Overview

Our context
- Computer graphics “Visualization”
- Leveraging design practice

A specific set of experiments
- Overlaid grids
- Example of visual metadata

Relate results to perception

Discussion

Context

Grids and other reference structures should be visually unobtrusive and subtle relative to the data

Too obtrusive

Appropriately subtle

Images from “After the Storm,” by Bushell & Baker

Attention hierarchy

Create visual “layers”
- Separable
- Legible
- Balanced

Tufte Envisioning Information, ch 3

How do we fix this?

Create a visual hierarchy

Wrong

Right

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Get it right in black & white

Our design case

Example by Diane Gromala

Our questions

How do we design a Great Grid?

Our insight

We seek a **range**

Too faint: unusable
Too strong: a fence

Maureen Stone & Lyn Bartram
School of Interactive Art and Technology, Simon Fraser University
Experiments

Design
- Fixed grid, fixed color, variable alpha
- Two boundary conditions: faint and strong
- 5 background values (grays)
- 4 images (scatter plots)
- 2 task blocks, 60 trials/block

Two sets of experiments
- Dark on light
- Light on dark

Same display, environment

Images

Background Colors

<table>
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<tr>
<th>L* value</th>
<th>4</th>
<th>15</th>
<th>30</th>
<th>45</th>
<th>60</th>
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</thead>
<tbody>
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<td>16</td>
<td>28</td>
<td>55</td>
<td>87</td>
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</tbody>
</table>

Demo

Hypotheses

1. Faint boundary less variable than "the fence"
2. Faint setting would be very faint
3. Background would have an effect
4. Density would have an effect
5. Results would be symmetric

Results: Dark on light

1. Faint is more stable
2. Faint is very faint
3. Background no effect
4. Density has an effect

Whisper, don't scream
Results: Light on Dark

- Faint is more stable
- Faint is very faint
- Background effect
- Density effect
- Not symmetric

There is a range

Ignore dense case

Results Summary

- Two boundaries exist (faint and strong)
- Range near alpha = 0.2 produces "good grids"
- Light and dark results not symmetric

Light on dark
- No dependency on background
- Dense case different than other three

Light on dark
- Noisier data
- Some dependency on background
- Density dependency is larger

Look at contrast

Key component of legibility, readability, layering

Approach
- Compute luminance from display parameters
- Compute contrast with background
- Flat, sparse, medium, dense

Compare Michelson contrast and ΔL* to alpha

Michelson contrast = (Y_{max} - Y_{min})/(Y_{max} + Y_{min})
Images from Tableau Software

**Color Imaging Conference 16, Portland OR**

Maureen Stone & Lyn Bartram
School of Interactive Art and Technology, Simon Fraser University

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**Transparency**

- Alpha is a transparency metric
  - $c = \alpha f + (1-\alpha) b$, where $f$ and $b$ are pixel values

**Metelli’s spinning disk model**
- Surface reflectances $R_s$ and $R_{disk}$
- Spinning disk with missing wedge
  - $R_t = R_s + (1-\tau)R_{disk}$
- Where $\tau$ is the wedge size in 0 to 1
Not classic transparency

What makes it look transparent?
- View an edge (Metelli, Brill)
- View an X-junction (Cavanaugh, Kitaoka)

Manipulating transparency

Too faint: unusable
Too strong: a fence

Summary

Design, vision and visualization

Look for a range
- Eliminate the bad
- Bound the acceptable

Grid experiments
- Encouraging initial results
- Alpha range around 0.2

Not completely explained by contrast
Not classic transparency

The challenge

What type of metrics and models do we need?
JND too small, may not capture cognition
JAD?

Just Attendable Difference

Slides will be on www.stonesc.com