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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: Majlkovic & 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).³

In TVA selectivity is obtained by adjusting attentional weights for perceptual categories by differentiating their pertinence values (W). Pertinence 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 inscrutably 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.

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

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.

Figure 2

Figure 3

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).

Conclusions

References

² Tallis & Förster, (1978) Visual attention and selection effects: Searching for visual targets in very brief displays, Perception
³ Bundesen (1990), A Theory of Visual Attention

Figure 3

For a concise introduction to TVA, please consult the CVC website (left) where you’ll find a list of TVA-related references. For a concise introduction to PoP influencing visual attention, please consult the CVC website (left) where you’ll find a list of PoP-related references.