



Properties of Context-driven Control Revealed through the Analysis of Conflict Adaptation Effects

Thomas G. Hutcheon^{1,2} & Daniel H. Spieler²

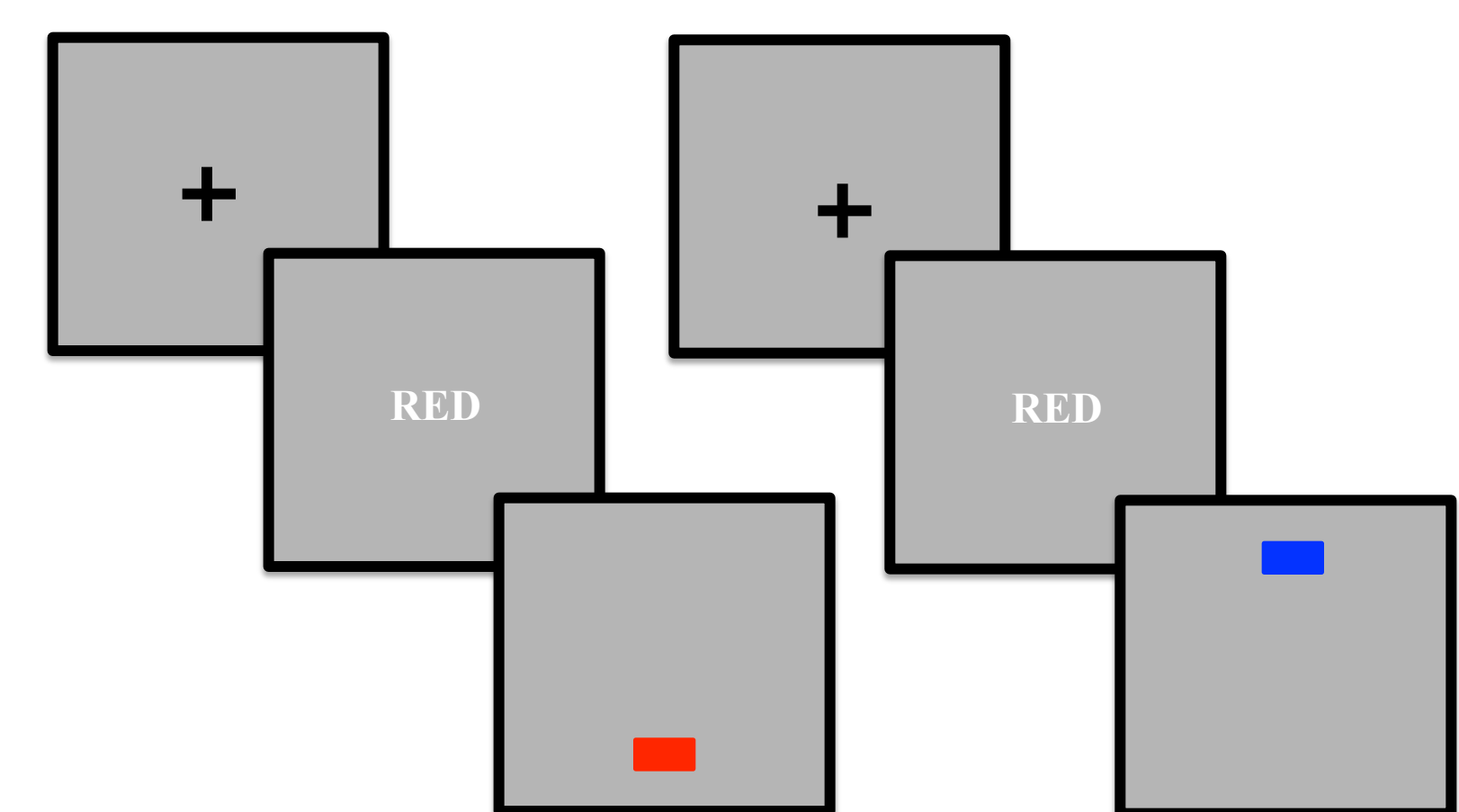
¹Bard College, Psychology Program

²Georgia Institute of Technology, School of Psychology



Context-driven control

The context specific proportion congruency (CSPC) effect refers to the finding that the size of the congruency effect is reduced at locations containing a high proportion of incongruent trials compared to locations containing a high proportion of congruent trials (Crump, Gong, & Milliken, 2006).



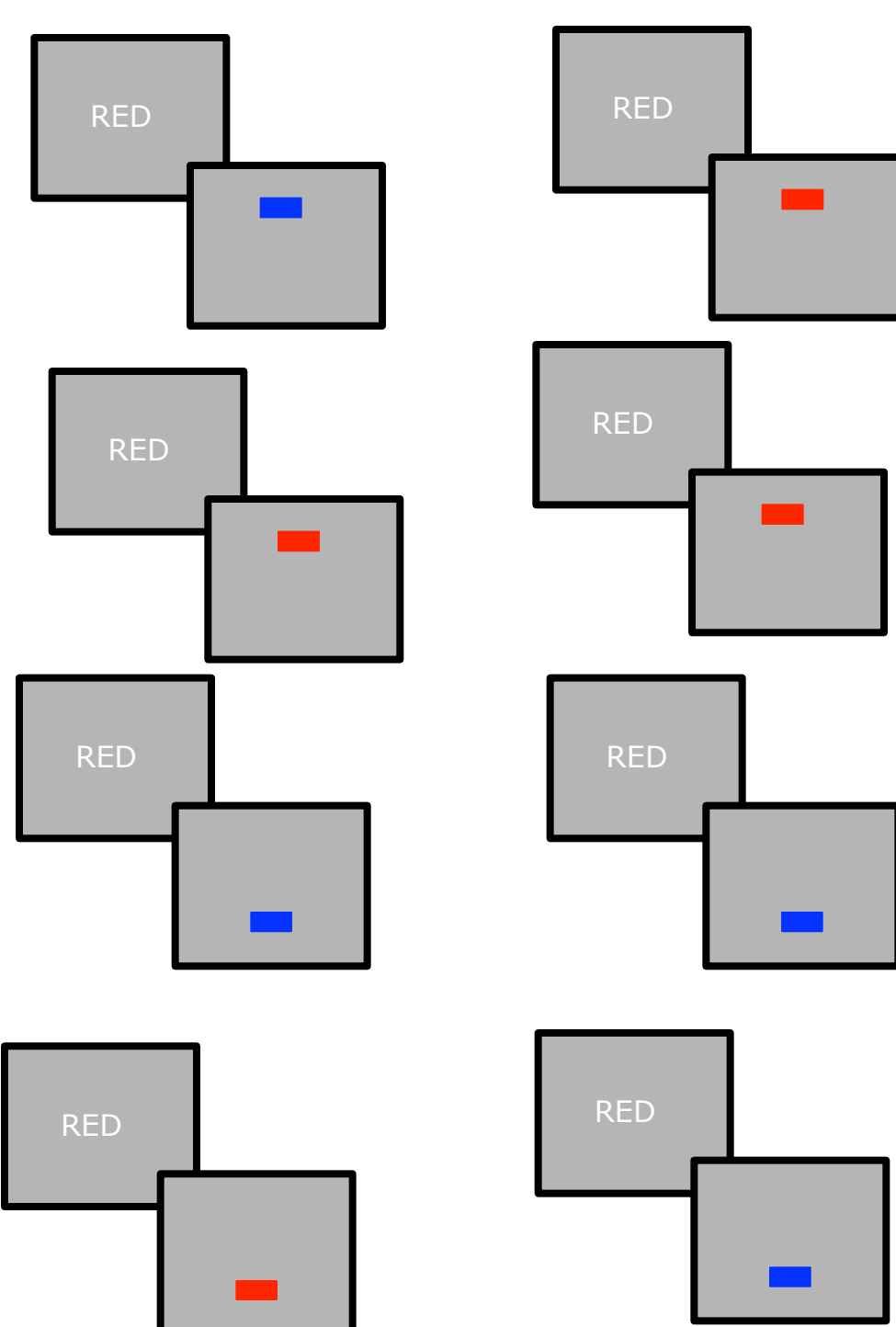
Mostly Incongruent Location
 $P(\text{incongruent}|\text{Location}) = 0.75$
 $P(\text{incongruent}|\text{Word}) = 0.5$
 $P(\text{incongruent}|\text{Color}) = 0.5$

Mostly Congruent Location
 $P(\text{incongruent}|\text{Location}) = 0.25$
 $P(\text{incongruent}|\text{Word}) = 0.5$
 $P(\text{incongruent}|\text{Color}) = 0.5$

Variations in the efficiency of control across locations are present despite task instructions to ignore the word and name the color. This result is taken as evidence for context-driven control.

Accounts for context-driven control extend conflict monitoring theory which states that the occurrence of conflict in processing serves tighten control processes in order to avoid conflict in the future (Botvinick et al., 2001). Control is tight at the mostly incongruent location due to the frequent occurrence of conflict and control is weak at the mostly congruent location due to the infrequent occurrence of conflict (Bugg & Crump, 2012; Verguts & Notebaert, 2008).

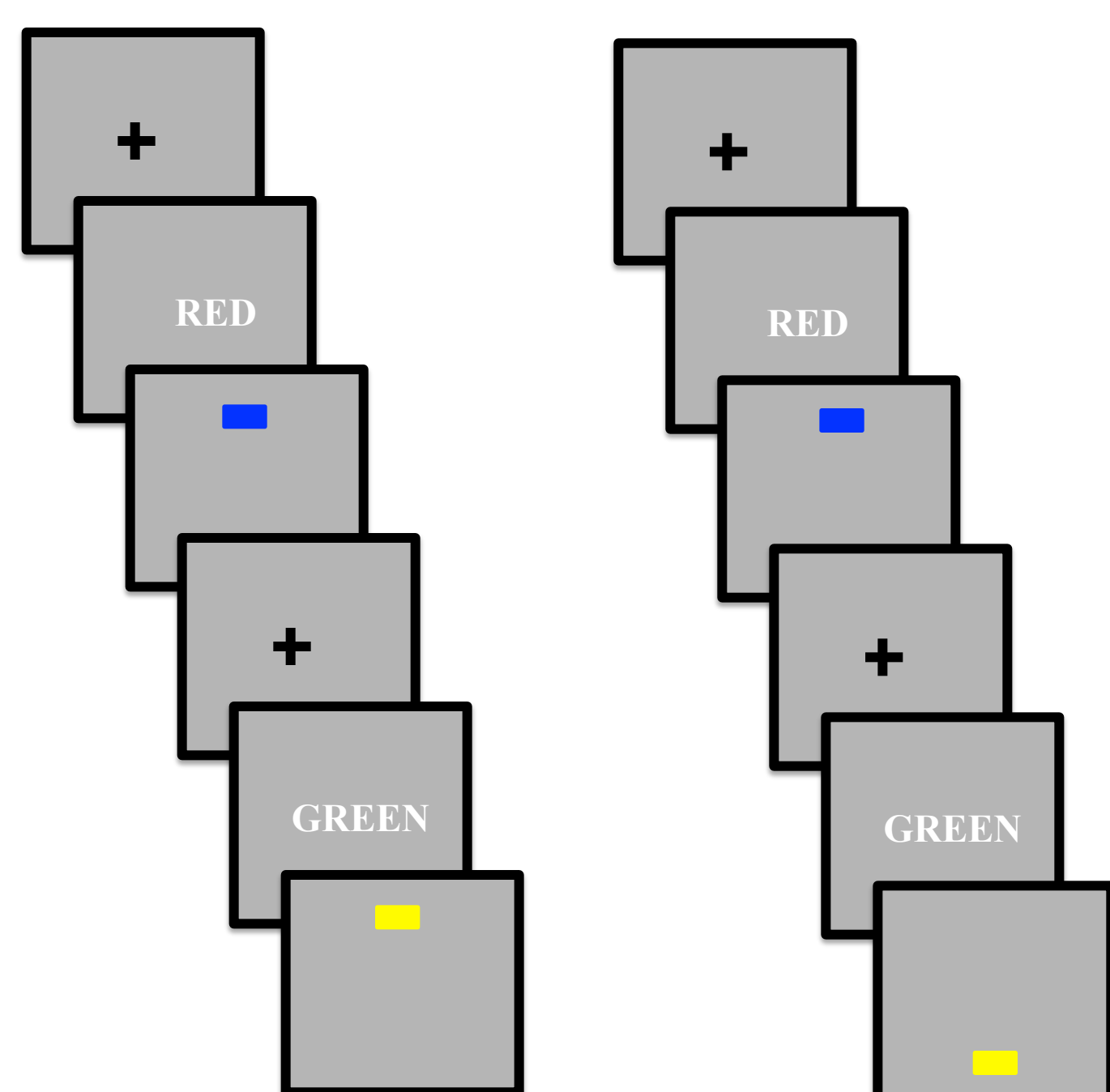
However, the CSPC effect may also be accounted for in terms of associative or contingency learning (Hutcheon & Spieler, in prep; Schmidt, 2013).



Maintenance of context-driven control

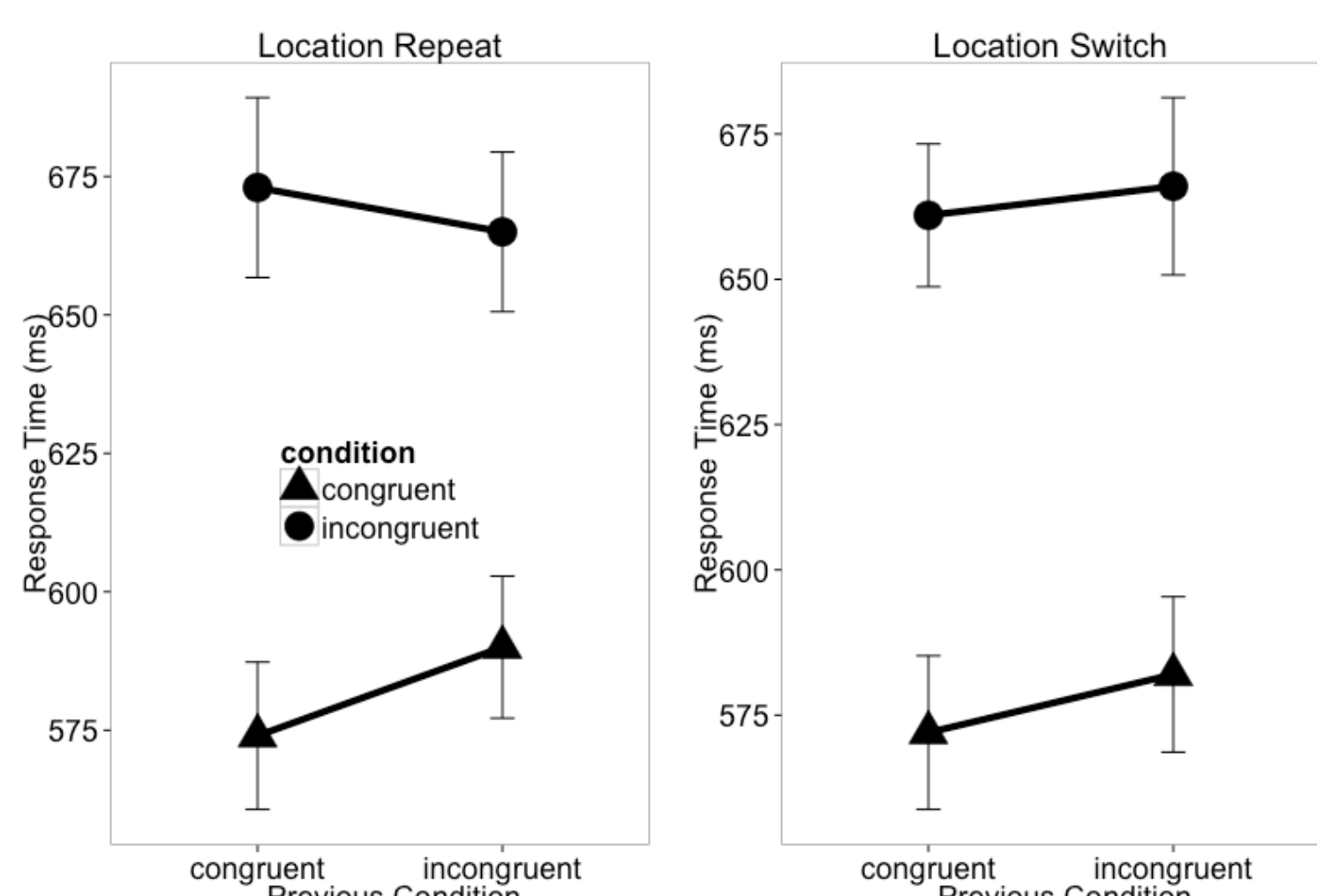
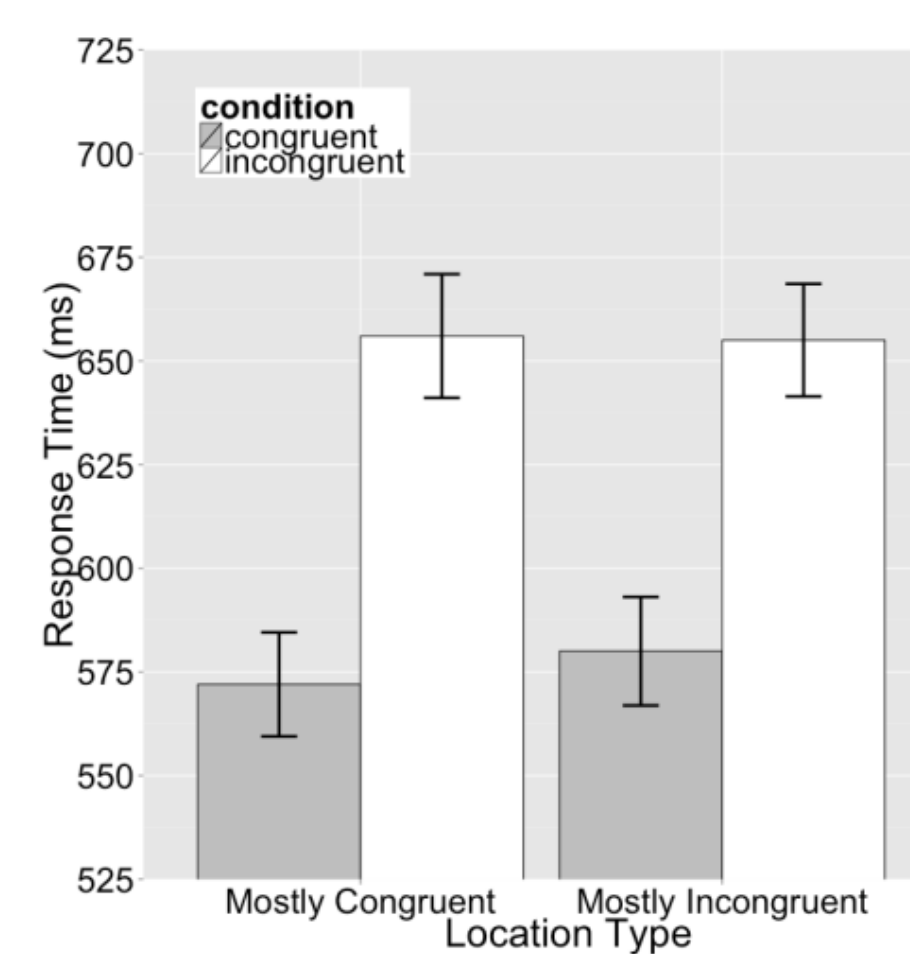
If separate control settings are maintained at each location and are updated by the occurrence of conflict, then conflict on trial N should influence performance on trial N+1 when the location repeats but not when the location switches.

In addition, this should be found in the absence of specific stimulus overlap from trial N to trial N+1.



Location Repeat Location Switch

Experiment 1
32 Participants



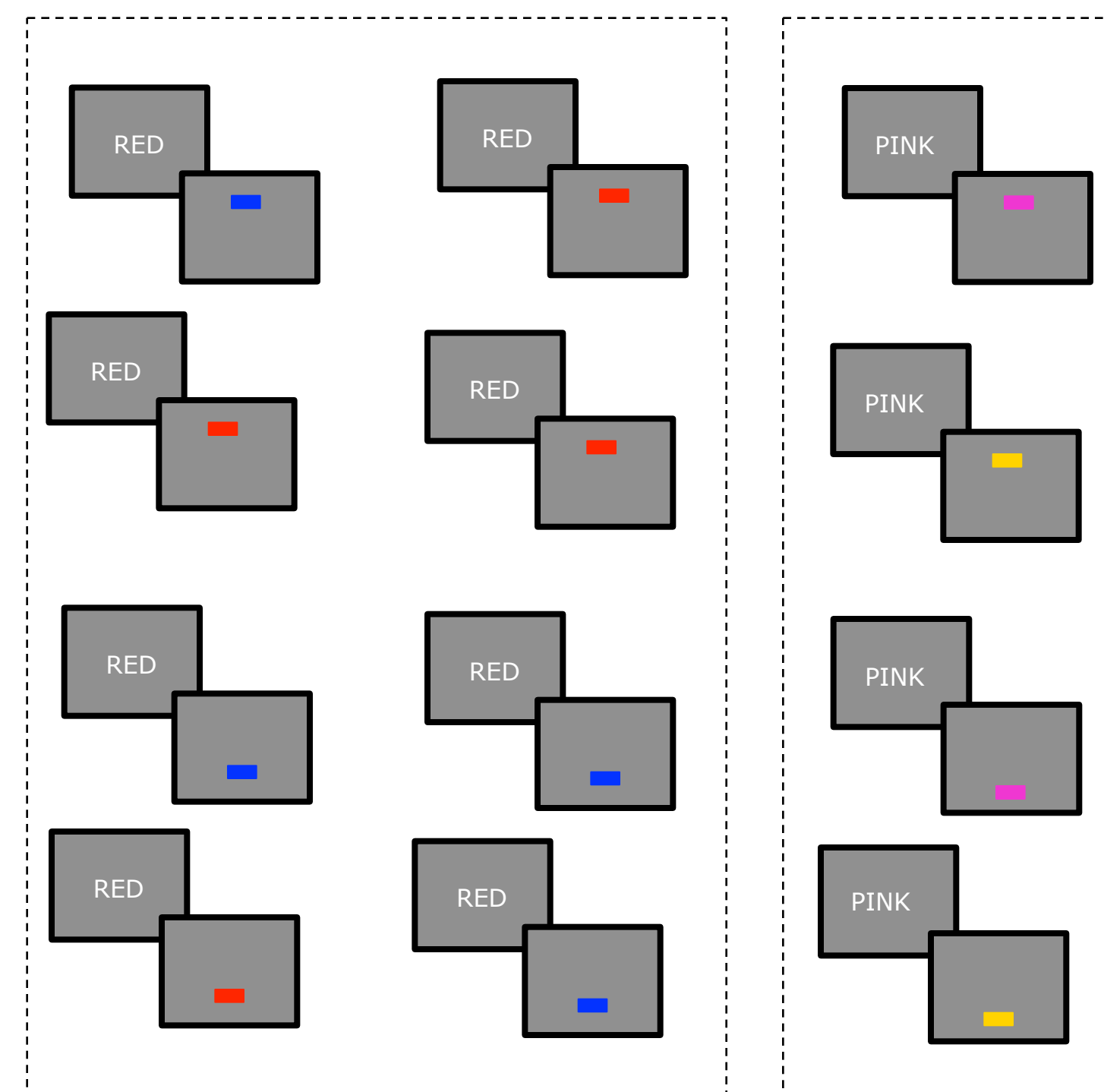
In the presence of a CSPC effect, conflict adaptation is observed when the location repeats but not when the location switches from trial N to trial N+1.

These effects are present despite no overlap on the word or color dimension from trial N to trial N+1 and thus cannot be accounted for in terms of associative or contingency learning.

Instead, these results are consistent with the maintenance of control settings tied to each location.

Does this generalize to unbiased stimuli?

Existing evidence suggest that context-driven control generalizes to frequency unbiased stimuli (Crump & Milliken, 2009).

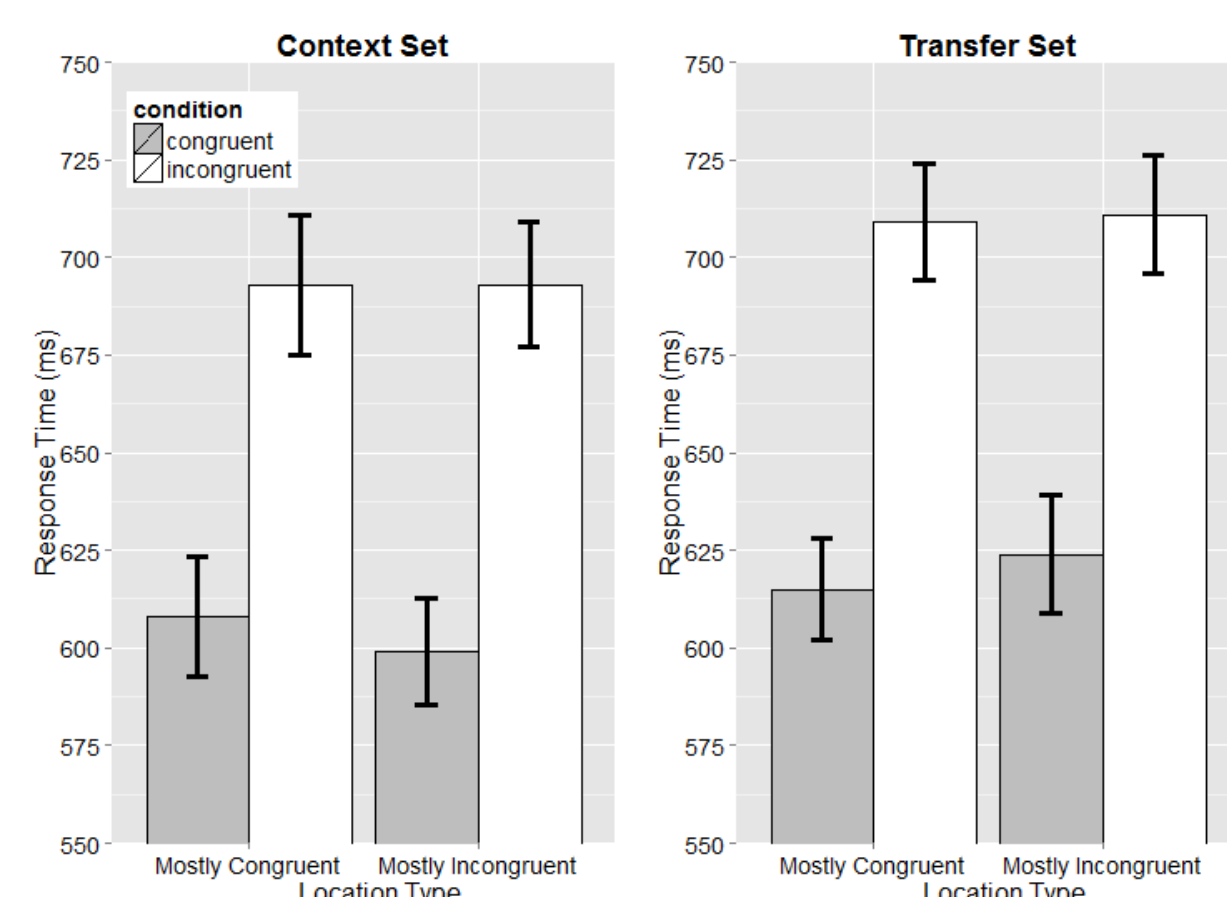


Context Set Transfer Set

Are conflict adaptation effects present within but not across locations in a context level transfer manipulation?

Experiment 2
32 Participants

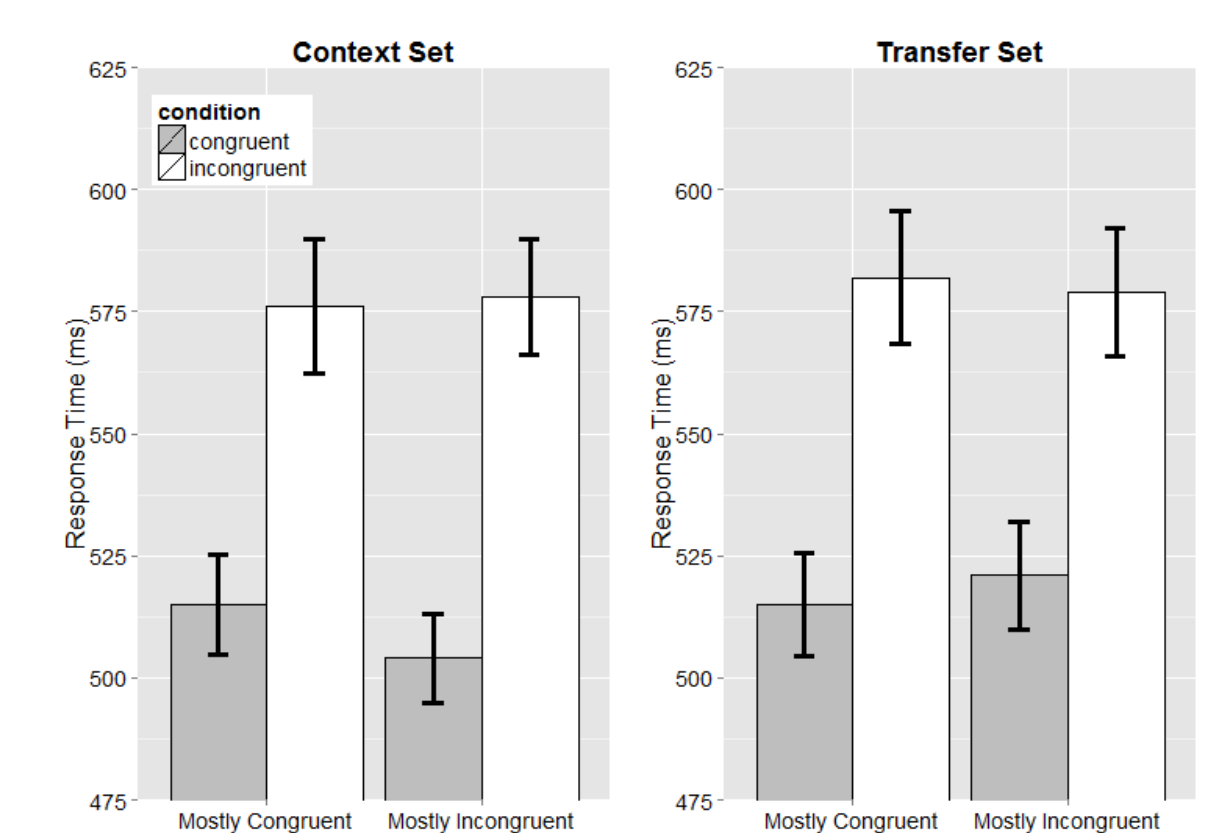
Location Type	Set	Word	blue	green	orange	purple	brown	pink	red	yellow
Mostly Congruent	Context	BLUE	15	1	1	1	1	1	1	1
		GREEN	1	15	1	1	1	1	1	1
		ORANGE	1	1	15	1	1	1	1	1
		PURPLE	1	1	1	15	1	1	1	1
		BROWN	1	1	1	1	15	1	1	1
Mostly Incongruent	Context	BLUE	3	5	5	5	5	5	5	5
		GREEN	5	3	5	5	5	5	5	5
		ORANGE	5	5	3	5	5	5	5	5
		PURPLE	5	5	5	3	5	5	5	5
		BROWN	5	5	5	5	3	5	5	5
Transfer	Context	BLUE	3	5	5	5	5	5	5	5
		GREEN	5	3	5	5	5	5	5	5
		ORANGE	5	5	3	5	5	5	5	5
		PURPLE	5	5	5	3	5	5	5	5
		BROWN	5	5	5	5	3	5	5	5



No evidence for CSPC Transfer effect in large stimulus set.

Experiment 3
32 Participants

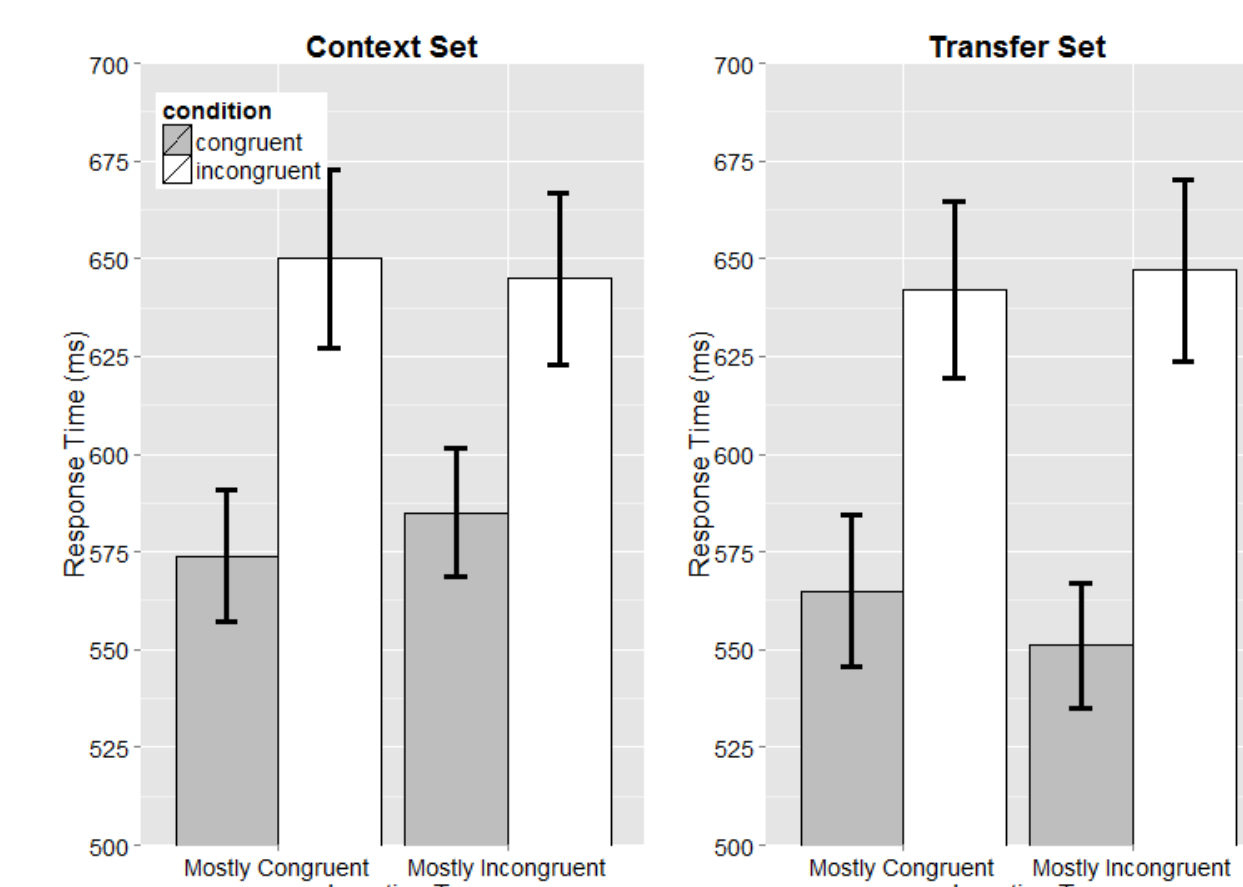
Location Type	Set	Word	blue	green	red	yellow
Mostly Congruent	Context	BLUE	11	1	1	1
		GREEN	1	11	1	1
		RED	1	1	11	1
		YELLOW	1	1	1	11
Mostly Incongruent	Context	BLUE	1	11	1	1
		GREEN	11	1	1	1
		RED	1	1	11	1
		YELLOW	1	1	1	11



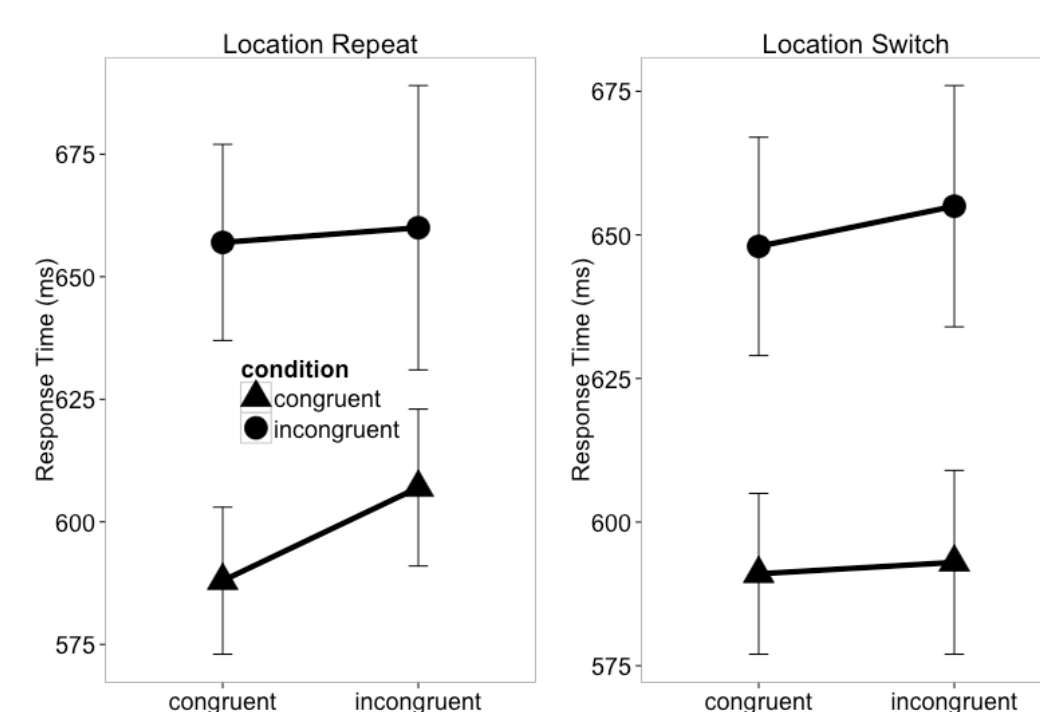
No evidence of CSPC Transfer effect in direct replication of Crump et al. (2009)

Introduction of unbiased stimuli

Use of context set only during training blocks leads to a CSPC effect. However, this effect goes away when a transfer set is including during test blocks.



No evidence for CSPC Transfer effect despite the presence of CSPC effect in training

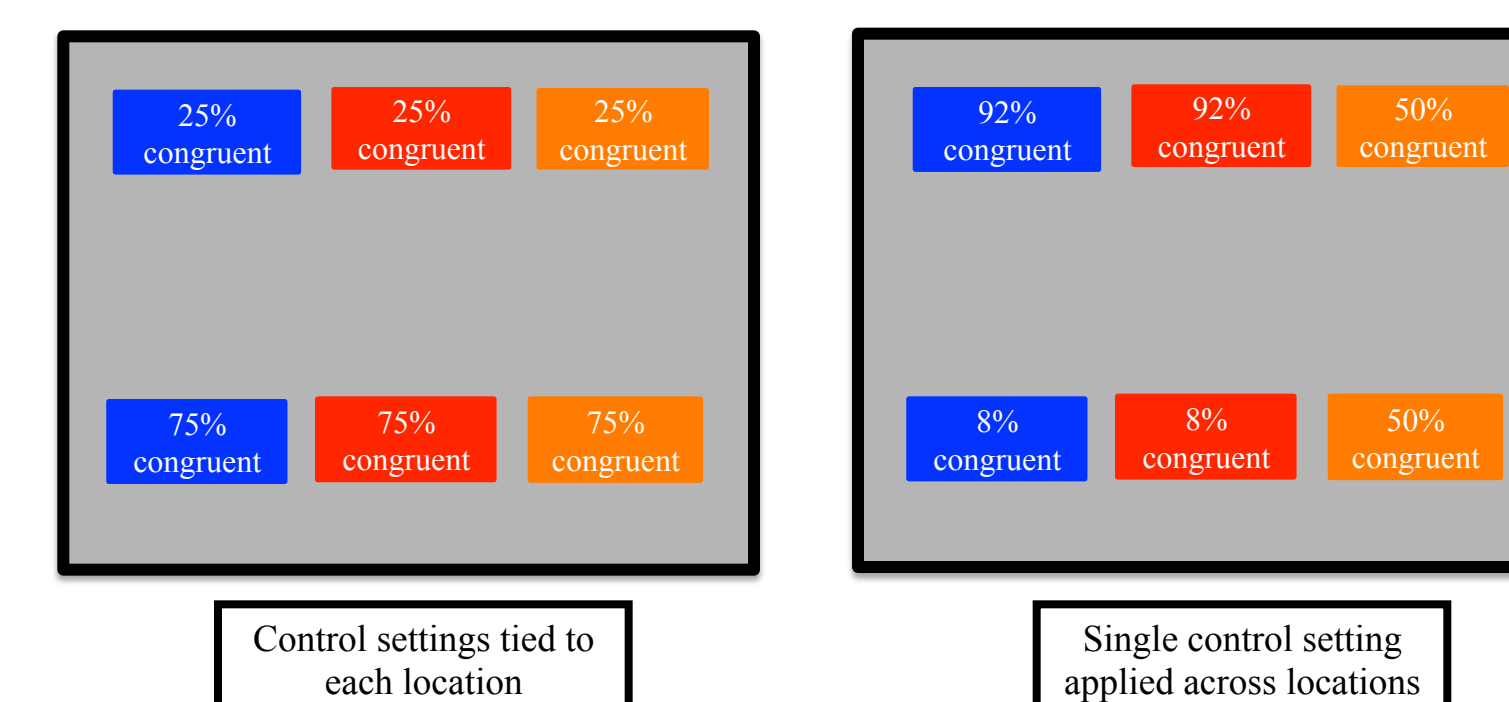


During training blocks, conflict adaptation is observed when the location repeats but not when the location switches from trial N to trial N+1.

Conclusions

The current results support the existence of context-driven control. In two context level manipulations, conflict adaptation is observed within but not across locations.

However, our results reveal a requirement for the implementation of context-driven control. Specifically, there must be consistency in the probability of conflict across colors at each location.



These results stress the importance of stimulus learning in context-driven control and provide insight into the organization of cognitive control.

References

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For more information please, contact Tom Hutcheon (thutcheo@bard.edu)