Capture and Control in Visual Attention

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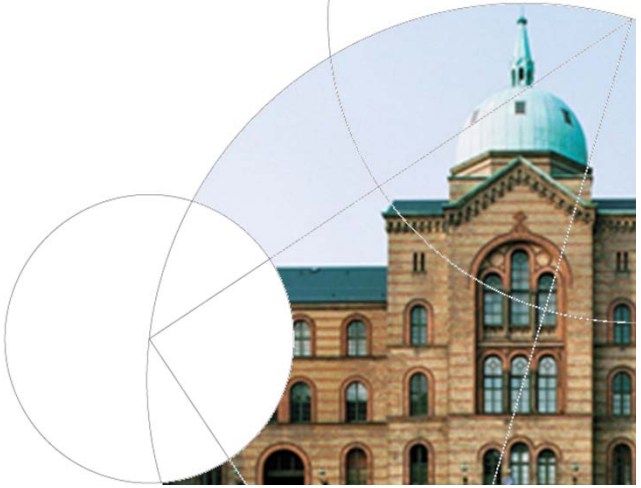
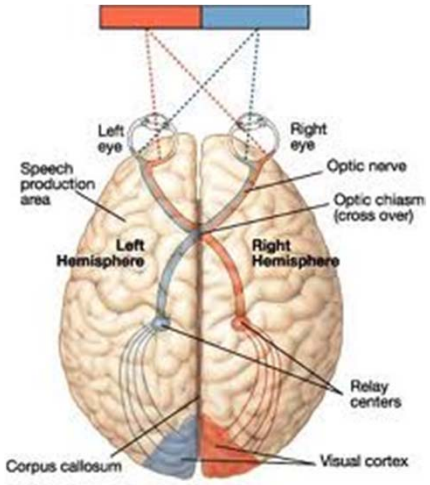


Selection of information



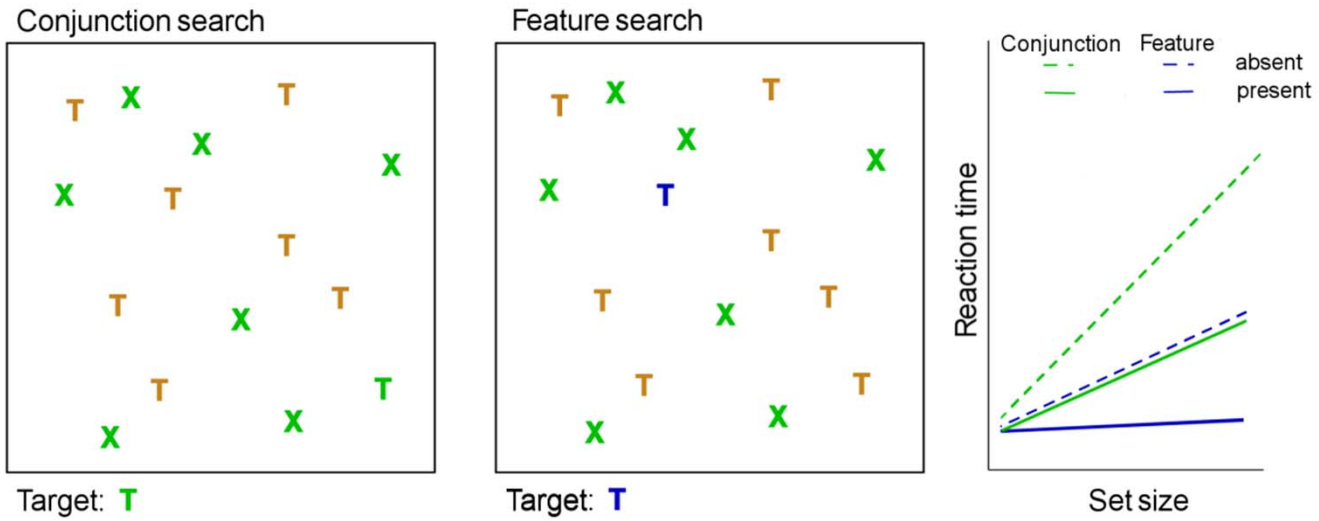
What happens when people *are* paying attention?

Change blindness

O'Regan, Rensink & Clark, 1998

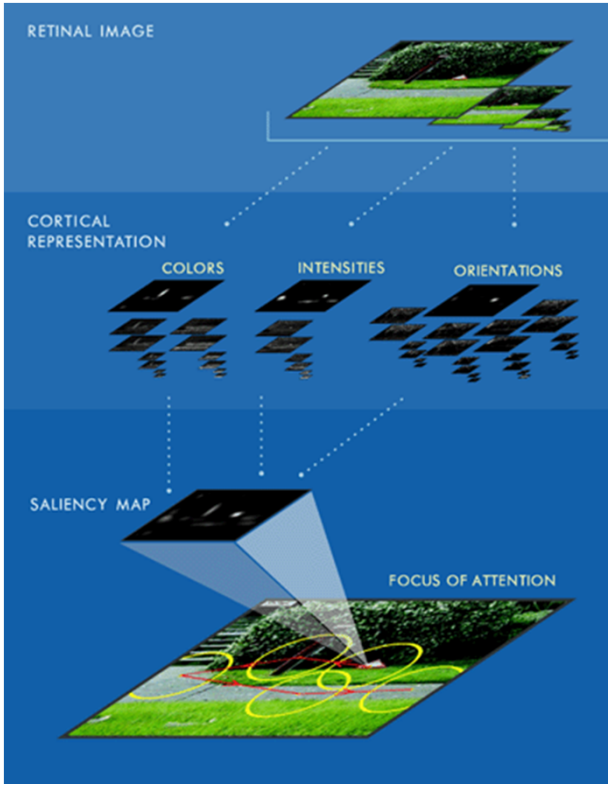
Not all objects in our field of vision are encoded into the visual short term memory (i.e. not all objects are noticed).

Feature versus conjunction search

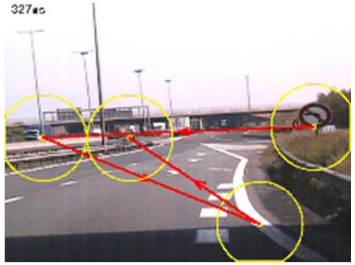


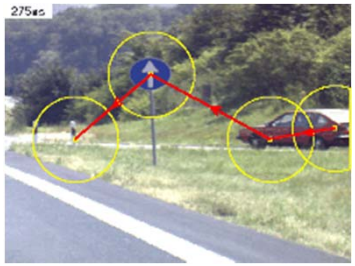
Feature Integration Theory, Treisman & Gelade, 1980

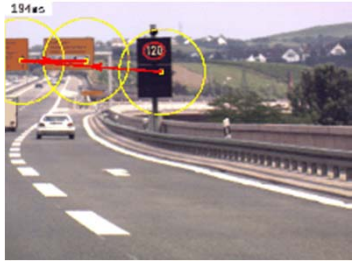
Saliency maps



Itti & Koch, 2000

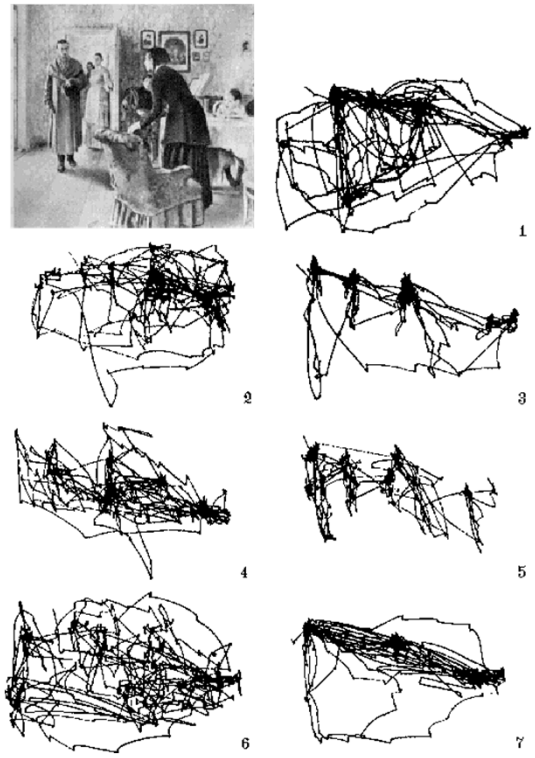






Saliency models do not accurately predict where we look

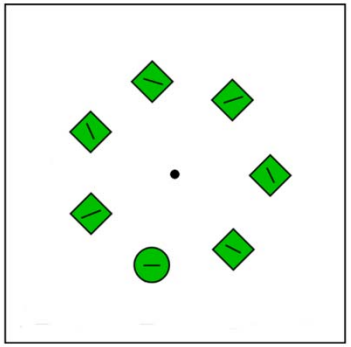
Foulsham & Underwood, 2008



Yarbus, 1967

Attentional capture

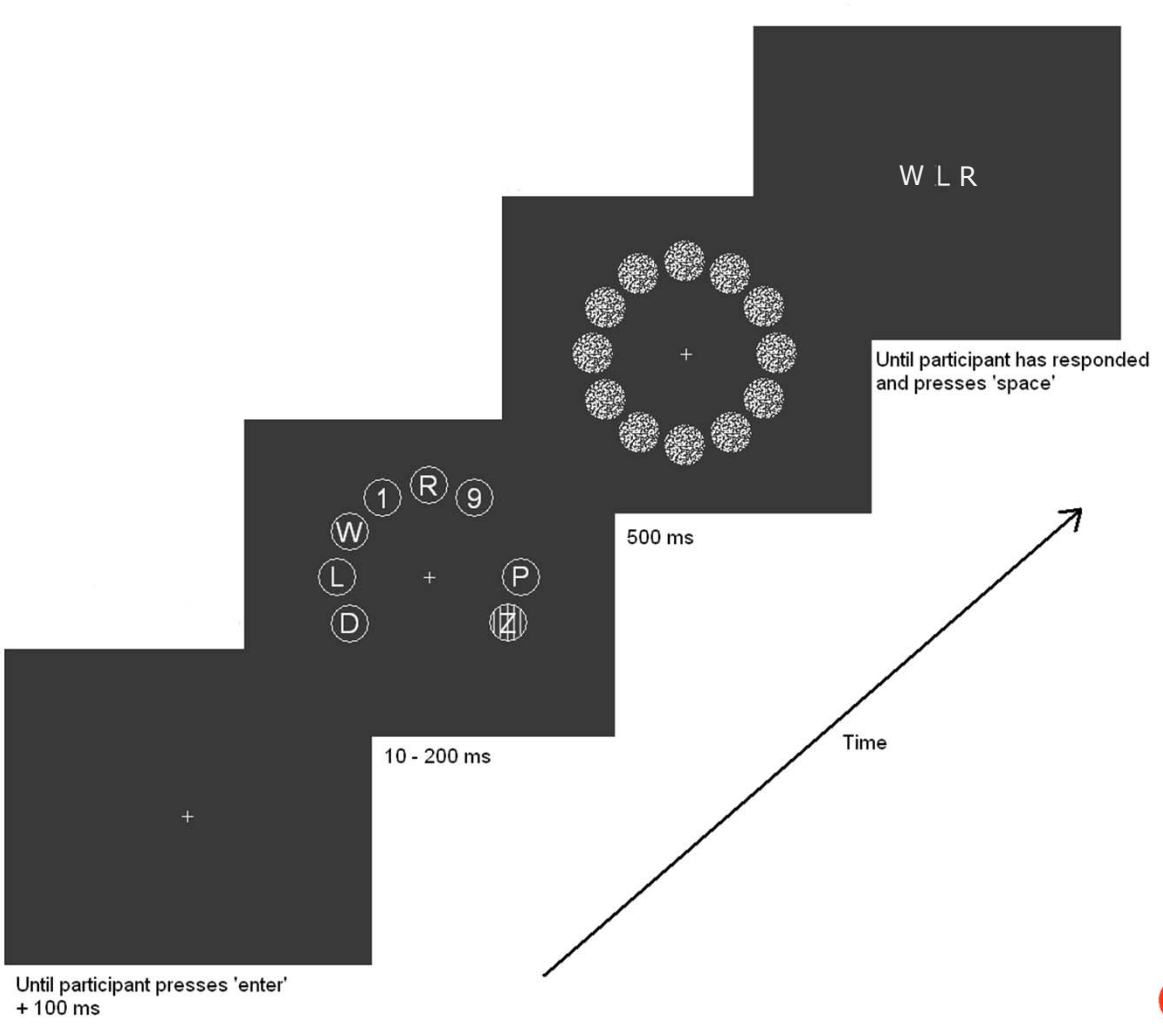
What happens when conspicuous ≠ relevant



Additional singleton paradigm, Theeuwes, 1991, 2010

New approach

Irrelevant singleton paradigm with short exposure durations

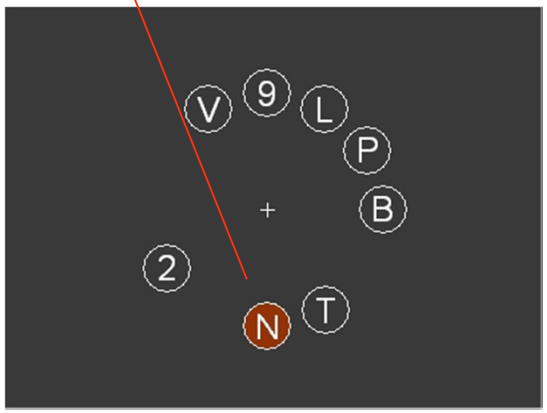


Experiment design

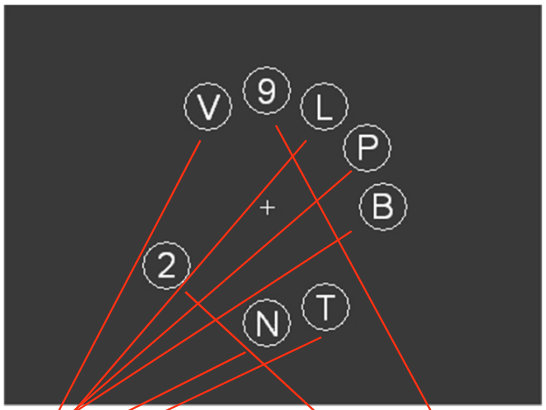
3 display sizes (6T; 6T 2D; 6T 4D)
6 exp.dur (10-200 ms)

10 participants
3600 trials pr. participant (4 sessions)

Singleton target

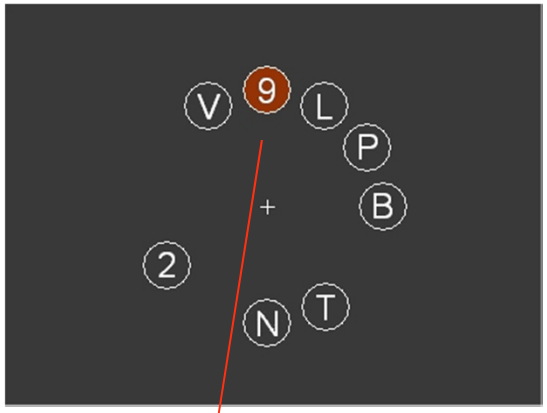


Baseline display



Nonsingleton targets

Nonsingleton distractors



Singleton distractor

Expected results

If attention is completely dependent on physical properties of the stimuli:

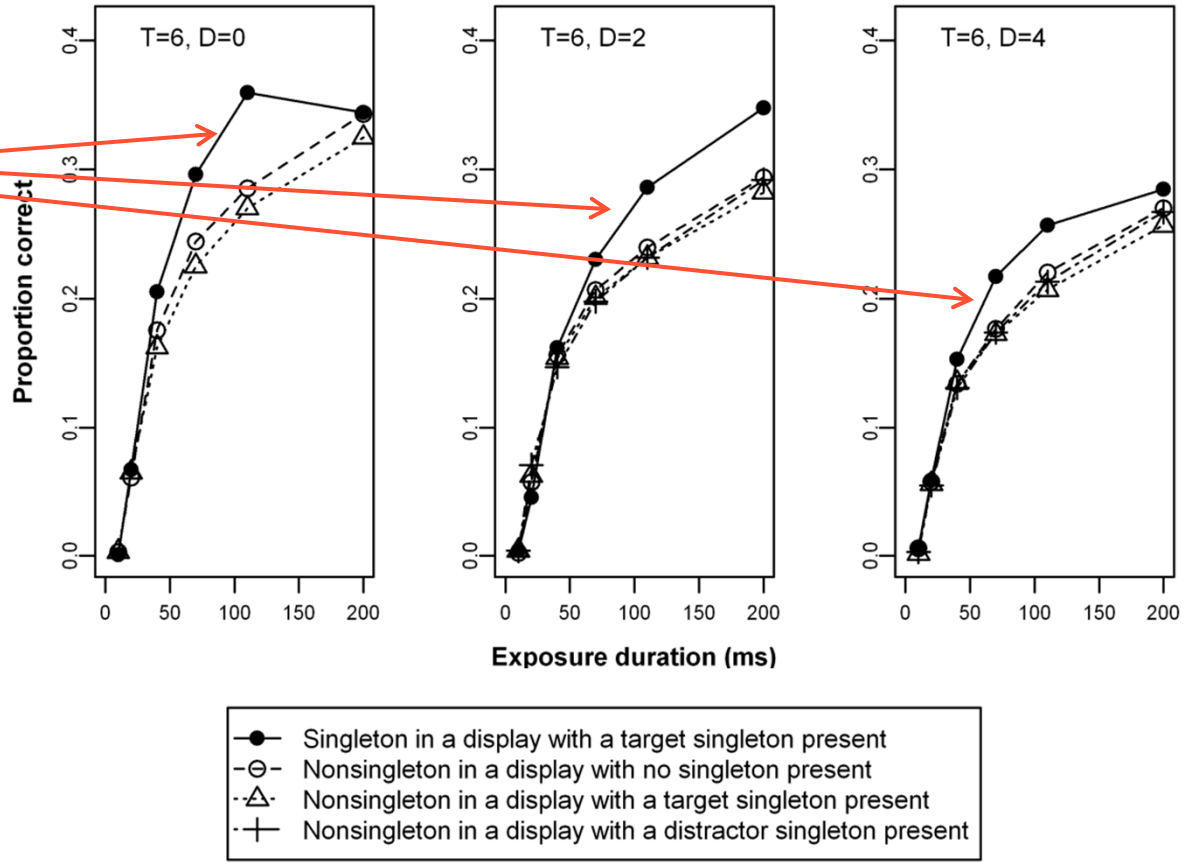
- Less target elements encoded when a distractor singleton is present
- Faster encoding of target singleton, i.e., higher probability of encoding a target singleton
- Equal attentional weights for targets and distractors

If attention is completely dependent on the observer's goals:

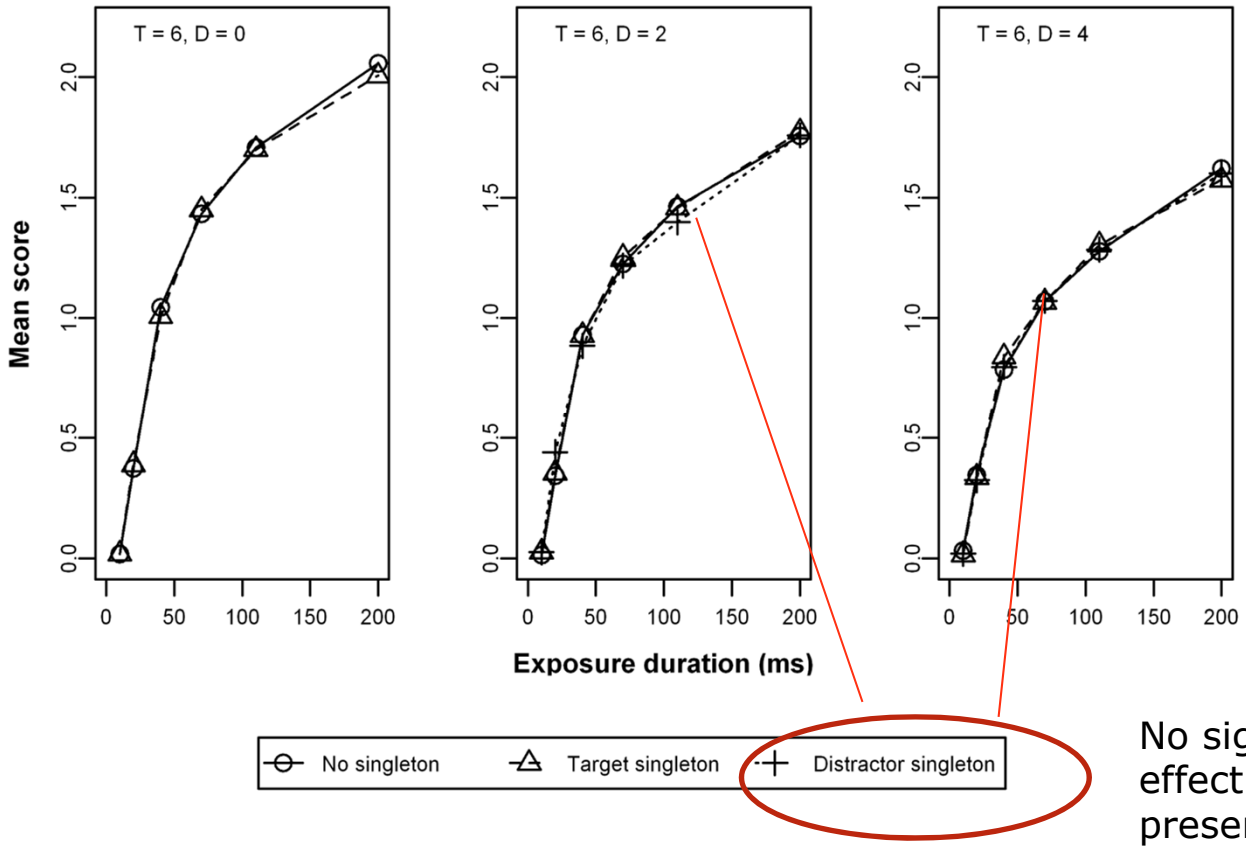
- No effect of neither distractor nor target singleton presence
- Higher attentional weights for targets compared with distractors

The probability of correctly reporting the different target types

Color singleton targets are reported with a higher probability than non-singleton targets

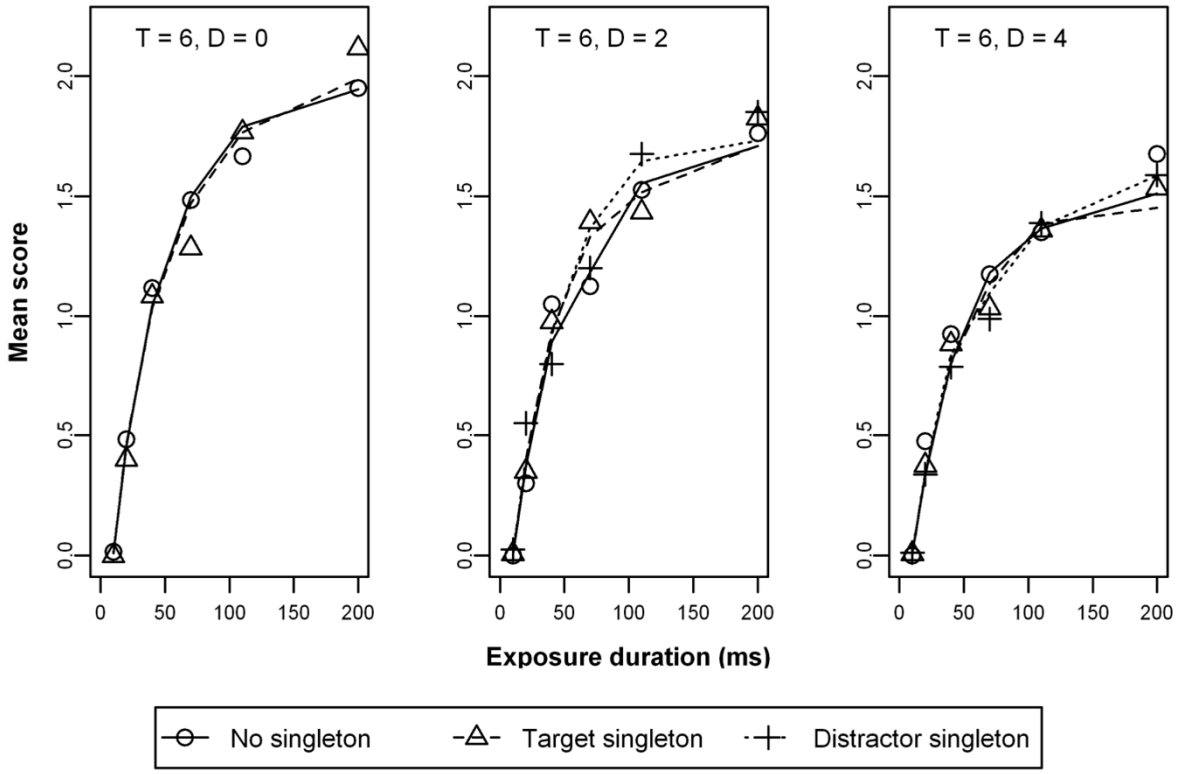


Mean number of correctly reported targets



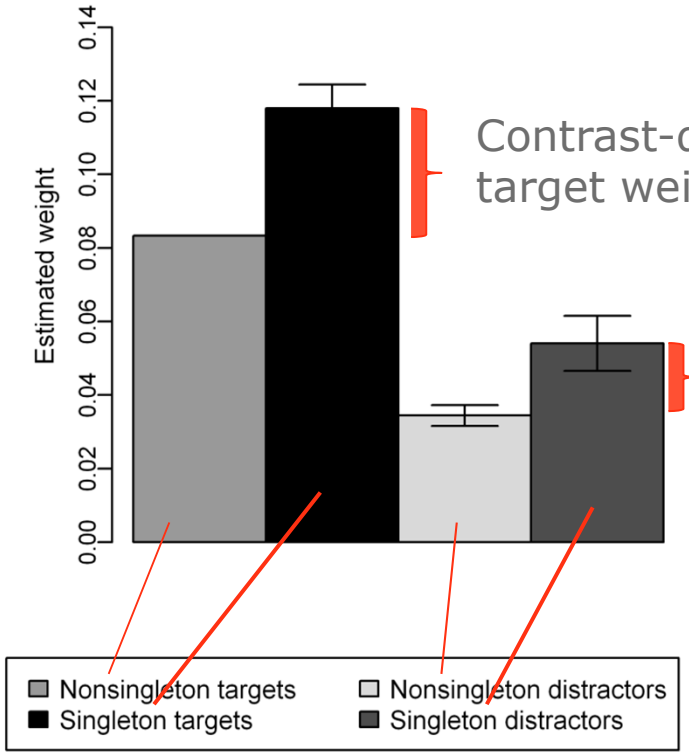
No significant effect of the presence of a distractor singleton

Model fits



Bundesen's (1990) Theory of Visual Attention (TVA)

Estimated attentional weights

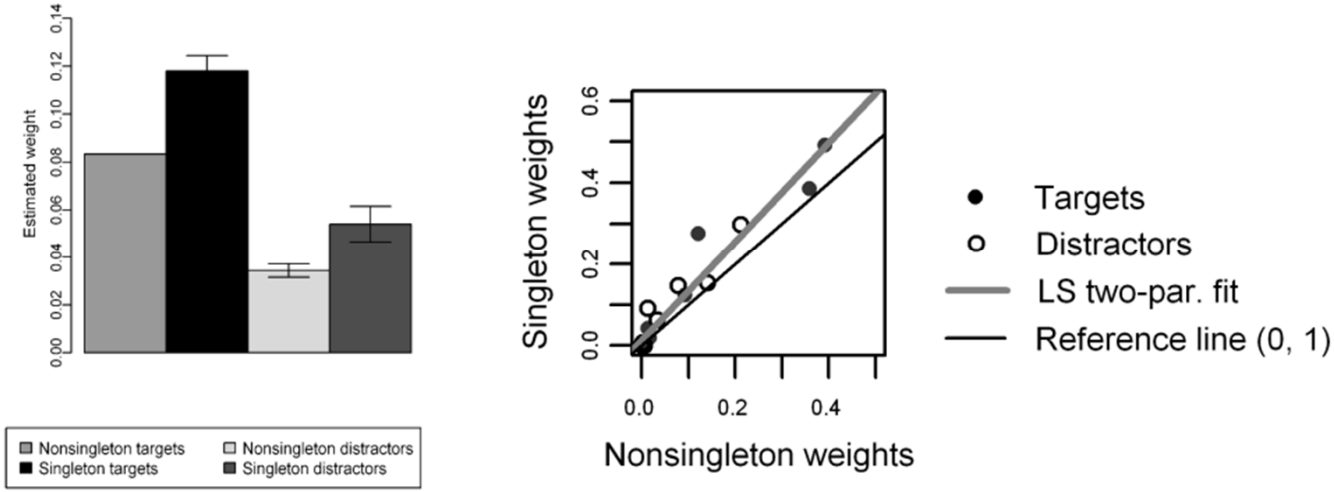


Contrast-driven increment in target weights

≠

Contrast-driven increment in target weights

Multiplicative relationship between singleton and nonsingleton weights



$$Weight_{singleton} = K * Weight_{nonsingleton}$$

Capturing driver attention is not only a question of conspicuity

It is necessary to investigate the top-down goals of the observers
- also when they *are* paying attention to the traffic ahead

More research questions:

- Can the interactive relationship between top-down and bottom-up signals be measured in naturalistic scenes?
- What happens when a strong bottom-up signal is always irrelevant to the task?
- How do we manipulate top-down settings in a traffic situation?
- Is there a difference between static features and dynamic features – abrupt onsets appear to be critical

Thank you for your attention!

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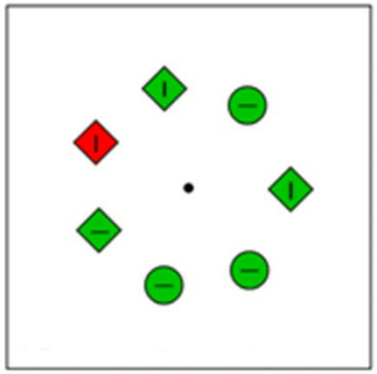
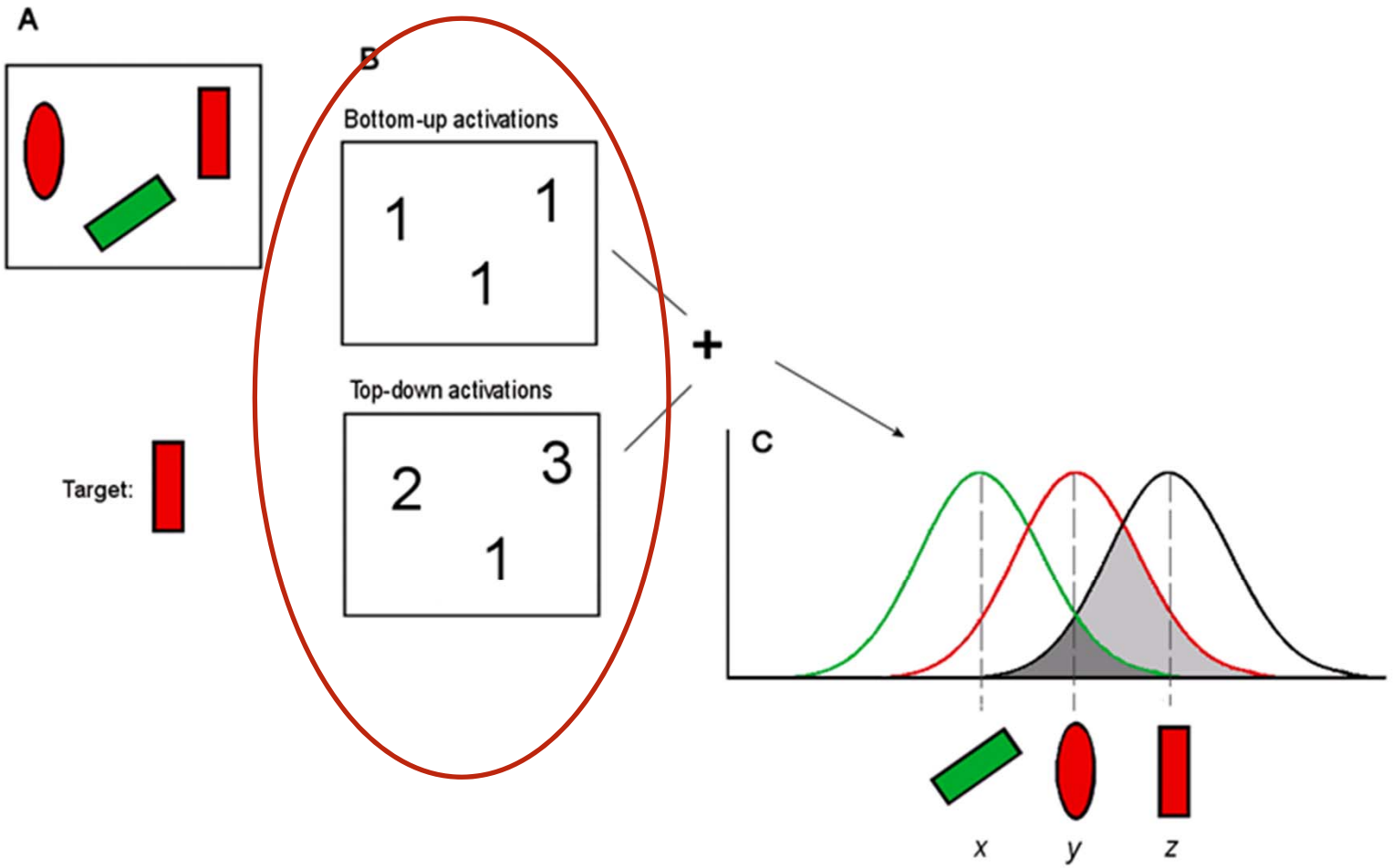
Contingent capture

The additional singleton only captures attention when the object is relevant to the current task

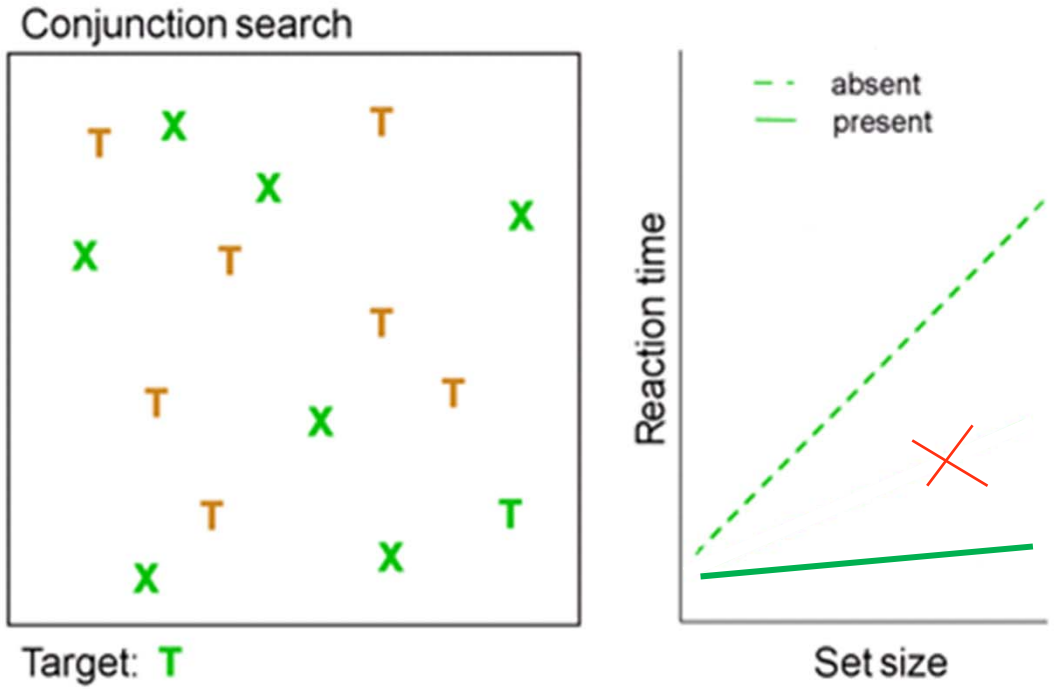


Bacon & Egeth, 1994; Folk Remington & Johnston, 1992, 1994

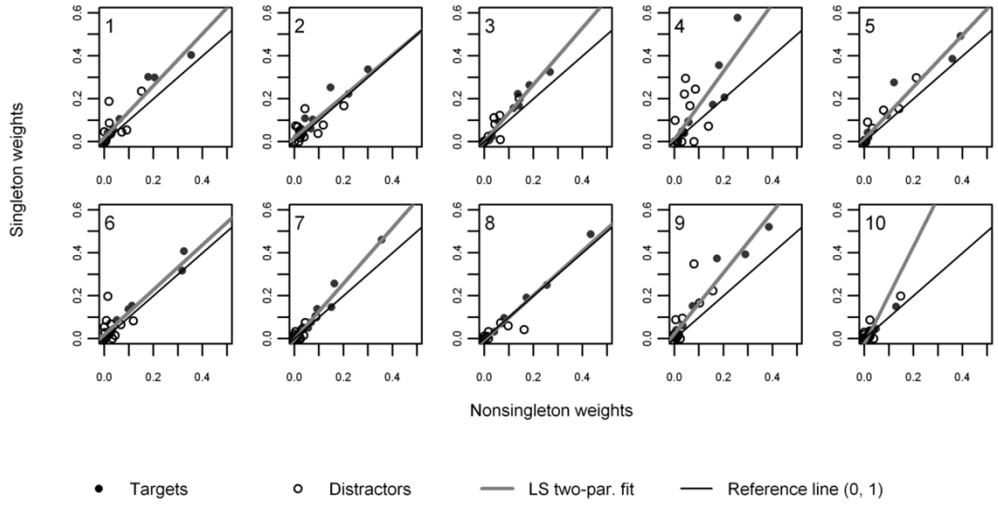
Guided search Wolfe, 1994, 2007



Bottom-up determined search at a glance?



= relevance guided attention


Singleton weights
Nonsingleton weights
1
2
3
4
5
6
7
8
9
10
Targets
Distractors
LS two-par. fit
Reference line (0, 1)