

Abstract

Decisions must sometimes be maintained in short-term memory before their execution, a period during which they are presumably prepared but can also undergo alterations. Previous studies in rodents point to the Anterolateral Motor cortex (ALM) as a critical area in delayed-response tasks with neural recordings showing selective encoding of the upcoming decision and local photo-inhibition introducing choice biases. Aiming to better understand the neural mechanisms underlying decision maintenance in short-term memory, we developed a novel multi-choice delayed response task (nDRT) in mice. Animals were trained to look at a visual stimulus displayed on a touchscreen at three possible locations, maintain its position during a short mnemonic delay, and execute a response by touching the remembered position.

We found that animals' errors increased as a function of delay duration showing that mice made maintenance errors. Forgetting rates were choice-specific, suggesting that memory stability is not homogenous across possible responses but subjects exhibit idiosyncratic preferences. Responses in memory trials were also biased by subjects' tendency to repeat the previous choice. Systemic NMDA receptor blockade increased previous choice repetitions and locomotion without affecting memory stability, but local blockade of NMDAR in ALM had, in contrast, no impact on task performance. Finally, we used a c-fos-driven tagging method (*TRAP2* mouse) for the permanent expression of channelrhodopsin in ALM ensembles. To provide choice specificity to the tagged neurons, only one choice was presented during the labeling session. Preliminary results indicate that tonic 20 Hz photo-stimulation during the mnemonic period did not cause a bias towards the labeled choice or impact the response accuracy, but it slightly decreased the probability of response omissions (i.e. yielded fewer trials with no response). Together, our results provide key constraints to the neural circuit mechanisms underlying short-term memory maintenance.