PERCEIVING SCENES

Visual Perception
Occlusion

- Face it in everyday life
- We can do a pretty good job in the face of occlusion
- Need to complete parts of the objects we cannot see
Visual Completion

- Perceive *partly occluded* surface as *complete*
Visual Completion

- Multiple possible perception
- Only one is dominant
- How might it happen?
  - Figural familiarity
  - Figural similarity
  - Ecological Constraint
complete occluded figures according to most frequently encountered shape that is compatible with the visible part
Cannot Explain

- We can complete novel shapes
- Theory still holds
Figural Simplicity

- Complete as the “simplest” figures
- What is simple?
  - Is simplicity number of sides or number of axes of symmetry?
Ecological Constraints

Based on ecological evidence of occluded contours
  - E.g. T- Junction
Relatibility Theory

- Edge discontinuities are necessary
- Relatable Discontinuities
  - Intersect at 90 degree
  - Smoothly Connected
Relatibility Theory

- Edge discontinuities are necessary
- Relatable Discontinuities
  - Intersect at 90 degree
  - Smoothly Connected
- Form a enclosed Area
- Infer position in depth
Let us take an example

- Can you almost perceive depth?
Illusory Contours

- Come with Visual Completion
- Enclosed space is important
Alternative Perception
Alternative Perception
Perceived Translucency

- Perceived as being viewed through a closer translucent object
Translucency

must satisfy two conditions

1. spatial condition
   (i) immersed in single region (B)
   (ii) unity destroyed (C)
   (iii) unity weakened (D)

2. color condition (E)
Multistability

- More than one perception
- Spontaneously alternate between more than one perception
- Necker Cube
Network Model

Assumption: different patterns of neural activity → different interpretations
Why only one interpretation at a time?

- Cooperation
  - mutual excitatory links
  - connecting same subnetwork
- Competition
  - mutual inhibitory links
  - connecting different subnetwork

Assumption: different patterns of neural activity $\rightarrow$ different interpretations
Why does alteration happen?

- Neural Fatigue Theory

Assumption: Neurons are getting tired

- Due to depletion of biochemical resources needed to fire
- cause alternating interpretation when combined with mutual inhibition
Why does alteration happen?

- Neural Fatigue Theory
- Not the only one
  - Role of eye fixation or instructions
Perceivable Properties

- Shape
- Orientation
- Size
- Position
Shape Constancy

- Perceive objects to be of same shape despite being viewed from different viewpoints

Figure: Doors at different slant look the same as door in the frontal plane.
Size and Shape is related

Depth information

- Accurate depth information from absolute sources
  - accommodation and/or convergence
  - shape and size can be completely recovered
- Accurate relative depth from quantitative sources
  - binocular disparity, motion parallax, or many of the metric sources of perspective information
  - shape will be recoverable but not size
- Only qualitative depth information
  - edge interpretation
  - neither precise shape nor size can be unambiguously recovered
2D objects

- When objects are close enough to provide accurate depth information, shape constancy is quite good.
- Shape constancy declines as the degree of slant increases.
- Strong bias toward perceiving symmetrical shapes and familiar shapes.

**Figure:** Perspective views of a square on a wide variety of different perspectives.
3D objects

Irvin Rock and his colleagues

- Observers have surprisingly poor shape constancy
- Perception of shape is strongly influenced by the qualitative changes in the retinally projected shape
- Under distant viewing conditions, shape constancy should be worse than in near viewing conditions
3D objects

Everyday experience
- We see objects from many different perspectives and manage to recognize them reasonably well despite the variations in appearance.

Possibilities
- Continuously moving from one view to another
- Correlated with object’s identity
- Axes of symmetry or elongation
Shape Illusions

- Cicle/Ellipse
- Ponzo
- Ames Room
Orientation Constancy

- Objects don’t tilt when our heads tilt
Proprioceptive System

The primary source of information about gravitational orientation of the head

Figure 2: The Vestibular System - semicircular canals and otolith organs
Tilted Room Illusion

https://www.youtube.com/watch?v=1BMSYXK4-AI  Frames of Reference - The Tilted Room Illusion
Zollner Illusion
Zollner Illusion
How much can we adapt?

Pointing without prism

Before Adaptation
How much can we adapt?

Pointing with prism

Before Adaptation
How much can we adapt?

Pointing with prism

After Adaptation
Retinal Un-Inversion Experiment

Prism shifted the image of the visible world to the side

► Miss object by the prism’s angle of displacement
► Caused by discrepancy between visually perceived position and actual position
► Practice reaching objects reduce in motor error
► Negative aftereffect
Parts

- Perceive shape, size and orientation by parts
  - Linguistic and phenomenological evidence
    - Refer by parts: Palm, toe, shin, ankle
    - All over the world in all cultures
Which comes first? Whole or parts?
Global Precedence

- Global advantage
  - Responds faster to global letters

- Global to local interference
  - Inconsistency slows local letter identification

- Lack of local to global interference
  - Inconsistency does not slow down the global letter identification

- Processed in different halves of brain
In two different parts of brain

- Preferences: Local on left, global on right