



How do distractors distract in multiple object tracking?

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Question: What is the effect of distractors on tracking?

Humans can track multiple independently moving targets among identical distractors (for a review, see [1]). The role of distractors is poorly understood. Do they simply serve as foils, which might be inadvertently tracked? Or does suppressing distractors demand resources? Contextual cueing studies suggest that distractors may be at least processed [2; but see 3]. Dual task probe studies argue that distractors are suppressed [4,5; but see 6].

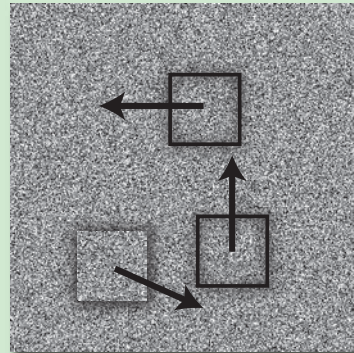
Methodological problem

We needed a tracking task that can be done with and without distractors; i.e. identifying targets at the end is not trivial in the absence of distractors.

Methodological solution

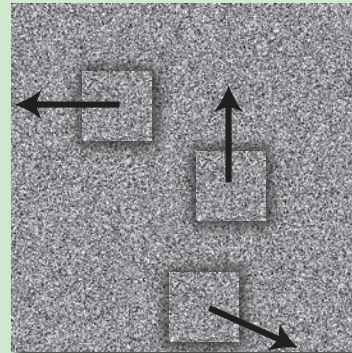
Objects were patches of pixel noise moving against a background of pixel noise drawn from the same distribution. Objects were only visible when in motion.

cue phase



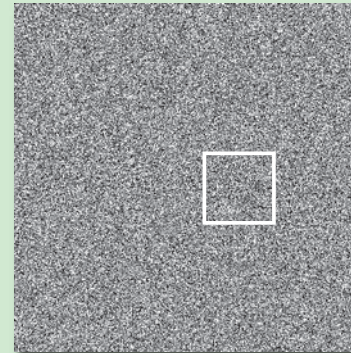
Targets were designated by black frames as they move for 1 s. Distractors (if present) were not framed. Note that drop shadows are for illustration only.

tracking phase

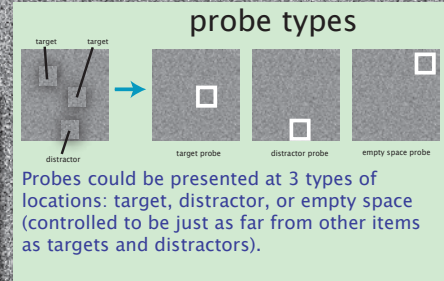


All objects moved for a variable duration (mean = 5 s).

probe phase



After 200 ms, a single stationary white probe frame was presented. The observer indicated whether or not the frame was presented at a target location.

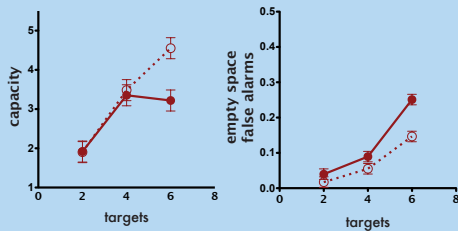


capacity
Capacity was measured with Cowan's k [7], based on hits and correct rejections.

empty space probes
We assume that false alarms (FAs) to distractors represent both tracking errors and attentional lapses, while FAs to empty space probes represent only lapses. If distractors affect performance only by being mistaken for targets, then empty space FAs should be constant whether or not distractors are present.

1: Is there an effect of distractors? yes!

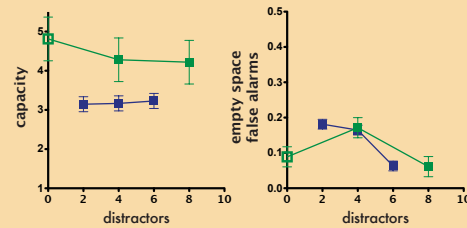
Observers tracked 2, 4, or 6 targets, with either an equal number of distractors (filled circles), or no distractors (open circles).



The presence of distractors reduced tracking capacity... and increased false alarms to empty space.

2: Does the number of distractors matter? no!

Observers tracked 4 (filled squares), or 6 (filled triangles) targets, while we varied the number of distractors.

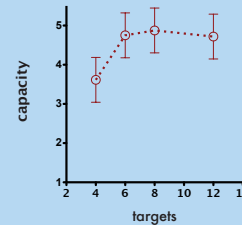


Capacity was constant as the number of distractors increased. If anything, FAs to empty space probes decreased, at least at low tracking load.

3: Can we "unmask" the capacity limit if there are no distractors? no!

Distractors reduced capacity in experiment 1. We hypothesized that removing distractors would double capacity.

Here, observers tracked 4, 6, 8, or 12 targets with no distractors.



Capacity reached an asymptote at approximately 5 items.

Conclusions

Distractors do not simply act as foils, but require additional resources to suppress.

However, these are not resources which could be used to track targets (e.g. "FINSTs")

Multiple object tracking requires more than simply tracking targets!

References

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7. Cowan, N., The magical number 4 in short-term memory: a reconsideration of mental storage capacity. *Behavioral and Brain Sciences*, 2001, 24(1): p. 87-114; discussion 114-85.

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