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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.

Questions:
1. Do color and/or position repetitions increase accuracy at brief exposure durations?
2. If so, is a category weighting account viable 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 (formula 2).

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

Here we treat W as a parameter that can be multiplicatively altered 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 ‘both repeated’ condition. These within-subject differences ranged from trial to trial by varying target identity during a task. The assumption is that

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

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

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

Majkovic & Nakayama (1994). The importance of a target category is affected by its importance on the previous trial.

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