



# Infant EEG markers of novelty detection show longitudinal associations with preschool executive function outcomes in rural Gambia.

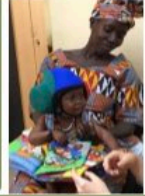
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## Background

- Neuroimaging is a useful method to study at-risk infant populations around the world [1,2], however predictive associations between infant neural markers and developmental outcomes have yet to be established
- EEG markers have been shown to be associated with concurrent developmental outcomes [3]
- Here, we examine the link between event related potential (ERP) responses measured during infancy with executive function (EF) at preschool age



## Method

- We assessed longitudinal associations between infant ERP markers of habituation and novelty detection (1, 5 and 18 months) and preschool EF (3-5 years) in a cohort of N = 181 in rural Gambia, West Africa

### Infant ERP markers

- We presented an auditory oddball event related potential (ERP) paradigm consisting of Frequent, Infrequent and Trial Unique sounds (Figure 1)
- We examined P3 mean amplitudes and extracted markers of habituation (Frequent trials 1-15 – trials 30-45) and novelty detection (Trial Unique – Frequent), both normalised by amplitudes to Frequent sounds

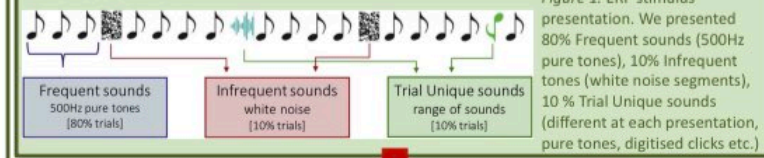


Figure 1. ERP stimulus presentation. We presented 80% Frequent sounds (500Hz pure tones), 10% Infrequent tones (white noise segments), 10% Trial Unique sounds (different at each presentation, pure tones, digitised clicks etc.)

### Preschool executive functions

- Children completed the EF tasks of the Early Years Toolbox [4], including tasks on working memory, inhibitory control and cognitive flexibility (Figure 2)
- Scores on each task were combined into a single latent EF factor via confirmatory factor analysis



Figure 2. Adapted from [4]. Overview of EF tasks: in the working memory task (left) children had to retain the location of a series of dots over a brief delay. In the Go/No-Go task (middle) they had to quickly and accurately respond to go trials but inhibit their response to no go trials. For the cognitive flexibility task (right) they had to sort by either colour or shape and flexibly adapt their response mode.

## Results

### Infant ERP markers

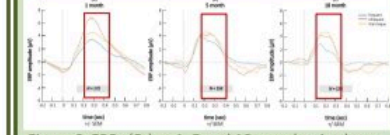
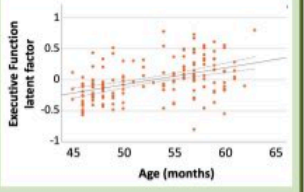


Figure 3. ERPs (Fz) at 1, 5 and 18 months. Analyses are based on the P3 component (highlighted).

- Our prior analyses [3] show a gradual emergence of a robust novelty response (evidenced by a high P3 to Trial Unique sounds) across infancy (Figure 3)

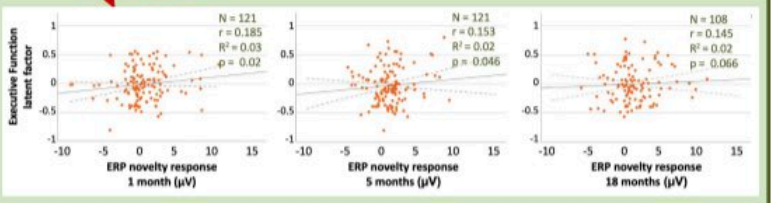
### Preschool executive functions

- Children's executive functions show meaningful individual differences and age-related increase



### Associations between infant ERP and preschool EF

- Controlling for age, preschool EF performance was associated with ERP markers of novelty detection measured at 1 and 5 months, and at trend level at 18 months
- No such associations were found for ERP habituation markers



## Discussion

- Our results show an association between infant ERP markers of novelty detection, but not habituation, and preschool EF, perhaps due to the greater reliance of novelty detection on early working memory
- Given our previous findings from this cohort [3] showing a gradual emergence of a novelty response over the first 18 months of life, the current findings indicate that individual variance in our neural markers of novelty detection holds potential as a meaningful early biomarker for later development even before the emergence of a group-level response
- These preliminary analyses highlight the potential of infant neuroimaging to inform identification of individuals at-risk for compromised long-term neurodevelopmental outcomes
- Next, we will expand our analyses to include population-specific risk factors to fully interrogate these individual differences in developmental trajectories

We thank

Reference

- [1] Katus, L., Haan, M. de, ... & Elwell, C. E. (2019). *Gates Open Research*, 3, 6, No. 3, p. 89). MDPI.
- [2] Blasi, A., ... & Prentice, A. (2020). *NeuroImage*, 210, 116591.
- [3] Katus, L., ... & Elwell, C. E. (2019). *Gates Open Research*, 3, 6, No. 3, p. 89). MDPI.
- [4] Howard, S. ... & Elwell, C. E. (2019). *Gates Open Research*, 3, 6, No. 3, p. 89). MDPI.



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