

Abstract: When people look for things in their environment, they hold a representation of the target in mind, so that they can guide attention toward objects that share its features, and away from objects with target-irrelevant features. Sometimes, this “target template” is precise, and contains many accurate details (e.g., color, shape, size), as when looking for your child’s favorite teddy bear in her messy room. In other situations, people have less precise guiding information, as when searching for any stuffed bear in a friend’s home. In those instances, the search template must be more flexible, and tolerant to deviations in appearance. In some new experiments, we investigated how the precision of a searcher’s mental representation affects his/her ability to perform search. Specifically, we are using eye-tracking to index differences in attentional guidance (e.g., scan-path ratios) and decision-making (e.g., time to respond once the target is seen) during search. Our results indicate that template imprecision – brought about by small perceptual differences between what is kept in mind, and what is actually seen during search – cause big problems for searchers, and our eye-tracking results suggest that attentional guidance is only half the story.

Small Perceptual Differences Cause Big Problems When They Make Your “Target Template” Imprecise.



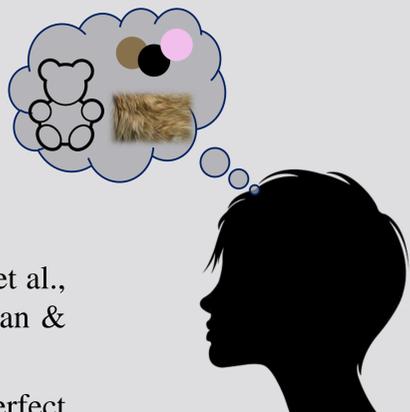
Michael C. Hout & Stephen D. Goldinger



20th Annual Meeting on Object Perception, Attention, and Memory.

--- THE TARGET TEMPLATE ---

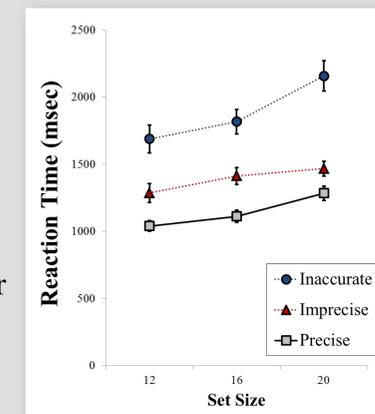
- Templates: Process whereby one holds in visual working-memory a representation of the to-be-located item.
- Top-down processing dominates guidance in visual search (Henderson et al., 2009; Wolfe et al., 2004).



- Attention is directed to items/regions that resemble the target (Hollingworth et al., 2008; Zelinsky, 2008) and away from features that are undesirable (Woodman & Luck, 2007).
- Unlike many laboratory search tasks, real-world searchers rarely have perfect knowledge of the target.
- People can tolerate imperfect templates (Bravo & Farid, 2009) and guide attention using what information they have available (Schmidt & Zelinsky, 2009).
- But templates are not uniformly precise or imprecise.

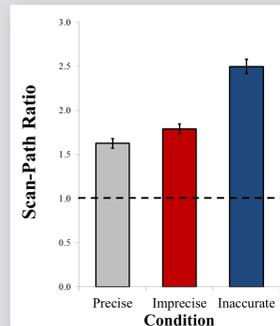
DO “BAD” TEMPLATES MAKE PEOPLE POOR SEARCHERS OR SLOW RESOLVERS?...

- Search requires more than just putting your attention in the right place.
- Faster RTs do not necessarily imply better oculomotor behavior (Hout & Goldinger, 2010; 2012).
- Search times dissected using eye-movement data (see Malcolm & Henderson, 2009).

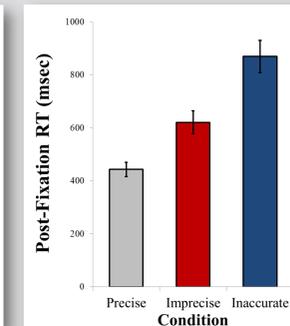


--- EXP 1 RESULTS ---

Attentional Guidance



Decision-making



...BOTH!

- Similar patterns appear in many other DVs: time to fixate target, fixation measures to the target, etc.



- When templates contain imperfect details about the target’s identity, search guidance is hindered.
- However, guidance is only half the story: Decision-making is also slowed when templates are imprecise.

EXP 1: IMPERFECT TEMPLATES

- On some trials, the target was a slight mismatch to the cue presented prior to search.
- We examined template imprecision by observing behavior on “mismatch” trials.
- Cue-to-target similarity: High = good template precision; low = bad template precision.

“Find this or something very much like it.”

CUE:

TARGET:

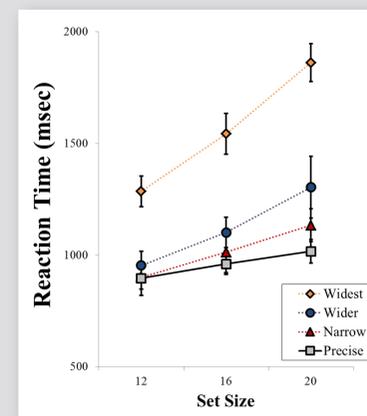
CONDITION: **precise** **imprecise** **inaccurate**

EXP 2: BROAD TEMPLATES

- People can guide attention using multiple representations (Beck et al., 2012).
- Exact target always shown prior to search, but may be one of a pair.
- The template was broadened by inclusion of new (unhelpful) features.

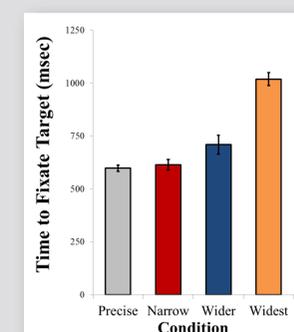
“Find this item.” --- or --- “Find one of these two items.”

precise **narrow** **wider** **widest**

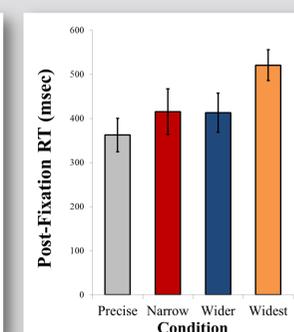


--- EXP 2 RESULTS ---

Attentional Guidance



Decision-making



- Similarly, when templates are precise, but contain too many features, both guidance and decision-making suffer.
- Conclusion: Small imperfections in the target template can have big effects on one’s ability to direct their attention to -- and recognize -- their target.

Thanks to the National Eye Institute and National Institute of Health for the Travel Award supporting this work!

Support from NIH grant R01 DC 004535-10 to Stephen D. Goldinger. References available on handout.

- Beck, V. M., Hollingworth, A., & Luck, S. J. (*in press*). Simultaneous control of attention by multiple working memory representations. *Psychological Science*.
- Bravo, M. J., & Farid, H. (2009). The specificity of the search template. *Journal of Vision, 9*, 1-9.
- Henderson, J. M., Malcolm, G. L., & Schandl, C. (2009). Searching in the dark: Cognitive relevance versus visual salience during search for non-salient objects in real-world scenes. *Psychonomic Bulletin & Review, 16*, 850-856.
- Hollingworth, A., Richard, A. M., & Luck, S. J. (2008). Understanding the function of visual short-term memory: Transsaccadic memory, object correspondence, and gaze correction. *Journal of Experimental Psychology: General, 137*, 163-181.
- Hout, M. C., & Goldinger, S. D. (2010). Learning in repeated visual search. *Attention, Perception & Psychophysics, 72*, 1267-1282.
- Hout, M. C., & Goldinger, S. D. (2012). Incidental learning speeds visual search by lowering response thresholds, not by improving efficiency. *Journal of Experimental Psychology: Human Perception and Performance, 38*, 90-112.
- Malcolm, G. L., & Henderson, J. M. (2009). The effects of target template specificity on visual search in real-world scenes: Evidence from eye movements. *Journal of Vision, 9*, 1-13.
- Schmidt, J., & Zelinsky, G. J. (2009). Search guidance is proportional to the categorical specificity of a target cue. *The Quarterly Journal of Experimental Psychology, 62*, 1904-1914.
- Wolfe, J. M., Horowitz, T. S., Kenner, N., Hyle, M., & Vasan, N. (2004). How fast can you change your mind? The speed of top-down guidance in visual search. *Vision Research, 44*, 1411-1426.
- Woodman, G. F., & Luck, S. J. (2007). Do the contents of visual working memory automatically influence attentional selection during visual search? *Journal of Experimental Psychology: Human Perception and Performance, 33*, 363-377.
- Zelinsky, G. J. (2008). A theory of eye movements during target acquisition. *Psychological Review, 115*, 787-835.