

# Rare threats pose cognitive challenges

Jeremy M Wolfe, PhD  
Professor of Ophthalmology & Radiology,  
Harvard Medical School

Visual Attention Lab  
Department of Surgery  
Brigham & Women's Hospital

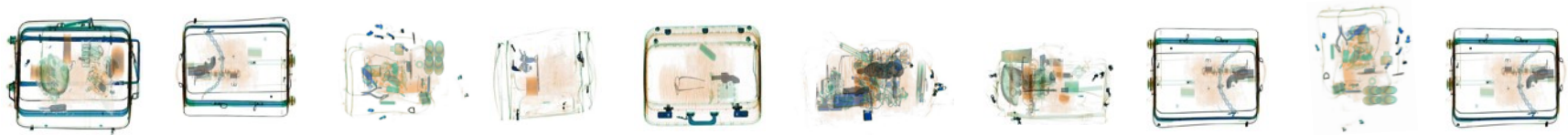


# So What? Who Cares?

- Mission: *Find and identify threats*
  - *In Intelligence, Surveillance, Screening, etc*
- Problems needing solutions
  - *Most of these threats are rare*
  - *Rare targets are missed more frequently*
  - *Need to reduce Misses without too many False Alarms*
  - *Today: I will tell you something new about prevalence effects.*
- Possible solutions include
  - *Intermittent high-prevalence retraining*
  - *Inserting cases with known truth as quality control (e.g. TIPS)*
- What is needed to make progress
  - *Access to experts to identify the problems*
  - *Basic research to identify candidate solutions*
  - *Access to experts to test solutions*

# Prevalence matters in search

Let's take 20 bags with guns and knives



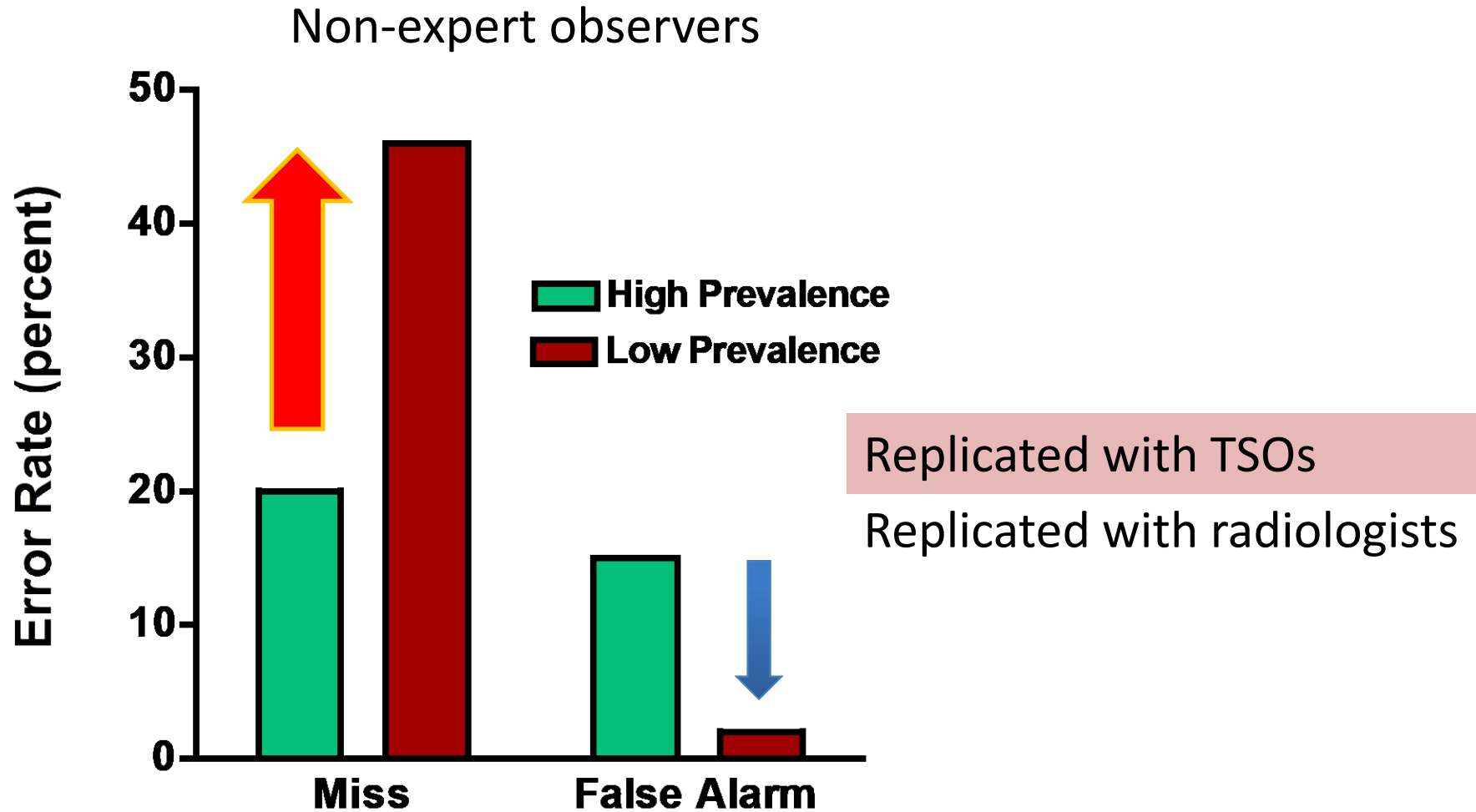
And put them in a stack of 40 bags  
50% Prevalence



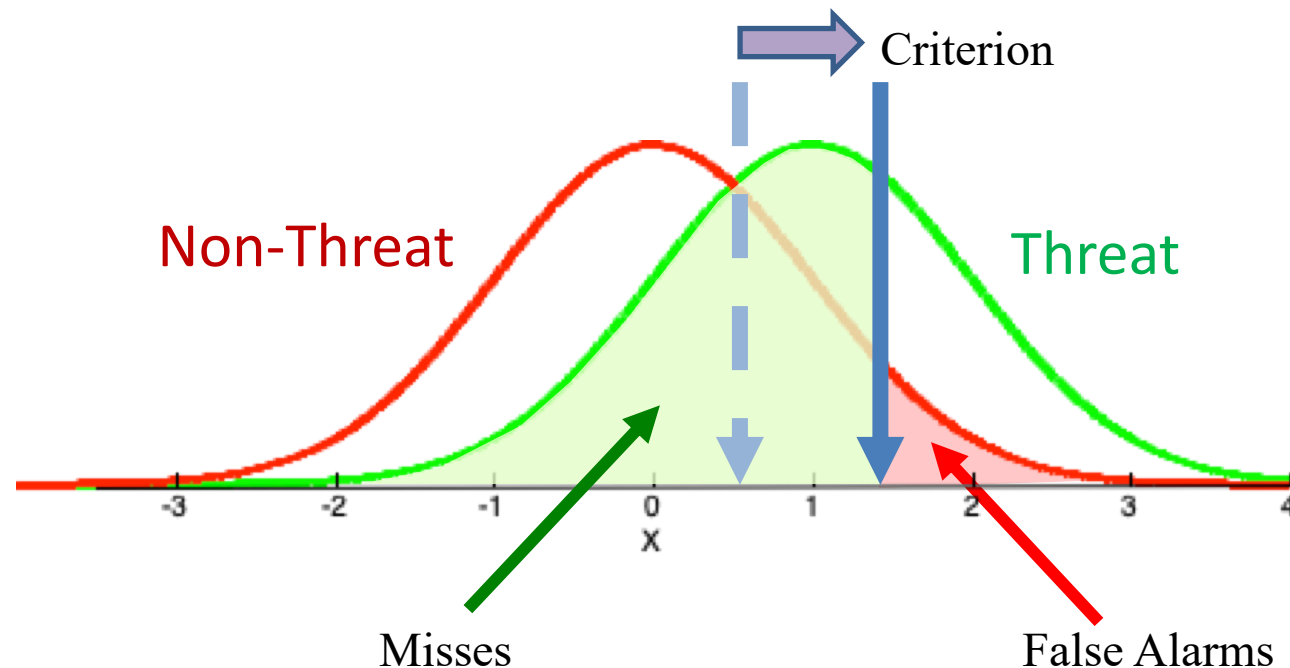
Or 1000  
bags  
2%  
Prevalence



# Miss error rates can double at low prevalence



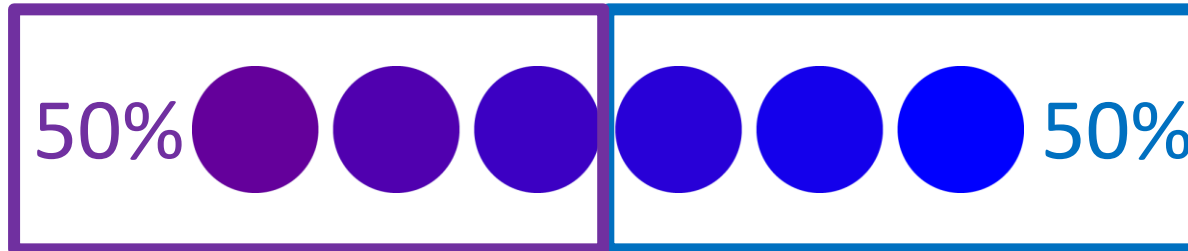
A neutral item is *less likely* to be called a target at low prevalence



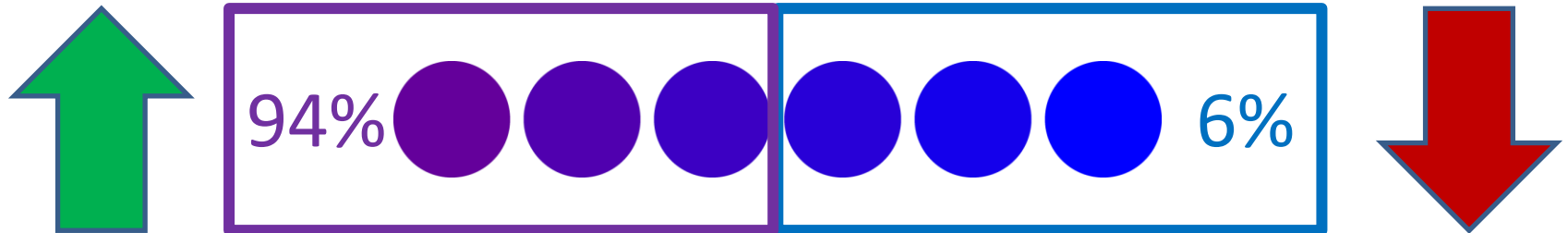
Wolfe, J. M., & Van Wert, M. J. (2010). Varying Target Prevalence Reveals Two Dissociable Decision Criteria in Visual Search. *Curr Biol*, 20(2), 121-124.

# New research: Just say if the dot is blue

Block 1 is high prevalence



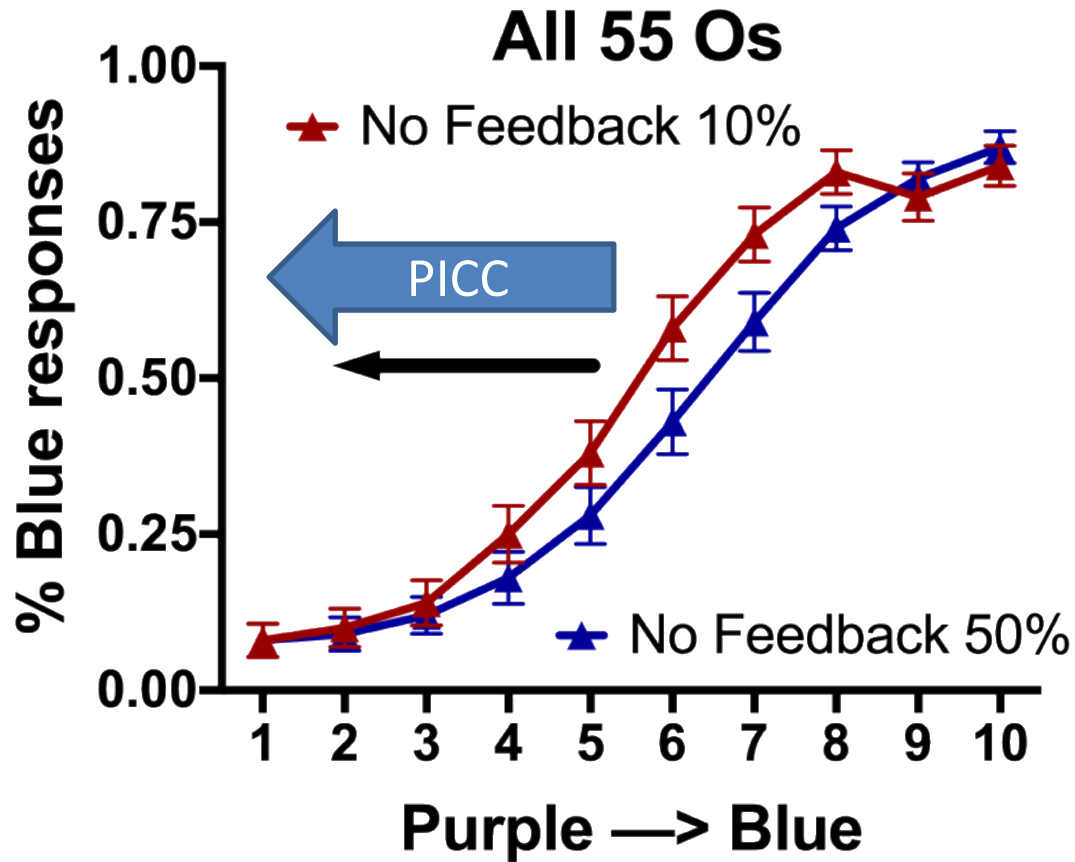
Block 2 is low prevalence



The classic result would be fewer dots would be called blue at low prevalence

Levari, D. E., Gilbert, D. T., Wilson, T. D., Sievers, B., Amodio, D. M., & Wheatley, T. (2018). Prevalence-induced concept change in human judgment. *Science*, 360(6396), 1465-1467.

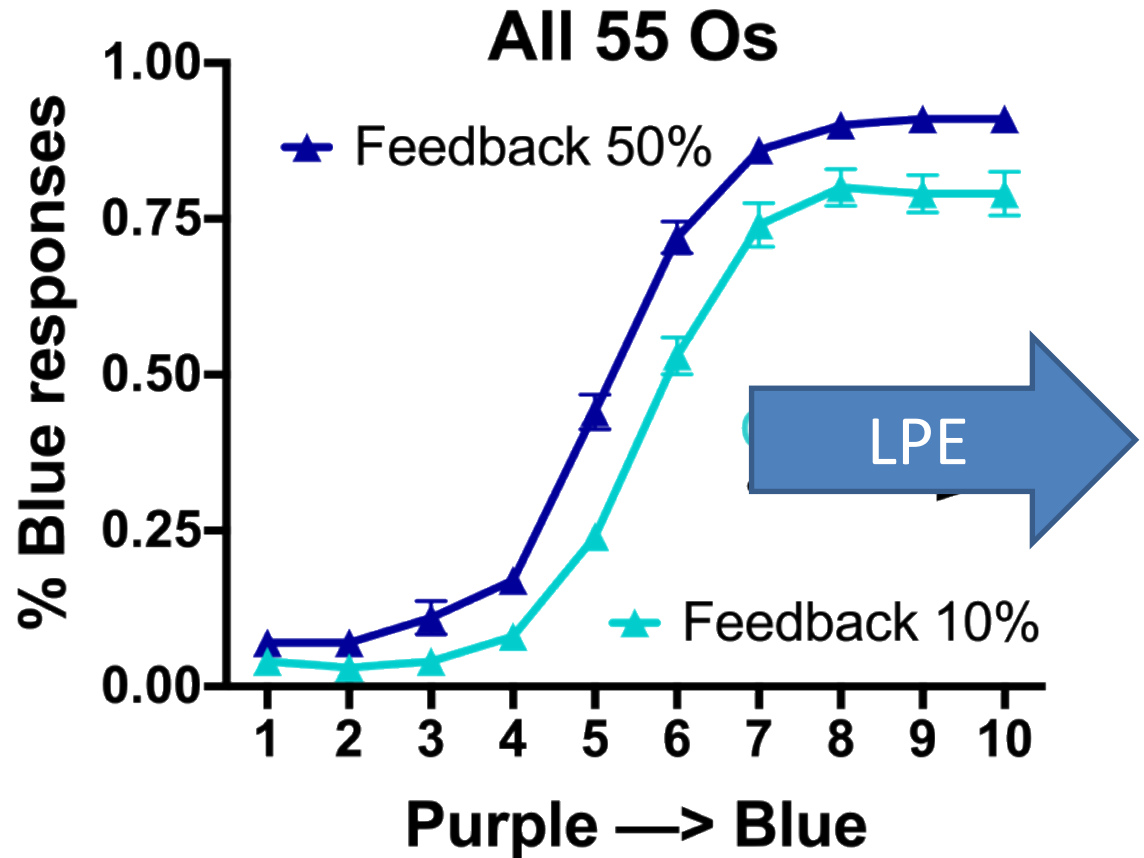
But without feedback, the result is opposite



An ambiguous item is more likely to be called “blue” at low prevalence

# With feedback, we get the classic result

An ambiguous item is less likely to be called “blue” at low prevalence





# So What? Who Cares?

- We had thought low prevalence was all about missing targets
  - *If you don't find it often, you often don't find it.*
- But there are also situations where you find too much
  - *If you don't see it often, you may broaden your definition.*
- Could be an opportunity
  - *We might be able to control the effect better.*
- Could be a problem
  - *Are there situations where searchers MISS targets and generate excess FALSE ALARMS?*