



Imbalanced Cortical Dynamics: How Dominant Top-Down Signals from the PPC Can Drive Phantom Sensory Percepts.

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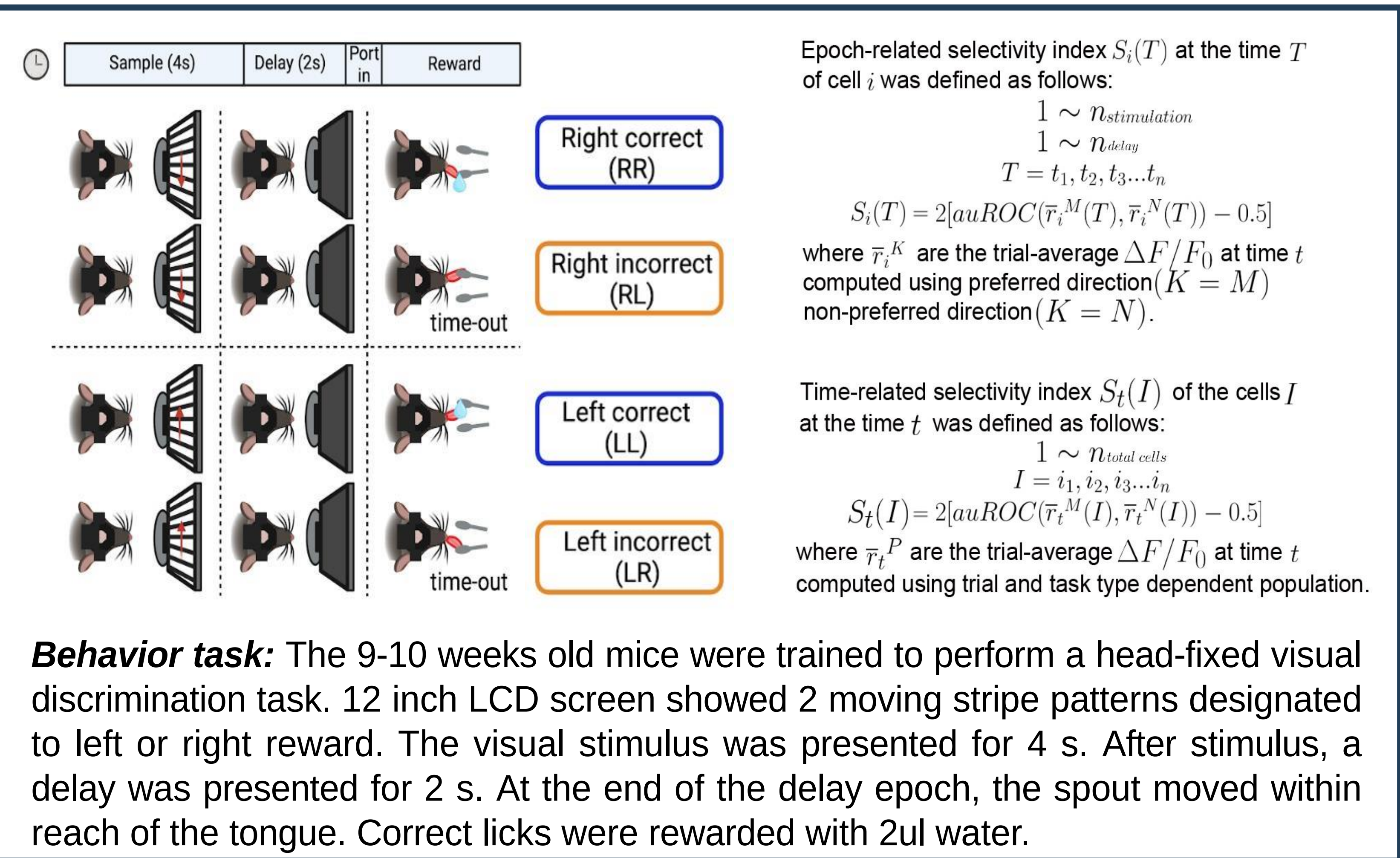
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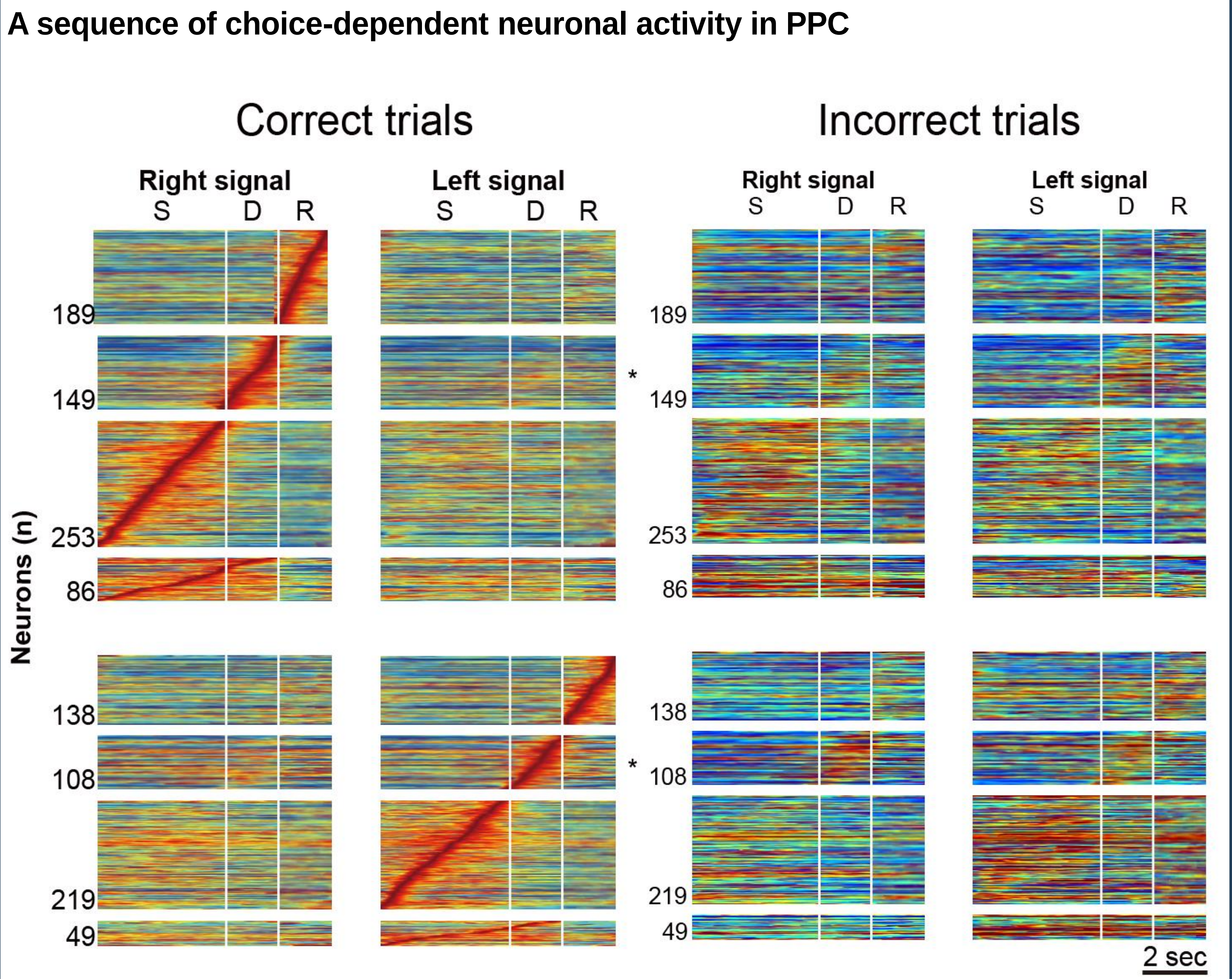
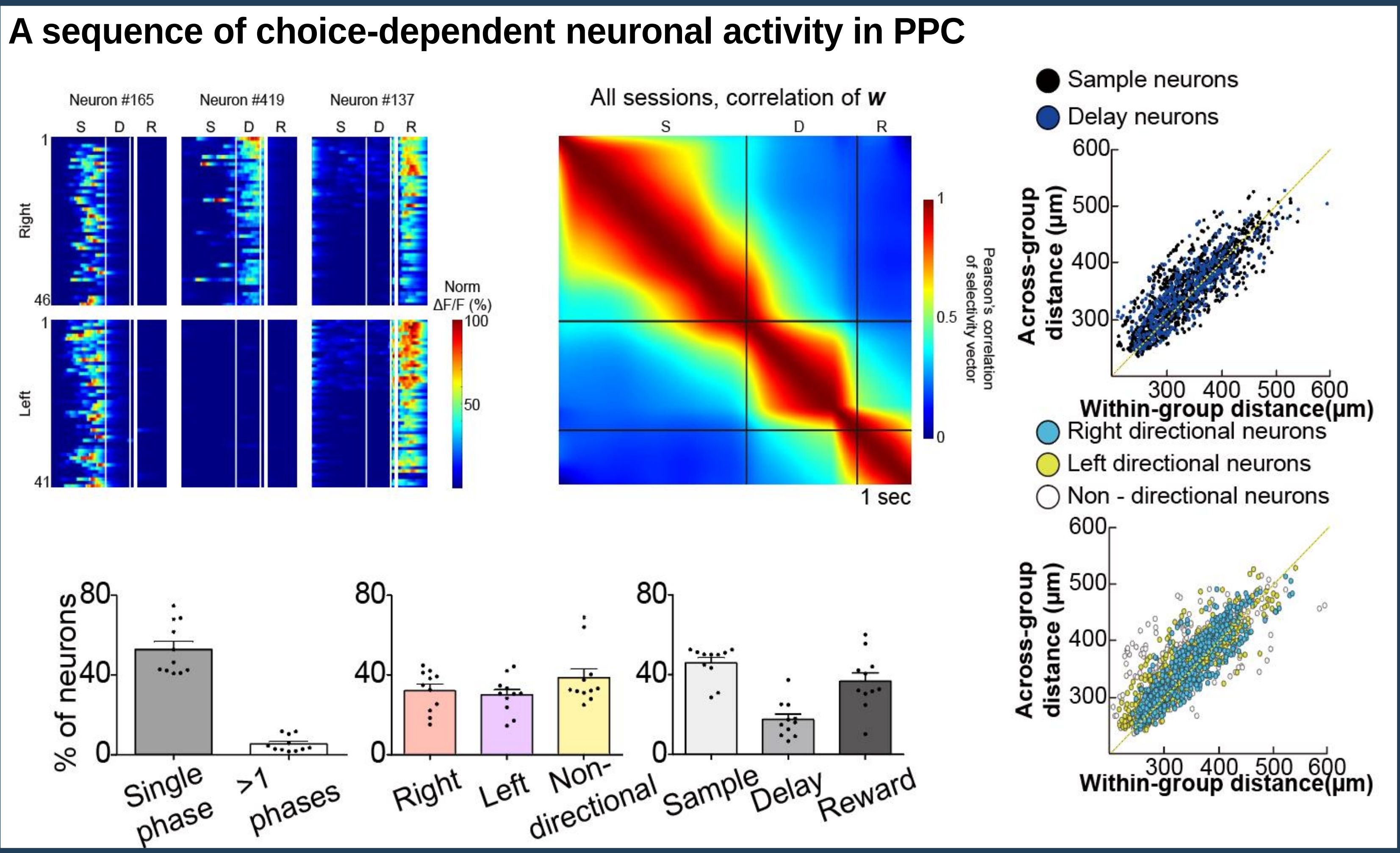
ABSTRACT

Normal perception relies on a delicate balance between bottom-up processing of external sensory stimuli and top-down modulation based on internal predictions and context. We hypothesize that a profound imbalance in this dynamic—specifically, when top-down signals overwhelmingly dominate weak or ambiguous bottom-up input—can lead to the generation of internally-driven, stimulus-independent percepts. The posterior parietal cortex (PPC) is a critical hub for formulating and transmitting such top-down, context-dependent signals. This study investigates how pathologically amplified top-down signals originating from the PPC can be propagated to primary sensory cortices, effectively overriding external reality and creating a neural basis for phantom perception. Using a mouse model, we employ a behavioral task that allows us to experimentally manipulate the top-down relevance of a physically identical bottom-up stimulus. By analyzing Local Field Potential (LFP) data and utilizing two-photon calcium imaging, we will compare neural dynamics across the PPC and a downstream sensory cortex under two conditions: one where the bottom-up stimulus is contextually meaningless, and another where it is imbued with significant top-down relevance. Our preliminary LFP analysis demonstrates that the assignment of top-down meaning generates a potent and distinct neural signature within the PPC. We predict that cellular-level imaging will reveal a specific PPC neuronal ensemble that orchestrates this top-down signal. Our central hypothesis is that the activity of this ensemble is transmitted to the sensory cortex, imposing a top-down interpretation onto its local circuits. In a disease model prone to perceptual distortions, we expect this PPC-driven top-down transmission to be abnormally strong and decoupled from sensory input, capable of driving sensory cortex activity even in the absence of a bottom-up stimulus. This would provide a direct circuit-level correlate for an internally generated sensory event. Ultimately, this research aims to delineate how an imbalance between cortical processing streams can lead to aberrant perception, identifying a potential mechanism for how the brain can generate its own sensory reality.

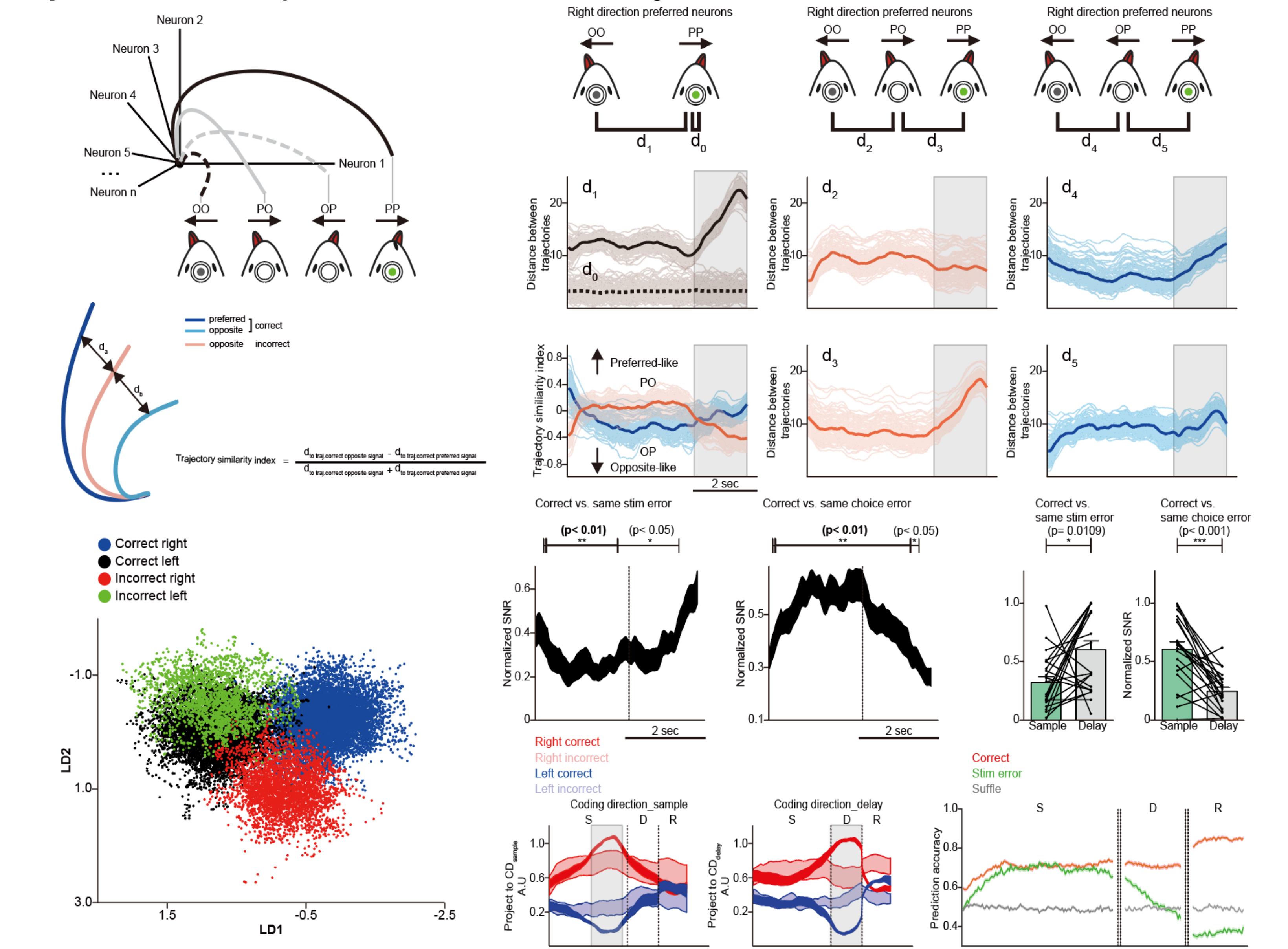
METHOD



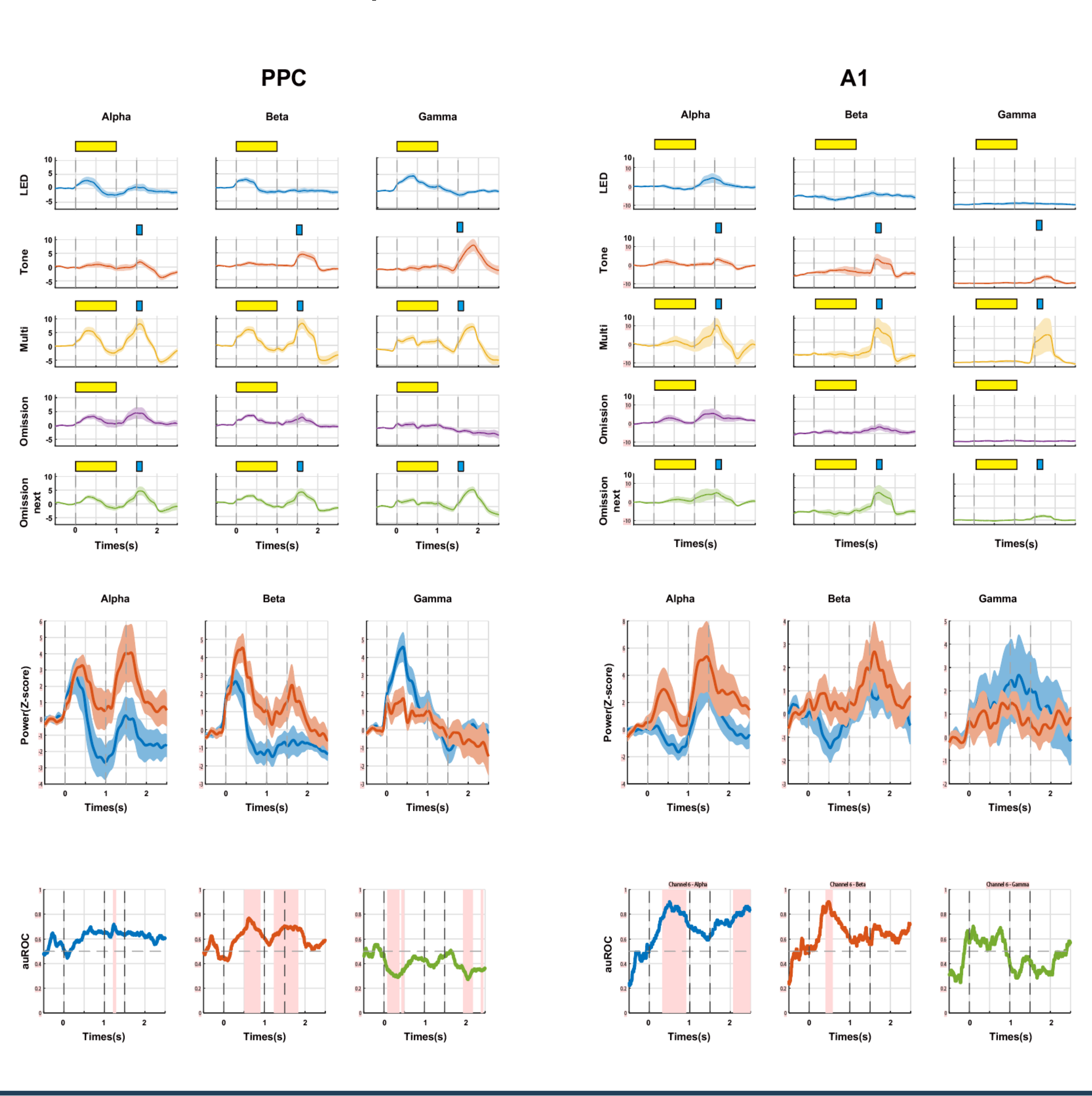
RESULT



Population activity of PPC neurons during the task



PPC-Driven Phantom Percepts



CONCLUSION

We developed a new GLM - based model for sorting neurons that showed significant activities in decision-making behavior. Mis-assigned activities of stimulation- or delay- phase specific directional neurons are observed during erroneous decision-making

ACKNOWLEDGEMENT

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