The Effect of Response Set Size on the Stroop Interference

Adam Chudeski & Tomasz Smoleń

Jagiellonian University, Kraków

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Problem

One of the most intensively examined effects related to Stroop interference is the response **set size effect** - in some studies, increasing the number of color-response pairs increased the observed interference effect. The response set size effect has been used in the testing of some Stroop models. However, **numerous studies did lead to ambigous findings** regarding whether increasing the number of possible responses in the Stroop task really increases the interference or whether it decreases it or does not have any effect. This mutually contradictory data might have resulted from differences in experimental designs, as both the standard Stroop task and its analogs (e.g., the picture-word) were used in various settings. Moreover, most of the studies confounded response set size with stimulus set size, as most commonly one-to-one SR mappings were applied.

In the present paper we tested the effect of increasing the number of manual reactions required in the Stroop task on the amount of Stroop interference. Moreover, we attempted to investigate the **influence of the ratio of stimuli to responses**, namely what will happen if not only one but two or three stimuli are associated with one response. The main goal of the study was theoretical: as we believe that the effects of set size on Stroop performance are important indicators of processes responsible for coping with the interference, we wanted to test some existing models of Stroop against data from our experiment on set size effects.

Predictions of Stroop models

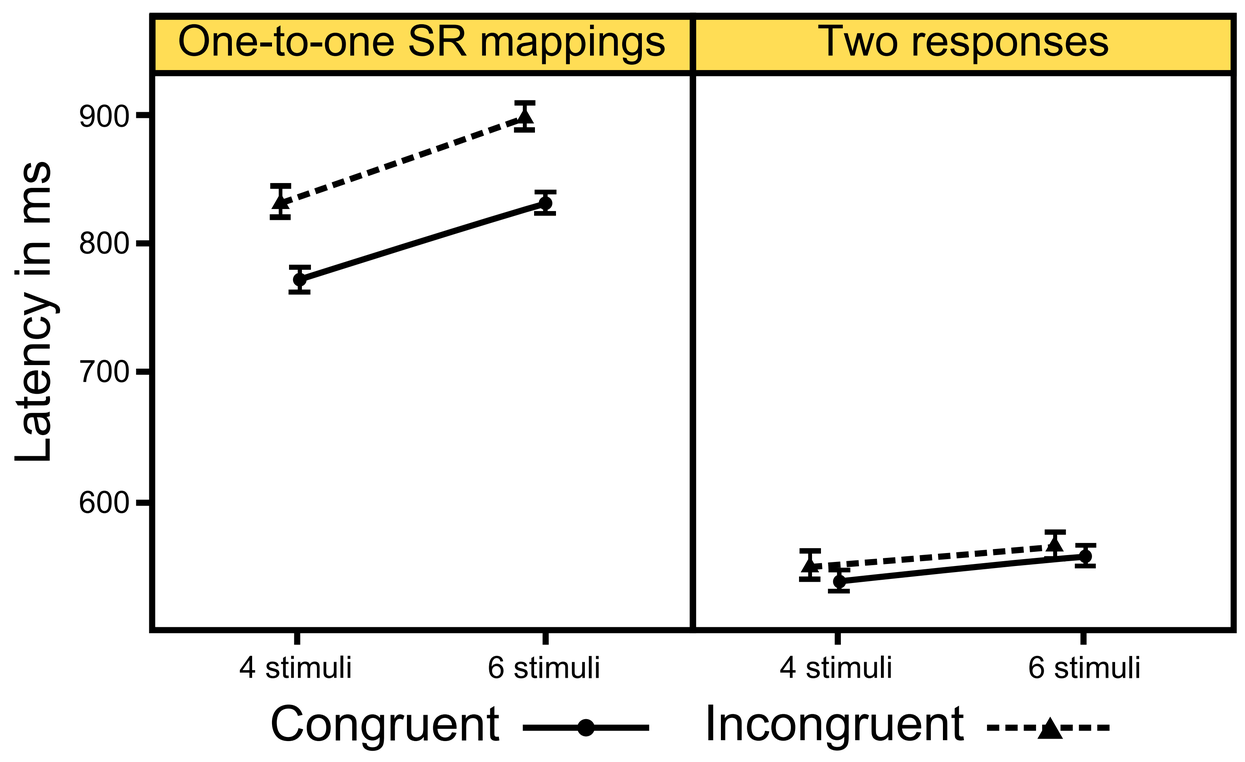
We analyzed predictions of three Stroop models: (a) **Cohen et al.'s (1990) connectionist model**, which explain the Stroop interference in terms of differences in strength between color and word naming as well as of the attentional modulation of color/word processing, (b) **Roelofs' (2003) theory**, which identify the interference as resulting from access to declarative memory, and (c) our own new model (**Smoleń & Chuderski, 2010**), which localizes the causes of the interference in the resolution of response conflicts.

Experiment

The **figure-word analog of the Stroop task** was used. The participants were randomly assigned to one out of four task conditions. Each condition involved either four or six stimuli and either two responses or the same number of responses as stimuli. This resulted in four conditions: four stimuli – two responses, four stimuli – four responses, six stimuli – two responses, and six stimuli – six responses. **Six geometric figures were used.** A word naming a figure was placed in the center of each figure. Congruent stimuli had the same meaning of the word as the shape of the figure. Incongruent figures were different than words. In each condition, the task started with a training sequence. Next a test sequence was presented in random order, which included **72 congruent and 48 incongruent trials**. The six-stimuli sequences were longer in order to give an equal number of presentations of each stimulus.

Results

The mean latencies for all conditions are presented in Figure. **All main effects were highly significant** ($p < .001$). Participants responded more slowly in (a) incongruent trials than in congruent ones, (b) when six stimuli were involved in comparison to the case of four stimuli, and (c) in one-to-one SR mapping conditions in comparison to two-response conditions. A two-way interaction between the number of stimuli and the number of responses was also significant.



Summary

The fact that an increase in the number of stimulus- response mappings in the manual version of the Stroop has virtually no effect on the amount of the Stroop interference is **in concord with the predictions of two models**, which explain Stroop phenomenon as the resolution of conflict either between processing paths (Cohen et al., 1990) or between response tendencies (Smoleń & Chuderski, 2010).

While, the lack of set size effect was an accidental rather than an intended property of Cohen et al.'s model, our model's **prediction on the lack of set size effects is a direct consequence of model's theoretical assumptions**. The response conflict resolution, which is the main cause of the emergence of interference effects in the model, always relates to only those responses, which are primed by actual stimuli presented to the model. All other potential stimuli-response mappings, which are not related to the actual stimuli, have no effect on the value of the conflict being resolved. This assumption naturally also explains the lack of the interference effect observed in the many-to-one Stroop task version, in which non-matching aspects of a stimulus prime the same response. Our model predicts that in such a situation simply no conflict is present (i.e., there are no competing responses), so there is no need for conflict resolution and thus no interference is involved.

References

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Adam Chuderski - adam.chuderski@gmail.com, Tomasz Smoleń - tomasz.smolen@mailplus.pl, Executive Control and Fluid Intelligence Research Group - http://ecfi-group.eu