The question I am asking in this project is how new visual evidence is used for the preparation of a manual movement. We know already that a moving hand can adjust its trajectory to account for new information in the environment, but it is less clear if comparably flexible adjustments happen during preparatory phases of the hand movements.

My paradigm to address this question prompts observers to decide if a moving point (the attacker) will hit or pass a target region (the goal). Critically, instead of showing the goal itself, we show a sequence of 6 dots sampled from the goal’s position. Our observers can use these samples to estimate the goal’s position and decide if the trial is a “hit trial” – where the intercepts the goal area – or a pass trial – where the attacker passes above or below the goal.

The experiment starts by pressing the space bar. After a short delay, the attacker moves, and the target sequence is shown. If the observer thinks that the current trial is a “hit”, they have to reach out and touch the screen to generate a “go” response. If they think the current trial is a “pass”, they keep their hand on the space bar to generate a “no-go” response. Every trial ends after 1 second.

With this paradigm, we can check, which samples contributed to a response, and which did not. There are some specific assumptions that we have here and to make them clear, let me take you to the detailed timeline of one trial down here.

Every dot on this timeline represents the appearance of a new sample. Because of the time constraint of one second observers will start their go response after on average 500 ms to reach the screen in time. Samples shown after that time should have no influence on the response. A linear regression model would reflect that difference as follows:

When an early sample shows strong evidence for a “hit”, the proportion of “go” responses should go up. With weak evidence for a hit, it should go down. Late samples, however, should not show that correlation. We can expect a similar pattern for reaction times, with faster responses for high “hit” evidence in early samples.

While this will tell us something about the time window that influences a response, linear regression models do not give us a mechanistic explanation how this integration is reached. But we can formulate our ideas about how motor plans evolve in time with the help of drift diffusion models.

In these models, we accumulate evidence for a “hit” trial in a decision variable (our drift value), till a boundary for the decision was reached. Our drift diffusion models formalize 3 different ways how motor plans can evolve over time.

Model one “Go with First” follows a very rigid strategy. Evidence for a hit is observed in the first sample and sets a drift-rate that is not changed by the subsequent samples. This model can serve as a baseline of what would happen if responses were made after seeing only one sample.

Model two “Wait and go” starts drifting when one sample provides evidence for a “hit” above a defined threshold. Afterwards the model is not adjusted. This model corresponds to a two – stage process, where a different decision is made about the crossing of a threshold before the motor plan is initiated.

Model three “go and adapt” starts drifting with the first sample and adjusts its drift rate to the evidence of every new sample. This corresponds to a dynamic decision-making process where the motor plan gradually reflects changes in the environment.

Those three models generate different responses to the paradigm I presented here. If you want to find out, how they look, and how they compared to the data we collected in our pilot experiment, you can download the full poster, or visit me at my poster in poster session A “Perception and Action: Decision making, models, neural mechanisms”, in room “Egret”. See you there.