This Way or That: Determining Where to Look First

Christopher W. Myers **Wayne D. Gray** **Michael J. Schoelles**
[myersc/grayw/schoem]@rpi.edu)
Cognitive Science Department, Rensselaer Polytechnic Institute
110 8th St., Troy, NY 12180 USA

Introduction

Although there are many studies of how distractor-target differences influence visual search (e.g., see Shen, Reingold, & Pomplun 2000), there are no studies on how configural or historic factors influence the initial saccade of a search. The current study suggests that both the current configuration and history are important and have an additive effect on saccadic selectivity.

Methods

Twenty-one undergraduates from Rensselaer Polytechnic Institute volunteered to take part in the study, with 8 participants removed due to poor calibration.

The experimental paradigm follows a typical visual search experiment where one must find a target (L) among distractors (T). Participants were instructed to find the target as quickly as possible.

Stimulus density was varied within subject such that the distribution of stimuli was either constant across all four quadrants (*No Difference*) or for one quadrant interstimulus density was 1/2 (*Medium Density* – as per Figure 1) or 1/4 (*High Density*) that of the other quadrants.

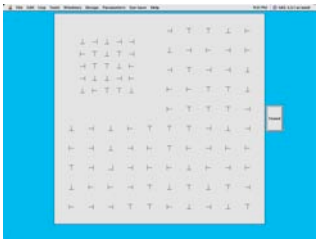

Figure 1: Meduim Density Cluster

On each trial, a target, L, always appeared at the center of one of the four quadrants. Both the quadrant in which the target appeared and the density of the quadrant were counterbalanced across trials.

The task was composed of four blocks, each block consisting of 48 trials. Each trial consisted of a Fixation Screen, Stimulus Screen, and a Test Screen. The participants fixated at a "+" (the Fixation Screen) which initiated the Stimulus Screen. Once the target (L) was found, the participant clicked-on the Found button (on the right side in Figure 1.), after which the Test Screen appeared. The participant then simply clicked the mouse in the quadrant where the target was found.

Results

There was a reliable effect of drawing initial saccades to clusters when compared to chance, the *Density Effect* (t = 2.18; p = 0.019). Figure 2 shows the strength of this effect increased with density such that there were more initial saccades to high density quadrants than to medium (t = 2.18, p = .01).

The effect of history was also reliable, such that there were more initial saccades to a target's last location (trial n-1) than would be expected by chance (t = 2.18; p = 0.004).

Both the density and history effect were small, occurring 31% of the time each (where chance is 25%). Furthermore, these two effects were additive. When the quadrant that contained the target on trial n-1 was also the quadrant with the medium or high density display on the current trial (trial n), the *Density-in-History Effect* drew 37% of the initial saccades (t = 2.18; p = 0.002).

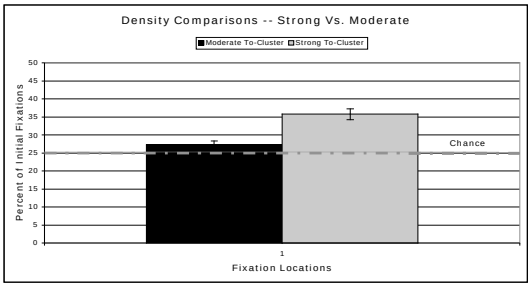

Figure 2: High density versus moderate density (dashed line = chance)

Discussion

The results clearly indicate an effect of stimuli density, an effect of history, as well as an additive effect. Higher density clusters have a greater effect than medium density clusters. Although these effects are small, we believe these results to be examples of bottom-up processes peering through top-down strategies.

There is absolutely no benefit to initially fixate on a high-density cluster; therefore, dense clusters in this situation are a distraction. Currently, work is being done to determine if increased workload, via a secondary task, will increase the likelihood of initially fixating a high-density cluster, thus increasing distraction.

Acknowledgments

This project was supported by Office of Naval Research grant #N000140310046 to Wayne D. Gray.

References

Shen, J., Reingold, E. M., & Pomplun, M. (2000). Distractor ratio influences patterns of eye movements during visual search. *Perception, 29,* 241 – 250.