Information: Perception and Representation

Lecture #7

Part A

Agenda

- Different mode of perceptions
- Theories of vision
  - Marr's theory
  - Constructivist approach
  - Ecologist approach
- How theories of vision can influence interface design
  - Graphical modeling
  - Graphical coding

Perception and Interface Design

- Perception is fundamental to interacting through computer
  - Information is perceived and represented at an interface
  - Perception can influence interface design

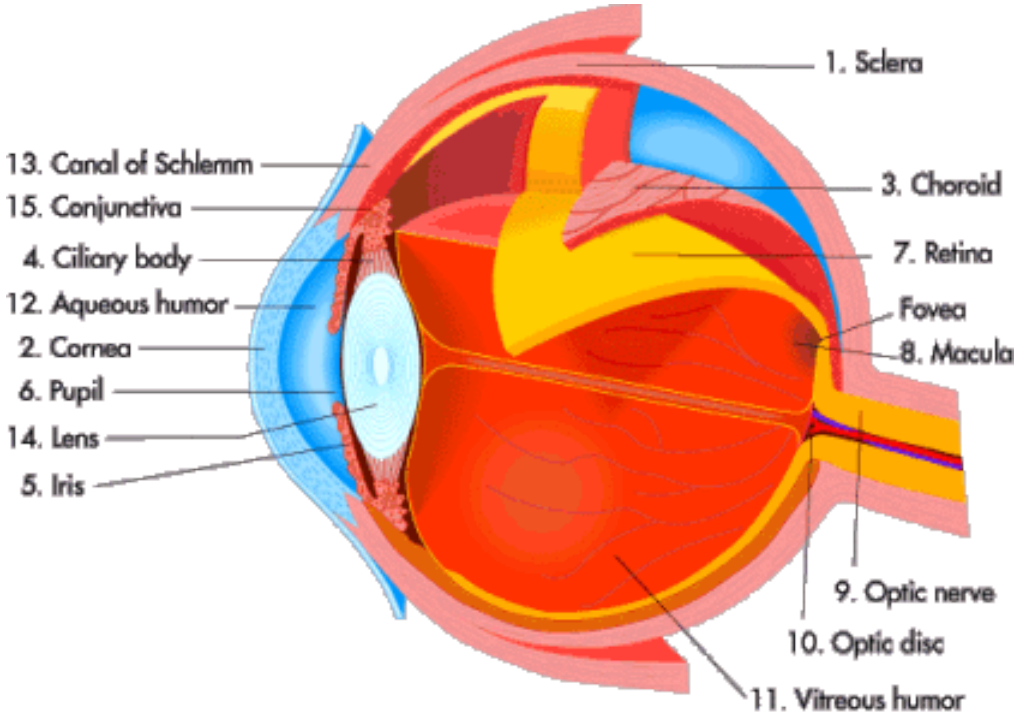
- Perceptual modalities
  - Visual perception
  - Speech perception
  - Touch perception

Visual Perception

- We can see an object if the object emits light itself (such as Sun) or light get reflected from the object (such as moon)
- We can not see a bullet fired from a gun or a plant is growing
- However, we can see an aero plane flying or a person walking

Visual Perception

- How we can see?



Theory of Visual Perception

- There are several theories about human visions
  - **Marr's theory**
  - **Constructivist theorists approach**
  - **Ecological theorist approach**
- These are the some notable theories to explain the vision phenomenon
- Not the different theories for the same things

Marr's Theory of Vision

- Vision can be explained with a three-level model

Marr's Theory of Vision

- First level is the retinal image
  - Light falls on retina through lens
  - Retina composed of brightness sensing rod cells and color sensing cone cells
  - Cone cells is sensitive to only red, green and blue illuminations
  - Color space is quantified and linearise the subjective impressions by stimulation at different levels
  - At this level, only boundary of objects are identified. This is called **primary sketch** or edge filtering

Marr's Theory of Vision

- Second level
  - 2D regions are identified
  - Background/foreground identification
  - Regions are identified as being in front of or behind other regions
  - This stage is called identification of objects as **2½D sketch**

Marr's Theory of Vision

- Third level
  - All the representation at the preceding levels is resolved into a 3D model of the object being perceived
  - This type of identification is called 3D sketch

Note: Marr's theory of vision has some analogy with the Computer graphics process

Constructivist Theorists Approach

- Process of seeing is an active one in which our view of the world is constructed both from information in the environment and from previously stored knowledge
- Or in other words

  Perception involves the intervention of representation and memories

Constructivist Theorists Approach

- What we see is not a replica or copy of the world such as the image that a camera would produce

- A lot of cognitive processing is required just to enable us to see

Constructivist Theorists Approach

- See the figure and identify what it is

Constructivist Theorists Approach

- We see the figure and identify that it is of Lord Budha

- Our ability to perceive objects is a result of our prior knowledge and expectations as to what should appear and the image that fall on our retinas

Constructivist Theorists Approach

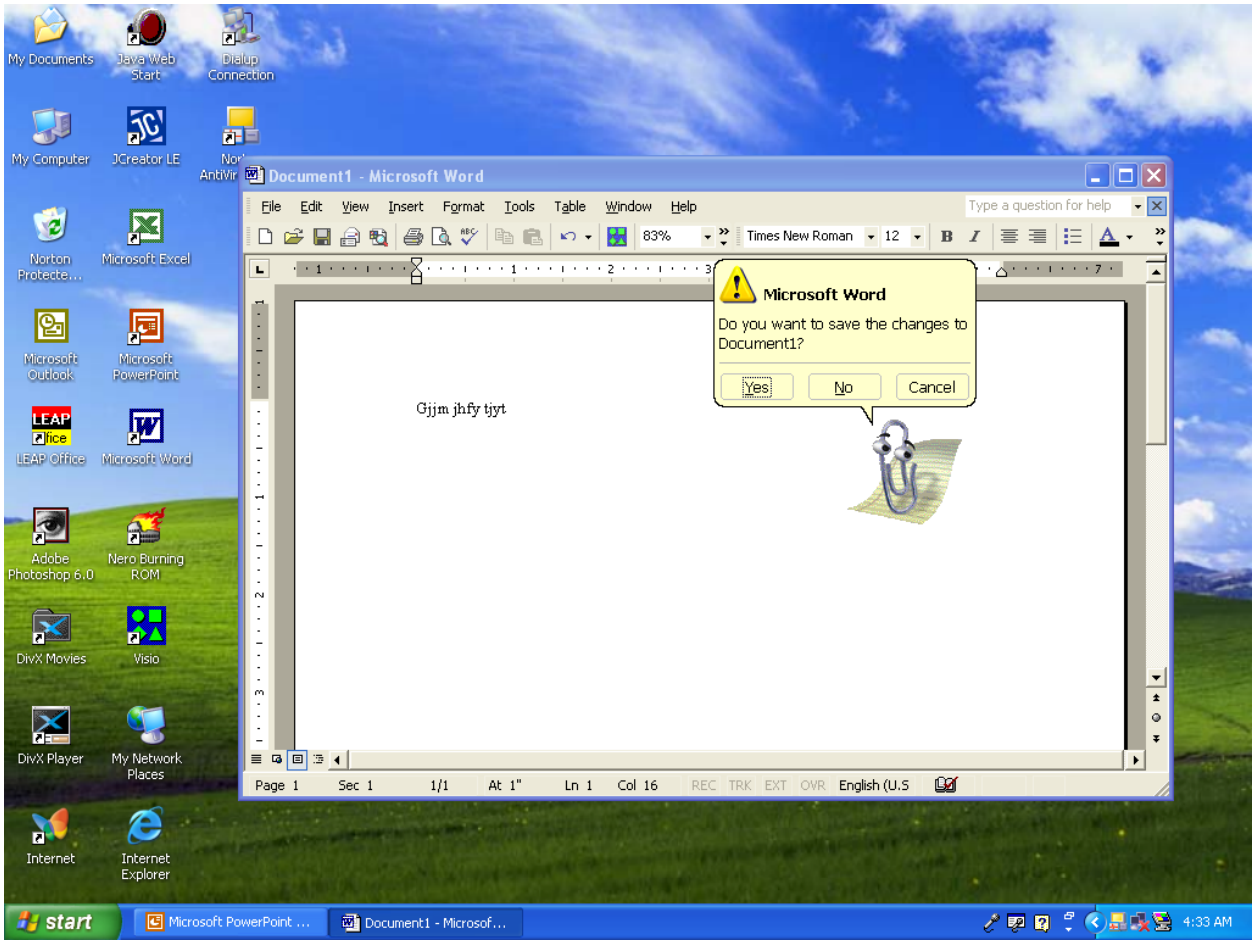
- There are two aspects of constructivist approach
  - Context of perception
    - There is an effect of context on perception
  - Gestalt psychology
    - Constructivist process involves decomposing or partitioning images into separate entities

Context of Perception

- Example …..

- Here the same stimulus is perceived as being an H in one word and an A in the other
- The context of other characters together with our prior knowledge enables us to interpret the A as being two different characters
- Hence, when presented with ambiguous stimuli, our prior knowledge of the world help us to make sense of it
- The same is true of ambiguous information display on computer screen

Gestalt Law of Psychology

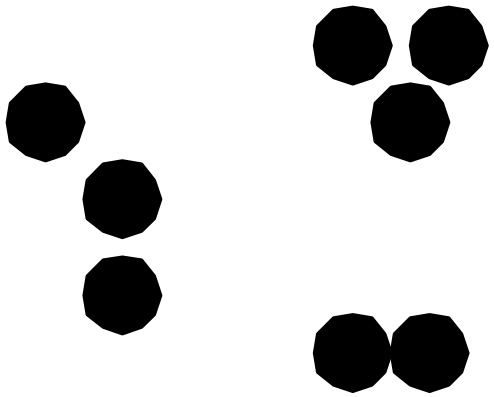


Gestalt Laws of Perception

- The organizing principles which enables us to perceive the patterns of stimuli as meaningful wholes are defined as
  - Proximity
  - Similarity
  - Closure
  - Continuity
  - Symmetry

Gestalt Laws of Perception: **Proximity**

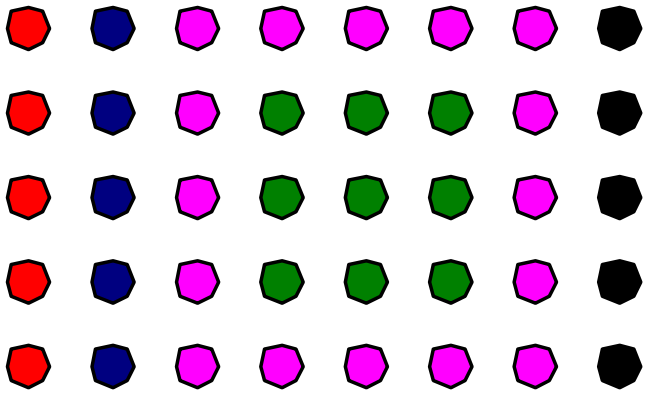
- Proximity
  - Elements close together tend to organize into units



Here, the dots appear as groups rather than a random cluster of elements

Gestalt Laws of Perception: **Similarity**

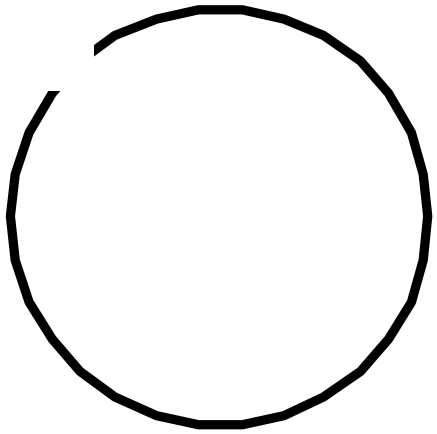
- Similarity
  - Objects that are look alike tend to be grouped together



There is a tendency for elements of the same shape or color to be seen as belonging together

Gestalt Laws of Perception: **Closure**

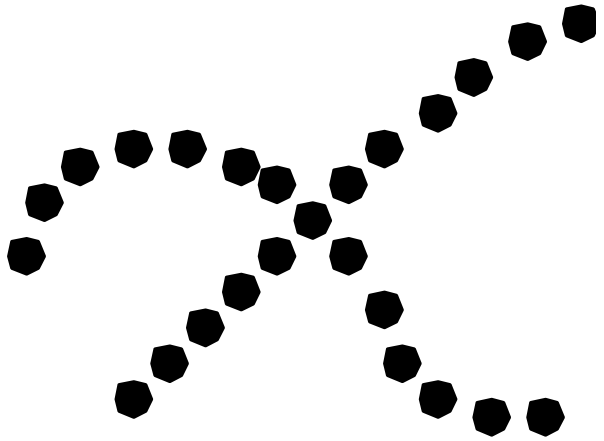
- Closure
  - Human prefer to see regular shapes, inferring occlusion to do so



Missing parts of the figure are filled in to complete it, so that it appear as a whole circle

Gestalt Laws of Perception: **Continuity**

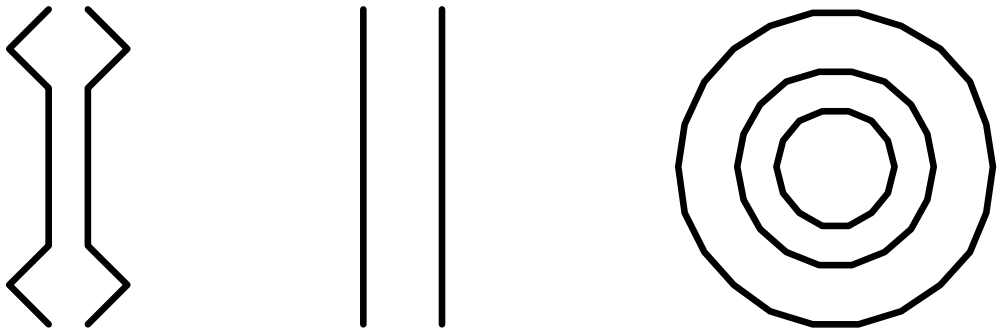
- Continuity
  - Human sees lines as being continuous



The stimulus appears to be made of two lines of dots, traversing each other, rather than a random set of dots

Gestalt Laws of Perception: **Symmetry**

- Symmetry
  - Region bounded by symmetrical borders tend to be perceived as coherent figures



Here we see some symmetric objects

The Ecological Approach

- According to this approach
  - The perception is a direct process, in which information is simply detected rather than being constructed
  - The primary concerns is understanding what we do when we perceive
  - A central concept of this approach is the notion of affordance

Affordance

- It refers to
  - What sorts of operations and manipulations can be done to a particular object

Examples

- Door – afford opening and closing
- Table clock – setting alarm on/off, adjust time
- DOS vs. Windows

Perceived Affordance

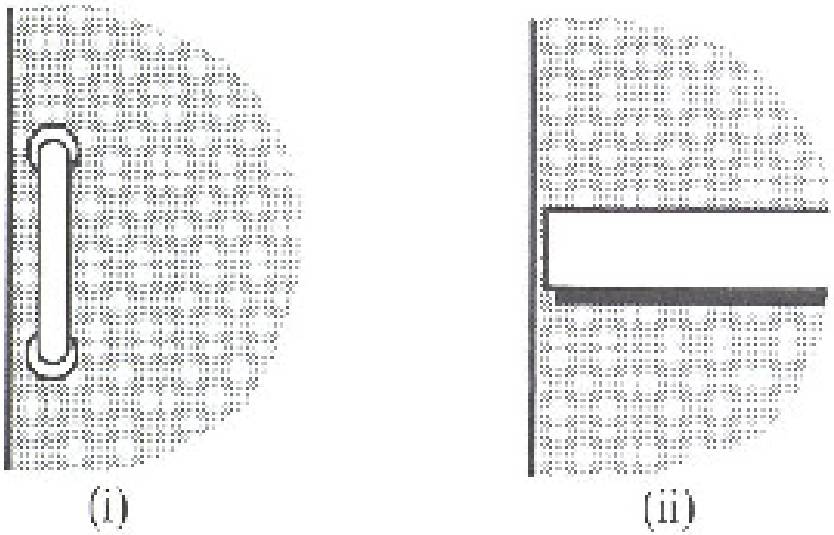
- It refers to
  - What a person thinks can be done with an object

Examples

- Door – Push + Pull
- Table clock – Alarm + Adjust
- Windows – Menu + Icon etc.

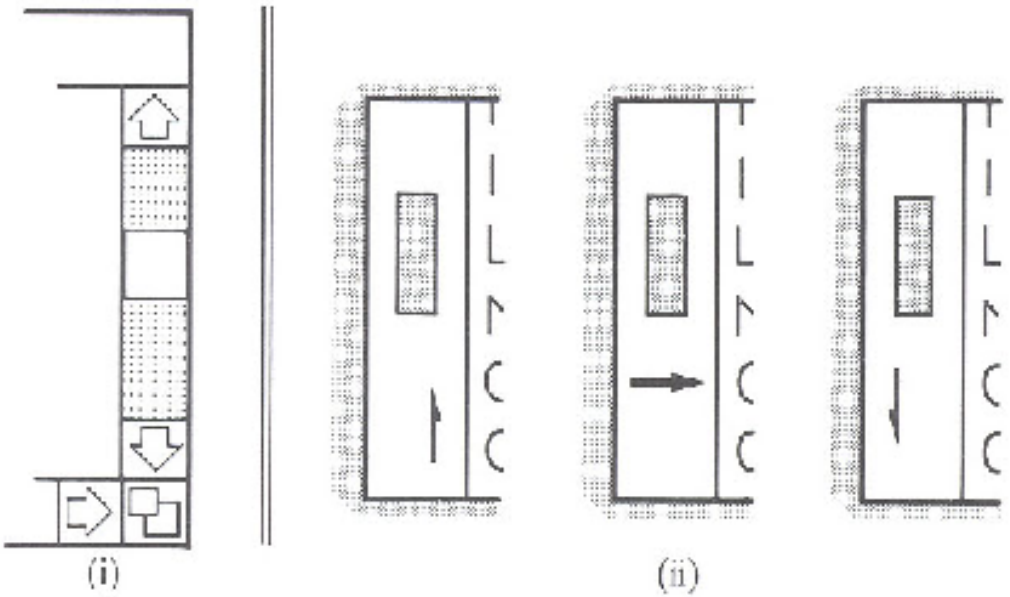
Perceived Affordance: Examples

- Door



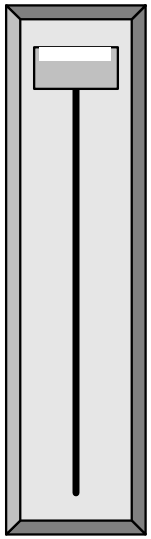
Perceived Affordance: Examples

- Scroll



Perceived Affordance: Examples

- Do these icons suggest how you use them?



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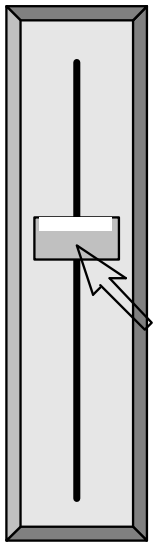
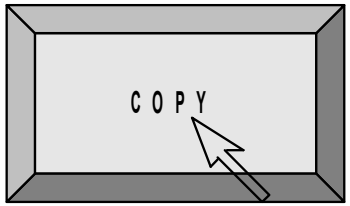
Perceived Affordance: Examples

- Slider and button icons with more obvious clues





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Visibility and Affordance

- If the perceived affordance is clear then it is easy to know how to interact with
- Or in other words, when the perceive affordances are less obvious or ambiguous, it usually make mistakes or errors when trying to interact with the object

The Ecological Approach

- The ecological approach has been influential in developing theoretical accounts of interface design
- A knowledge of affordance can be very beneficial when designing direct manipulation interfaces
- In particular, making affordance of interface objects perceptible can help to make system easy to use

Recommended Materials

- My Home page

  http://facweb.iitkgp.ernet.in/~dsamanta

  (For the presentation slides of the current lecture

- Book

  Human-Computer Interaction by Jenny Preece and et al. Addison-Wesley, New York

  Chapter 4