

Posterior parietal cortex neurons distinguish memorized past from what is perceived as reality

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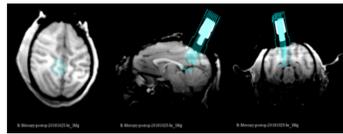
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Introduction

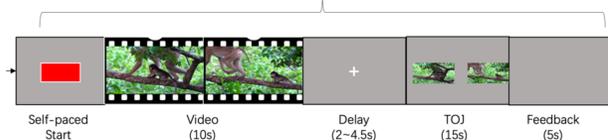
- Visual imagery and visual perception share similar activation in the visual cortex, and can both lead to the subjective feeling of seeing (Pearson & Kosslyn, 2015).
- The posterior parietal cortex (PPC) recently has been identified as an information accumulator for conscious visual awareness (Pereira et al., 2020).
- Can PPC neurons monitor whether an object externally exists in the world or is internally held in visual working memory?

Experimental Design



- Recorded electrophysiology data from a monkey's dorso-medial PPC while a temporal-order judgement (TOJ) task.

x20 per block



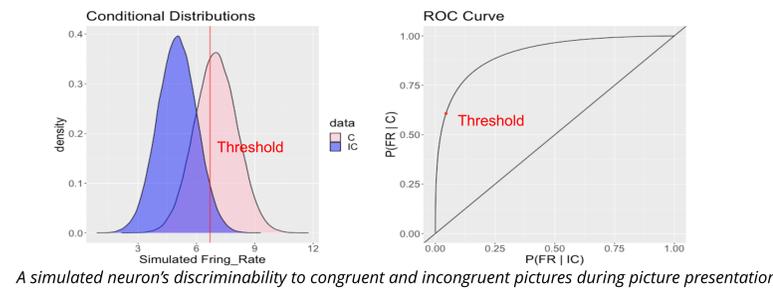
- In the delay/maintenance period:
 - 25%: a congruent image (i.e., extracted from the encoded video)
 - 25%: an incongruent image (i.e., extracted from other videos)
- Pictures were presented for 0.5s, with an onset time $\sim N(1.5, 0.5)$. No picture trials were assigned with a pseudo picture onset time.
- White noise at one of three intensity level were added onto each picture.

References

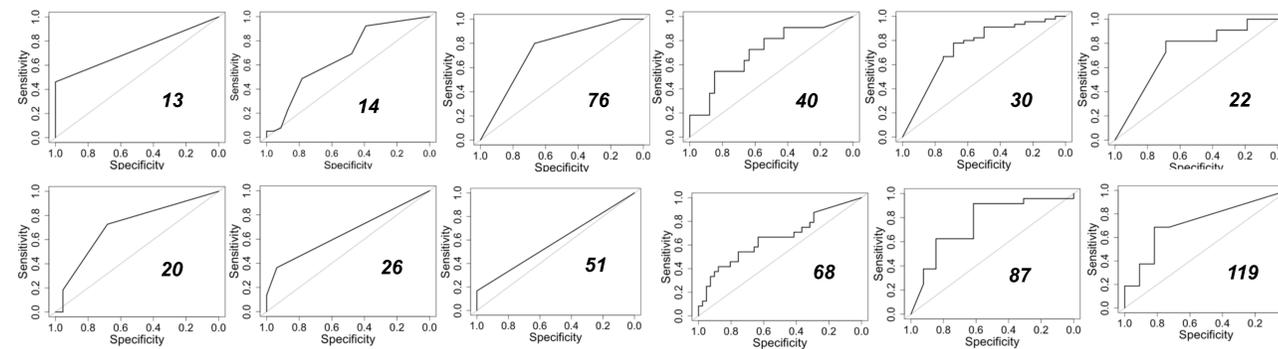
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2. Pereira, M., Megevand, P., Tan, M. X., Chang, W., Wang, S., Rezai, A., ... & Faivre, N. (2020). Evidence accumulation determines conscious access. *bioRxiv*.

Neuronal Results

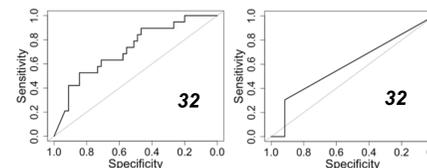
- 121 neurons were recorded. Area under the receiver operating characteristic curve (auROC) was computed to quantify a neuron's ability to discriminate between all possible pairs of picture conditions in each epochs (pre-picture, picture, post-picture).



	Congruent vs No Picture	Incongruent vs No Picture	Congruent vs Incongruent	Congruent vs No Picture	Incongruent vs No Picture	Congruent vs Incongruent
Total number of neurons	6	6	6	8	14	7
Mutually Exclusive	6	4	4	5	8	4



Example neuron showed discriminability to both C&NP and IC&NP condition pairs



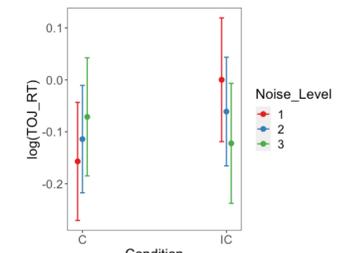
*None of these neurons had discriminability prior to picture presentation

Neuronal Results (continued)

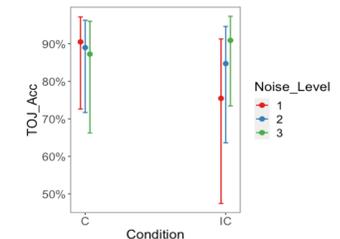
- To reflect collective dynamics of neural populations, we analyzed the local field potential (LFP) signals during reality monitoring
- Applied the same ROC analysis to LFP high gamma response (>500 Hz)
- Among all 32 channels in one recording day:
 - 4 channels showed exclusive discriminability in C&NP during picture presentation
 - 5 channels had exclusive discriminability in C&NP after the picture viewing

Behavioural Results

- Picture conditions did not affect TOJ correctness and response time (RT)
- Condition x Noise Level interaction on TOJ correctness and RT



- With higher noise, incongruent picture (IC) condition had longer RT, while congruent condition (C) condition had shorter RT



- With higher noise, IC condition had greater accuracy, while C condition had lower accuracy

Discussion

- Groups of neurons responded differently to different picture conditions:
- Given the content of congruent pictures overlapped with the video information held in working memory for later TOJ, findings suggest that PPC neurons can engage in perceptual reality monitoring.