"Curing" the prevalence effect in visual search

Michael J. Van Wert [1] Todd S. Horowitz [1,2] Jeremy M. Wolfe [1,2]

Brigham and Women's Hospital [1]

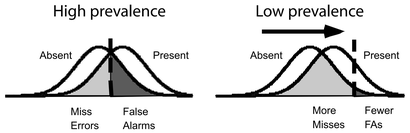
Harvard Medical School [2]

The Prevalence Effect

In many socially important search tasks (e.g., medical screening and airport security) targets are rare.

Miss error rates are 2-3 times higher at low (1-2%) target prevalence than at high (50%) prevalence (Wolfe et. al, 2007, Wolfe et. al, 2005).

This effect reflects a shift in decision criterion, rather than a loss of sensitivity (Wolfe et. al, 2007).



GOAL: To reduce low prevalence miss errors by getting observers to maintain a high prevalence criterion under low prevalence conditions

Methods

Search Task: Is a gun or knife (target) present or absent? Respond quickly and accurately

Low Prevalence: targets present in 2% of bags
High Prevalence: targets present in 50% of bags

Set Size: 3, 6, 12, or 18 items inside bags (includes non-weapon objects)

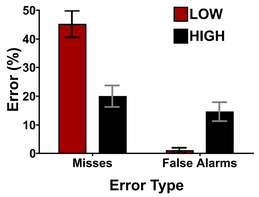
On each trial, a fixation cross and audible 'click' were followed by the appearance of a bag

The bag remained visible until observers responded

Experiment 1

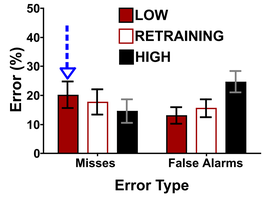
Does regular retraining erase the prevalence effect?

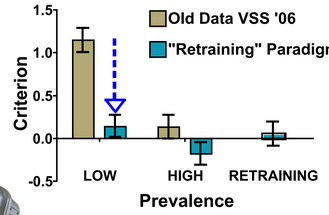
Old Data VSS '06:
Full feedback, no retraining
The Prevalence Effect!



VS.

"Retraining" Paradigm:
Limited feedback, retraining
NO Prevalence Effect!





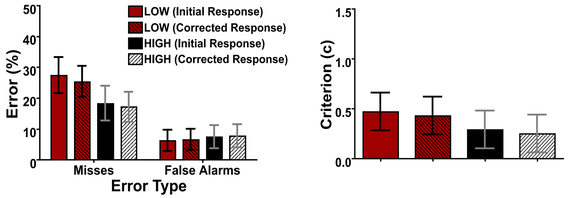
Conclusion
Does retraining erase the prevalence effect?
YES!

Experiments 2 and 3

Does a second chance to respond help?

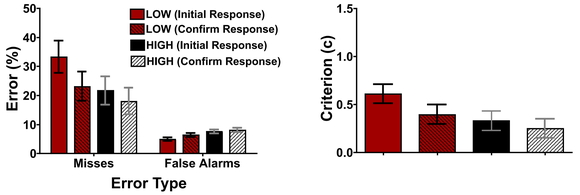
Background: Fleck and Mitroff (2007) gave Os the option to hit the 'esc' key to reverse a response after the image was gone; Os received no feedback

Experiment 2: We replicated this with our realistic bag stimuli



Prevalence effect is reduced but not eliminated

Experiment 3: We required a second response and left the image visible until response; Os received no feedback

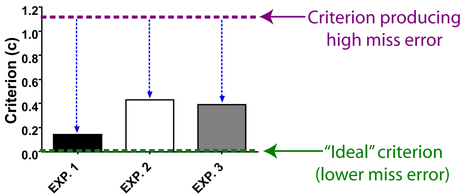


Prevalence effect is eliminated

Conclusion
Does a second chance to respond to the display cancel the prevalence effect?
YES, but more so if the bag remains visible!

Conclusions

Low Prevalence Criterion (Manipulation Conditions)



1. A) Retraining at high prevalence can help to reset criterion to a more satisfactory location

   B) Slowing the observer shows promise too

2. At low prevalence, feedback acts to increase the prevalence effect by encouraging Os to speed up and shift criterion in a direction favoring misses

3. Fortunately, a lack of feedback is characteristic of the real world low prevalence situation (e.g., baggage screening, medical screening) making these interventions plausible for field studies

References

Fleck, M. S., & Mitroff, S. R. (2007). Rare targets rarely missed in correctable search. *Psychological Science*, in press.

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For more information, contact:
mike@search.bwh.harvard.edu

http://search.bwh.harvard.edu