Quantifying the effects of feature similarity on attentional selection using psychophysical scaling

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Background
- Many models of attention cite the importance of target-distractor similarity, though few experiments have attempted to quantify this.1,2,3,4
- There is little evidence for how similarity impacts attentional efficiency across different tasks or different measures (e.g., search slopes vs response times).
- Other studies have relied on distance between targets and distractors in a given stimulus space5,6, which may not map linearly to psychophysical estimates of similarity7

Psychophysical Scaling

Which of the two bottom circles is most similar to the top?

Does psychophysical dissimilarity better predict attention performance?

Experiment 1
How does similarity affect visual search RT?

Search RTs were non-linearly related to both distance around the color wheel and psychological estimates of color similarity, and did not improve beyond 40-50°

Experiment 2
How does similarity interact with the number of distractors?

The number of distractors only mattered when they were highly similar to targets (10-15°)

Experiment 3
Does the effect of similarity generalize from visual search to a sustained attention task?

Task: attend dots in the target color to detect decreases in luminance

Performance was comparable to visual search, with no improvement beyond ~30°

Summary
- Comparable patterns of performance across visual search and sustained attention tasks, suggesting the effects of similarity generalize across different tasks.
- Psychological similarity alone does not explain the non-linear relationship between similarity and attention.
- Attention may act to exaggerate differences between targets and distractors, particularly for representations that are most similar8

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References
4. Lleras et al., 2020. Att, Percept, & Psychophys