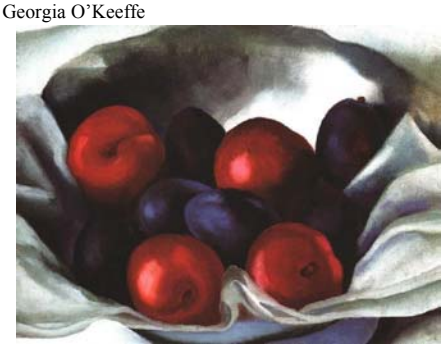
Perceptual and Artistic Principles for Effective Computer Depiction

Gestalt and Picture Organization

Fredo Durand
MIT- Lab for Computer Science

Grouping by color

Georgia O'Keeffe



Grouping, illusory contour & fig/gnd

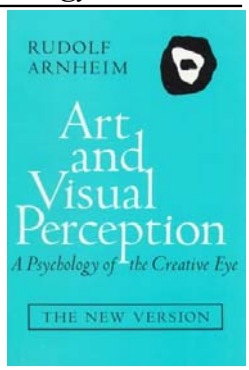
Absolut

Context: Gestalt psychology

- [Palmer 99]
- Early 20th 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

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



Prägnanz

- 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

- Grouping
- Figure-ground
- Completion and illusory contours

Grouping

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

Grouping

- By Proximity

- By Color

- By size

Grouping

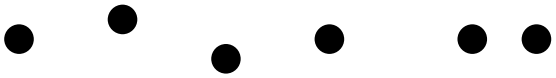
- By Region

- By connectedness

Grouping by synchronicity

Grouping by synchronicity

Grouping by synchronicity

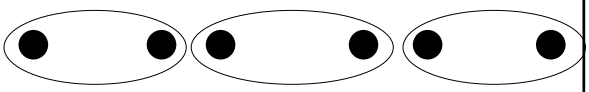


Grouping by synchronicity II

Grouping by synchronicity II

Grouping conflict

- Proximity is overweighed by region



- Proximity is overweighed by connectedness

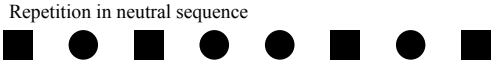
Grouping effect

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

Repetition within group

Repetition across group

Repetition in neutral sequence



Redrawn after [Palmer 99]

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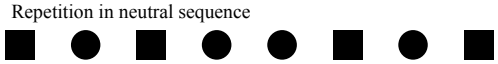
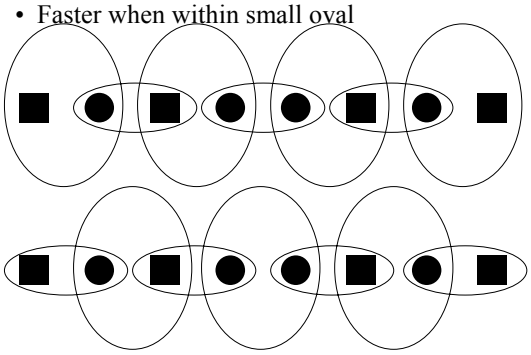


Redrawn after [Palmer 99]

Grouping conflict

- Faster when within small oval



Redrawn after [Palmer 99]

Grouping in complex situations

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

Grouping and photo

Edward Weston

Grouping

- Grouping by proximity tells story

Grouping & Map Making

- Grouping provides efficient analysis

Grouping and ornament

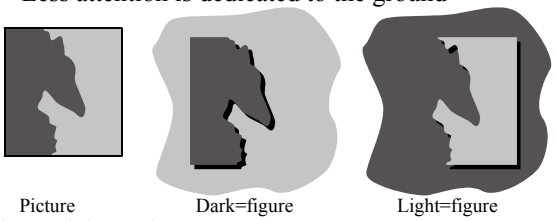
- Repetition, rhythm

Plan

- Grouping
- Figure-ground
- Completion and illusory contours

Figure-ground

- 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

Redrawn after [Palmer 99]

Figure-ground

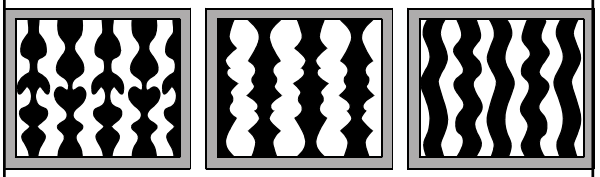
- The shape with the best "Prägnanz" is the figure
- Can be bimodal: we switch from one interpretation to the other
  - Visible on brain imagery
- But only one at a time

Picture

Redrawn after [Palmer 99]

Figure-ground

- Effect of geometric properties on the "Prägnanz"

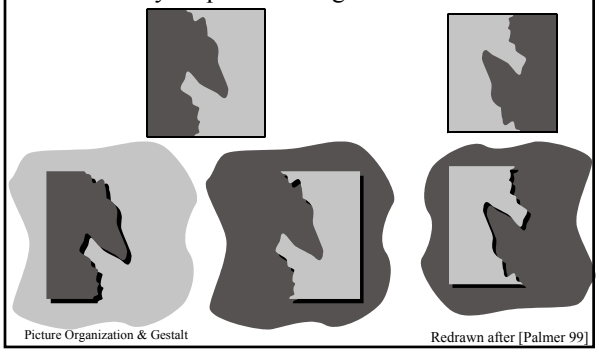


symmetry Convexity vs. parallelism parallelism

Redrawn after [Palmer 99]

Figure-ground & familiarity

- Familiarity helps: We recognize a horse



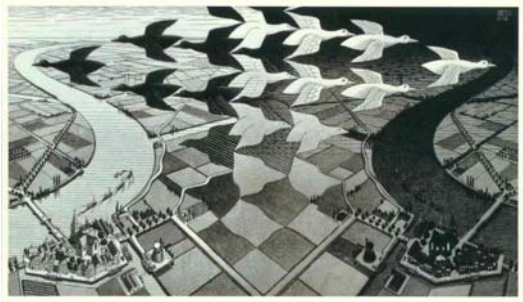
Redrawn after [Palmer 99]

Figure-ground pun

- Rubin vase

Figure-ground transition

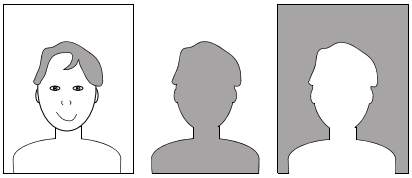
- +grouping



Enhancing depth through contrast

Negative space

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



picture figure negative space

Closure & Negative space

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

Plan

- Grouping
- Figure-ground
- Completion and illusory contours

Continuation

- Lines are continued after junctions

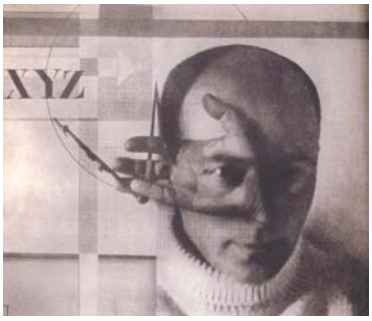
Picture good "Prägnanz" not so good "Prägnanz"

- And after gaps

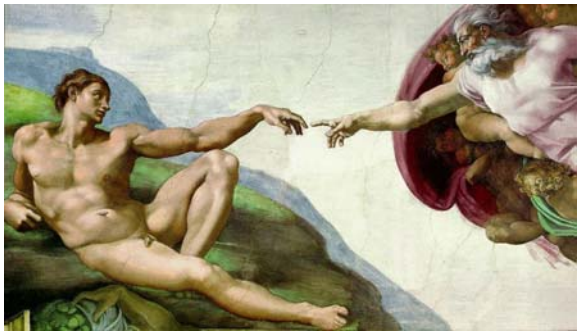
Continuation and Map-Making

Continuation and design

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

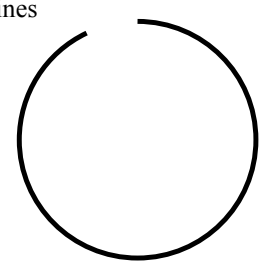


Continuation



Closure

- Closed shapes have better "Prägnanz"
- + continuation
- + illusory lines

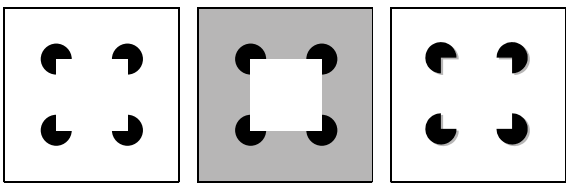


Closure

- Matisse

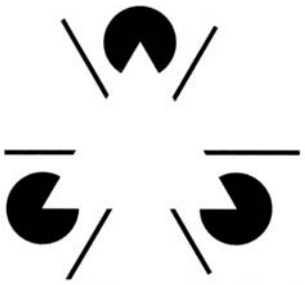
Illusory contour

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



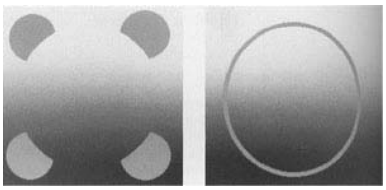
Illusory contours

- Kanisza



Illusory contour

- Can be more effective



Illusory contour

- Familiarity helps

Disappears rather quickly, doesn't it.

Illusory contour

- Matisse

Figure-ground and illusory contour

Visual completion

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

Picture Simplest interpretations Other possible interpretations

Redrawn after [Palmer 99]

Completion

- Magritte

Completion

- Marc Riboud
- Completion is challenged

Summary

- Prägnanz (goodness, simple in terms of information)

- Grouping
- Figure-ground
- Completion

- As usual pictures can
  - Simplify
  - Challenge

History of science

- 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