Positions priming in briefly presented search arrays
Asgeirsson, Arni Gunnar; Kristjánsson, Árni; Kyllingsbæk, Søren; Fjóla Hrólsfóttir, Kristbjörg; Hafþórsdóttir, Heiðrún; Bundesen, Claus

Published in: Perception

Publication date: 2011

Document Version Peer reviewed version

Position and color priming in briefly presented search arrays

Árni Gunnar Ásgeirsson¹, Árni Kristjánsson², Søren Kyllingsbæk¹, Kristbjörg Þóra 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: 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 a viable 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 parameter values (κ). Peristimulus can be adjusted voluntarily by current goals or instructions, but involuntary factors can also affect it.

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

The model is only instrumental, since it is limited to one-target memory, which will not suffice to describe PoP in detail. PoP has been 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 (κ, α, col.resp and pos.resp weights) and a fixed C parameter is fixed at 50 (towards table 1).

Results

- A 2x2 within subjects analysis revealed significant main effects of position and color repetition (ps <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).

Acknowledgments

This work was supported by grants from the Danish Research Councils and a postdoctoral scholarship from the Danish Society of Sciences.

References

2. Yashar & Lamy (in press). Refining the dual-stage account of intertrial feature priming: Does motor response or response repetition benefits, decision bias or other "late" effects?
7. NIC (2004). Viewing and selection effects: Searching for features that defined target in a visual search task.

Central for Visual Cognition
Department of Psychology
University of Copenhagen
Boler Fælledsgade 2A
1353 Copenhagen K
www psy ku dk/cvc

Corresponding Author
Árni Gunnar Ásgeirsson
arga2@hi.is

For a concise introduction to TVA, please consult the TVA website (http://www.videnskab.dk/videnskab/videnskab) and graphics in the introduction to Theory of Visual Attention by Bundesen is reprinted.