Dissociating Proactive and Reactive Control: A Replication and Extension using Color-Word Stroop

Erin M. Gourley, Todd S. Braver, & Julie M. Bugg

Department of Psychological and Brain Sciences, Washington University, St. Louis, MO 63130

INTRODUCTION

▪The dual mechanisms of cognitive control account proposes that conflict, like that observed in the Stroop task, is resolved in a preparatory (proactive) or just-in-time (reactive) manner (Braver, 2012). (Bugg, 2012)

List-Wide Proportion Congruency (LWPC)

Stroop interference is reduced when most trials in a list are INCONGRUENT

<-75% of the list consists of incongruent trials:

List-Wide Mostly Incongruent (LWMI)

as opposed to

List-Wide Mostly Congruent (LWMC)

75% of the list consists of congruent trials->

- Global, proactive strategy for the entire list?
- Participants prepare for conflict, reducing interference overall

Item-Specific Proportion Congruency (ISPC)

Stroop interference is reduced for a particular item when that item is mostly INCONGRUENT

The color red is usually (always) congruent->

Mostly Congruent (MC) *item*->

<-The color blue is usually incongruent

<-Mostly Incongruent (MI) *item*

- Reactive response to select items?
- Cognitive control is implemented when an item associated with conflict shows up

Distinct Behavioral Signatures

- Cost of proactive control-> inhibited word reading means CONGRUENT trials are slower in proactive (LWMI) than in baseline (LWMC) or reactive (ISPC)= **CONGRUENCY COST**
- Cost of reactive control-> Reactive benefit does not transfer to all items, so Stroop effect is greater for unbiased items than for MI items= **TRANSFER COST**

THE PREVIOUS STUDY

Gonthier, Braver, and Bugg (2016) found evidence suggesting that
-PC effects can be observed in picture-word Stroop using a within-subjects design
-LW and IS PC prompt proactive and reactive functions
-Proactive and reactive control are dissociable

CURRENT GOALS

Can the same effects be observed in the color-word Stroop task?

Can further biasing *away from* preparation (proactive strategy) in the ISPC condition more solidify our observations of reactive mechanisms?

METHODS

LW-Mostly Congruent

192 MC-Biased (75% Con)

96 Unbiased (50% Con)

LW-Mostly Incongruent

192 MI-Biased (25% Con)

96 Unbiased (50% Con)

Item-Specific

192 MC-Biased (100% Con)

192 MI-Biased (25% Con)

96 Unbiased (50% Con)

Each participant completed all 3 conditions (counterbalanced order)

N= 94 participants

Unbiased trials are fully matched across conditions, provide a **pure** comparison of condition-related context effects

MC changed from 75% congruent to 100% congruent in this replication

RESULTS

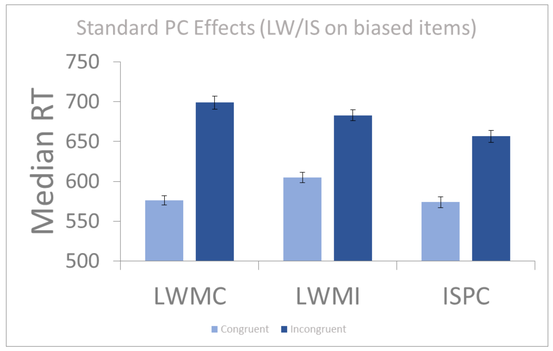
Differences between MC/MI and MC/IS, displaying standard PC Effects

$p < .001$

MC block Stroop Effect 123ms

MI block Stroop Effect: 78ms

IS block Stroop Effect: 82ms



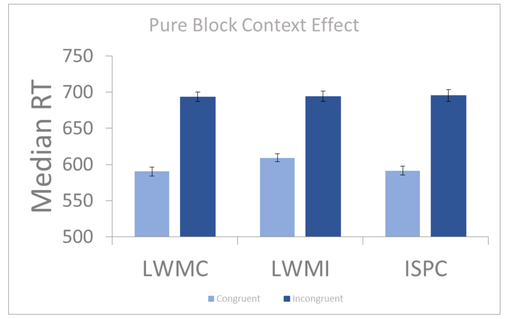
Differences between MC/MI and MI/IS, displaying pure effects seen in unbiased items

$p < .001$

MC block Stroop Effect 103ms

MI block Stroop Effect: 85ms

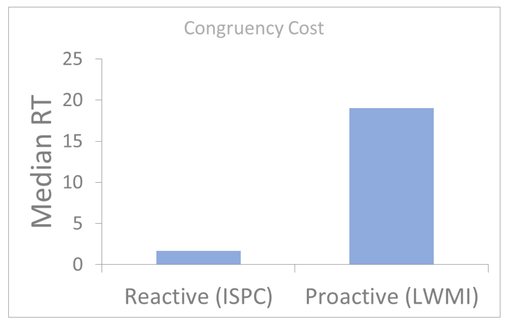
IS block Stroop Effect: 104ms



The Congruency Cost is unique to proactive (LWMI) control

$p < .001$

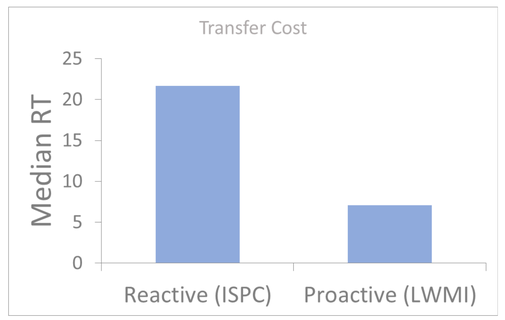
In proactive, participants inhibit word reading on congruent trials as well as incongruent, so there is a cost; something we don't see in reactive



The Transfer Cost is unique to reactive (ISPC) control

$p < .01$

In reactive, participants do not implement a global, preparatory strategy, so reactive benefits do not extend to unbiased items (only MI items); transfer cost is avoided when being proactive



CONCLUSIONS

1. Within subjects observations of proportion congruency effects can be demonstrated via color-word Stroop.
2. LWMI and ISPC lists are associated with unique costs and benefits, suggesting that these manipulations induce proactive and reactive control respectively.
3. Unexplained effect : Strop patterns did not indicate a direct interference benefit in proactive (LWMI) on unbiased incongruent trials.