Re-examining the sequential-simultaneous paradigm: orientation judgements and iconic memory

Christie R. M. Haskell & Britt Anderson

Research Question:
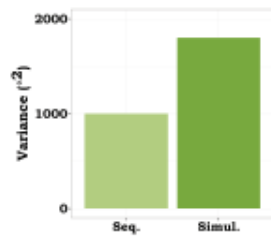Is the sequential benefit the result of persistent iconic memory traces of the second stimulus on sequential trials?

What we did:
we manipulated the delay between stimulus offset and response to investigate the influence of iconic memory on accuracy.

1

Prior work has demonstrated that: orientation judgements are less variable when stimuli are consolidated sequentially compared to simultaneously.[1]
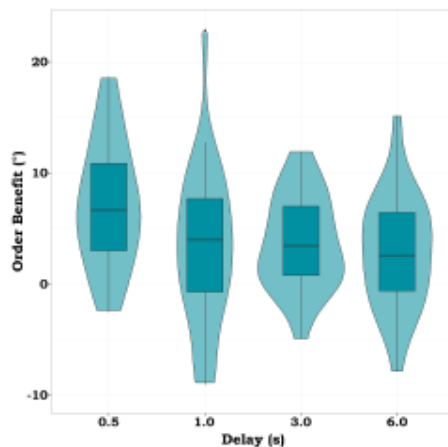
We observed that: the sequential benefit was the result of better performance when the target was the second stimulus.[2]
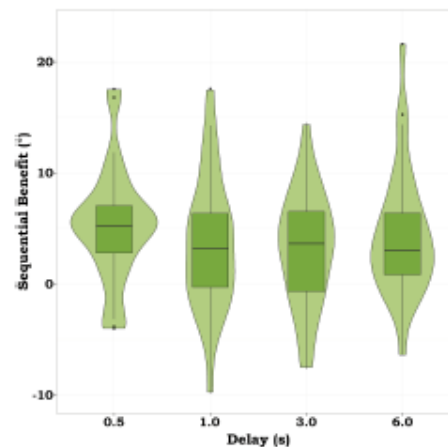

2

Sequential   Simultaneous

3
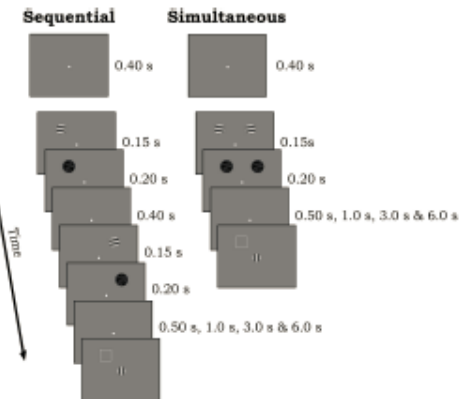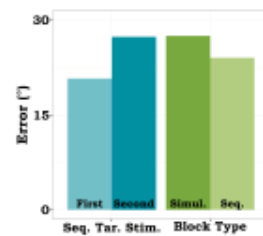
What we found:

The order benefit reduced for delays greater than one second.

The sequential benefit reduced at one and three second delays along with the order benefit.

However, there was no relation between the size of the order benefit and the size of the sequential benefit.

References:
[1] Liu, T., & Becker, M. W. (2013). Serial Consolidation of Orientation Information Into Visual Short-Term Memory. *Psychological Science, 24* (6), 1044–1050.
[2] Haskell, C. R. M. and Anderson, B. Distinct effects of memory and cue validity on orientation judgments; submitted.

crmhaske@uwaterloo.ca
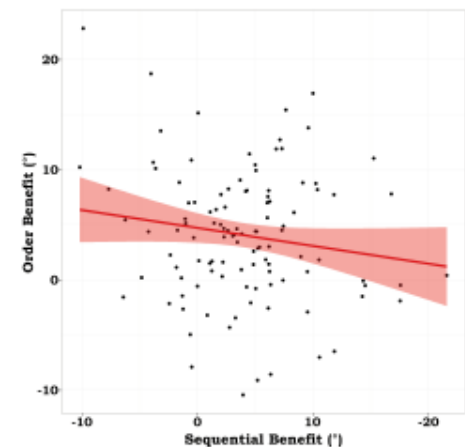
1. Using the sequential/simultaneous paradigm described in detail in number two, Liu and Becker demonstrated that orientation judgments were less variable when two stimuli were consolidated sequentially compared to simultaneously (left plot).

   Using this same protocol, we replicated the result of Liu and Becker (right plot, green bars). Critically, we observed that better accuracy on sequential trials was entirely driven by a recency effect. It was not that accuracy on sequential trials was better overall; it was that accuracy was better when the target stimulus was the second stimulus (right plot, light blue bar). When the target was the first stimulus (right plot, dark blue bar), accuracy was not different from that observed for simultaneous trials (right plot, dark green bar).

   We were interested in investigating whether the sequential benefit resulted from iconic memory traces improving performance when the target was the second stimulus.

2. The experimental trials consisted of sequentially and simultaneously presented stimuli, which were presented to participants blocked. Two circular gratings, which were backwards masked, were displayed. In the sequential condition, the gratings were presented one after the other, and in the simultaneous condition they were presented at the same time. The delay between the offset of the mask(s) and the onset of the response slide was manipulated within-subjects and was 0.5, 1, 3, or 6 seconds. The delays were blocked, presented in random order, and all subjects completed trials with all delays. When prompted for a response, a white square appeared in a location previously occupied by a grating to indicate which grating should be recalled. Participants were instructed to respond as accurately as possible (responses were unspeeded) and were required to rotate a central response grating to match the angle of the indicated grating.

3. We demonstrated that the difference in accuracy on sequential trials between when the target is the first and second stimulus (order benefit) reduces for delays greater than one second (blue violin/box plot) suggesting that iconic memory has some effect on accuracy on sequential trials. Critically, the sequential benefit (green violin/box plot) also reduces for delays greater than one second. However, the sequential benefit was not eliminated even at the longest delay of six seconds, and a regression analysis (right plot) revealed no relation between the size of the order benefit and the size of the sequential benefit.

   Taken together, our results suggest that iconic traces confer some accuracy improvement for the second stimulus at short delays, but they are not sufficient to explain the sequential advantage.