

Today's Agenda

- Human abilities – Vision
- Human abilities – Cognition

Reminder: Paper Reading Proposal (Graduate Only)

- A literature review on your selected HCI research topic
- A proposal including
 - The topic
 - A brief background introduction
 - A list of papers (tentative) – you can add more papers later
 - You are expected to include 15+ papers in your final list
 - **Proposal due 11:59pm EST, Friday, Sep. 15, 2023**

Reading Assignments

- Interaction Design Chapters 2, 3
- Understanding your users Chapters 1 & 2

Review: About the Visual System

- Brightness adaptation - subjective brightness
- Brightness discrimination
 - Brightness discrimination at different intensity levels
- Perceived intensity is not a simple function of the actual intensity
- Illusory contours

What Do We Do with All of This Visual Information?

Perception of a scene involves multiple levels of perceptual analysis.

- “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

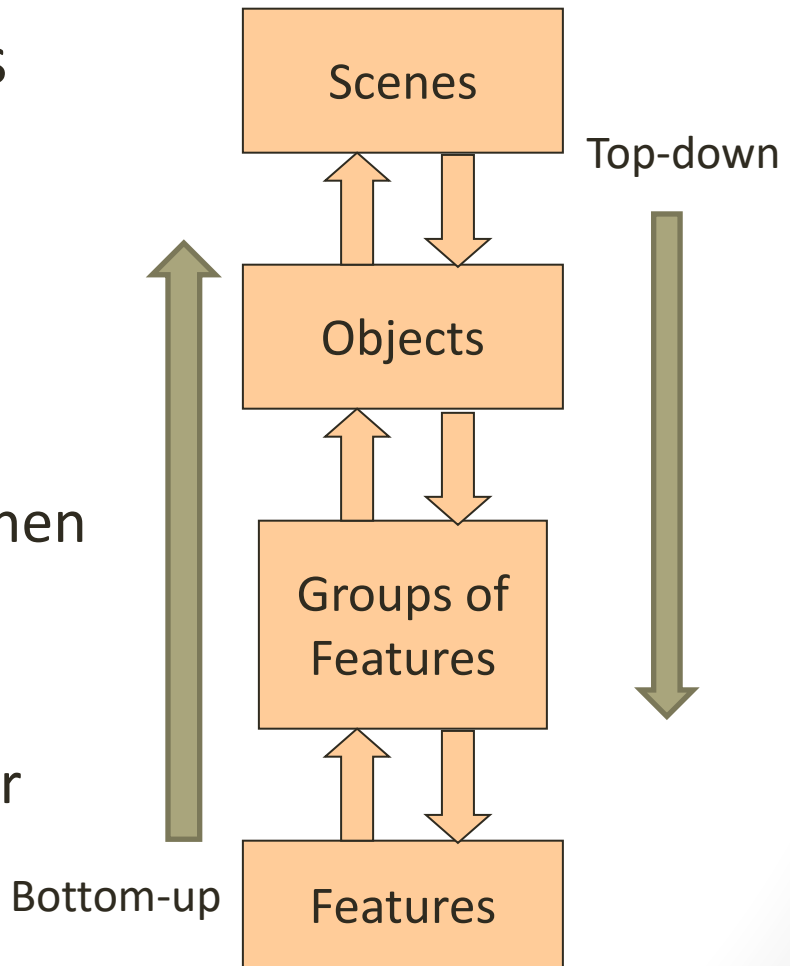
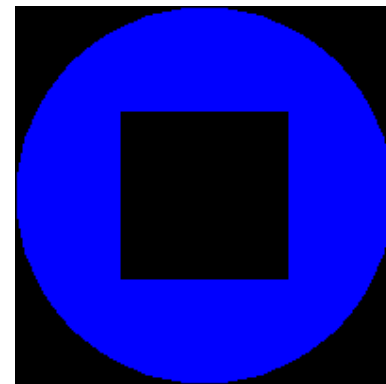


Figure & Ground Perception

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.



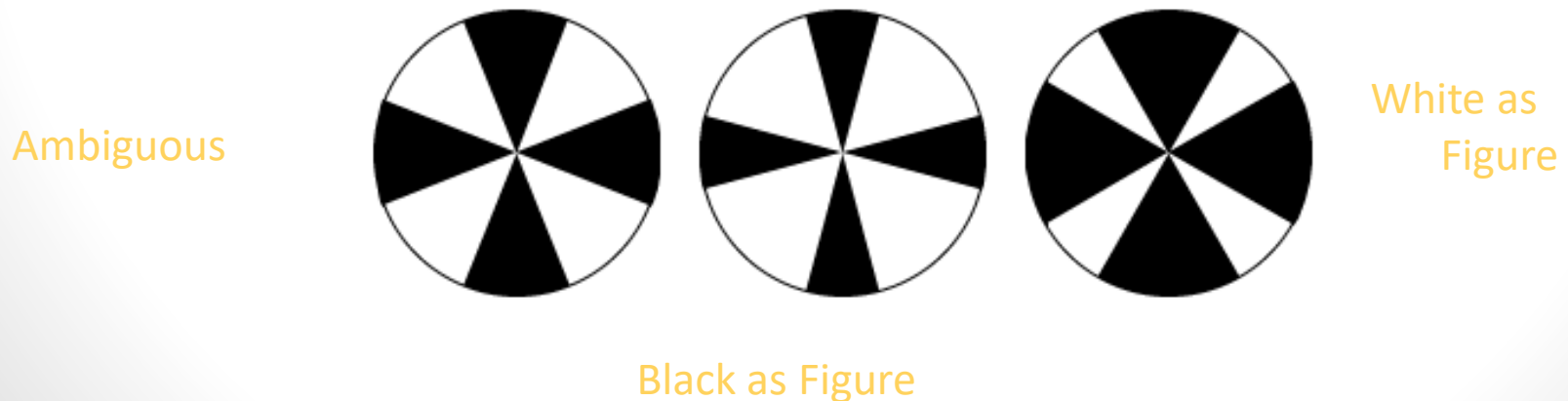
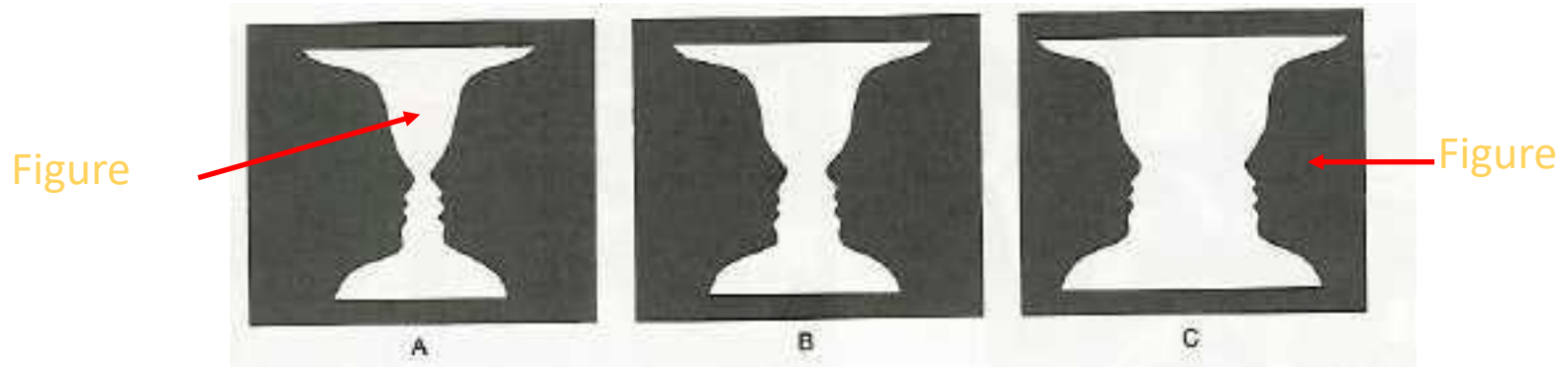
Factors that Affect Figure-Ground Perception

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

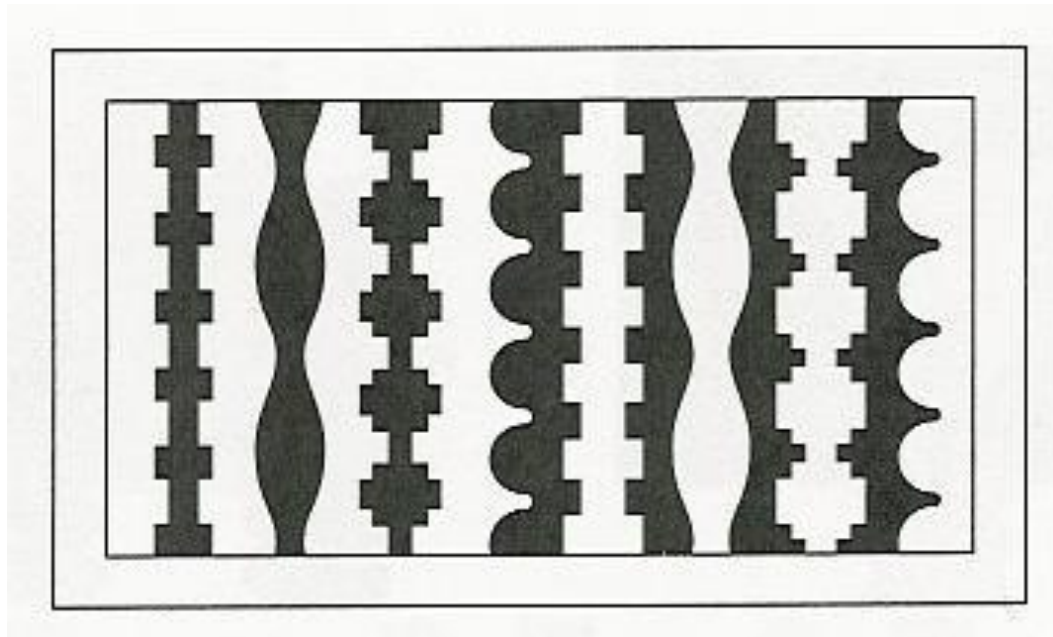
Size of Features

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



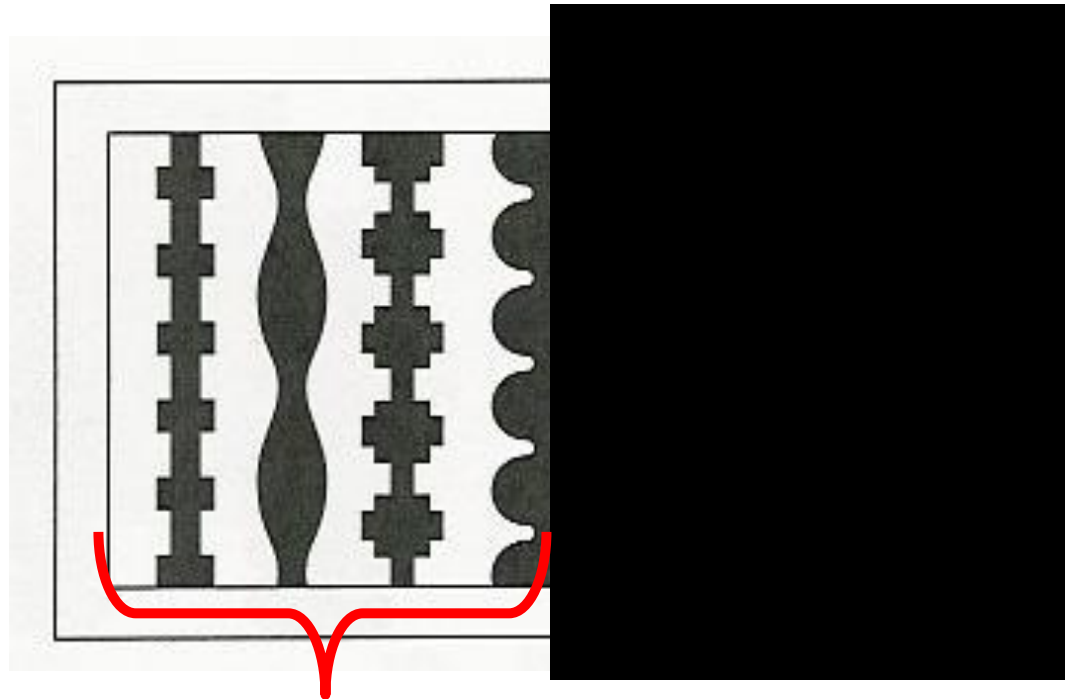
Symmetry

Symmetric areas tend to be perceived as the figure.



Symmetry

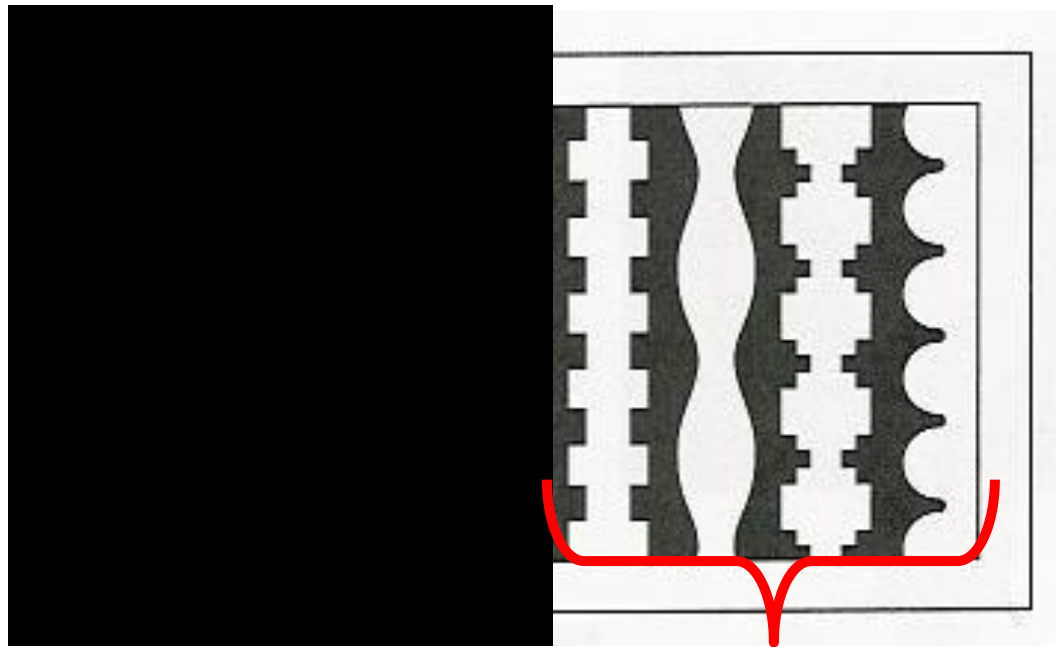
Symmetric areas tend to be perceived as the figure.



Black seen as figure

Symmetry

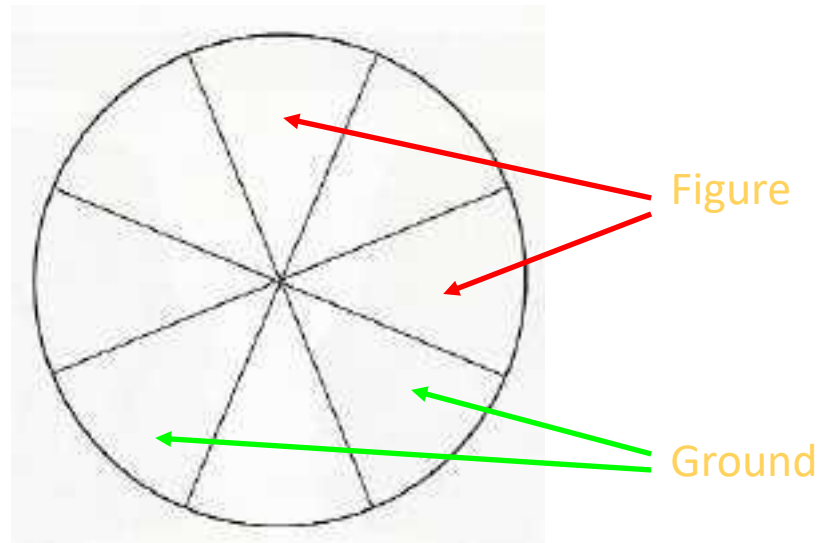
Symmetric areas tend to be perceived as the figure.



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.



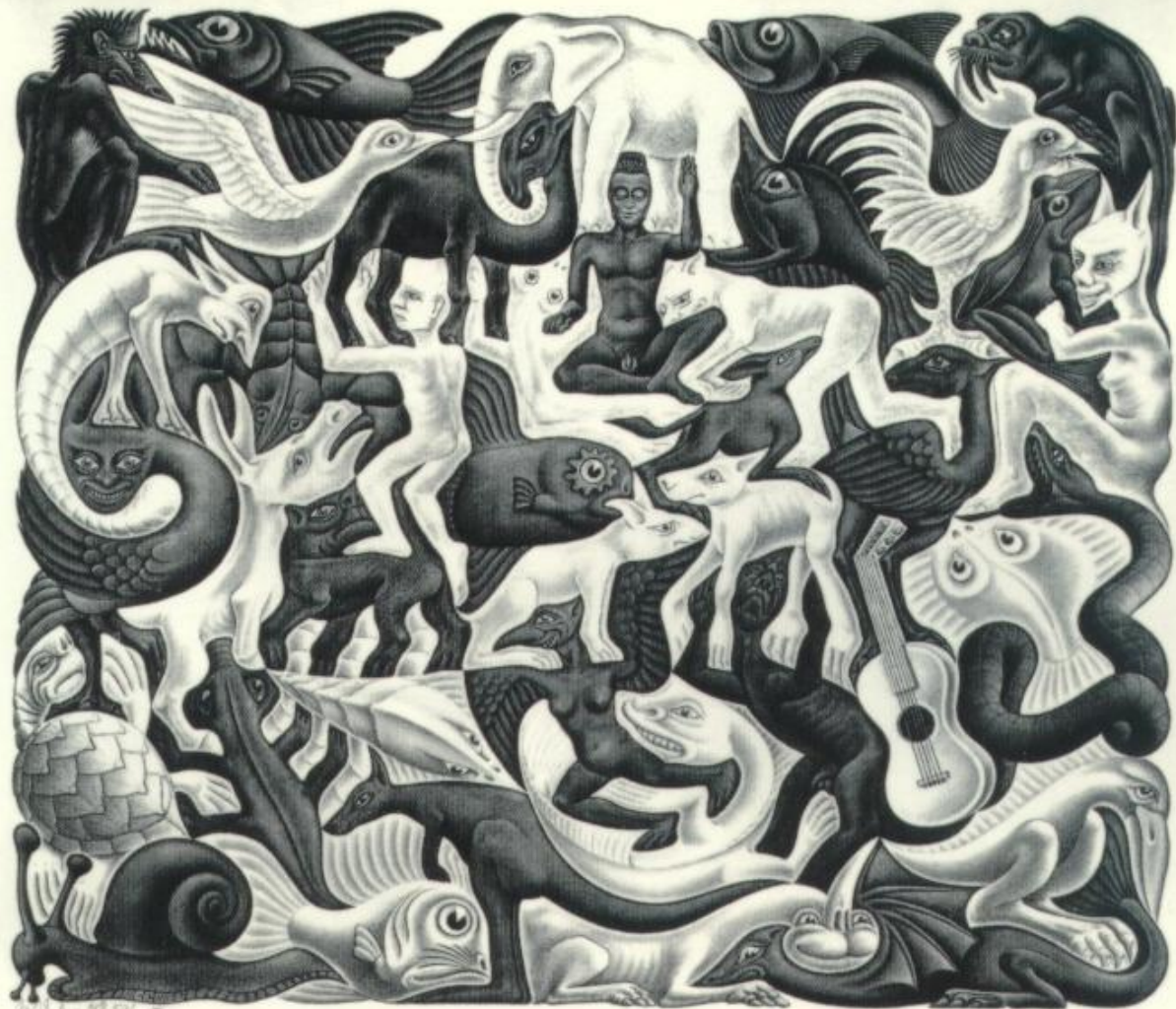
“Home run” overpowers the smaller areas once you see it.

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

Visual Search

Targets vs distractors

- 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

Find "Kane & Hasher"

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Visual Search

Parallel search vs. Serial search

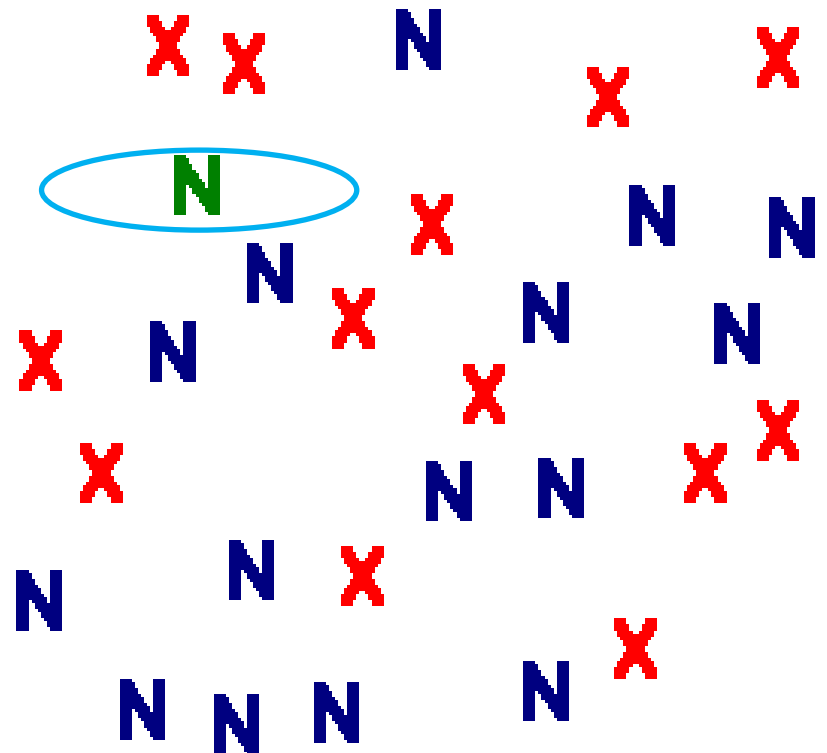
Parallel Search

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?

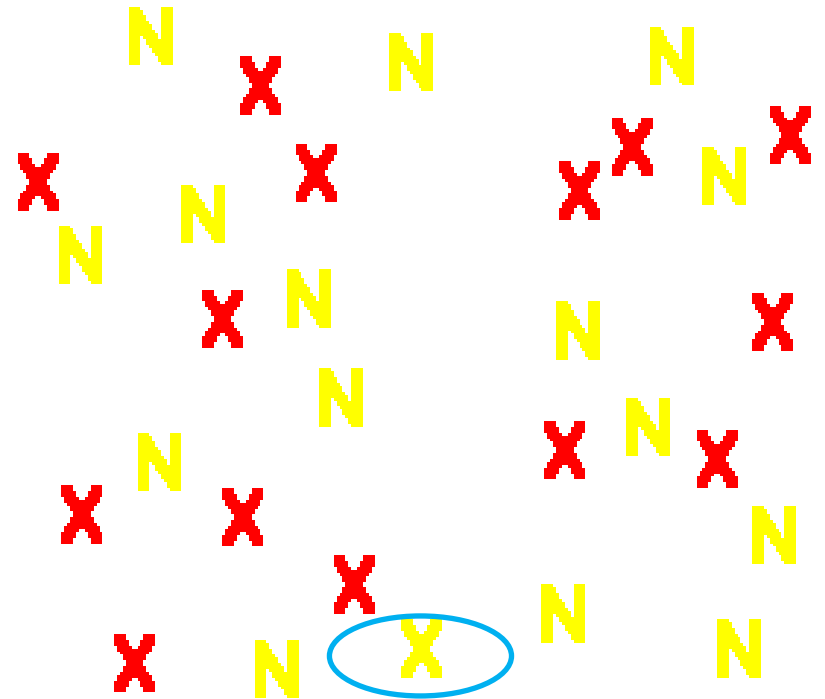
Bottom up!



Serial Search

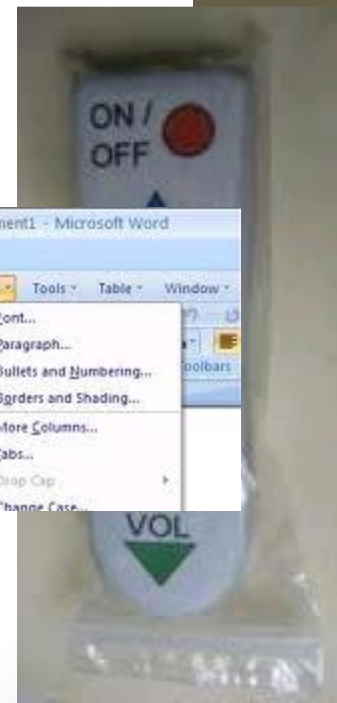
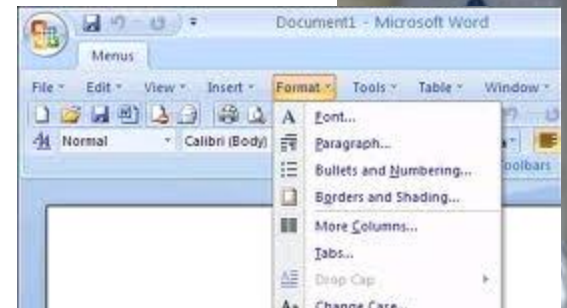
Find yellow “X”

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



Reducing Search Time

- Reduce search time:
 - Reduce N
 - Reduce I
- What if you can't do that?
- Capitalize on bottom-up strategies?
 - Make target easy to locate (pop-out)
- Capitalize on top-down strategies?
 - Build on what people are familiar with



Read Flow (Related to Visual Search)

Eye Movements

Pursuit movements

- Tracking an object across the visual field
 - i.e. following the path of the mouse

Saccades

- Abrupt, short, discrete movements
 - i.e. reading
 - Used a lot as a measurement in HCI!

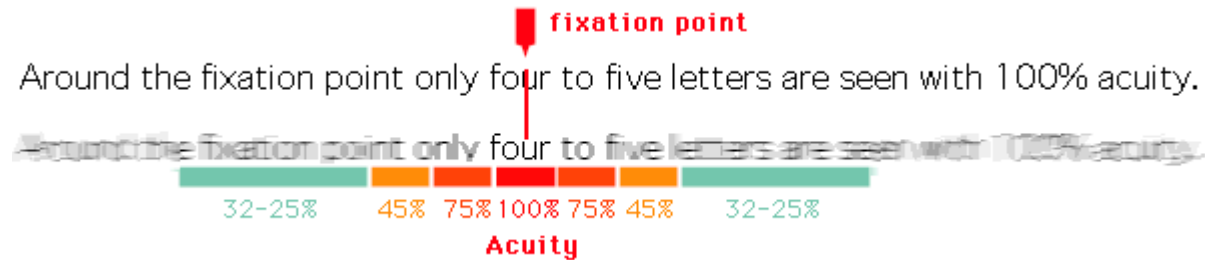
Saccades-Reading

Pursuit movements are almost completely automatic and generally require physically moving stimulus. In contrast to saccades, pursuit movements are smoothly executed and are comparatively slow. Generally, they are used to track an object moving in a stationary environment; hence target velocity rather than target location is the appropriate stimulus.

Smooth
saccades

Saccades-Reading

Pursuit movements are almost completely automatic and generally require physically moving stimulus. In contrast to saccades, pursuit movements are smoothly executed and are comparatively slow. Generally, they are used to track an object moving in a stationary environment; hence target velocity rather than target location is the appropriate stimulus.



https://en.wikipedia.org/wiki/Eye_movement_in_reading

Read Flow

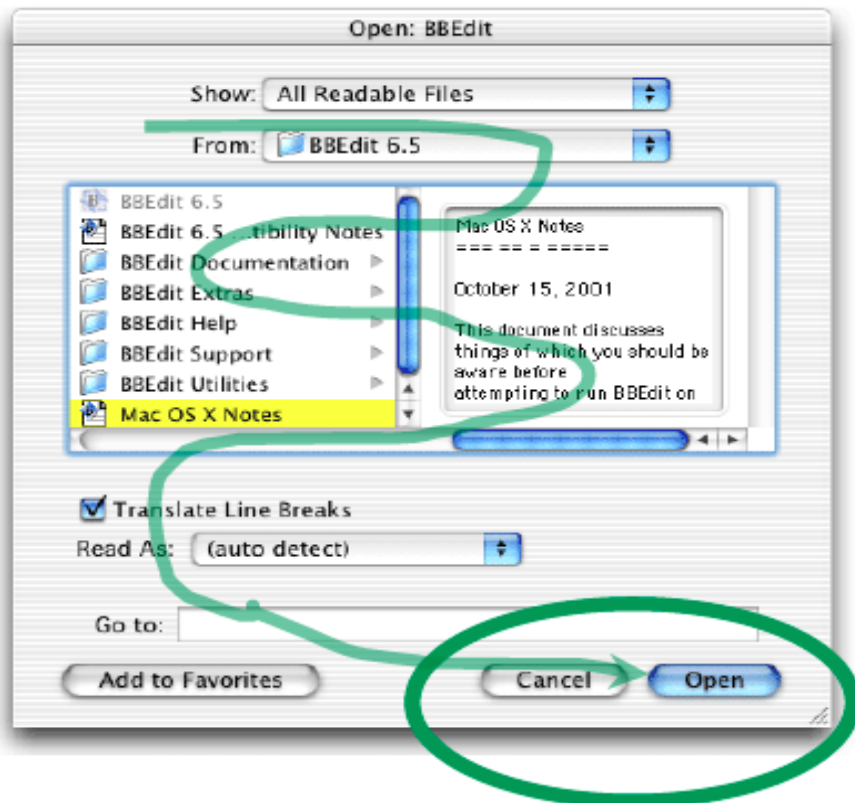
➤ **Read-flow principle:**

- ❖ Action items (buttons, links) should support the flow of the user in the same way as reading occurs.
- ❖ The last action should be the most-likely action to avoid backtracking.
- ❖ Left=back, stop, quit, cancel, previous
- ❖ Right=next, continue, submit

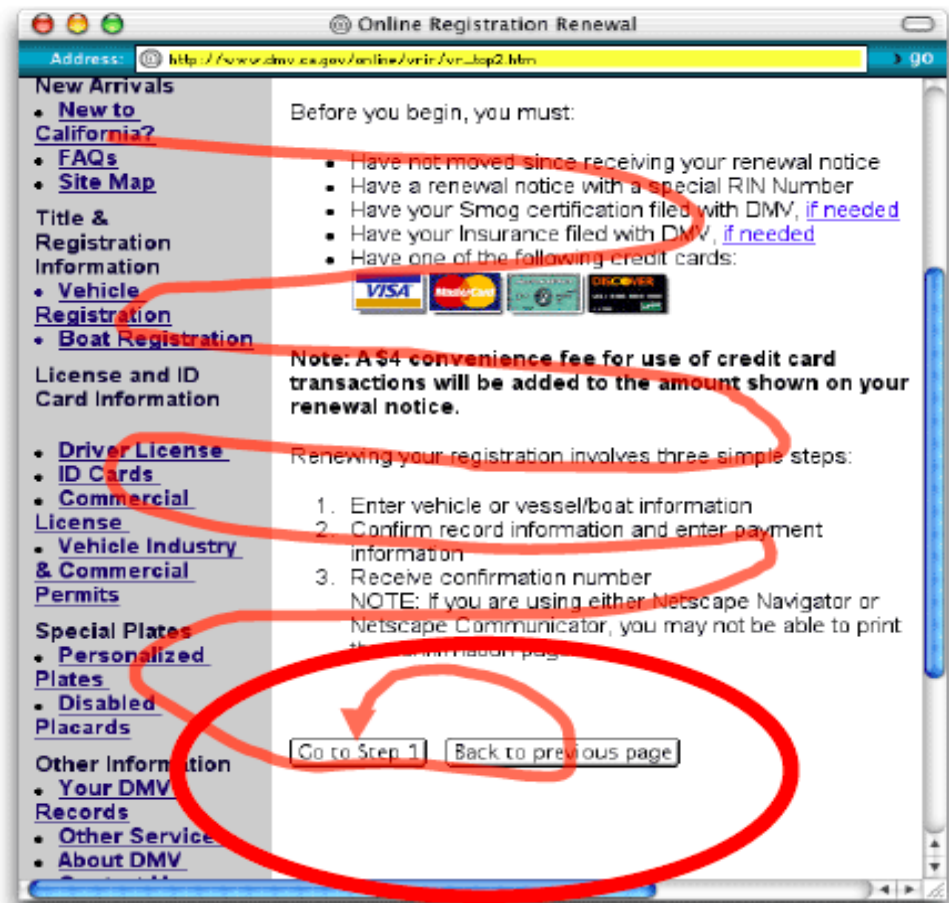
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Read Flow



FLAWS



DOES NOT FLOW

Some Visual Guidelines

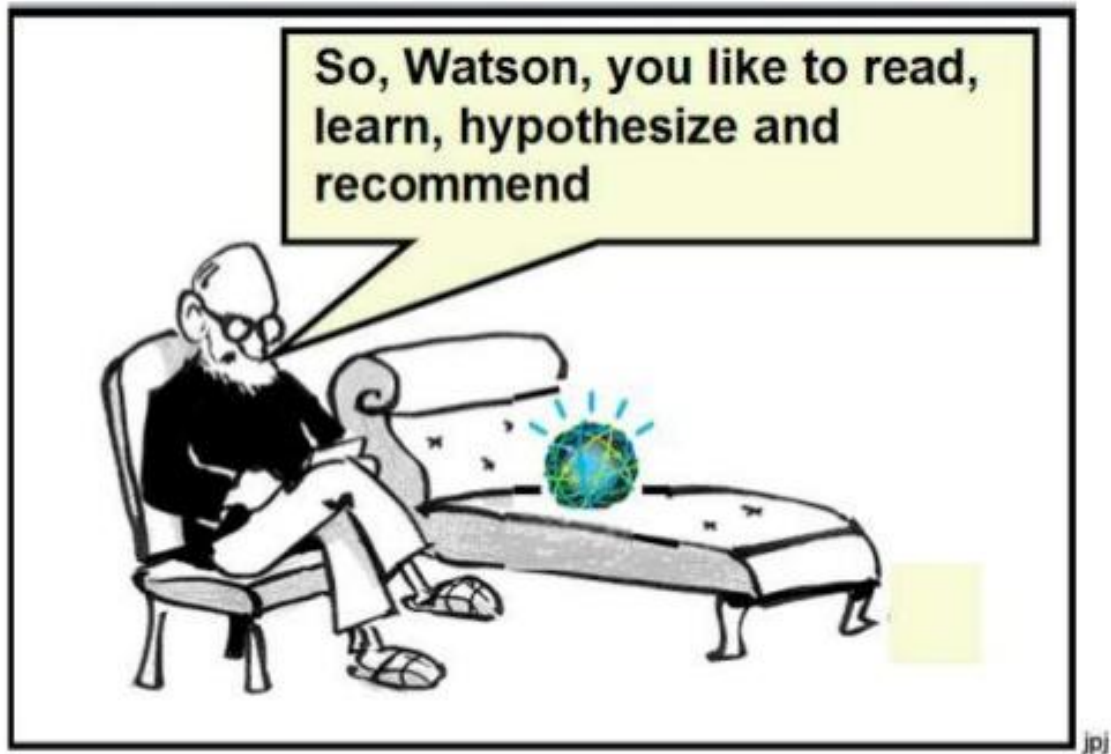
Finally, I will leave you with some general design guidelines on human visual capabilities...

Some Visual Guidelines

1. Large font is good, so is contrast
2. Don't use too many graphics
 - distracting and bad for screen readers
3. Something is important?
 - make it “pop” (bottom up processing) to reduce visual search
4. Simple text – easier to read and understand
5. “Color match” when you can (consistency)

Some Visual Guidelines

6. Never blur pictures
 - bad for low vision
7. Blue is hard to read
 - less blue cones in fovea
8. Group similar items
9. Use logical visual order – helps with read flow
10. Think about foreground and ground



Cartoon courtesy of Jean Paul Jacob, IBM Research Emeritus & IBMer on Campus, UC Berkeley

9/12/2014

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COGNITION

Cognition

Norman's two general modes: (ID 3.2)

- **Experiential cognition**
 - Perceive, act, and react
 - Effortless
 - Requires a certain level of expertise and engagement
 - E.g., driving, reading, conversation
- Reflective cognition and slow thinking

Human Information Processing - General

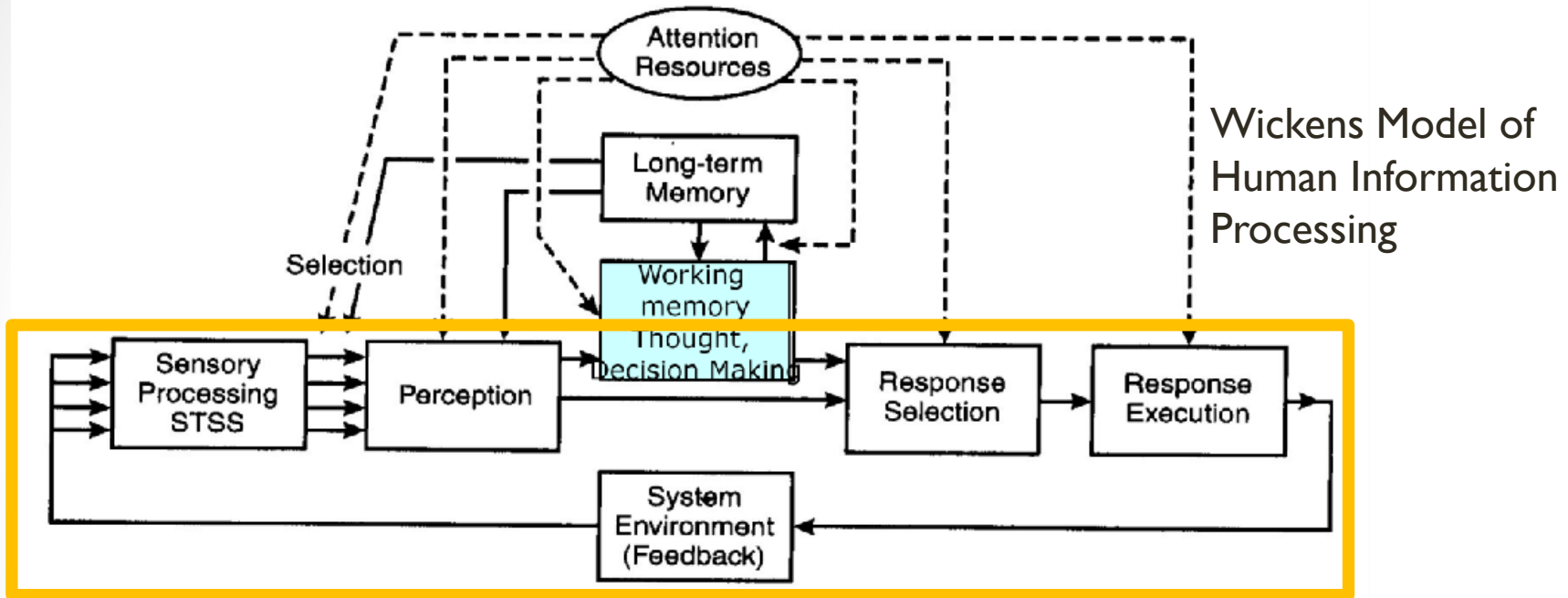


Figure 1.3 A model of human information processing stages.

1. Information from sensory system is perceived
2. Information is processed and transformed
3. Information is responded to

Cognition

Norman's two general modes: (ID 3.2)

- Experiential cognition
- Reflective cognition and slow thinking involving
 - Mental effort
 - Attention
 - Judgement
 - Decision making
 - New ideas and creativity, e.g., designing, learning, and writing a paper/book

Human Information Processing - Attention

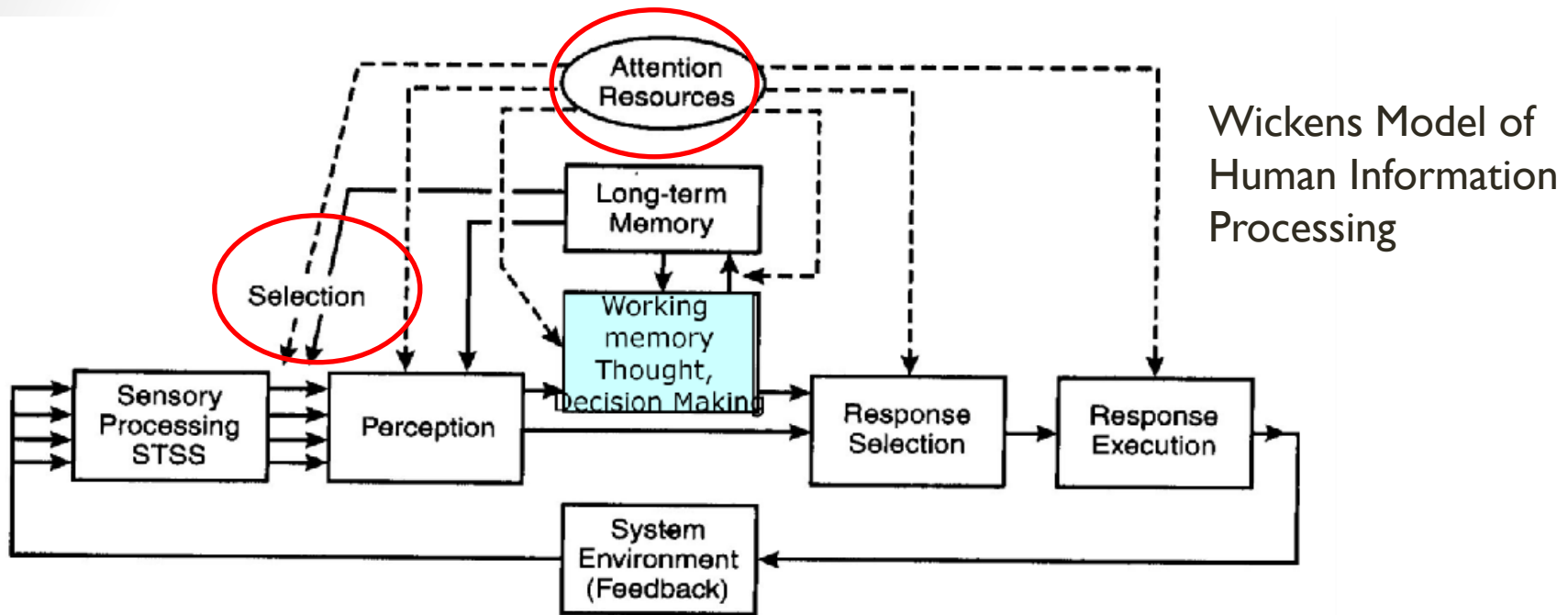


Figure 1.3 A model of human information processing stages.

- Mental effort
- Selecting sensory channels for further processing

Selective Attention

Does NOT guarantee perception

- Awareness test
- <http://www.youtube.com/watch?v=Ahg6qcgoay4>
- <https://www.youtube.com/watch?v=ubNF9QNEQLA>
- The “Door” study
- <http://www.youtube.com/watch?v=FWsxSQsspiQ>

Quiz #2

Quiz # 2 is available in Blackboard.

Due date: **3:35pm EST, Wednesday, Sep. 15, 2021**

Open book and open notes

Time to work in your groups!

Before you start...

Figure out who is taking notes.

1. Identify 3 project ideas
2. Identify for each project idea, 5 questions you may have
3. Create a Gantt Chart (I understand it is going to be vague – you can always update it)