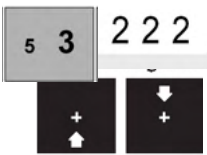


## INTRODUCTION

- Stroop task measures interference between cognitive processes
- Different variants:

Type  
– Color-word  
– Emotional  
– Stroop-like



### Design:

- Blocked design: different blocks for incongruent, congruent and/or neutral conditions
- Mixed design: mixing the different conditions

### Additional cognitive demand:

- Stimulus matching or combination with secondary task

Do these variations affect recruitment of brain regions?

→ Neuroimaging meta-analysis to summarize neuroimaging results and to test for commonalities and differences between Stroop variants

## METHODS

- Activation likelihood estimation (ALE) meta-analysis [1] across fMRI or PET experiments using a Stroop task.
- Inclusion criteria: healthy adults, whole brain-analyses, coordinates in a standard anatomical reference space, tasks inducing Stroop response conflict
- In total 125 individual neuroimaging experiments were included.
- Separate meta-analyses:

### Color-word only:

- Blocking conditions
- Mixing conditions
- Additional cognitive demand

### Task type:

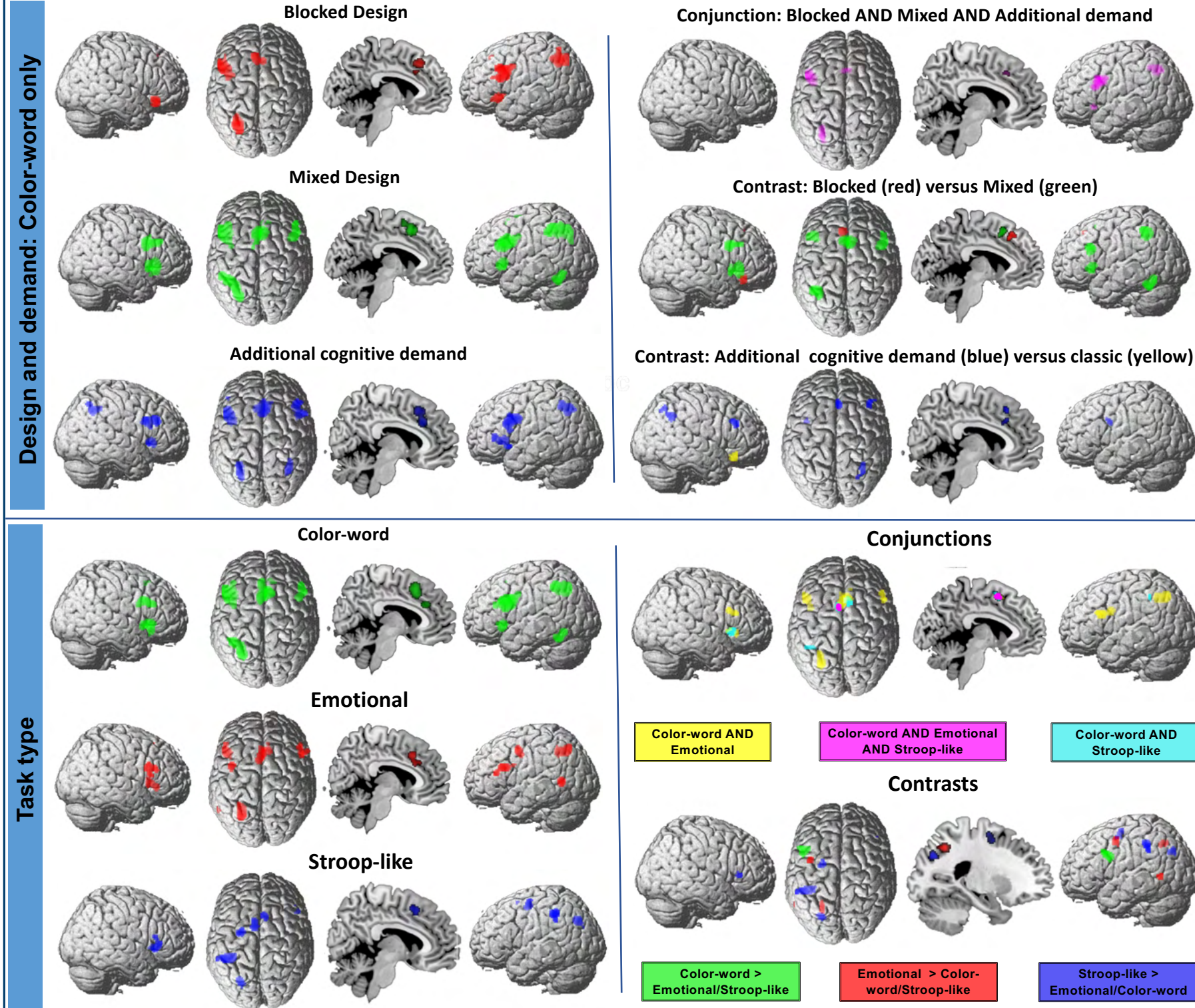
- Color-word
- Emotional face-word
- Stroop-like (numerical, counting, spatial, face-word)

Activation Likelihood Estimation Meta-Analysis

Experiment	Subjects	N	X	Y	Z
Experiment 1	28	40	37	33	
Experiment 1	28	39	22	-9	
Experiment 1	28	38	25	-4	
Experiment 1	28	18	27	16	
Experiment 1	28	14	27	24	
Experiment 1	28	17	3	31	
Experiment 2	28	41	-29	-10	
Experiment 2	28	-29	-19	5	
Experiment 2	28	54	-45	52	
Experiment 2	28	-40	77	-18	
Experiment 2	28	39	-78	-3	
Experiment 3	28	33	-40	-15	
Experiment 3	28	45	-49	3	
Experiment 3	28	30	-40	42	
Experiment 3	28	27	-54	60	
Experiment 3	28	24	0	60	
Experiment 3	28	31	-30	51	

cluster-level family-wise error corrected threshold of  $p < 0.05$

## RESULTS



## DISCUSSION

- Consistent recruitment of regions of the Multiple demand (MD) [2] system across color-word stroop experiments
- Additional cognitive demand leads to stronger convergence in the MD network
- Left-sided dominance: right-sided regions might only be involved when demand is high [3], which is especially the case when conditions are presented in a mixed design
- Differentiation within dorsomedial frontal cortex in blocked versus mixed designs might reflect differences in proactive and reactive control mechanisms [4]
- Most striking differences were found for task type, with especially Stroop-like tasks revealing convergence in different regions than emotional and color-word stroop
- Conjoint involvement of only the pre-supplementary motor area (preSMA) across task variations, while parietal and frontal regions are more material specific

Results therefore point to the preSMA as a core region of interference processing and additionally highlight that, even though the MD network plays a major role in Stroop interference, some regions are modulated by task design, cognitive demands and especially by task type.

### References

- [1] Eickhoff, S. B., Bzdok, D., Laird, A. R., Kurth, F., & Fox, P. T. Activation likelihood estimation meta-analysis revisited. *NeuroImage*. 2012; 59 (3): 2349-61.
- [2] Duncan, J. The multiple-demand (MD) system of the primate brain: mental programs for intelligent behavior. *TICS*. 2010; 14 (4): 172-179.
- [3] Shashidara, S., Mitchell, D.J., Erez, Y. & Duncan, J. Progressive recruitment of the frontoparietal multi-demand system with increased task complexity, time pressure and reward. *J Cogn Neurosci*. 2019; 31 (11): 1617-1630.
- [4] Burgess, G. C. & Braver, T. S. Neural mechanisms of interference control in working memory: Effects of interference expectancy and fluid intelligence. *PLOS one*. 5 (9): e12861.