

The influence of prior experience on saccade choice

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Visually-guided saccades bring items of interest onto the fovea, and have been the subject of intensive study. Under uncertain visual conditions (e.g., fog, dark, or lack of visual structure), eye movements are guided not only by what is observable in the visual world, but also by prior experience about which locations are likely to provide information or reward. However, little is known about the planning of saccades that are guided by non-visual representations of where to look next.

We designed a task in which human and macaque monkey subjects searched for a target on a structured noise background (1/f, pink noise). The location of the target in each case did not correspond to any visual element on the screen, but was drawn from a gaussian probability distribution with a given center and spread. The subjects were asked to find the target as quickly as possible; an eye movement to the correct location was rewarded with a tone. Human eye movements were measured with an ISCAN video-based eye-tracking system and monkey eye movements were measured with a scleral eye coil system.

We obtained pilot data from both naive human and monkey subjects. Subjects' eye movements revealed that they had learned both the location of the center of the probability distribution from which the targets were drawn and also had some knowledge of the shape of the distribution (see figure below). Specifically, a comparison of the subjects' first saccade end point with the endpoints of the following 3 saccades revealed that subjects knew the rewarded target distribution had a central peak. In addition, subjects seemed to utilize the visual landmarks in the pink noise background despite the fact that they were uncorrelated with target location.

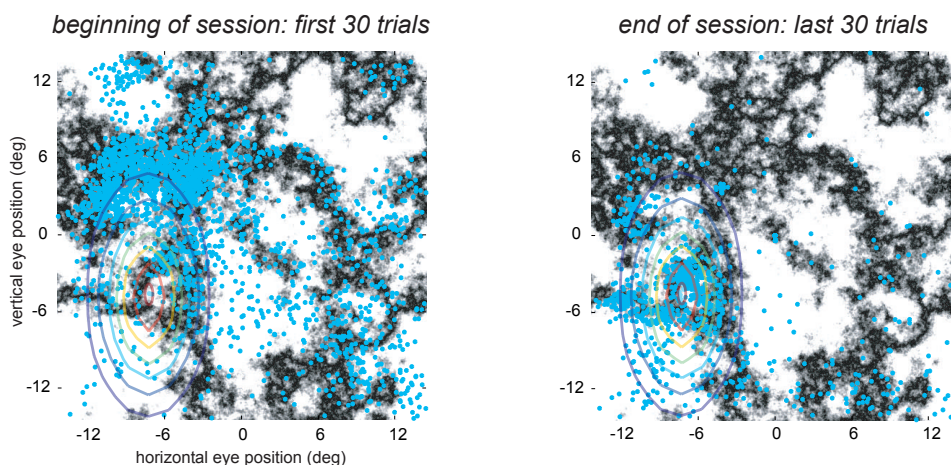


Figure 1: Representation of (invisible) rewarded target distribution shown with all eye movement endpoints for first the 30 trials (left) and last 30 trials (right) superimposed on the pink noise background

We conclude that humans were able to build estimates of where to look even when visual cues do not provide information about the location of the rewarded target. By separating what is salient to the observer into visual and prior experience components our task provides a framework for probing how prior information is integrated with visual information to decide where to look.