

# **ATTENTION**

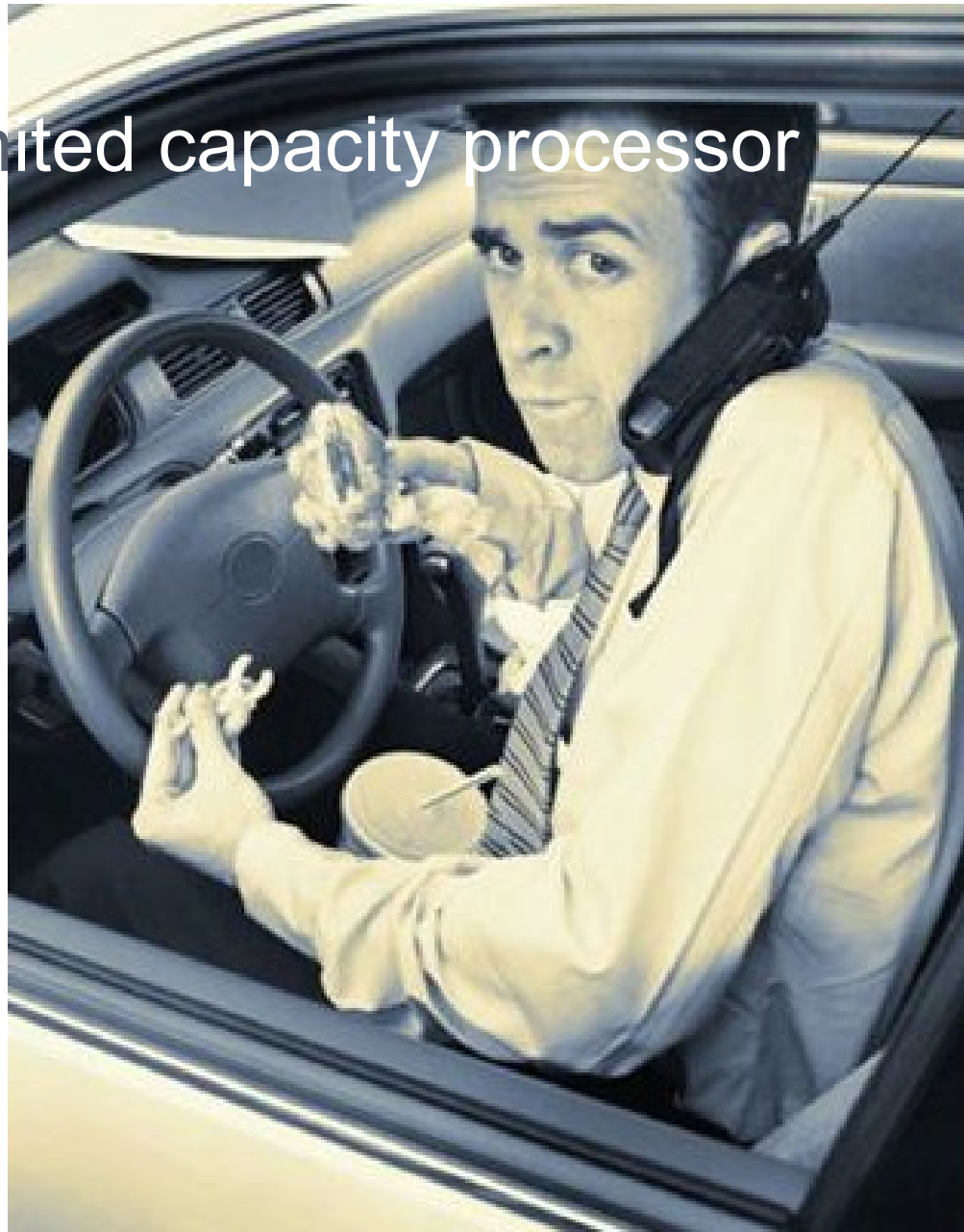
**Michaela Porubanova**

## WILLIAM JAMES (1890)

- Everyone knows what attention is. It is the taking possession of the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalisation, concentration, of consciousness are of its essence.



Attention as limited capacity processor



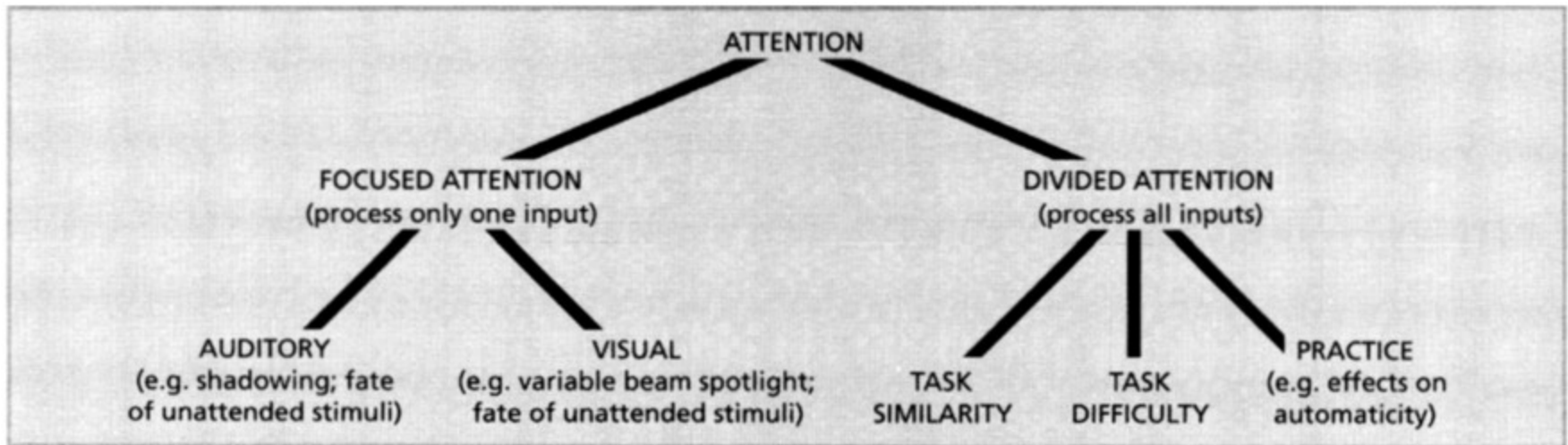
# INTRODUCTION TO ATTENTION

- After behaviorism
- selectivity of processing
- Content vs. span
- Baars- connection between A and consciousness
- : “We look in order to see” / “We listen in order to hear”
- W. James: active and passive models of attention (bottom-up vs. top-down)
- Covert versus overt attention
- G.E.Miller –  $7 \pm 2$ , chunks



# FOCUSED VS. DIVIDED ATTENTION

unitary attentional system?



# RESEARCH ON ATTENTION

- Disadvantages of laboratory experiments on attention:
  - - separation of external and internal stimuli
  - - only environmental stimuli
  - - disregard of „internal motivation“, but rather task specificity
  - - 2 D images



,  
COCKTAIL PARTY EFFECT,  
Colin Cherry (1953)

- Focused auditory attention
- The ability to tune our **attention to just one voice** from a multitude
- As at a party....
- <http://www.youtube.com/watch?v=INv4v3KQJRA>



# Dichotic listening versus shadowing task

- Shadowing task= listening to two messages but attending to only one (repeat out loud)
- Simultaneous listening to 2 messages (nonsensical or by the same speaker)= dichotic listening
- Broadbent (presenting two rows of digits)
- But unattended message:
  - could not identify a single phrase from the speech presented to the rejected ear.
    - weren't sure the language in the rejected ear was even English.
    - failed to notice when it changed to German.
  - mostly didn't notice when the speech to the rejected ear was being played backwards (though some did report that it sounded a bit strange).
- But! Gender change, tone → speaker change





# DICHOTIC LISTENING

- <http://www.youtube.com/watch?v=NCIuZGsSmII>
- Broadbent:
- First message has dominance for processing, later one processed after → preventing the system overload
- Role of expertise
- Similarity of inputs deteriorates the performance



# THEORIES OF ATTENTION

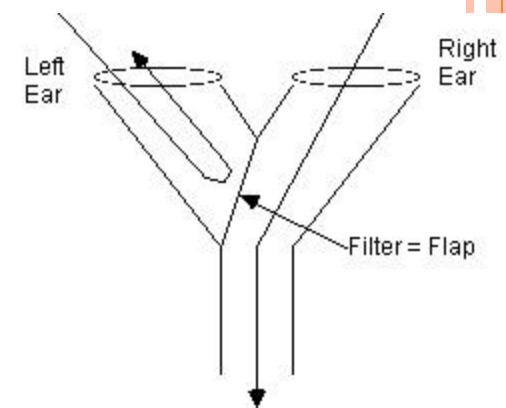
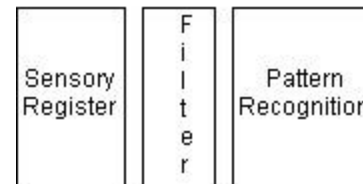
- Broadbent (1958)
- Treisman (1960)
- Johnston and Heinz (1978)



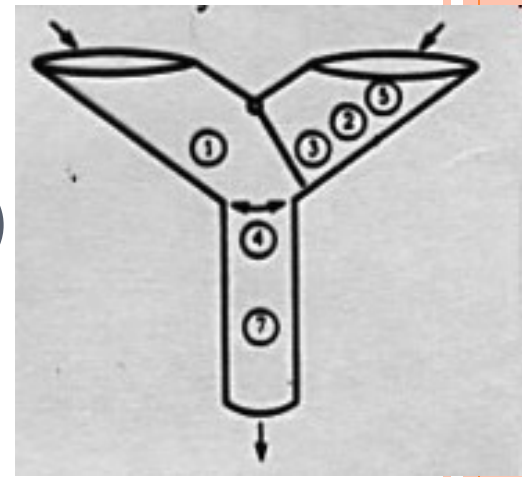
# BROADBENT'S FILTER THEORY

- Inspired by divided auditory attention research
- Attention as a filter: it prevents overloading of the limited-capacity mechanism beyond the filter
- Importance of physical characteristics of stimulus
- Unattended stimuli rejected! (untrue)
- Role of similarity of the messages

- - inflexibility of the model
- - ignorance of meaning in selective attention (no physis. charact.)

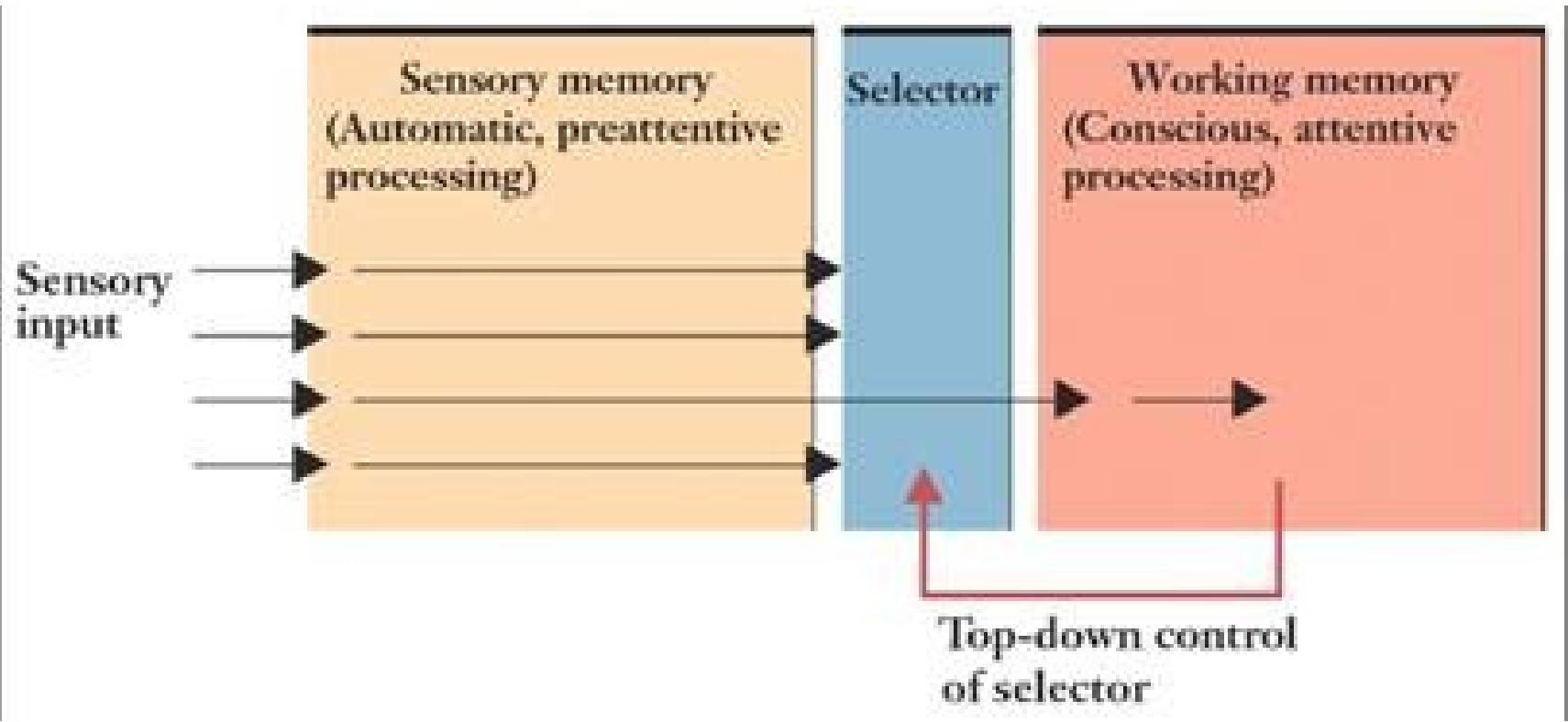


# Filter theory of attention (Broadbent)



- Sensory channels have an unlimited capacity
- There is a bottleneck allowing only one piece of information into working memory at a time.
- A selective filter allows in information from only one channel at a time.
- Information from unattended channel is completely blocked
- Time is required to switch from one channel to the next





# Treisman's attenuation model

- Messages differ in terms of their "subjective loudness". Paying attention to a message means increasing its subjective loudness.
- In the shadowing task, messages from the shadowed ear have a higher subjective loudness than messages from the non-shadowed ear.
- There is also a dictionary which contains words and concepts. Concepts in the dictionary differ in terms of the subjective loudness required for that concept to be noticed.
- Some concepts are permanently in the dictionary at a low threshold (like one's name) and some concepts are temporarily in the dictionary at a low threshold due to one's current goals.

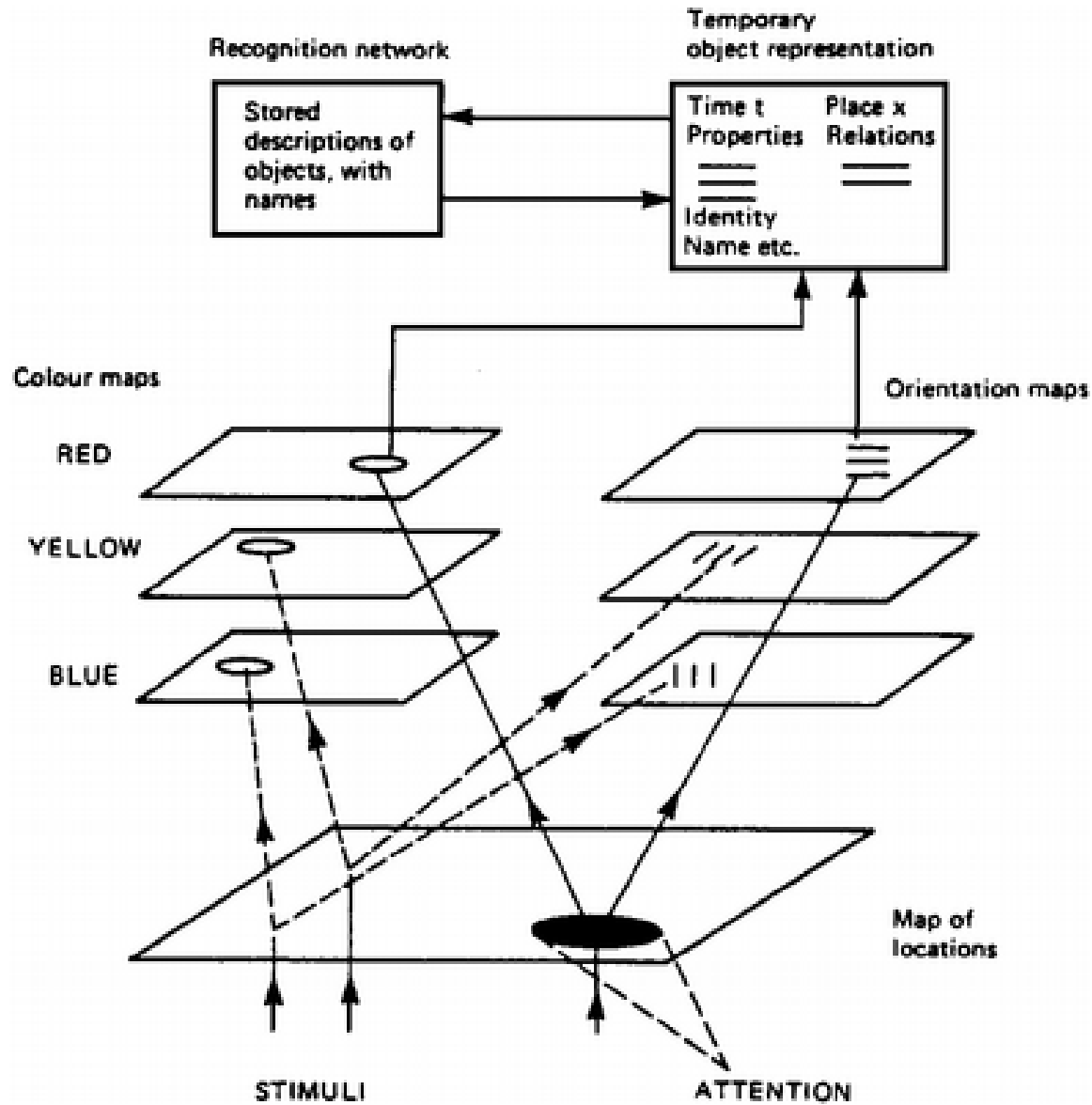


# TREISMAN



- Even some unattended stimuli were processed-  
“breakthrough”
- Context dependence on what is attended
- Levels of processing:
  - physical cues → syllabic pattern → specific words →  
→ individual words → grammatical structure → meaning
  - thresholds of all stimuli (e.g., words) consistent with current expectations are lowered
  - all stimuli are fully analyzed, with the most important or relevant stimulus having preference (Deutsch & Deutsch, 1968)









Input channels

Inputs, including attenuated inputs are passed on for semantic analysis.



# SELECTIVE ATTENTION DEMONSTRATION

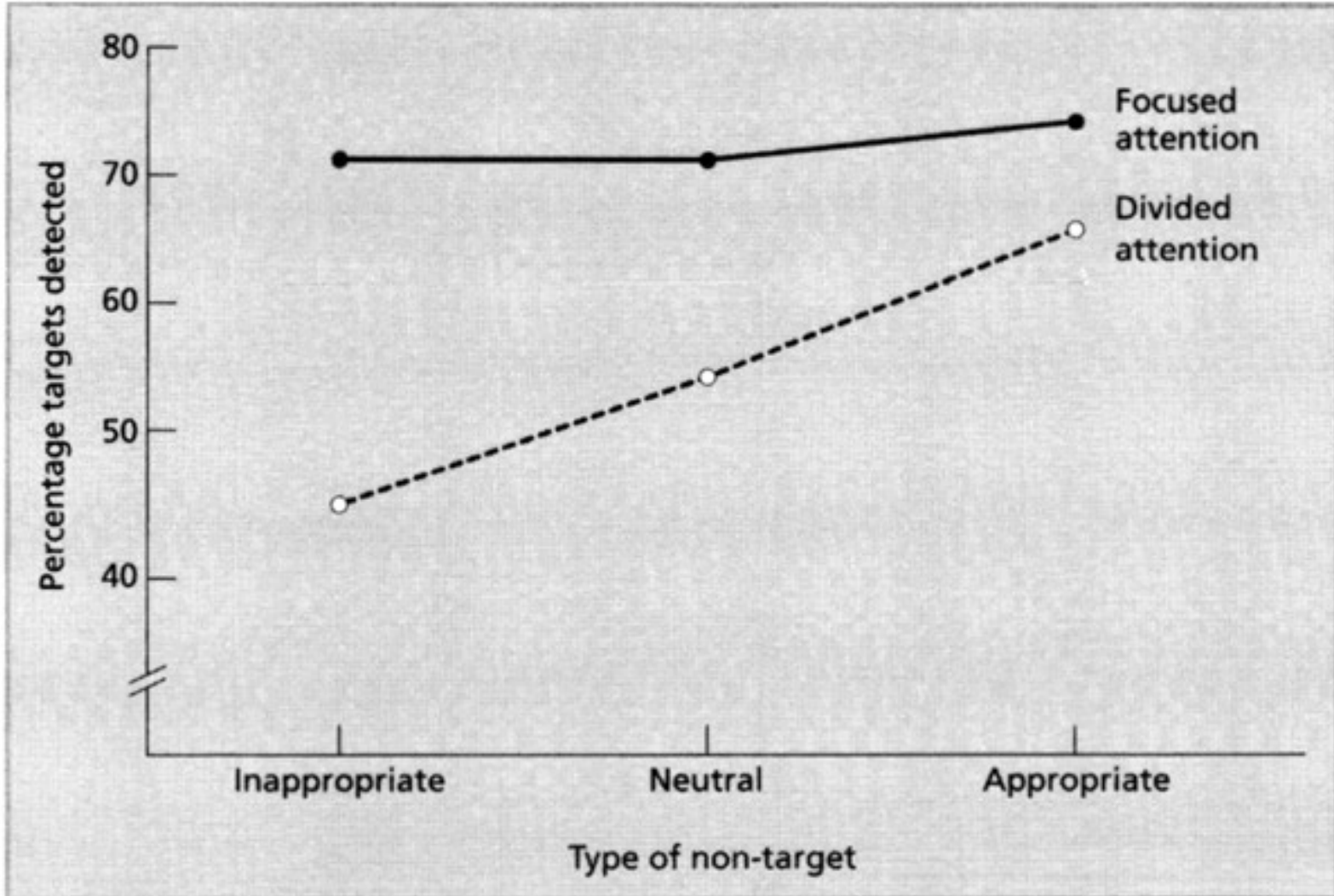
- <http://www.youtube.com/watch?v=vJG698U2Mvo>



# JOHNSTON AND HEINZ'S THEORY

- Importance of early selection of information- to decrease the overload of capacity
- Experiment: dichotic listening
- 1 pair of words:
- A, target word from a category
- B, non-target: neutral, confusing meaning, appropriate meaning





# FOCUSED ATTENTION

- Spotlight or zoom lens?
- Unattended visual stimuli
- Visual search
- Disorders of visual attention



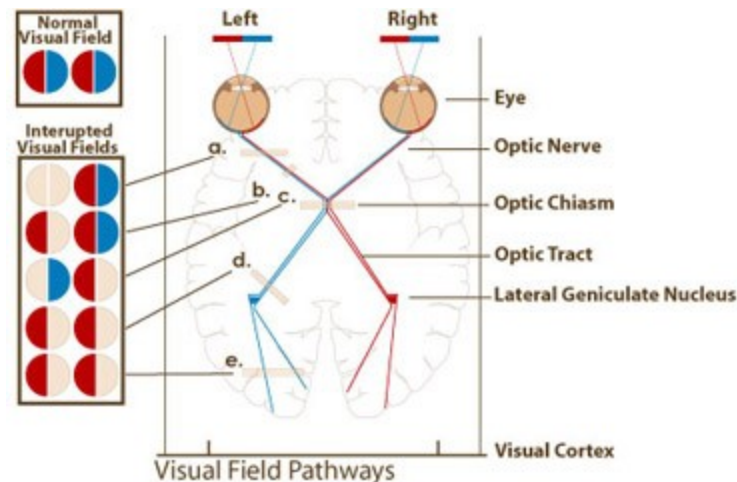
# ATTENTIONAL DISORDERS

- Neglect
- Extinction
- Balint's syndrome



# NEGLECT

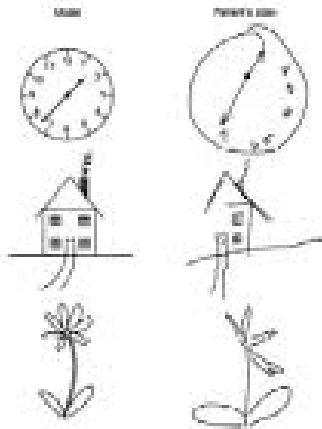
- after damage to one hemisphere of the brain, a deficit in attention to and awareness of one side of space is observed
- Right parietal lobe
- Sensation is intact, perception of hemifield is damaged
- Usual cause: stroke
- Contralateral



- <http://www.youtube.com/watch?v=ymKvS0XsM4w>

# NEGLECT

Copying:



Spontaneous drawing:





## EXTINCTION

- a neurological disorder which occurs following damage to the parietal lobe of the brain
- difficulty to perceive contralesional stimuli when presented simultaneously with an ipsilesional stimulus
- but the ability to correctly identify them when not presented simultaneously
- frequently found in neglect patients



## *BALINT'S SYNDROME*

- triad of severe neuropsychological impairments:
- inability to perceive the visual field as a whole (simultanagnosia)- only one object can be fixated at a time
- difficulty in fixating the eyes (ocular apraxia)
- inability to move the hand to a specific object by using vision (optic ataxia)- difficulty in reaching for stimuli using visual guidance
- Causes: consequence of two or more strokes at more or less the same place in each hemisphere (rare)
- <http://www.youtube.com/watch?v=4odhSq46vtU>

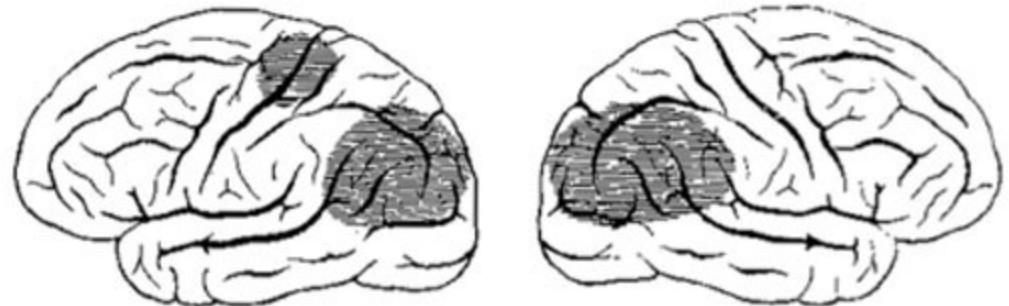


# BALINT'S SYNDROME

- Posterior parietal cortex
- Occipito-parietal region
- In Alzheimer or other injuries to PC or OC

**FIGURE 4.**

**Balint's schematic drawing of the areas of softening in his patient<sup>50</sup>**



De Renzi E. *Disorders of Space Exploration and Cognition*. Chichester, UK: John Wiley; 1982. Adapted with permission.

Vallar G. *CNS Spectr*. Vol 12, No 7. 2007.

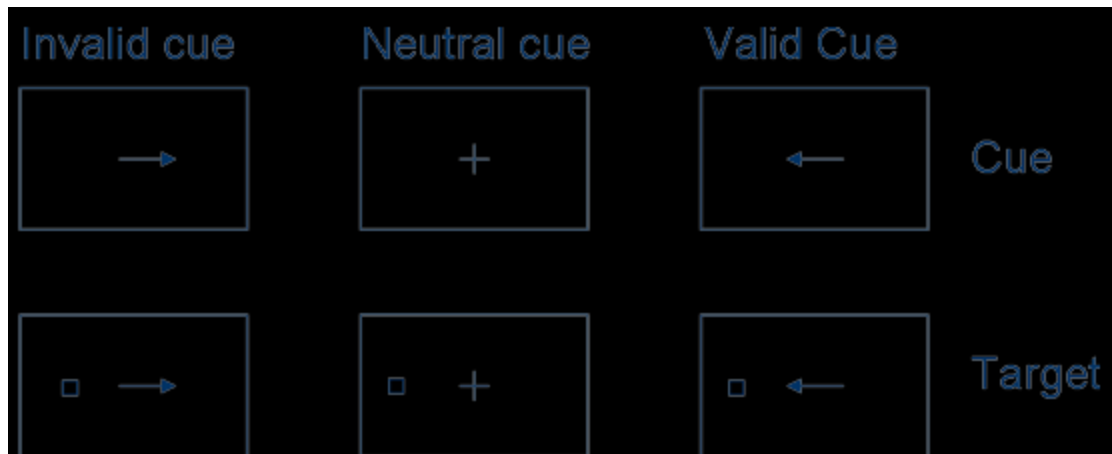
# FOCUSED VISUAL ATTENTION

- Spotlight or zoom lens?
- Pashler- **spotlight** moving across visual scene
- the attentional spotlight moves at a constant rate
- **Zoom-lens** model- decreasing or increasing the region which is dependent on task demands



# FOCUSED VISUAL ATTENTION

- Posner:
- 2 attentional systems:
- Exogenous (“automatic”, stimulus properties)
- Endogenous (intentions, motivations, top-down)

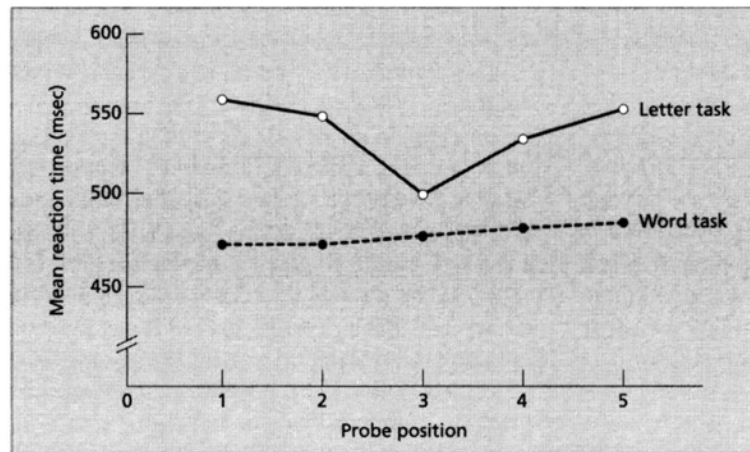


Reaction times in moving eyes to the target are quicker in the valid cue trials (Posner, 1980). This could suggest that attention is linked with planning of eye movements.



# FOCUSED VISUAL ATTENTION

- La Berge (1983):
- - categorize letter
- - categorize word



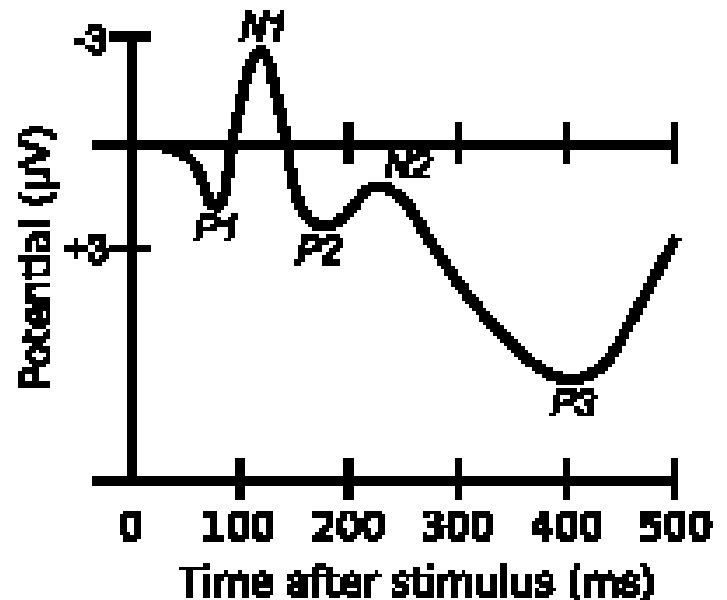
# FOCUSED VISUAL ATTENTION

- <http://www.youtube.com/watch?v=mAnKvo-fPs0>
- <http://nivea.psycho.univ-paris5.fr/Slowchanges/index.html>
- [http://nivea.psycho.univ-paris5.fr/Mudsplash/Nature\\_Supp\\_Inf/Movies/Movie\\_List.html](http://nivea.psycho.univ-paris5.fr/Mudsplash/Nature_Supp_Inf/Movies/Movie_List.html)



# UNATTENDED VISUAL STIMULI

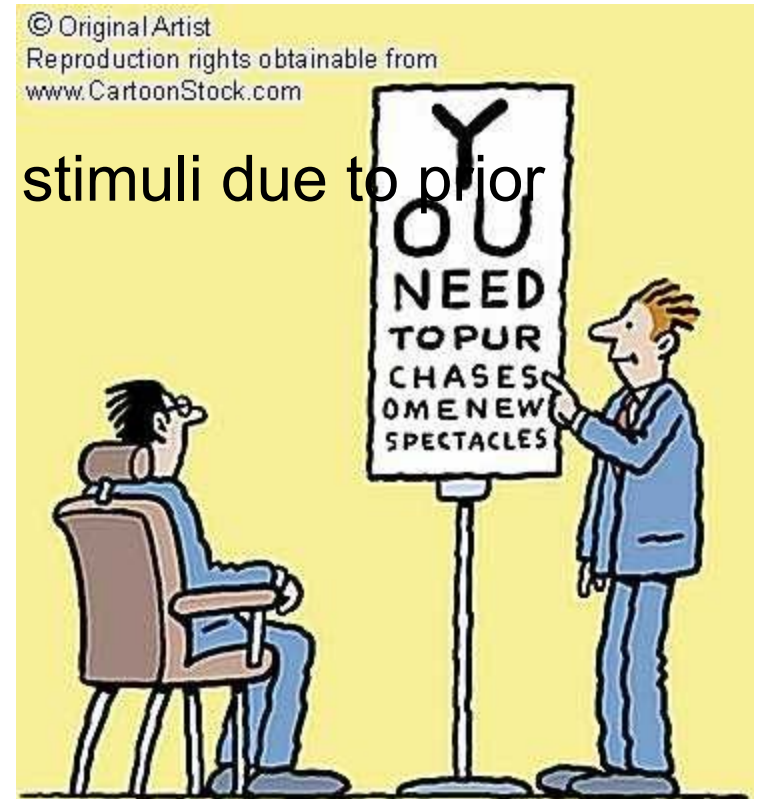
- reduced processing
- ERPs larger to attended stimuli than unattended
- ERPs show that attention influences visual info processing 100ms after the stimulus onset (such as early selection models of A propose)
- Processing of unattended stimuli
- (evidence from neglect patients)





# UNATTENDED VISUAL STIMULI

- Priming-
- increased sensitivity to certain stimuli due to prior experience

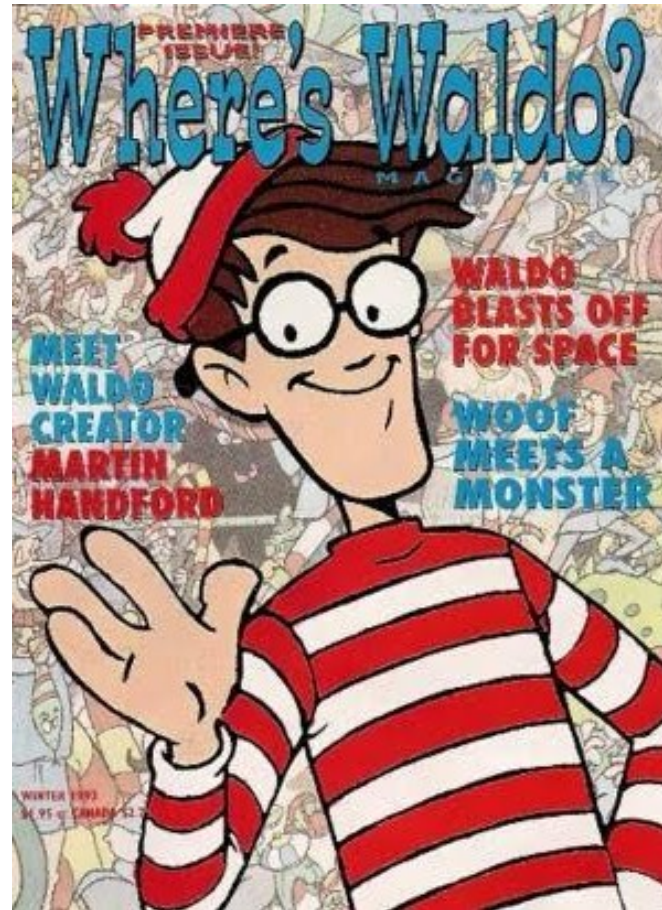


- <http://www.youtube.com/watch?v=McS9BNeeW2k&feature=related>

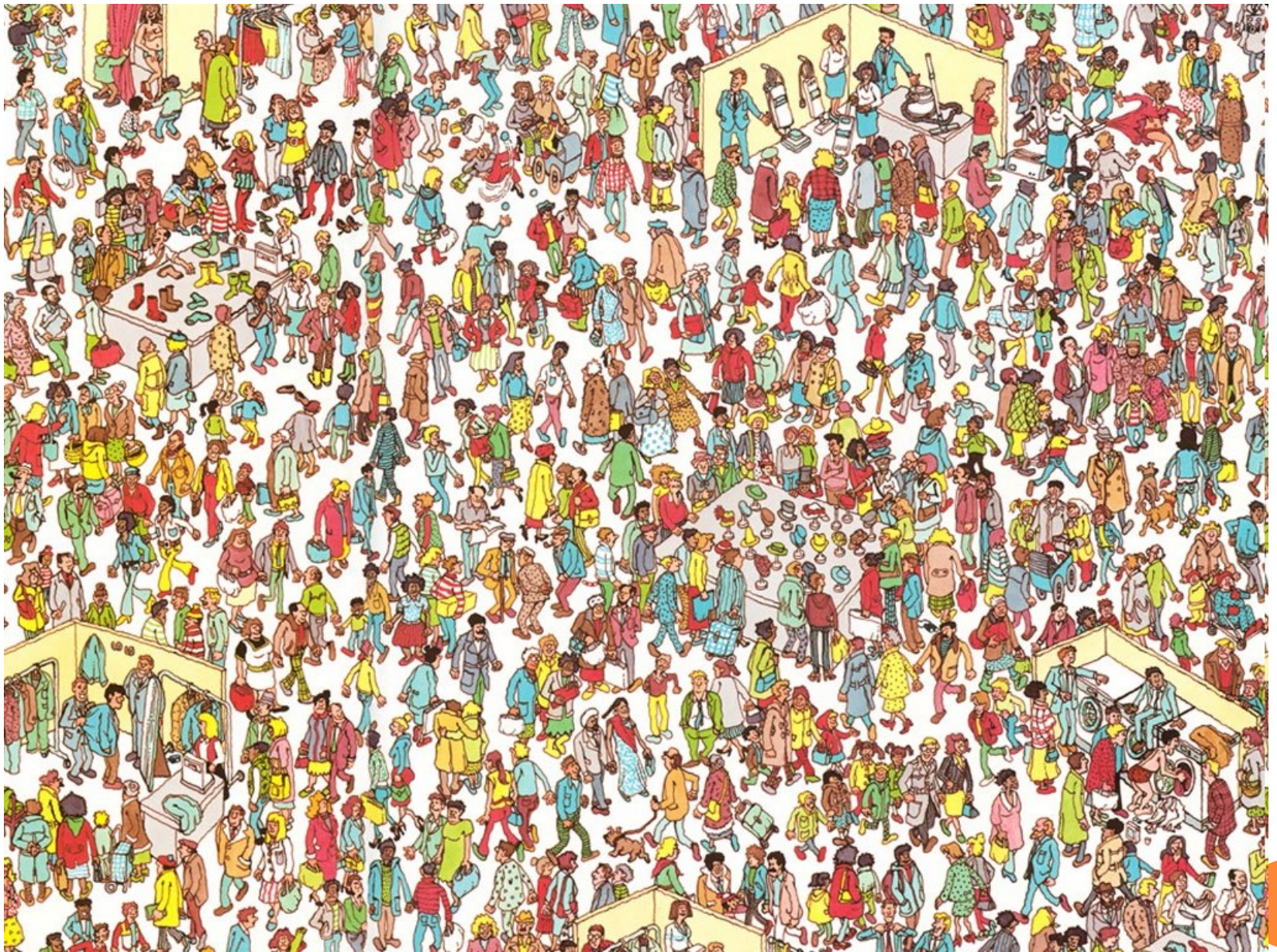
# VISUAL SEARCH



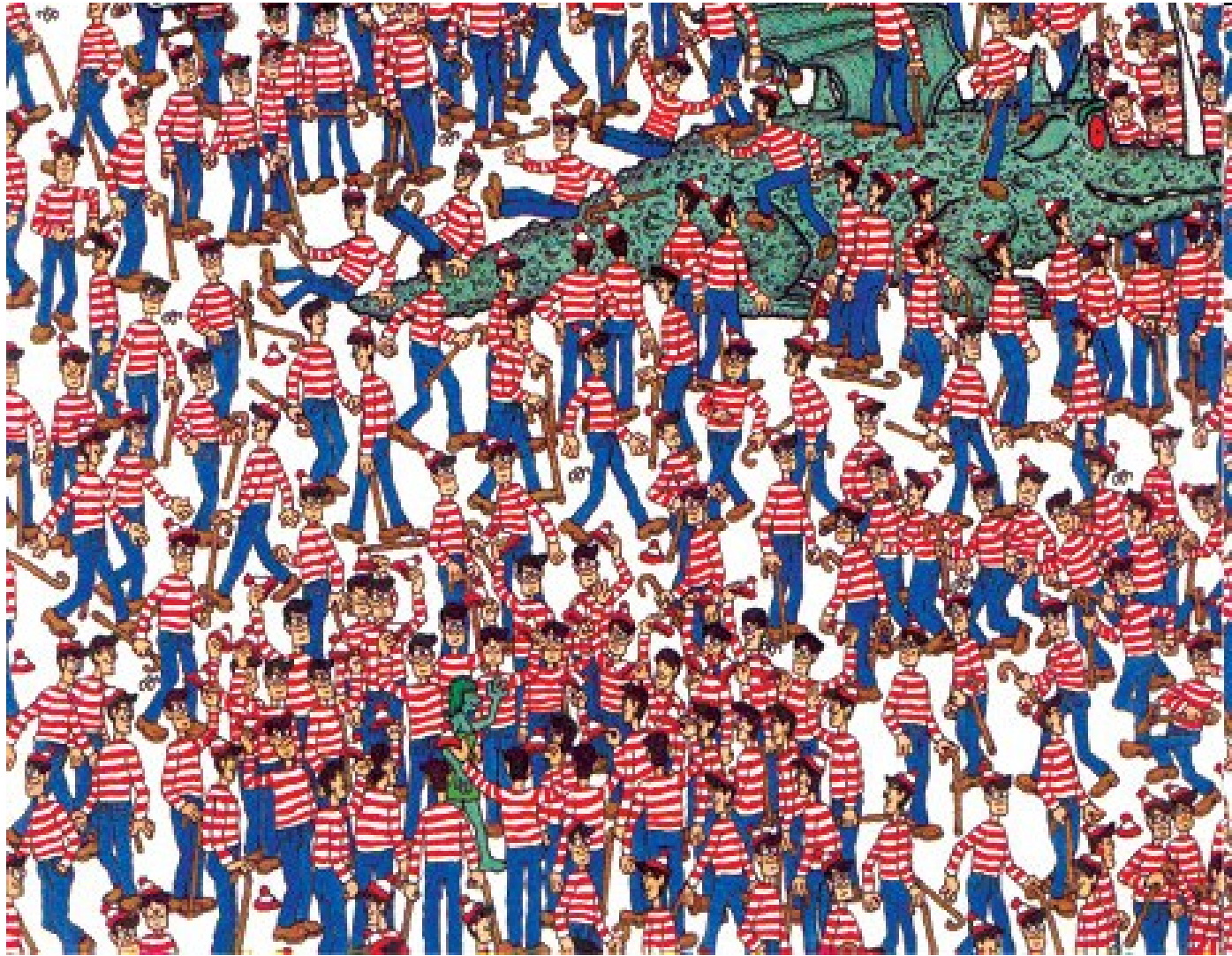
# Visual search





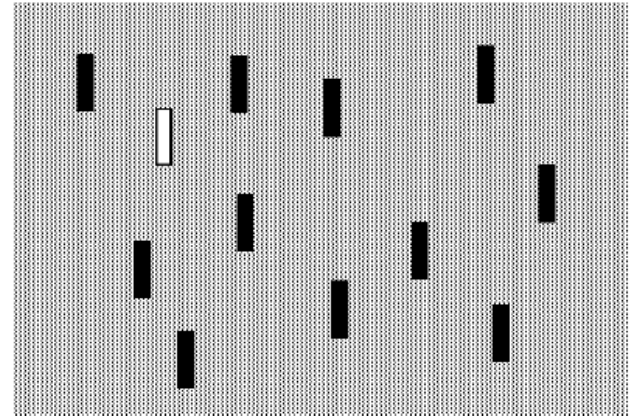




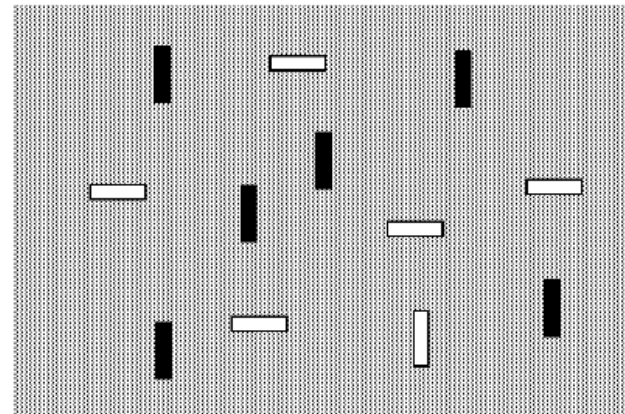


# VISUAL SEARCH

- Feature
- Or
- Conjunction
- search



Feature Search

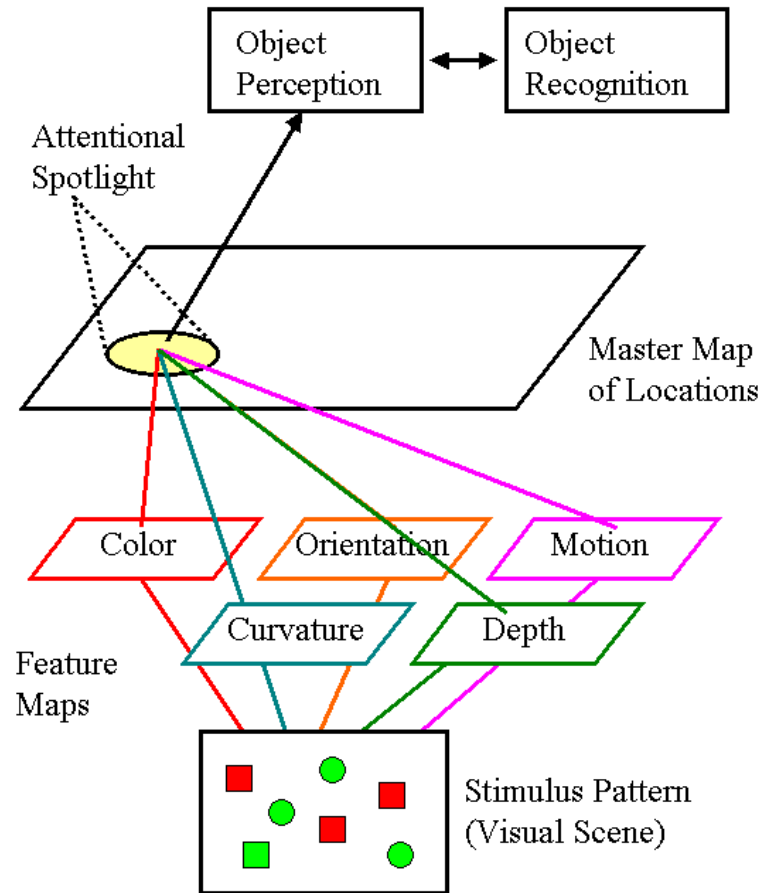


Conjunction Search



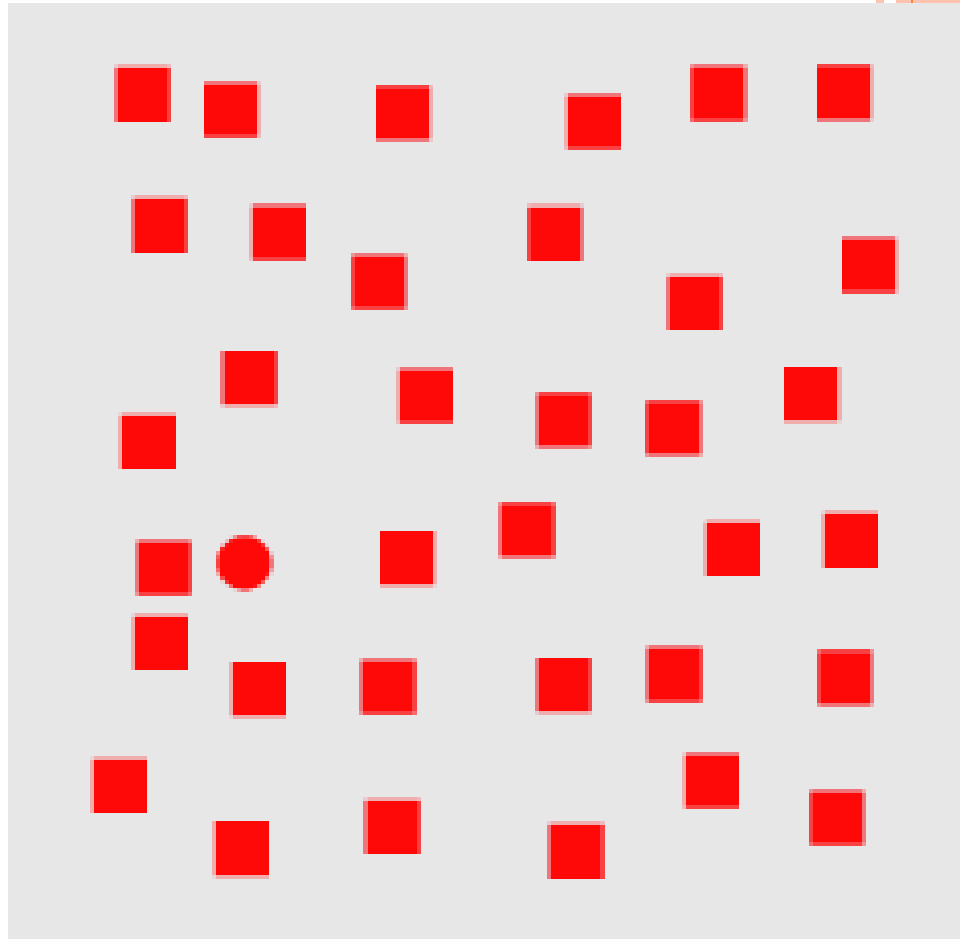
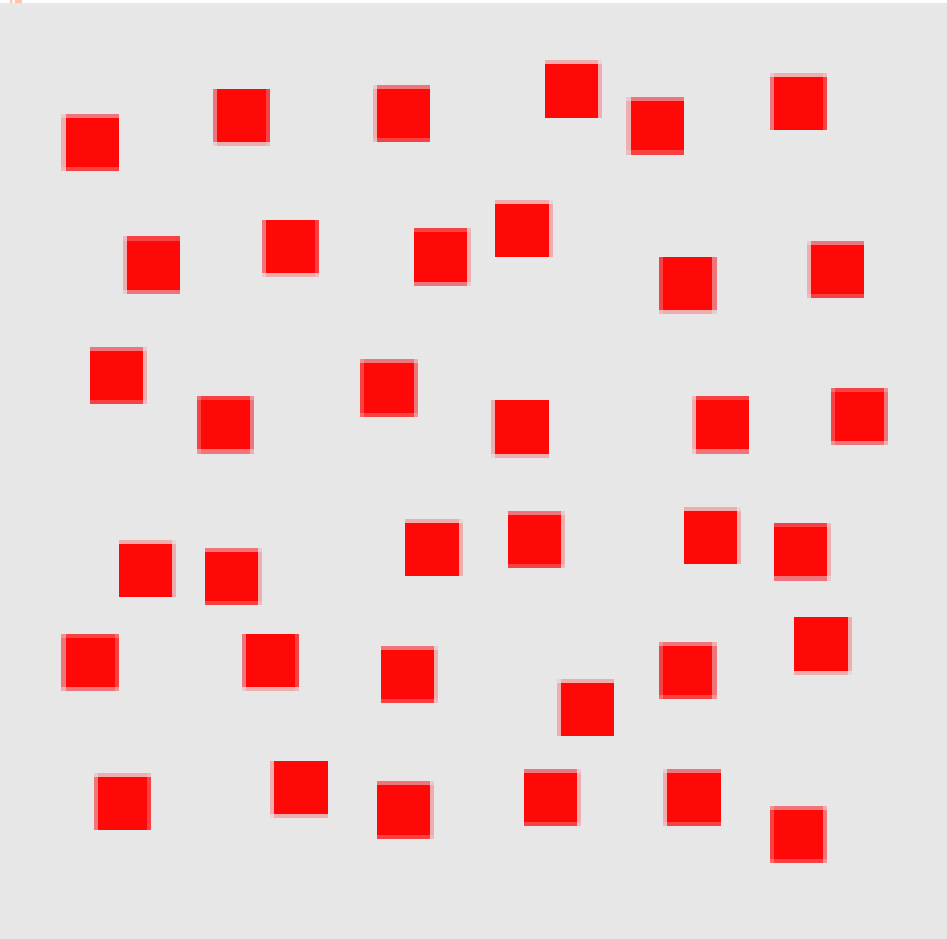
# FEATURE INTEGRATION THEORY

Feature Integration Theory (Treisman)



# PREATTENTIVE STAGE

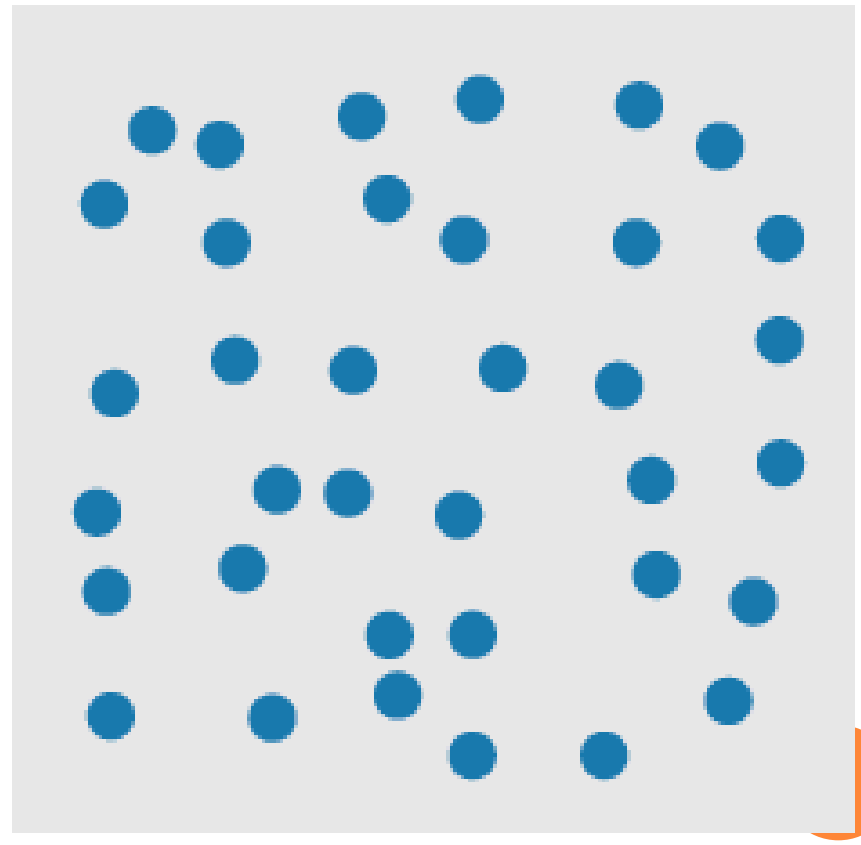
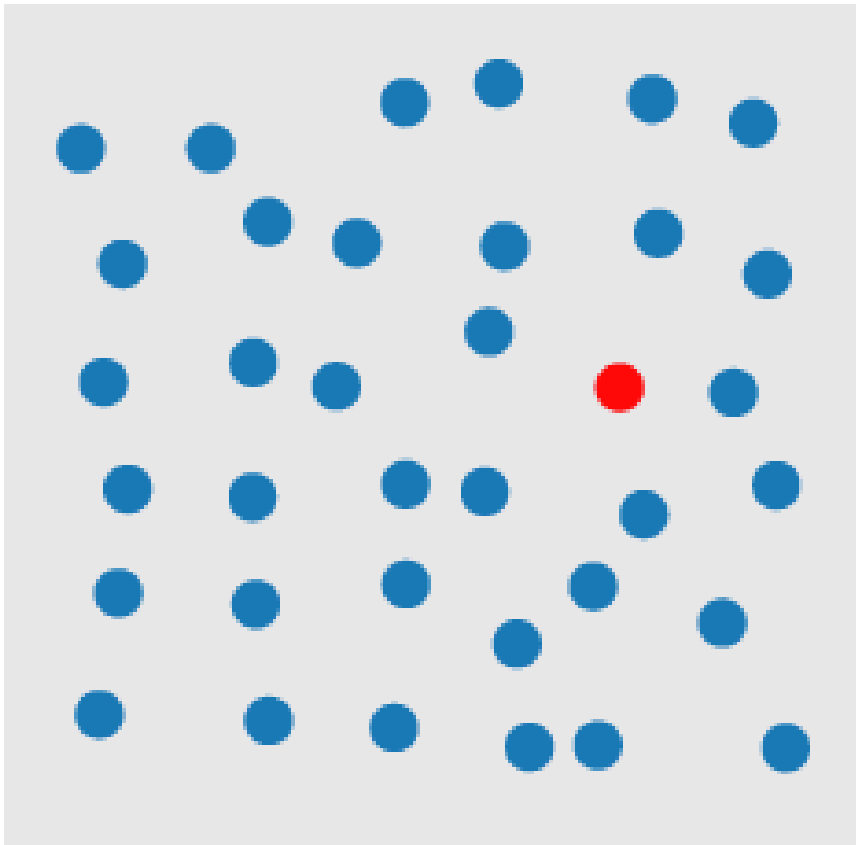
- RED CIRCLE?





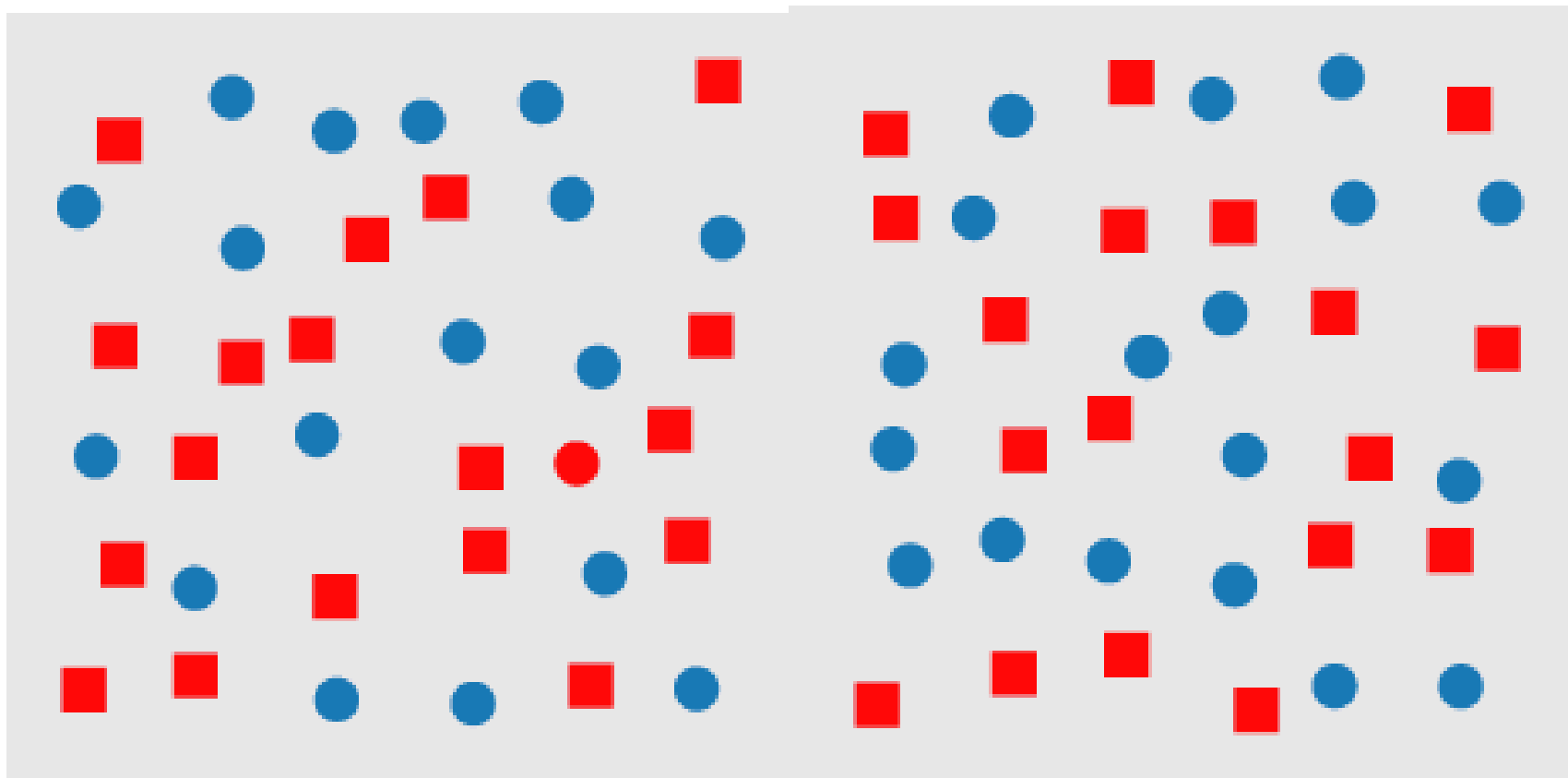
# PREATTENTIVE STAGE

- RED CIRCLE?



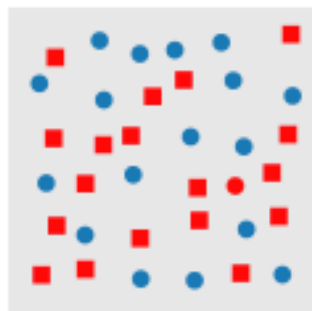
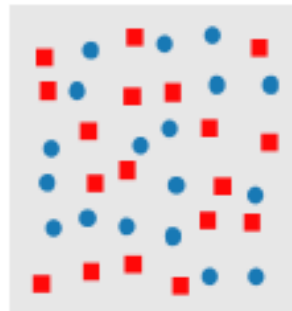
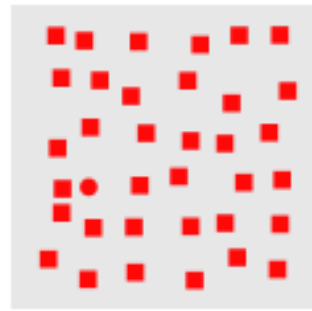
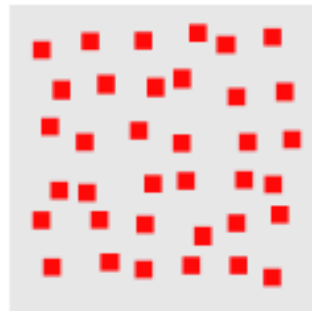
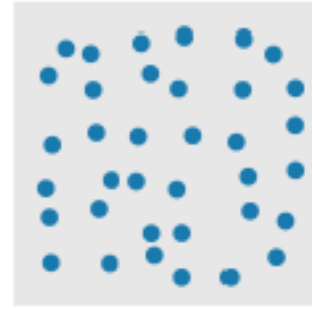
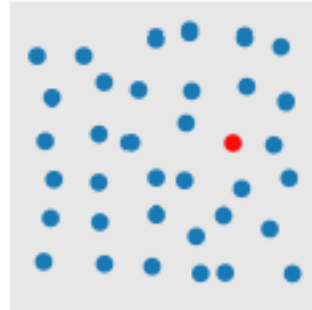
# FOCUSED ATTENTION STAGE

- RED CIRCLE?



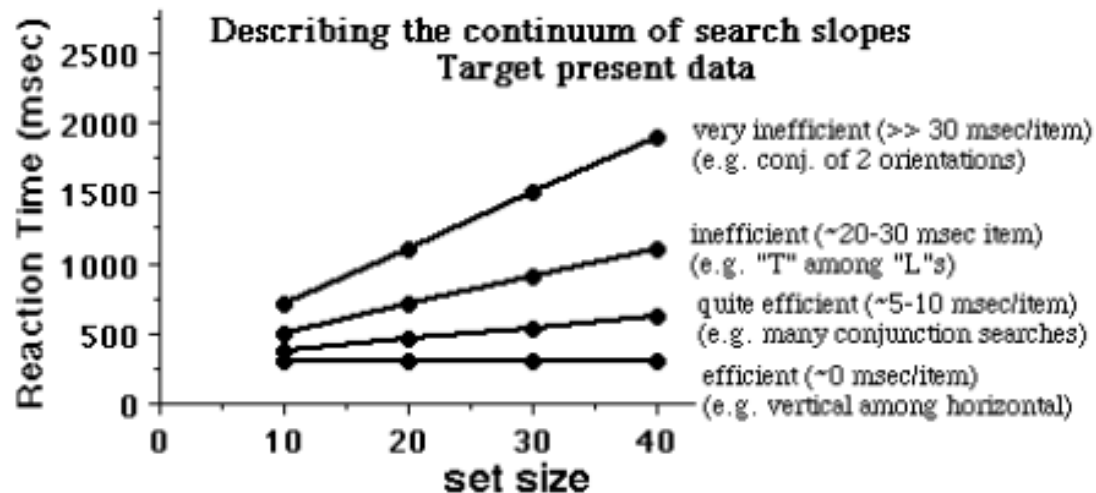
# FIT

- feature search
- conjunction search



# FIT

- feature search
  - conjunction search
- ≈
- parallel search
  - serial search

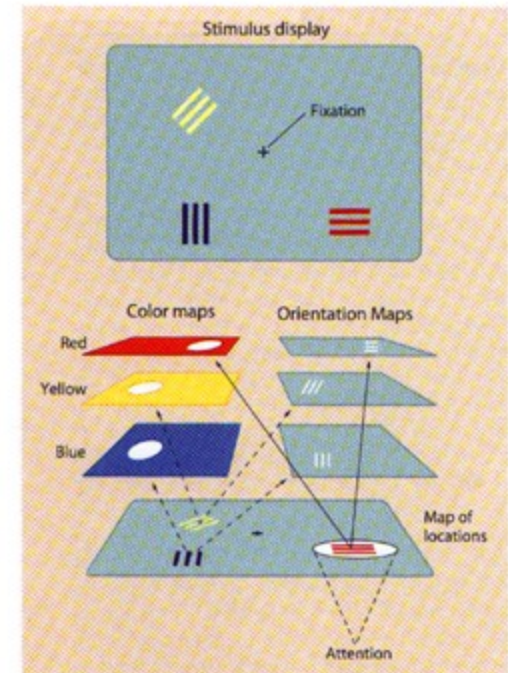


Wolfe (98)



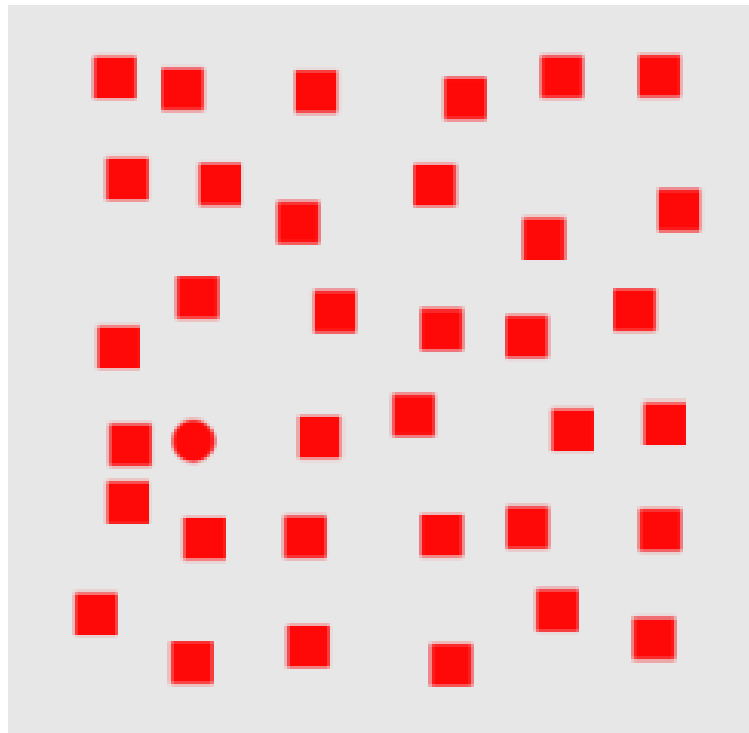
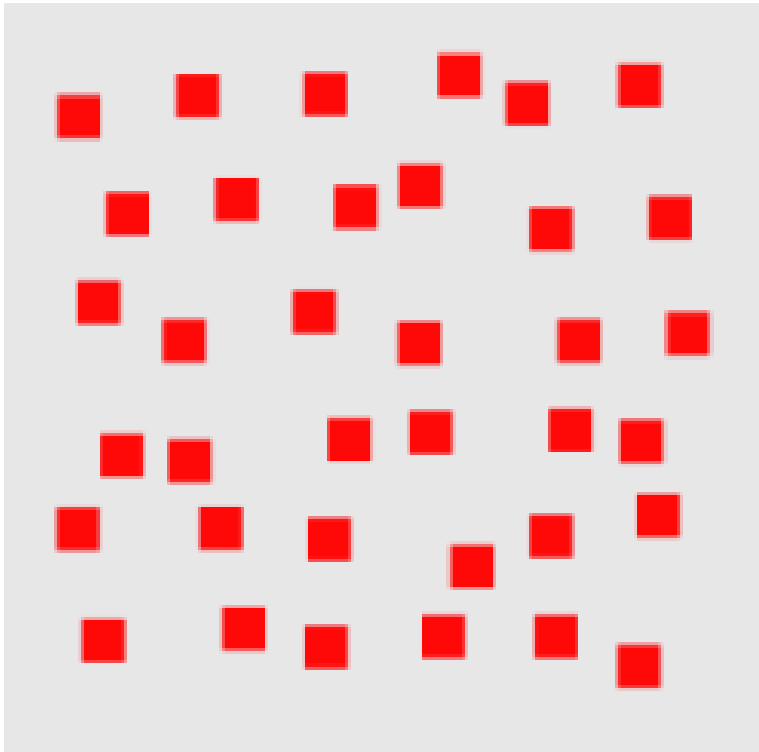
# Treisman's feature integration theory

- rapid initial parallel process- not dependent on attention
- features combined to form objects
- attention provides the “glue” forming unitary objects
- Feature combination can be influenced by stored knowledge

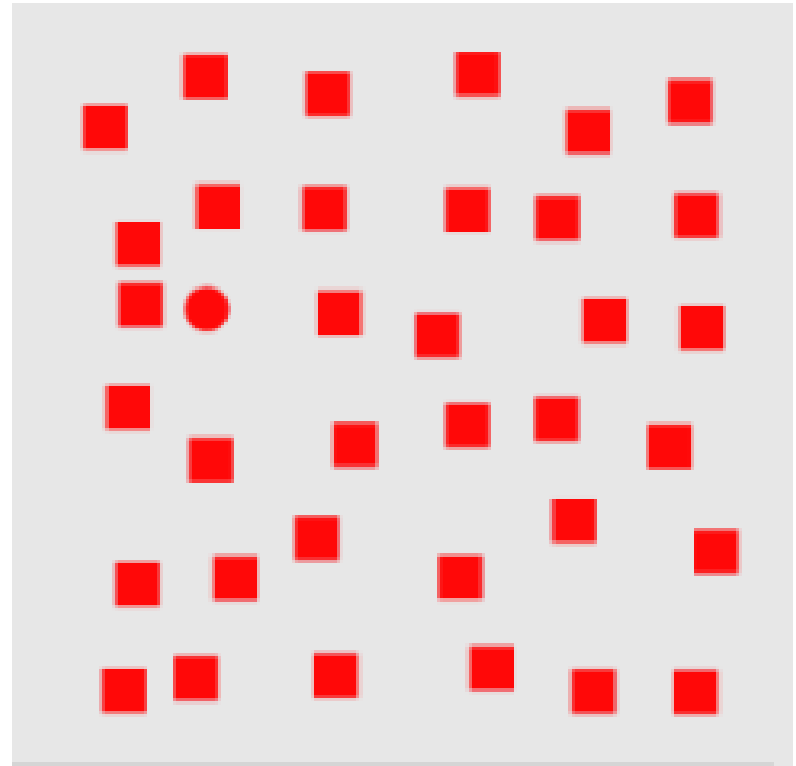
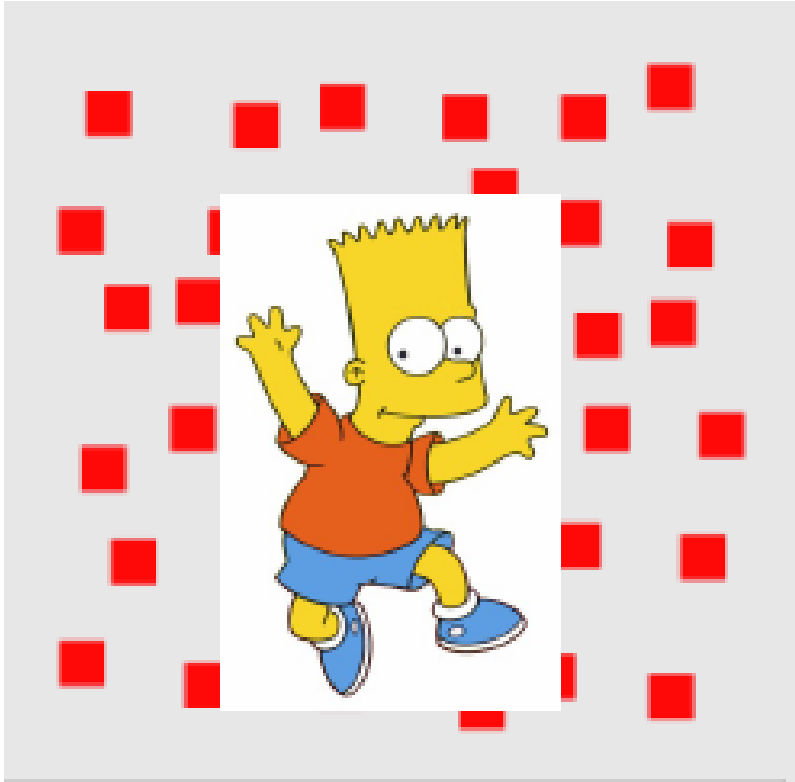


**Figure 4.16** Treisman's psychological model of feature perception and integration. The dimensions of color and orientation are represented by a series of feature maps tuned to specific values (e.g., red, yellow, or blue for color maps). Stimuli automatically activate cells tuned to their features on these maps. Attention is directed to particular locations and allows the features at that location to be integrated. Adapted from Treisman (1988).

# FOCUSED VS. INVOLUNTARY ATTENTION



# FOCUSED VS. INVOLUNTARY ATTENTION



# FOCUSED ATTENTION

- Eye movement tracking
- 1, scan-paths
- 2, task-dependence
- Yarbus





# Yarbus (1967)

- 1) Free examination.
- 2) estimate the material circumstances of the family
- 3) give the ages of the people
- 4) surmise what the family had been doing before the arrival of the "unexpected visitor;"
- 5) remember the clothes worn by the people;
- 6) remember the position of the people and objects in the room;
- 7) estimate how long the "unexpected visitor" had been away from the family



1



2



3



4



5



6

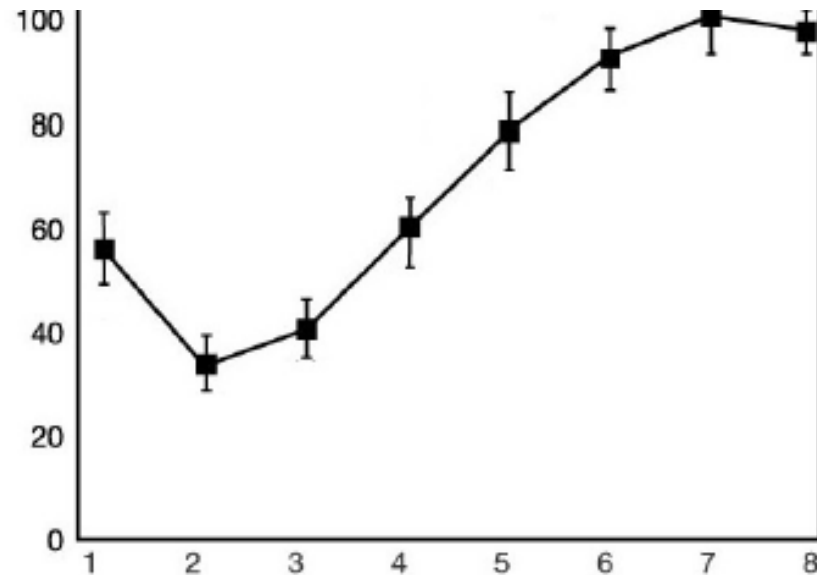
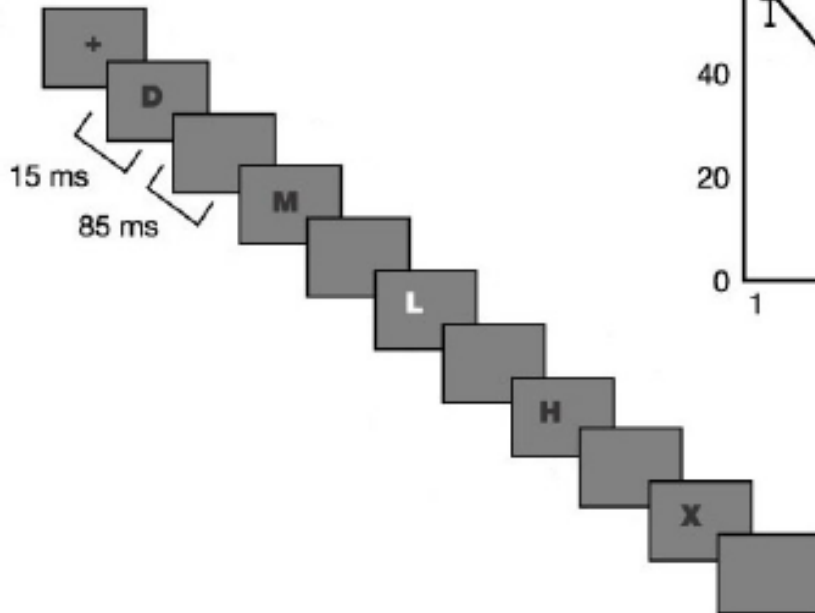


7

# ATTENTIONAL BLINK

o <http://www.youtube.com/watch?NR=1&v=MH6ZSfhdluM>

- attentional blink



# Attention restoration theory (Kaplan, 1995, 2001)



- natural versus urban environments- influence on cognitive processing
- involuntary versus directed attention
- Restorative effects of nature on directed attention
- 2 groups: attention test:



# “THE DOOR” STUDY

<http://www.youtube.com/watch?v=FWSxSQsspiQ&feature=related>



red blue orange purple  
orange blue green red  
blue purple green red  
orange blue red green  
purple orange red blue  
green red blue purple  
orange blue red green  
green purple orange red

# Automatic processing

- Stroop effect
- <http://www.youtube.com/watch?v=Tpge6c3lc4g>



Pay attention!

