Looking at oddballs: Target absence influences attention and eye movements in pop-out search

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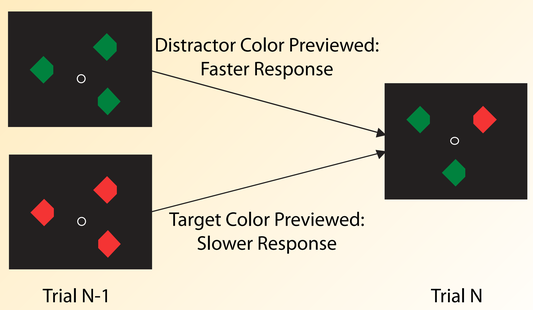
Distractor Previewing Effect

In pop-out visual search, response is slower when the feature defining the target was just viewed on the preceeding target-absent trial.

Ariga & Kawahara (2004), Goolsby, Grabowecky, & Suzuki (2005)
Lleras, Kawahara, Wan, & Ariga (2008)



Identical displays were used in experiments 1–3

Where does this bias originate?

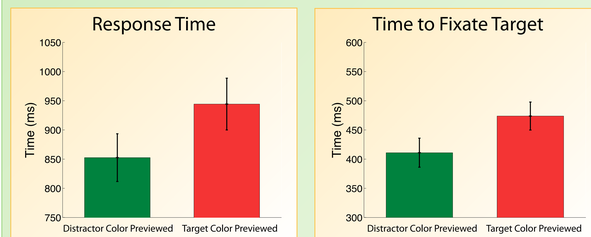
- Delay in display segmentation
- Delay in target selection
- Increased attention to distractors
- Delay in response selection/execution

Goal:
Examine eye-movement behavior to constrain the locus of the effect.

Experiment 1: Target Discrimination

Task: Report side of missing notch of the odd-colored diamond.

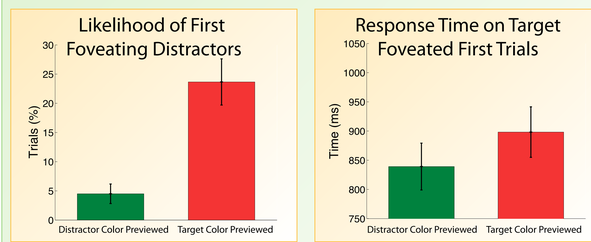
Discriminating side of tiny notch requires target foveation.



Participants showed a response time cost for responding to targets in the target-color previewed condition.

A delay in the time to foveate targets in the target-color previewed condition was also present.

This is consistent with the attentional biasing account of the DPE, which predicts higher likelihood of attention being directed to distractors on target-color previewed trials.



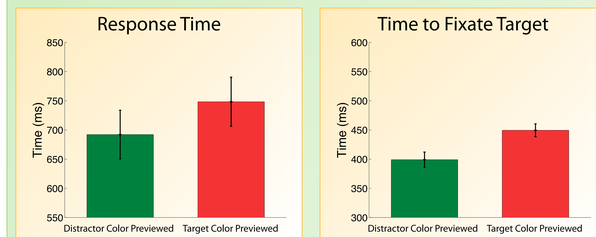
Participants failed to directly foveate the "pop-out" target on nearly 25% of the trials in the target-color previewed condition.

Even on trials when participants *did* foveate targets first as they moved away from fixation, a response time difference was observed.

Experiment 2: Target Selection

Task: Foveate odd-colored diamond. Press button to indicate trial completion.

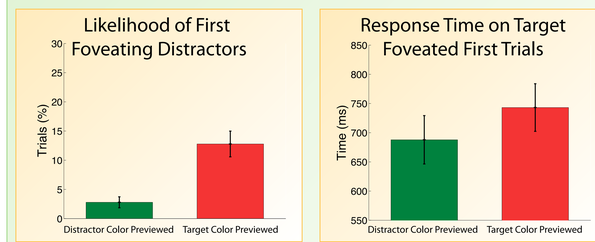
Foveation of target requires attentional selection (Deubel & Schneider, 1996).



Response time and fixation costs for target-color previewed condition show the same pattern of results seen in Experiment 1.

Scrutiny of the target is not necessary for the effect.

We can rule out a response-level locus of the DPE.



Response time differences replicate Experiment 1 even when task requires target localization only.

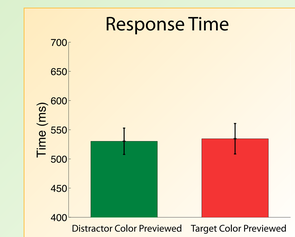
Distractor foveation occured less often, but show same pattern as Experiment 1.

This is consistent with ERP evidence that a delay in the selection of targets underlies the effect (Shin et al., 2008).

Experiment 3: Target Detection

Task: Maintain central fixation, press button to indicate presence of odd-colored diamond.

Localization of the target not required for pop-out detection task (Bravo & Nakayama, 1992).



False Alarm rate < 1%

No response time difference between conditions.

Repetition/alternation of segmentation is not driving this effect.

Attentional selection (foveating the pop-out) is necessary for the distractor previewing effect.

Conclusion

Response selection/execution does not drive the distractor preview effect (Experiment 1 vs. Experiment 2), nor does ease of display segmentation (Experiment 3).

Wan & Lleras (submitted) have also shown that increased difficulty of the response discrimination increases the magnitude of the DPE (Experiment 1 vs. Experiment 2), suggesting longer attentional dwell times on attended distractors.

The locus of the DPE seems to be at the level of attentional selection (Lleras et al., 2008).

Act of selection is influenced by recent events, even when selection is as easy as foveating a pop-out!

Levinthal & Lleras (talk this afternoon) show that the attentional bias underlying the DPE is not specific to a given search task and can transfer across different types of tasks.

Works Cited

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