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| Adaptive Coding of Task Relevant Attributes in the Prefrontal Cortex**Panagiotis Sapountzis** 1,#,\***, Sofia Paneri** 1,2**, Sotirios Papadopoulos** 2,3**, Georgia G. Gregoriou** 1,21 Institute of Applied and Computational Mathematics, Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece2 University of Crete, Faculty of Medicine, Heraklion, Greece3 Lyon Neuroscience Research Center, Lyon, France#,\* Presenting/Coresponding author: Panagiotis Sapountzis, email:pasapoyn@iacm.forth.gr |

abstract

Despite the indisputable role of the prefrontal cortex (PFC) in the encoding of task relevant information, it remains unclear how stimulus attributes are encoded across different PFC regions. The prevailing view postulates that PFC neurons are not inherently feature selective, but rather represent task relevant parameters in an adaptive way according to behavioral demands. The degree to which this adaptive processing is constrained by anatomy, however, remains unknown. Moreover, the temporal dynamics of the neural population code during the encoding and maintenance of spatial and non-spatial features have yet to be explored.

To examine how population activity patterns in distinct PFC regions encode task relevant attributes, we performed simultaneous extracellular recordings in two prefrontal areas, the frontal eye field (FEF) and the ventrolateral PFC (vlPFC) in a cued attention task with either a spatial or a color cue.

We employed multivariate pattern-classification and manifold optimization approaches, to assess whether encoding of color and spatial information differs within the same and across PFC regions during cue presentation and maintenance of cue information in working memory and to identify patterns and population-level representations of neuronal activity.

We found that neural ensembles in PFC encode and retain information about the location and the color of a future target in an anatomically specific manner. Specifically, spatial information was decoded from both FEF and vlPFC but with higher accuracy from the FEF population, whereas color information was decoded robustly only from vlPFC during the stimulus presentation and delay periods. Moreover, the population code for color identity was highly dynamic during the delay period in vlPFC whereas the code for location was relatively stable. These results suggest that adaptive coding in PFC is shaped by functional selectivity and can be implemented by different mechanisms and population-level representations for different features even within the same area.

**Acknowledgments**

Work was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the “1st Call for H.F.R.I. Research Projects to support Faculty Members & Researchers” (Project Number: 41).