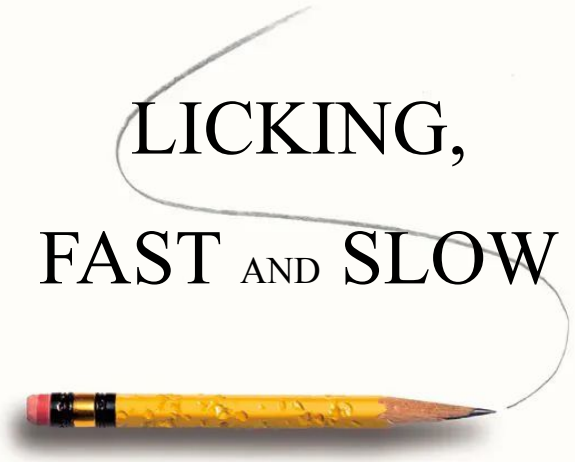


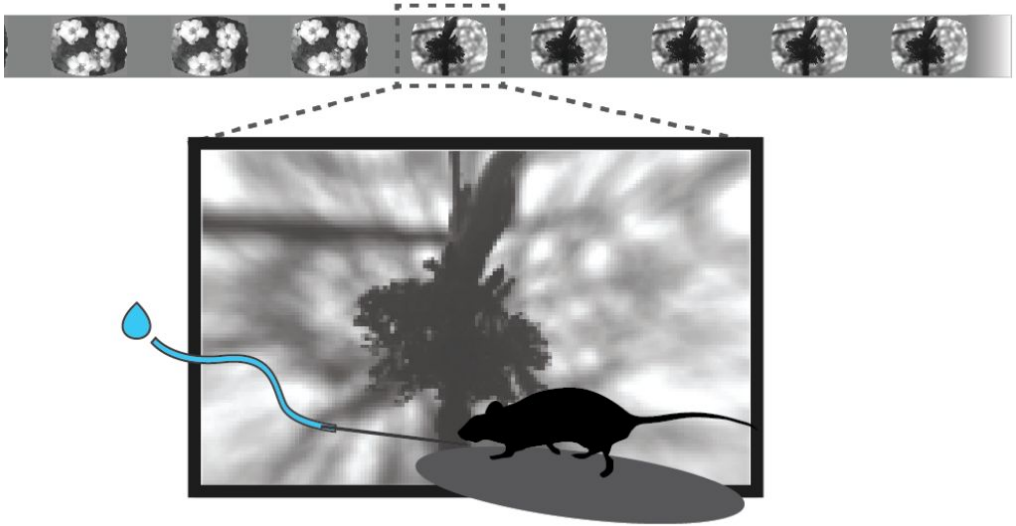
Misha Sokoletsky, Maria Shujah, CiCi Xingyu Zheng

SWDB 2024 Project

Aug 31, 2024

Task and Strategy

Human invented whack-a-mole for fun, and scientists at Allen designed **lick-at-change** for mice …



1. Thirsty 🥵
2. But should not simply lick impulsively as change will be delayed 🥲
3. Stimuli continuously coming .. for an hour 🫠

Modeling Strategy

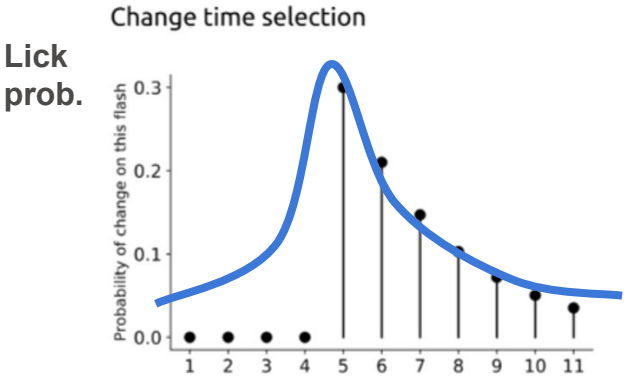
The goal: predict the initiation of lick bouts:

Binary events for every frame

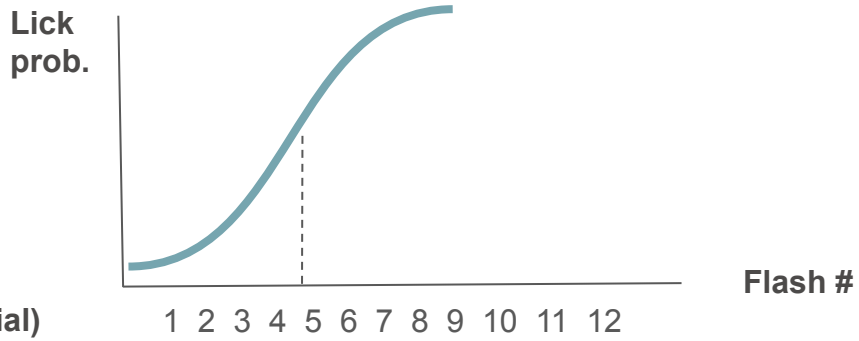
1. **Visual strategy**

2. **Timing strategy**

a. Estimating Change Distribution

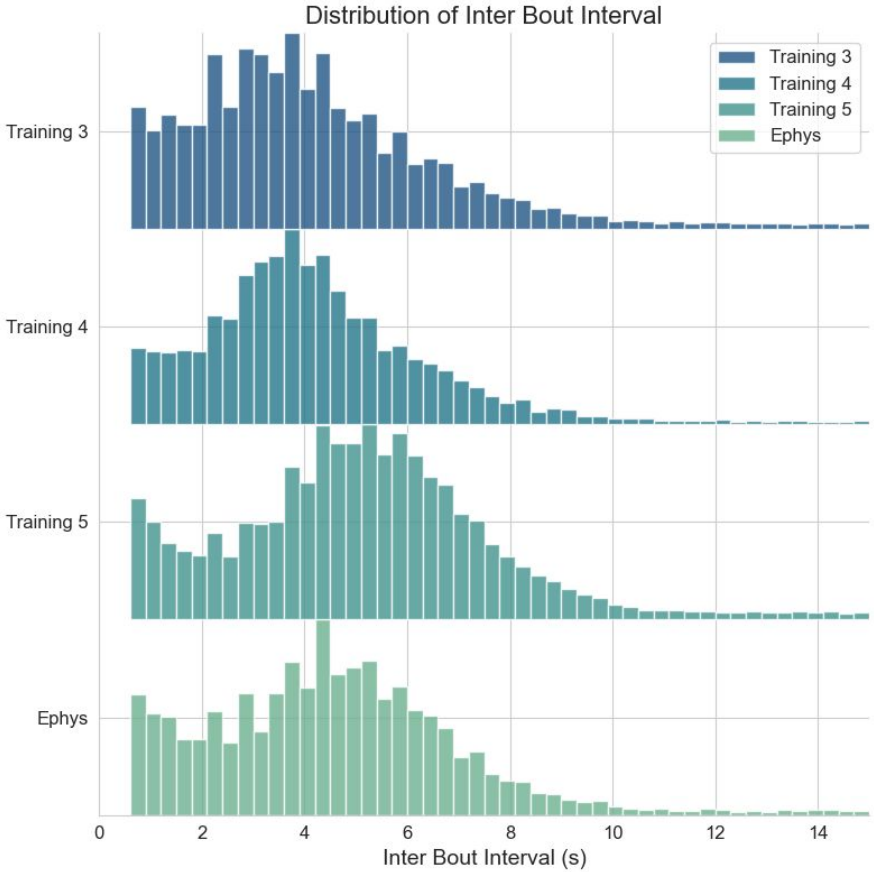


b. Probability Thresholding

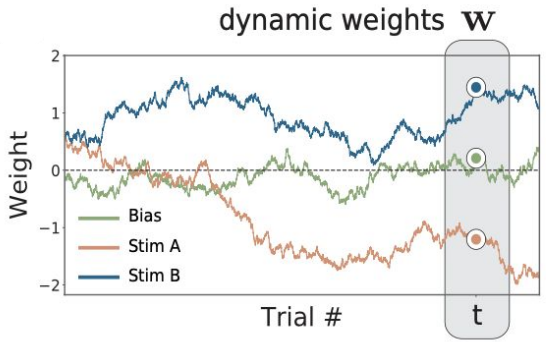


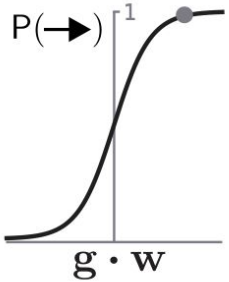
(Piet et al., 2024, *Neuron*)

Inter Bout Interval across sessions



Dynamic Logistic Regression Model



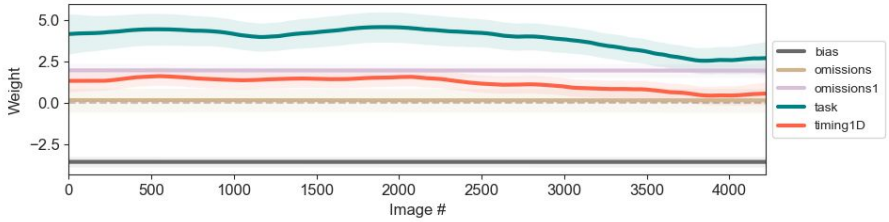


(Roy et al 2018, *NeurIPS*,
(Roy et al 2021, *Neuron*,
Piet et al 2024, *Neuron*)

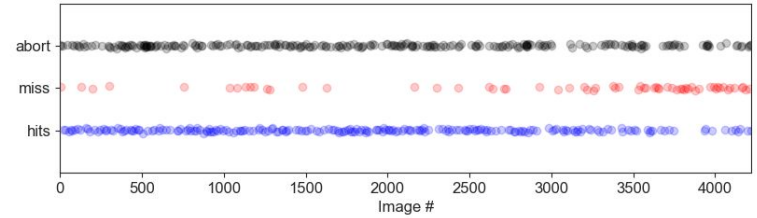
Come and chat if you want to hear more about strategies!

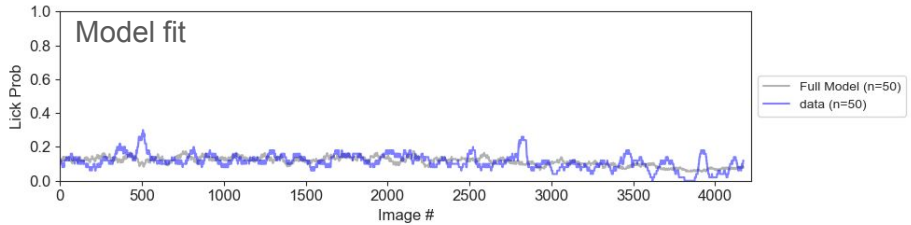
Modeling Results (54 ephys sessions, wt)

Example **visual-dominant** session
(bsid: 1062781531)

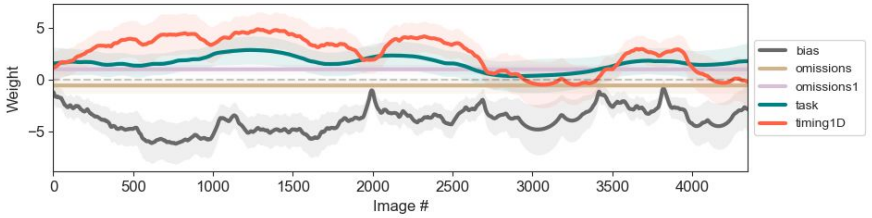


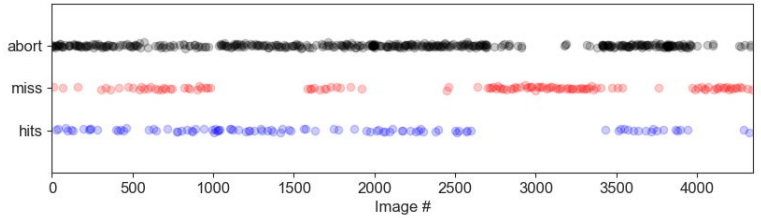
Lick performance metrics:

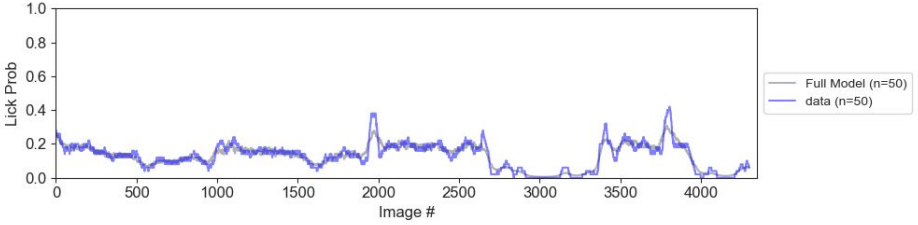




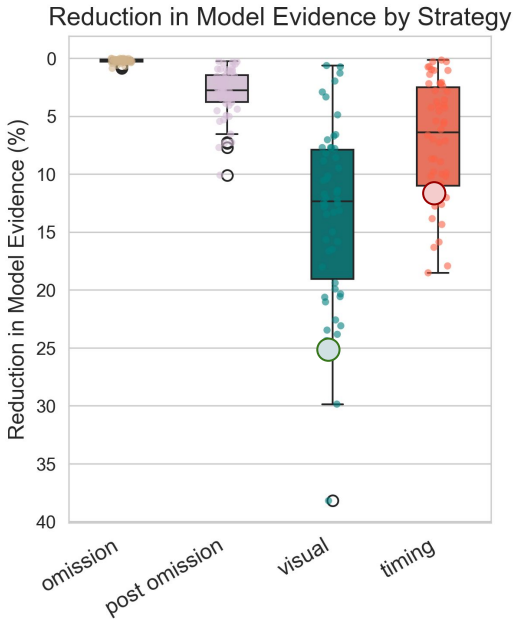
Example **timing-dominant** session
(bsid: 1056528863)



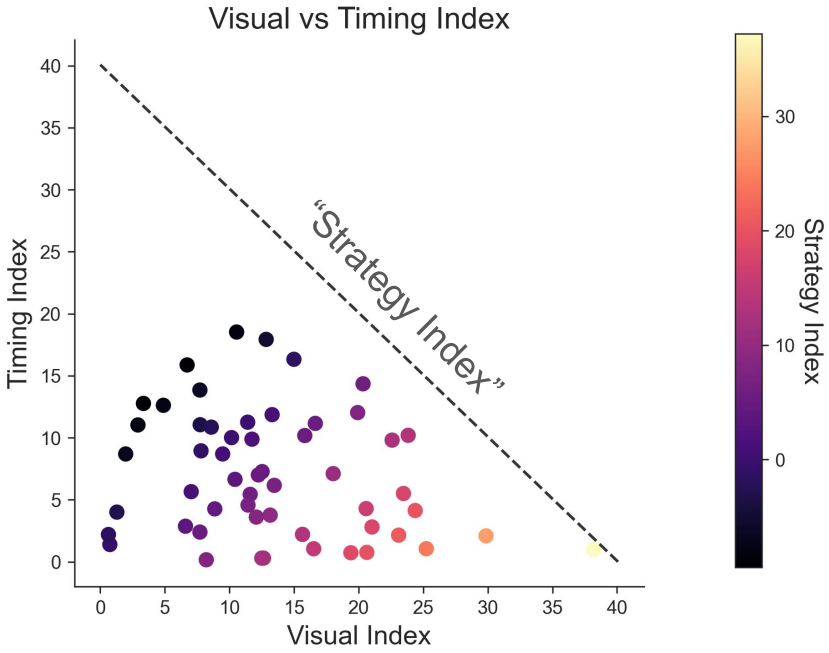




Modeling Results Cont.

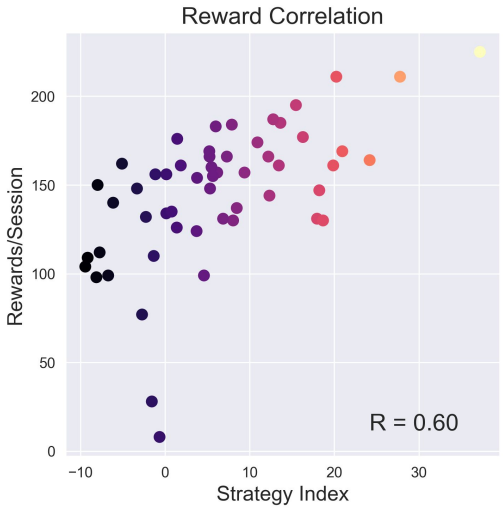


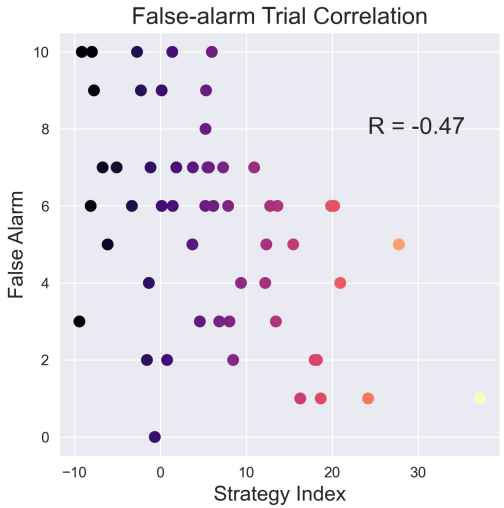
“Strategy Index”



Modeling Results Cont.

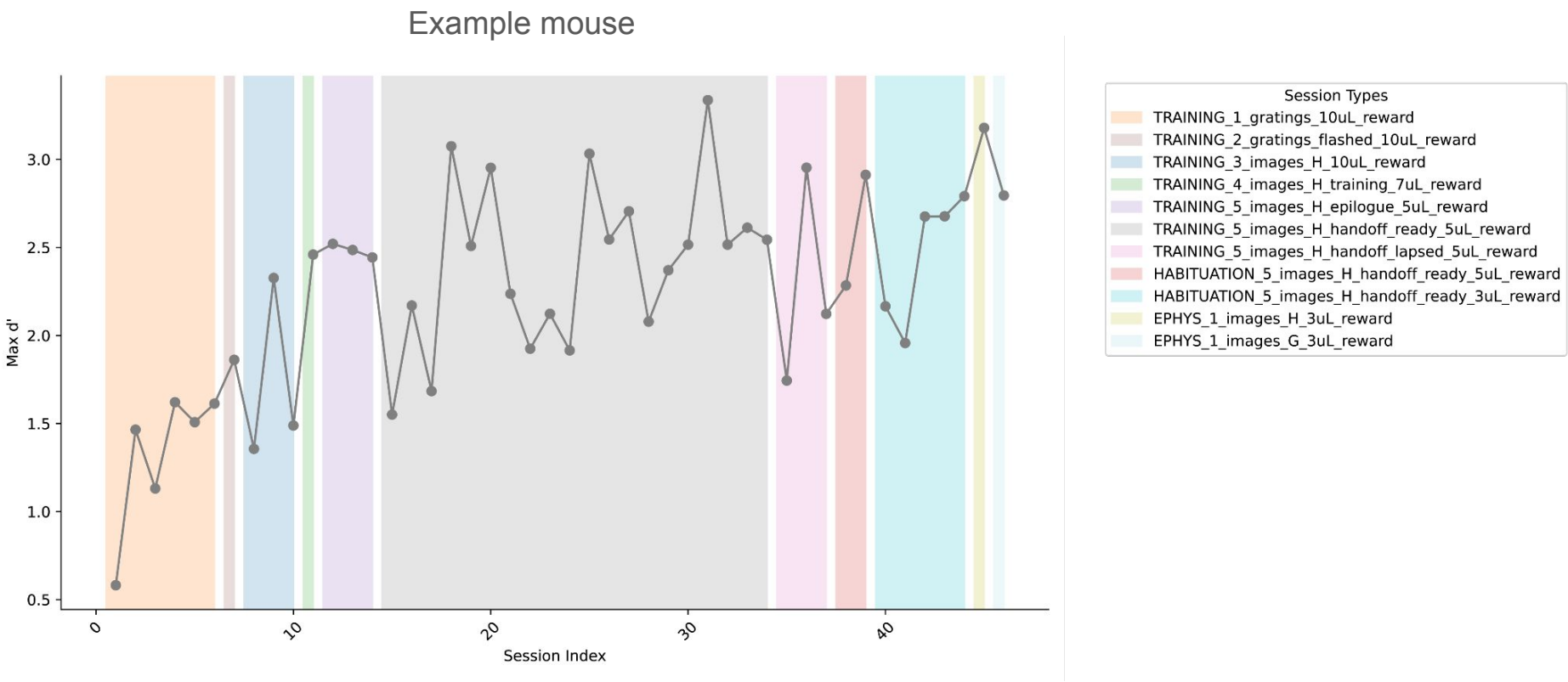
Correlation to task performance



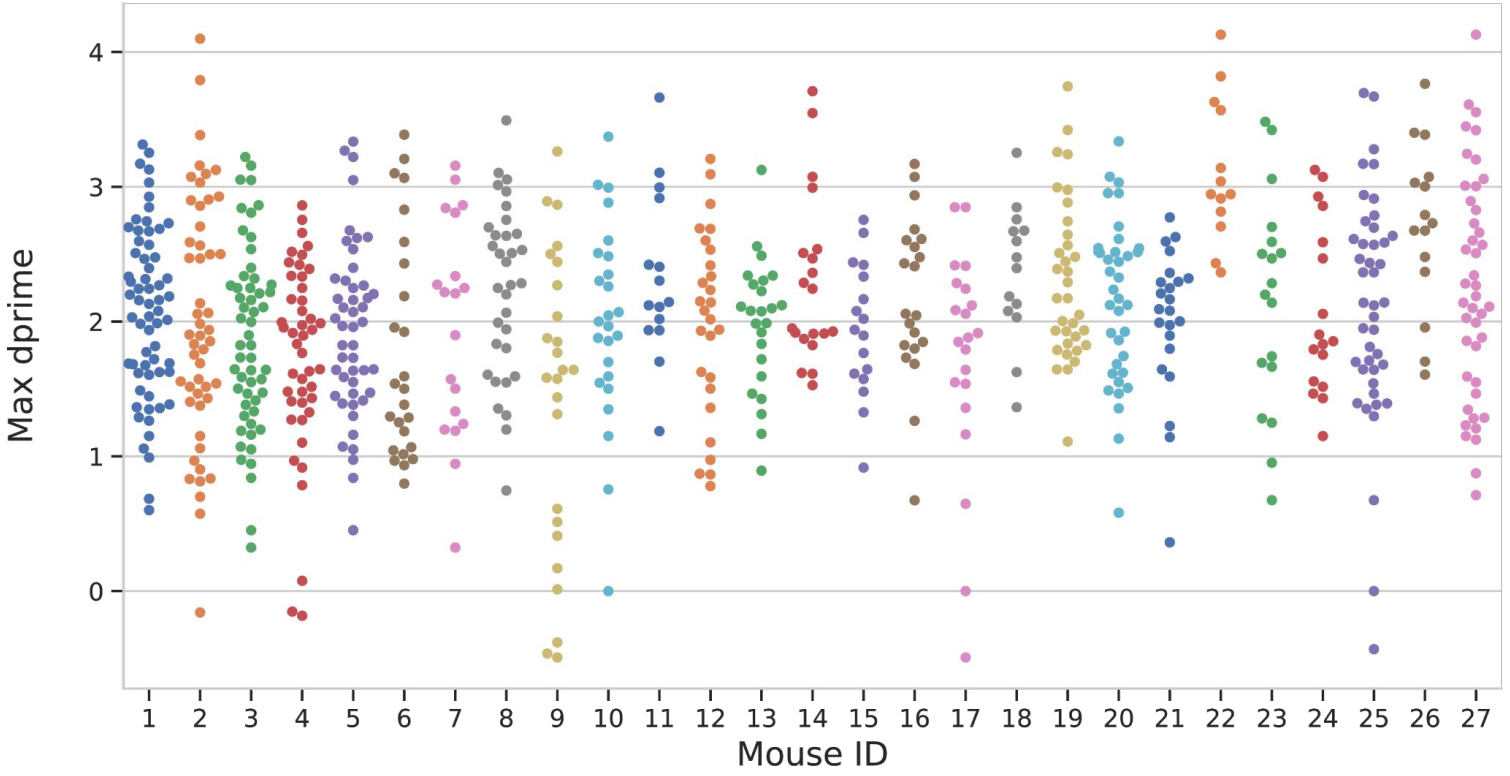


Consistency within each animal

How do the learning dynamics depend on strategy?

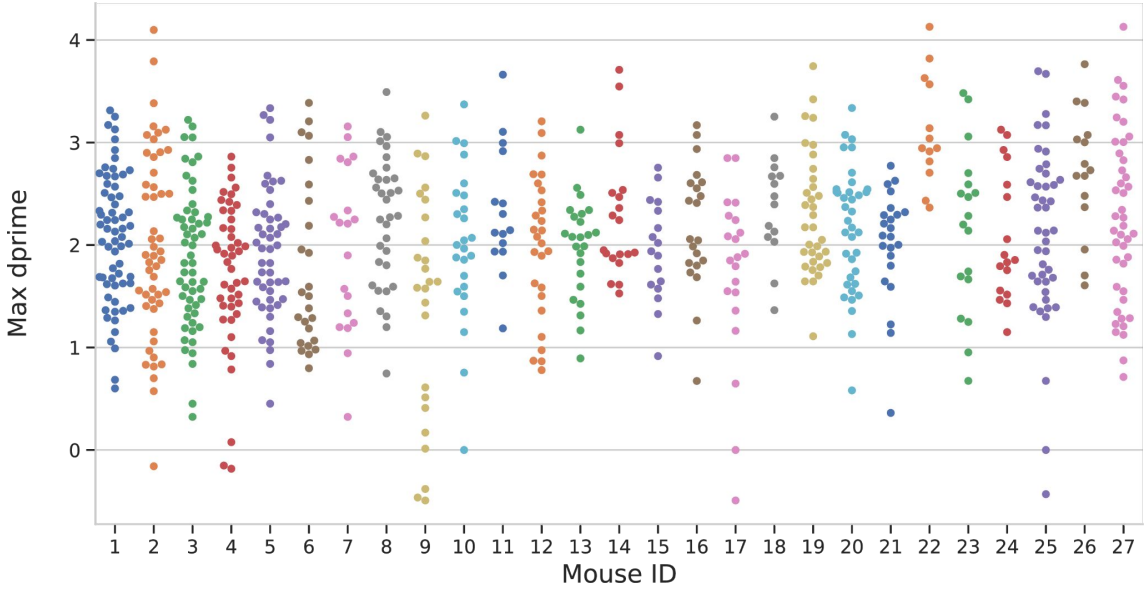


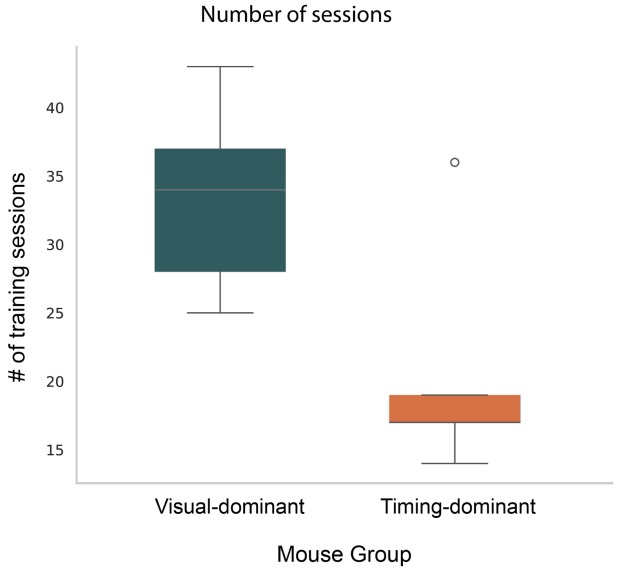
How do the learning dynamics depend on strategy?



How do the learning dynamics depend on strategy?

Visual strategy mice are slower to reach criterion.

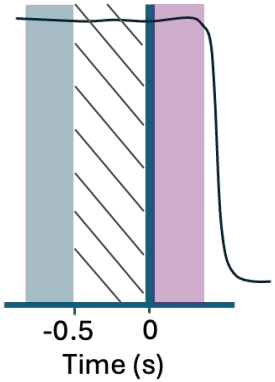




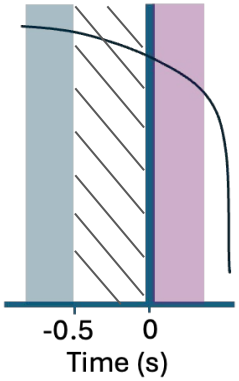
Rational inattention?

How do the learning dynamics depend on strategy?

Visual-dominant

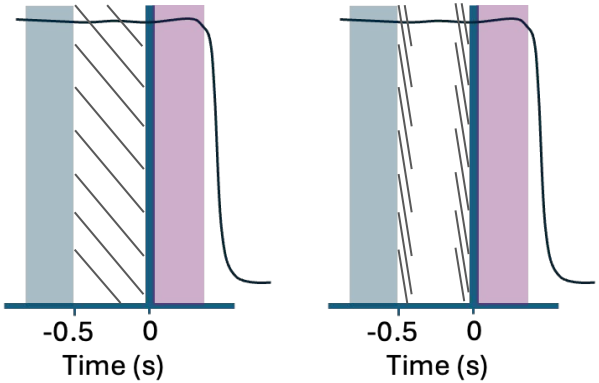


Timing-dominant

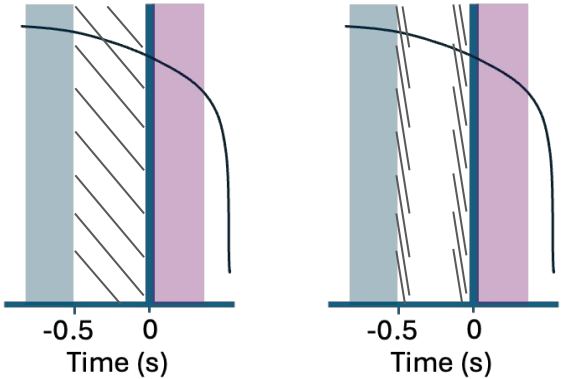


How do the learning dynamics depend on strategy?

Visual-dominant

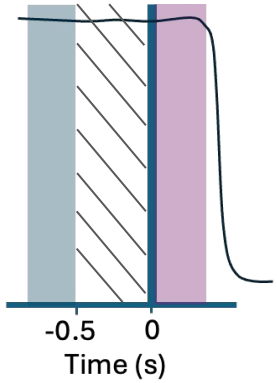


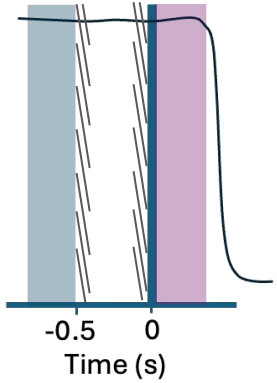
Timing-dominant

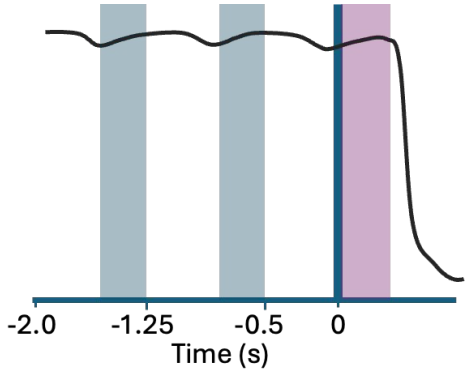


How do the learning dynamics depend on strategy?

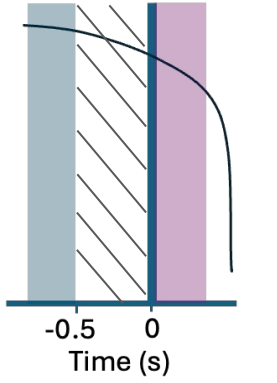
Visual-dominant

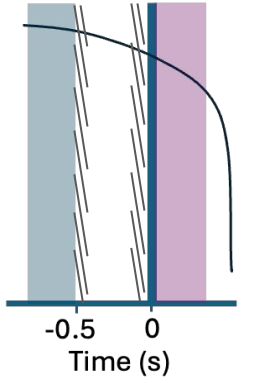


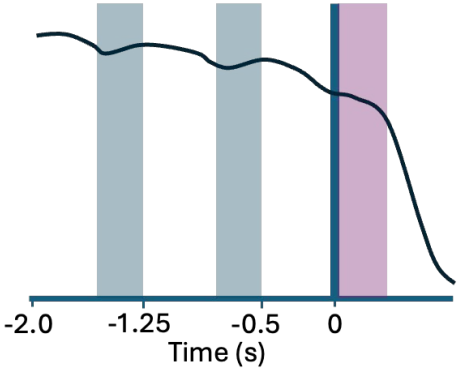




Timing-dominant

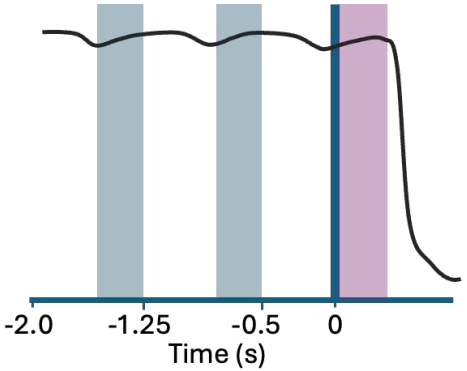




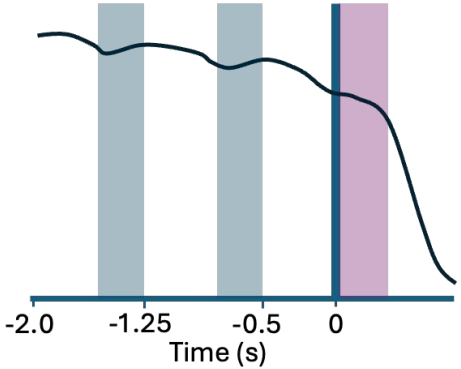


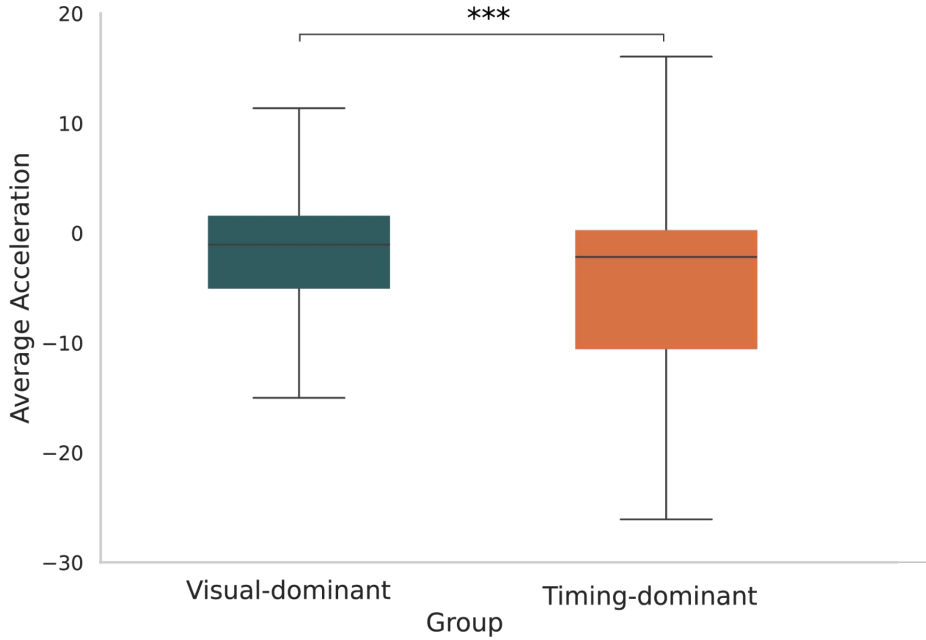
How do the learning dynamics depend on strategy?

Visual-dominant



Timing-dominant





Timing-strategy mice start slowing down a few flashes before anticipated go image.

How does visual representation depend on strategy?

Representation Similarity Analysis (RSA)

Visual-dominant Strategy

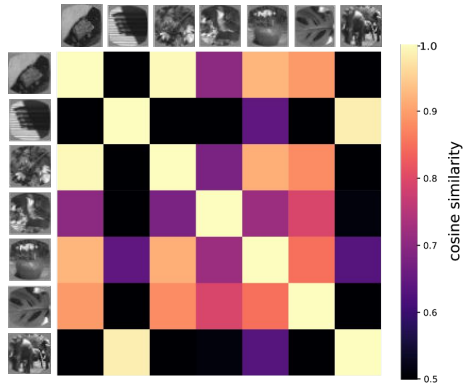
(Example mouse)

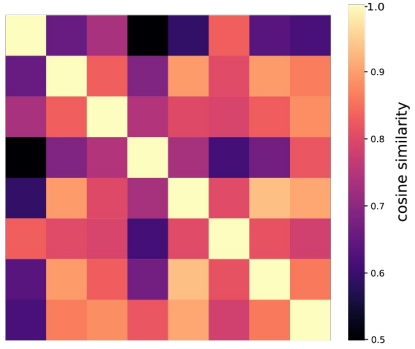
Timing-dominant Strategy

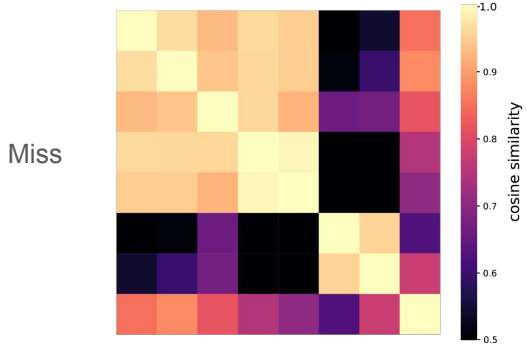
(Example mouse)

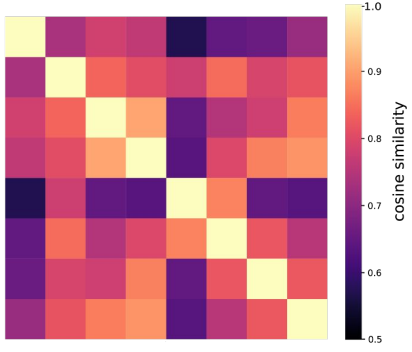
Hit

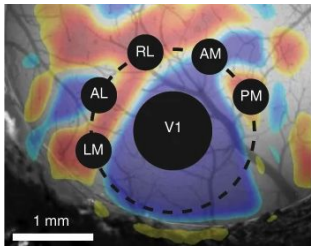
Miss









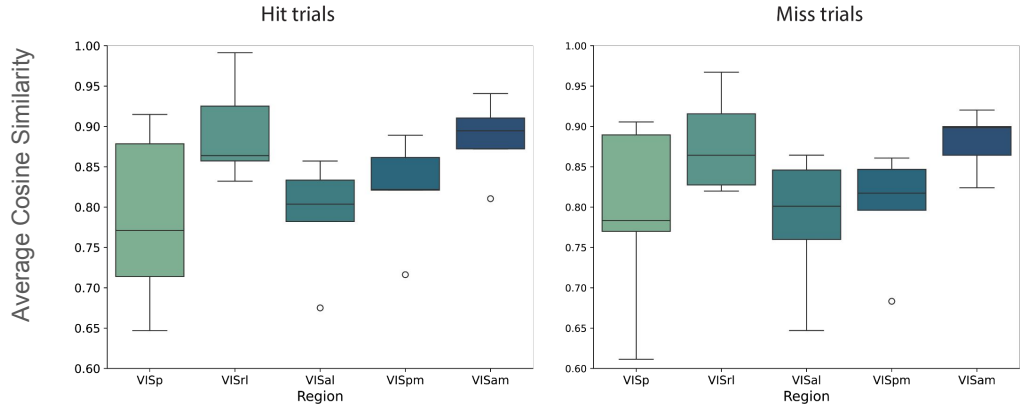


Paw plot

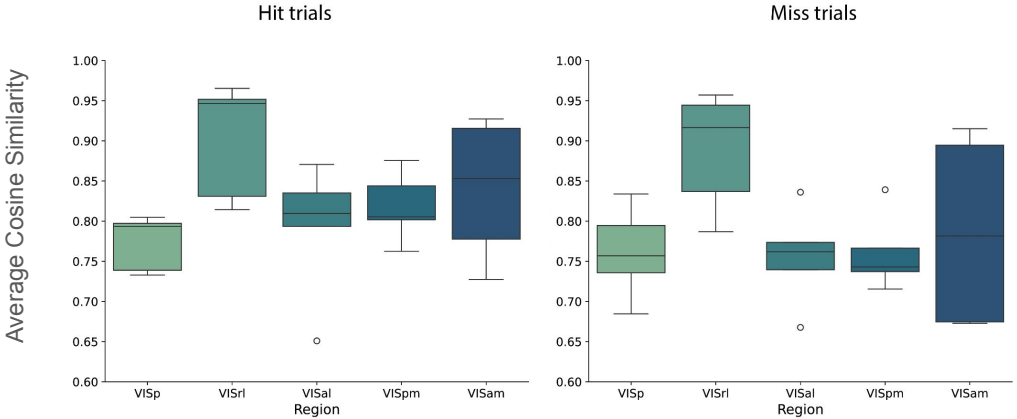
Region: VISp
Session: Ephys Image set H

How does visual representation depend on strategy?

Visual-dominant



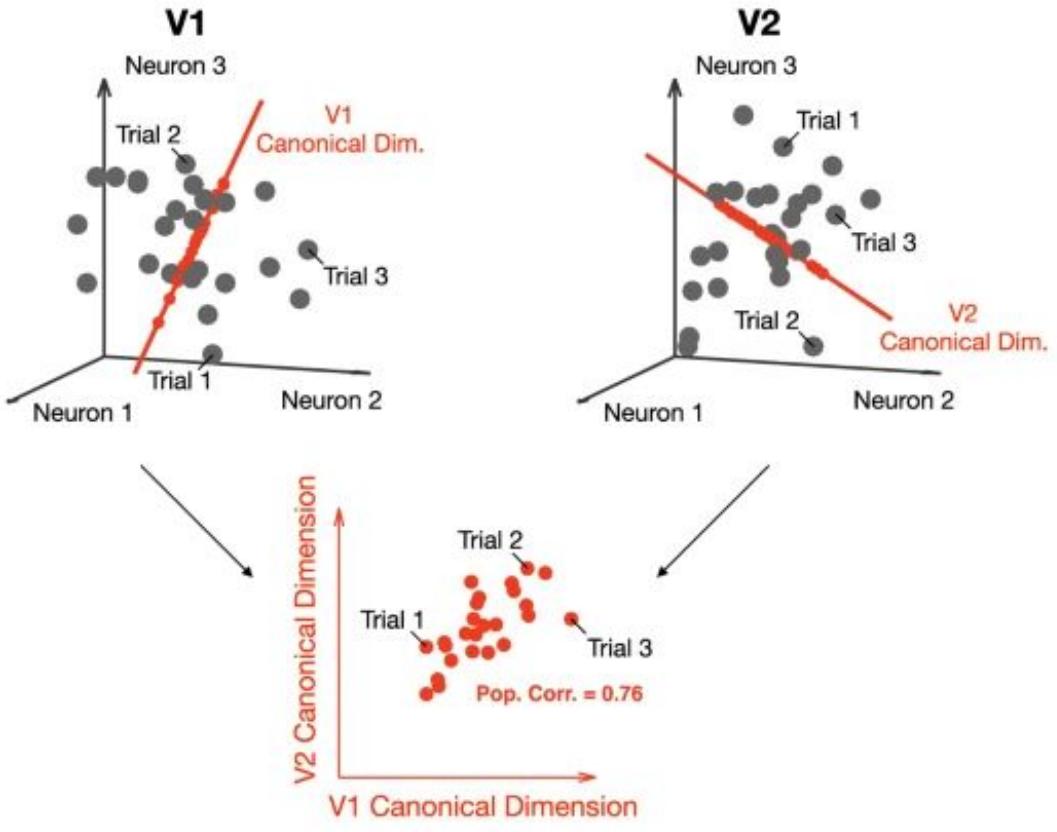
Timing-dominant



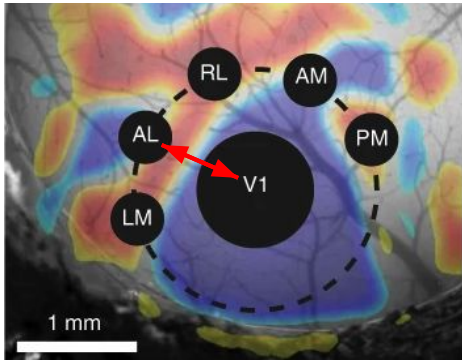
How does inter-areal communication depend on strategy?

Canonical Correlations Analysis (CCA) examines how trial-to-trial variability correlates across regions.

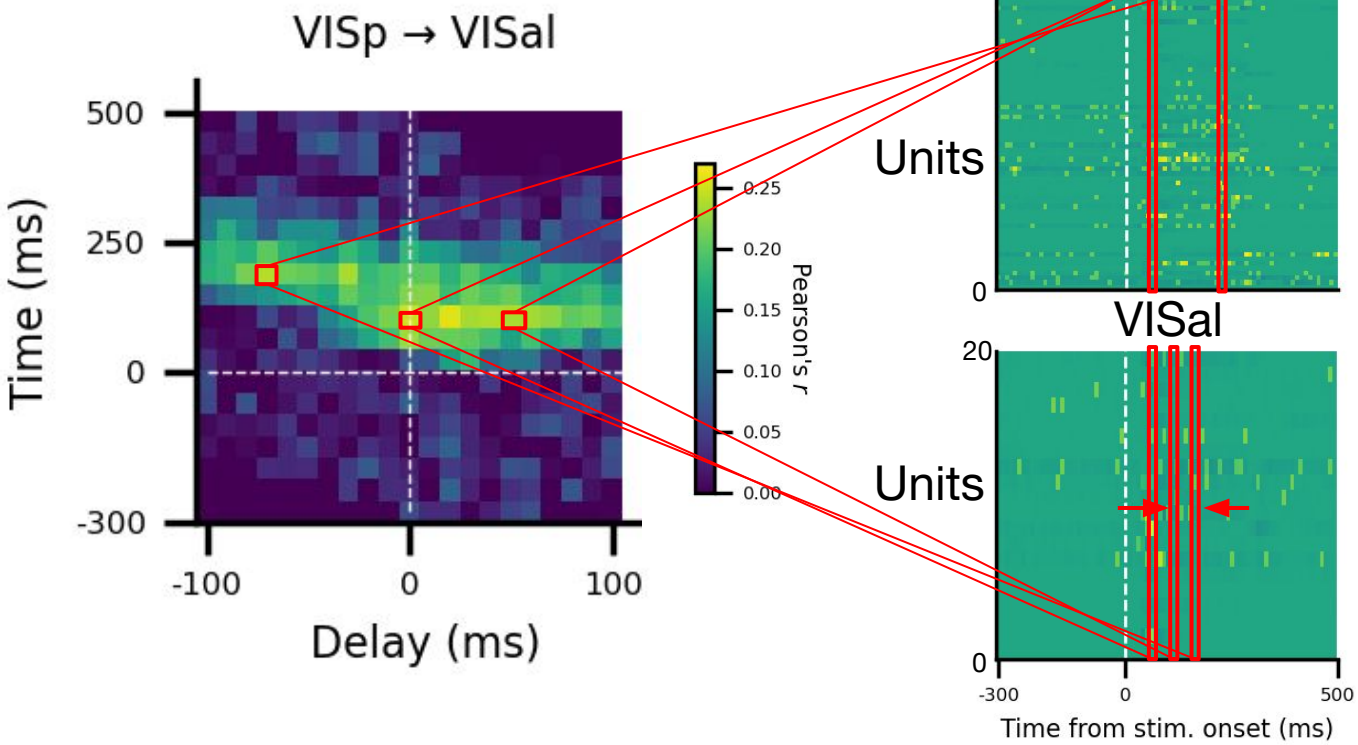
(Semedo et al., 2022)



How does inter-areal communication depend on strategy?

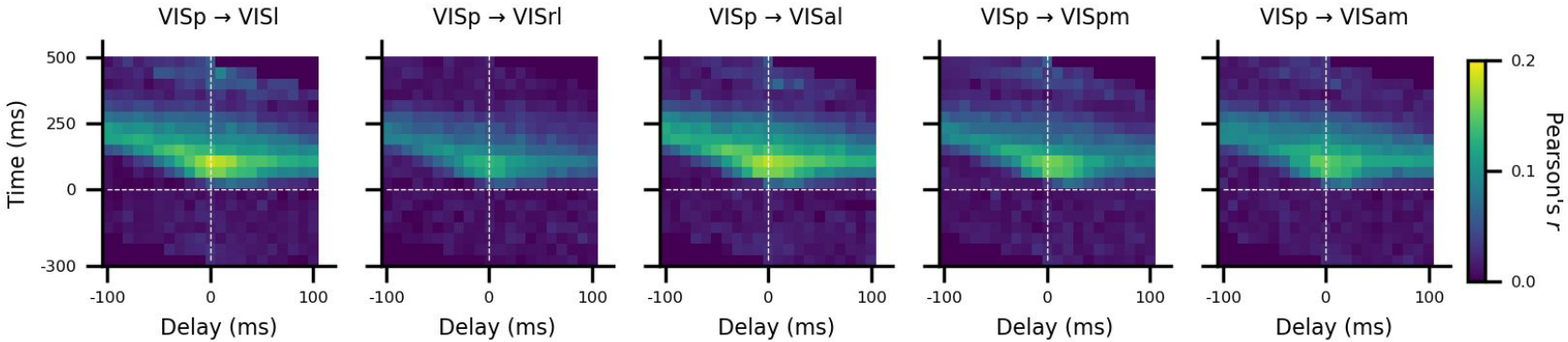


1 session example



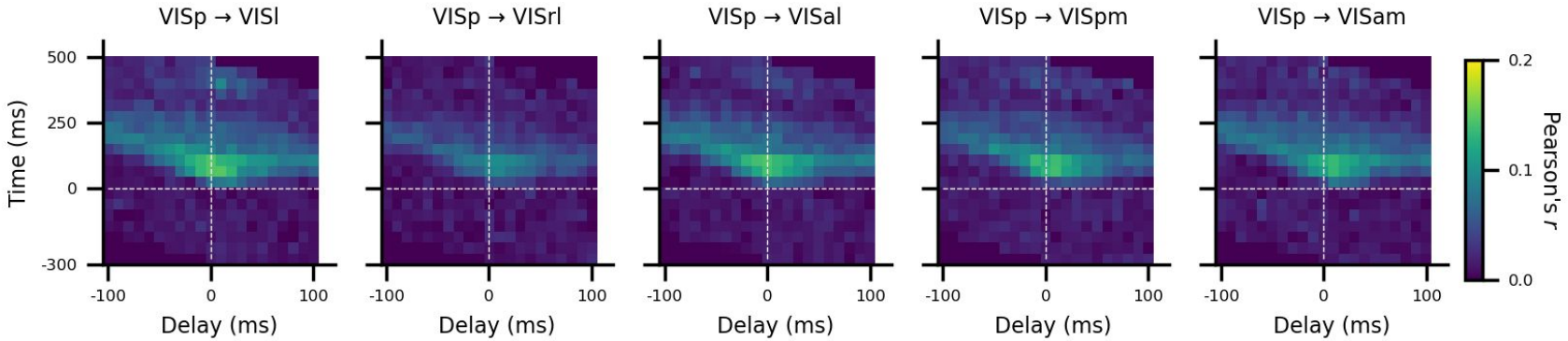
Feedback correlations are higher in hits vs. misses

Hit trials, all sessions

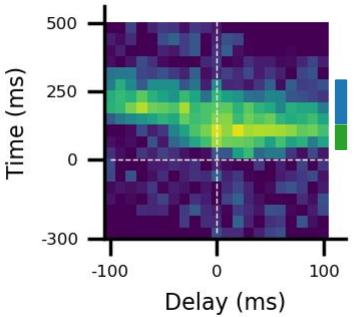


Feedback correlations are higher in hits vs. misses

Miss trials, all sessions



Feedback correlations are higher in hits vs. misses

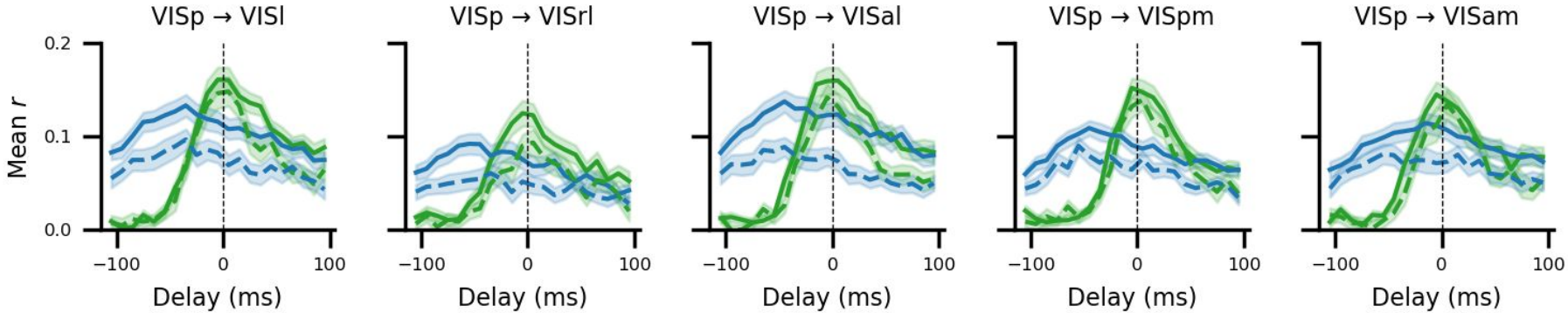


Feedback (150-300 ms)

Feedforward (50-150 ms)

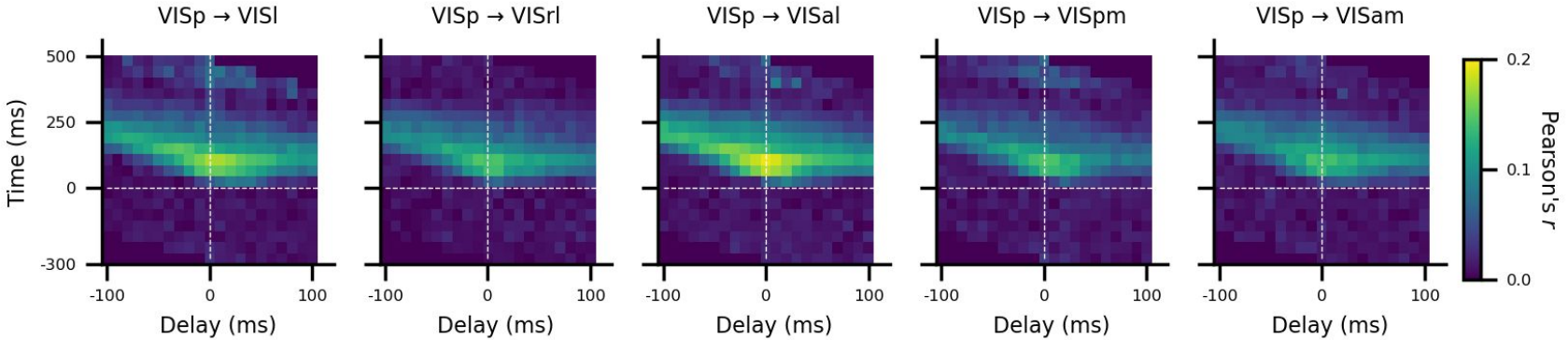
— Hits

--- Misses



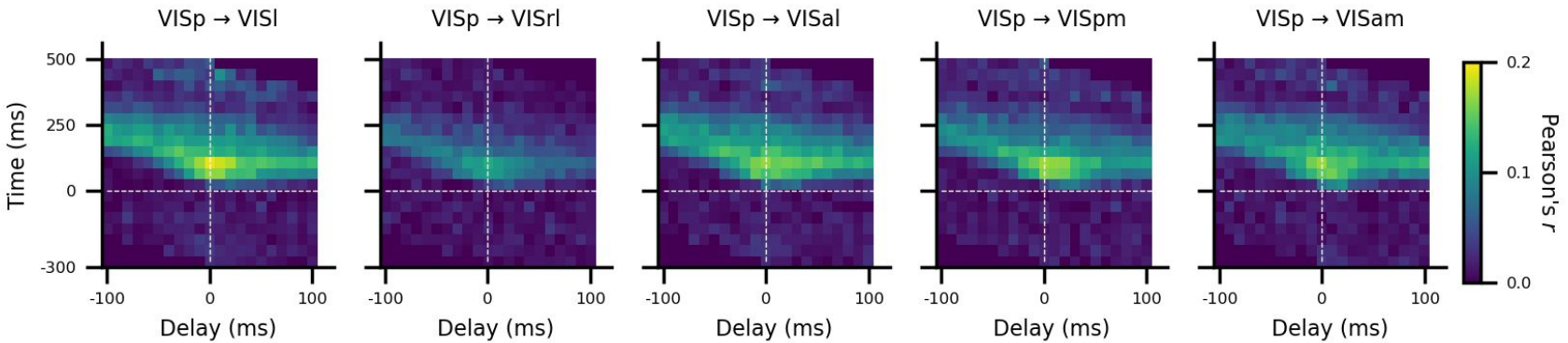
Region-specific correlates of strategy in hits

Hit trials, visual strategy-dominant mice

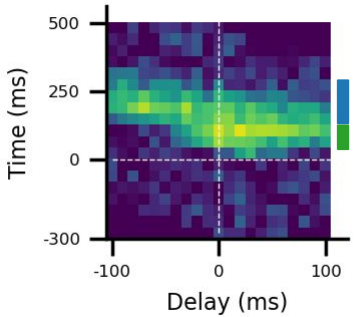


Region-specific correlates of strategy in hits

Hit trials, timing strategy-dominant mice



Region-specific correlates of strategy in hits

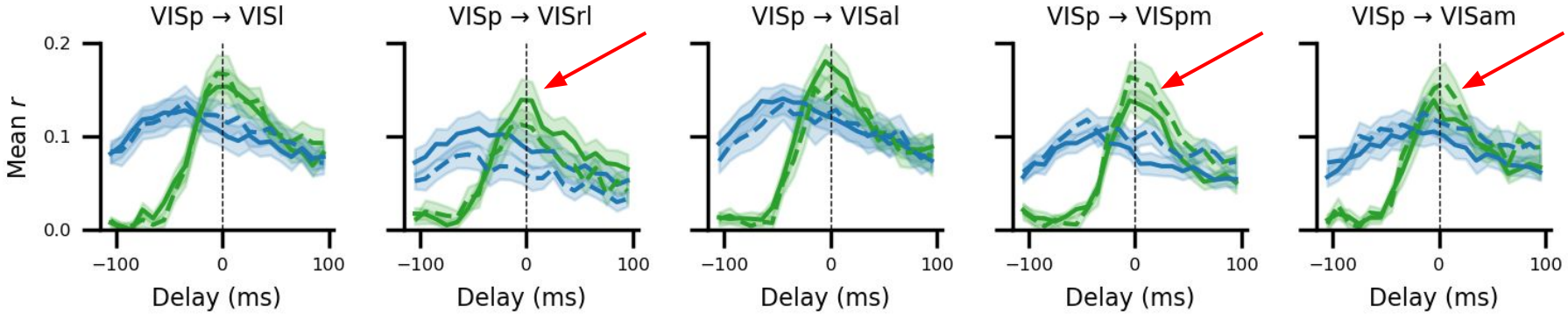


Feedback (150-300 ms)

Feedforward (50-150 ms)

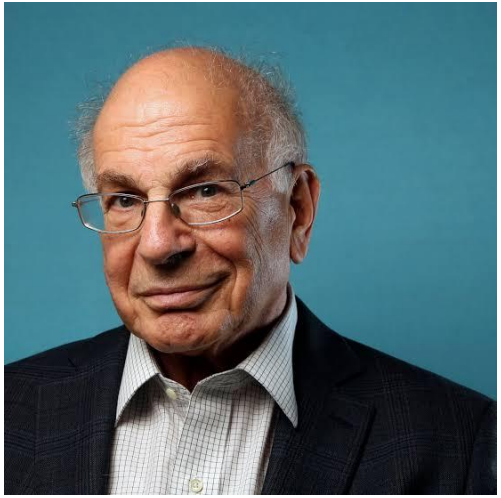
— Visual

--- Timing



Thank you

- Marina
- Shawn
- Alex Piet
- Matt
- Scott
- Andrew
- Vergil
- Yoni
- And all other students, faculties, speakers at SWDB 2024!!!



Daniel Kahneman, 1934- 2024

Humans made whack-a-mole for fun,
While scientists cooked up a new one.
At Allen, they found
For mice, joy abound,
In lick-at-change, a game to be won

Courtesy of ChatGPT,
Tribute to Anne Churchland