Organization Objects and Scenes

Chapter 6

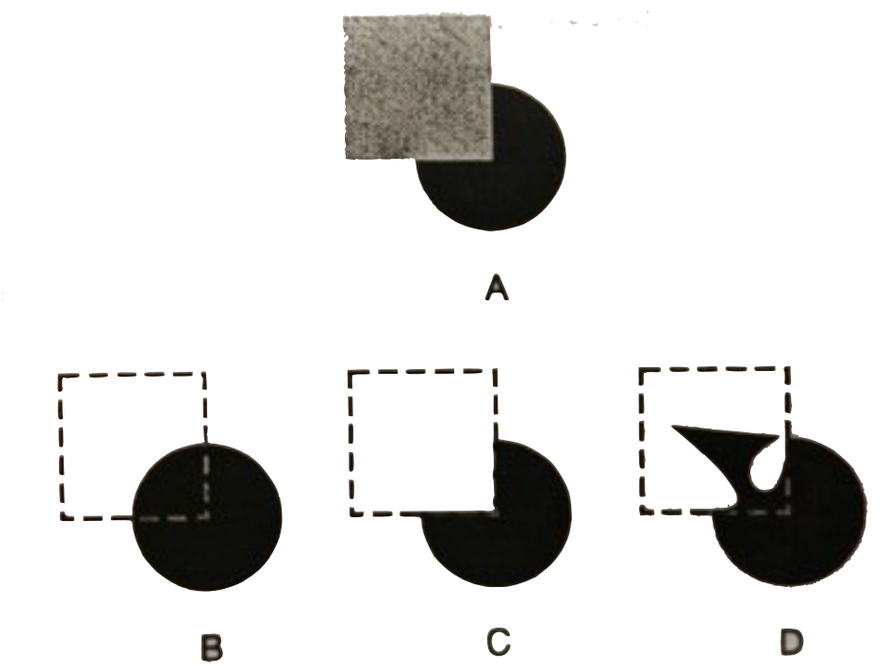
Visual Interpolation

- Infer the nature of hidden parts from visible ones.

- Different kinds of Perceptual completion
  - Parts of a surface are occluded
  - Filling-in that occurs in the blind spot

Visual Completion

- Completion
  - Amodal: local stimulation or sensory experience do not support the completed portion.
  - Visual: completed portion is supported indirectly by visible information elsewhere in the image.



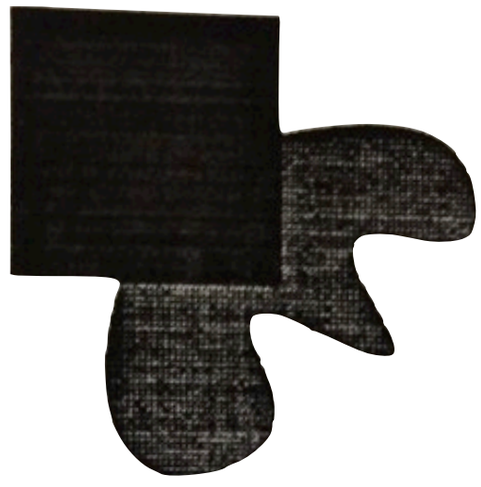
Theories

- Figural familiarity theories
- Figural simplicity theories
- Ecological constraint theories

Figural Familiarity

- Completing partly occluded figures according to the most frequently encountered shape.
- Problem:
  - We seem able to complete objects that we have never seen before.

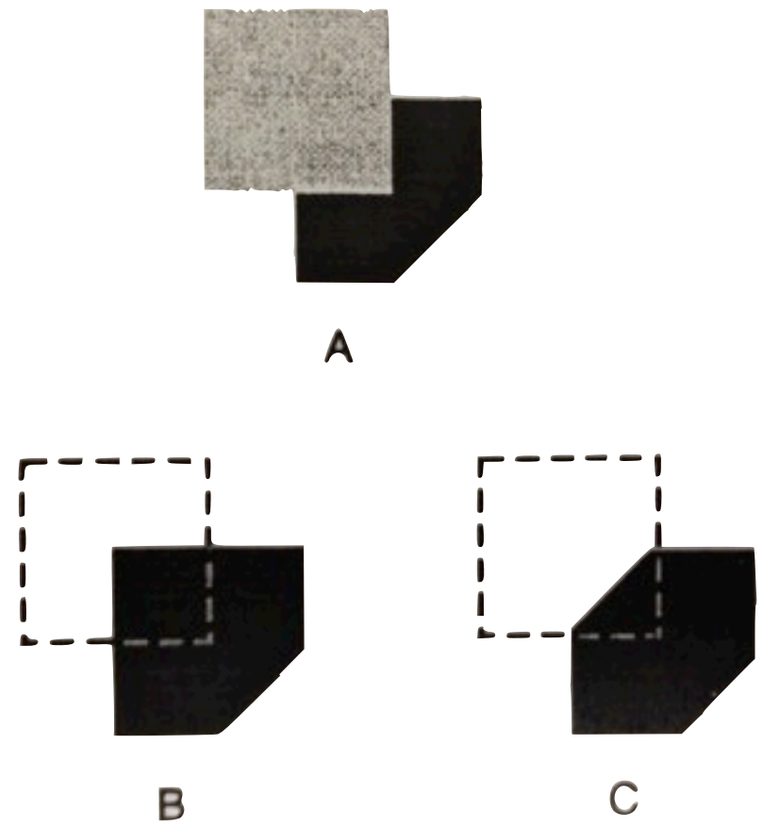
B



A

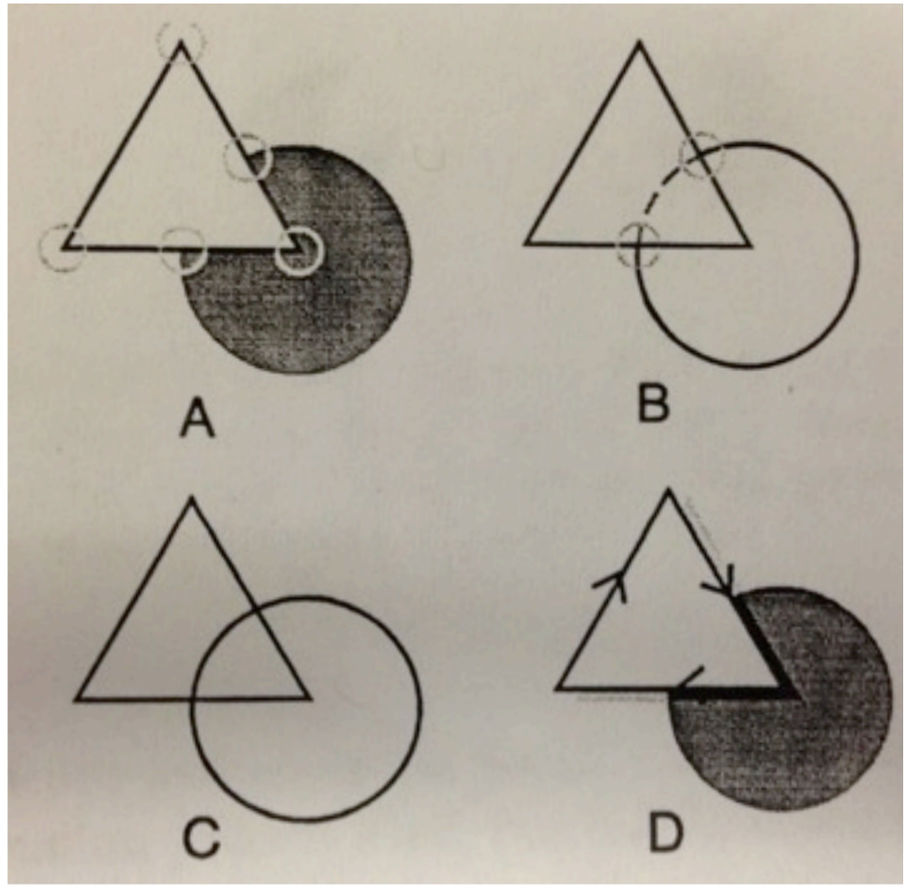
Figural Simplicity

- Figures are completed in the way that results in the simplest perceived figure.
- Gestalt psychologists (principle of pragnanz)
  - The percept will be as good as the prevailing condition allow.



Ecological Constraint

- Relatability theory
  - Edge discontinuities
  - Amodally completed contours
  - Forming a new perceptual unit
  - Assigning positions in depth



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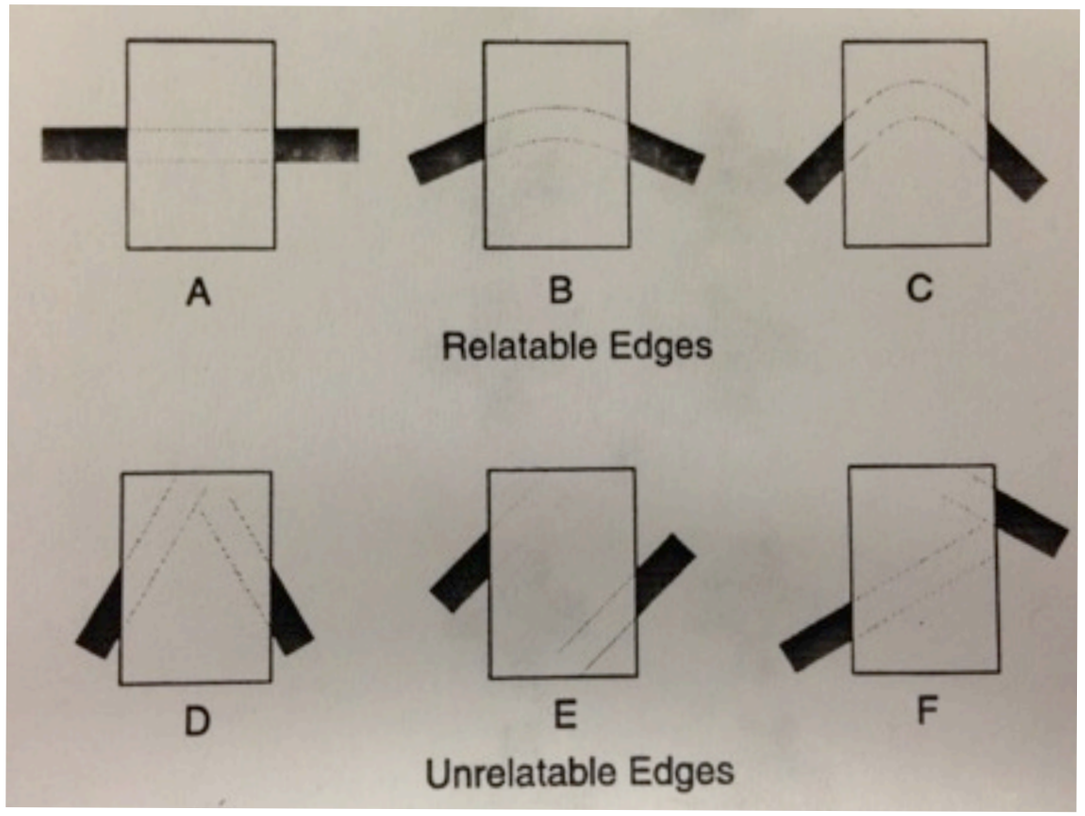
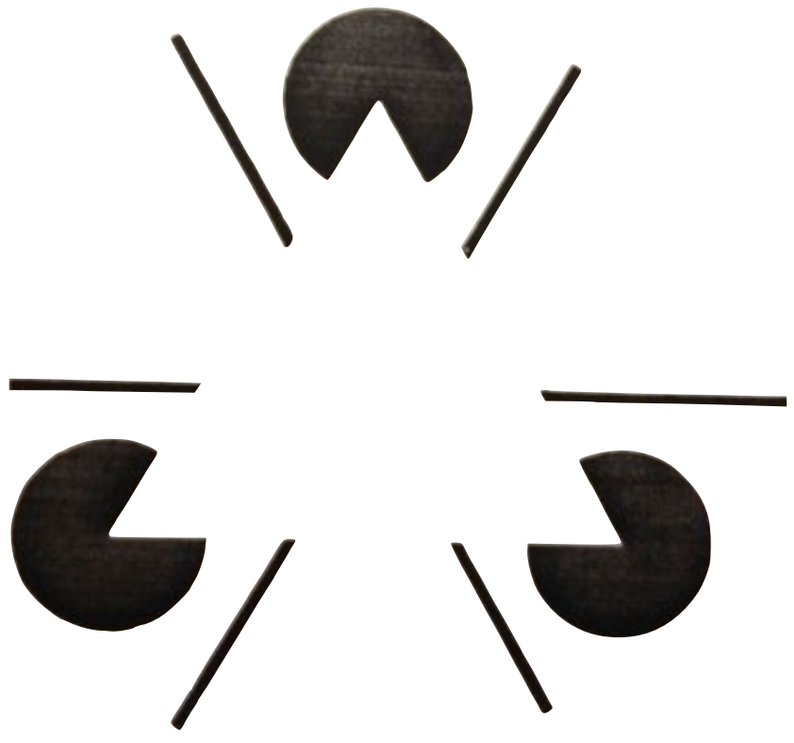


Illusory Contours

- Subjective contours
- Kanizsa triangle
- Generally accompanied by amodal completion of the inducing elements.
- Depend on the perception of occlusion.



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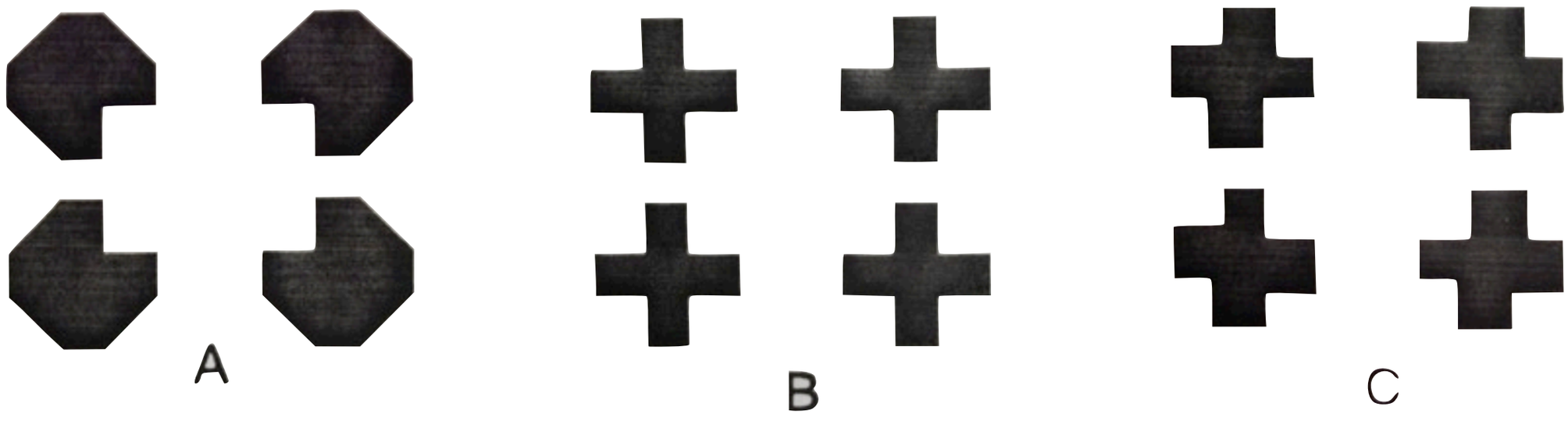

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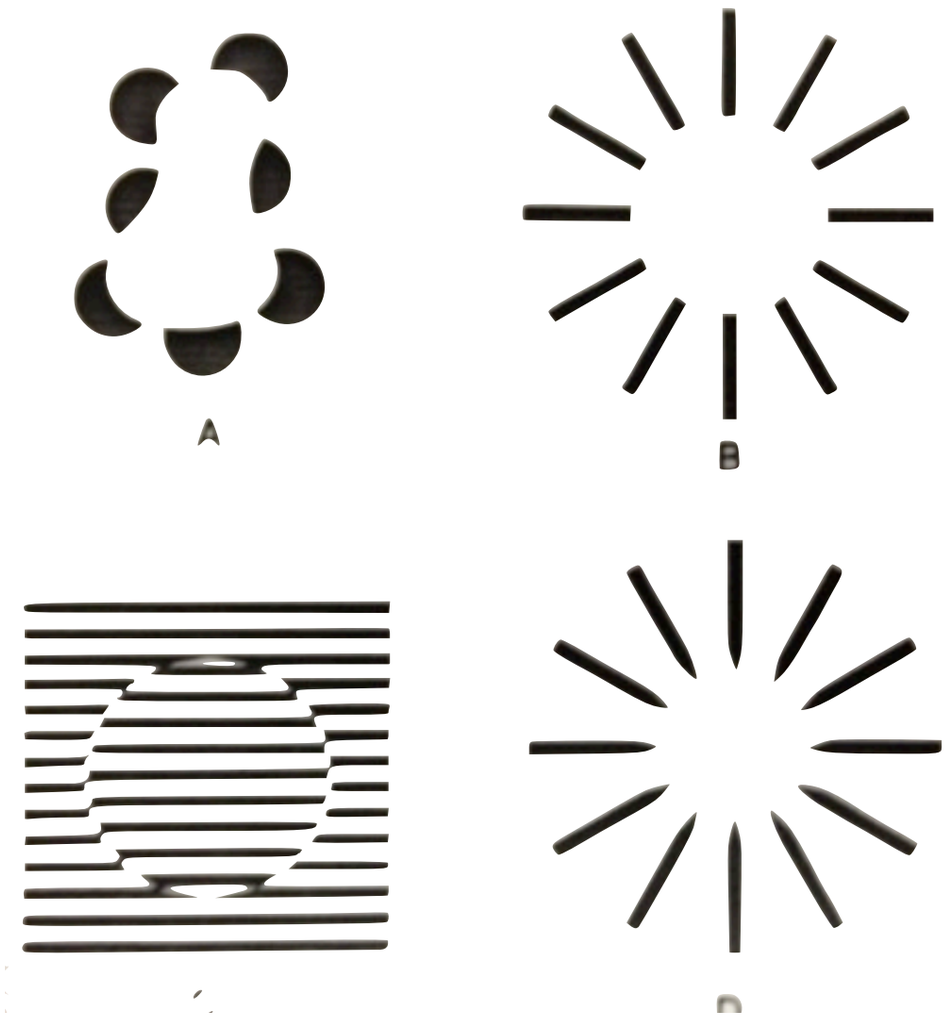
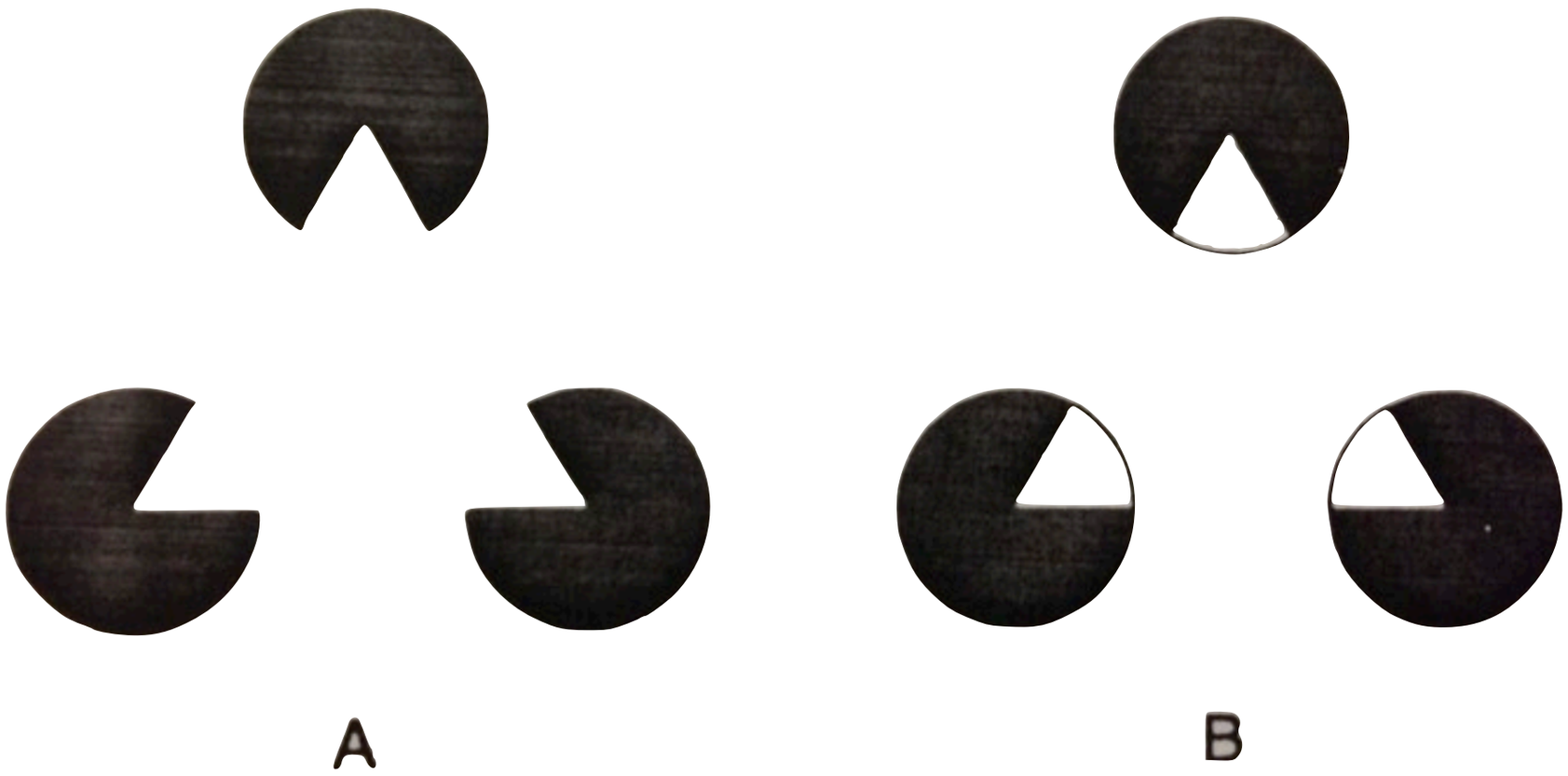


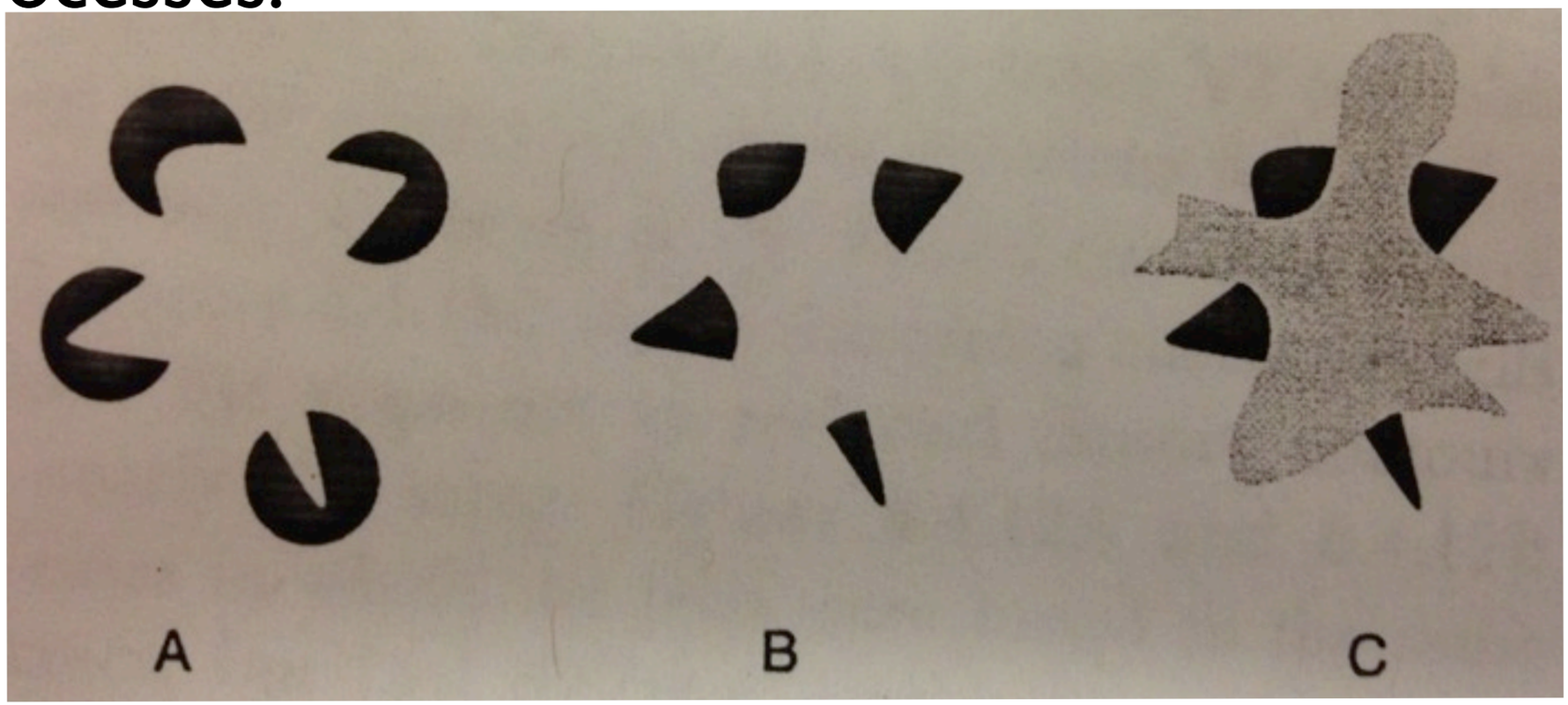
Relation to Visual Completion

- The inducing elements are amodally completed behind the illusory figure.



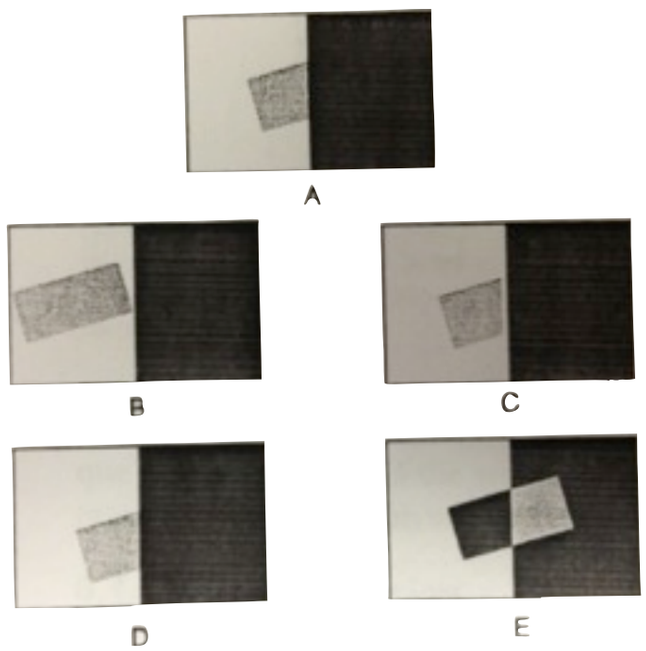
Relation to Visual Completion

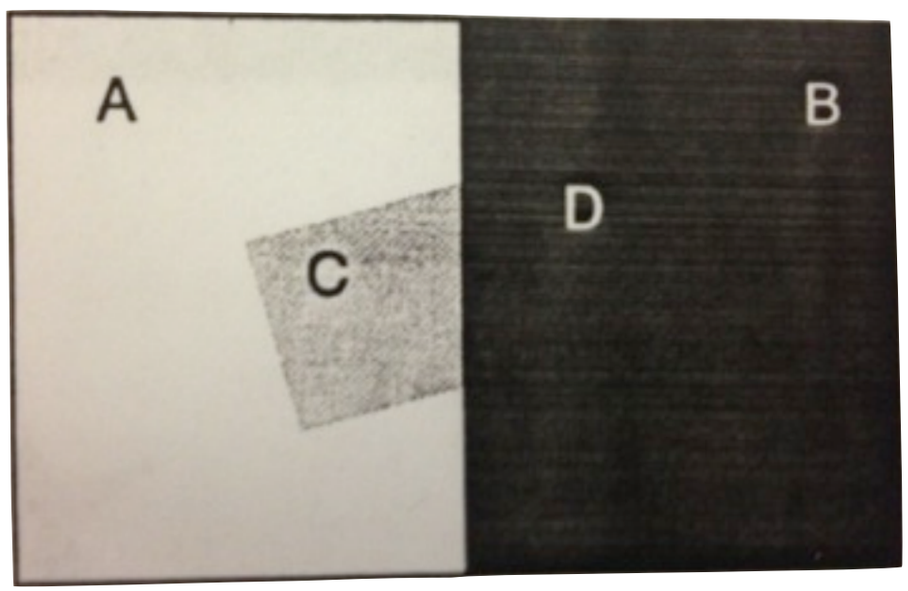
- Illusory contour configurations can be converted into examples of amodal completion.
- (Kellman) These two are just two different manifestations of the same underlying unit formation processes.



Perceived Transparency

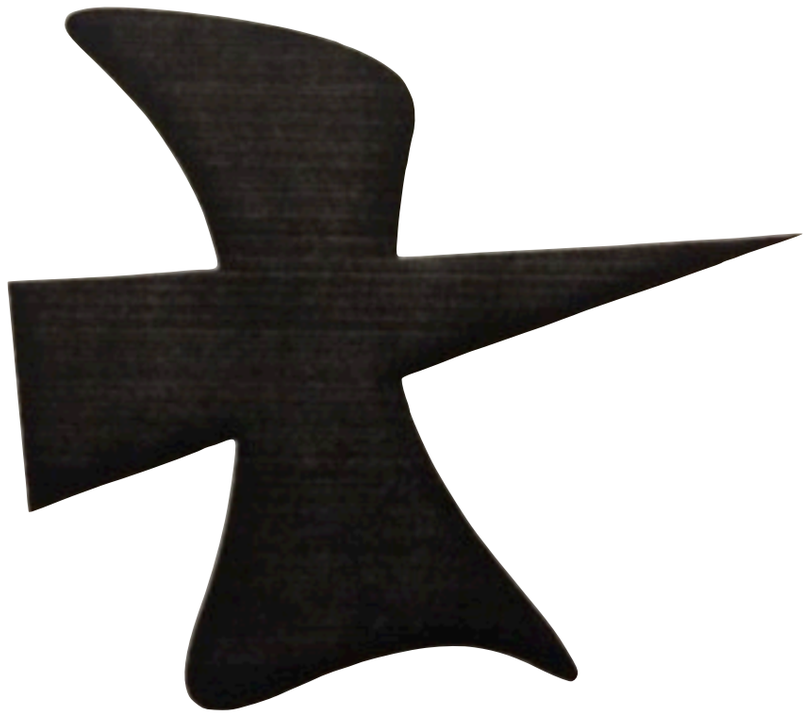
- The perception of an object as being viewed through a closer translucent object.
- Perception of transparency
  - Spatial and color conditions
  - Heuristic assumptions
- color scissions or color splitting.





Figural Scission

- Perceptually splitting one single region into two figures.
- Interesting aspects:
  - Underdetermination
  - Illusory contours
  - Completion
  - Ambiguity
  - Multistability

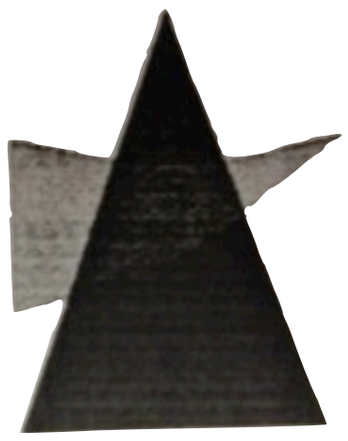


Relation Among Several Organization Phenomena

A

B

C



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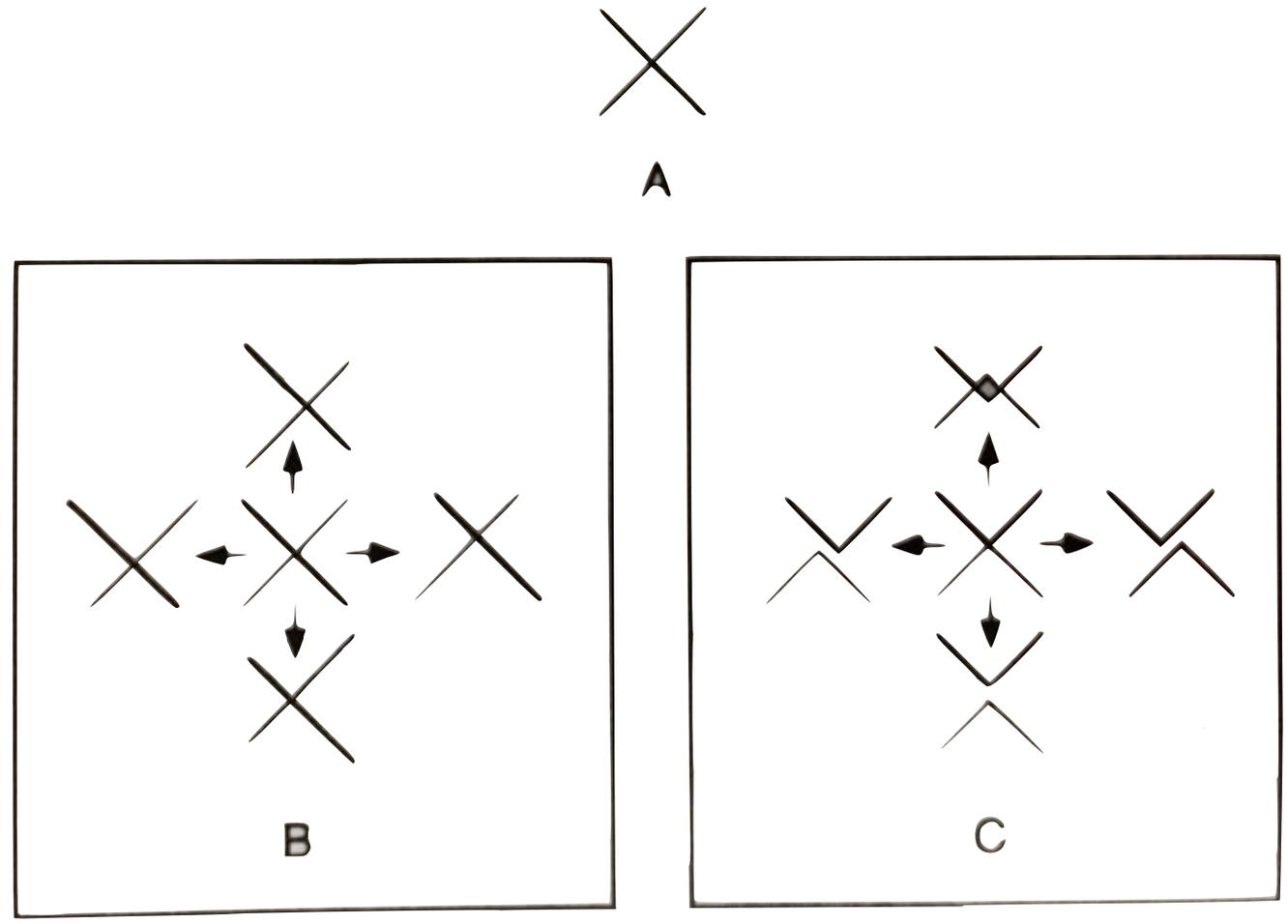
The Principle of Nonaccidentalness

- The visual system prefers the nonaccidental interpretation.
- Rejection-of-Coincidence principle (Irvine Rock)



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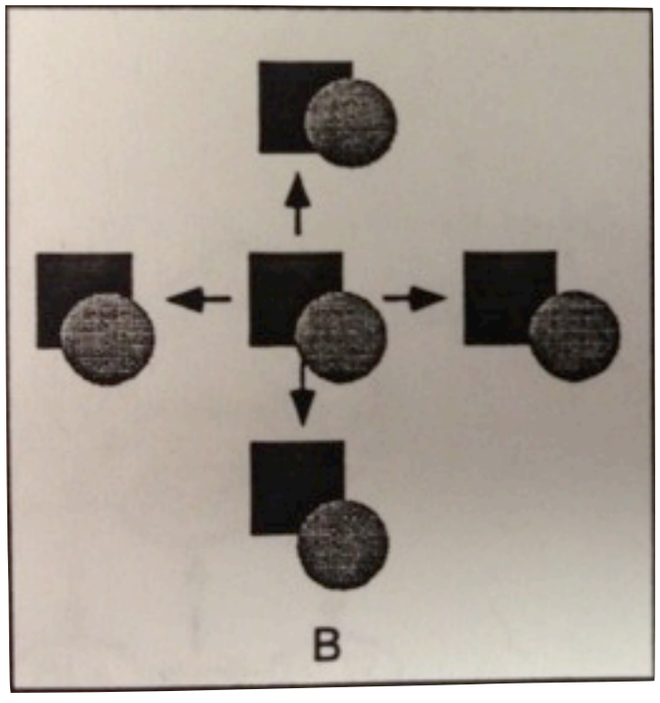

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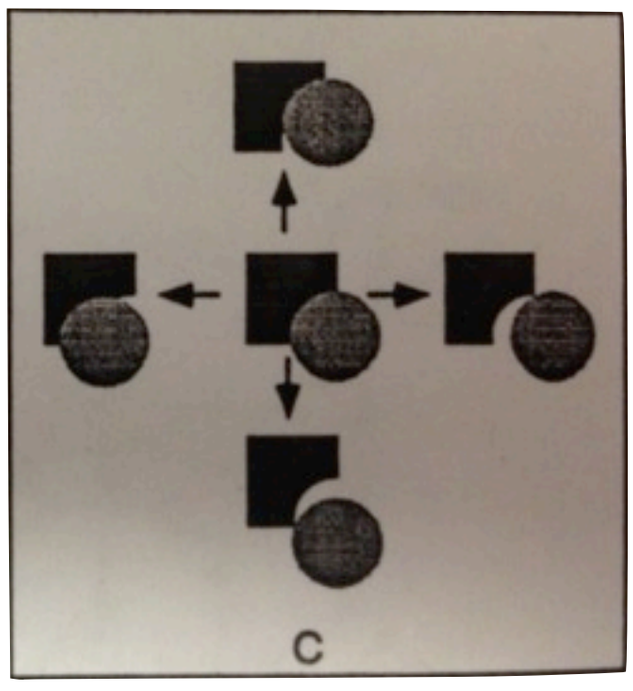


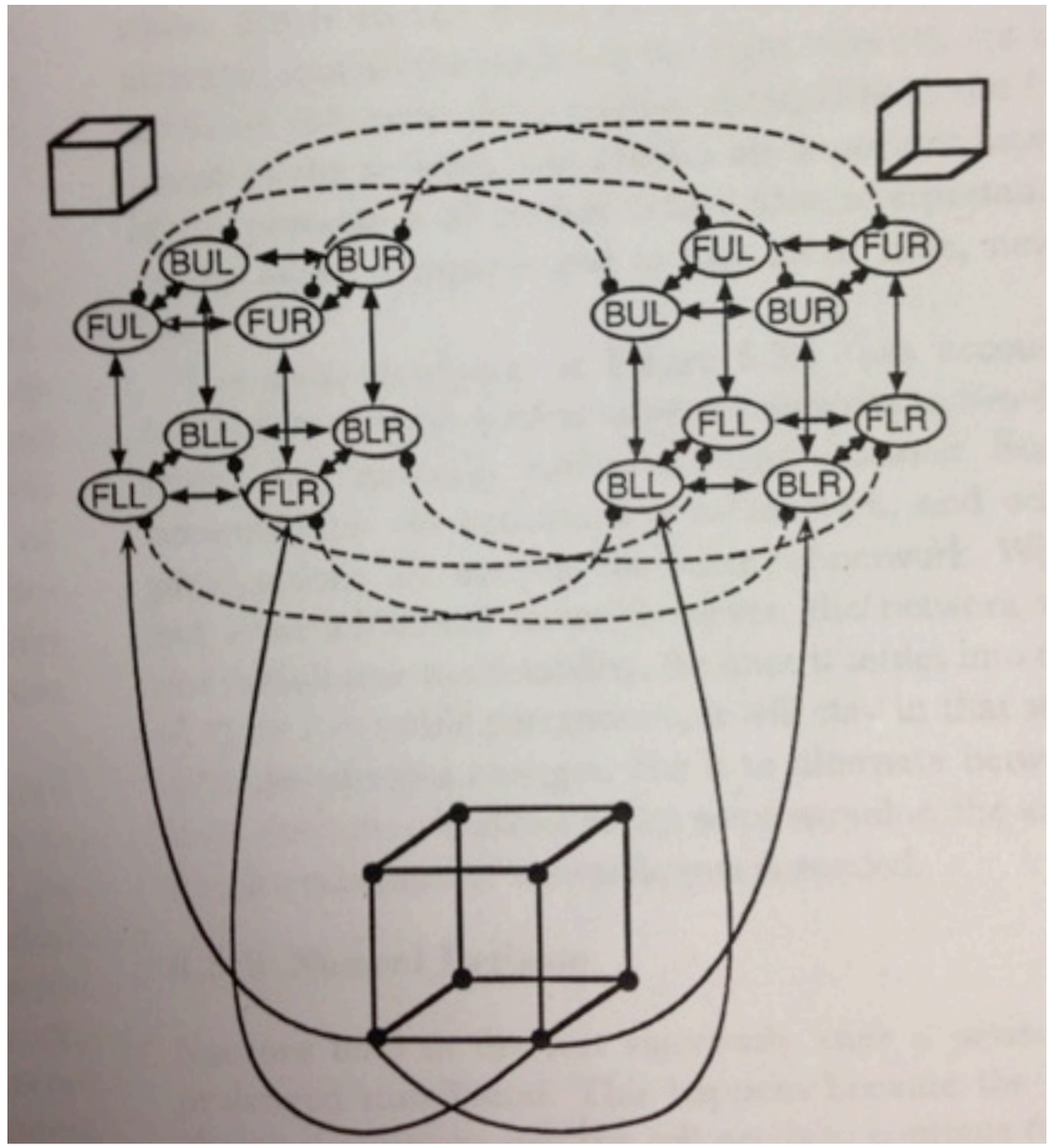
C

Multistability

- Alternating perception among different interpretations.
- Neural fatigue hypothesis
  - Different patterns of neural activity.
  - Perception corresponds with most active pattern.
  - Neural fatigue causes domination of different patterns.

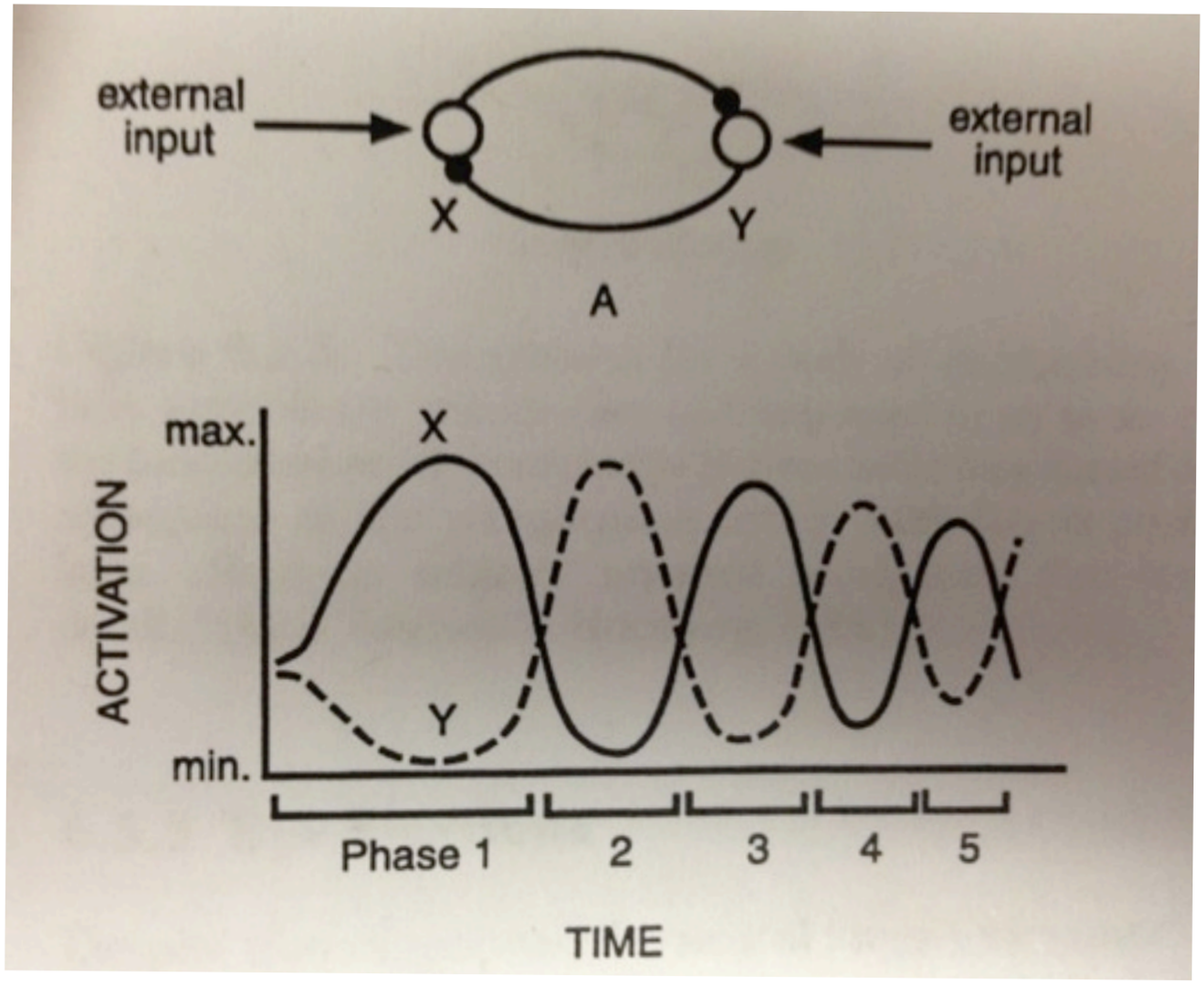
Connectionist Network Model

- Firing rate in two different neural network.
- The bistability of network
  - Cooperation
  - Competition



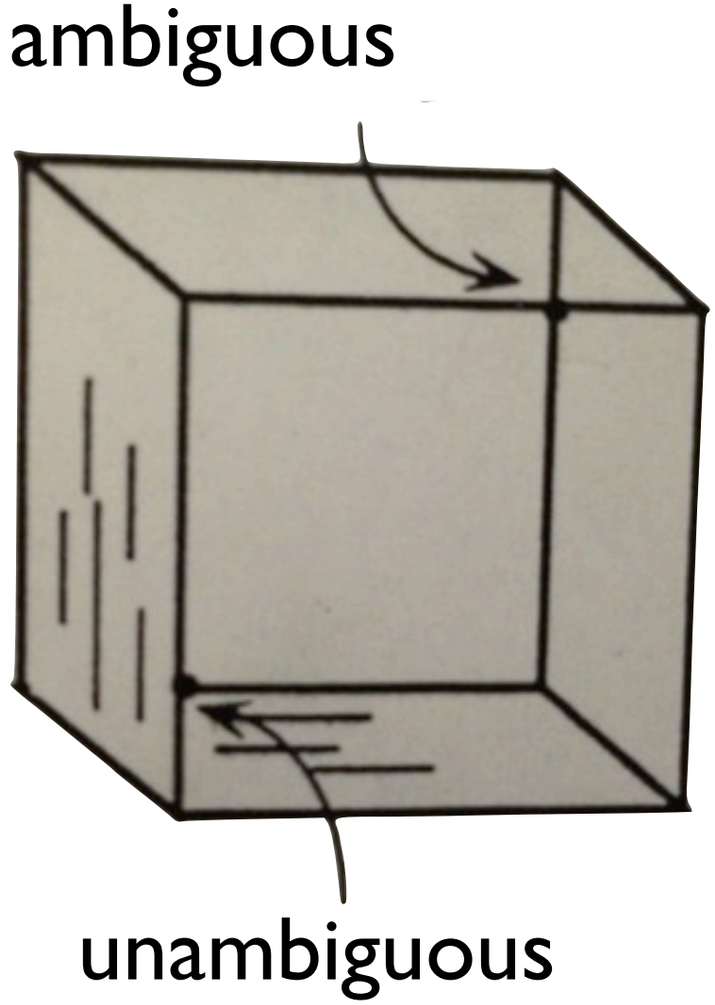
Neural Fatigue

- Mutual excitation
- Mutual inhibition
- Neural fatigue



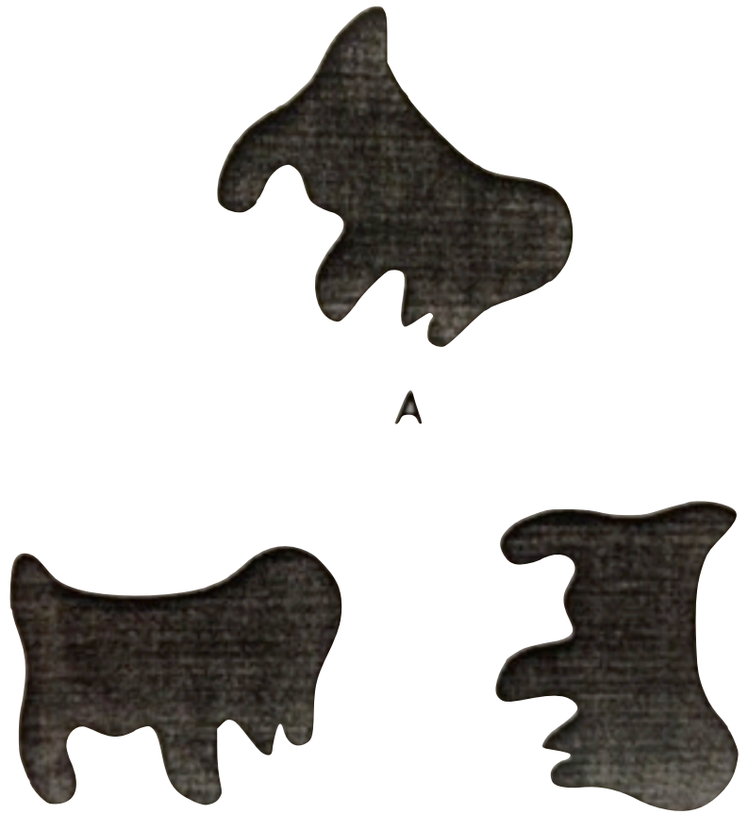
Eye Fixations

- Eye Movement
- Local Information
- Subject's intention



The Rule of Instructions

- The alternative interpretations had to be represented within different internally cooperative subnetworks.
- Subnetworks had to compete with each other through mutual inhibition.



Perceiving Object Properties and parts

chapter 7

Shape

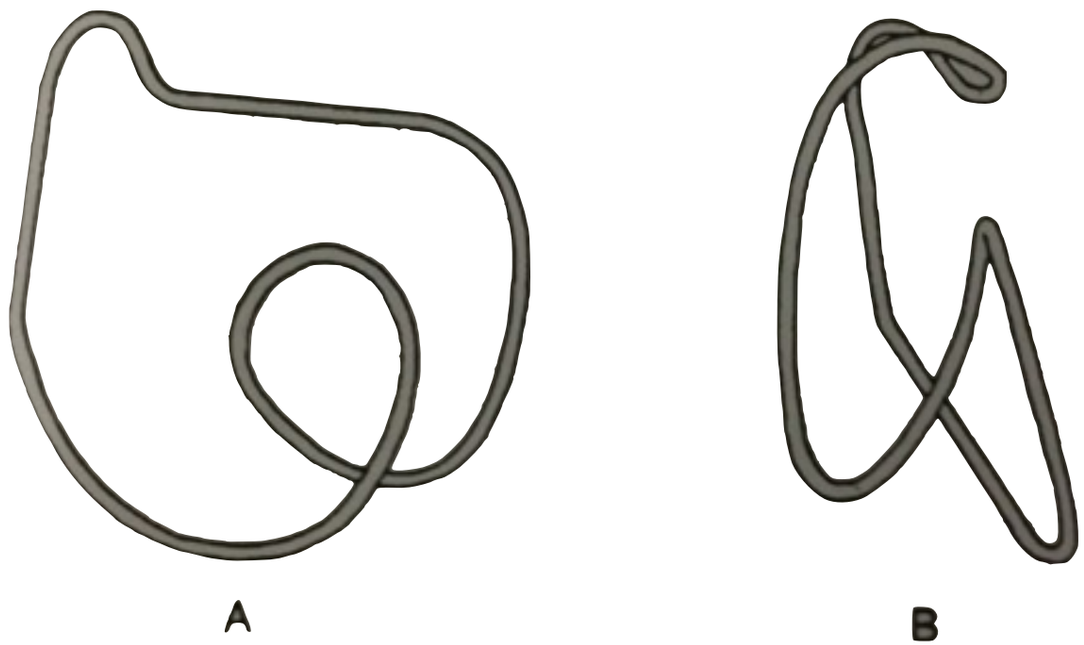
- Most complex of all visually perceivable properties.
- Combination of different attributes.
  - Size
  - Orientation
  - Position
- No accepted theory of what shape is or how shape perception occurs.

Two Dimensional Figures

- 2D shapes presented at varying slants.
- Shape constancy declines by the degree of slants.
- Tendency to perceive the figures as the most symmetrical shape.
- Gestalt Principle of Pragnanz
  - the percept will be as good as prevailing condition allow

Three Dimensional Objects

- More difficult than 2D figures.
- Shape constancy
  - Perceive same object from different stationpoints
  - Correlated with its identity
  - Particular parts of object



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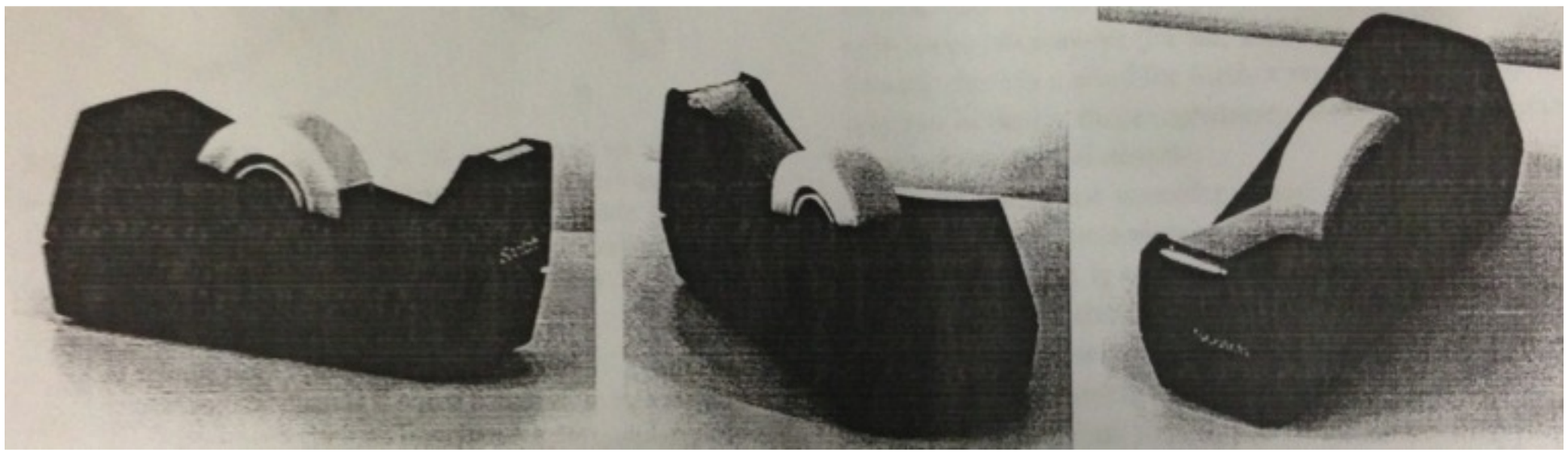
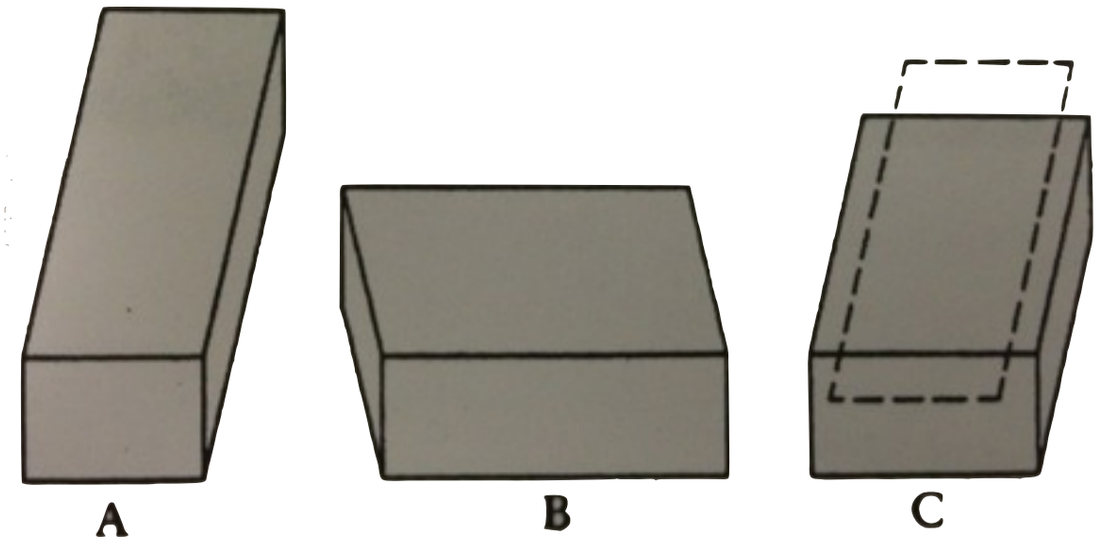
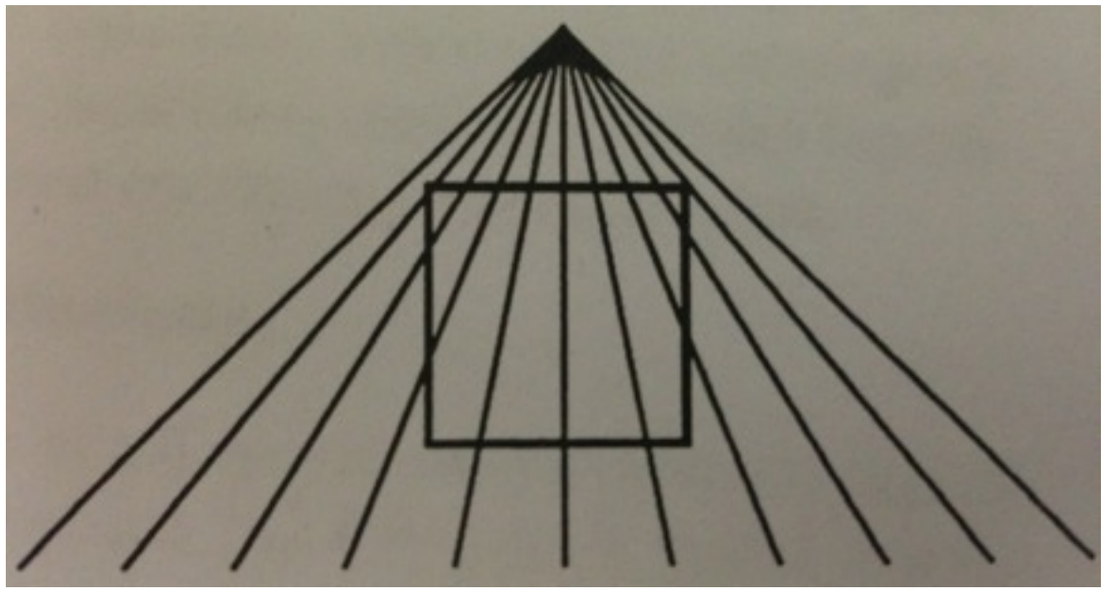


Shape Illusions

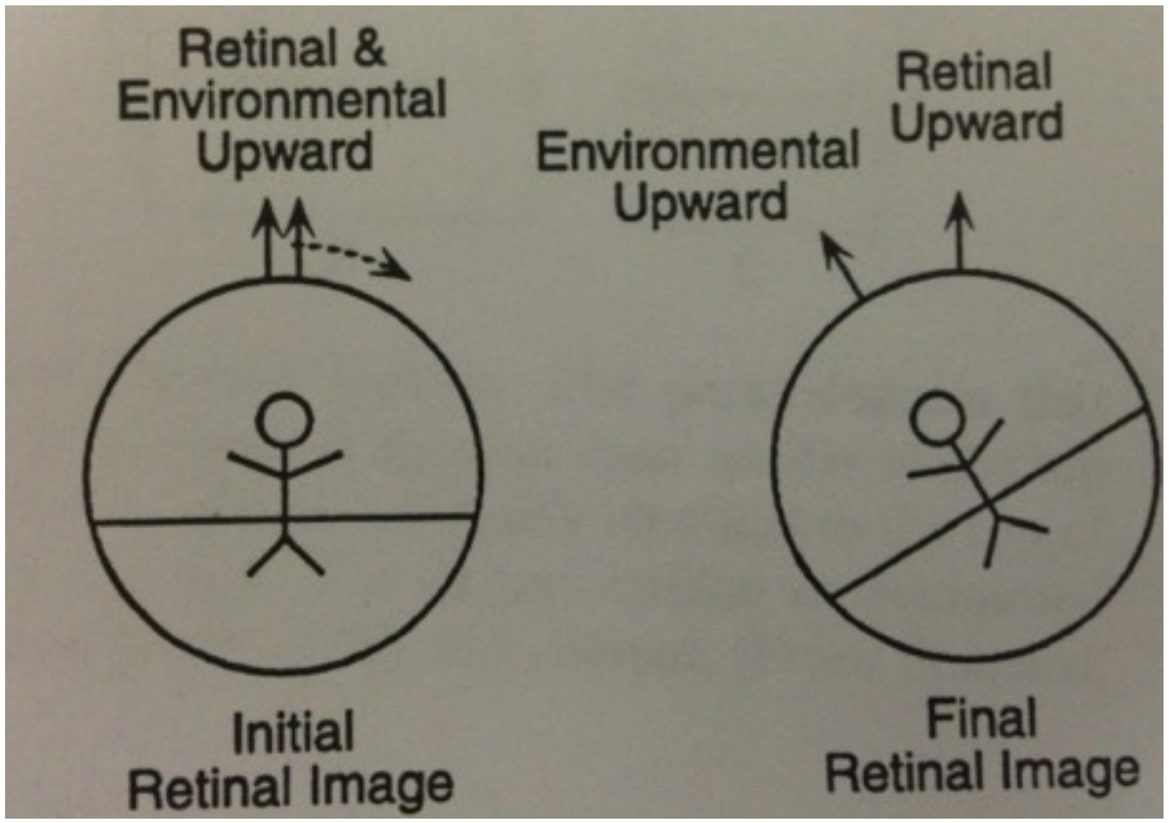
- Ames room
- Shepard illusion
- Ponzo illusion





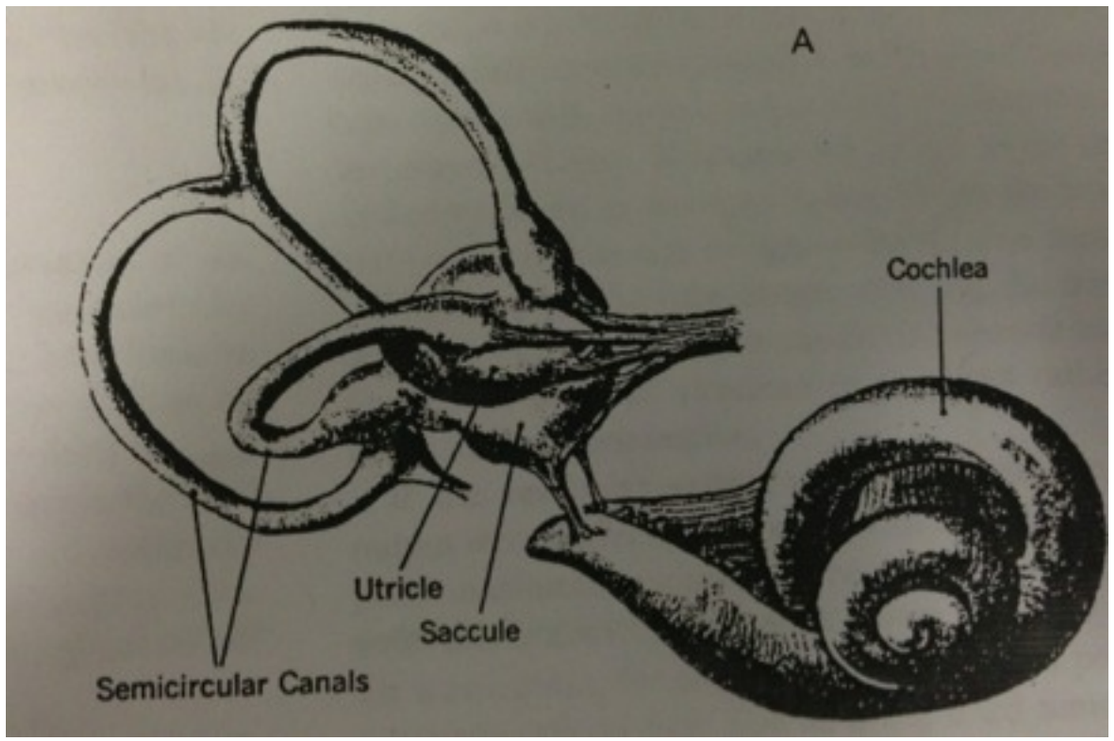
Orientation Constancy

- Orientation of object's image on the retina
- Orientation of the head
- $O_{object} = O_{image} + O_{head}$



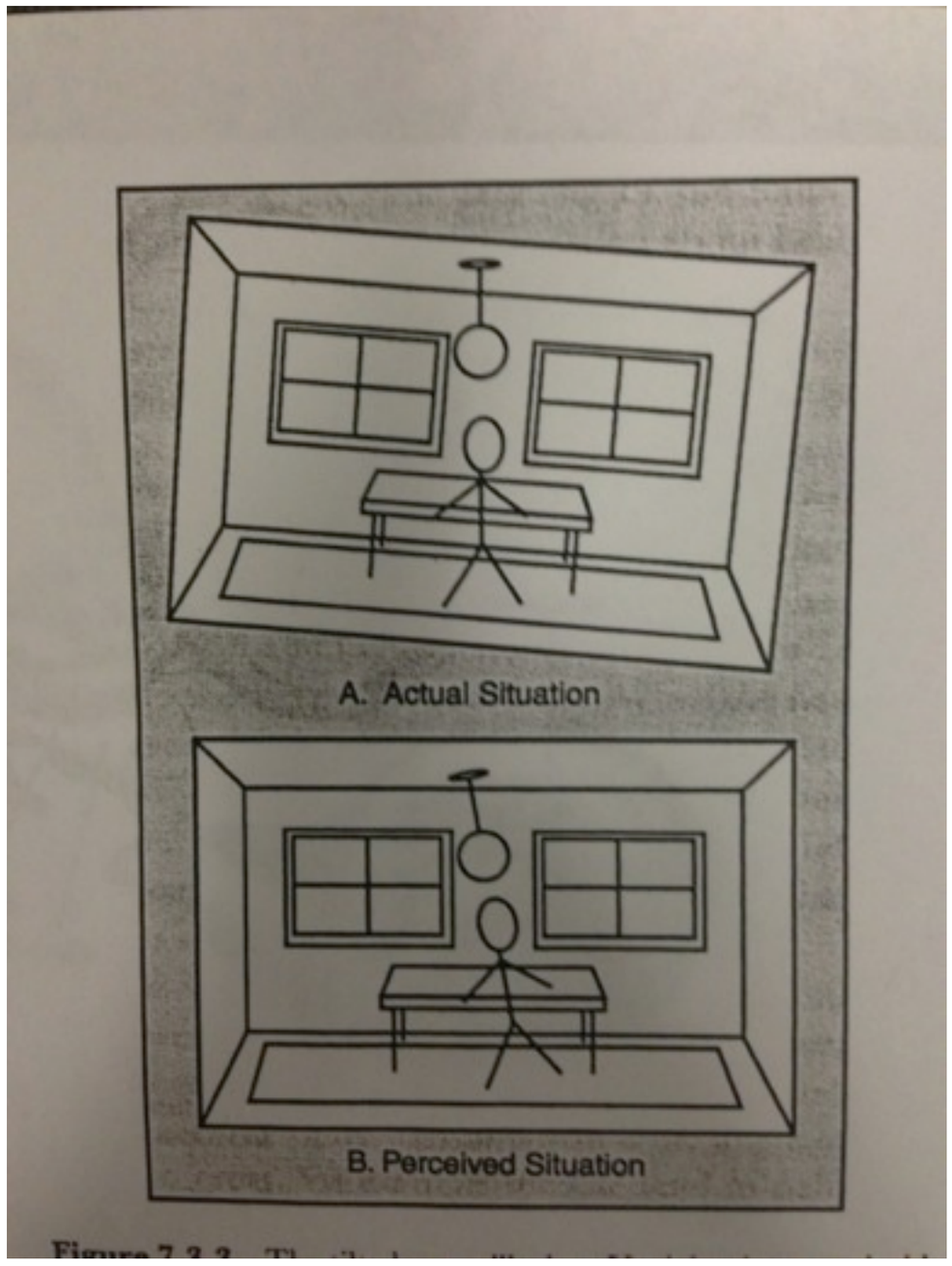
Orientation Constancy

- Vestibular system
  - Semicircular canals
  - Utricle
  - Saccule
- Visual system doesn't rely entirely on vestibular information
  - Effects on body



Orientation Illusions

- Visual information also affects orientation perceptions.
- **Frames of Reference**
- Rod-and-Frame effect
- Geometric illusions
  - Zollner illusion



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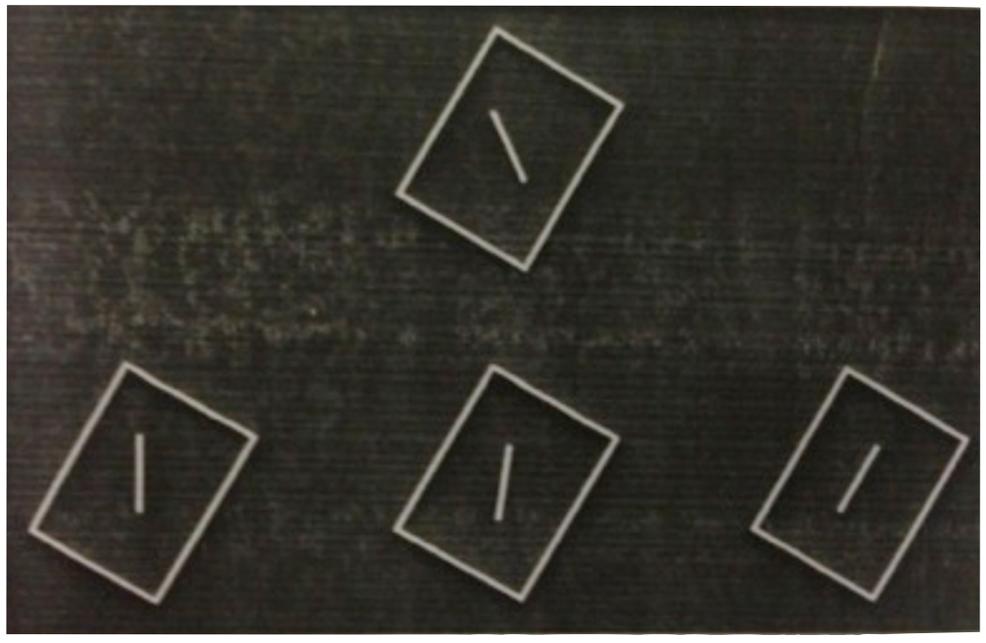

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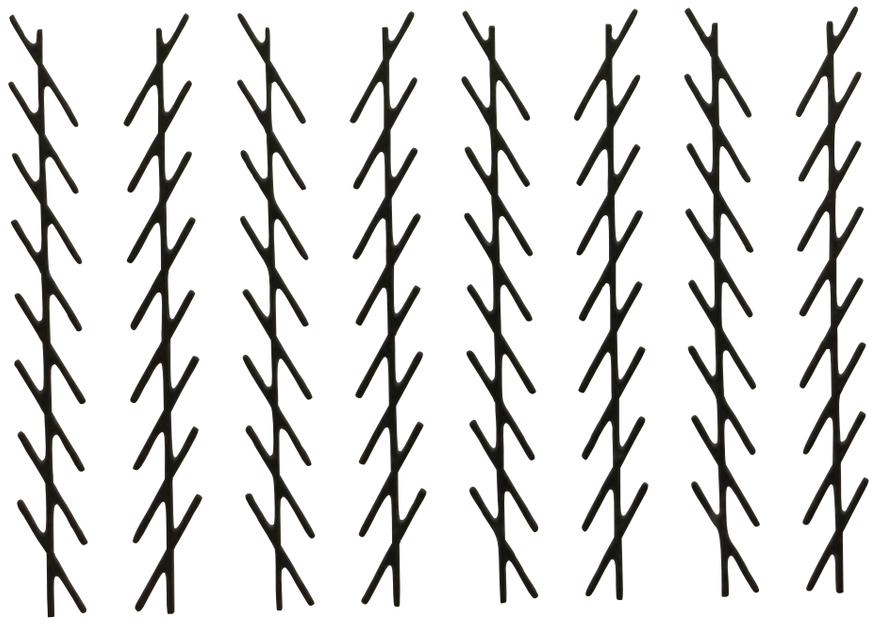
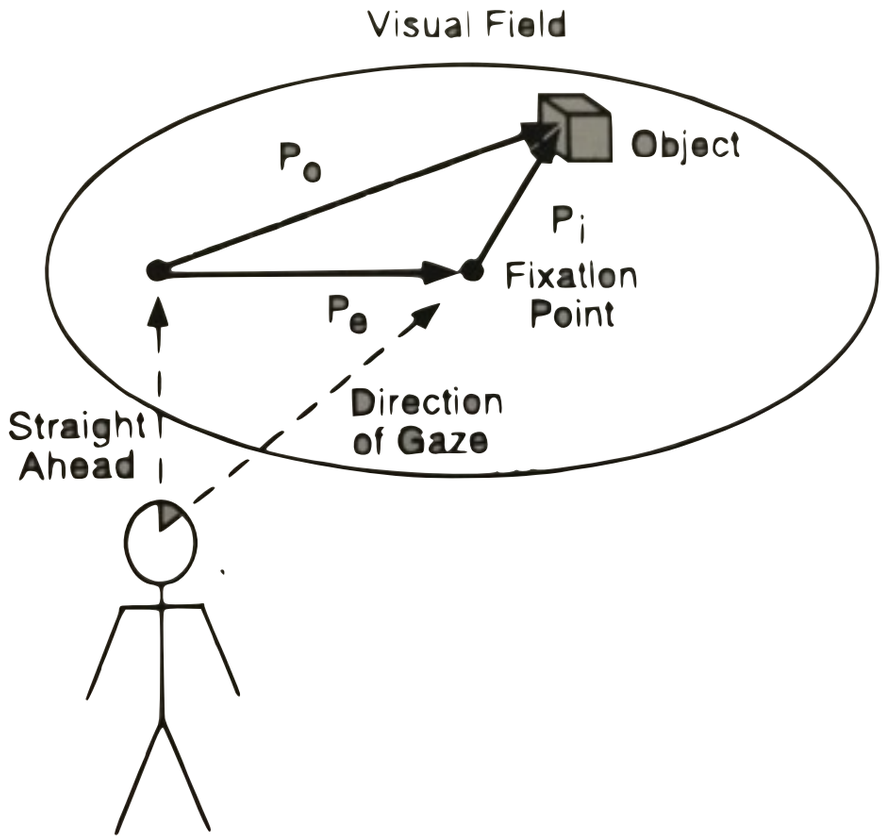


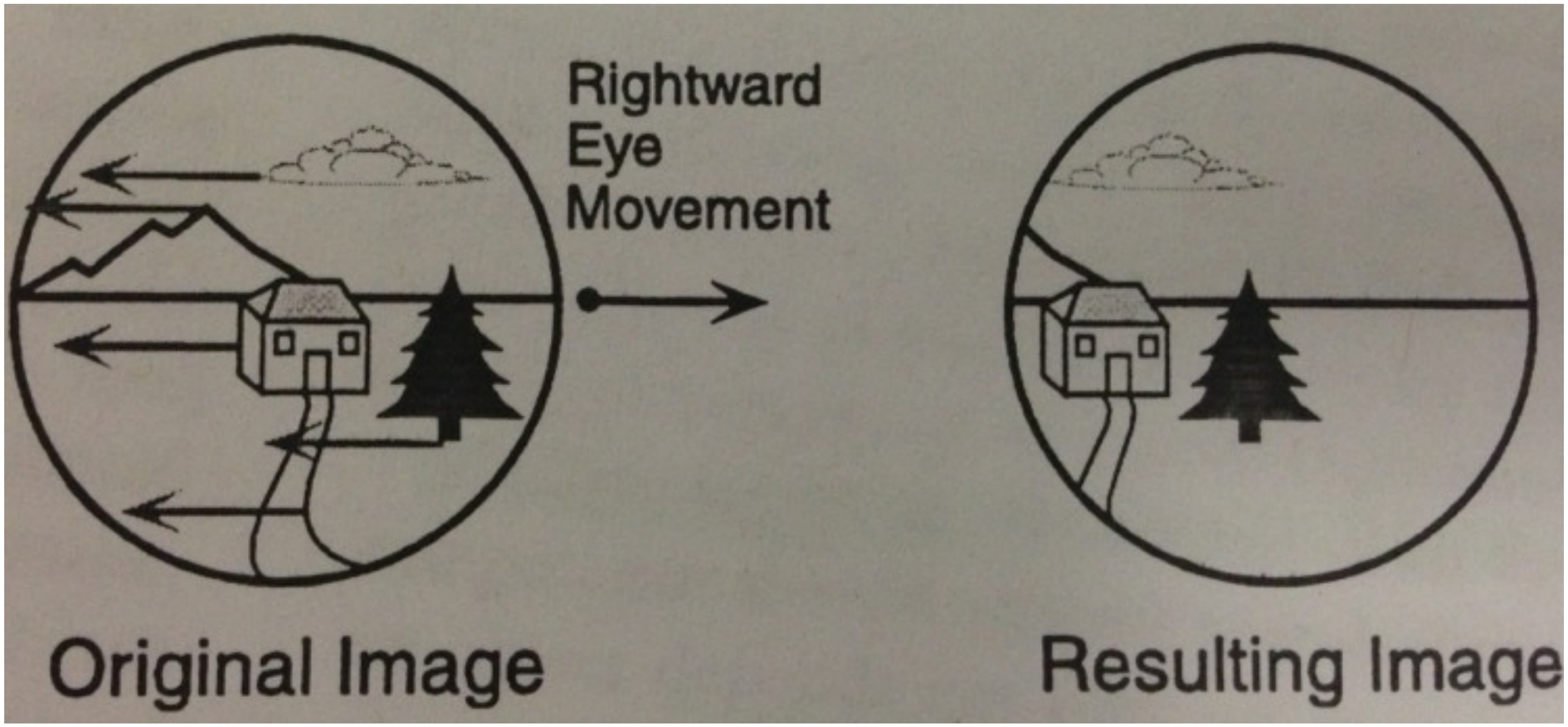
Position

- Different ways of perceiving object's position
  - Relative to the observer's body (egocentric position)
  - Relative to other objects
- Polar coordinate
  - Radial direction
  - Distance
- Perception of Direction
  - Position of the object on the retina
  - Direction in which the eyes are pointed
  - Pobject = Pimage + Peye



Position Constancy

- $DP_{object} = DP_{image} + DP_{eye}$



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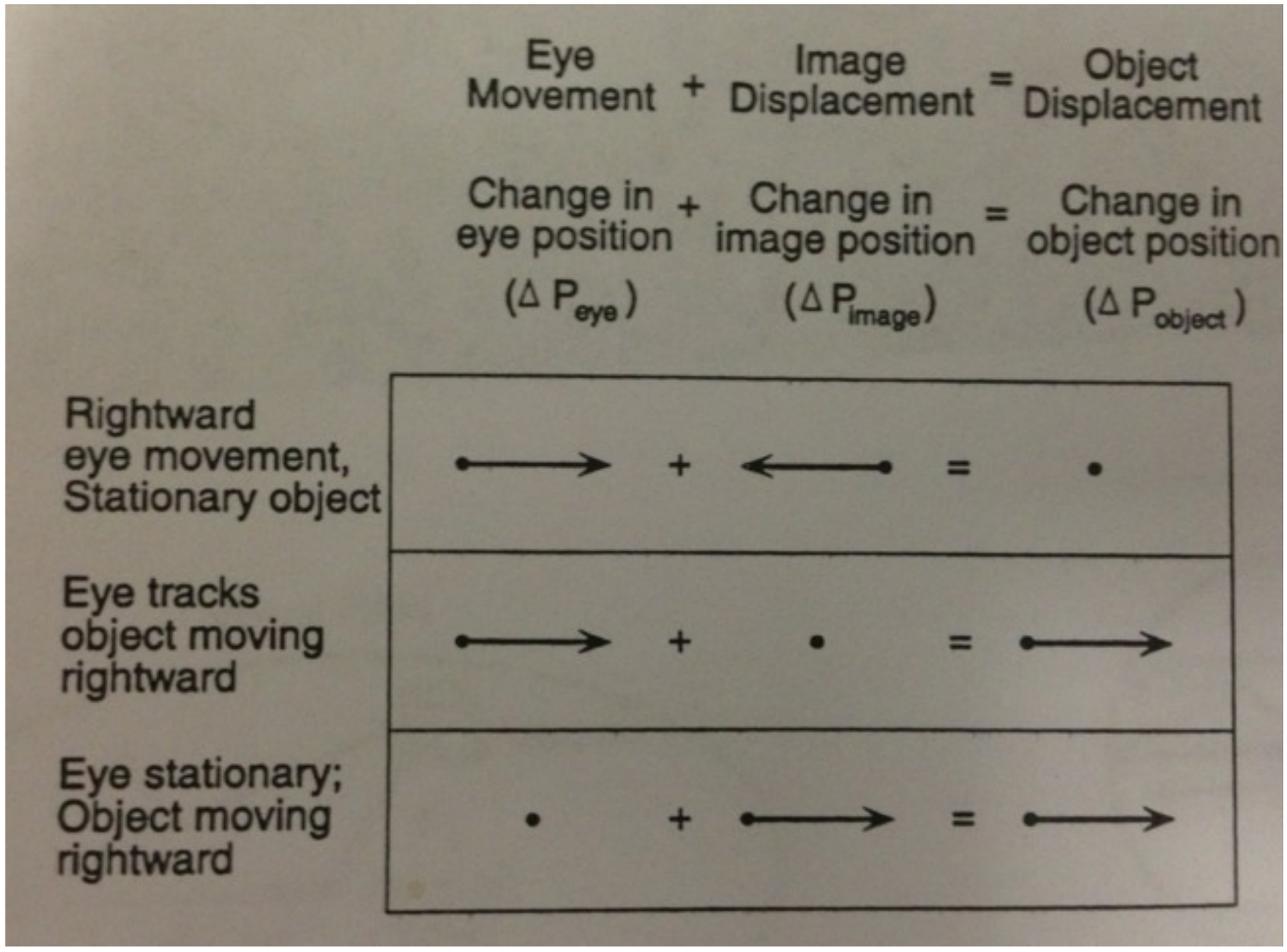
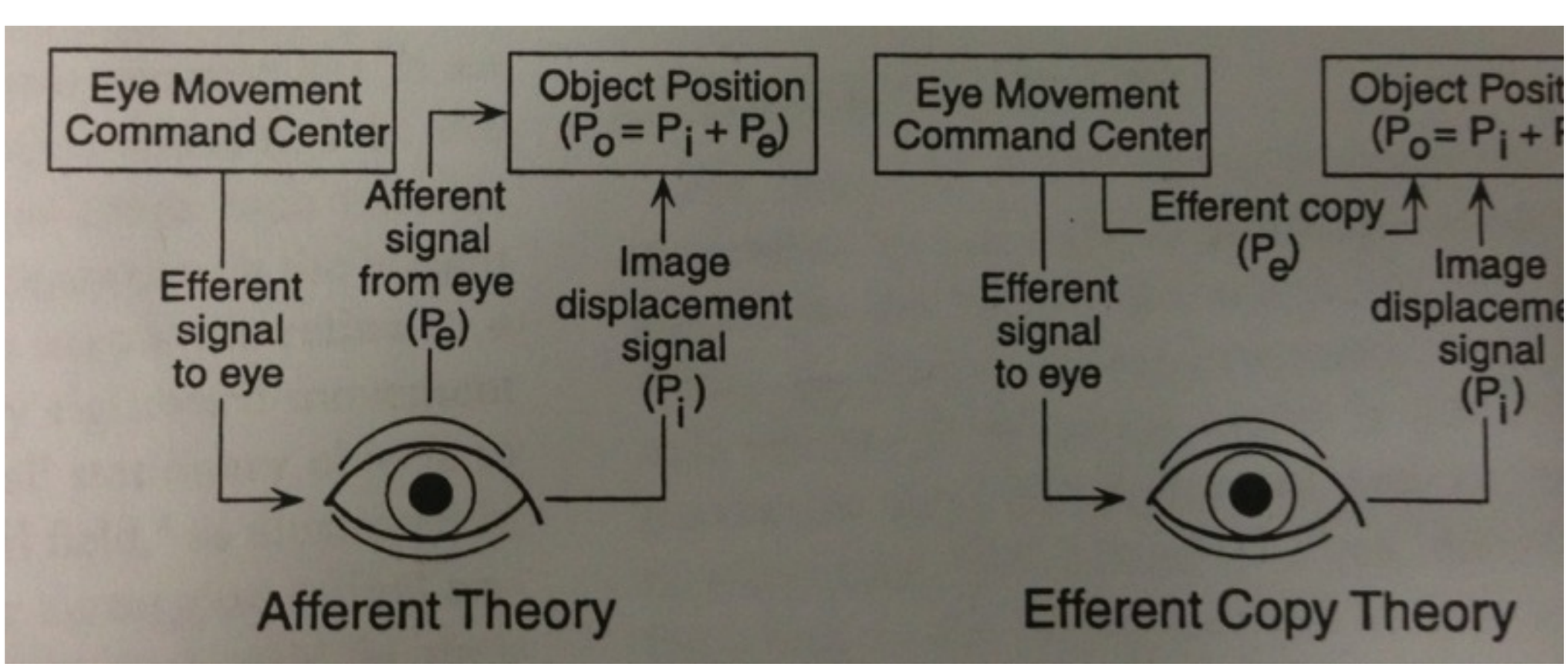


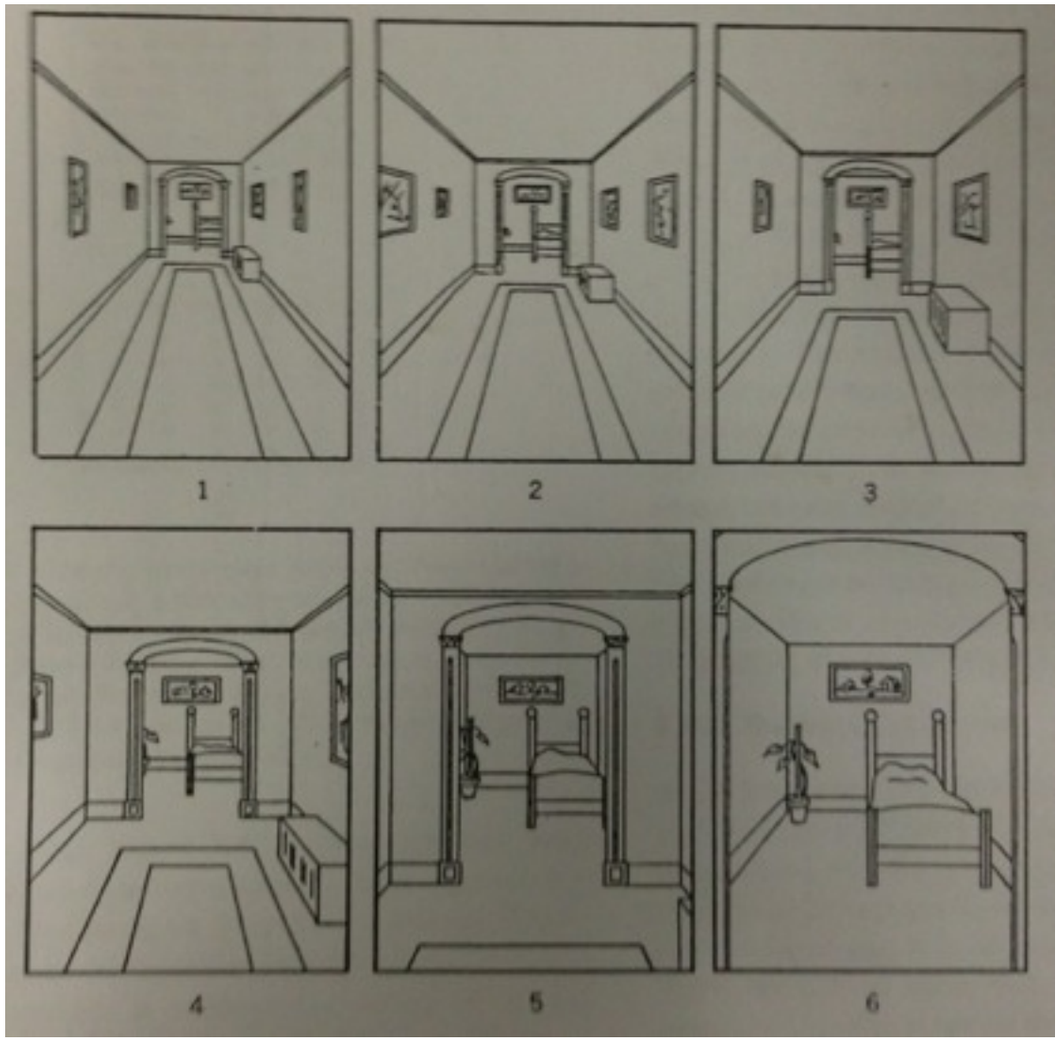
Indirect Theories of Position Constancy

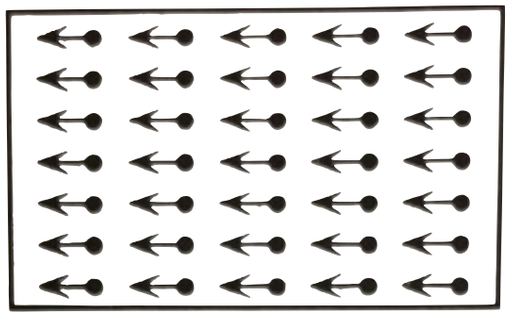
- Classical Theory (Helmholtz)
- Information about eye displacement
  - Afferent theory
  - Efferent theory



Direct Theories of Position Constancy

- Gibson (1966)





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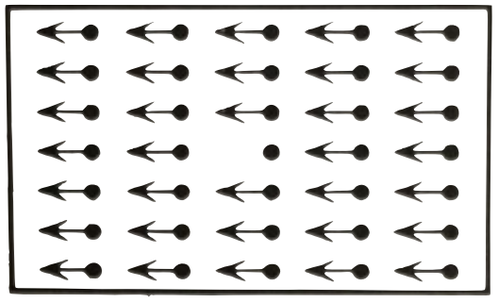

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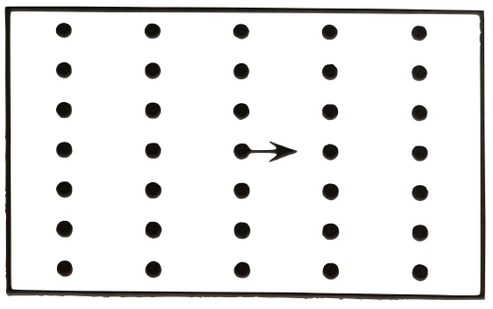
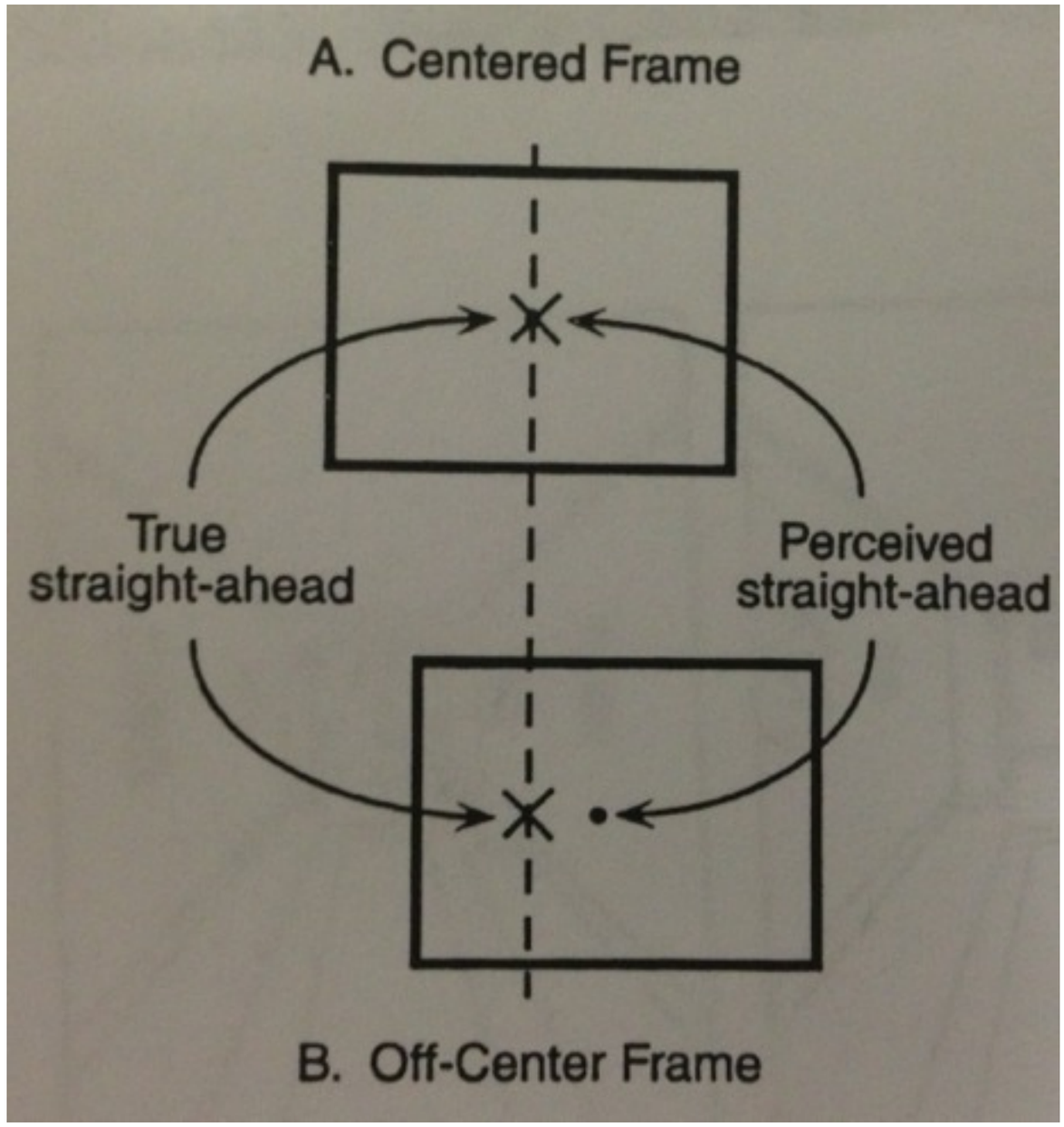


C

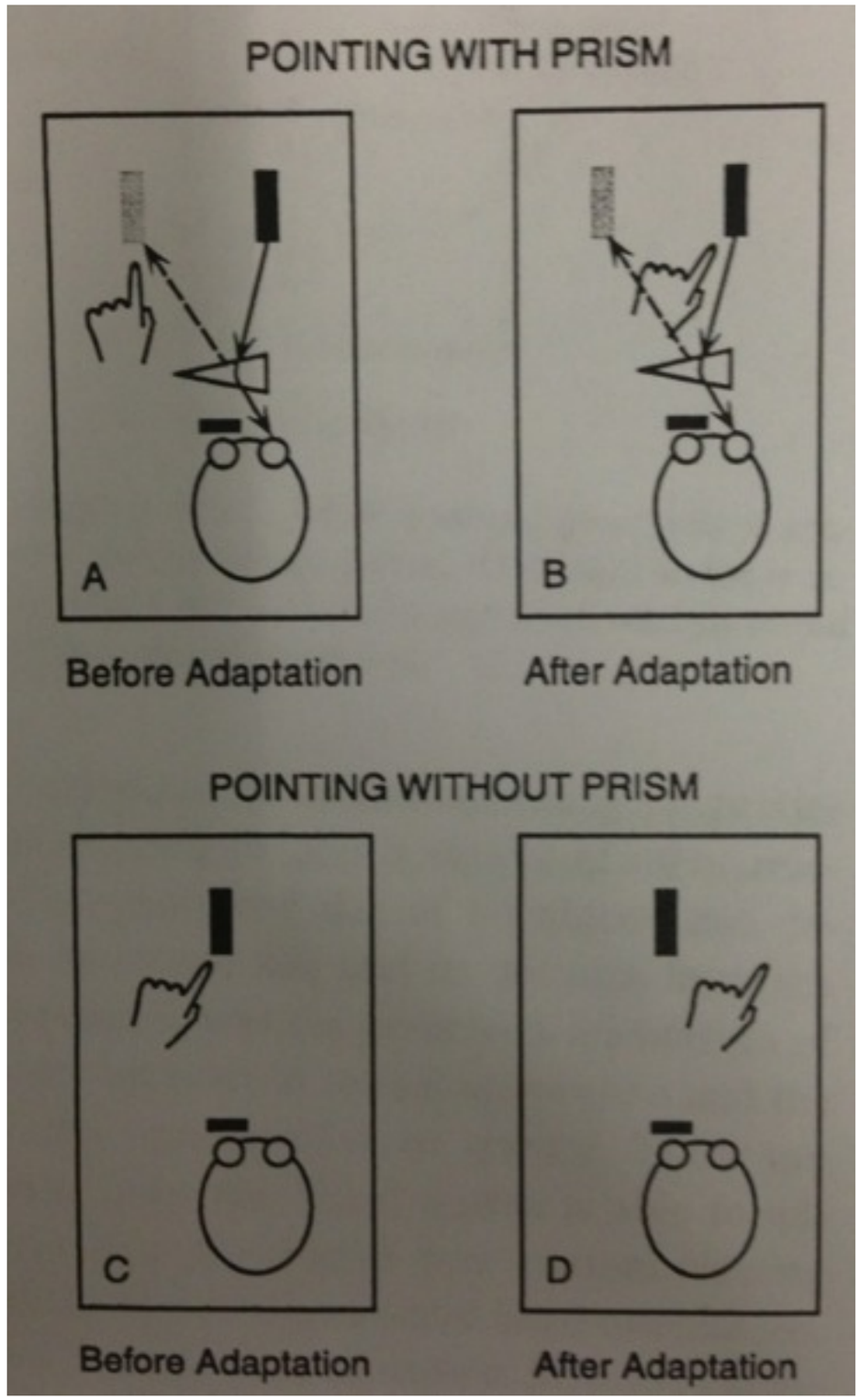
Position Illusions

- Contextual influence of a surrounding object
- Roelofs' effect



Perceptual Adaptation

- **Helmholtz's experiment**
- **Kohler**
- George Malcolm Stratton
  - uinverting the retinal image
  - the swinging of the filed
- Richard Held
  - Amount of adamptation



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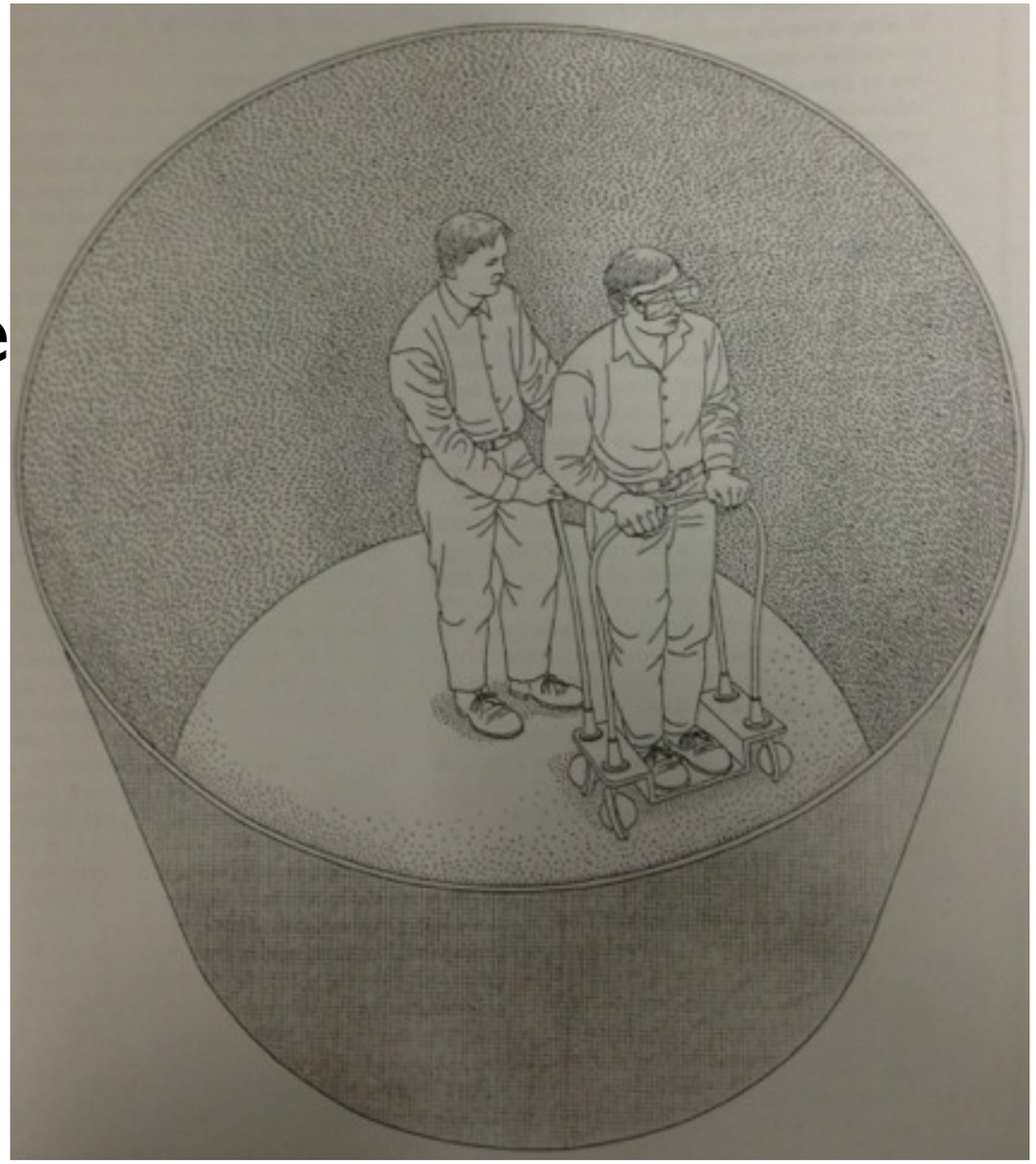


Parts

- Cannot be captured by veridical perception of global properties such as size, shape ...

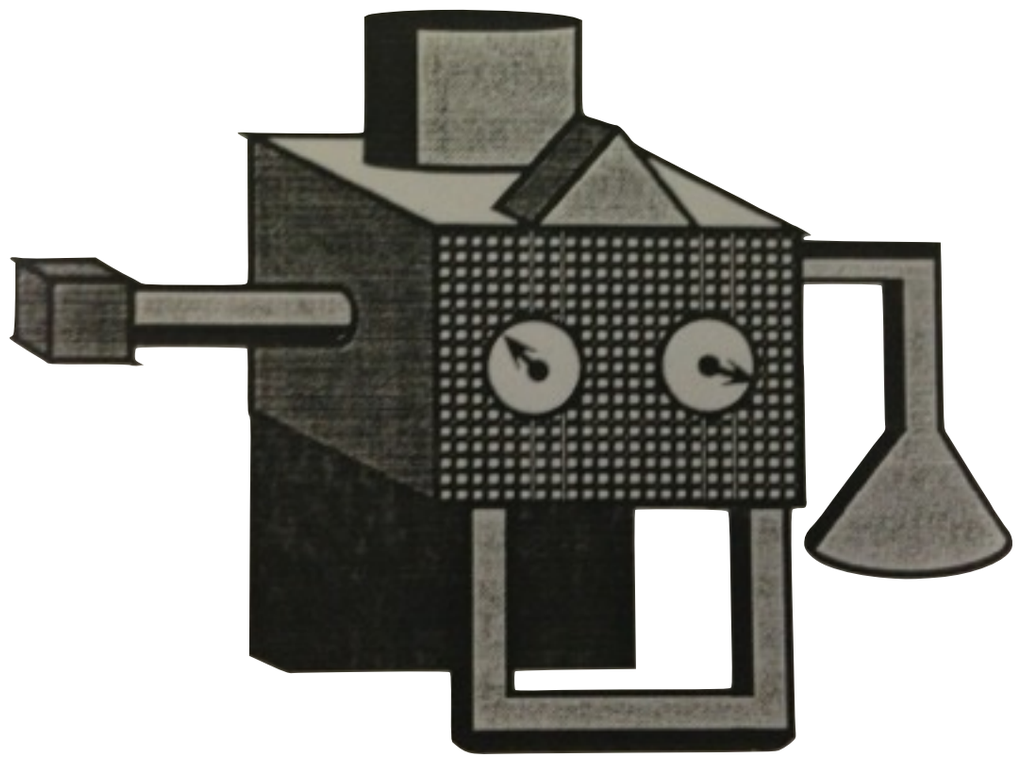
- Part is restricted portion of an object that has semi autonomous, objectlike status in visual perception

Evidence for Perception of Parts

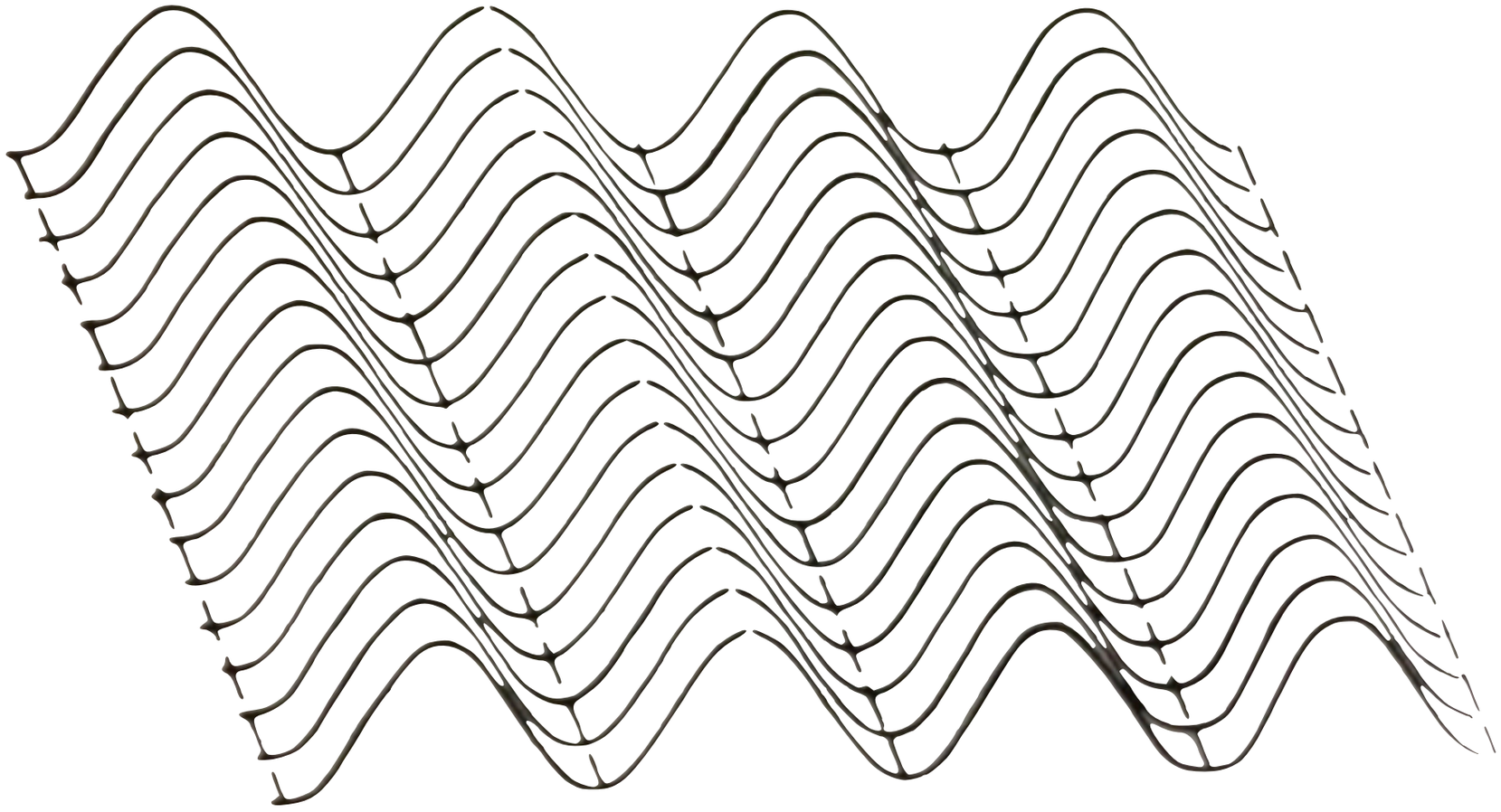
- Linguistic evidence
- Phenomenological Demonstration
- Perceptual Experiment

Linguistic Evidence

- Linguistic Conventions of our culture
- Evidences against this idea
  - Similarity across languages
  - perceiving parts in objects we have never seen



Phenomenological Demonstration



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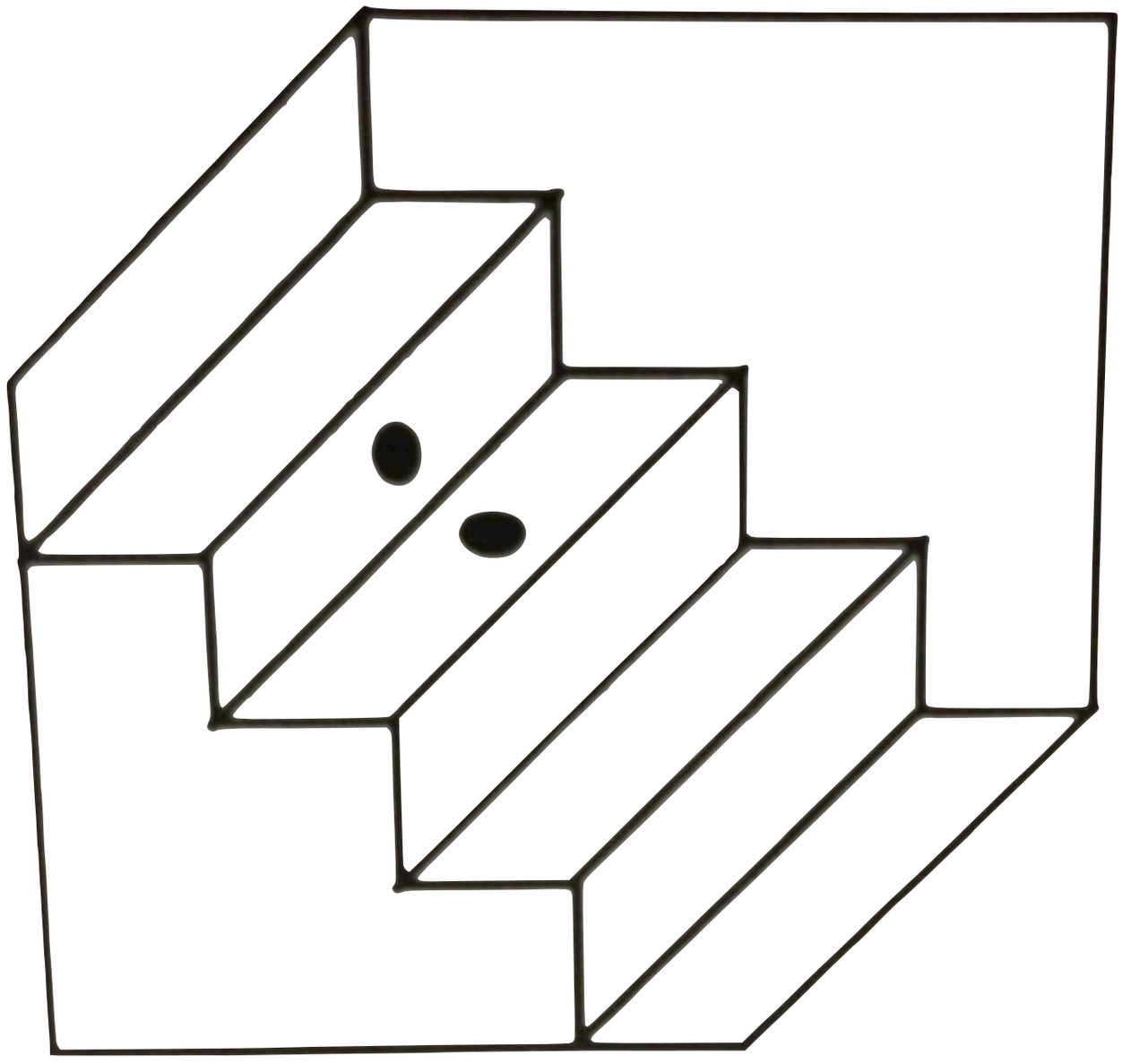
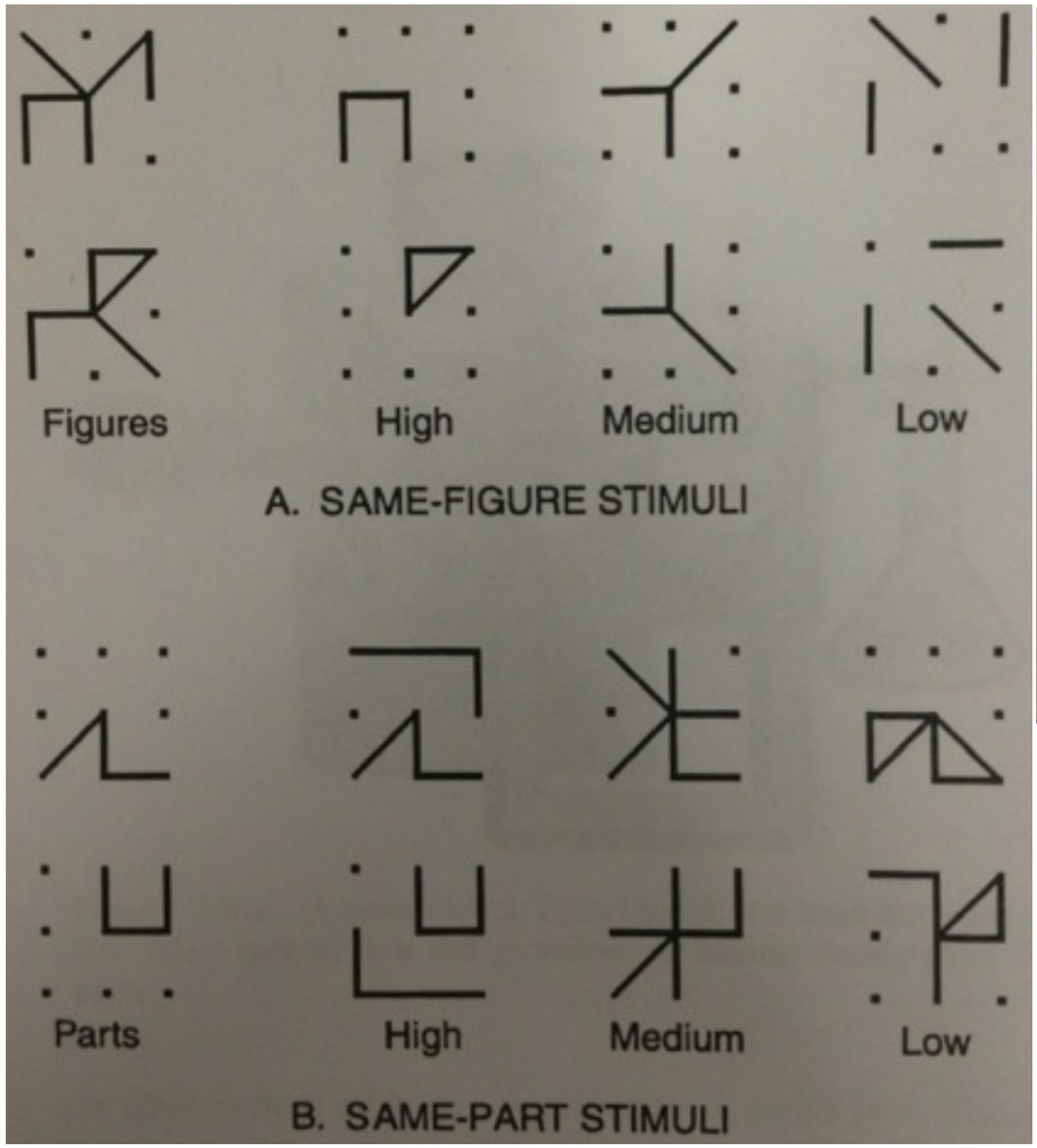
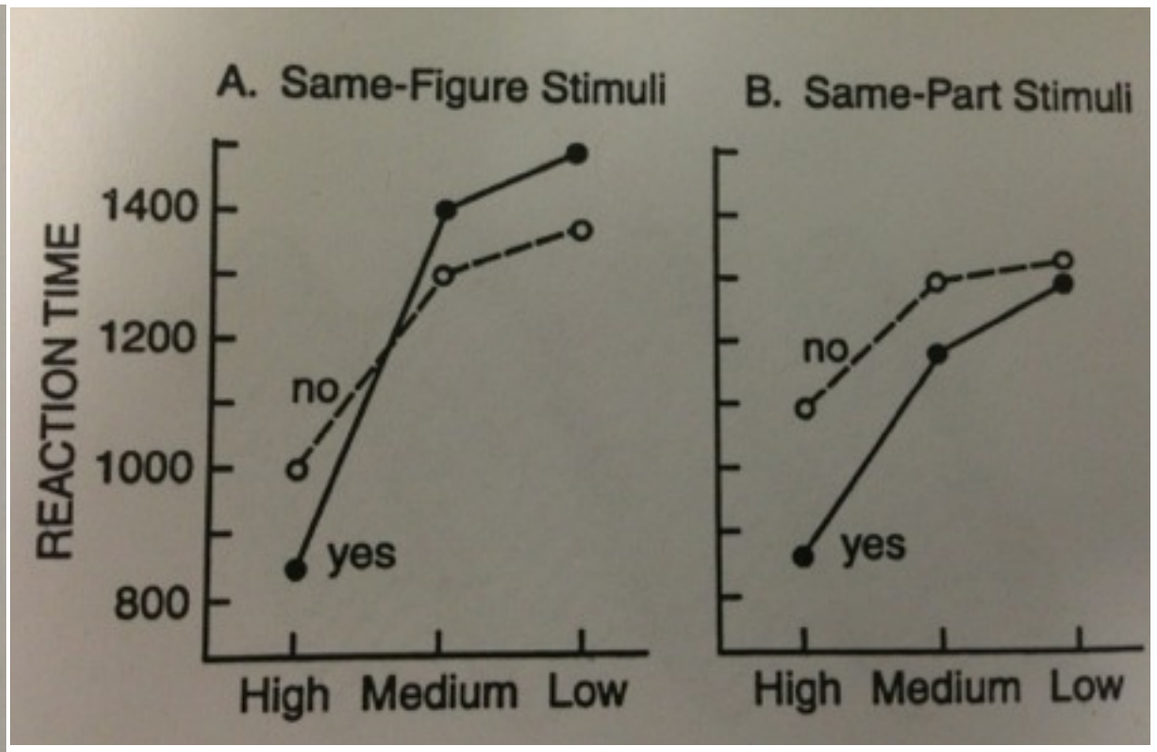


Perceptual Experiment

- 2D non-sense figures.
- Even these novel figures perceived as having parts



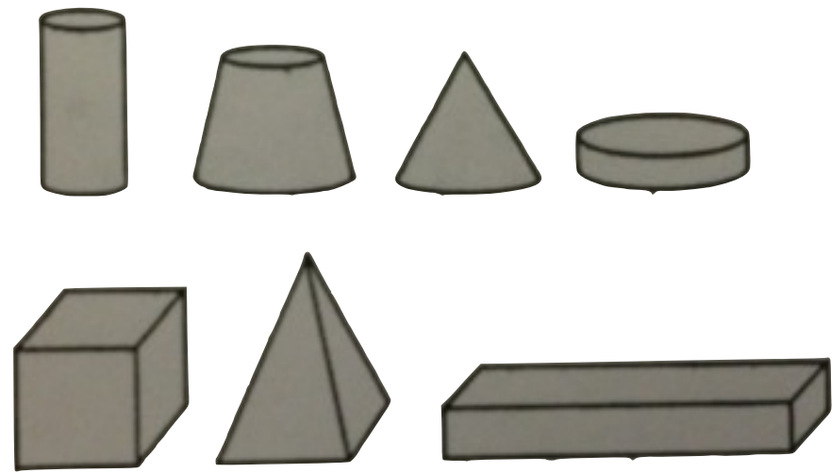


Part Segmentation

- Two ways to divide an object into parts
  - Shape primitive
  - Boundary rule

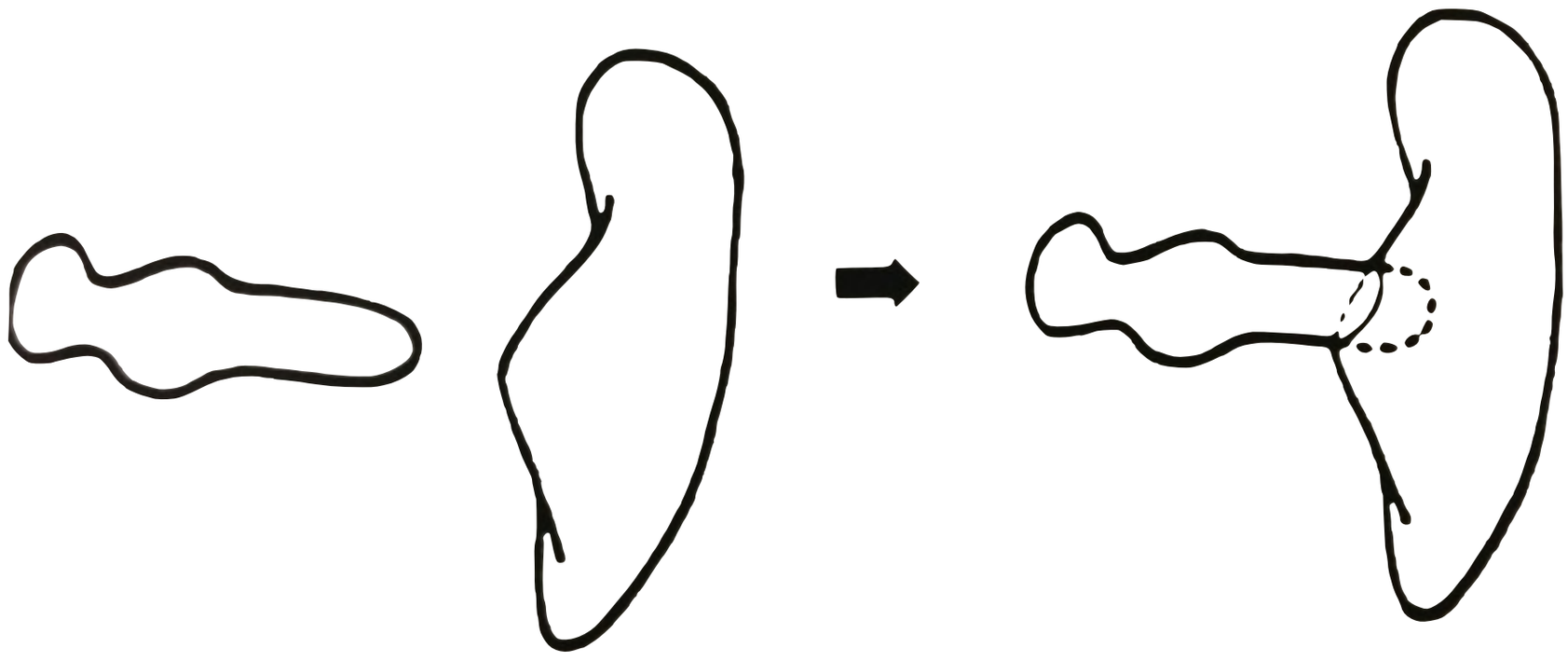
Shape Primitives

- Decompose into relatively small set of atomic shapes
- Problems:
  - Existence of contextual effects
  - Some parts have subparts
    - Multiple scale
    - Grouping Principle
- There most be some well defined process
- What set of primitives



Boundary Rules

- Transversality regularity (Hoffman and Richard)
- **Concave discontinuity rule**
  - Problem: having smooth transition between parts
- Deep Concavity rule



Boundary Rules

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