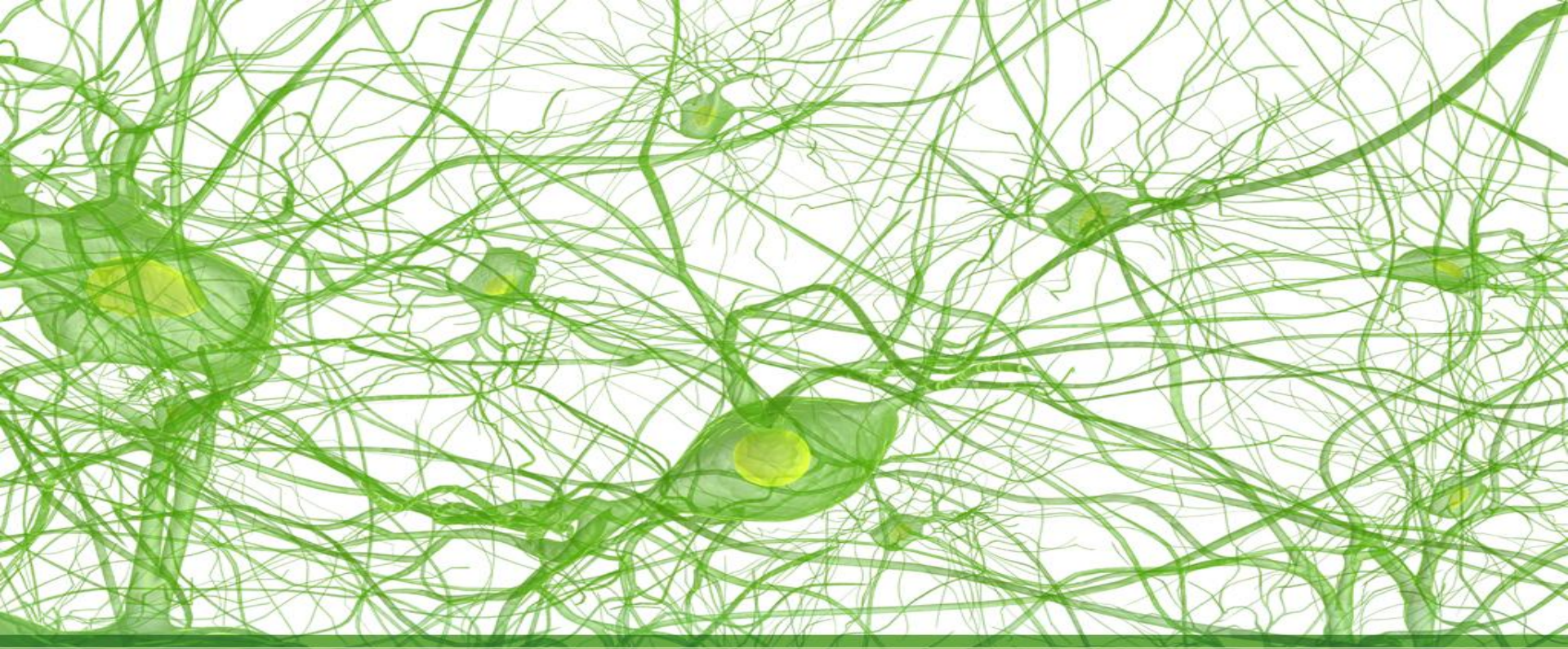
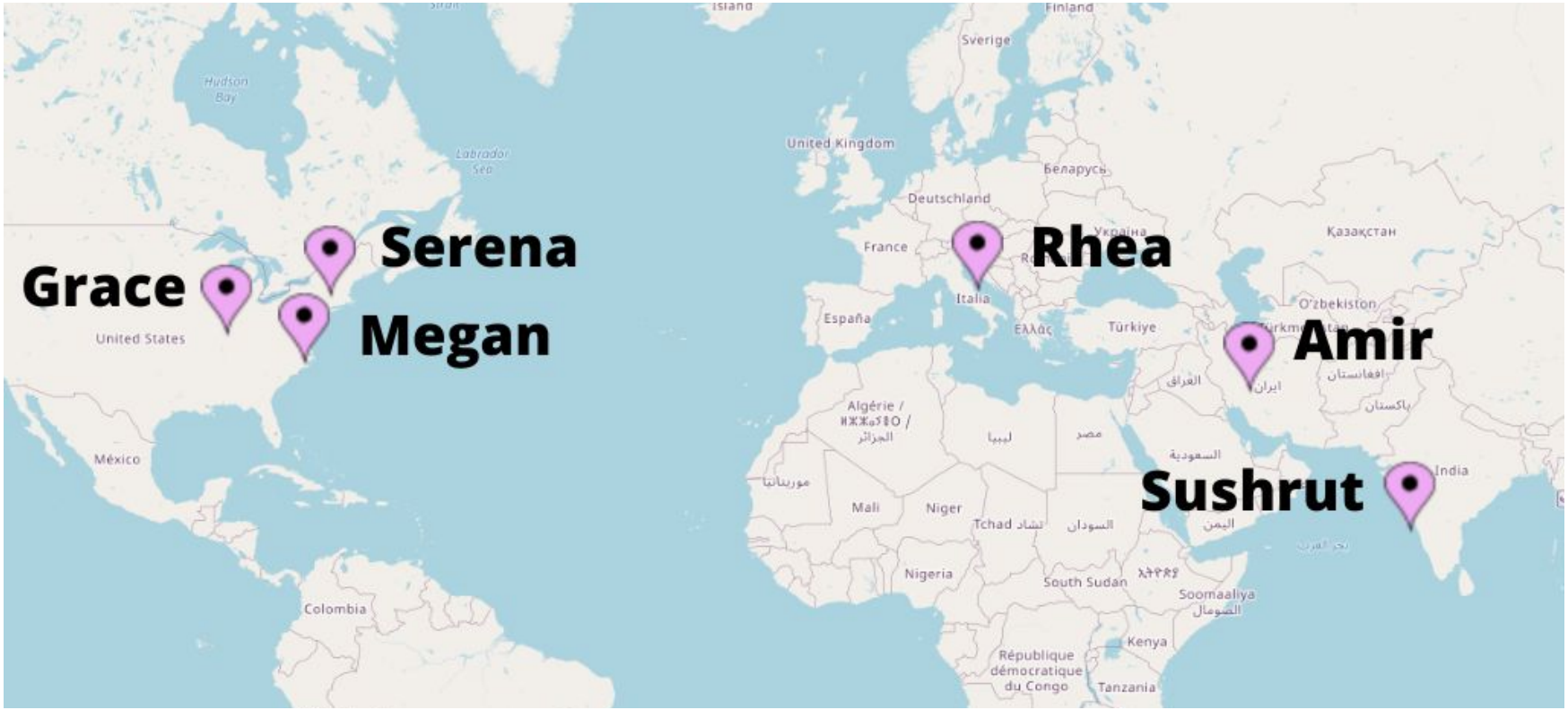


Effect of stimulus context on behavior state and neural representation in change detection task

The members of our group



Intro

Imagine you are an ostrich

you look around

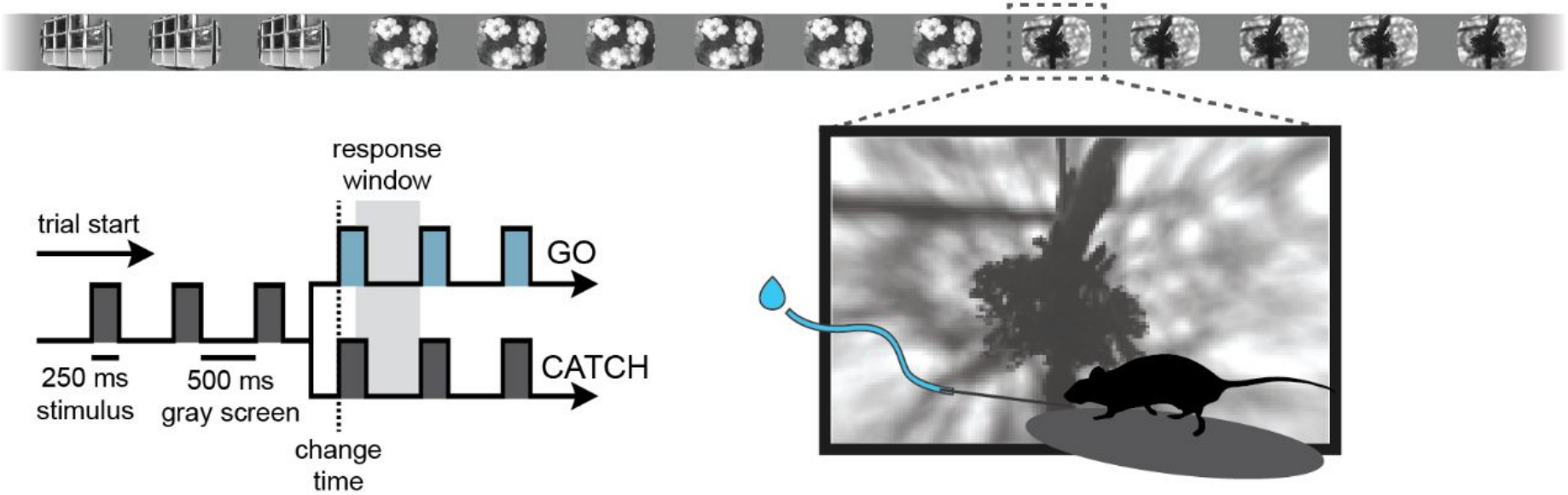
It seems normal

Suddenly, you see something changed

Run Forrest Run!

Schema of the Task

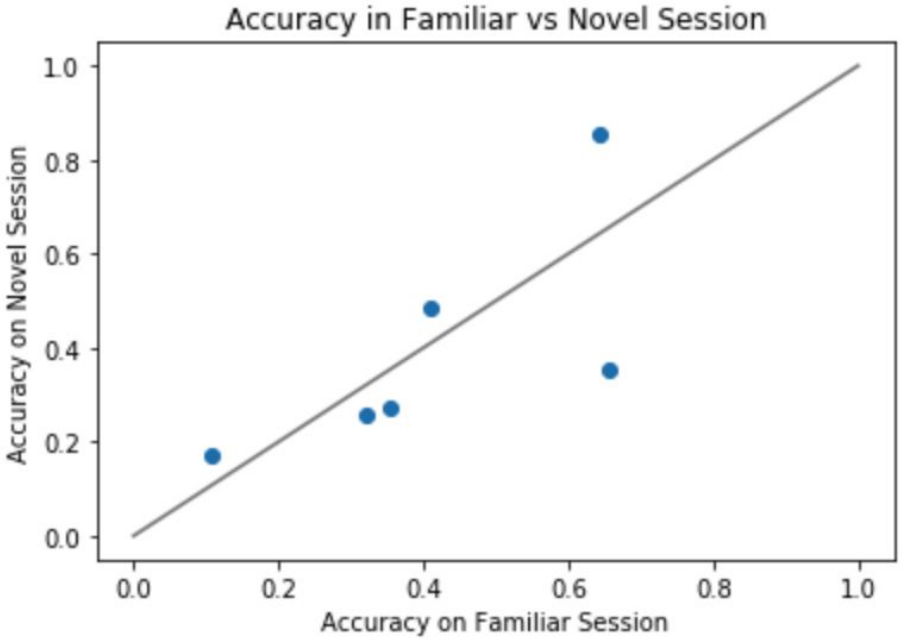
- Change Detection Task
- 2-photon Calcium Imaging in mouse V1

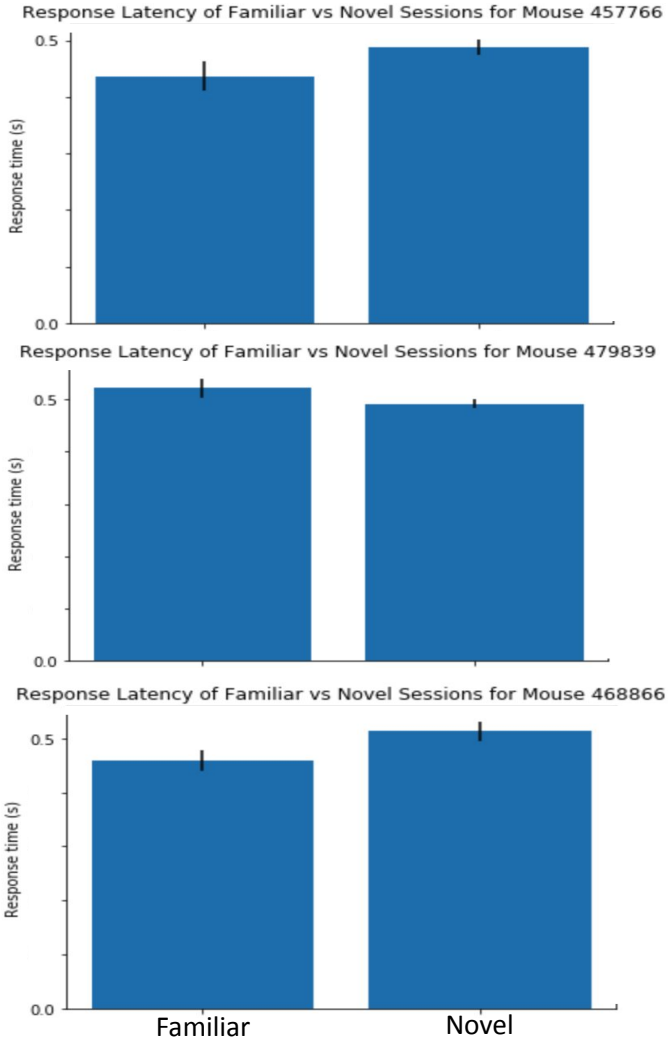


Research Questions

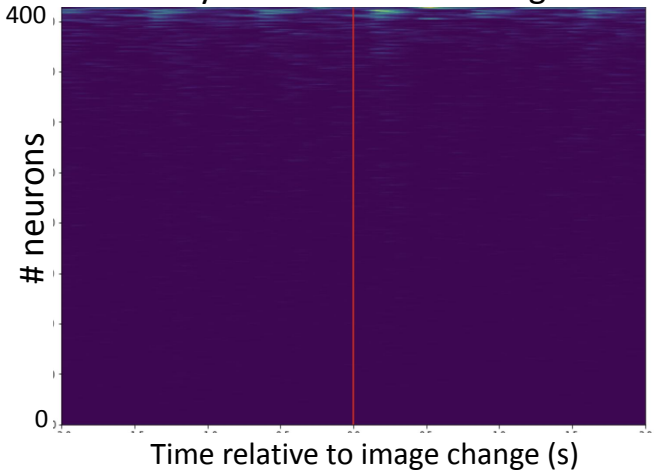
- How does familiarity impact behavior on the change detection task?
- How do excitatory and inhibitory neurons respond during changes?
- Does familiarity impact inhibitory neuronal responses to change?
- What is the dynamic of inhibitory neural responses post-change specifically in familiar versus novel trials?

Familiarity has no effect on accuracy and response latency

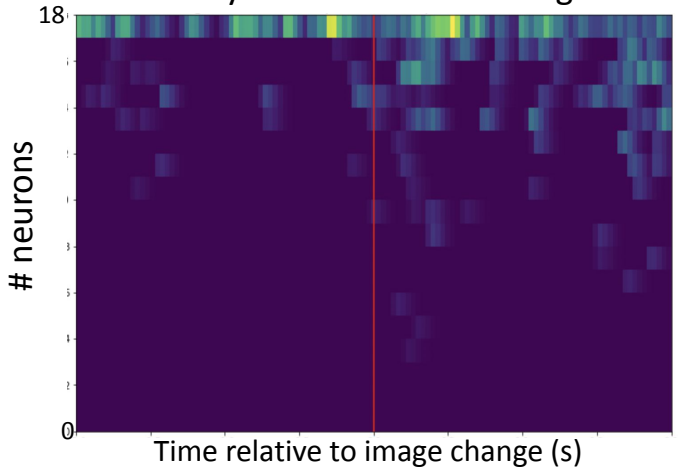




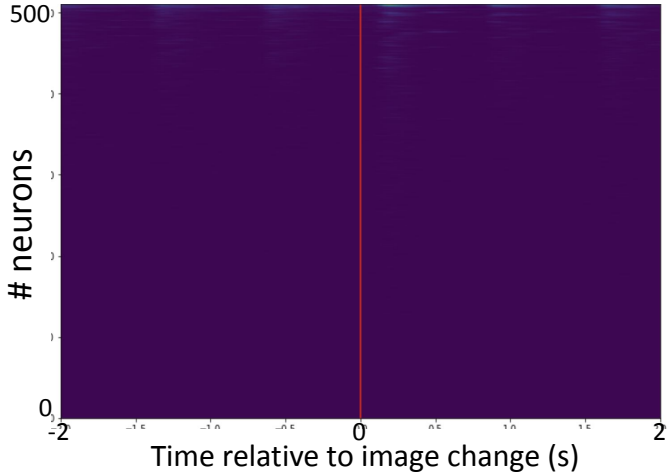
Excitatory cells for familiar image set



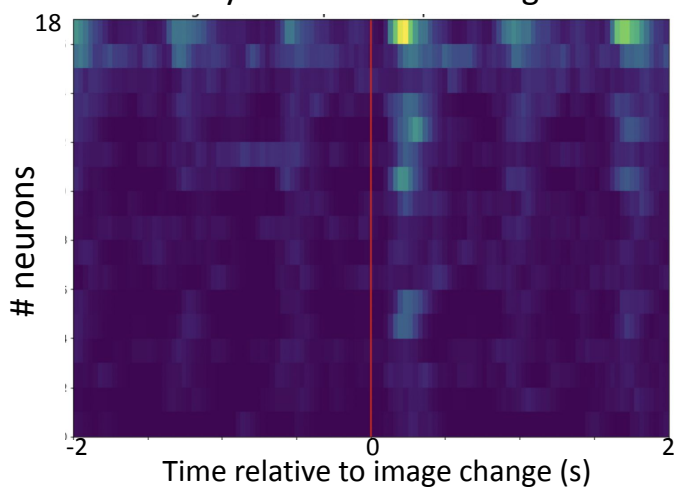
Inhibitory cells for familiar image set



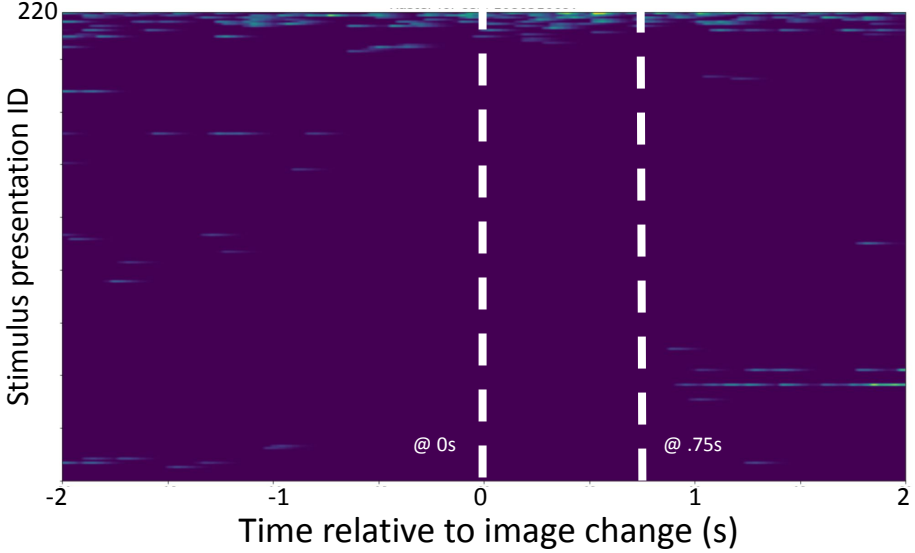
Excitatory cells for novel image set



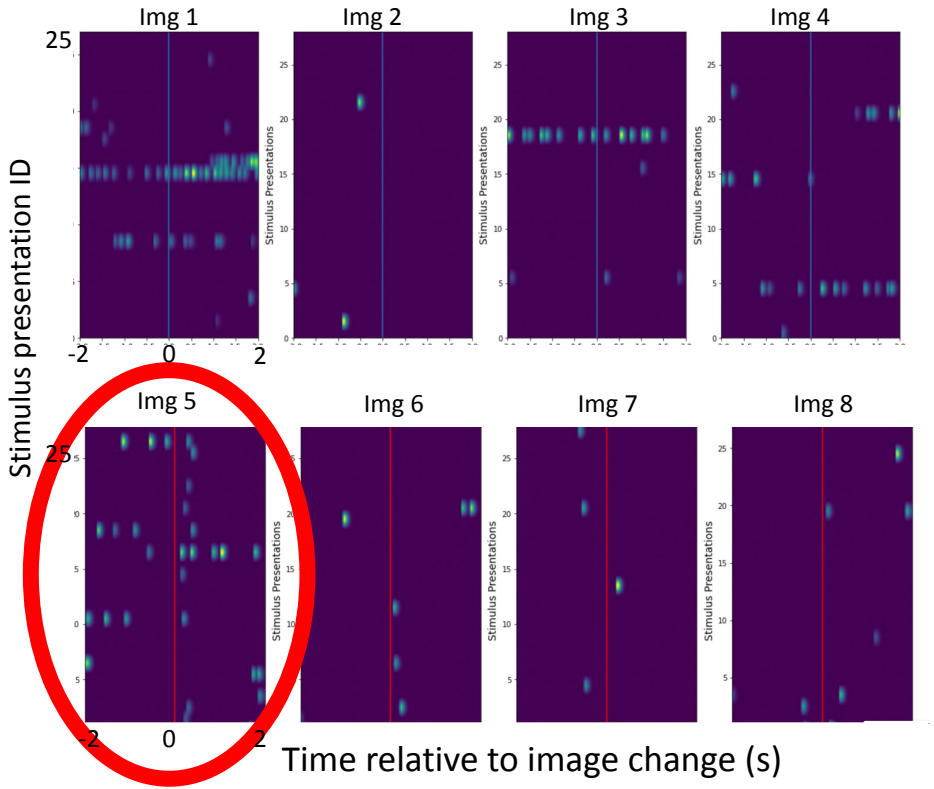
Inhibitory cells for novel image set



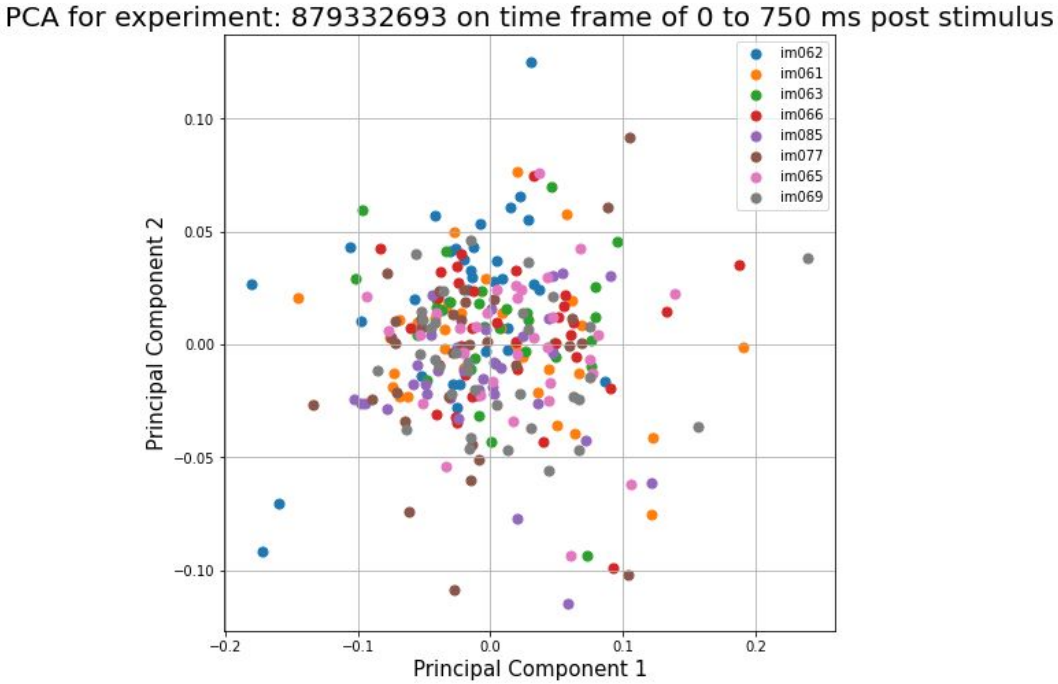
Example cell, sorted

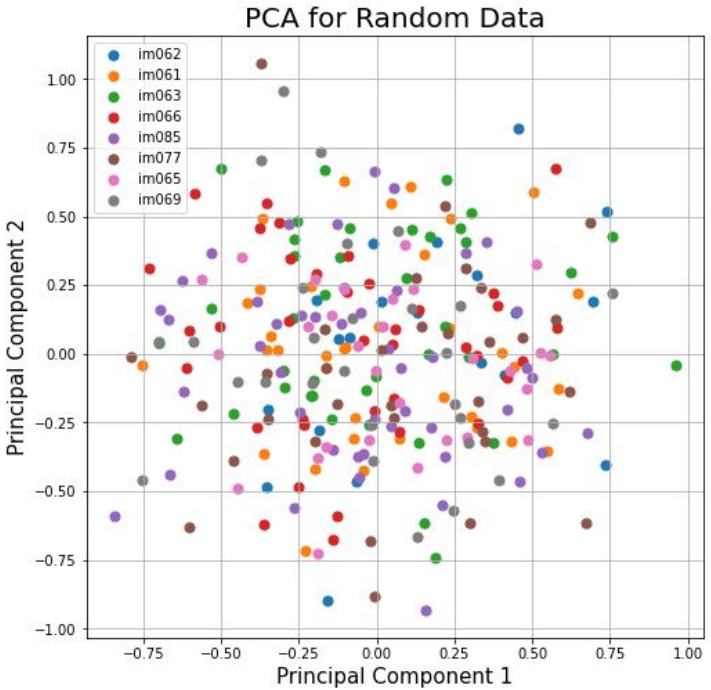


Example cell



Principal Components Analysis shows no underlying structure



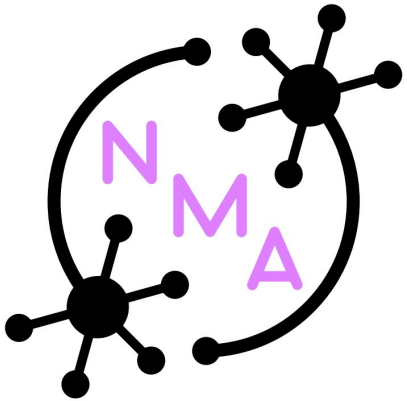


What we learned

- Pros/cons of working with a variable-rich dataset
- Importance of data visualization
- “Label your axes”
- The value of coming from a diverse set of backgrounds and expertise!
    - We come from neuroscience, psychology, physics, and crypto
    - 5 different countries

Thank you!

- NMA for the opportunity and the workshops to guide our learning
- Allen Institute for the dataset and commitment to open science
- Our mentors: Xaq, Sinem, Janaki, and Tomi!



Not using slides after this

Motivation

- Importance of change detection for animal's survival
- Sensory circuits across different modalities can detect novelty, but the underlying mechanism is unknown.
- We chose the Allen Institute dataset because it provided us with an opportunity to combine behavioral and neural analyses, a task that is both unfamiliar and challenging to our group.
- Hypotheses:
  - Behavior
  - Exc vs inh
  - Inh_novel vs inh_exc

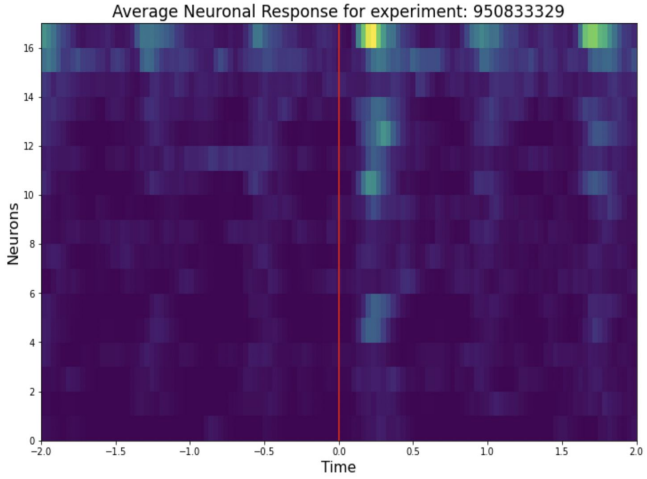
- Abstract:

In an ever-changing environment, animals must rapidly extract behaviorally essential information from sensory stimuli. Appropriate behavioral adjustments to unexpected changes in stimulus statistics are fundamental for the survival of an animal. We still do not fully understand how the brain detects such changes reliably and quickly.

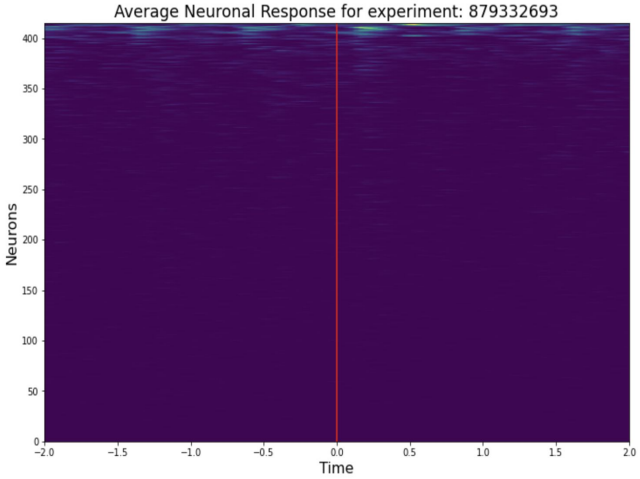
Recent experiments have demonstrated that sensory circuits across different modalities can encode a sequence or expectation violation and can detect novelty (Keller et al., 2012; Natan et al., 2015; Zmarz and Keller, 2016; Hamm and Yuste, 2016; Homann et al., 2017). The underlying neuronal and circuit mechanisms behind expectation alteration and novelty detection, however, remain difficult to describe.

- Based on the literature, our first hypothesis in this study is to detect the different performance of the mice in reaction time and accuracy during change detection task in both familiar and novel images. We assumed that in familiar trials the performance of the mouses in detecting the change should be higher than novel trials.
- Recent experimental studies suggest that inhibition and the plasticity of inhibitory synapses shape the responses to repeated and novel stimuli (Chen et al., 2015) so in second step we want to compare the pattern of firing rates of excitatory and inhibitory cells both in sessions with familiar and novel stimulus.

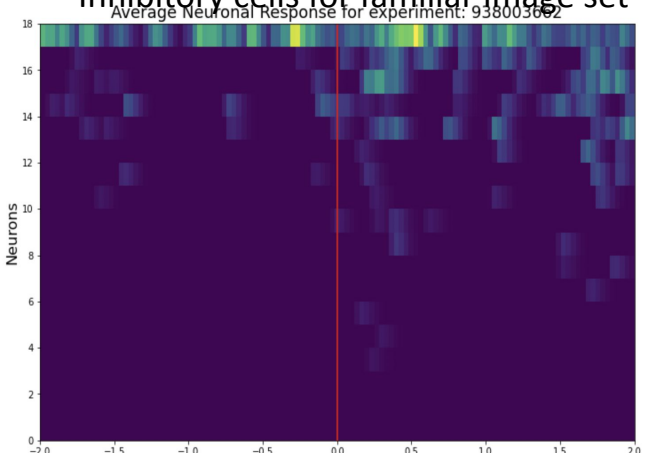
Inhibitory cells for novel image set



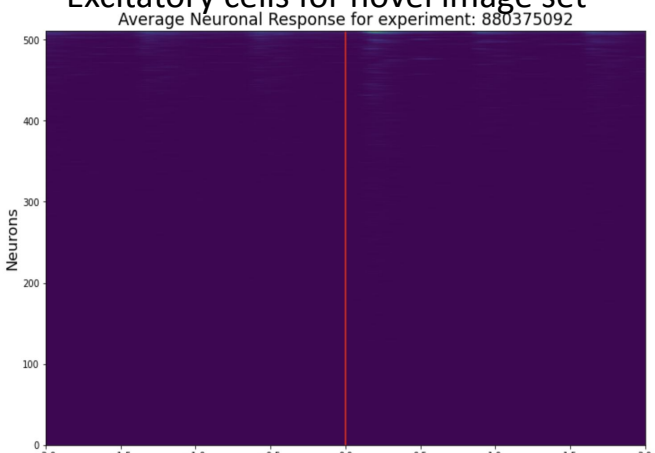
Excitatory cells for familiar image set



Inhibitory cells for familiar image set



Excitatory cells for novel image set



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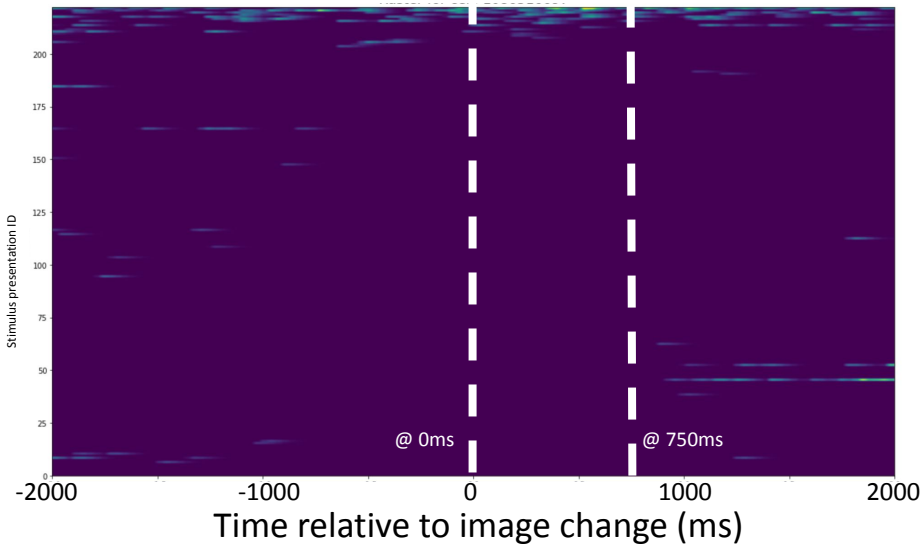

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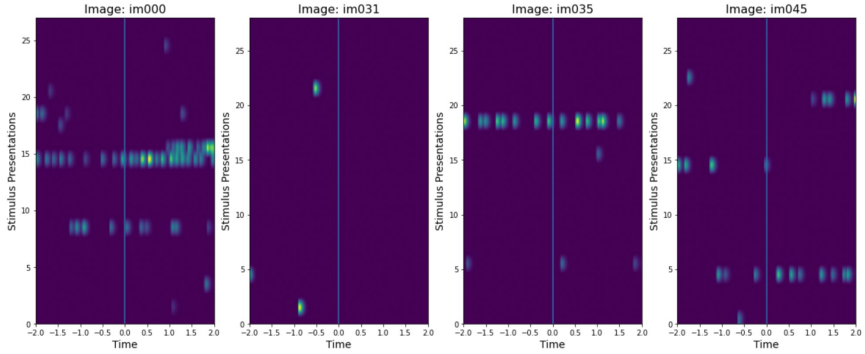
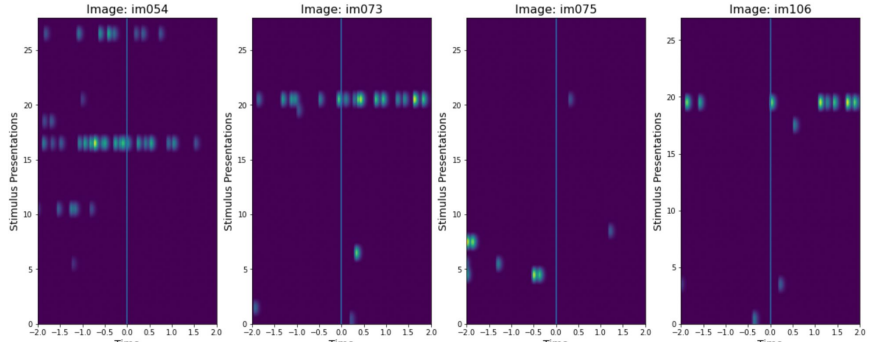
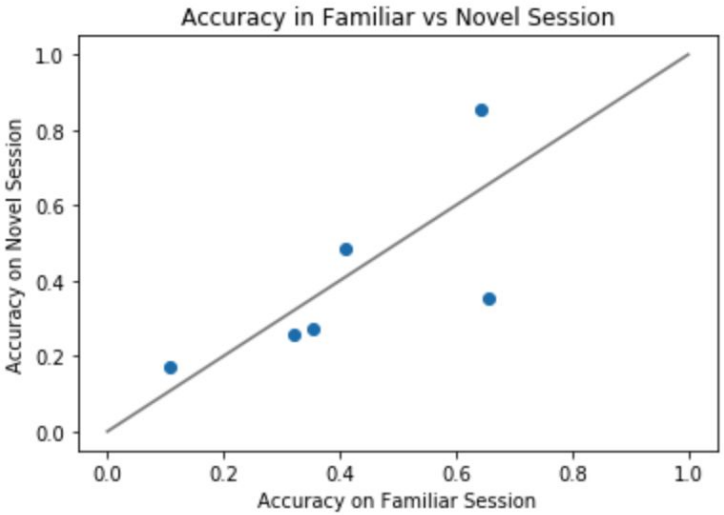
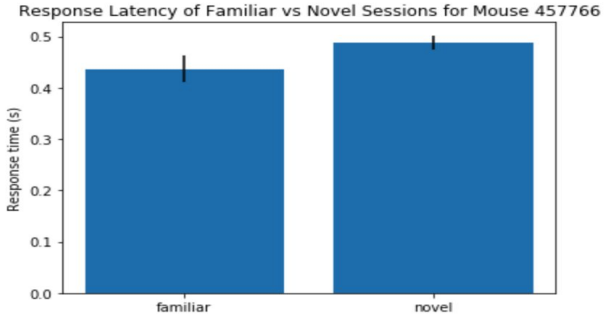
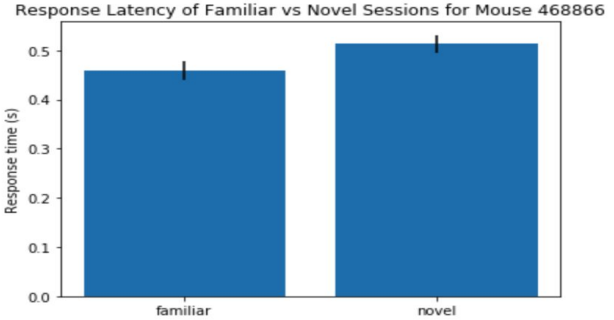


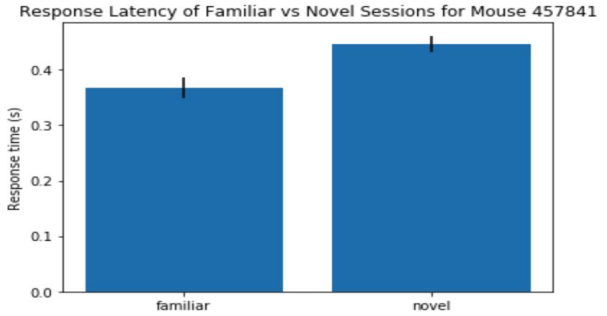


Behavioral Data









Behavioral Data