Working memory for sequentially presented objects does not rely on location to bind features
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Introduction
- Several studies have proposed that spatial location takes a privileged role in binding other visual features (Treisman & Zhang, 2006; Schneegans & Bays, 2017). Supporting this view, Pertzov & Husain (2014) found that presenting sample items sequentially at the same location leads to an increase in misbindings between their features.
- However, a recent study investigating crowding effects in visual working memory did not observe an impairment of binding when stimuli were presented sequentially in close proximity (Harrison & Bays, 2018).
- Here we test how general the same-location effect on binding is, and whether the conflicting results may be explained by differences in the timing of stimulus presentation in the two studies.

Behavioral task
We used a four-item cued recall task adapted from Pertzov & Husain (2014), but introduce a variation in inter-stimulus interval (ISI) as a new within-subjects variable.

Analysis
- We fit responses for each subject as a mixture of von Mises and uniform distributions:
  \[
  p_{\text{swap}}(\theta) = \sum_{i} p_i \cdot \text{vonM}(\theta; \mu_i, \kappa, \lambda_i) + \text{uniform}(\theta)
  \]
- We used \( p_{\text{swap}} \) as a measure of binding performance, and employed Bayesian statistics to determine whether it was differently affected by the location condition for short and long ISIs (Bayesian stopping criterion of BF > 10 for difference of differences in \( p_{\text{swap}} \) reached after 12 subjects).

Results
- Confirming earlier results, we found strong evidence for a location effect with short ISIs (impaired binding in the same-location condition).
- Critically, the effect was not observed for longer ISIs (weak evidence against difference and strong evidence for interaction), suggesting that it is caused by temporal interference (Yeshurun, Rashal & Tkacz-Domb, 2015).

Follow-up experiment
We tested binding for sequentially presented items using a dual-report paradigm adapted from studies investigating independence of feature stores (Bays, Wu & Husain, 2011) and spatial binding (Schneegans & Bays, 2017).

Discussion
- Our results indicate that feature binding is not exclusively mediated by space, as binding memory is not impaired for items presented sequentially at the same location if enough time is given.
- However, we still found no evidence for direct binding of surface features in memory. Instead, different features appear to be bound independently to ordinal position.

References