Design Principles for Visualization

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February 20, 2019
1:15pm-2:30pm, Fainsod Room
Littauer Building, Room 324
Visualization for data exploration and presentation.

What we imagine visualization is like:
Visualization for data exploration and presentation.

...10x

What it’s actually like.
Workflow for creating visualizations for presentation.

- Begin by defining the purpose of your visual(s) and its intended audience.
- Choose appropriate form(s) for intended function.
- Consider aesthetic/design principles.
Workflow for creating visualizations for presentation.

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What we’ll cover

- The psychology of interpreting visuals
- Color
- Form (or types of visual you might consider)
- Quick overview of key graphic design principles
Background and theory:
How do our brains process visuals?
Preattentive visual cues

3 9 2 8 1 0 2 4 3
5 8 7 1 3 4 5 9 2
0 4 6 2 7 3 2 2 9
9 4 8 2 7 5 1 0 3
8 1 9 4 0 2 6 3 5

3 9 2 8 1 0 2 4 3
5 8 7 1 3 4 5 9 2
0 4 6 2 7 3 2 2 9
9 5 8 1 2 5 1 0 6
8 1 9 4 0 2 6 3 5
Why bother? To add complexity.

Feature level tuning can allow us to attend to different layers of information.
Gestalt principles: proximity
Gestalt principles: similarity
Gestalt principles: connectedness
Gestalt principles: continuity
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Curved lines make continuity easier to follow.
Gestalt principles: closure and common region
Applications

Julia Louis-Dreyfus is good at almost everything
IMDb ratings for appearances by Louis-Dreyfus

Denzel Washington is unstoppable
Domestic box office in 2015 dollars vs. Rotten Tomatoes rating
Some cues are more powerful than others
Color
Color basics
There are many ways to visualize color.
This chart shows the dominant color names over the three fully-saturated faces of the RGB cube (colors where one of the RGB values is zero)
Choosing a palette: general guidelines

- You need different palettes for continuous, divergent, and discrete data.
- 10 colors max for reliable differentiation
- Vary your palette in hue and brightness.
Color blindness

original
deuteranomaly
protanomaly
tritanomaly

original
deuteranomaly
protanomaly
tritanomaly

original
deuteranomaly
protanomaly
tritanomaly

original
deuteranomaly
protanomaly
tritanomaly
What happens when you use the wrong palette?
Tips for color usage

When color coding large background areas overlaid with small colored symbols, consider using all low-saturation, high-value (pastel) colors for the background, together with high-saturation symbols on the foreground.
Be intuitive.

Where there are cultural biases for certain color choices, adhere to them.
Good use of color

Period 1

<table>
<thead>
<tr>
<th>Team</th>
<th>Points scored</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crows</td>
<td>24</td>
</tr>
<tr>
<td>Blue Jays</td>
<td>36</td>
</tr>
<tr>
<td>Seagulls</td>
<td>12</td>
</tr>
<tr>
<td>Hawks</td>
<td>38</td>
</tr>
<tr>
<td>Robins</td>
<td>25</td>
</tr>
</tbody>
</table>

Previous record

Each line represents the evolution of the average number of children per woman in a country.
Monochromatic, complementary, & analogous colors
Form
Choose form based on the desired purpose of your visualization.

Points scored

- Crows
- Blue Jays
- Seagulls
- Hawks
- Robins
Distributions

- Histogram
- Density plot
- Cumulative density
- q-q plot
Comparisons

- Grouped bars
- Grouped bars
- Stacked bars
- Stacked bars
- Heatmap
Proportions
x-y relationships
Geospatial and chronological
Network
Or something else entirely
Some examples
Screenplay Dialogue, Broken-down by Gender

Men have 60%+ Dialogue

- The Jungle Book: 98% Male Dialogue
- Monsters, Inc.: 90%
- Up: 87%
- Toy Story: 87%
- The Rescuers Down Under: 75%
- Aladdin: 75%
- Holes: 75%
- Cars 2: 75%
- The Lion King: 75%
- Ratatouille: 75%
- Something Wicked This Way: 75%
- Monsters University: 75%
- Hercules: 69%
- Hunchback Of Notre Dame: 69%
- Toy Story 3: 69%
- Finding Nemo: 69%
- Mulan: 69%
- Star Wars: Episode VII...: 69%
- Beauty And The Beast: 69%
- The Little Mermaid: 69%
- Wreck-It Ralph: 69%
- Mighty Joe Young: 69%
- Pocahontas: 69%

Gender Balance, +/- 10%

- Frozen: 57% / 43%
- The Incredibles: 57% / 43%
- Into The Woods: 57% / 43%
- Tarzan: 57% / 43%

Women have 60%+ Dialogue

- Inside Out: 36% / 64%
- Alice In Wonderland: 36% / 64%
- Maleficent: 36% / 64%
- Sleeping Beauty: 36% / 64%
Waiting For Sanctity

Why Brazil, even as the country with the largest Catholic population, fails to find saints.

In 2006, Pope John Paul II said that the country needed a saint of its own. Since then, there have been only two: Mother Patrícia in 2002 and Padre Galvão in 2007. But the number of candidates hasn't stopped growing.

There are nearly 70 Brazilian candidates for canonization waiting to be recognized by the Vatican. The list below includes the 15 most well-known cases, along with their years of vagary.

Number of bishops, archbishops, and cardinals. The total number of bishops, archbishops, and cardinals in Brazil is 175, with 34 of them holding the title of cardinal.

Countries with largest Catholic populations (Millions of adherents):

1. Brazil - 165
2. Mexico - 104
3. USA - 65
4. France - 44
5. Spain - 33
6. Argentina - 32
7. Portugal - 28
8. Russia - 25
9. Philippines - 24
10. India - 18
11. Canada - 14
12. Italy - 11
13. Chile - 10
14. Colombia - 6
15. Germany - 5
16. Indonesia - 4
17. Vietnam - 4
18. Pakistan - 3
19. Australia - 3
20. Peru - 3

The percentage of the decline of the Evangelical Church is 79%.

Number of priests per country:

1. Brazil - 40
2. USA - 28
3. France - 26
4. Spain - 25
5. Philippines - 23
6. Italy - 15
7. Germany - 14
8. Canada - 13
9. Indonesia - 9
10. Vietnam - 9
11. Australia - 8
12. Pakistan - 7
13. Peru - 6
14. Argentina - 5
15. China - 4
16. Mexico - 3
17. Chile - 3
18. Colombia - 2
19. Russia - 2
20. India - 1

Pope John Paul II consecrated 10 of the 11 saints canonized in the last 400 years. The last was Pope Paul VI in 1978.
Design
C.R.A.P. principles of graphic design

- **Contrast**: be bold in your differences
- **Repetition**: repeat visual elements to make visual themes
- **Alignment**: everything should align to something. Beware of centering.
- **Proximity**: related things should be closer together.

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**Title**

Texty text example text text text to show some good design principles about alignment and lots of other things.

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**TITLE**

Texty text example text text text to show some good design principles about alignment and lots of other things.

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**How about an advertisement?**

- The best ad ever
- With an image and all
- It’s really the best
- Check it out

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Omeka Plugin Development

In addition to supporting a standard installation of Omeka for FAS courses, Academic Technology for the FAS, DARTH, and the History Department have collaborated on a number of Omeka plugins to extend Omeka functionality, making it easier to use the platform in a classroom setting.

HarvardKey Integration

When the service first launched, Omeka users had to maintain separate login information for each site. With the integration of HarvardKey credentials, students, staff, and faculty can all use their HarvardKey credentials to log in to Omeka sites. This plugin also allows users to be added in bulk, simply by copying a list of emails into the plugin configuration. This plugin has greatly simplified the use of Omeka in a classroom setting.

Elasticsearch

For larger Omeka collections, it can be beneficial to have a faster, more robust search engine. The Omeka Elasticsearch plugin not only allows users to search through the contents of their Omeka sites more easily, but also gives them all of the features that Elasticsearch has to offer, including advanced facets and filters through a simple search syntax.

Course Tools

This plugin allows instructors to manage the permissions of their students dynamically throughout the term, enabling and disabling various editing and viewing permissions.
Who is eligible to vote

Under a change of rules stipulated by Pope Paul VI, only cardinals who have not yet reached their 80th birthday on the day of the papal death may enter the conclave. Those over 80 may participate in preliminary meetings.

Conclave rules

Each cardinal has to be present to vote and must cast his own ballot.

Other people allowed inside the conclave: two technicians, medical personnel, and several scribes.

Cardinals and assistants swear an oath of absolute secrecy. Leaking information would result in excommunication.

The cardinals are not permitted any contact with the outside world: no telephones, newspapers, television, messages, letters or signals. Observers are not appointed to speak to them.

The conclave is conducted in the Sistine Chapel.

About the 135 electors

Forty-eight cardinals were appointed by Pope Pius XII. Fifty-one were appointed by Pope John XXIII. Fifty-six were appointed by Pope Paul VI. Fifty-one were appointed by Pope Paul VI.

They come from 54 countries.

The average age is 72 years.

Ballots are counted

The cardinal Camerlengo and his three assistants tally the ballots and read aloud the name of the cardinal who received each vote. The ballots and any votes are then burned. A record is kept for the Vatican archives.

How ballotting takes place

Voting begins the first afternoon. No one can receive the required two-thirds of ballots cast, voting takes place twice each morning and afternoon. If after the third day no pope is elected, a conclave is declared.

Determining a winner

A two-thirds majority of the cardinals present is required to win. After 33 rounds, a new pope is elected. After 33 rounds, the voting process repeats after each seven votes.

A new pope is announced

Smoke signals announce the election of a new pope. Black smoke signals mean no pope has been elected. White smoke signals announce the election of a new pope.
Questions?

...I’m happy to help!

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Or search “visualization” at library.harvard.edu and contact me there.
Image sources


Cotnoir, Leigh. "Hue, Value, Saturation." Published on learn.leighcotnoir.com; link here. Slide 22.


RGB color cubes by Horst Frank, CC-BY-SA, slide 23.

Fivethirtyeight plot1, plot2, slide 19.

XKCD RGB, LotR, slides 24 and 42.

Verdant Labs, Politics by job, slide 45.

NYTimes, Election Maps, slides 41-42, 54.


Image sources


Kencf0618. Facebook network diagram, CC-BY-SA. Slide 41.


Hannah Anderson and Matt Daniels. “Film dialogue from 2,000 Screenplays, broken down by gender and age.” Slides 46-47.


Brooks, Megan, and Lindahl, Chrissa. Syllabus before and after, from Design Principles: CRAP. Slide 53.
Color tools and reading

- Color picker
- Color Brewer
- Bjango Color Creator
- Adobe’s (free) color palette tool


Cool guide about harmonious color palettes from a UX perspective: https://uxplanet.org/color-theory-brief-guide-for-designers-76e11c57eaa

Helpful reading

Visualization:

Wilke, Claus O. Fundamentals of Data Visualization. License CC-By-NC-ND. https://serialmentor.com/dataviz/. (free online!)


Graphic Design: