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Introduction

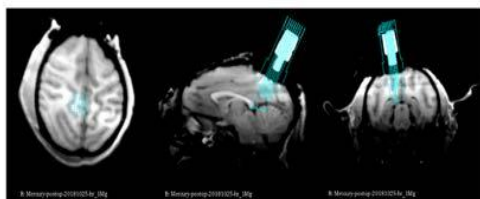
- fMRI studies in human and macaque monkeys revealed involvement of posterior parietal cortex (PPC) during temporal order memory retrieval^{1,2}.
- However, the neurophysiological evidence of PPC in temporal order memory retrieval is lacking.
- In this study, we explored the role of PPC neurons in temporal order memory judgement (TOJ).

Methodology

- **Temporal order judgement task:** In each trial, the monkey watched an 8-s video, and following 3.6-s delay or 0-s delay, the monkey judged which frame they had seen earlier to get a reward.



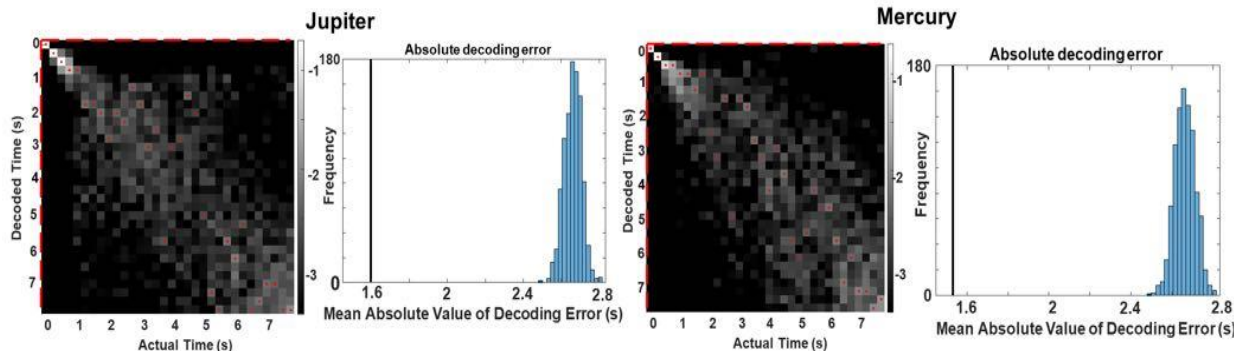
- **Electrophysiology:** We recorded extracellular activities in posterior parietal cortex (PPC) of two monkeys with 32 microelectrodes.



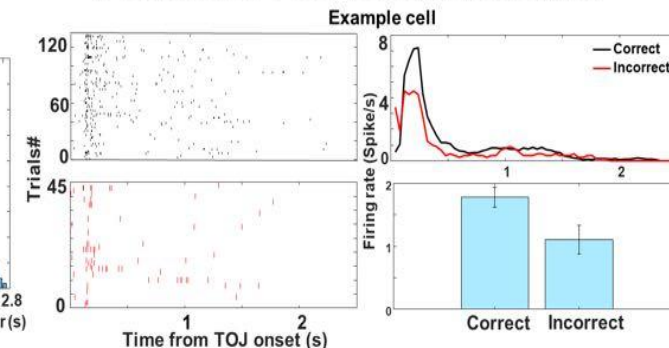
- **SPIKE-distance:** We calculated real time SPIKE-distance³ to estimate instantaneous spike train synchrony. A lower value of SPIKE-distance indicates higher synchrony.

Results

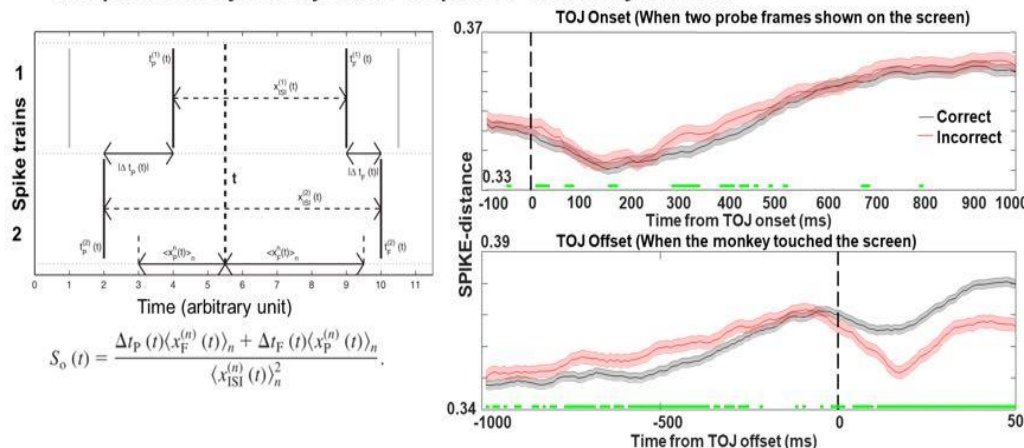
II. The population of PPC neurons encodes temporal information.



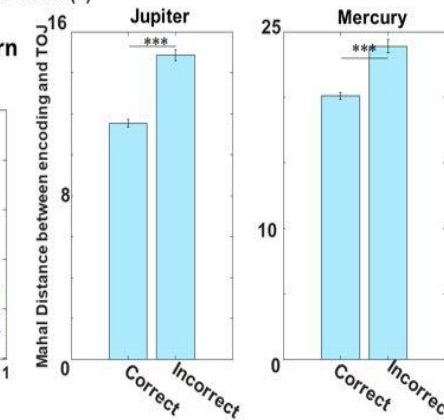
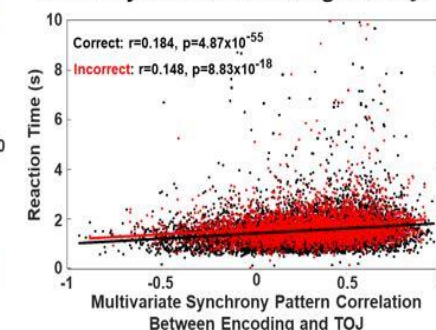
I. Neurons in PPC carry memory-related signals.



III. Spike trains synchrony tracks the process of memory retrieval.



IV. RT increase as a function of pattern similarity between encoding and TOJ.



Discussion

- At both single neuron and population level, we show evidence of involvement of PPC in temporal order memory judgement.
- For the video-watching stage, our linear discriminant analysis (LDA) decoder can reliably estimate the passage of time over the time course of a video, indicating the population of PPC carry temporal information.
- Regarding TOJ period, neurons synchrony level increase when memory retrieval is initiated, and reach the peak at around 200 ms. More interestingly, during evidence accumulation towards TOJ decision, the synchrony level differentiate response outcome.
- Furthermore, TOJ decision time increase with pattern similarity between encoding and TOJ.

References

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2. Miyamoto, K., Osada, T., Adachi, Y., Matsui, T., Kimura, H. M., & Miyashita, Y. (2013). Functional differentiation of memory retrieval network in macaque posterior parietal cortex. *Neuron*, 77(4), 787-799.
3. Kreuz, T., Chicharro, D., Houghton, C., Andrzejak, R. G., & Mormann, F. (2013). Monitoring spike train synchrony. *Journal of neurophysiology*, 109(5), 1457-1472.