Do rare features pop out? Exploring the boundaries of the low prevalence effect

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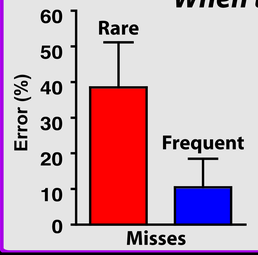
MACCS Macquarie Centre for Cognitive Science — An ARC Funded Special Research Centre

The low prevalence effect:
When targets are rare, they are often missed



Why?

Perception → Search → Decision/ Response

There is no drop in sensitivity (d') [1]

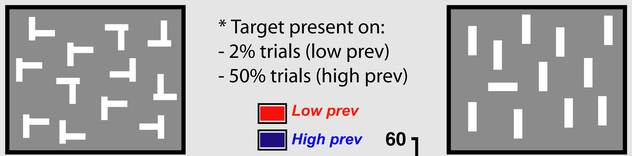
Are Os quitting too early? [1]

Is it a prepotent motor response? [2]

Expt. 1: Manipulate the search component...

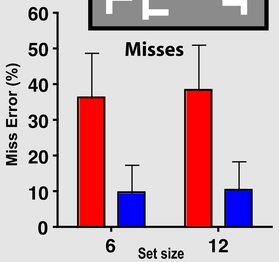
Configuration search
…both search & decision/response

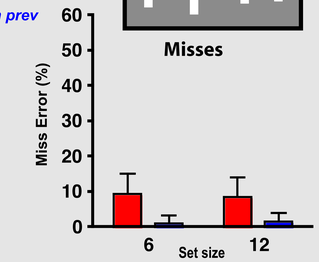
Feature search
. . .trivial search; requires only decision/response

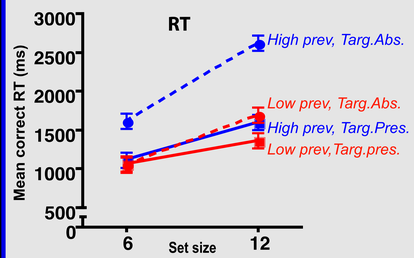


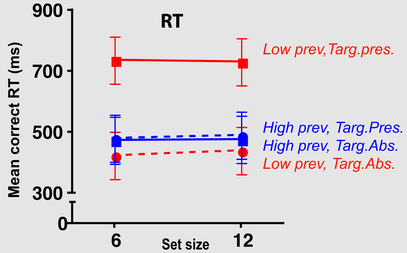
* Target present on:
- 2% trials (low prev)
- 50% trials (high prev)

Low prev
High prev









Significant prevalence effect in both search types...but different RT patterns

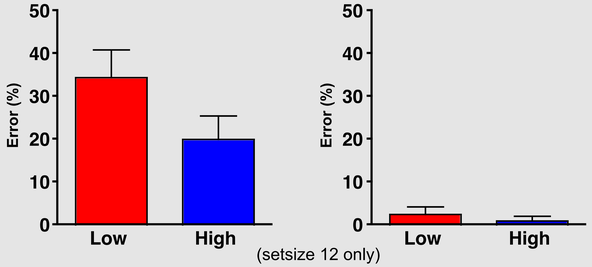
Expt. 2: Slow the response stage

Minimum exposure duration before response allowed

Configuration search
Delay = 2000ms

Feature search
Delay = 500ms

Eliminates prevalence effect *only* for feature search



Pressure of low target prevalence affects different components:
In effortful search, may alter search termination criteria
In pop-out search, low prevalence produces motor errors

Expt. 3: Remove the target-absent quitting issue

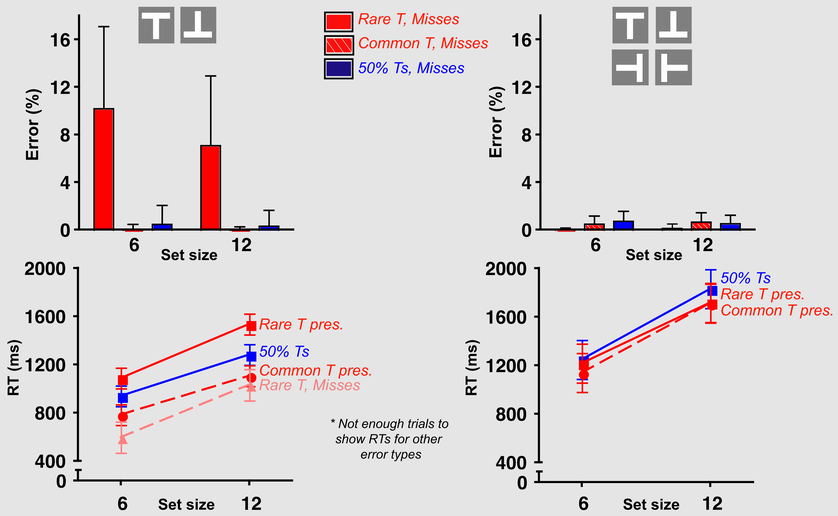
Effortful search, T always present: identify the orientation

	2 AFC:	4 AFC:
High prev:	50% upright, 50% inverted	equiprobable (25%)
Low prev:	2% one orientation, 98% other orientation	4% one orientation, other orientations equiprobable (32%)
	strong motor bias	weaker motor bias

Expt. 3 continued...

2AFC: Rare target missed more often

4AFC: No effect of prevalence



* Not enough trials to show RTs for other error types

With effortful search, if we eliminate the quitting threshold problem, the prevalence effect occurs only when there is a strong motor response bias

Conclusions

*** Low target prevalence can affect multiple components of search behaviour:**
- Effortful present/absent search :
  Change in search process (change search termination criterion)
- Easy search and/or identification task:
  Change in decision/response process (prepotent motor errors)

*** Slowing participants down only decreases the motor component**

References

1. Wolfe, J. M., Horowitz, T. S., Van Wert, M. J., Kenner, N. M., Place, S. S., & Kibbi, N. (in press). Low target prevalence is a stubborn source of errors in visual search tasks. *Journal of Experimental Psychology: General.*
2. Fleck, M. S., & Mitroff, S. R. (in press). Rare targets rarely missed in correctable search. *Psychological Science.*

Acknowledgements

ANR is supported by the National Health & Medical Research Council (Australia) & the Menzies Foundation (Australia). Special thanks to Dr. Todd Horowitz.

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