PERCEIVING SCENES

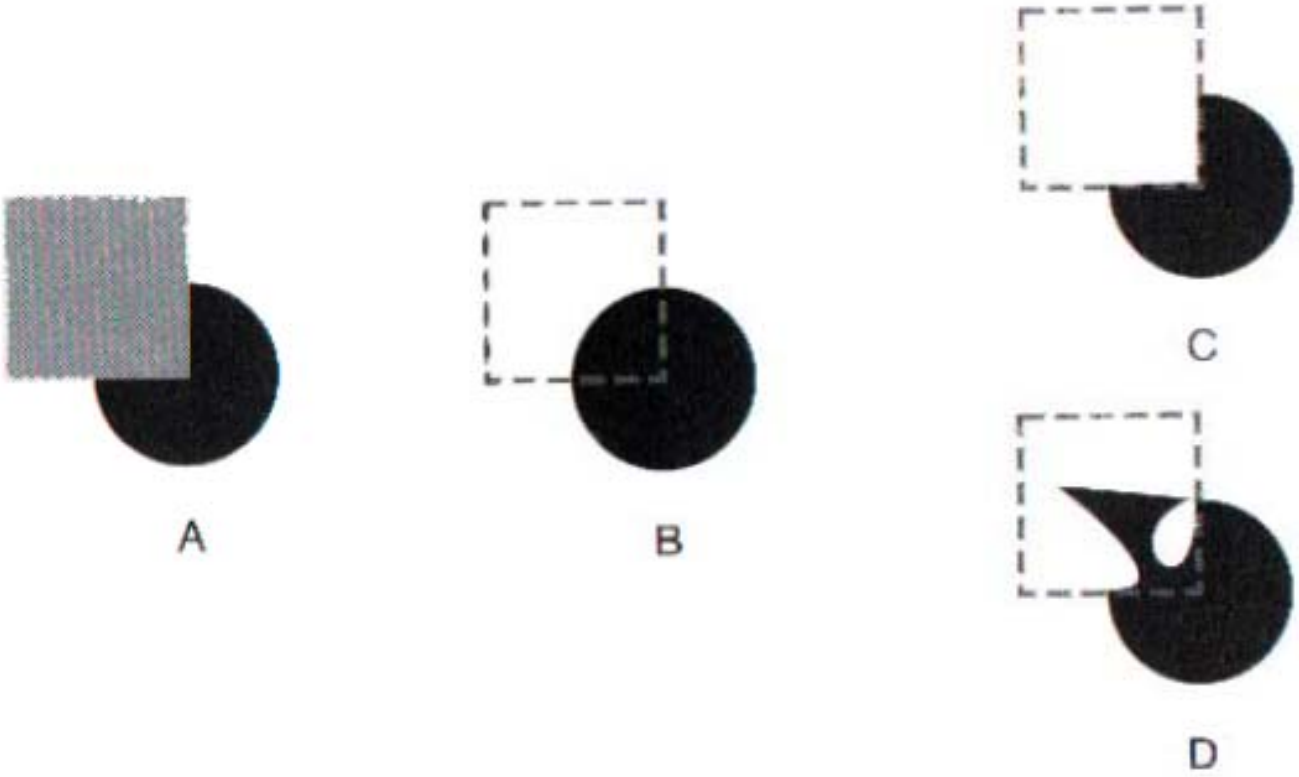
Visual Perception

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

Figural Familiarity

complete occluded figures according to most frequently encountered shape that is compatible with the visible part

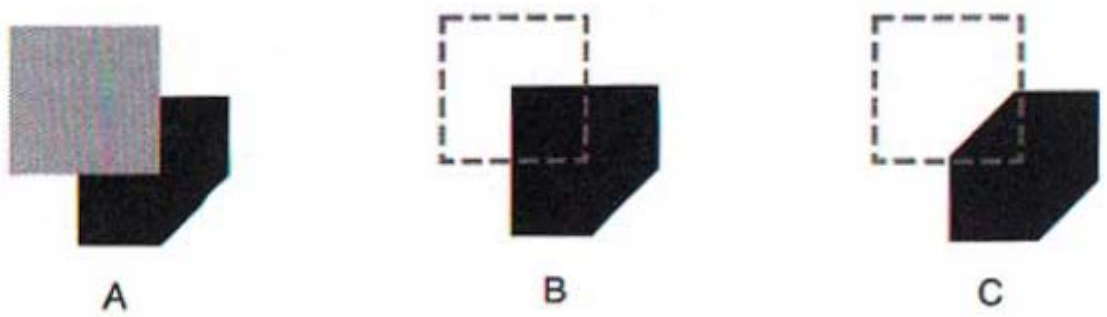
Cannot Explain

- 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?

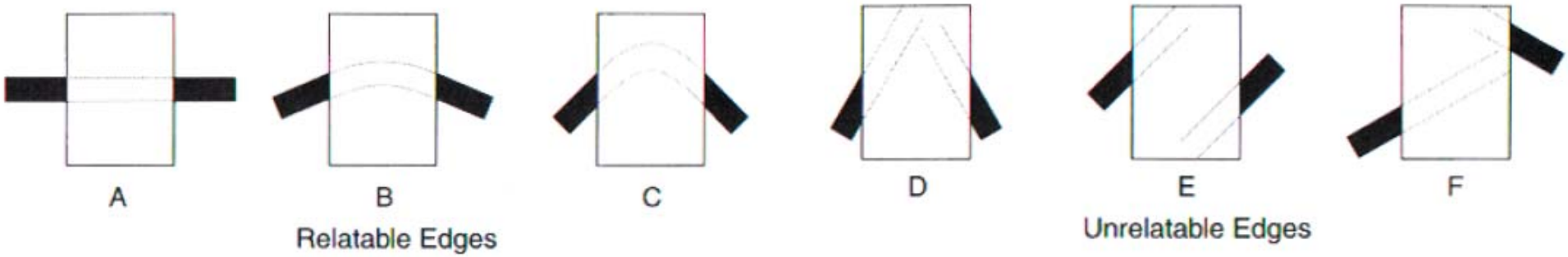


Ecological Constraints

- 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

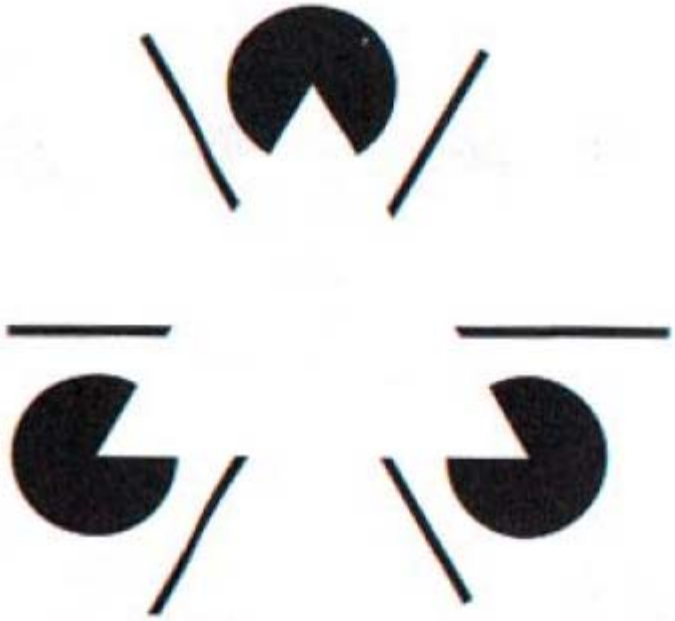


Relatibility Theory

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

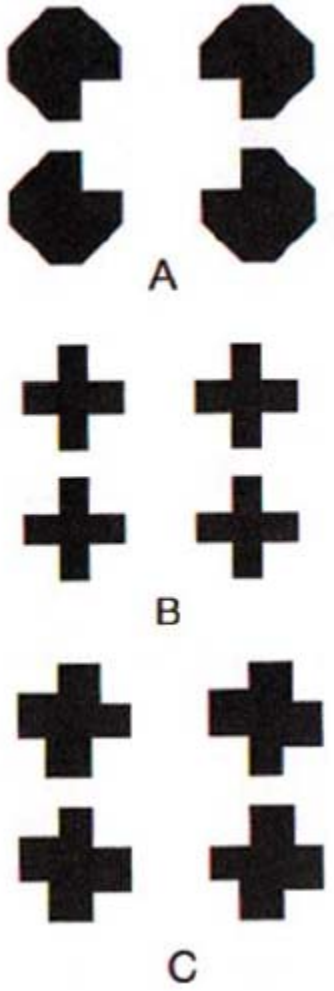
Let us take an example

- Can you almost perceive depth?

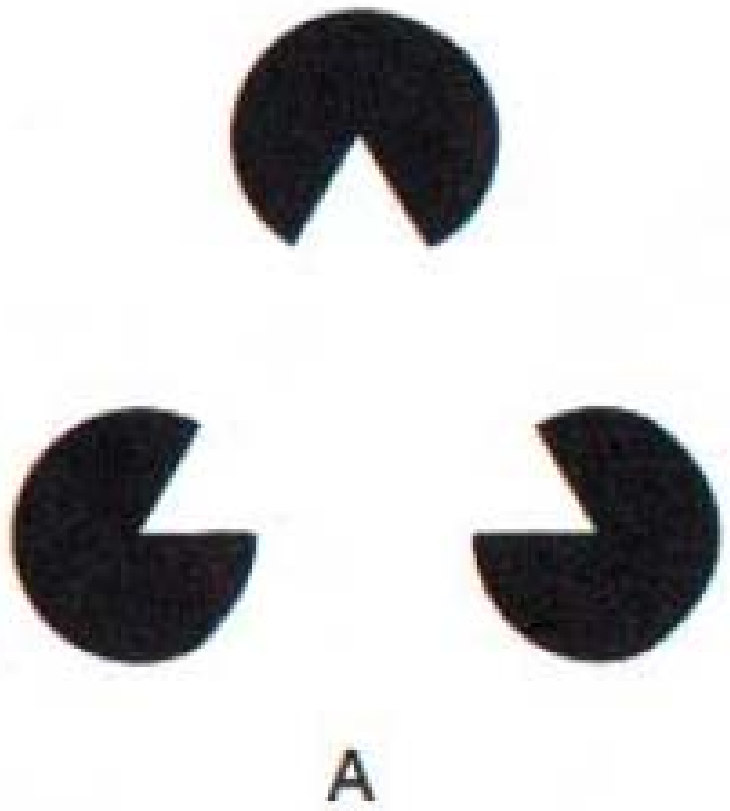


Illusory Contours

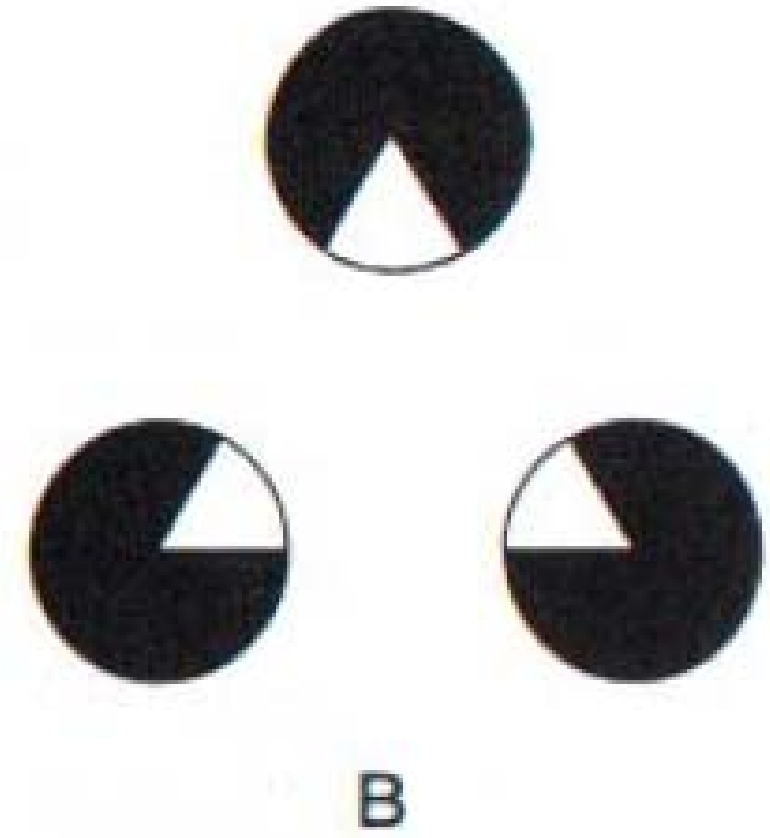
- Come with Visual Completion
- Enclosed space is important



Alternative Perception

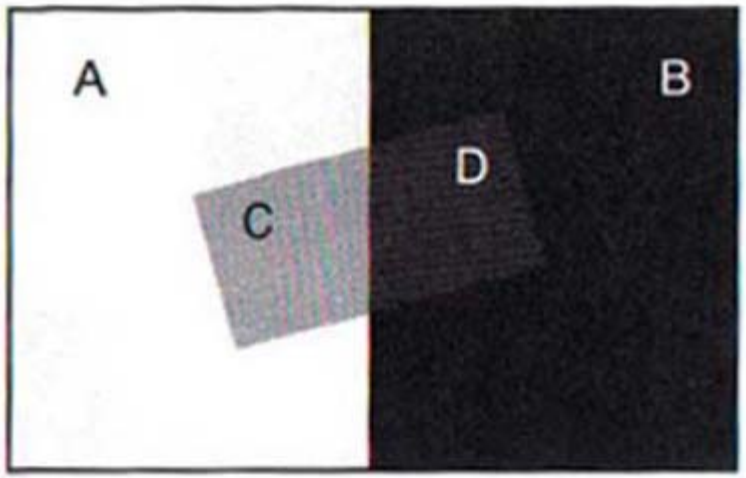


Alternative Perception



Perceived Translucency

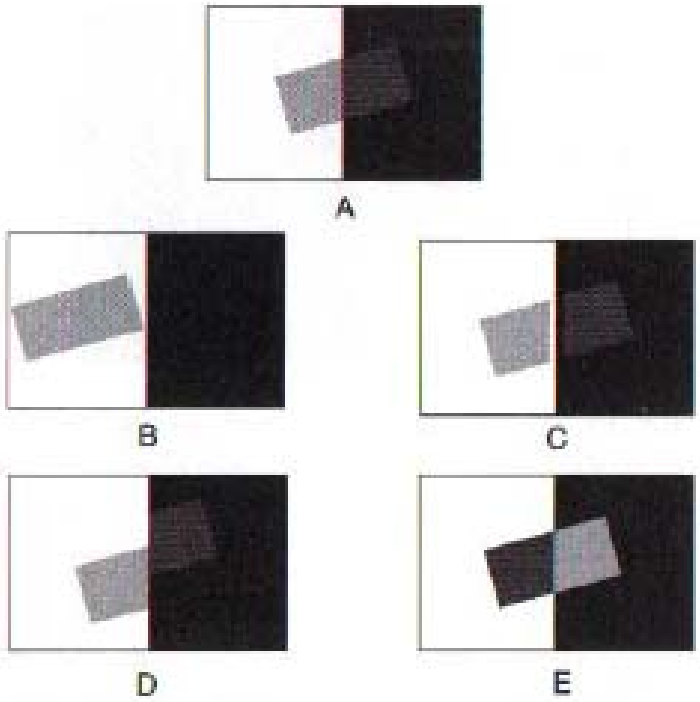
- Perceived as being viewed through a closer translucent object



Translucency

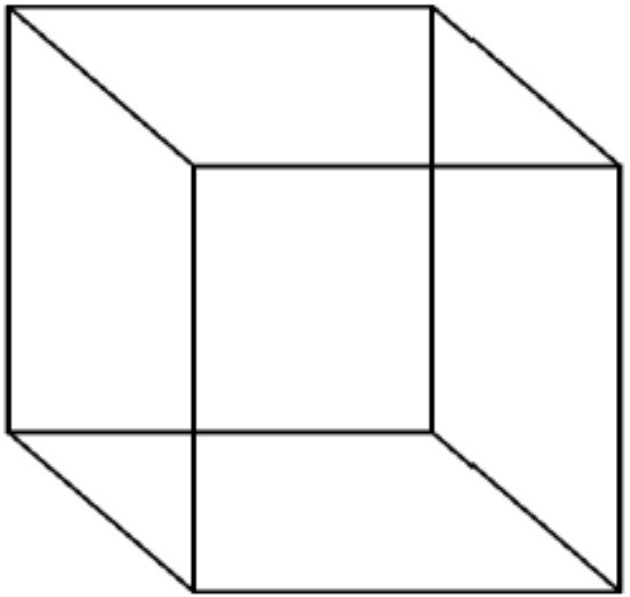
must satisfy two conditions

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

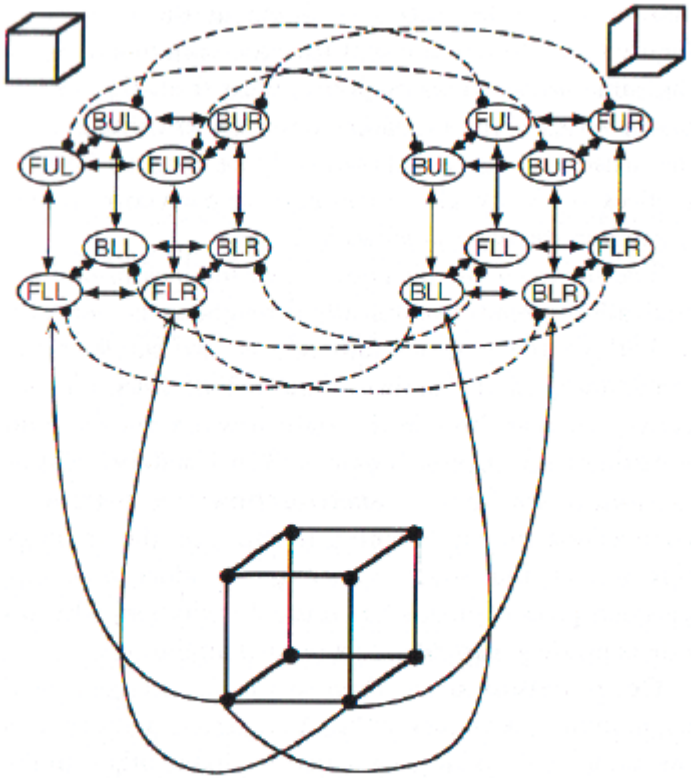


Multistability

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

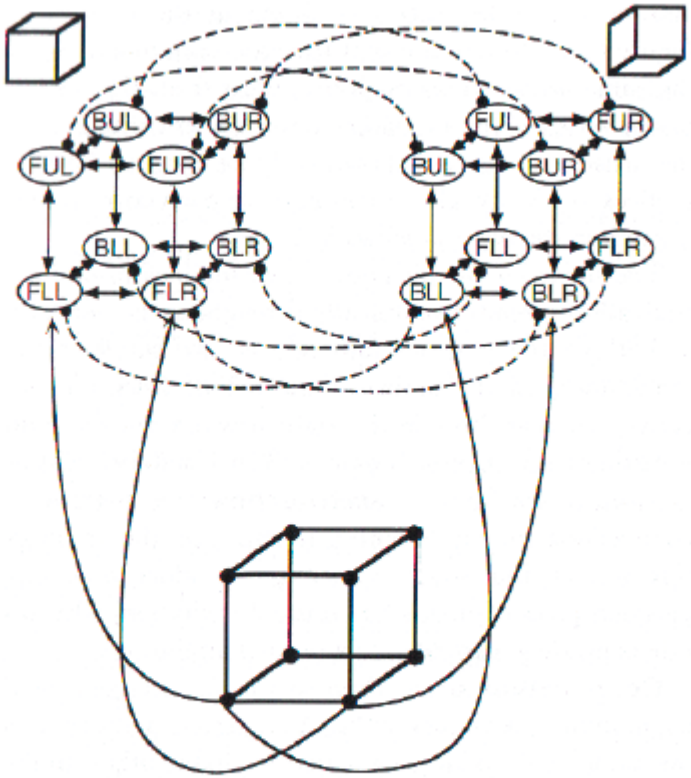


Network Model



Assumption : different patterns of neural activity $\rightarrow$ different interpretations

Why only one interpretation at a time?



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

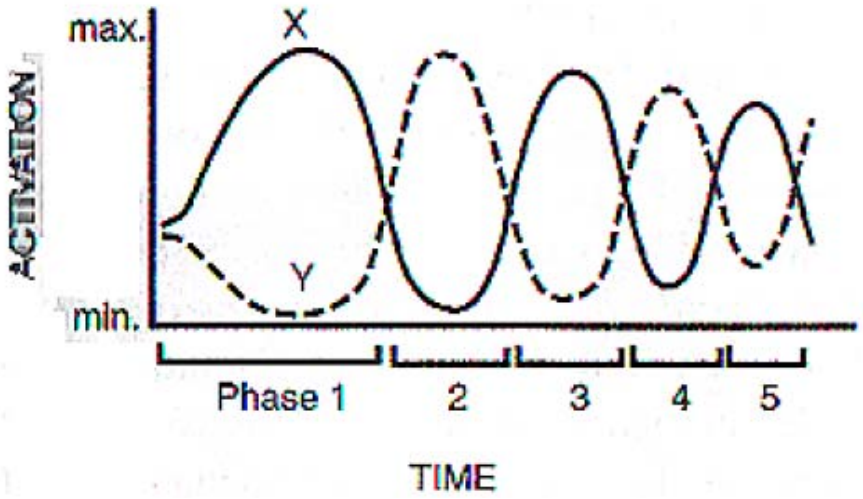
Assumption : different patterns of neural activity $\rightarrow$ different interpretations

Why does alteration happen?

- Neural Fatigue Theory

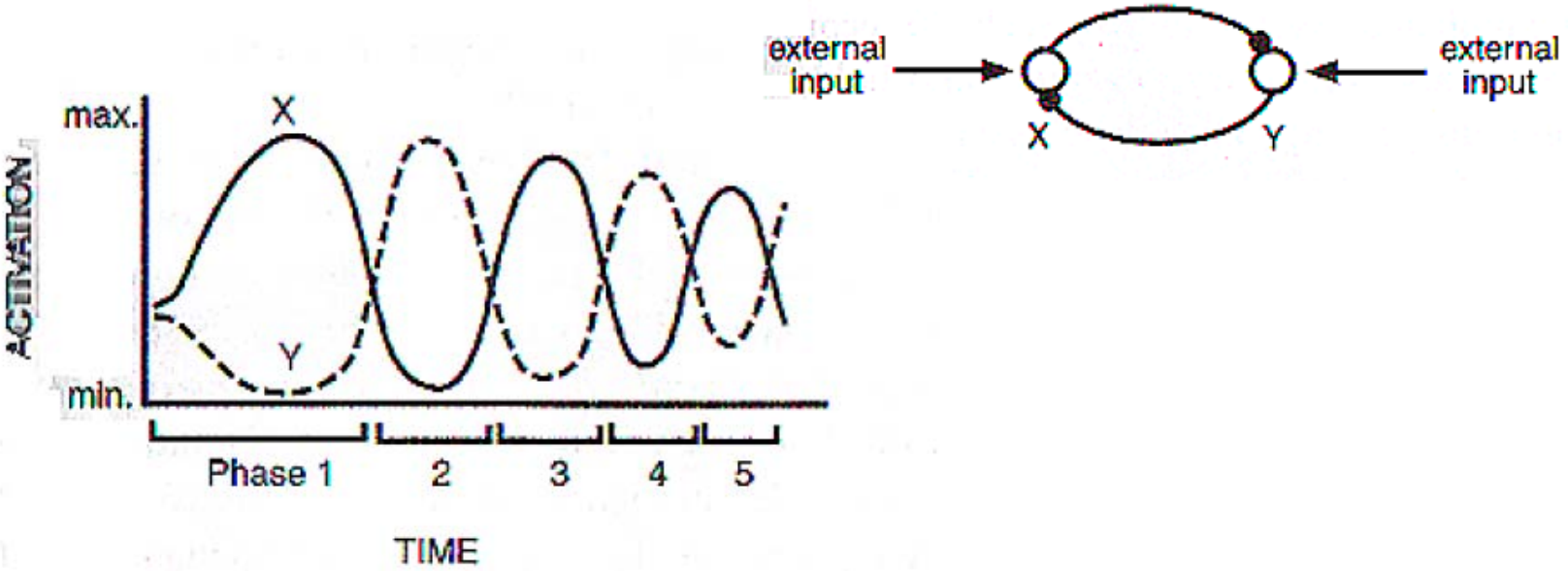
Assumption : Neurons are getting tired

- 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

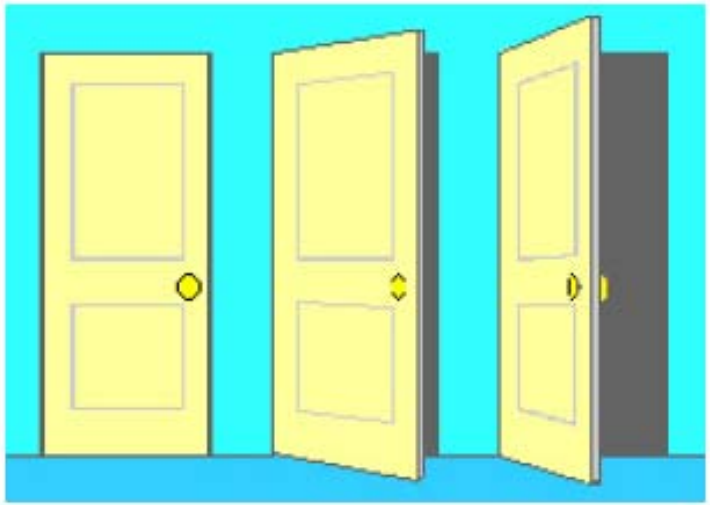


Figure: Doors at different slant look the same as door in the frontal plane.

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

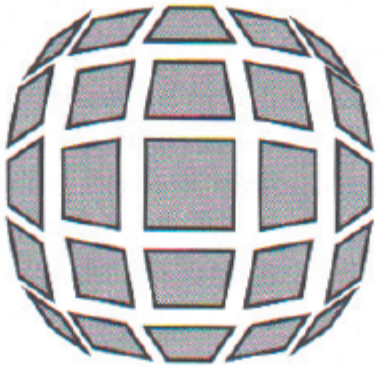


Figure: Perspective views of a square on a wide variety of different perspectives

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

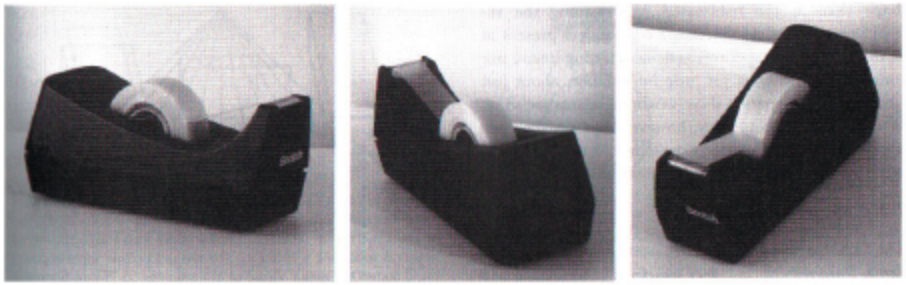
3D objects

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

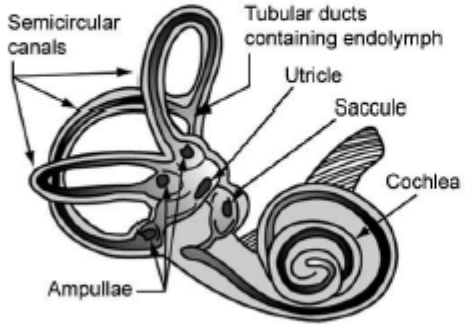
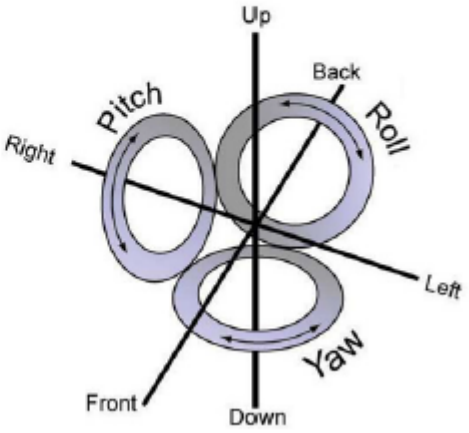
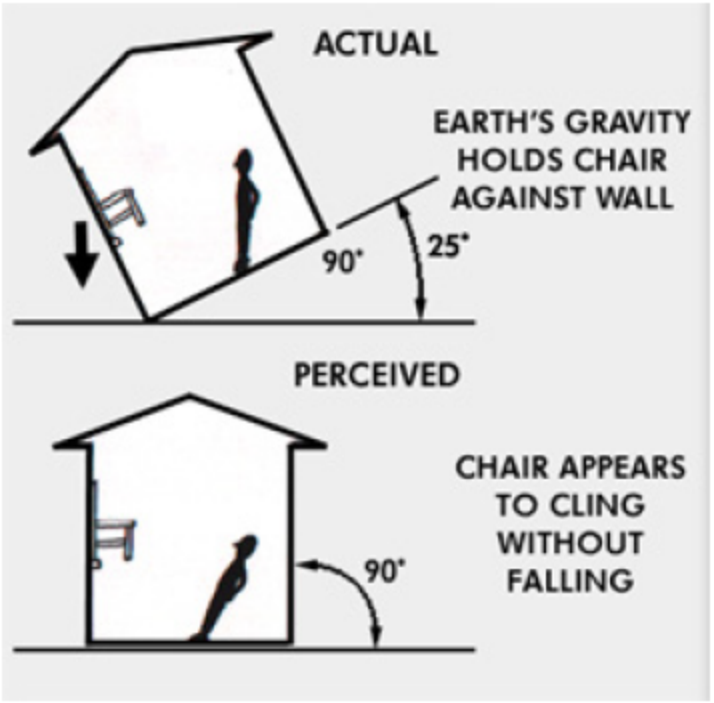


Figure 2: The Vestibular System - semicircular canals and otolith organs

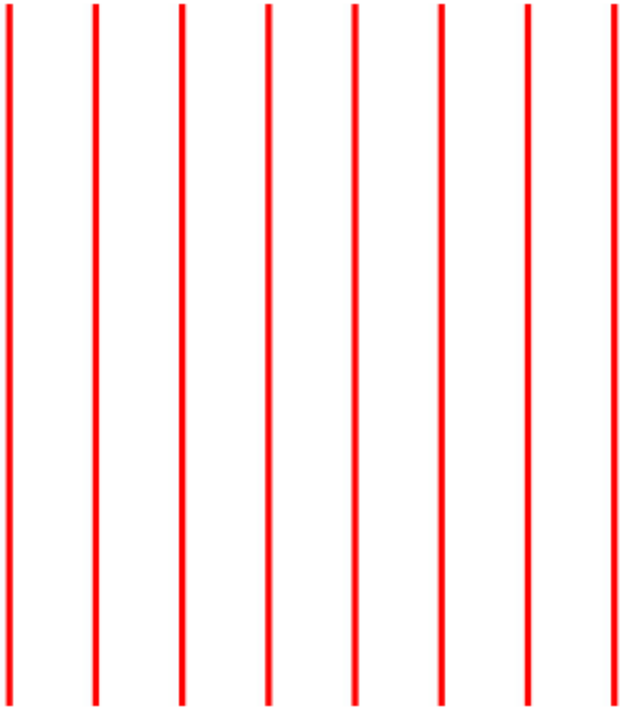


Tilted Room Illusion

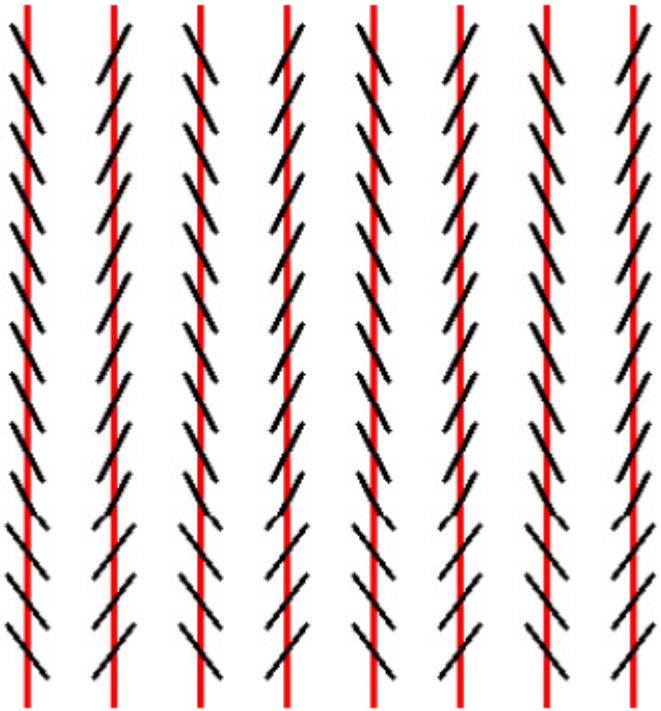
- https://www.youtube.com/watch?v=1BMSYXK4-AI



Zollner Illusion

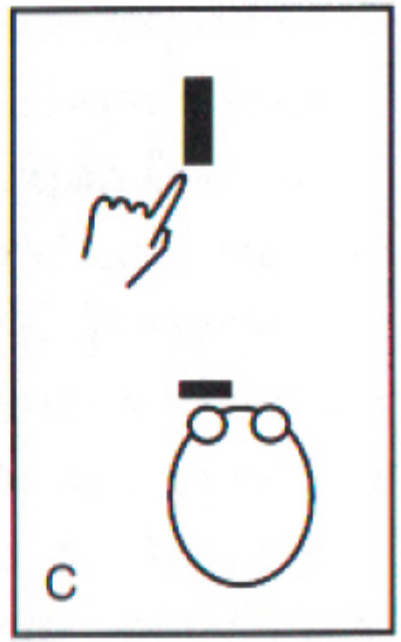


Zollner Illusion



How much can we adapt?

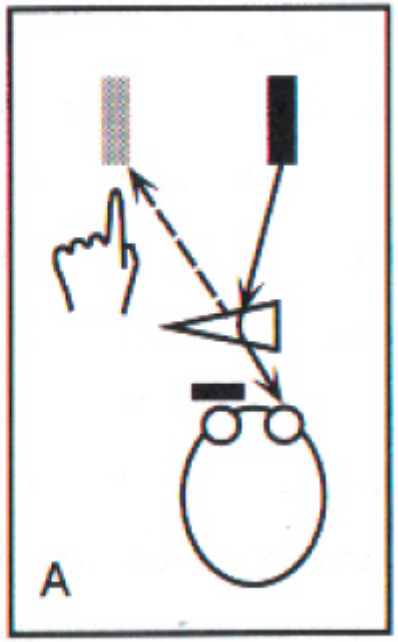
Pointing without prism



Before Adaptation

How much can we adapt?

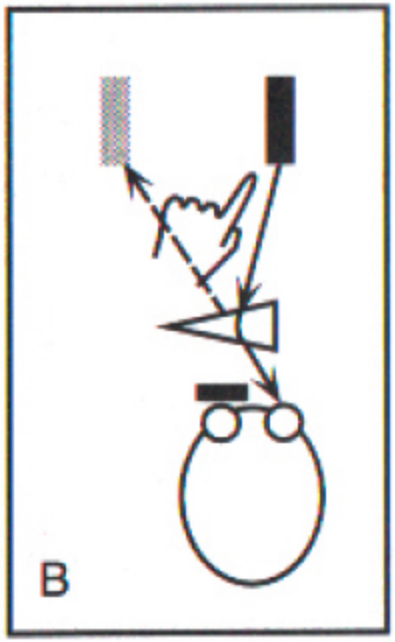
Pointing with prism



Before Adaptation

How much can we adapt?

Pointing with prism



After Adaptation

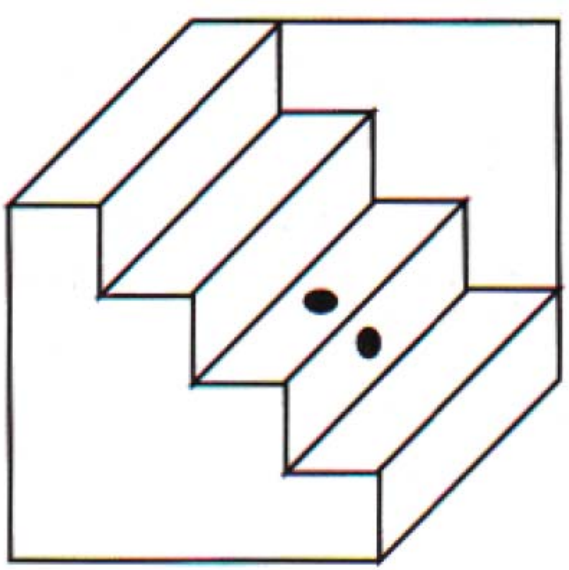
Retinal Un-Inversion Experiment

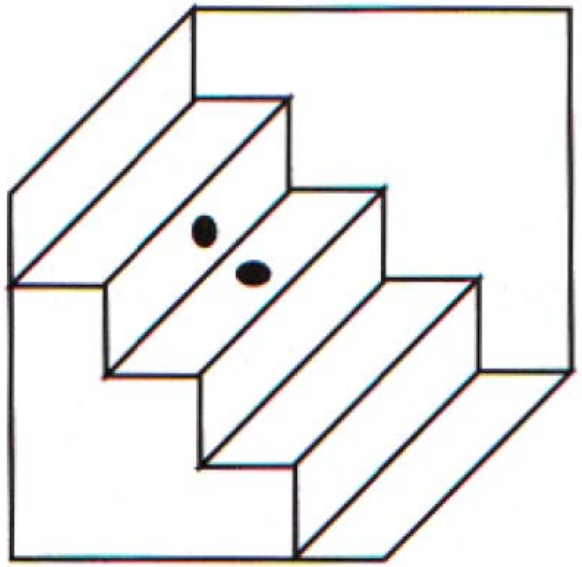
Prism shifted the image of the visible world to the side

- Miss object by the prism's angle of displacement
- Caused by discrepency between visually perceived position and actual position
- Practice reaching objects reduce in motor error
- Negative aftereffect

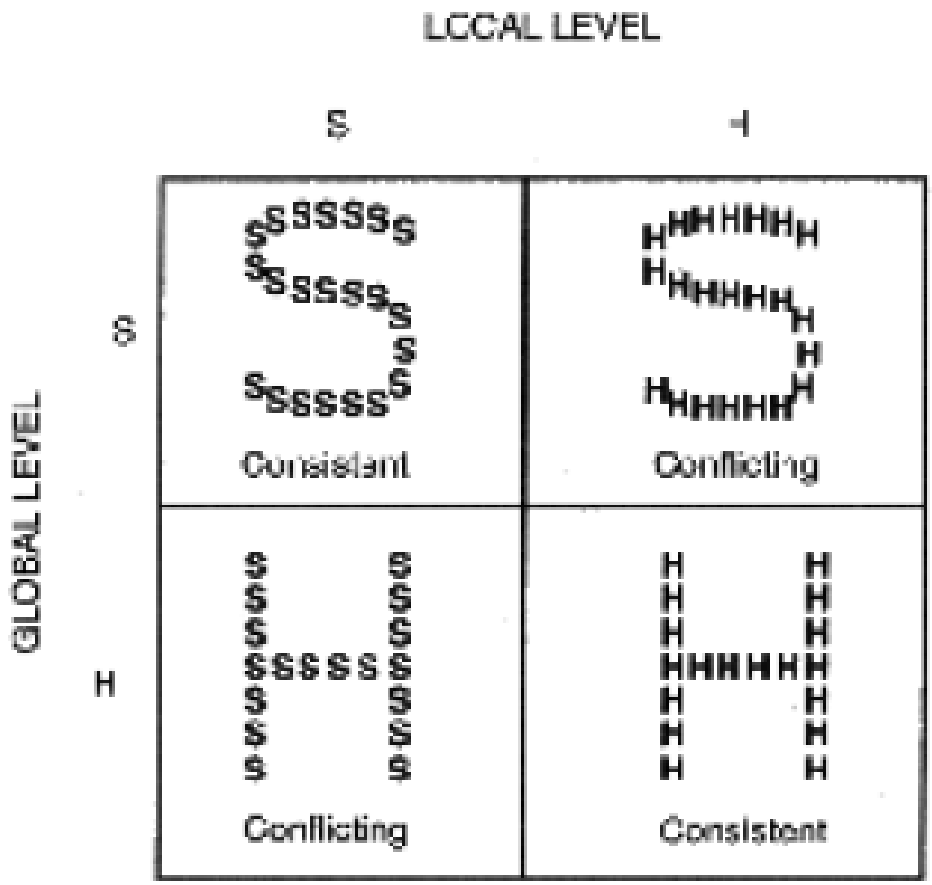
Parts

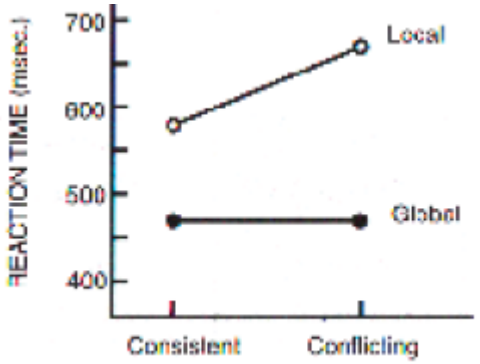
- Perceive shape, size and orientation by parts
  - Linguistic and phenomenological evidence
    - Refer by parts: Palm, toe, shin, ankle
    - All over the world in all cultures





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