

Stimulus encoding, working memory, and action selection in dorsolateral prefrontal cortex during perceptual decision making

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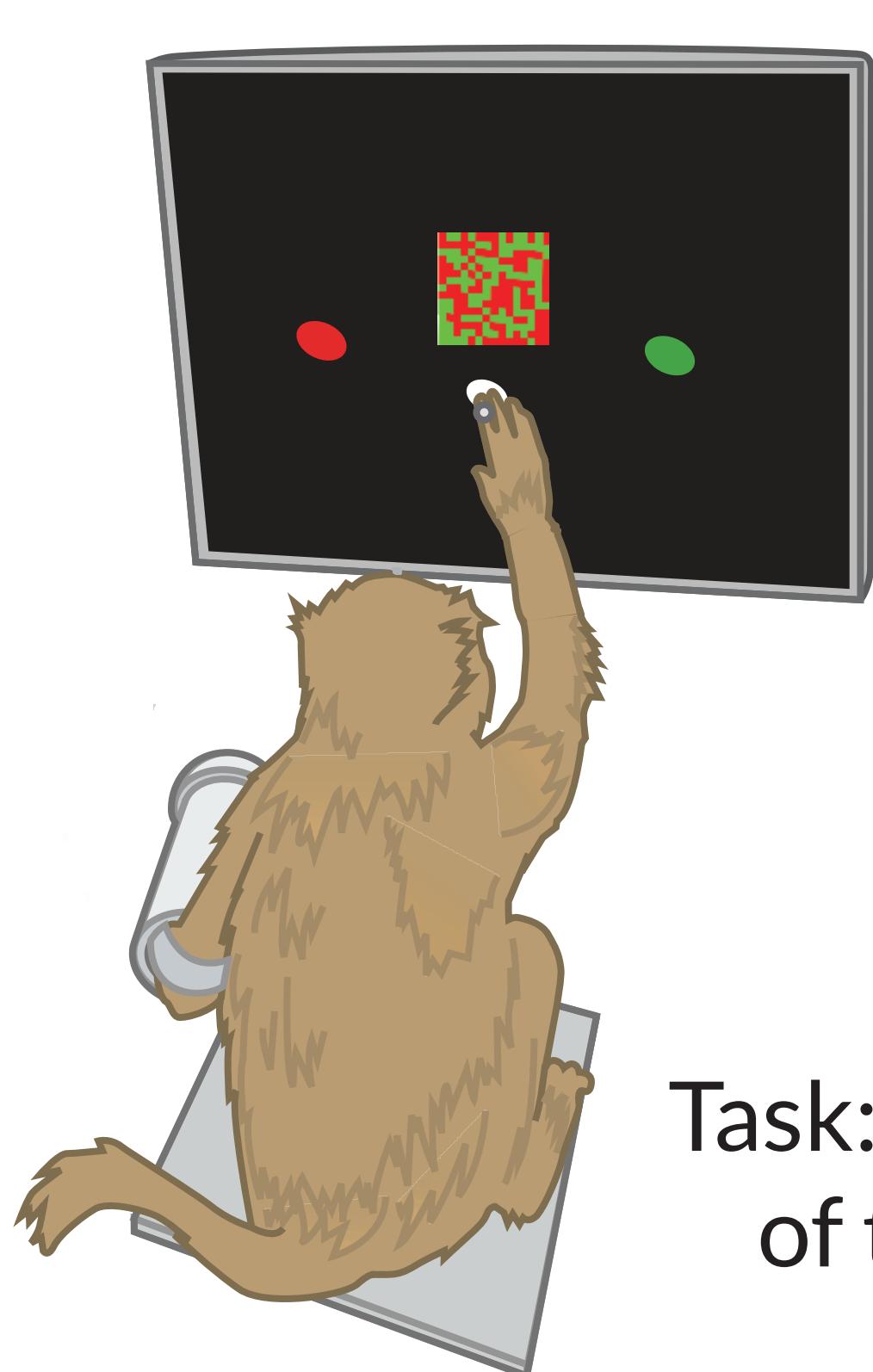
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Introduction

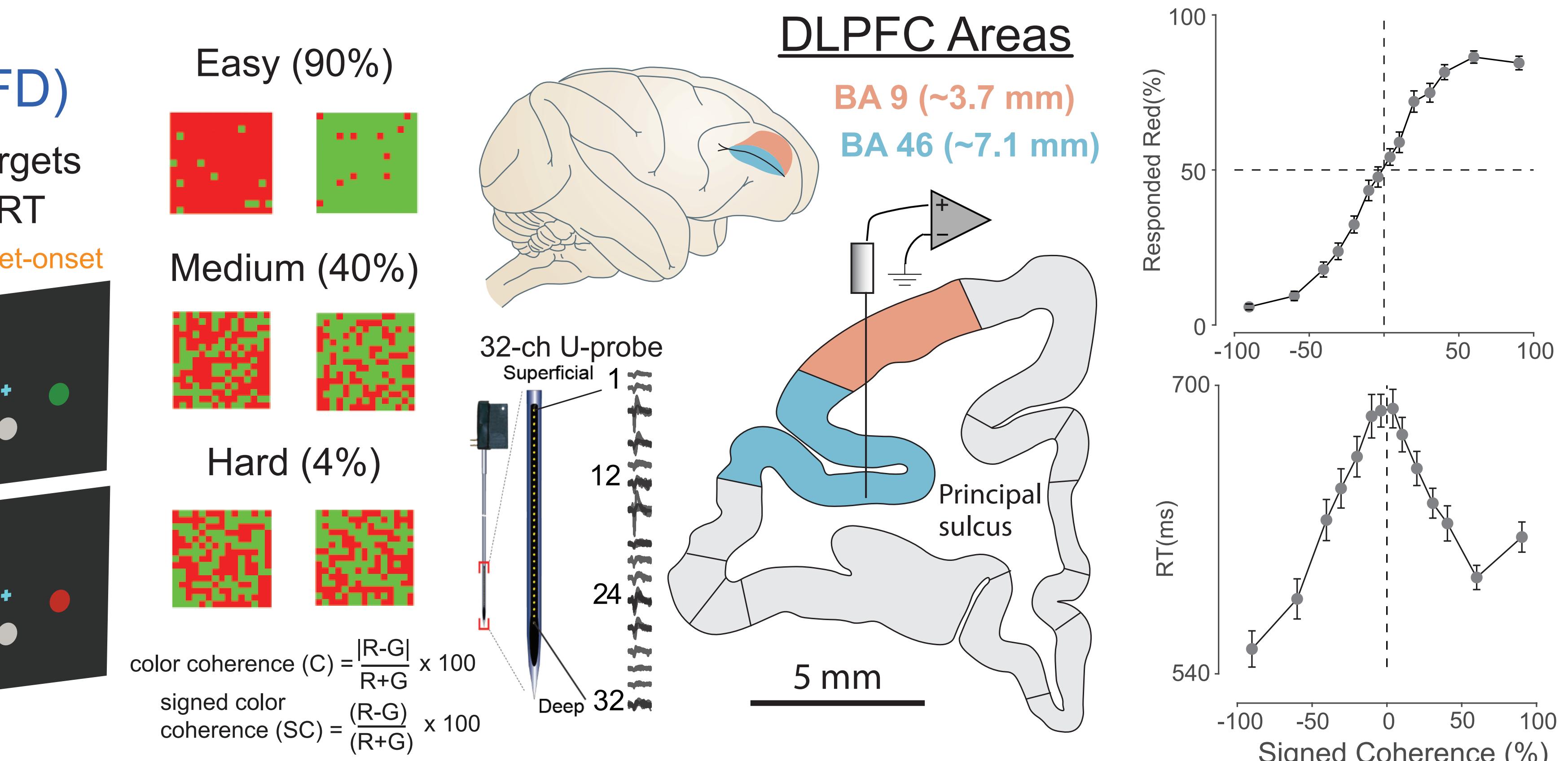
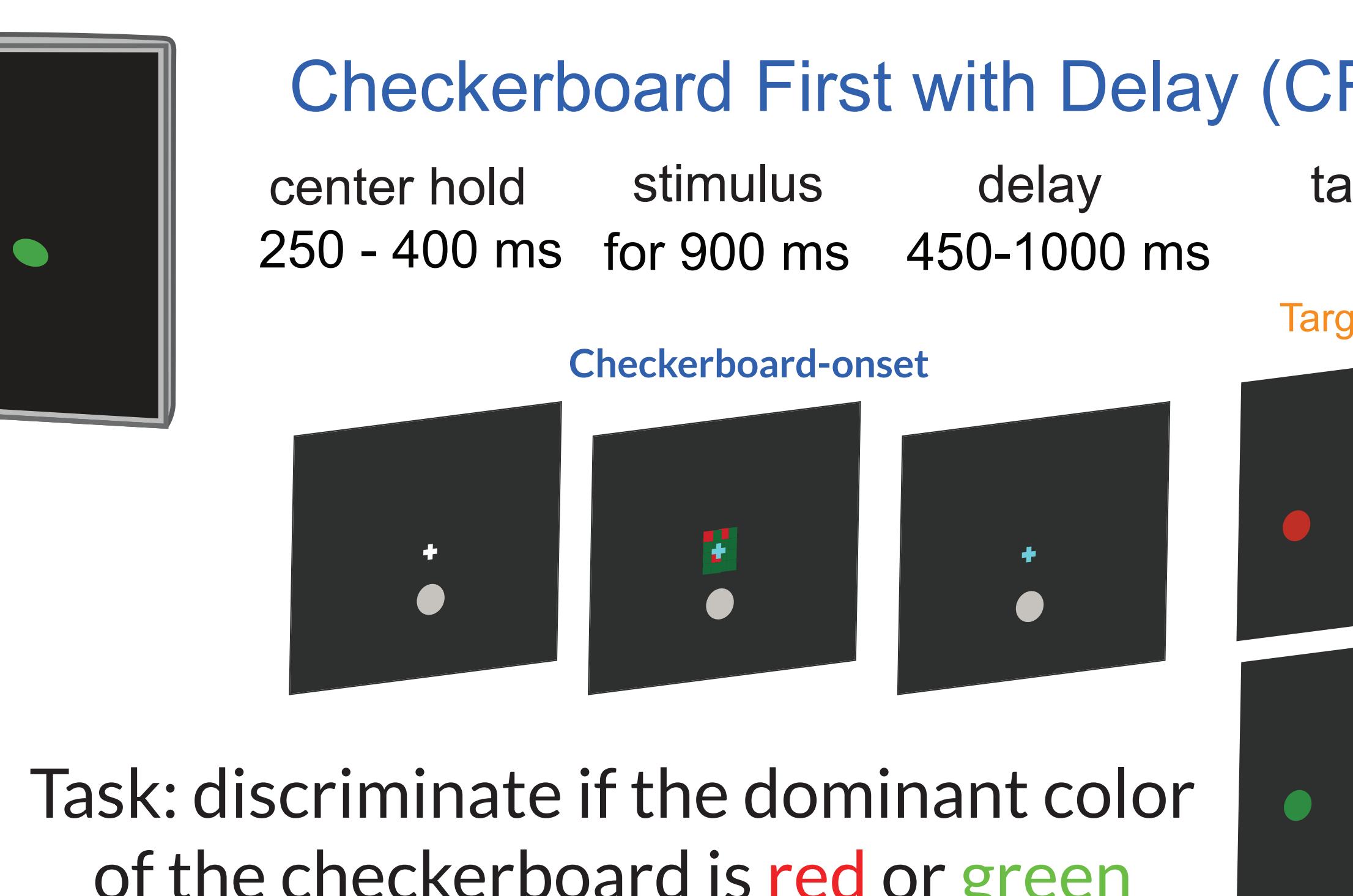
Background: Perceptual decision-making consists of two components: abstract decision formation (“examine the stimulus and choose the correct target”) and motor action planning/execution (“decide to reach left and execute the action”). Previous studies of dorsal premotor and parietal areas during decision-making have documented neural correlates of motor action planning but not found either stimulus representation or abstract decision formation.

Motivating Questions:

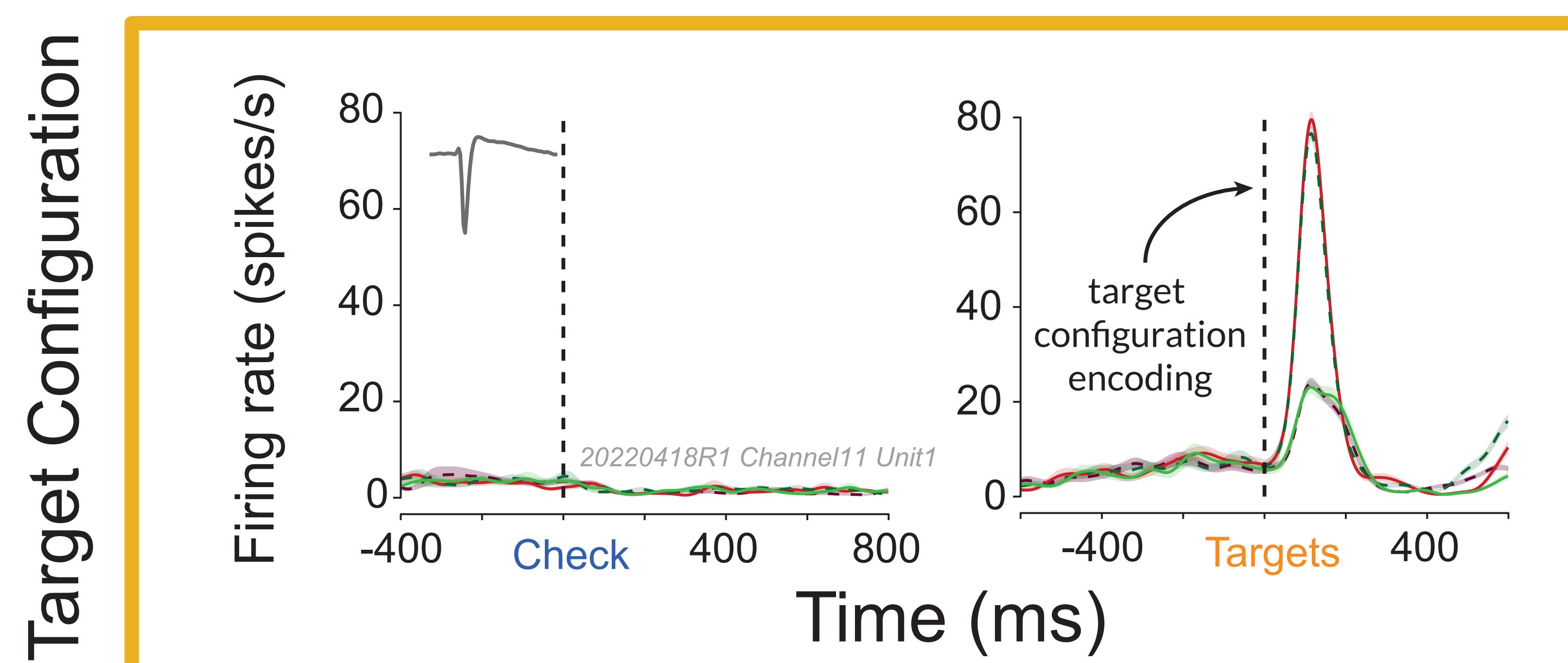
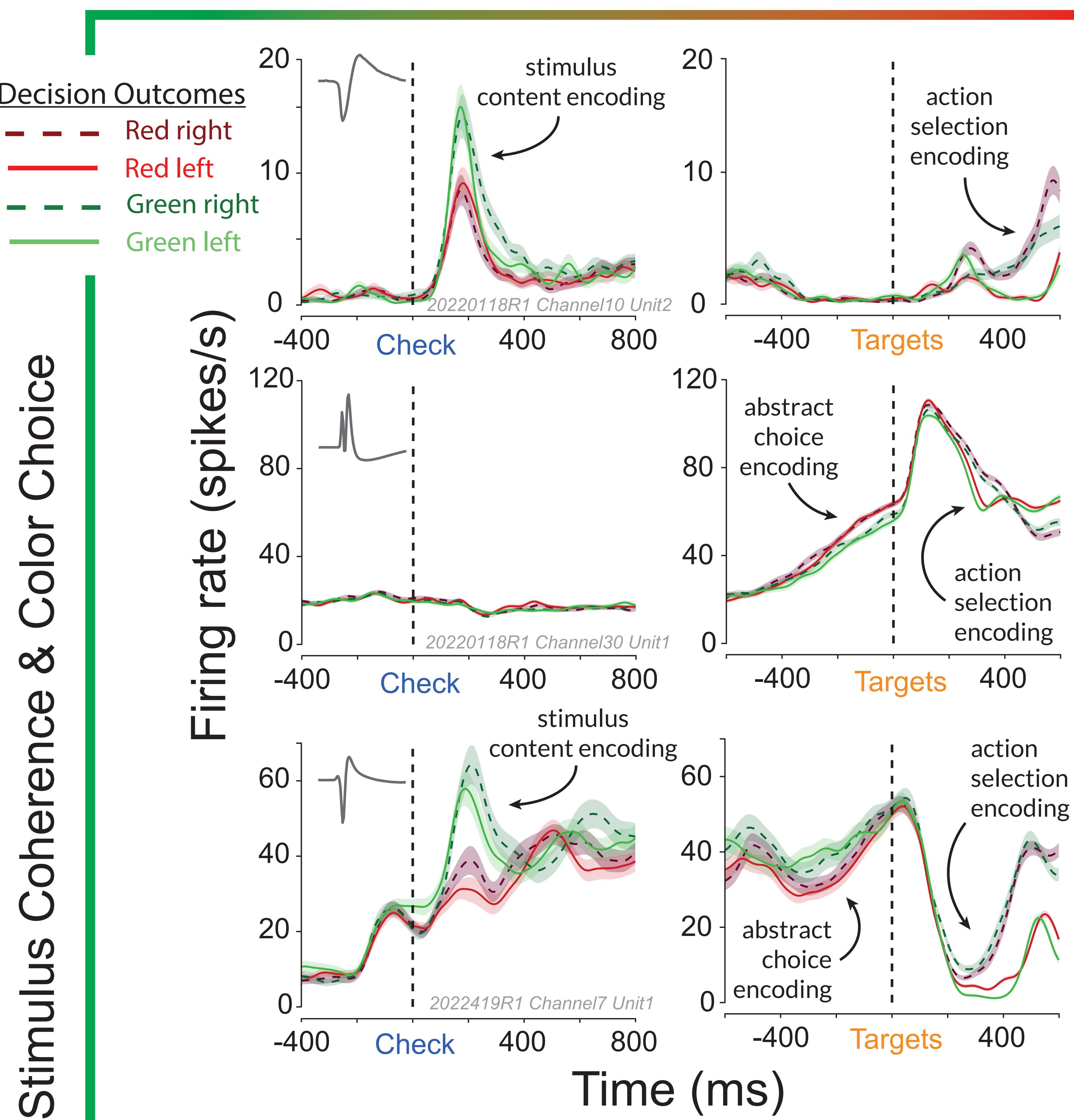
- 1) What task variables are represented in DLPFC?
- 2) How are these task variables represented at the single neuron and population levels?
- 3) Do abstract perceptual decisions exist?



Experimental methods

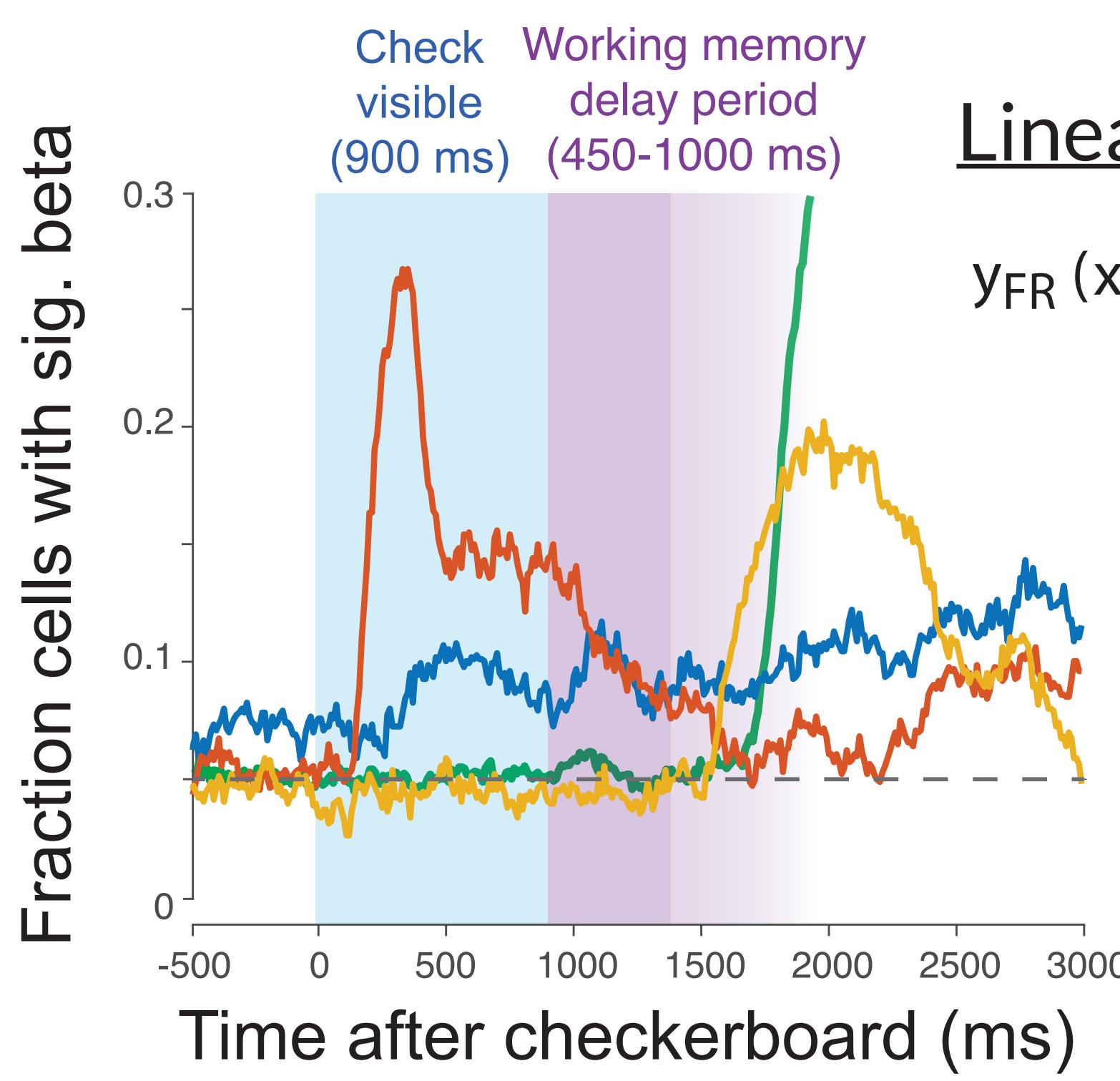


Single units encode task variables

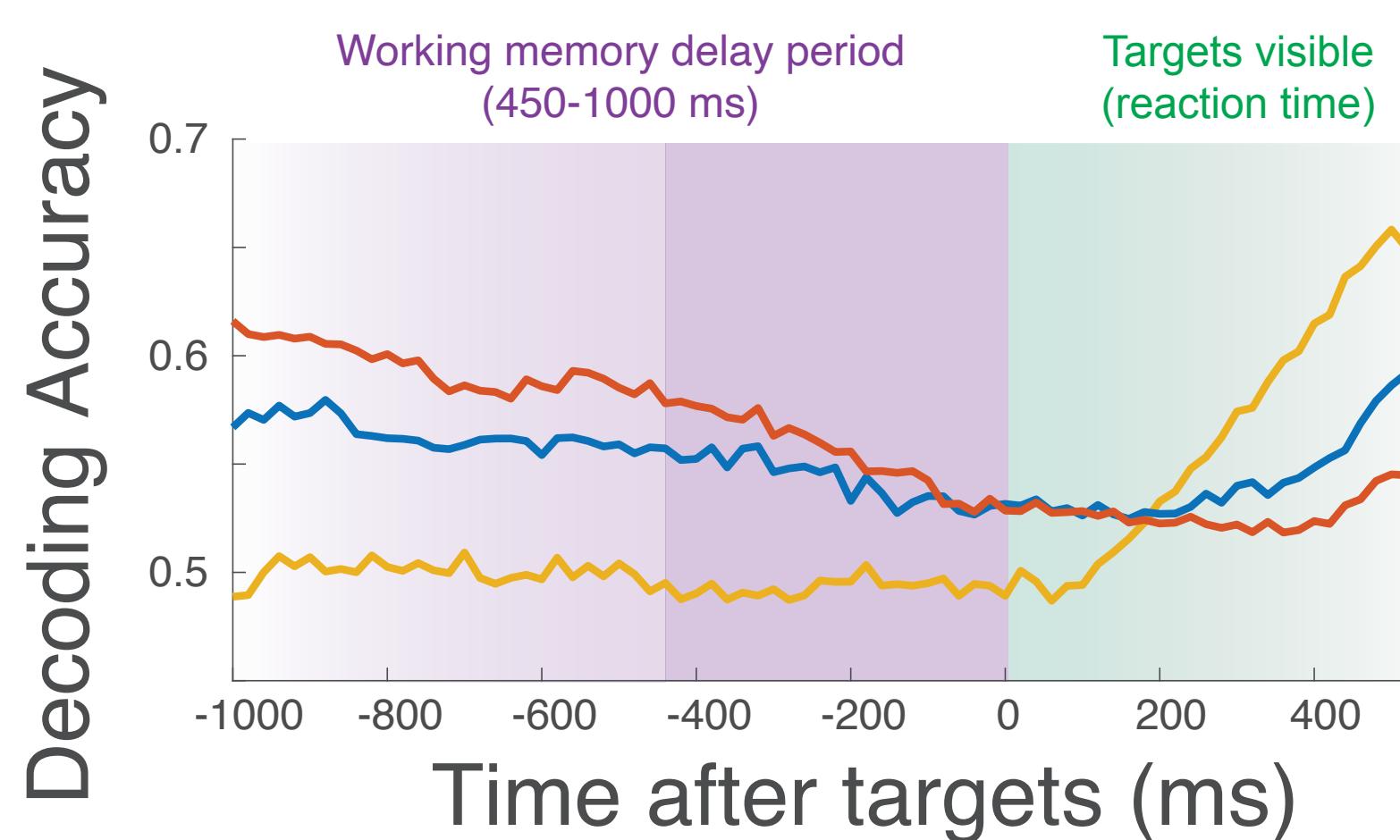


DLPFC encodes sensory evidence and color choice during the stimulus viewing and working memory period

Regression Analysis



Decoder (SVM) Analysis



Conclusions

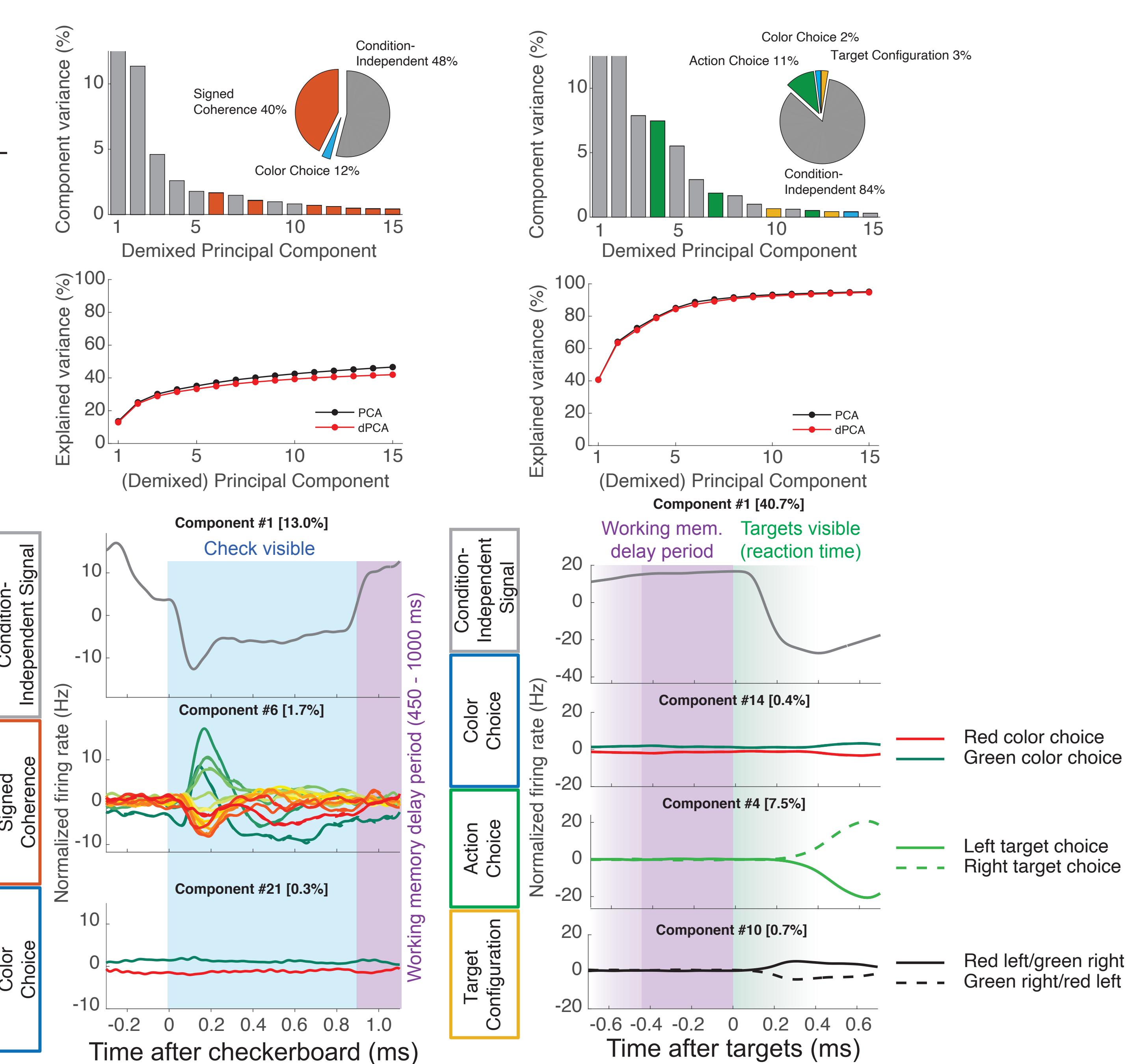
Previous work in PMd and LIP have shown encoding of action choice but not encoding of sensory evidence or color choice during decision-making (Wang and Montanede et al. 2019; Shushruth et al., 2022). Recording from macaque dorsolateral prefrontal cortex (BA 46/9), we find evidence of strong encoding of sensory evidence (40% variance) and weak encoding of color choice (12% variance) during the stimulus viewing and working memory delay periods. Furthermore, color choice is more strongly represented than stimulus evidence during the working memory delay (especially just before target appearance) and through the rest of the trial including after target appearance. This was also validated using a classifier decoding analysis. This implies that DLPFC lies upstream of other decision-marking areas.

References

Wang, M. et al. Macaque dorsal premotor cortex exhibits decision-related activity only when specific stimulus-response associations are known. *Nature Communications* 10, (2019).

Shushruth, S., Zylberberg, A. & Shadlen, M. N. Sequential sampling from memory underlies action selection during abstract decision-making. *Curr Biol* 32, 1949-1960.e5 (2022).

Demixed Principal Component Analysis



Acknowledgments



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