

Functional neural signal variability increases with age during decision making

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Introduction

Most functional neuroimaging research focuses on changes in mean activation across different experimental conditions. However, recent studies have shown that it could be useful to investigate the variability of the neural signal as well. Some researchers have reported increases in variability with age, while others have reported the opposite.

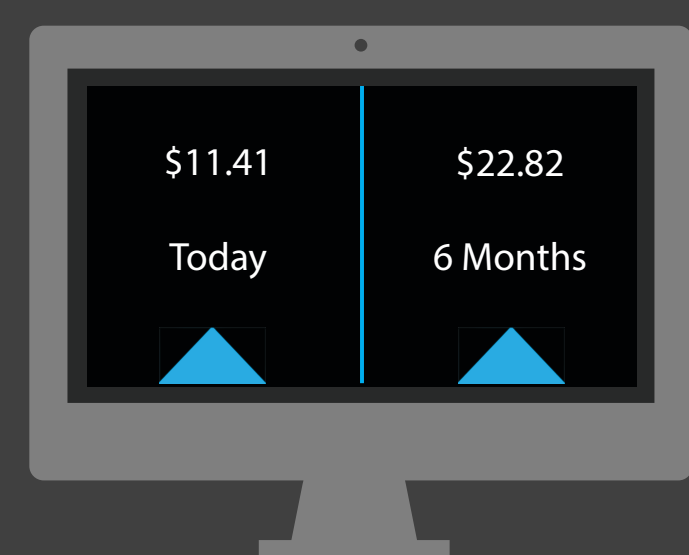


? In decision making tasks, does functional neural signal variability increase or decrease across the adult life span?

Methods

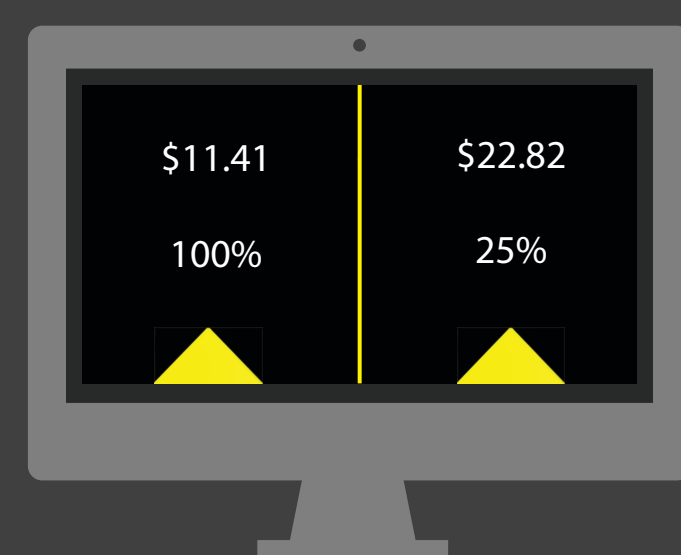
Discounting Tasks during fMRI

75 participants (22 — 83 years old) made choices across 3 different tasks between smaller rewards with shorter time delays, higher probabilities, and lower effort and larger rewards with longer time delays, lower probabilities, and higher effort. They completed 82 unique trials of each task.



Time

Delay periods: today, 2 months, 4 months, 6 months



Probability

Probability levels: 100%, 75%, 50%, or 25%



Effort

Effort levels: 35%, 55%, 75%, or 95% of max. pinky press rate

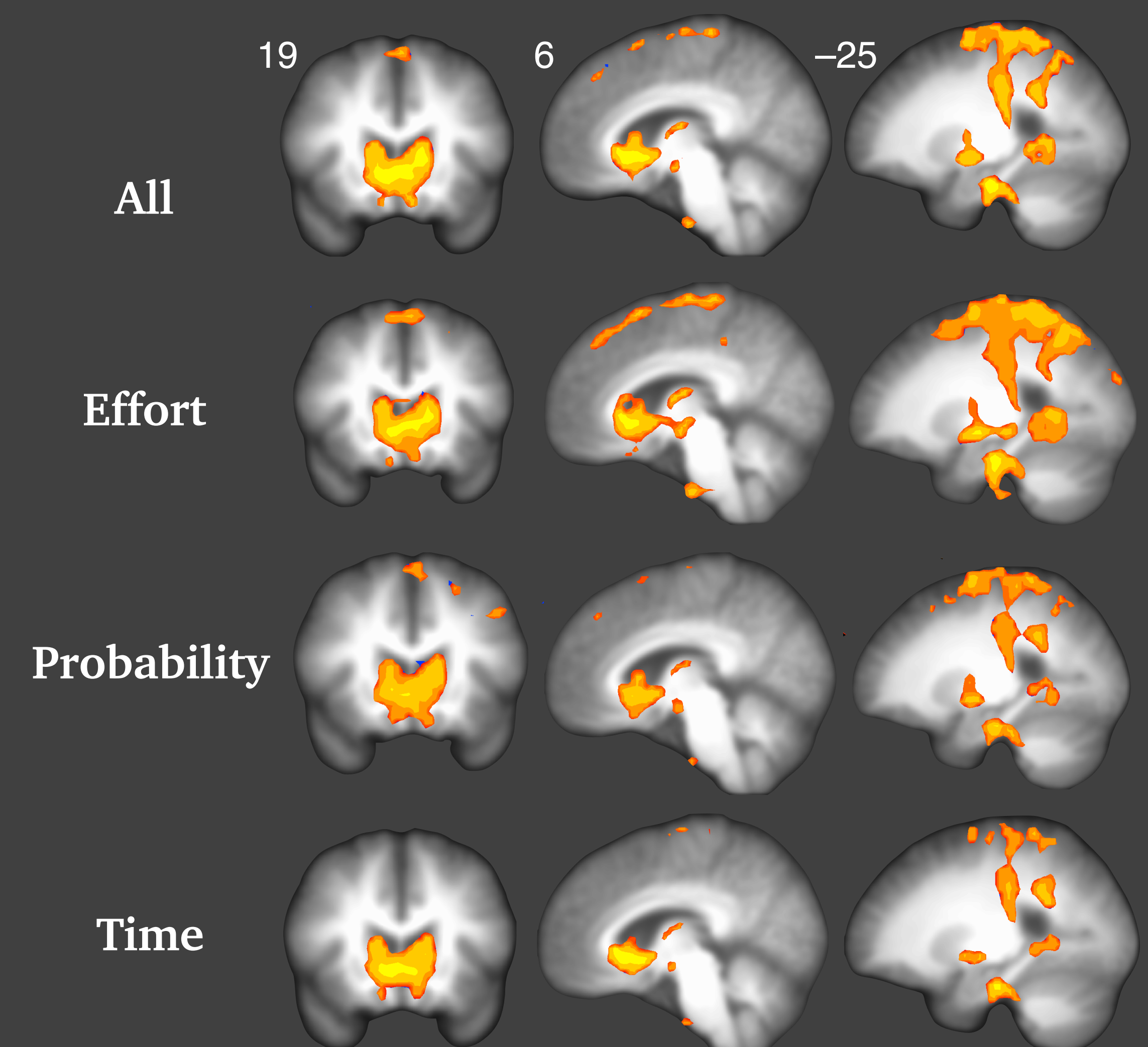
Analysis & Results

- Calculate the mean squared successive difference (MSSD) of the BOLD signal

$$\delta^2 = \frac{\sum_{\tau=1}^{n-1} (x_{\tau+1} - x_{\tau})^2}{n-1}$$

- Whole brain analysis - correlate MSSD with age

Variability *increased* with age in bilateral striatum, hippocampus, and parietal cortex ($p < .0001$, 20 voxel cluster threshold)



Discussion

These age-related increases in variability are consistent with previous studies of reward-based decision making, but inconsistent in direction with some other resting state and cognitive task-based effects. Further investigation is needed to determine what (i.e. sample characteristics, tasks, analysis methods) drives these differences across studies.

Next steps:

- MELODIC ICA
- Analyze resting state data
- Examine associations with decision making performance / preferences