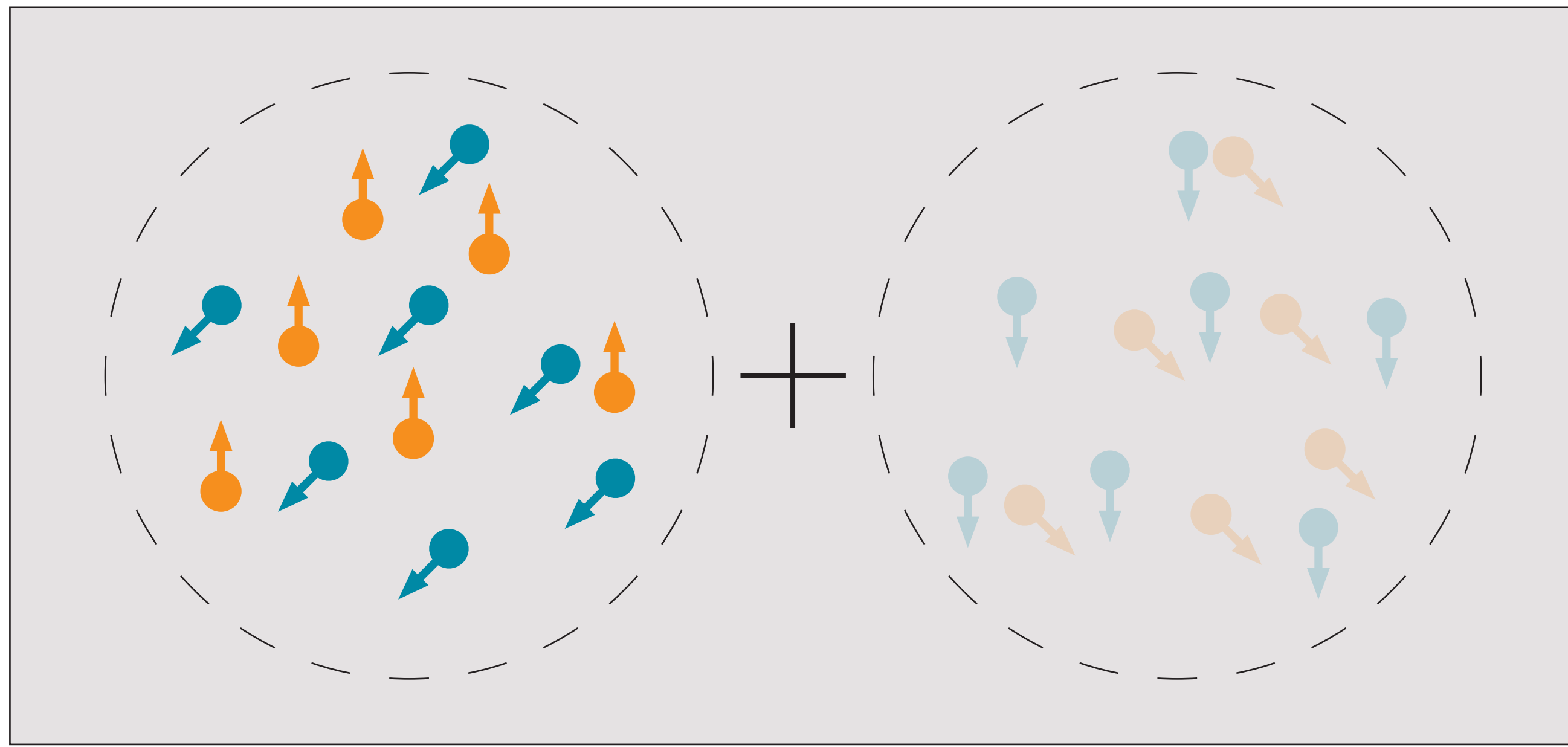


Putting spatial and feature-based attention on a shared perceptual metric

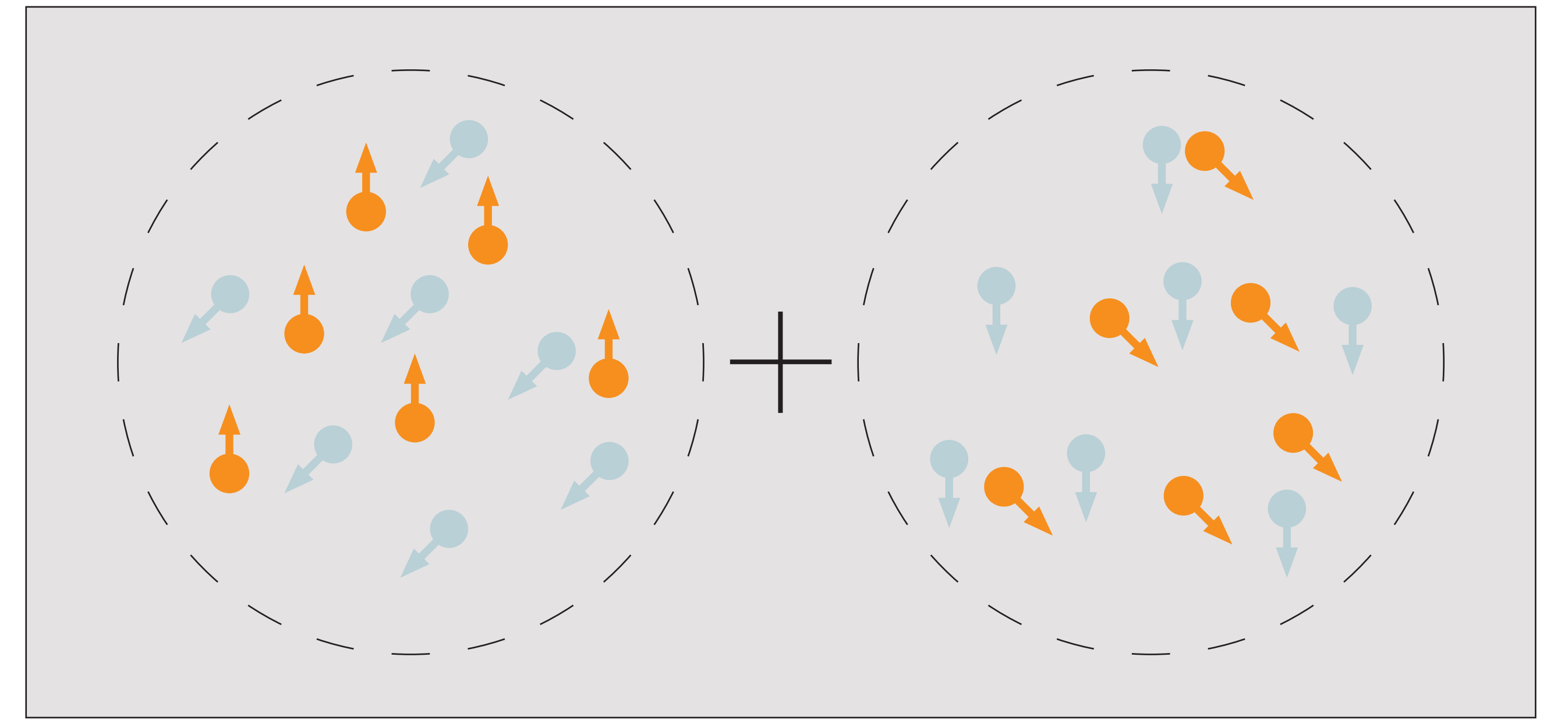
1. Introduction

How can we compare different forms of sensory selection? We used two tasks designed to measure perceptual sensitivity in which observers could either select information by location or by feature (e.g. color).

Selection by side:

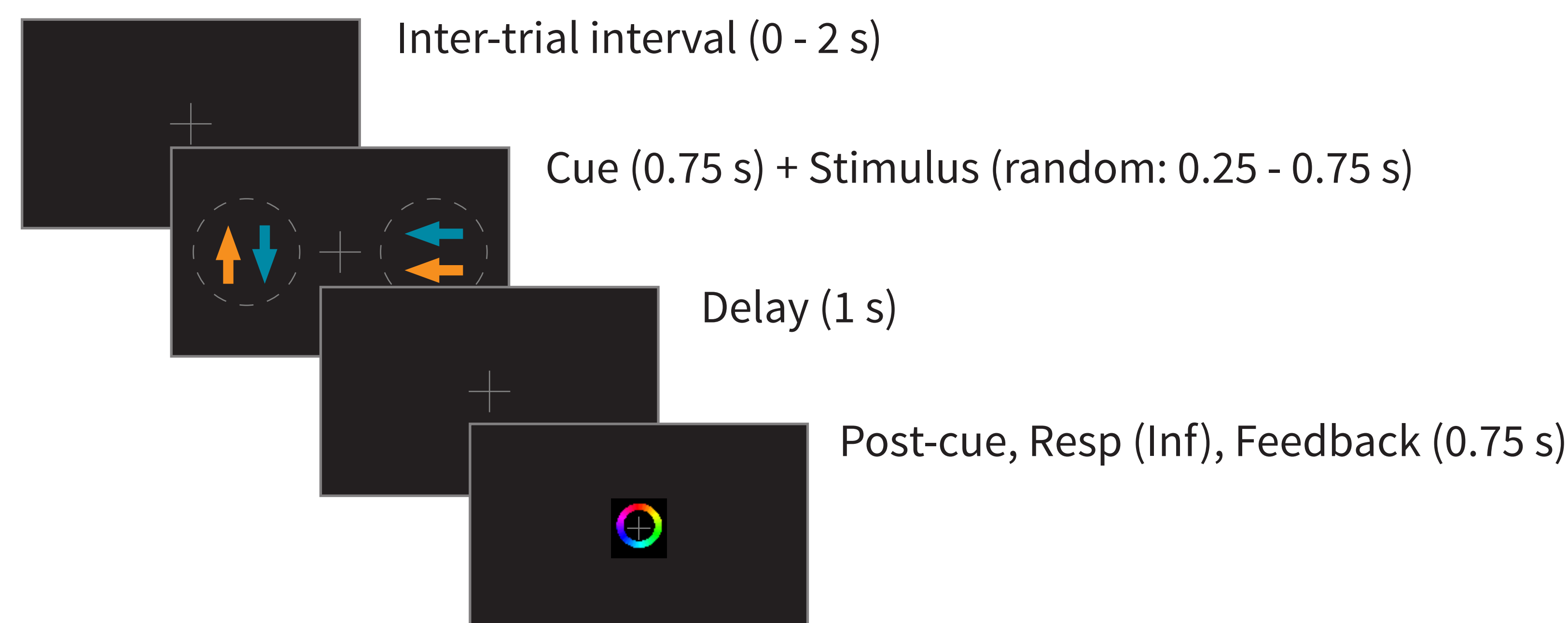


Selection by feature (color):

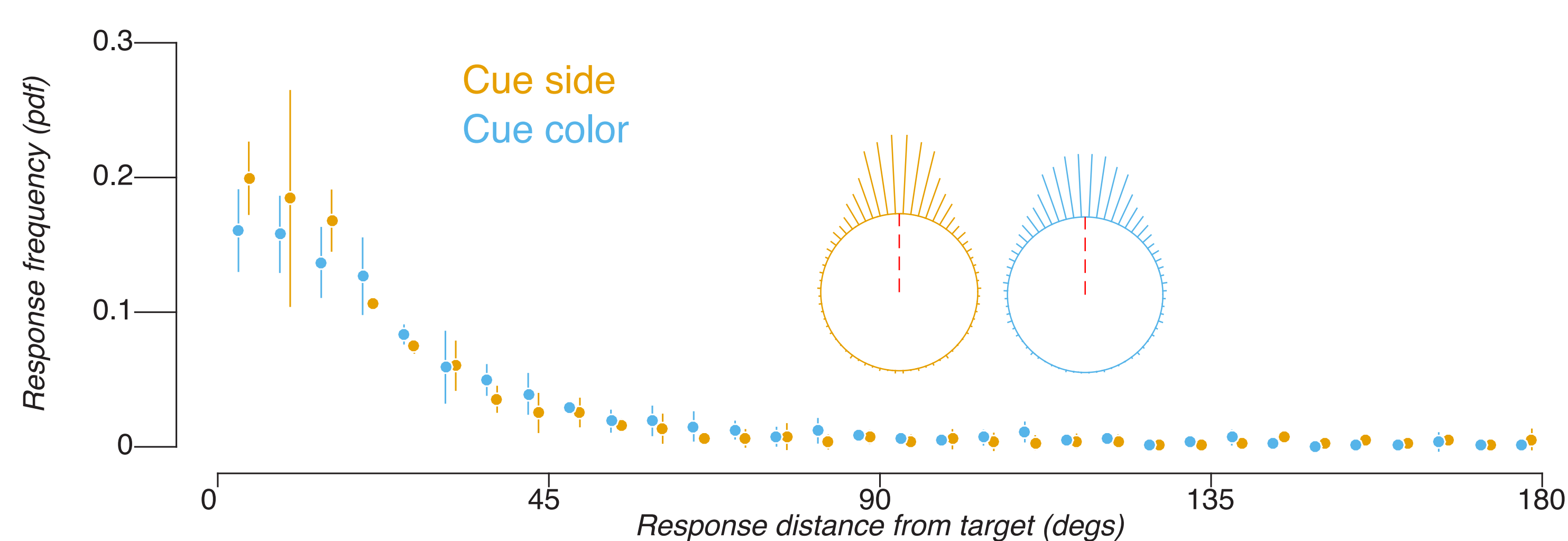


2. Similar strength of selection

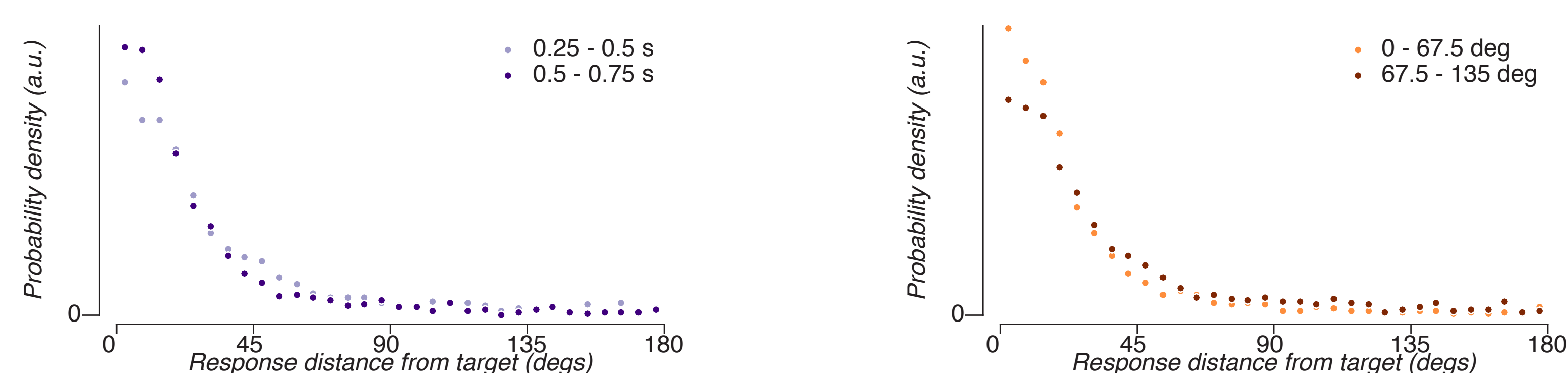
Observers (n=4, >600 trials per subject) were asked to average the motion direction of two patches, selected by color or side.



It is slightly harder to average patches cued by color:



Duration and angle difference affect performance, as expected:

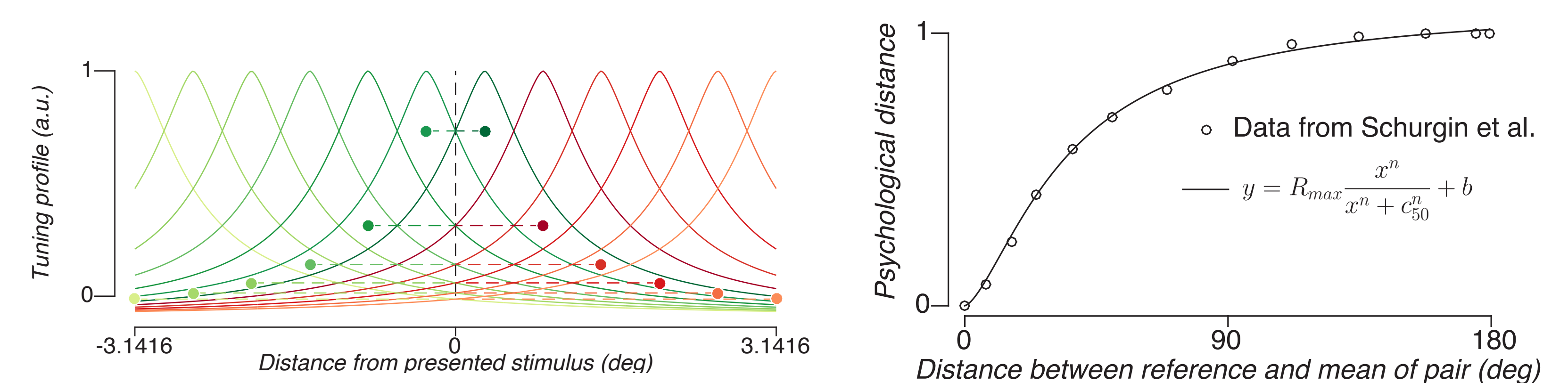


4. Just as good?

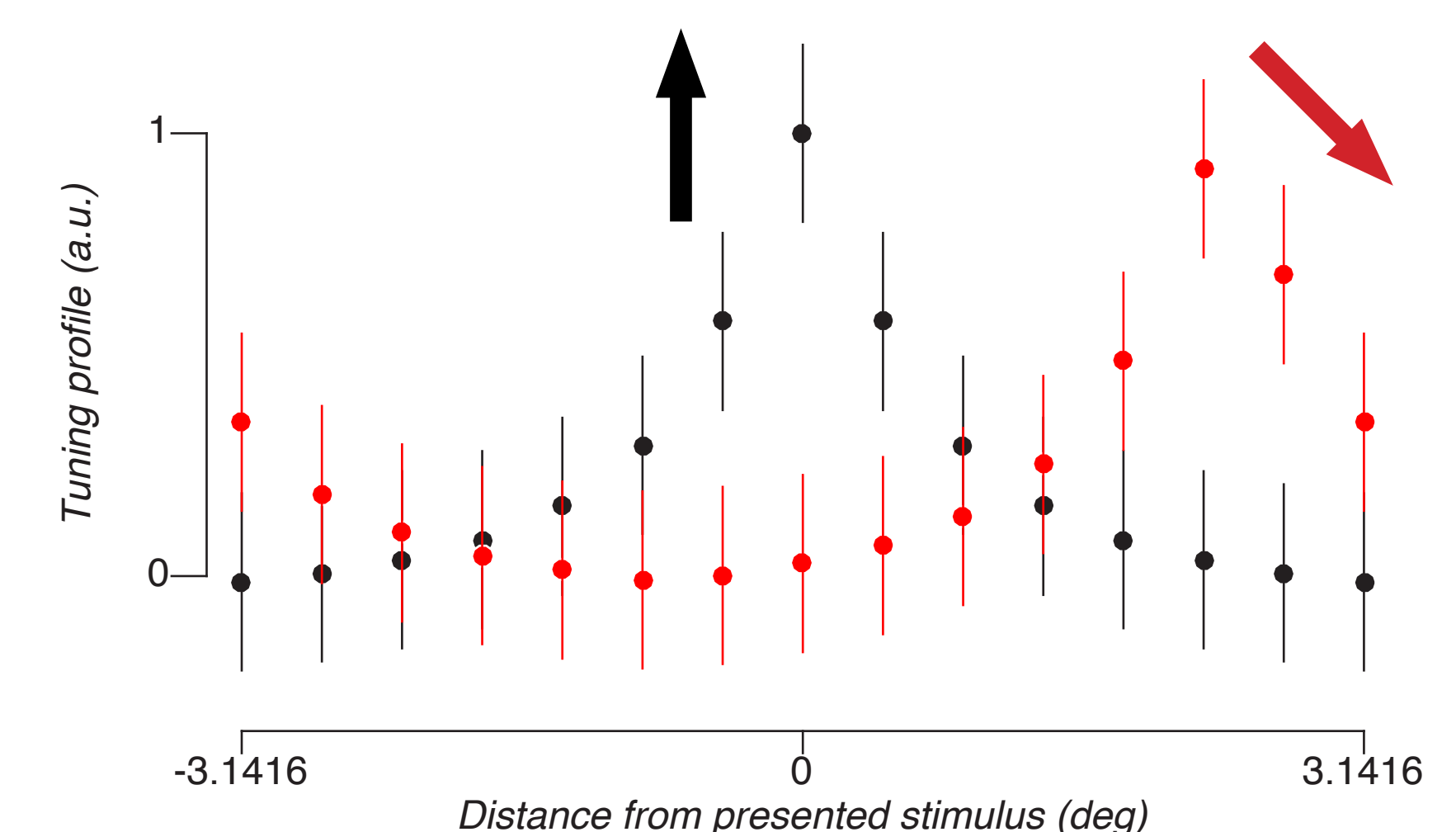
Averaging by spatial location and by color are about the same. Where do the small differences come from? Using the channel model and a task with a single recall can show whether bias or perceptual sensitivity changes during selection.

3. Channel model

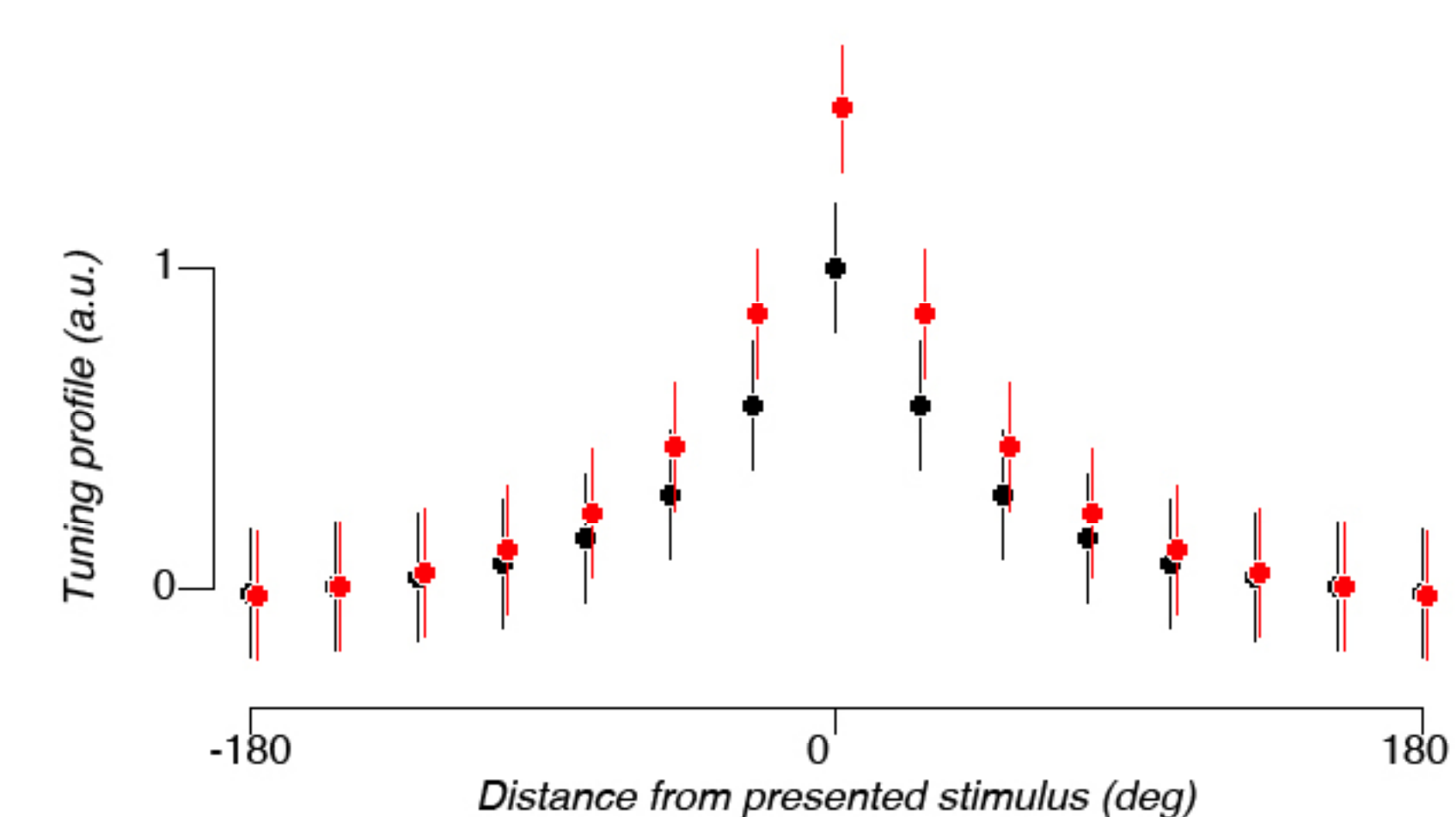
The model encodes the stimulus in independent “channels” tuned to the stimulus properties¹. The number of channels controls the precision of predictions.



In the averaging task, two population codes are combined to solve the task.

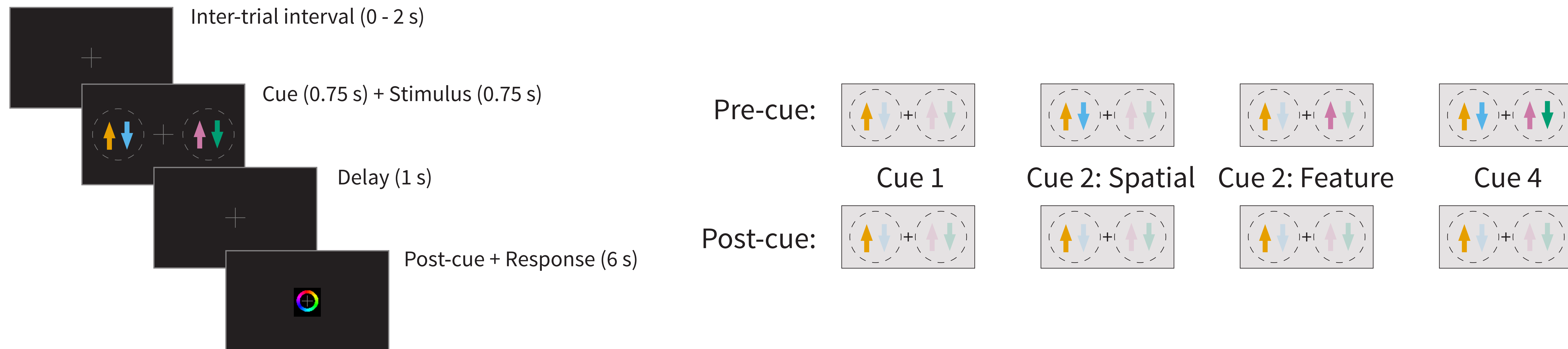


To account for the effects of sensory selection, the population codes can become more or less sensitive. Readout can also be biased by the activations from the irrelevant stimuli.



5. Bias due to spatial overlap

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 flipped task was also run, recalling the direction of motion cued by the location or color.

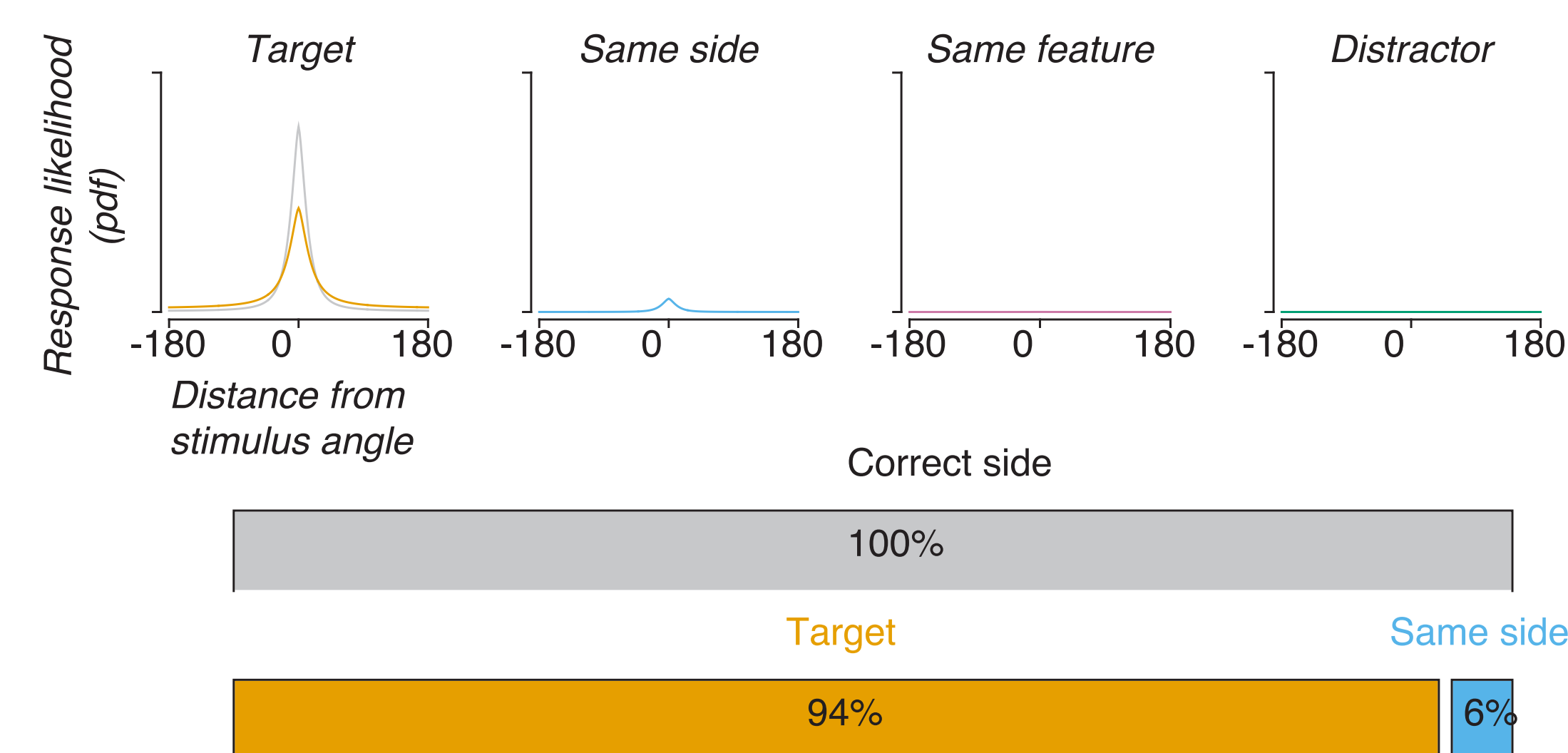


6. Model

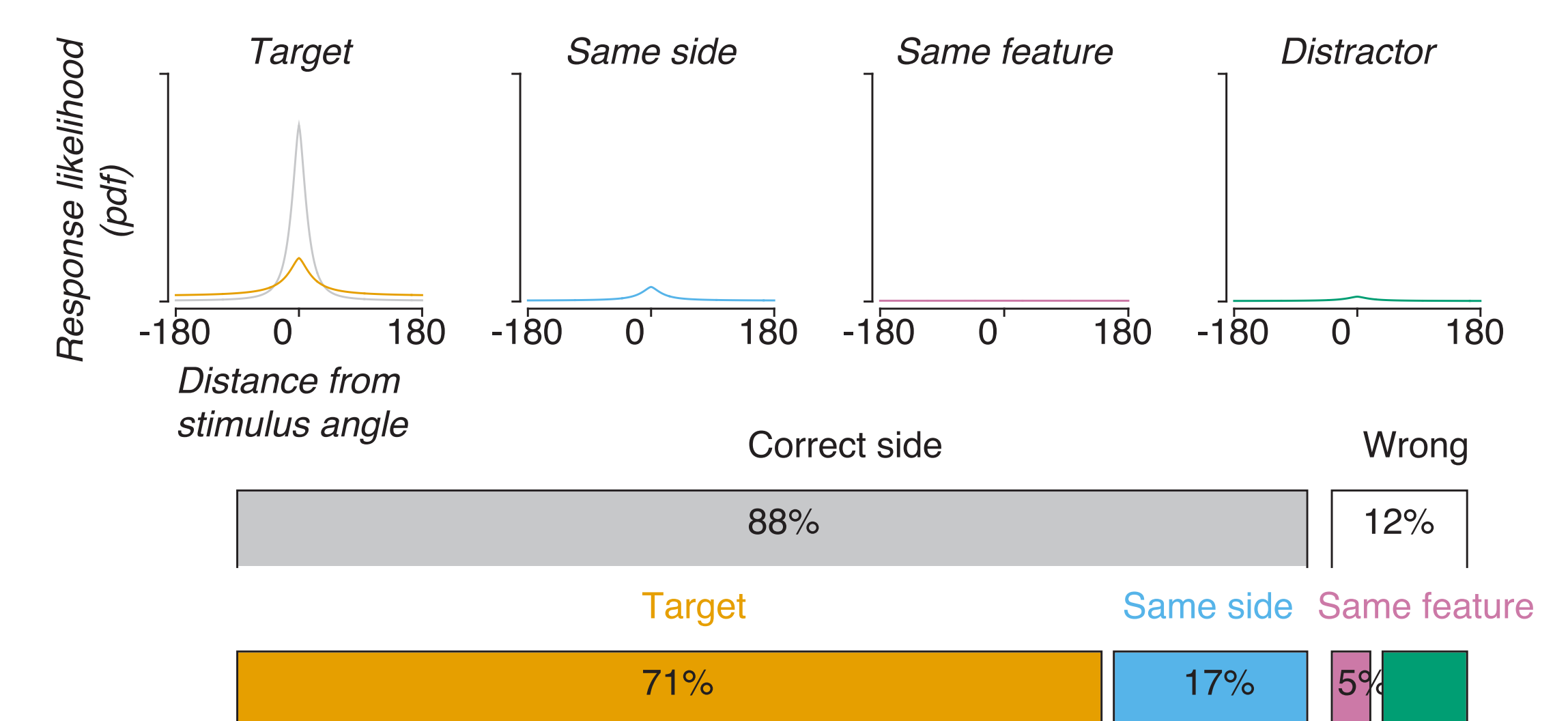
7. Fits

Data shown from the report color condition, with duration 0.25 s. Note shown: duration 1 s and report direction with duration 0.25 and 1 s.

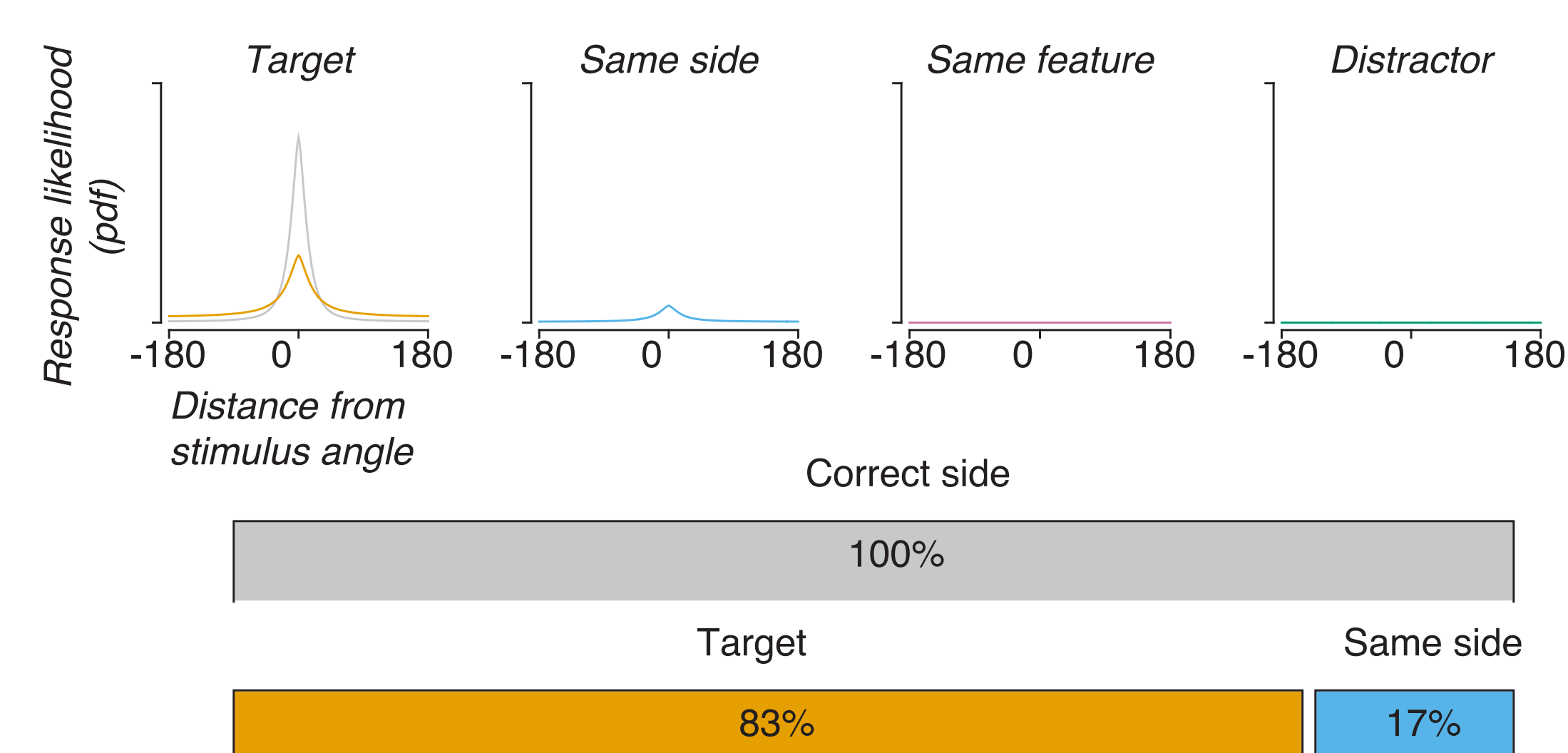
Cue 1



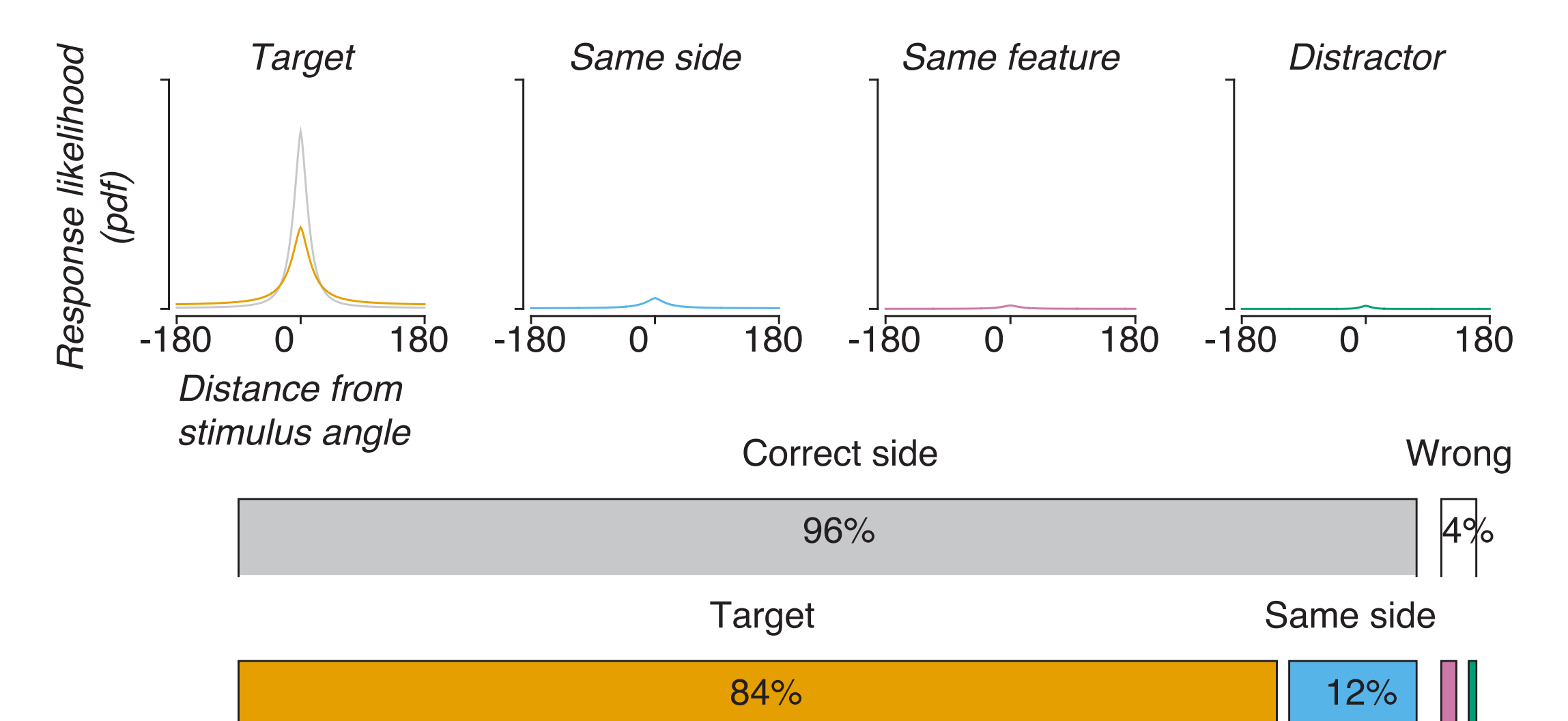
Cue 4



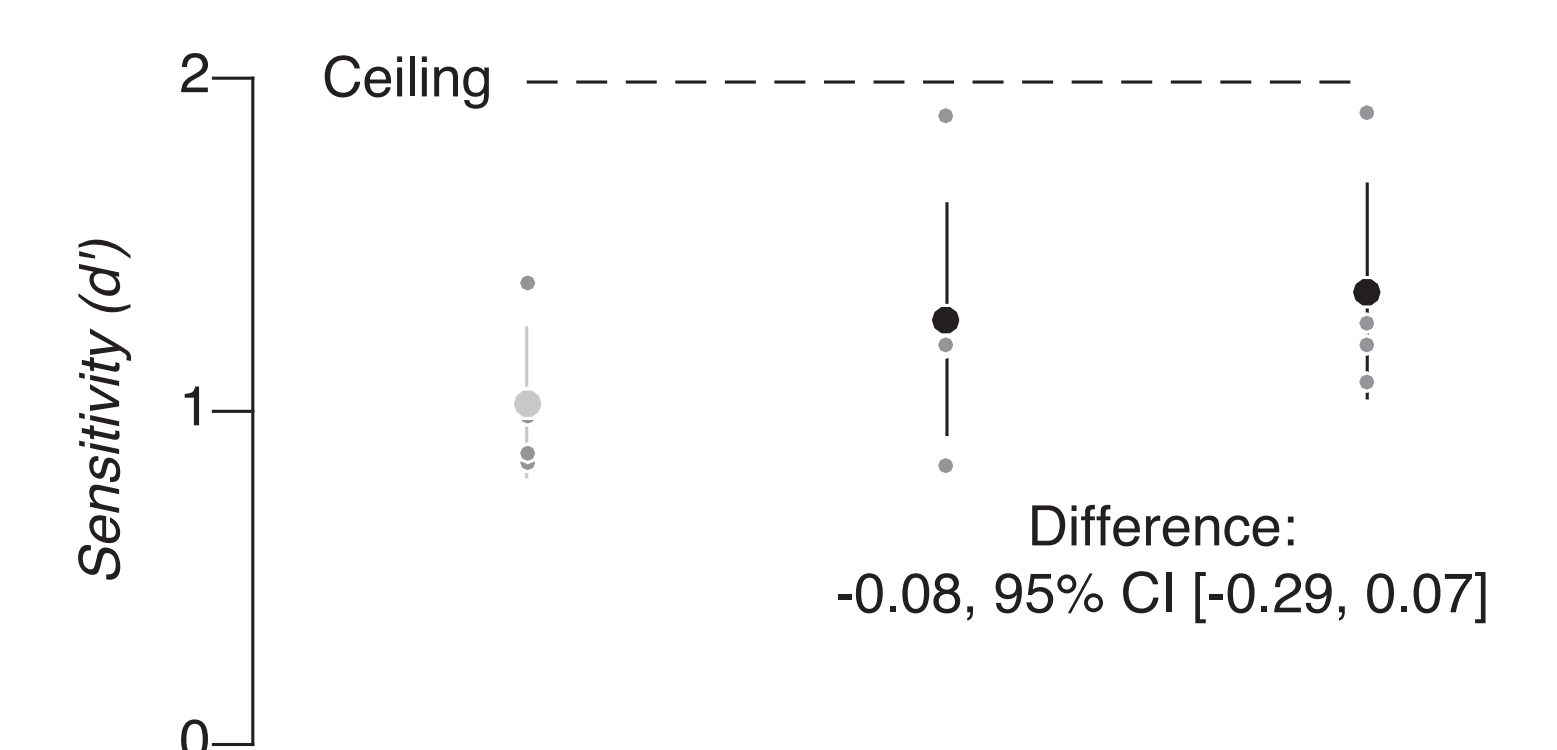
Cue 2: Spatial



Cue 2: Feature



A direct comparison of the d' parameter from the model showed that (after accounting for the lapses) there was an effect of selection, but there were no differences between spatial selection and feature-based selection.



8. Conclusions

Overlapping stimuli in space leads to confusions. Once these are accounted for, spatial and feature-based selection exert a similar improvement on perceptual sensitivity.

Future work: This similarity exists despite the vast difference in feature and spatial representation in visual cortex, how can we reconcile the effects of sensory selection with the implementation of spatial and feature-based attention?