

# Spatial overlap of collections affects the resolution of ensemble features

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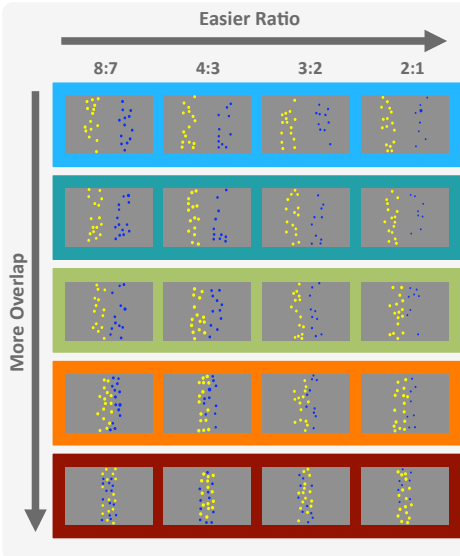
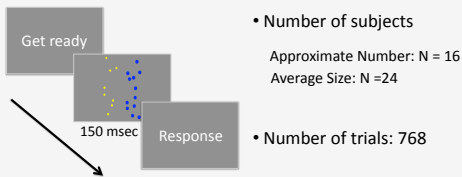
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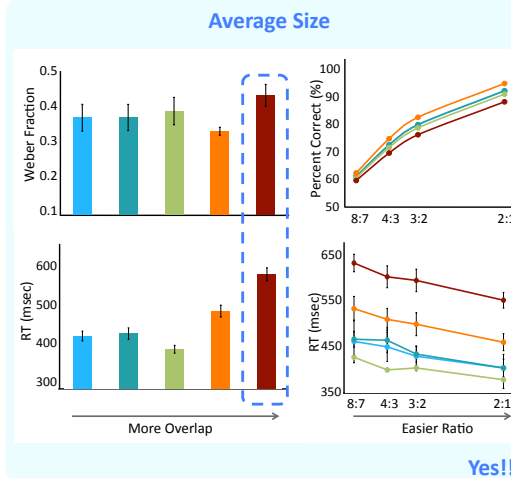
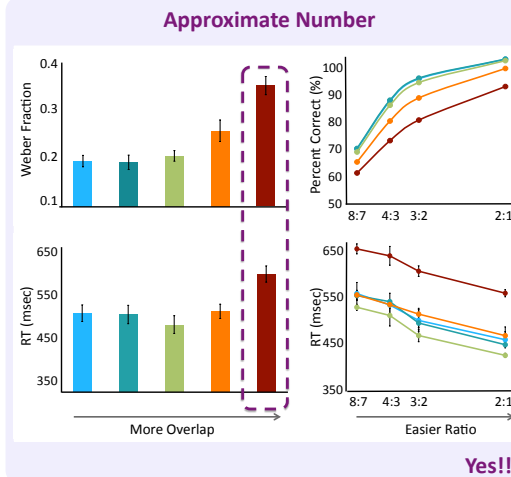
## Introduction

- Collections of visual objects can be grouped and statistical properties of the group encoded as ensemble features (e.g., average size<sup>[1]</sup>, centroid<sup>[2]</sup>, approximate number of items<sup>[3]</sup>). While features from multiple salient groups may be stored, spatial separation between groups may affect group selection<sup>[4]</sup>.
- We investigated the effects of degree of spatial overlap between two groups, specified by color, on the discrimination threshold for the ensemble features of approximate number and average size.

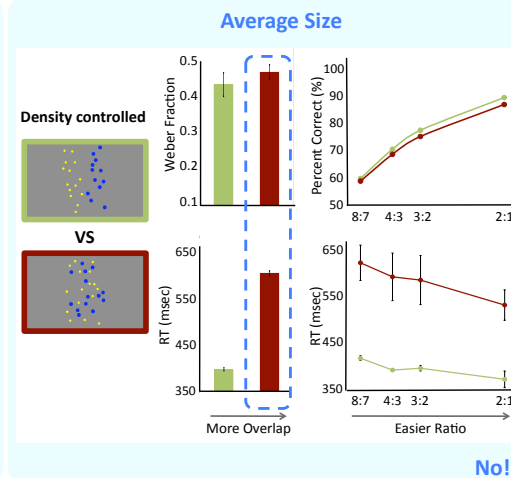
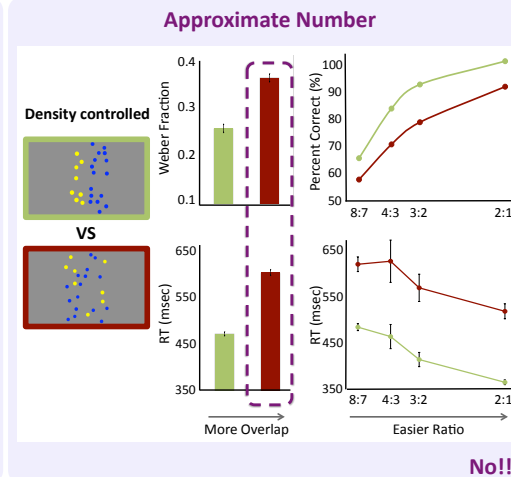
## Task: "Which set has (more dots/larger mean size)?"



## Question #1: Does spatial overlap reduce resolution of ensemble feature?

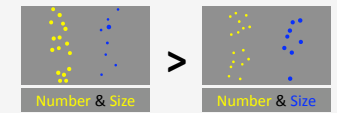


## Question #2: Is spatial overlap just increased density?



## Other results

- There was no difference in performance between 150-msec and 500-msec display times for both approximate number and average size suggesting that sets were selected in parallel.
- When the answers for approximate number and average size agreed, performance was better suggesting that both number and size are automatically computed for an attended set.



## Conclusions

- Spatial overlap of two sets of dots deteriorates performance in both number and average size discriminations even when density of display was controlled.
- While encoding features from more than one collection may be possible, ensemble features encoded from spatially localizable collections are more accurate than those from spatially overlapping collections.

## Future directions

- How do density, size, and number interact for processing the ensemble features of a group?
- Does spatial overlap similarly affect other ensemble features: Centroid? Average orientation?

## References

- [1] Chong, S. C., & Treisman, A. (2003). Representation of statistical properties. *Vision Research*, 43, 393-404.
- [2] Alvarez, G. A., & Oliva, A. (2008). The representation of simple ensemble visual features outside the focus of attention. *Psychological Science*, 19, 392-398.
- [3] Halberda, J., Sires, S. F., & Feigenson, L. (2006). Multiple spatially overlapping sets can be enumerated in parallel. *Psychological Science*, 17, 572-576.
- [4] Watson, D. G., Maylor, E. A., & Bruce, L. A. M. (2005). The Efficiency of Feature-Based Subitization and Counting. *Journal of Experimental Psychology: Human Perception and Performance*, 31, 1449-1462.