# Fine-Scale and Dynamic Spatial Clustering of Local Field Potentials in the Macaque Lateral Prefrontal Cortex during Sequential Shape Manipulation Planning*

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**Abstract**

Local field potentials (LFPs) play a crucial role in the dynamics of functional connectivity across brain areas, yet the spatial range of their signals—whether spanning millimeters or confined to sub-millimeter scales—remains debated. In particular, the spatial resolution at which LFPs encode functional information in the prefrontal cortex, which integrates abstract cognitive processes, is unclear. To address this issue, we recorded LFPs from the lateral prefrontal cortex (lPFC) of macaque monkeys performing a shape-manipulation task requiring sequential actions based on visual recognition. We extracted task-dependent time–frequency modulations using stepwise multiple regression and assessed functional similarity across recording sites using non-negative matrix factorization (NMF) and k-means clustering. We found that the spatial distribution of LFP-based functional clusters changed dynamically over the course of the task. Moreover, individual recording sites exhibited distinct functional properties, and similarity between sites showed no significant dependence on physical distance. These findings suggest that LFPs reflect functionally differentiated information at a fine spatial scale of less than 1 mm within the prefrontal cortex.

**Keywords:**

Macaque monkey, Local field potentials, Lateral prefrontal cortex, Shape manipulation task, Spatial resolution

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