



CREST GUIDE: DETECTING RARE TARGETS

This guide presents an overview of some of the difficulties in finding hidden targets.



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COMMON VS RARE TARGETS

It is more difficult to detect rare targets than common targets. Low target prevalence leads people to search less persistently for evidence of the target before deciding that it is absent.

When the detection task requires search through multiple objects, the behaviour demonstrated is that (a) observers often look at but fail to identify the rare target, when present, and (b) observers are more likely to look at each object in the display only once, if at all. Both of these behaviours raise the likelihood of missing the target when it is present.

This doesn't occur simply because observers are generally prepared to say no target is present. Researchers have shown this by asking observers to search for two targets where one is substantially more common than the other, which raises the overall likelihood of responding that a target is present compared

to the situation of searching for only the rare target. In this scenario, where on any trial either no target is present or one of the targets is present, searchers still have a tendency to miss the rarer target.

TARGET PREVALENCE

The expectation of how likely it is that a target will appear builds up slowly over experience with the detection task. Long-term history of target likelihood is more influential than what has happened on recent trials or what is predicted to happen. Performance can be affected by the length of time spent on a detection task.

However, research suggests that target prevalence does not have an effect on whether time-on-task affects performance. In addition, when time-on-task does affect performance, this effect is not varied by target prevalence.

WHAT IMPROVES PEOPLE'S ABILITY TO DETECT RARE TARGETS

People are influenced by target prevalence regardless of their professional experience and amount of training. One individual difference in cognitive ability appears to partly mitigate the effect of target prevalence: working memory capacity. People who can hold more in mind at one time show less effect of target prevalence than those with lower working memory capacity.

An effective method to help observers deal with target prevalence is to change the prevalence of the target. In airport search

In other domains it may not yet be possible to create TIPs that look real enough to improve the perceived target prevalence. If TIPs do not look like the real rare targets but observers are expected to detect them, their inclusion in images effectively increases the number of targets that observers must seek, which is counter-productive. Where TIPs are realistic, they are generally inserted fairly randomly during search. However, short bursts of multiple TIP trials further apart in time works just as well.

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of X-ray images of luggage, for instance, a technique is used whereby images of rare threat objects are artificially superimposed on a subset of images of real bags. This technique is called Threat Image Projection, or TIP.

Using TIP increases the target prevalence that security officers perceive, thereby maintaining their persistence in searching for targets that are actually quite rare.



READ MORE

Hayward Godwin, Tamaryn Menneer, Kyle Cave, Shaun Helman, Rachael L Way, and Nick Donnelly. (2010). The impact of Relative Prevalence on dual-target search for threat items from airport X-ray screening. *Acta Psychologica*, 134(1), 79–84. <http://doi.org/10.1016/j.actpsy.2009.12.009>

Jeremy M Wolfe, Todd S Horowitz, and Naomi M Kenner. (2005). Cognitive psychology: rare items often missed in visual searches. *Nature*, 435(7041), 439–440. <http://doi.org/10.1038/435439a>

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