

Direct Selection by Color for Visual Encoding

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Effects of color cuing

In visual search tasks where location varies (i.e., multiple item displays) several experiments (e.g., Brawn & Snowden, 1999) have reported faster target detection when the target appears in a precued color than when it does not. But it is unclear whether the observed benefit is due to a direct selection by color or whether the advantage is mediated by location. Paradigms in which location varies do not allow a decision between these two options.

In designs without variation in location (i.e., rapid serial visual presentation or "RSVP" tasks) the possible mediating influence of location is avoided. Previous studies examining the effect of advance color cues in RSVP tasks have found no evidence for direct selection by color (Pöder, 2001; Shih & Sperling, 1996), but in these studies advance color information was of limited use because it only reduced the set of to-be-processed stimuli by half. In contrast, studies of the effects of spatial cuing typically only cue a single location for processing (Posner, Snyder, & Davidson, 1980).

Research question

This study sought to determine whether valid color information can aid perceptual processing in visual selective attention tasks where location is kept constant and the incentive for the use of the cue is increased. Similar to location cuing tasks, valid color cues used in our experiments enabled attentional processes to focus on one particular item in the sequence.

Task and Stimuli

Participants were asked to determine whether a specific target letter was presented in its upper or lower case version (e.g., "Does the RSVP sequence contain an H or an h?"). An advance color cue indicated the color in which the target letter was most likely to occur.

The RSVP sequence consisted of 15 frames, each containing a single colored letter. The sequence contained a single target letter and three different distractor letters in both upper and lower case forms, and each letter could be presented in any of six different colors.

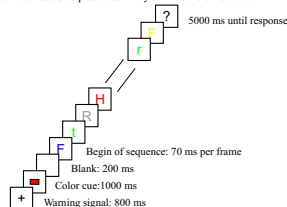


Figure 1. Example representation of a valid trial.

Experiment 1

Color cues were presented at the beginning of each trial and were either:

- valid only the target letter was presented in the cued color (80% of all trials), or
- neutral none of the letters in the sequence was in the cued color, so the cued color provided no information about the target (20% of all trials).

Predictions

If color can be used to select an item for encoding, performance should be better in trials where the color cue was valid compared to trials where the color cue was neutral.

Results

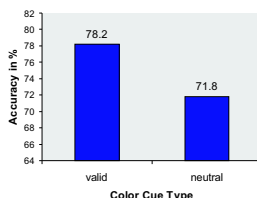


Figure 2. Average accuracy in % as a function of color cue validity in Experiment 1.

Conclusions

Performance in trials preceded by valid informative color cues was significantly better than performance in trials with neutral uninformative color cues. These results indicate that items can be directly selected for visual encoding by color, and the effect cannot have been mediated by location because location did not vary.

Experiment 2

This experiment was conducted to investigate whether there would be costs of misleading color cues in addition to the benefit of valid color cues observed in Experiment 1. For this purpose a third cue condition was included. The cue conditions were:

- valid the target letter was presented in the cued color (80% of all trials) or
- neutral no letter appeared in the cued color target (10% of all trials), or
- invalid a distractor letter appeared in the cued color therefore the color cue was misleading (10% of all trials).

Predictions

It was expected that this manipulation would lead not only to benefits in performance for valid trials, but also to costs in performance for invalid trials, when compared with the neutral condition.

Results

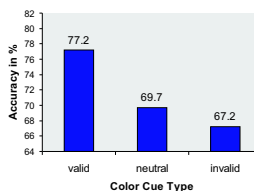


Figure 3. Average accuracy in % as a function of color cue validity in Experiment 2.

Conclusions

As before, performance in valid color cue trials was significantly better than performance in neutral color cue trials, indicating benefits of correct color cues. In addition, performance in invalid trials was significantly worse than performance in neutral trials, therefore indicating costs of misleading color cues.

General Conclusions

The advantage of valid color cues found in these two experiments suggests that color can be used to directly select items out of an RSVP sequence for further processing.

The benefit of valid color information cannot be attributed to mediation by location, because spatial location was kept constant.

In addition, misleading color information was shown to cause costs in performance, consistent with the idea that allocation of capacity to processing of a distractor in the cued color reduced the capacity available for processing the target.

The observed effects are similar to results reported in location cuing paradigms (Posner et al., 1980).

References

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Acknowledgments

This research was supported in part by a Marsden grant from the Royal Society of New Zealand to Jeff Miller.