Experiment 1

Rational: Investigate whether humans' eye-movements when sampling new information during visual perceptual decision-making are biased.

Stimulus: We used a gaze-contingent stimulus display. At any time, three oriented stimuli were present: one at the location where the eyes were fixating, and two in the periphery (Fig 1a top). Each stimulus consisted of bandpass-filtered noise with excess orientation power at -45deg or +45deg. The orientation of each stimulus was drawn from a Bernoulli distribution, matching the correct category of the with probability 0.7. The fixated stimulus was presented for 250ms. After it disappeared the subject made a voluntary saccade to one of the two peripherally presented target. As soon as the saccade was detected, the non-foveated target disappeared and two new peripheral targets were shown. Subjects indicated their decision about the category of the trial by a button press. We also performed a second version of this task that was identical up to the fact that three peripheral target were shown at any one time rather than only two (Fig 1a bottom). Accuracy for three subjects was approximately at threshold (Fig. 1b for both versions of the task (C1 and C2, respectively)). Panel c shows the weighing of the foveated evidence over time (average in black, individual subjects in color matching panels b+d). The *key analysis* is shown in panel d. For saccades when stimuli of different orientation were shown in the periphery, we computed the subject's probability of making a saccade to a stimulus whose orientation agreed with the orientation of the majority of foveated stimuli so far. We found that subjects were more likely to saccade to a stimulus whose orientation matched that believed to be the dominant orientation in that trial (all bars significantly above 0.5 in Fig. 1d), demonstrating a perceptual 'confirmation bias'.

Experiment 2

Rational: Same as experiment 1 but in a more natural scenario where the stimulus is static and subjects freely move their eyes to infer the overall category of the image.

Stimulus: 18 small ellipses with an aspect ratio of 0.55 were presented for 1.5s (Fig. 2a). Subjects voluntarily moved their eyes in order to accumulate information about whether the majority of ellipses were vertically or horizontally oriented. The ratio of vertical to horizontal ellipses was varied by a 2:1 staircase (psychometric curves in Fig. 2b, thin lines individual subjects, mean as solid line). Overall, we found that ellipses fixated in the first half of the trial had a larger effect on the final decision than ellipses fixated in the second half of a trial (Fig. 2c). As in Experiment 1 we found that subjects were systematically biased to be more likely to make saccades to ellipses whose orientation agreed with their accumulated evidence at that point in time (Fig. 2d).

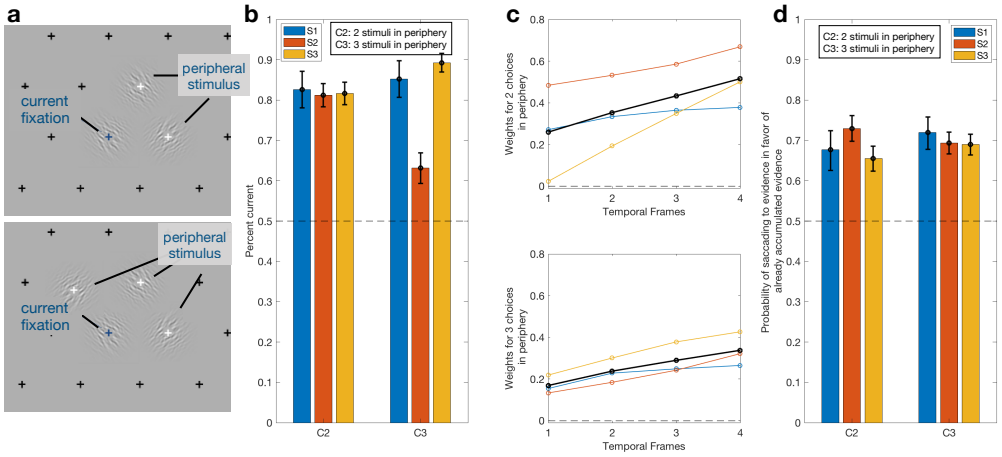

Figure 1: **Task and empirical observations for Experiment1**

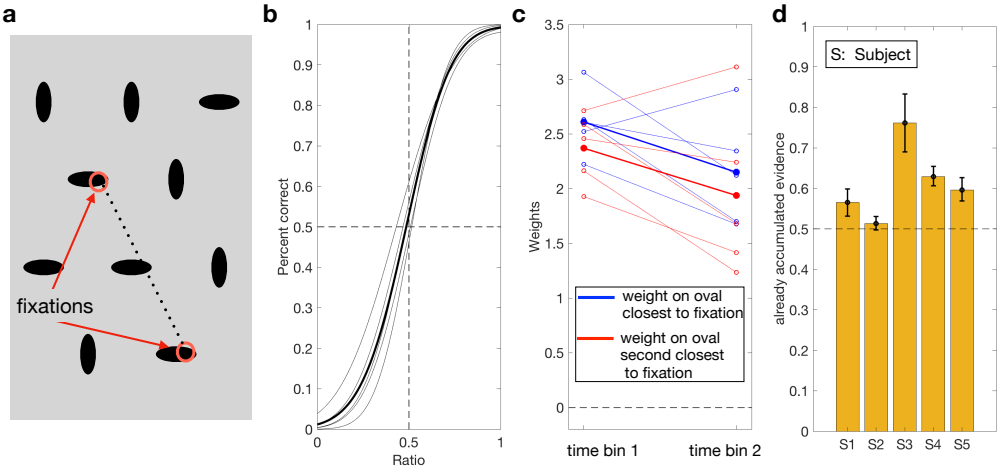

Figure 2: **Task and empirical observations for Experiment2**