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Differential Effects in Bimodal Directional Stroop Interference

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Summary

The directional Stroop task (e.g., Cannon, 1998) creates interference between a directional word and a directional cue, such as an arrow. This study was conducted to replicate directional Stroop interference using bimodal stimulus pairs and then to determine whether or not interference occurs when the word is replaced with a sound. In Experiment 1, an arrow, pointing up or down, was paired with a directional word (UP or DOWN). Subjects were faster responding to the direction of the arrow when the pairs were congruent compared to incongruent indicating interference. In Experiment 2, the visual word was replaced with a voice. Incongruent trials produced longer RTs but there was no statistical difference between conditions. In Experiment 3, the auditory word was replaced with the sound of a slide whistle either going up or going down. Although response times were longer for incongruent pairs and the effect size was moderate, there was no significant interference between the arrow and a direction-related sound. Experiment 4 utilized the same design as Experiment 3. However, in Experiment 4 subjects responded to the direction of the sound instead of the arrow. Performance across conditions was virtually identical indicating that the visual directional cue (i.e., the arrow) had no impact on identifying the direction of the sound. Together, the results replicate previous research with a visual directional task but did not extend these findings to auditory-visual cross-modal tasks. However, the initial results from Experiments 3 and 4 suggest that auditory cues may influence visual directional cues but that visual cues do not influence auditory directional cues.

Objectives

The current study was conducted to:

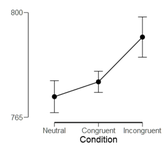
1. replicate the directional (or spatial) Stroop task (Experiment 1);
2. extend the directional Stroop task to cross-modal pairings (Experiment 2);
3. determine if a directional sound has the same impact as a directional word (Experiment 3); and
4. examine differences between auditory and visual distractors in a directional Stroop task (Experiments 3 and 4).

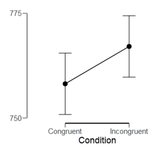
Experiment 1

Participants. Twenty-five psychology students participated in the experiment for class credit. All participants had normal or corrected to normal vision.

Procedure. Either upward pointing or downward pointing arrows were presented on the monitor. Participants were instructed to press the press the 1 key on the number pad if an arrow was pointing up and the 2 key if it was pointing down. On some of the trials, the arrows were presented alone, on some trials the arrows were presented with a congruent direction work (i.e., UP or DOWN), and on other trials the arrows were presented with direction incongruent words. There were a total of 180 randomly presented experimental trials.

Results. There was no difference between neutral (M = 771.9, SD = 58.25) and congruent (M = 776.8, SD = 60.73) trials but RTs for incongruent (M = 791.8, SD = 84.07) trials were significantly longer ($F(2, 48) = 3.73$, $p < .04$; $\eta^2 = .14$) indicating Stroop interference.





Experiment 2

Participants. Twelve psychology students participated in the experiment for class credit. All participants had normal or corrected to normal vision and normal hearing.

Procedure. The procedure was the same as in Experiment 1 except for two changes. Instead of viewing a word, participants heard a word through headphones. Also, neutral trials were eliminated resulting in 120 experimental trials.

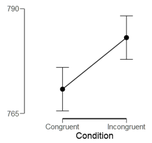
Results. Although congruent trials (M = 758.2, SD = 74.57) were faster than incongruent trials (M = 767.1, SD = 88.91), the difference was not significant ($p > .05$, $d = .25$).

Experiment 3

Participants. Ten psychology students participated in the experiment for class credit. All participants had normal or corrected to normal vision and normal hearing.

Procedure. The experiment was identical to Experiment 2 except the voice was replaced with the sound from a slide whistle either going up in pitch or down in pitch. Participants responded to the direction of an arrow with a key press.

Results. Response times for incongruent trials (M = 783.1, SD = 91.66) were slightly longer than those for congruent trials (M = 770.8, SD = 75.73). Although this difference was not significant, Cohen's d was .53 and the power was low with the current sample size.



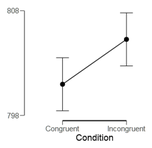
Experiment 4

Experiments 2 and 3 examined the impact of auditory information (i.e., the voice or slide whistle) on the processing of visual information (i.e., the arrows). Experiment 4 was conducted to examine the impact of visual information on processing auditory information.

Participants. Twenty-one psychology students participated in the experiment for class credit. All participants had normal or corrected to normal vision and normal hearing.

Procedure. The experiment was identical to Experiment 3 except participants responded to the direction of the slide whistle instead of the direction of the arrow.

Results. No difference was found between the congruent (M = 801.0, SD = 118.8) and incongruent (M = 805.3, SD = 7114.9) trials.



Discussion

This study was conducted to replicate directional Stroop interference using bimodal stimulus pairs and then to determine whether or not interference occurs when the word is replaced with a sound. Experiment 1 replicates findings (e.g., Brooke, 1998) that a directional word can interfere with a visual directional cue (i.e., an arrow). This finding, however, was not extended to a cross-modal presentation (Experiment 2). These results suggest that a visually presented directional word can interfere with identifying the direction an arrow is pointing but an aurally presented word does not. However, this is consistent with Mahr and Wentura (2018) who found that spoken cues can enhance visual detection within the context of driving (cf., Liao and Wang, 2015).

Experiment 3 was conducted to determine if nonverbal auditory stimuli interfere with a visual directional cue. Although the inferential test was not significant, the results suggest that a slide whistle sound may interfere with responding to the direction of an arrow. Interestingly, there was no indication that an arrow interfered with responding to the direction of a slide whistle. Pending further investigation, these results suggest that visual information may not interfere with auditory processing but auditory information may interfere with visual processing in this paradigm. This finding would be inconsistent with other research indicating that visual distractors create more interference than auditory distractors in a cross-modal Stroop task (Donohue et al., 2013).

References

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