

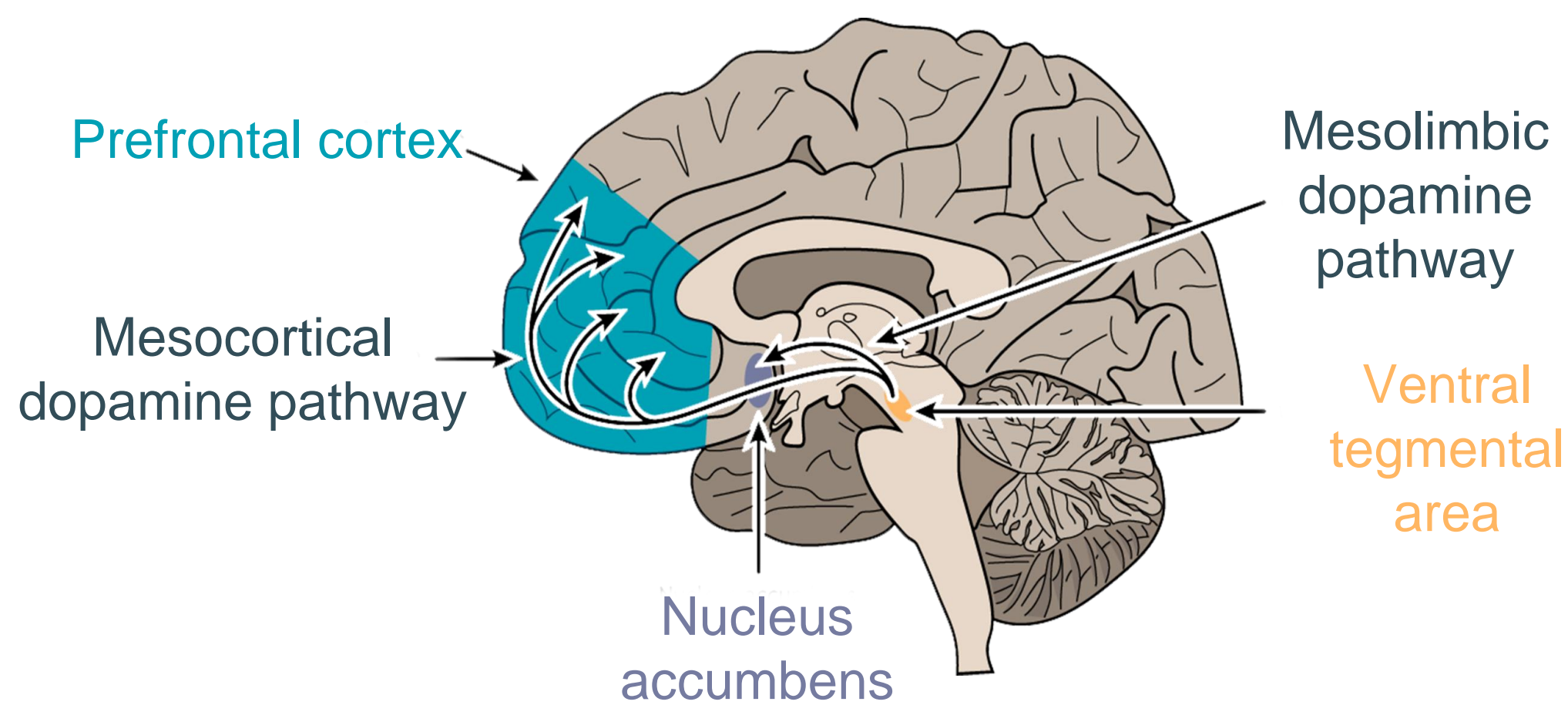
# An fMRI study of reward processing in schoolchildren

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### BACKGROUND

- Understanding what drives and motivates you can explain if you rely more on **extrinsic** or **intrinsic** motivation, which is related to better mental health outcomes in adults<sup>1</sup>.
- The distinction between process-oriented and outcome-oriented mindsets is closely linked to the brain's **reward system**, which comprises two primary pathways: the **mesolimbic** pathway, involved in pleasure and reinforcement, and the **mesocortical** pathway, which plays a role in integration and decision-making.



- Childhood and school years are a crucial period of brain maturation and much of the neural changes are shaped in an experience-dependent manner<sup>2</sup>.
- Current traditional schooling systems emphasize extrinsic rewards to motivate students (i.e., grades, punishments, pride). Alternative schooling systems which rely more on intrinsic motivators exist, such as the Montessori pedagogy.
- Preliminary studies comparing schoolchildren in traditional versus Montessori education showed differences in the following areas:
  - Cortical thickness asymmetry in the parahippocampal region related to memory<sup>3</sup>.
  - Brain activity in regions involved in math processing during an fMRI task<sup>4</sup>.
  - Functional connectivity patterns, particularly between error-monitoring areas and other brain regions, following both correct and incorrect responses<sup>4</sup>.
- Given the implication of reward processing in these competencies, it may be that activities in underlying brain structures related to the mesolimbic and mesocortical tracts may also differ.

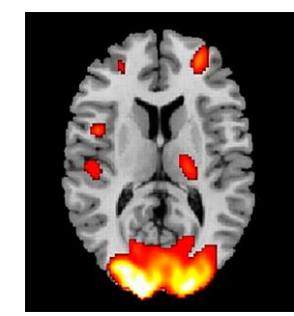
### AIMS

Investigate if and how school experience (i.e., with or without rewards) modulates mesolimbic and mesocortical brain activities

### METHODS

#### 1. Data acquisition (n = 35, 8-12 yo)

Functional MRI data

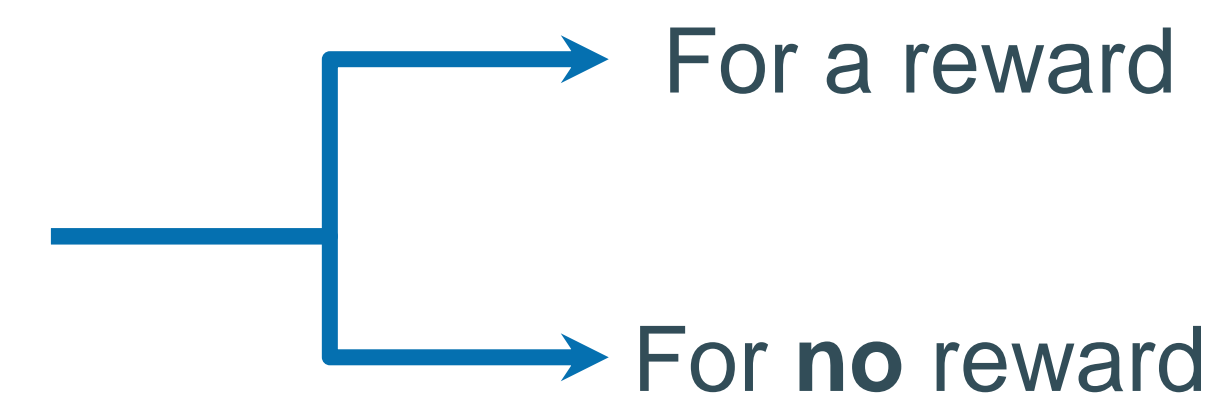


Behavioral and control variables data



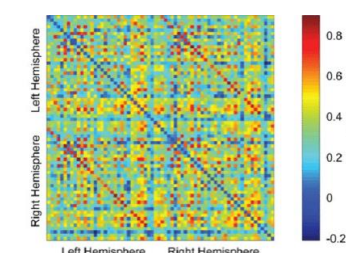
5 + 8 =

Correct  
Incorrect

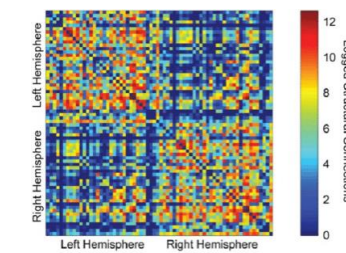


#### 2. Preprocessing (fMRI prep) and functional connectivity matrices

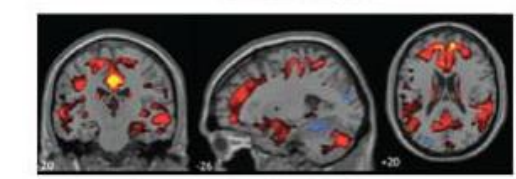
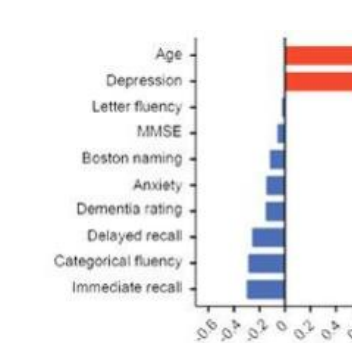
reward condition



no reward condition



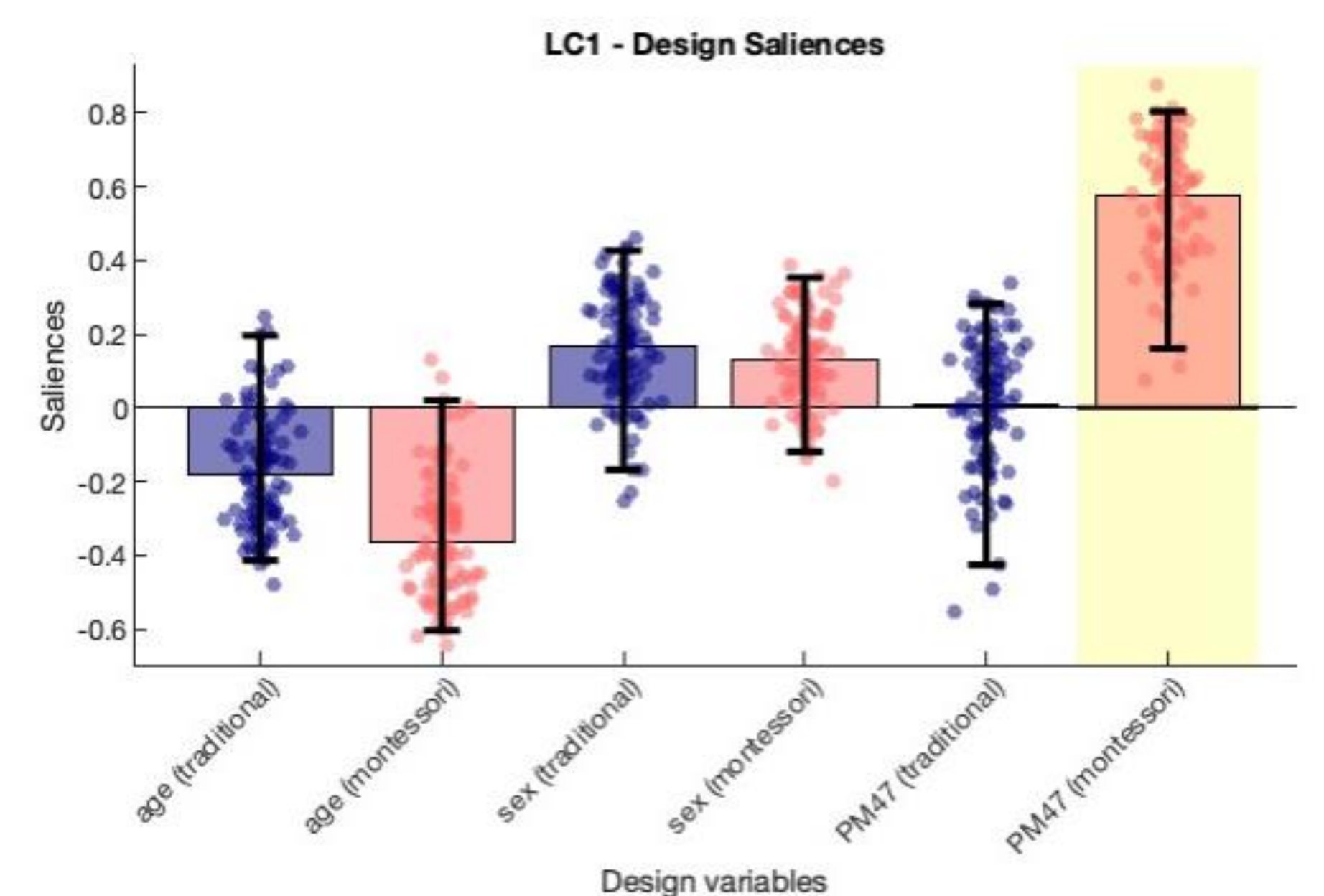
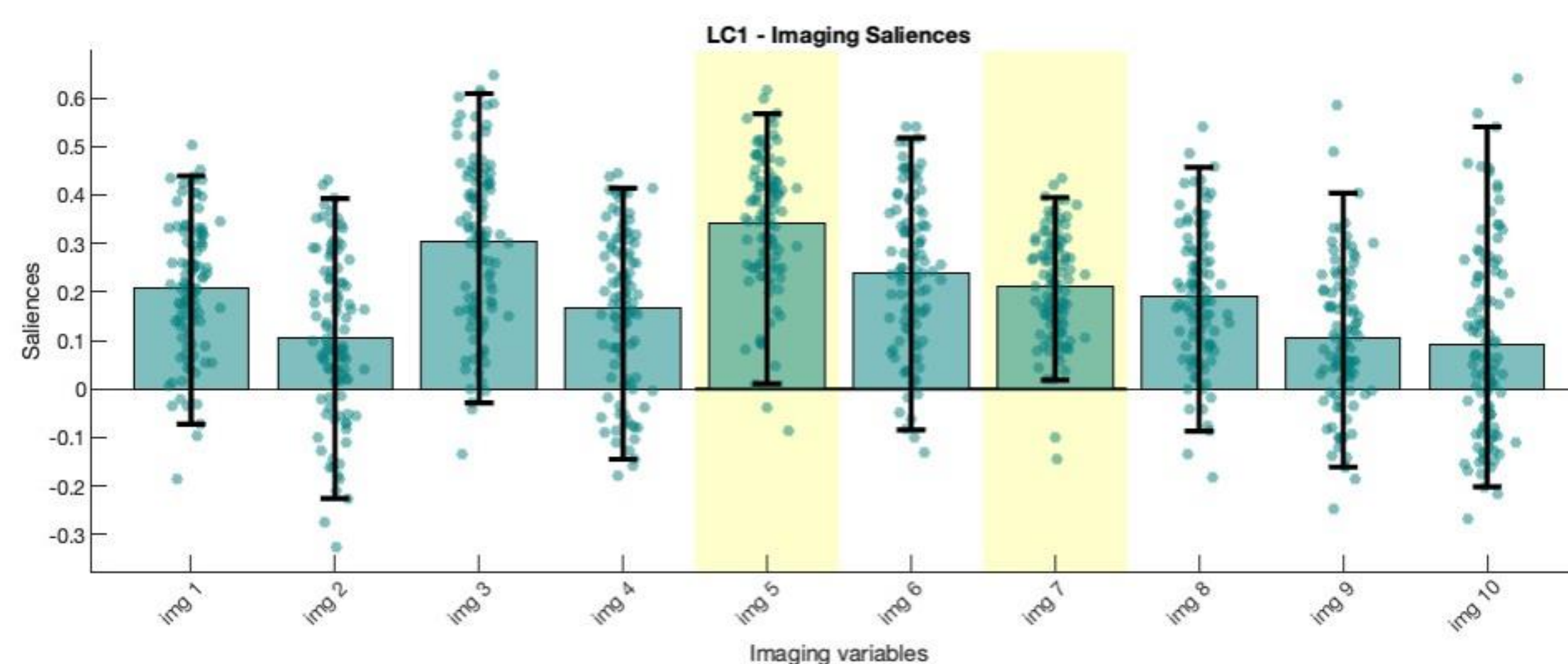
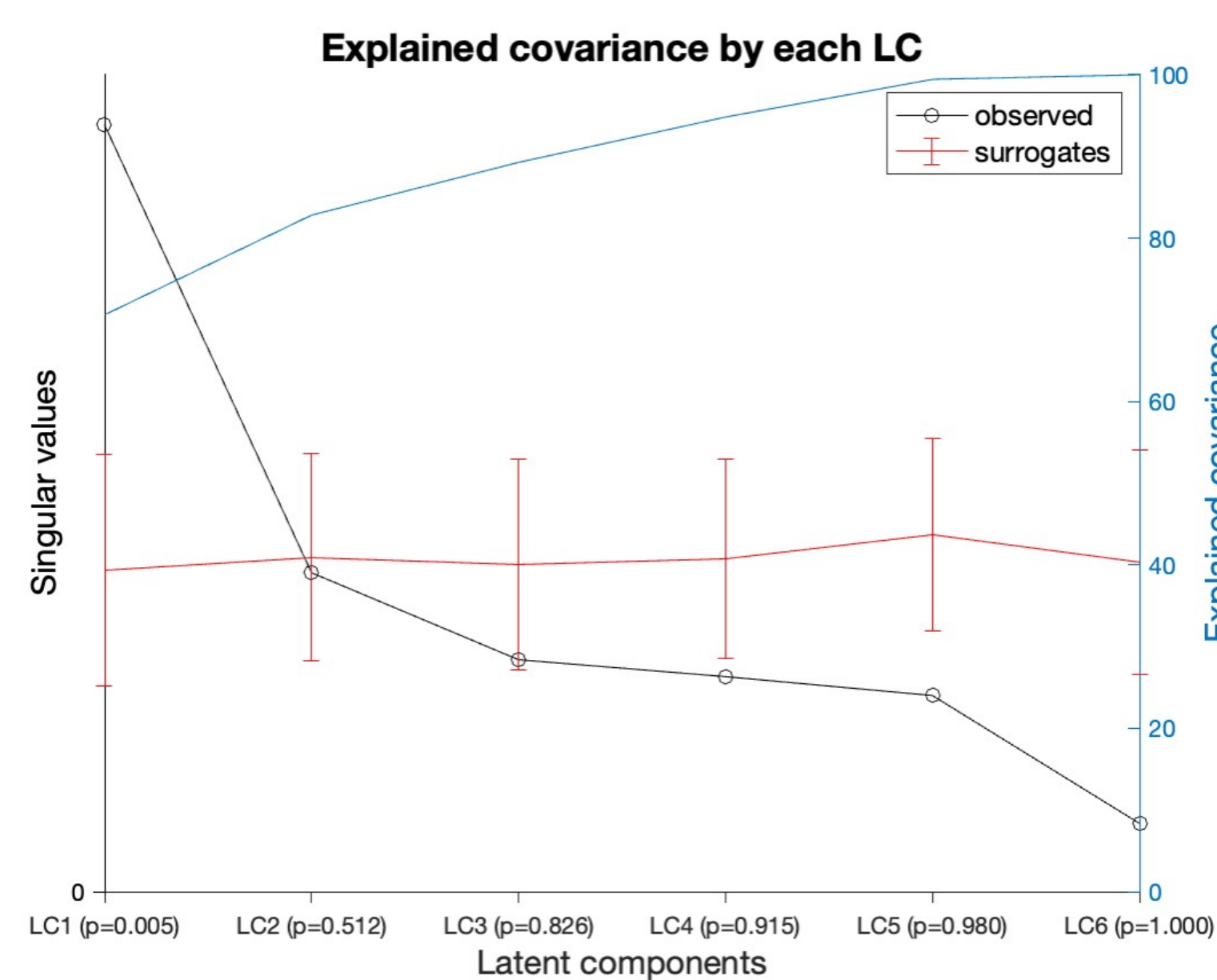
#### 3. Mean functional connectivity activities within ROIs: mesolimbic and mesocortical regions



#### 4. Relate brain and behavioral data using Partial least squares correlations analysis (myPLS)

### PRELIMINARY RESULTS

#### Partial least squares correlations analysis (myPLS) analysis relating neural activity and behavior



### CONCLUSION

Preliminary results suggest a difference in brain activity when children work without reward (i.e., intrinsic motivation), signalling a possible effect of school experience on brain activity in 8-12 yo. children. The analyses are being pursued to confirm and extend these results. If confirmed, this study draws attention on the impact of using reward-based learning at school.

1. Ryan & Deci, 2000; 2. Thomas & Knowland, 2009; 3. Schetter et al. 2023; 4. Denervaud et al., 2020