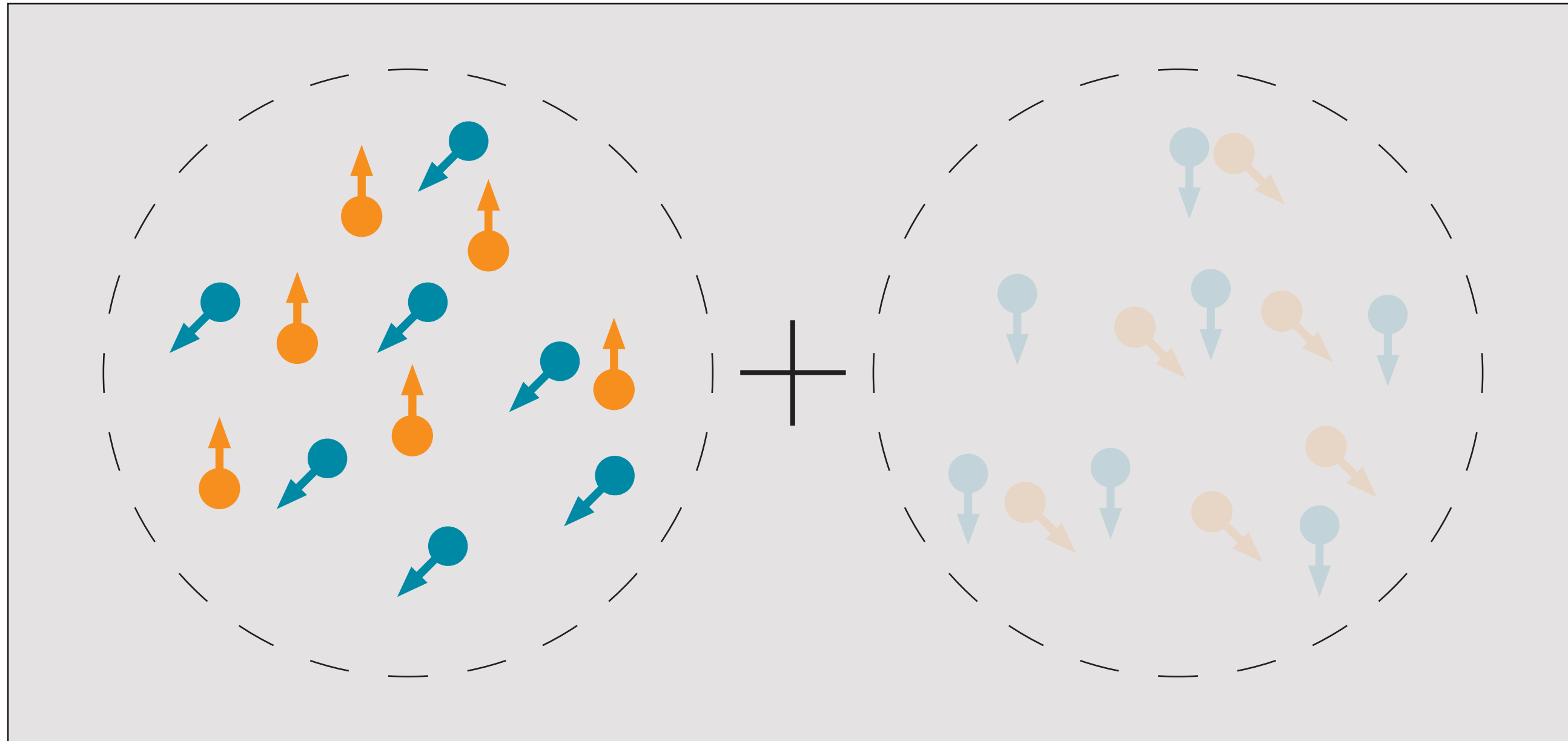


Putting spatial and feature-based attention on a shared perceptual metric

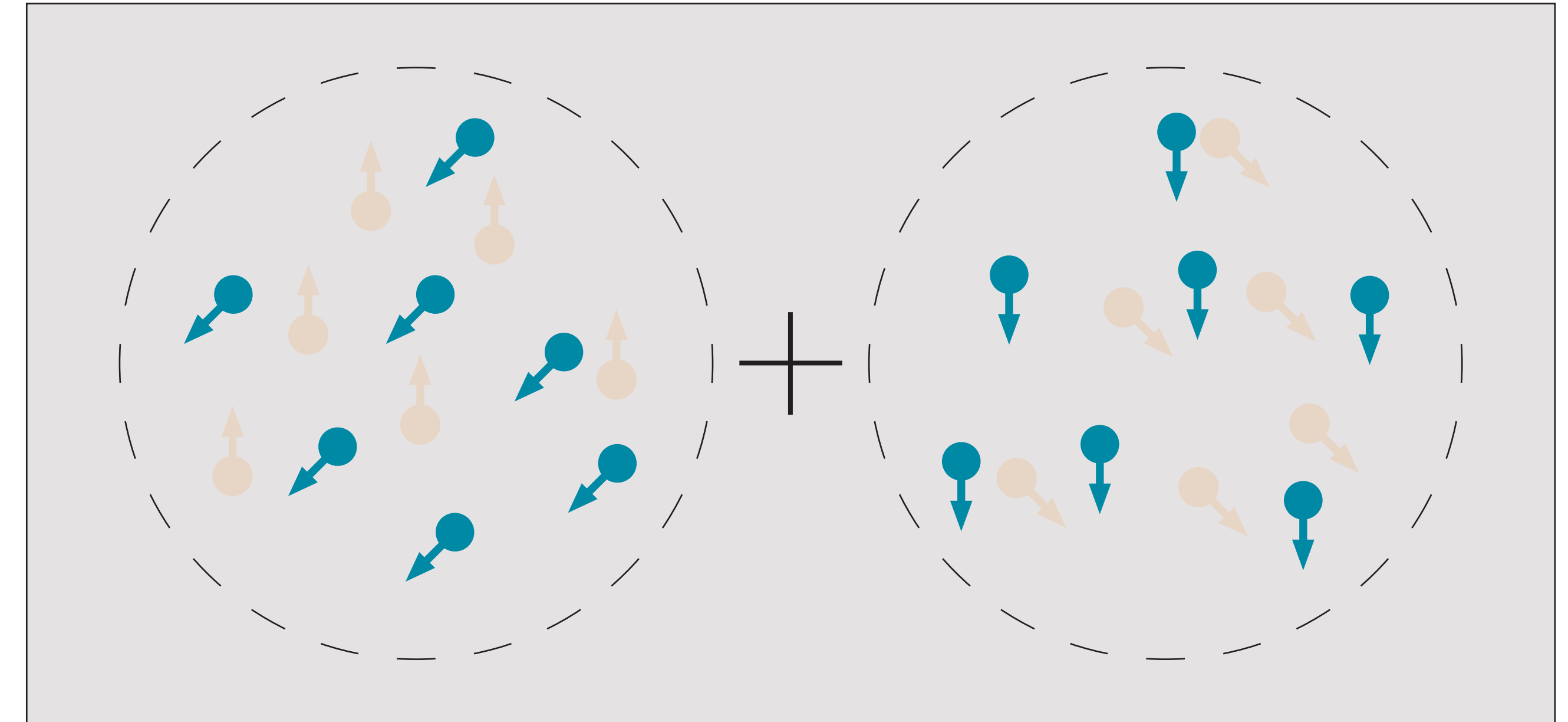
1. Introduction

How can we compare different forms of sensory selection?

Selection by spatial location:



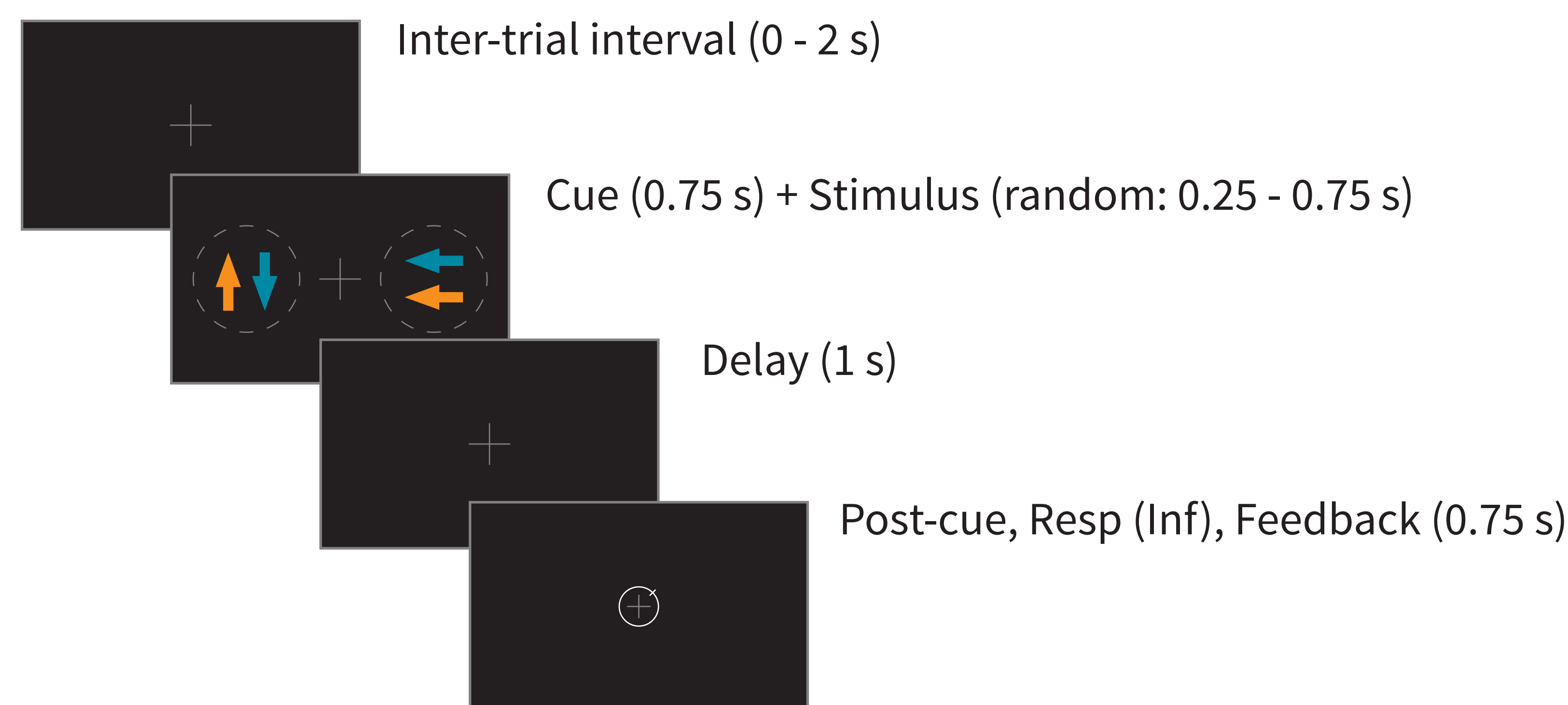
Selection by feature (color):



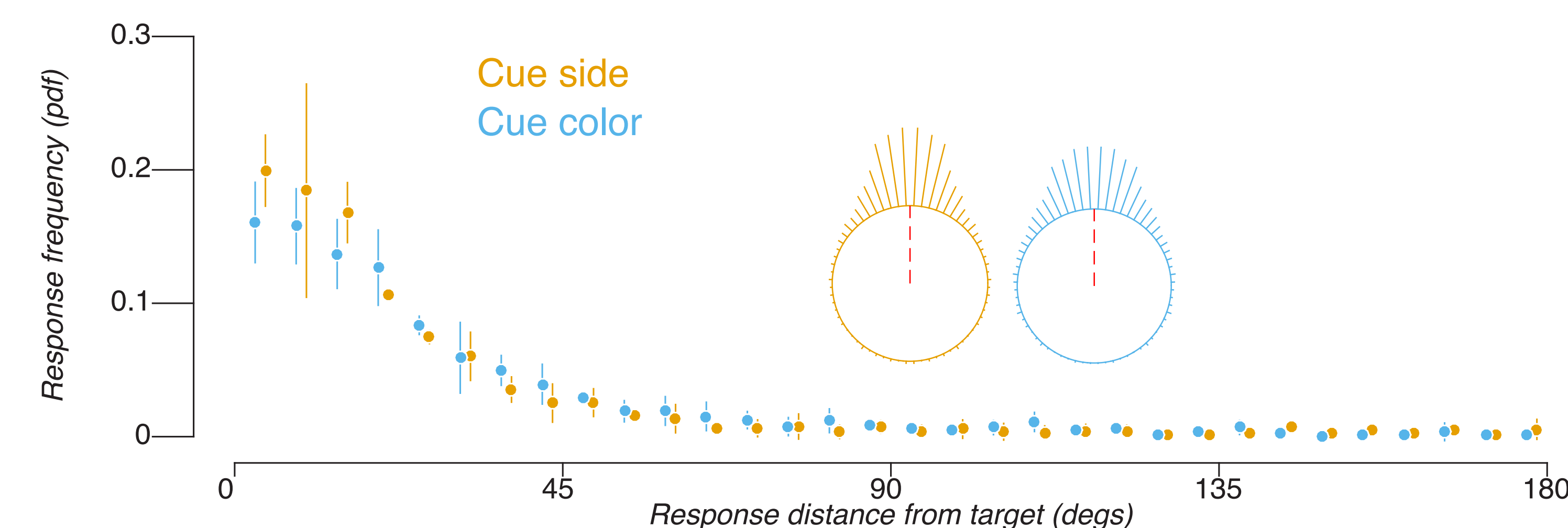
We used two tasks designed to measure perceptual sensitivity in which observers could either select information by location or by feature (e.g. color). In the first task we asked whether you are **just as good at averaging spatially as by feature**.

2. Perceptual averaging task

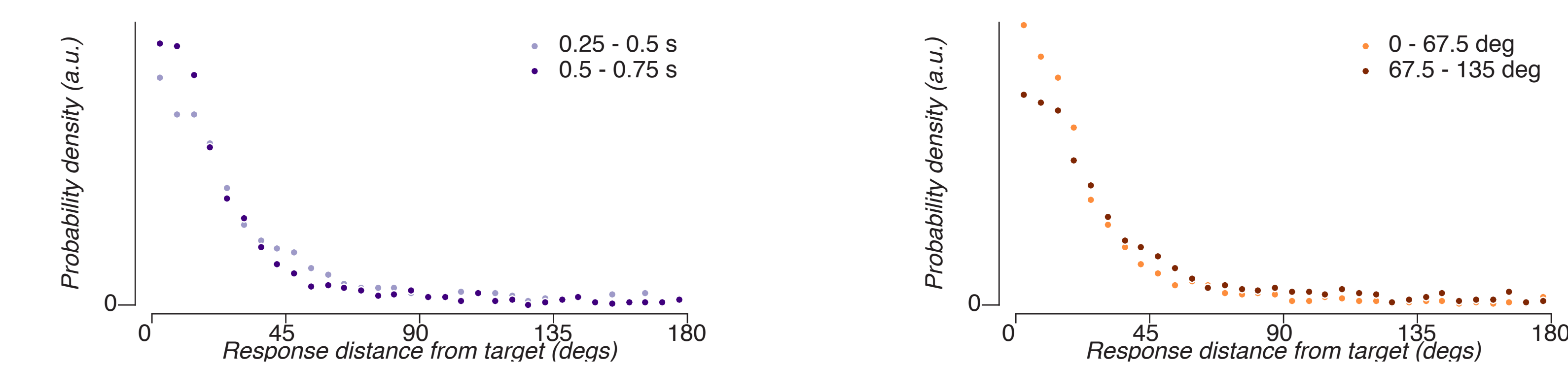
Observers (n=4, >600 trials per subject) were asked to average the motion direction of two patches, selected by color or side.



Observers found it slightly harder to average patches cued by color:



Duration and angle difference affect performance, as expected:

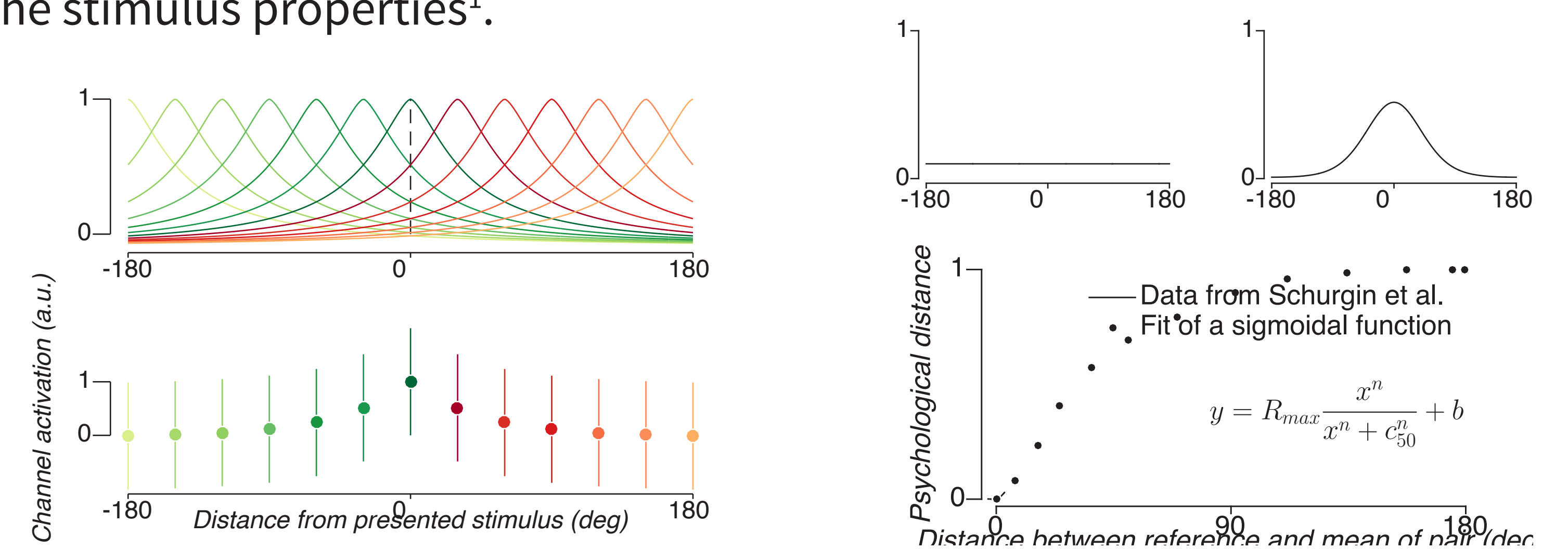


4. Similar selection strength

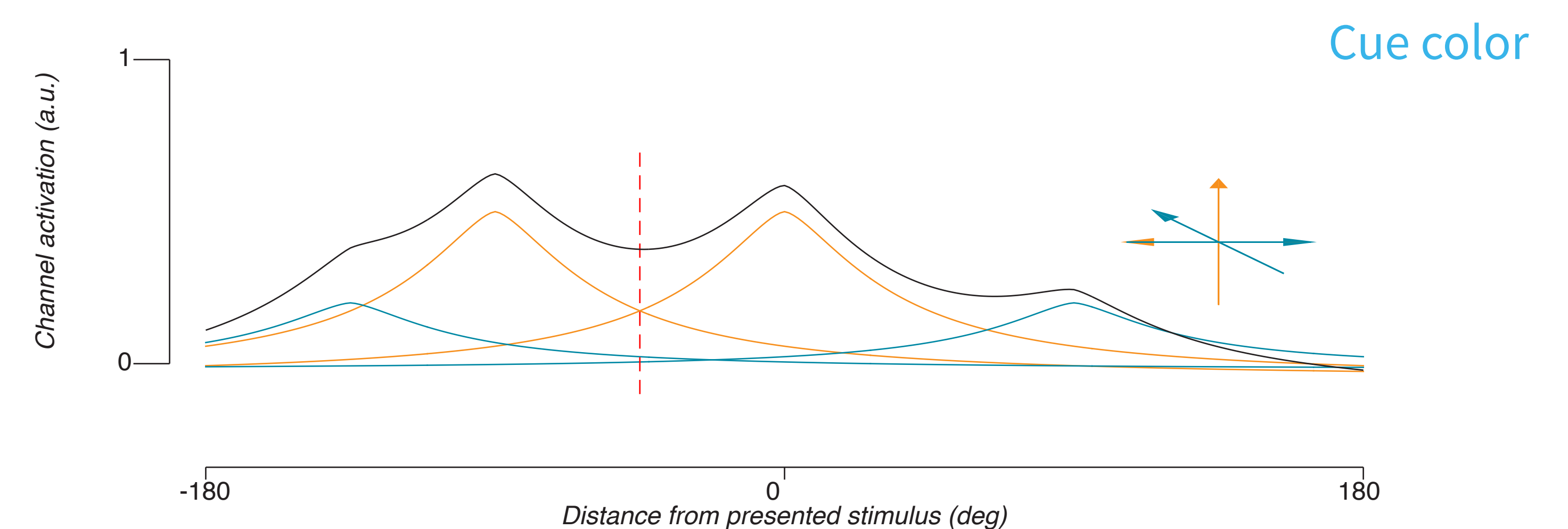
Selection by spatial location and by color have similar strength. Where do the small differences come from? To separate difference in **bias** from changes in **sensitivity** we asked observers to recall about a single dot patch.

3. Channel model

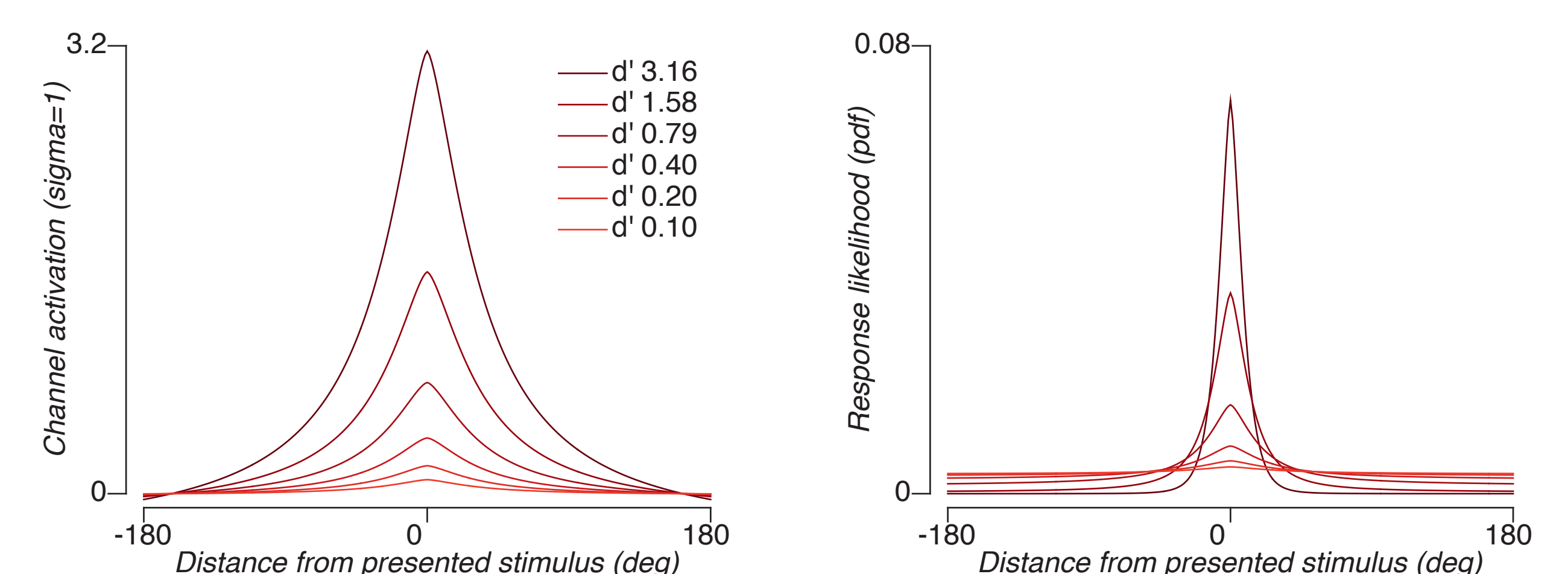
To model behavior we encode the stimulus in independent “channels” tuned to the stimulus properties¹.



In the averaging task, the channels are activated by both stimuli that are selected.

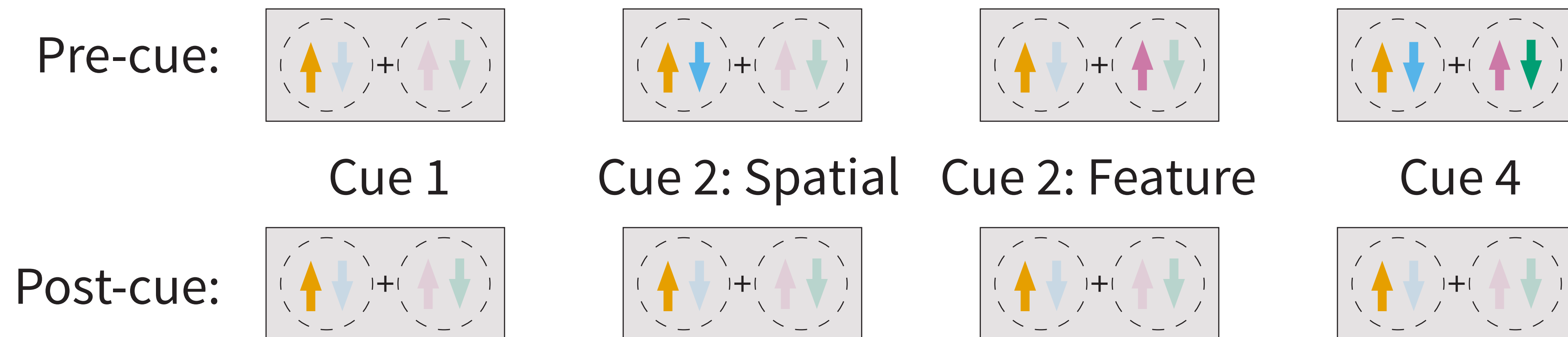
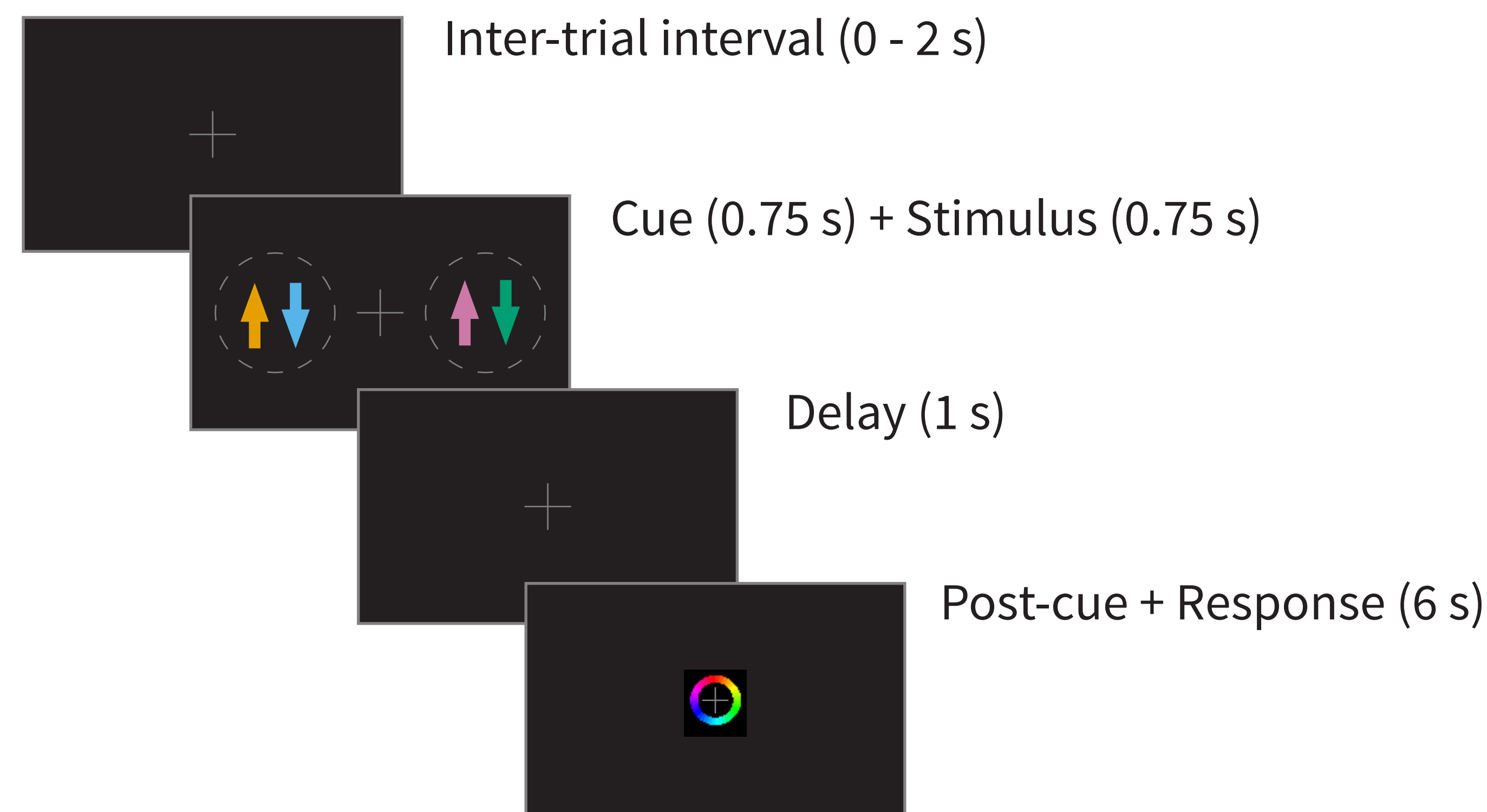


The sensitivity of an observer is controlled by the amplitude of the channels compared to noise (this indirectly changes the tuning width). But observers can also be biased to the irrelevant stimuli.



5. Recall task

Observers ($n=5$, mean 2290 trials, range 1770-2613) were asked to recall the color of a single patch. We varied what information was cued in advance to control sensory selection. (data from 250 ms duration). The reversed task was also run, recalling the direction of motion cued by color, or location.

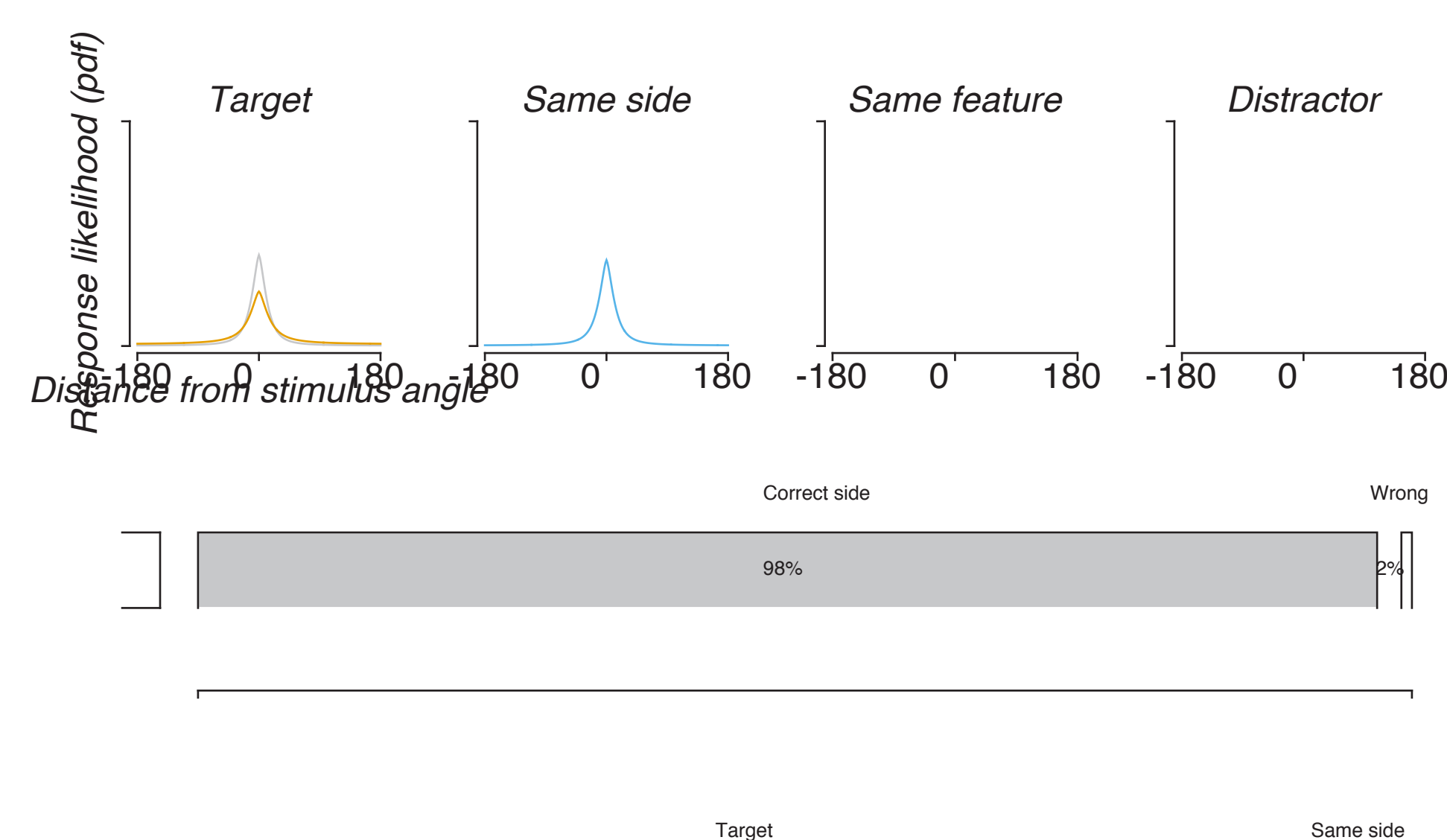


6. Model

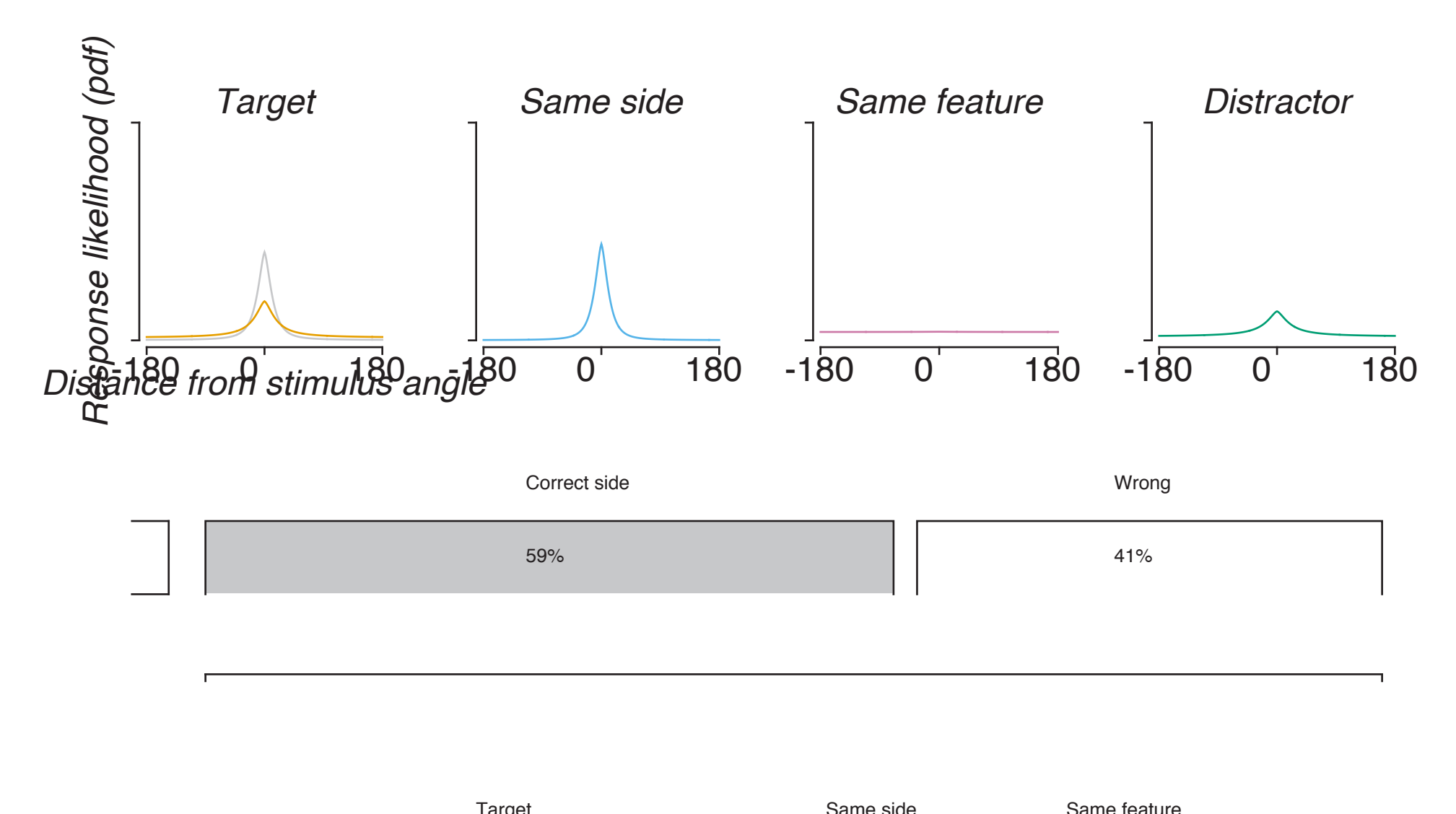
7. Are differences in selection due to sensitivity or bias?

Data shown from the report color condition, with duration 0.25 s. Not shown: duration 1 s and report direction with duration 0.25 and 1 s.

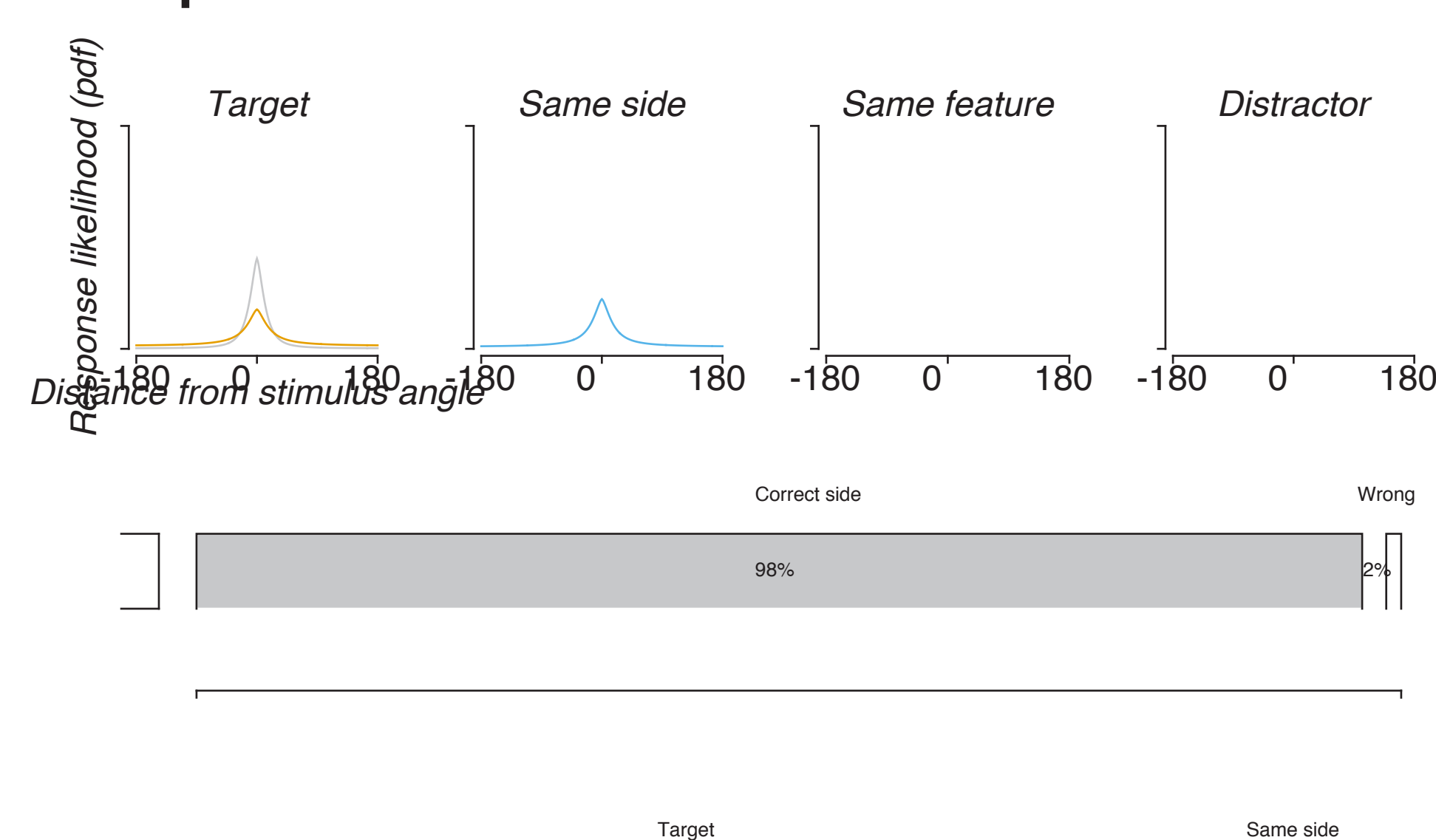
Cue 1



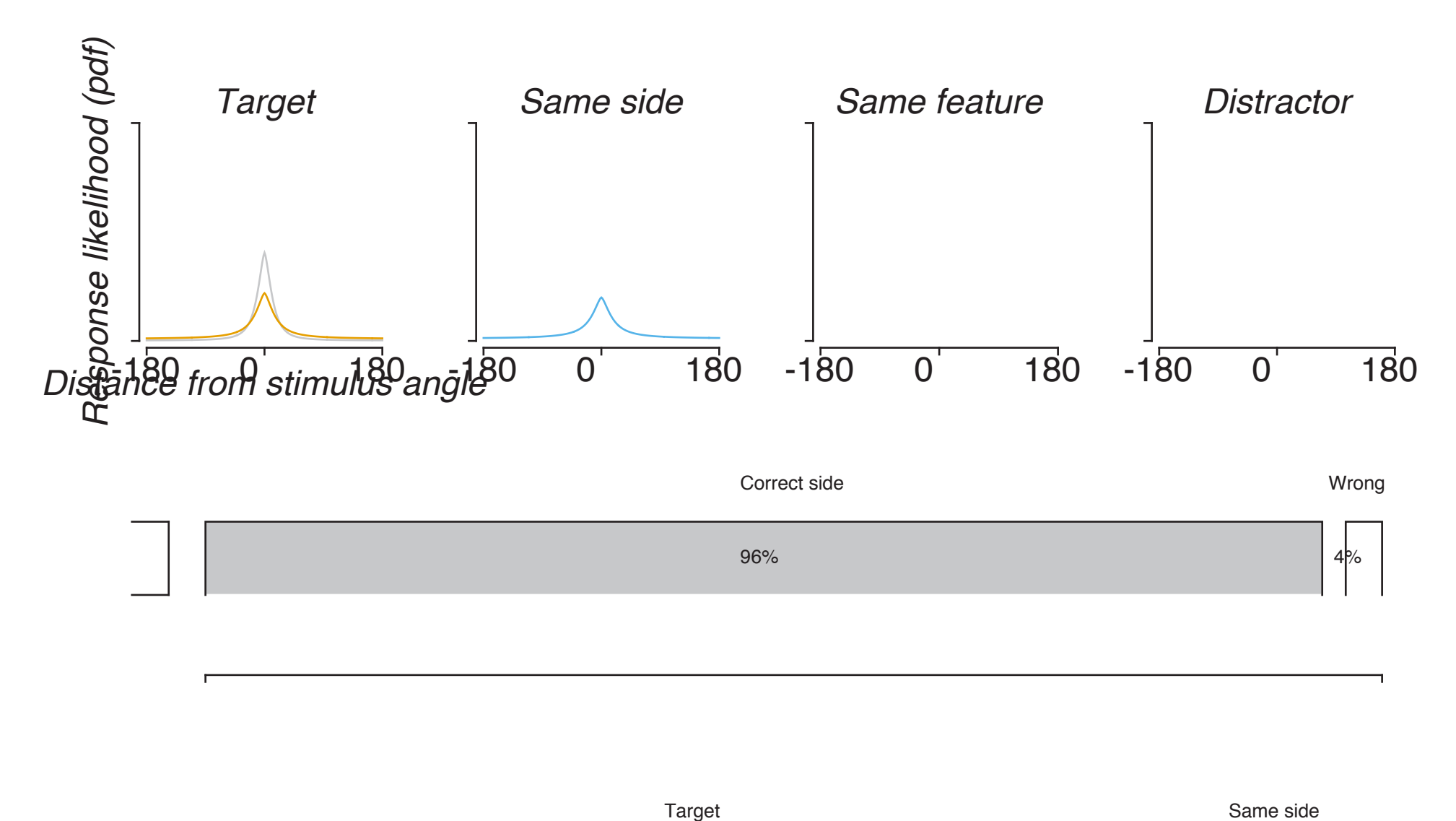
Cue 4



Cue 2: Spatial

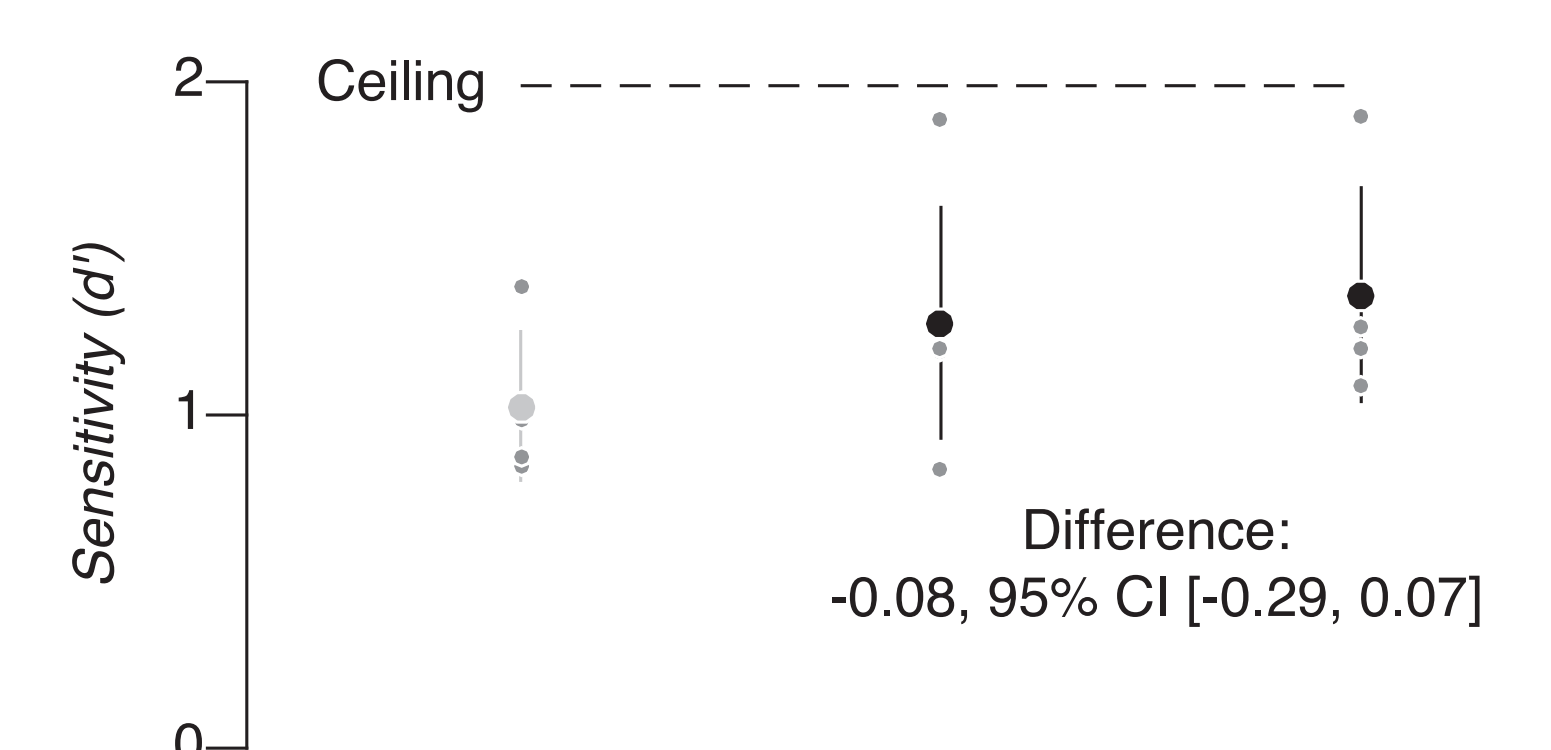


Cue 2: Feature



The sensitivity parameter from the model showed that there was an effect of selection, but there were no differences between spatial selection and feature-based selection.

Instead of differences in sensitivity, differences in bias seem to drive the small differences seen in the averaging task.



8. Can we predict this from representation?

Both features and location are represented by populations of neurons with properties similar to the “channels” in our model. Are these behavioral results a result of that representation?