Single Neuronal Correlates of Subjective Opinion in the Human Prefrontal Cortex

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Introduction

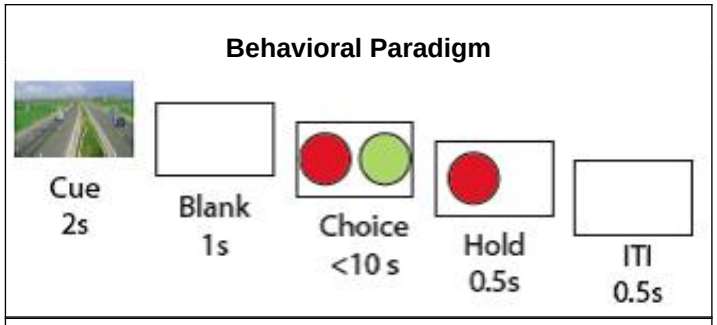
Subjective opinions play a prominent role in human behavior - from how we vote in democratic elections to whether we agree with a particular argument. While opinions may be grounded in fact (e.g., the person took the money), they are innately subjective judgements about the world (e.g., the person had the right to take the money) and therefore, are neither explicitly true nor false. Prior imaging studies in humans have shown the importance of frontal cortical areas in decision making. Our ability to study their single cellular or population level bases in humans, however, has remained a significant challenged. Particularly within prefrontal cortical areas which has been traditionally inaccessible to direct neuronal recording techniques. These limitations have been especially relevant to implicit cognitive processes such as subjective opinion, which are not easily amenable to study in animals. Thus, the single-neuronal computations and precise causal underpinnings by which subjective opinions are made by humans about the world remains unclear.

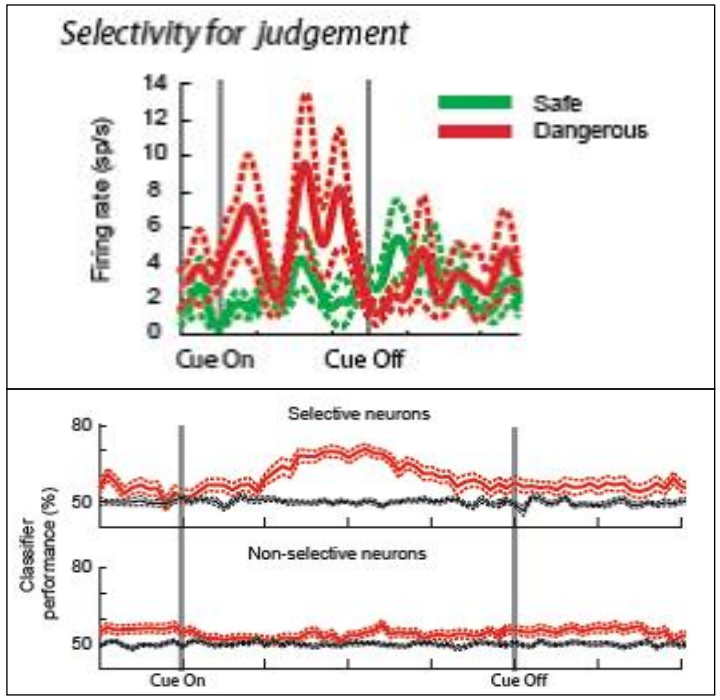
Methods

Eight human subjects undergoing DBS surgery gave informed consent to participate in our study. Using microelectrodes, we isolated single units in the dorsolateral prefrontal cortex (DLPFC) along the trajectory of the clinical target. Patients then completed a subjective opinion task, where they are presented with visual stimuli of seven different real-world scenes with varying levels of danger and asked to judge whether the scene is safe or dangerous. The spiking activity of DLPFC neurons were collected and single units were then spike-sorted and analyzed offline.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Discuss ways in which the DLPFC participates in decision-making, 2) Identify neuronal responses in the DLPFC to subjective valuations of danger





Conclusions

Here, we identify a novel group of neurons in the human DLPFC that closely followed the subjective opinions held by the participants on individual scenes. We specifically observed heterogeneous computations in different neuronal ensembles in DLPFC that reflected both, the boundary between different judgements and the judgement itself. Furthermore, we confirmed these findings by decoding the neuronal signals as they relate to these variables. These findings highlight the neuronal basis for decision making in situations where learning is not possible and provide new insight into how to treat individuals with higher cognitive disorders.