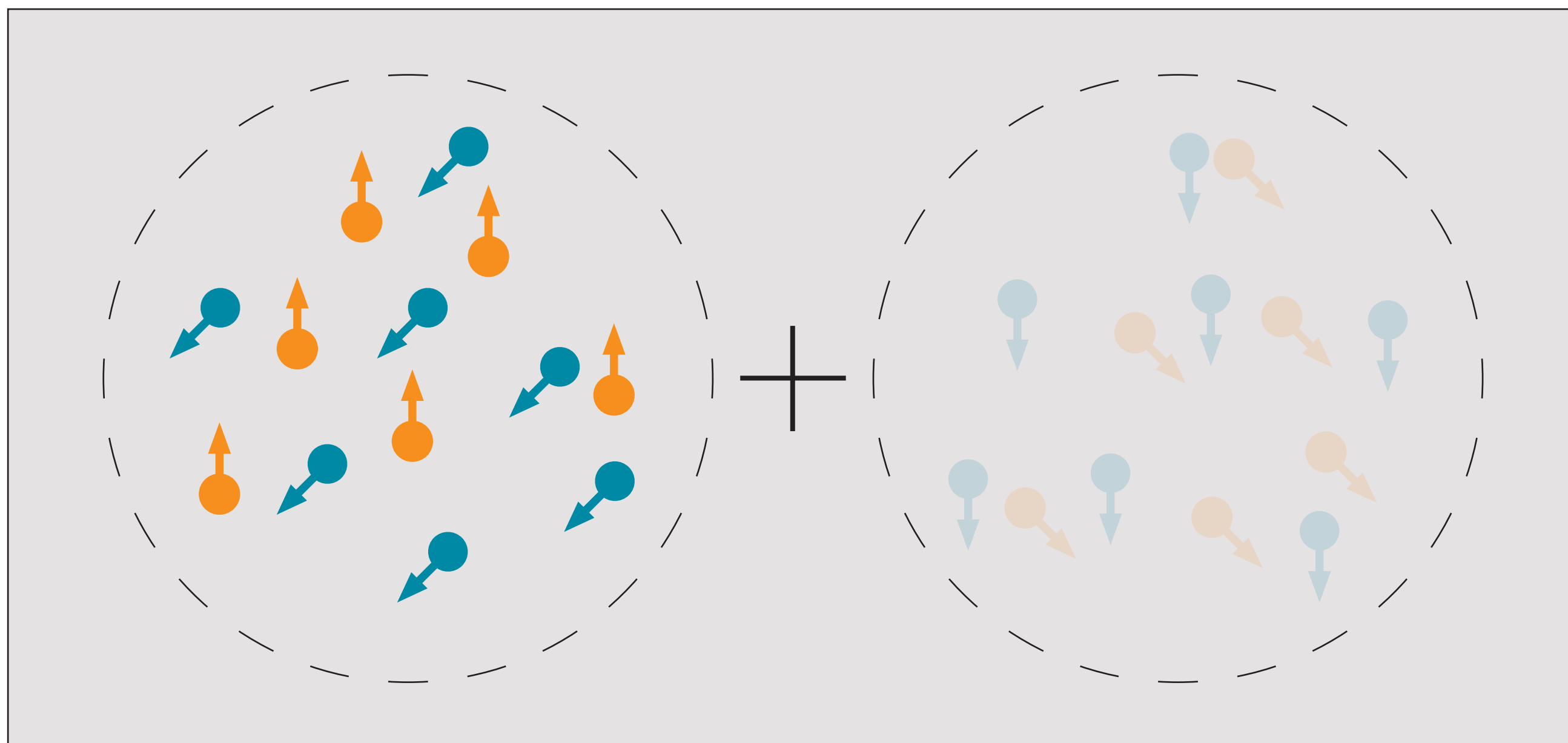


# Putting spatial and feature-based attention on a shared perceptual metric

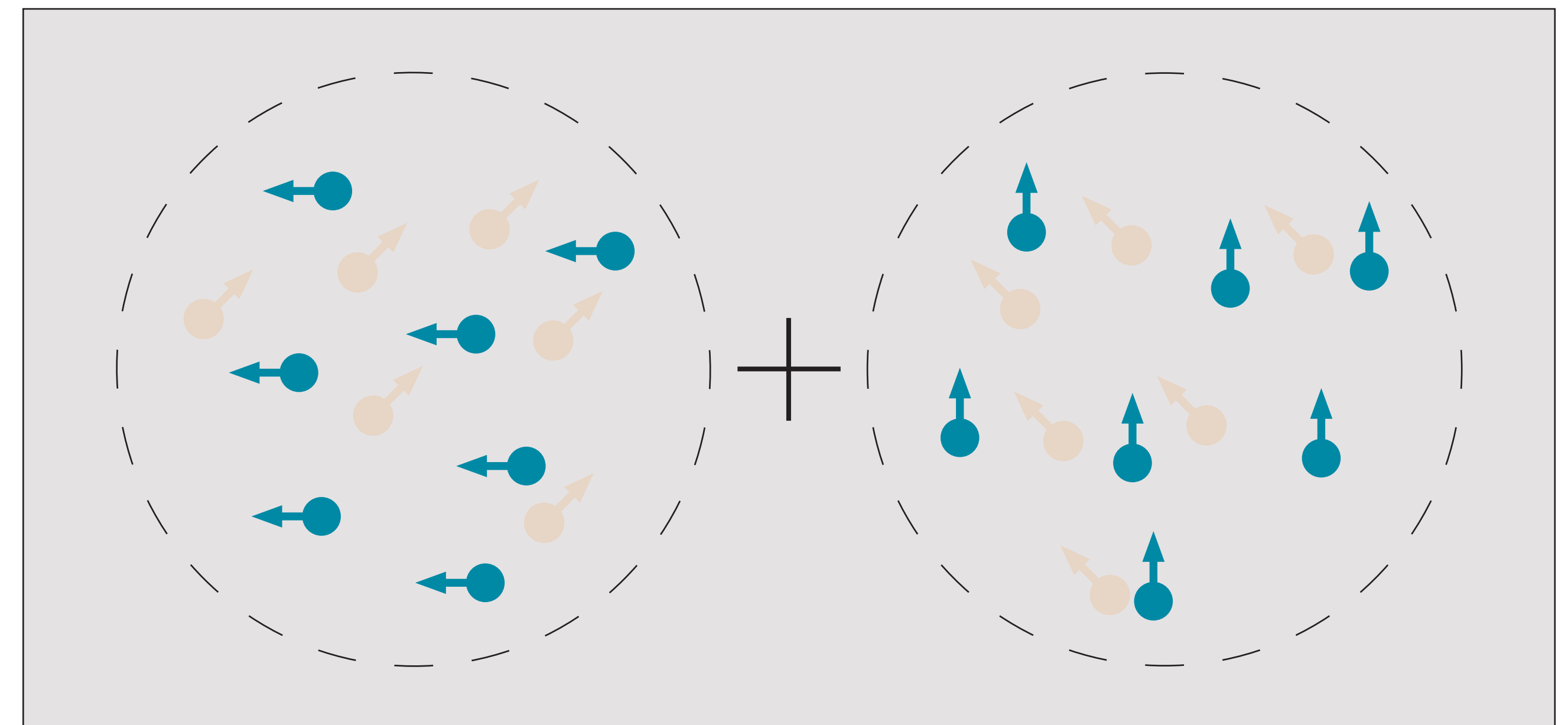
## 1. Introduction

How do different forms of sensory selection affect perceptual sensitivity?

Selection by spatial location:



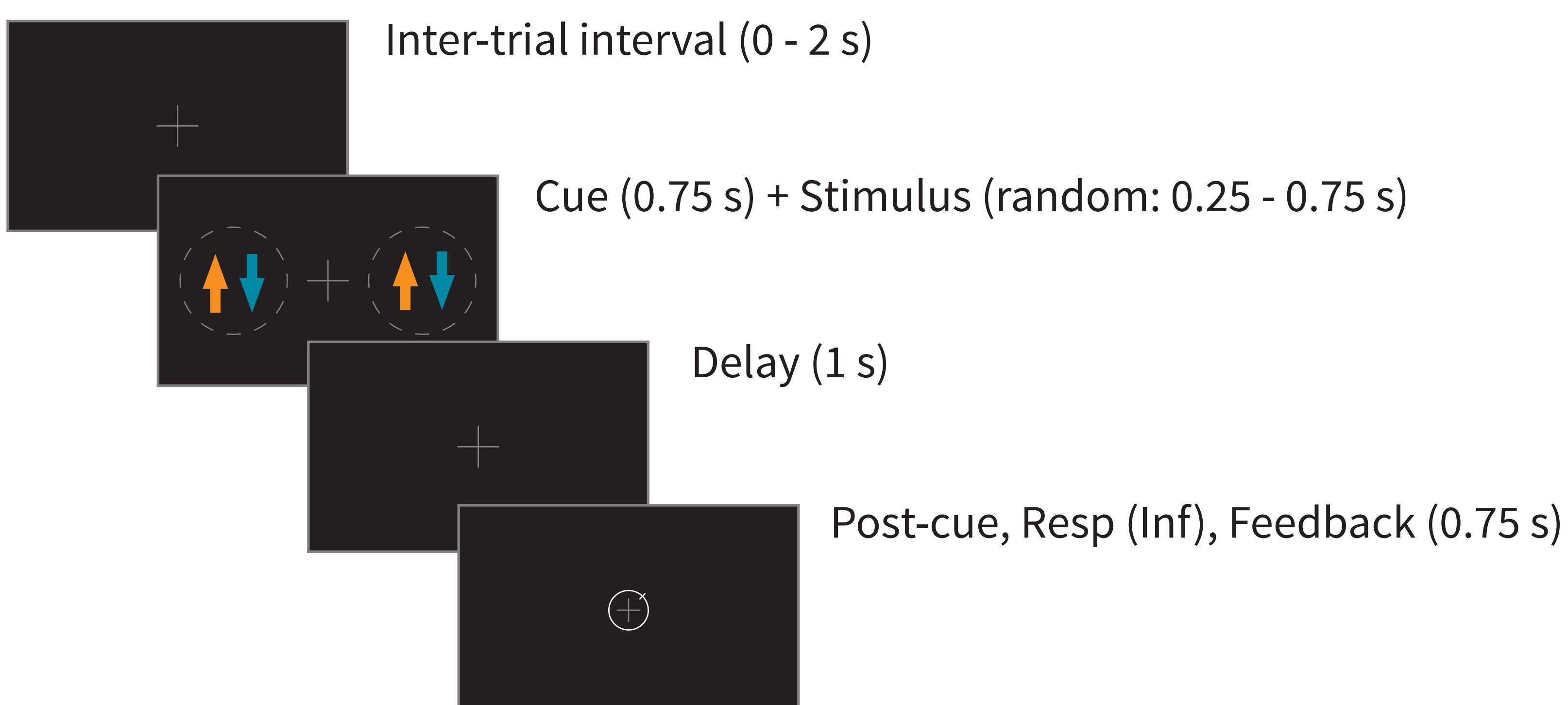
Selection by feature (color):



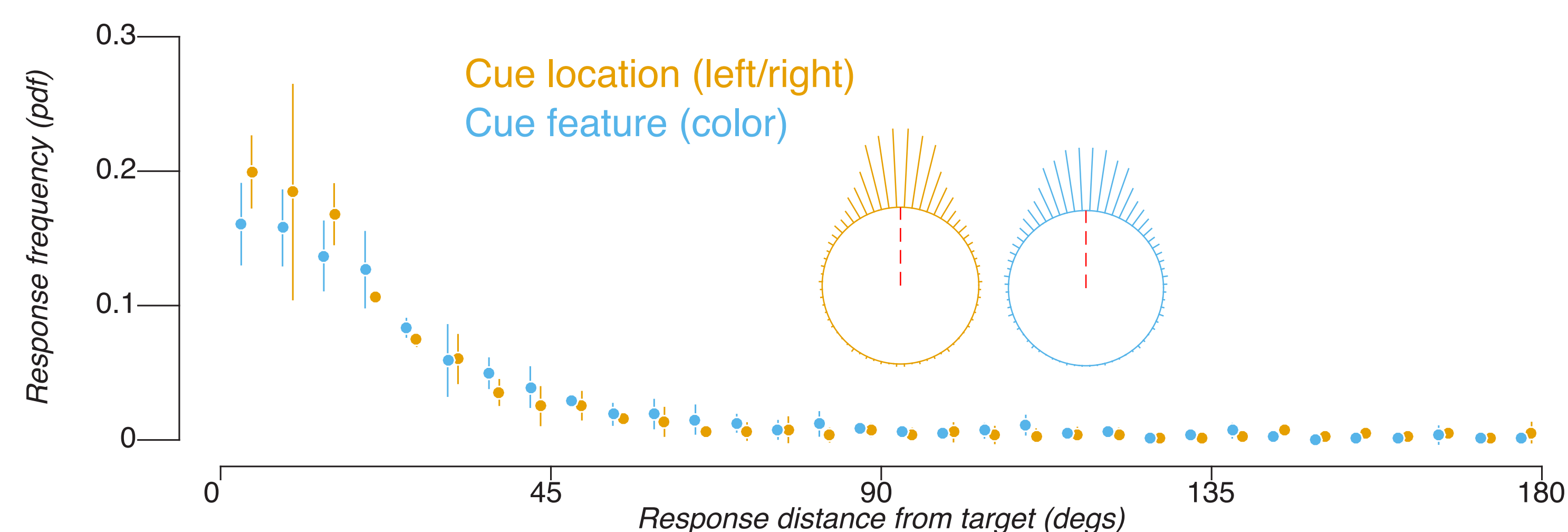
We first asked whether observers are equally capable of averaging motion direction, when two patches are selected by spatial location (left side or right side) or by color (blue dots, or orange dots).

## 2. Perceptual averaging task

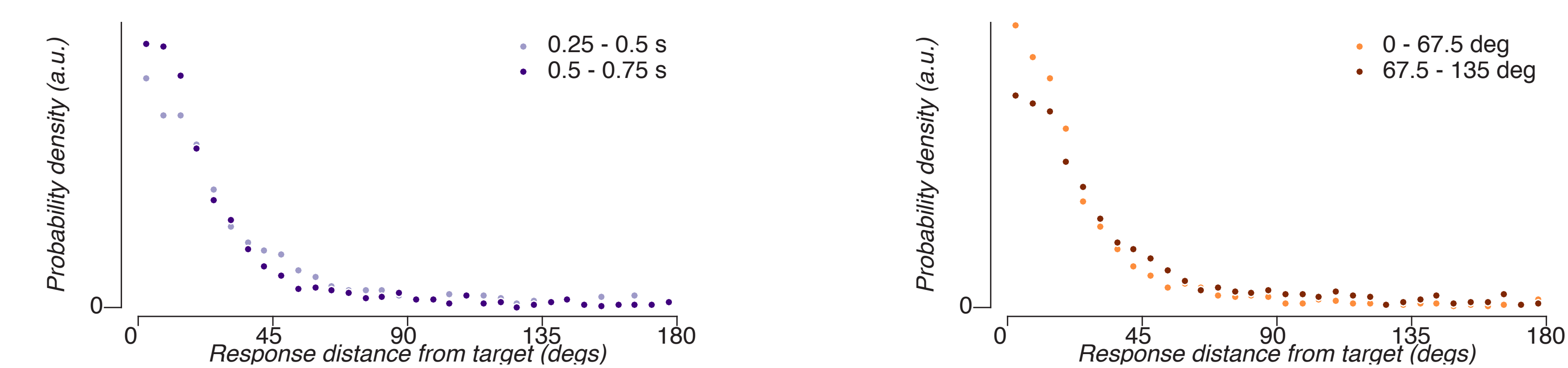
Observers (n=4, mean 657 trials, range 280-819) were asked to average the motion direction of two random dot patches, selected by feature or side.



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



Duration and angle difference affect performance, as expected:

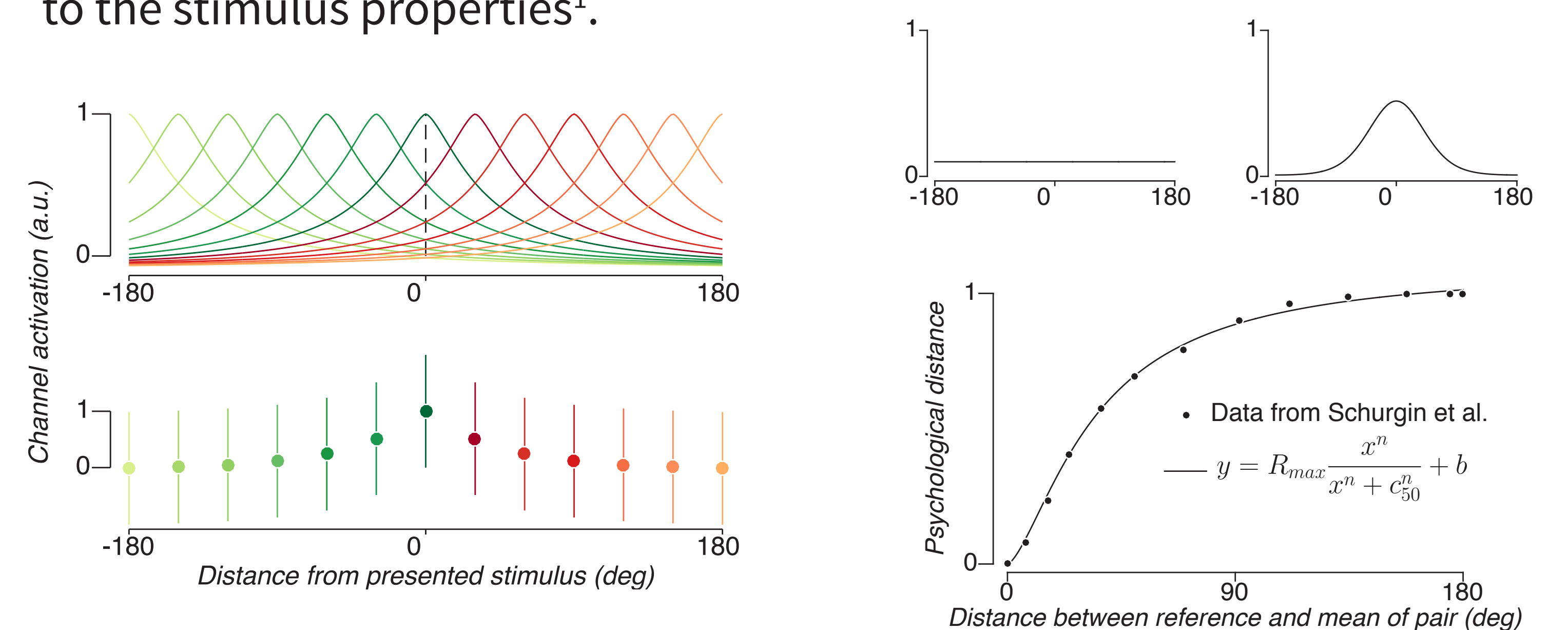


## 4. Similar selection strength

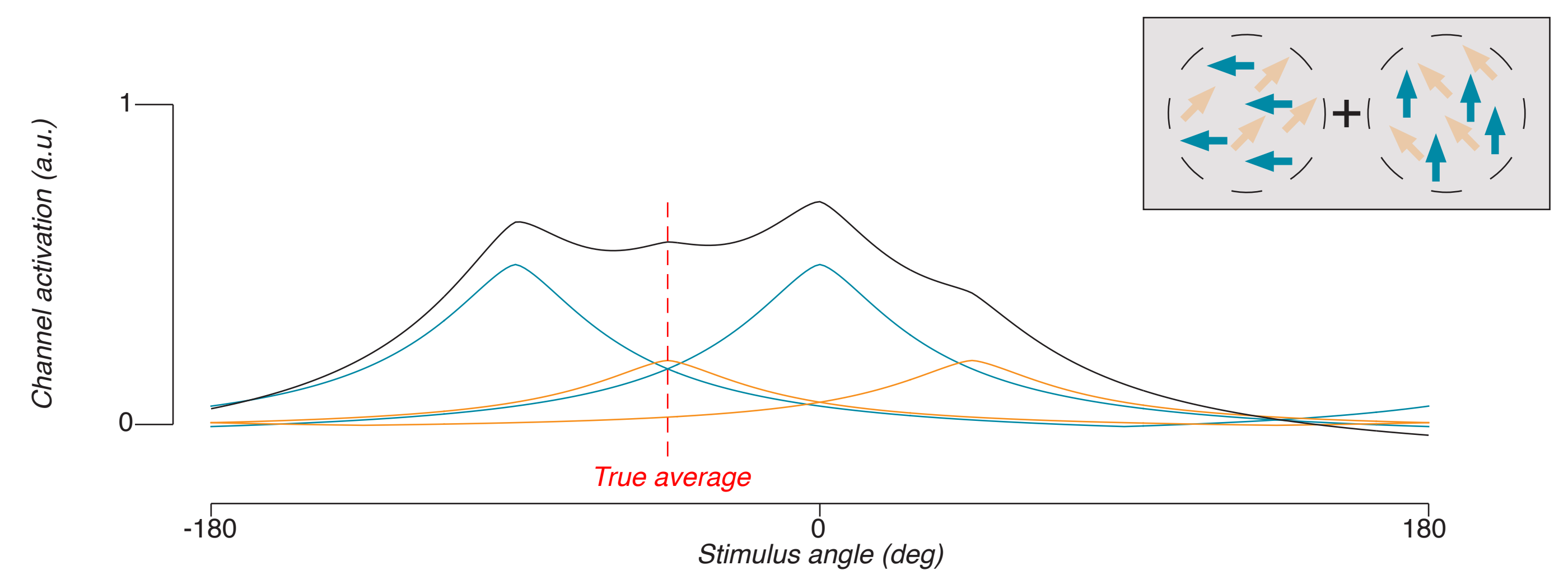
Selection by spatial location and by color have similar strength. Where do the small differences come from? To separate difference in **bias** from changes in **sensitivity** we asked observers to recall about a single dot patch.

## 3. Channel model

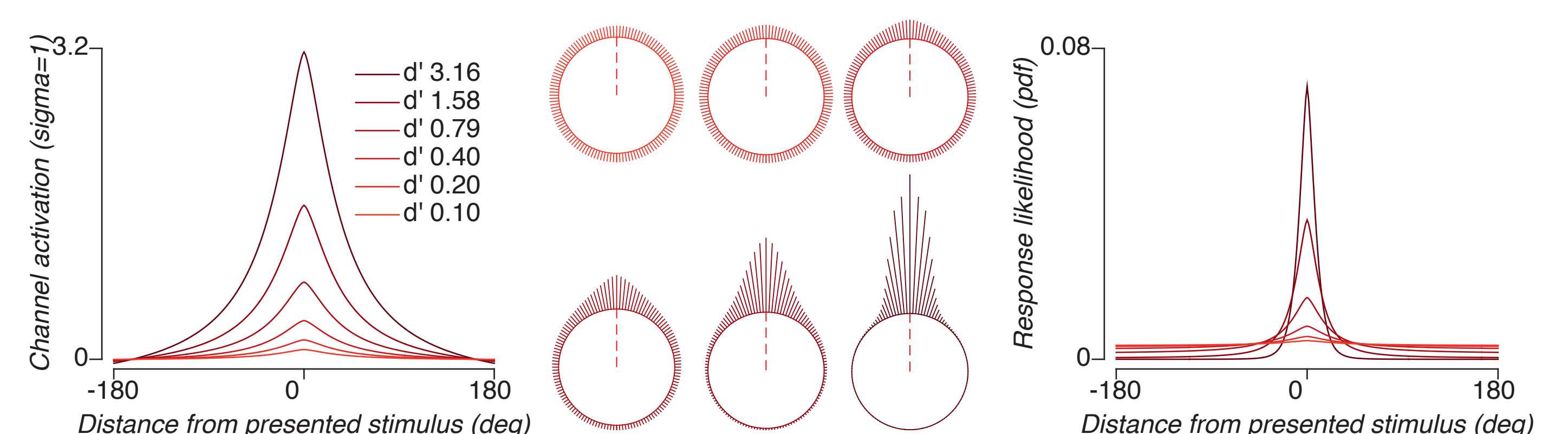
To model the behavior we encode the stimulus in independent “channels” tuned to the stimulus properties<sup>1</sup>.



In the averaging task, the channels are activated by all the stimuli, biased towards the ones that are selected.



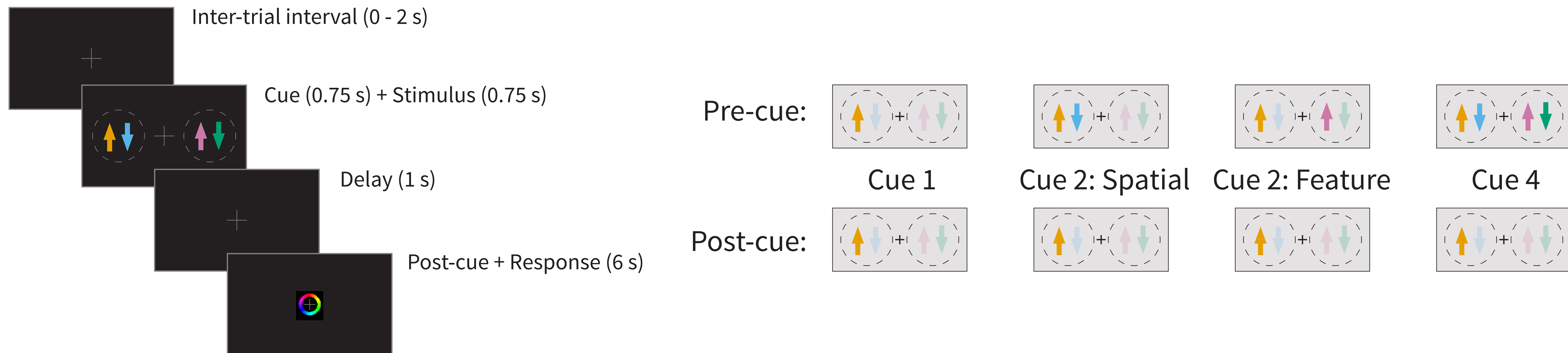
Selection can affect the sensitivity of an observer by scaling the amplitude of the channels relative to noise (left). This changes the width of the response likelihood distribution (right).





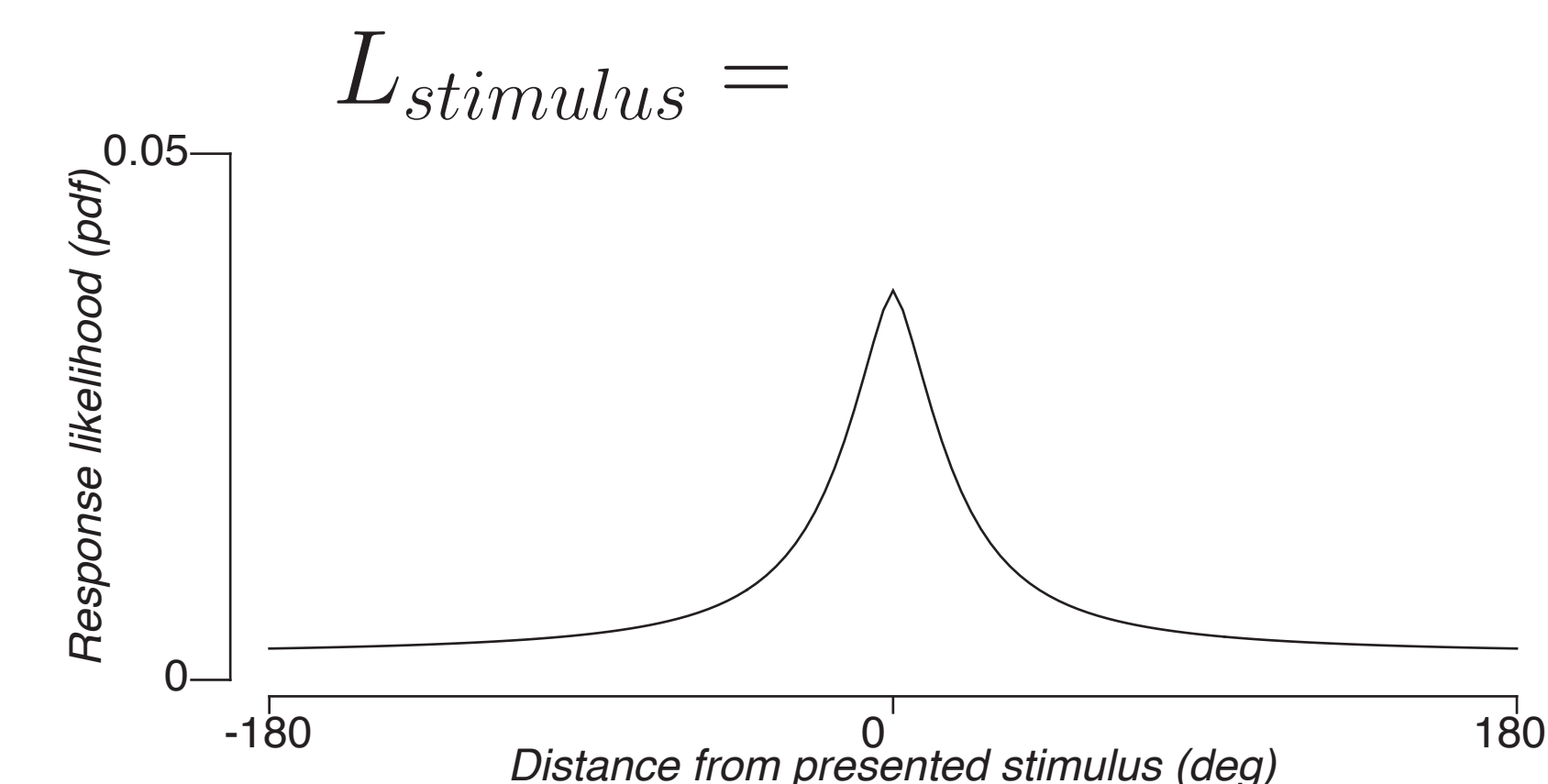
## 5. Recall task

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 where observers recalled direction of motion, as in the first task.

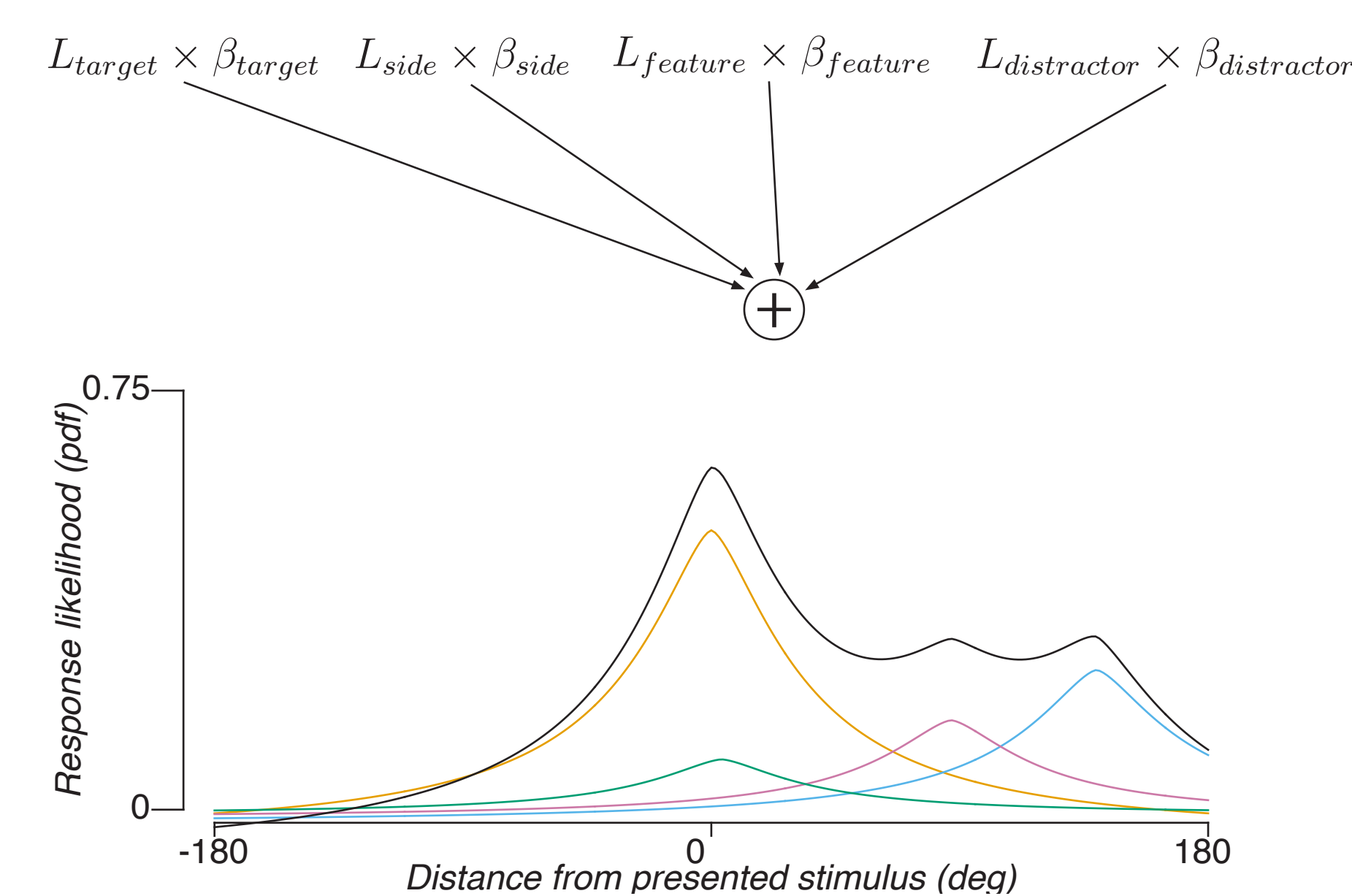


## 6. Recall model

The response color (or direction) is predicted by taking the maximum over the channel activations, scaled by the sensitivity.



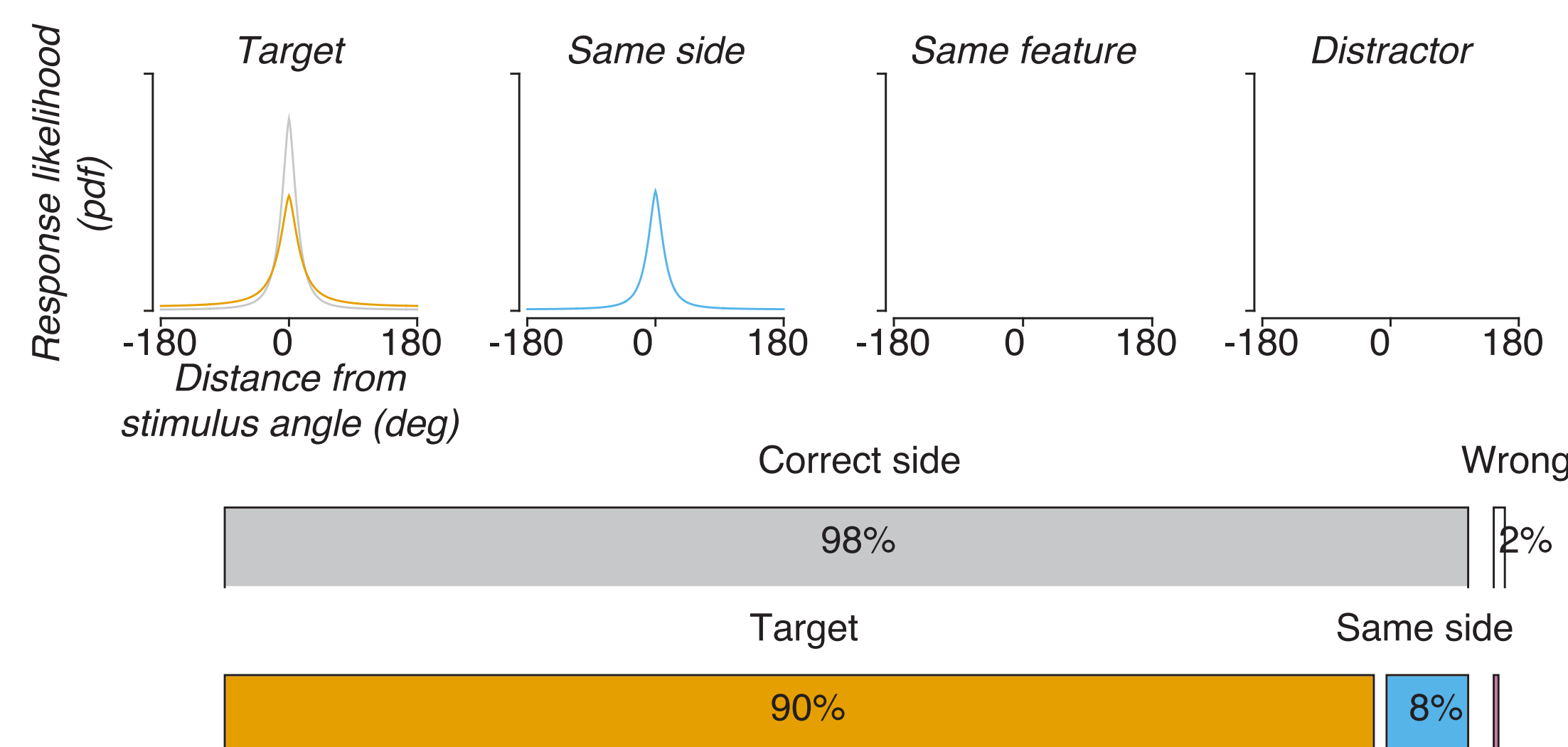
These are then weighted according to the observer's bias in different conditions, to compute the full response likelihood.



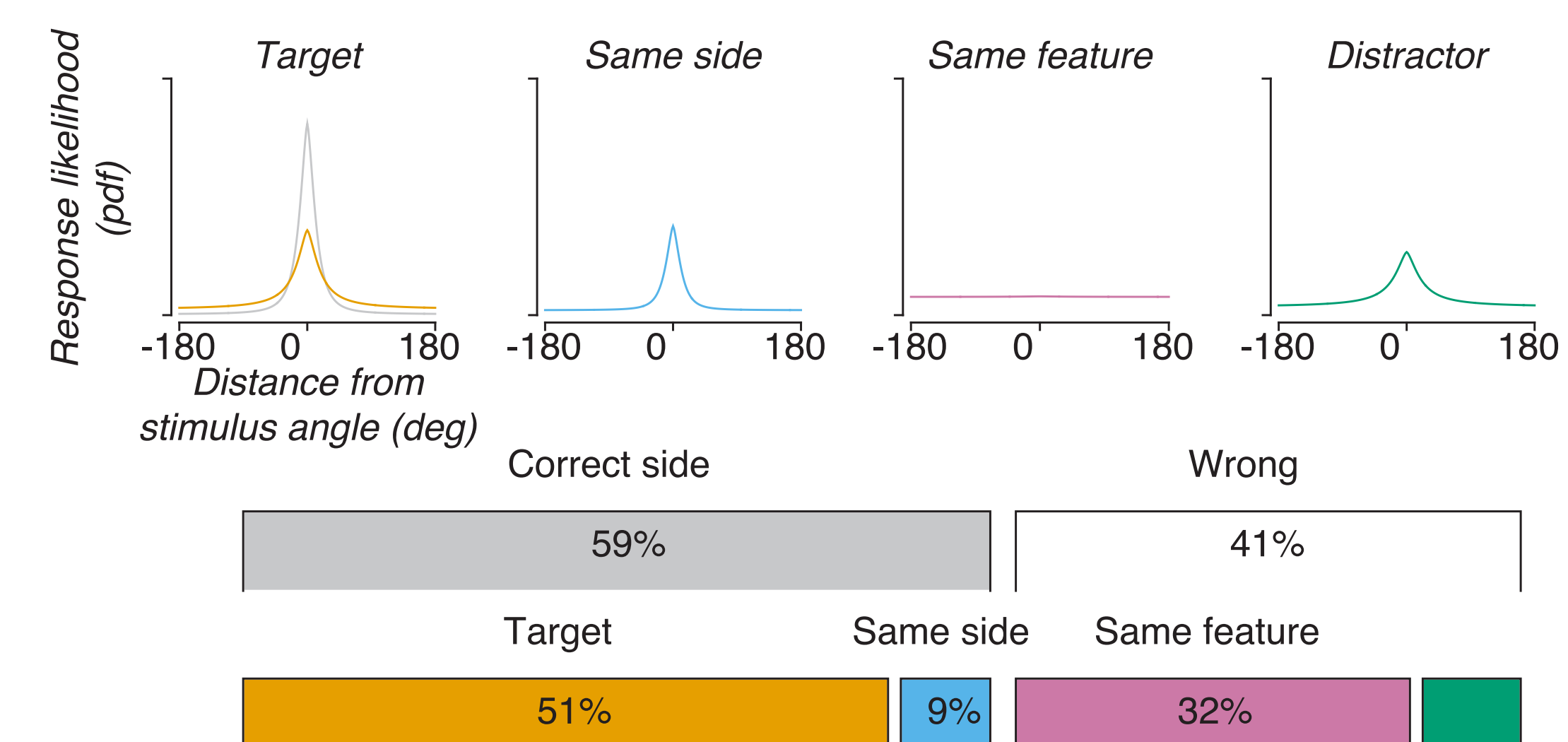
## 7. Are differences in selection due to sensitivity or bias?

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.

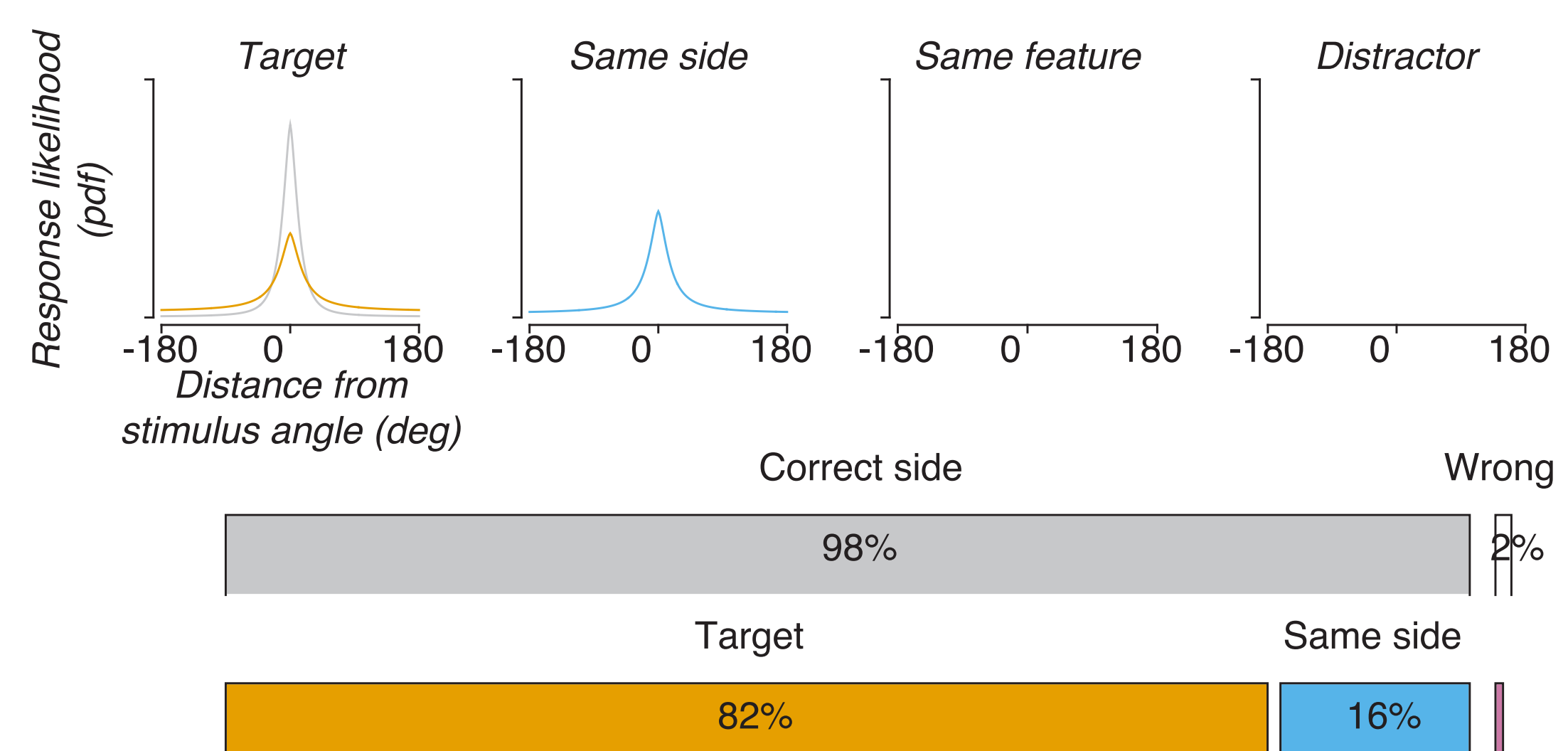
### Cue 1



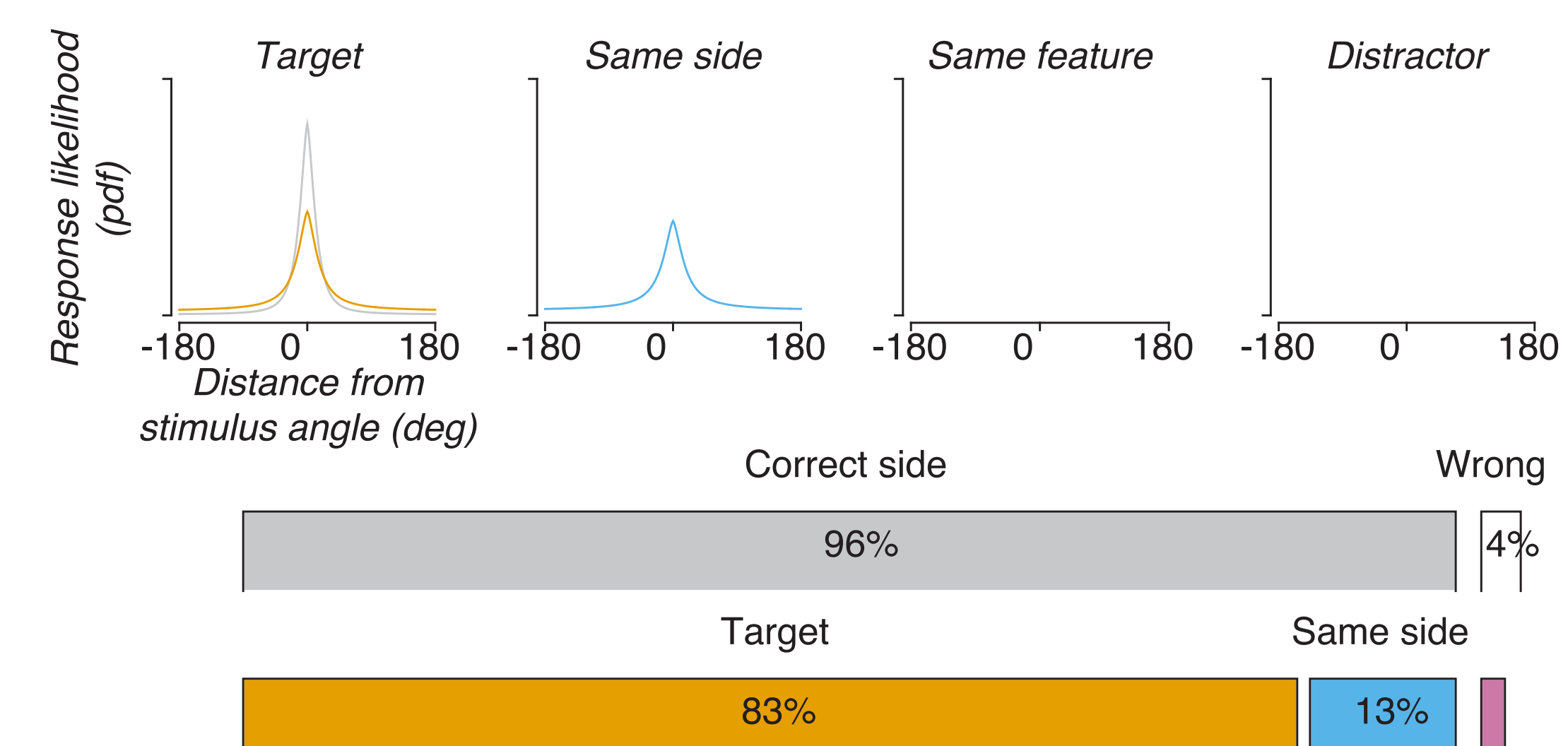
### Cue 4



### Cue 2: Spatial

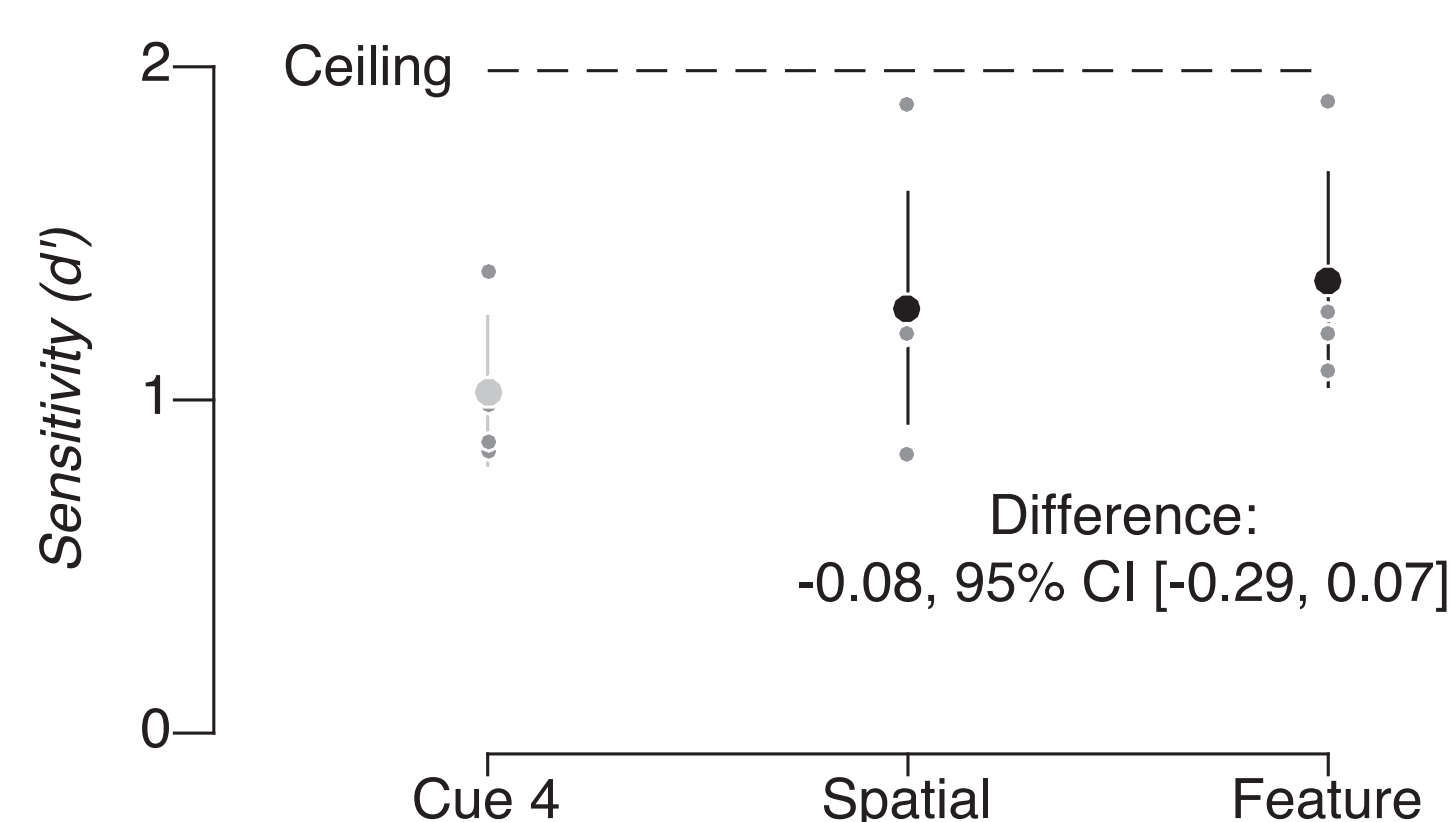


### Cue 2: Feature



## 8. Spatial bias, not sensitivity

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.



Selection by location (and by feature) are both sensitive to interference from other stimuli that are present, especially those that are spatially overlapped.

The perceptual sensitivity, or precision of recall, is unaffected by the change in selection: observers show equal strength selecting by location and by feature.