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Synesthesia induced colors do not bias attention in the same manner as physical colors do

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Background

It has been demonstrated that content of visual short-term memory can guide attentional resources (Carlisle & Woodman, 2011). We want to employ a similar paradigm to investigate whether synesthesia concurrent colors are represented in visual memory as physical colors. If they are, they should bias attention towards same-colored objects in a visual search task.

Experimental variation

Main task: reaction time on an odd-one-out visual search identification task of four colored Landolt squares (↑ or ↓) while an object is retained in visual short-term memory.

- Experiment 1: Color memory item (replication task)
- Experiment 2: Achromatic grapheme memory items
- Experiment 3: Colored grapheme memory items
- Experiment 4: Induced color predicts target (75% valid)

Participants

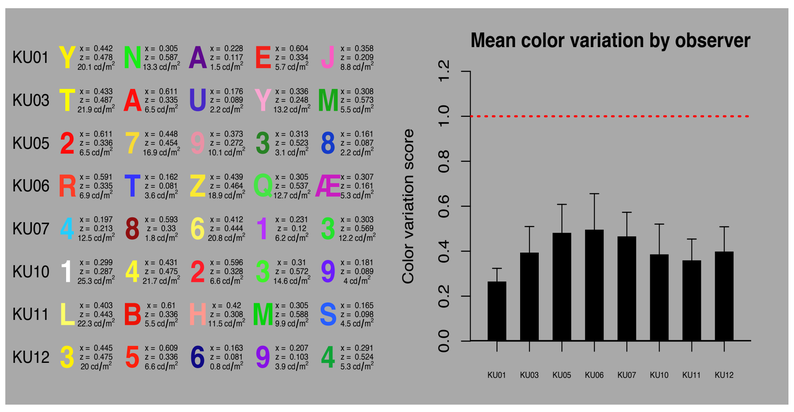

Figure 1. Stimulus and participant color-grapheme consistency.

8 (7 female) observers with grapheme-color synesthetes participated in the study. Mean age was 33.9 years (sd =7.5).

Design

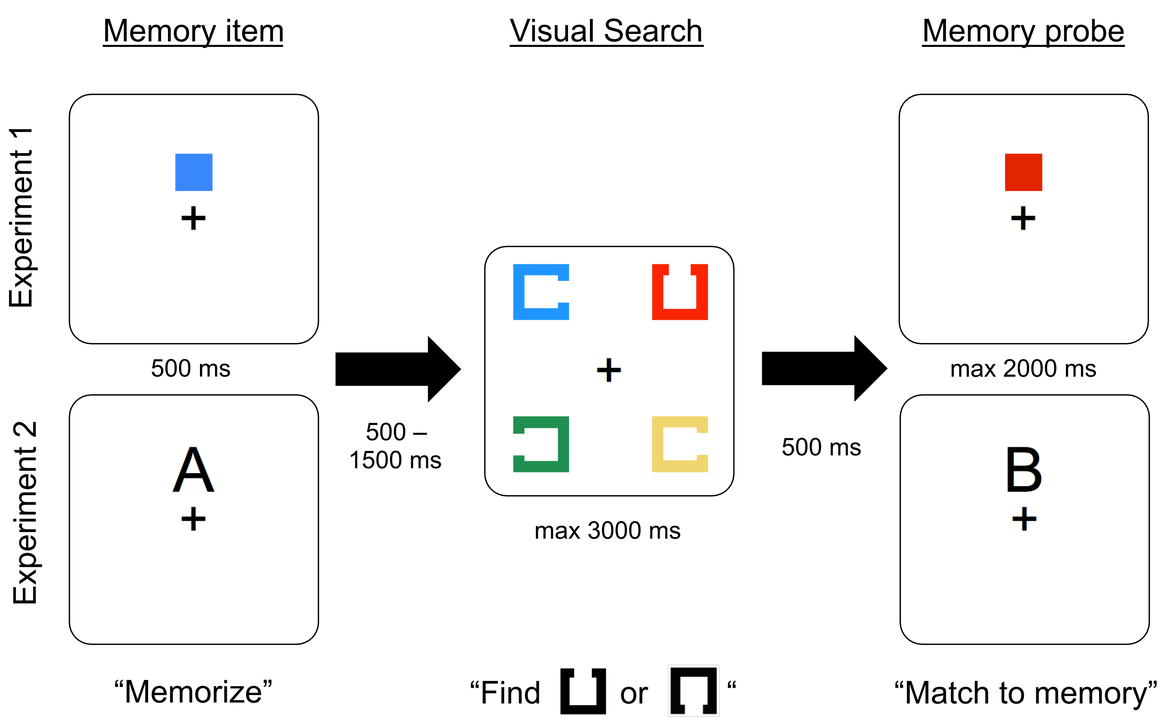

Figure 2. Trial outline of experiment 1 and 2.

Results

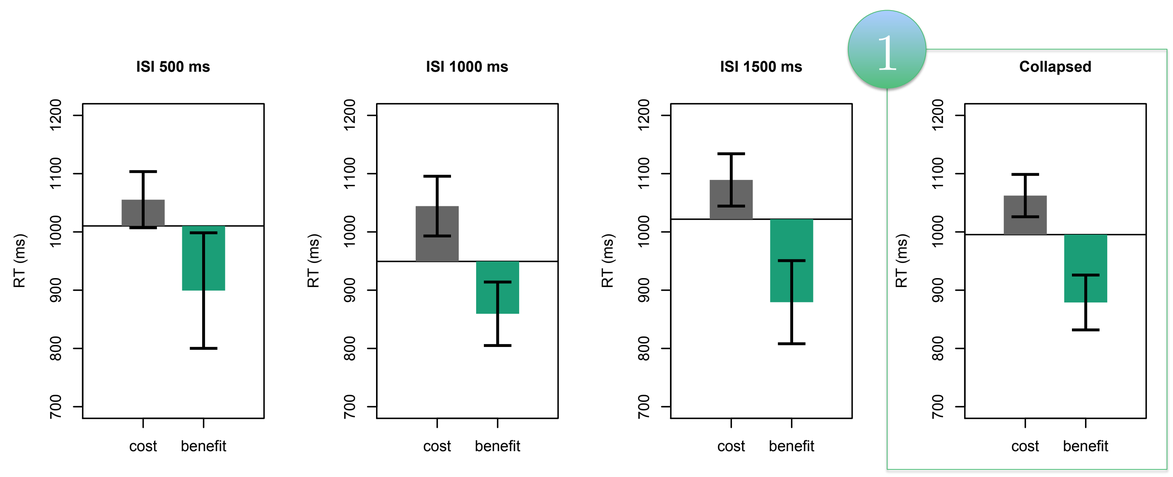

Figure 3. Experiment 1, color guidance: Response times by distractor (gray) or target (green) match with memory item and inter-stimulus interval. The horizontal line shows the response times in the neutral condition; where the memorized color was absent in the search display. Error bars represent within-subject 95% confidence intervals (Cousineau, 2005).

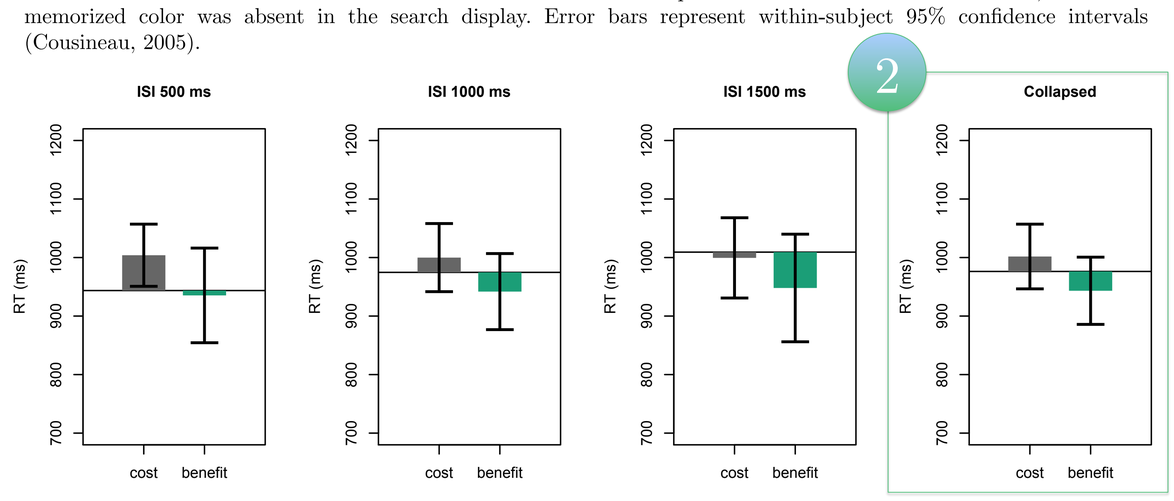

Figure 4. Experiment 2, color induced guidance: Response times by distractor (gray) or target (green) match with memory item and inter-stimulus interval.

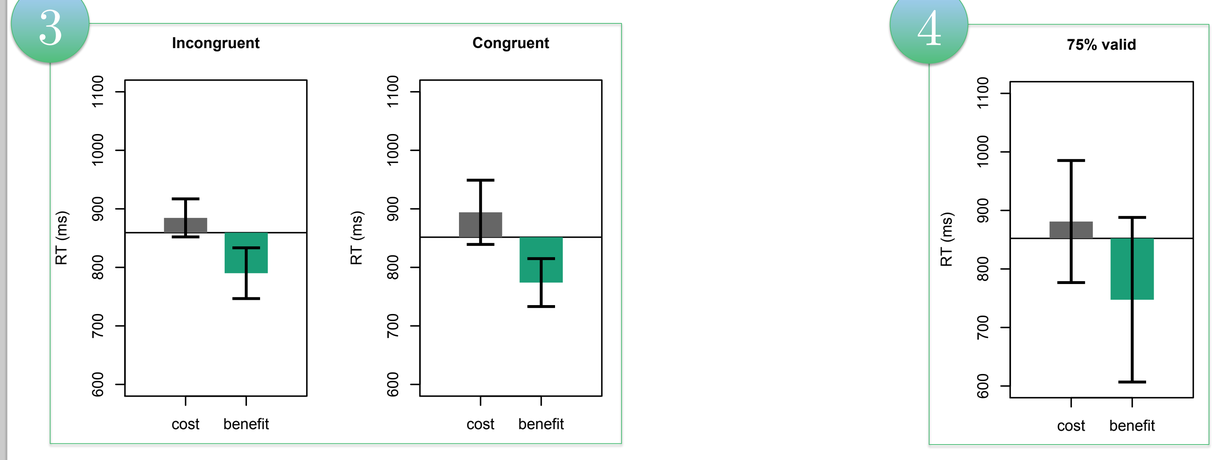

Figure 5. Experiment 3, colored graphemes (pane 1 and 2, from the left): Response times by distractor (gray) or target (green) match with memory item dependent on grapheme-color congruency. Experiment 4, strategic use of color concurrent (the right pane): Response times shown as costs (grey; distractor matches memory) and benefits (green; target matches memory).

Discussion

We replicated the results from Carlisle & Woodman (2011) in experiment 1, using simple colors. However, in experiment 2 the induced colors seem to only drive a potential weaker effect, that was not significant in the current sample, despite that the pattern was similar to experiment 1. In experiment 3 the physical color demonstrate effects similar to experiment 1, however, color-congruency does not affect reaction time. Finally, in experiment 4, there seem to be a tendency that strategic effects could guide attention, however, this tendency is mainly driven by two of the eight participants and thus not a general trend.

Why two observers demonstrate strong strategic effects in experiment 4 is still unclear, and needs to be examined further. But in the four experiments we demonstrate that a synesthetic color concurrent modulate attention differently form physical colors.