Today's Agenda

- Human abilities – Vision

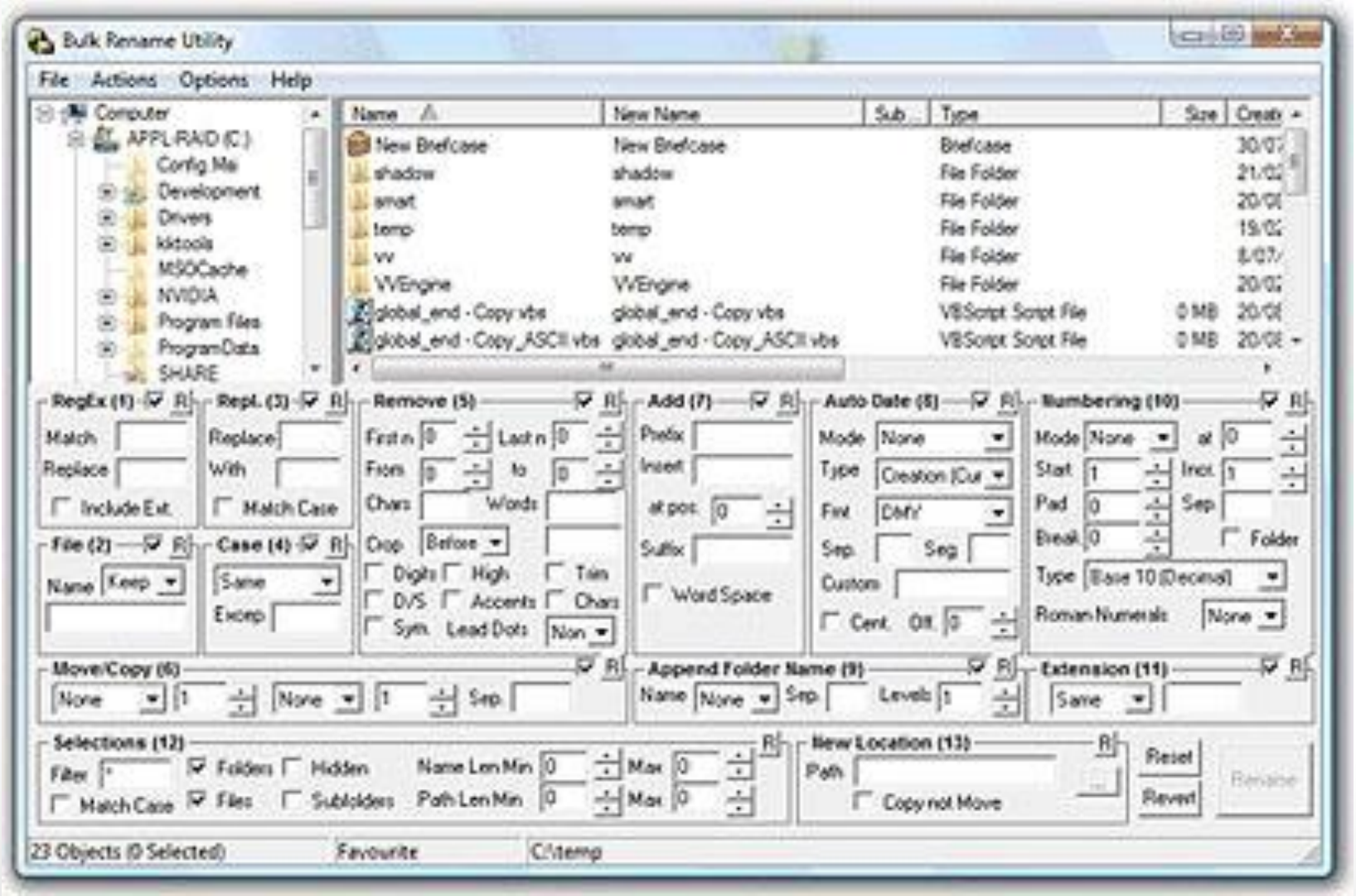
Announcement: Quiz #2

Quiz # 2

- Tuesday, Sep. 10 in class
- Via Blackboard – Bring your laptop to class!
- Open book and open notes

Is It Easy to Find a Specific Person

What's Wrong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Extension (11)
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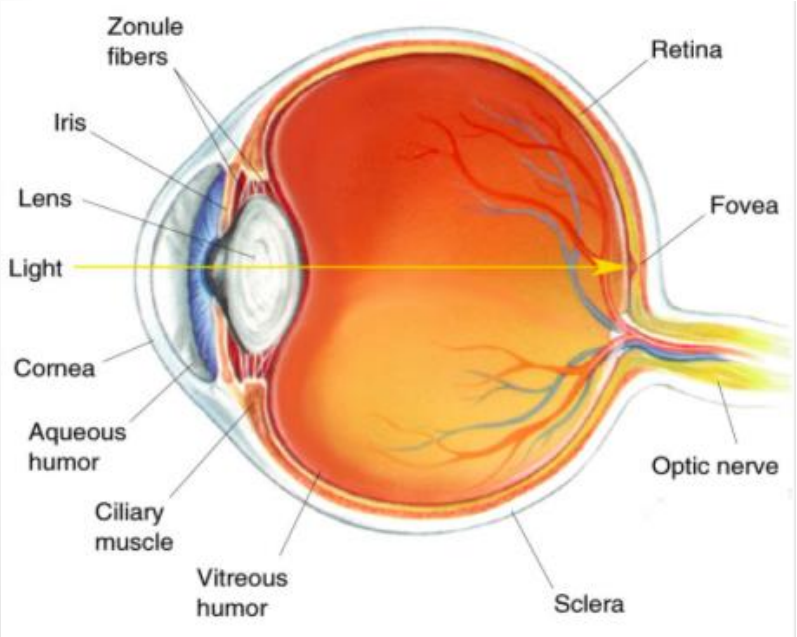
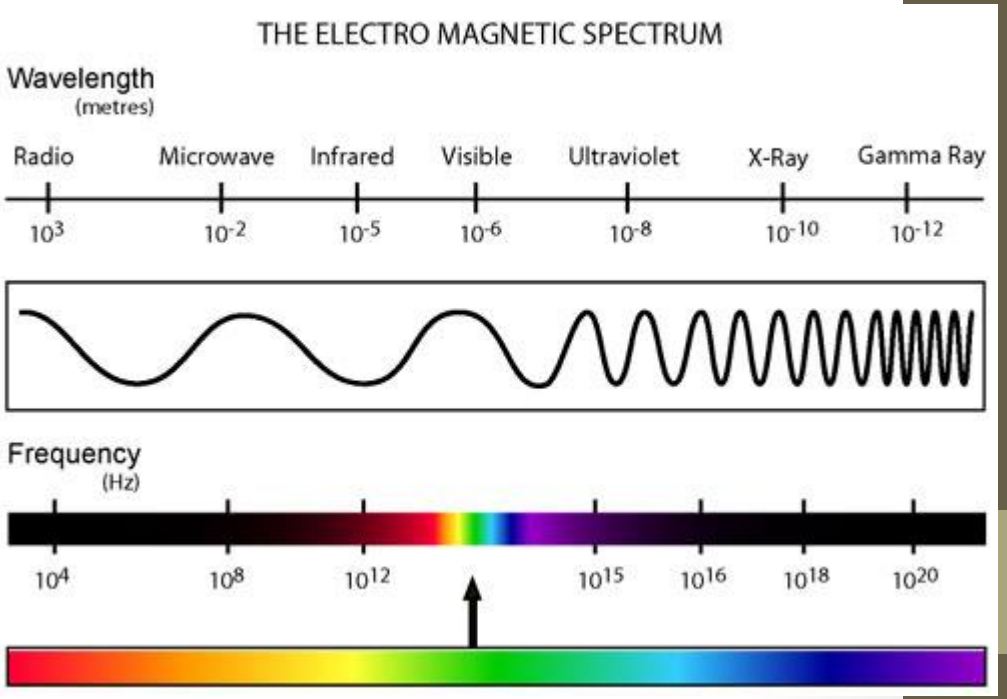
Human Vision

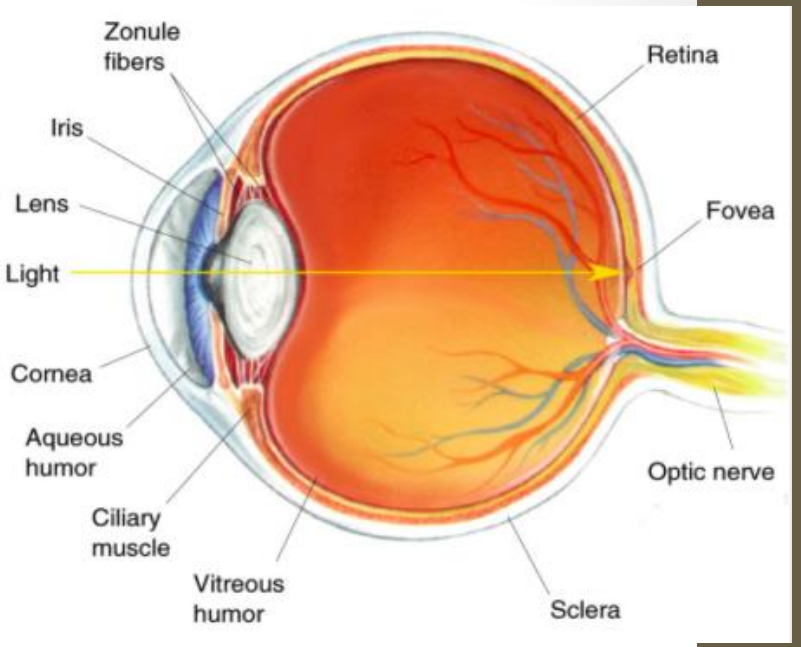


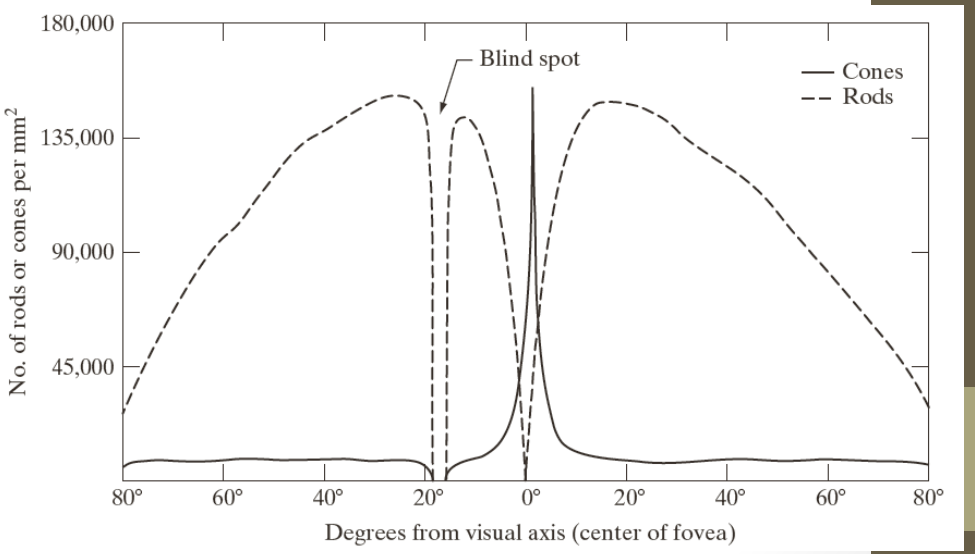


http://www.kollewin.com/blog/electromagnetic-spectrum/

Human Vision

- Photoreceptors:
  - Cones
  - Rods
- 6.5 M Cones (color vision)
  - Mostly at Fovea
  - Fewer blue cones at Fovea, mostly red/green
- 100 M Rods (night vision)
  - Spread throughout retina





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Brightness Adaptation - Subjective Brightness

Scotopic: Vision under low illumination

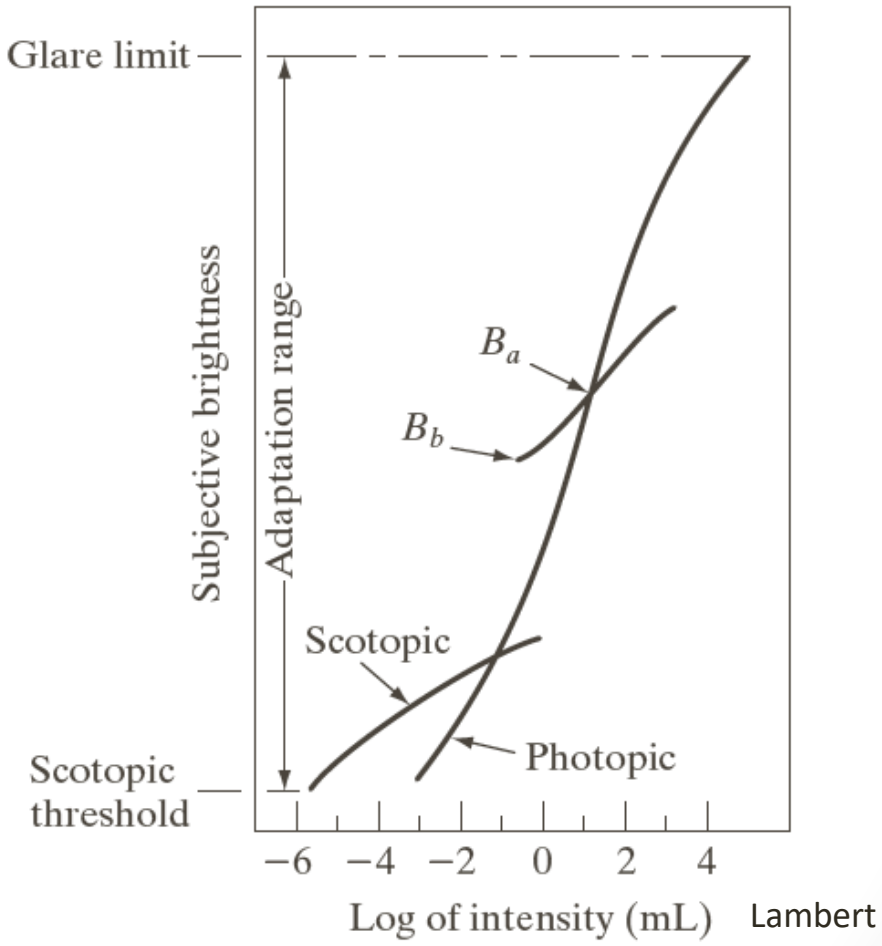
- rod cells are dominant

Photopic: Vision under good illumination

- cone cells are dominant

The total range of distinct intensity levels the eye can discriminate simultaneously is rather small

Brightness adaptation level



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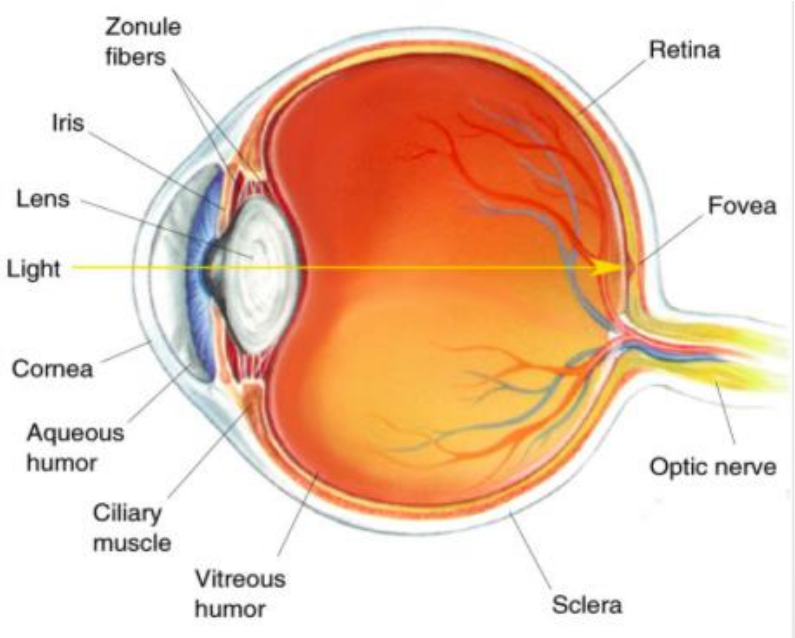
The Visual System

- Some terms
  - Sensitivity (luminance, how much light is needed)
  - Acuity (clarity of vision)
  - Movement (tracking, saccades)
- Vision decreases with age



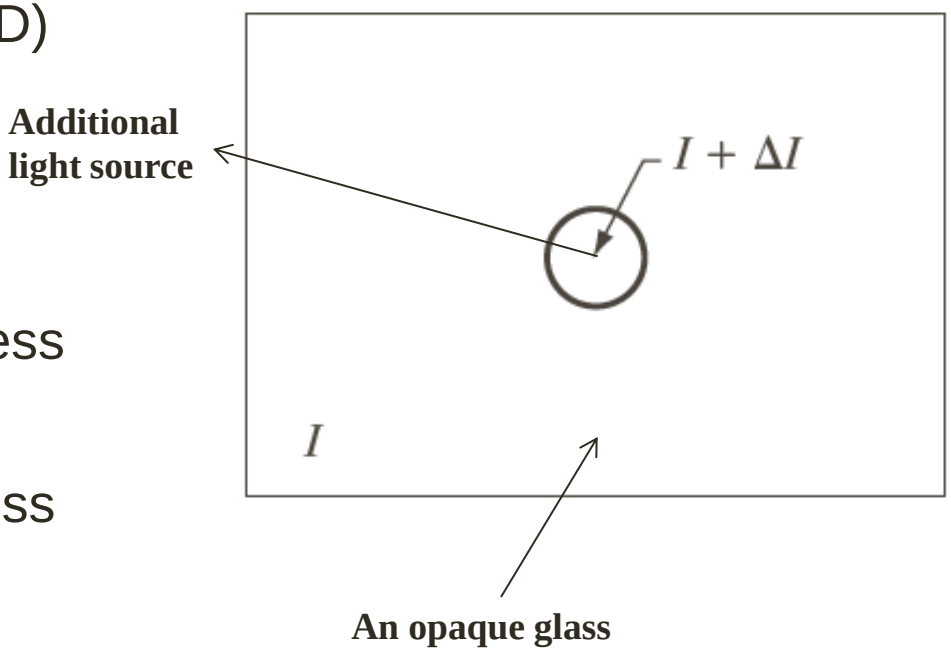
Brightness Discrimination

Weber Ratio/Fraction (Just-Noticeable Difference JND)

$$\frac{\Delta I_c}{I}$$

Small ratio: good brightness discrimination

Large ratio: poor brightness discrimination



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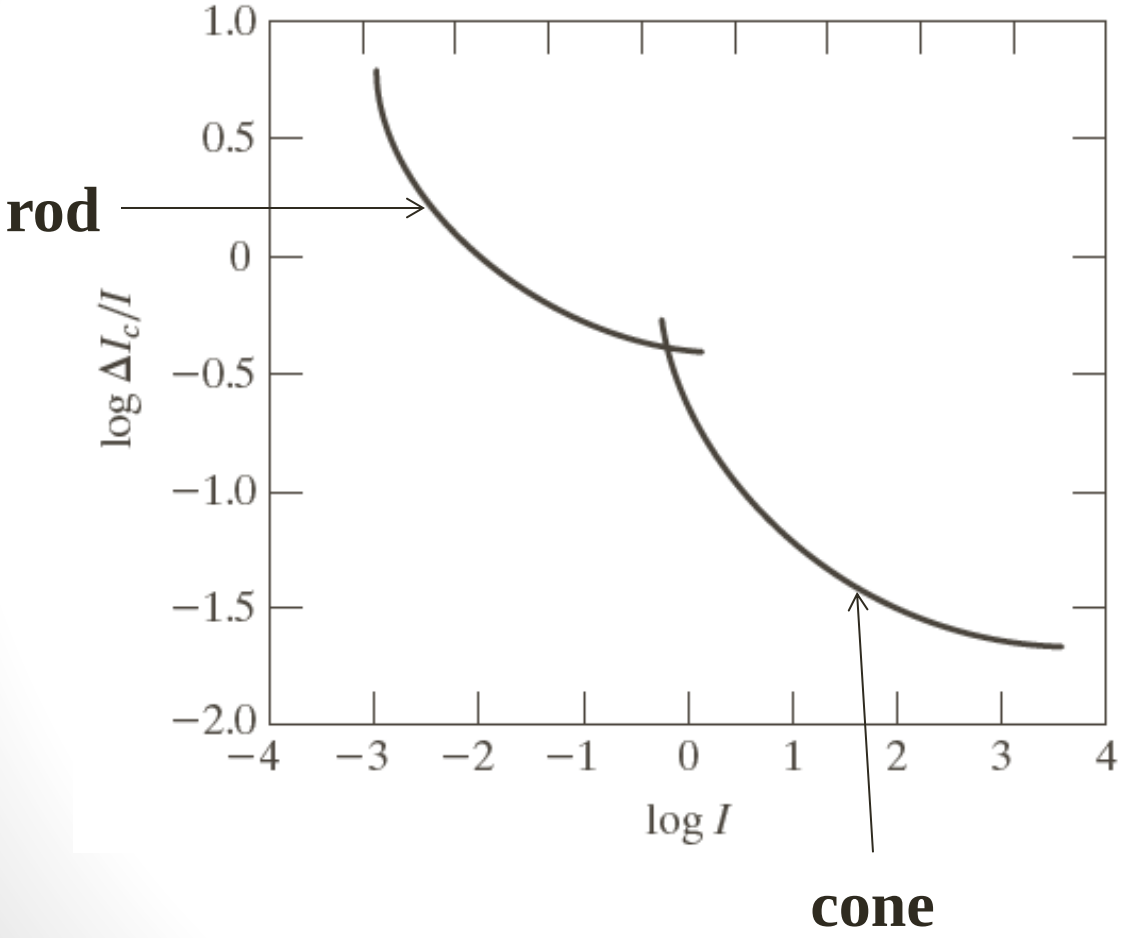
Brightness Discrimination at Different Intensity Levels



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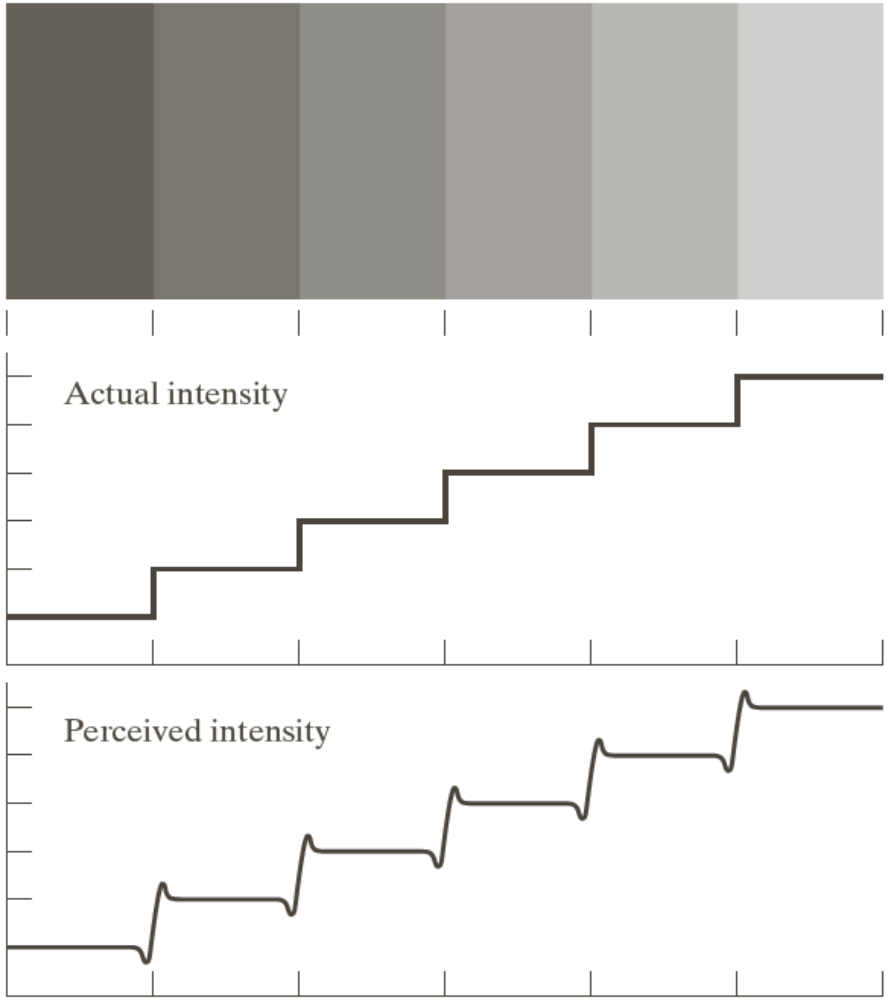
Perceived Intensity is Not a Simple Function of the Actual Intensity

Edge response



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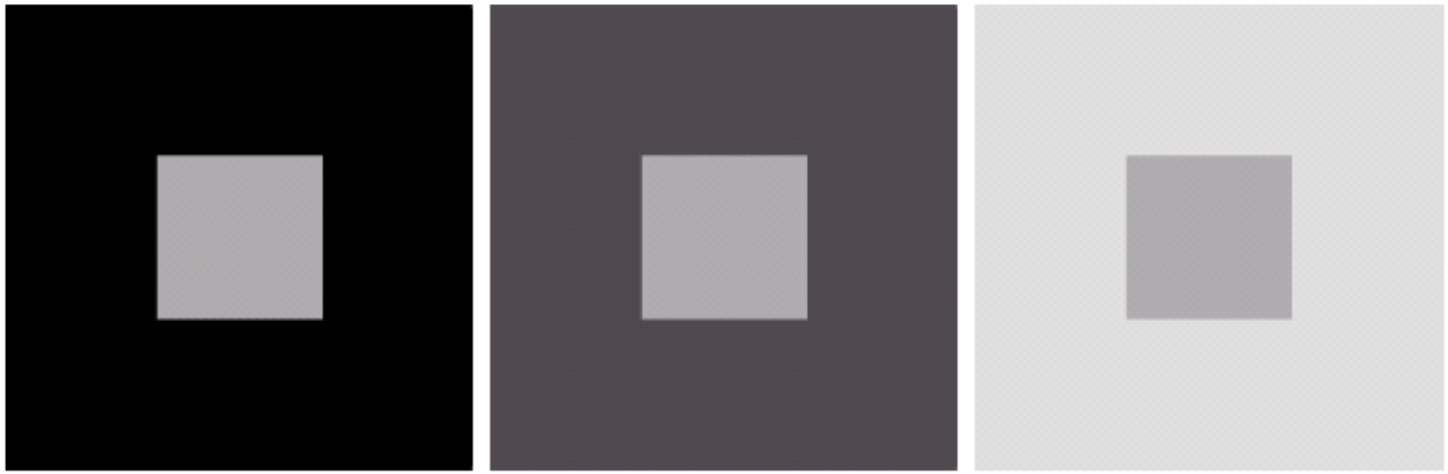
Perceived Intensity is Not a Simple Function of the Actual Intensity

Simultaneous Contrast



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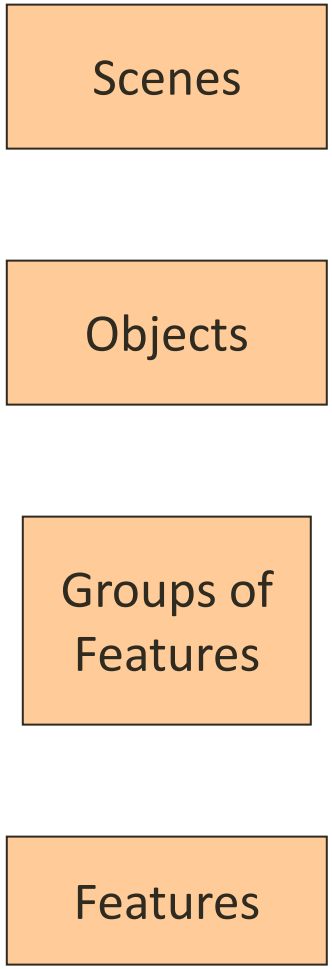
Object Perception

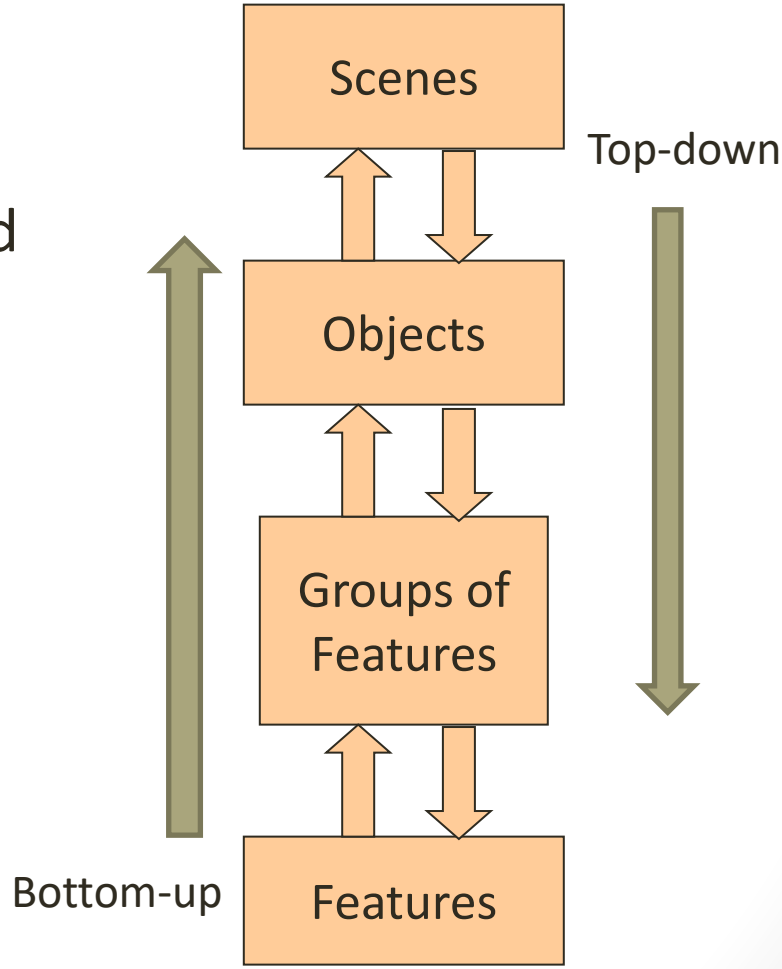
How do we perceive separate features, objects, scenes, etc. in the environment?

- Perception of a scene involves multiple levels of perceptual analysis.



What Do We Do With All Of This Visual Information??

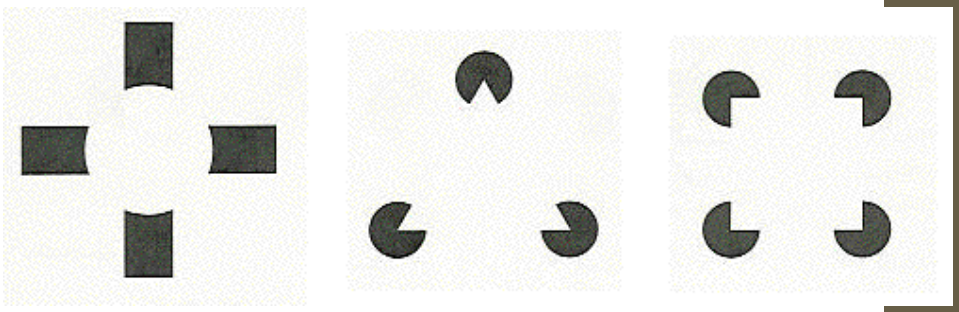
- "Bottom up processing"
  - Data-driven
  - Sensation reaches brain, and then brain makes sense of it
- "Top down processing"
  - Cognitive functions informs our sensation
  - E.g., walking to refrigerator in middle of night

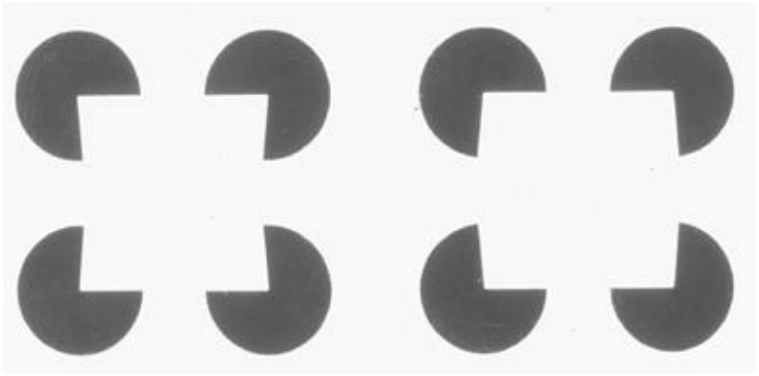


Illusory Contours

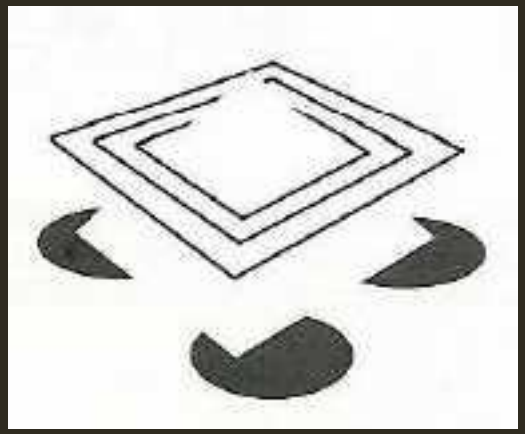
Perception of an edge where no edge is explicitly present in the stimulus.

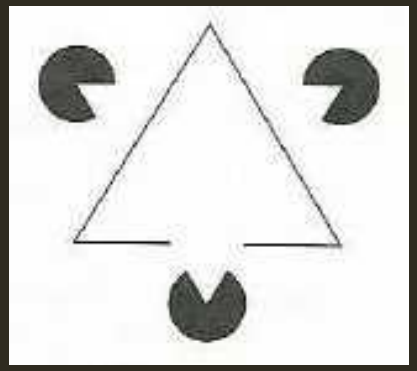
- The perception of the edge is due to the relations among the features.
- Clearly there is more to object perception than just the stimulus features alone.

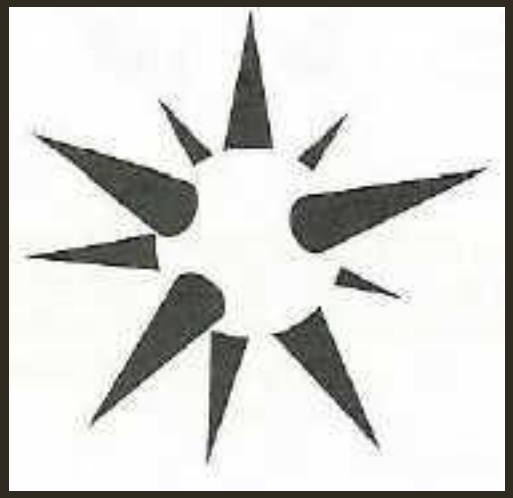


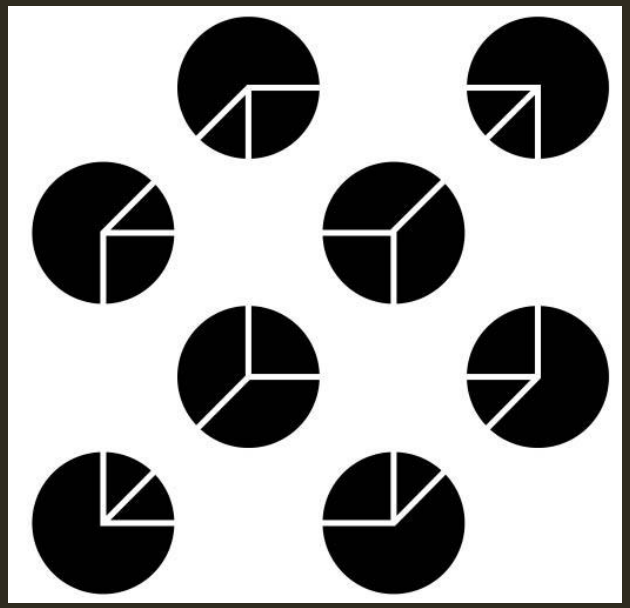


Complex Illusory Contours









Complex Illusory Contours cont.

We can alter our perception of illusory contours by changing how we interpret the stimulus using top-down processing.

https://www.semanticscholar.org/paper/Subjective-contours-and-apparent-depth.-Coren/012a0acbf2dd3bca9b7867146a03b8cd9ef45c9c/figure/4

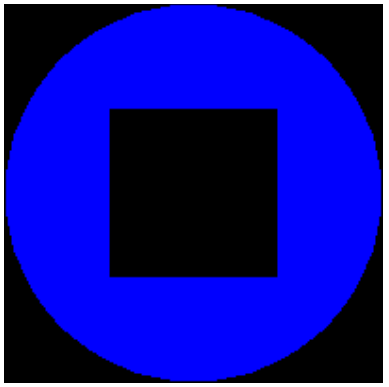
Figure & Ground Perception

When looking at a visual scene, we tend to see coherent shapes (figures) that are in front of a background area (ground).

- The figure will be perceived as separate from its ground.

– Can only see one part as the figure at a time.

- Must switch to see the other as the figure



Examples

- Either see a saxophone player or a woman's face.
  - Don't see them both simultaneously.

Examples

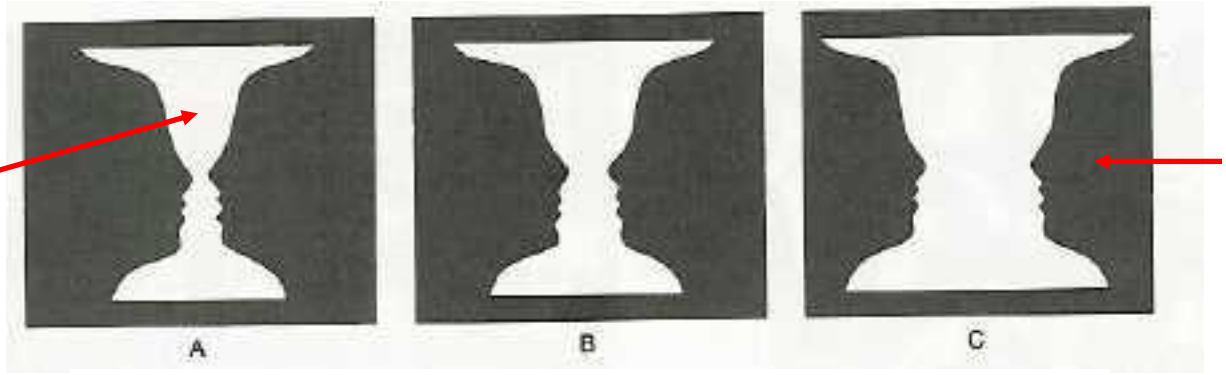
Factors that Affect Figure-Ground Perception

Why do we tend to see certain parts of an image as the figure and other parts as the background?

1. Size of Features
2. Symmetry
3. Vertical & Horizontal Layouts
4. Meaningfulness

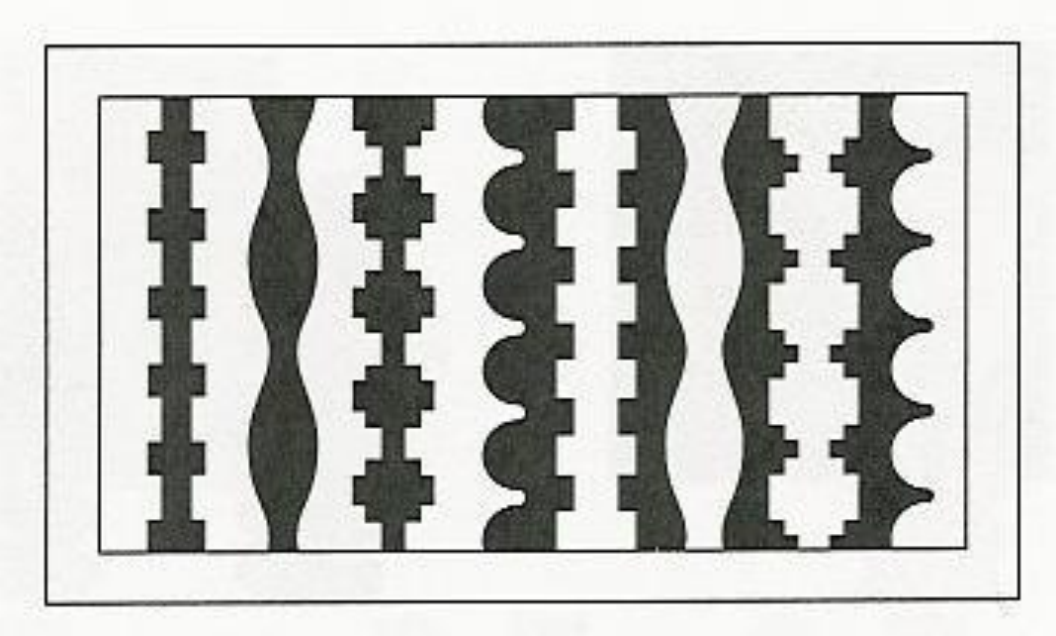
Size of Features

The element with the smaller area will tend to be perceived as the figure.



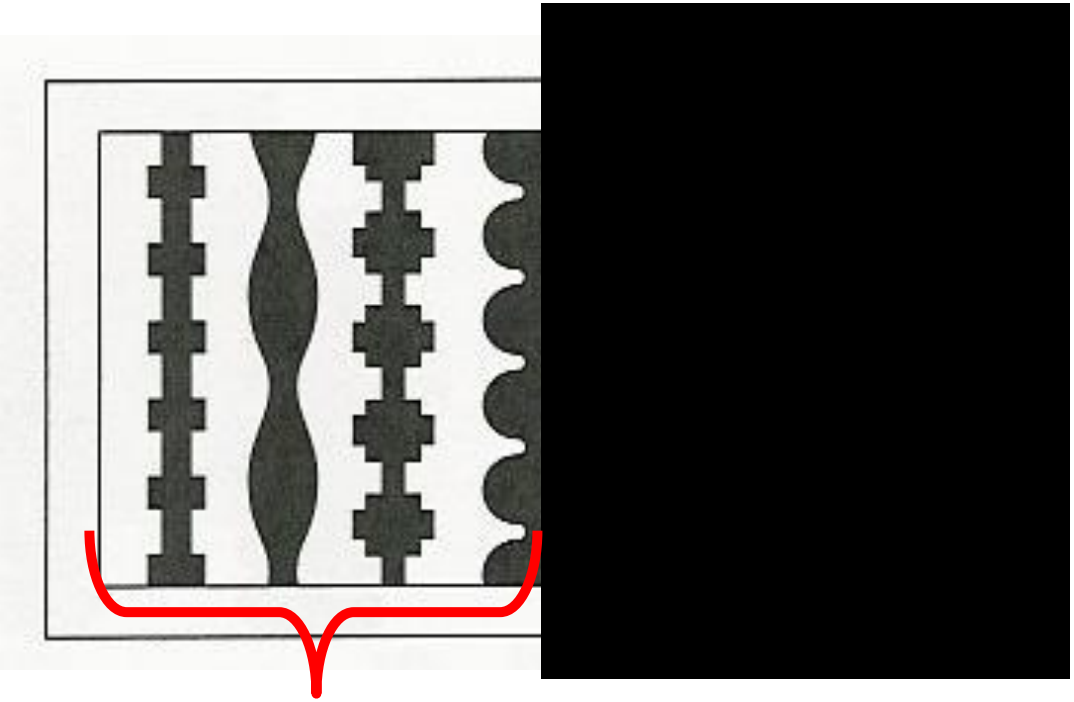
Symmetry

Symmetric areas tend to be perceived as the figure.



Symmetry

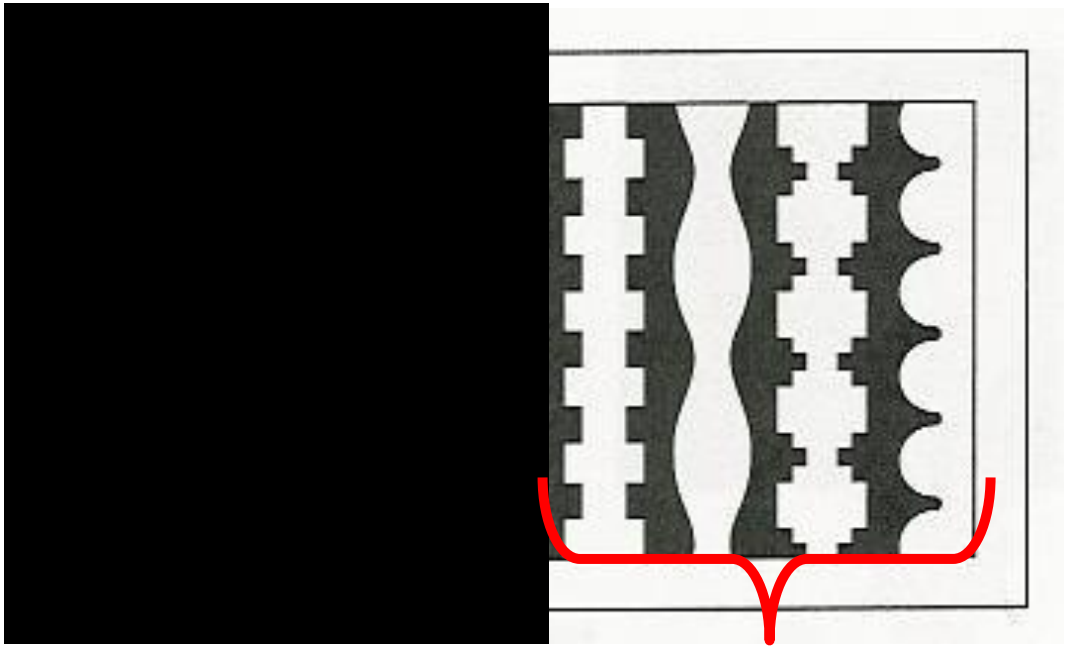
Symmetric areas tend to be perceived as the figure.



Black seen as figure

Symmetry

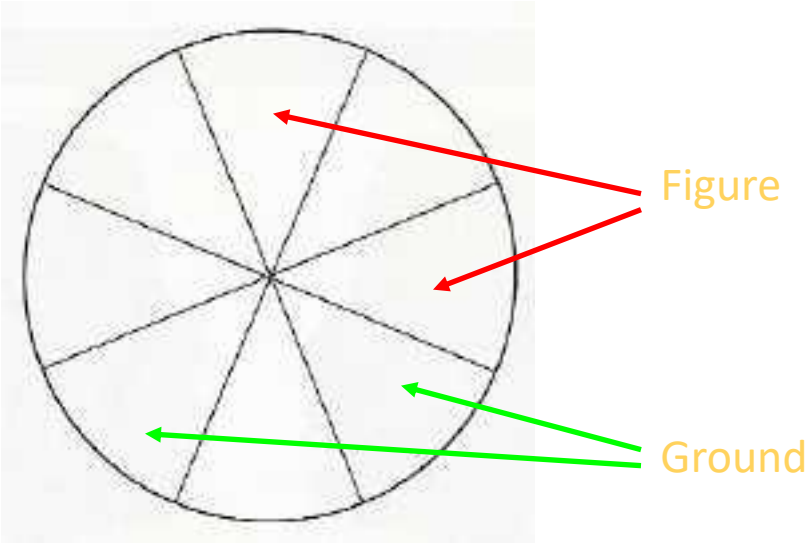
Symmetric areas tend to be perceived as the figure.



White seen as figure

Vertical & Horizontal Layouts

Elements oriented in the vertical or horizontal direction are more likely to be perceived as the figure than elements in a diagonal orientation.



Meaningfulness

Meaningful areas are more likely to be perceived as the figure.

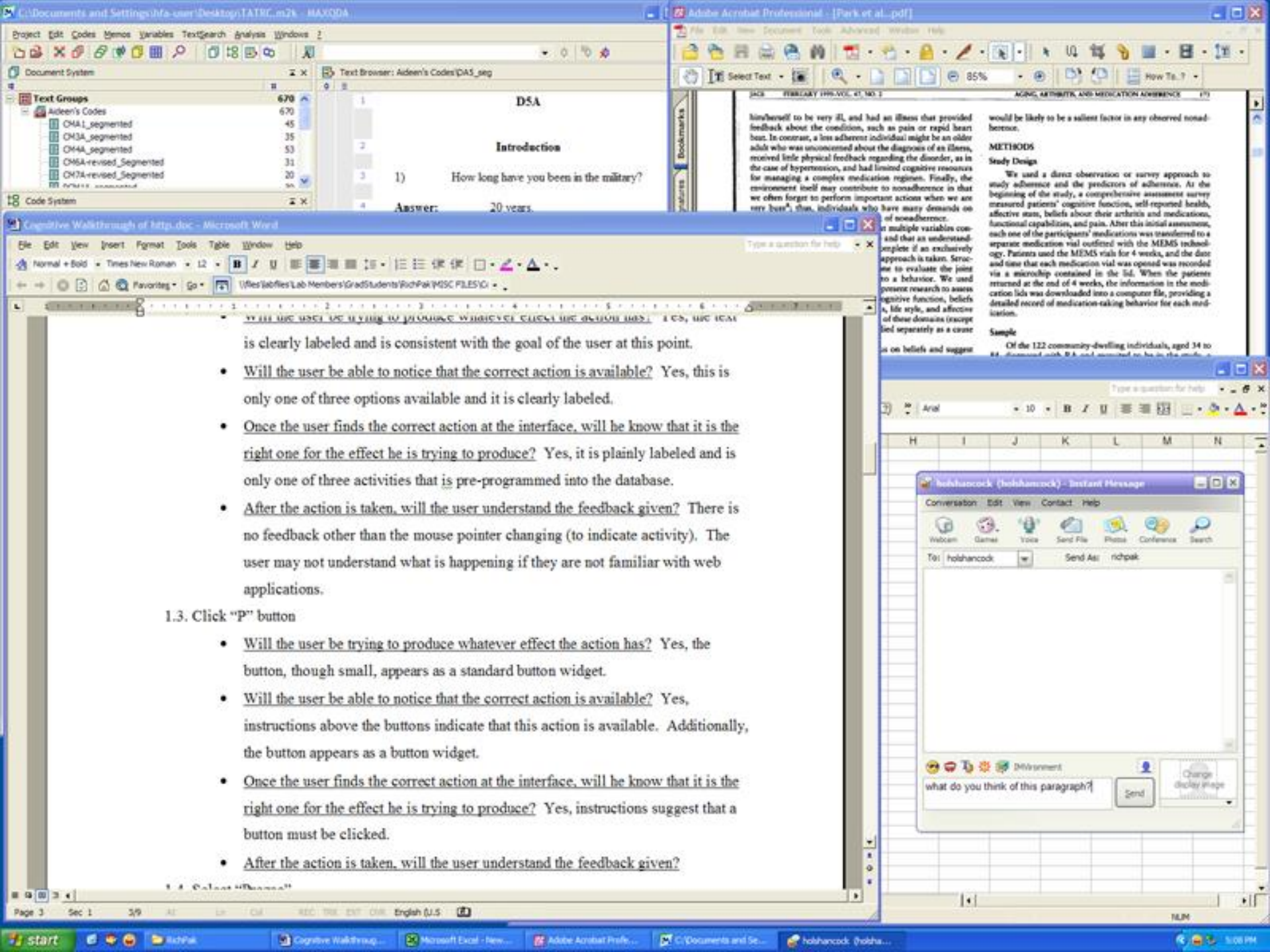
“Home run” overpowers the smaller areas once you see it.

Ambiguity in Figure/Ground

- Drawings created so that many areas are equally likely to be seen as the figure.
- They tend to switch back and forth from figure to ground.
  - e.g. M.C. Eschers artwork http://www.mcescher.com/

Questions so far?

Visual Search



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CM4A_segmented 53
CM6A-revised_Segmented 31
CM7A-revised_Segmented 20
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Introduction
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Answer: 20 years.
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JACS FEBRUARY 1999, VOL. 47, NO. 2 AGING, ARTHRITIS, AND MEDICATION ADHERENCE
him/herself to be very ill, and had an illness that provided feedback about the condition, such as pain or rapid heart beat. In contrast, a less adherent individual might be an older adult who was unconcerned about the diagnosis of an illness, received little physical feedback regarding the disorder, as in the case of hypertension, and had limited cognitive resources for managing a complex medication regimen. Finally, the environment itself may contribute to nonadherence in that we often forget to perform important actions when we are very busy[8]; thus, individuals who have many demands on
would be likely to be a salient factor in any observed nonadherence.
METHODS
Study Design
We used a direct observation or survey approach to study adherence and the predictors of adherence. At the beginning of the study, a comprehensive assessment survey measured patients' cognitive function, self-reported health, affective state, beliefs about their arthritis and medications, functional capabilities, and pain. After this initial assessment, each one of the participants' medications was transferred to a separate medication vial outfitted with the MEMS technology. Patients used the MEMS vials for 4 weeks, and the date and time that each medication vial was opened was recorded via a microchip contained in the lid. When the patients returned at the end of 4 weeks, the information in the medication lids was downloaded into a computer file, providing a detailed record of medication-taking behavior for each medication.
Sample
Of the 122 community-dwelling individuals, aged 34 to
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is clearly labeled and is consistent with the goal of the user at this point.
- Will the user be able to notice that the correct action is available? Yes, this is only one of three options available and it is clearly labeled.
- Once the user finds the correct action at the interface, will he know that it is the right one for the effect he is trying to produce? Yes, it is plainly labeled and is only one of three activities that is pre-programmed into the database.
- After the action is taken, will the user understand the feedback given? There is no feedback other than the mouse pointer changing (to indicate activity). The user may not understand what is happening if they are not familiar with web applications.

1.3. Click "P" button

- Will the user be trying to produce whatever effect the action has? Yes, the button, though small, appears as a standard button widget.
- Will the user be able to notice that the correct action is available? Yes, instructions above the buttons indicate that this action is available. Additionally, the button appears as a button widget.
- Once the user finds the correct action at the interface, will he know that it is the right one for the effect he is trying to produce? Yes, instructions suggest that a button must be clicked.
- After the action is taken, will the user understand the feedback given?

1.4. Select "Process"
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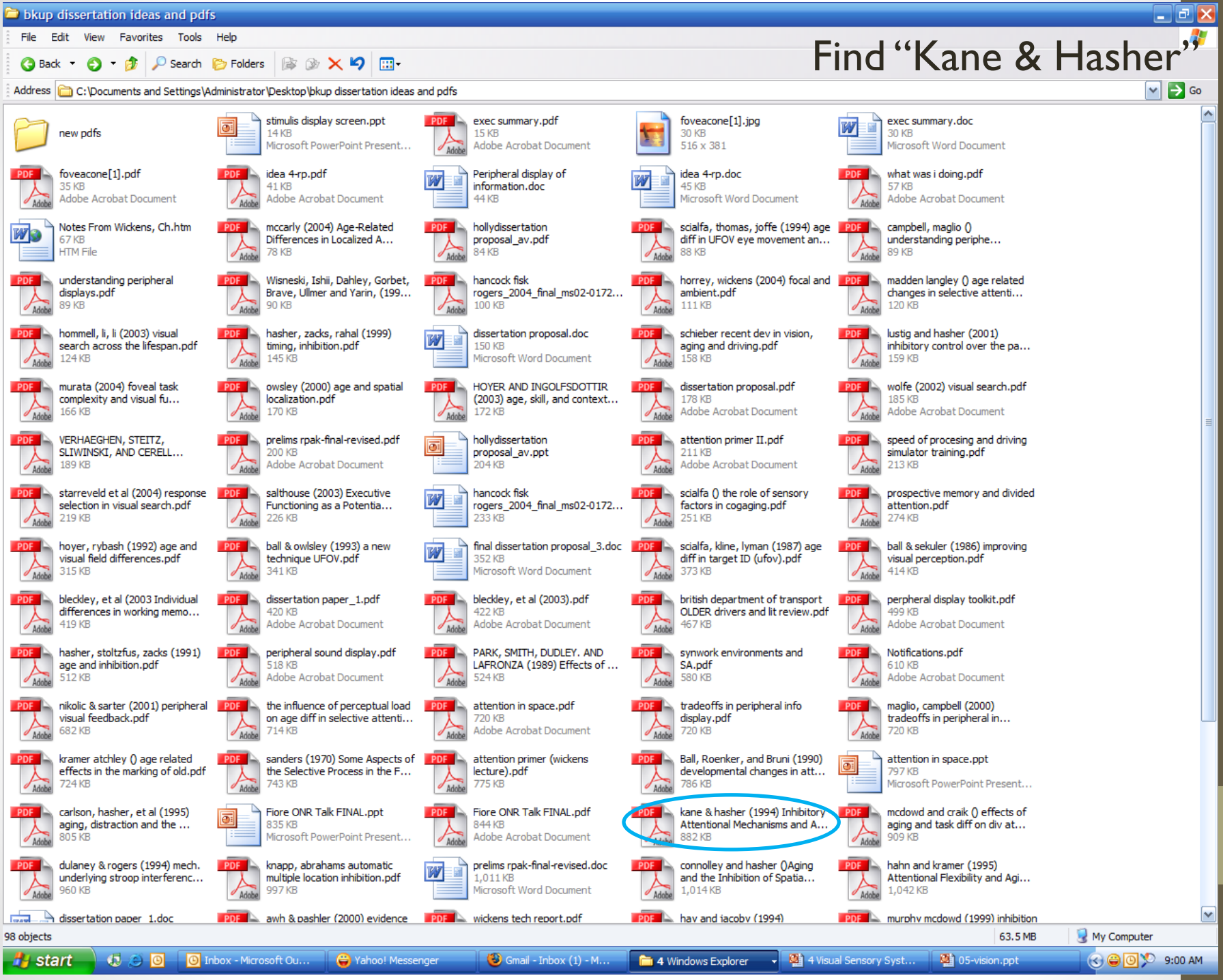
5:08 PM

Visual Search

Targets vs distractors

In the next slide, find the file "Kane & Hasher" (the target – all others are distractors)

- Record how many seconds you need to find it with a timer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sanders (1970) Some Aspects of the Selective Process in the F... 743 KB
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Ball, Roenker, and Bruni (1990) developmental changes in att... 786 KB
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Visual Search

- Average search time = $\frac{N \times I}{2}$
  - N = number of items
  - I = how much time you spend on each item
- Reduce search time:
  - Reduce N
    - Make all targets/distractors similar
  - Reduce I
    - Make each item clear

Visual Search

Parallel search vs. **Serial search**

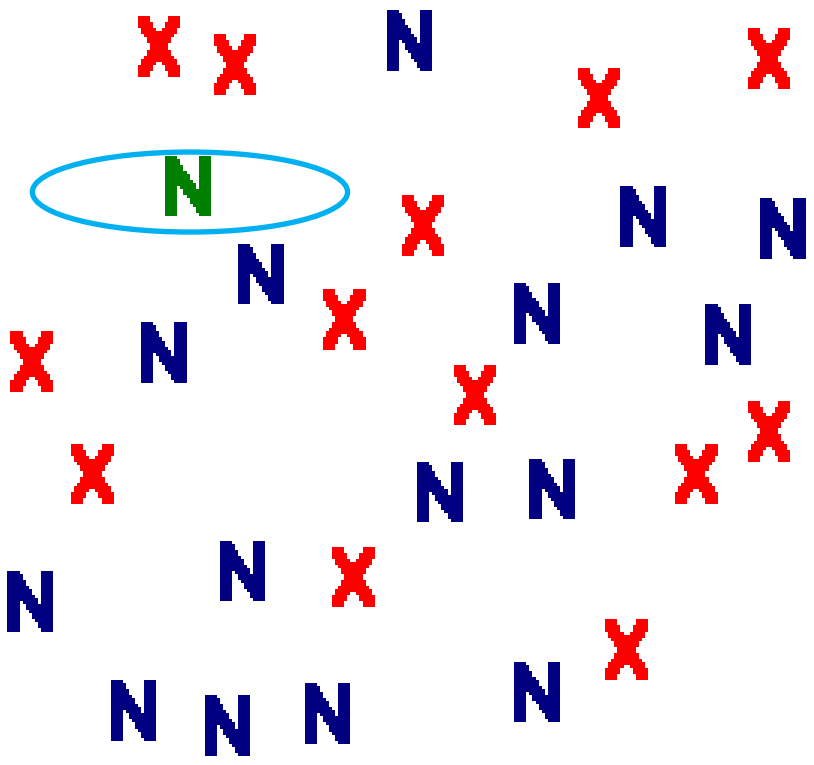
Parallel Search

Find green "N"

- Search all items at once (search "at a glance")
- Pop-out effect
- Fast
- Effortless
- Few errors
- # of distractors does not matter

What type of processing?

Bottom up!



Serial Search

Find yellow "X"

- Search every item
- **Slow**
- **Effortful**
- **Error prone!**
- # of distractors matters