The Constructivist View of Perception

Lecture 16

Problems for Ecological Perception

- Conceptual Problem
  - Availability vs. Utilization
- Empirical Problems
  - Organization
  - Pattern Recognition
  - Perceptual Constancies
  - Ambiguous (Reversible) Figures
  - Perceptual Illusions
  - Cultural Differences
  - Perceptual Problem-Solving

Perception as Construction

The perceiver must go

"*beyond the information given*"

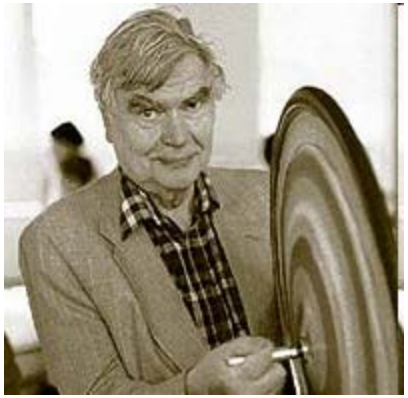
by the stimulus

Jerome Bruner (1973)

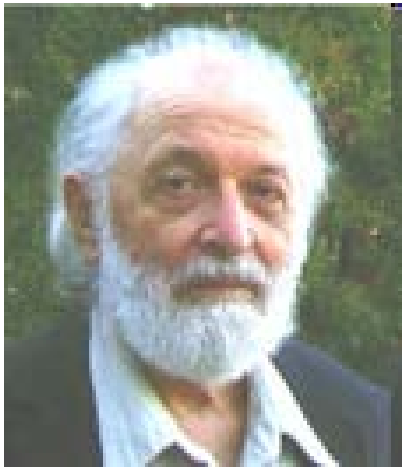
- Conditions
  - Stimulus information insufficient for perception
  - Stimulus information is misleading
- Perception is intelligent
  - Problem-Solving Activity
  - Requires knowledge of the world
  - Entails judgment, inference, reasoning

The Constructivist Tradition in Perception

Hermann von Helmholtz



Richard Gregory

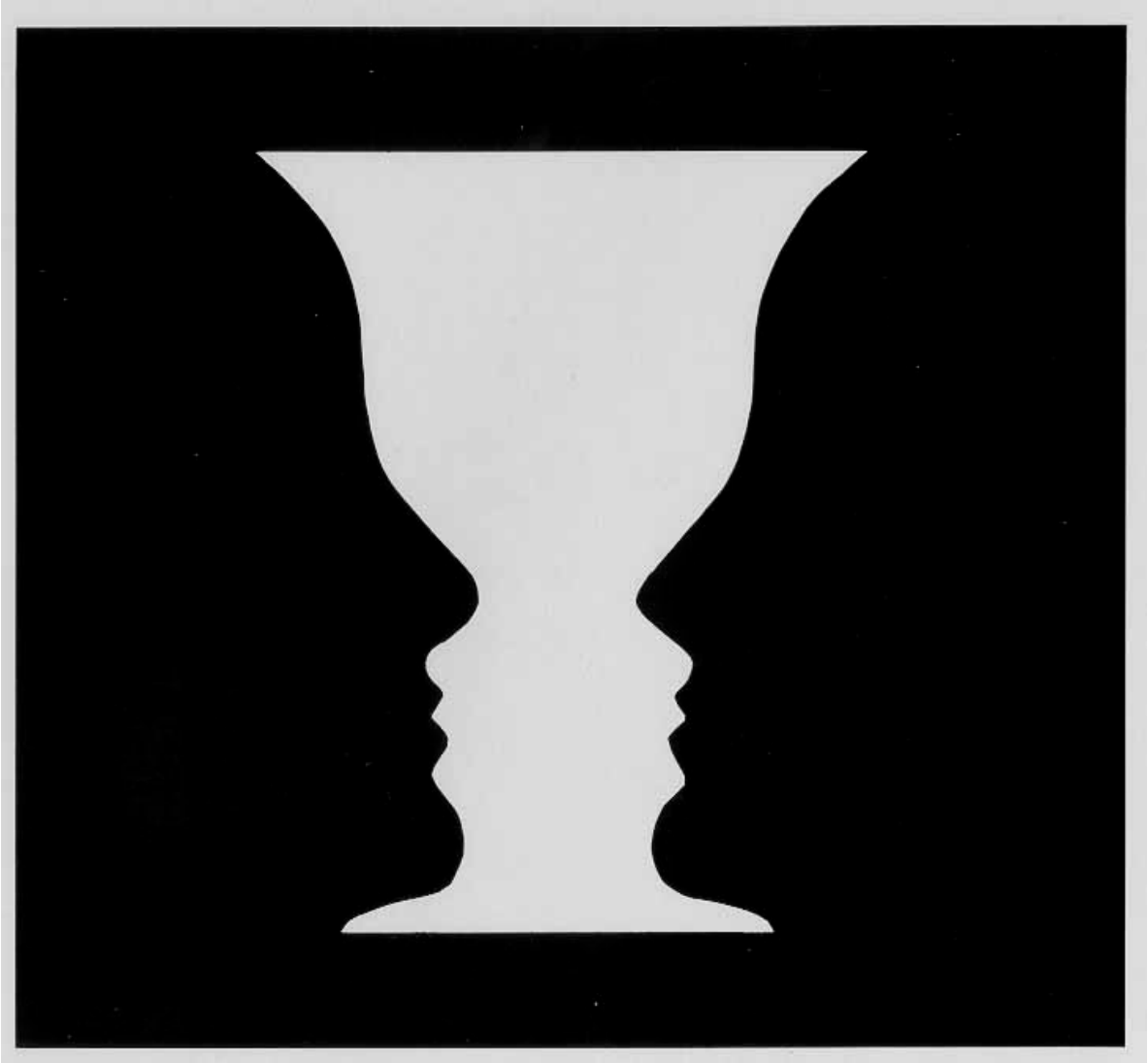


Julian Hochberg

Irvin Rock

The Rubin Vase

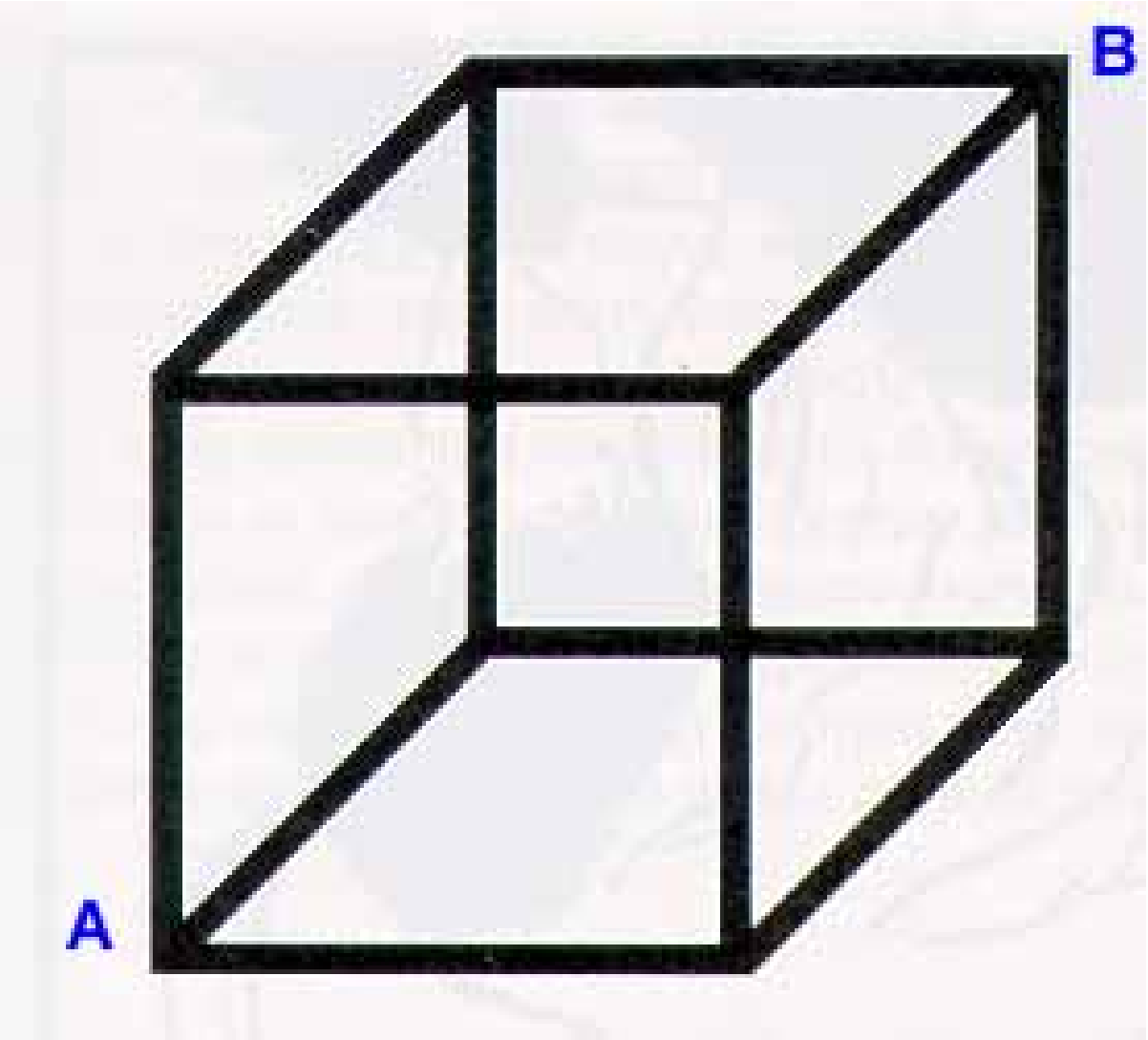
Rubin (1915)



Silver Jubilee
of
Queen Elizabeth II

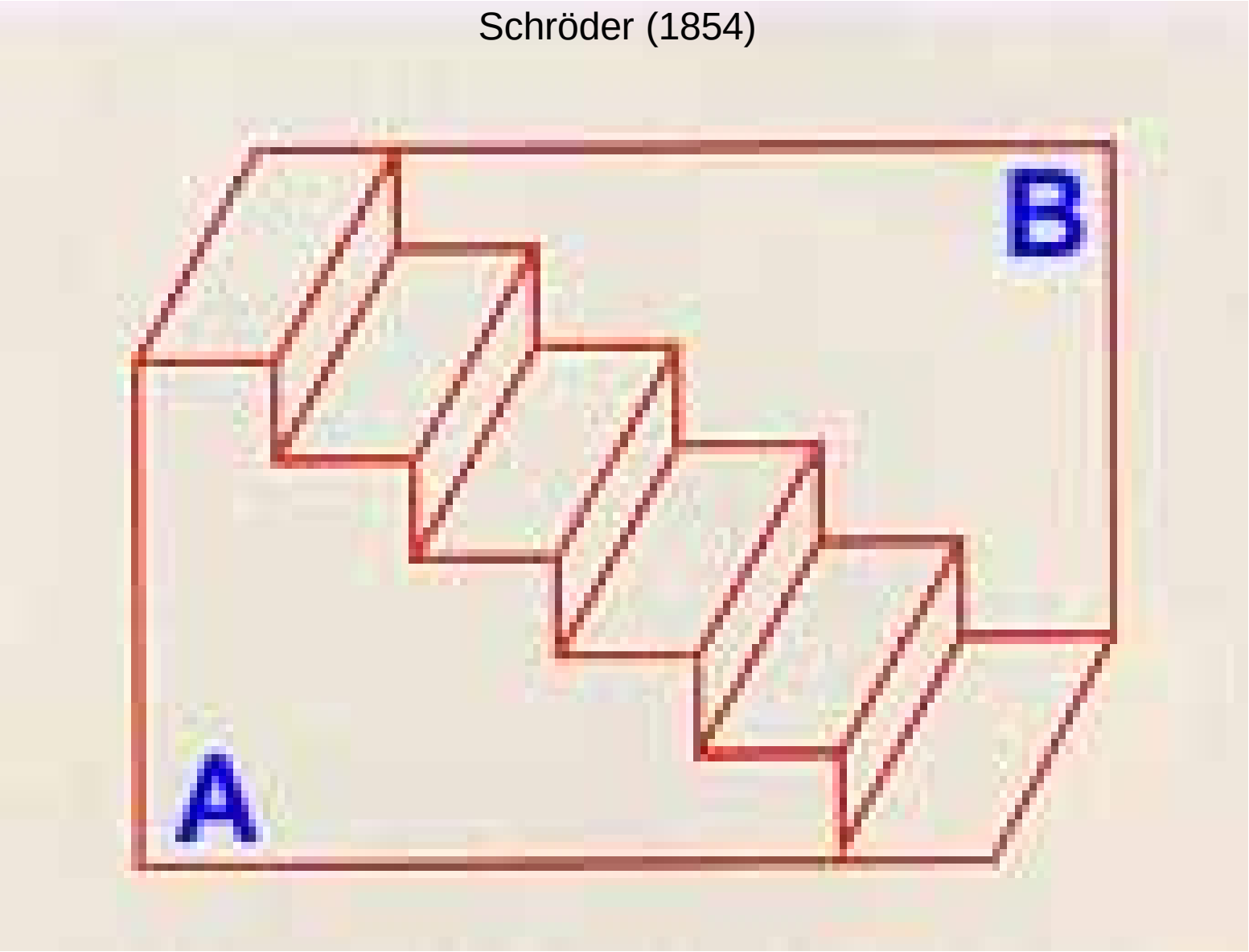
The Necker Cube

Necker (1832)



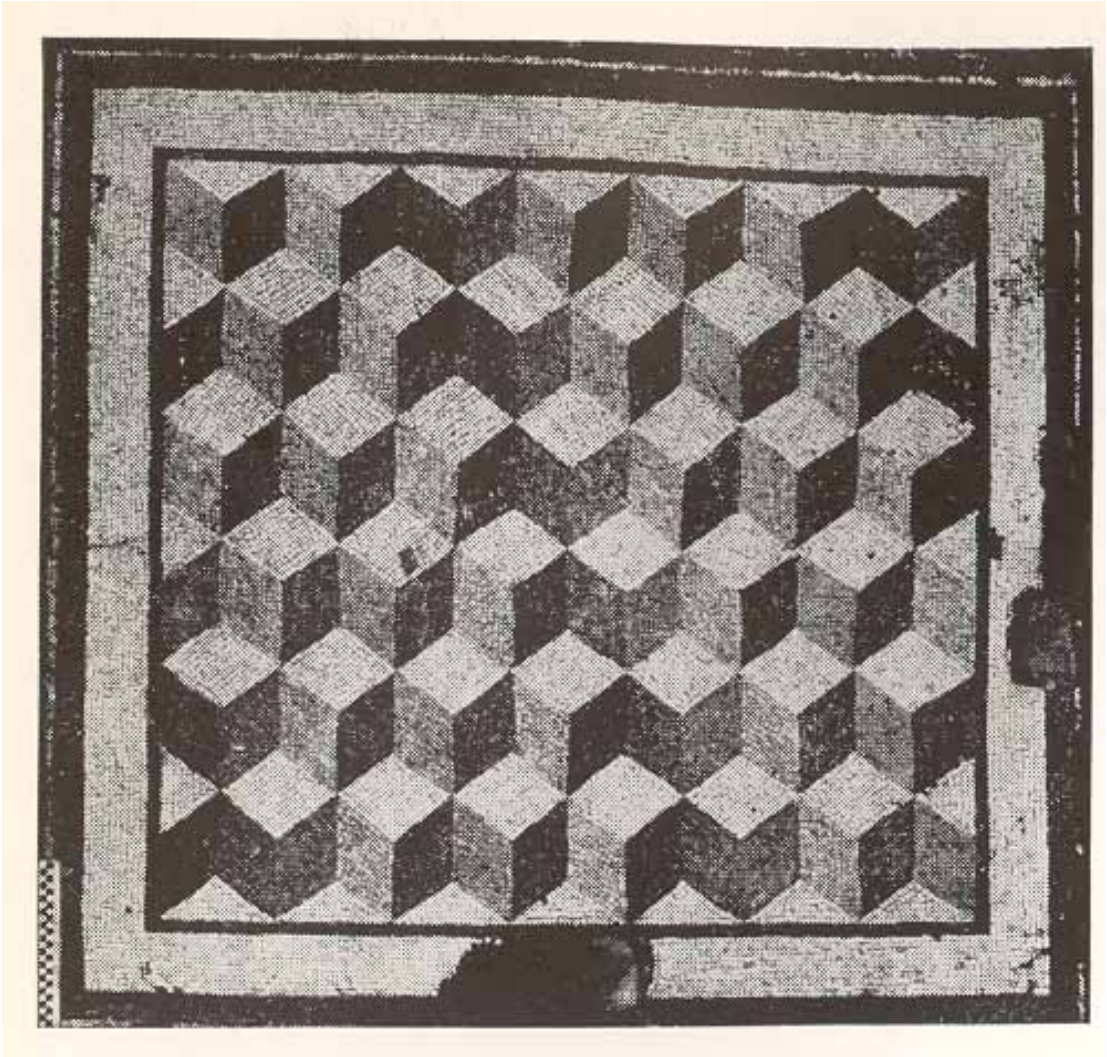
The Schröder Staircase

Schröder (1854)

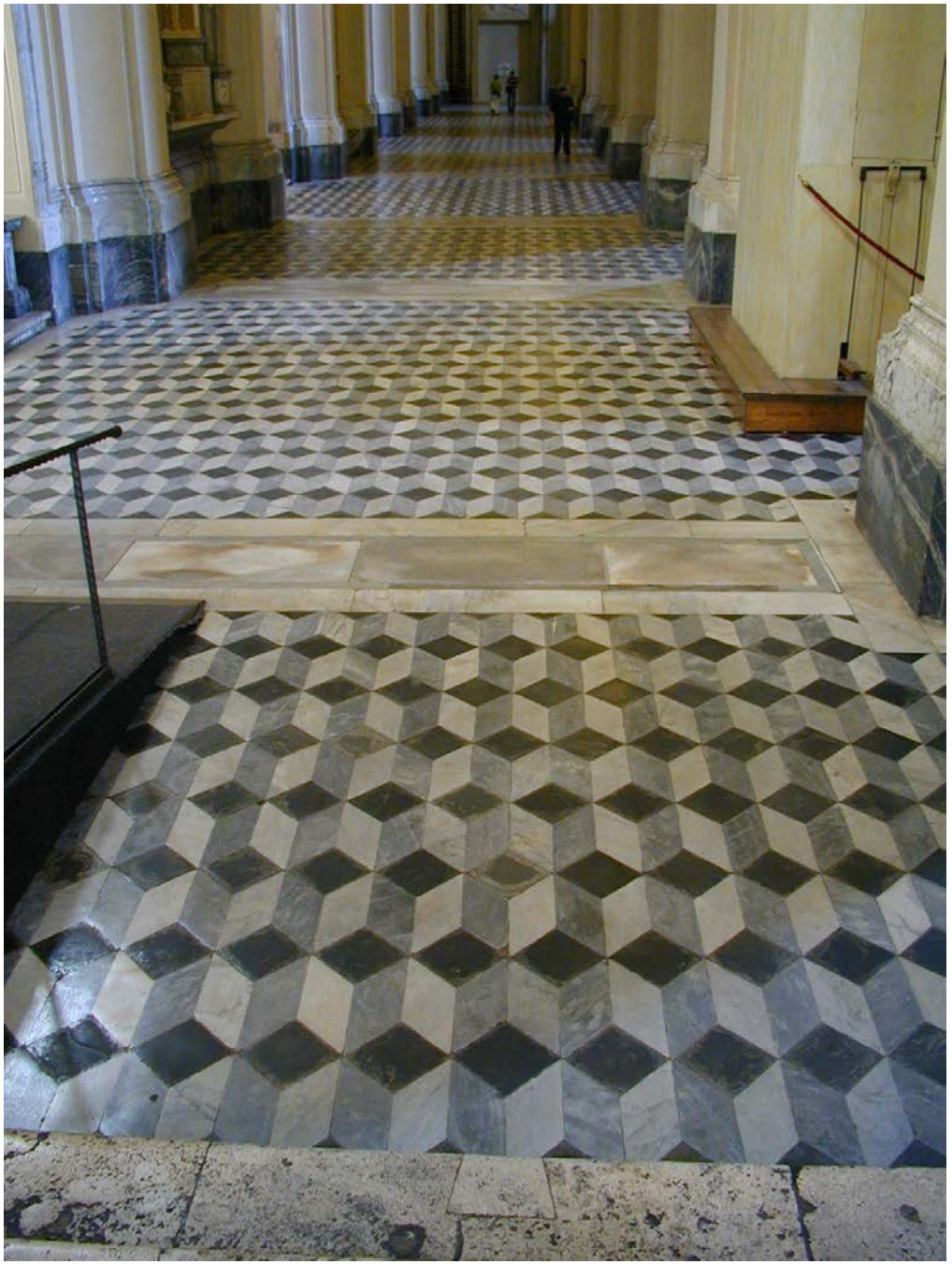


The “Antioch Cube”

Gombrich (1960)



San Giovanni Laterno
Rome, c. 1587



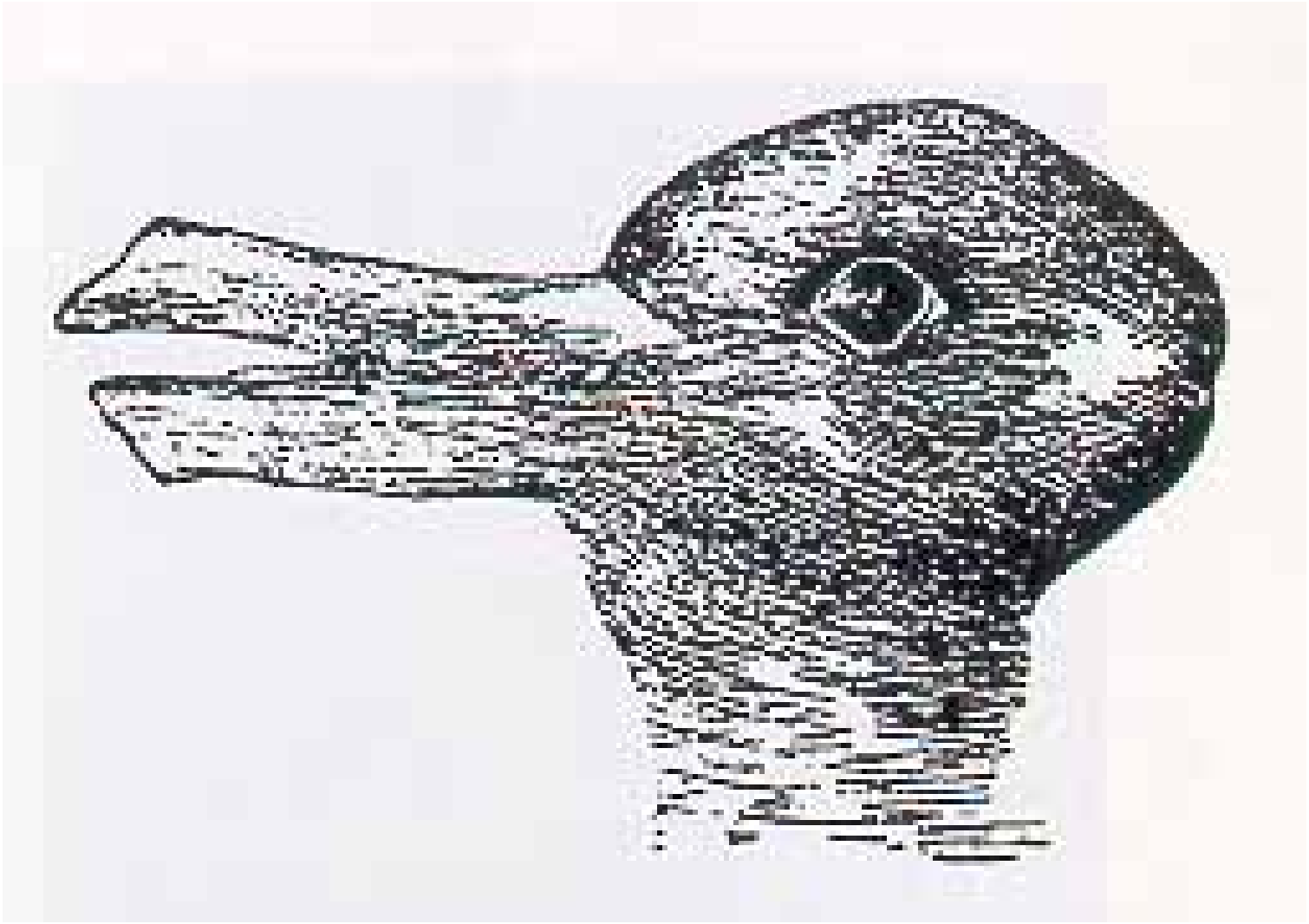
The “Boring” Figure

Boring (1930)*; Puck* (1915)

The Jastrow Figure

Jastrow (1899, 1900)

Harper's Weekly (1892); *Die Fliegende Blatter* (1892)

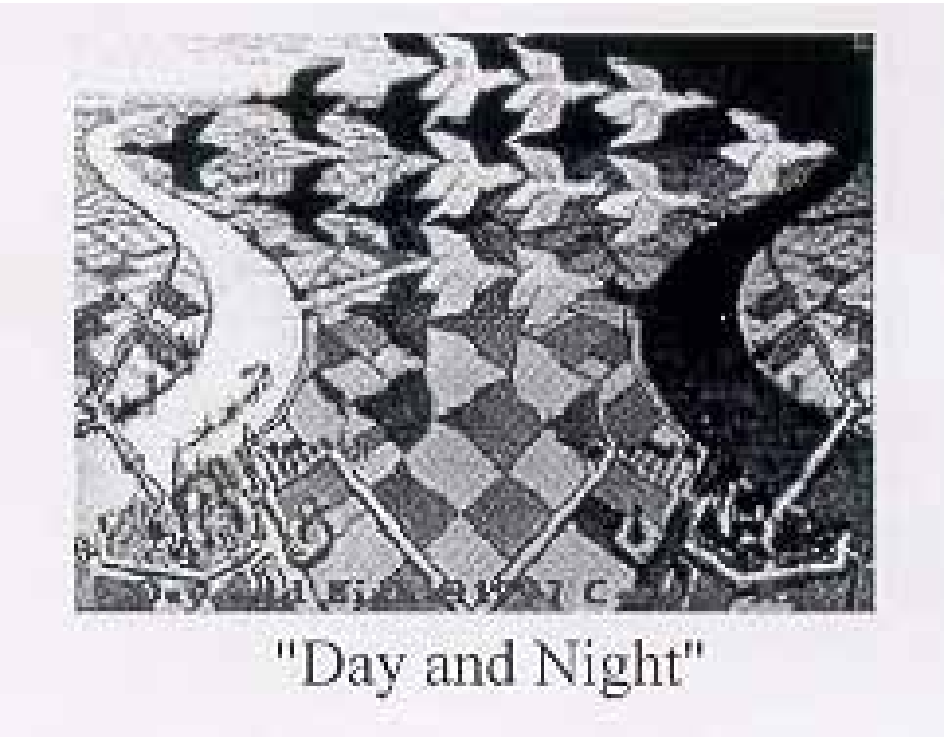


Ambiguous Figures

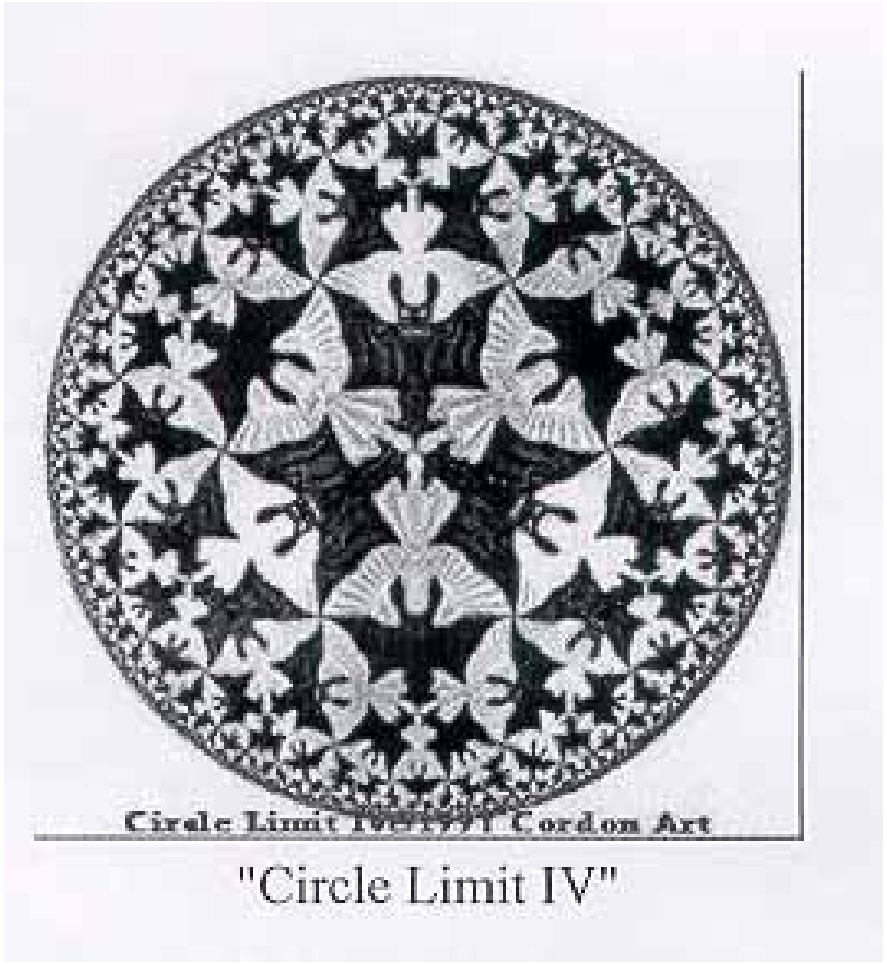
Reversible Figures
Bistable Figures

- Pattern of proximal stimulation constant
  - Retinal image doesn't change
- Perception of distal stimulus is changes
  - Mental representation does change

MC. Escher



"Day and Night"

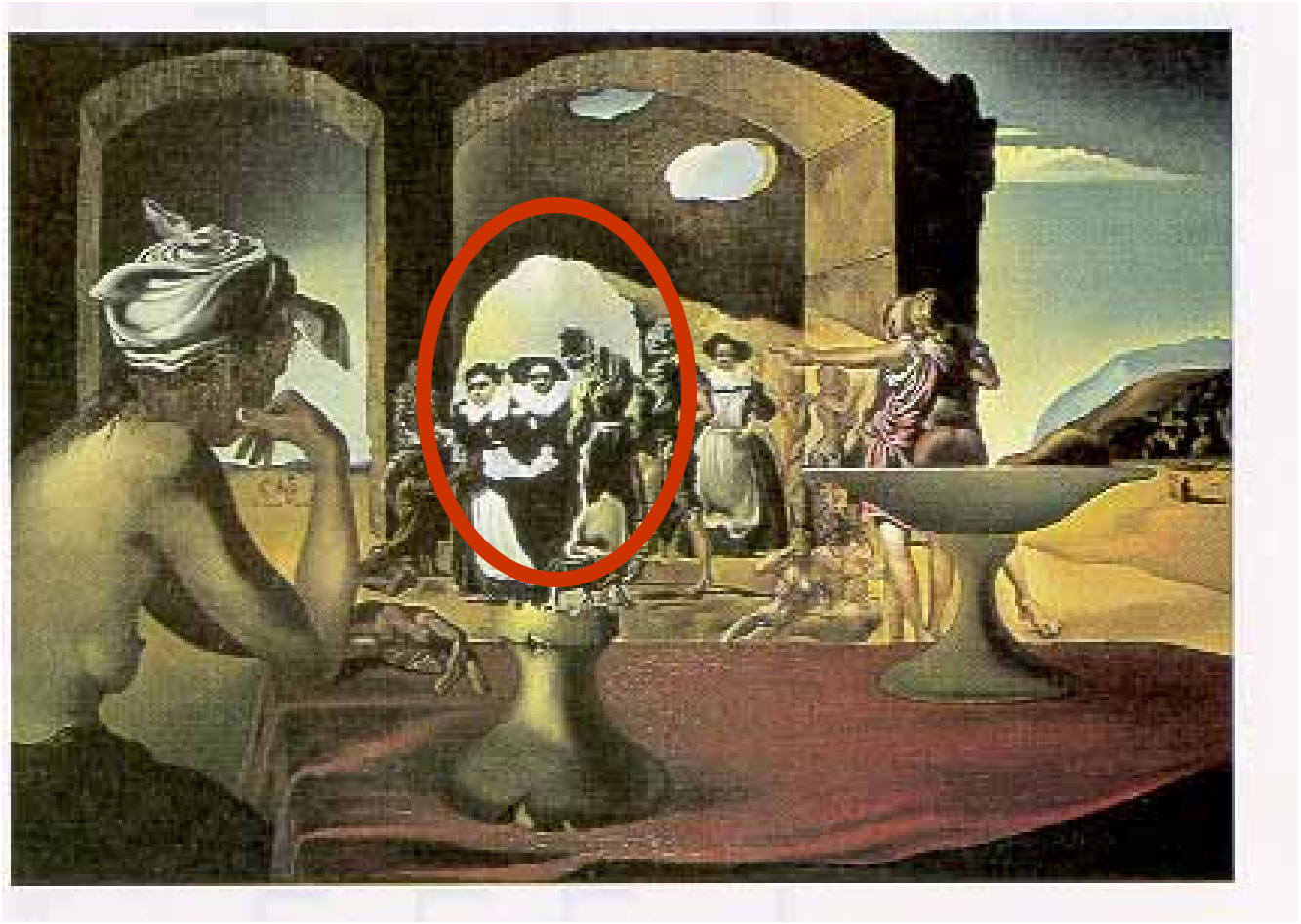


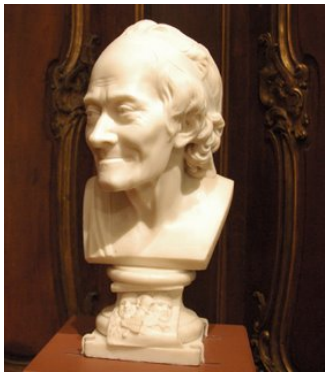
"Circle Limit IV"

Salvador Dali

“Slave Market with Disappearing Bust of Voltaire”

Dali (1940), after Houdon (1778)

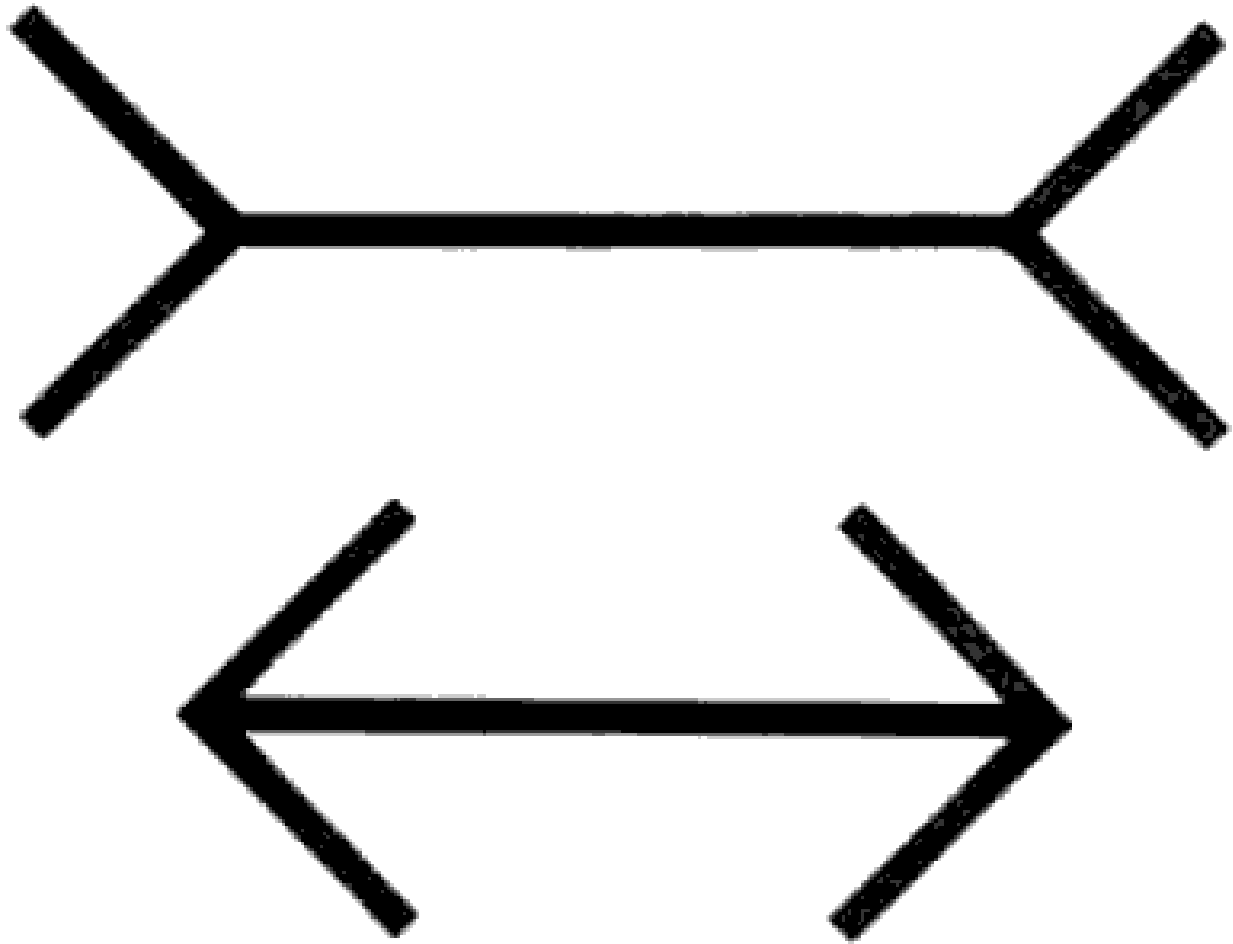




The Müller-Lyer Illusion

Müller-Lyer (1889)

-



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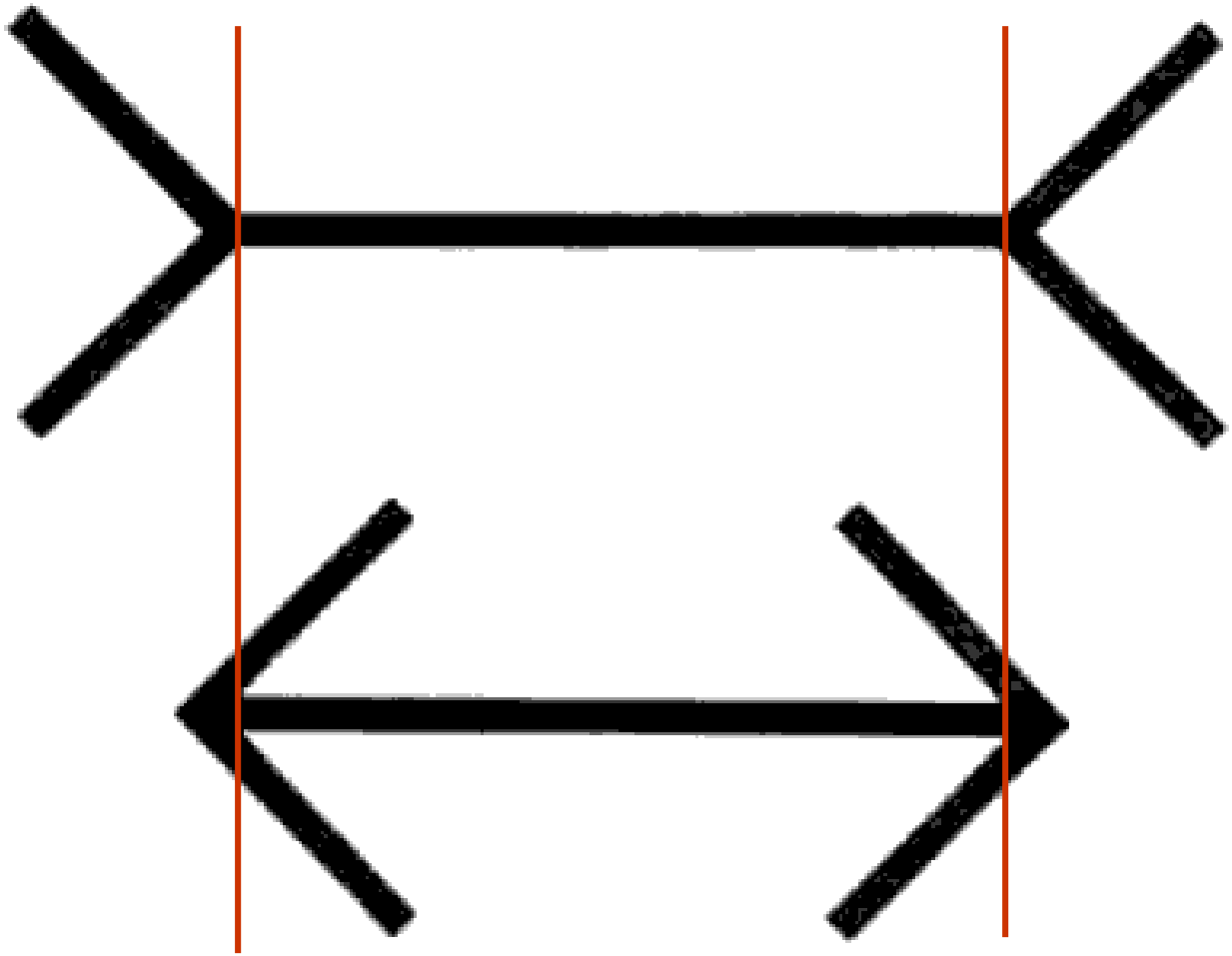


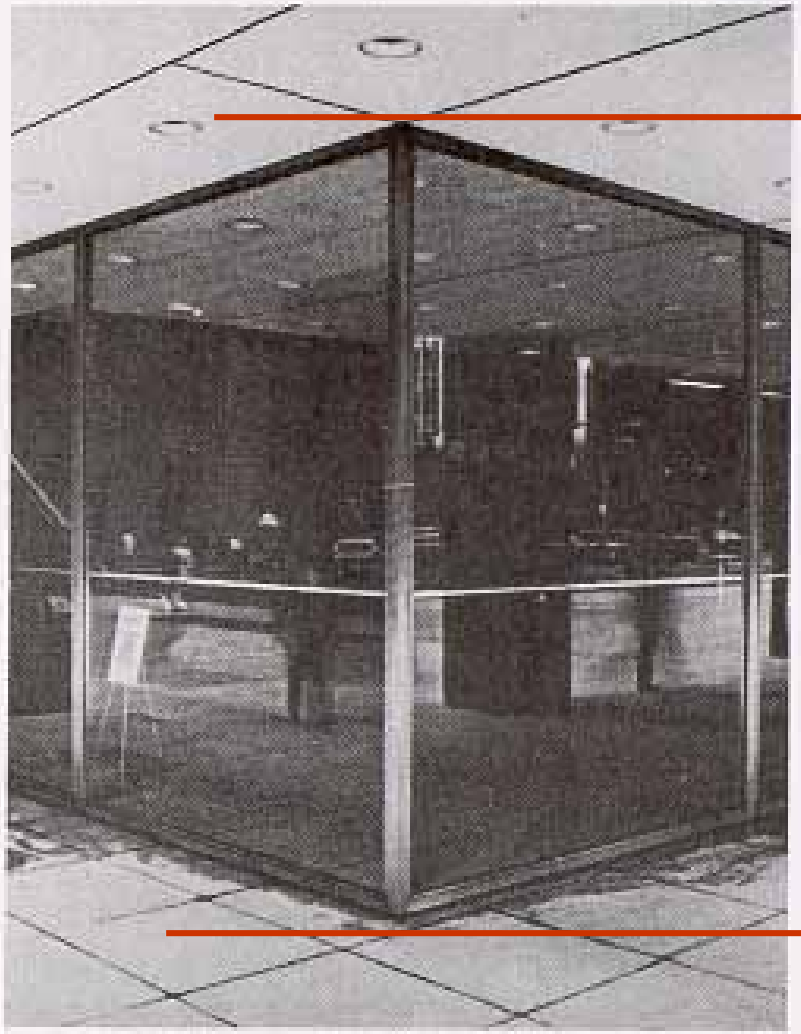
Muller-Lyer Illusion

Convex Corner

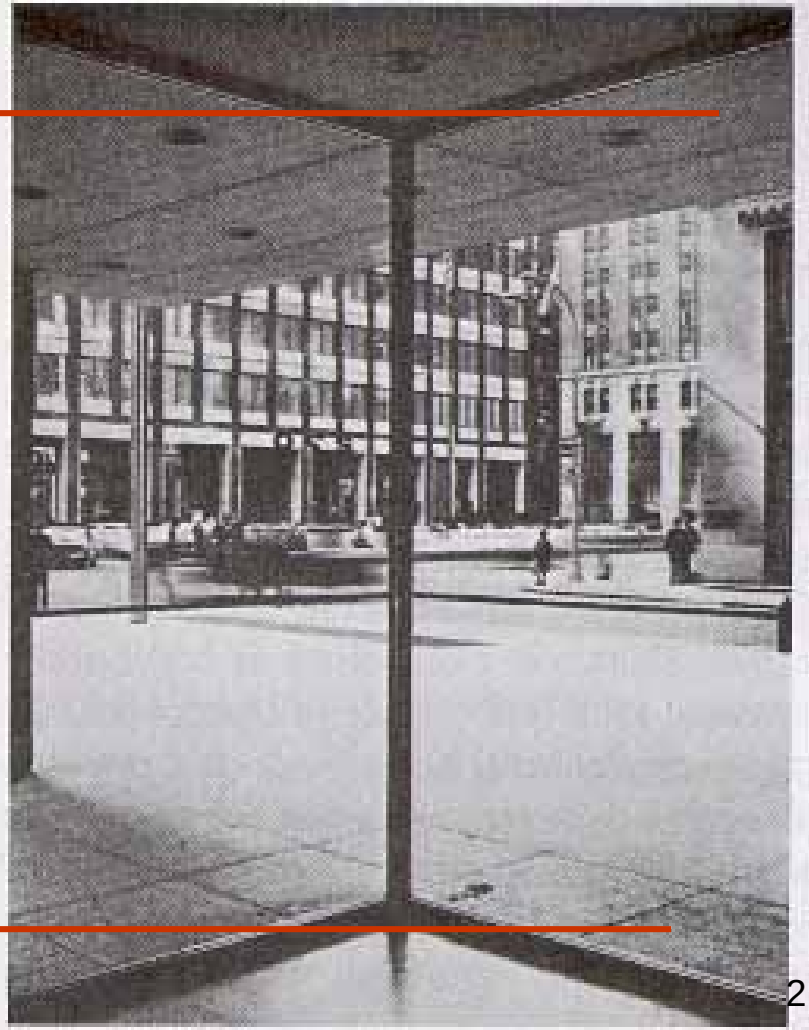
Concave Corner

Muller-Lyer Illusion

Convex Corner

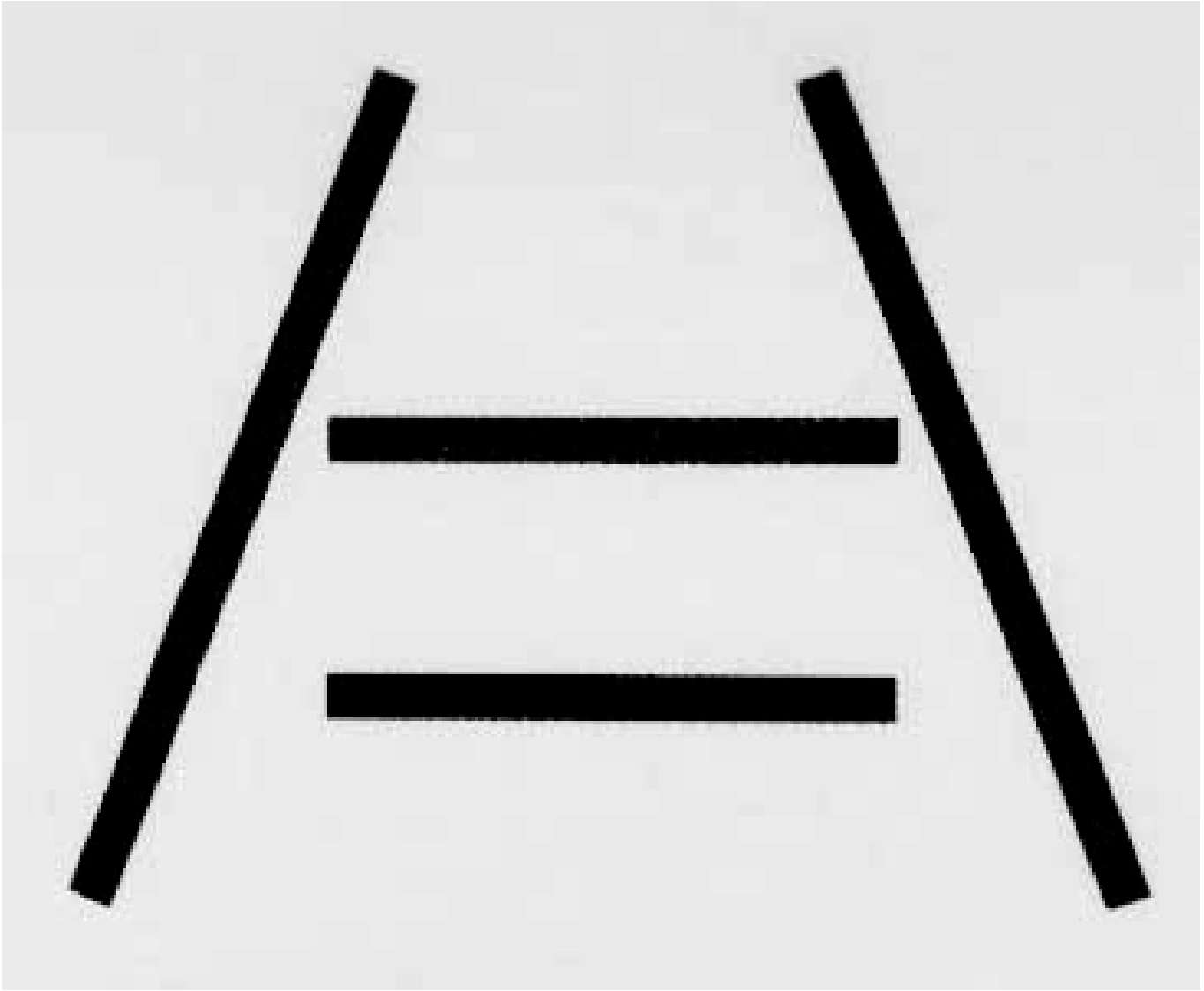


Concave Corner



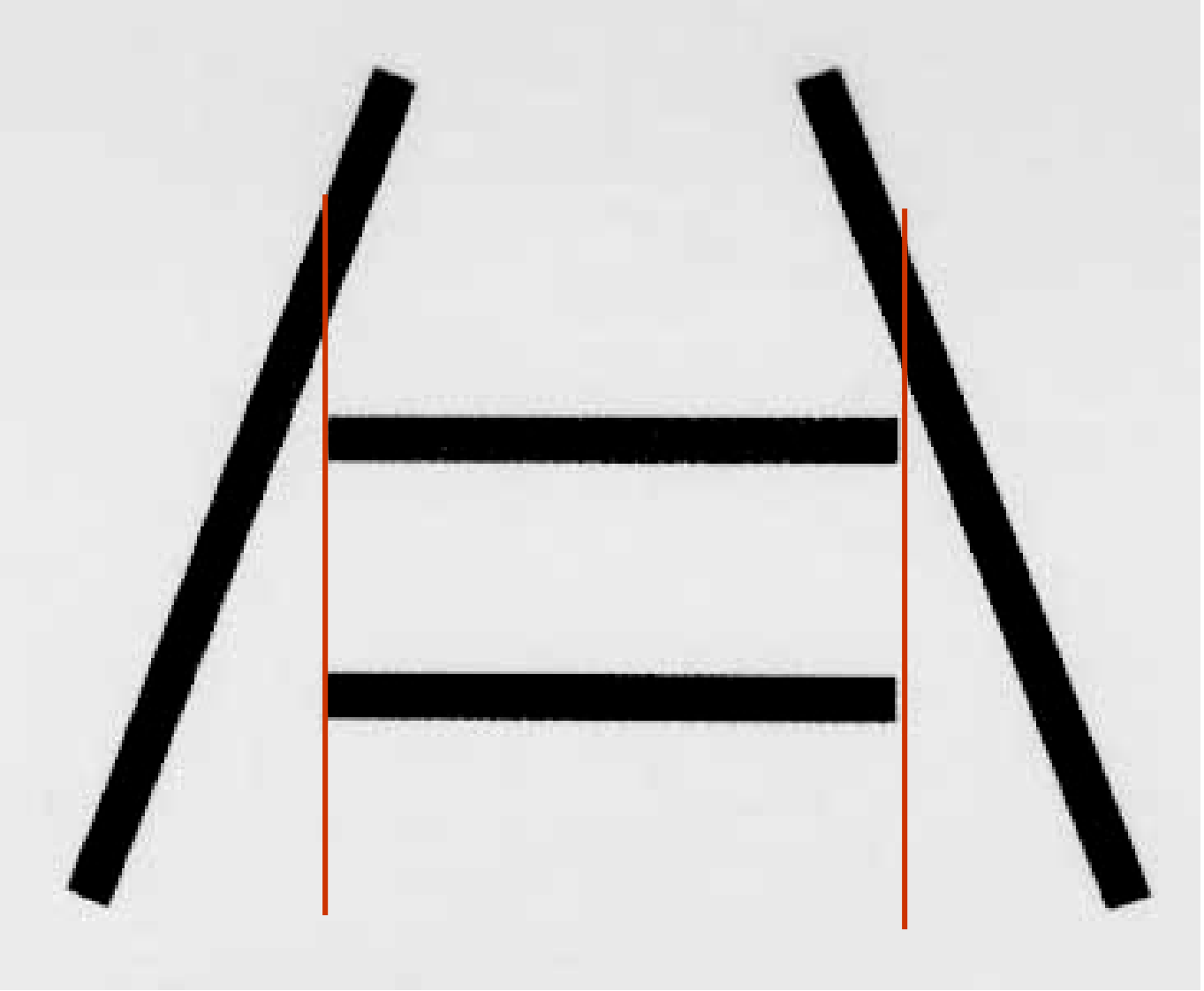
The Ponzo Illusion

Ponzo (1913)



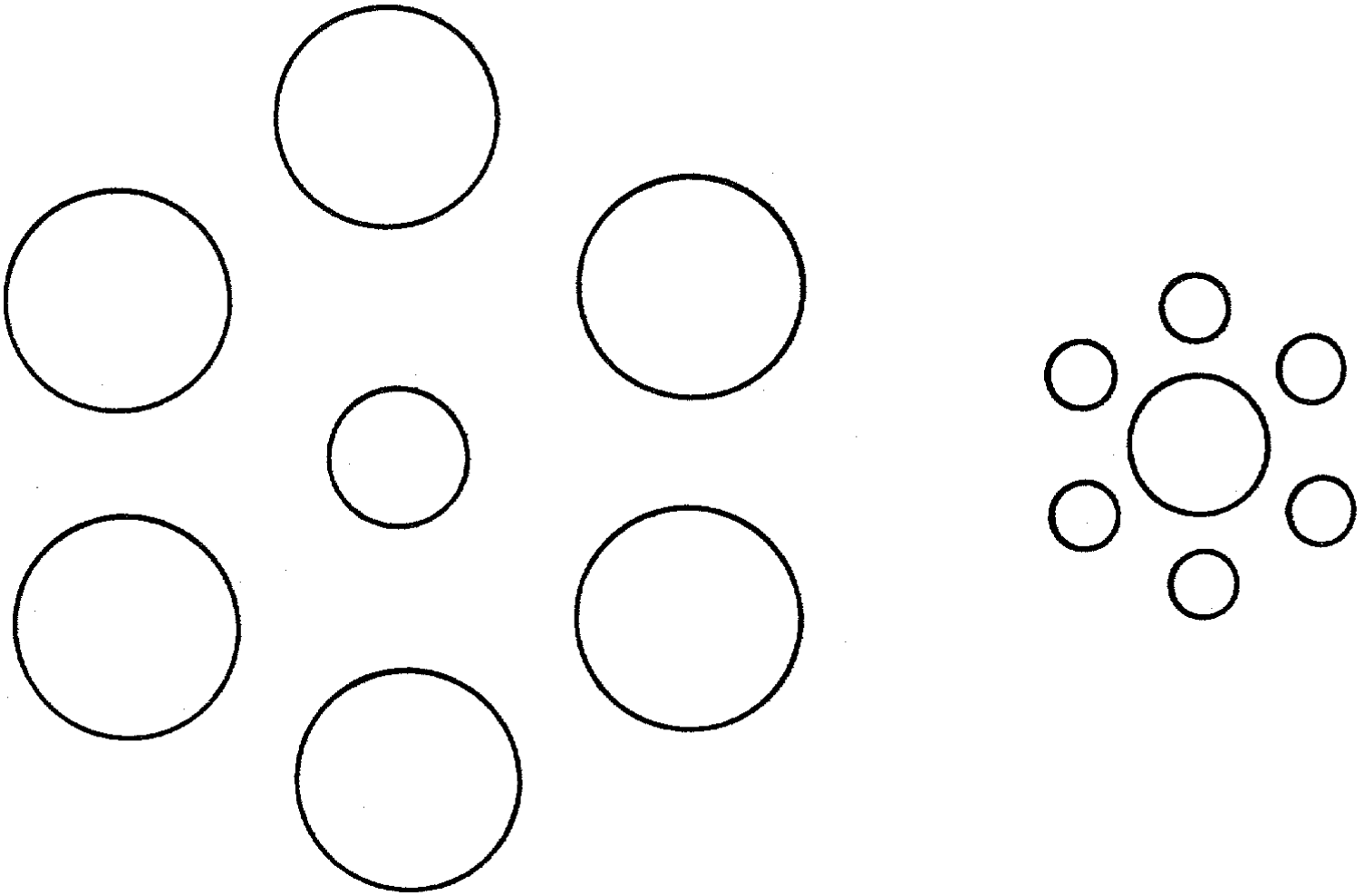
The Ponzo Illusion

Ponzo (1913)



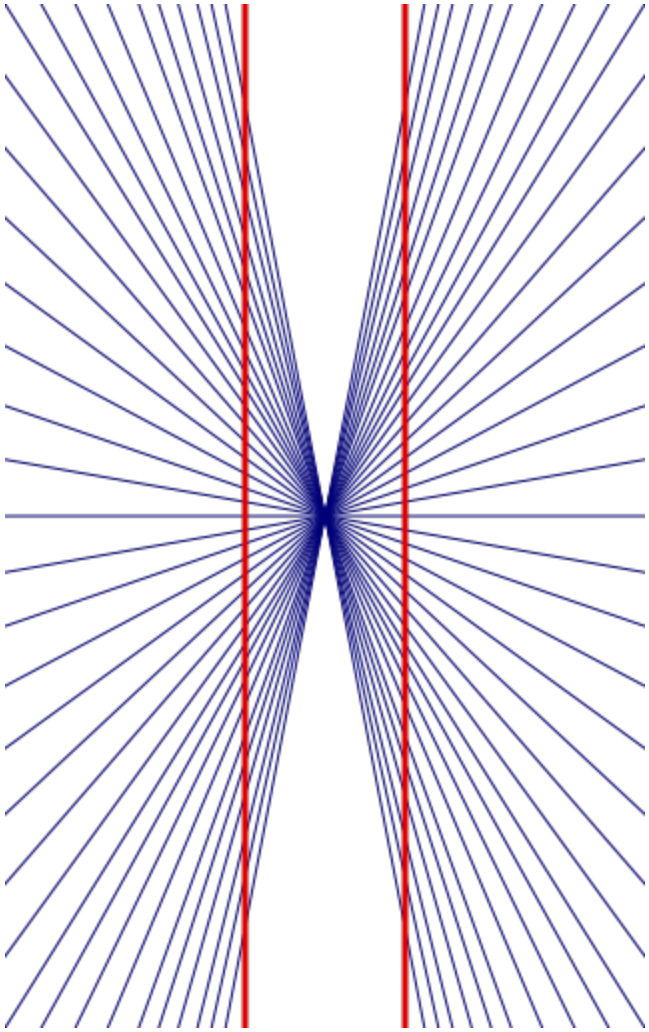
The Ebbinghaus Illusion

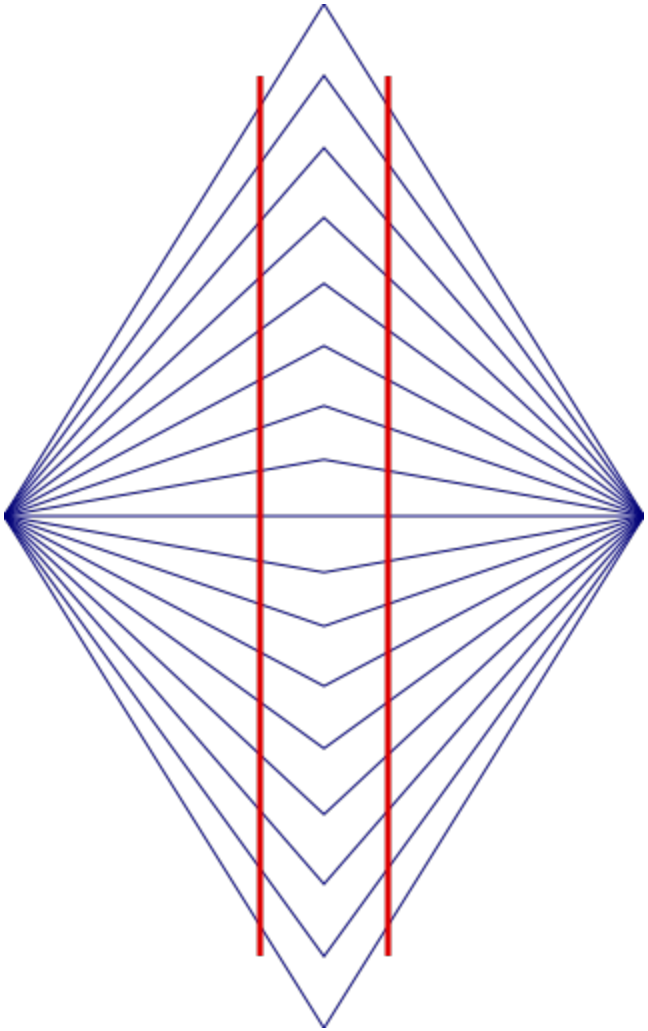
Ebbinghaus (1897); aka “Titchener Circles” (1901)



Parallel Lines Illusions

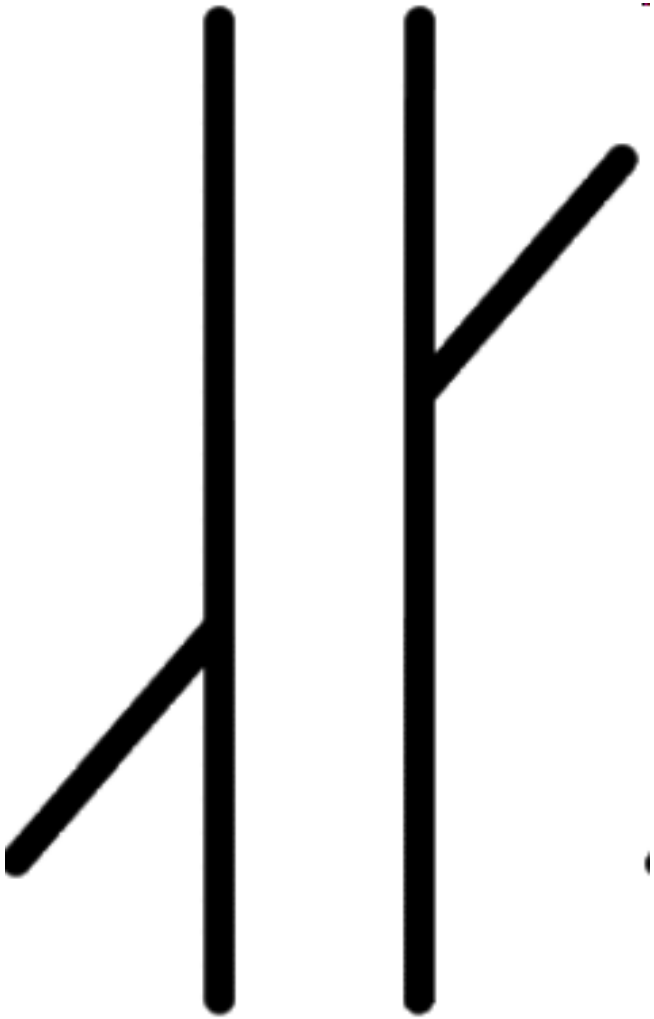
Hering (1861); Wundt (1897)





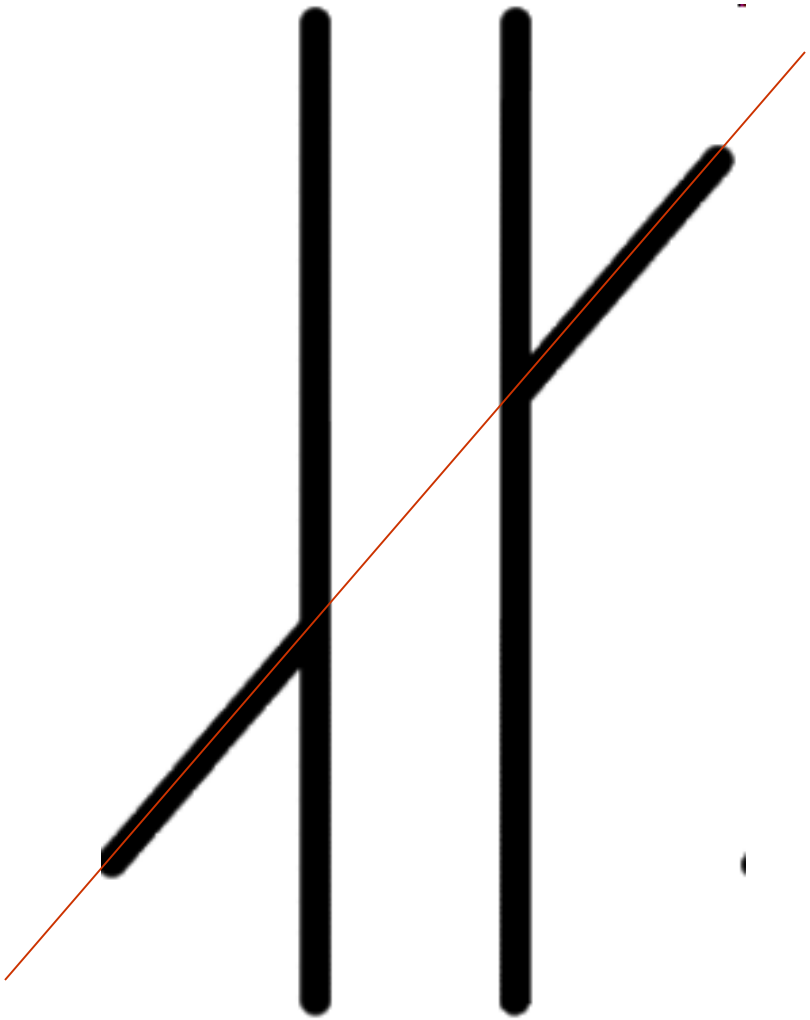
The Poggendorf Illusion

Poggendorff (1860), after Zollner (1860)



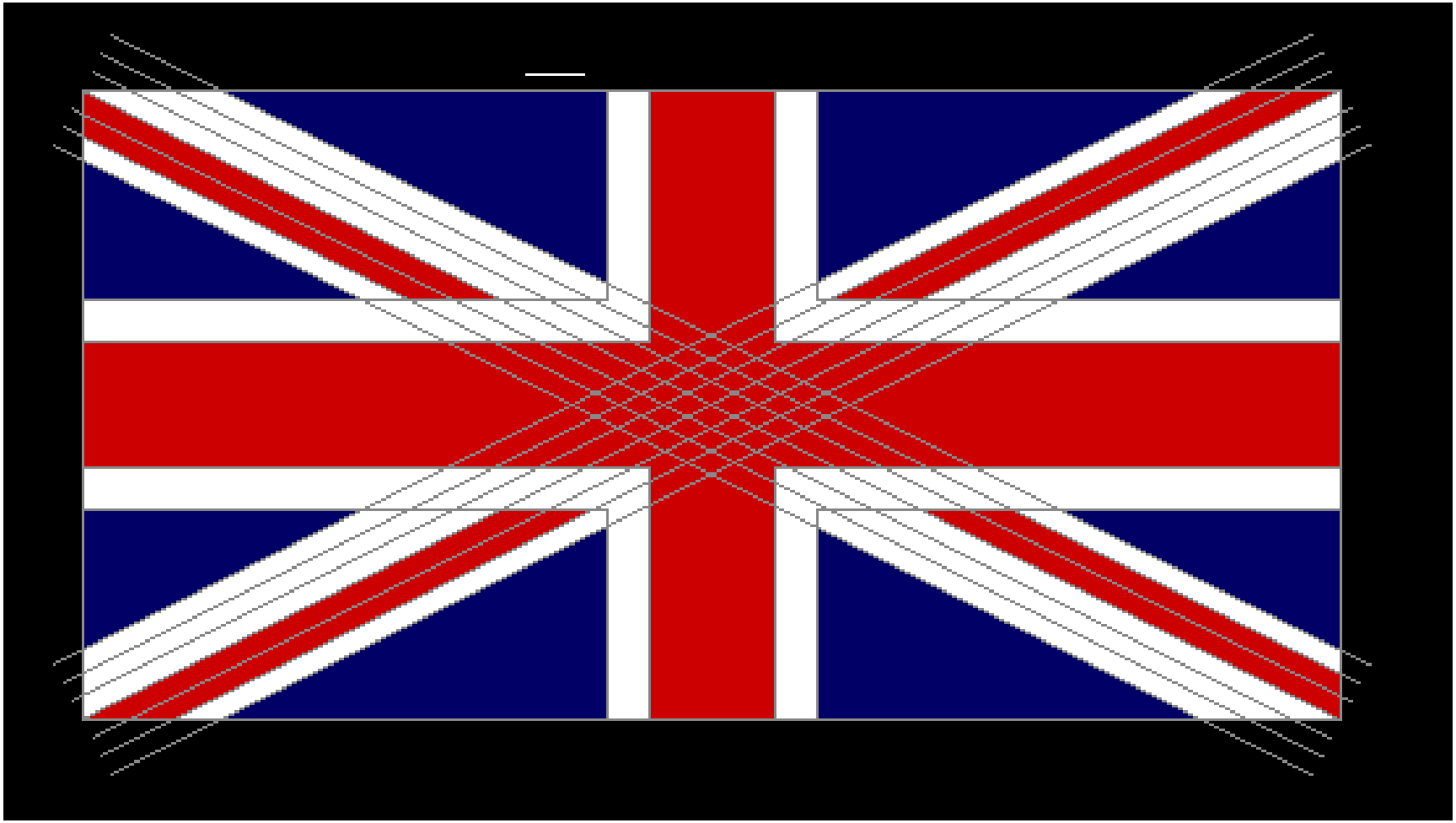
The Poggendorf Illusion

Poggendorff (1860), after Zollner (1860)



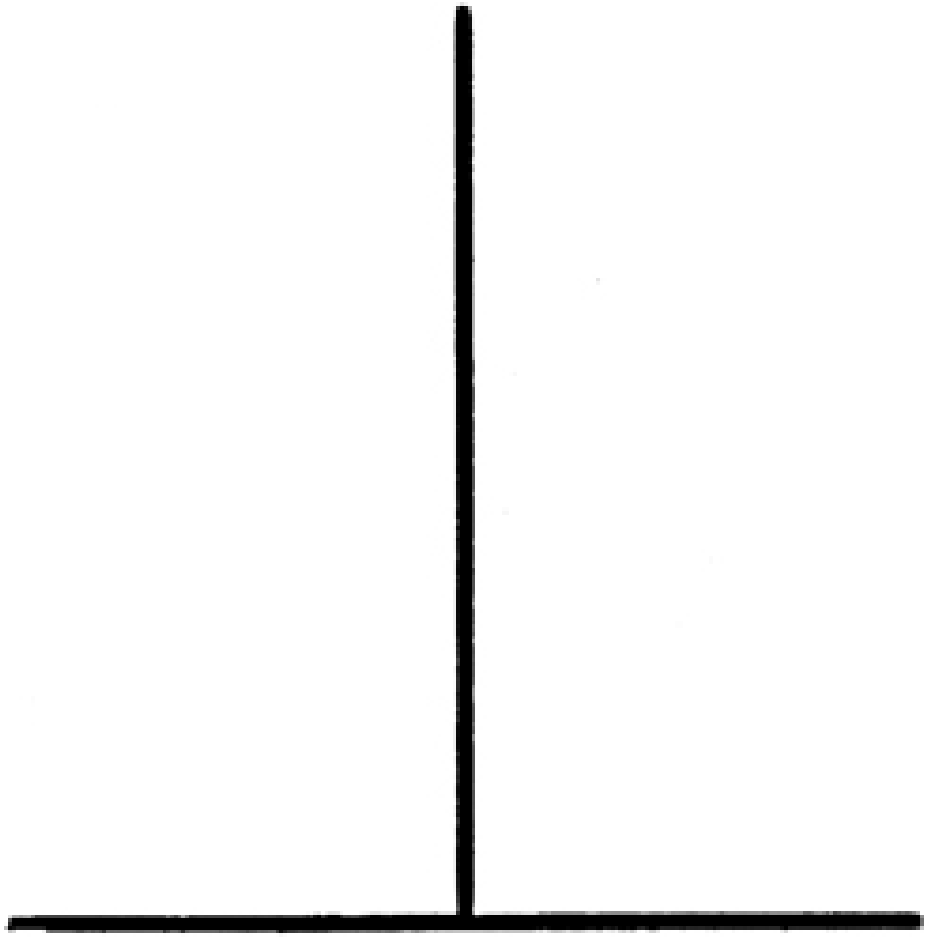
The Poggendorf Illusion and the Union Jack

Poggendorff (1860), after Zollner (1860)



Horizontal-Vertical Illusion

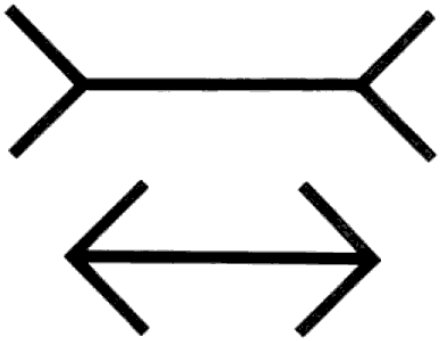
Wundt (1858), after Fick (1851)



Gateway Arch, St. Louis

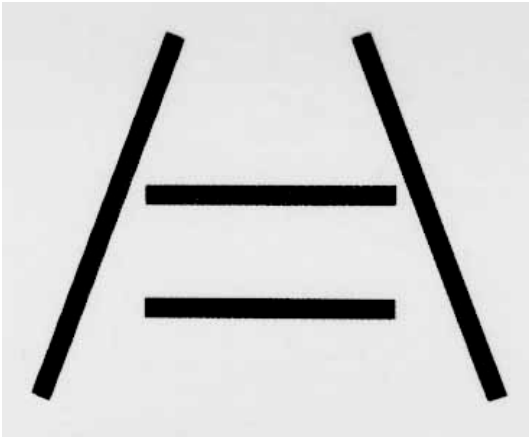
Eero Saarinen (1947)

Unconscious Inference in Illusions



- Upper line appears farther away
  - Size an inverse function of distance
- Retinal image same size as lower line
- Therefore the upper line must be longer than the lower line

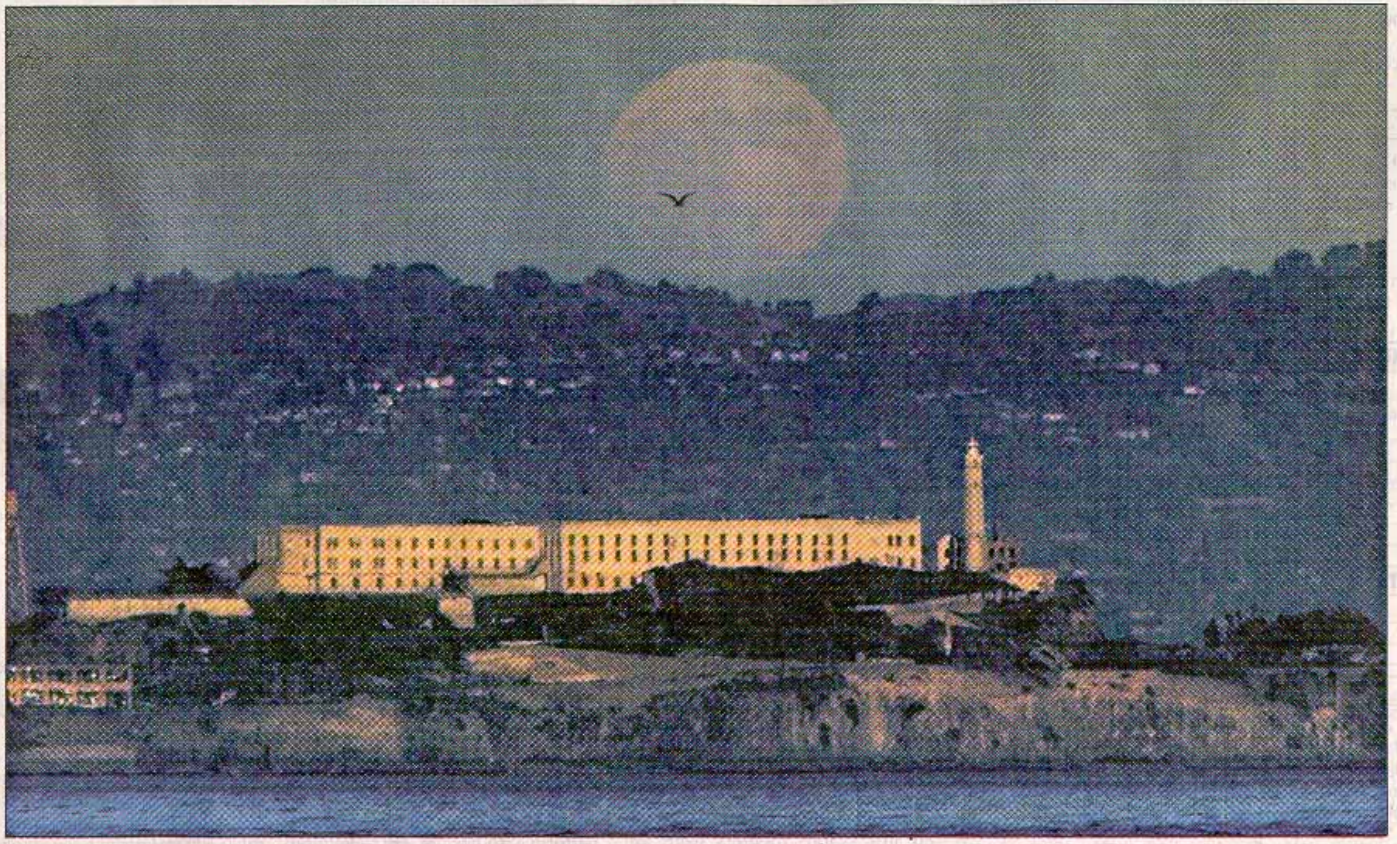
Unconscious inferences represent
"going beyond the information given"



The Moon Illusion

Kaufman & Rock (1962); Rock & Kaufman (1962)

Moonshine on the Bay



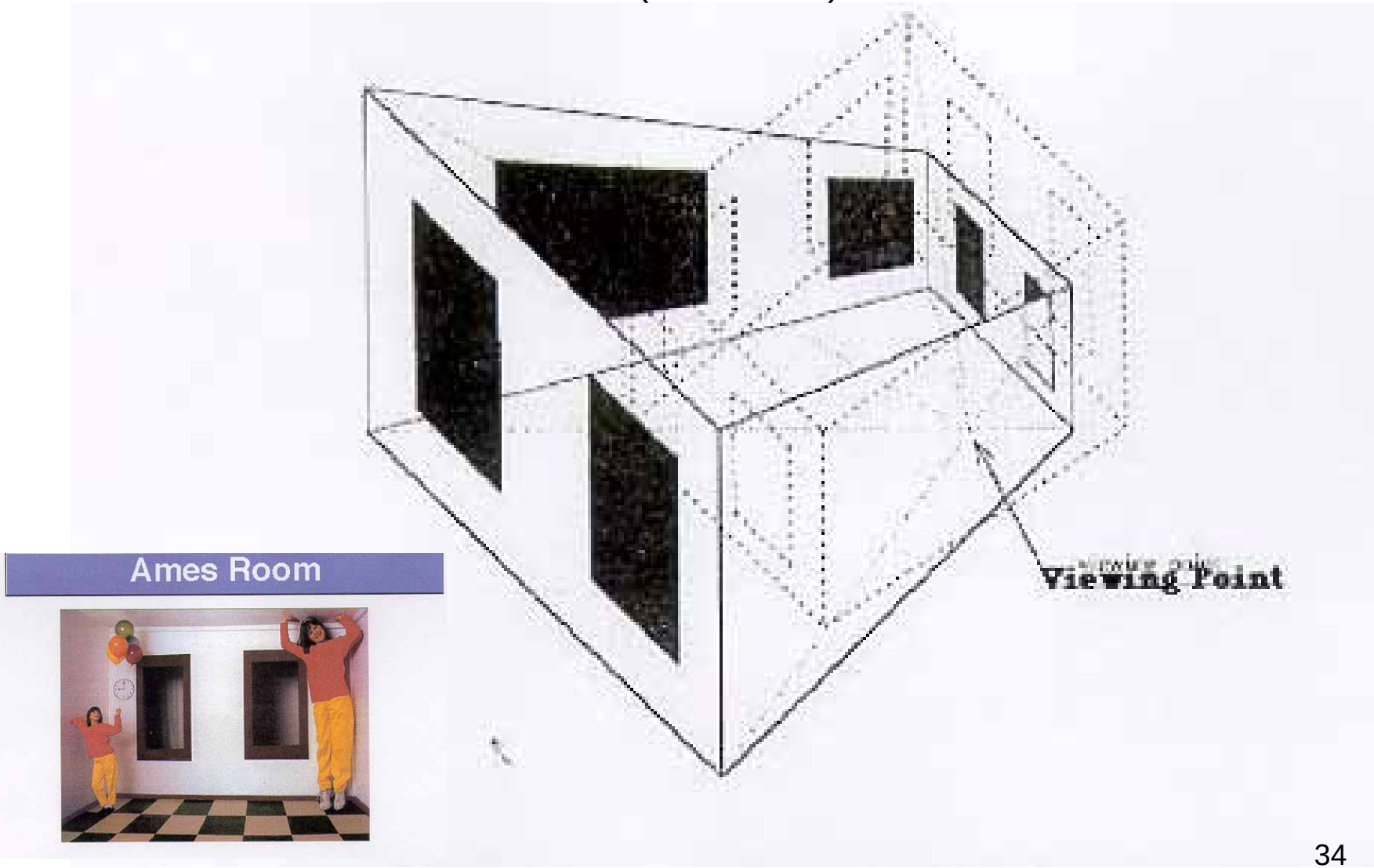
FREDERIC LARSON / *The Chronicle*

Alcatraz Island and the full moon over the Berkeley hills highlighted the arrival of the winter solstice, the longest night of the year. Also, the moon was at its closest point to the Earth last night, appearing 14 percent bigger than usual. And there are only 12 days until the Earth's perihelion, the planet's closest point to the sun. Since the moon shines with reflected sunlight, it was 7 percent brighter than usual. These events occur together only once every 133 years.

Ames Room

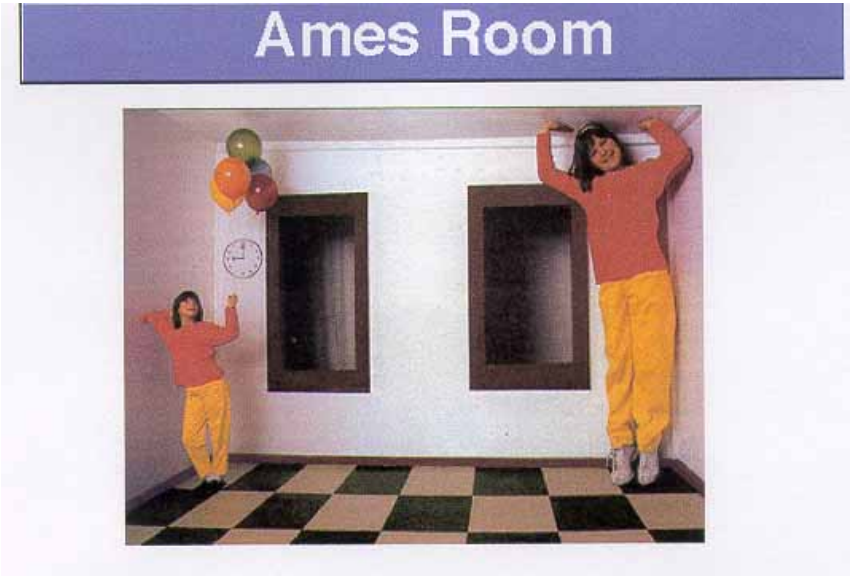
How the Ames Room Works

Ames (1934-1935)



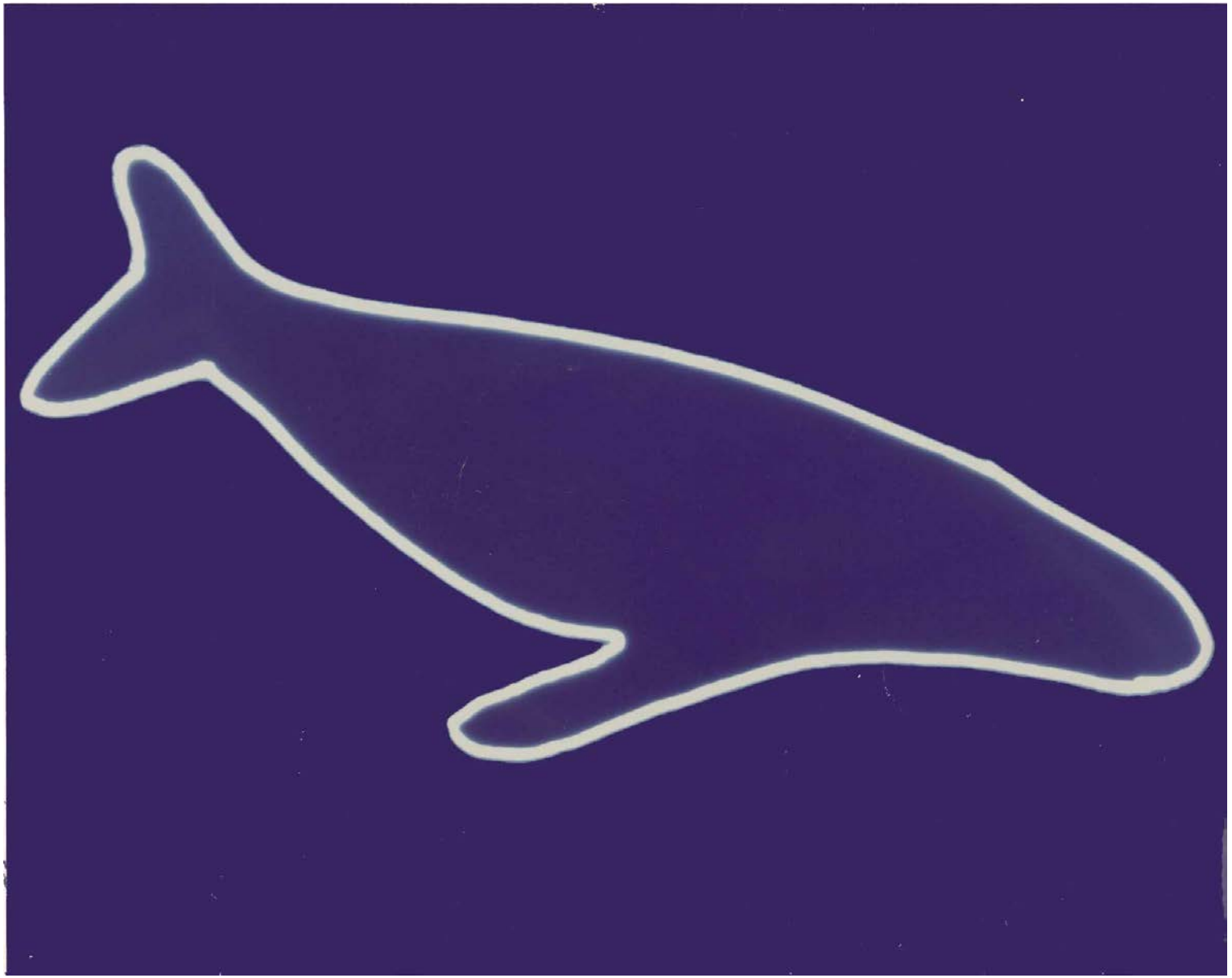
Distance Cues and Unconscious Inference in the Ames Room

- Lack of distance cues
  - Misleading stimulus information
- Unconventional geometry
  - Inappropriate expectations
- No compensation for differences in retinal size



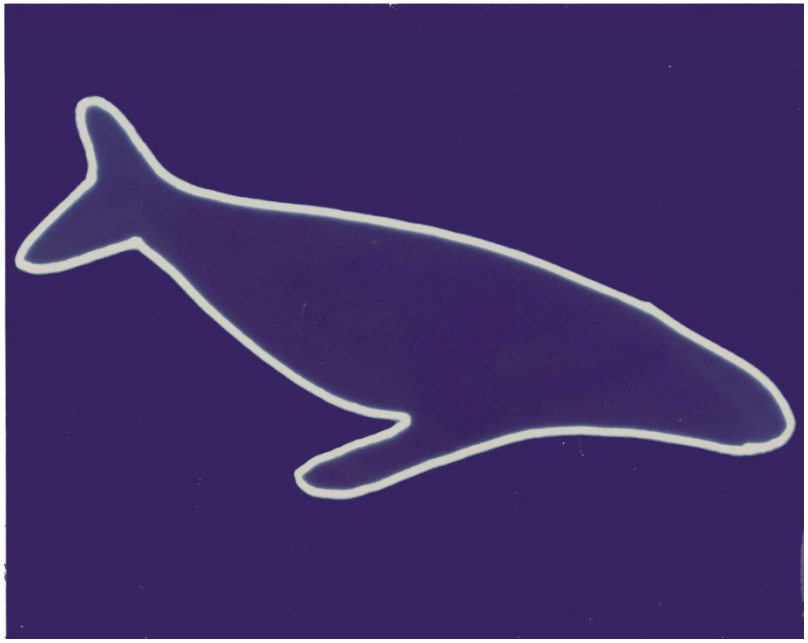
“Shiprock” or “Rock with Wings”?

Tse’Bit’Ai

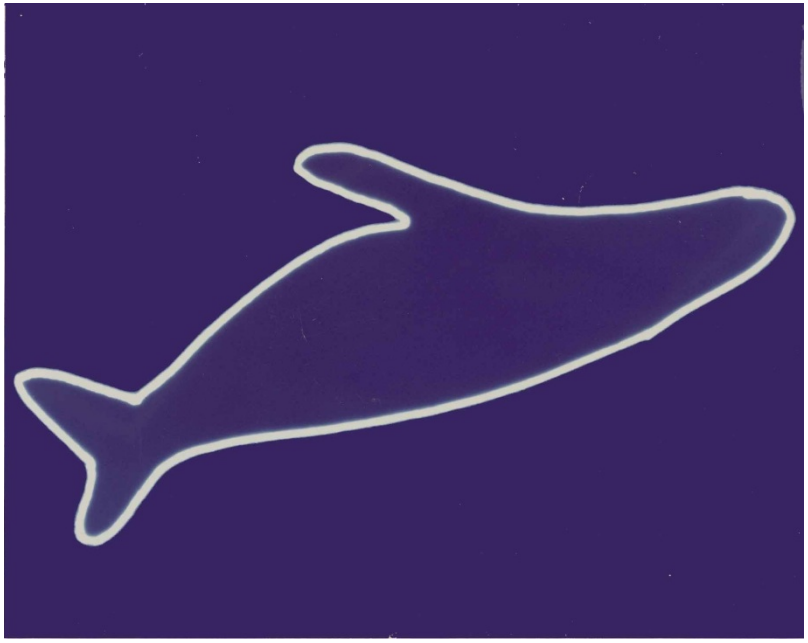


Two Views of the Arizona Whale-Kangaroo

Canonical

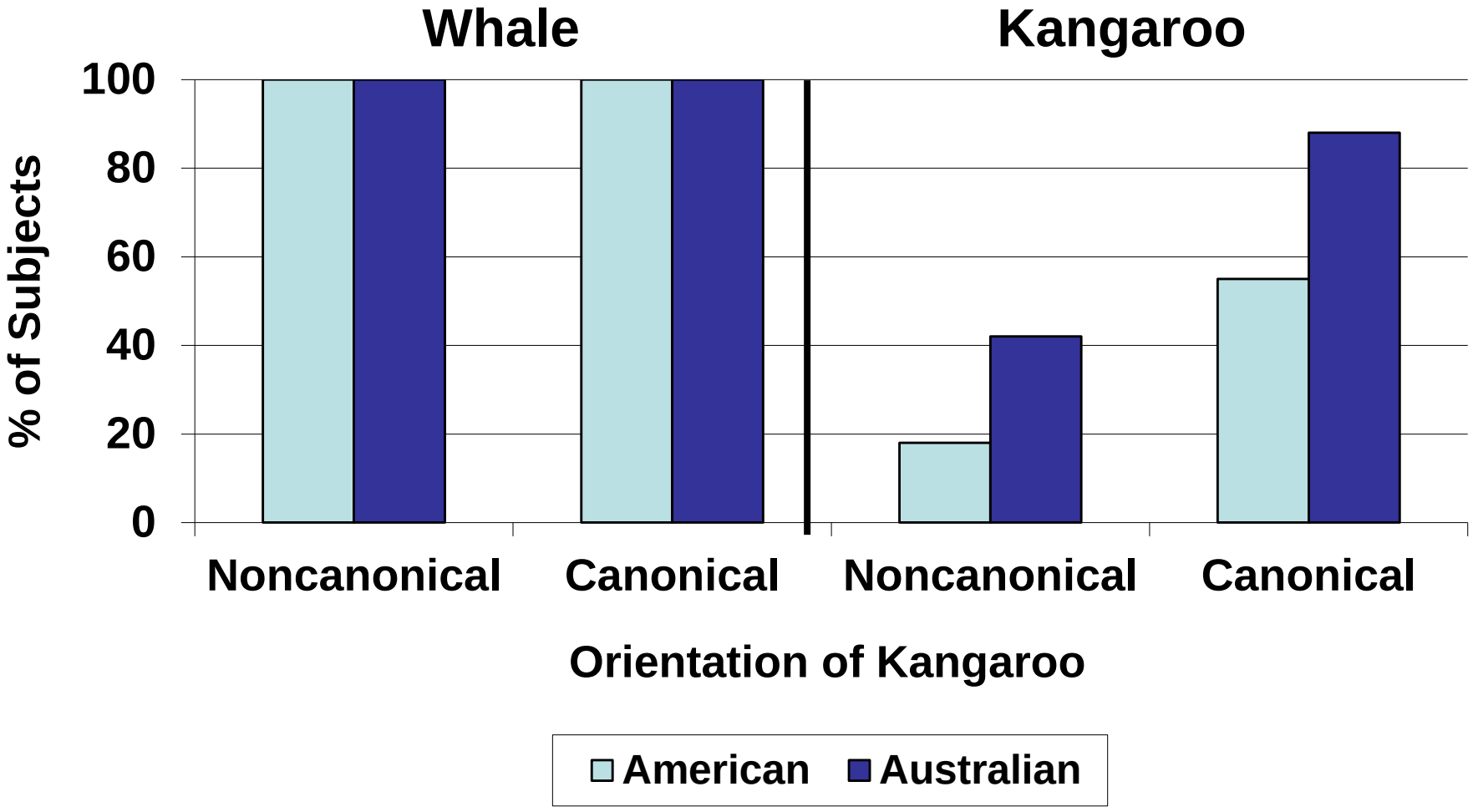


Noncanonical



Comparative Frequency of Percept

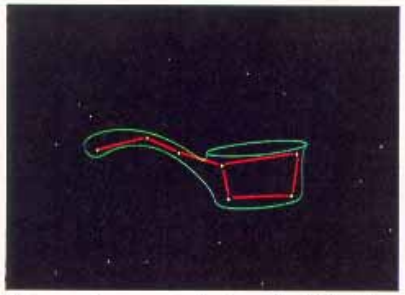
Kihlstrom, Peterson, et al. (2006)



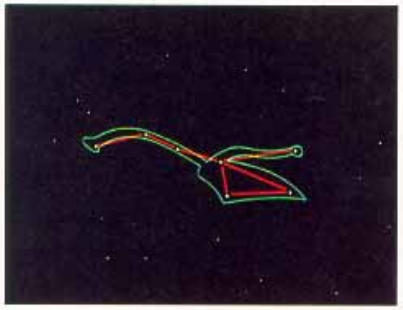
Constellations as Percepts
Orion, Taurus, and Friends

Perceptions of *Ursa Major*

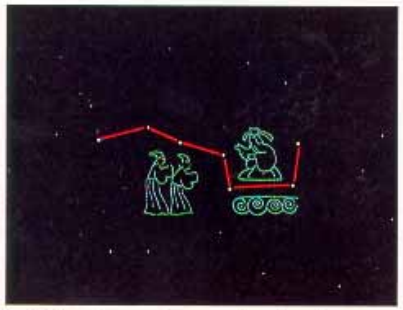
Japan Aerospace Exploration Agency
Carl Sagan, *Cosmos*



The northern constellation called The Big Dipper in North America. In France it is called The Casserole.



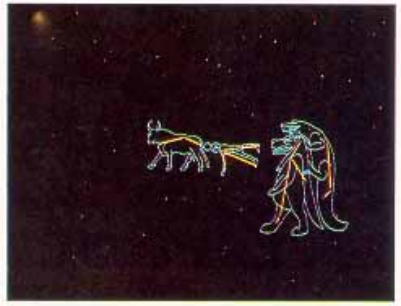
The same group of seven stars (connected by red lines) in England is called The Plough.



In China, it was imagined to be the constellation of The Celestial Bureaucrat, seated on a cloud and accompanied on his rounds about the north pole of the sky by his eternally hopeful petitioners. The above animated and photographed by Judy Kreijanovsky (Cartoon Kitchen).

In medieval Europe, the same stars were seen as Charles' Wain, or Wagon.

The ancient Greeks and Native Americans saw these stars as the tail of The Great Bear—Ursa Major.



This larger group of stars, containing The Big Dipper, was portrayed by the ancient Egyptians as a curious procession of a bull, a horizontal man or god, and a hippopotamus with a crocodile on its back. The above animated and photographed by Judy Kreijanovsky (Cartoon Kitchen).

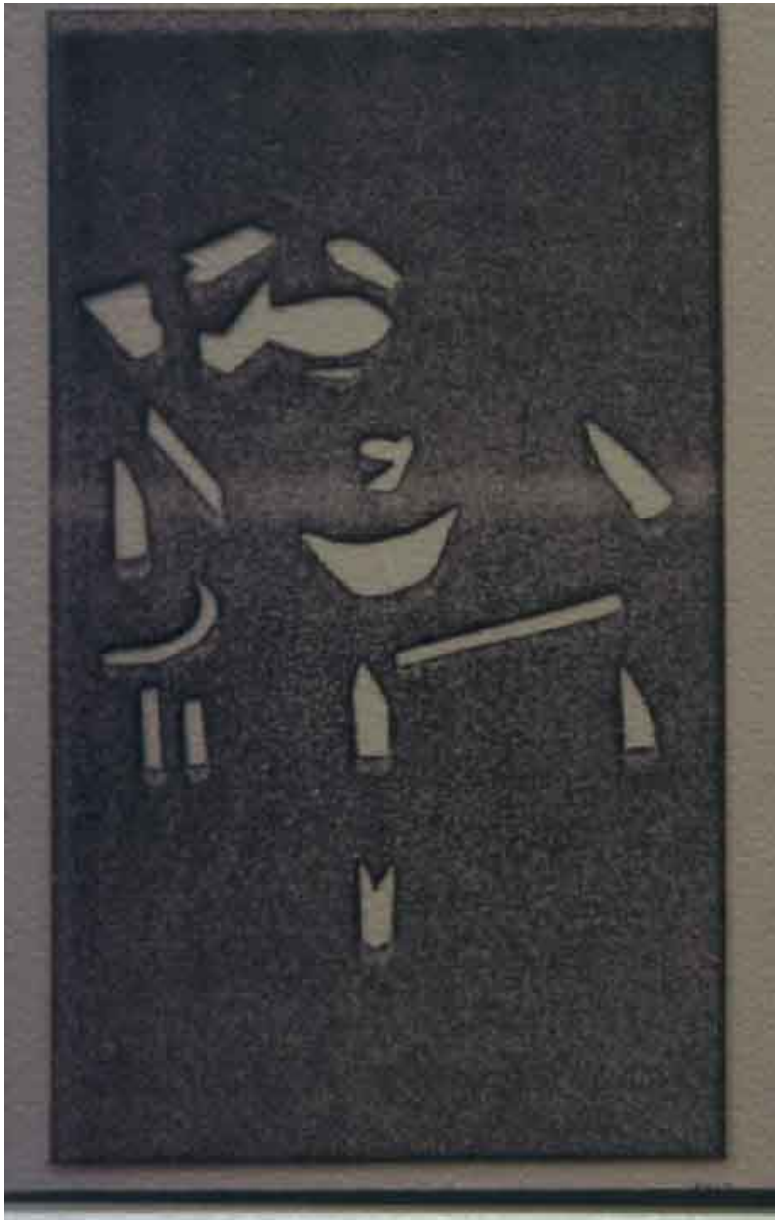
A “Gestalt” Figure

Gestalt Completion Test

Street (1931)

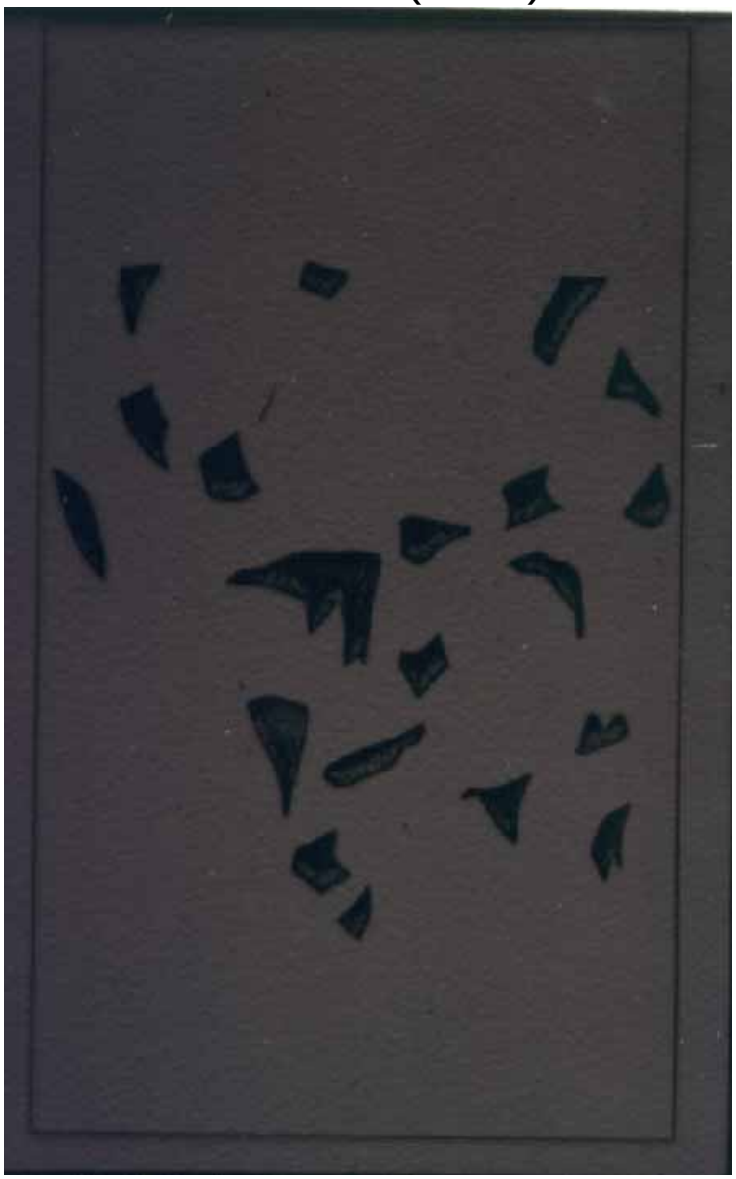
Gestalt Completion Test

Street (1931)



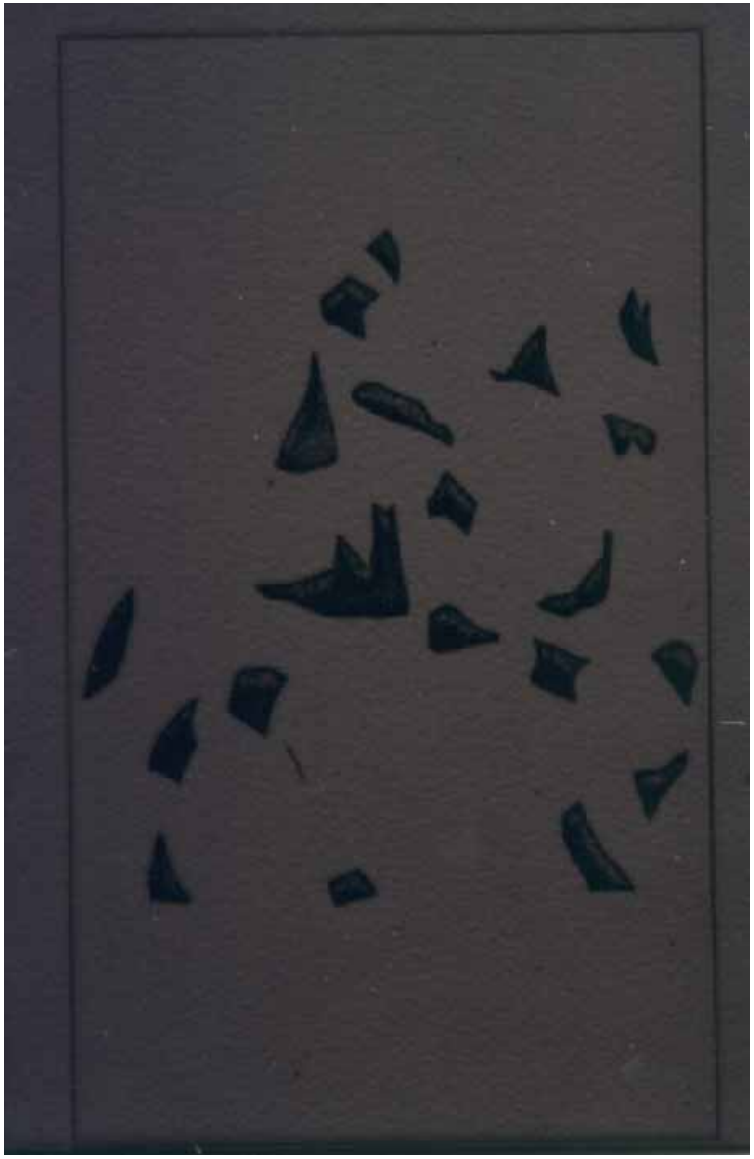
Gestalt Completion Test

Street (1931)



Gestalt Completion Test

Street (1931)



"*Canali*" On Mars

Schiaparelli (1880s)

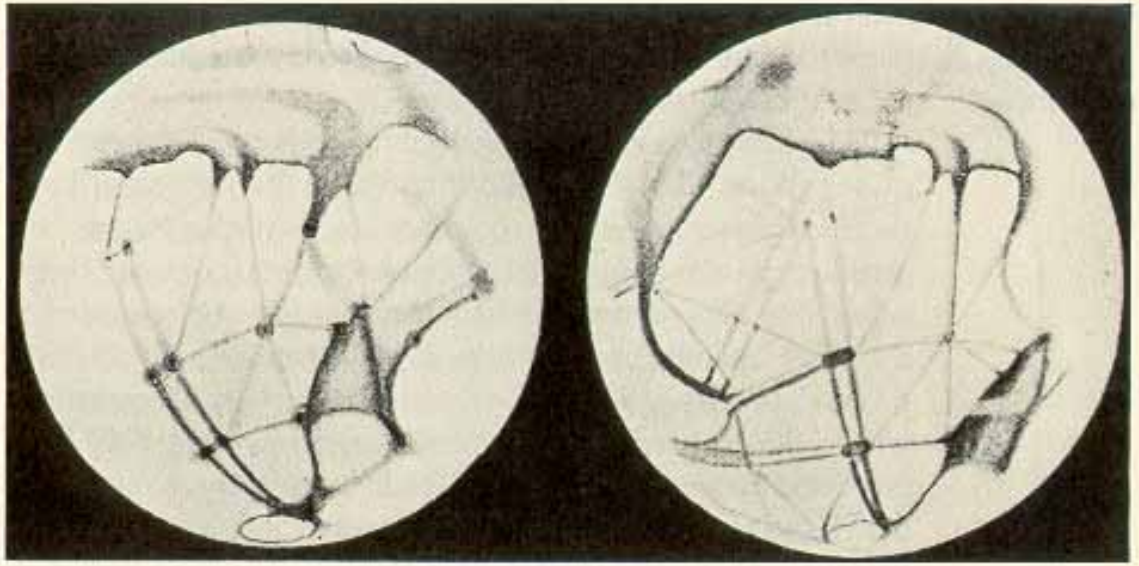


Figure 10.1
Mars as drawn by Schiaparelli on May 27 and June 2, 1888, showing the highly geometric forms given to the Martian surface markings in Schiaparelli's later drawings. The instrument used was the 18-inch Merz-Repsold refractor of the Brera Observatory. Following its erection in 1886, this was Schiaparelli's chief instrument for planetary work, largely replacing the celebrated 8.6-inch Merz refractor.

Sheehan (1988)
Sheehan & O'Meara (2001)

“Canals” on Mars

Lowell (1894)

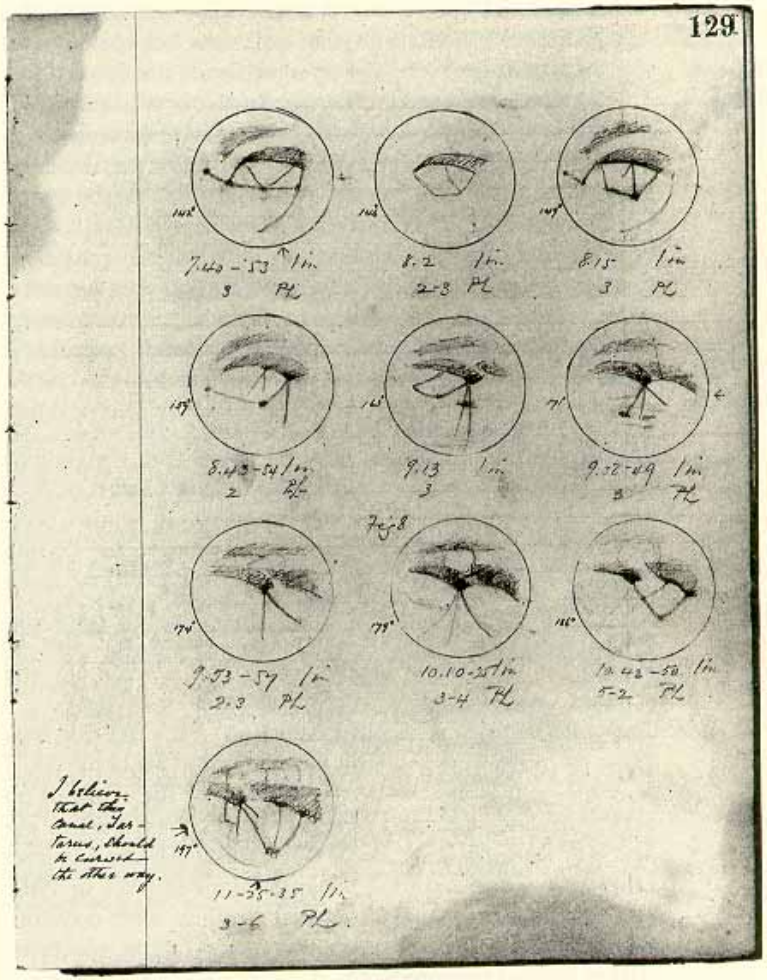
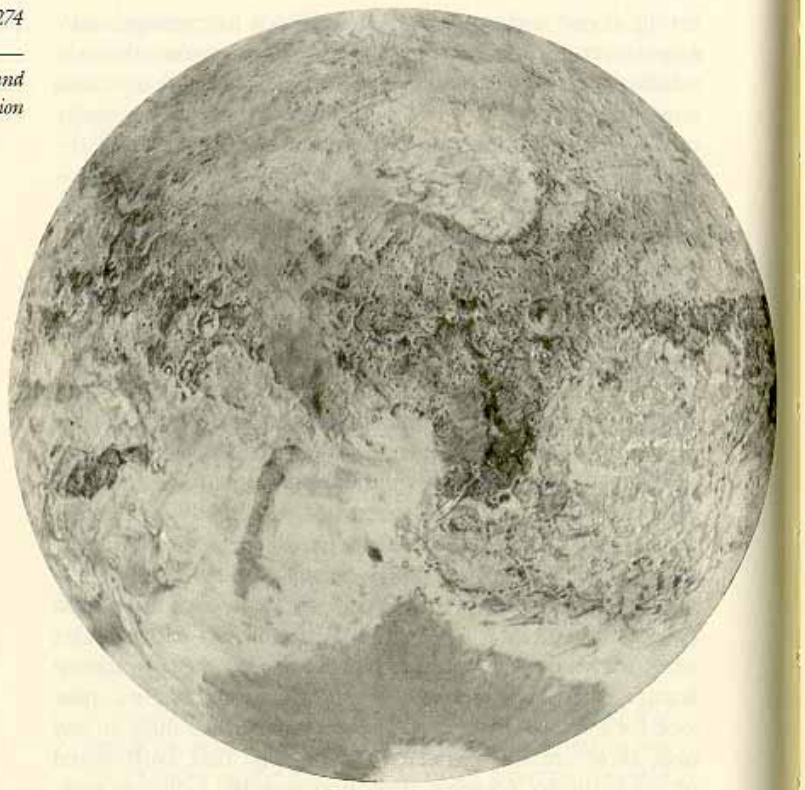


Figure 16.2
Impressions of Mars by Percival Lowell. Representative page from his observing logbook, 1894, showing how the canals appeared to him during the momentary flashes of good seeing. This illustrates the concept referred to in the text as the tachistoscope effect.

Sheehan (1988)
Sheehan & O’Meara (2001)

Mars: The View from Mariner

NASA, 1960s



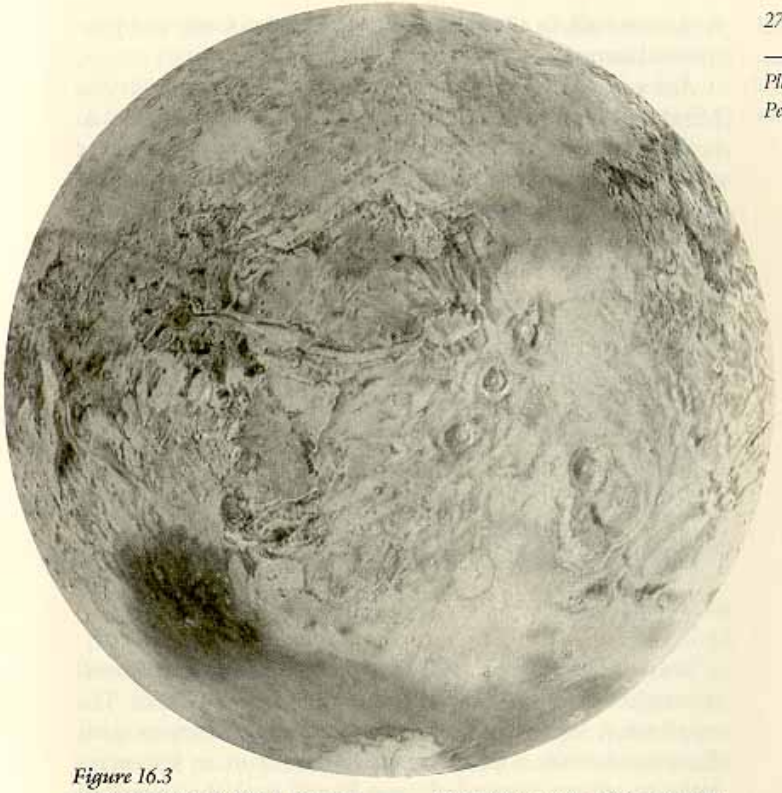


Figure 16.3
Modern charts of Mars, showing complementary hemispheres and based on spacecraft photographs. The charts are inverted, with south at the top, to facilitate comparison with telescopic views of the planet. The chart on the left is centered nearly on the conspicuous dark area Syrtis Major, and that on the right shows the gigantic canyon Valles Marineris and the volcanoes of the Tharsis region.

Sheehan (1988)
Sheehan & O'Meara (2001)

Contrasting Views of Perception



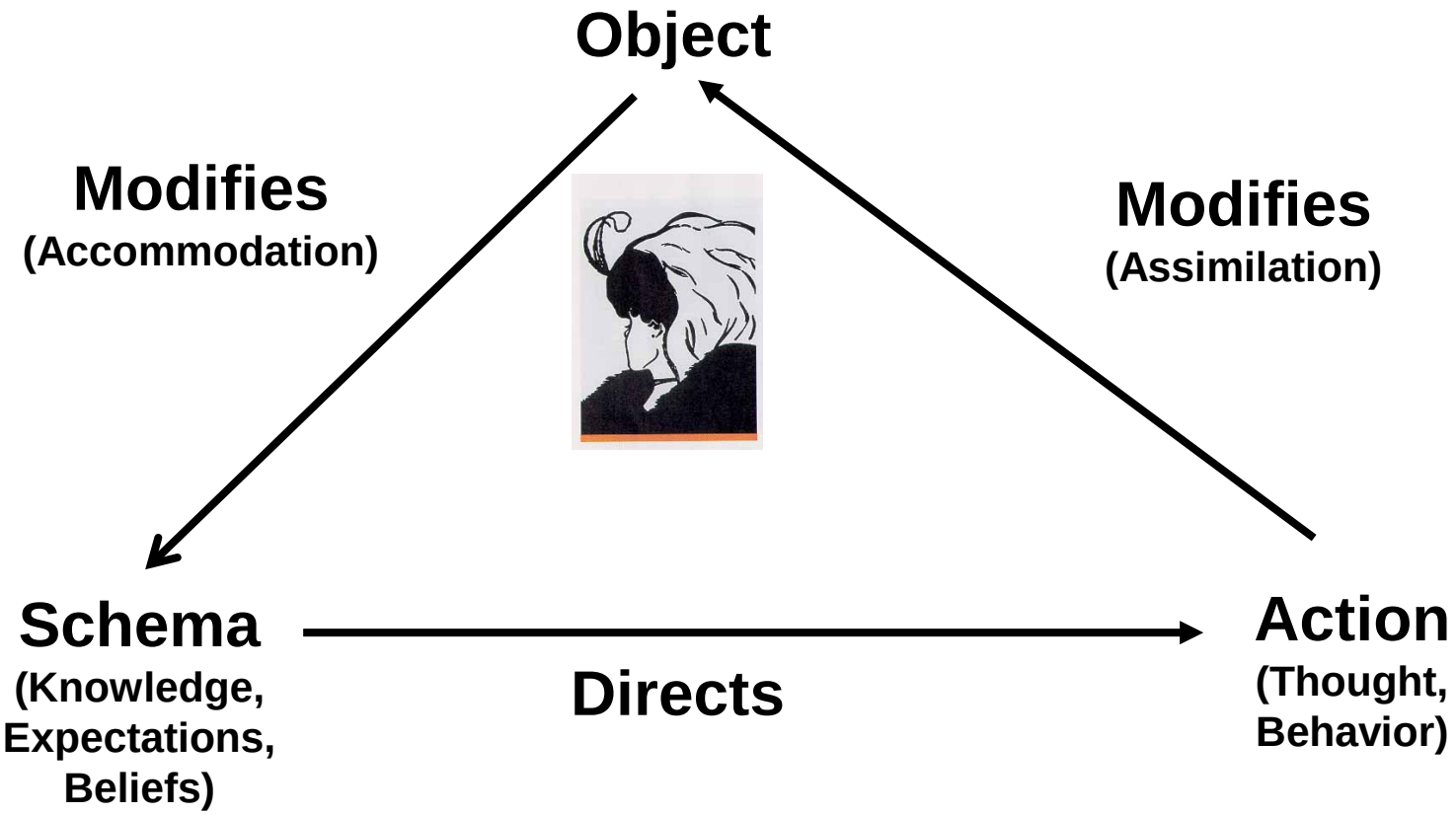
- Ecological View
  - Perception given by information in stimulus
  - Perceive the world, as it is, directly
- Constructivist View
  - Perception “goes beyond the information given”
  - Actively construct mental representation of world

Perception as Problem Solving

- Sources of Information
  - Proximal Stimulus (“Bottom-Up”)
    - figure, ground
    - primary, secondary modalities
  - Schemata (“Top-Down”)
    - world knowledge
    - expectations, beliefs
- Inferential Rules
  - Unconscious inferences
  - Conscious problem-solving

The Perceptual Cycle

Neisser (1976)



"Perception is where cognition and reality meet"

Perceptual Hypothesis-Testing

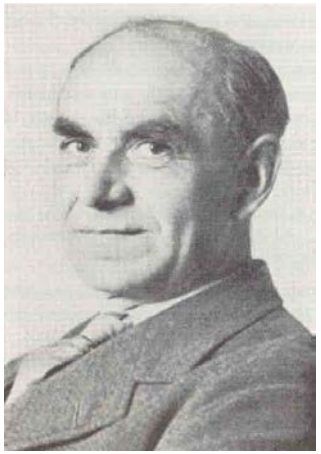
- Perceptual Cycle Begins
  - Mismatch between object and schema
- … Continues
  - Assimilation of object to schema
  - Accommodation of schema to object
- … Completed
  - Object identified, categorized
- … Begins Anew
  - New surprising event

Perceptual Hypothesis-Testing

- If Stimulus Information Rich, Structured
  - Perception is Automatic
- If Stimulus Information Vague, Fragmentary
  - Perception Requires Active Problem-Solving
- Percept as Compromise
  - Between Expectations, Reality
- Constructive Alternativism
  - Different Perceptions of Same Object, Event

Perception as Effort After Meaning

Bartlett (1932)



- Constructive Activity
  - "Build Up" Mental Representation of World
  - Test a Hypothesis About the World
- Goes "Beyond the Information Given"
  - Draws on Memory
  - Invokes Judgment, Reasoning, Inference