Introduction
Signal detection theory describes detection and discrimination decisions as a comparison of stimulus "strength" to a fixed decision criterion. When we need to make decisions in situations we have never before experienced and adapt to changes in the environment, we need to make decisions in situations we have never before experienced and adapt to changes in the environment.

We designed a novel paradigm in which we overtly overtly measure trial-by-trial criterion placement.

Q1: How is criterion set in a novel environment with static uncertainty?
Q2: How is criterion set in a novel environment with dynamic uncertainty?

We designed a novel paradigm in which we overtly overtly measure trial-by-trial criterion placement.

Stimuli
Two categories of ellipses with mean orientations chosen randomly at the beginning of each block.

Procedure
Calibration task
Overt-criterion task
Covert-criterion task

Calibration task
★ 2AFC orientation-discrimination
★ Estimated sensory uncertainty (\\sigma_i)
★ Set δθ = \sqrt{2(\\sigma_i^2 + \sigma_e^2)} for use in the covert- and overt-criterion tasks

Covert-criterion task
★ 2AFC
★ Criterion is implicit

Overt-criterion task
★ Analogous to 2AFC
★ Criterion is made explicit

Results
Overt-criterion placement for representative observers

Models
Ideal Bayesian (IB)
★ Sets criterion to maximize p(correct), given the sample history and all possible criteria.
★ Sets criterion between the best estimates of the category means.

Exponential moving-average (EMA)
★ Computes a weighted average, giving more weight to recently experienced stimuli.
★ Updates criterion when receiving negative feedback by a proportion of the error.

Limited memory (LM)
★ Sets criterion between the last observed sample from each category.

Model comparison: Relative DIC scores

Summary & Conclusions
When uncertainty was static, observers converged on the optimal criterion over many trials.

When uncertainty was dynamic, observers adapted to the changes in the environment with a lag rate ranging from 1 to 4 trials.

Similar strategies were used in the covert- and overt-criterion tasks.

A model in which the history of recently viewed samples determines a belief about category means (the exponential moving-average (EMA) rule) fit the data best for both experiments.

Criterion placement is dynamic, even after prolonged training.

References

Acknowledgements

Contact Information