Visual Processing of Spatial Relations Within and Between Objects

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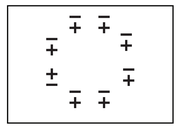
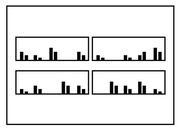
SPATIAL RELATIONS

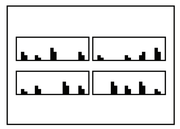


Prior work shows that visual search for a target defined by the spatial relationship between its parts is highly inefficient...[1, 2]

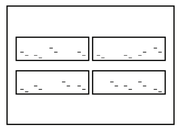
... But improves **36-69%** when the target is a single object[3]:



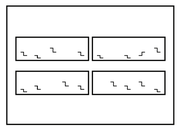
114 ms/item



73 ms/item



62 ms/item



19 ms/item

1 OBJECT > 2 OBJECTS?

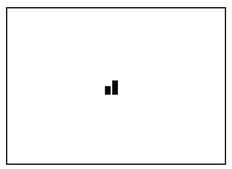
Question:
Does this improvement stem from the target simply being a **single object**? Or because the target's components are **closer together** (proximity leads to stronger grouping)?

Object-Based Prediction:

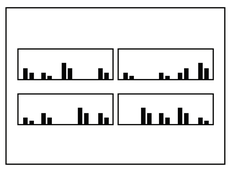
Space-Based Prediction:

GENERAL PROCEDURE

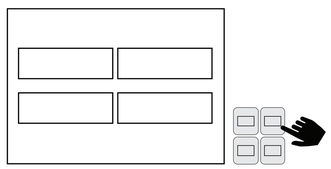
Task: Which quadrant contains the target relation?



Target Relation Preview
Until Response



Test Display
Until Response

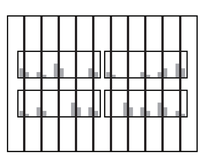


Response Display
Until Response

CONCLUSIONS

Unclear whether visual attention for spatial relations is better for single objects (rather than separate objects) because it is one object or due to closer proximity of its parts.

It is possible that performance may benefit from perceiving separate objects as a single object, and may improve with stronger occlusion cues.



Possible Occlusion Cue

REFERENCES

[1] Logan, G. D. (1994). Spatial attention and the apprehension of spatial relations. *Journal of Experimental Psychology: Human Perception and Performance, 20*(5), 1015.
[2] Wolfe, J. M. (1998). What can 1 million trials tell us about visual search? *Psychological Science, 9*(1), 33-39.
[3] Nothelfer, C., & Franconeri, S. Visual Search Through Displays of Data. Poster presentation at the Vision Sciences Society Annual Meeting, St. Pete Beach, Florida (May, 2017).

ACKNOWLEDGEMENTS

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CONTACT

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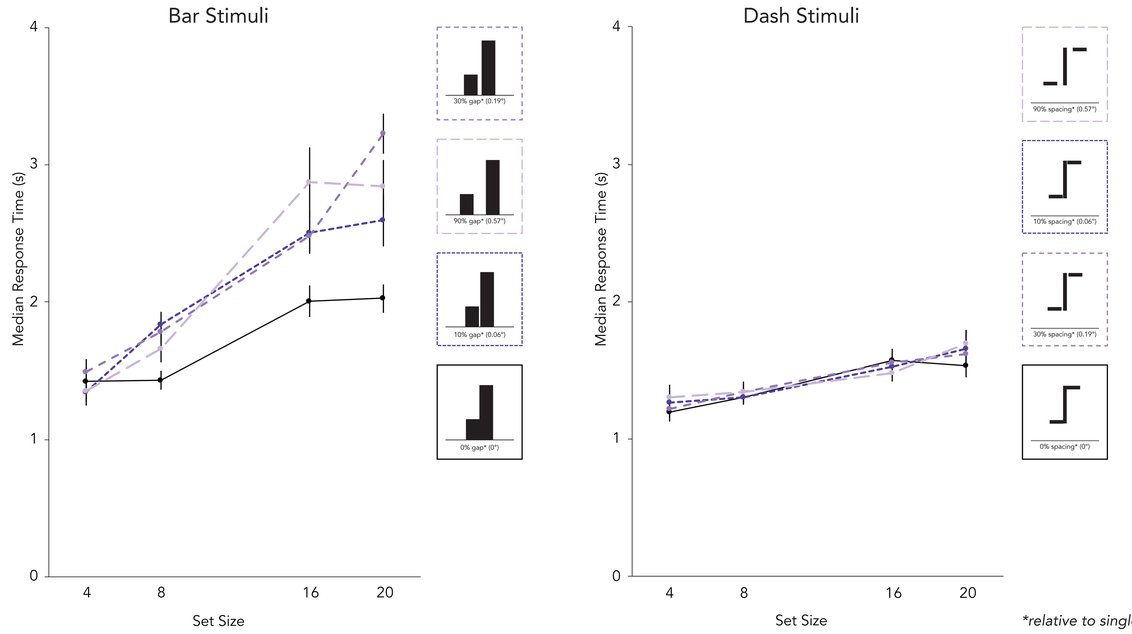
EXPERIMENT 1

Is visual search for spatial relations supported by an object-based or space-based view?



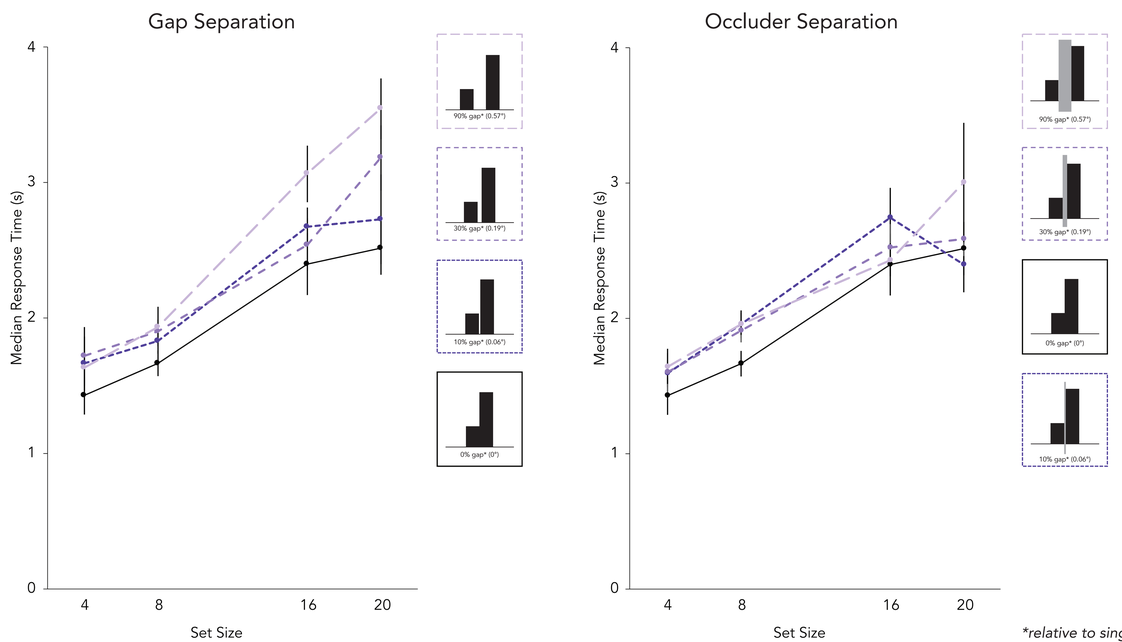
*relative to single bar/dash width

Additional space between bars does not further degrade visual search efficiency, supporting an object-based view.

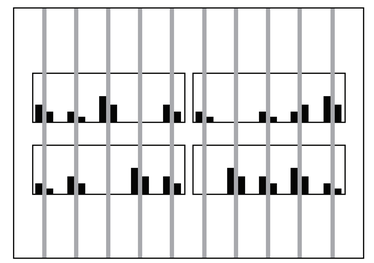
However, additional space between dashes does not degrade visual search efficiency at all - all stimuli may be perceived as single objects with the addition of vertical bar, unlike prior stimuli.[3]

EXPERIMENT 2

Can separate objects yield a visual search benefit if they are *perceived* as a single object?



*relative to single bar width



Occluders slightly improve overall search performance (p = 0.088).

However, the single-object benefit did not replicate, supporting a space-based view.