Episodic Chronometry in The Macaque Medio-posterior Parietal Cortex

Leyu Huang[1], Lei Wang[1], Yunxuan Zheng[1], Kusunoki Makoto[2], Sze Chai Kwok*[1 3] (join-first)

1 Shanghai Key Laboratory of Brain Functional Genomics, Key Laboratory of Brain Functional Genomics Ministry of Education, Affiliated Mental Health Center (ECNU), School of Psychology and Cognitive Science, East China Normal University, Shanghai, 200062, China
2 Department of Experimental Psychology, University of Oxford, Oxford OX1 3UD, UK
3 Division of Natural and Applied Sciences, Duke Kunshan University, Duke Institute for Brain Sciences, Kunshan, Jiangsu, China

Introduction

- Neurons in primate **posterior parietal cortex (PPC)** were indicated to mediate event-related memory retrieval and consolidation.
- Nonhuman primate showed capacity of successful **Episodic memory retrieval** in temporal order judgement (TOJ) task with naturalized dynamic videos, but it merely gave the views on behavioral performance.
- Relevant studies demonstrated that monkeys might be able to reconstruct the temporal order of multiple events.
- **Video sequence**: the temporal order of videos watching.
- **Video interval**: the interval between two different videos defined by the temporal order.

Objectives

Investigating how PPC neurons deal with multiple events spanning across intertwined episodes.

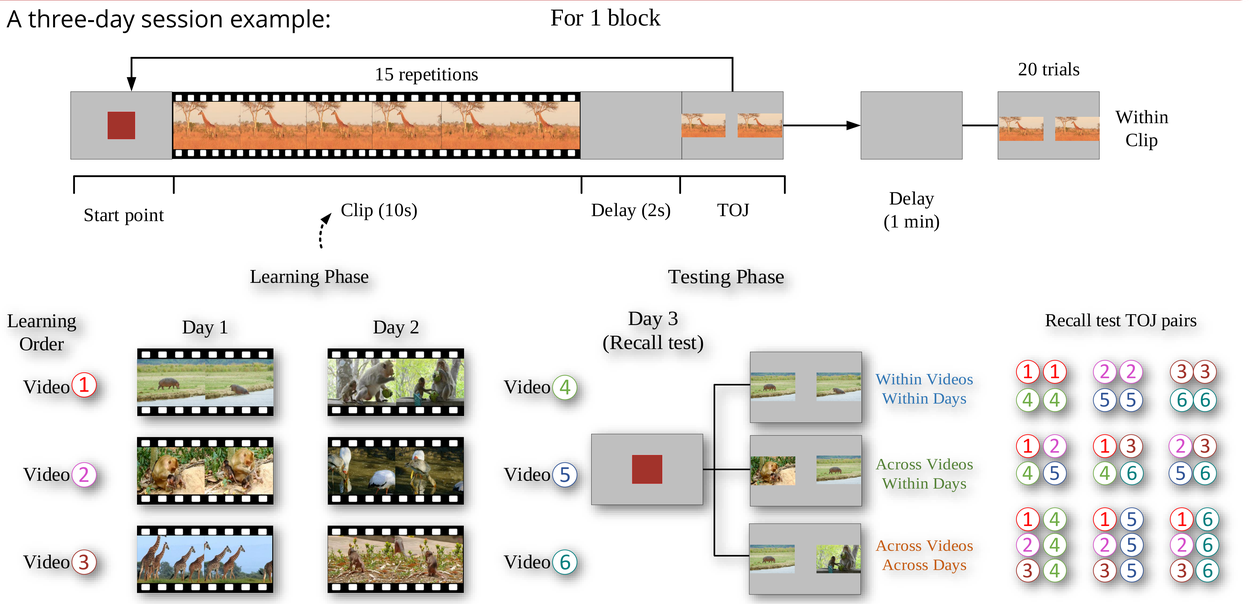
Hypotheses

- Monkeys might construct the videos into a temporal sequence with their temporal order by comparing TOJ on two different videos from different days versus from a single video.
- The PPC neurons participate differently in short- and long-term memory construction.

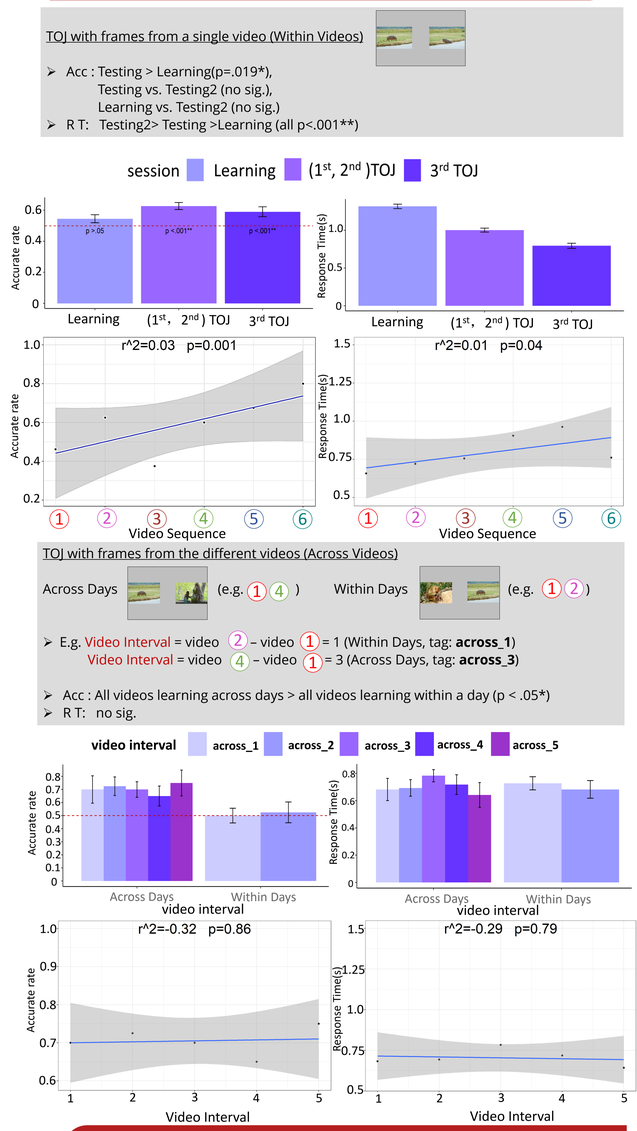
Bibliography

1. Wang L, Zuo S, Cai Y, Zhang B, Wang H, Zhou Y-d, Kwok SC* (2020) Fallacious reversal of event-order during recall reveals memory reconstruction in rhesus monkeys. Behavioural Brain Research, 394: 112830.bbr.2020.112830.
2. Zuo S, Wang L, Shin JH, Cai Y, Zhang B, Lee SW, Appiah K, Zhou Y-d, Kwok SC* (2020) Behavioral evidence for memory replay of video episodes in the macaque. eLife, 9: e54519 /eLife.54519
3. Ece, Boran, Tommaso, Fedele, Peter, & Klaver, et al. (2019). Persistent hippocampal neural firing and hippocampal-cortical coupling predict verbal working memory load. Science Advances.

Paradigm

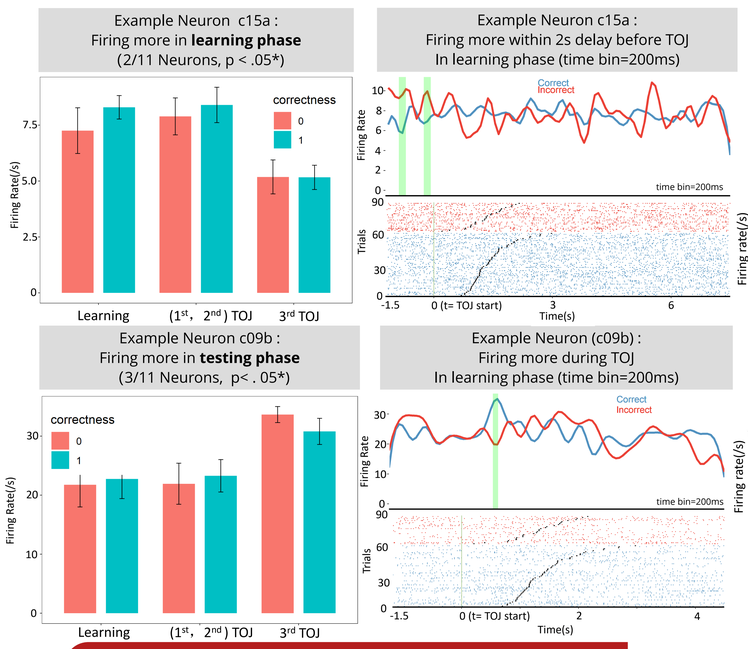


Behavioral Performance



Electrophysiological Result

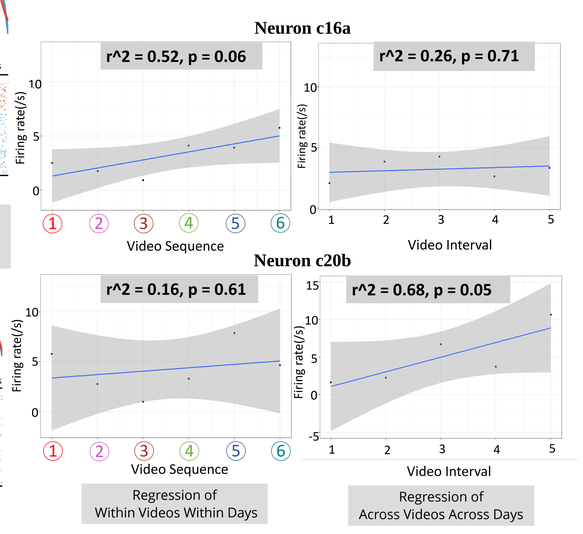
Two example Neurons in three-day sessions (0 = incorrect)



Behavior + Electrophysiology:

- 1 monkeys, 4 three-day sessions, the data of 1 session with 11 neurons recorded across days was analyzed.
- **Learning** [1st & 2nd day, TOJ after video]; **(1st, 2nd) TOJ** [1st & 2nd day, TOJ] ; **3rd TOJ** [3rd day, TOJ]

Two example Neurons in 3rd Day TOJ



E.g. Video Interval = video 6 – video 1 = 5

Conclusion

- Monkeys are capable of forming an order of multiple-events sequence in a long-time scale, but some information about details in time might be lost.
- There might be two exclusive subsets of PPC neurons take responsibility for episodic memory at different time scales – especially activate for only the learning phase or testing phase.

Contact

leyuh98@gmail.com, sk695@duke.edu
@Huang_Letitia, @Kwokszechai
Contact us via www.kwoklab.org or scan the QR code

KwokLab