NoiseStrike Diary

Friday, 21st August

What I read this week: Properties and temporal dynamics of choice‑ and action‑predictive signals during item recognition decisions Guidotti et al 2020, Brain Structure and Function

Paper Summary: No evidence for encoding of a memory decision variable in the motor system (not a statement about perceptual decisions). At the end of a memory decision period a second activity peak in striatum might represent choice- to- action mapping. This was an fMRI study.

My thoughts: Maybe there is less variance in a memory decision signal than in a perceptual signal and this eliminates the effect in the motor system. This study shows that decision signals are used to trigger a response, and that the value of that decision is not necessarily reflected in the motor system.   
Based on this study it would make sense that the decision signal comes from the perceptual system instead of being generated in the motor system.

What I implemented (model): Decision strategies yield different levels of performance, using the mean location of the goal as estimate is better than collapsing or expanding bounds.   
A more elaborate decision strategy relies on the probability of a point being inside the goal. Sampling from point far away from the attacker end point decreases the estimated probability of the attacker being inside the goal.

In most cases, the belief about where the attacker landed is strong from the very beginning, even though very little is known about the actual goal location. (i.e. width of the goal is not known, but the distribution is known, and thus the probability of a hit/no-hit).

Changes of mind occur in ~ 60 % of the trials, but often early during the trial.

What I need next is a model than translates the certainties, CoMs into reaction times.   
I’d like to implement a drift diffusion model with 3 different assumptions:

1. The slope is set at the beginning and kept constant
2. The slope is set at the beginning and updated with every new evidence
3. The slope is set and updated only after a CoM

What I implemented for the experiment:

Attacker is now flying straight, trial starts with key press and a response requires hitting the screen.

I need to remove the old fixation point

And I need to get times how long it takes to reach from the keyboard to the screen.

Friday 28th

Paper of the Week: Miriam Spering and Montagnini: Do we track what we see?   
Paper Summary: shared and common parts of pursuit and perception of motion. Sometimes, pursuit is better than human perception, we track things that we don’t perceive, pursuit precedes perception of motion. Some effects i.e. the oblique effect have been found in both pursuit and perception and illusory motion can also be tracked. This speaks for a common mechanism underlying pursuit and perception of moving objects (maybe M4).  
Pursuit can also be independent from processing. Towards the motor output end the streams need to be decorrelated. Difference between perception and pursuit could be two different decision thresholds.

What happened this week:

Got a new EyeLink system, is set tup, works, for documentation see Eyelink Setup Document.  
Working on a short script that measures reach time from keyboard to screen and tracks the eye to find which positions on the screen can still be eye-tracked when the hand moved.

Modelling: 3 drift diffusion models are implemented. 1: go signal after threshold is reached, 2: interruption with every new stimulus and new drift, 3: interruption if the new stimulus requires a change of mind.

Model 1 achieves higher performance on the simulated data than models 2 and 3, but depends a lot on how conservative the decision criterion is.

Maybe the drift rate is not strong enough in the first frame.  
Next week: take a unified strategy for the first frames for all models  
How to fit/optimize that model?

Friday 4th September

What I read this week: Liston, Krauzlis, Shared Decision Signals explain performance and timing of pursuit and saccadic eye movements

Finding: Speed-Accuracy Trade off is comparable for 2 movement types but they are time-shifted. This could be explained by a decision making signal that is shared but informs the movement at different thresholds.

My thoughts: If I find similar looking curves in hand and eye movements, they might be guided by the same signal.

Who I talked to: Alexander Goettker and Philipp Kreyenmeyer  
Thoughts: check omnipause neurons (gunnar bloom), maybe they “decide” at which threshold information is forwarded

Muscular activity for arm movements precede eye movements, maybe the decision signal that guide these two is not delayed.

Lisberger/gain control seems to be an important framework

What I coded: Reach time and reaction times for keyboard to touchscreen

What I found: upper right part of screen seems to have shorter movement durations (80 ms difference between fast and slow reaches), and right side of the screen has faster reaction times.

What I also coded: Drift diffusions with 3 different models, model 1 strongly depends on the threshold. Model 2 (many stops) outperforms model 3 (few stops) which seems counter intuitive, but also these models aren’t fit yet.

I suggest the following setup for the model:

A decision threshold to start the drift (the silent period of evidence integration)  
A threshold for the decision OR a factor to scale the drift rate/probability  
-> we decided to use an overall threshold   
(Q: can I assume that the drift rate scales with certainty?)  
A threshold for re-evaluation of the signal, changing the drift  
A stop time mean  
A stop time SD  
  
Questions for model fitting: can I “just” code a function and fit it? Or do I need a mathematical formulation?

Friday, 11th of September

What I read: A deep learning framework for Neuroscience, many famous authors, First: B. Richards, Senior: K. Kording  
What I learned: When a (neural) model is too complicated to describe it in terms of every single parameter (weights between nodes in the network), an alternative approach could be to define the learning functions, the objective function and the architecture and then let it learn freely.   
What I think: Interesting big-picture framework for system neuroscience.

What I did:  
Eye-Tracker Set-Up, Paradigm for Noise Strike is almost complete and entertaining. The eye tracker can’t sit on top of the screen -> too high, eyes not visible  
Alternative: Screen on Desk, Eye Tracker behind.   
Model: The decision value is a sum of the intervals between stimulus presentation times.

y =

Friday, 18th of September

What I read: Week without paper

What I did:

EyeLink – Billy (SR Research) suggested to put the camera below the eye and have the screen behind it. For an example video, see here:  
https://drive.google.com/file/d/0BwIhfAwd6UJAVXVMMFBQMExjTnc/view  
I tested this and it works but atm the lense is not suited for the short distance atm, I asked Billy which lense could be used instead.   
Jolande Fooken uses a tower mount for movements, with the screen vertical, but we want the screen to be horizontal, or slightly tilted, on the table.

Martin about Eyetracker: we will wait for a response by Billy and check the EyeLink manual to find the right lense.

Model – See here: https://github.com/ClaraKuper/NoiseStrikeMatlab/blob/master/Full\_DDM.ipynb

Martin about Model: b should be defined mathematically, then the model captures all conditions we have. We want to run a grid search to find the optimal parameter, because there are few parameters (4 – 3 thresholds, one stop time duration), and I have an intuition how to do it. We need to make sure that changing different parameters would affect the data (reaction time distributrion) differently. That can be simulated

Paradigm: Integrated Eye Tracking in the Noise Strike, forgot to write all messages to the eyelink, so edf to ascii translation worked, but the events are not listed in the file.

Talk by Jolande Fooken: After a no-go decision, subjects often blink, maybe I want to take care of that in the NoiseStrike Paradigm.

Friday 25th September:

What I coded:

Full decision model with 4 different parameters, available under the github link above. The definition of the decision value is based on a cumulative density function between the last known point of the goal and the maximum width the goal can get.   
The model produces reaction times that are either heavily left-sided with a cutoff at 200 ms or look uniformly distributed. The noise in the distribution comes for the noise in the task itself, not from the noise in the decision-making process. The next step should be to simulate each trial type x times with noise in the drift diffusion process and look at the results.

I also coded a parser to write out data from the eyelink file.  
I found that the following information is still missing and needs to be added as messaged to the eyelink file:

nr of trial  
nr of block  
info about trial (resp etc)  
info about events, button presses etc  
sync time  
start of experiment  
end of experiment

also, design and data from the experiment are currently not being saved.

Setup: We will try to use a 25 mm lense that can hopefully be borrowed from Pia Knoeferle’s group. With that, the eyelink can be moved below the eye and the screen placed on the desk – no tower mount would be needed even though that would still be a good final resort.

Paper of next week: A Role for the Superior Colliculus in Decision Criteria, Crapse et al 2018

Next Week:  
Monday: Change code according to notes from Thursday

Tuesday: (Hopefully)