

discrimination in some spatially differential delay neurons when a more preferable outcome could be expected. Thus, reward-expectancy appears to enhance WM activity in LPFC neurons. However, omission-expectancy activity is not thought to be involved in supporting correct task performance. Indeed, spatial-WM neurons were more likely to be associated with reward-expectancy than with omission-expectancy, and only the minority of the omission-expectancy neurons showed spatial-WM activity. Furthermore, it is interesting to note that those neurons that did not show delay-period activity during the spatial-memory task also failed to show reward-expectancy activity during the outcome-expectancy task.

Ablation of the monkey LPFC invariably induces severe impairments in the learning and performance of WM tasks, including delayed response and delayed alternation, although there is no impairment if there is no delay in these tasks (Mishkin 1957; Gross and Weiskrantz 1962; Goldman et al. 1971). It has been proposed that delay activity supports WM task performance by “bridging temporal separations between mutually contingent events such as between the cue and motor response (cross-temporal contingency)” (Fuster 1997). During the outcome-expectancy and spatial-memory tasks in the present experiment, several different types of delay-period activity were observed that could bridge the temporal separation between the cue and response, and the LPFC delay activity was not concerned exclusively with retaining task-relevant cognitive information in WM. In fact, some delay neurons were concerned predominantly with reward-expectancy and/or omission-expectancy. These might be involved in attention control during WM task performance. Importantly, we also found many delay neurons that had both spatial-WM and reward/omission-expectancy activities. Employing a more preferred reward induced better task performance in the monkey, as well as enhanced spatial-WM activity in many LPFC delay neurons. This suggests that the LPFC might play a principal role in the integration of cognitive and motivational operations, allowing the monkey to obtain a reward more efficiently.

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