Positions priming in briefly presented search arrays

Asgeirsson, Arni Gunnar; Kristjánsson, Árni; Kyllingsbæk, Søren; Fjóla Hrólsfóttir, 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, Heiðrun Hafþórðsdóttir² 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: Majkovic & 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 along with the PoP explanation of the PoP when applied within a TVA-framework (Bundesen, 1990)?

Accounting for repetition priming within TVA (Bundesen, 1990)
A Theory of Visual Attention (TVA) is a combined theory of selection and recognition. It has been mathematically formalized in a fixed capacity, independent race model (FIRRM). The central assumptions of the theory are described by the rate and weight equations (figure 2).  

In TVA selectivity is obtained by adjusting attentional weights for perceptual categories by differentiating their attentional values (r). Perceptual channels can be adjusted voluntarily by current goals or instructions, but involuntary factors also affect it.

Here we treat r as a parameter that can be substantially affected from trial to trial by varying target identity during a task. The assumption is that m-calculations are ongoing and the current importance of a target category is affected by its importance on the previous trial.

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

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

Figure 2: Weight equation

Figure 3: Exposure Durations (msec.)

Figure 4: C parameter estimation

For a concise introduction to TVA please consult the TVA website (www.tva.psy.vu.nl) where you can find an introduction to Theory of Visual Attention by Bundesen is available.