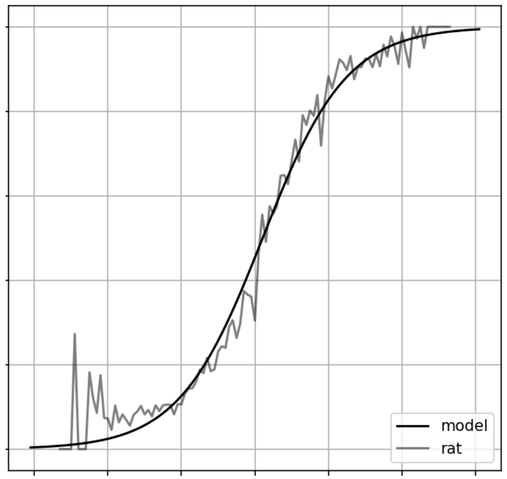
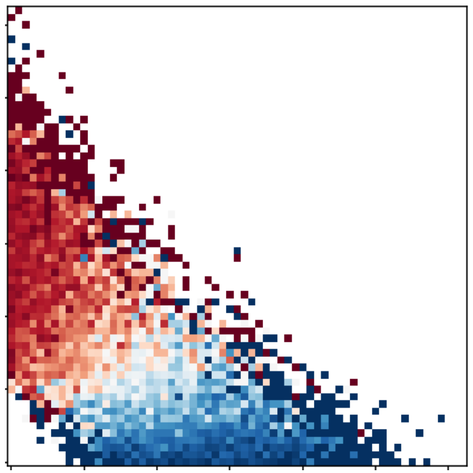
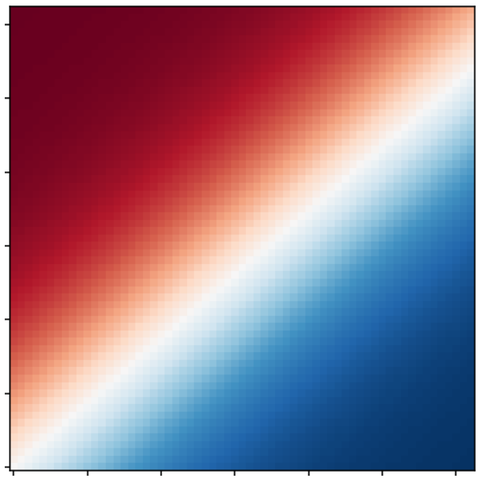
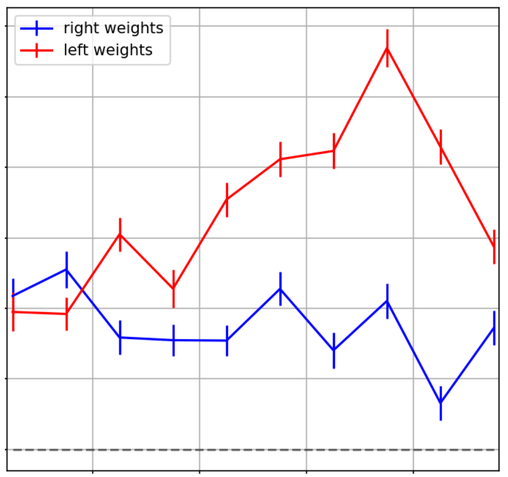
Rotation project: lots of rat logit models

Jorge Yanar
Feb 4 2020

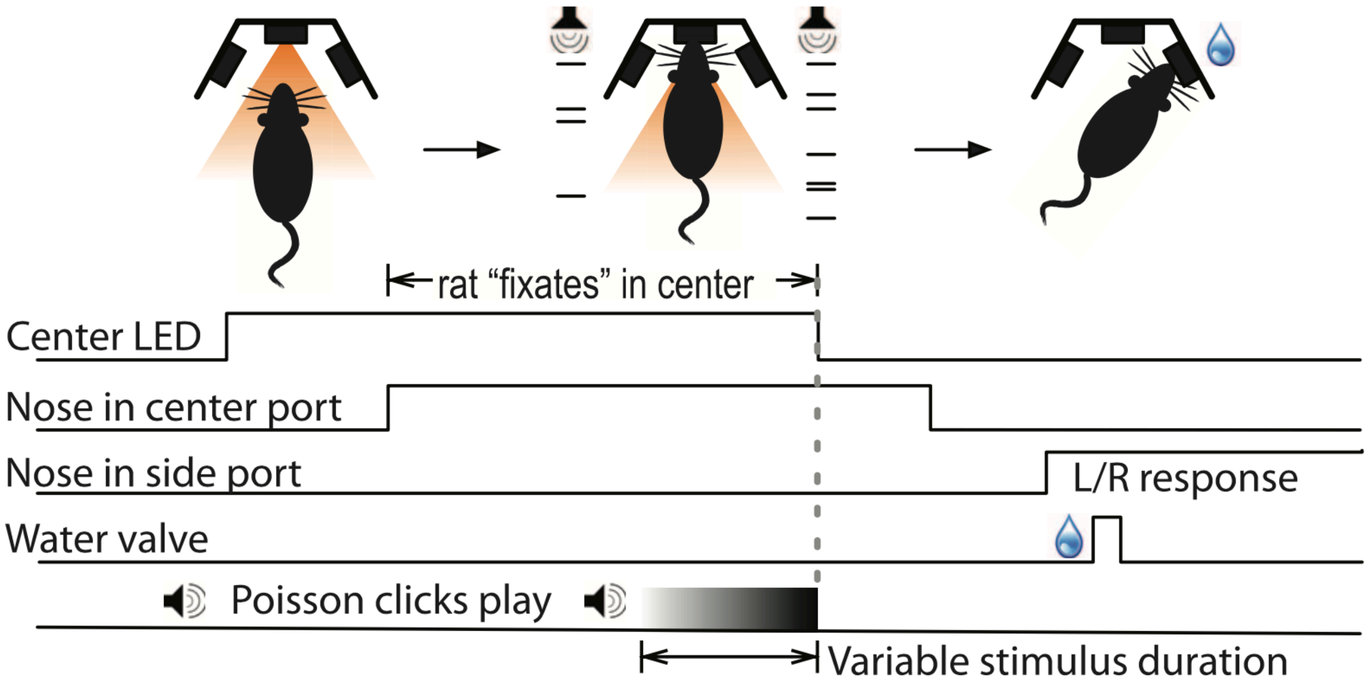








The Poisson Clicks task



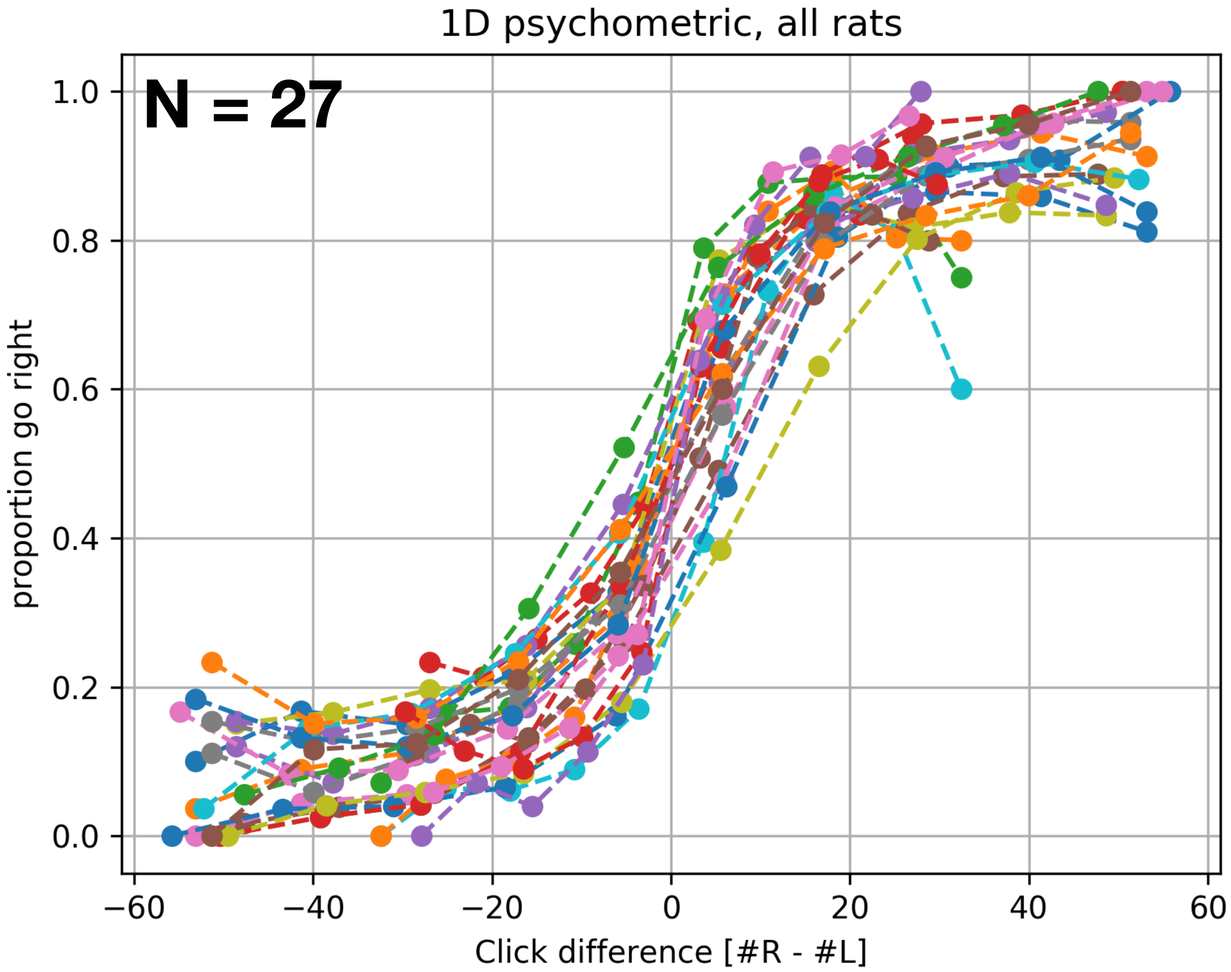
Analysis restricted to:

- Sessions where rats were rewarded for orienting towards side with greatest number of clicks.
- Both ‘classic’ and ‘frequency’ versions included.
- N=27 rats, average of ~25,000 trials per rat.

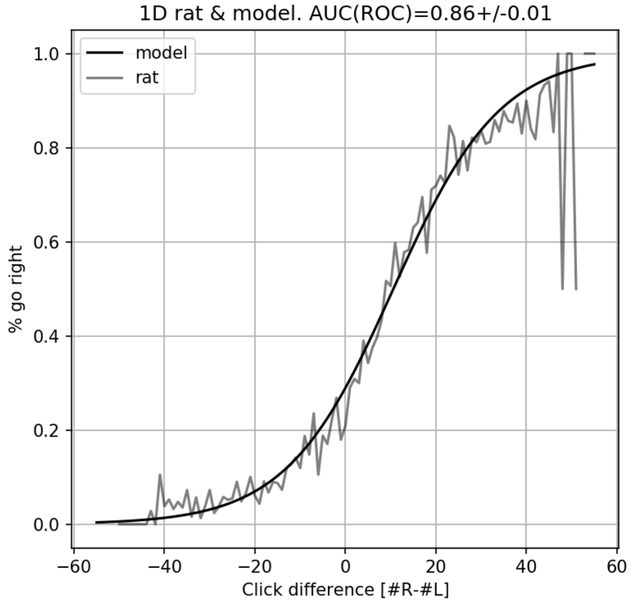
Brunton et. al, *Science* 2007

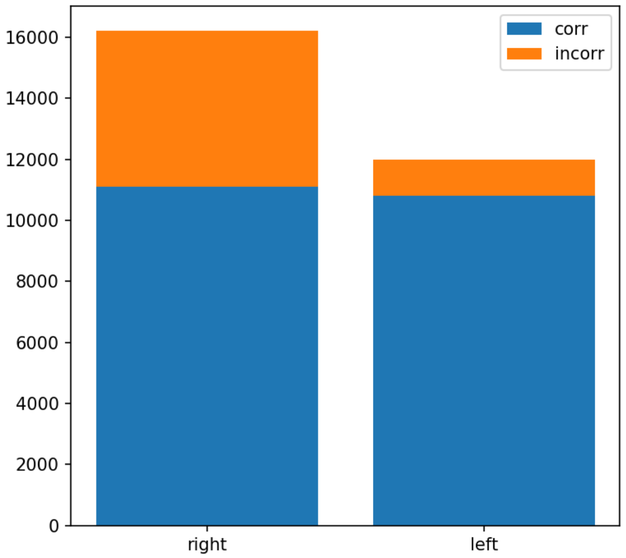
Most rats perform quite well

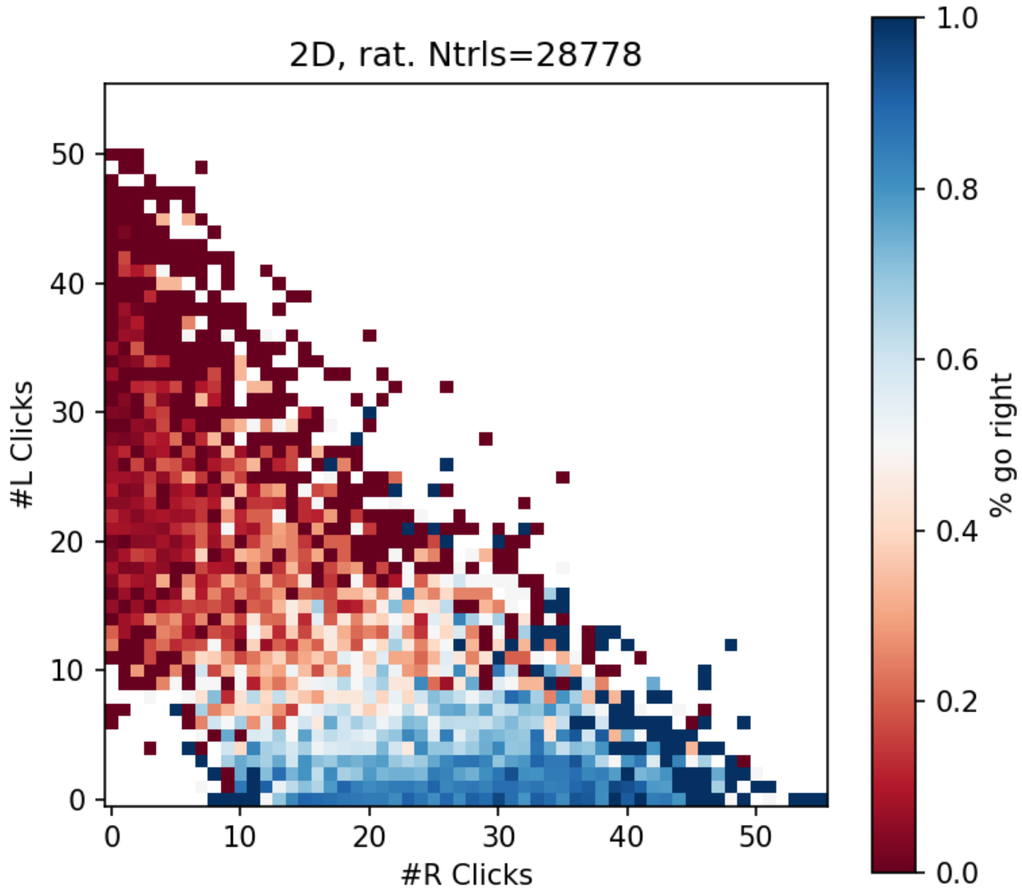
- Most rats hit a performance level between 85 and 100% on the easiest trials.
- Potentially biased towards one side ***(pays more attention to left than right clicks)***
- Or biased towards different temporal epochs ***(pays more attention to clicks at the end of a trial)***



2D psychometric allows us to see these biases a little better



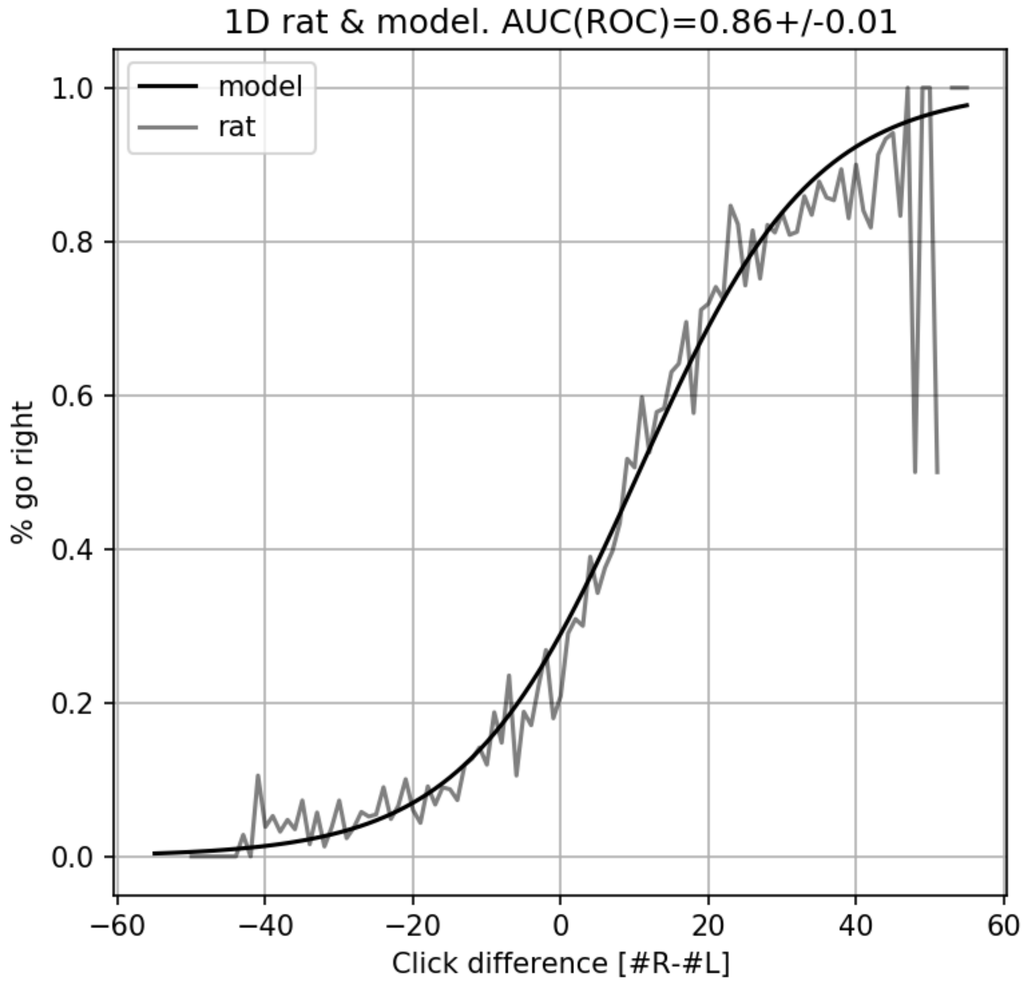




Many potential logit models

Total click difference:

$$log(\frac{p_R}{1-p_R}) = w(N_R - N_L) + \beta$$



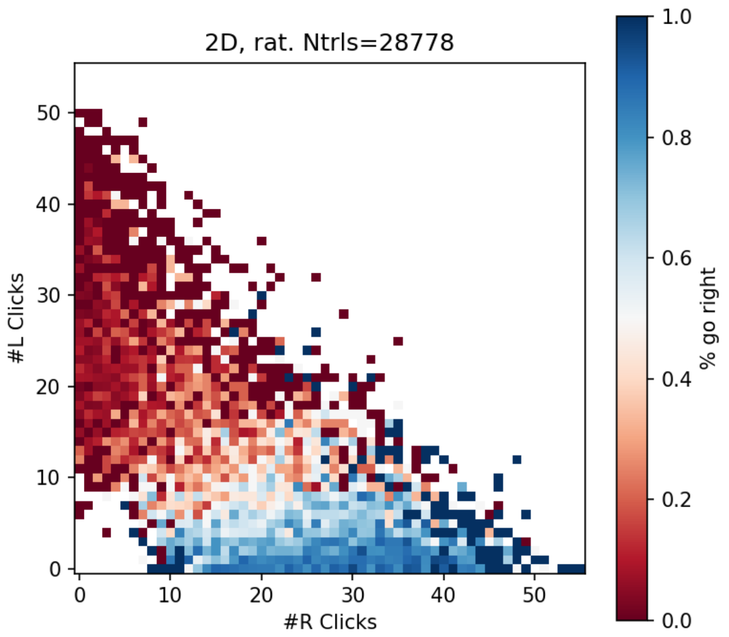
Many potential logit models

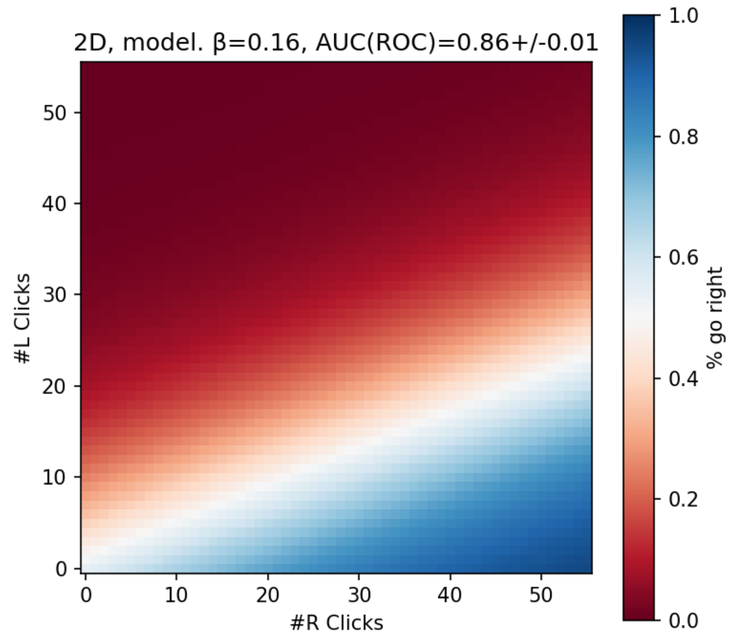
Total click difference:

$$log(\frac{p_R}{1-p_R}) = w(N_R - N_L) + \beta$$

Number of right and left clicks:

$$log(\frac{p_R}{1-p_R}) = w_R N_R + w_L N_L + \beta$$





Many potential logit models

Total click difference:

$$log(\frac{p_R}{1-p_R}) = w(N_R - N_L) + \beta$$

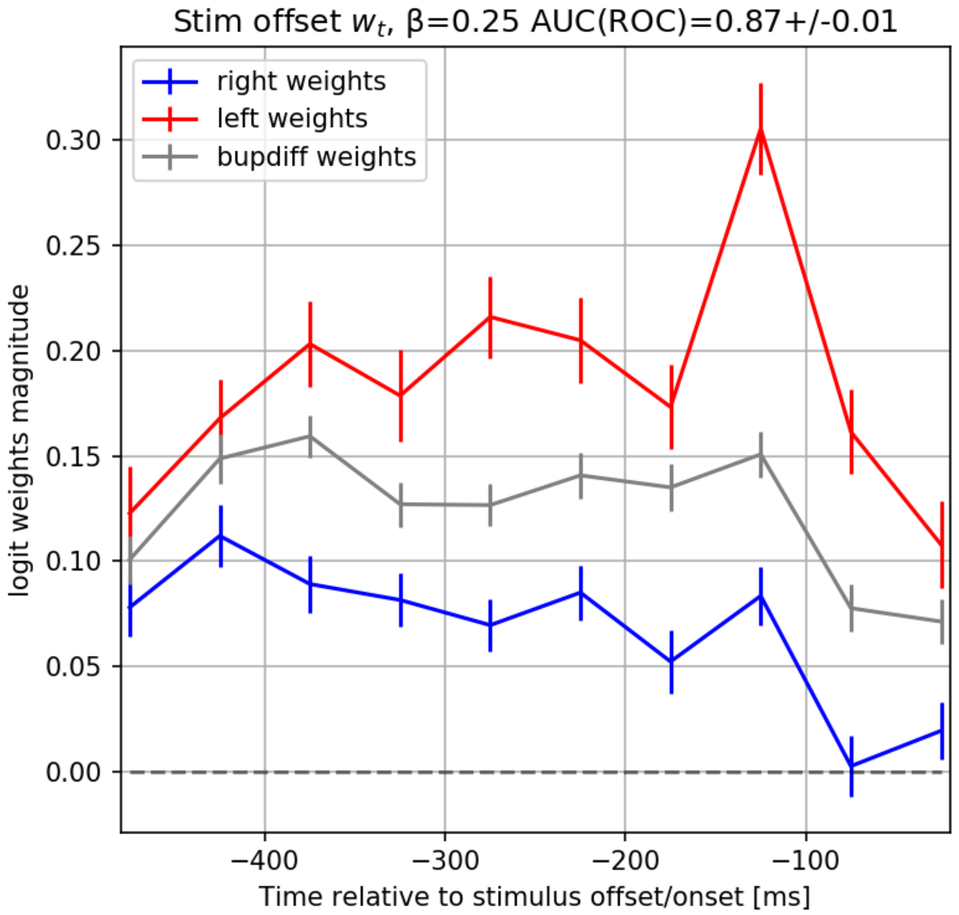
Number of right and left clicks:

$$log(\frac{p_R}{1-p_R}) = w_R N_R + w_L N_L + \beta$$

Click difference, or right and left clicks over time:

$$log(\frac{p_R}{1-p_R}) = w_1 \Delta_1 + w_2 \Delta_2 + \ldots + w_N \Delta_N + \beta$$

$$log(\frac{p_R}{1-p_R}) = w_{R1} N_{R1} + w_{R2} N_{R2} + \ldots + w_{L1} N_{L1} + \ldots \beta$$

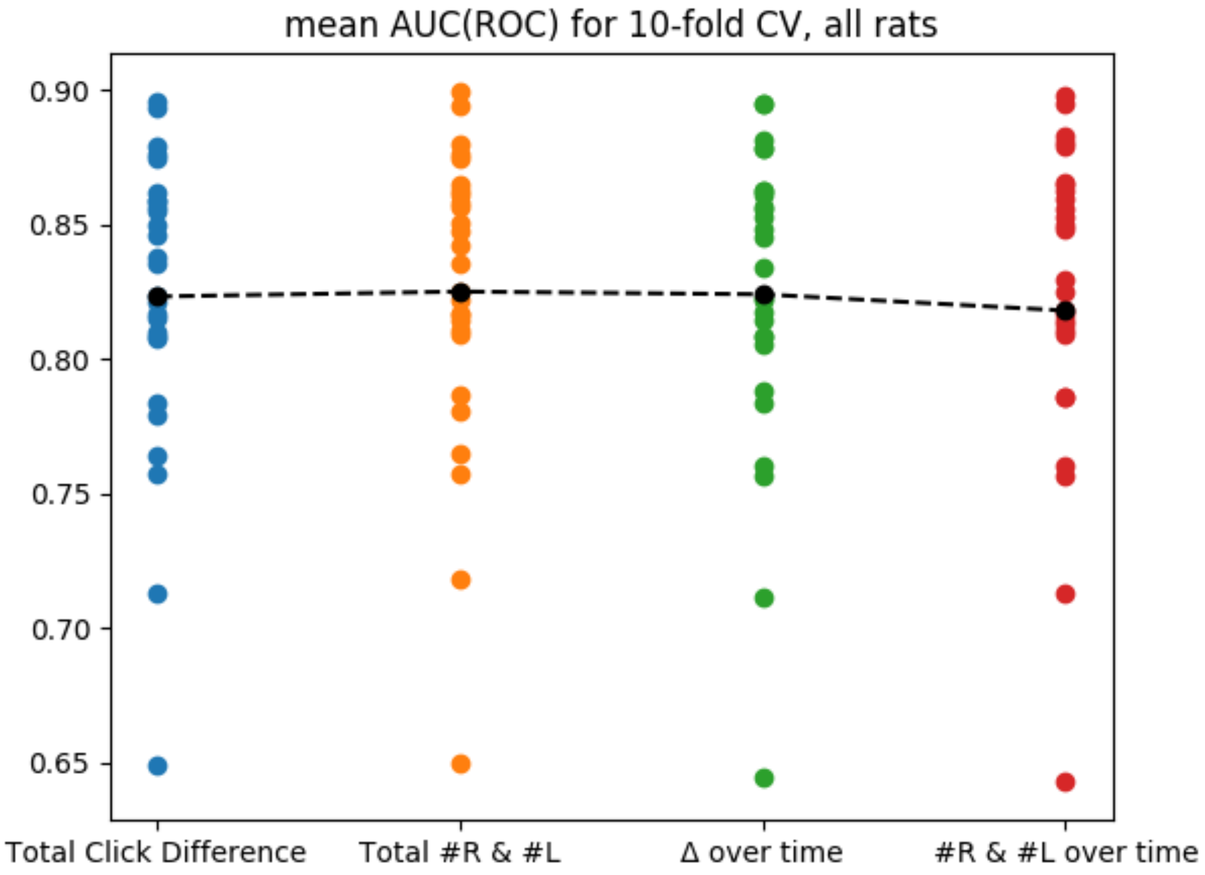


Used the GLM.jl package!

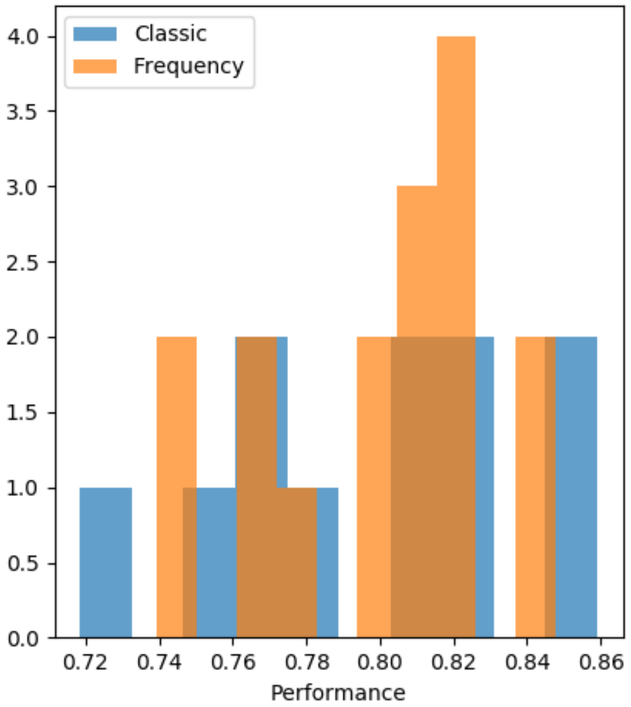
More complicated models don’t seem to do any better

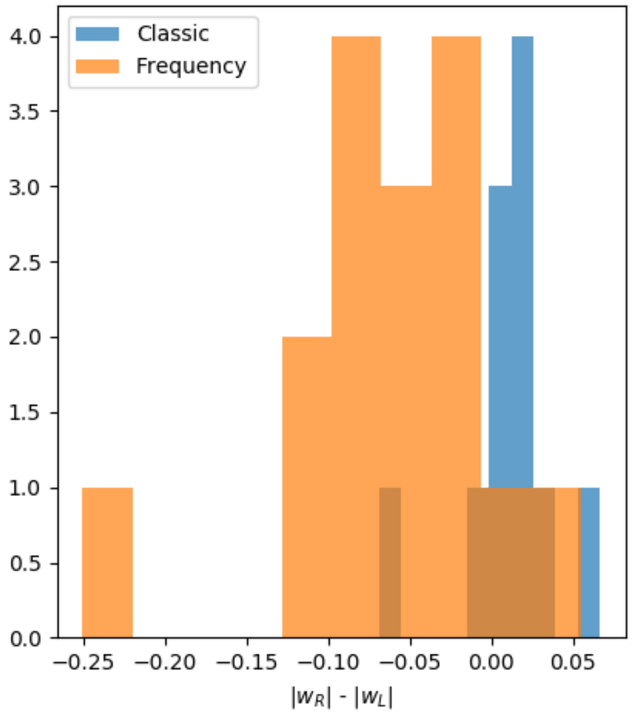
- For each rat, performed 10-fold cross-validation on these 4 models.

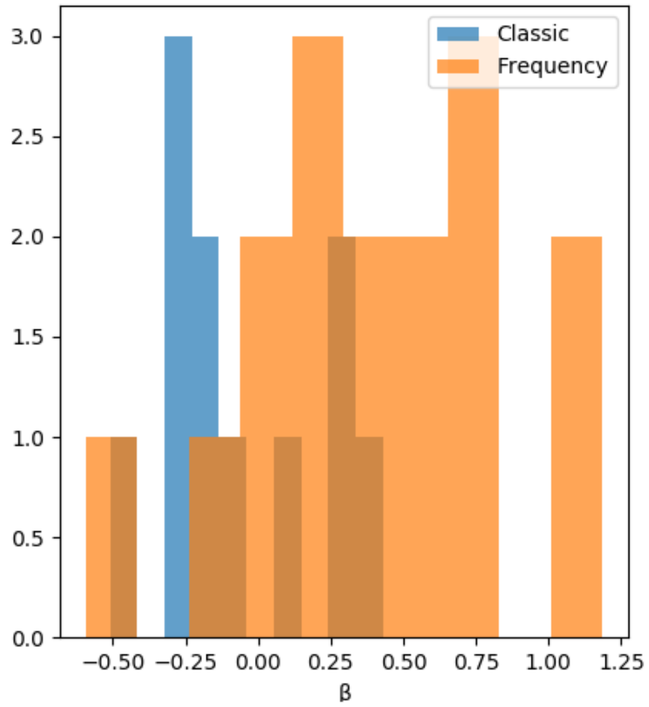
- Quantified performance by computing AUC of the ROC curve (varies between [0,1]). AUC(ROC) is a metric of a model’s capability to distinguish between classes.



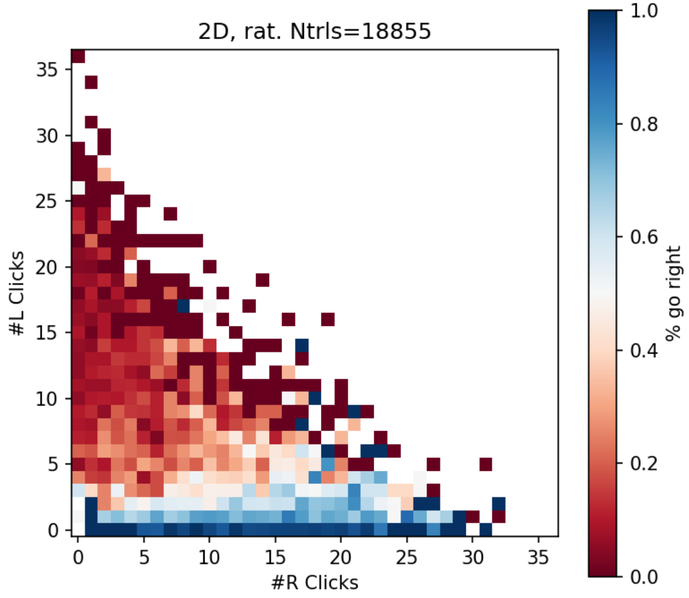
Frequency rats tend to be more left-biased

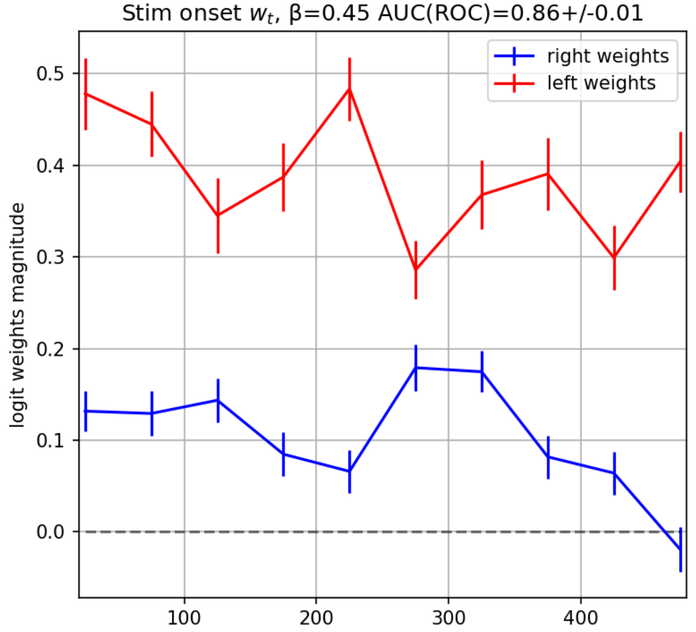


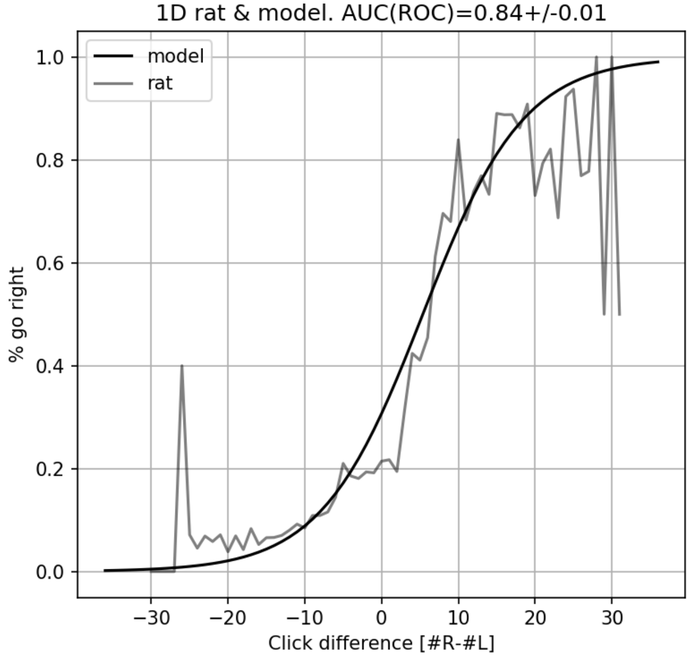


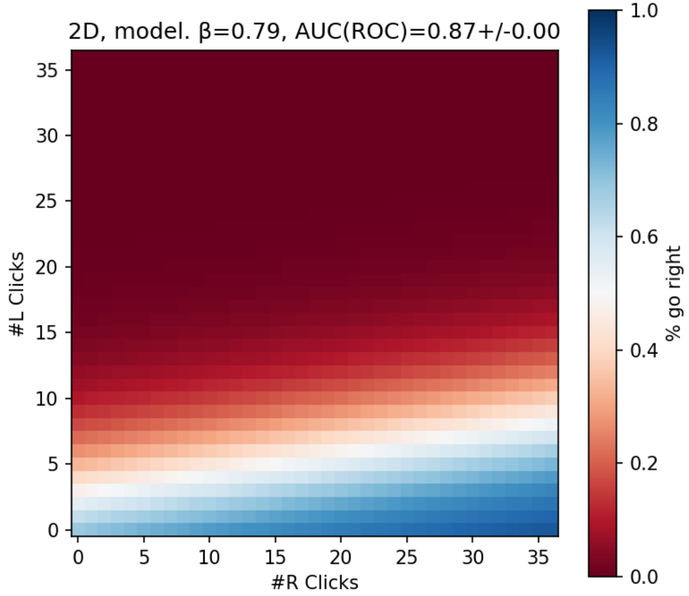


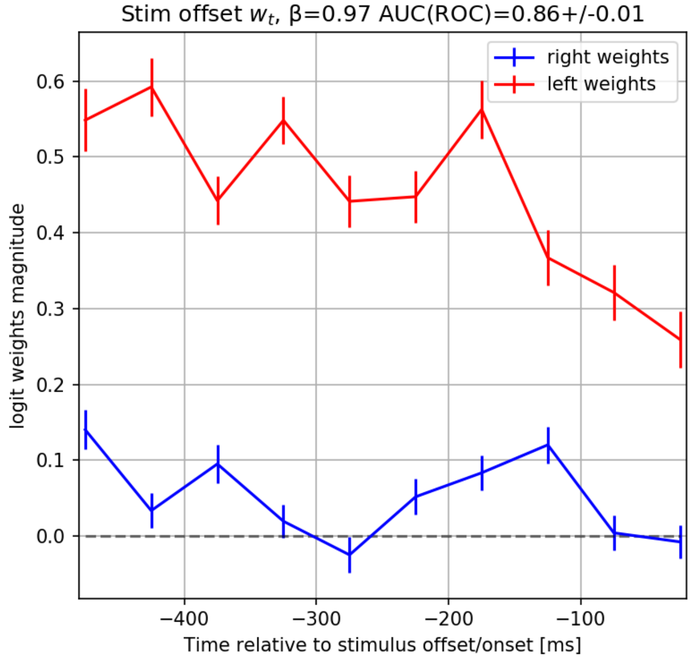
K298_Frequency_20Hz

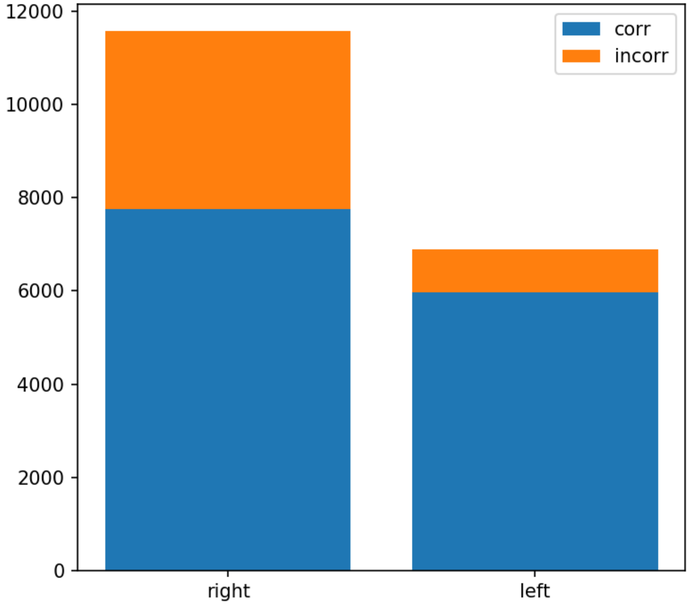




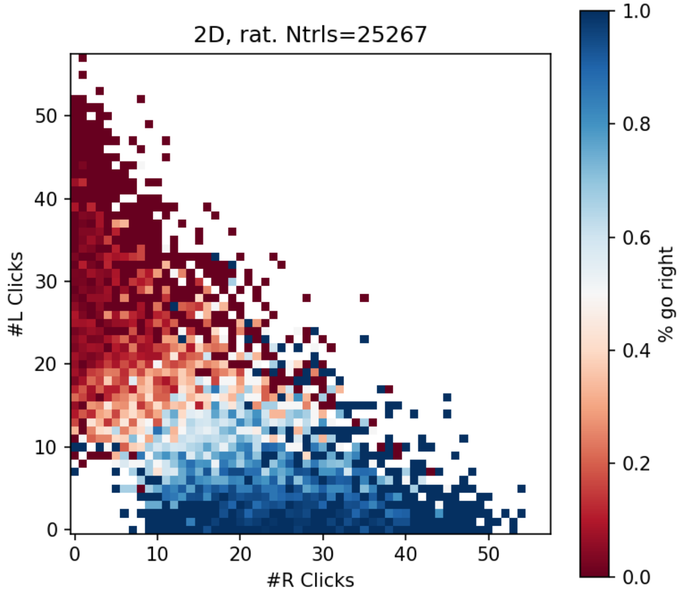


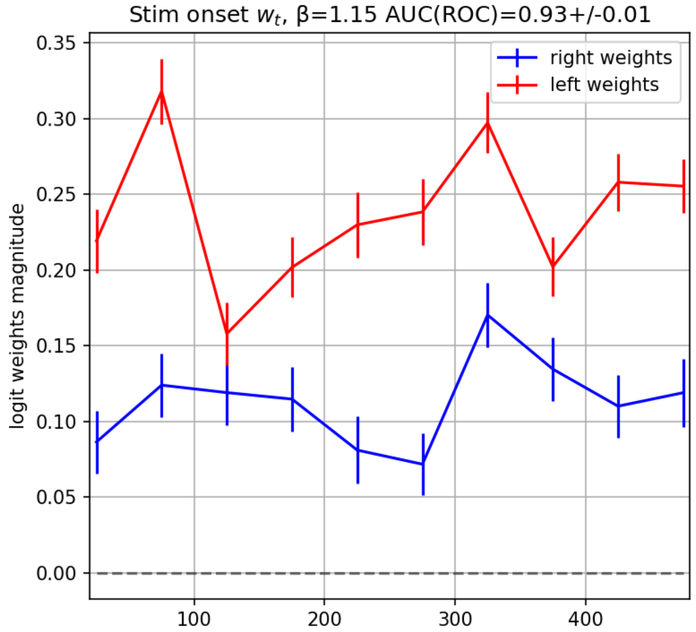


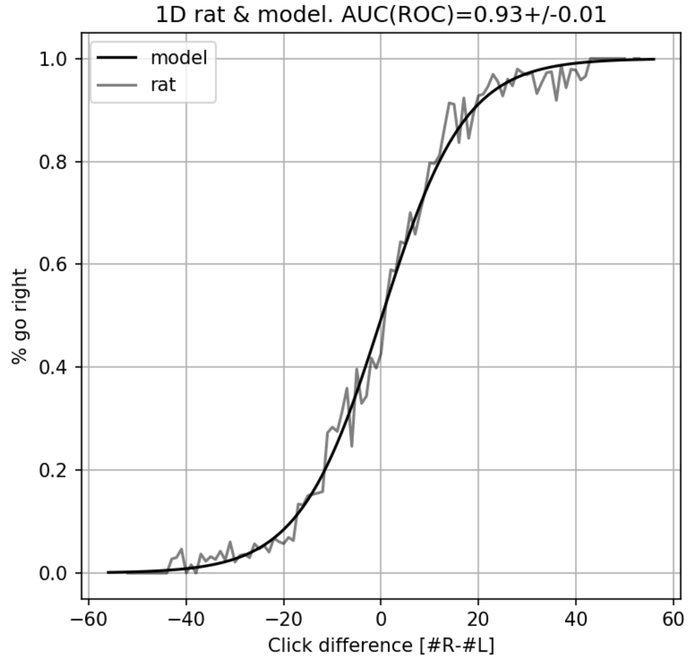


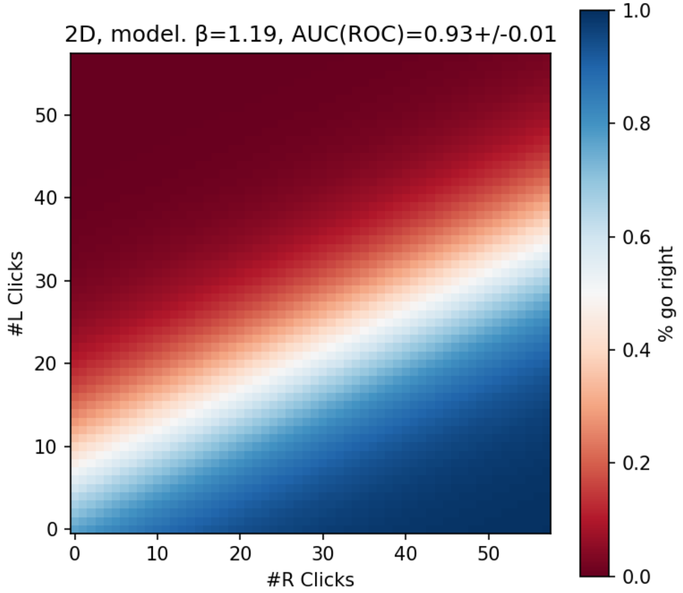


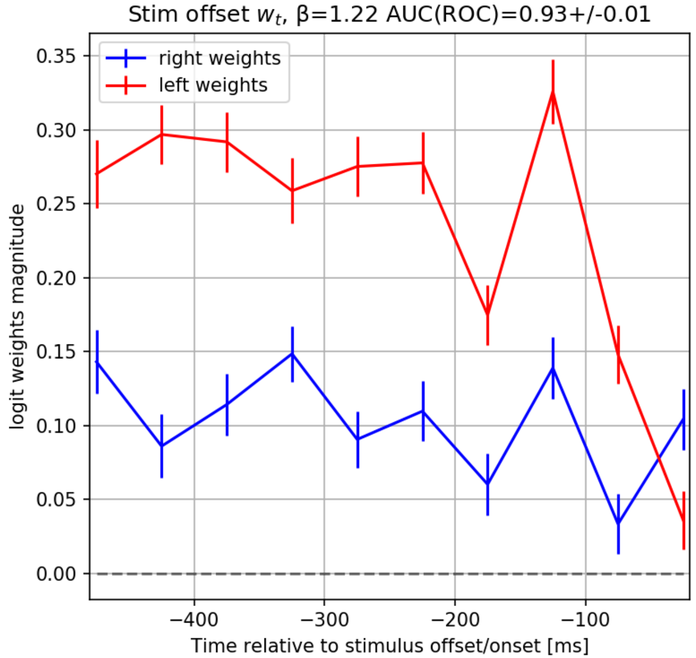
K305_Frequency_40Hz

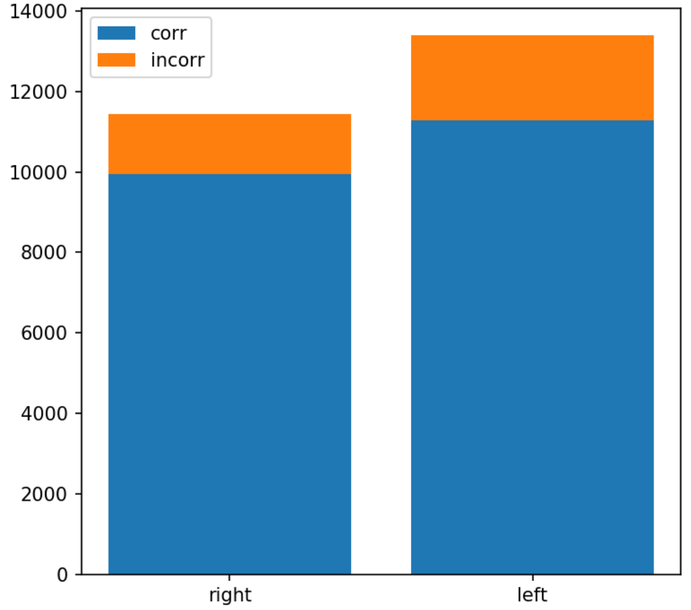




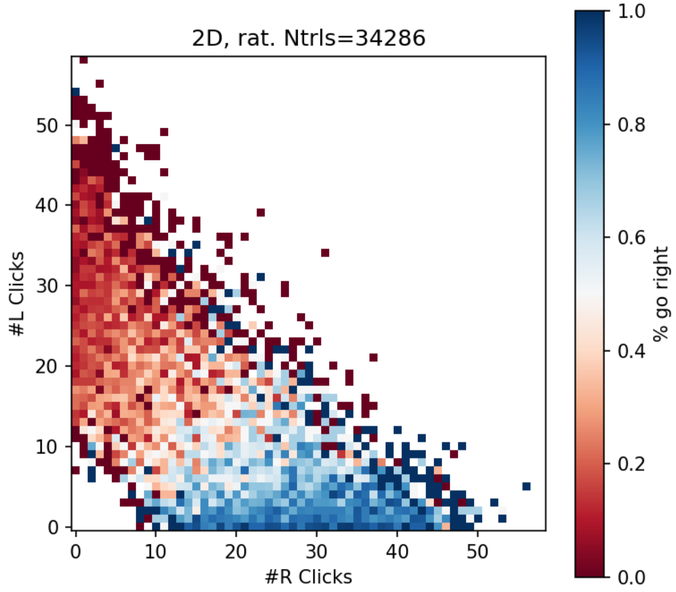


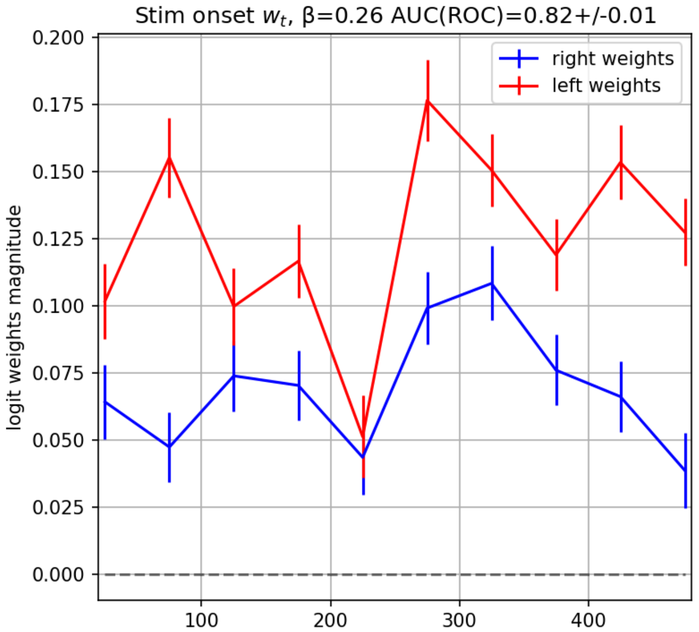


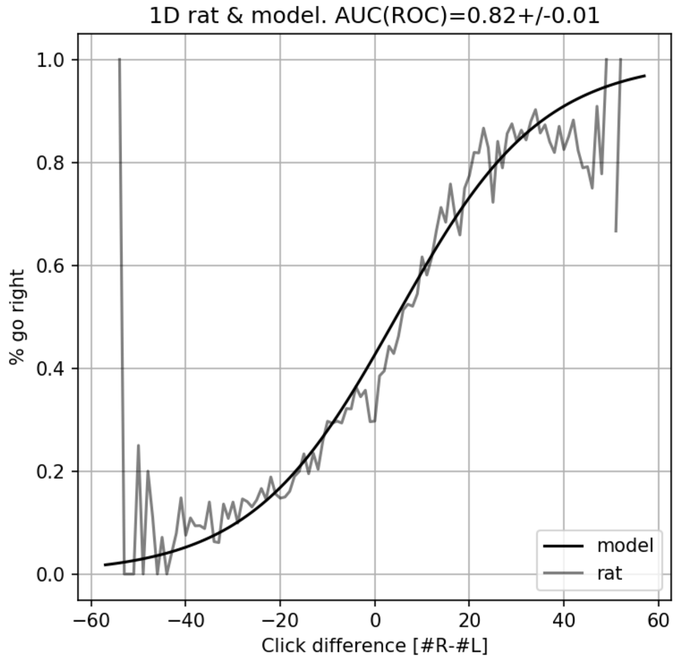


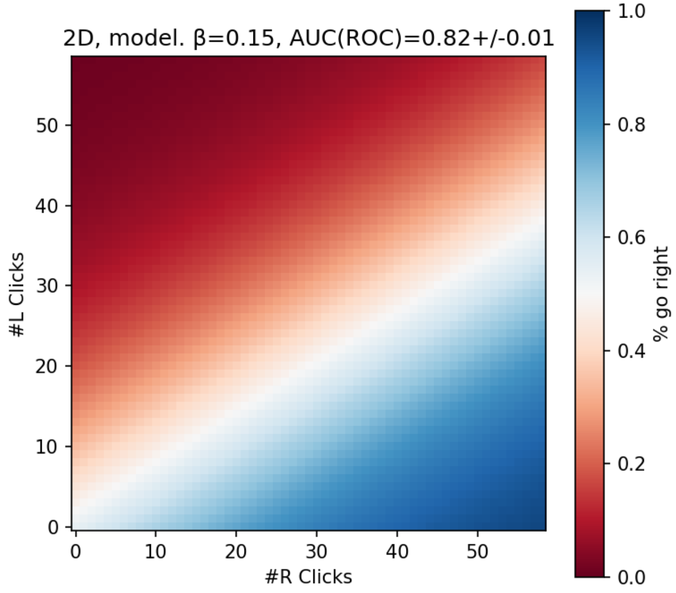


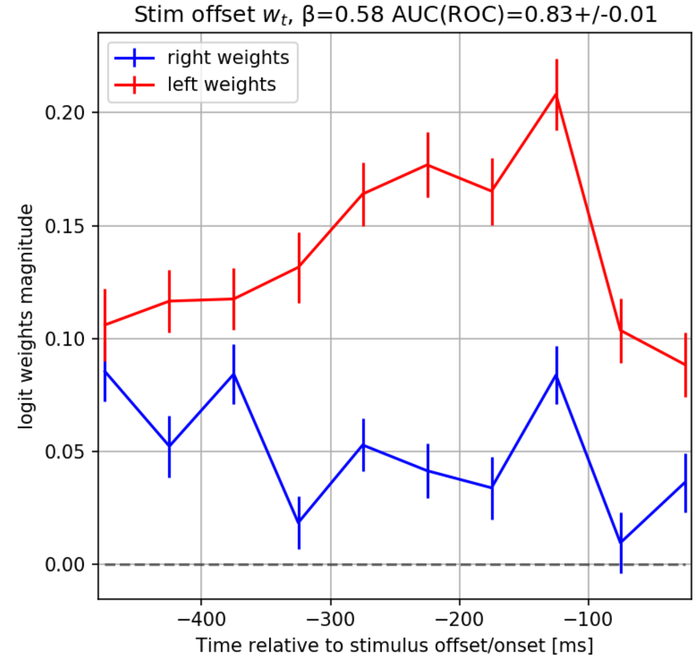
K311_Frequency_40Hz

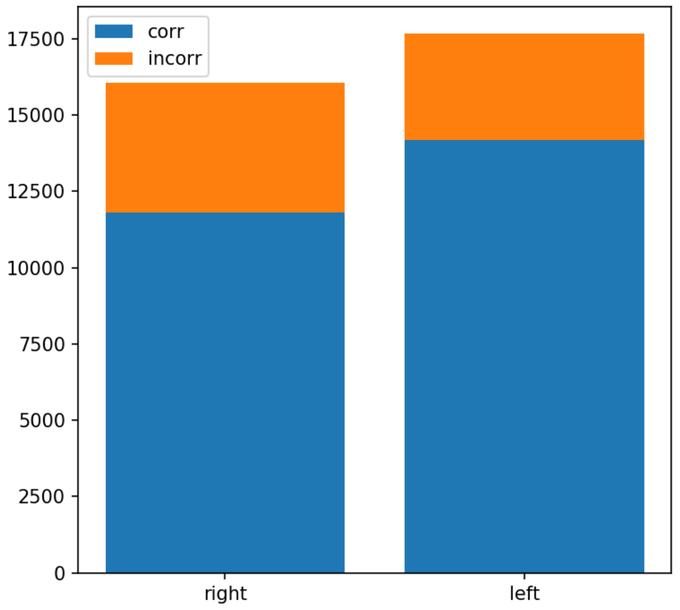




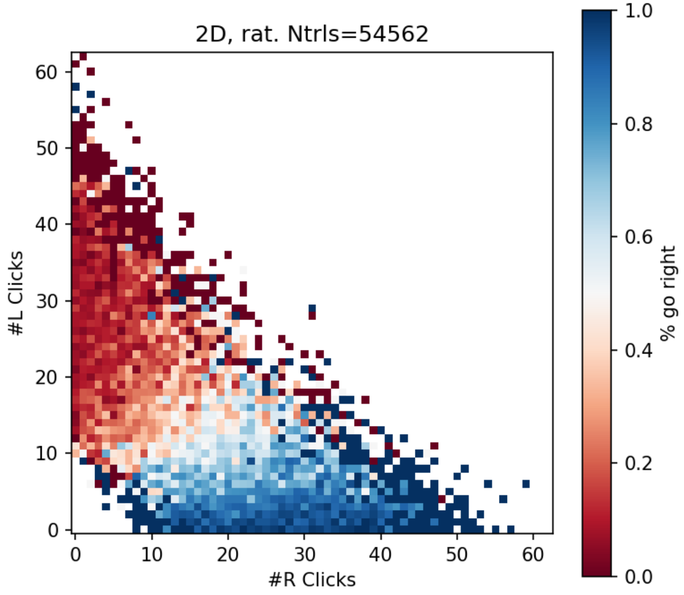


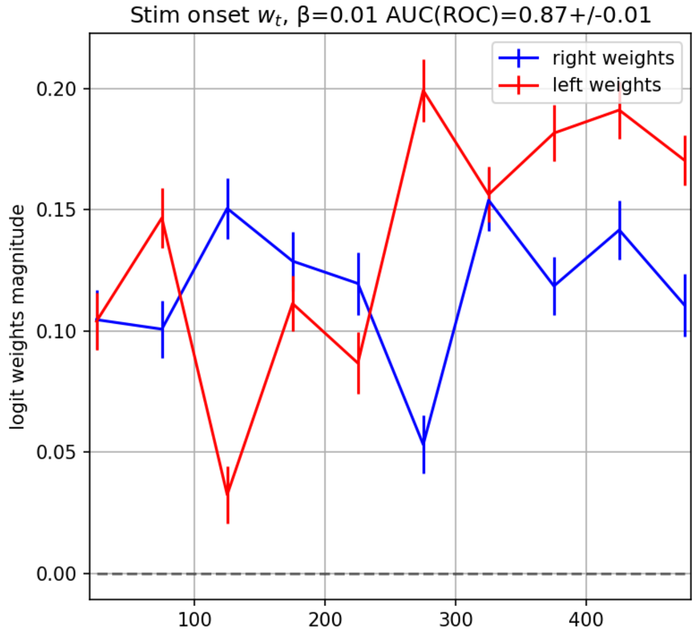


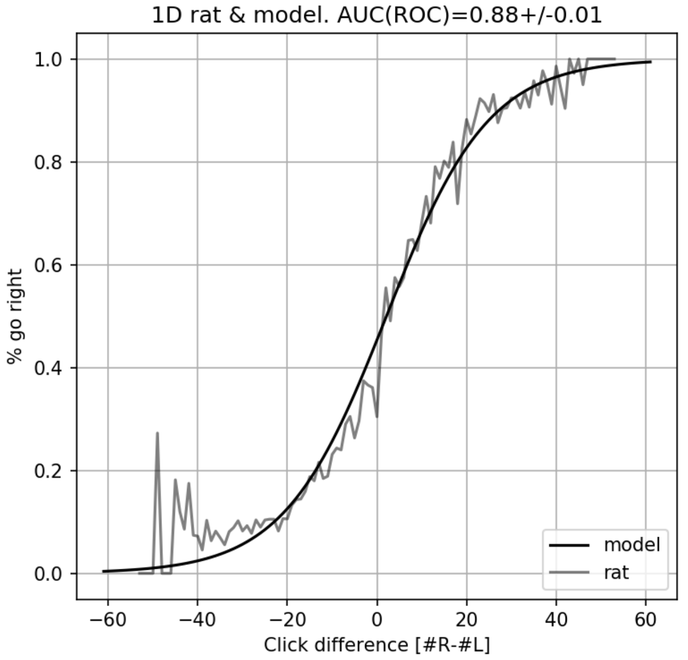


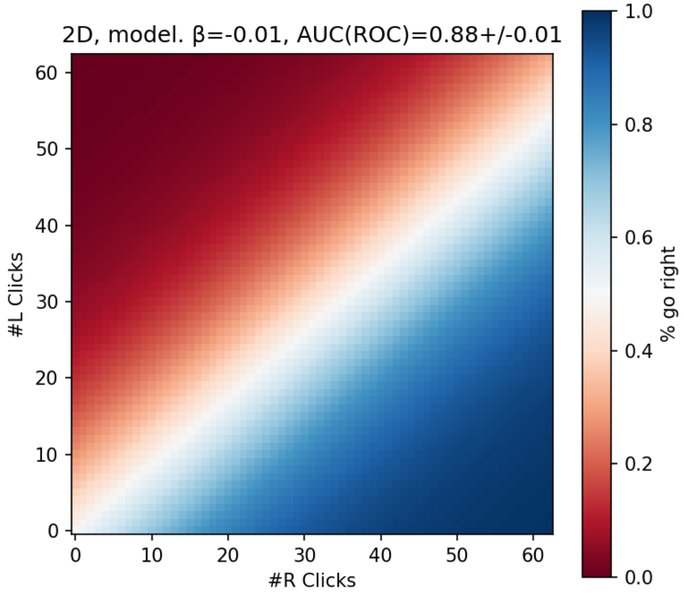


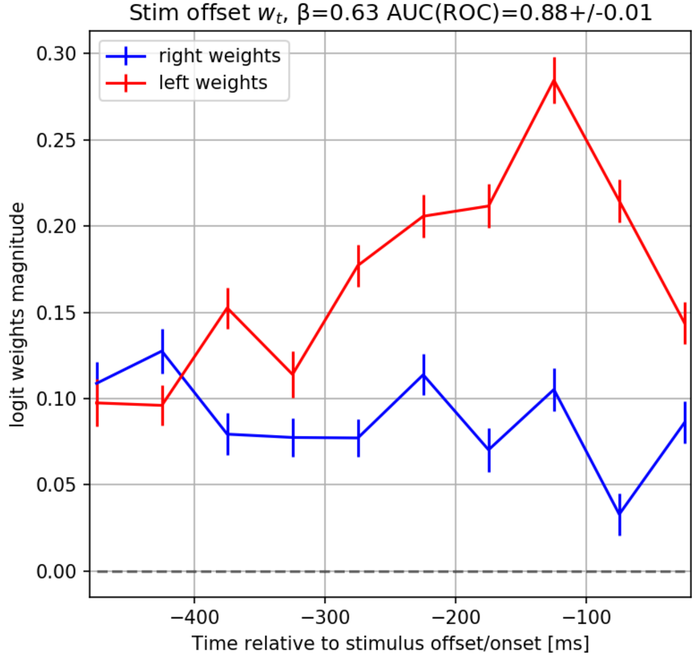
K314_Frequency_40Hz

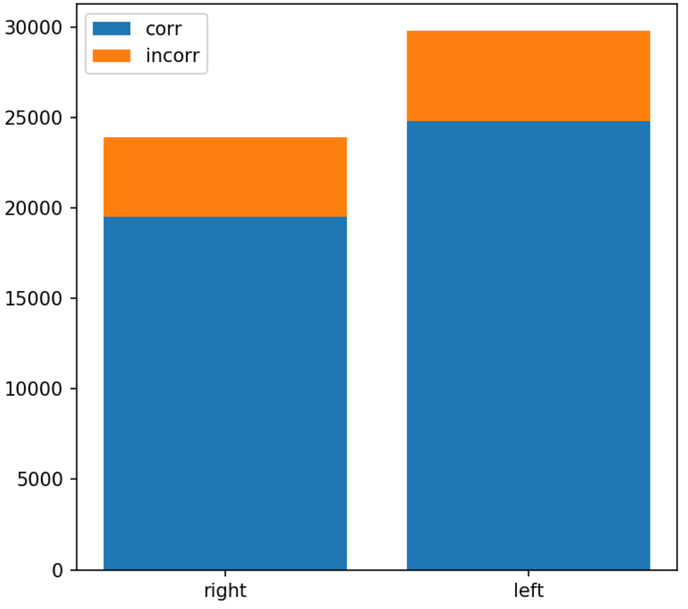












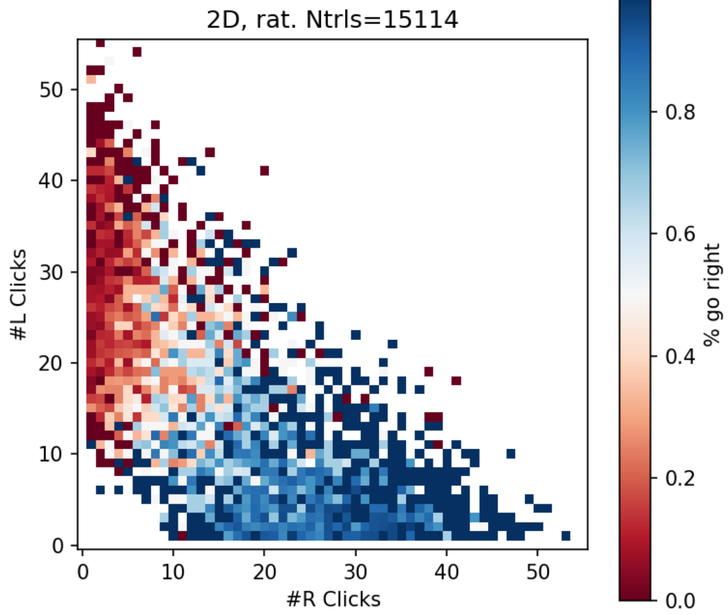
Fin

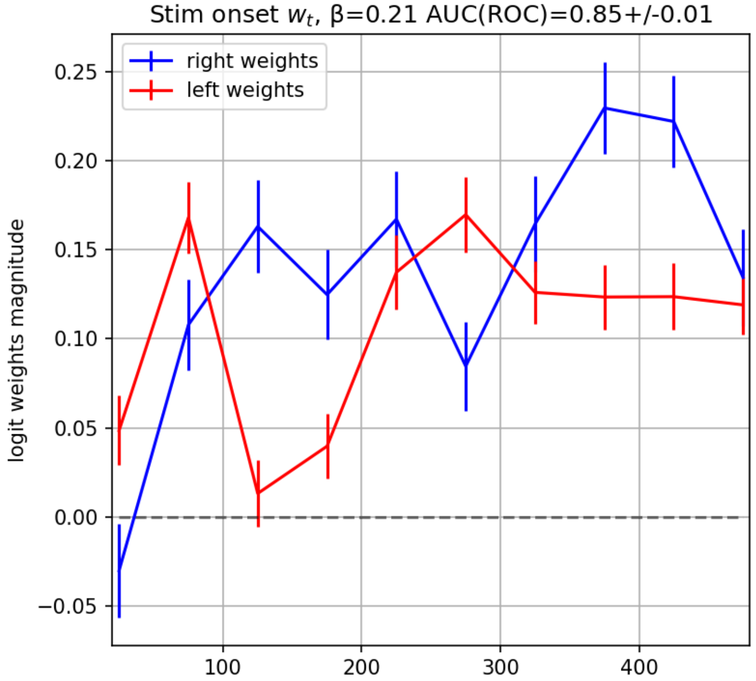
Still to be done:

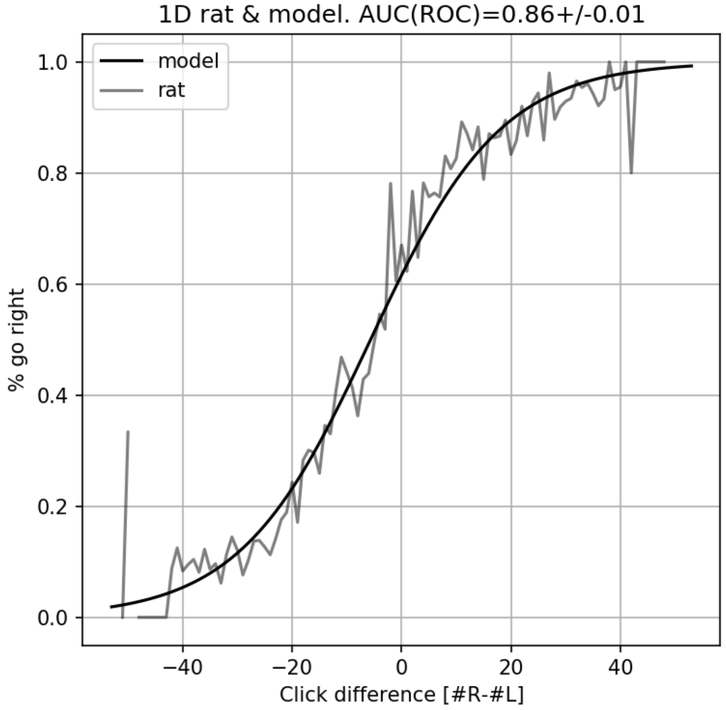
- Clean up and package code into usable lab repo.
- Incorporate trial history effects.
- Better model comparison methods.

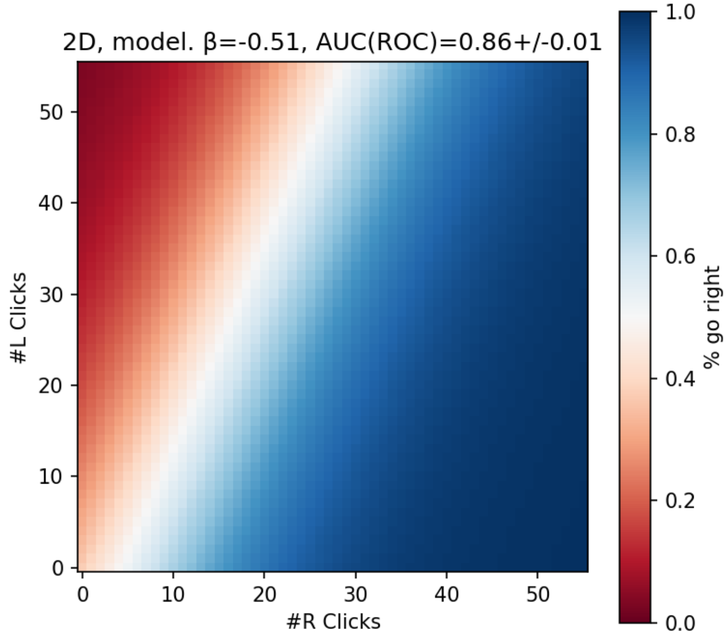
Thanks!

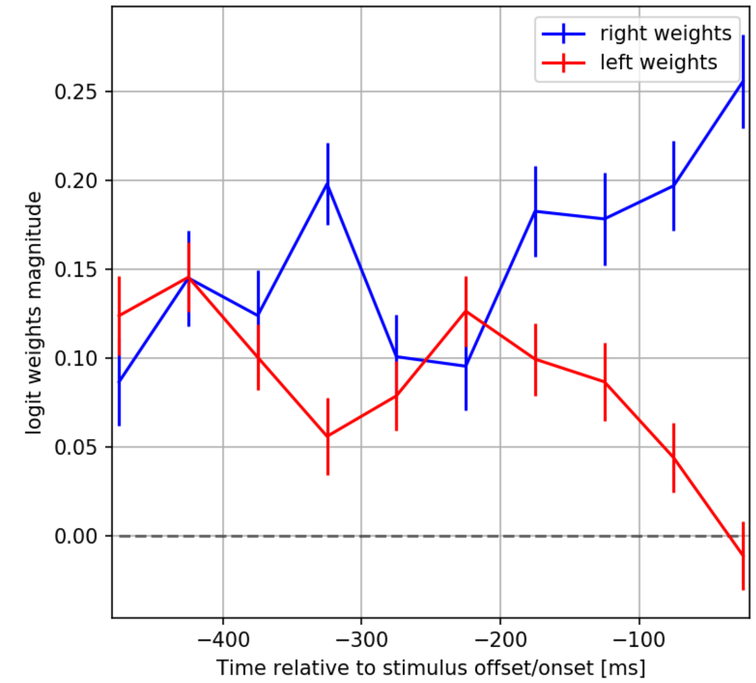
K330_Classic_40Hz

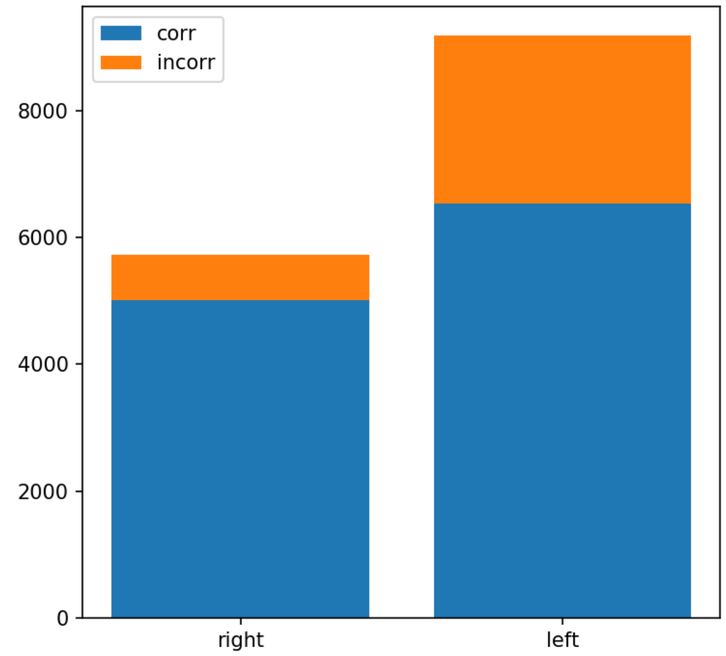












K339_Classic_40Hz