PERCEPTION

- **Sensation**
  Raw information from environment
- **Perception**
  Interpretation of sensation by the brain

Perception

1. Attention
2. Localization
3. Recognition
4. Abstraction
5. Perceptual Constancies

Attention

Attention

Selective Attention

Physically reorienting our sensory receptors to object of interest.

Attention

Visual Attention

Moving our eyes until the object of interest falls on the 'fovea'

Visual Attention

Eye Movements

- Observing an observer looking at a picture.
- Fixate (300 msec) – Saccade (20 msec)
- During fixation , visual information is acquired from the environment.
- During saccade, visual information is suppressed
- Person's fixation pattern = sequencing of visual attention

Visual Attention

Eye Movements

- The points on which the eyes fixate are not random, but are the area of picture that contain the most information
- Face = eyes, nose, mouth

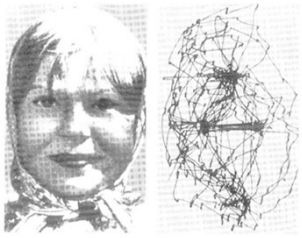


Figure 5-2
Eye Movements in Viewing a Picture
Next to the picture of the girl is a record of the eye movements made by an individual inspecting the picture. (D. L. Yarbuss (1967) "Eye Movements and Vision," Plenum Publishing Corporation. Reproduced by permission of the publisher)

Eye fixations will be direct earlier and more frequently on the unusual object than the normal object (Pashler, 2001)

Weapon Focus

Victims of armed crime can accurately describe <u>what the weapon looks like</u> but seem to know little about other aspects in the scene such as the person who use the weapon (Pashler, 2001).

- **Attention is multimodal**
- **It can move <u>within</u> a modality (i.e. visual to visual) or <u>between</u> the modalities (i.e. visual to auditory)**

Selective Attention

Cocktail party phenomena

The sounds of many voices bombard our ears. However, we can use purely mental means to <u>selectively attend</u> to the desired message and ignore others.

Attention, Perception, & Memory

- **Unattended message**
  the message that we are consciously unaware of, and remember only little.
- **Shadowing Procedure - to study Auditory domain = Repeat (shadow) back one auditory message**

Shadowing = repeat message from the LEFT ear

Unshadowed message

Auditory (Moray, 1969)
- **Can tell only Characteristics of Sound (high/low, male-female)**
- **no content**
- **Not notice language change (Eg., English / French)**

Visual (Loftus, 1972)
Memory for attended picture, not for unattended one

Attention, Perception, & Memory

- **Unattended message**
  we are consciously unaware of, and remember only little.
- **Our perceptual system processes some extent of unattended stimuli even though those stimuli rarely reach consciousness.**

We are likely to hear the sound of <u>our own name</u> in the cocktail party

Localization

Localization

- Separation of objects
  - Figure & Ground
  - Grouping of Object
- Perceiving Distance
- Perceiving Motion

Separation of Objects

Gestalt Psychology

- **emphasizing the importance of perceiving *whole objects or forms***
- **proposed principles to explain how we organize WHOLE objects**
  - ***Figure & Ground***
  - ***Grouping of Objects***

Figure & Ground
Seeing objects against the ground

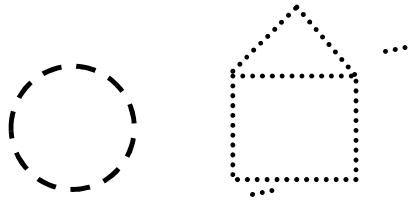
- **We classify most of what we see as either *object* (figure) or *background* (ground).**
- **What we pay attention to is "figure", the remaining is "background".**
- **The organization into "figure" and "ground" is in your mind, not in the stimulus.**
- **You "know" that both are possible, but you cannot "see" both at the same time.**

Grouping of Objects

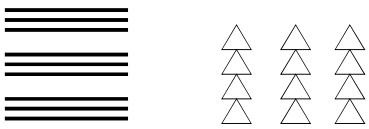
We see objects in a particular grouping

- **Closure**
- **Proximity**
- **Similarity**
- **Continuation**

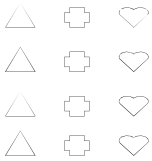
1. Closure



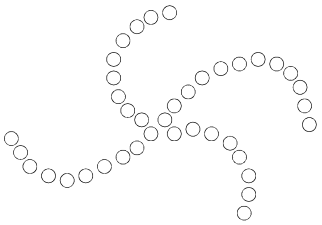
2. Proximity



3. Similarity



4. Continuity



Perceiving Distance

- To know where the object is, we must know its distance or depth
- Our retinal image contains only 2-dimensional information, width and height.
- The depth cue is perceived by "binocular disparity" to produce 3-D image like in the real world

Binocular Disparity

- Vertebrates have one eye on each side to see in almost every direction without moving their heads
- Unlike vertebrates, most **mammals** have 2 eyes on the front of the head
- This cuts down the field of view, but is insures that most of what is seen is seen through both eyes and can create **depth perception**

Binocular Disparity

- Each eye sees things from a slightly different perspective = there is a difference in the two retinal images = **Binocular Disparity**
- The eyes converge (turn slightly inward) to adjust the 2D image of retina to 3D perception of the brain
- **Binocular Disparity is greater for closer things**
- Binocular disparity helps the brain create a 3D perception from 2D retinal image = **Depth perception**

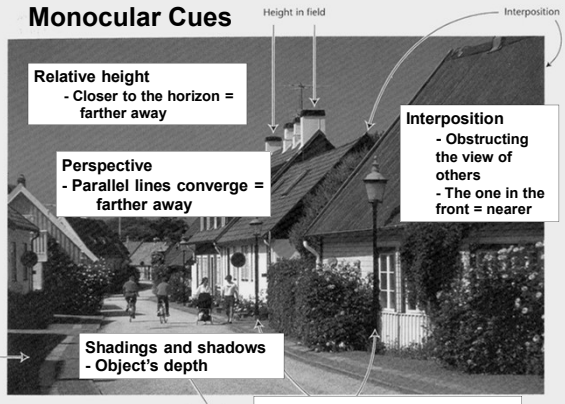
Binocular Disparity

The demonstration of binocular disparity and convergence is the first of the demonstrations that punctuate this chapter. If you compare the views from each eye (by quickly closing one eye and then the other) of objects at various distances in front of you—for example, your finger held at different distances—you will notice that the disparity between the two views is greater for closer objects. Now try the mysterious demonstration of the cocktail sausage. Face the farthest wall (or some other distant object) and bring the tips of your two pointing fingers together at arm's length in front of you—with the backs of your fingers away from you, unless you prefer sausages with fingernails. Now, with both eyes open, look through the notch between your touching fingertips, but focus on the wall. Do you see the cocktail sausage between your fingertips? Where did it come from? To prove to yourself that the sausage is a product of binocularity, make it disappear by shutting one eye. Warning: Do not eat this sausage.

Monocular Cues

- Binocular cues are limited to objects that are relatively close.
- Monocular cues are used for the objects that are far away (i.e. distant clouds, mountains, etc.) for the "depth perception"

Monocular Cues



1. **Relative size**
   - smaller = far away
2. **Interposition**
   - Obstructing the view of others
   - The one in the front = nearer
3. **Relative height**
   - Closer to the horizon = farther away
4. **Perspective**
   - Parallel lines converge = farther away
5. **Shadings and shadows**
   - Object's depth
6. **Relative motion (different speed)**
   - Move quickly = nearby objects move quickly toward us
   - Move slowly = distant object

Perceiving Motion

To know the trajectories (directions) of moving objects

- <u>Stroboscopic Motion</u>

Flashing the light in the darkness and then, <u>a few milliseconds</u> later, flashing another light near the location of the first light = moving object. (Wertheimer, 1912)

Perceiving Motion

To know the trajectories (directions) of moving objects

- **Stroboscopic Motion**

  Movie = a series of still photograph

  Ex. = .5 sec

Perceiving Motion

- **Real Motion (Relative > Absolute)**

  - **Relative Motion - See an object against a structured background**

  - **Absolute Motion – The background is a uniform color and only the object is seen**

Perceiving Motion

Selective Adaptation = A loss in sensitivity to motions that occurs when we view motion (but not to motion that differ significantly in direction or speed).

Ex. - A man in a moving car.

- Looking at water fall, then looking at the cliff beside it. The cliff appears to move upward because of this perceptual aftereffect

Lo

Recognition

Recognition

Determining <u>what</u> an object is.

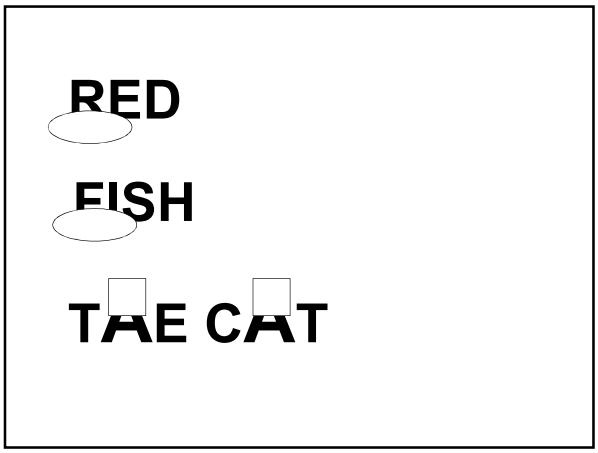
- Top-down processes

Determine by person's knowledge, experience, attention, expectation

- Bottom-up processes

Determine by sensory data, raw information

Air ticket Code = fgzd85at



Bottom-up

Stimulus ----------> BRAIN -------> Perception

Air ticket Code = fgzd85at

Top-down Processing

Experience
Knowledge ----------> Perception
Expectation
(BRAIN)

Abstraction

Abstraction

The process of reducing the vast amount of information from the physical world to a more manageable set of categories.

Abstraction

- **We don't need to get ALL information.**
- **We need to know only enough to carry out whatever task is requiring you to perceive the object to begin with.**
- **When we see a person, typically, we need only some details to**
  - **1). Recognize the face**
  - **2). Face expression – what kind of mood**

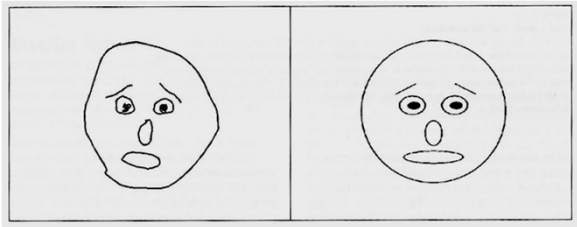


Figure 5-22
The Process of Abstraction
Two versions of the same sad face. The one on the left was drawn freehand, and the one on the right was drawn with "abstracting" tools such as ovals and lines. The left face takes up considerably more disk space than the right, which illustrates one of the virtues of abstracting for any visual-processing device, including biological visual systems.

- **Free hand version = 30,720 bytes**
- **Abstract version (Ovals + lines) = 902 bytes (97% less)**

Lo

Perceptual Constancy

Perceptual Constancy

- **Color & Brightness Constancy**
- **Illusions**

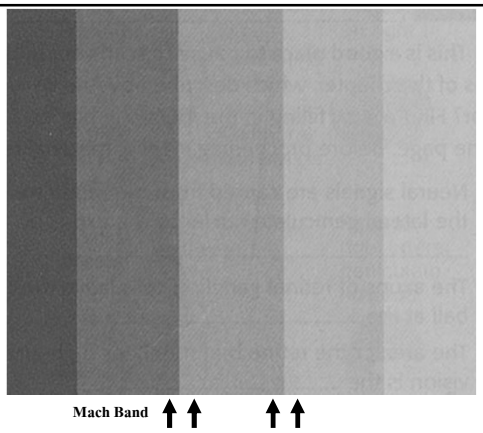
COLOR CONSTANCY

Retinex Theory (Land, 1977)

The color of an object is determined by the light reflectance from the object and from surface surrounding them

Illusions

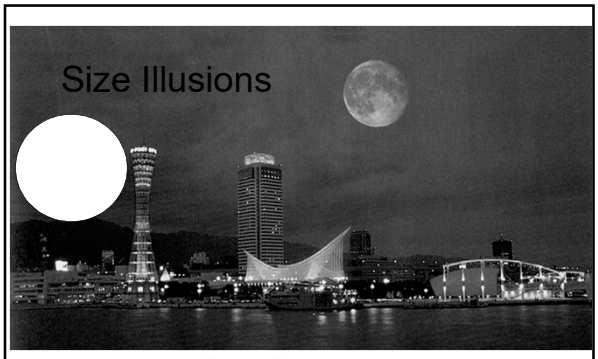
- **A perception of something that differs systematically from physical reality.**
- **The attempts of visual system to maintain constancy**



Contrast: Edge Perception

- **Edges are the most important stimuli in visual world**
- **Edges define the position and extent of things**
- **Edge perception is the perception of a contrast between 2 adjacent areas of the visual fields = Brightness Contrast**
- **Contrast Enhancement** *(What we see is better than the physical reality)*
- **Mach Band Illusion is the result of Contrast Enhancement**
- **Mach Band = Light area will look lighter / dark area will look darker**

Size Illusions



The moon looks much larger when it is near the horizon than when it is high in the sky, even though in both locations its retinal image is the same size.

Figure 5-28
The Ames Room
A view of how the Ames room looks to an observer viewing it through the peephole. The sizes of the boy and the girl depend on which one is in the left-hand corner of the room and which one is in the right-hand corner. The room is designed to wreak havoc with our perceptions. Because of the perceived shape of the room, the relative sizes of the boy and the girl seem impossibly different.

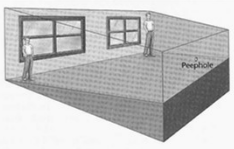


Figure 5-29
The True Shape of the Ames Room
This figure shows the true shape of the Ames room. The boy on the left is actually almost twice as far away as the boy on the right. However, this difference in distance is not detected when the room is viewed through the peephole. (After Goldstein, 1984)