

*Perceptual and Artistic Principles for Effective Computer Depiction*

*Gestalt and  
Picture Organization*

*Fredo Durand*

*MIT- Lab for Computer Science*

# *Grouping by color*

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Georgia O'Keeffe



# *Grouping, illusory contour & fig/gnd*

Absolut



# *Context: Gestalt psychology*

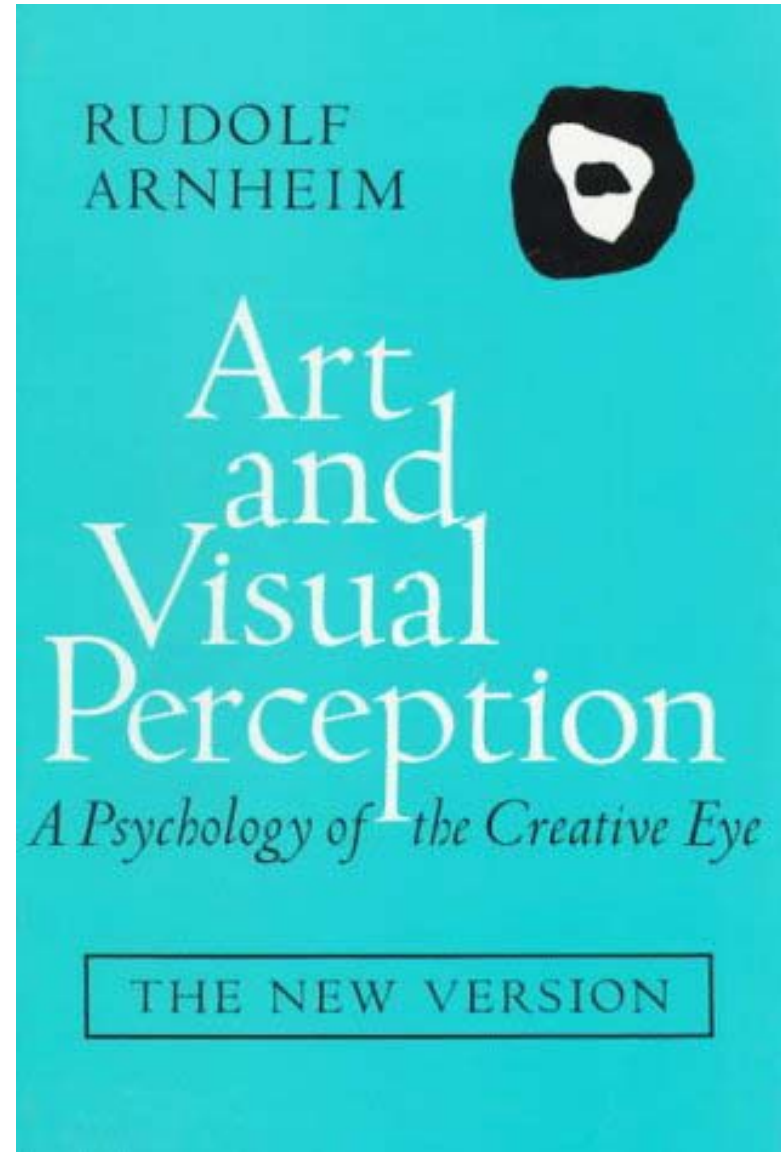
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- [Palmer 99]
- Early 20<sup>th</sup> century
- Inspired by field theory in physics
- Holistic philosophy of vision
  - “Spontaneous” organization
  - Opposed to unconscious inference
- Has been integrated recently into modern framework

# *Context: Gestalt psychology*

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- Early 20<sup>th</sup> century
- Arnheim had a Gestalt psychology background
- Very popular in design
- Advertisement vs. art



# *Prägnanz*

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- Cornerstone of Gestalt
- “Goodness”
- “Simplest” possible figure or organization
- Things are organized spontaneously and assumed to be in the simplest configuration
  
- Has recently been related to information theory (simple in terms of amount of information required to encode it)

# *Plan*

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- Grouping
- Figure-ground
- Completion and illusory contours

# *Grouping*

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- “Similar” or “close” objects are perceived to belong to groups
- Spontaneous and powerful perceptual effect



# *Grouping*

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- By Proximity



- By Color



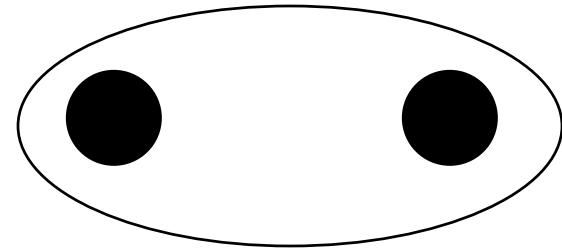
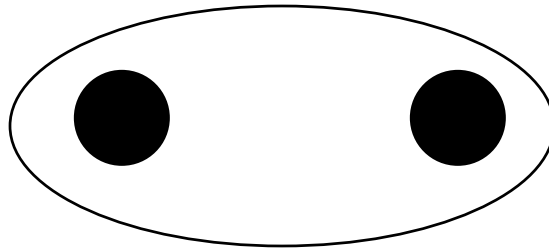
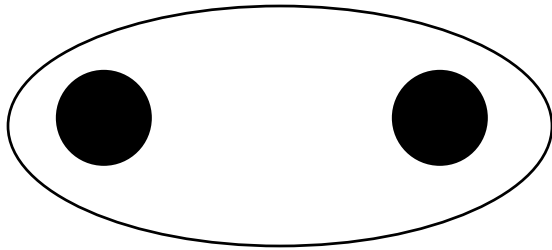
- By size



# *Grouping*

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- By Region



- By connectedness



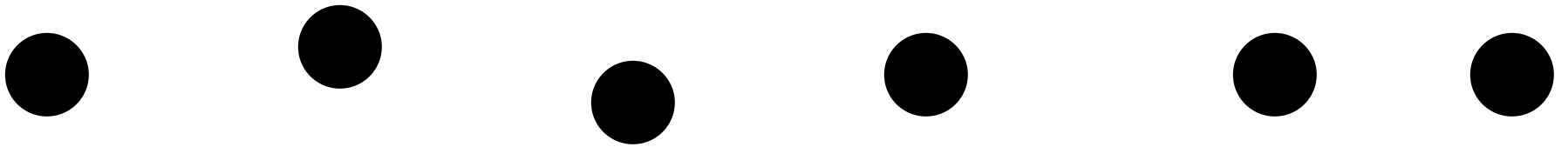
# *Grouping by synchronicity*

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# *Grouping by synchronicity*

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# *Grouping by synchronicity*

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# *Grouping by synchronicity II*

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# *Grouping by synchronicity II*

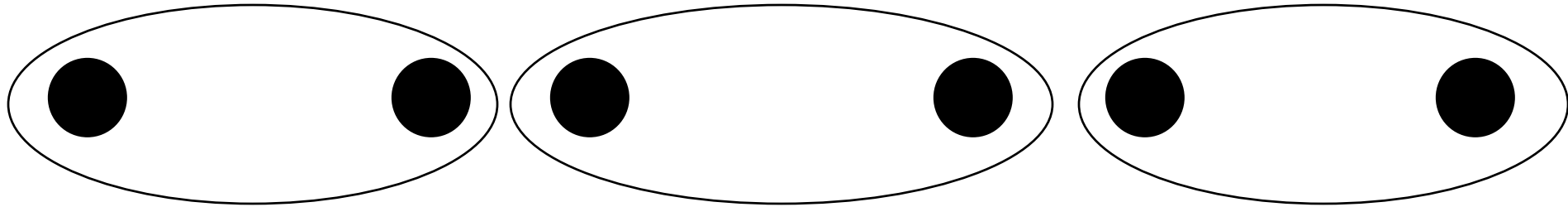
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# *Grouping conflict*

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- Proximity is outweighed by region



- Proximity is outweighed by connectedness





# *Grouping effect*

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- Task: Detect repetition of a shape in a sequence
- The repetition can be inside or across a group
- Slower when between groups ( $\sim 0.7$  vs.  $\sim 1.1$ s)

Repetition within group



Repetition across group



Repetition in neutral sequence

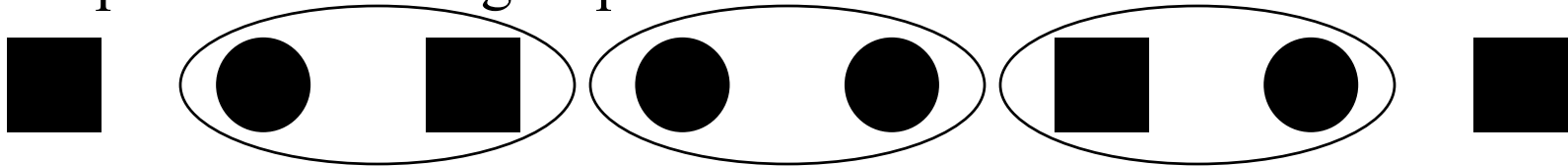


# *Grouping effect*

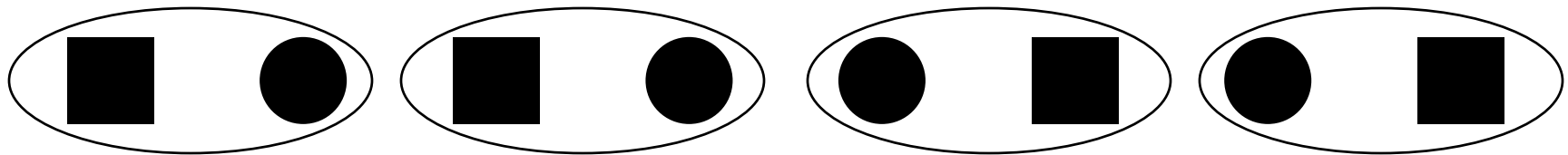
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Repetition within group



Repetition across group



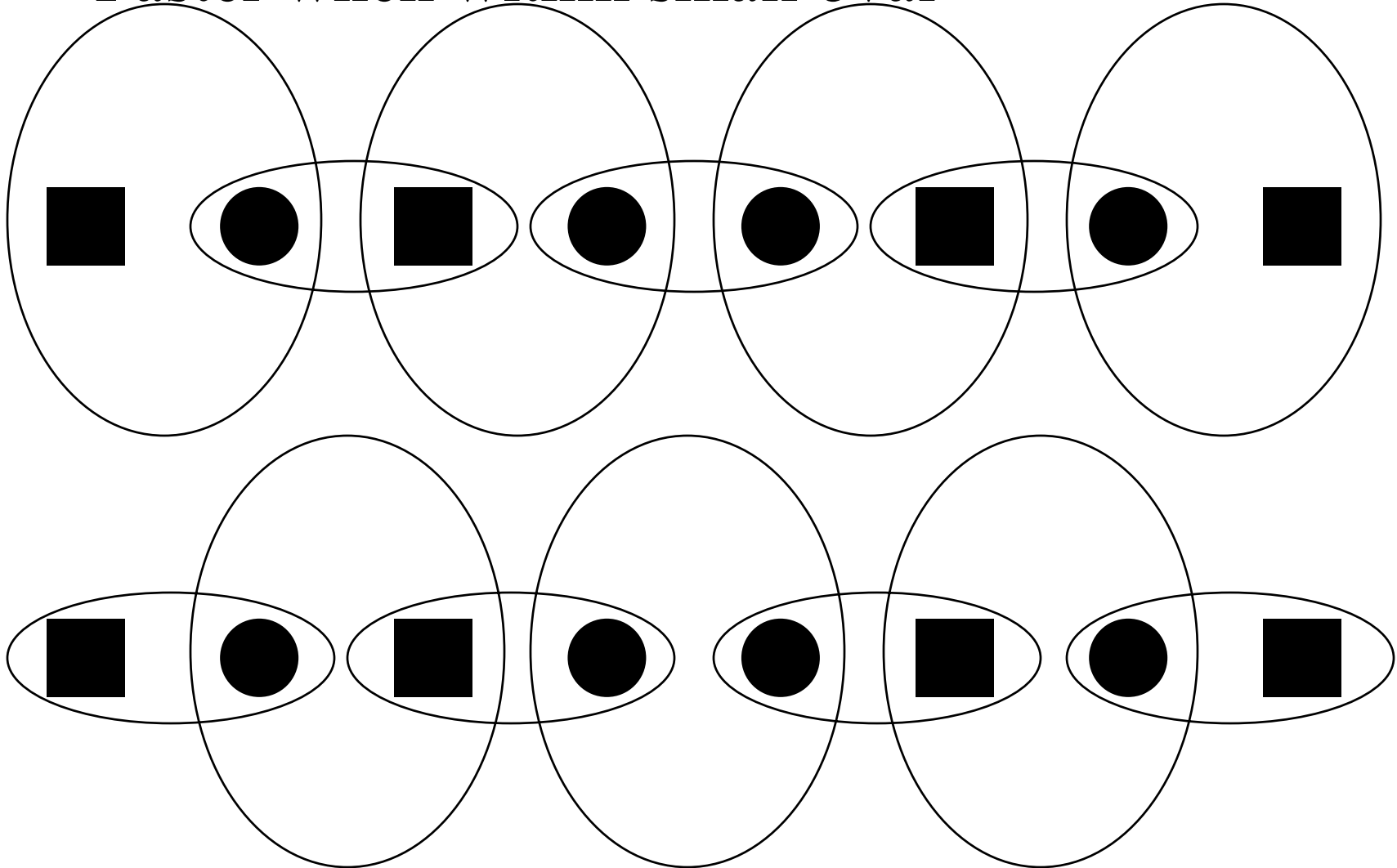
Repetition in neutral sequence



# *Grouping conflict*

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- Faster when within small oval



# *Grouping in complex situations*

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- No quantitative rule yet!
- Very complex problem
- Too many parameters

# *Grouping and photo*

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Edward

Weston



# *Grouping*

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- Grouping by proximity tells story



# Grouping & Map Making

- Grouping provides efficient analysis



# *Grouping and ornament*

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- Repetition, rhythm





# *Plan*

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- Grouping
- Figure-ground
- Completion and illusory contours

# *Figure-ground*

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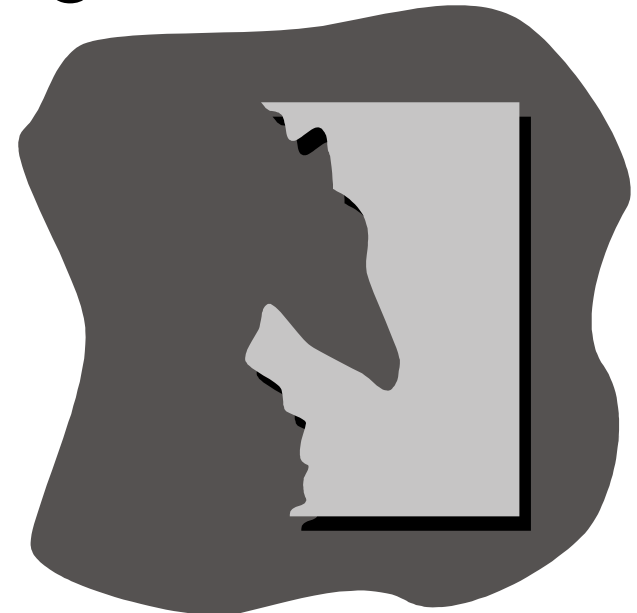
- What is in front (figure), and behind (ground)?
- There has to be one figure and one ground
- Related to occlusion and thus to depth
- Less attention is dedicated to the ground



Picture



Dark=figure



Light=figure

# *Figure-ground*

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- The shape with the best “Prägnanz” is the figure
- Can be bimodal: we switch from one interpretation to the other
  - Visible on brain imagery
- But only one at a time

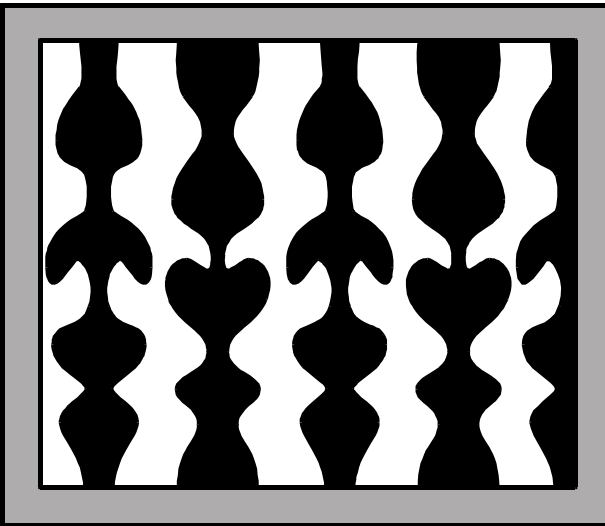


Picture

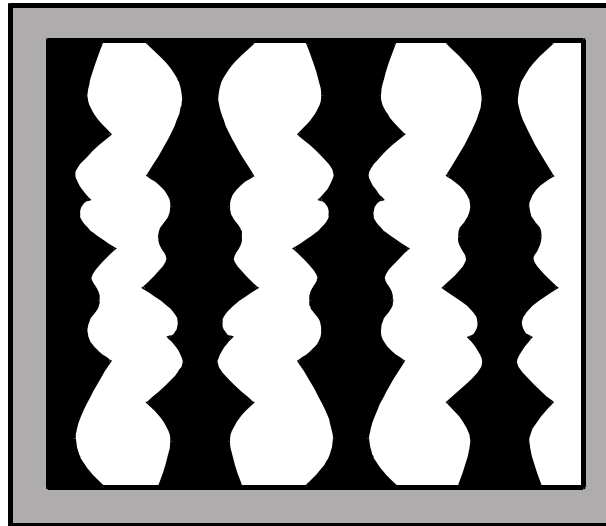
# *Figure-ground*

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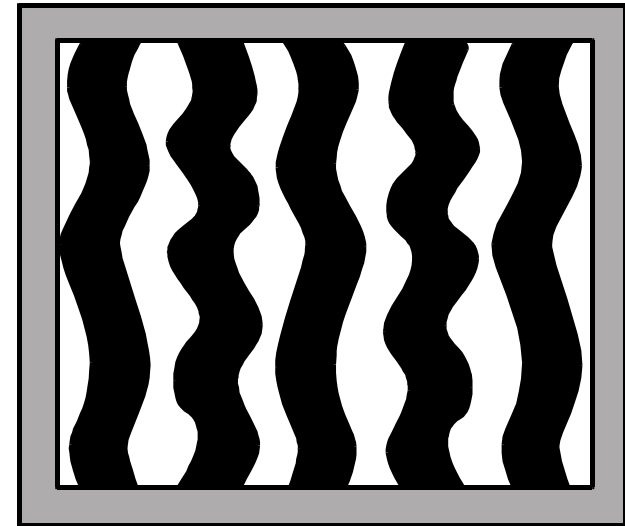
- Effect of geometric properties on the “Prägnanz”



symmetry



Convexity  
vs. parallelism

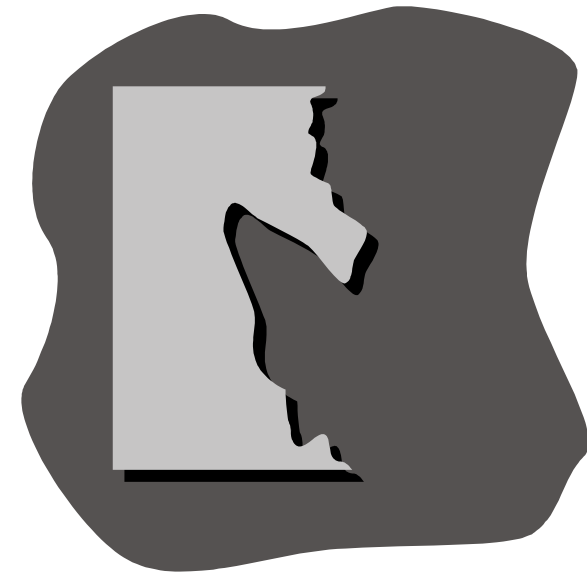


parallelism

# *Figure-ground & familiarity*

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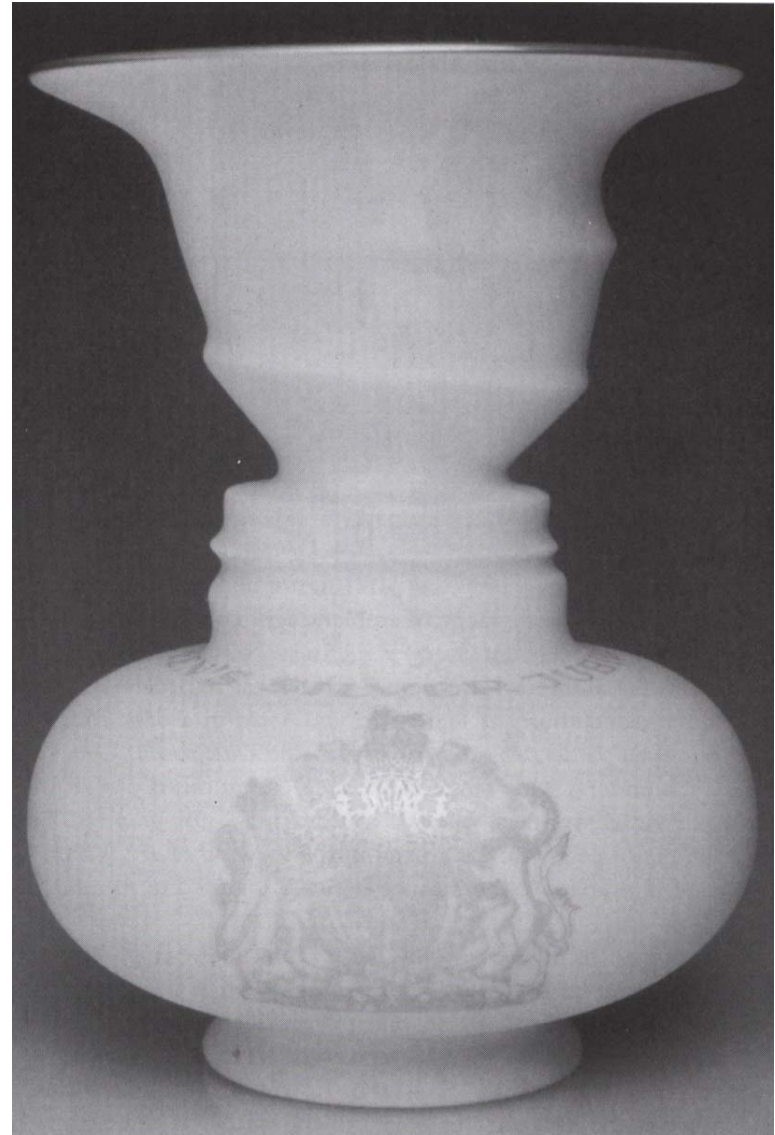
- Familiarity helps: We recognize a horse



# *Figure-ground pun*

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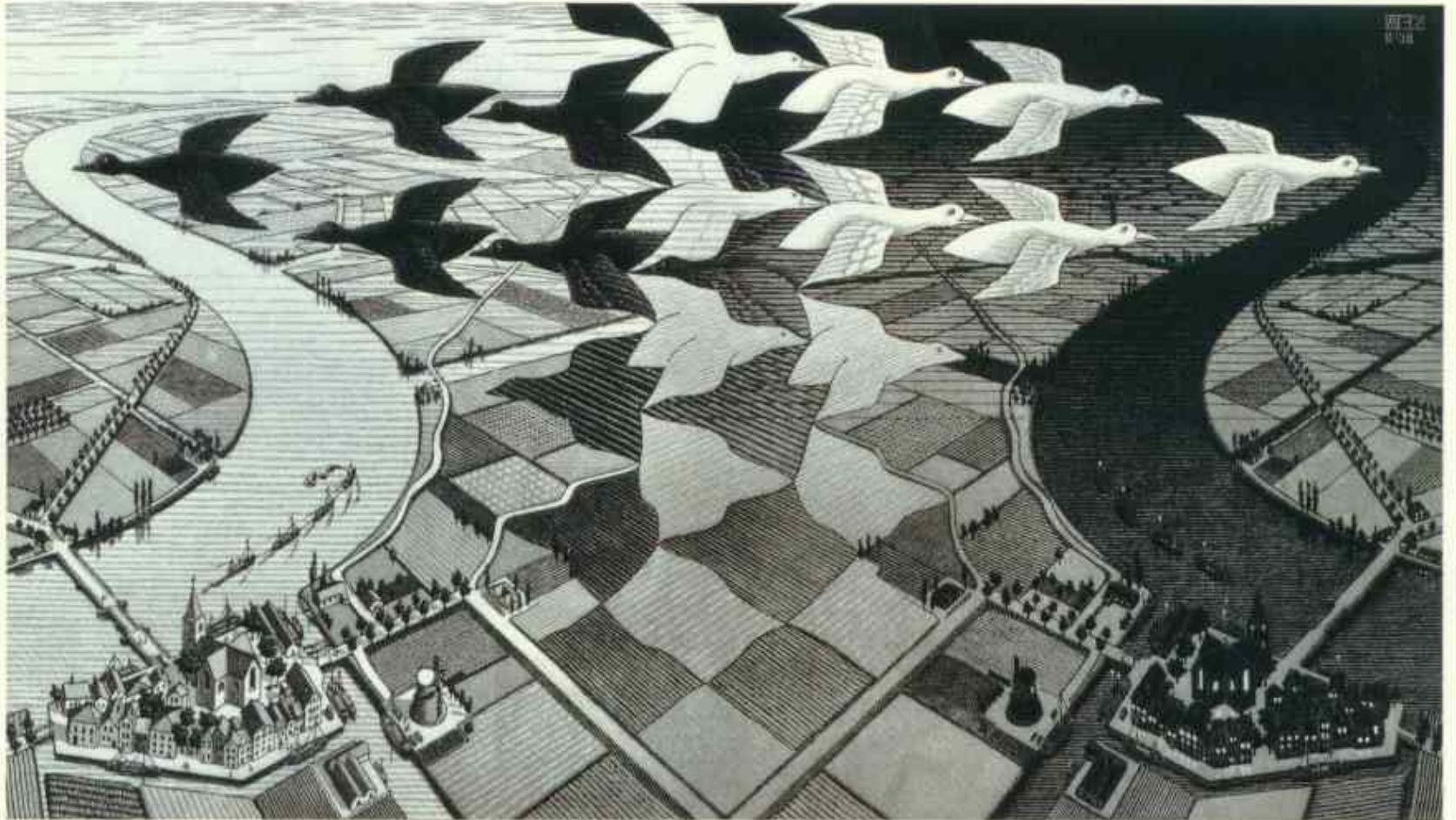
- Rubin vase



# *Figure-ground transition*

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- +grouping



# *Enhancing depth through contrast*

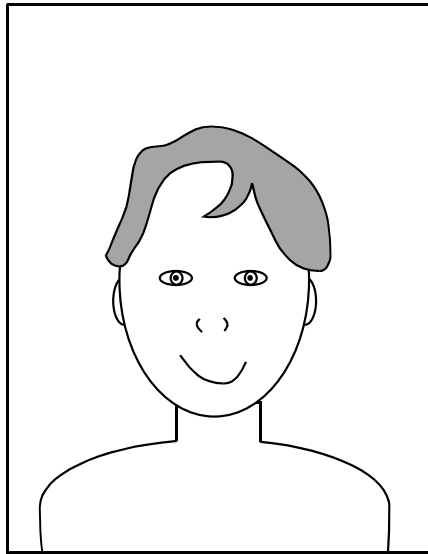




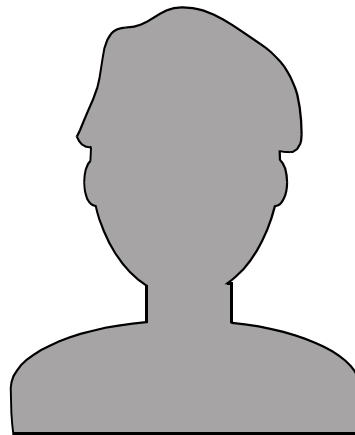
# *Negative space*

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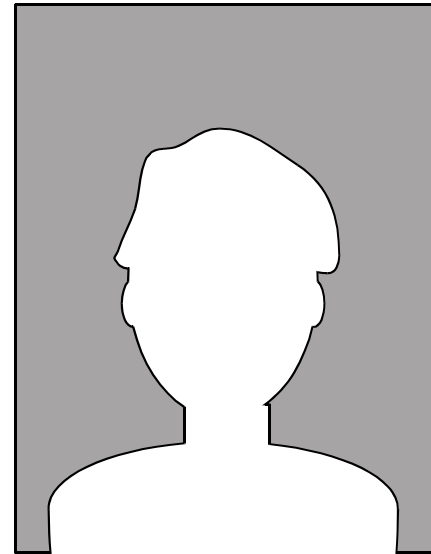
- The ground defines the negative space
- Usually overlooked
- Fundamental for balance
  - Also for typography



picture



figure



negative space

# *Closure & Negative space*

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- George Seurat
- Negative space are enclosed in the picture frame



# *Plan*

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- Grouping
- Figure-ground
- Completion and illusory contours

# *Continuation*

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- Lines are continued after junctions



Picture

good “Prägnanz”

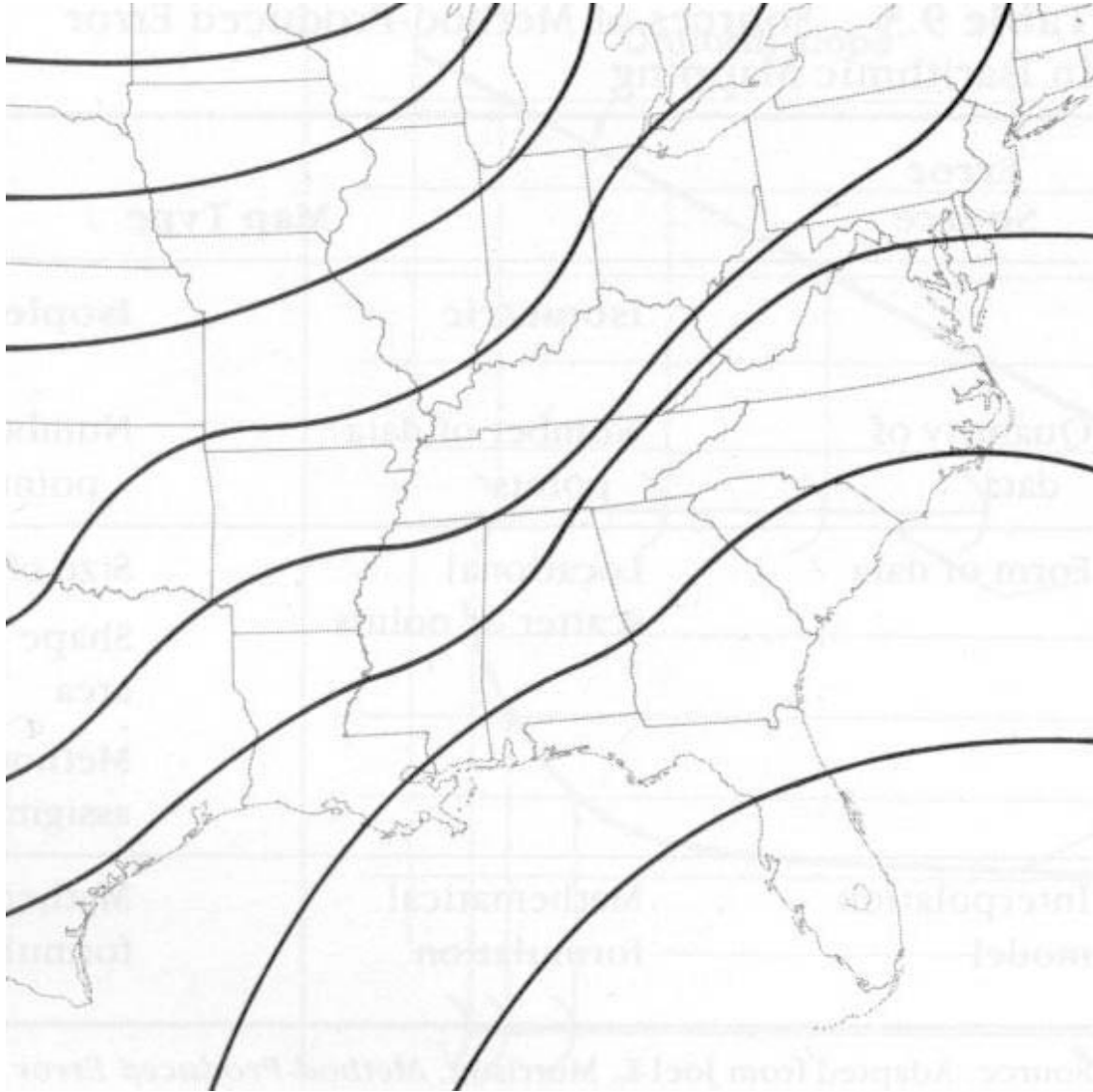
not so good “Prägnanz”

- And after gaps



# *Continuation and Map-Making*

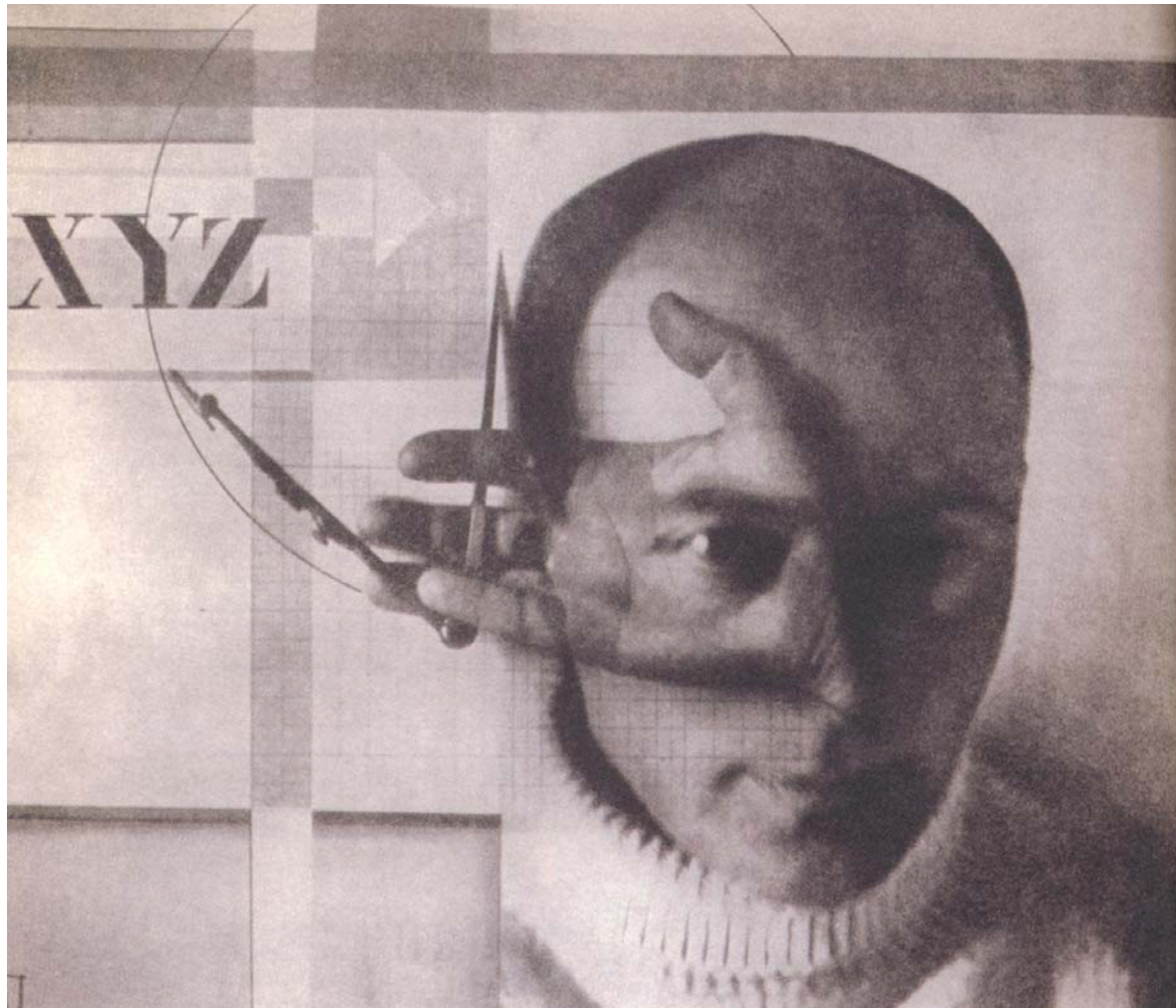
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# *Continuation and design*

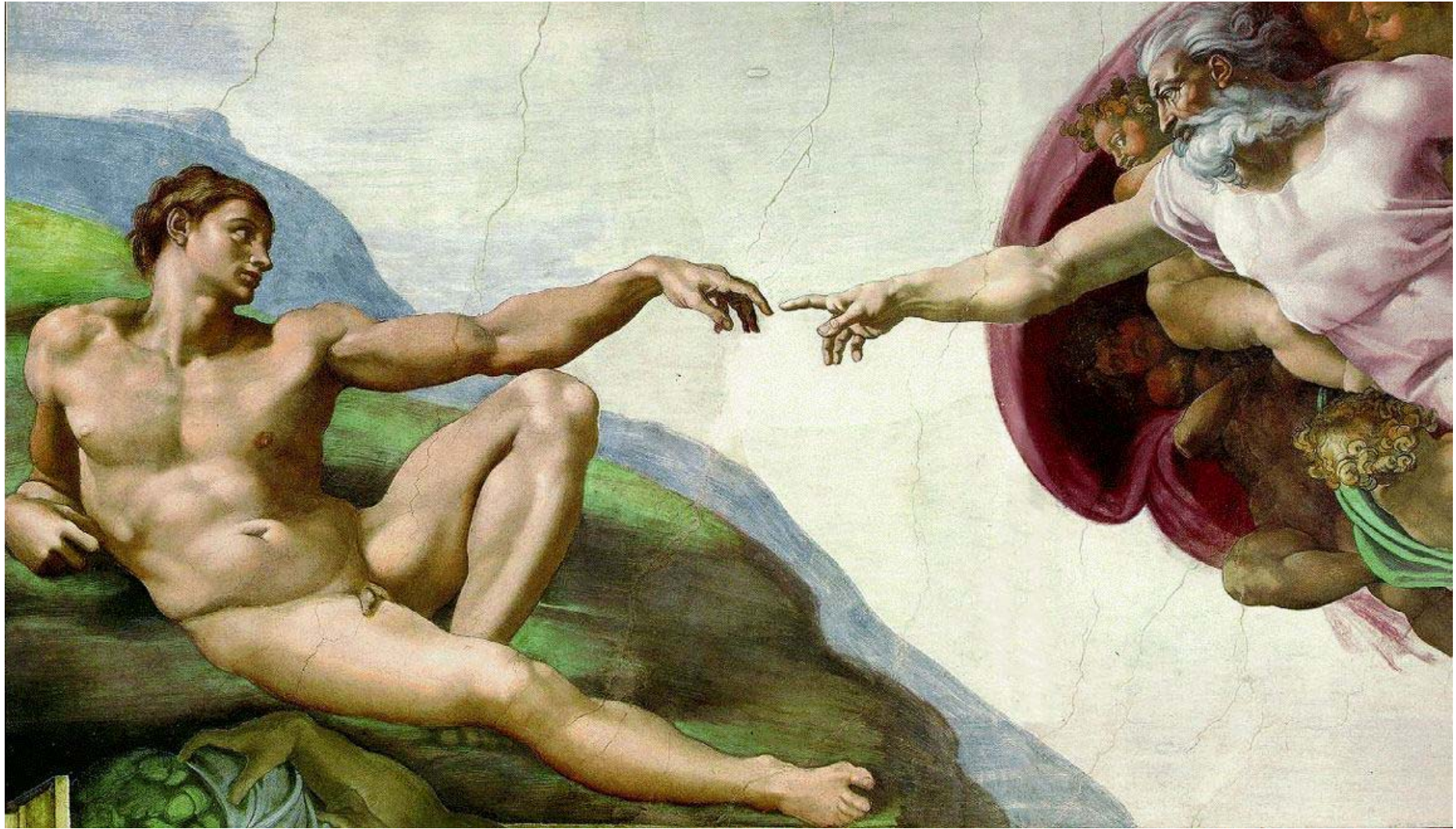
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- El Lissitzky, *Self Portrait: The Constructor* 1924



# *Continuation*

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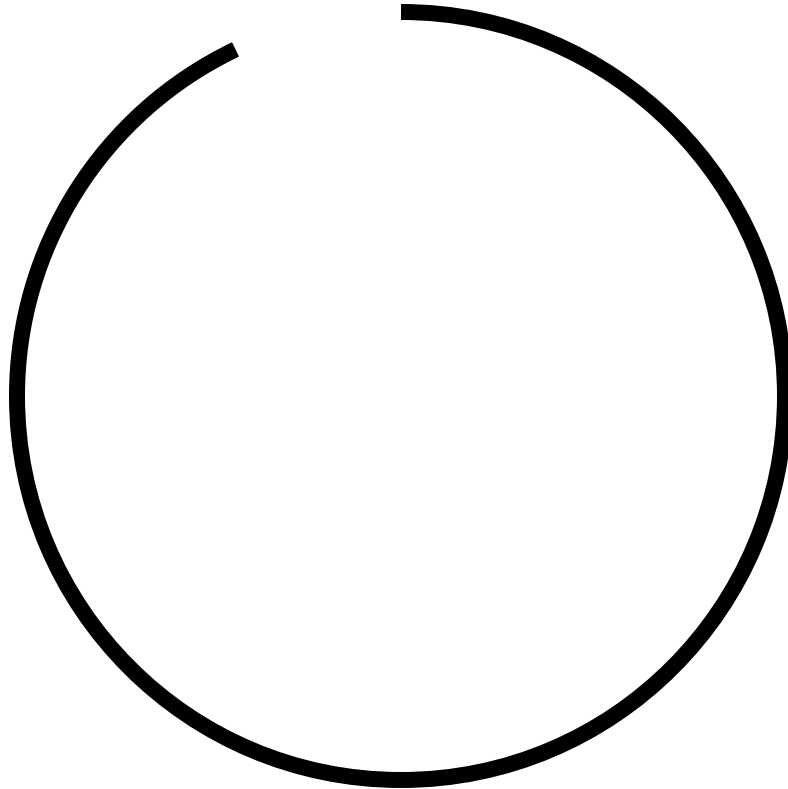


Picture Organization & Gestalt

# *Closure*

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- Closed shapes have better “Prägnanz”
- + continuation
- + illusory lines

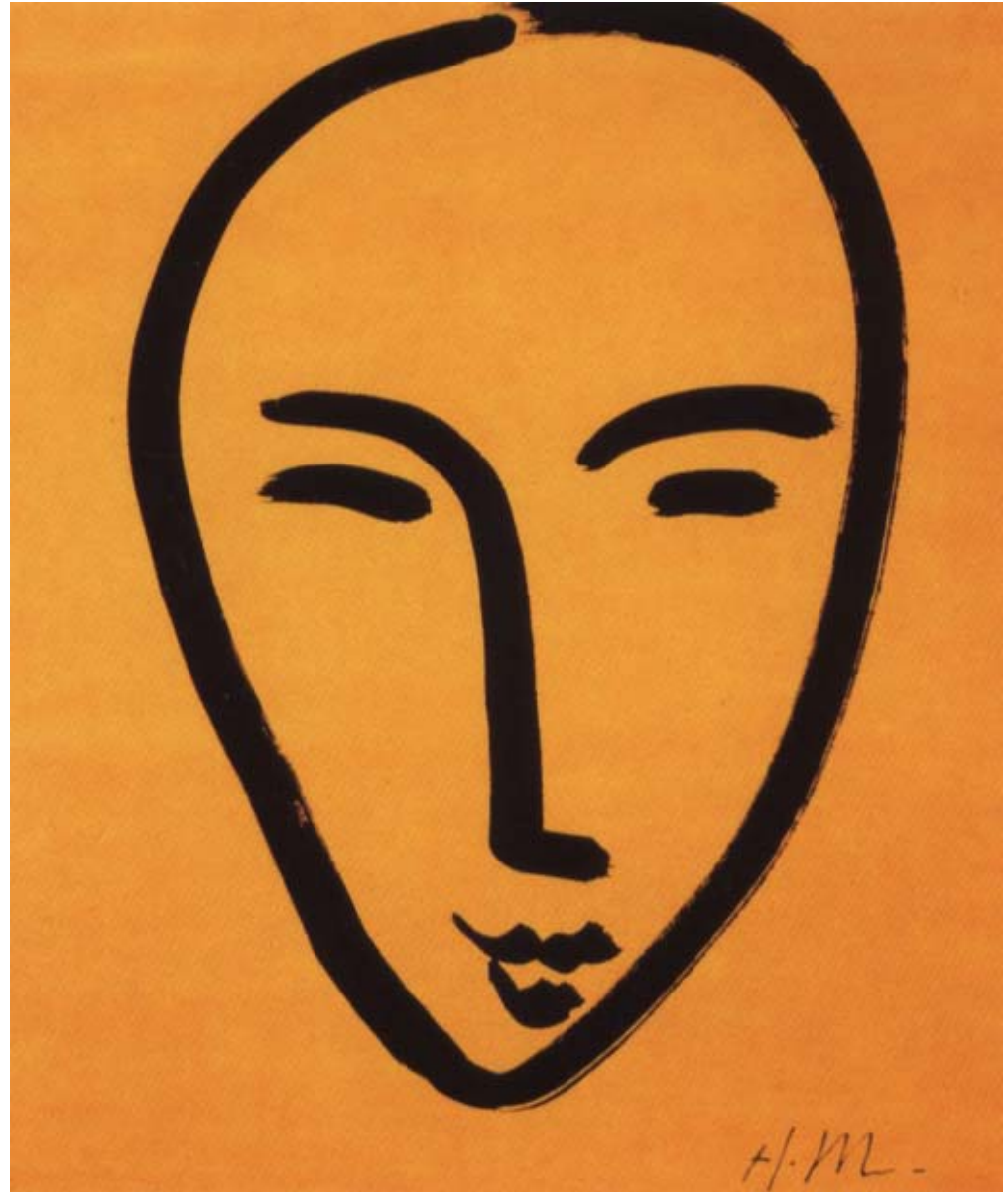




# *Closure*

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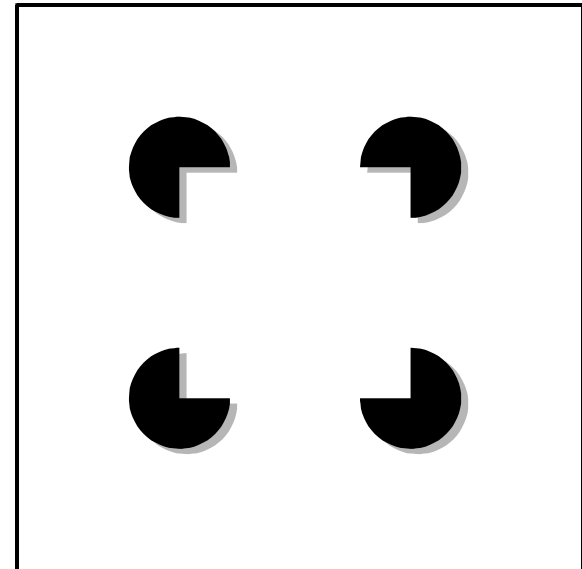
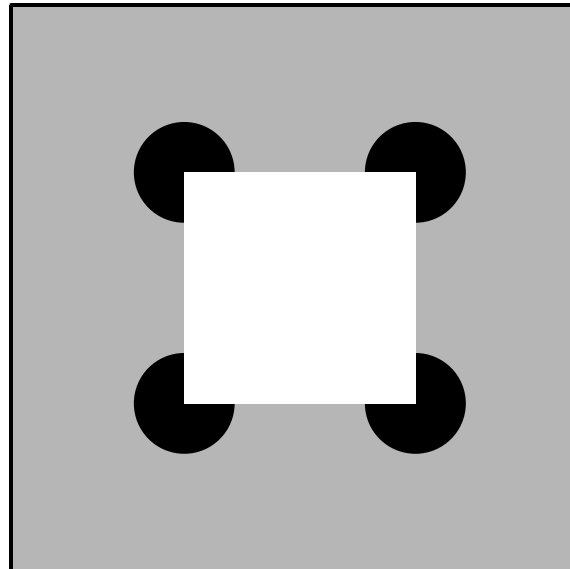
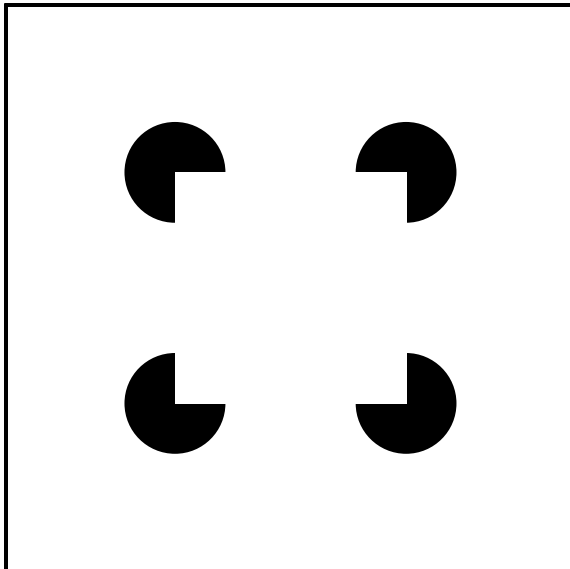
- Matisse



# *Illusory contour*

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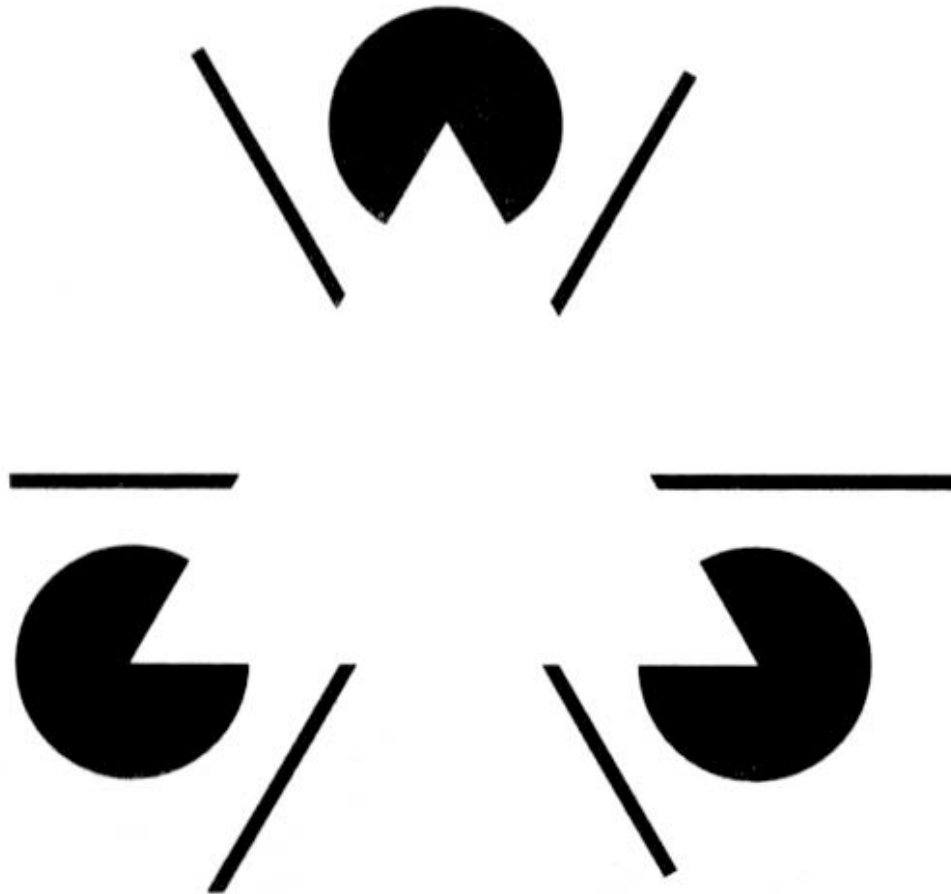
- An illusory contour is implied by continuation of the lines
- Related to figure ground



# *Illusory contours*

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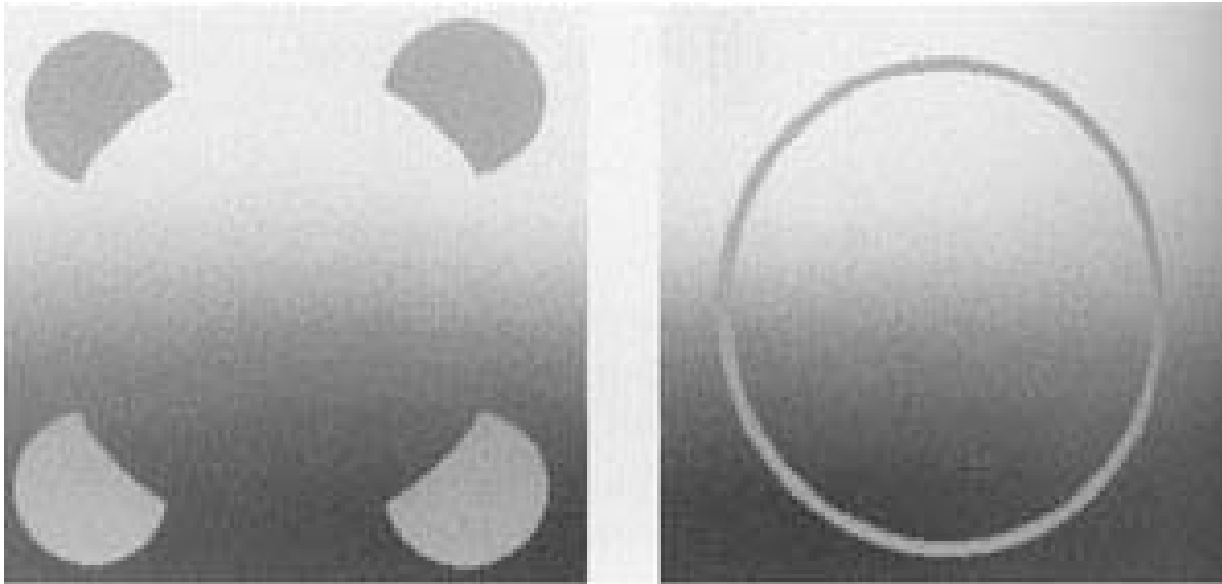
- Kanisza



# *Illusory contour*

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- Can be more effective



# Illusory contour

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- Familiarity helps



Disappears rather quickly, doesn't it.

# *Illusory contour*

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- Matisse



# *Figure-ground and illusory contour*

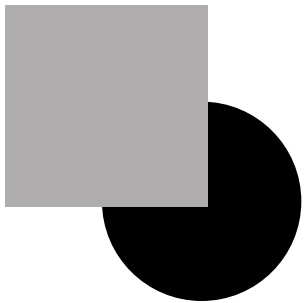
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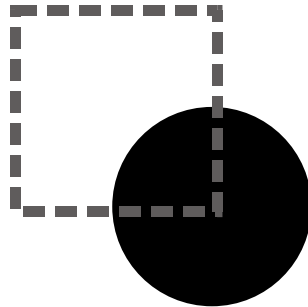
# *Visual completion*

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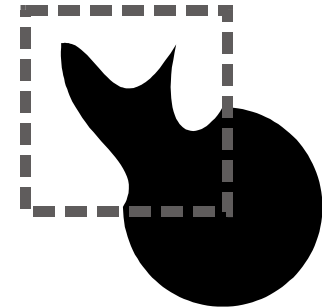
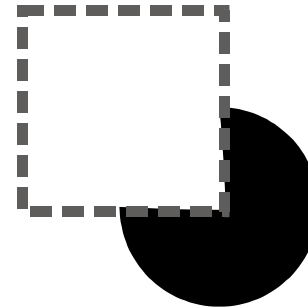
- We complete the occluded part with the simplest shape (best “Prägnanz”)
- Related to continuation and closure



Picture



Simplest interpretations



Other possible interpretations



# Completion

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- Magritte



# *Completion*

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- Marc Riboud
- Completion is challenged



# *Summary*

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- Prägnanz (goodness, simple in terms of information)
- Grouping
- Figure-ground
- Completion
- As usual pictures can
  - Simplify
  - Challenge

# *History of science*

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- Initially, strong opposition between Gestalt and other theories
- Lack of experimental data
- Has been applied beyond its scope
- Has been taken too literally
  
- Now, has been integrated with other theories
- Experiments
- Computational models