Extensive Data Shows Punishing Reach of Racism for Black Boys

Black boys raised in America, even in the wealthiest families and living in some of the most well-to-do neighborhoods, still face less in adulthood than white boys with similar backgrounds, according to emerging new study that traced the lives of millions of children.

White boys who grow up rich are likely to remain that way. Black boys raised at the top, however, are more likely to become poor than to stay wealthy in their own adult households.

READING RESPONSE: QUESTIONS/THOUGHTS

When discussing alternatives to d3, it seems to be other HTML and javascript type software. However, I am curious if anyone considered using a c# type software. ... The assignment could be easily done in a day in unity, as many of the components are built into unity for that kind of interaction.

“How can we find the balance between simplicity and flexibility in making interactive data visualizations?” My guess is that the most elegant solution for interactive visualizations varies from case to case and relies on a variety of factors such as how the data is organized.

The “Overview + Detail”, “Details on Demand”, and “Cross-Filtering” sections were very novel to me in terms of the actions required for users to interact with the data. I don’t know if the average person would be able to guess how they should click in order to see the information they are interested in, or even more important, the information that the source hopes to emphasize to the reader.

The piece on “The death of interactive infographics?” ... begins to veer towards generally recommending against data visualization unless 3 specific requirements can be met regarding the audience: Time, Goals, and Care. ... An interesting counterpoint that I considered is, what if you have a visualization where interactivity is essential to explain the data, regardless of the audience’s time or care.

GRAPHICAL PERCEPTION
DESIGN PRINCIPLES [Mackinlay 1986]

Expressiveness
A set of facts is expressible in a visual language if the sentences (i.e., the visualizations) in the language express all the facts in the set of data, and only the facts in the data.

Effectiveness
A visualization is more effective than another visualization if the information conveyed by one visualization is more readily perceived than the information in the other visualization.

DESIGN PRINCIPLES TRANSLATED [Mackinlay 1986]

Expressiveness
Tell the truth and nothing but the truth.
(don’t lie, and don’t lie by omission)

Effectiveness
Use encodings that people decode better.
(where better = faster and/or more accurate)
### EFFECTIVENESS RANKINGS [Mackinlay 1986]

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<thead>
<tr>
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### Graphical Perception

The ability of viewers to interpret visual (graphical) encodings of information and thereby decode information in graphs.
Learning Objectives

1. Understand basic features of human visual perception.

2. Understand why some visualizations more perceptually effective than others (i.e., understand graphical perception).

TODAY

SIGNAL DETECTION
DETECTING BRIGHTNESS

Which is brighter?

DETECTING BRIGHTNESS

Which is brighter?
JUST NOTICEABLE DIFFERENCE

JND (Weber’s Law)

\[ \Delta S = k \frac{\Delta I}{I} \]

Perceived change in Sensation \rightarrow \text{Scale Factor (Empirically Determined)} \rightarrow \text{Change of Intensity} \rightarrow \text{Physical Intensity}

Ratios more important than magnitude
Most continuous variations in stimuli are perceived in discrete steps
ENCODING DATA WITH COLOR

Value is perceived as ordered
- Encode ordinal variables (O)
  ![Ordinal Variables]

- Encode continuous variables (Q) [not as well]
  ![Continuous Variables]

Hue is normally perceived as unordered
- Encode nominal variables (N) using color
  ![Nominal Variables]

STEPS IN FONT SIZE

Sizes standardized in 16th century

6 7 8 9 10 11 12 14 16 18 21 24 36 48 60 72
ESTIMATING MAGNITUDE
Compare areas of circles
Compare lengths of bars
Compare areas of circles

Compare lengths of bars
**STEPHEN’S POWER LAW**

\[ S = I^p \]

Exponent (Empirically Determined)

Perceived Sensation

Physical Intensity

\( p < 1 \): underestimate

\( p > 1 \): overestimate

Graph from Wilkinson 1999, based on Stevens 1961

**EXPONENTS OF POWER LAW**

<table>
<thead>
<tr>
<th>Sensation</th>
<th>Exponent</th>
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<tbody>
<tr>
<td>Loudness</td>
<td>0.6</td>
</tr>
<tr>
<td>Brightness</td>
<td>0.33</td>
</tr>
<tr>
<td>Smell (Coffee)</td>
<td>0.55</td>
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<tr>
<td>Smell (Heptane)</td>
<td>0.6</td>
</tr>
<tr>
<td>Taste (Saccharine)</td>
<td>0.6</td>
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<tr>
<td>Taste (Salt)</td>
<td>-1.3</td>
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<tr>
<td>Temperature (Cold)</td>
<td>1.0</td>
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<tr>
<td>Temperature (Warm)</td>
<td>1.6</td>
</tr>
<tr>
<td>Vibration (250 Hz)</td>
<td>0.6</td>
</tr>
<tr>
<td>Vibration (60 Hz)</td>
<td>0.95</td>
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<tr>
<td>Duration</td>
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<tr>
<td>Pressure</td>
<td>1.1</td>
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<tr>
<td>Heaviness</td>
<td>1.45</td>
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<tr>
<td>Electric Shock</td>
<td>3.5</td>
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Psychophysics of Sensory Function [Stevens 1961]
APPARENT MAGNITUDE SCALING

$$r = r_0 \left( \frac{u}{u_0} \right)^{0.5716}$$  [Flannery 1971]

ABSOLUTE SYMBOL SCALING

Total Firearm Assaults in 2011 By State
FLANNERY
SCALING

\[ r = r_0 \left( \frac{v}{v_0} \right)^{0.5716} \]

RANGE
GRADING
Graphical Perception [Cleveland and McGill 1984]
Graphical Perception [Cleveland and McGill 1984]

### RELATIVE MAGNITUDE ESTIMATION

- **Most accurate**
  - Position (common) scale
  - Position (non-aligned) scale
  - Length
  - Slope
  - Angle
  - Area
  - Volume
- **Least accurate**
  - Color hue-saturation-density

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Figure 16: Log absolute error means and 95% confidence intervals for judgment types in position-length experiment (top) and position-angle experiment (bottom).
### EFFECTIVENESS RANKINGS [Mackinlay 1986]

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### MULTIPLE ATTRIBUTES
**ONE-DIMENSIONAL: LIGHTNESS**

- White
- White
- White
- Black
- White
- Black

**ONE-DIMENSIONAL: SHAPE**

- Square
- Circle
- Circle
- Square
- Circle
- Circle
REDUNDANT: SHAPE & LIGHTNESS

- Circle
- Square

ORTHOGONAL: SHAPE & LIGHTNESS

- Circle
- Square
SPEEDED CLASSIFICATION

Redundancy gain
Facilitation in reading one dimension when the other provides redundant information

Filtering interference
Difficulty in ignoring one dimension while attending to the other
TYPES OF PERCEPTUAL DIMENSIONS

Integral
Filtering interference and redundancy gain

Separable
No interference or gain

Configural
Only interference, but no redundancy gain

Asymmetrical
One dimension separable from other, not vice versa
Example: The Stroop effect – color naming is influenced by word identity, but word naming is not influenced by color

STROOP EFFECT: WHAT WORD?

blue
yellow
red
orange
green
purple
STROOP EFFECT: WHAT COLOR?

- blue
- yellow
- red
- orange
- green
- purple

REDUNDANT: SIZE & VALUE

W. S. Dobson, Visual information processing and cartographic communication: The role of redundant stimulus dimensions, 1983 (reprinted in MacEachren, 1995)
ORTHOGONAL: HEIGHT & WIDTH

How well can you see temperature or precipitation? Is there a correlation between the two?

ORTHOGONAL: ORIENTATION & SIZE

How well can you see temperature or precipitation? Is there a correlation between the two?
ORTHOGONAL: SHAPE & SIZE

Easier to see one shape across multiple sizes than one size of across multiple shapes?

[MacEachren 1995]

SUMMARY OF INTEGRAL-SEPARABLE

Figure 5.25, Color Plate 10, [Ware 2000]
VISUAL POP-OUT: COLOR

https://www.csc2.ncsu.edu/faculty/healey/PP/
VISUAL POP-OUT: SHAPE

https://www.csc2.ncsu.edu/faculty/healey/PP/

FEATURE CONJUNCTIONS

https://www.csc2.ncsu.edu/faculty/healey/PP/
PRE-ATTENTIVE FEATURES

- Line (blob) orientation: Julesz & Bergen [1983]; Wolfe et al. [1992]
- Length: Triesman & Gormican [1988]
- Width: Julesz [1985]
- Size: Triesman & Gelade [1980]; Triesman & Gormican [1988]
- Curvature: Julesz & Bergen [1983]
- Number: Julesz [1985]; Trick & Pylyshyn [1994]
- Terminators: Julesz & Bergen [1983]
- Intersection: Julesz & Bergen [1983]
- Closure: Enns [1986]; Triesman & Souther [1985]
- Intensity: Beck et al. [1983]; Triesman & Gormican [1988]
- Flicker: Julesz [1971]
- Binocular lustre: Wolfe & Franzel [1988]
- Stereoscopic depth: Nakayama & Silverman [1986]
- 3-D depth cues: Enns [1990]
- Lighting direction: Enns [1990]

http://www.csc.ncsu.edu/faculty/healey/PP/index.html
PRE-ATTENTIVE CONJUNCTIONS

Spatial conjunctions are often pre-attentive
Motion and 3D disparity
Motion and color
Motion and shape
3D disparity and color
3D disparity and shape

Most conjunctions are NOT preattentive
ANNOUNCEMENTS

ASSIGNMENT 3: INTERACTION

Due 10/30  11:30am

Create a small interactive dynamic query application similar to HomeFinder, but for local software companies data.

1. Implement interface
2. Submit the application as a website and a short write-up on canvas

Can work alone or in pairs