused attention in Visual Working Memory

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Motivation

Focused attention / cognitive effort, deployed purposefully, is a critical component of Executive Function, and supports the active processing of information.

The integration of memory and attention occurs between 6- to 15-month of age, as a result of the maturation of frontal circuitry (Colombo & Cheatham, 2006).

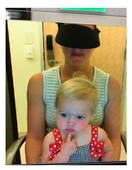
However, the link between focused attention and Visual Working Memory has not been well-studied in infants.

Questions

Can focused attention (as indexed by pupillometry) predict VWM performance?

Higher attention during encoding has been shown to correlate with phasic pupil diameter (task-evoked pupil responses; TEPRs) and better subsequent WM performance in adults and older children (Kahneman, 1973; Unsworth & Robison, 2015; Johnson et al., 2014), but what about infants?

Does the familiarity of the to-be-remembered objects affect their memorability, or the allocation of focused attention?



VWM capacity in adults is greater for familiar, real-world objects than for unfamiliar abstract shapes (Brady et al., 2016). Here, instead of abstract shapes we used up-side down versions of the objects (to control low-level information).

Method

Familiar Objects (Exp 1)

Participants

N = 22
M_age = 13.4 months
Range = 11- 15 months

Stimuli

Upside Down (Exp 2)

N = 21
M_age = 13.4 months
Range = 11- 15 months

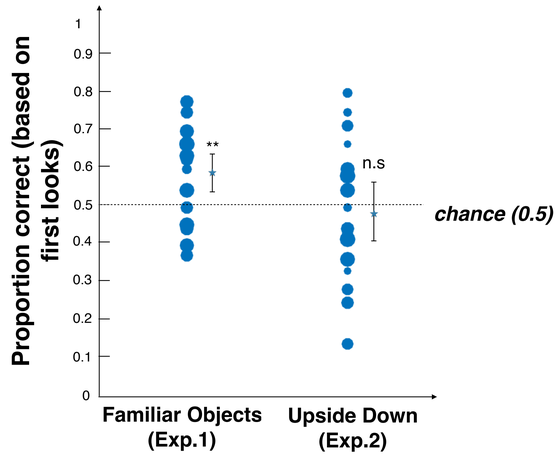
Procedure

Dependent measure: *first anticipatory saccade to face-down 'Match' (correct) vs. 'Non-match' (incorrect) card, during the response interval*

- 12 **trials** of Delayed-Match Retrieval (Kaldy, Guillory, & Blaser, 2016).
- Min **3** trials had to be completed

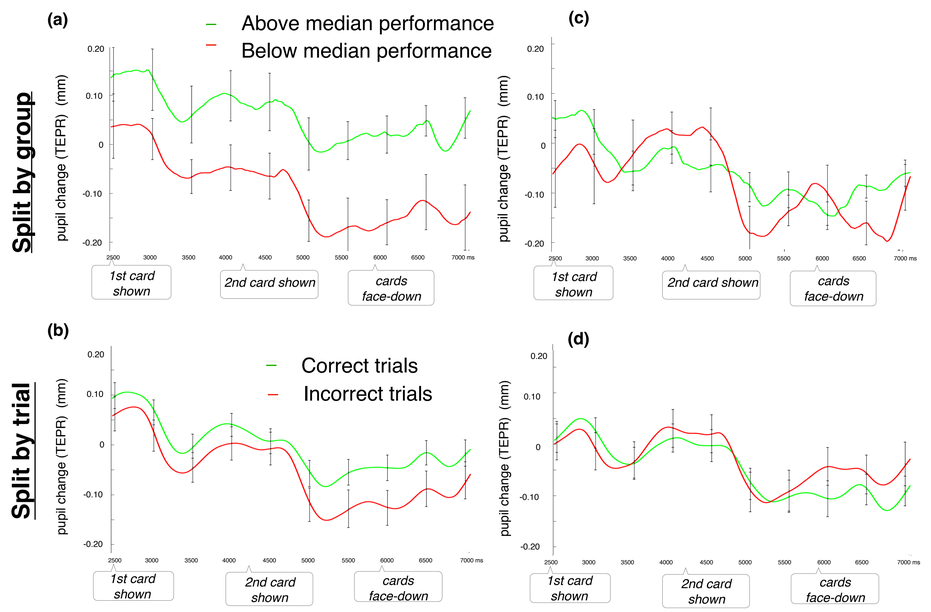
Results

VWM performance



- 13-month-olds performed significantly above chance in our VWM task, but only when the to-be-remembered objects were familiar (Exp. 1).
- In Exp.1, we found a significant correlation (r = 0.52, p =0.018) between infants' pupil response (TEPR) (at the end of encoding) and their VWM performance. This was not present in Exp. 2 (as performance was at chance).

Task-evoked pupil responses (TEPRs)



Task evoked pupil dilation during encoding was significantly greater in better-performing kids than lower-performing, and in correct vs opposed incorrect trials. This relationship between focused attention and VWM only held for Familiar (Exp 1), not Upside down, objects (Exp 2).

Acknowledgement & References

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Kahneman, D., & Beatty, J. (1966). *Science.*
Kaldy, Z., Guillory, S. B., & Blaser, E. (2016). *Developmental Science*
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Conclusions

- Infants have better memory for familiar objects.
- Focused attention (as indexed by the pupil), during memory encoding, predicted better VWM performance.
- Pupillometry is a promising tool to measure focused attention with high temporal resolution in infants.

Exp. 1: ***Cheng, Kaldy, & Blaser, under review***