Positions priming in briefly presented search arrays

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Position and color priming in briefly presented search arrays

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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.

Response repetition benefits, decision bias or other “late” benefits

Post-perceptual accounts

Features via short-term memory. Priming at perceptual level.

Questions:

1. Do color and/or position repetitions increase accuracy at brief exposure durations?

2. If so, is a category weighting view 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 (FRIM). 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 variance (σ). Pertinence can be adjusted voluntarily by current goals or instructions, but involuntary factors can also affect it.

Figure 2:

Figure 3:

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.

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-shot, 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 (Majkovic & Nakayama, 1994). The model also applies to protocols, rather than individual data. However, the goodness of fit is quite promising.

The model has 4 free parameters (σ, alpha, color rep. and pos. rep. weights) and a fixed C (processing speed). The C parameter is fixed at 50 hemacy (table 1).

The fits in figure 3 show the curves predicted by the model.

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 Lam & Yashar, in press; Kristjánsson & Campana, 2010).

References