Positions priming in briefly presented search arrays

Asgeirsson, Arni Gunnar; Kristjánsson, Árni; Kyllingsbæk, Søren; Fjóla Hrólsfdóttir, Kristbjörg; Hafþórsdóttir, Heiðrún; Bundesen, Claus

Published in:
Perception

Publication date:
2011

Document version
Peer reviewed version

Citation for published version (APA):
Position and color priming in briefly presented search arrays

Árni Gunnar Ásgeirsson¹, Árni Kristjánsson², Søren Kyllingsbæk¹, Kristbjörn Fjöla Hrólfssóttir³, Heiðrun Hafþórsdóttir³ 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 alternative?

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

PoP affects accuracy at very brief exposures. The effects cannot be explained by reference to perceptual effects. PoP affects accuracy at very brief exposures. The effects cannot be explained by reference to perceptual effects.

The experiment

We tried to replicate perceptual priming effects in an accuracy based design (Yashar & Lamy, 2010) while generalizing to alphanumeric stimuli. Our design also has the advantage of multiple responses (15 consonants), which minimizes any effects of response repetition and visuomotor effects, leaving the results more readily interpretable.

We presented subjects with a 3x3 consonant matrix where a target would always occupy one of the four corner positions. The displays where presented for 10-180 msec.

The subjects’ task was to report the odd-one-out letter by pressing the appropriate key on a keyboard. The target identity was determined by color and varied randomly (Figure 1).

Methods

Participants were 6 students at the University of Iceland (3 male, aged 22-28). Each subject participated in at least 16 blocks of 100 trials. Trials following incorrect trials and trials after incorrect trials were excluded from further analysis.

Stimuli

The experiment required participants to report the odd one-out letter in a 3x3 consonant matrix of 3x3 letters. The matrix was presented for 10-180 msec.

The subject’s task was to report the odd-one-out letter by pressing the appropriate key on a keyboard. The target identity was determined by color and varied randomly (Figure 1).

The fits in figure 3 show the curves predicted by the model. The model is only instrumental, since it is limited to one-trial 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 (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 (K, alpha, color and pos. rep. weights) and a fixed C (processing speed). The C parameter is fixed at 50 (Table 1).


t-test (msec.)

<table>
<thead>
<tr>
<th>C (fixed)</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>K (msec.)</td>
<td>6.6</td>
</tr>
<tr>
<td>alpha</td>
<td>0.19</td>
</tr>
<tr>
<td>CR weight</td>
<td>0.3</td>
</tr>
<tr>
<td>PR weight</td>
<td>0.98</td>
</tr>
<tr>
<td>Least Sq.</td>
<td>0.0327</td>
</tr>
</tbody>
</table>

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