

Introduction

PURPOSE

- This study examined the role of grouping via illusory contours (e.g., objects forming a Kanizsa triangle) toward improving visual working memory (VWM) binding processes for color-orientation conjunctions

BACKGROUND

- Previous studies suggest that VWM performance can be improved by perceptual grouping cues (e.g., similarity, connectedness, proximity)
 - Woodman, Vecera, & Luck (2003); Peterson & Berryhill (2013)
- Recent findings suggest that grouping via illusory contours (e.g., grouping the stimulus array into a Kanizsa figure) benefits VWM performance for single features (e.g., color, orientation)
 - Allon, Vixman, & Luria (2018); Gao, Gao, Tang, Shui, & Shen (2016)
- It remains unclear whether these grouping-related benefits associated with illusory contour formation extend to VWM binding processes (e.g., color-orientation conjunction stimuli)

HYPOTHESES & PREDICTIONS

- Grouping color-orientation conjunctions via illusory contours should produce an overall grouping-related benefit to VWM performance
- We also predicted that the VWM grouping benefit would be largest during tests of binding relative to single features

Methods

Participants

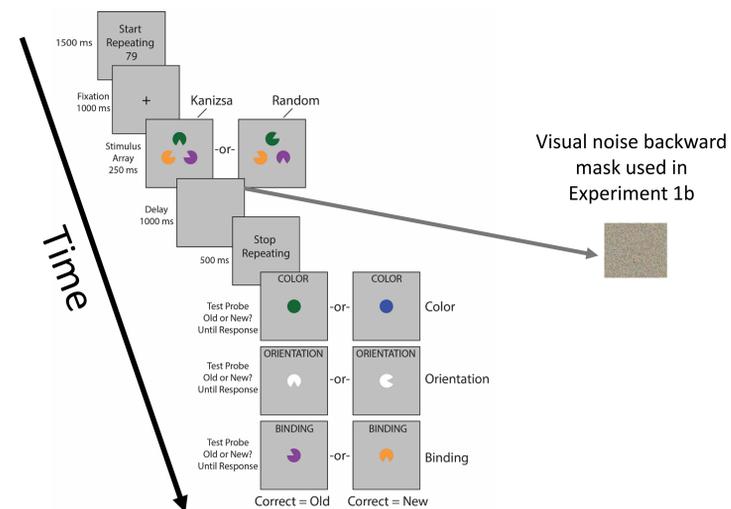
- Experiment 1a: N = 66; Experiment 1b: N = 35
- Experiment 2a: N = 57; Experiment 2b: N = 46
- Age range for both experiments: 18-22
- All had normal or corrected-to-normal color vision as confirmed by the Ishihara Color Test administered prior to the experiment

Experimental Design

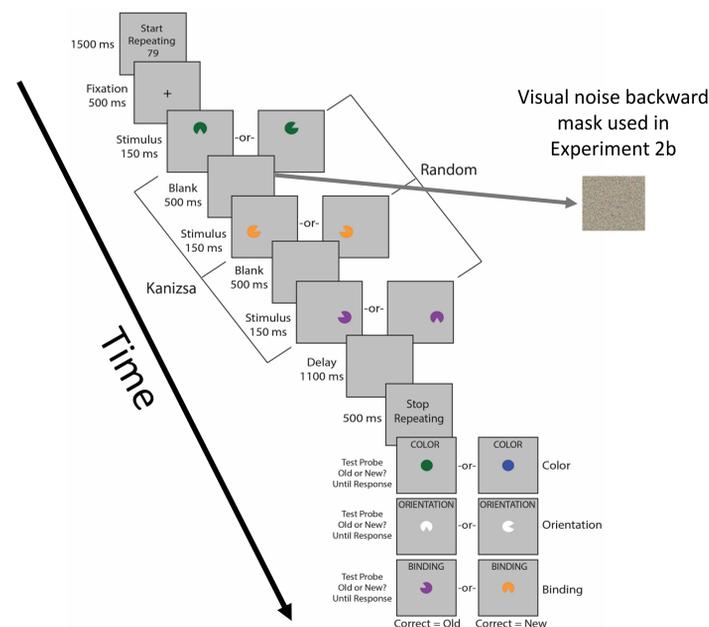
- Both Experiments used a 2 (Grouping: Kanizsa, Random) X 3 (Test: Color, Orientation, Binding) within-subjects factorial design
- 288 Trials (48 trials per block; 6 blocks total)
- Articulatory Suppression task performed during each trial
- Within each block:
 - 24 grouped, 24 ungrouped stimulus arrays
 - 8 color, 8 orientation, 8 binding test trials (randomly intermixed)
 - 4 old trials, 4 new trials per sub condition
- Stimulus Array: 3 color-orientation conjunction stimuli (i.e., "pac-man inducers") with each item arranged to either form an illusory Kanizsa triangle (Kanizsa) or with each item randomly oriented to form no illusory percept (Random)
- Experiment 1a & 1b: Simultaneous presentation of inducer stimuli (each inducer stimulus was backward masked in Exp. 1b)
- Experiment 2a & 2b: Sequential presentation of inducer stimuli (each inducer stimulus was backward masked in Exp. 2b)

Visual Working Memory Task Paradigms

Experiment 1a & 1b: Simultaneous Presentation



Experiment 2a & 2b: Sequential Presentation



Results

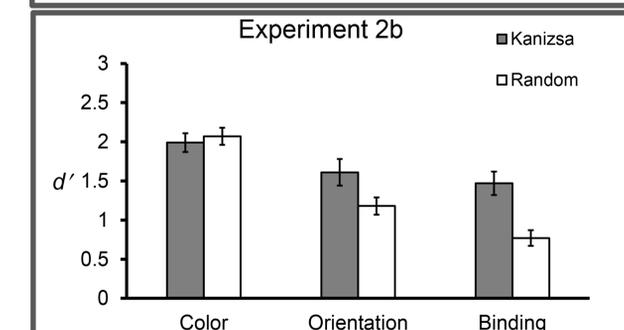
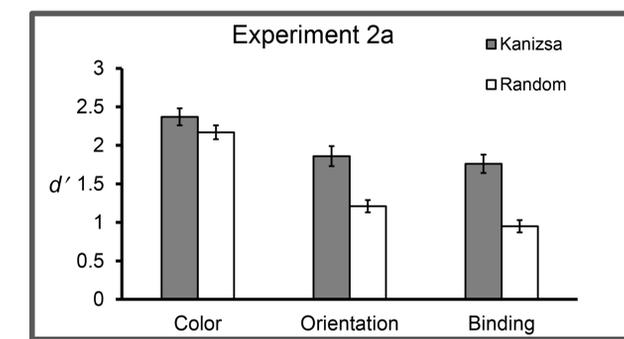
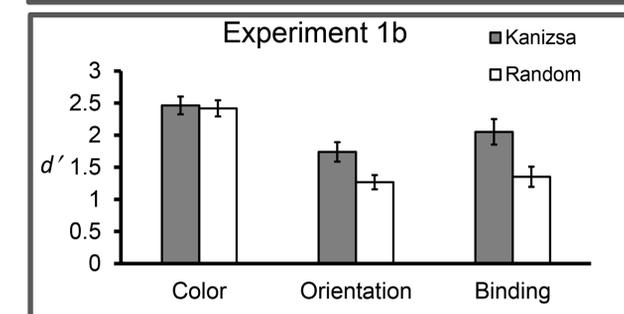
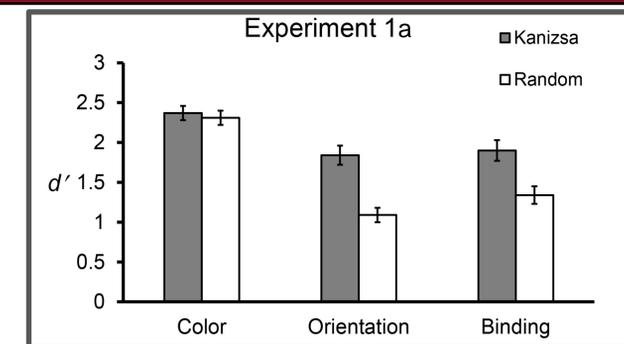


Figure Caption: Sensitivity (d') during change detection task at all levels of each factor (error bars depict the standard error of the means) for Experiment 1a & 1b and Experiment 2a & 2b.

Conclusions

- There was an overall grouping-related benefit to VWM performance.
- This grouping-related benefit was selective to the orientation and binding conditions, with only marginal benefits for color in Exp. 2a.
- In contrast to our predictions, the grouping-related benefit was equivalent in both the orientation and the binding test conditions.

Implications

- These findings partially replicate previous grouping-related benefits found using illusory contours, which typically find larger grouping benefits when testing the feature of orientation compared to color.
- These findings suggest that grouping-related benefits in VWM are strongest for the stimulus feature that is relevant to the grouping cue being used (e.g., illusory contours in this suite of experiments).

References

- Allon, A. S., Vixman, G., & Luria, R. (2018). Gestalt grouping cues can improve filtering performance in visual working memory. *Psychological Research*.
- Gao, Z., Gao, Q., Tang, N., Shui, R., & Shen, M. (2016). Organization principles in visual working memory: Evidence from sequential stimulus display. *Cognition*, 146, 277-288.
- Peterson, D. J., & Berryhill, M.E. (2013). The Gestalt principle of similarity benefits visual working memory. *Psychonomic Bulletin & Review*, 20(6), 1282-1289.
- Woodman, G.F., Vecera, S.P. & Luck, S.J. (2003). Perceptual organization influences visual working memory. *Psychonomic Bulletin & Review*, 10(1), 80-87.

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