Cortical efficient coding dynamics shape behavioral performance.

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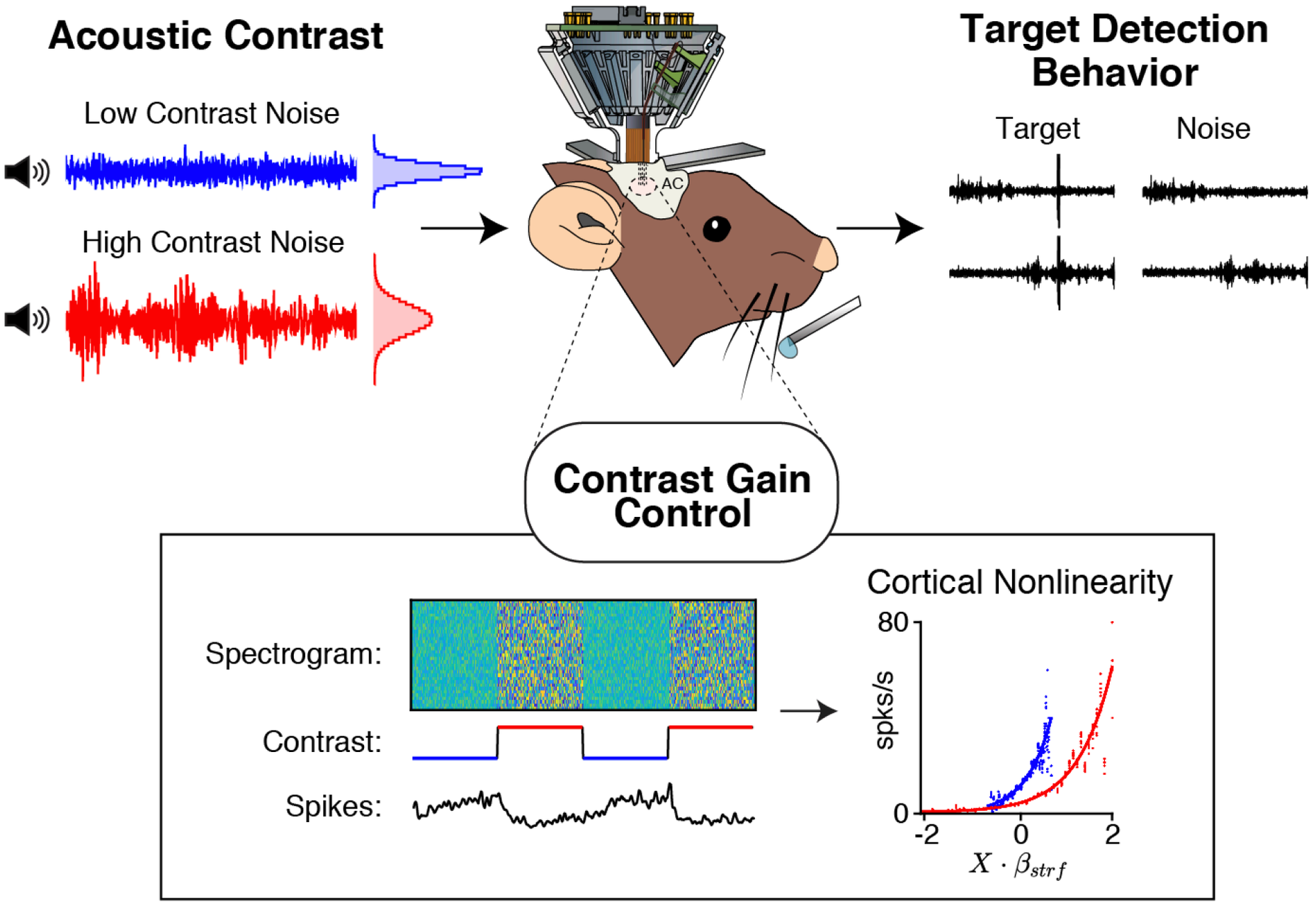
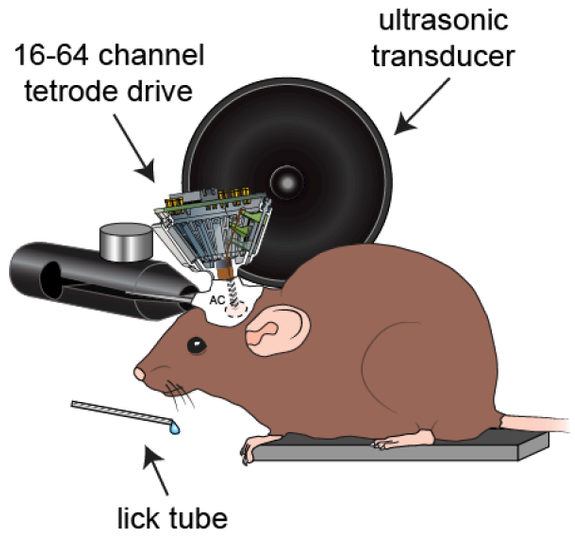
Check out the preprint: https://www.biorxiv.org/content/10.1101/2021.08.11.455845v1

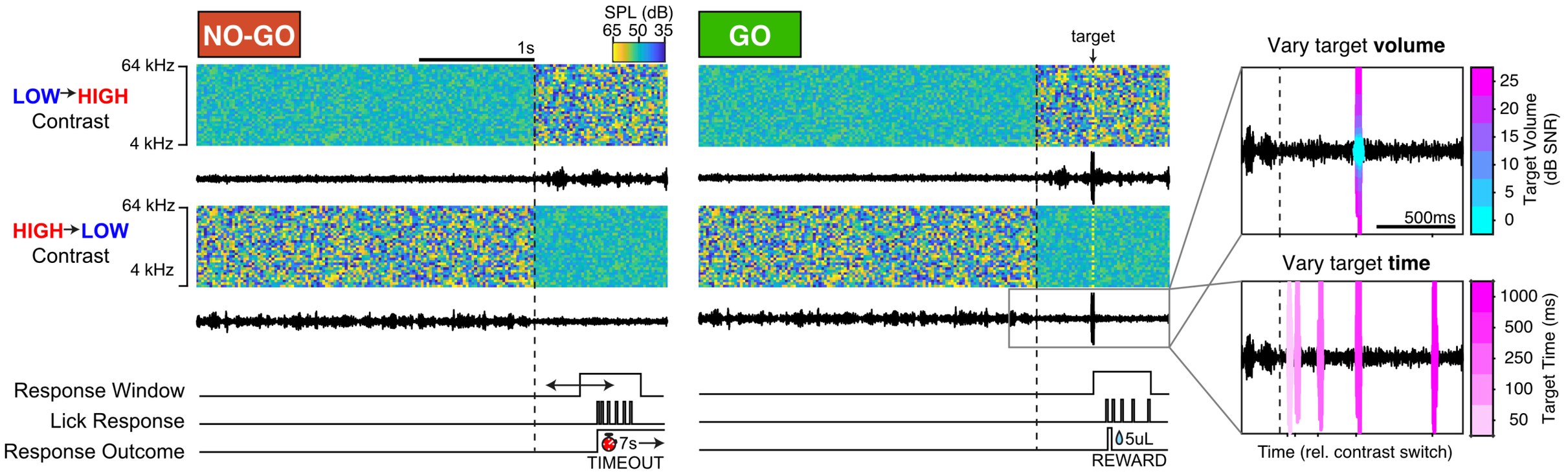
Efficient coding of contrast through gain control



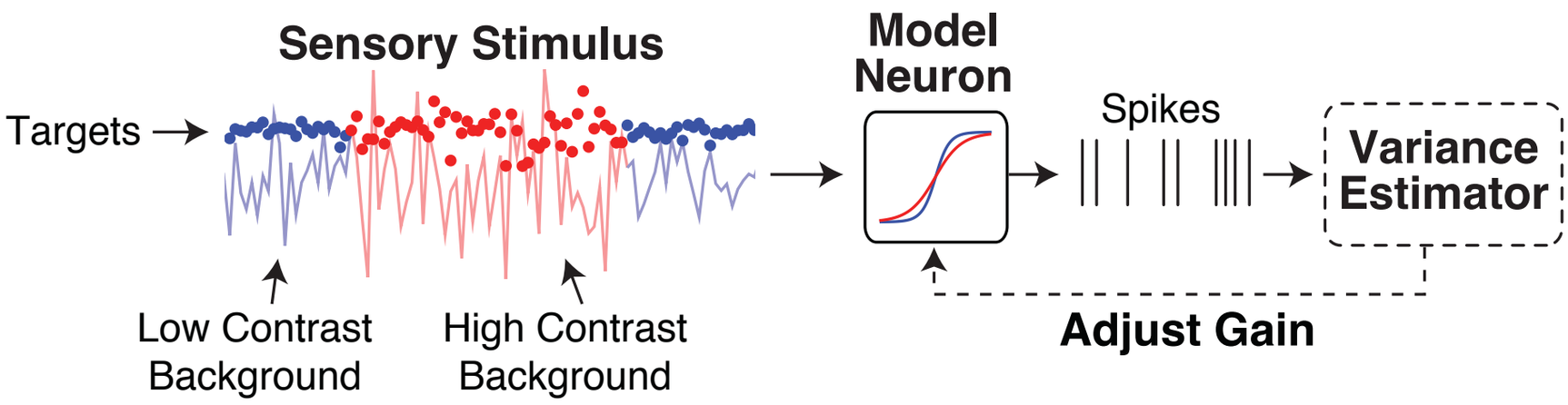
Question: How does contrast gain control affect perception of sounds?

Go-NoGo target-in-background task

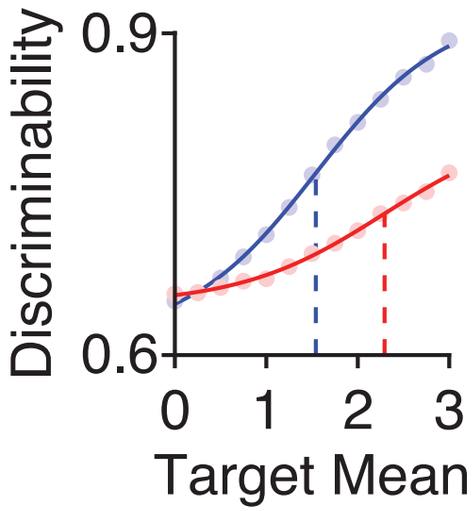




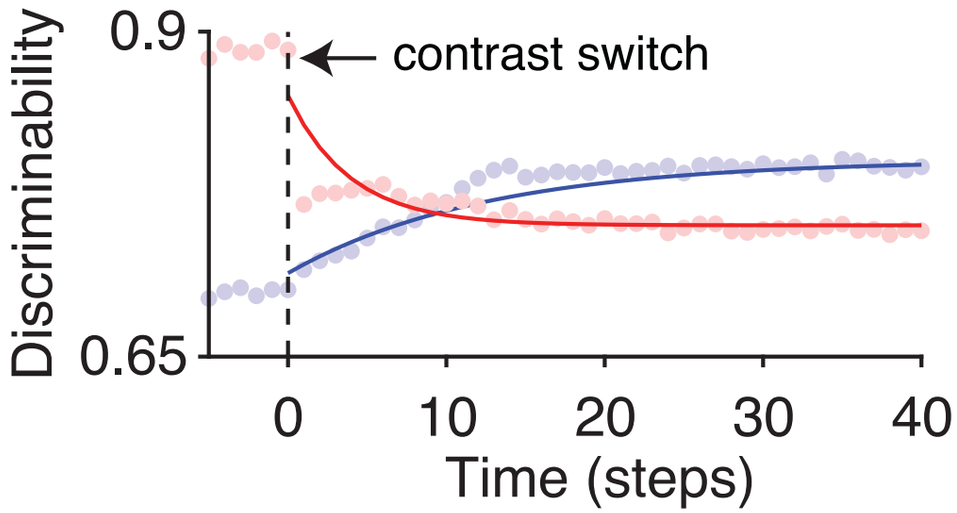
Normative model of efficient gain control for predicting task performance



Task Prediction 1:
changes in threshold/slope

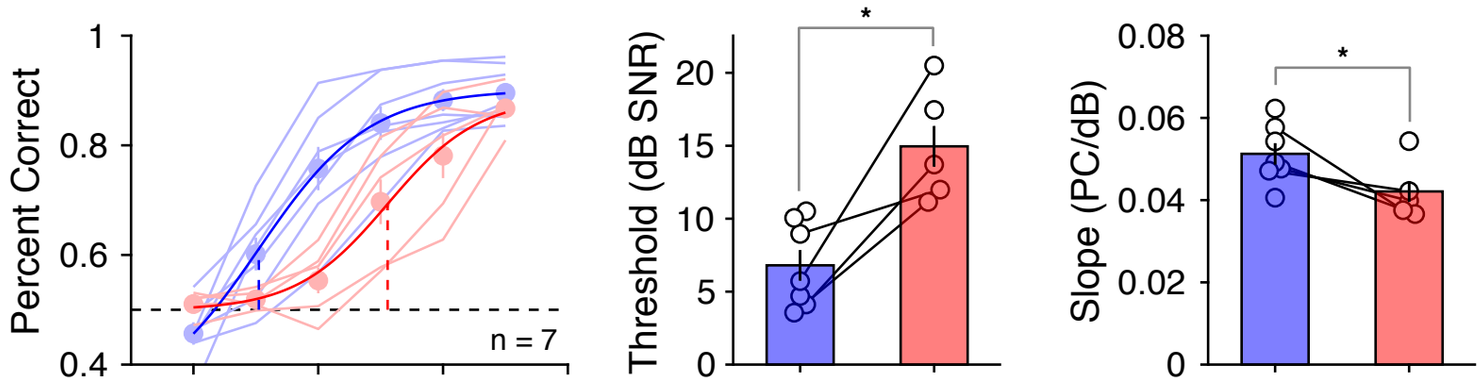


Task Prediction 2:
asymmetric adaptation

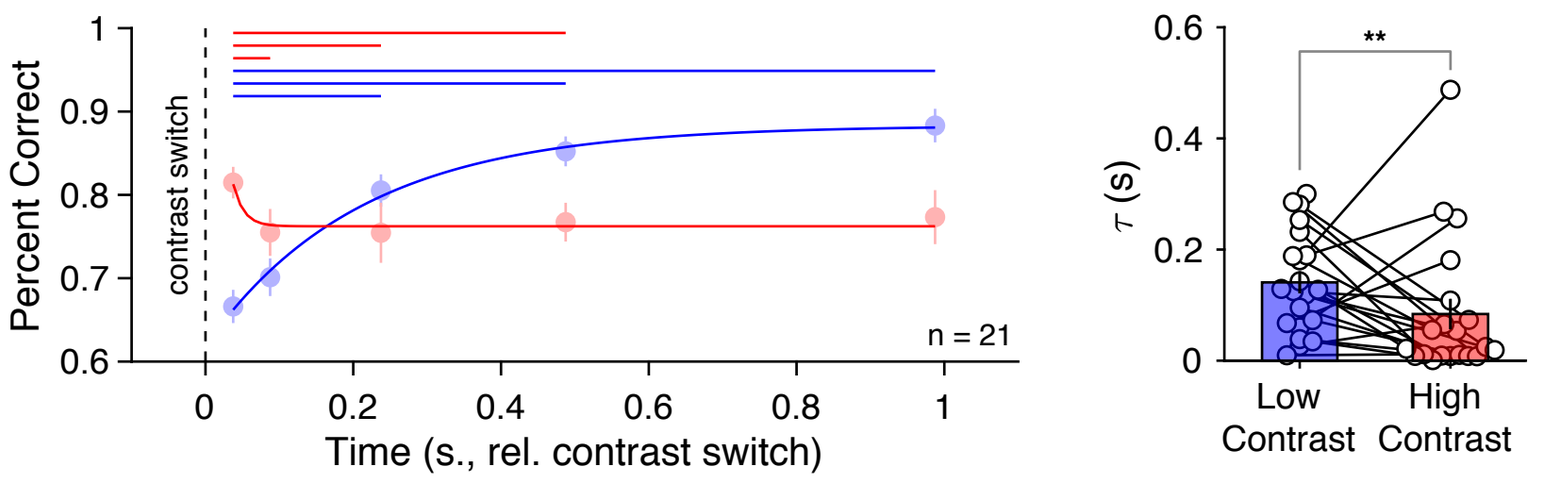


Behavioral performance is consistent with the model predictions.

Prediction 1: sensitivity is lower and thresholds are higher in high contrast

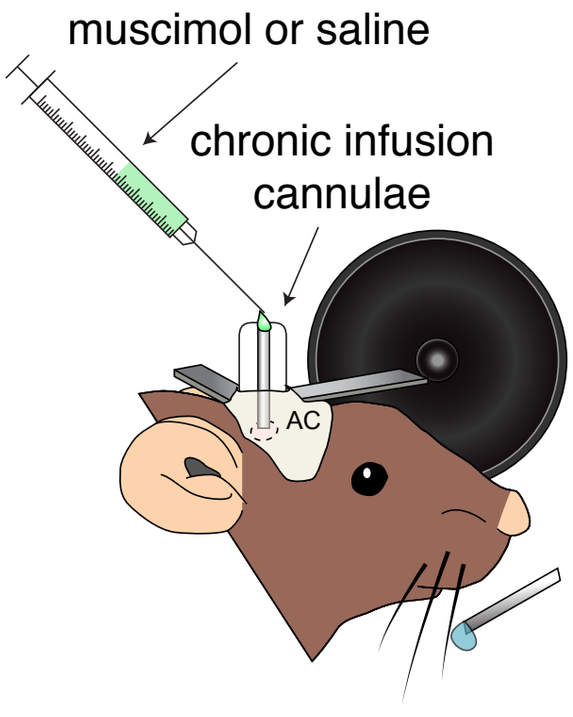


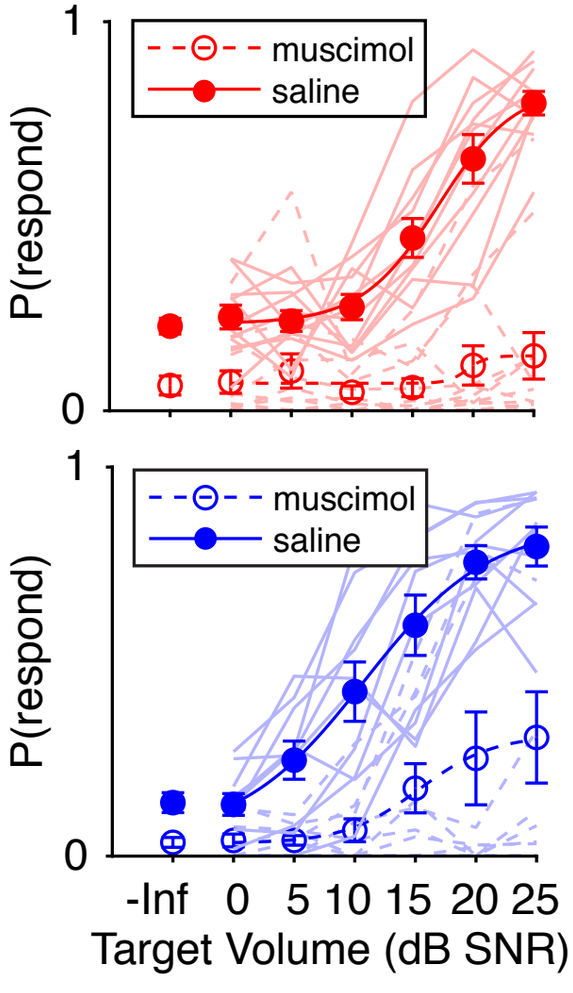
Prediction 2: adaptation is asymmetric and faster in high contrast



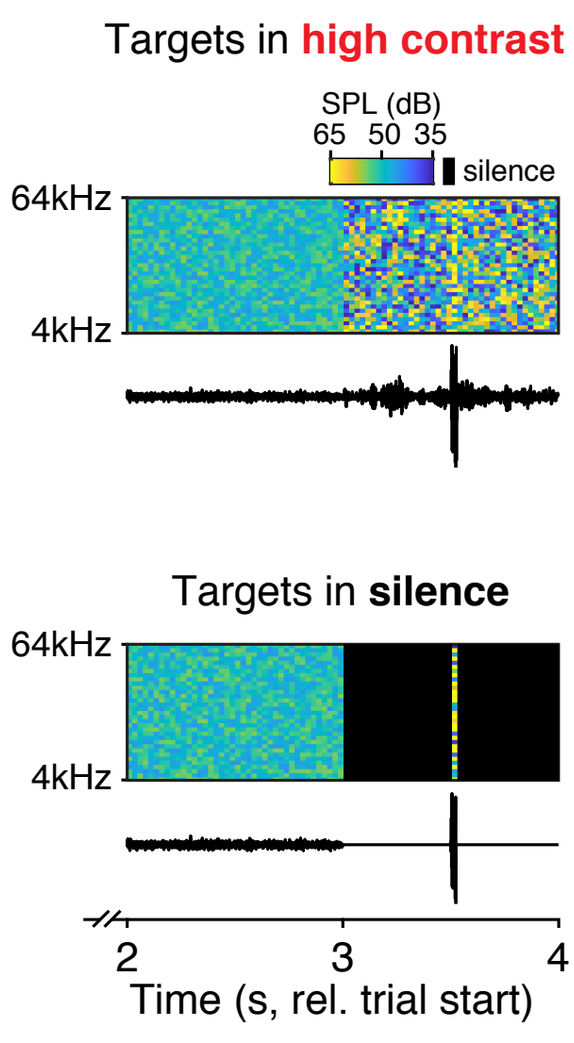
Auditory cortex is necessary for task performance in a noise background

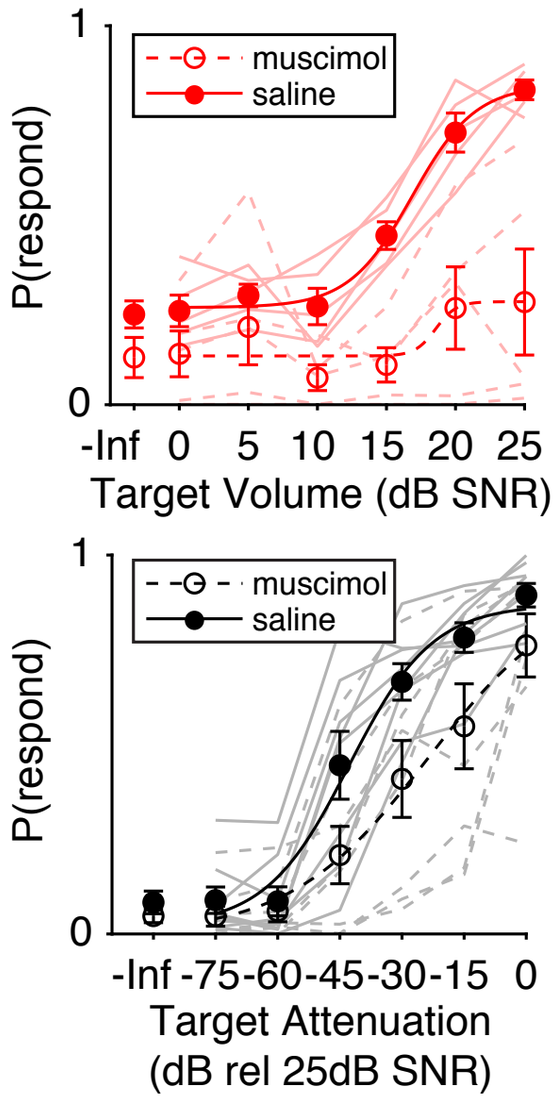
Muscimol affects performance in low and high contrast





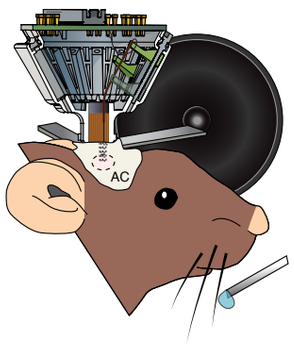
… but does not have a large effect in silence

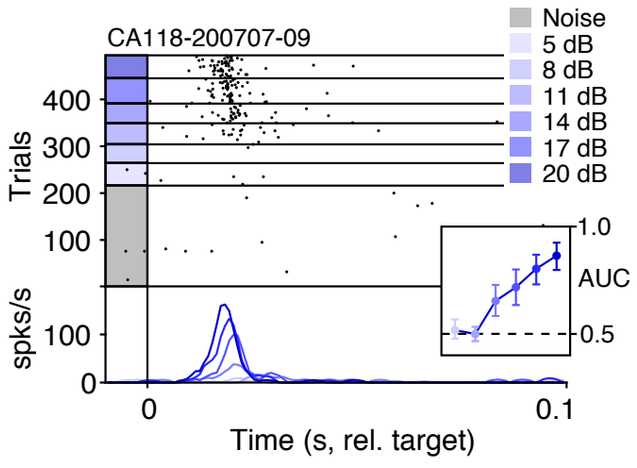


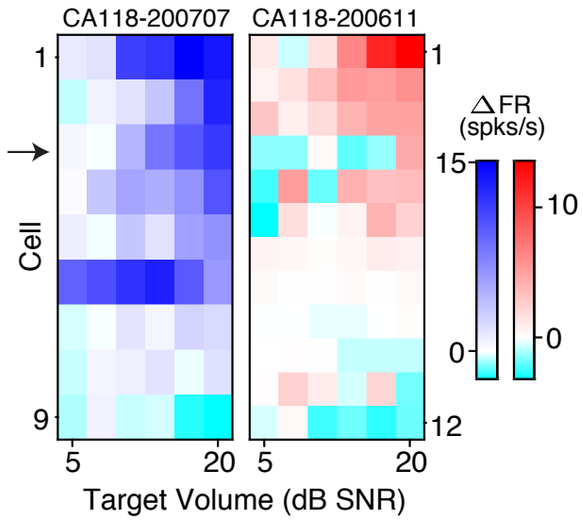


Population-based decoding of target vs. noise predicted behavioral performance

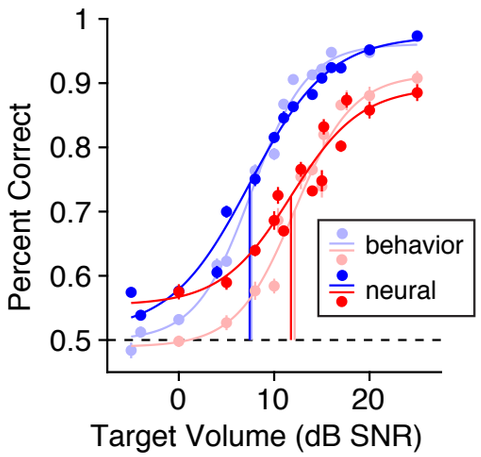
Population recordings in AC predicted individual variability in behavior



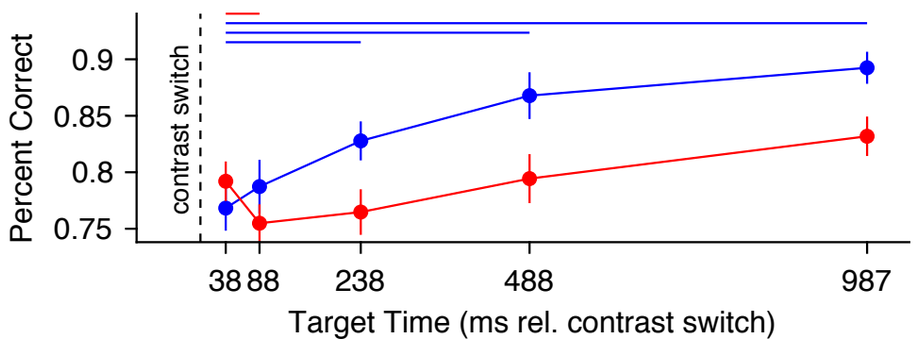


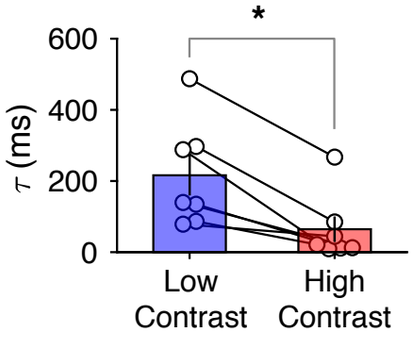


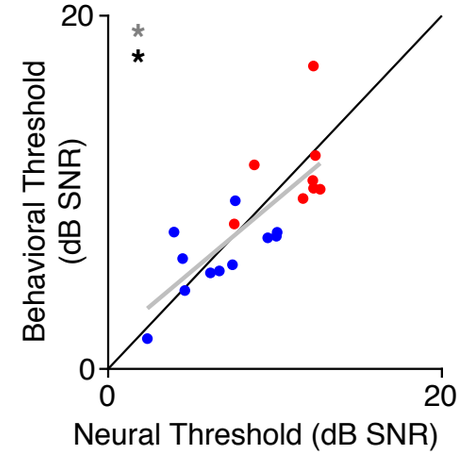
decoder

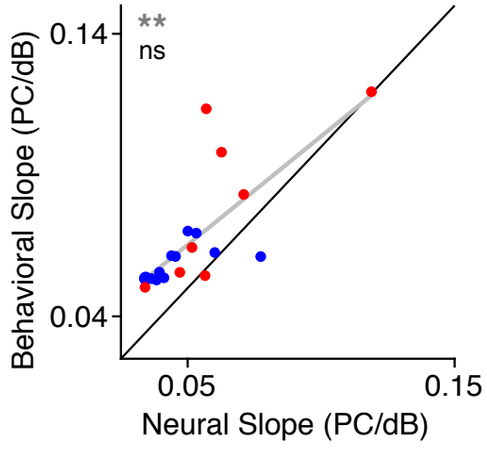


Population encoding of targets adapted asymmetrically, as observed in behavior



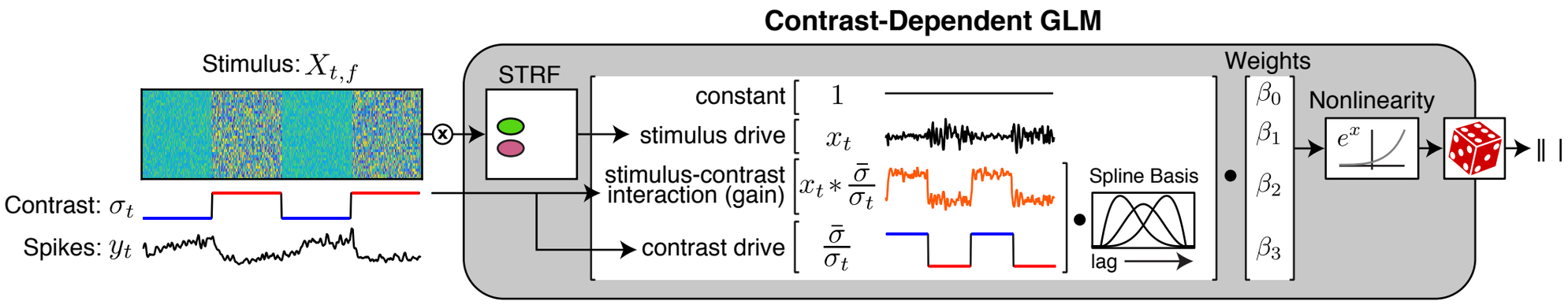




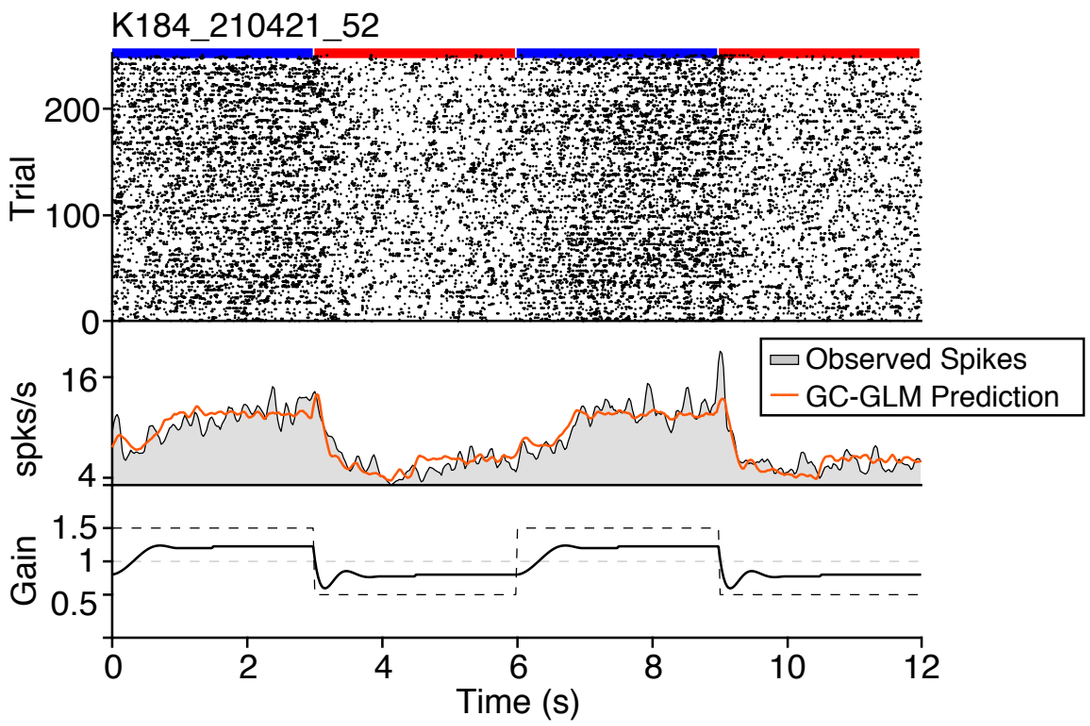


Cortical gain adapts asymmetrically.

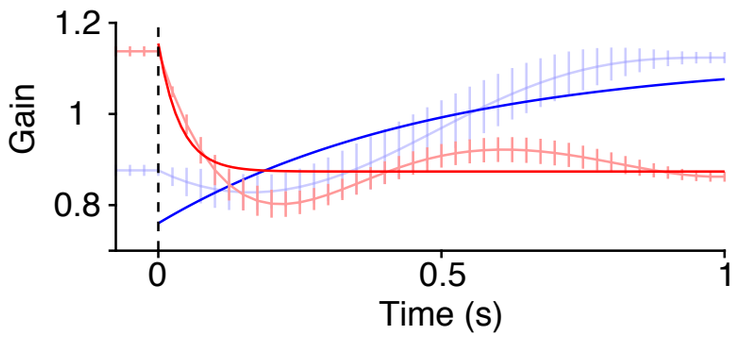
GLM for estimating gain control dynamics (GC-GLM)

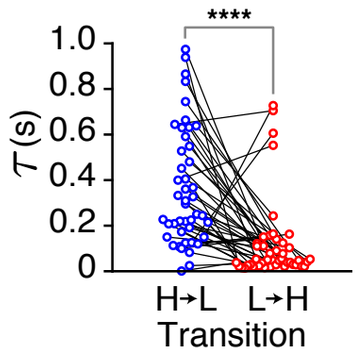


Model fit to a single neuron



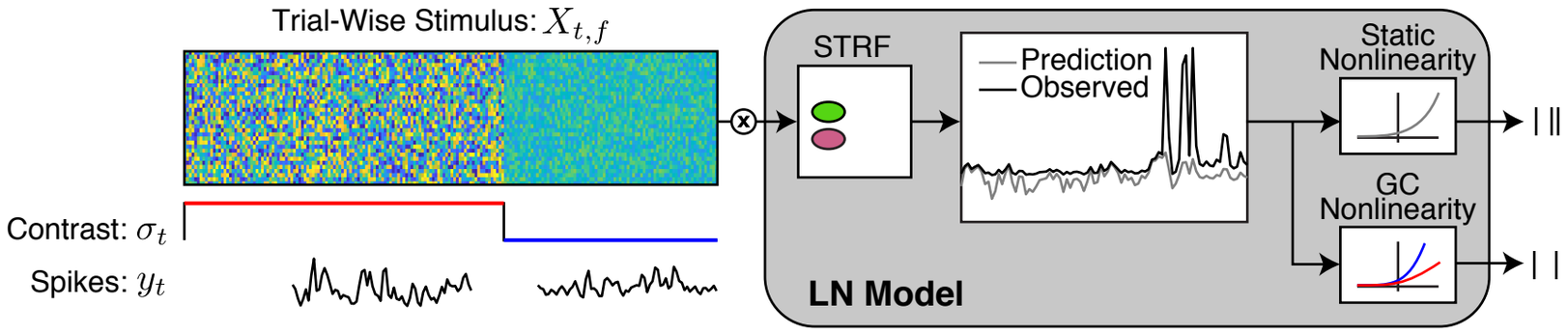
Estimated cortical gain control was asymmetric



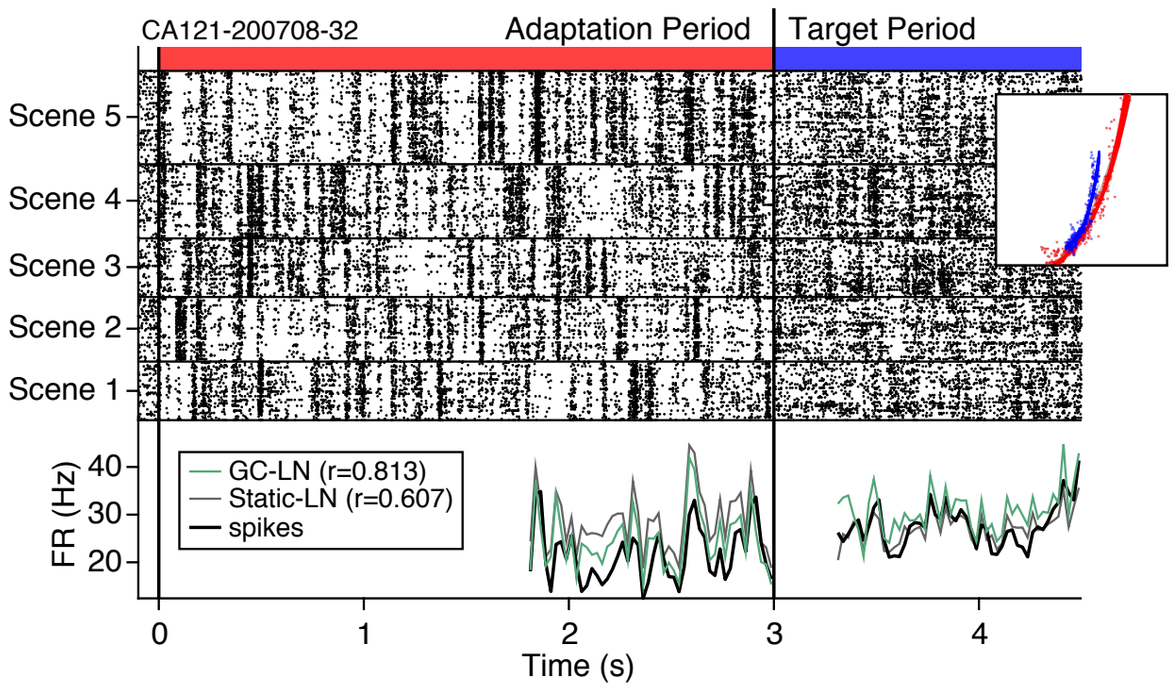


Cortical gain during target presentation predicts task performance.

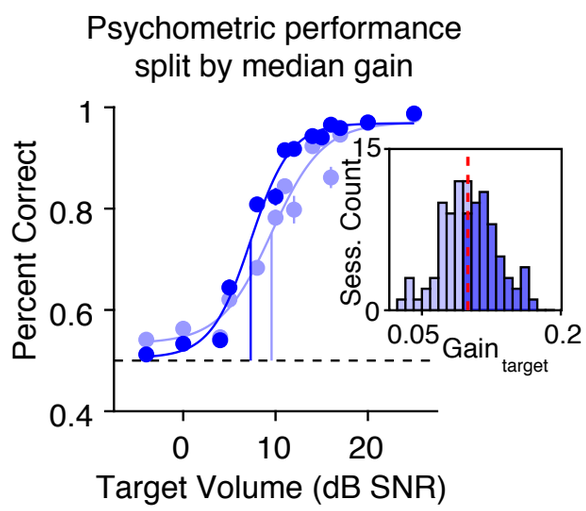
LN model to estimate gain during the behavioral task (GC-LN)

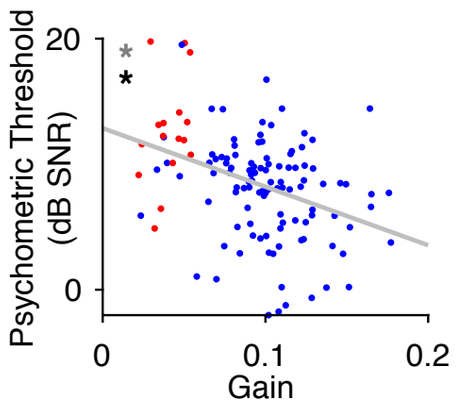


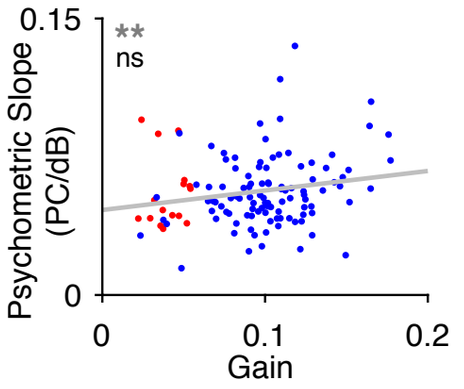
Model fit to single neuron

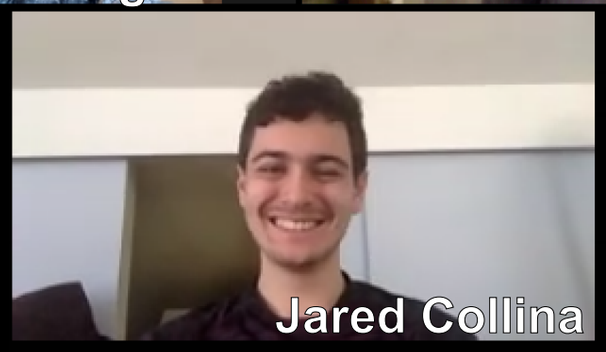


Cortical gain predicted psychometric thresholds and slopes









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