Background

Huang & Sekuler (2010) found that when estimating the spatial frequency of a target stimulus in presence of a distractor stimulus, responses were influenced by the target, the distractor, and also the central tendency bias. Many studies involving orientation estimation in the presence of a distractor (Rademaker et al., 2015; Bae & Luck, 2017), however, have not taken the central tendency bias into account. In these experiments, we show that a central tendency bias is present in orientations estimation tasks, and that it must be accounted for to get an accurate estimate of the distractor interference.

Experiments 1 and 2

Goal – To measure distractor interference in orientation estimation tasks

Study Design – Several small rectangles were spatially arranged to create a single big rectangle (Experiment 2) or three big rectangles (Experiment 1). Participants estimated the orientation of either the big rectangle or the small rectangles in Experiment 2, and the mean orientation of all the big rectangles or all the small rectangles in Experiment 1.

Results – An additional bias was present along with the distractor bias

Experiment 3

Goal – To determine whether the central tendency bias is also present in tasks involving distractor stimuli

Study Design – Three groups of participants were exposed to three different orientation distributions:
- Group 1: [15, 20, 25, 30, 35, 40, 45, 50, 55] Distribution Mean: 35
- Group 2: [25, 30, 25, 40, 45, 50, 55, 60, 65] Distribution Mean: 45
- Group 3: [35, 40, 45, 50, 55, 60, 65, 70, 75] Distribution Mean: 55

Results – A central tendency bias was also present along with a distractor bias

As the mean of the stimulus distribution shifts towards the right, the confidence interval of the x intercept, also shifts towards the right, indicating the presence of a central tendency bias.

Table 1: ‘Mean’ refers to the mean of the stimulus distribution. ‘C.I.’ refers to the confidence interval of the x intercept of the regression line in Experiment 3.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>35</td>
<td>[30.6 35.5]</td>
</tr>
<tr>
<td>Group 2</td>
<td>45</td>
<td>[38.4 43.2]</td>
</tr>
<tr>
<td>Group 3</td>
<td>55</td>
<td>[42.6 54.1]</td>
</tr>
</tbody>
</table>

Figure 4: The green line represents the x intercept of the regression line, and the yellow line represents the mean of the stimulus distribution in Experiment 3.

Figure 5: The trial structure in Experiment 4.

Results – The bias appears to be towards the mean of the distribution.

Table 2: ‘Mean’ and ‘Mode’ refer to the mean and mode of the stimulus distribution. ‘C.I.’ refers to the confidence interval of the x intercept of the regression line in Experiment 4.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Mode</th>
<th>C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Skew</td>
<td>58.9</td>
<td>74</td>
<td>[58.9 64.1]</td>
</tr>
<tr>
<td>Right Skew</td>
<td>26.4</td>
<td>14</td>
<td>[20.9 24.5]</td>
</tr>
</tbody>
</table>

Conclusion

A central tendency bias is present in orientation estimation tasks (Experiments 3 and 4). This bias should be accounted for to get an accurate estimate of the distractor interference (Experiments 1 and 2).

References


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