Positions priming in briefly presented search arrays

Asgeirsson, Arni Gunnar; Kristjánsson, Árni; Kyllingsbæk, Søren; Fjóla Hrólsdóttir, Kristbjörg; Hafþórsdóttir, Heiðrún; Bundesen, Claus

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Position and color priming in briefly presented search arrays
Árni Gunnar Ásgeirsson¹, Árni Kristjánsson², Søren Kyllingsbæk¹, Kristbjörg Fjöla Hrólfsdóttir², Heiðrún Hafþórsdóttir² and Claus Bundesen¹
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 to explain 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 alphanumeric 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 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 9 students at the University of Iceland (3 male), ages 22-28. Each subject participated in at least 10 blocks of 100 trials. Trials following incorrect trials are not considered as trials per subject, since the effects of repetition are cumulative. The first block was discarded, since it may be meaningless to speak of repetitions/alternations from an individual point of view.

We presented subjects with a 3x3 consonant matrix where a target would always occupy one of the four corner positions. The displays were presented as “unseen” trials. All letters were equally likely to appear at any time, but only one letter at each target position could appear on a single trial. Targets and distractors were stimuli from a consonant matrix. The target was always one letter, and an filler consisted of four letters from the same consonant matrix.

All of these were presented as “unseen” trials. The “seen” trials were presented in a 3x3 consonant matrix. Two letters were presented as targets, but only one letter at each target position could appear on a single trial. In these “seen” trials, the subjects were requested to press the appropriate key on a keyboard. The target identity was determined by color and varied randomly.

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.

Conclusions
• 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
523-547.
547.

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

Table 1: We present least squares fits by a simple additive TVA-based model of PoP. The model is only instrumental, since it is limited to one-step memory, which will not suffice to describe PoP in detail. PoP has shown to be a cumulative effect, building up over several trials and decaying relatively slowly (Maljkovic & Nakayama, 1994). The model also applies to pooled, rather than individual data. However, the goodness of fit is quite promising.

The model has 4 free parameters (X, alpha, color and pos. rep. weights) and a fixed C (processing speed). The C parameter is fixed at 50 items/s (table 1). The fits in figure 3 show the curves predicted by the model.

Figure 2: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 3: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 4: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 5: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 6: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 7: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 8: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 9: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 10: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 11: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 12: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 13: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 14: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 15: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 16: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 17: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 18: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 19: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 20: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 21: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 22: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 23: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 24: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 25: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 26: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 27: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 28: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 29: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.

Figure 30: Experience is adjusted voluntarily by current goals or pertinence, and does not follow classical rules.