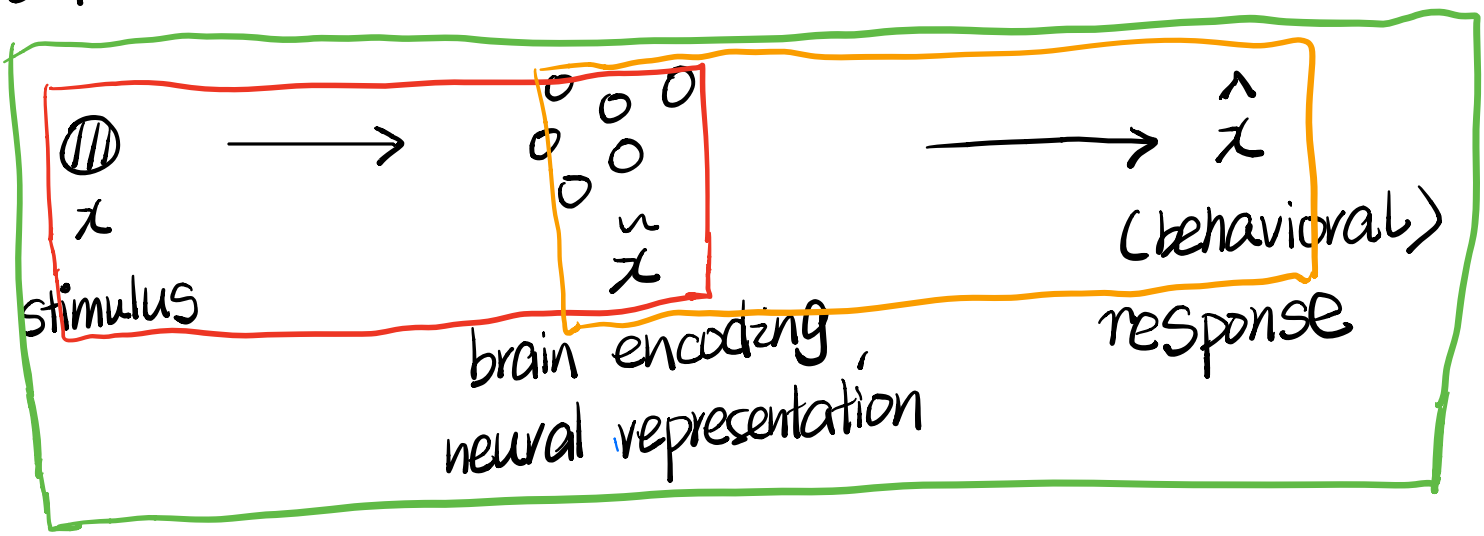
Bayesian Behavior Model

W2D1



- encoding $\tilde{x} \sim p(\tilde{x} \mid x)$

T3S5

→ stocastic due to noise & uncertainty

→ brain does not have direct access to the (distal) stimulus of interest

- decoding (given encoding $\tilde{x}$)

1) Bayes rule: $p(\tilde{x} \mid x) \times p(x) \xrightarrow{\text{normalize}} p(x \mid \tilde{x})$

T3S1-S3

likelihood × prior → posterior

2) decision rule:

T3S4, T4

$$\hat{x} = \underset{\hat{x}}{\operatorname{argmax}} \int u(\hat{x}, x)\, p(x \mid \tilde{x})\, dx$$

choose action (response) to max expected utility

utility function: e.g. $-(x - \hat{x})^2$

expected utility under our posterior

under which $\hat{x}$ is posterior mean

- from encoding $\tilde{x}$ to response $\hat{x}$ based on likelihood, prior, and utility function

- full Bayesian behavior model (from stimulus x to response $\hat{x}$)

$$p(\hat{x}|x) = \int p(\hat{x}|\tilde{x})\, p(\tilde{x}|x)\, d\tilde{x}$$

T356

decoding (deterministic function in our tutorial)

encoding

marginalization over $\tilde{x}$ since we do not observe the encoding

can be used for model fitting (calculate the likelihood of experimental data)

T357