Mapping the Temporal Dynamics of Visual Perception: A Novel Framework Using White Noise Optogenetics and Bayesian Inference

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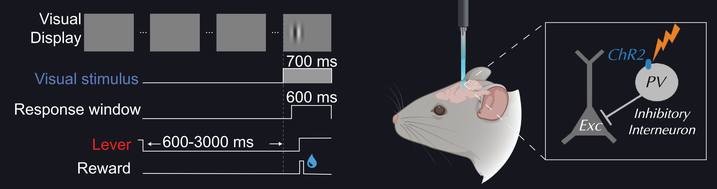
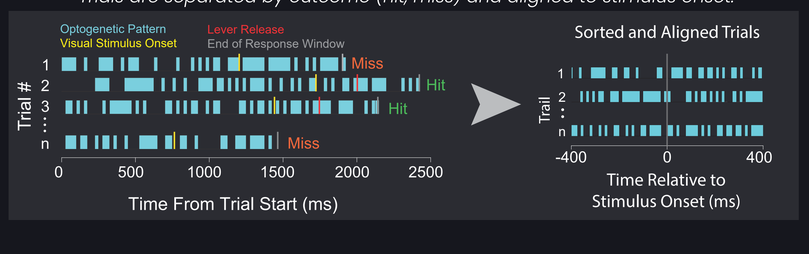
White noise optogenetics was used to perturb visual processing while miced performed a challenging visual detecion task near their perceptual thresholds. Using a probabilistic Bayesian framework we were able to quantify, on a millisecond timescale, how transient disruptions in visual cortex and superior colliculus activity drive changes in visual detection performance.

INTRODUCTION & METHODS

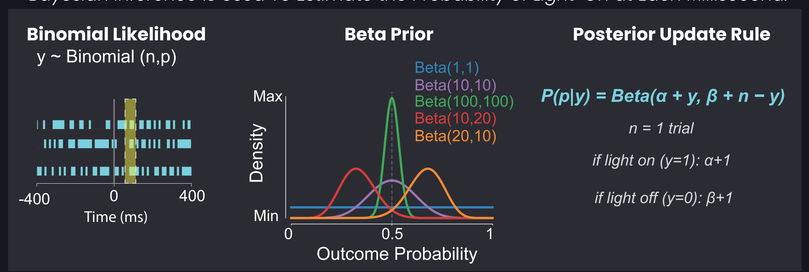
Binary white-noise optogenetic pulse trains (25 Hz) were delivered to mouse primary visual cortex (V1) or Superior Colliculus (SC) during a visual detection task.

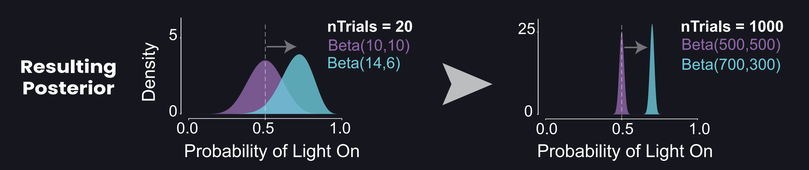


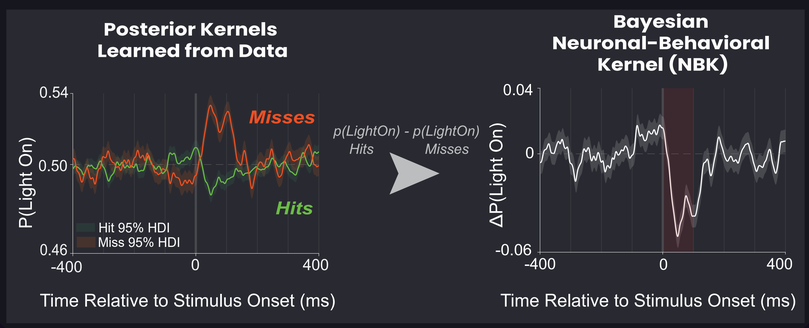
Trials are separated by outcome (hit, miss) and aligned to stimulus onset.



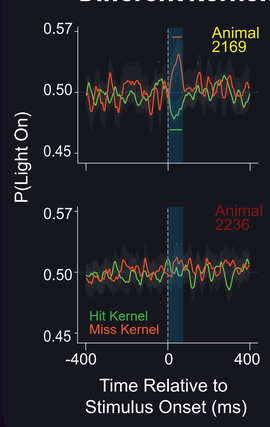
Bayesian Inference is Used To Estimate the Probability of Light-On at Each Millisecond.

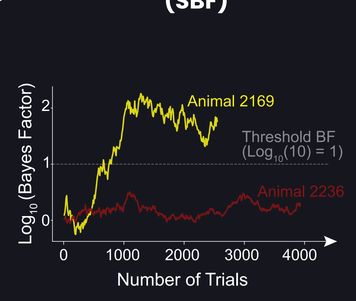




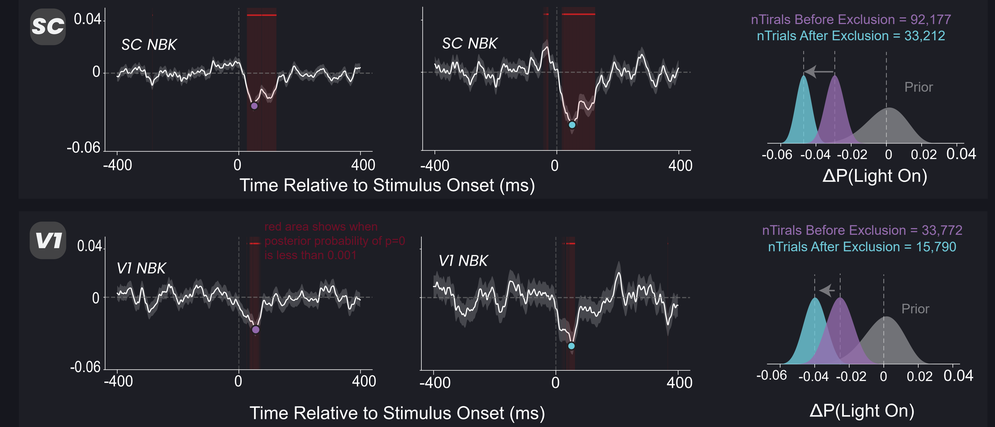


RESULTS: Bayesian Inclusion Criteria Amplify Optogenetic Perturbation Effects in SC and V1

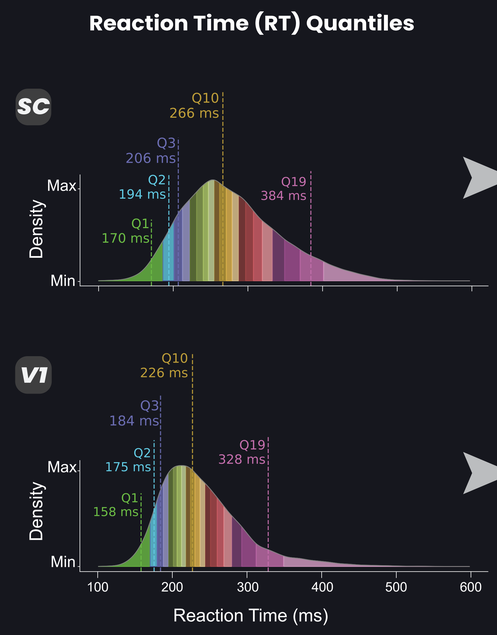


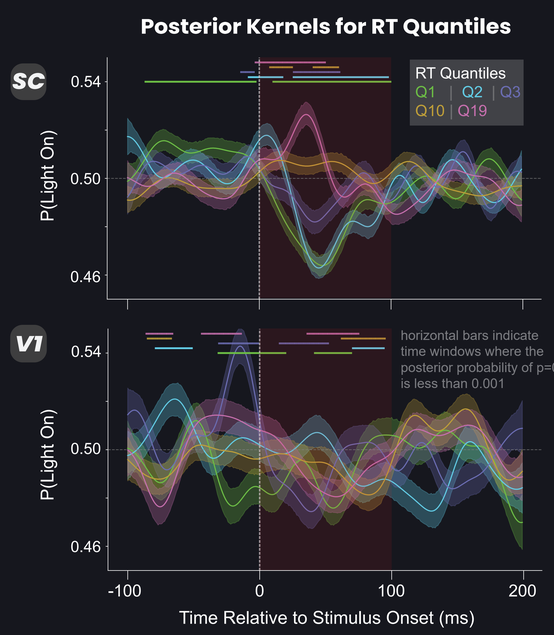


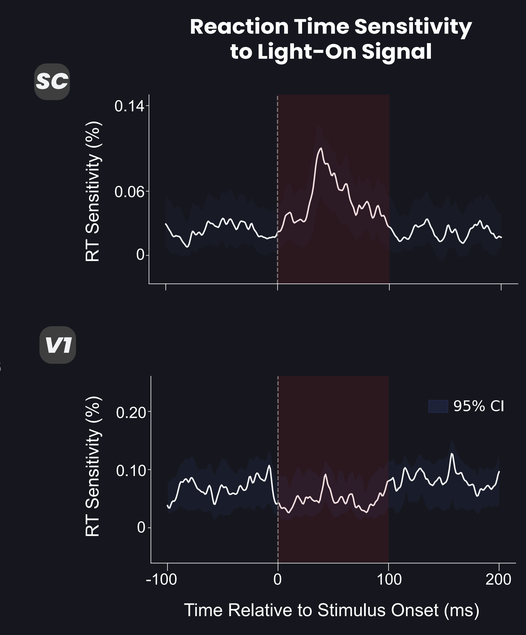
Inclusion Critiria:
Only animals with a Bayes factor above threshold were included.



RESULTS: Optogenetic Stimulation of SC But Not V1 Systematically Impacts Reaction Time







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