Search Strategies in Simulated Hemianopia

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BACKGROUND AND MOTIVATION

How are search strategies and eye movements affected by absent and partial information? Patients with hemianopia tend to have longer search times and abnormal scanning (e.g., [1, 2]). Similar deficits are observed in simulated hemianopia, when a gaze-contingent mask blanks out the part of the search array falling into the left or right visual field (3). This latter result suggests it is the missing visual information that causes slowed search, rather than damage to the brain per se. One strategy to compensate for a lateralized field deficit is to saccede as far into the blind field as possible to increase visibility of the search area. However, this strategy is sub-optimal in some circumstances—for example, if the target is in the sighted field, or the locations of potential targets in the blind field are known. In addition, many patients with hemianopia retain some visual capacity in their “blind” field, so it is important to determine how partial information affects search in healthy participants.

Here we simulate hemianopia using the novel approach of removing either some or all information from the “blind” field to answer two general questions:

1) How are search patterns affected by missing and partial information?
2) To what extent does searching the blind field earlier in the trial lead to faster and more efficient search?

Methods

Search for the angry face among neutral faces. Target present on half the trials. Eight search items. The part of the display falling to the left or right of current fixation (blocked) is replaced with one of four counterbalanced conditions:

1) The grey background (blank)
2) Low spatial frequency versions of the faces
3) Dots representing the spatial locations of the faces
4) An unaltered version of the display (control)

Each condition has 64 trials. N=30. Four exclusions for poor performance.

OBSERVATIONS & CONCLUSIONS

Removing stimulus information from one visual field led to search deficits, as has been previously demonstrated. In contrast with previous observations [1-3], however:

- Search times were slower due solely to an increased number of fixations. Fixation durations were the same across conditions.
- Saccadic amplitudes towards the blind field were longer (not shorter) than towards the sighted field.
- More saccades were made into the sighted field, particularly the first saccade of each trial.
- Stimulus position markers alone did not improve search relative to no information at all. Removing only high-spatial frequency information from the “blind” field resulted in search performance that was only modestly impaired relative to unmodified search. This suggests not just location, but also target identity information, is being used to search more efficiently. To the extent that different kinds of information are preserved in hemianopia, different degrees of search deficits can be expected.
- When the target appeared in the sighted field, search was unaffected by condition, suggesting participants tend to search the sighted field first and then the blind field. This tendency is borne out in the large proportion of first saccades executed towards the sighted field. This could be thought of as sub-optimal, however, our preliminary analysis found no clear relationship between early search of the blind field and faster search overall.

REFERENCES


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