Perception, Part 4
Gleitman *et al*. (2011), Chapter 5

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Psych 9A / Psy Beh 11A
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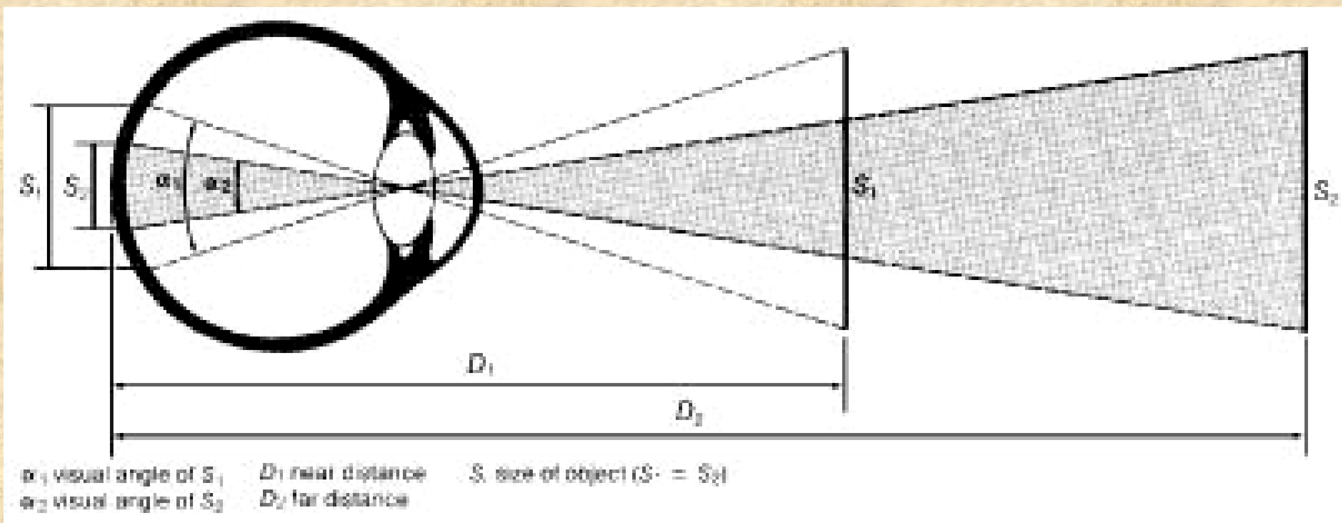
Perceptual Constancy

Size Constancy – determine an object's true size

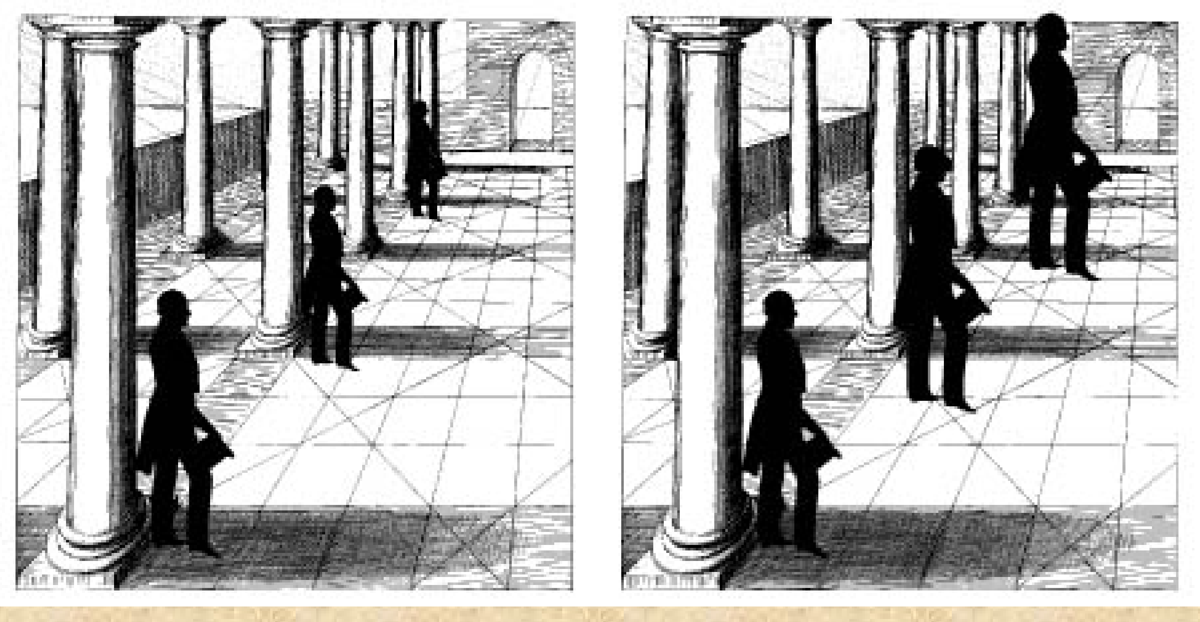
important variables: retinal image size and distance



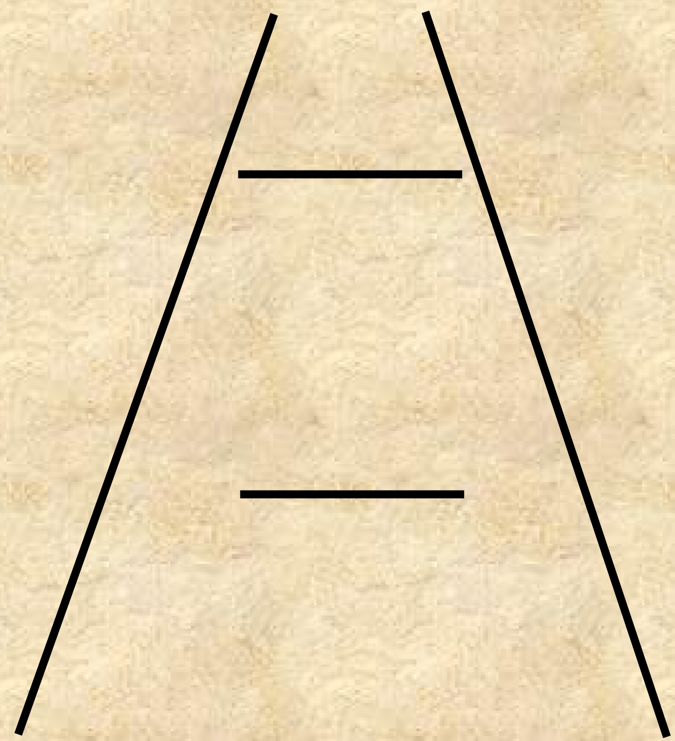
Helmholtz – *unconscious inference*

Use retinal image size, together with estimated distance, to judge object's true size

Size Constancy



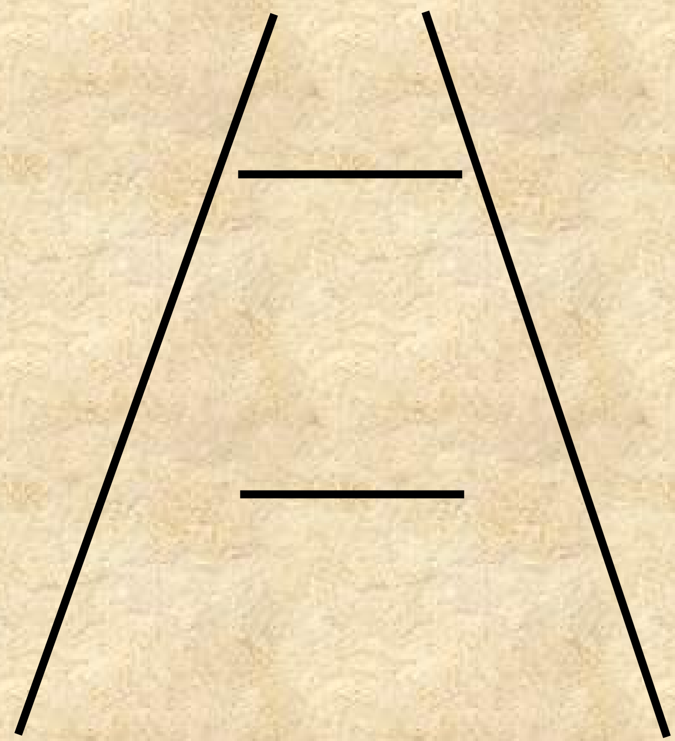
Size Constancy



Ponzo Illusion

Horizontal lines of identical physical length. Do they appear to have the same length?

Size Constancy

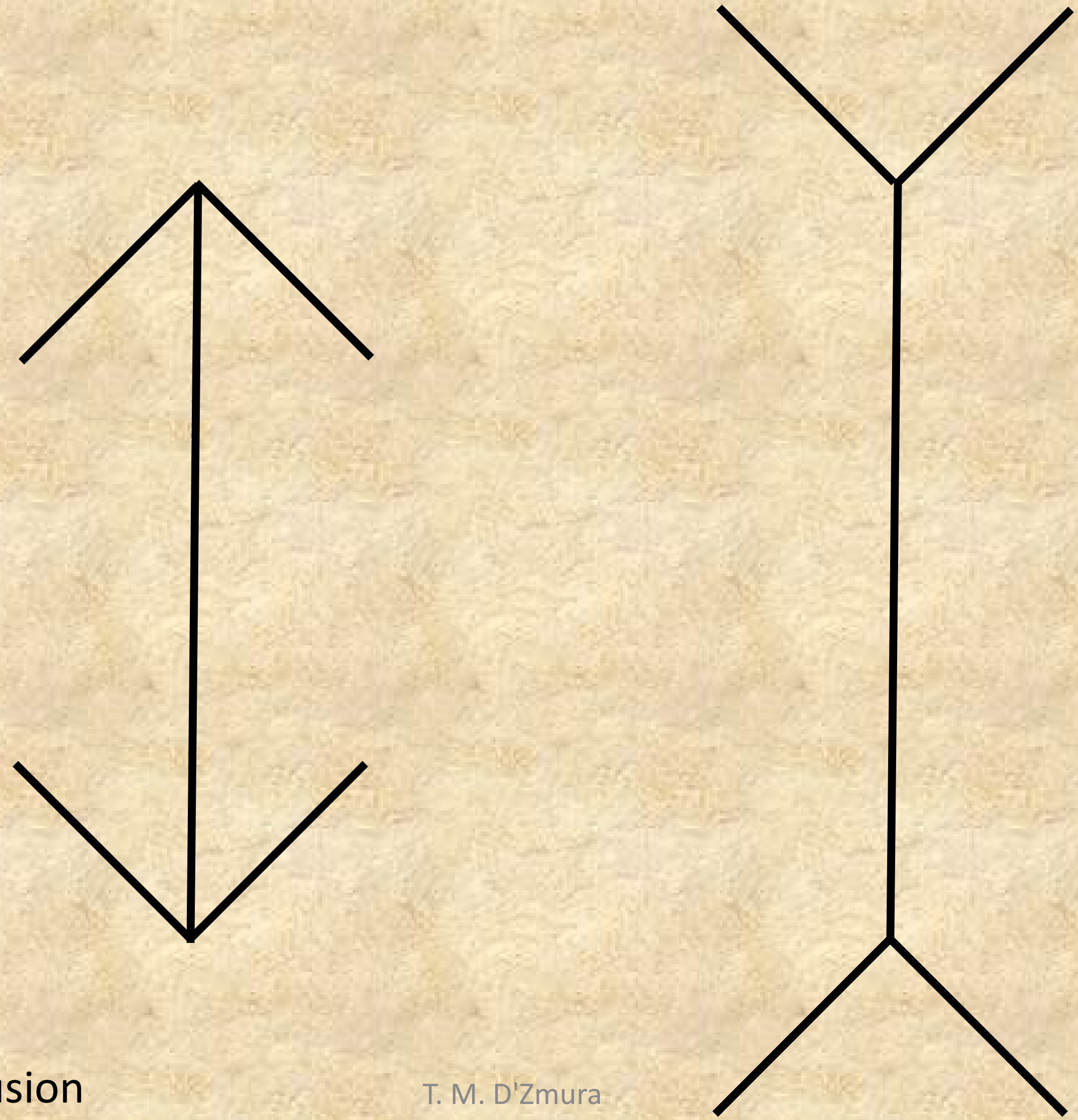


Ponzo Illusion

Our minds try to construct 3D interpretations of what they see.
Here the stimulus suggests parallel lines in 3D heading off
into the distance (like railroad tracks – linear perspective cues).
The horizontal line at bottom is “closer” and appears smaller;
the one at top is “farther” and appears larger

Vertical lines
are of identical
physical length.

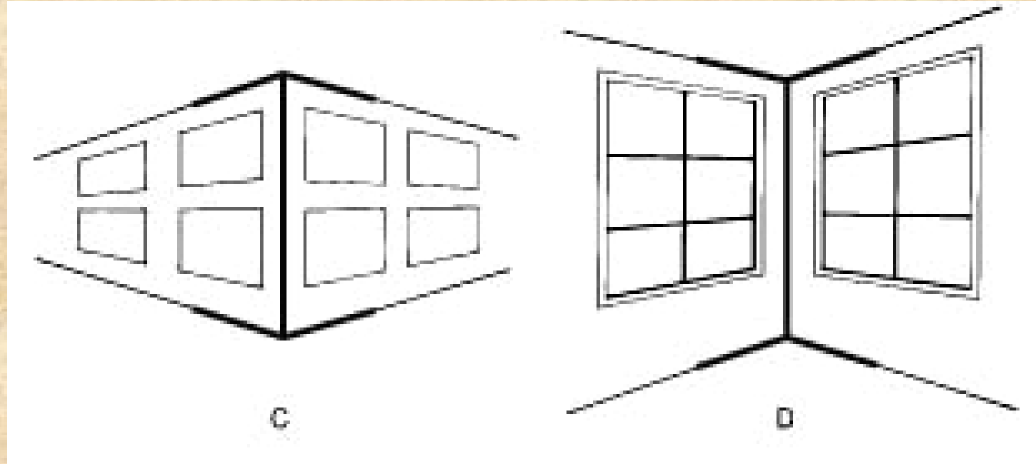
Size Constancy



Mueller-Lyer Illusion

Size Constancy

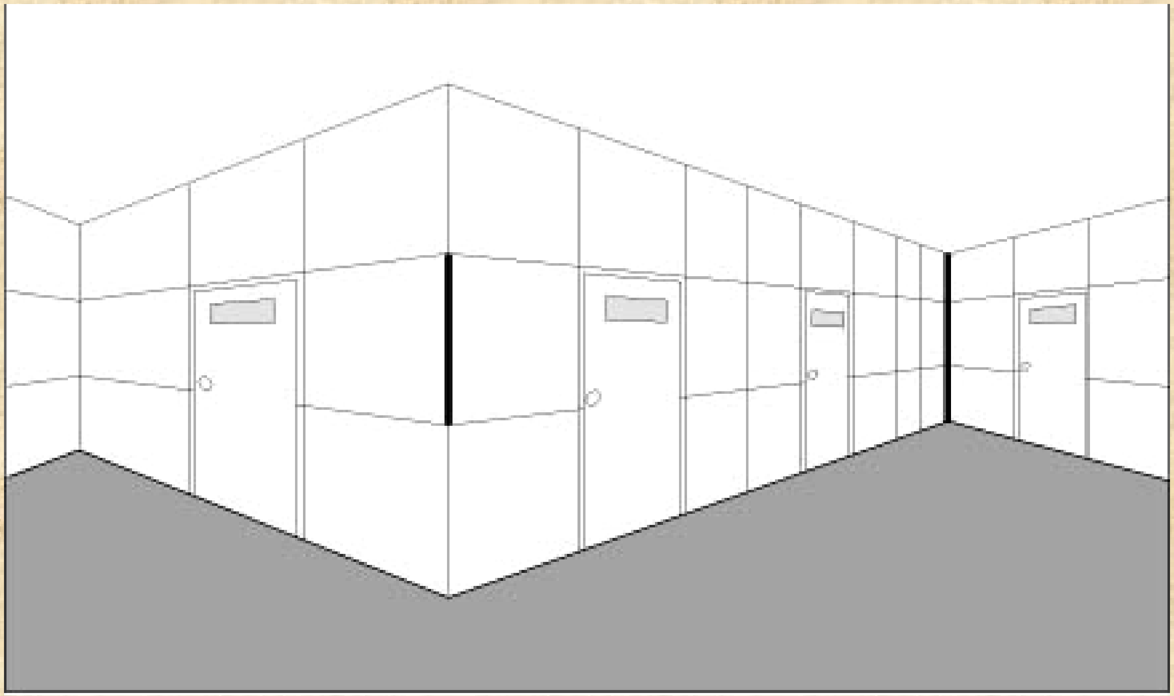
Mueller-Lyer Illusion



Our minds try to construct 3D interpretations of what they see.
Here the stimulus suggests corners of a room (left) seen from outside
(vertical line closer) or (right) seen from inside (vertical line farther).
Try http://michaelbach.de/ot/sze_muelue/index.html

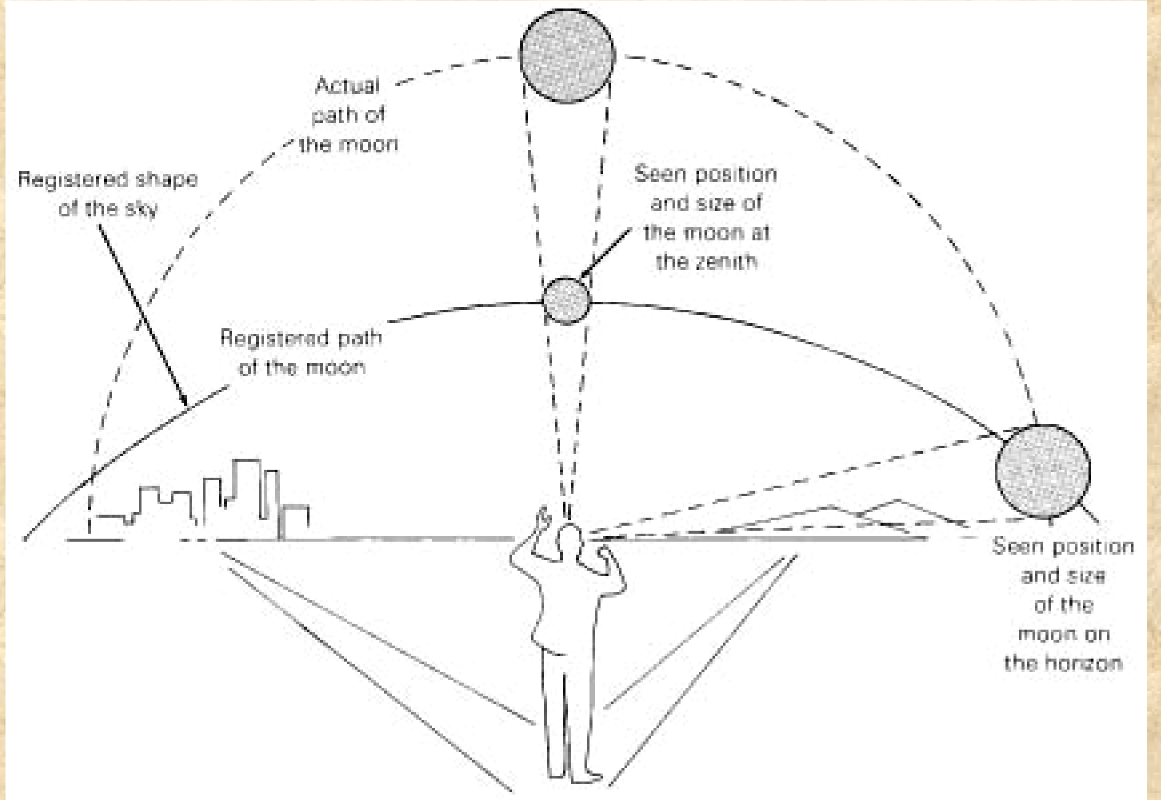
Size Constancy

Mueller-Lyer Illusion

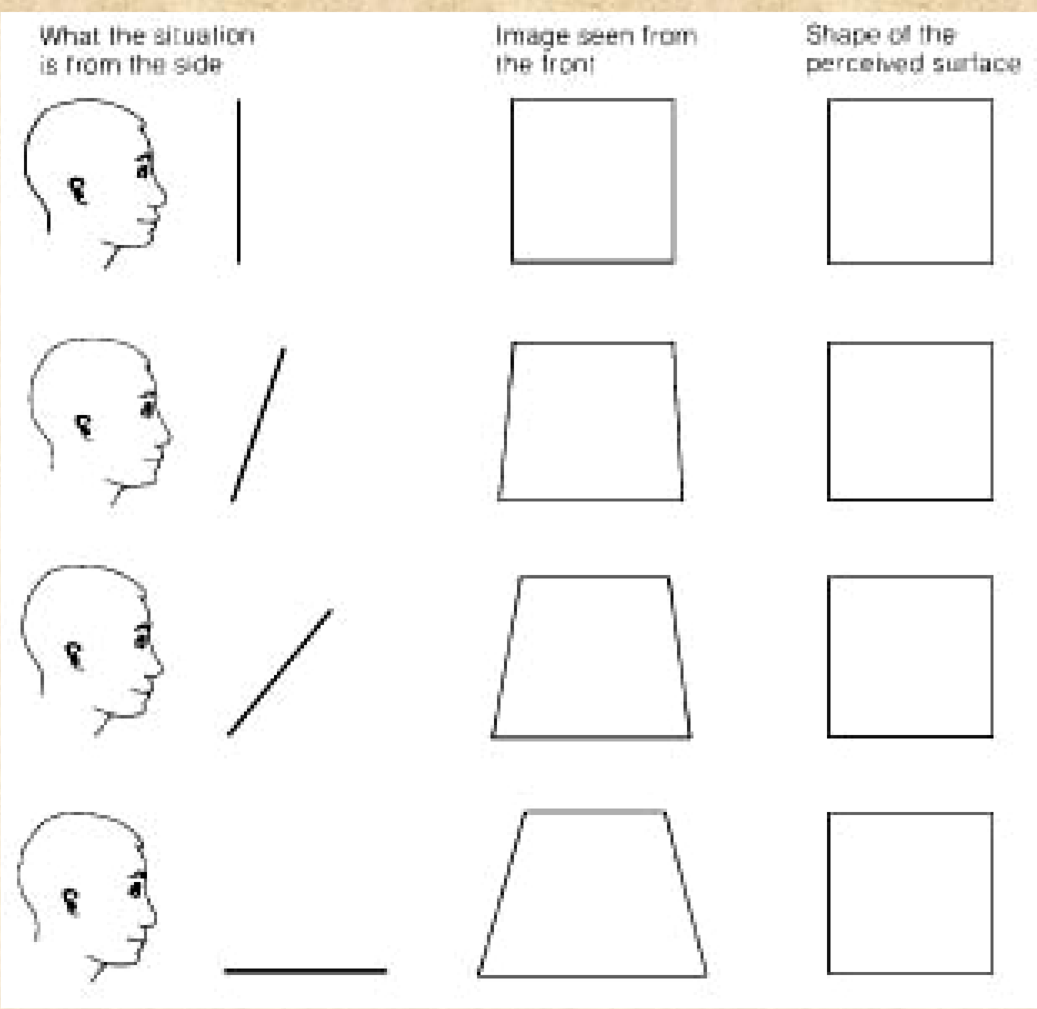


Size Constancy

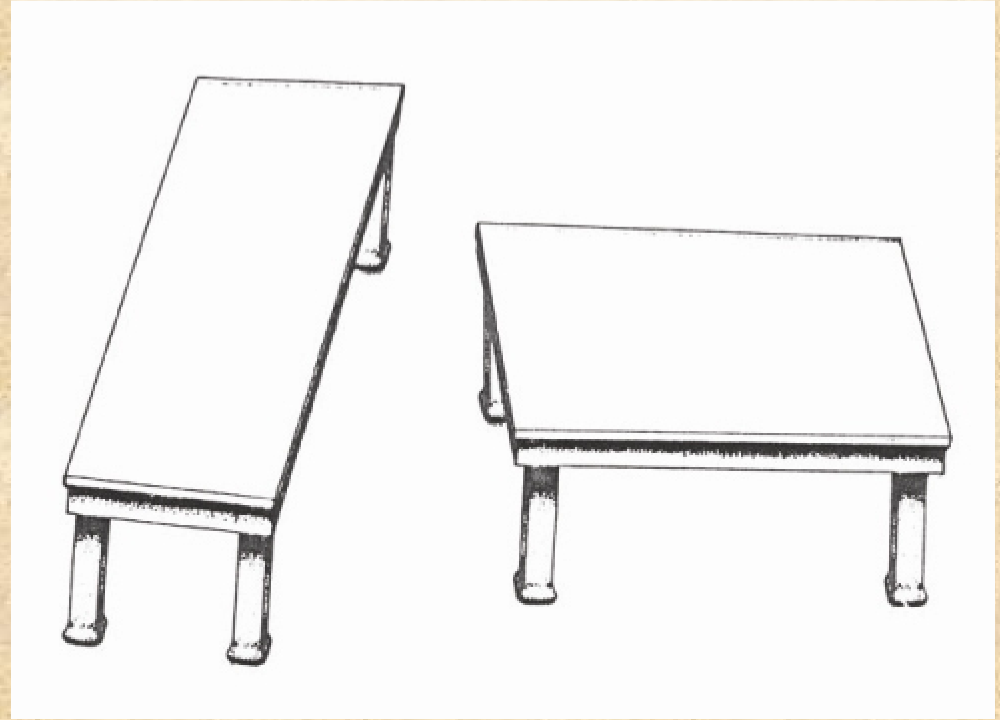
The moon appears larger when it is viewed close to the horizon and smaller when it is directly overhead. This is the *Moon Illusion*.
We perceive objects on the horizon as farther away from us than objects up high in the sky. Our perceived sky is “flattened” at the top!



Shape Constancy – determine an object' s true shape



Shape Constancy – determine an object's true shape

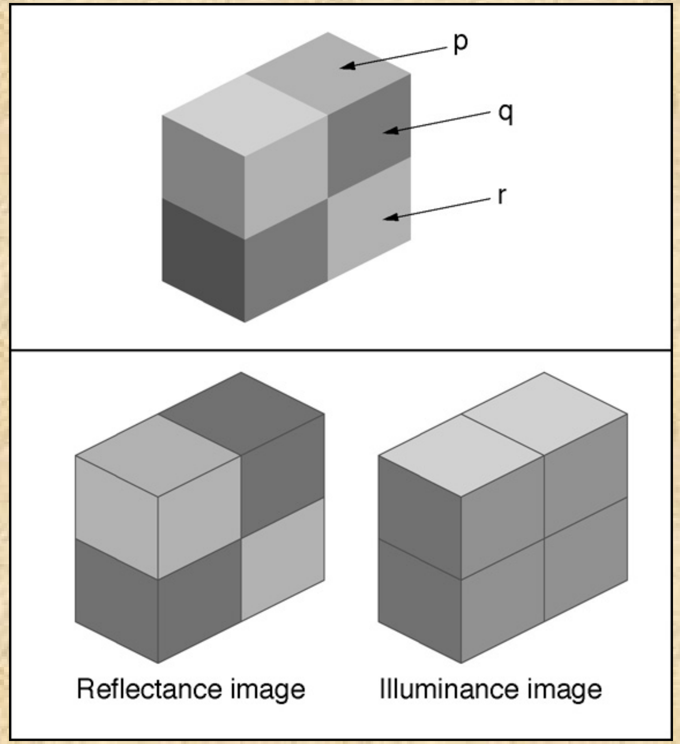


tabletop illusion
Here's an animated version: http://www.eyetricks.com/4701.htm

Lightness Constancy - determine a surface's propensity to reflect light

The intensity L of the light reaching the eye from a surface is the *product* of
the illumination intensity I and the surface reflectance R: $L = I\,R$

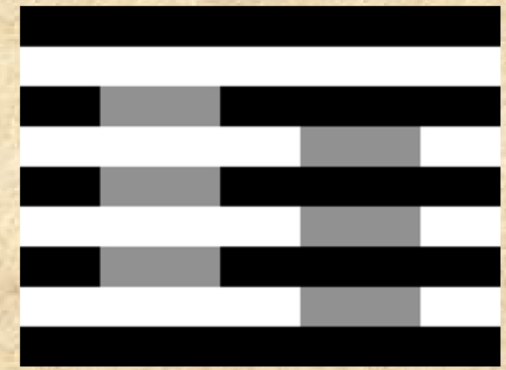
Our visual systems split the proximal image data (reflected light L reaching the eye) into two parts: the reflectance image (surface) and illuminance image (light)



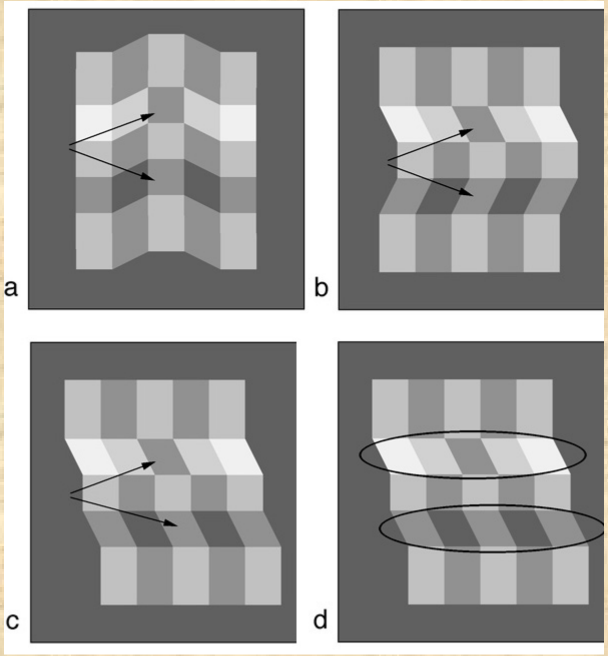
from Ted Adelson's web page, http://persci.mit.edu/people/adelson/

Lightness Constancy

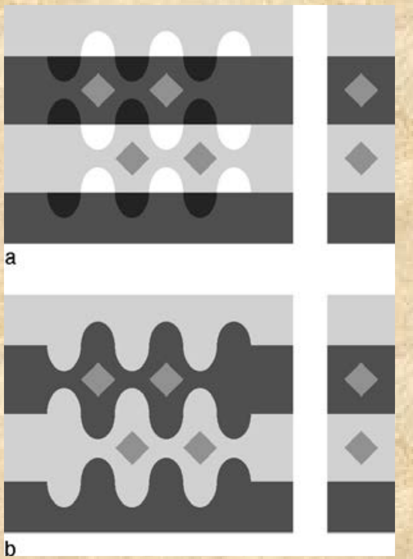
Lots of neat lightness illusions



White's illusion

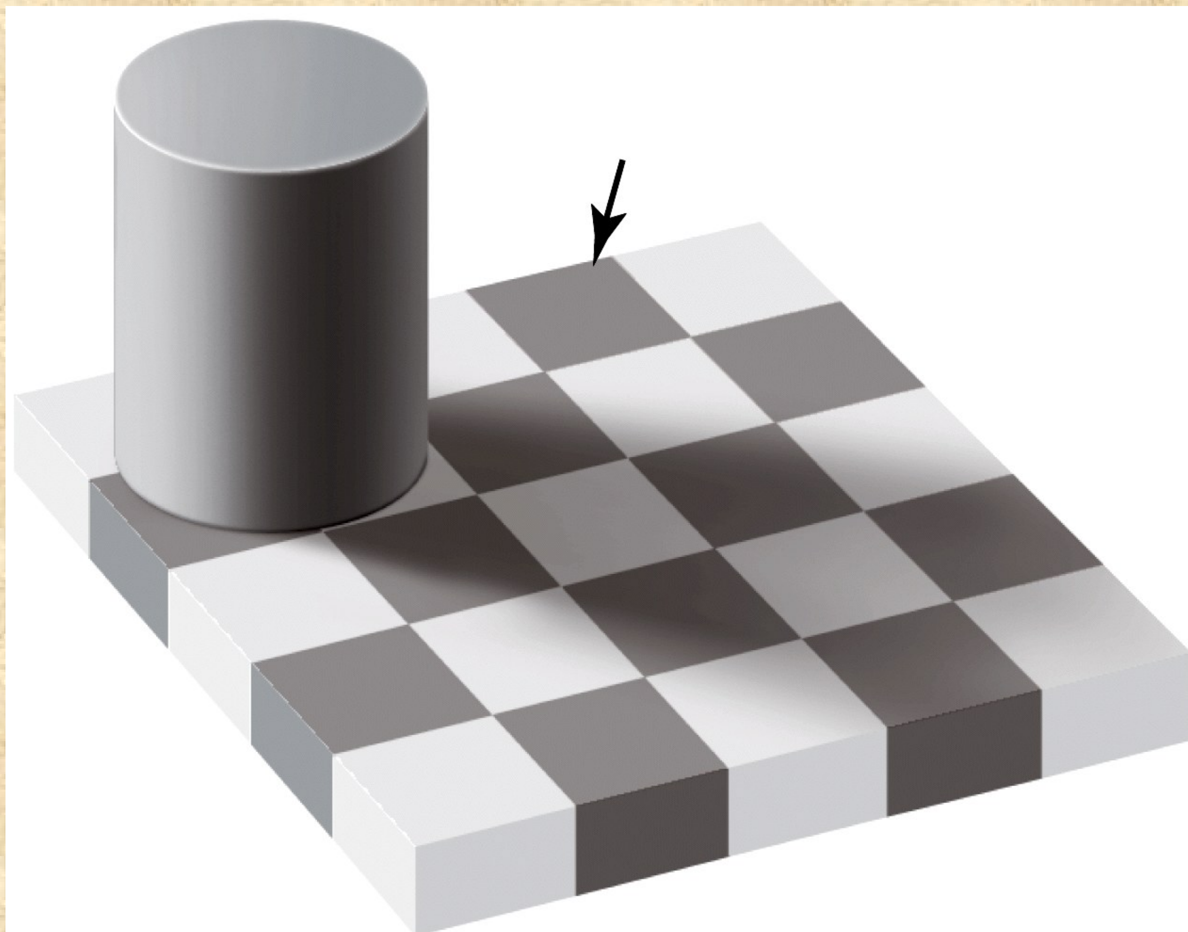


Corrugations



Snake illusion

try Ted Adelson's Gallery of Illusions:
http://persci.mit.edu/gallery



Psychology, 8/e Figure 5.25

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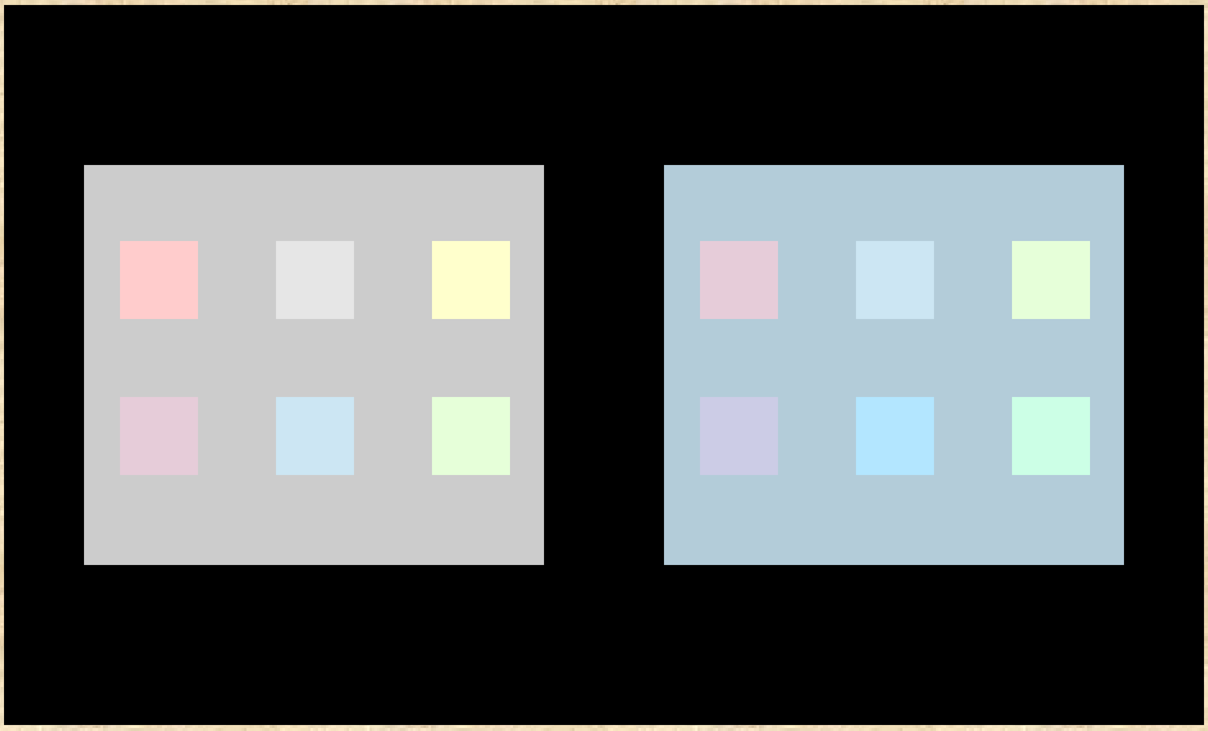
the central square has a physical gray value identical to that of the square marked by the arrow

Color Constancy

a simulated change in color of illumination (left vs. right)



from http://www.cnl.salk.edu/~thomas/cc.html

bottom row at left physically identical to top row at right!

Attention

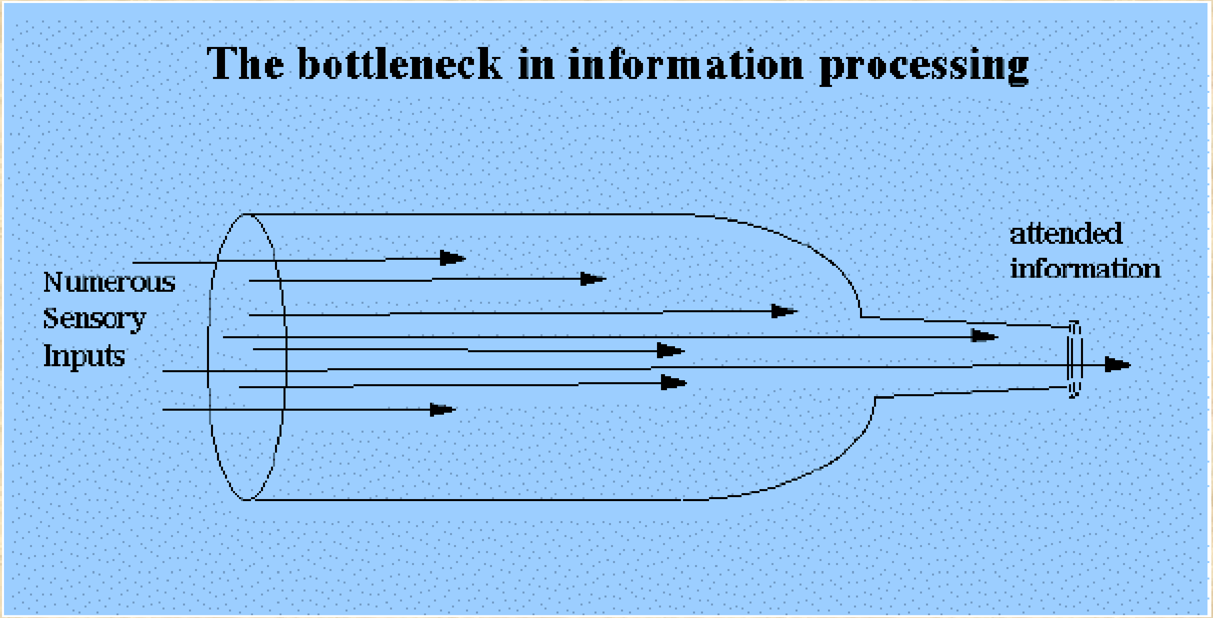
- Perception is selective.
  - Selectivity is produced by *orienting* and through central adjustments.
  - Adjustments depend in part on our ability to prepare ourselves by priming relevant detectors and processing pathways.

Eye movements: fine example of physically orienting oneself toward a stimulus

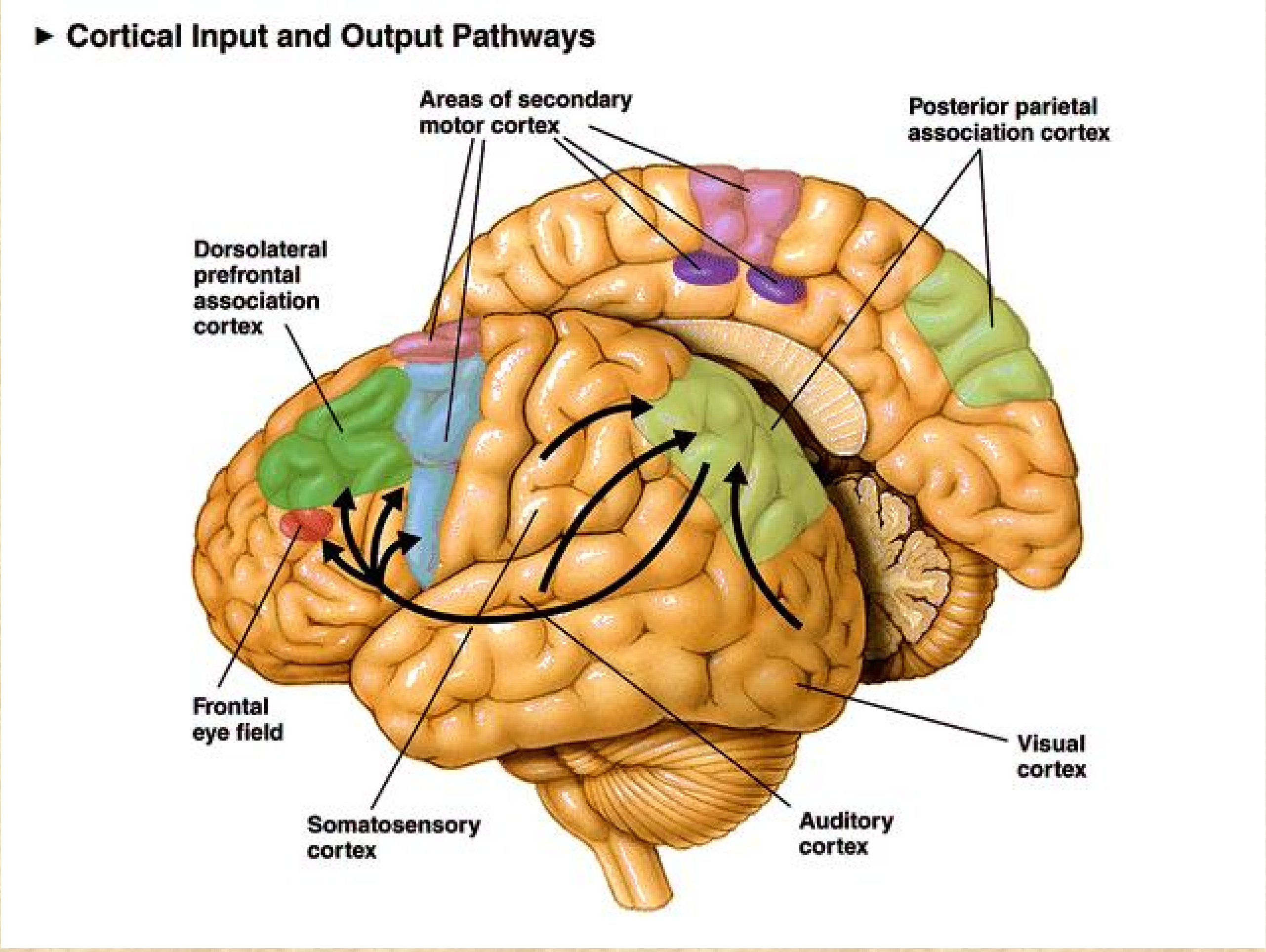
Although there is massive parallel processing evident in
sensory processing, coordinated movement, and the like,

There are bottlenecks in human information processing:
later stages of information processing depend on the
sequential processing of limited amounts of information.

Attentional systems select information to process at bottlenecks.

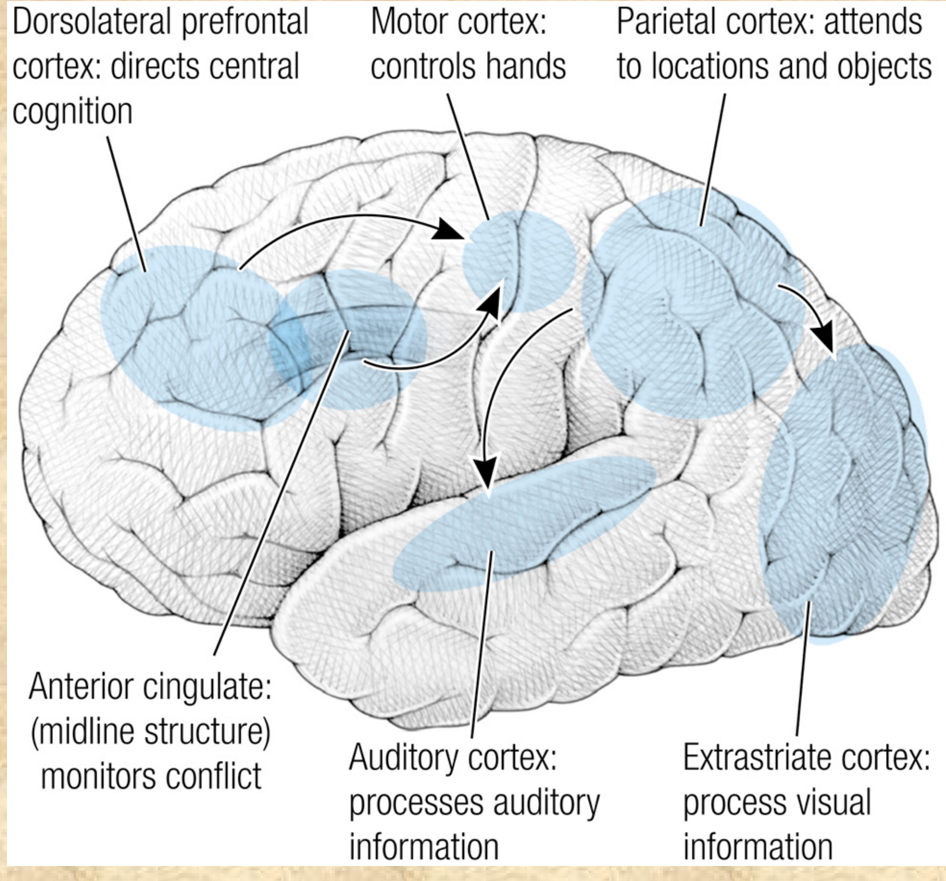


Brain areas implicated in attentional processing



Dorsolateral prefrontal cortex: receives information from parietal cortex; implicated in cognitive processing, control motor behavior

Parietal cortex: attentional control of sensory processing



Anterior cingulate: involved in both cognitive and affective processing

http://brain.oxfordjournals.org/cgi/content/full/126/10/2119
http://www.annalsnyas.org/cgi/content/full/935/1/107?ijkey=e59d472ad30e1c5094da2ad053ceb48a5417af98

Visual attention – selective looking

We deploy visual attention when we search.

An important skill in normal vision…

-Find somebody you are looking
for in a crowd.

-Find your car in a crowded
parking lot.

An early study by Neisser

Find the letter K:

TWLN
XJBU
UDXI
HSFP
XSCQ
SDJU
PODC
ZVBP
PEVZ
SLRA
JCEN
ZLRD
XBOD
PHMU
ZHFK
PNJW
CQXT
GHNR
IXYD
QSVB
GUCH
OWBN
BVQN
FOAS
ITZN

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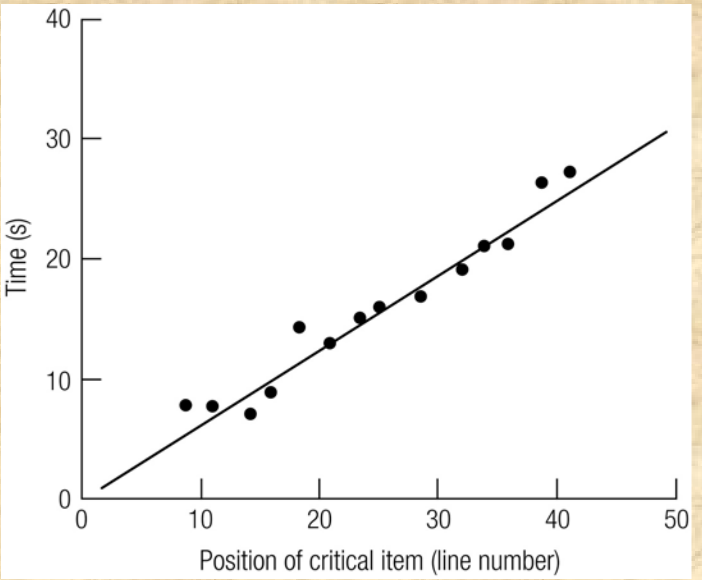
FOAS
ITZN

Search of this sort is *serial* –
look through the displayed letters one-by-one for the target

In this example, visual structure is present which suggests search order:
line by line



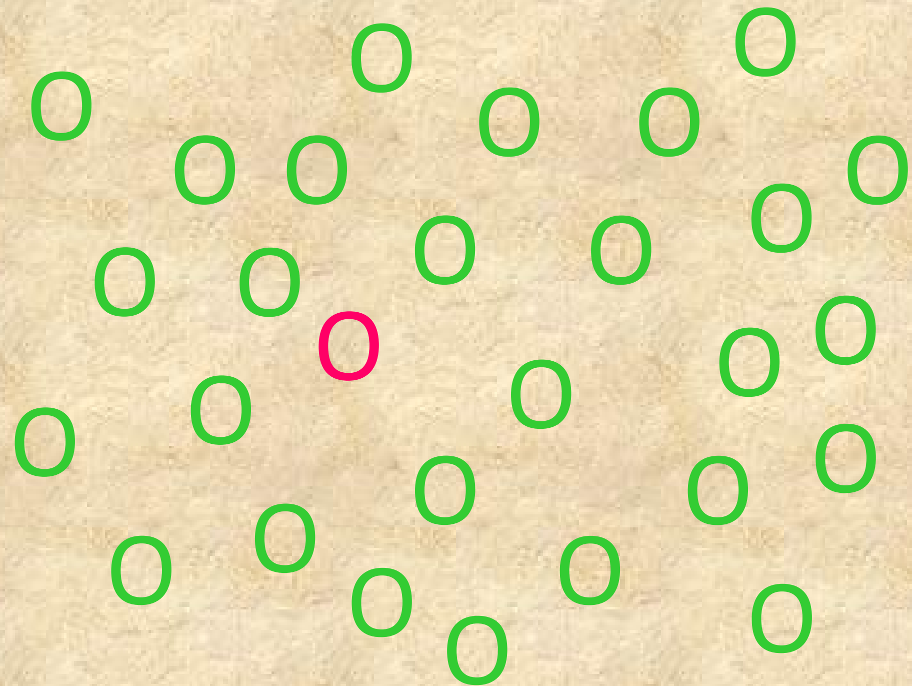
-The time it takes to find the target depends on which line the target is located.

- Slope is 0.6 sec

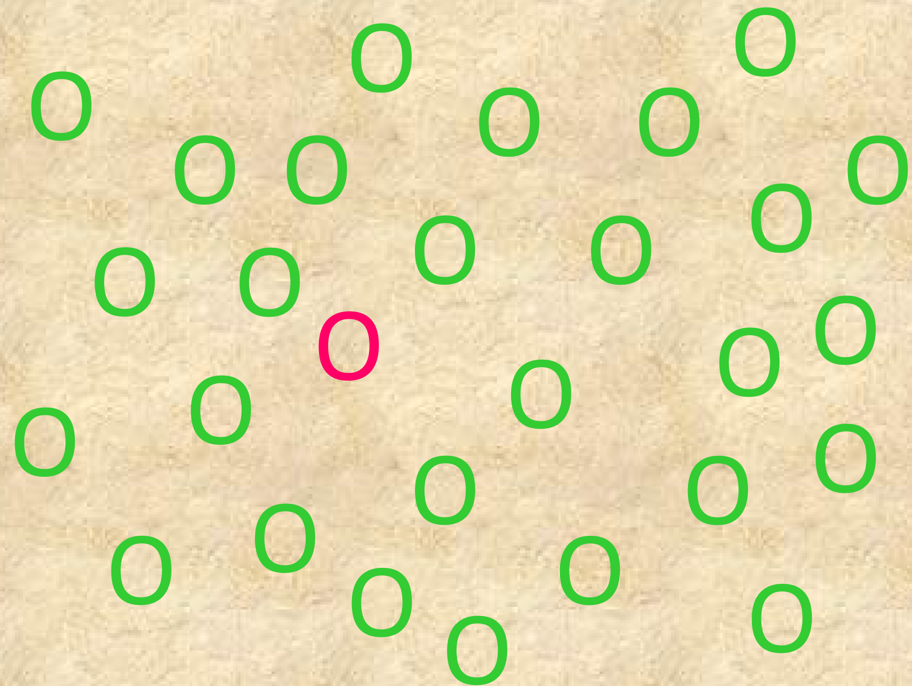
Anne Treisman's visual search paradigm, which we saw in an earlier lecture:

O target

Show a display like that below.
Green O’s are distractors.
Vary the number of distractors.
On half the trials, the target (red O) is present.
On half the trials, it is absent.
Subject presses key for target present vs. target absent as quickly as possible.
Measure reaction time as a function of number of distractors.



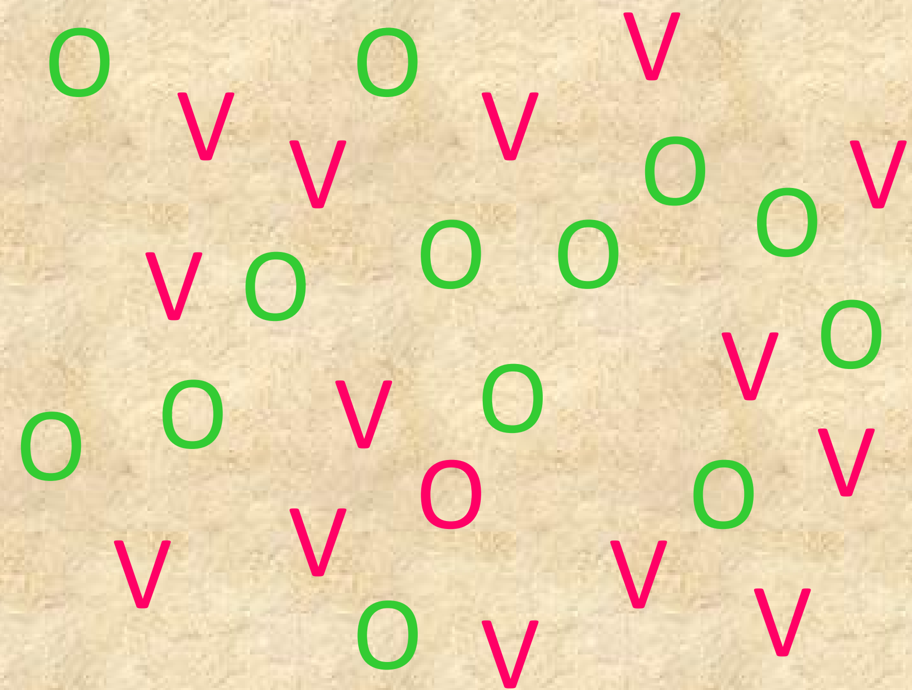
Some searches are very easy. Indeed, it appears that certain items (like the red O) can draw one's visual attention. Such a target is said to *pop out.* In this case, attention is directed by the stimulus (bottom-up). The target is distinguished by a color *feature*.



Here's another example of pop out – bottom-up direction of visual attention by the stimulus.

Visual search

When a single feature does not suffice to distinguish target from distractors, search is usually more difficult. Search times are longer and search gets tougher the more items there are being displayed.



In such cases, people tend to search through the items one-by-one, looking for the red O. People direct their visual attention in such cases in a top-down way. The target is a *"conjunction"* of features shared with distractors.

Priming

For example, if a person expects to read the word “cat”, then when it actually appears they will be quicker to detect it

This is an example of “top-down” processing.

Visual priming (Posner)

if you “cue” a particular location where a visual stimulus is to appear, you will detect that stimulus more rapidly than when not cued, even if there is not enough time to move the eyes (<250 msec)

“the spotlight of attention”

“the mind’s eye”

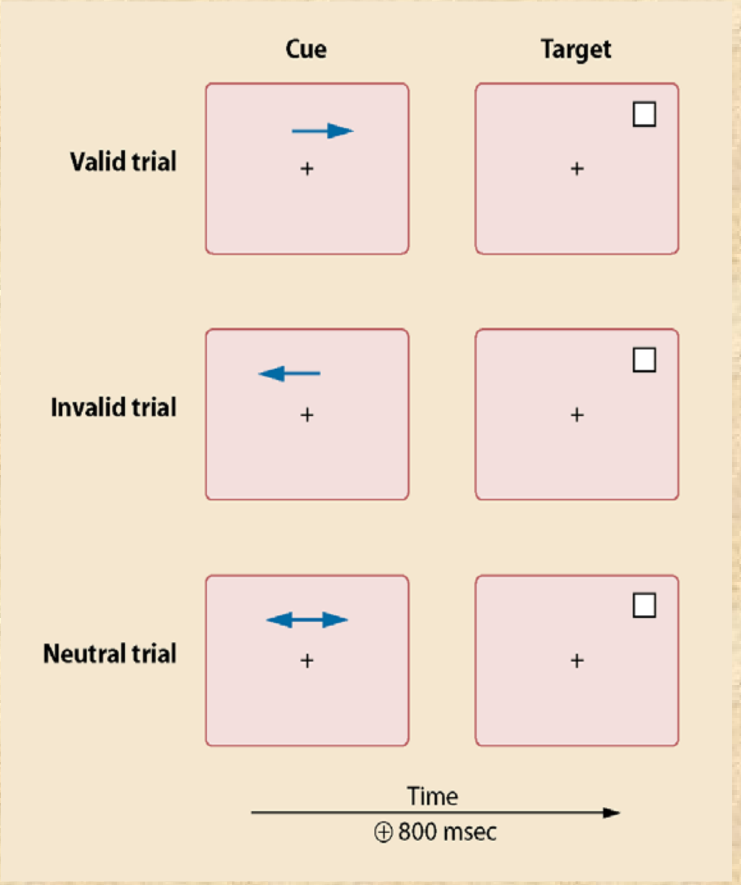
basic idea: you can direct visual attention to something you are not foveating

Posner, Nissen & Ogden (1978)

“expected”

“unexpected”

“no expectation”



Subjects fixate on a “fixation point” (plus sign)

On some trials, a cue (arrow) flashes to indicate on which side the target will appear.

On other trials (neutral, no expectation) there is no cue (double-headed arrow).

Target presented at an eccentricity of 7 deg.

80% of trials, the cue is valid, in the sense that the target appears on the expected side.

20% of trials, the cue is not valid; the target appears on the unexpected side.

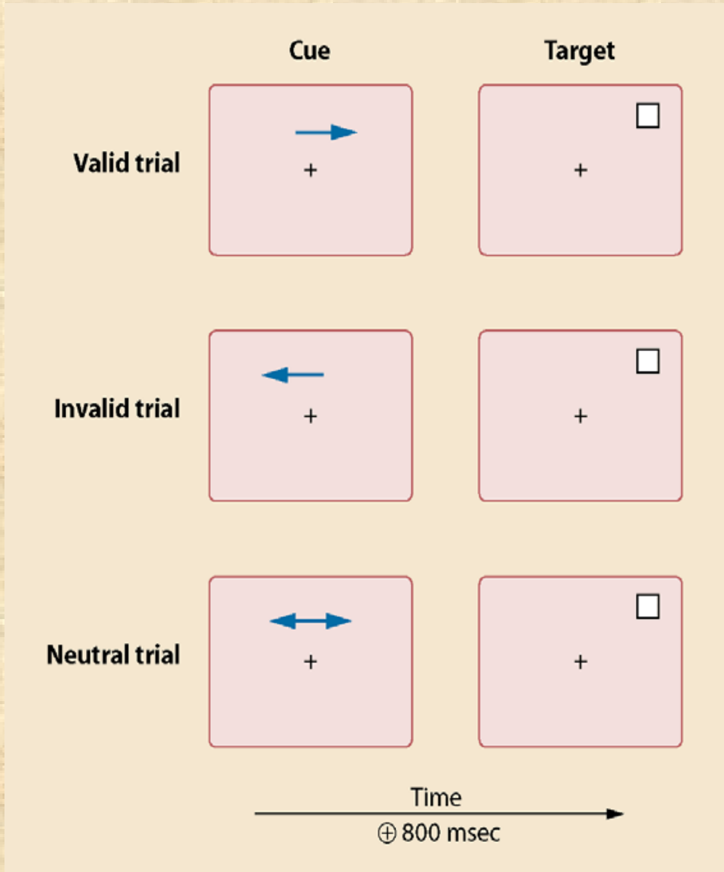
Reaction time to judge stimulus recorded.

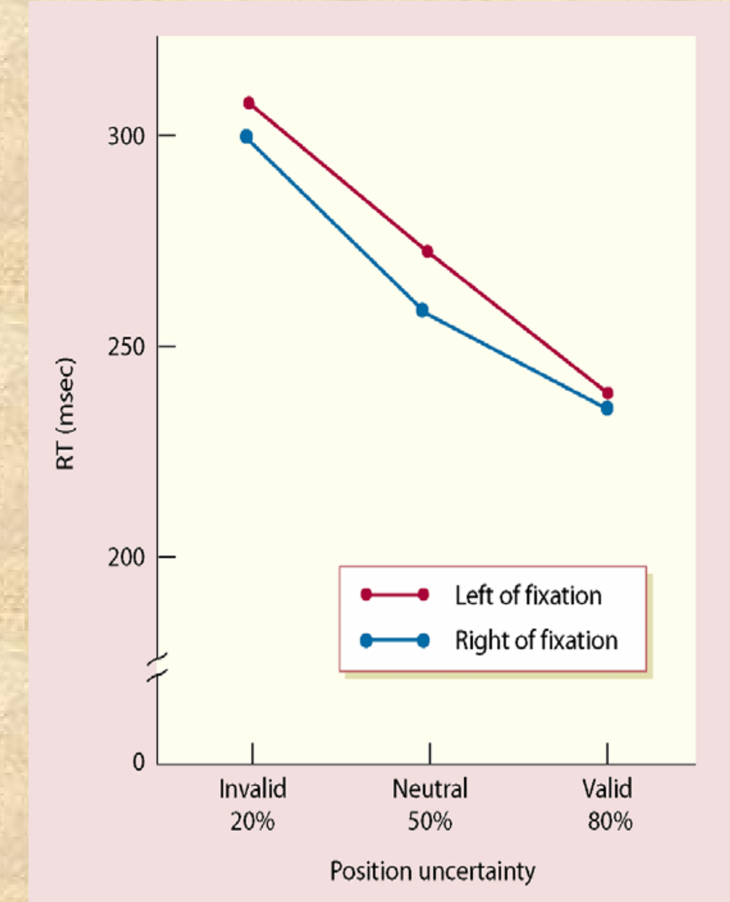
Posner, Nissen & Ogden (1978)

“expected”

“unexpected”

“no expectation”





Response times faster when cues are valid (expected) than when invalid (unexpected).
Eye movements were monitored; trials on which subjects moved their eyes
towards the target were eliminated.
We can shift the visual field locus of attention centrally.
Such shifts (as large as 24 deg) can help in planning eye movements.

Bottom line:

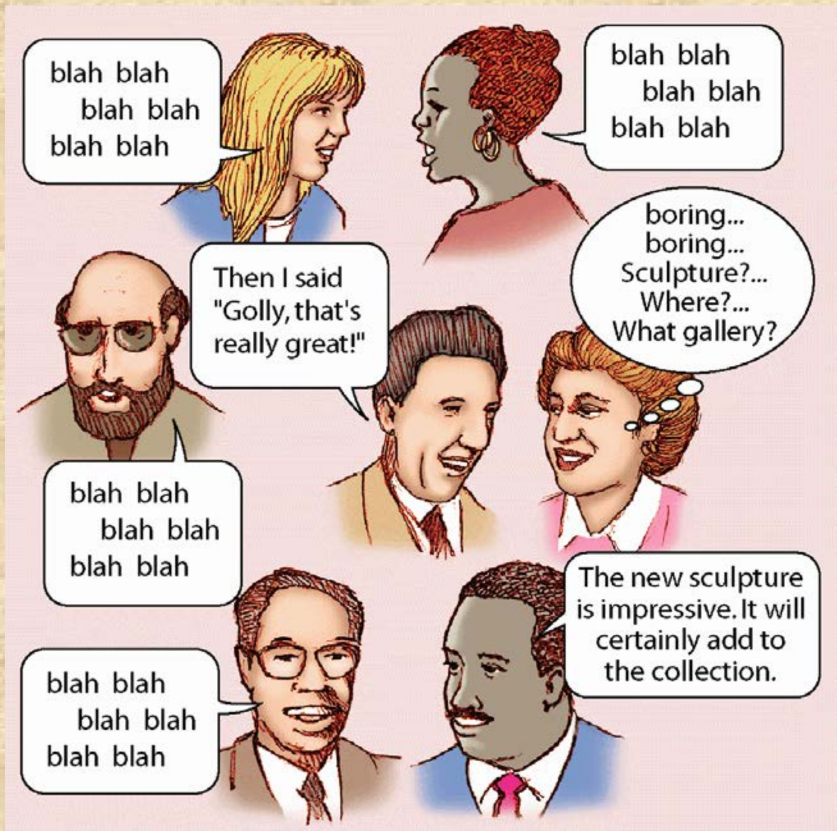
Usually we orient our bodies, heads and eyes so that a region of visual space falls on our fovea(s) (visual orienting - fixation)

Yet, we can direct visual attention to areas of the visual field that do not fall on the fovea (peripheral, nonfoveal areas of the visual field): *covert attention*

Auditory attention – selective listening

Cocktail party effect

Ability to focus attention on a particular person's voice (the person you're talking to) in a situation where lots of people are talking simultaneously



Auditory attention – selective listening

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Ability to focus attention on a particular person's voice (the person you're talking to) in a situation where lots of people are talking simultaneously

Dichotic presentation (di = two, ot = ear)

Have a subject wear headphones. Each ear receives a different message, for instance, different people say different things in each ear.

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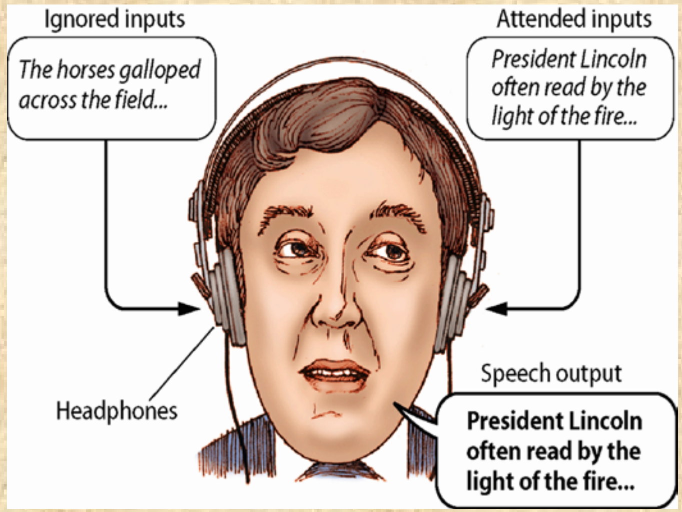
Shadow

Have the subject repeat back aloud one of the ear's messages. This forces the subject to pay attention to one of the messages.



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Unattended message

Won't notice: speaker changes language
Won't notice: playing the speech backwards
Will notice sometimes: your name
Will notice sometimes: loved one's voice (Mom)
Will notice almost always: change from male to female voice

Perception in the absence of attention

http://nivea.psycho.univ-paris5.fr/Mudsplash/Nature_Supp_Inf/Movies/Movie_List.html

http://viscog.beckman.uiuc.edu/grafs/demos/23.html

http://viscog.beckman.uiuc.edu/grafs/demos/3.html

How many times does the white team pass the ball?

http://viscog.beckman.uiuc.edu/grafs/demos/15.html

Change Blindness basic ideas:

If we do not attend to an object which is changing,
it is possible we will not perceive the change
Our perceptual representation of a complex scene is
somewhat less complete than we would
like to think!

A nice demonstration of the effects of sustained attention by Simon & Chabris

Ss (subjects) watch video of a first team, dressed in white, passing basketball,
and a second team, dressed in black, doing the same
Ss report number of passes made by either white- or by black-clothed team.

A black-suited gorilla walked through the scene…

Ss attending to passes by white-clothed team often missed this event!
Ss attending to passes by black-clothed team did not.
(8% vs. 67% rates of detection)