

Today's Agenda

- Human abilities – Auditory systems
- Human abilities – Vision

Announcement: Quiz #2

Quiz # 2

- Thursday, Sep. 14 in class
- Via Blackboard – **Bring your laptop to class!**
- Open book and open notes

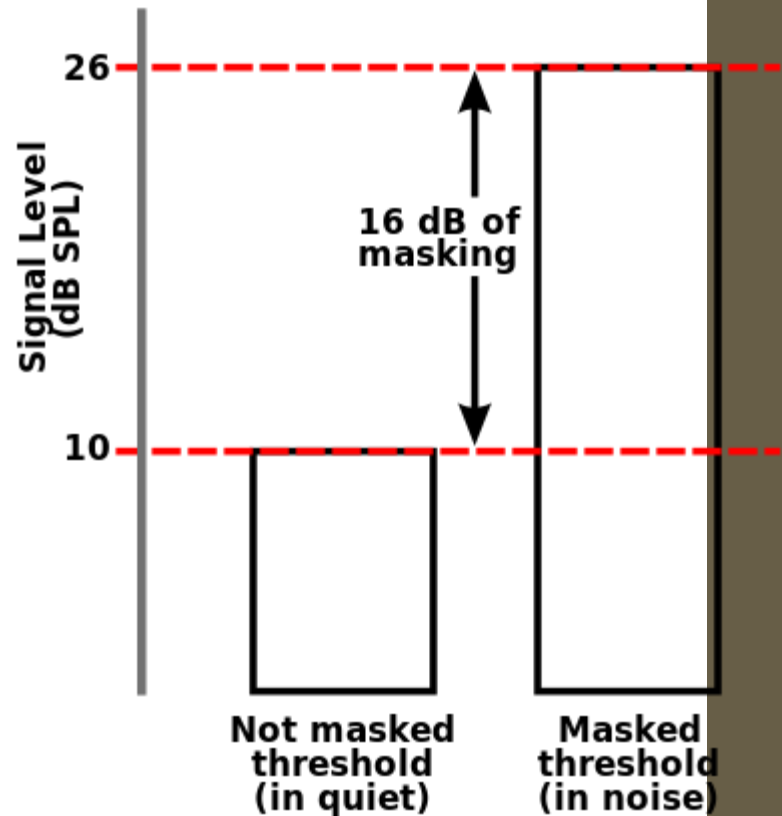
How to design to avoid false alarms? Thoughts?

- Improve sensitivity of system
 - More sophisticated decision algorithms
- Training users
- Provide “raw data” on why triggered
- Signals the system’s confidence

Design Consideration: Noise

Masking effects of noise

- Some sounds make it difficult / impossible to hear other sounds
- Needs environmental analysis!



Masking: Frequency (Pitch)

- Louder sound masks soft sound within the critical bandwidth - with similar frequency
- Lower frequency masks higher frequency
 - Gender: Female = higher ; male = lower

Enhancing auditory performance

Designer must consider:

- Ambient noise (environment analysis)
- Frequency of sound
- Intensity of the sound
- Duration of the sound

Depends on the user, the task, the environment

Examples of sound

- Factory
 - http://www.youtube.com/watch?v=-l--kN_1AC0
- Subway
 - <http://www.youtube.com/watch?v=NS7iiVCUwXM>
- Airport
 - <https://www.youtube.com/watch?v=jlnPa4eU3gk>

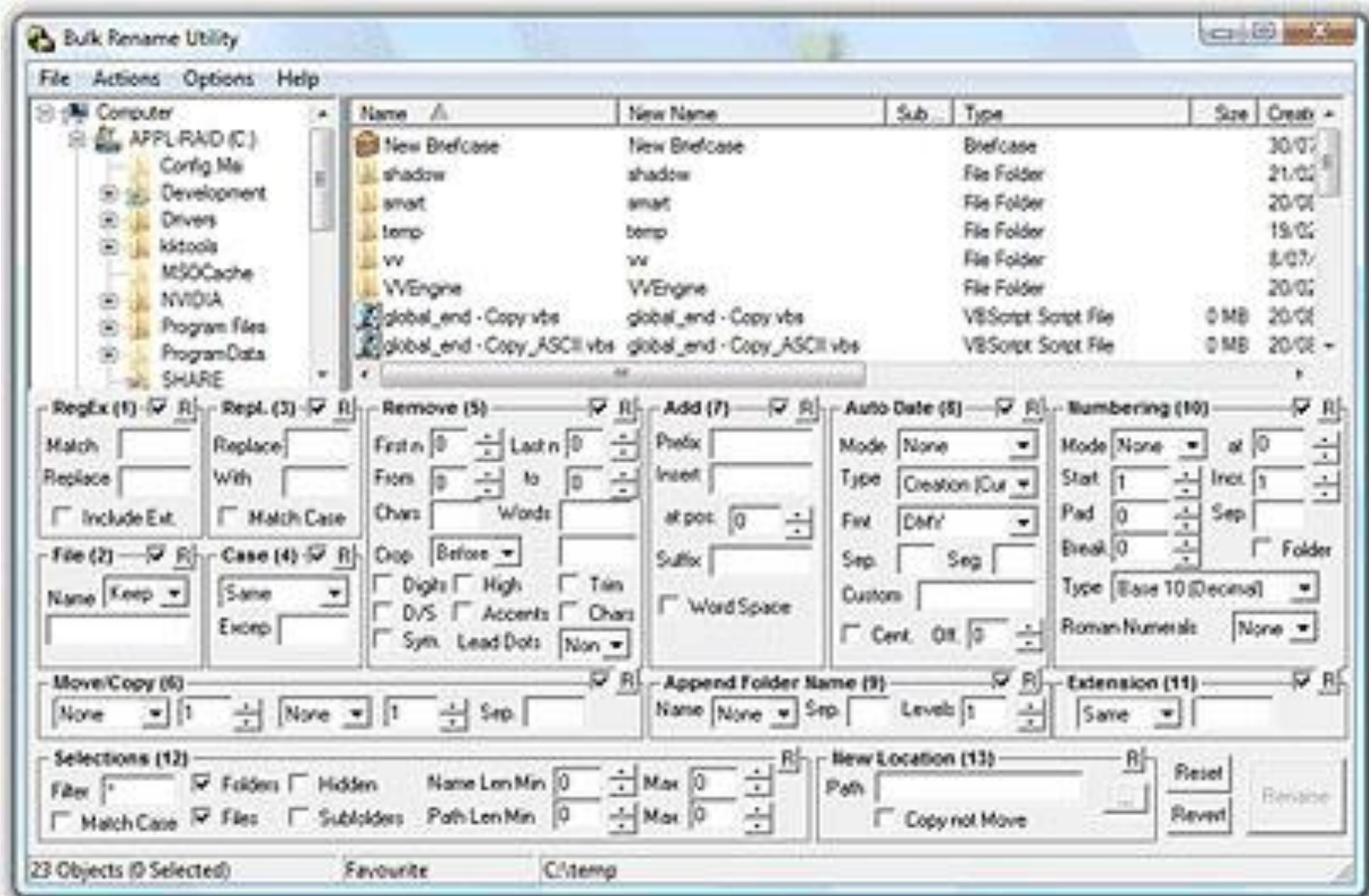
One last example

- Imagining you are hired by Boeing to improve communication systems between pilot and air traffic control.
- https://www.youtube.com/watch?v=jZPvVwvX_Nc

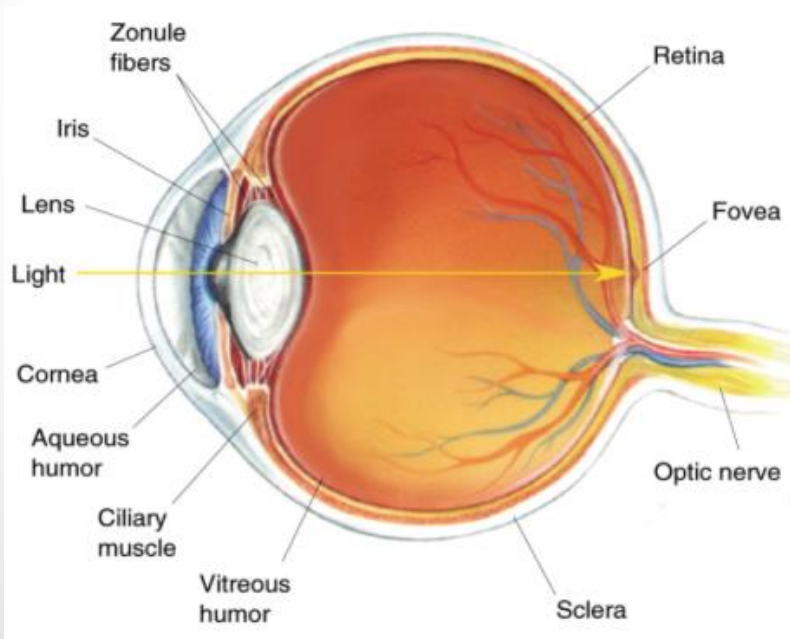
Is It Easy to Find a Specific Person



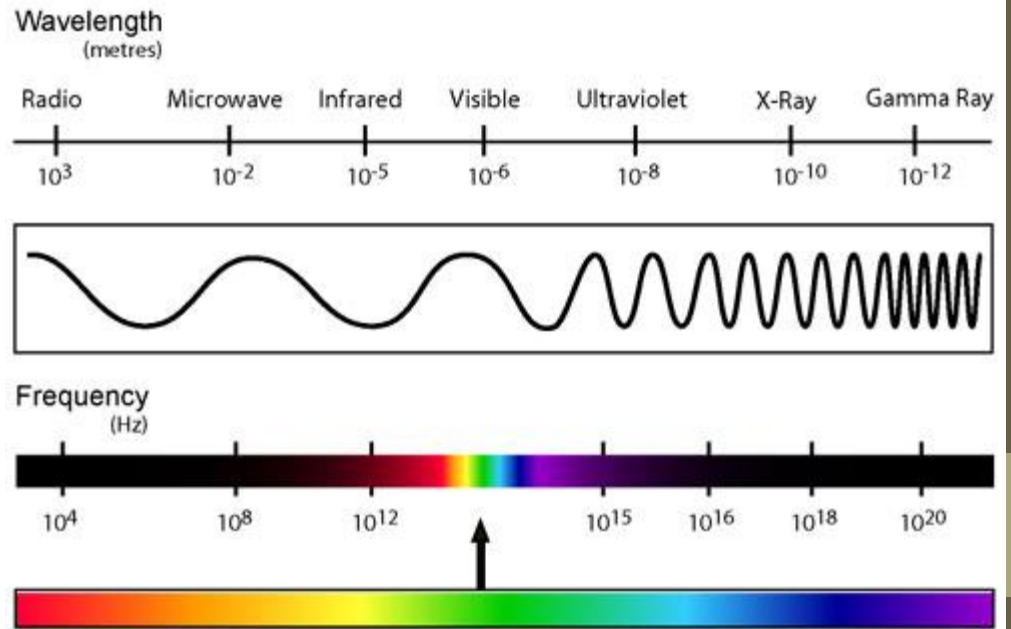
What's Wrong



Human Vision

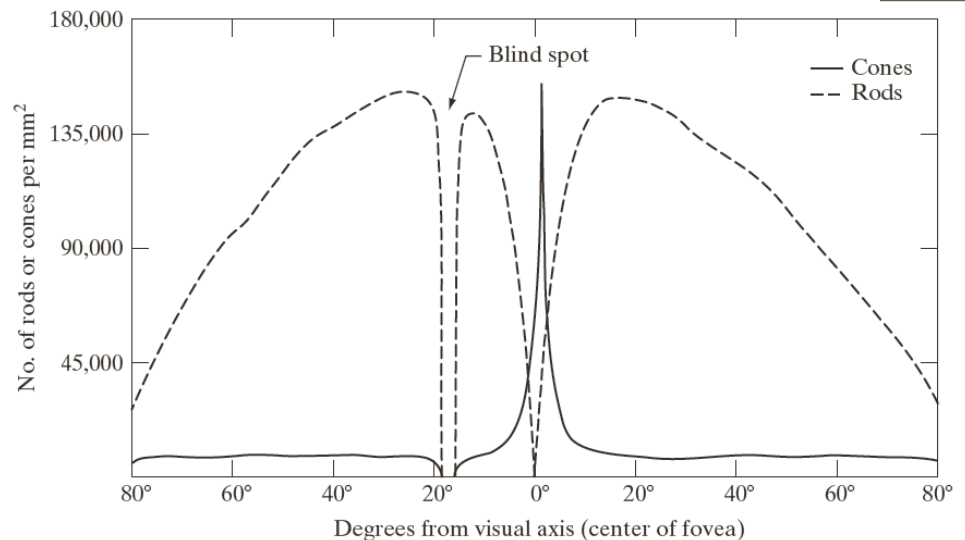
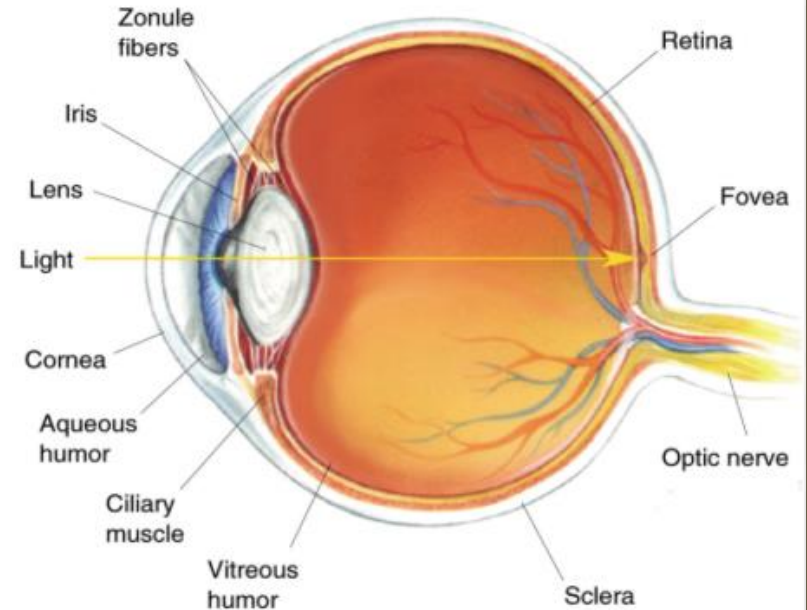


THE ELECTRO MAGNETIC SPECTRUM



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



Brightness Adaptation - Subjective Brightness

Scotopic: Vision under low illumination

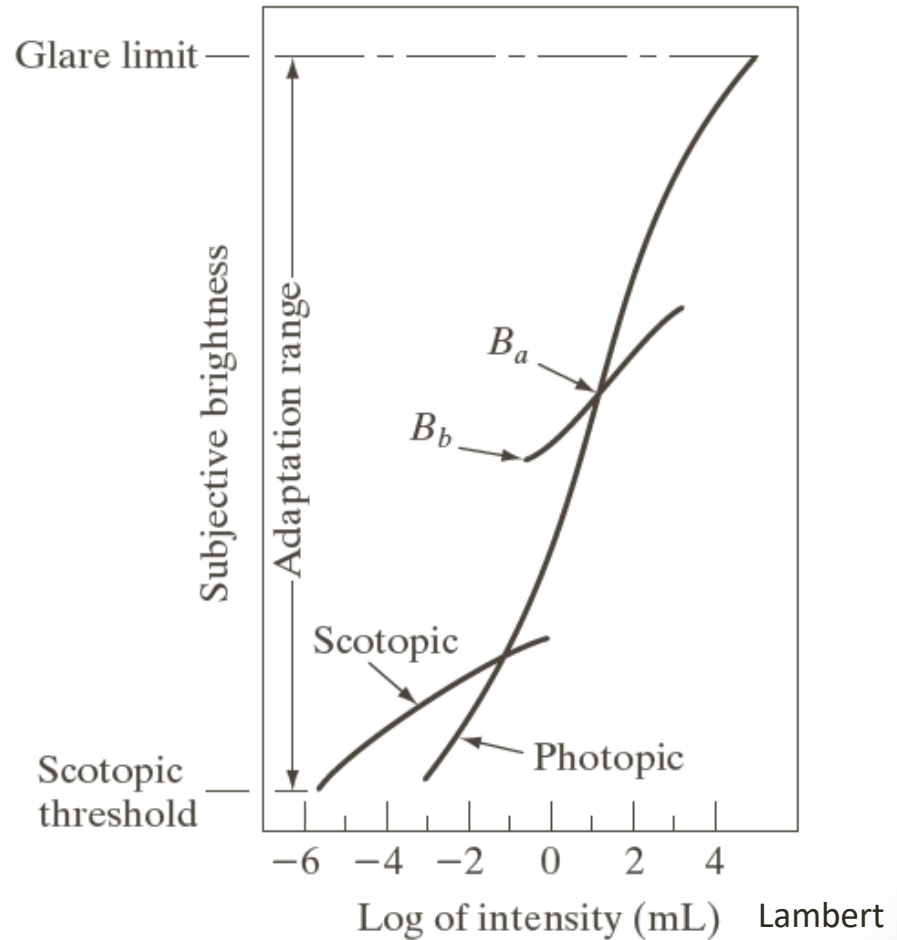
- rod cells are dominant

Photopic: Vision under good illumination

- cone cells are dominant

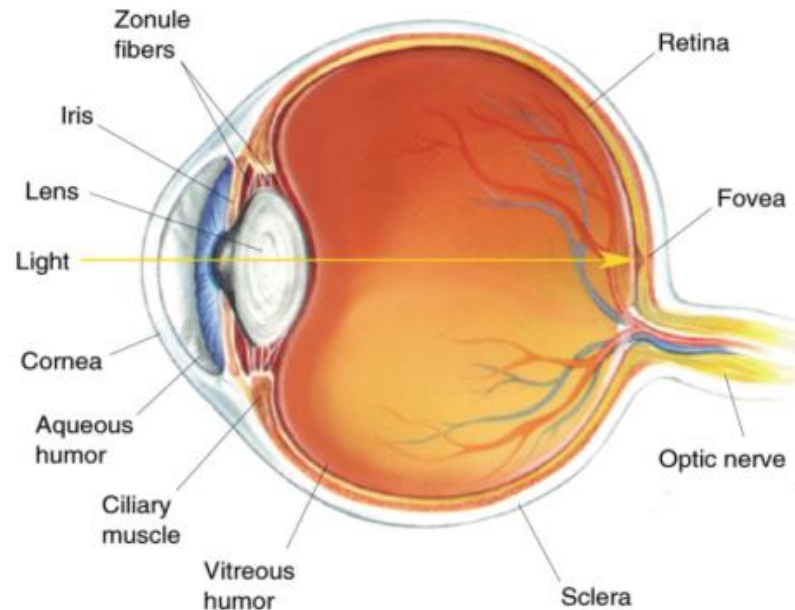
The total range of distinct intensity levels the eye can discriminate simultaneously is rather small

Brightness adaptation level



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

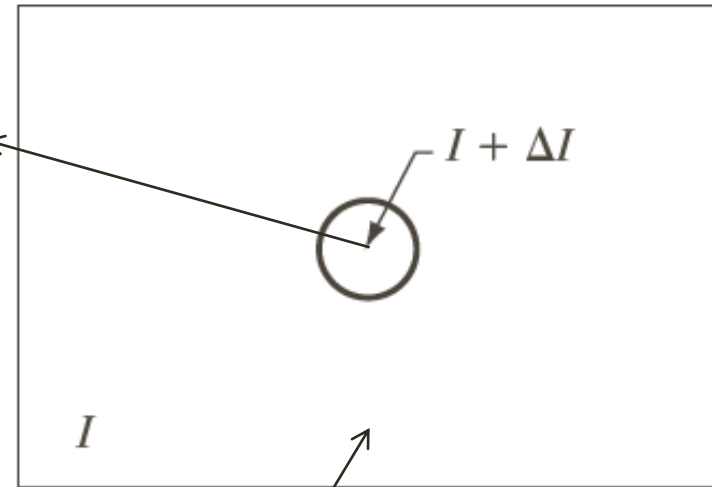
Weber Ratio/Fraction (Just-Noticeable Difference JND)

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

Small ratio: good brightness discrimination

Large ratio: poor brightness discrimination

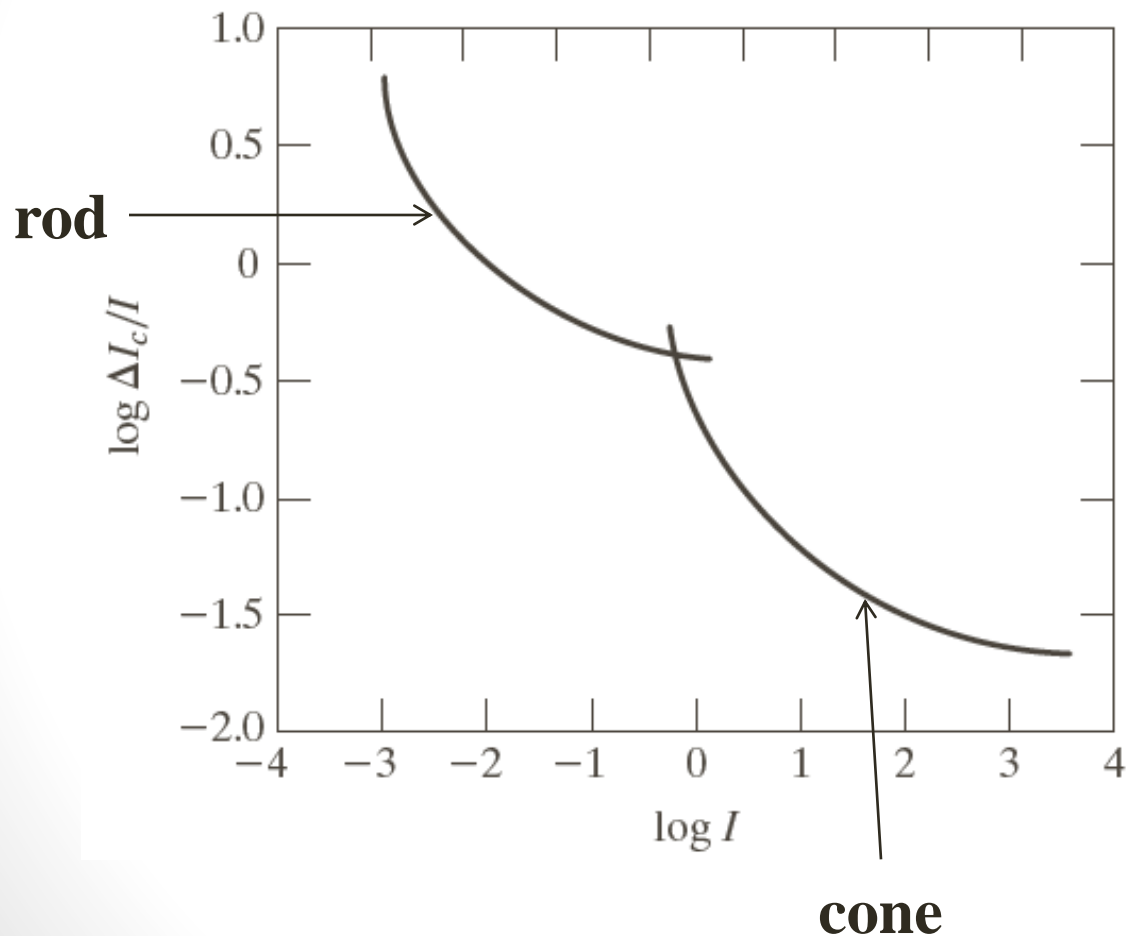
Additional light source



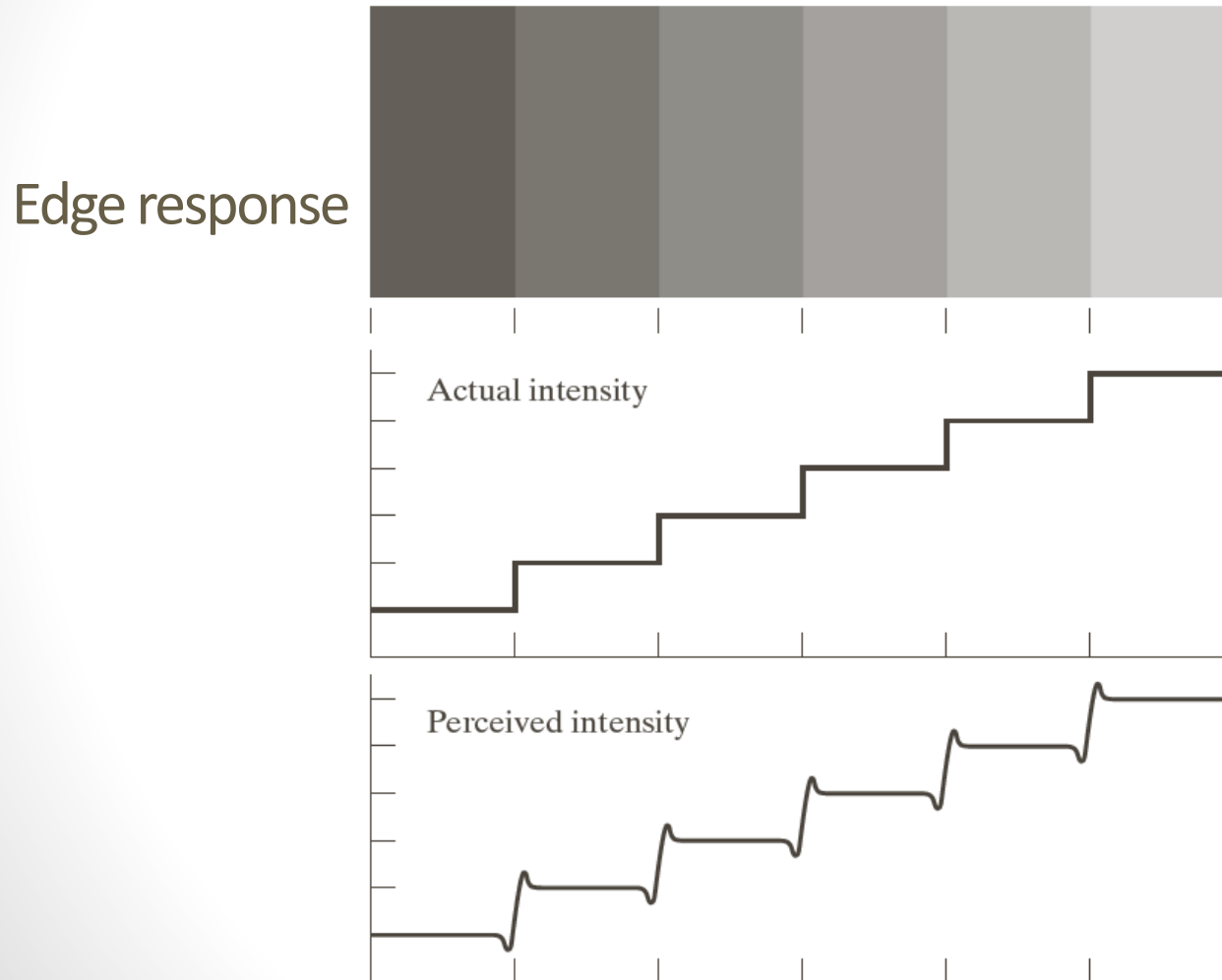
An opaque glass

Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods

Brightness Discrimination at Different Intensity Levels

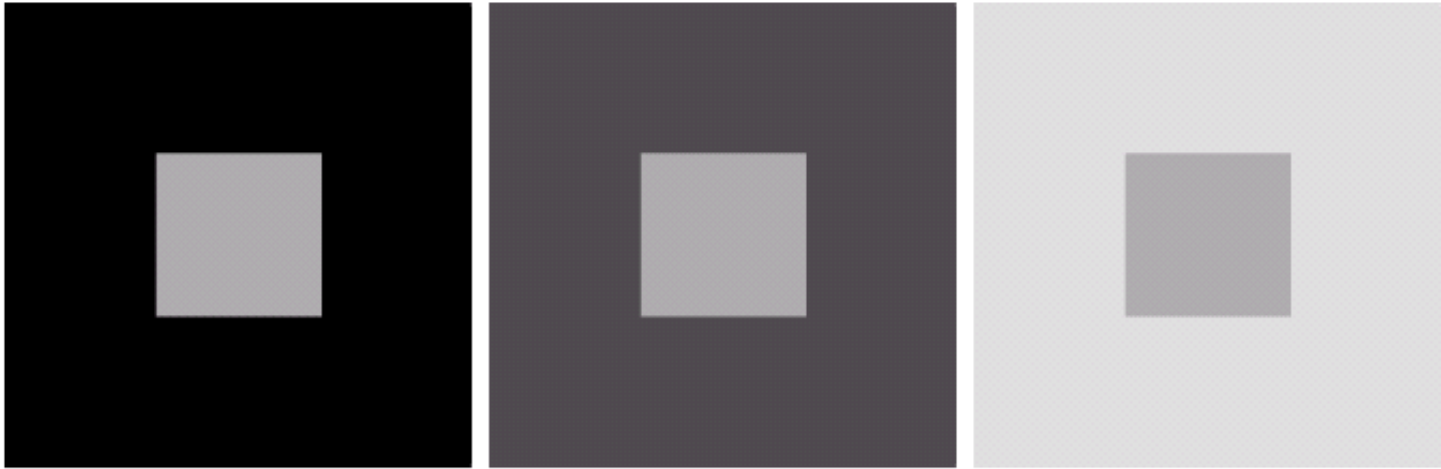


Perceived Intensity is Not a Simple Function of the Actual Intensity



Perceived Intensity is Not a Simple Function of the Actual Intensity

Simultaneous Contrast



Object Perception

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

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

Scenes

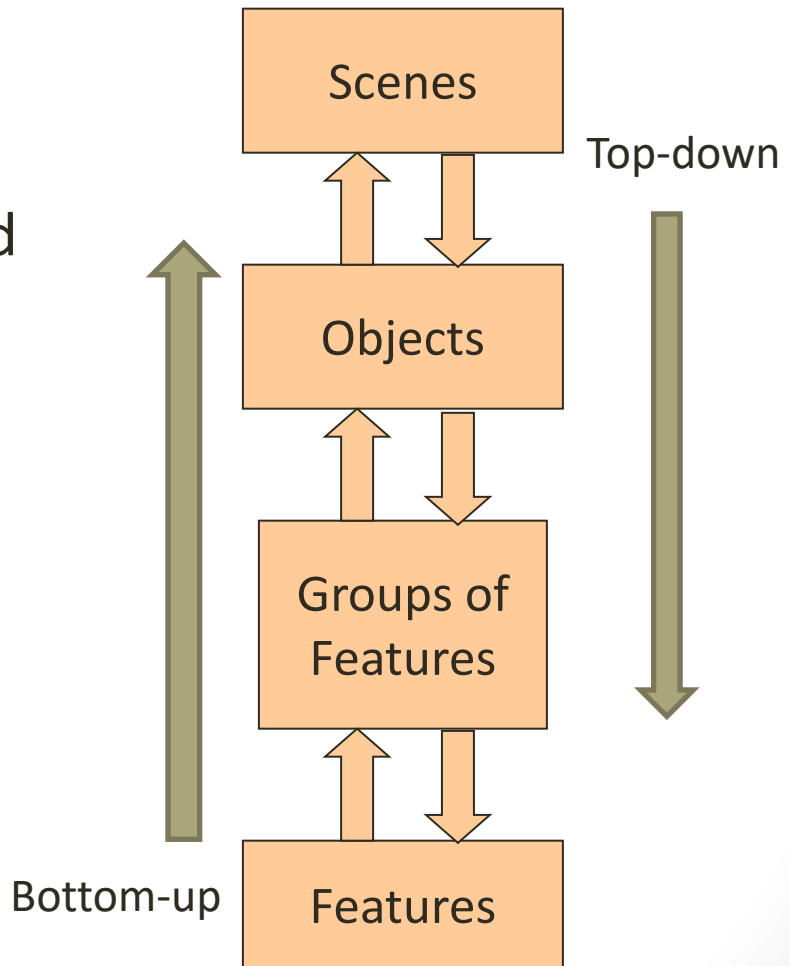
Objects

Groups of
Features

Features

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

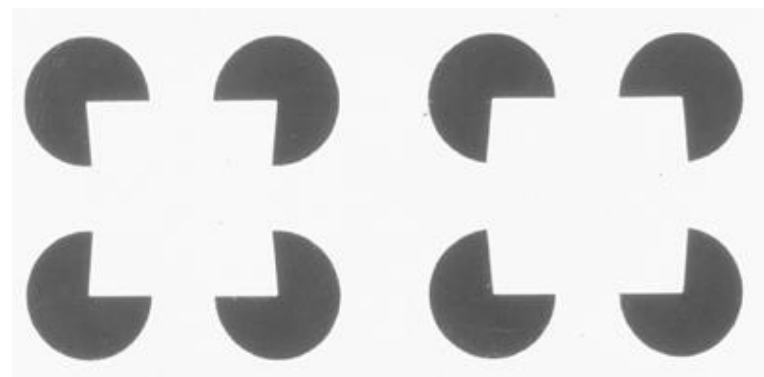
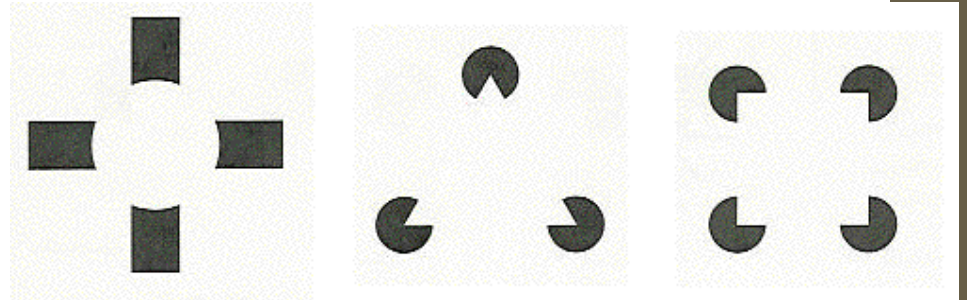
- “Bottom up processing”
 - Data-driven
 - Sensation reaches brain, and then brain makes sense of it
- “Top down processing”
 - Cognitive functions informs our sensation
 - E.g., walking to refrigerator in middle of night



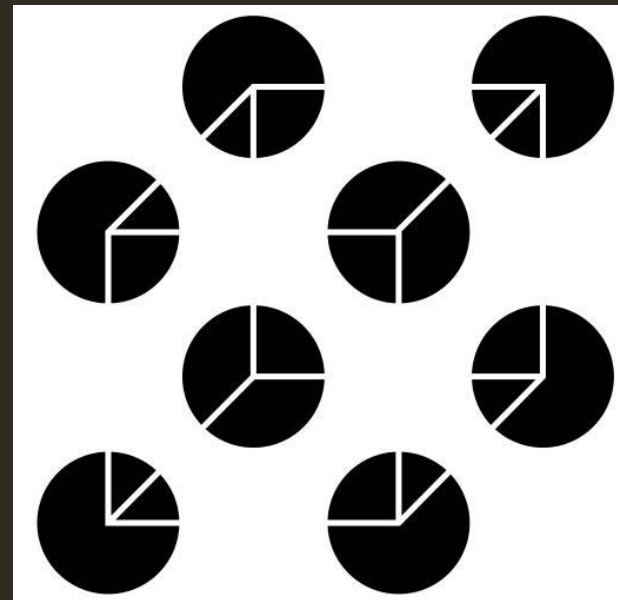
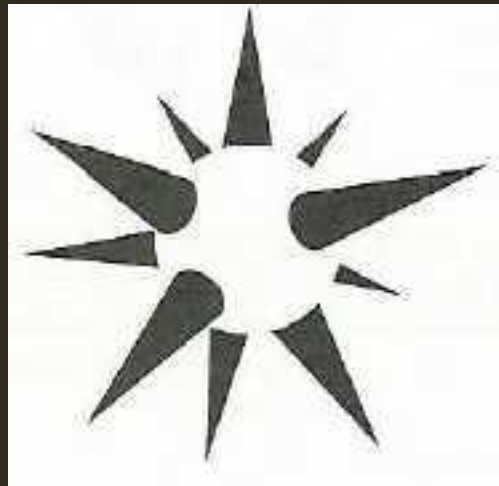
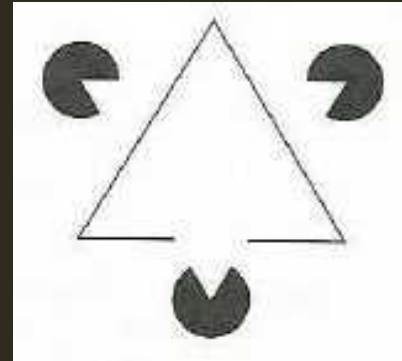
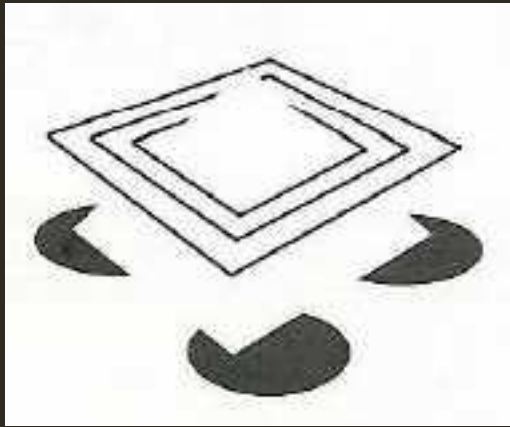
Illusory Contours

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.

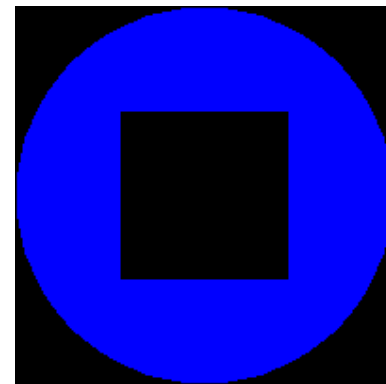


<https://www.semanticscholar.org/paper/Subjective-contours-and-apparent-depth.-Coren/012a0acbf2dd3bca9b7867146a03b8cd9ef45c9c/figure/4>

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



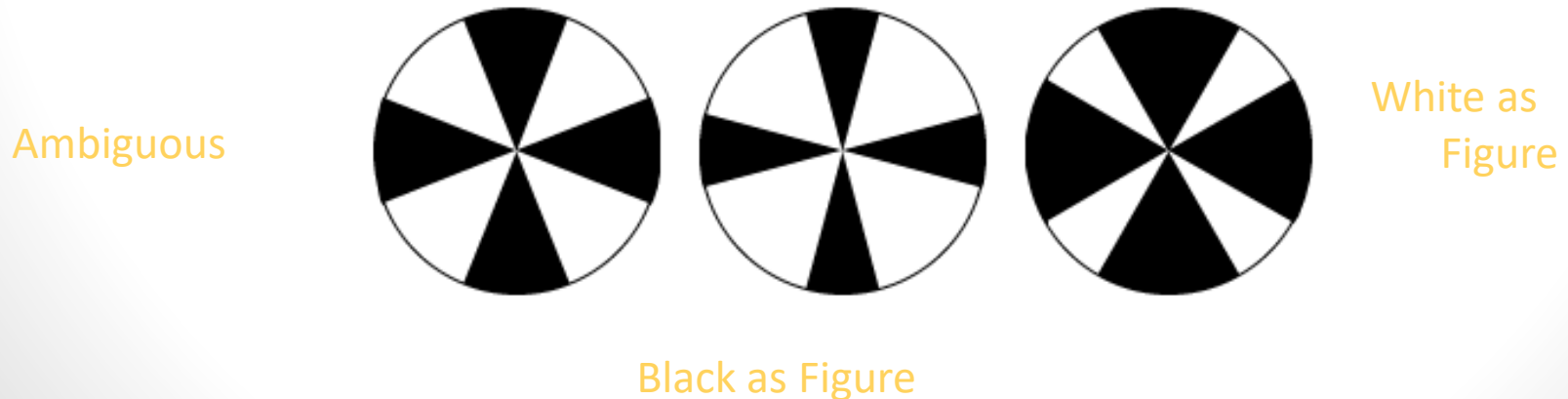
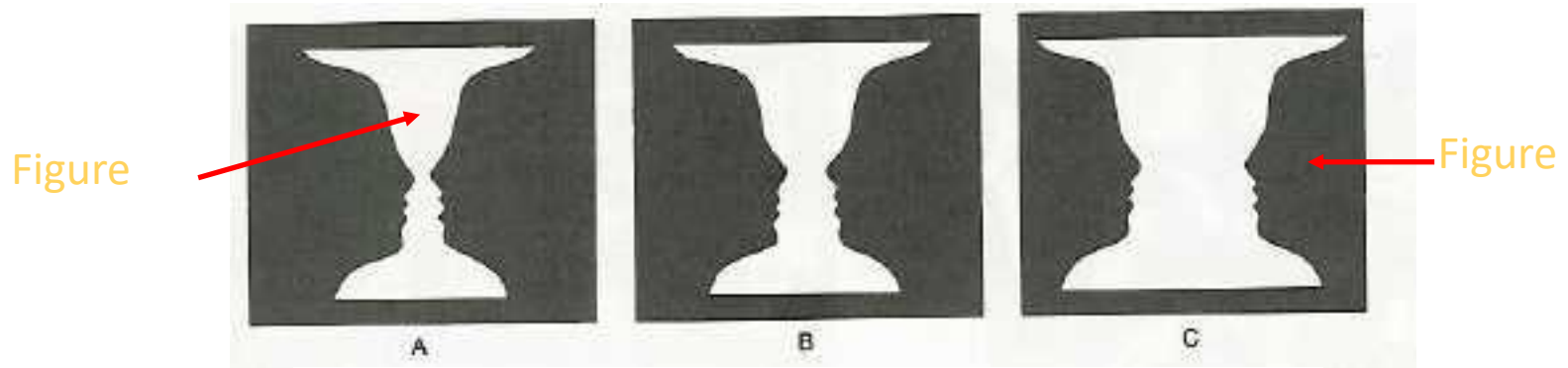
Factors that Affect Figure-Ground Perception

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

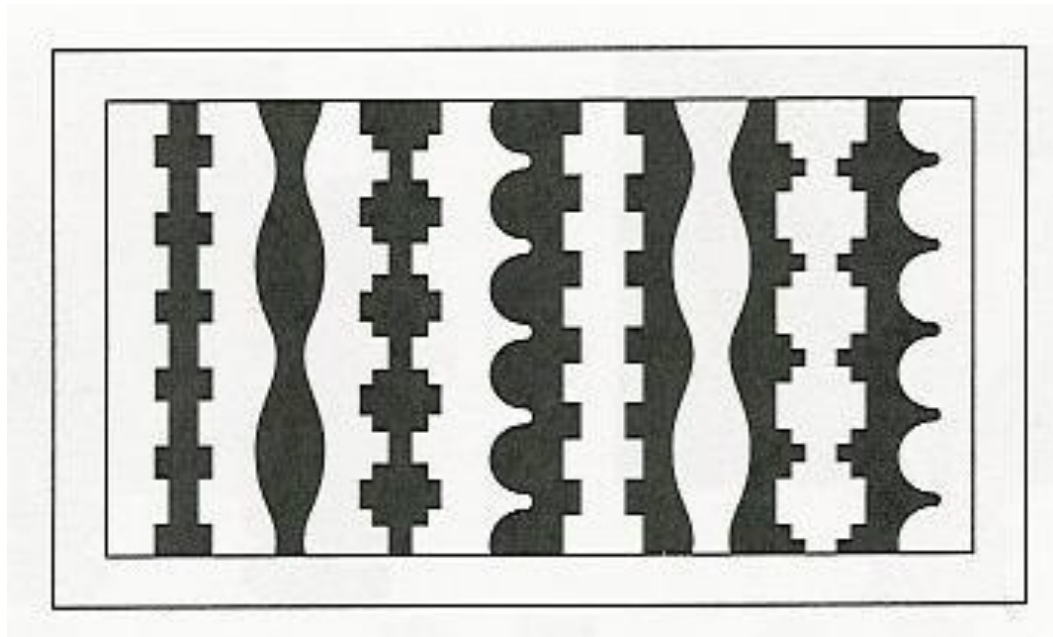
Size of Features

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



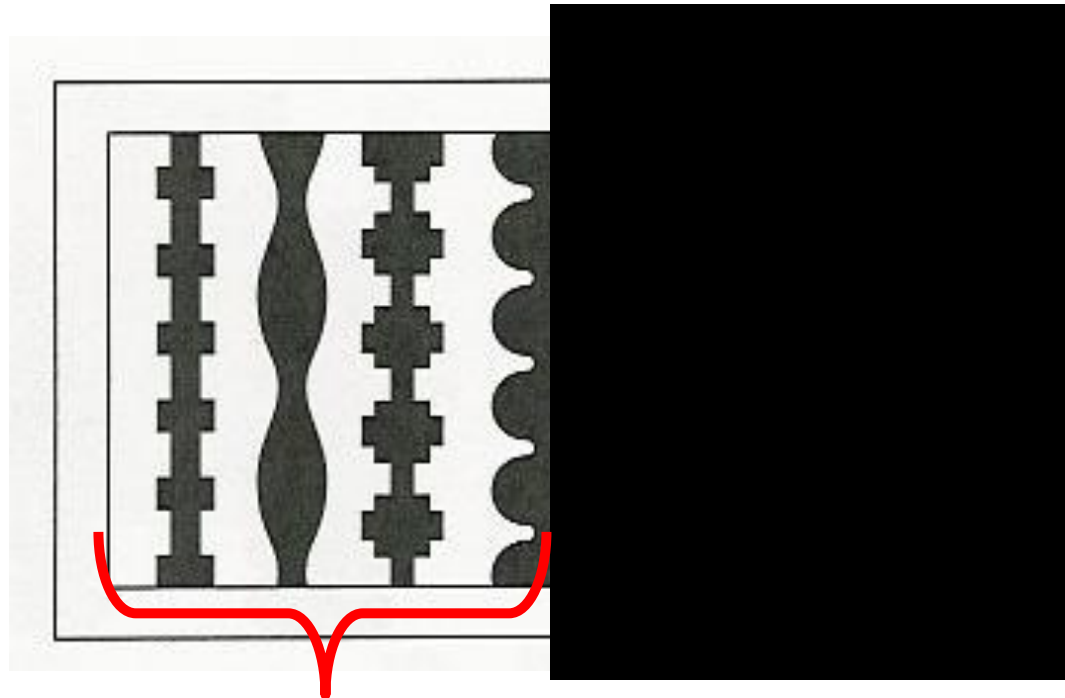
Symmetry

Symmetric areas tend to be perceived as the figure.



Symmetry

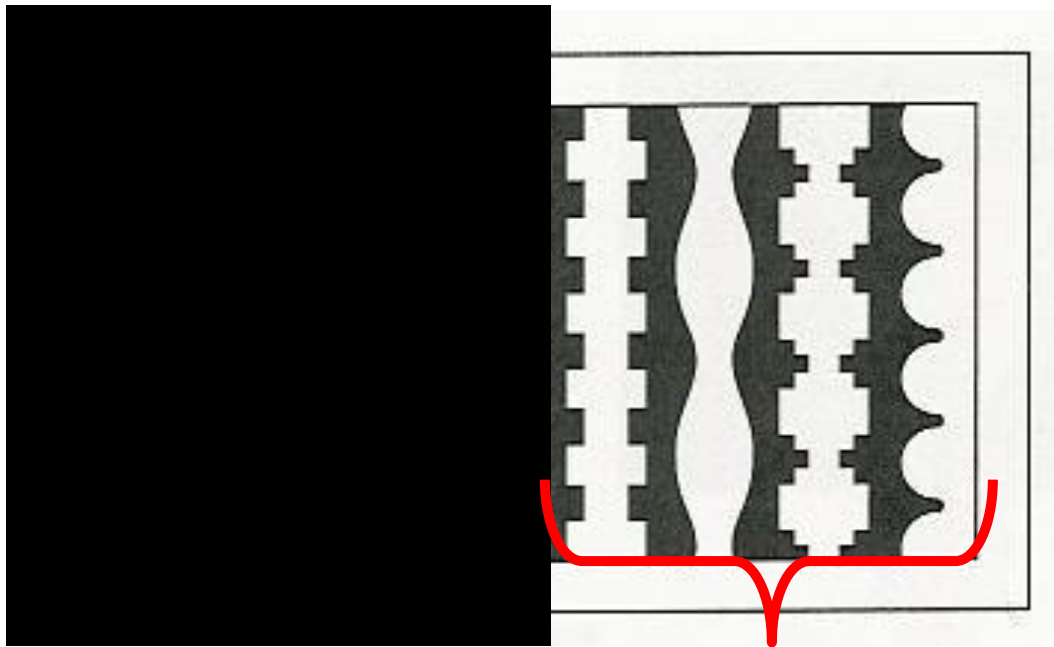
Symmetric areas tend to be perceived as the figure.



Black seen as figure

Symmetry

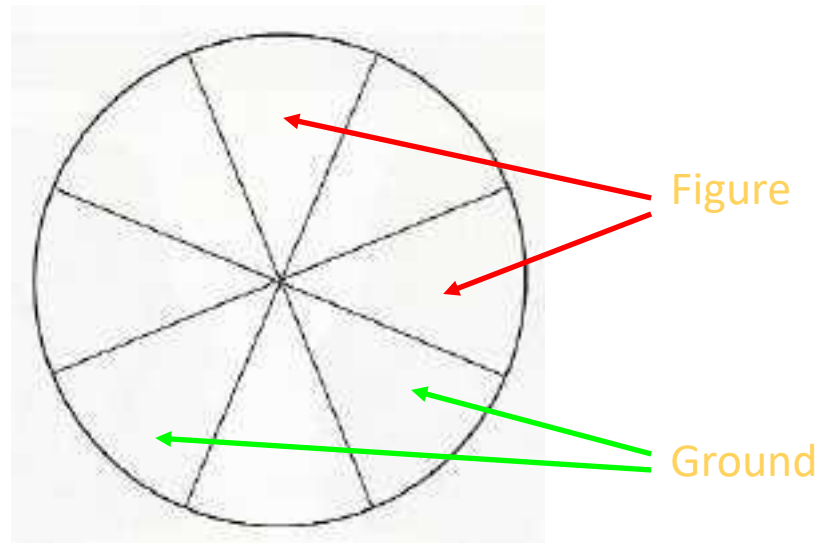
Symmetric areas tend to be perceived as the figure.



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.



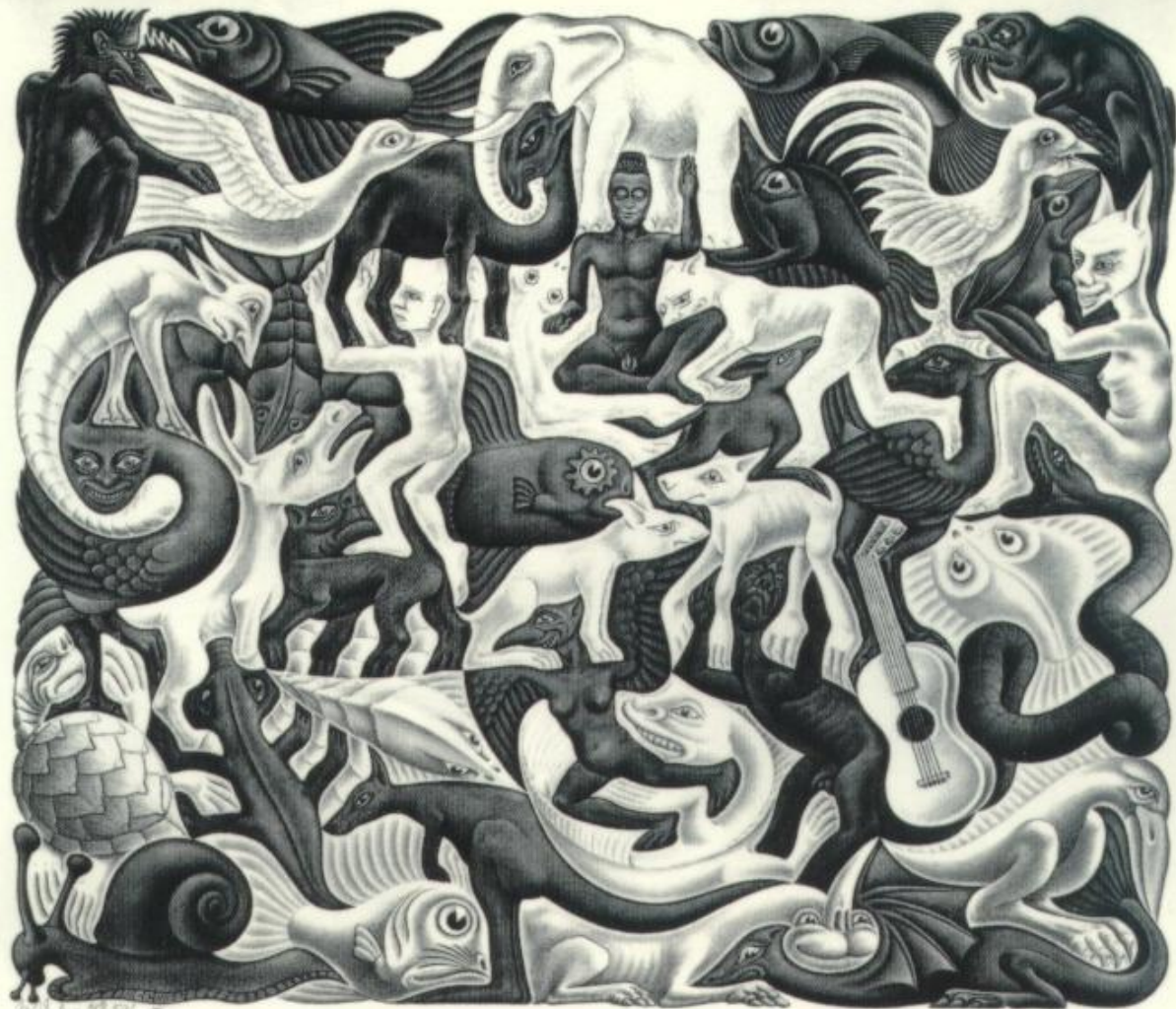
“Home run” overpowers the smaller areas once you see it.

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/>



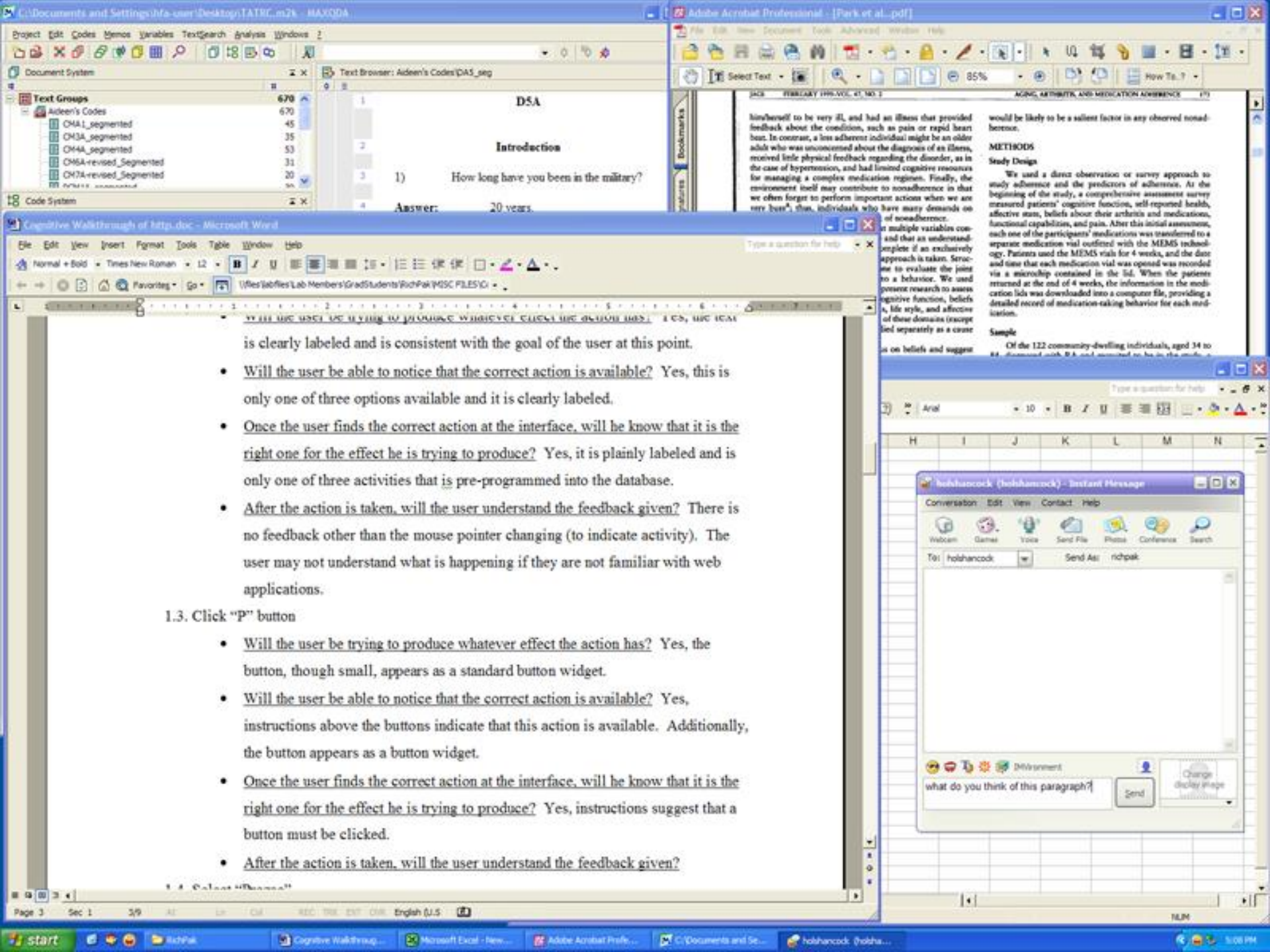




M.C. Escher 1938

Questions so far?

Visual Search



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?**

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

Find "Kane & Hasher"

File Edit View Favorites Tools Help

Back Search Folders

Address C:\Documents and Settings\Administrator\Desktop\bkup dissertation ideas and pdfs

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