



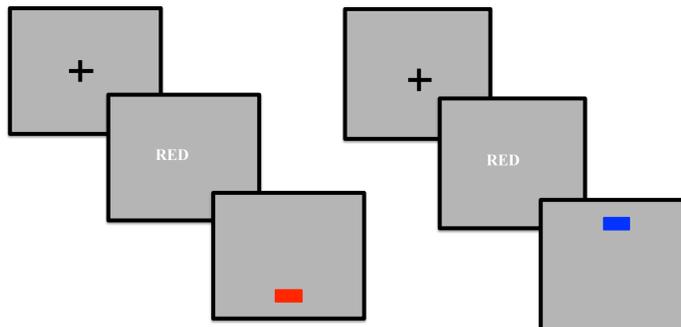
Moving Beyond the Mean in Studies of Stimulus-driven Control

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A Place to Think

Stimulus-driven control

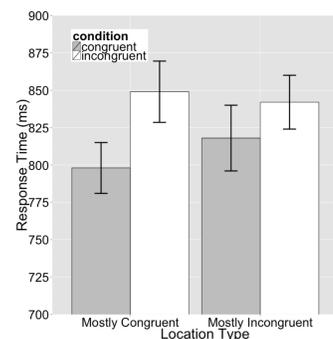
The context specific proportion congruency (CSPC) effects refers to the finding that the size of the congruency effect is reduced at locations containing a high proportion of incongruent trials compared to a high proportion of congruent trials (Crump, Gong, & Milliken, 2006).



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

Thus, the impact of the irrelevant word dimension varies as a function of stimulus experience. This variation in the efficiency of cognitive control within a single task has been taken as evidence of “**stimulus-driven**” control.



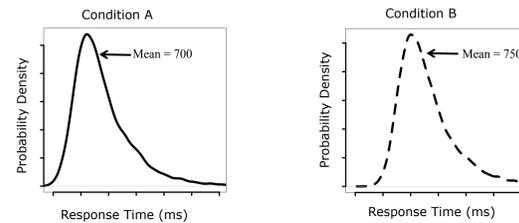
Stimulus-driven control is commonly thought to be a flexible form of control that is implemented **within** an experimental trial (Blais, Robidoux, Risko, & Besner, 2008; Bugg, 2012; Verguts & Notebaert, 2009).

To date, the study of stimulus driven control has focused on comparing mean response times (RTs) which does not capture the impact of control processes within a single trial.

In the current study, we use delta plots to visualize how the impact of the irrelevant word dimension unfolds over the course of a trial (Balota & Yap, 2011; Pratte, Rouder, Morey, & Feng, 2010).

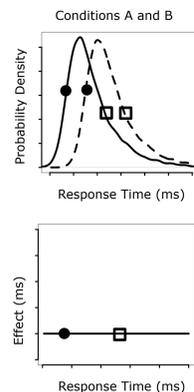
Delta Plots Reveal the time-course of Control

The time-course of an effect is determined by underlying response time (RT) distributions (De Jong, Liang, & Lauber, 1994).



Constructing Delta Plots

RTs for conditions of interest rank ordered and separated into deciles. Mean RT calculated for each decile.

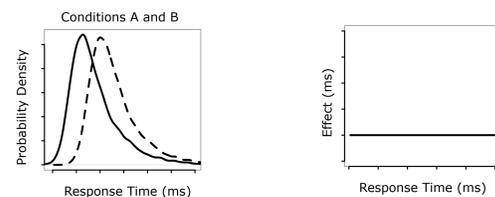


Difference in RT between condition A and B calculated at each decile.

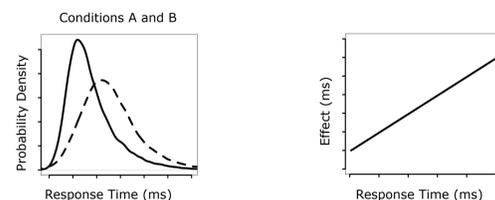
Difference at each decile plotted as a function of the mean RT at that decile.

The difference in RT at each decile represents the average effect for the time spanned by that decile.

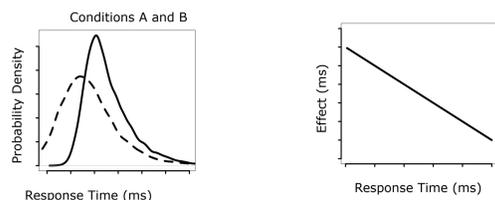
Hypothetical Delta Plots



The size of the effect constant as RT increases



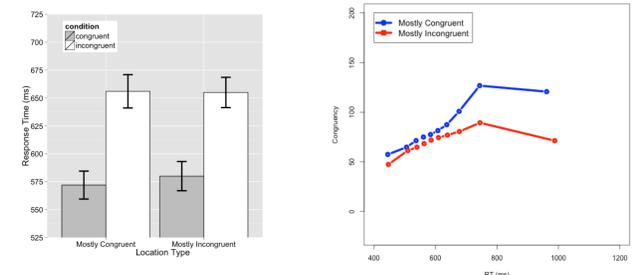
The size of the effect increases as RT increases



The size of the effect decreases as RT increases

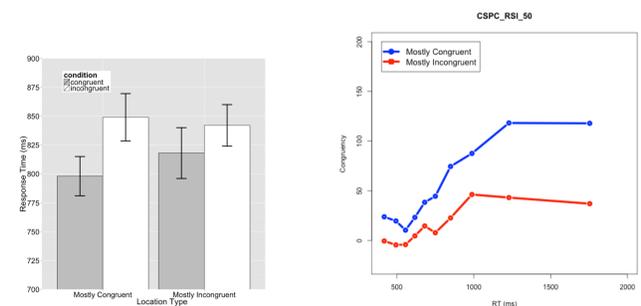
Delta Plots of CSPC Effect

We assessed the time-course of stimulus-driven control by examining delta plots for mostly congruent and mostly incongruent locations across two studies in which a CSPC effect was observed.



The influence of the irrelevant word dimension increases over the course of a single trial.

The diverging delta plots for the mostly congruent and mostly incongruent location indicate that control is implemented within a single trial.



Conclusions

Consistent with existing models of stimulus-driven control we find evidence that control is implemented within a trial across two datasets.

We argue that delta plots provide a unique window into the time-course of stimulus-driven control.

Future work will apply delta plots to manipulations that have demonstrated a CSPC effect using other contextual features (e.g. different fonts, different words, and different shapes). A better understanding of how these effects unfold over time will lead to a better understanding of the mechanisms underlying cognitive control.

References

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