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Introduction

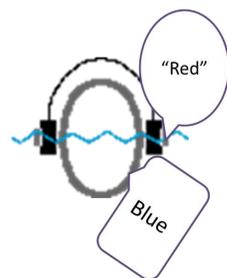


Attention capture occurs when attention is temporarily disengaged from a focal task, often leading to a behavioral change in response times (RTs) and error rates.

Cross-Modal Stroop

See a stimulus:

Hear a stimulus:



Name the color of the visual stimulus (Cowan & Barron, 1987)

In **cross-modal Stroop**, one names the color of a visual stimulus while ignoring auditory color words.

- incongruent trials (the visual color and auditory color word do not match) display slower RTs and higher error rates than control (tone or silence) and congruent trials (the visual color and auditory color word match).

- Thus, due to the fact that the semantics of the auditory words are having an impact on the cross-modal Stroop effect, it is feasible that they are doing so because they are capturing attention.

Research examining attention capture has found that a **being warned** that a distractor is about to appear lessens the effect of that distractor through the **top-down control of attention** (Horvath et al., 2011; Hughes et al., 2013; Parmentier & Hebrero, 2013; Shelton et al., 2009; Sorqvist & Marsh, 2015).

Thus, we **hypothesize** that if attention capture is playing a role in the size of the cross-modal Stroop effect, being warned about what type of trial is about to occur should lead to a decrease in the size of the cross-modal Stroop effect.

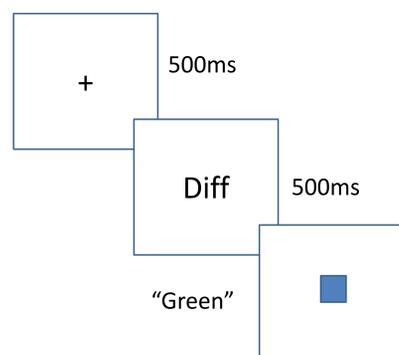
Experiment 1

Participants

72 LSU undergraduate students. All had normal color vision, normal hearing, and their first language was English. One participant was removed due to microphone problems, and another eight for falling more than outside 3 standard deviations from the average for either the number of errors and false starts produced or their RTs.

Final N= 63 (predictive cue N = 34; non-predictive cue N = 29)

Materials, Design, and Procedure



Participants were told to **vocally** name the color of the square as quickly and accurately as possible.

Auditory distraction consisted of incongruent, congruent, and control trials.

Warning cues consisted of the words Same (congruent trials), Diff (incongruent trials), and Tone (control trials)

Whether the warning cues were predictive or unpredictable was tested between-subjects.

Table 1: Experiment 1 warning cue and auditory condition combinations for the non-predictive condition

	Auditory Condition		
	Incongruent Trial	Congruent Trial	Tone Trial
Warning Cue	Same	Same	Same
	Diff	Diff	Diff
	Tone	Tone	Tone

Experiment 1 consisted of a 2 (warning cue: predictive, non-predictive) x 3 (auditory distraction: congruent, incongruent, control) mixed-factor design.

Experiment 2

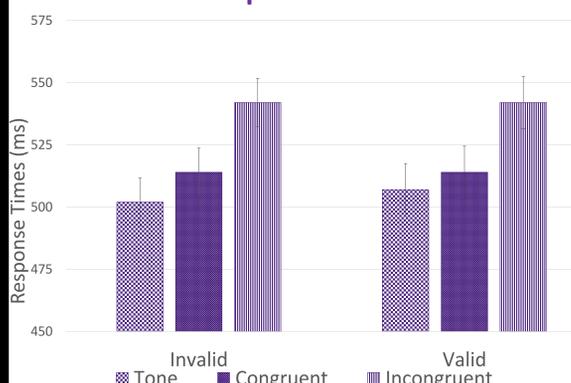
Experiment 2 was a replication of Experiment 1, except we increased the length of the warning cue to 1000ms (or 1 second) to ensure that participants had adequate time to process it (some participants had said 500ms was too short).

Also, the predictive, non-predictive manipulation was dropped.

Results: Experiment 1

Two 2 (warning cue) x 3 (auditory distraction) mixed-model ANOVAs were used to analyze the means of medians of RTs and the count of inaccurate trials separately.

Response Times



- Significant main effect of auditory distraction, $F(2, 122) = 29.25, p < .01, MSE = 23602.13, \eta_p^2 = .32$, with tone < congruent < incongruent.
- No main effect of warning cue, $F(1, 61) = 0.01, MSE = 105.92, p = .94, \eta_p^2 < .01$.
- No significant interaction, $F(2, 122) = .13, MSE = 107.99, p = .88, \eta_p^2 < .01$

Error Rates

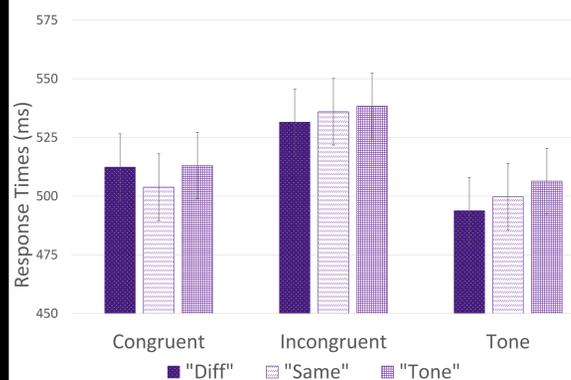
	Predictive Warning Cue	Non-predictive Warning Cue
Tone	0.92 (0.17)	0.56 (0.15)
Congruent	0.60 (0.12)	0.33 (0.11)
Incongruent	1.10 (0.18)	0.99 (0.17)

- Significant main effect of auditory distraction, $F(2, 122) = 10.77, p < .01, MSE = 5.24, \eta_p^2 = .15$, but with congruent < incongruent, and tone not significantly different from either.
- No significant main effect of warning cue, $F(1, 61) = 2.59, p = .11, MSE = 2.98, \eta_p^2 = .04$
- No significant interaction, $F(2, 122) = .51, p = .60, MSE = .25, \eta_p^2 = .01$ (see Table 2).

Non-Predictive Cue Response Time Analyses

We were also interested in the specific pairings of warning cues and trial types. Thus, a 3 (warning cue) x 3 (auditory distractor) repeated-measures ANOVA was used to analyze this relationship.

Given that there were slightly different conditions in this version of the experiment than overall, outliers and participants were re-examined. There were a total of 14 participants who displayed scores more than three standard deviations from the means and were, therefore, removed.



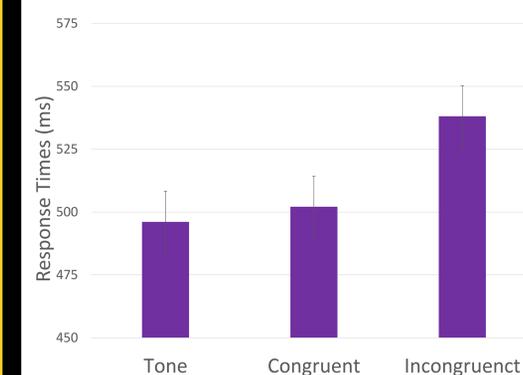
- Significant main effect of auditory distractor, $F(2, 48) = 5.13, p = .01, MSE = 6.84, \eta_p^2 = .18$, with congruent trials < incongruent trials with tone not different from either
- No significant main effect of warning cue, $F(1.62, 38.80) = 2.56, p = .12, MSE = 2.60, \eta_p^2 = .09$.
- No significant interaction, $F(2.94, 70.61) = 2.48, p = .07, MSE = 1.03, \eta_p^2 = .09$ (see Figure 2).

Results: Experiment 2

Participants

22 LSU undergraduate students. All had normal color vision, normal hearing, and their first language was English. One bilingual participant was not included.

Response Times



- Significant main effect of auditory distraction, $F(2, 42) = 14.47, p < .01, MSE = 850.36, \eta_p^2 = .39$, with tone < congruent < incongruent.

Error Rates

Auditory Distraction	Mean (SE)
Tone	1.39 (0.27)
Congruent	1.26 (0.27)
Incongruent	1.86 (0.24)

- No significant main effect of auditory distraction, $F(2, 42) = 1.10, p = .34, MSE = 2.00, \eta_p^2 = .05$.

Discussion

- Overall, it does not appear that being warned about what type of trial is about to appear has any impact on the size of the cross-modal Stroop effect.

- This implies that the role of attention capture in this effect is either not under top-down control, or that the sounds are not harming performance through attention capture mechanisms.

- Future directions include using very specific warning cues.

References

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