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Position and color priming in briefly presented search arrays

Árni Gunnar Ásgeirsson¹, Árni Kristjánsson², Søren Kyllingsbæk¹, Kristbjörg Fjóla Hrólfsdóttir², Heiðrún Hafþórsvöld³ and Claus Bundesen⁴

1: Center for Visual Cognition, Department of Psychology, University of Copenhagen.
2: Laboratory for Visual Perception and Visuomotor Control, Faculty of Psychology, University of Iceland.

Introduction

In efficient visual search, priming of pop-out (PoP; Maljkovic & Nakayama, 1994, 1996) is usually reported as a speeded response when a target feature is repeated on consecutive trials.

Feature facilitation accounts: Sensitization to features via short-term memory. Priming at perceptual level.

Post-perceptual accounts: PoP affects response times, not accuracy, via response repetition benefits, decision bias or other "late" effects.

Questions:

1. Do color and/or position repetitions increase accuracy at brief exposure durations?
2. If so, is a category weighting account viable as an explanation of the PoP when applied within a TVA-framework (Bundesen, 1990)?

The experiment

We tried to replicate perceptual priming effects in an accuracy based design (Yashar & Lamy, 2010) while generalizing to alphabetic stimuli. Our design also has the advantage of multiple responses (15 consonants), which minimizes any effects of response repetition and visuomotor effects, leaving the results more readily interpreted as perceptual effects.

We presented subjects with a 3x3 consonant matrix where a target would always occupy one of the four corner positions. The displays where present for from 10-180 msec.

The subjects’ task was to report the odd-one-out letter by pressing the appropriate key on a keyboard. The target identity was determined by color and varied randomly (Figure 1).

Methods

Participants were 8 students at the University of Iceland (3 male, ages 20-26). Each subject participated in at least 15 blocks of 100 trials. Trials following incorrect trials are repeated after a short delay (500 msec) to prevent the use of "newtonian" (insight) strategies. Trials were split into familiarization (25 trials), 10 blocks of 100 trials and a block of 25 practice trials. The subjects were informed that they were participating in a study on human memory and perception and that there were no right or wrong answers, but rather that the purpose of the experiment was to test their memory.

Results

• A 2x2 within subjects analysis revealed significant main effects of position and color repetition (p < 0.001 and 0.003, respectively). No interaction was found between the two (p=0.619).

• Position priming effects ranged from 2.5-11.4 pp, between subjects.

• Color priming effects ranged from 1.7-11.8 pp, between subjects.

• All subjects showed the same pattern of lowest accuracy under the “no-repetition” condition and highest accuracy under the “both repeated” condition. These within-subject differences ranged from 10-23 pp.

Conclusion

• PoP affects accuracy at very brief exposures.

• The effects cannot be explained by reference to response related mechanisms.

• The results suggest a perceptual component in PoP. This does in not exclude response related PoP.

• A simple additive TVA model can be fitted quite well to experimental data.

• Recent literature suggests that repetition are the result of two or multiple mechanisms (see Lamy & Yashar, in press; Kristjánsson & Campana, 2010).

References


Figure 1: (1) a trial (black arrow) and (2) between trial stimulus arrays (red arrow).