The Low-prevalence Effect Counteracts Confirmatory Bias in Visual Search

Stephen C. Walenchok[1], Stephen D. Goldinger[1], and Michael C. Hout[2]

1 Arizona State University

2 New Mexico State University

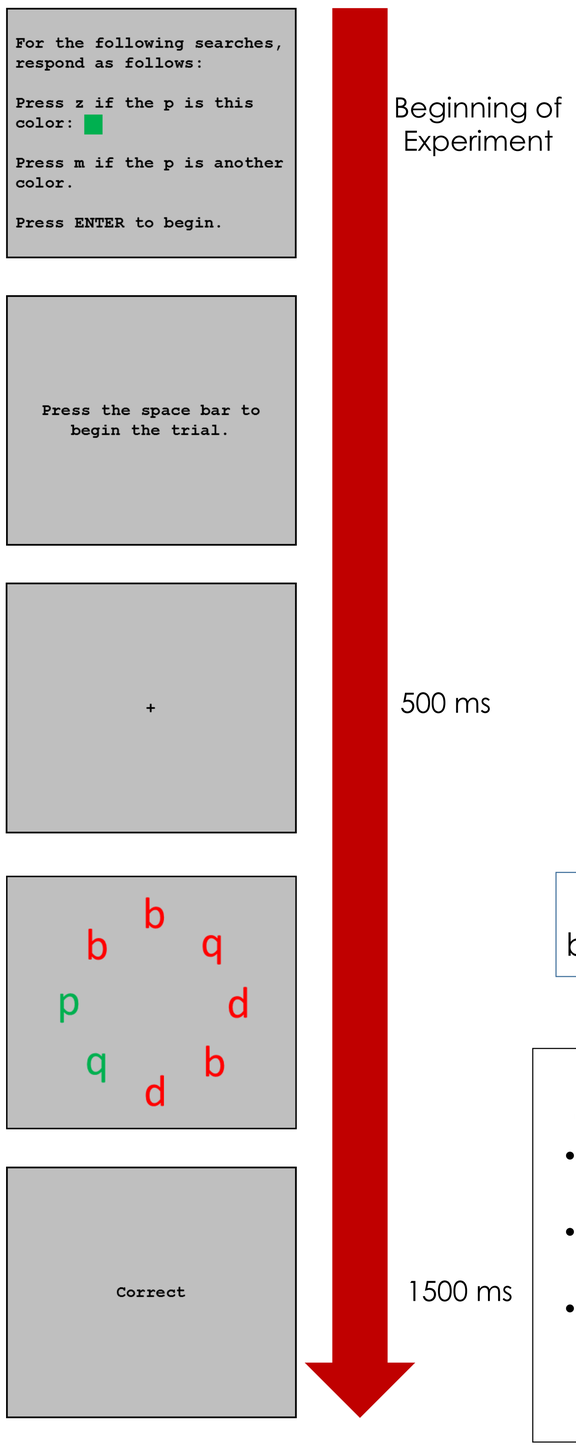
Confirmation Bias in Visual Search

Rajsic, Wilson, and Pratt (2015) found that people use a "confirmatory," template-matching strategy in simple visual search for colored letters:

1. The fastest strategy is to search through the fewest letters, regardless of their color (e.g., if only 2 are green, just look at greens). A target is always present, so use process-of-elimination if necessary.
2. People fail to do this—they simply find it easier to search for what they are cued with, even if this strategy is not always efficient. Even when explicitly told the best strategy, search RTs indicate that people primarily attend to the template-colored letters; analogous to matching bias (Evans, 1972; 1998).

Might this stubborn pattern change when template-colored targets are rare (i.e., with an unreliable initial template)?

Procedure



The Paradigm

Search for a "p" that's either green or red

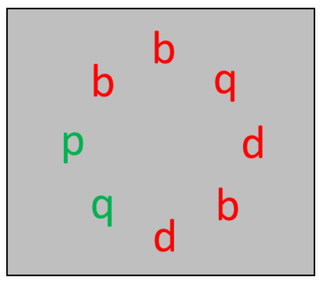
Press Z if the p is this color:

Press M if the p is another color.

Note that only the green template is mentioned

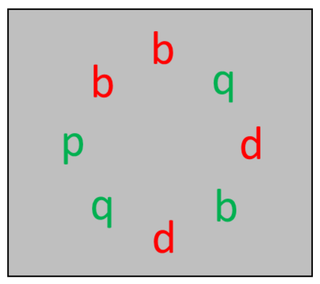
Three proportions of template-matching colors:

.25 letters match the template



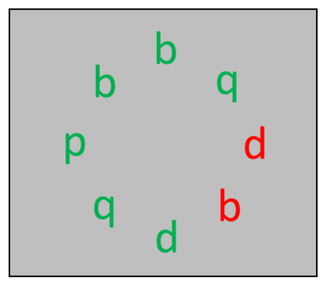
Best strategy: Only look at greens

.50 letters match the template



(No best strategy)

.75 letters match the template



Best strategy: Only look at reds

Variables

1. Prevalence Group (PG)

Proportion of trials containing template-matching targets

*Balanced: .50 match, .50 mismatch
High: .85 match, .15 mismatch
Low: .15 match, .85 mismatch

2. Target Color (TC)

Target in the display matches vs. mismatches initial template color

3. Template Color Proportion (TCP)

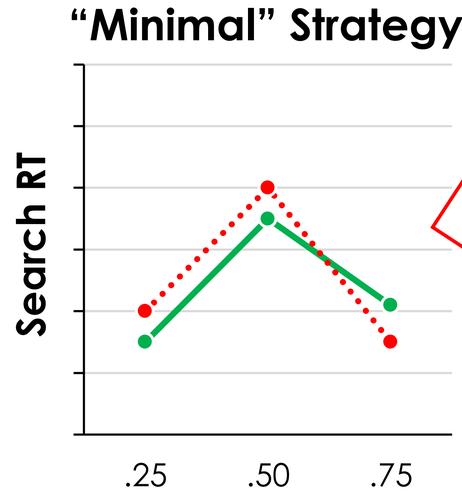
Proportion of distractors that match the template; .25, .50, and .75

*Direct replication of Rajsic, et al. (2015), Experiment 3

Potential Results

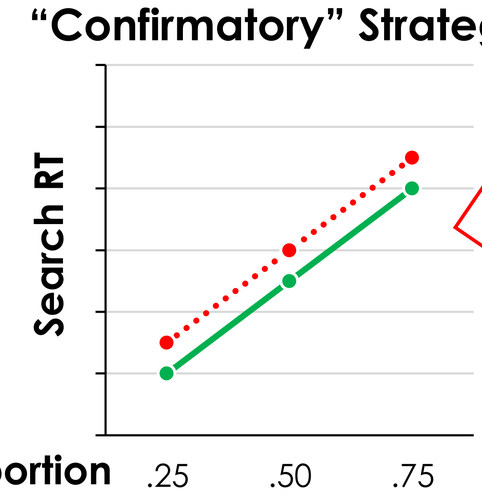
Target Color: Template Match • • • Template Mismatch

Optimal, "Minimal" Strategy



Quadratic function indicates flexible attention to minority-colored letters, tailored to the current display characteristics.

Perseverative, "Confirmatory" Strategy



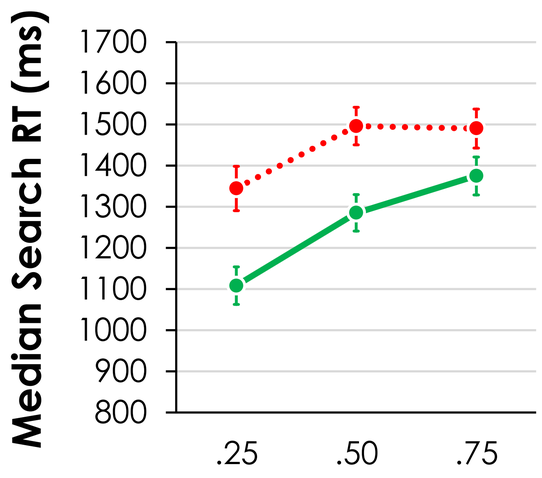
Linear function indicates "stubborn" attention to primarily template-colored letters.

Template Color Proportion

Results

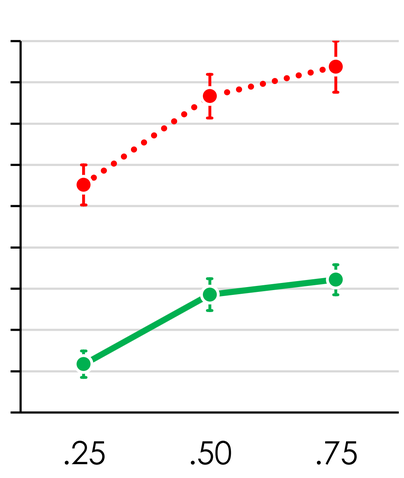
Overall main effects and interactions ($p < .05$): **TC**, **TCP**, **TC × PG**, **TCP × PG**

Balanced Prevalence



***TC**, **TCP**
Quadratic and **Linear** trends

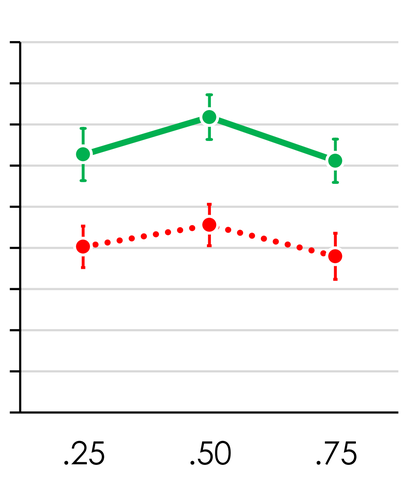
High Prevalence



Template Color Proportion

***TC**, **TCP**
Quadratic and **Linear** trends

Low Prevalence



***TC**, **TCP**
Quadratic trend

Bold indicates better-fitting trend

Conclusions

- In conditions of balanced and high template prevalence, people search for what they are shown; "matching" the initial template as their preferred mental representation to guide search (Evans, 1972; 1998; Wolfe, Cave, & Franzel, 1989).
- When this *explicit* template is unreliable, under low template prevalence, search appears to be flexible. This might suggest that they flexibly adopt "ad hoc" mental templates that match the minority color in each display.
- However, this "flexible" RT pattern likely reflects two opposing processes: (1) *template matching bias*, or the tendency to use the explicitly provided template, which is usually reliable in everyday search, and (2) *the low-prevalence effect*, in which people gradually learn to adopt the more frequent, non-cued template color to guide search (Wolfe, et al., 2005).

References

- Evans, J. St. B. T. (1972). Interpretation and matching bias in a reasoning task. *Quarterly Journal of Experimental Psychology, 24*(2), 193-199.

- Evans, J. St. B. T. (1998). Matching bias in conditional reasoning: Do we understand it after 25 years? *Thinking and Reasoning, 4*(1), 45-110.

- Wolfe, J. M., Cave, K. R., & Franzel, S. L. (1989). Guided search: An alternative to the feature integration model for visual search. *Journal of Experimental Psychology: Human Perception and Performance, 15*(3), 419-433.

- Wolfe, J. M., Horowitz, T. S., & Kenner, N. M. (2005). Rare items often missed in visual searches. *Nature, 435,* 439–440.

- For additional information and reprints, please contact Stephen Walenchok at swalench@asu.edu.