

# **Attention II**

## **Disorders of Visual Attention**

# Hemispatial Neglect

(半侧空间忽略)

- Cause

- often a stroke that has interrupted the flow of blood to the right parietal lobe (右顶叶) that is thought to be critical in attention and selection

- Symptoms:

- Failure to acknowledge objects in the field **contralateral** to the lesion

- Often no perceptual deficit

- Neglect patients still activate visual regions in occipital lobes (枕叶) that they claim not to be aware of

# Neglect of the Visual Field

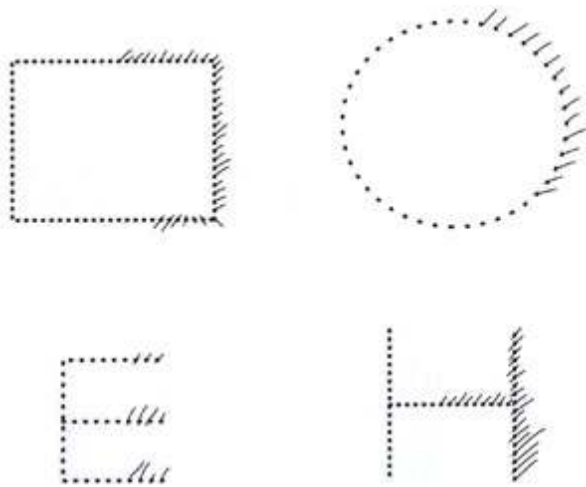
Patients may:

- fail to dress the left side of their body
- disclaim “ownership” of left limbs
- not recognize familiar people presented on the left side
- deny the illness

Neglect patients sometimes confabulate letters to the left side of short words, reading short words as longer than their objective length

E.g., “pot” is read as “teapot”

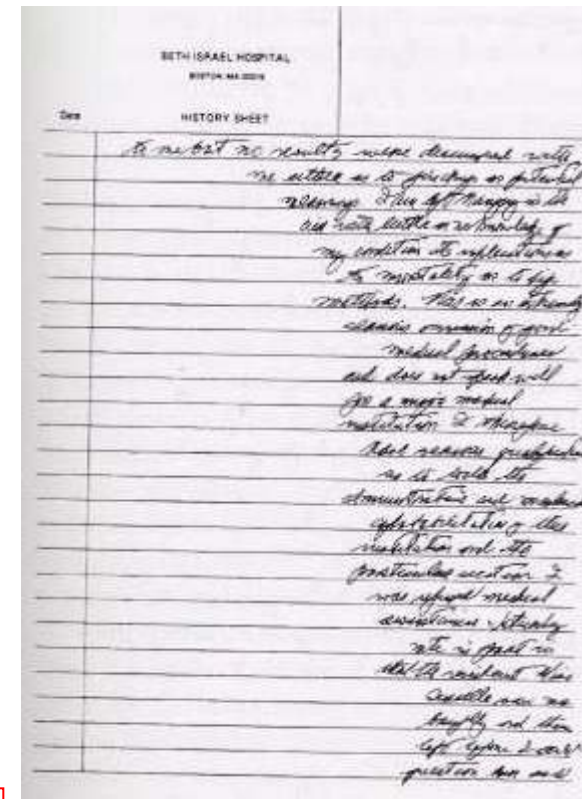
# Neglect of the Visual Field



Difficulty crossing out items



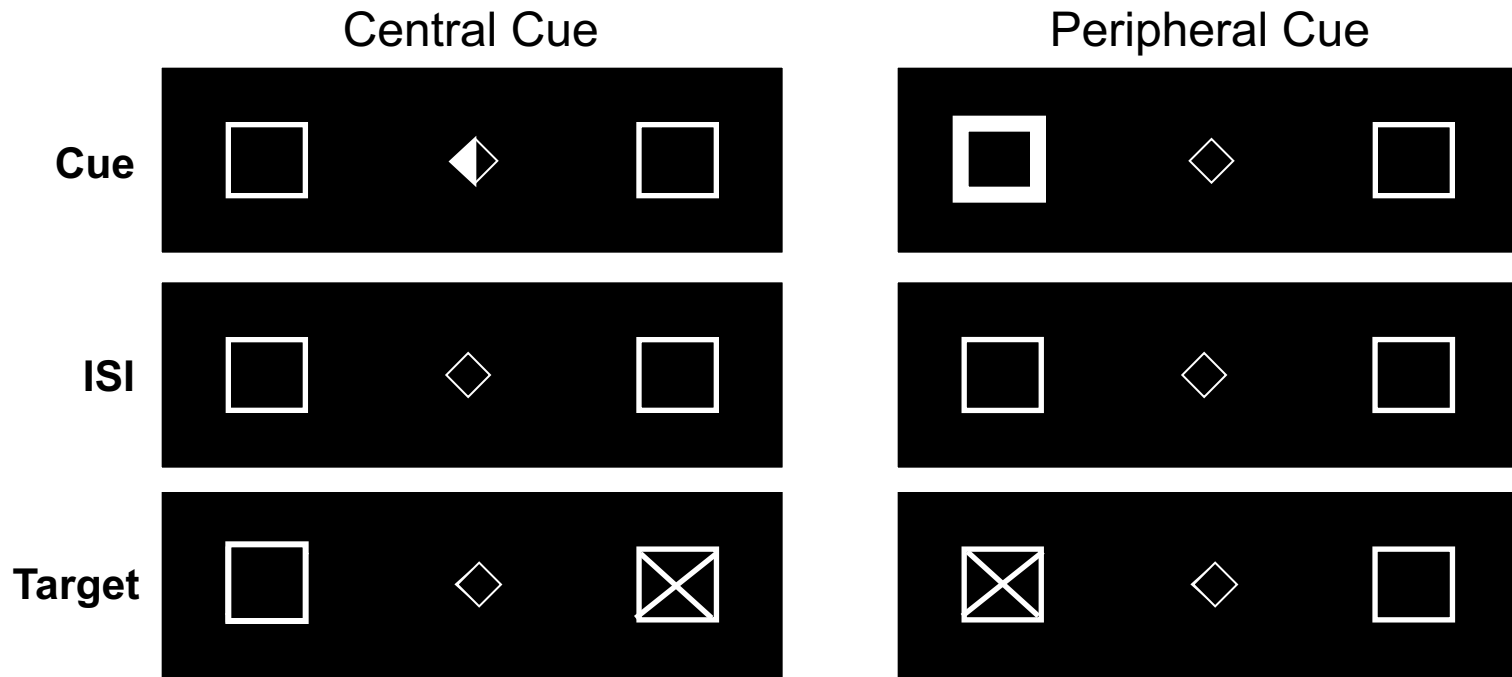
Difficulty copying items



55 y.o. right handed male R TPJ infarct (Mesulam, 2000)

When these patients are asked to copy or even draw from memory a clock or a daisy, they do not attend to (that is, they fail to select) information on the side of space opposite the lesion and so do not incorporate this information in their pictures.

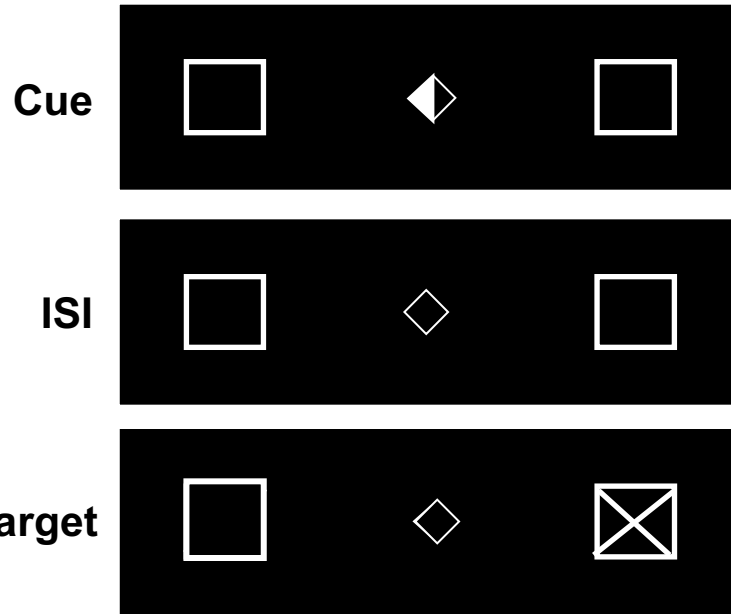
# Posner Cueing Task



- Posner presented either a **central cue** or a **peripheral cue** before a target appeared
- Cues **valid** on 80% of the trials, **invalid** on 20% of the trials or vice-versa

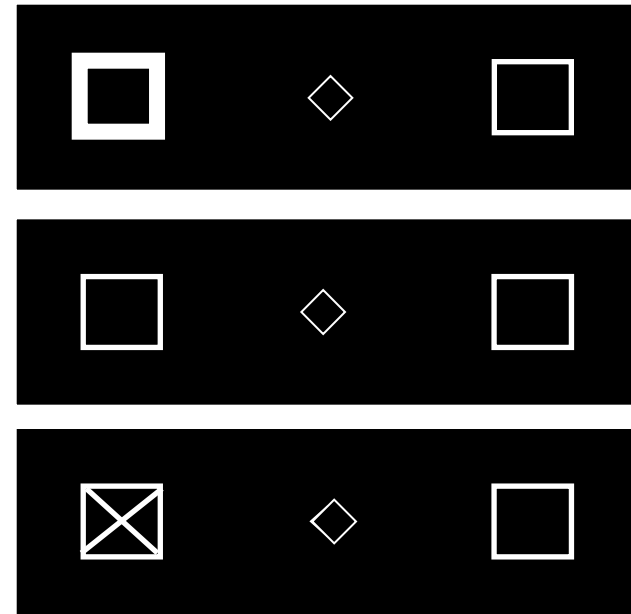
# Posner Cueing Task

Central Cue



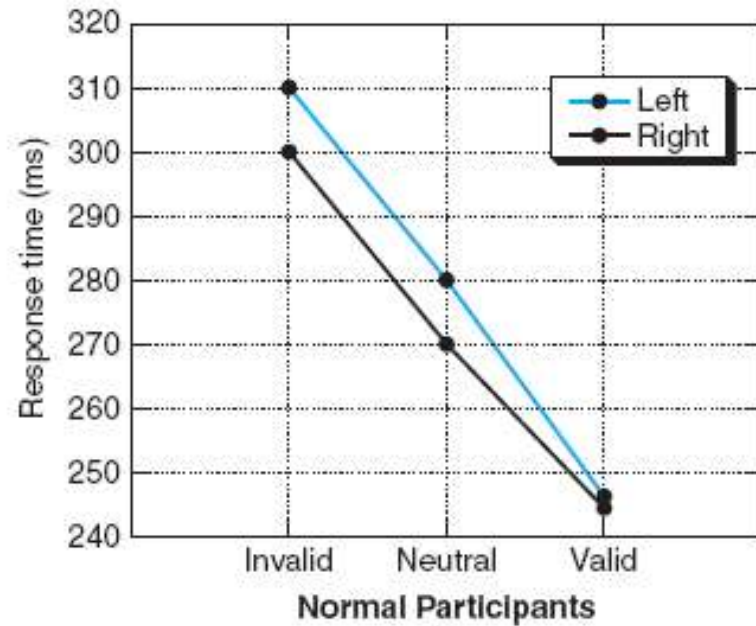
Central Cue condition triggers  
**endogenous (内源的) attention:**  
voluntary attention  
Top-down

Peripheral Cue



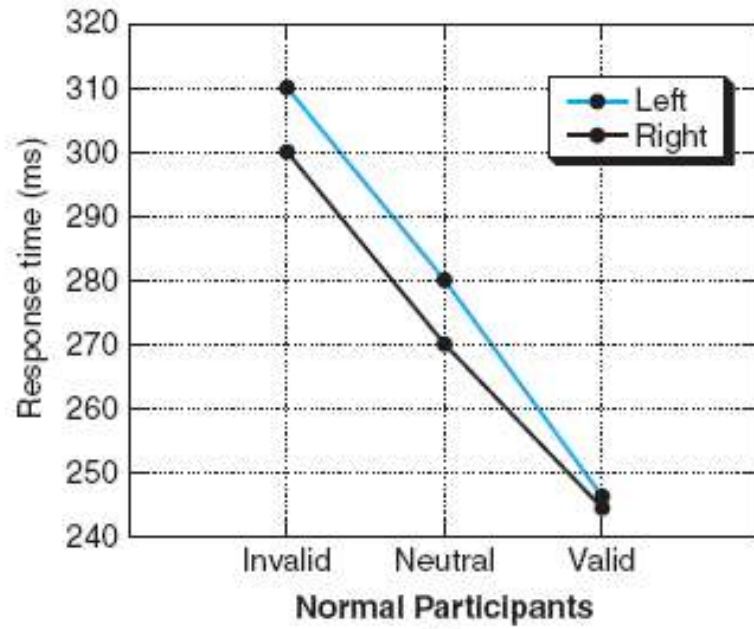
Peripheral Cue condition triggers  
**exogenous (外源的) attention:**  
Bottom-up  
i.e. stimulus driven

# Endogenous Cueing Task

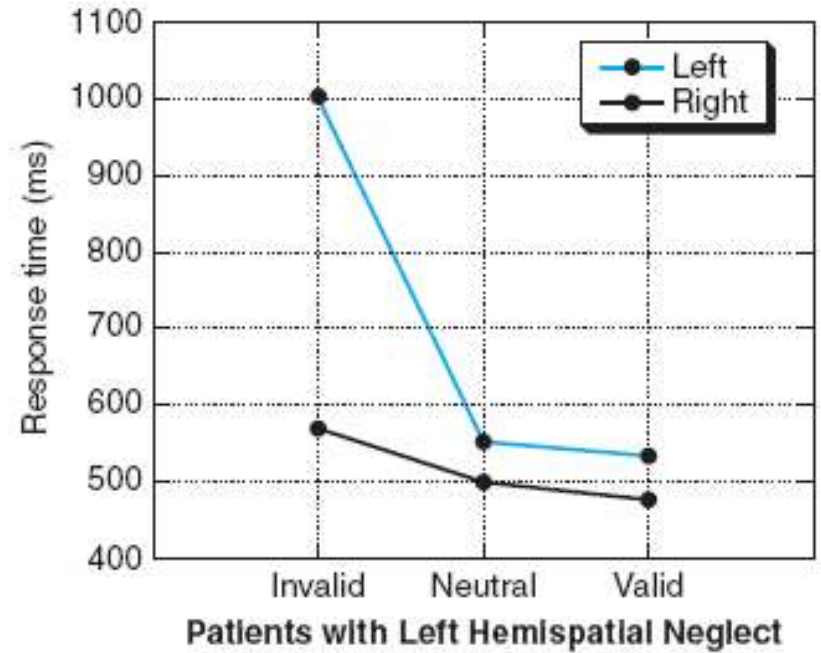


(b)

# Endogenous Cueing Task



(b)



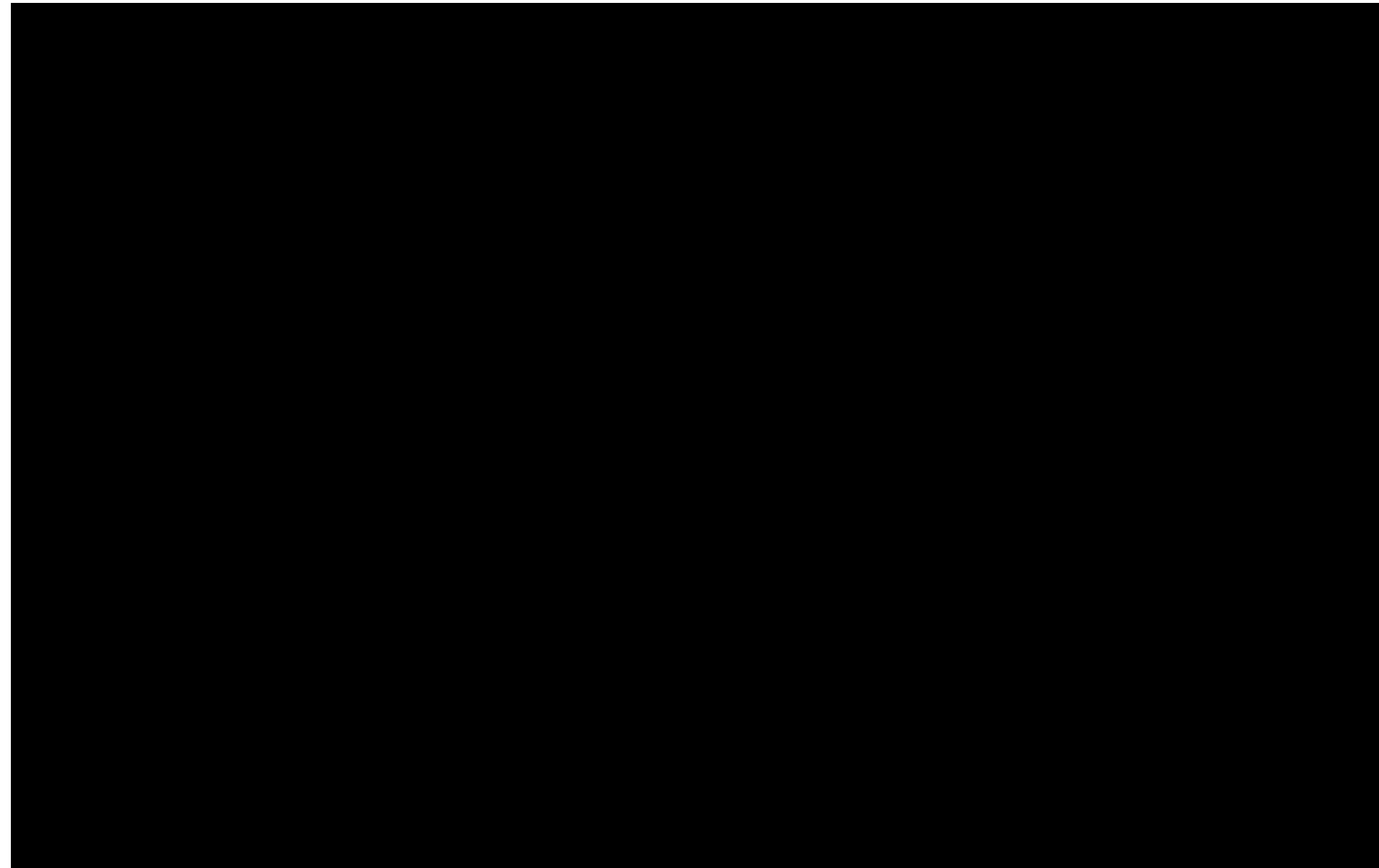
# Components of Attention

- The findings from patients with brain damage led Posner to construct a model for attention that involves three separate mental operations:
  - **disengaging** (释放) of attention from the current location
  - **moving** attention to a new location
  - **engaging** (吸引) attention in a new location to facilitate processing in that location

Some hemispatial neglect patients appear to have a problem only of disengagement.

Interestingly, Posner and colleagues found other patient groups who appeared to be impaired in either the “**move**” or “**engage**” operations posited by their attention model.

# Hemispatial Neglect



# Location-based and object-based theories of attention

# Spotlight Theory of Attention

- Theory which holds that we can move our attention around to focus on various parts of our visual field



Spotlight is often but not always at location of the fovea (指视网膜的中央凹): spotlight can move in the absence of eye movements.

# Problem (1) for spotlight theory

- Attention does not appear to move around in continuous fashion (like a moving spotlight)
  - Moving attention isn't slowed down by intervening stuff
  - Distance spotlight needs to travel does not affect response time (when other artifacts are controlled)
- Quantal theories of attention (Sperling & Weichelgartner, 1995)
  - attention jumps from place to place

# Problem (2) for spotlight theory

- Attention appears to be **object-based**, not location based



location-based attention

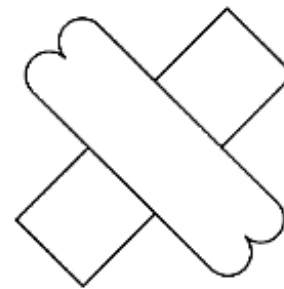


object-based attention

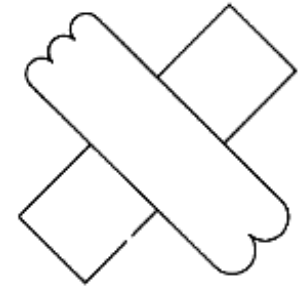
A number of experiments have shown that attention can be directed to a single object, even if superimposed on another object, demolishing the idea that a “***spotlight***” of attention highlights information in a particular spatial region.

# Evidence for object-based attention

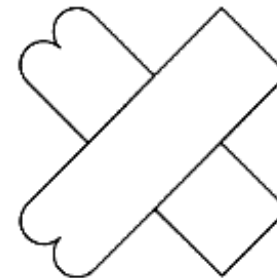
- Experiment: are number of bumps on the ends of the objects the same?
- Faster judgments when bumps are on the same object (in spite of slightly larger distance)
- compatible with an object-based attention theory



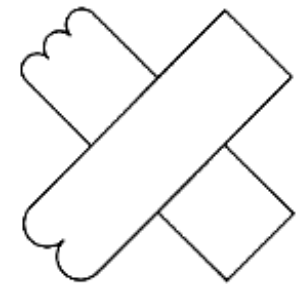
(a)



(d)



(b)

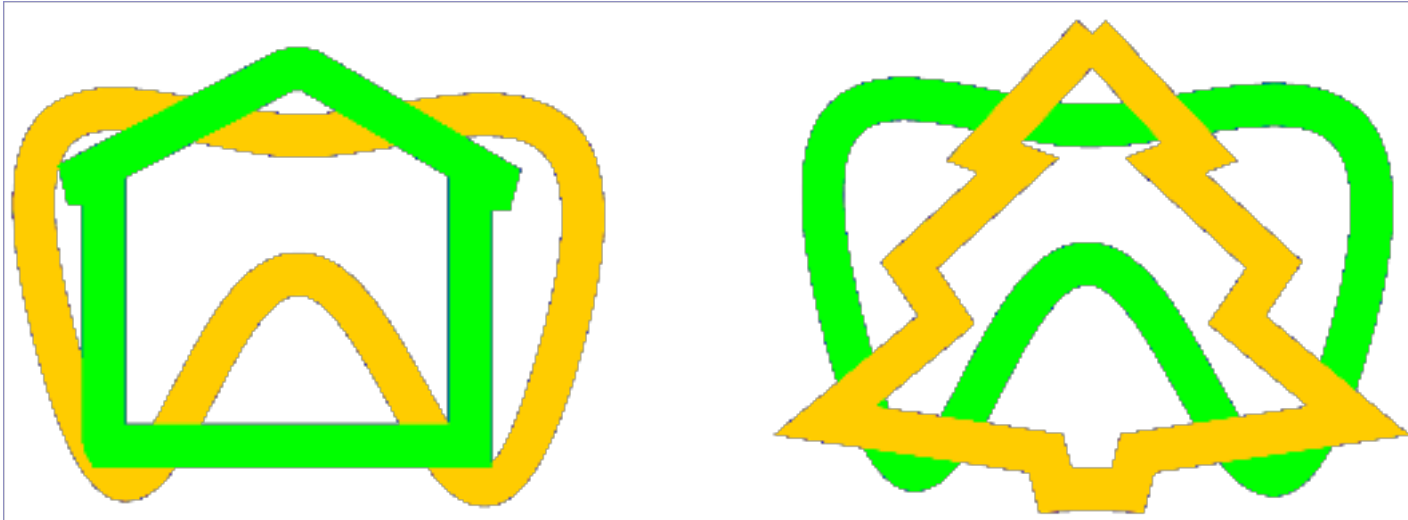


(e)

# Object-based Attention

- Recent studies of object-based attention show that when attention is directed toward an object, all the parts of that object are simultaneously selected for processing.
- An immediate example: you think of your friend in green as a single object (and no doubt, because she's a friend, as greater than the sum of her parts). As you focus on her, you would be more likely to notice the watch on her wrist, because it is a part of her, than to notice the watch worn by the person standing next to her, even if that person is standing just as close to you as she is—that watch is a part of a different object.

We can select a shape even when it is intertwined among other similar shapes



Are the green items the same? On a surprise test at the end, subjects were not able to recall shapes that had been present but had not been attended in the task  
→ Evidence for object-based attention

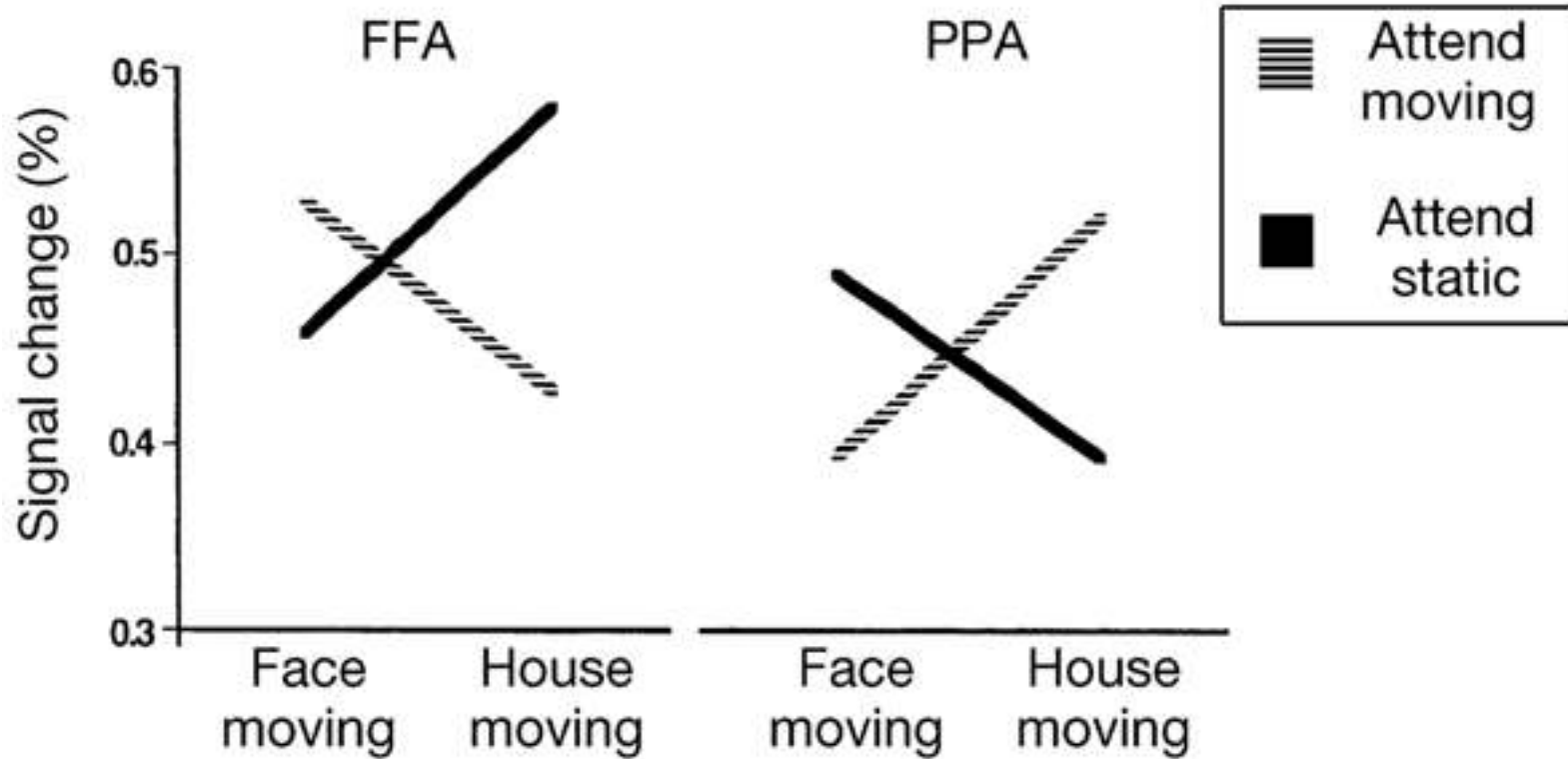
# Object-Based Attention

- Location-based attention would not efficiently select just one of the two objects in this figure; attention to the face, for example, would entail selection of the house as well, because both appear in the same location.
- For object-based selection alone, however, attention directed to one of the stimulus dimensions (e.g. the motion) should lead to selection of that entire object, including its irrelevant dimension (e.g. the face) but not the other object at the same location (e.g. the house).



Subjects attended either the moving or the static object

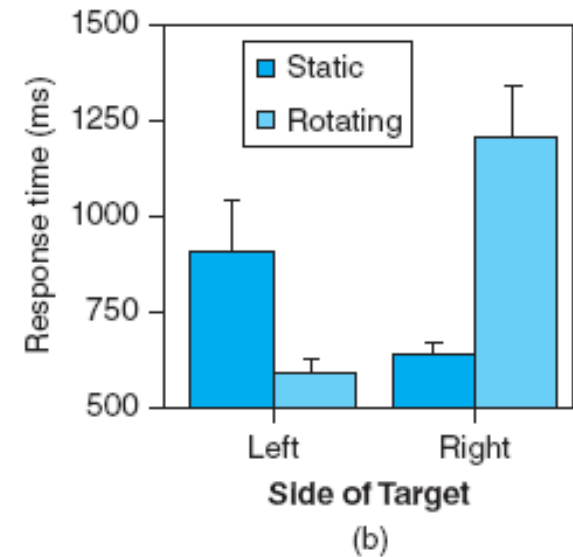
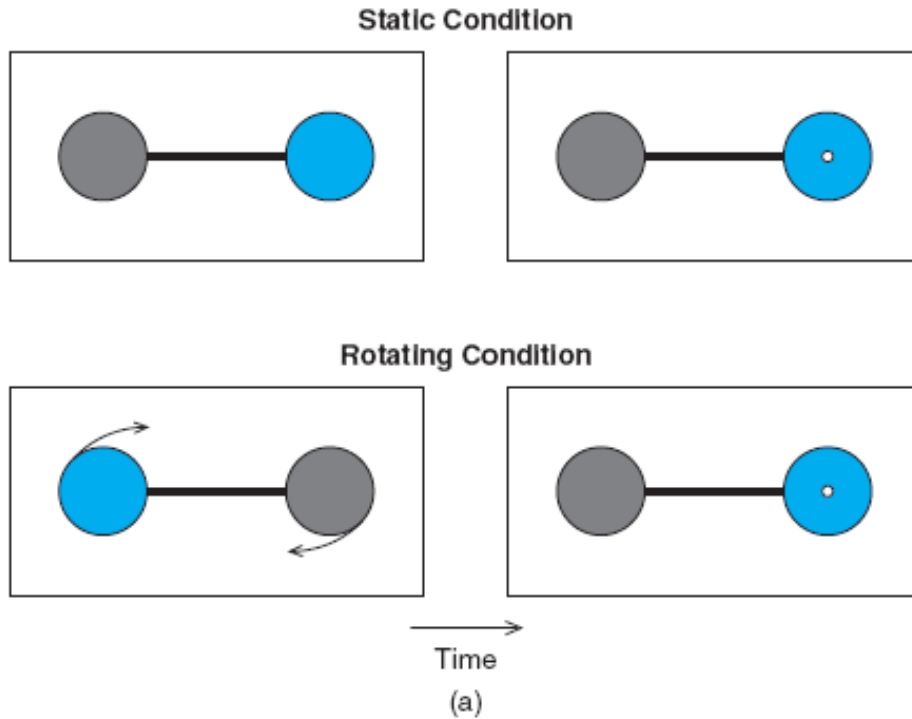
# Object-Based Attention



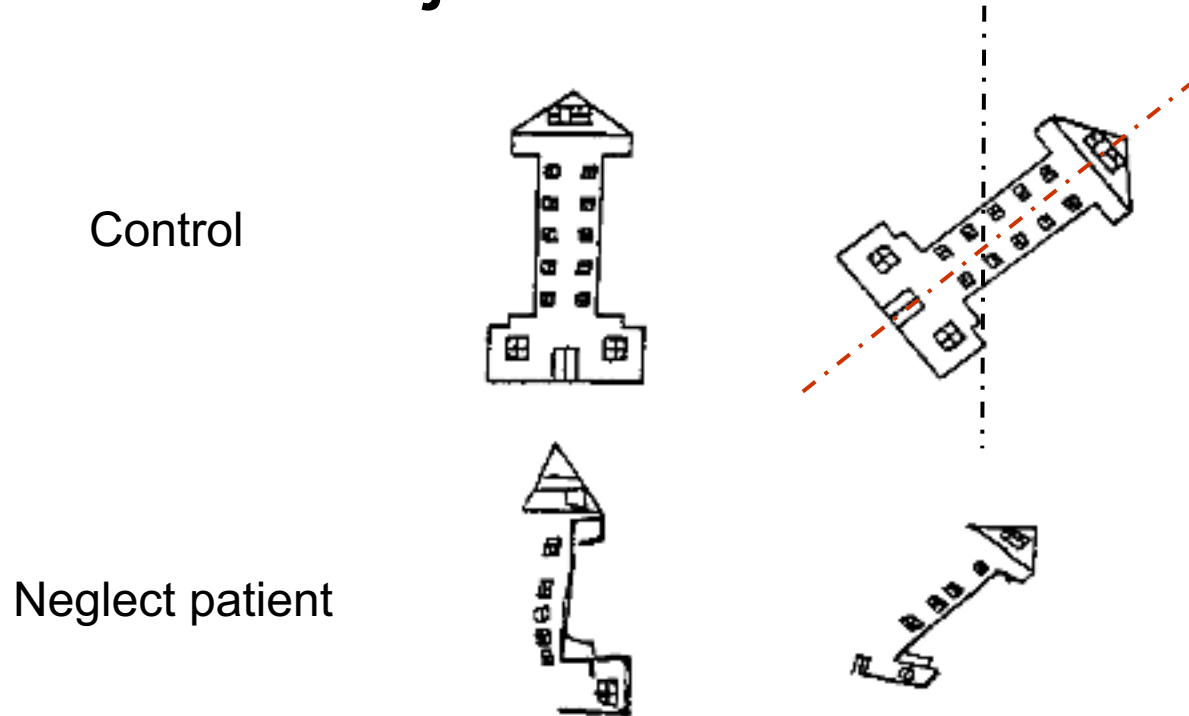
FFA = fusiform face area

PPA = parahippocampal place area

# Visual neglect syndrome can be object-based

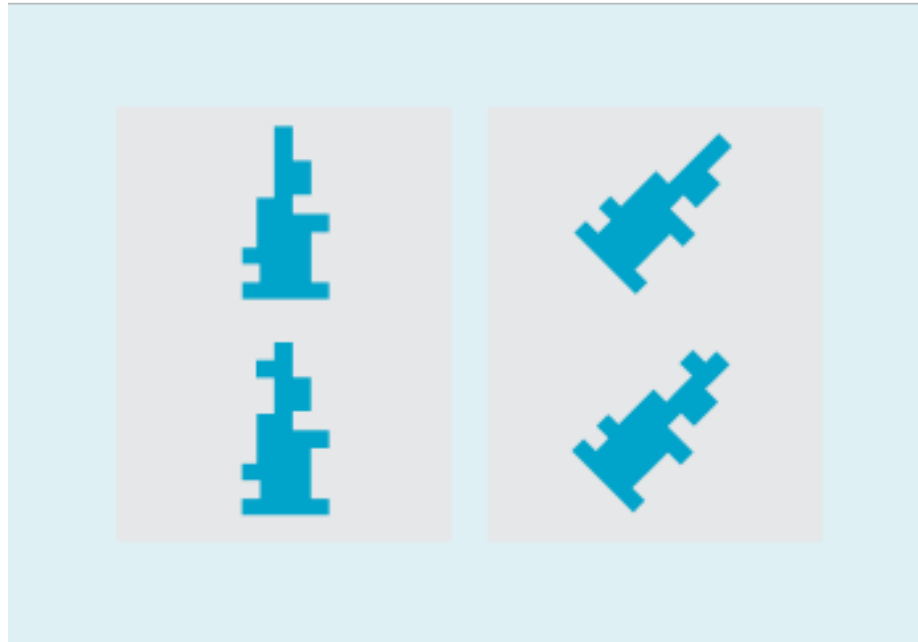


# Visual neglect syndrome can be object-based



Patients can neglect the left side of the object, rather than the left side of space. Black lines show expected left-sided person-centred versus red lines showing actual point where the patient neglected

# Visual neglect syndrome can be object-based



Patient with object neglect cannot detect differences on left side of an object even when falling into right side of space

# Simultanagnosic (Balint Syndrome) patients only attend to one object at a time

## 巴林特氏综合征



Simultanagnosic patients cannot judge the relative length of two lines, but they can tell that a figure made by connecting the ends of the lines is not a rectangle but a trapezoid.

Balint patients can only attend to one  
object at a time  
*even if they are overlapping*

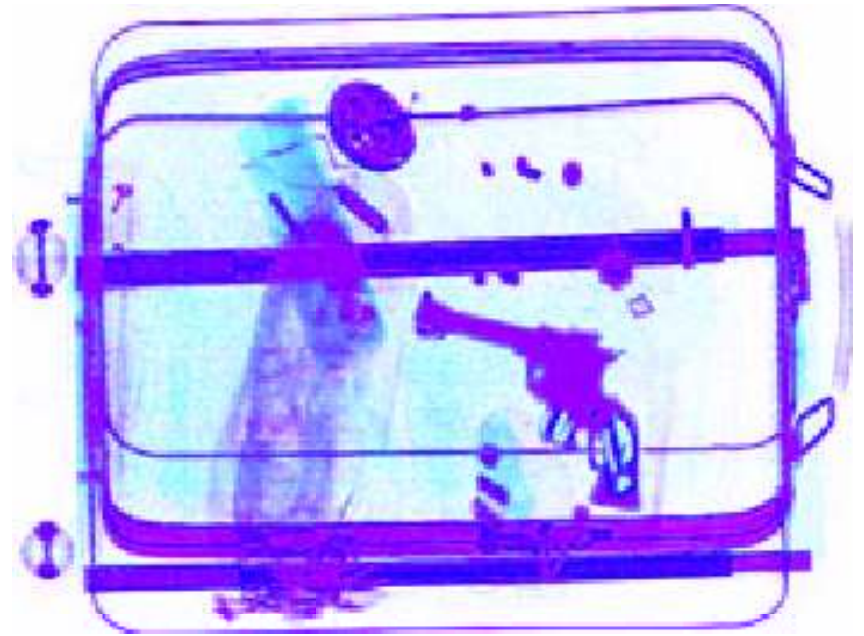


# Visual Search

# Examples of Visual Search

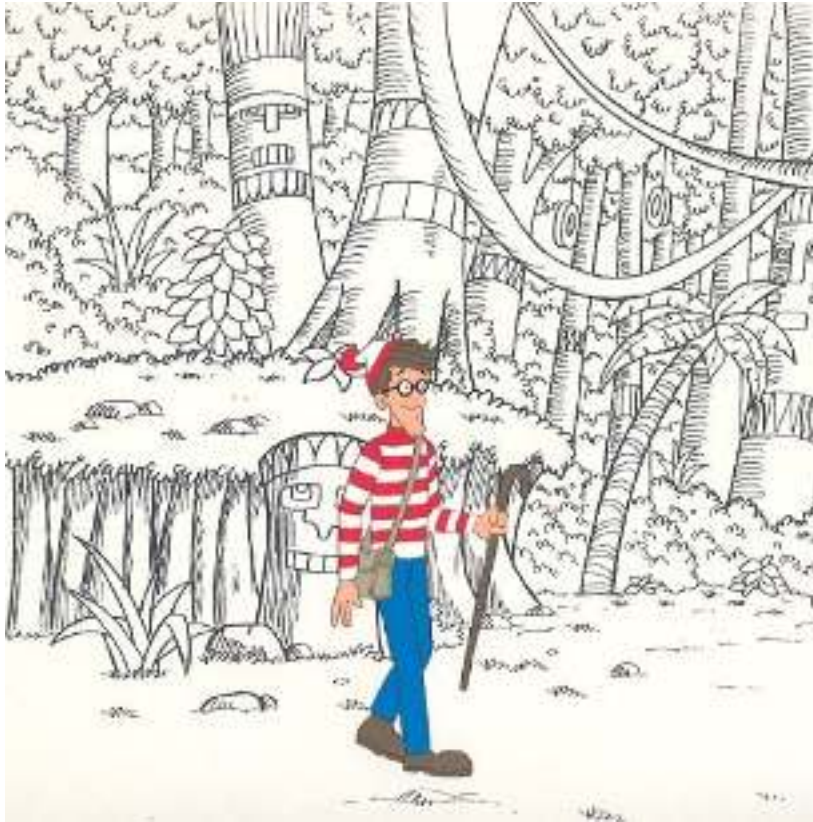


Finding a face



Finding objects

# Where's Waldo?



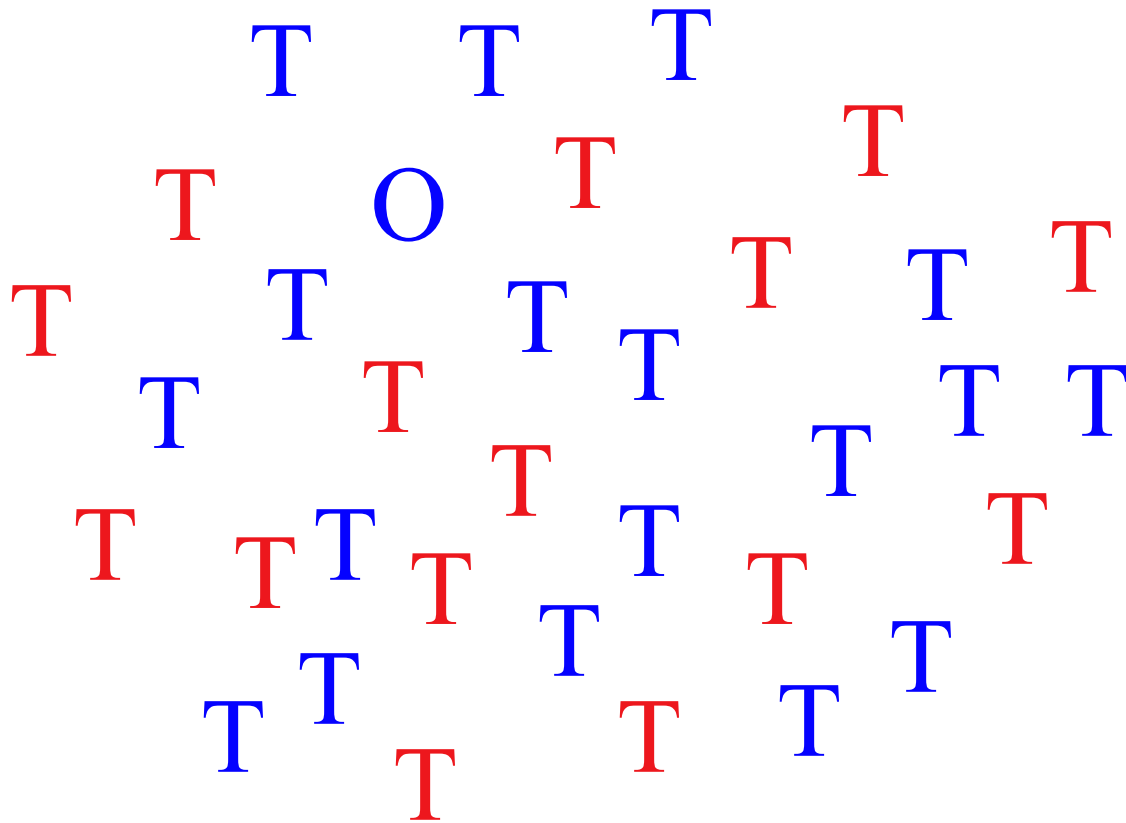
Disjunctive Search



Conjunctive Search

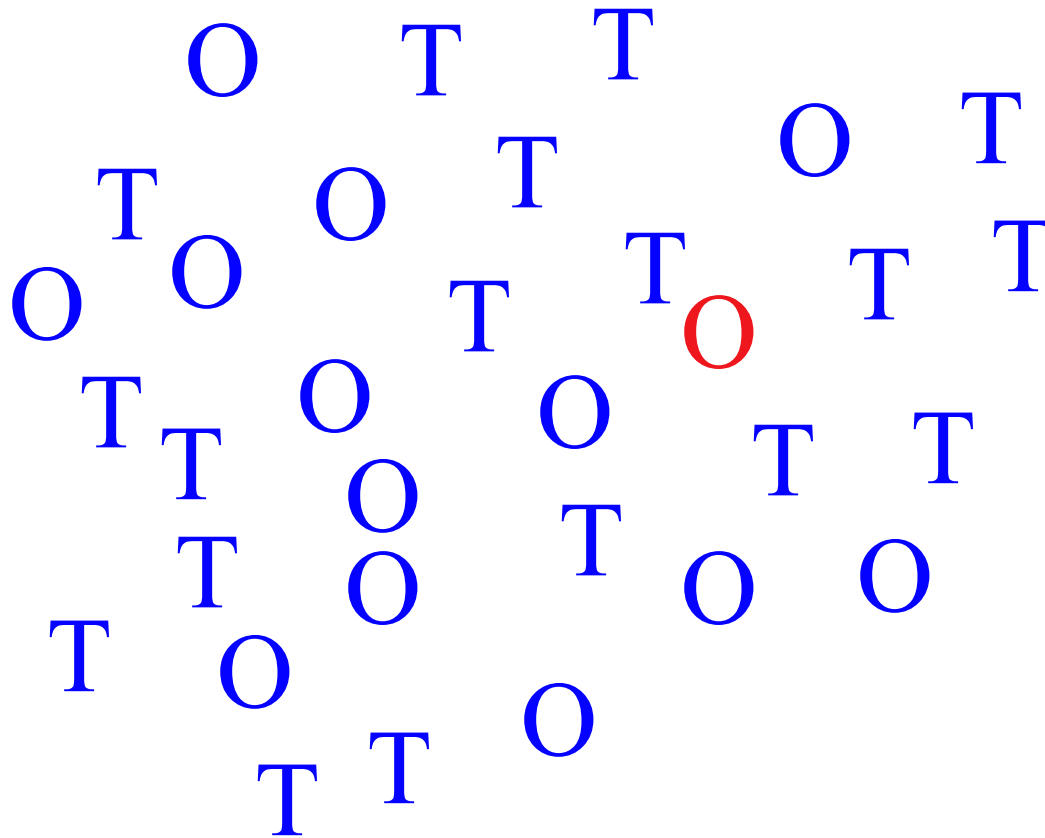
# Disjunctive Feature Search

Look for an "O"



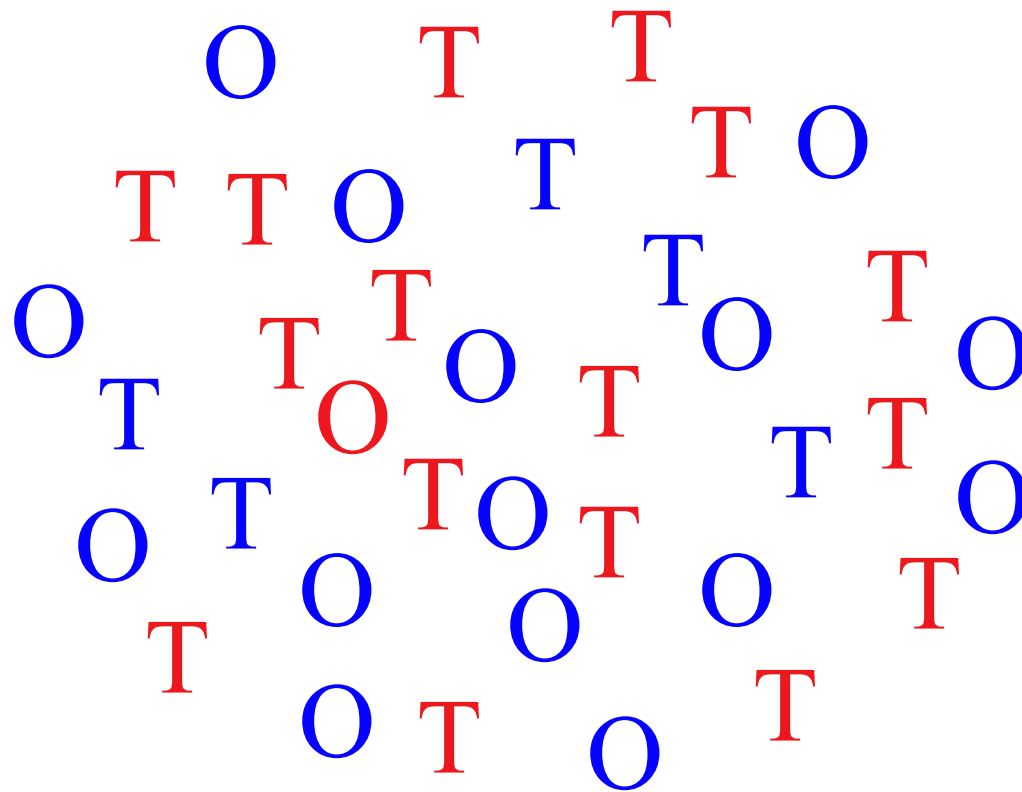
# Disjunctive Feature Search

Look for something red

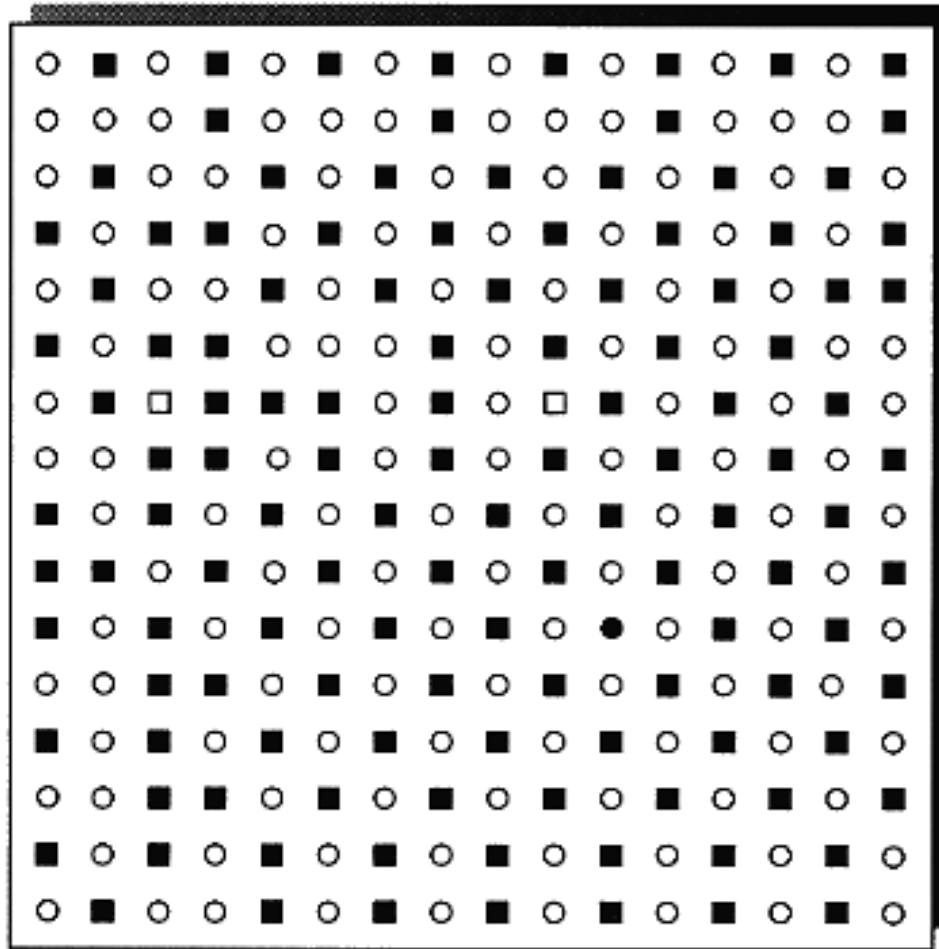


# Conjunctive Feature Search

Look for something red AND "O"

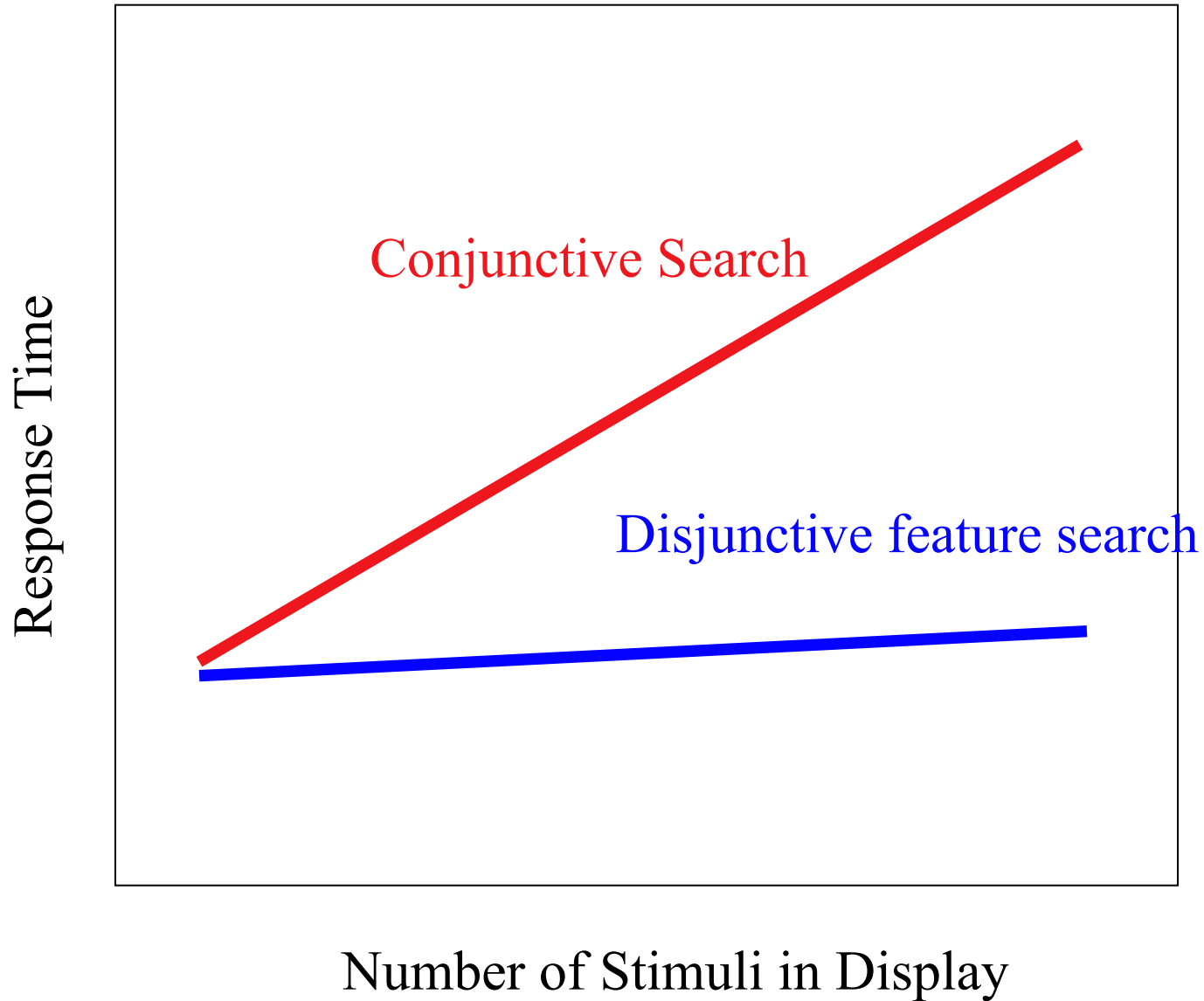


# Search times can be influenced by set size



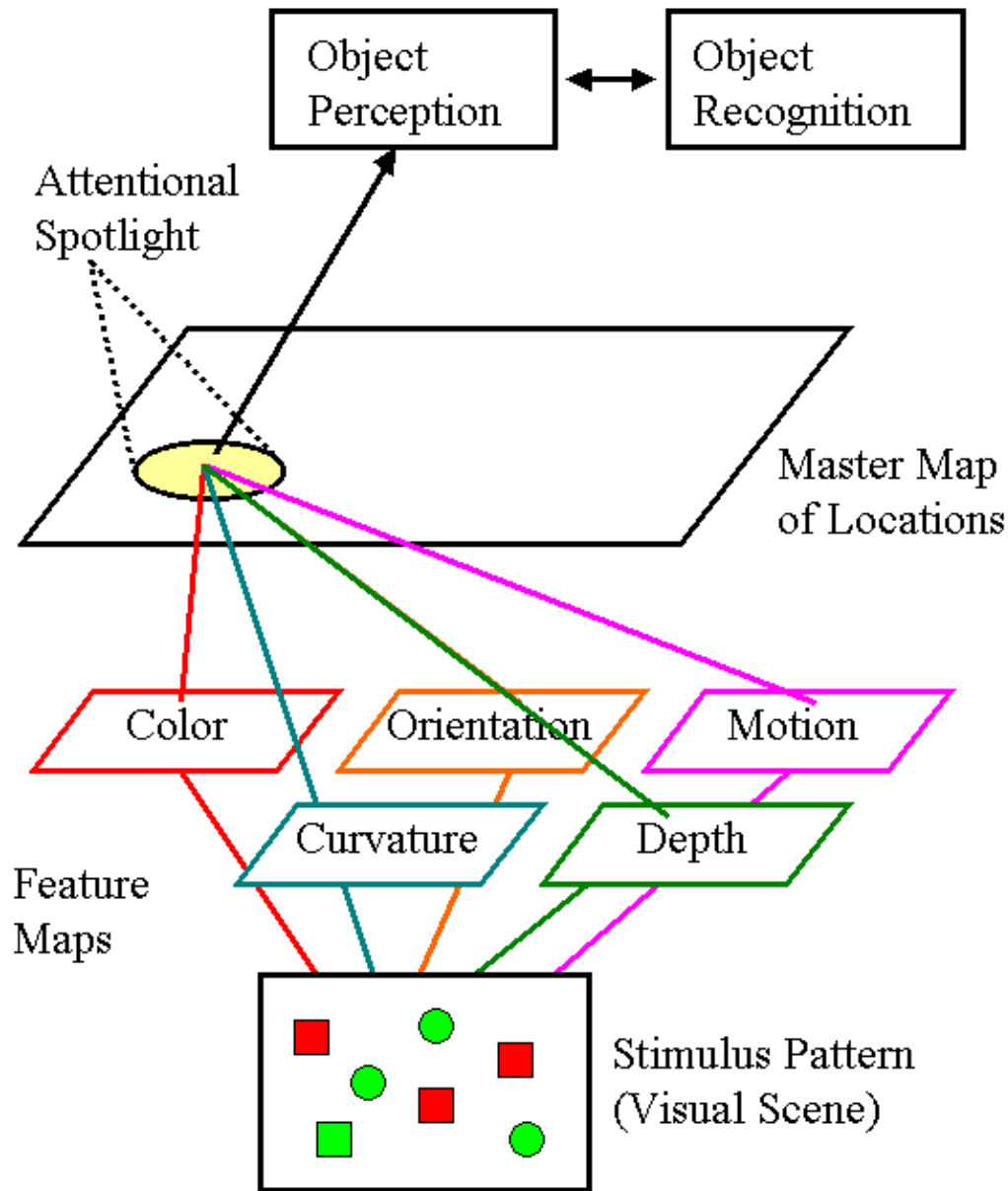
is there a black circle?

# Typical Results

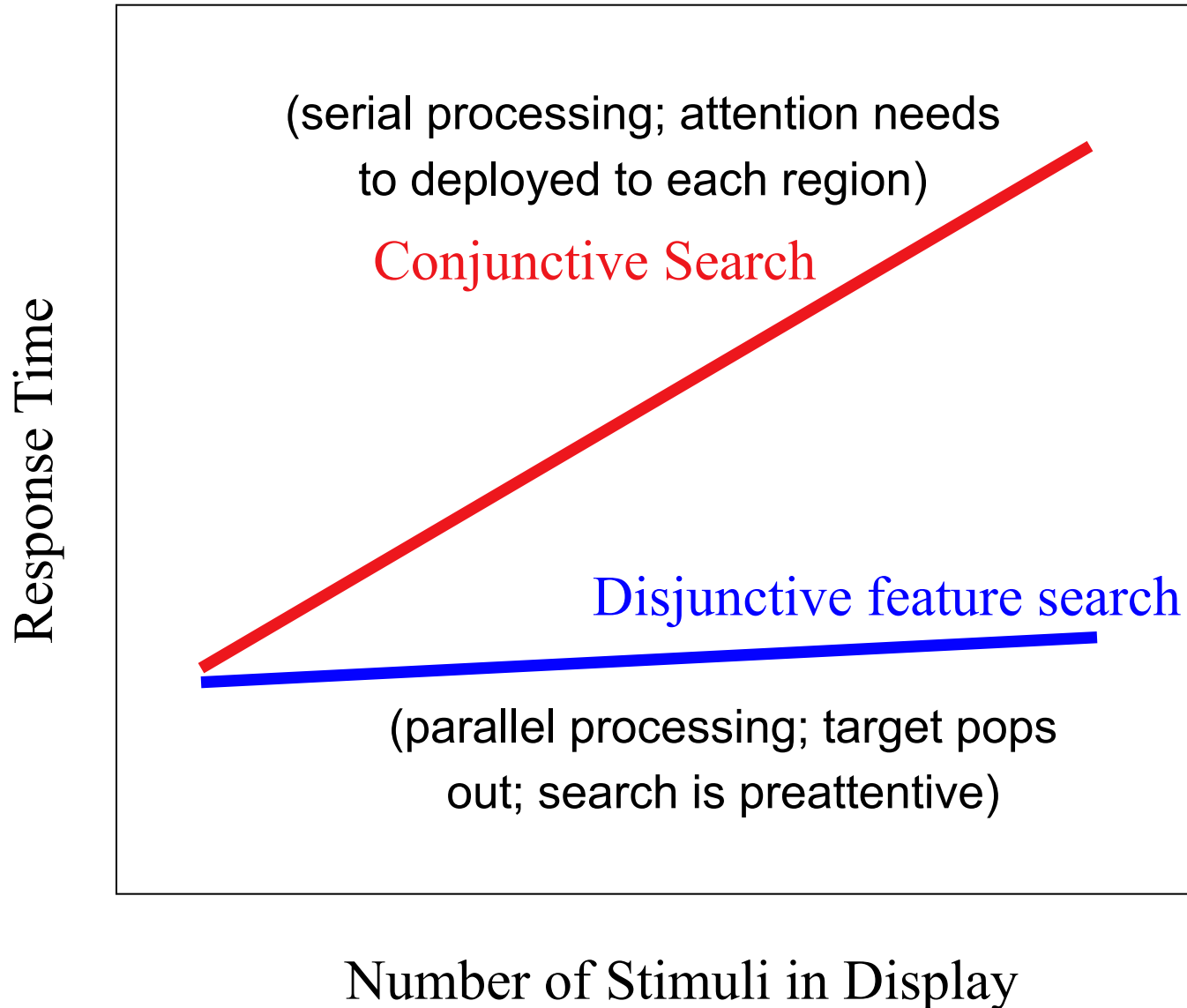


# Feature Integration Theory (FIT)

(特征整合理论)



# Interpretation in FIT

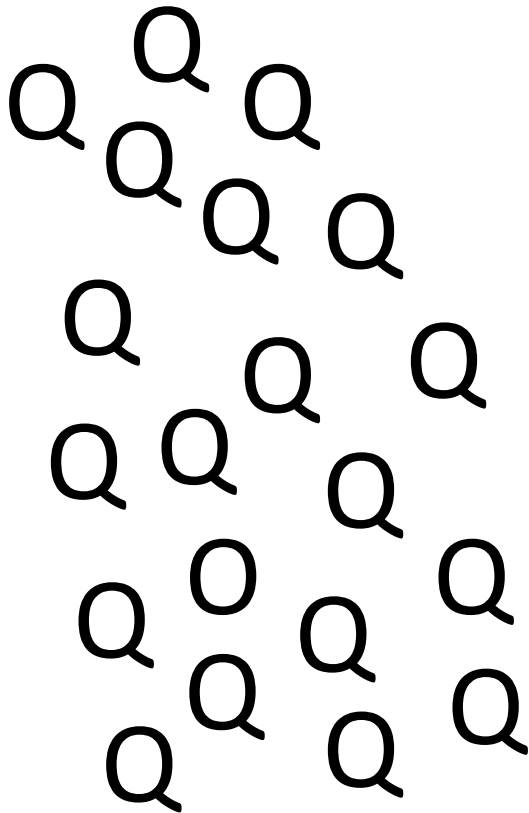


# Feature Integration Theory

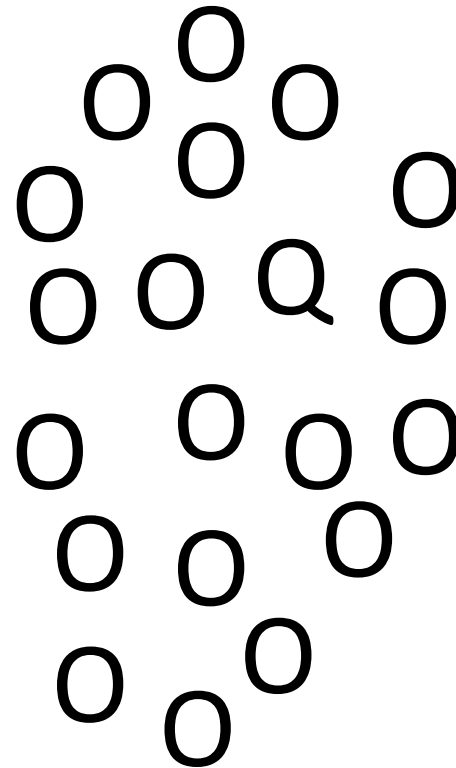
- Different visual features are coded in parallel in separate feature maps. Visual search is easy (“pop out”) when it involves only a single feature that can be computed by a feature map → no attention is required, i.e., search is **preattentive** (前注意的)
- Visual search becomes more difficult when **conjunctions** of features are involved. Theory states that attention is needed on a particular location to synthesize its features into an object. Attentional spotlight can only be deployed locally → viewer must apply **serial search**

# Feature search asymmetries

It is easier to find X among Ys than Y among Xs if X has an extra feature compared to Y.



Find the O



Find the Q

# Illusory conjunctions

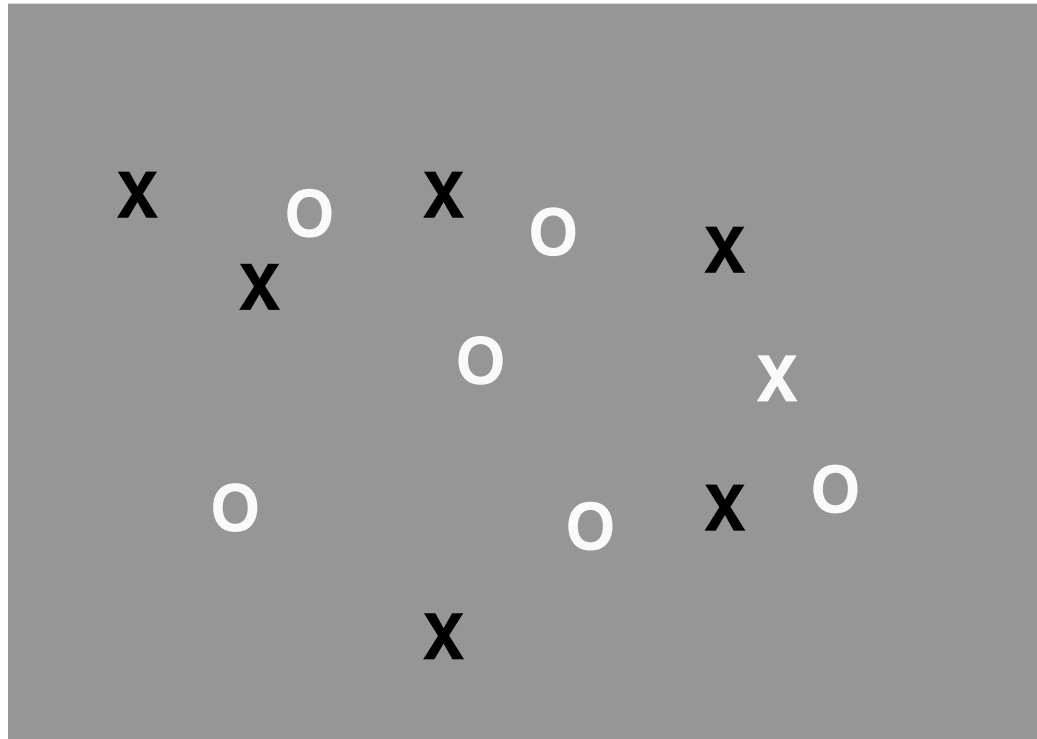
- Prediction of theory: if attention can conjoin features correctly, the lack of attention can lead to incorrect (illusory) conjunctions?

Read the vertical line of digits in the following display



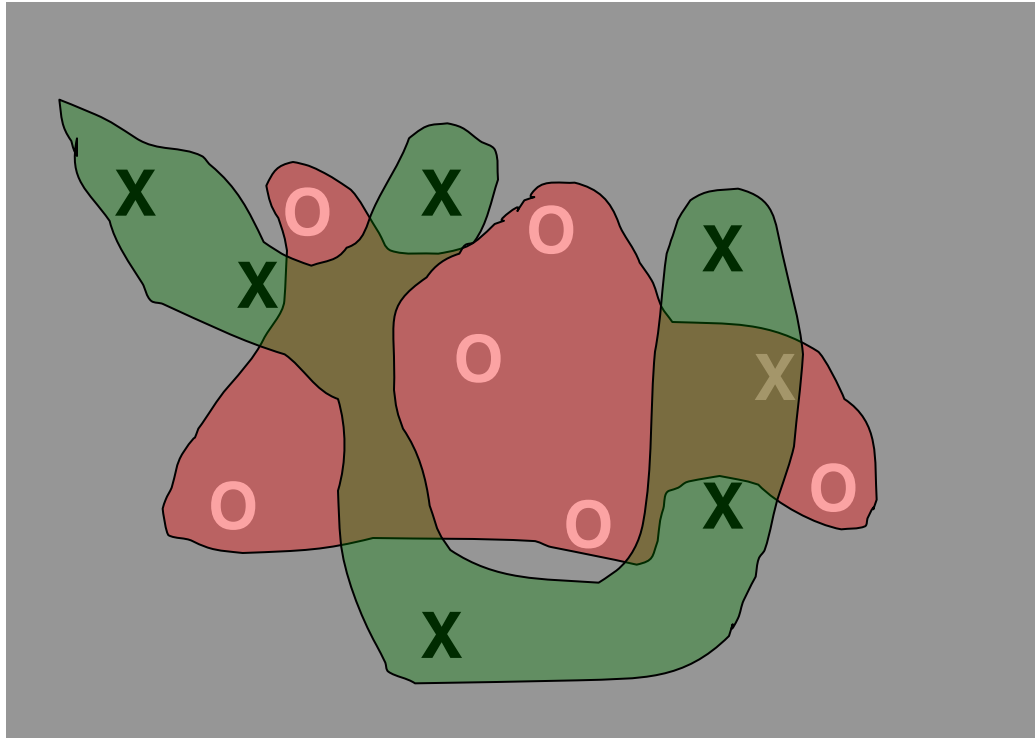
For unattended locations, subjects might report illusory conjunctions of features, e.g. blue “O”

# Problem for Feature Integration Theory



Some conjunctions are easy and produce fast search times.

# Guided Search



- Guided search model is a modification of feature integration theory
- Separate processes search for Xs and for white things (because they are the target features), and there is a consequent area of double activation that draws attention to the target

# Early vs. Late Selection Theories

# When listening to somebody, what else might get noticed?



# Dichotic listening/ Shadowing tasks



demo: <http://www.linguistics.ucla.edu/people/schuh/lx001/Dichotic/dichotic.html>

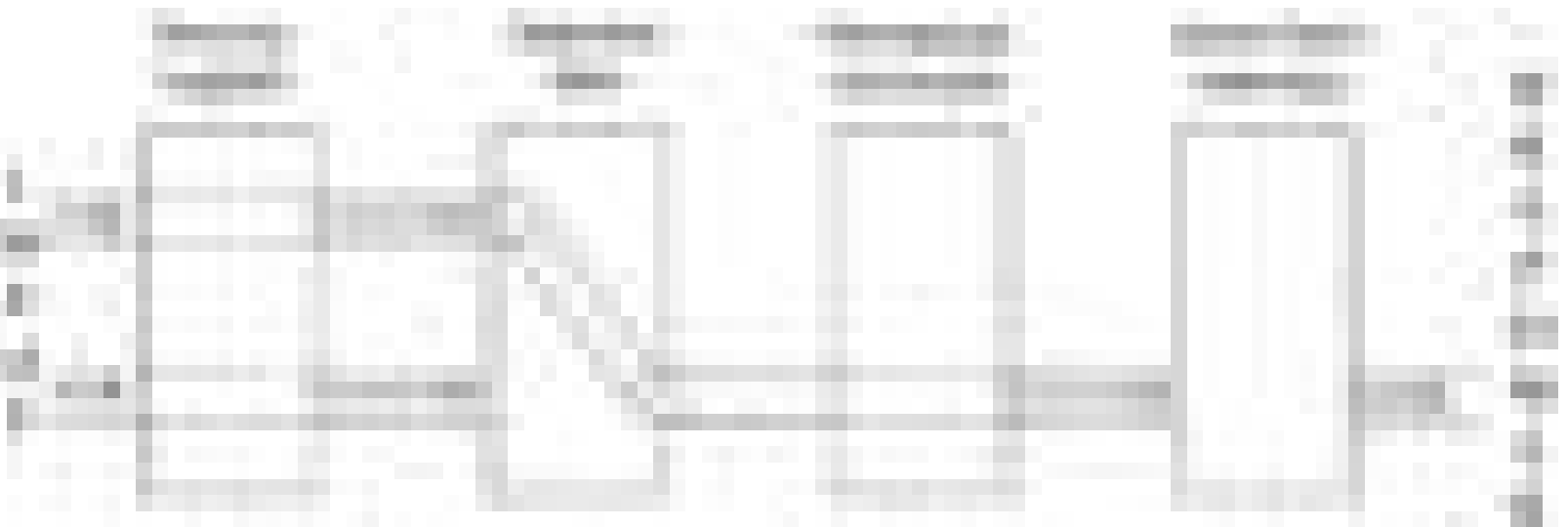
# What gets through?

- What happens to unattended message?
  - Not much, we seem to remember mostly low-level information (human voice or not, changes in gender, not a change in language)
  - The same word can be repeated without being noticed

# Early Selection Theory

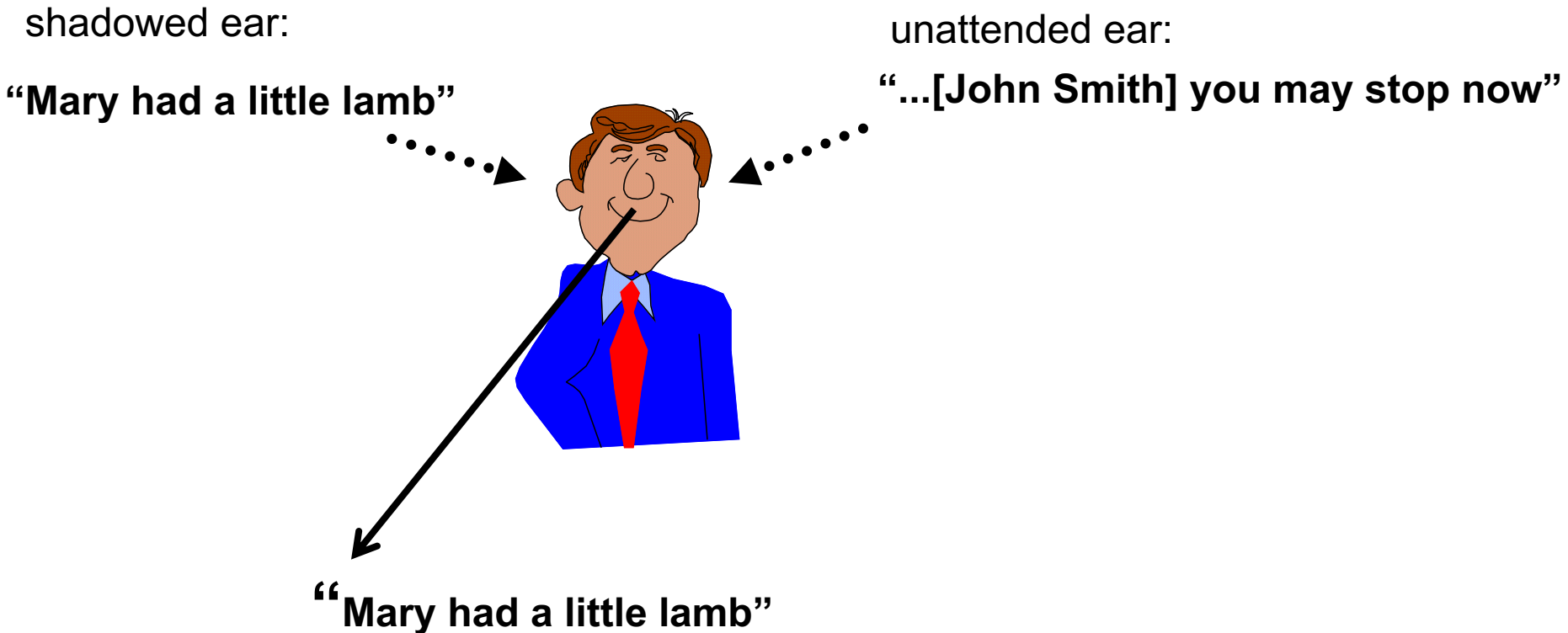
(Broadbent)

- Sensory information is processed until a bottleneck is reached
- One of the inputs is then allowed through a filter on the basis of its physical characteristics, with the other input remaining in the buffer for later processing



# Problem (1) for early selection theories

- People notice their own name at parties: **cocktail party effect**





# Treisman's Attenuation theory

- Messages are attenuated but not filtered on the basis of physical characteristics
- Semantic criteria can apply to all messages, attenuated or not
- Semantic criteria are harder to apply to attenuated messages, but still possible

