Perceptual and Artistic Principles for Effective Computer Depiction

Gestalt and Picture Organization

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Grouping by color

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Picture Organization & Gestalt
Grouping, illusory contour & fig/gnd

Absolut

Picture Organization & Gestalt
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
  ![Black dots](image)

- By Color
  ![Black and red dots](image)

- By size
  ![Black circles of various sizes](image)
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

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Redrawn after [Palmer 99]
**Grouping effect**

- Task: Detect repetition of a shape in a sequence
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Repetition within group

Repetition across group

Repetition in neutral sequence

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

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Grouping

- Grouping by proximity tells story
Grouping & Map Making

- Grouping provides efficient analysis

The city with the overall least stress is State College, PA, and that with most stress is Reno, NV.

City stress is based on combined overall rates of alcoholism, crime, suicide, and divorce.

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

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

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

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Enhancing depth through contrast

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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

- And after gaps

Picture good “Prägnanz” not so good “Prägnanz”

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Continuation and Map-Making

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Continuation and design

• El Lissitzky, *Self Portrait: The Constructor* 1924
Continuation

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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
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

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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