Interplay between the Ebbinghaus illusion and hierarchical coding in visual working memory

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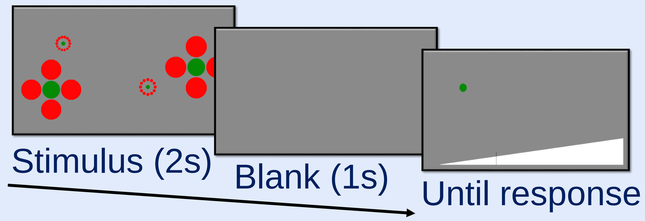
It was shown that recalled size of an individual item is systematically biased towards the mean size of a set (Brady & Alvarez, 2011), suggesting hierarchical encoding in visual working memory (VWM). Yet, we also observe somewhat opposite trend in perception: perceived size of a circle, surrounded by other circles, is biased away from the mean (e.g., Ebbinghaus illusion).

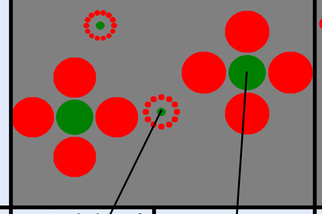
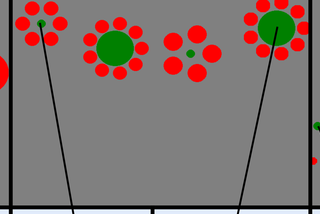
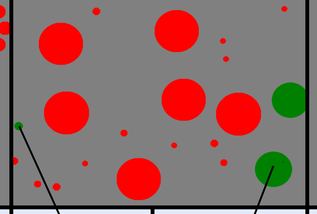
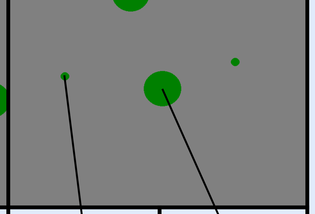
Exp 1: Ebbinghaus Illusion VS Hierarchical Encoding

Q: Do the Ebbinghaus illusion and hierarchical encoding interplay in VWM?

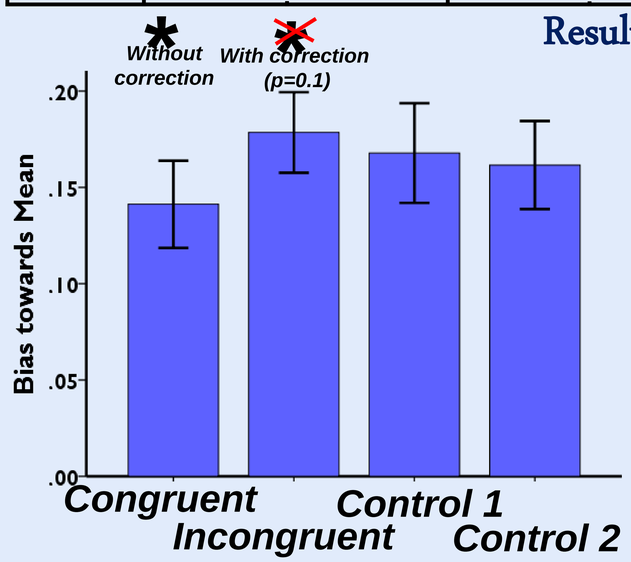
Task: Memorize green circles and adjust the probe after the blank screen to match one of them size.

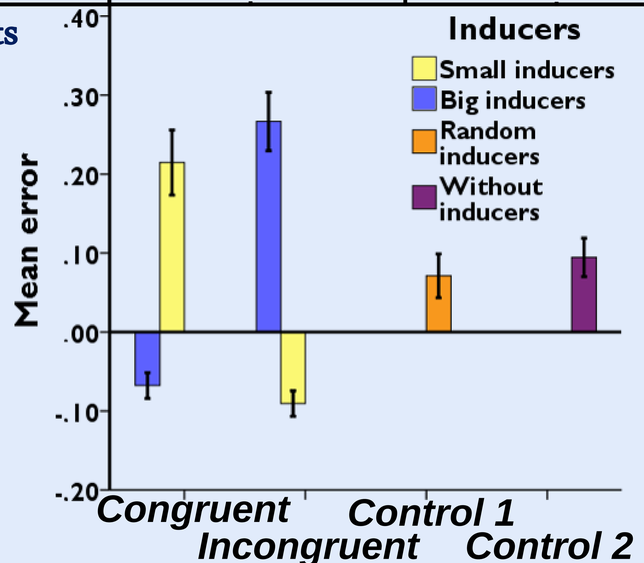


Stimuli and Expected Biases

Condition	Congruent	Incongruent	Control 1	Control 2
Stimuli				
Expected VWM bias	Real size of circle Towards the Mean	Towards the Mean	Towards the Mean	Towards the Mean
Expected Ebbingh. bias	Towards the Mean	Away from the Mean	No bias	No bias

Results

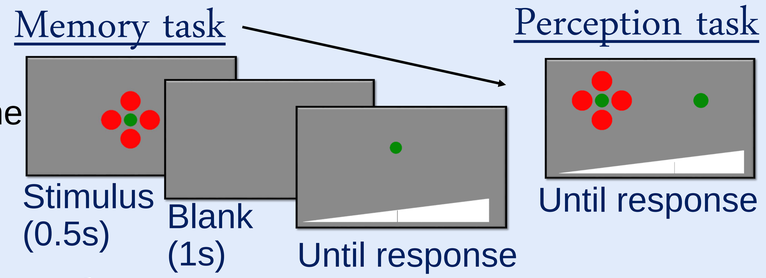




Exp 2: Memory VS Perception

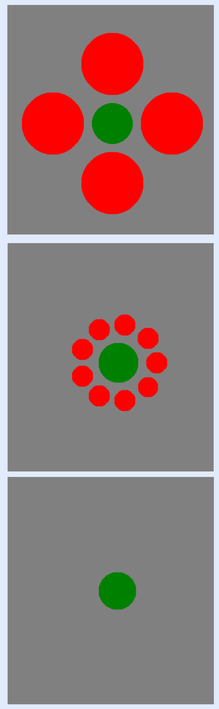
Q: Can our stimuli induce good level of the Ebbinghaus illusion? How does the Ebbinghaus illusion behave in memory and perception?

"Memorize green circle and adjust the probe after the blank screen."



"Adjust the size of probe on the right to match the sample size on the left."

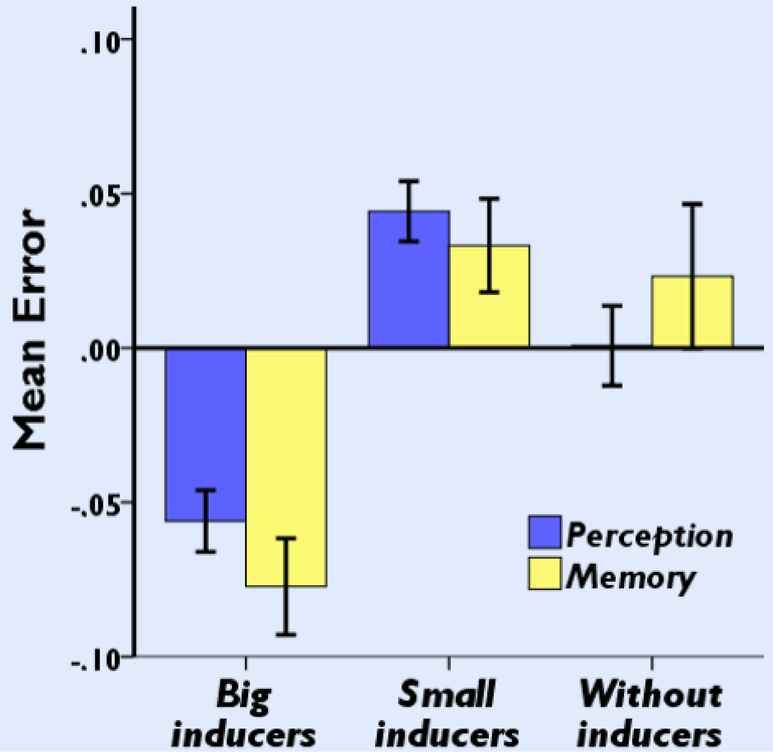
Stimuli and Results



Big Inducers

Small Inducers

Without Inducers



Summary:

- Although Ebbinghaus stimuli elicited a bias away from the inducer size both in perception and memory, there was (almost) no inducer-associated bias when Ebbinghaus stimuli are memorized.
- At the same time, there was a strong bias towards the mean size of the targets, as predicted by the hierarchical coding model.
- Therefore, hierarchical coding prevails over the Ebbinghaus illusion in VWM.

References:

1) Brady T.F., Alvarez G.A. (2011) Hierarchical Encoding in Visual Working Memory: Ensemble Statistics Bias Memory for Individual. *Psychological Science, 22*. 384 –392.

2) Im H.Y, Chong S.C. (2009). Computation of mean size is based on perceived size. *Attention, Perception, & Psychophysics, 71*, 375-384.