

Reward modulates cortical representations of action

Tyler Adkins and Taraz Lee

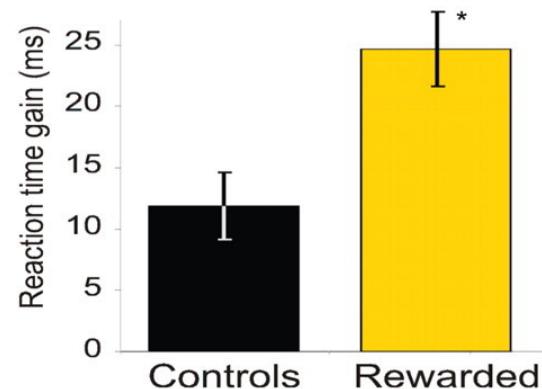
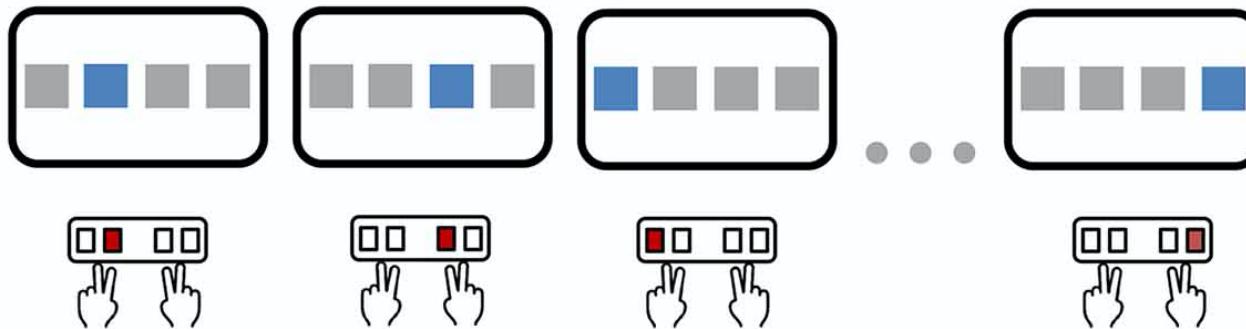
University of Michigan

Department of Psychology - CCN



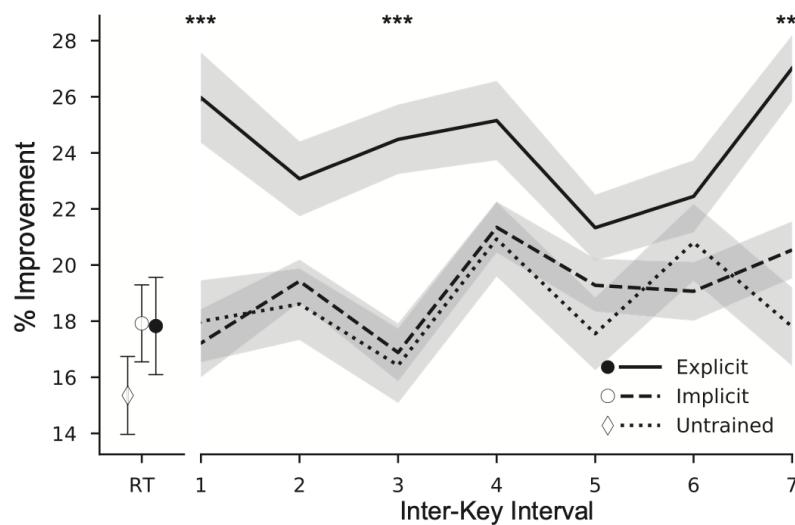
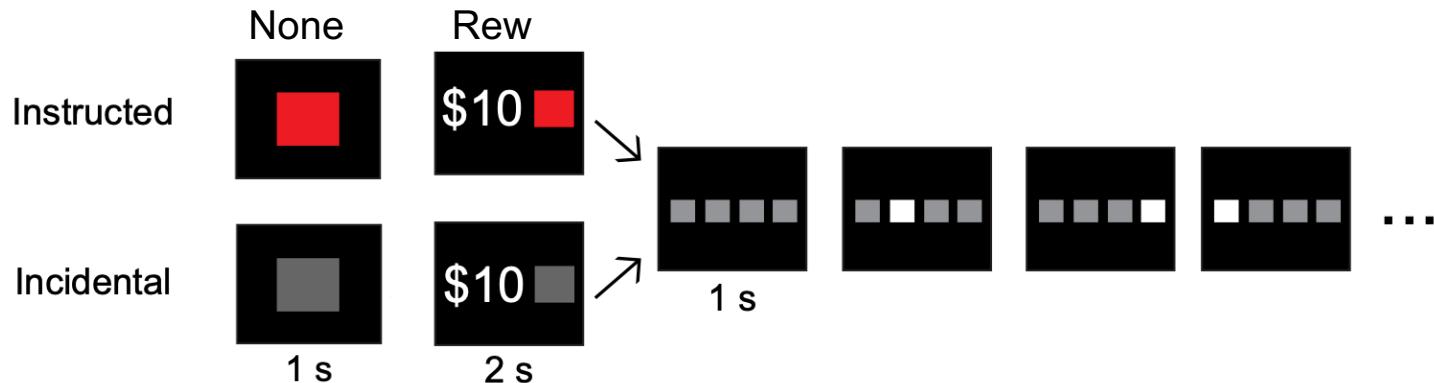
Background

Rewards enhance speed and accuracy of movement.



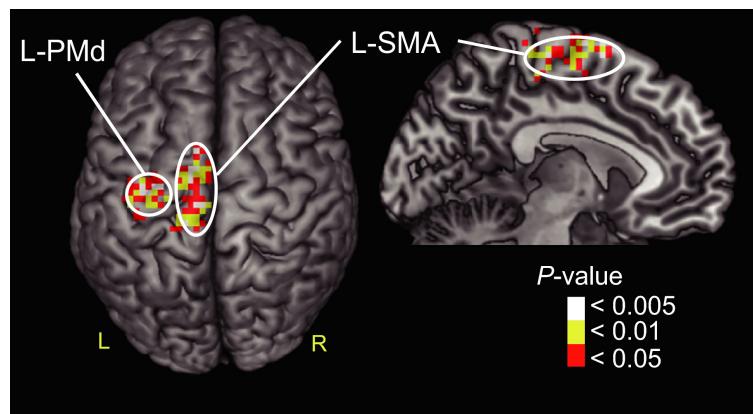
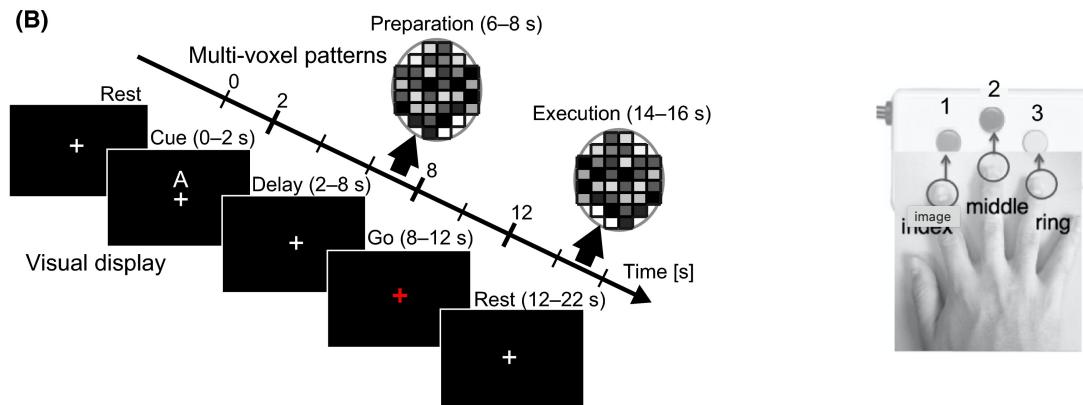
Background

Reward-related enhancements greater for cued actions.



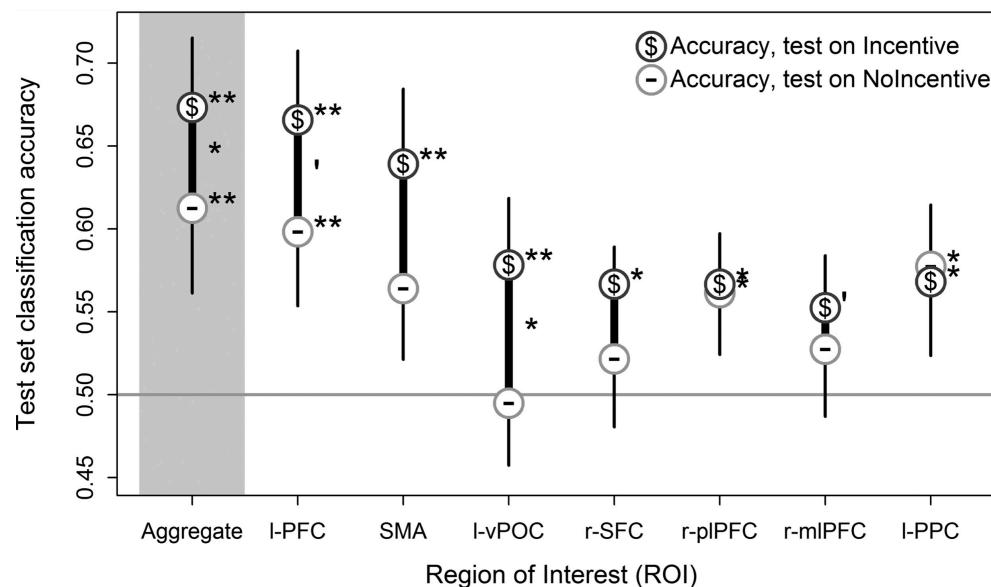
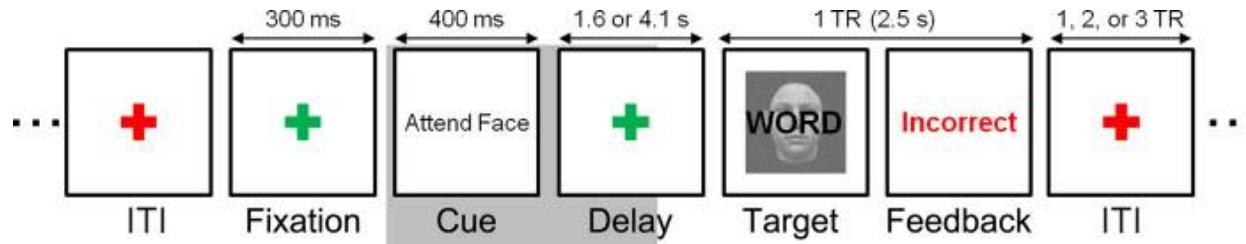
Background

Actions can be decoded from brain activity preceding movement.



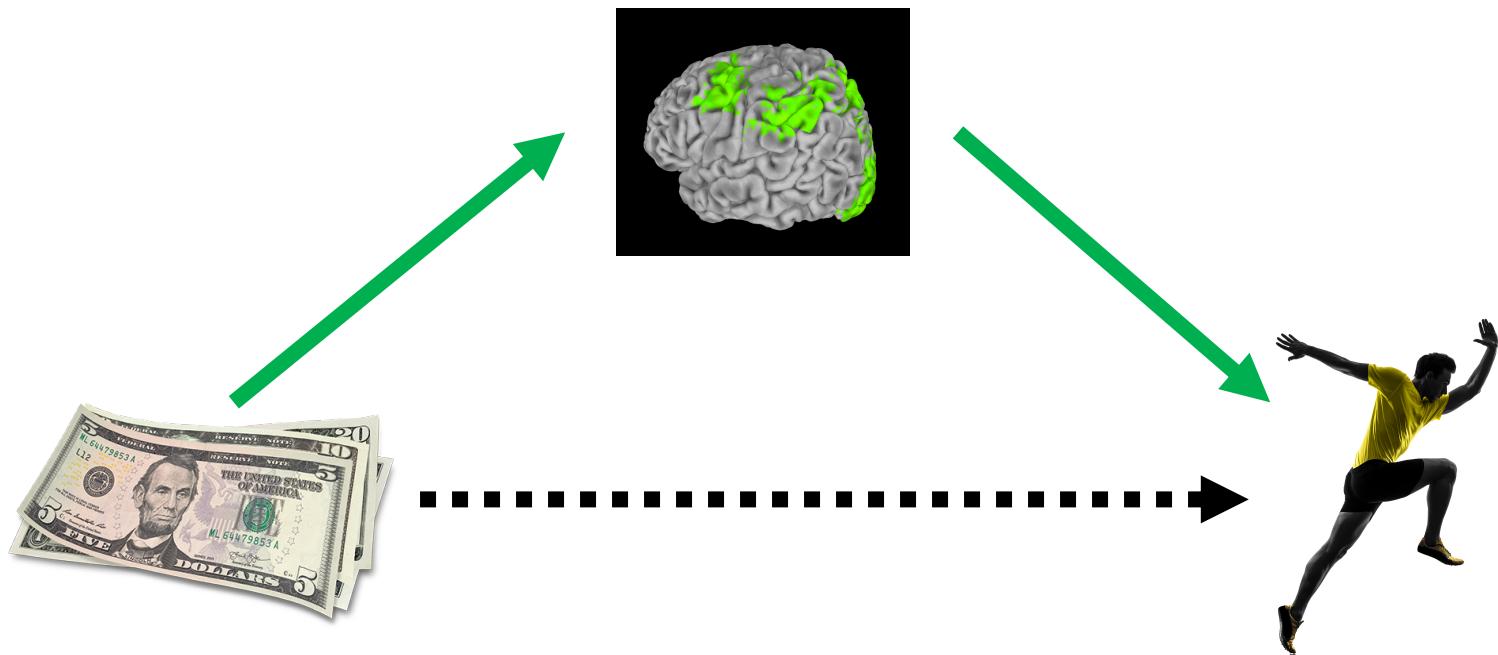
Background

Reward enhances decoding of upcoming task



Question

Does reward affect performance by modulating representations of action used in movement planning?



Experiment

Training Session

T1	Rest	Task <i>DSP Training</i>
~8 min.	~5 min.	H: 200 trials, L: 40 trials Random: 40 trials 8 x ~5 min. runs

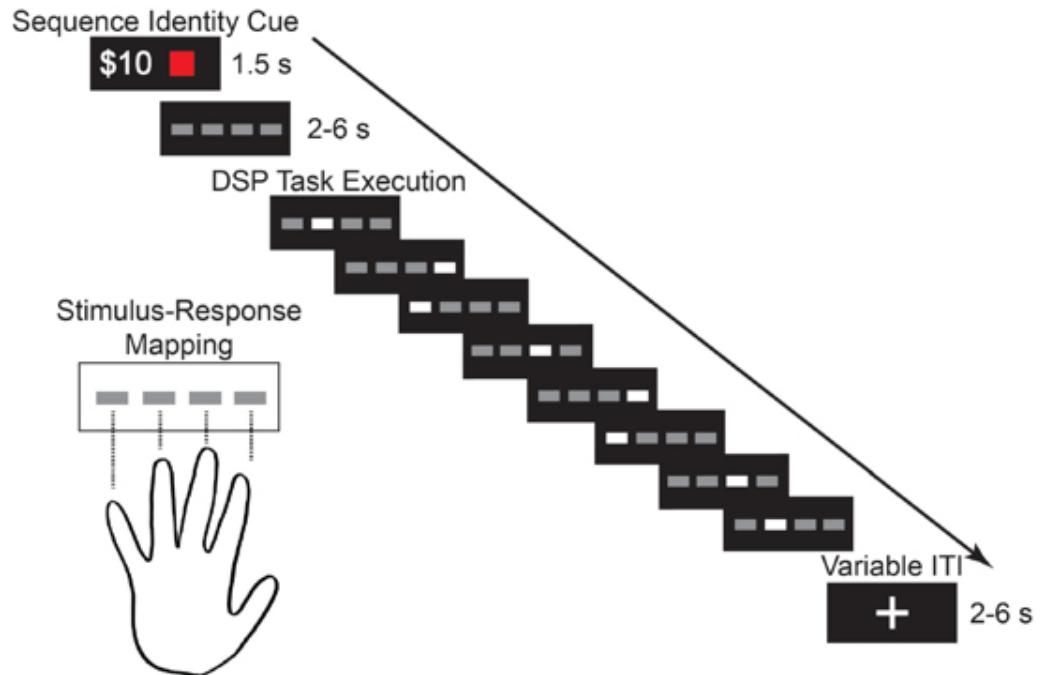
Test Session (2 days later)

DTI	Rest	Task <i>DSP w/ Rewards</i>
Warm-up 90 trials ~8 min.	~5 min.	240 trials 8 x ~5 min. runs

Initialize time limits

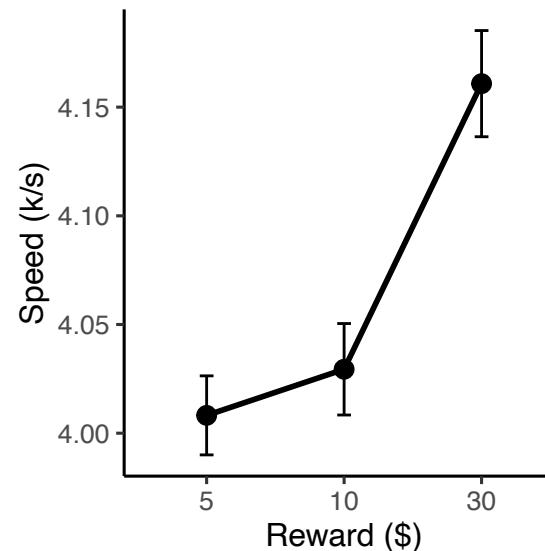
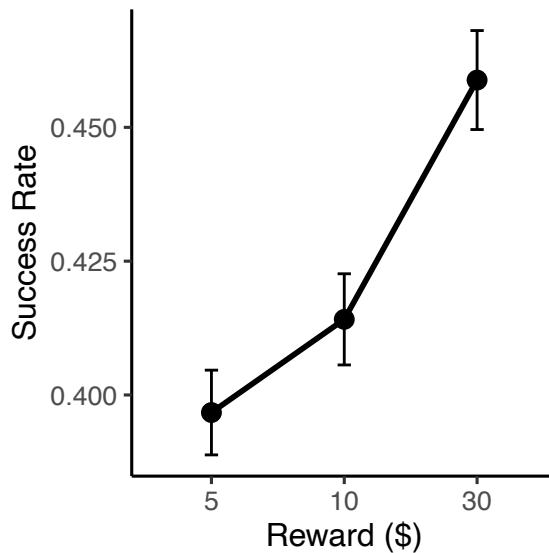
Each trial, participants performed one of two 8-item sequences with opportunities for reward (\$5, \$10, or \$30).

Our fMRI analyses focused on cue-related activity.



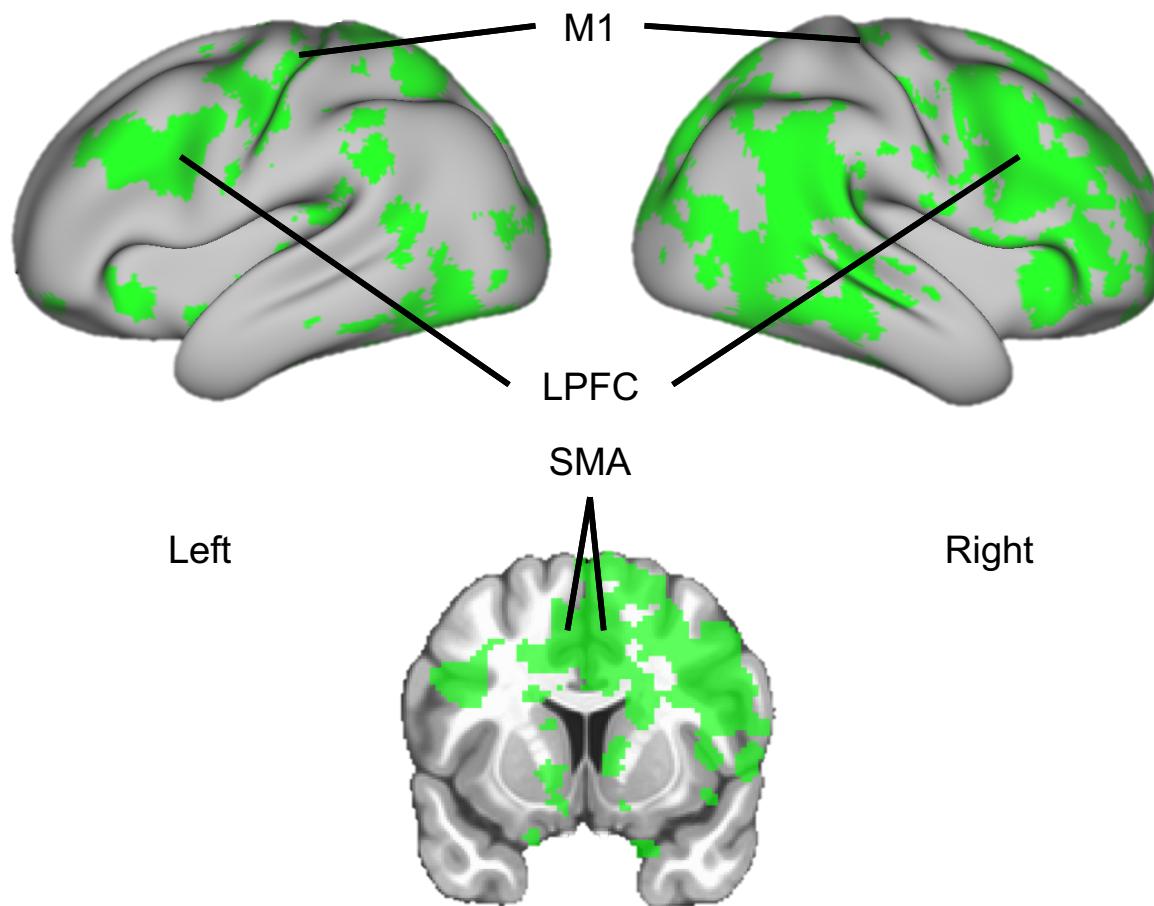
Reward-modulated behavior

Participants performed sequences more quickly and accurately as the size of the reward offer increased.



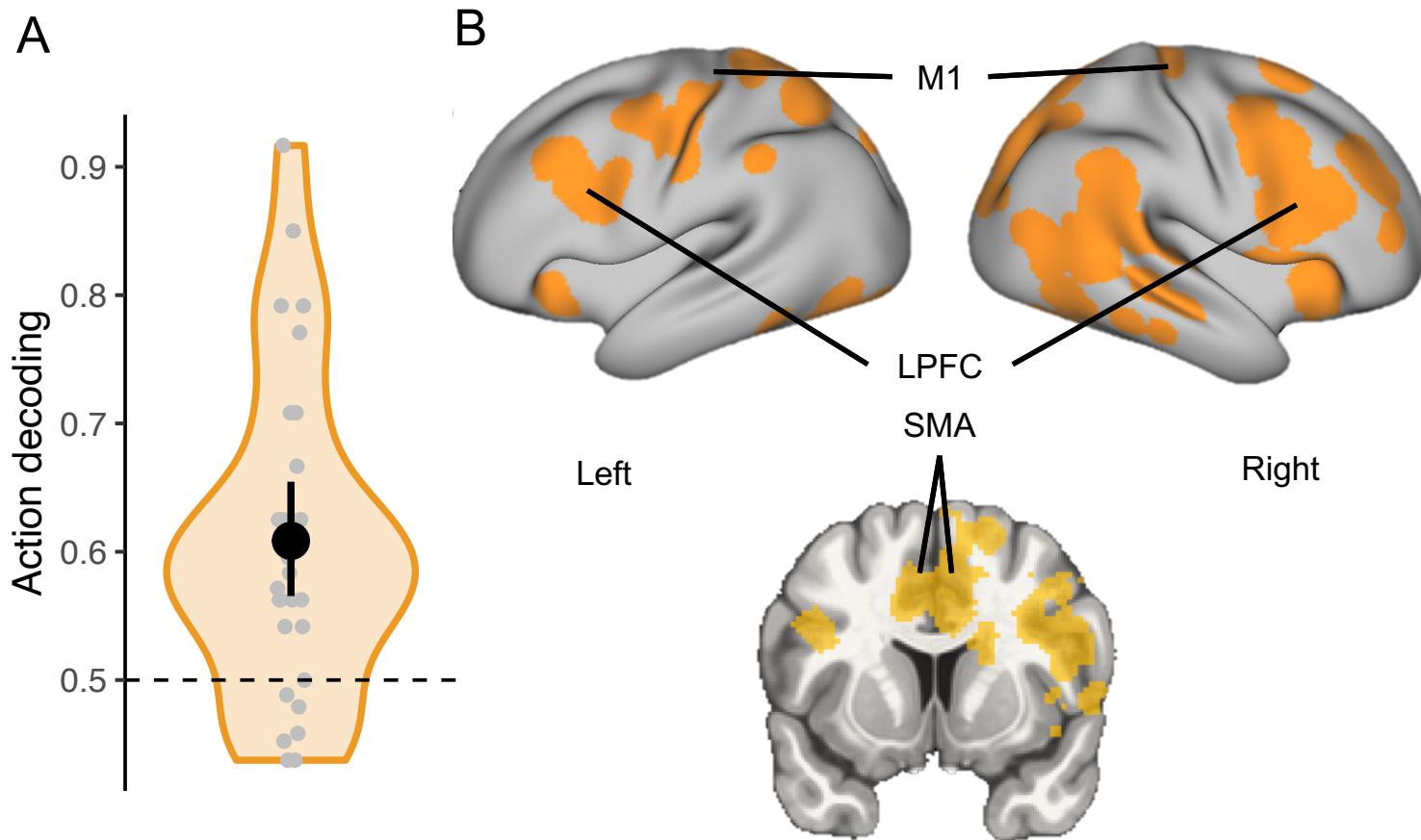
Reward-modulated areas

Univariate cue-related activity in these areas increased with incentive value.



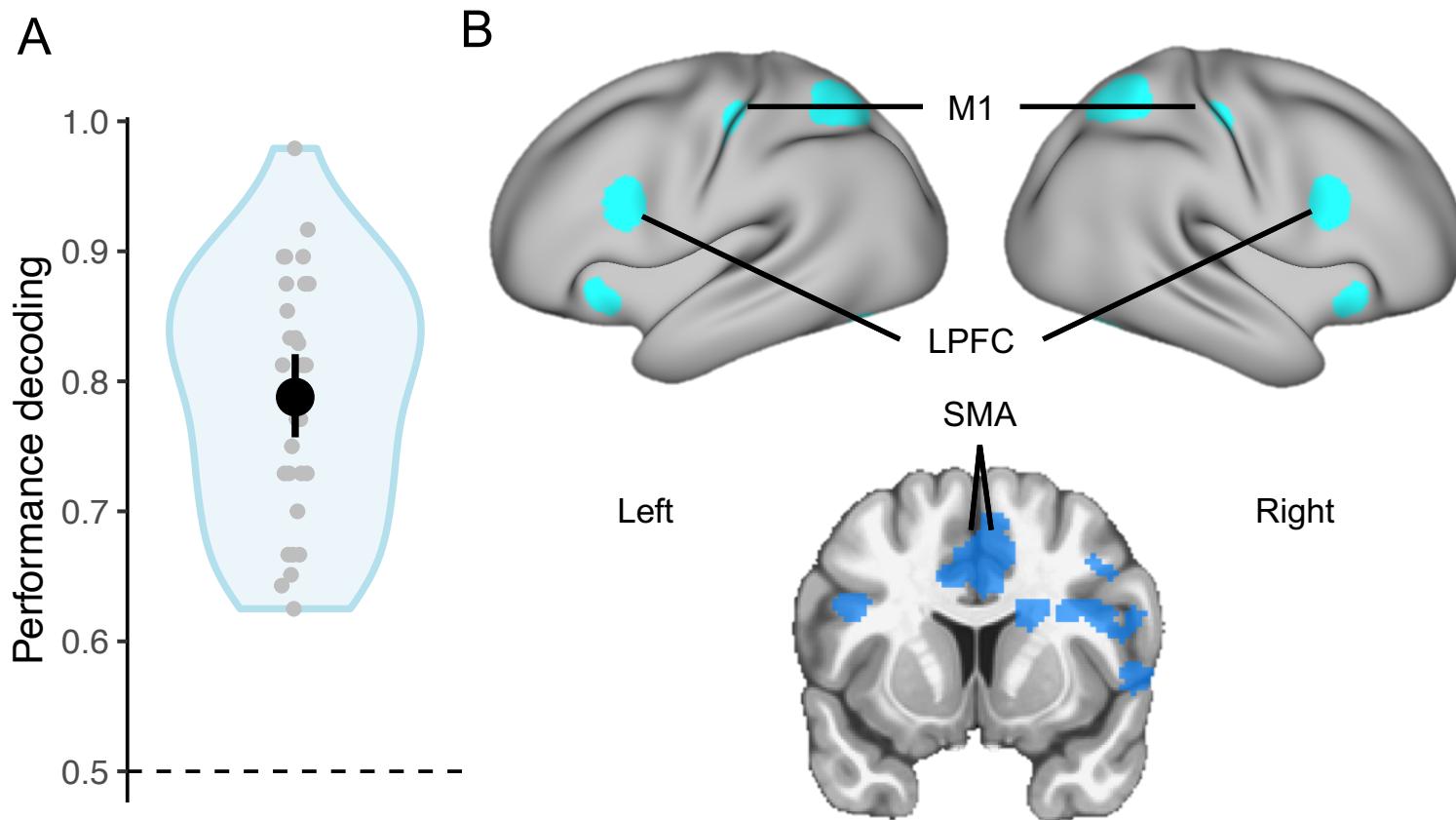
Action information map

Multivariate cue-related activity across these areas was predictive of which action was being prepared.



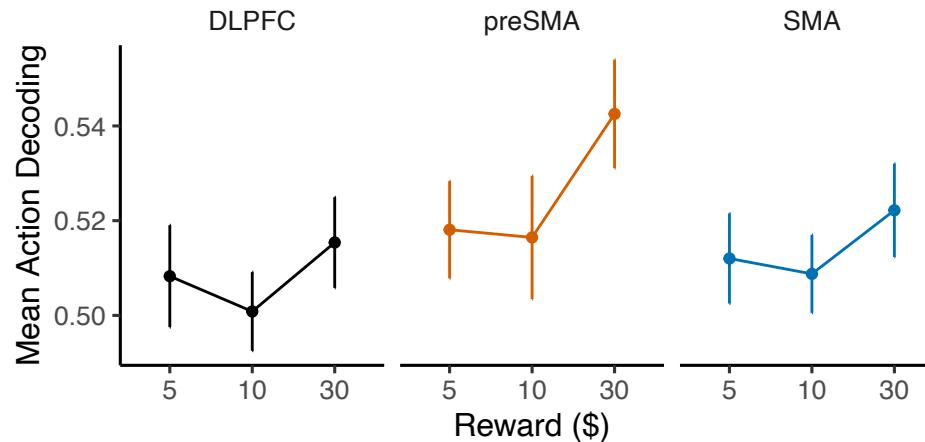
Performance information map

Multivariate cue-related activity across these areas was predictive of whether the upcoming action would be performed successfully.

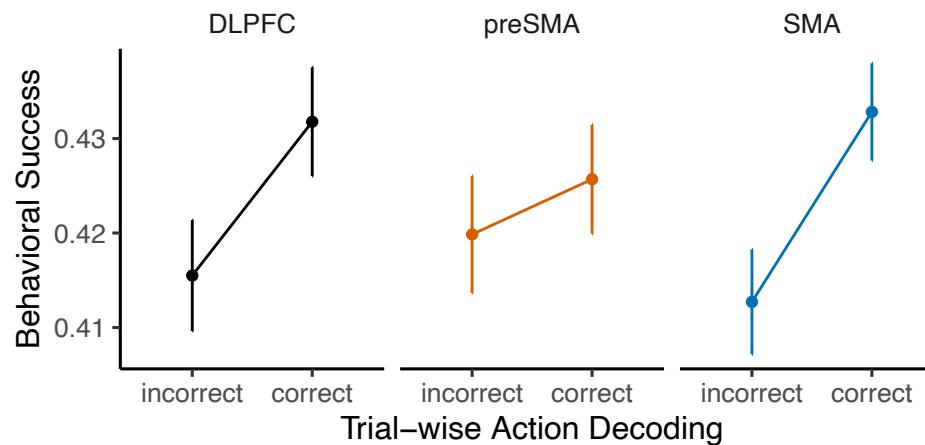


ROI analyses

Action decoding was enhanced on high reward trials.



Action decoding coincided with improved behavioral performance.



Conclusions

Reward enhanced the speed and accuracy of action.

During movement preparation, many brain areas were modulated by reward.

Some of these areas contained information about the target *action* and the quality of *performance*.

Action decoding in motor planning areas was more accurate for high reward trials and coincided with improved future behavioral performance.

Rewards may enhance action by enhancing representations of action in planning areas.