The Attentional "White Bear" Evades Visual Working Memory

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Introduction

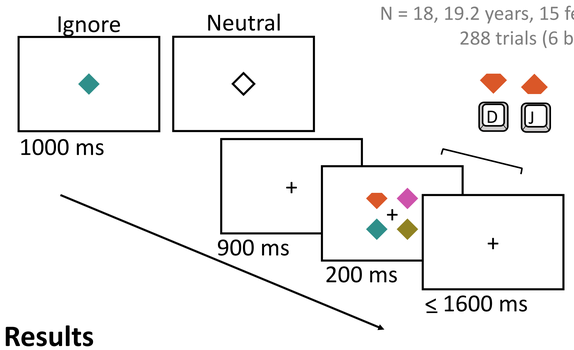
Cueing the color of a to-be-ignored item slows target judgments in visual search through a paradoxical process of attentional selection[1]. Given that attention modulates the quality of VWM representations[2-3], we asked, does cueing the color of a to-be-ignored item degrade the representational quality of task-relevant items held in VWM? We first validated a cueing procedure, in which we cued the color of to-be-ignored items in a visual search task (Experiment 1). We then applied this procedure to a delayed estimation task of VWM, manipulating set size (Experiment 2), and delay duration (Experiment 3).

Experiment 1: Visual Search Task

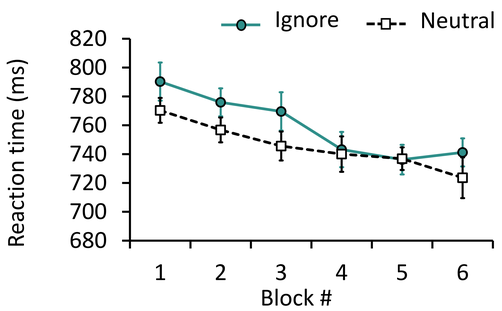
Procedure

Identify the position of the "chip". The Ignore cue indicates one item that can be ignored. The Neutral cue provides no information.

N = 18, 19.2 years, 15 female
288 trials (6 blocks)

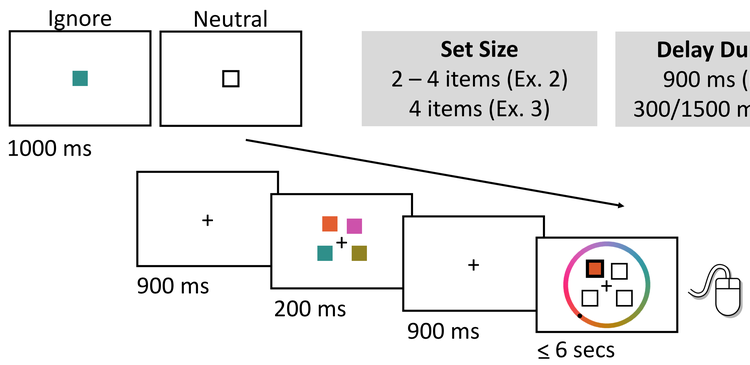


Results



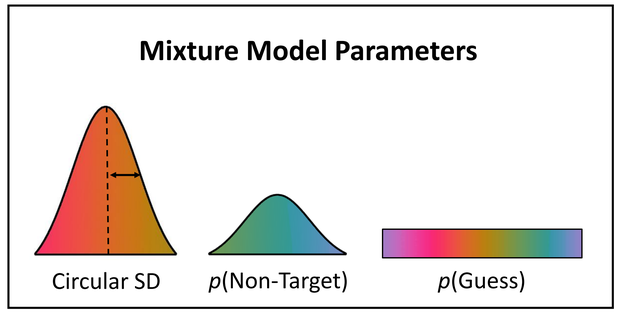
- Increased RT for Ignore vs. Neutral cues (p = .005) independent of time-on-task [Cue x Block (p = .629)].

Experiments 2 & 3: Visual Working Memory Task



Set Size
2 – 4 items (Ex. 2)
4 items (Ex. 3)

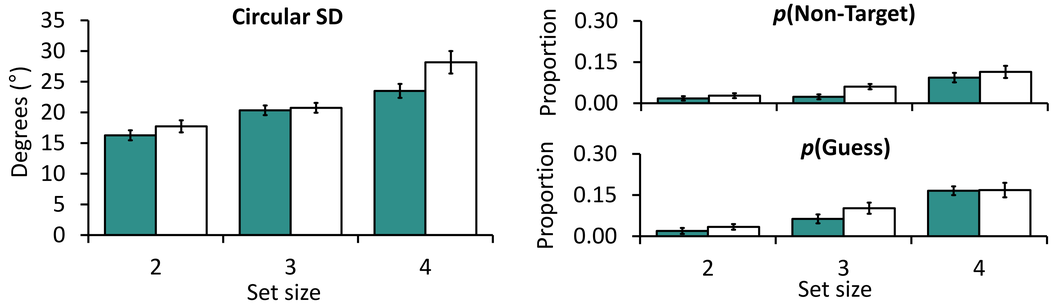
Delay Duration
900 ms (Ex. 2)
300/1500 ms (Ex. 3)



Experiment 2: Set Size

Ignore Neutral

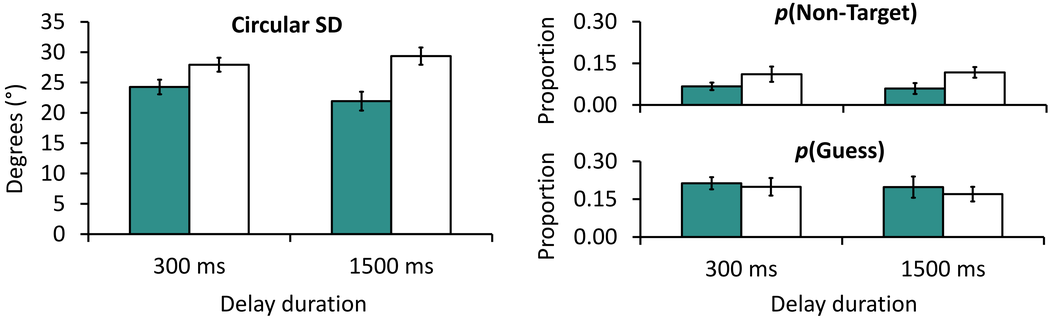
N = 18, 20.1 years, 13 female
360 trials (6 blocks)



- Cueing non-target items benefits circular SD (p = .012) and non-target response probability (p = .043) across set sizes [Cue x Set Size (p's > .05)].

Experiment 3: Delay Duration

N = 18, 20.5 years, 15 female
240 trials (6 blocks)



- The benefit of cueing non-target items on circular SD (p < .001) and non-target response probability (p = .035) is observed for both short and long retention intervals [Cue x Delay Duration (p's > .05)].

Conclusions

Experiment 1:

- As expected, trial-by-trial cueing of to-be-ignored items interferes with performance in visual search.

Experiments 2 & 3:

- Cueing to-be-ignored items does not impair VWM performance in a delayed estimation task – instead, it improves VWM quality.
- As delay length does not modulate this effect, we hypothesize that encoding, rather than maintenance processes subserve this benefit.

General:

- While cueing the color of to-be-ignored items is detrimental when speeded decisions are required, deliberative processes may be resistant to the initial capture by the to-be-ignored item.
- Further, attentional deployment may differ between the two tasks, favoring singleton detection in visual search[4], versus a broad distribution in VWM.

1. Moher & Egeth (2012). *Atten Percept Psychophys, 74*.
2. Bays & Husain (2008). *Science, 321*.
3. Emrich, Lockhart, & Al-Aidroos (2017). *J Exp Psychol Hum Percept Perform, 43*.
4. Gaspelin, Leonard, & Luck (2017). *Atten Percept Psychophys, 79*.

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