The Trial-History Dependence of Mice in the Behavioural Task

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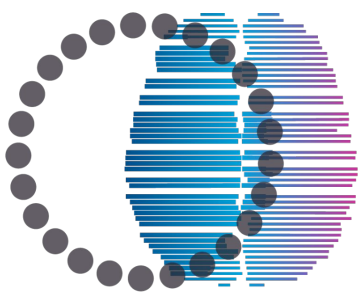
Intro



INTERNATIONAL
BRAIN
LABORATORY

Objective

- Study decision-making in mice using the IBL dataset
- Focus on trial-history bias in the 2AFC task

Motivation

- Traditional psychometric curves fail to capture behavioural variations
- Explore influence of historical trial outcomes on current decisions

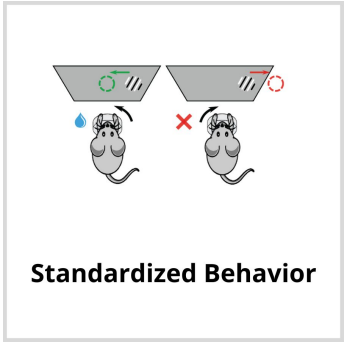
Experiment on a single mouse

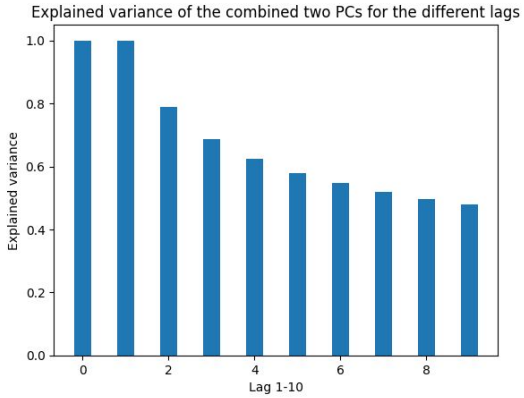
We selected the **‘choice’** column as our objective, y.

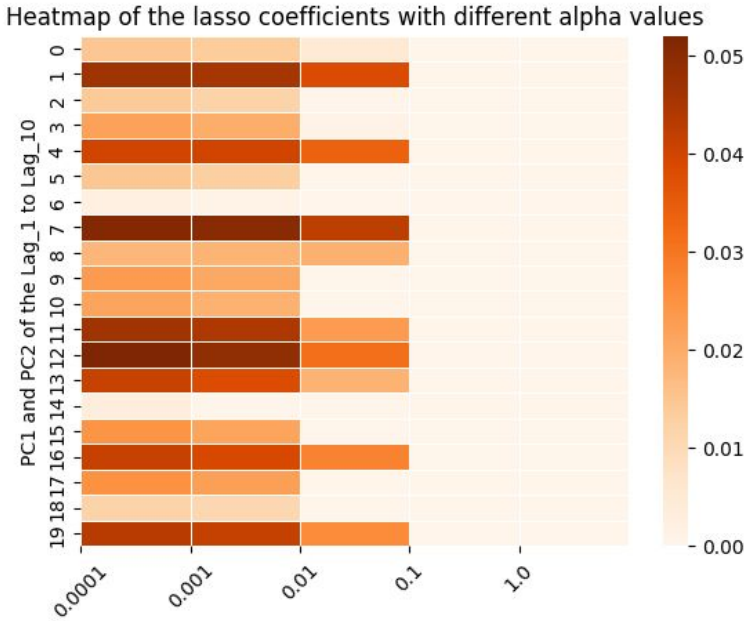
We created the **lagging frames** from 1 to 10 and jointed those columns as matrices X.

We performed **PCA** on X and selected the first **two PCs** to reconstruct the objective according (y’ = X * v), where v is the principal component vector.

We concatenated all y’s into a matrix and performed the **lasso regularisation**, **L1** with different alpha values.







Multiple subjects (n = 7)

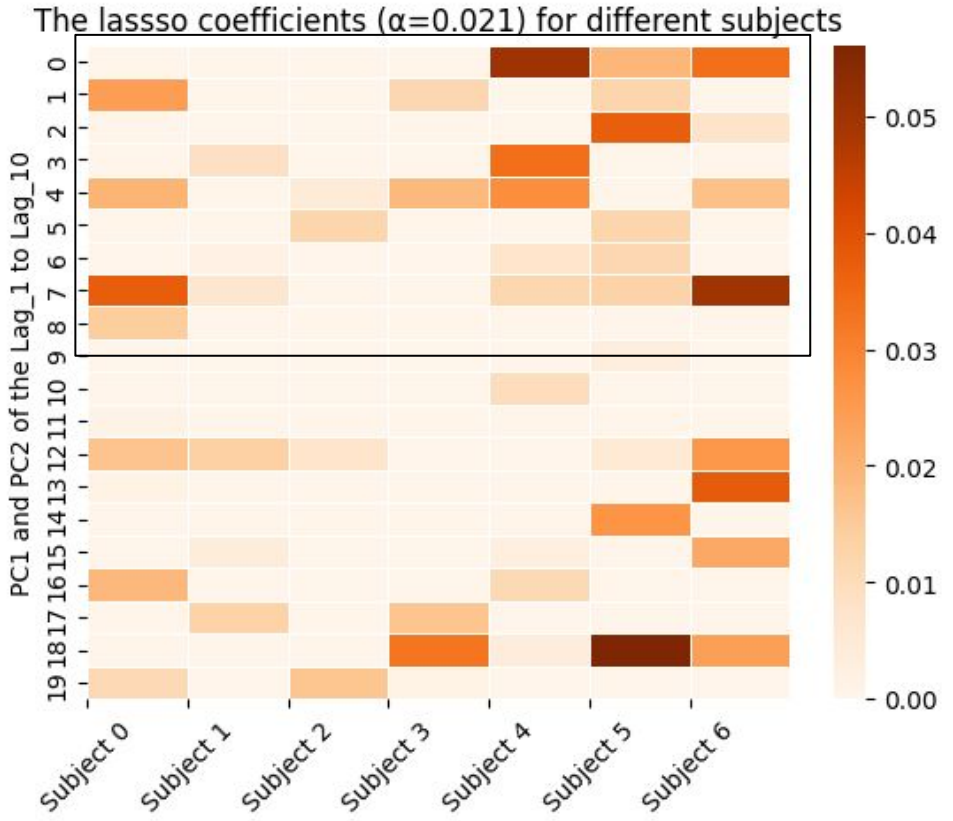
Training > 700 for all subjects.

Larger coefficients are concentrated in the first 5 lags -> More recent choice history.

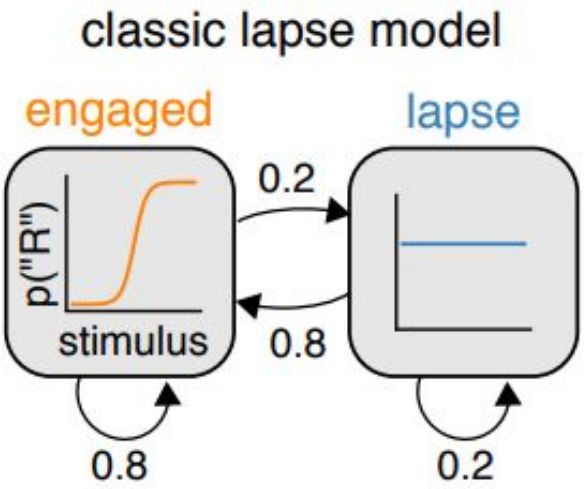
In some trials, the early lags is negatively correlated to their current choice -> a tendency to switch side.

Small coefficient magnitude (0.02 < || α_coef || < 0.04).

In essence, the mice **learn to not rely on history biases with longer training periods.**



$$p(y_t = 1 \mid \mathbf{x}_t) = \begin{cases} \frac{1}{1+e^{-\mathbf{w}\cdot\mathbf{x}_t}}, & z_t = \text{“engaged”} \\ \frac{\gamma_r}{\gamma_r+\gamma_l}, & z_t = \text{“lapse”}, \end{cases}$$

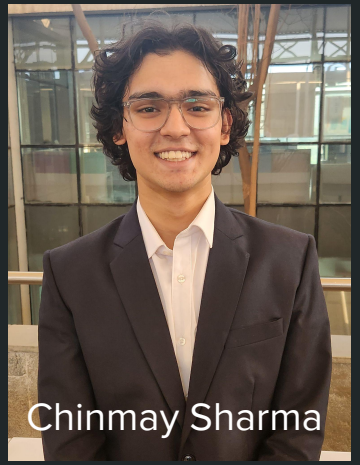


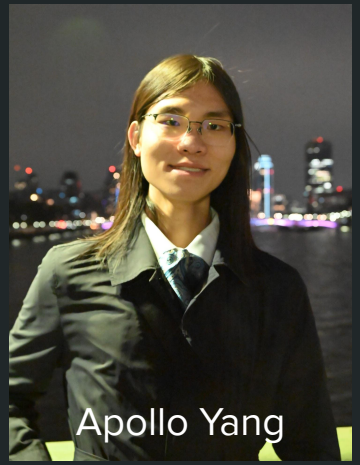
(Figures from Ashwood et. al 2021)

Outro and Future Work

- Incorporate trial-dependency in the SLDS and Lapse Rate models of Psychometric curves (Ashwood et. al 2021)
- Investigate the training duration with the level of trial-history dependency

Thank you!
and any questions?





Project Github
https://github.com/UberMayinch/Neuromatch-24