

Design Principles for Visualization

Jess Cohen-Tanugi

February 20, 2019

1:15pm-2:30pm, Fainsod Room

Littauer Building, Room 324

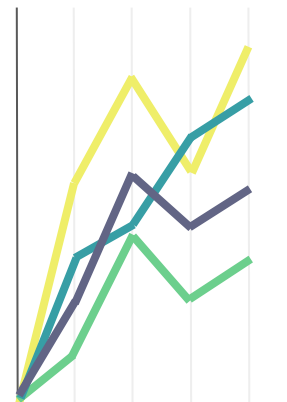
HARVARD
LIBRARY



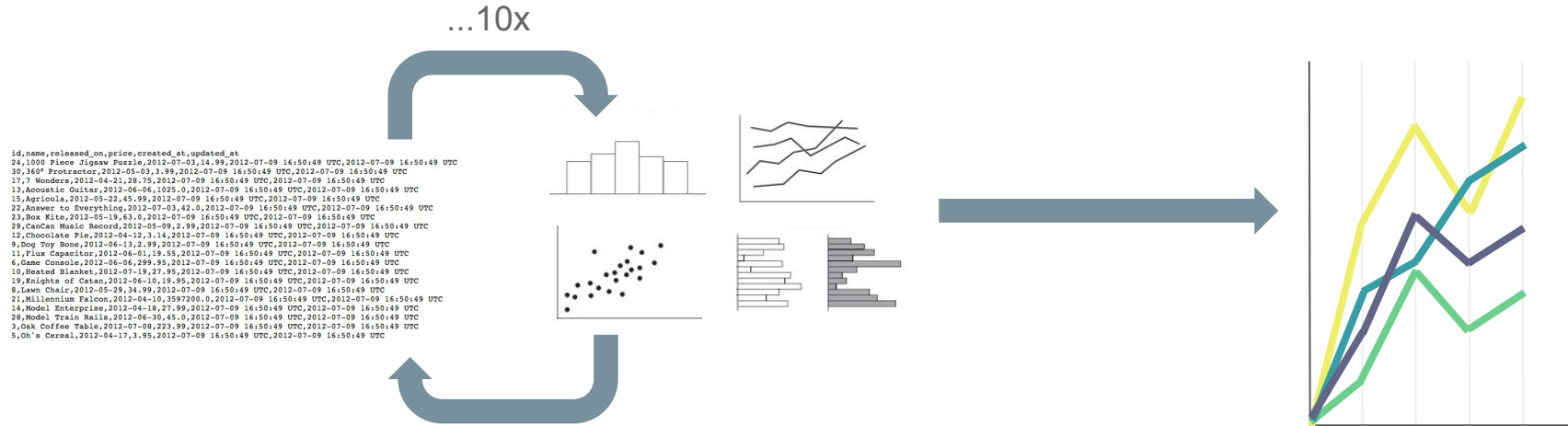
Visualization for data exploration and presentation.

What we imagine visualization is like:

```
id,name,released_on,price,created_at,updated_at
24,1000 Piece Jigsaw Puzzle,2012-07-03,14.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
30,360° Protractor,2012-05-03,3.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
17,7 Wonders,2012-04-21,28.75,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
13,Acoustic Guitar,2012-06-06,1025.0,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
15,Agricola,2012-05-22,45.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
22,Answer to Everything,2012-07-03,42.0,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
23,Box Kite,2012-05-19,63.0,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
29,CatCan Music Record,2012-05-09,2.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
12,Chocolate Pie,2012-04-12,3.14,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
9,Dog Toy Bone,2012-06-13,2.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
11,Flux Capacitor,2012-06-01,19.55,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
6,Game Console,2012-06-06,299.95,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
10,Heated Blanket,2012-07-19,27.95,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
19,Knights of Catan,2012-06-19,19.95,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
8,Lawn Chair,2012-05-29,34.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
21,Millennium Falcon,2012-04-10,359700.0,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
14,Model Enterprise,2012-04-18,27.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
28,Model Train Rails,2012-06-30,45.0,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
3,Oak Coffee Table,2012-07-08,221.99,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
5,Oh'm Cereal,2012-04-17,3.95,2012-07-09 16:50:49 UTC,2012-07-09 16:50:49 UTC
```



Visualization for data exploration and presentation.



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.

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} this presentation.

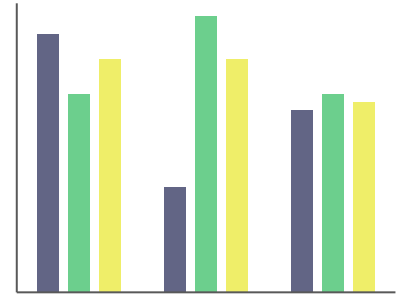
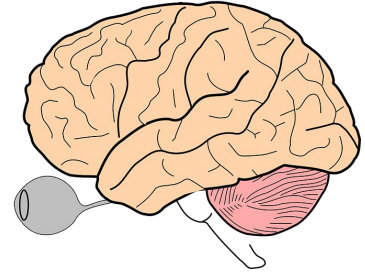
What we'll cover

- The psychology of interpreting visuals
- Color
- Form (or types of visual you might consider)
- Quick overview of key graphic design principles

rainbow scale



rainbow converted to grayscale

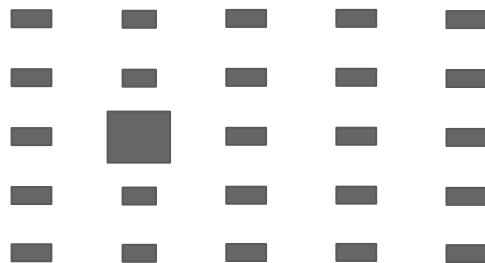
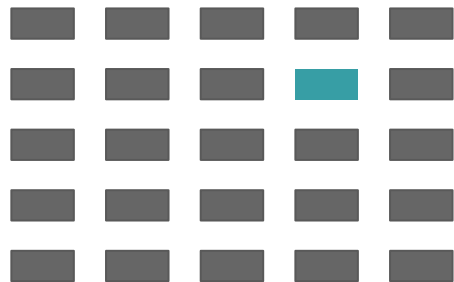


Background and theory:

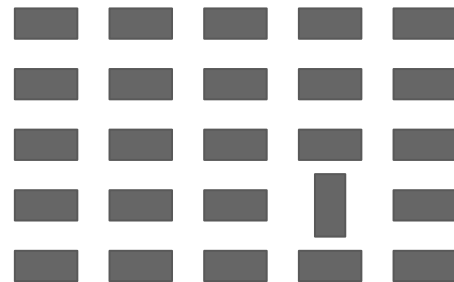
How do our brains process visuals?

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

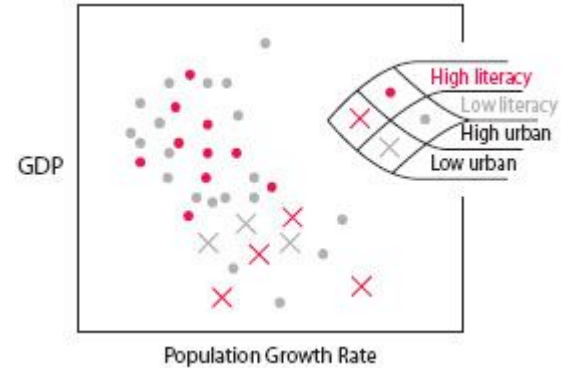


3 9 2 8 1 0 2 4 **3**
5 8 7 1 **3** 4 5 9 2
0 4 6 2 7 **3** 2 2 9
9 5 8 1 2 5 1 0 6
8 1 9 4 0 2 6 **3** 5

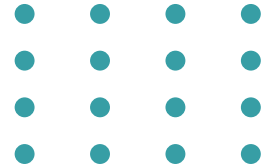
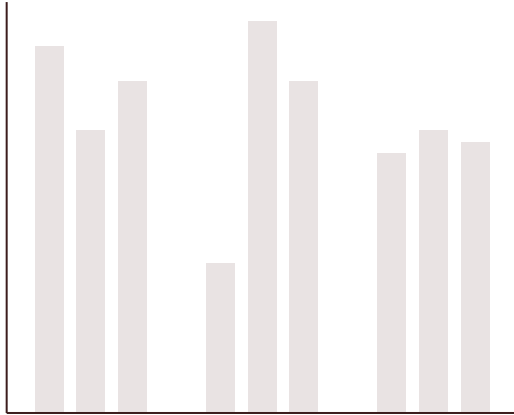


Why bother? To add complexity.

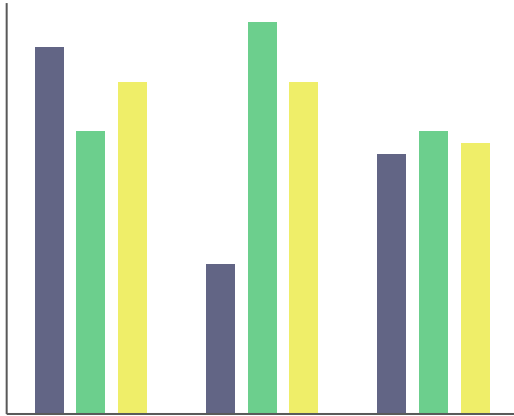
Feature level tuning
can allow us to attend
to different layers of
information



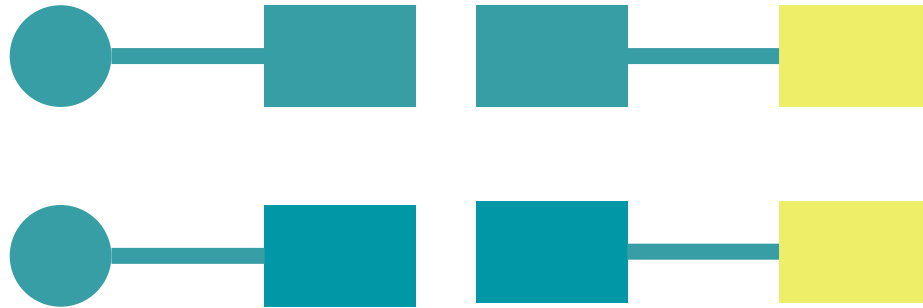
Gestalt principles: proximity



Gestalt principles: similarity



Gestalt principles: connectedness



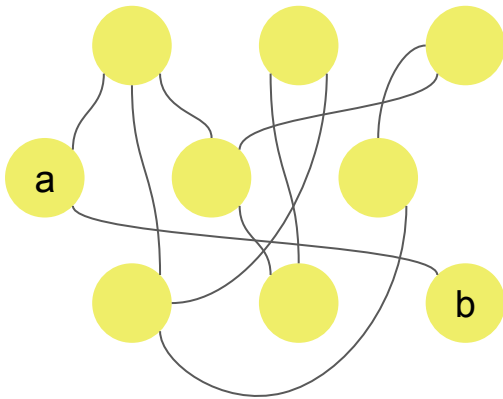
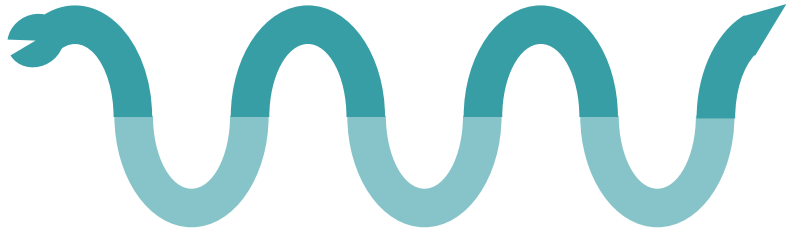
Gestalt principles: continuity



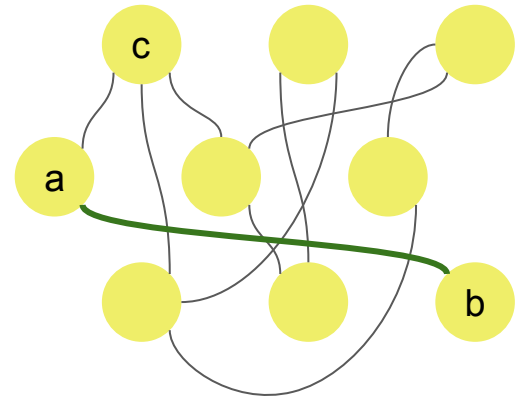
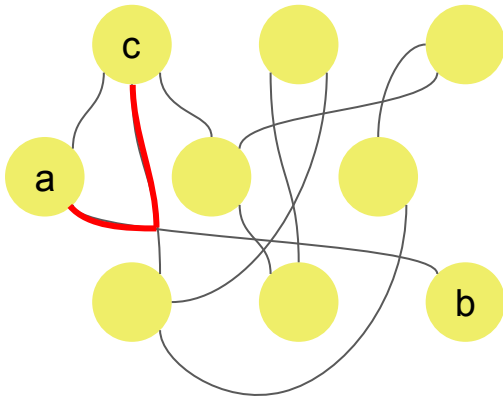
Gestalt principles: continuity



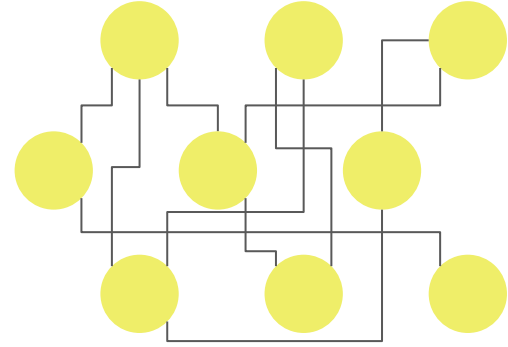
Gestalt principles: continuity



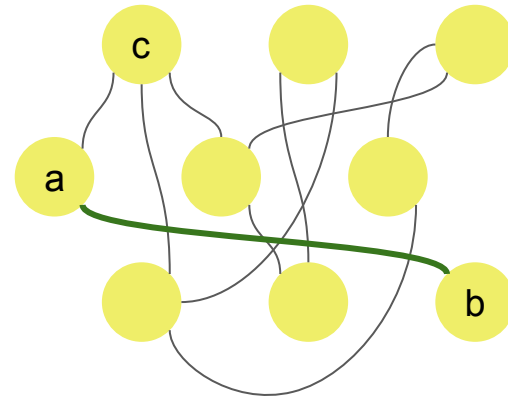
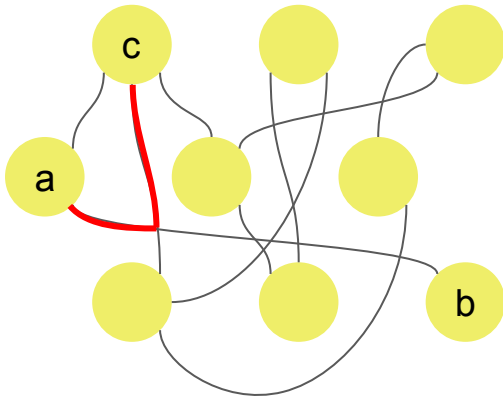
Gestalt principles: continuity



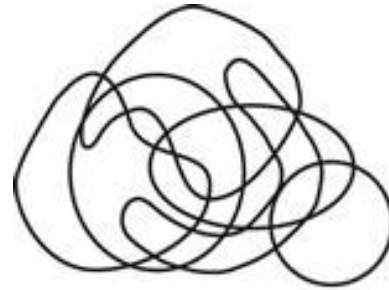
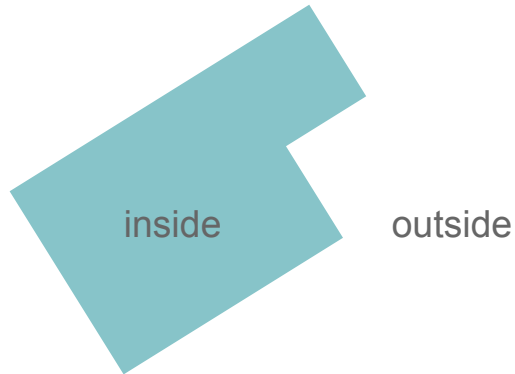
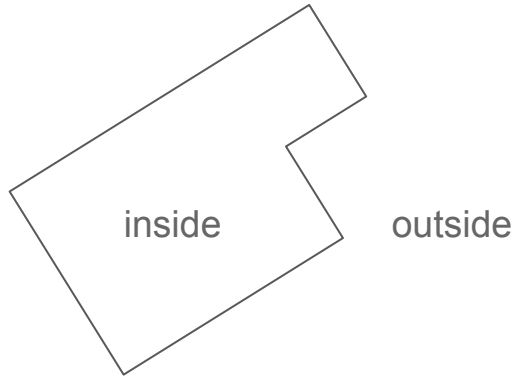
Gestalt principles: continuity



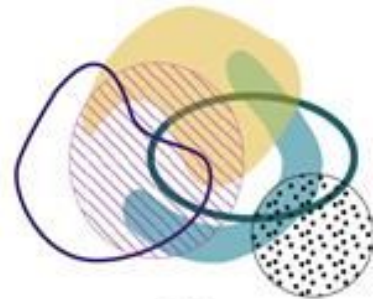
Curved lines make continuity easier to follow.



Gestalt principles: closure and common region



(a)

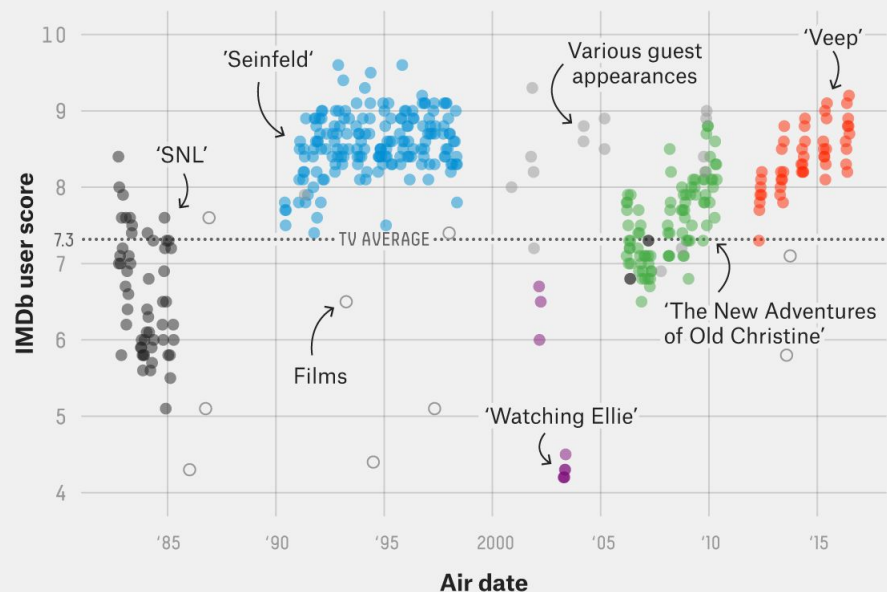


(b)

Applications

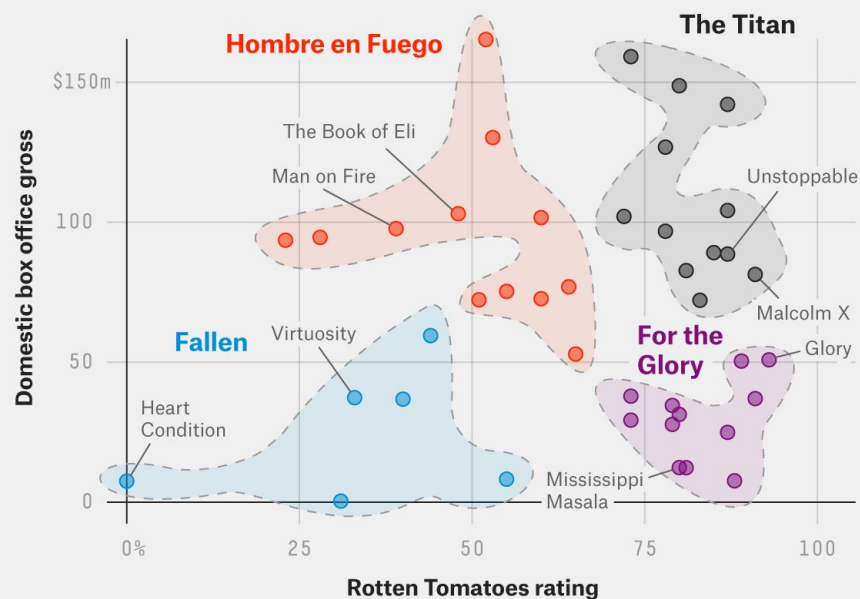
Julia Louis-Dreyfus is good at almost everything

IMDb ratings for appearances by Louis-Dreyfus

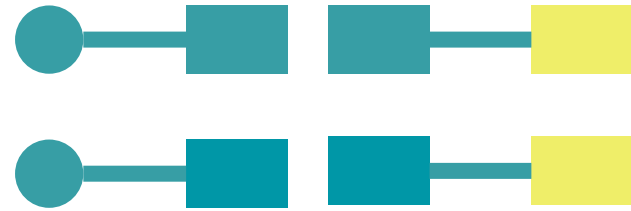


Denzel Washington is unstoppable

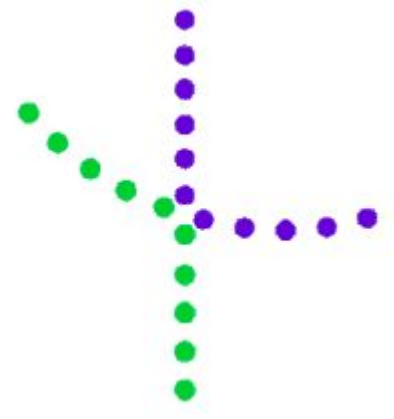
Domestic box office in 2015 dollars vs. Rotten Tomatoes rating



Some cues are more powerful than others

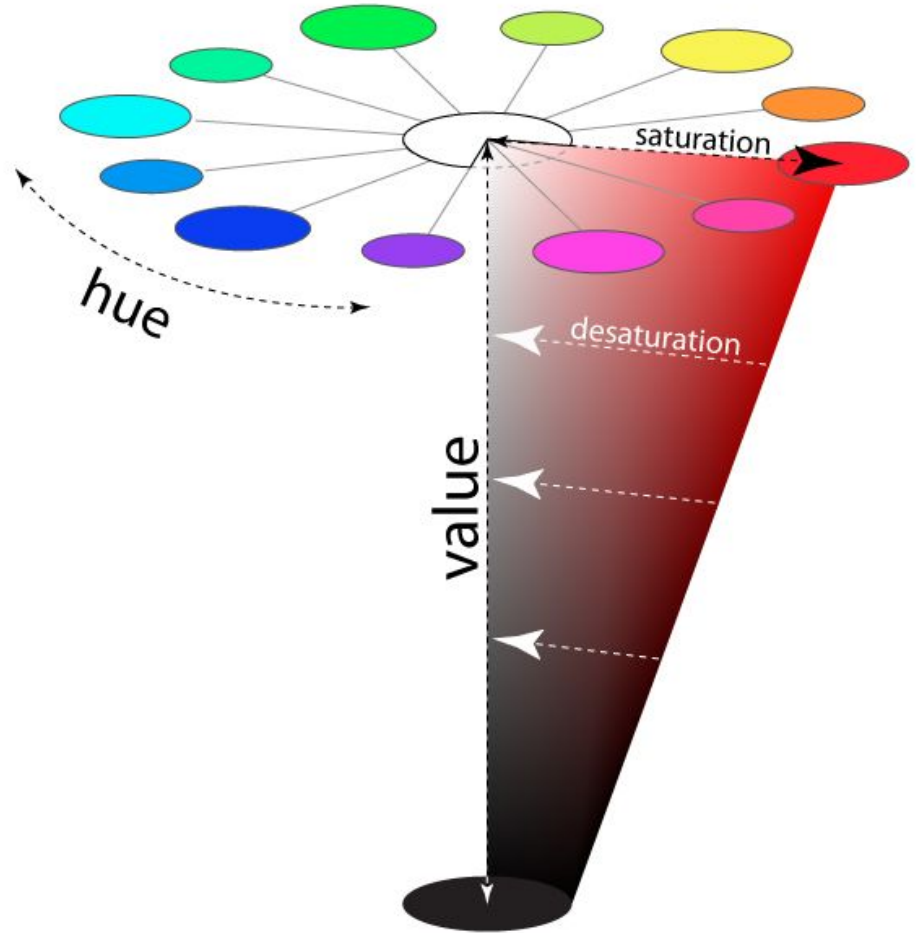
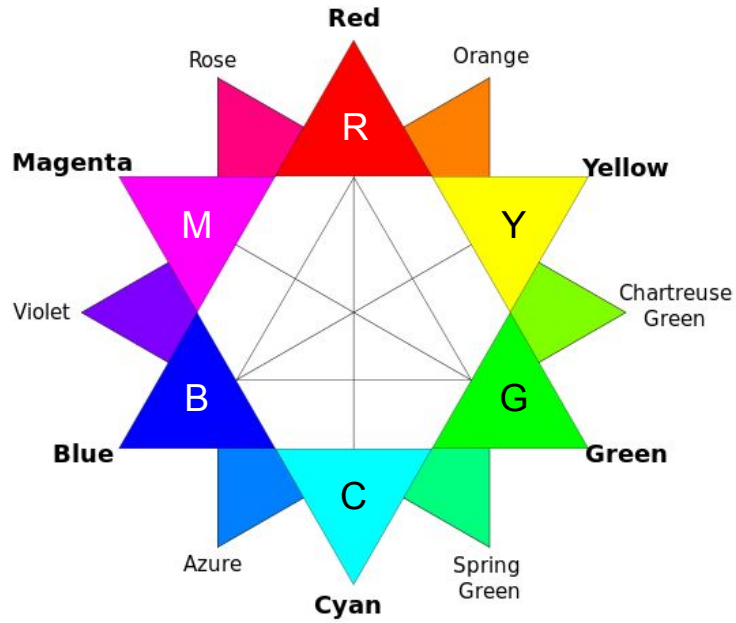


Green	Red	Blue
Purple	Red	Purple

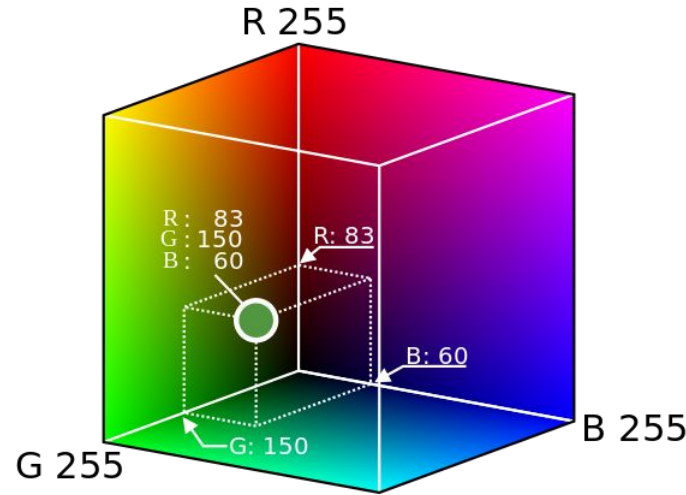
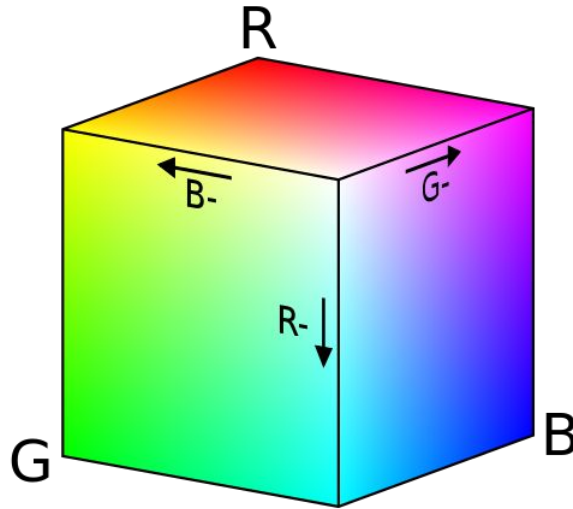
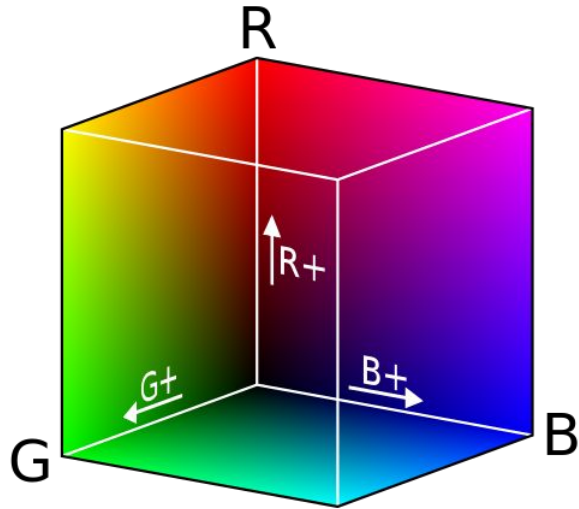


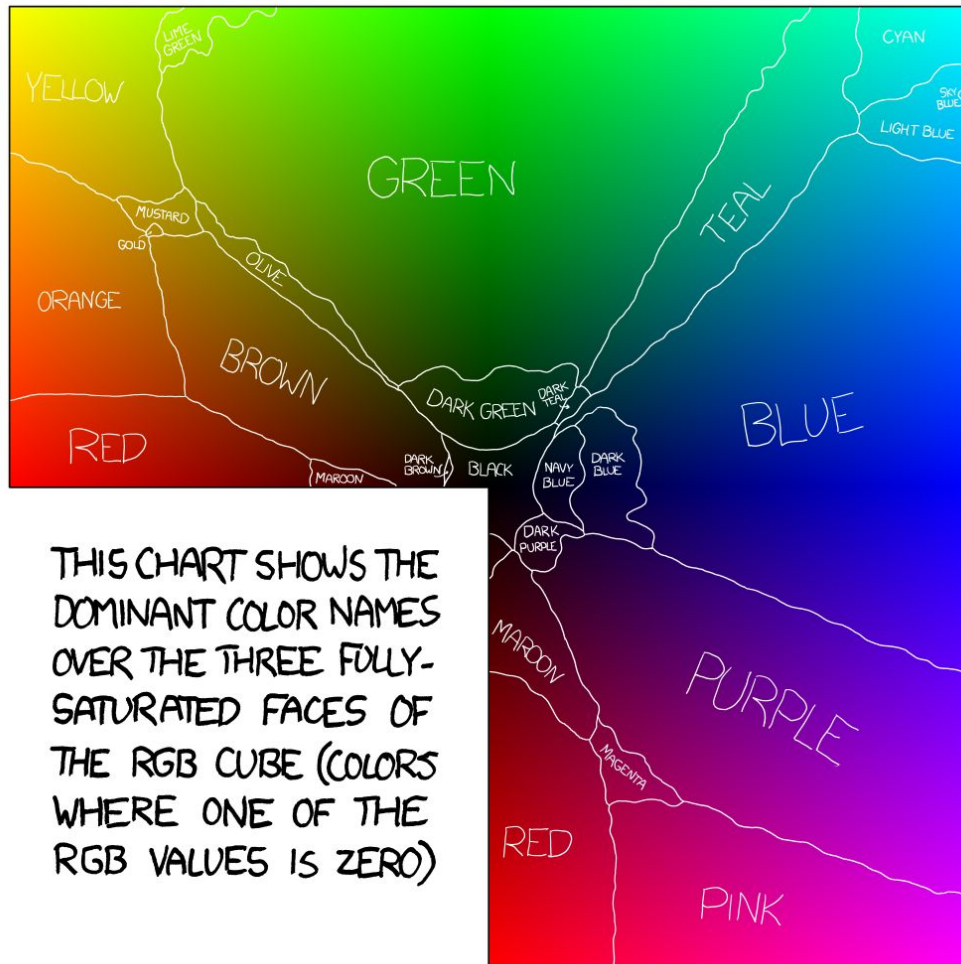
Color

Color basics



There are many ways to visualize color.





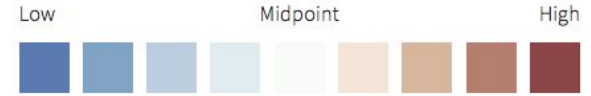
Choosing a palette: general guidelines



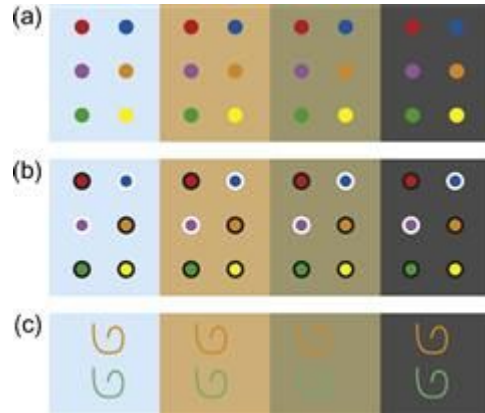
qualitative



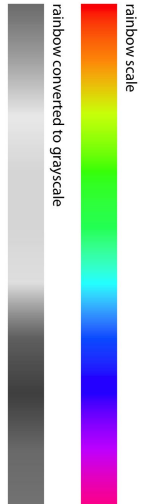
sequential



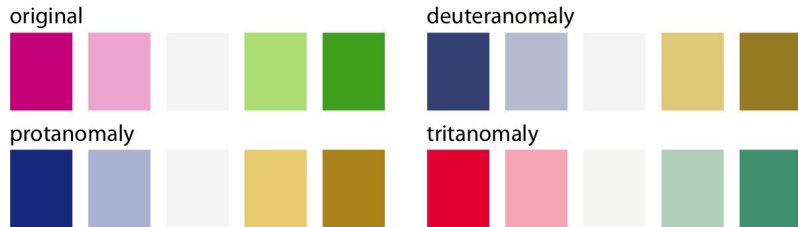
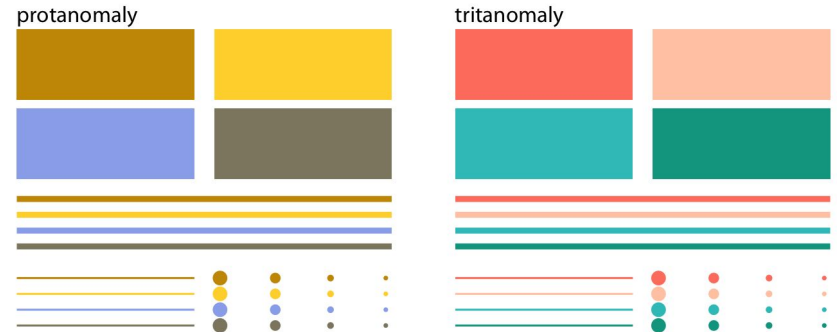
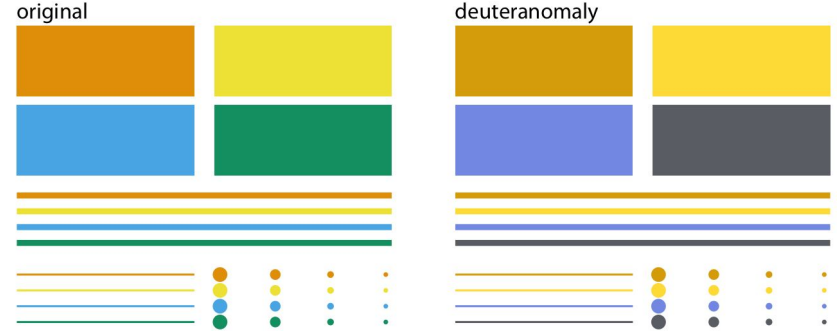
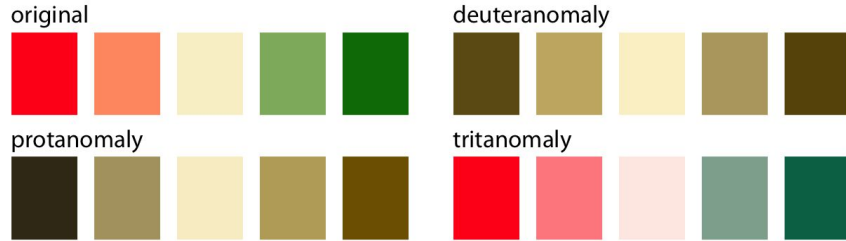
diverging



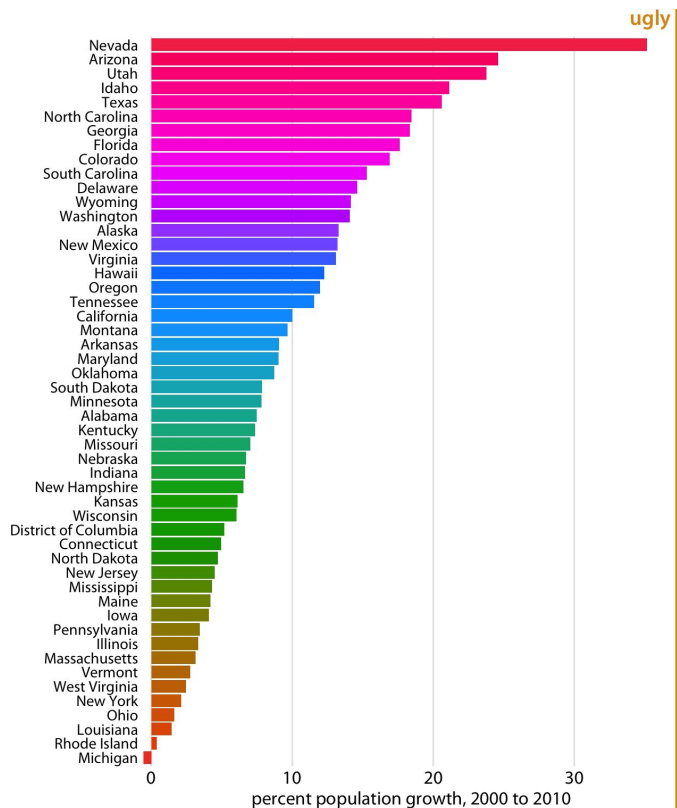
- You need different palettes for continuous, divergent, and discrete data.
- 10 colors **max** for reliable differentiation
- Vary your palette in hue **and** brightness.



Color blindness



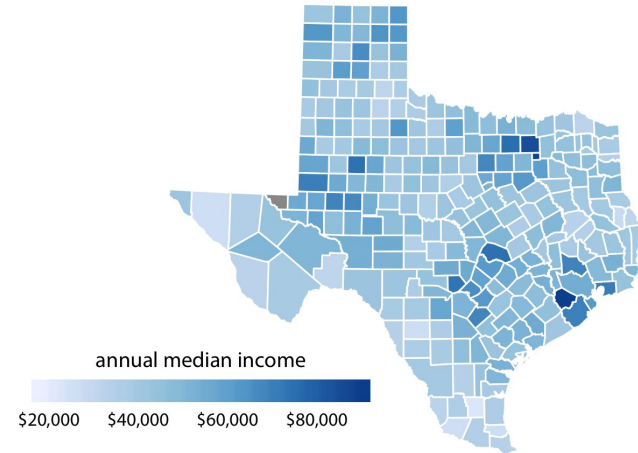
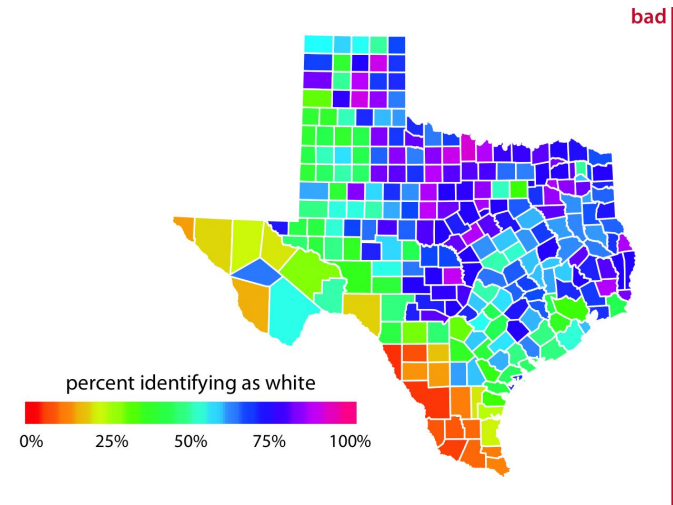
What happens when you use the wrong palette?



Tips for color usage

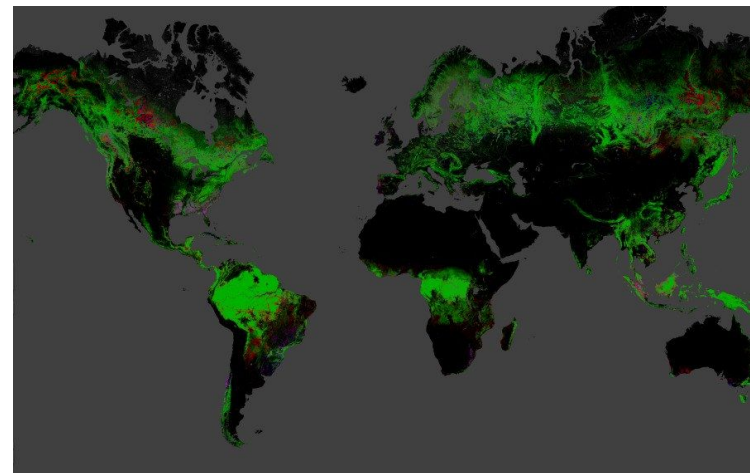


When color coding large background areas overlaid with small colored symbols, consider using all low-saturation, high-value (pastel) colors for the background, together with high-saturation symbols on the foreground.



Be intuitive.

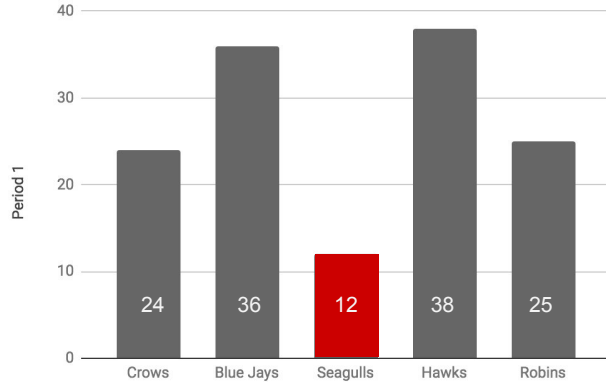
		# Patients	% Recovered	# Recovered
Male	Treatment	200	70.0%	140
	No treatment	100	80.0%	80
Female	Treatment	100	10.0%	10
	No treatment	200	20.0%	40
Grand Total	Treatment	300	50.0%	150
	No treatment	300	40.0%	120



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

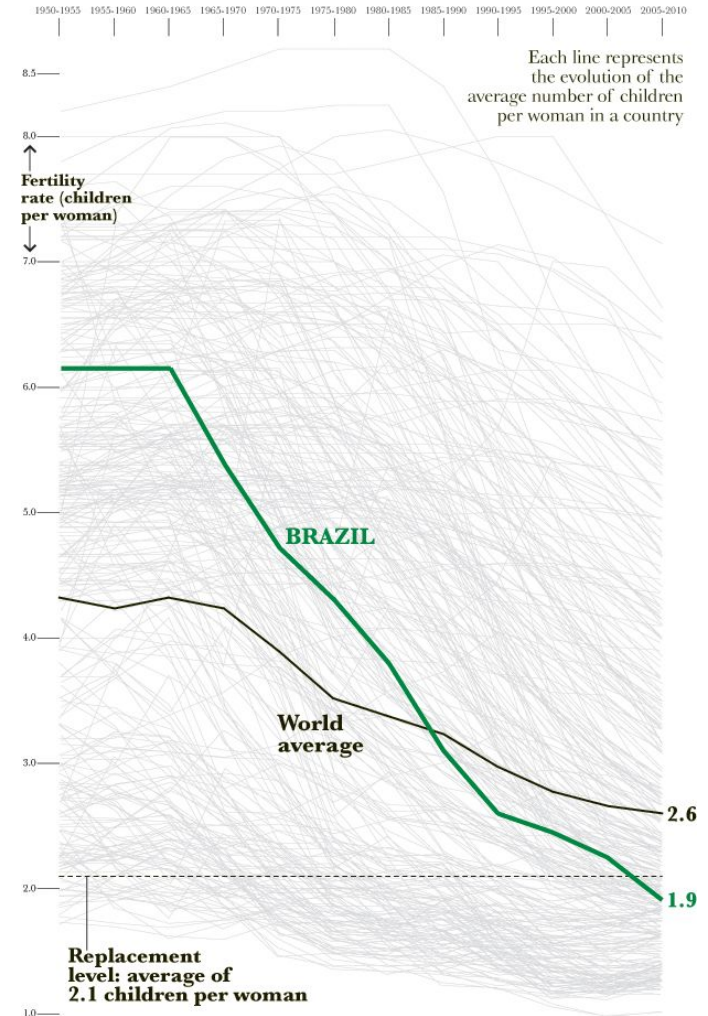
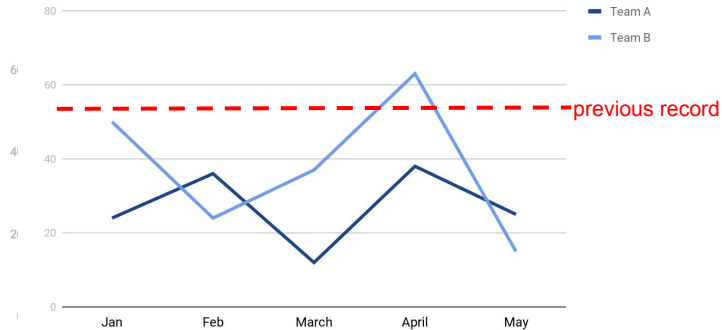
Good use of color

Period 1

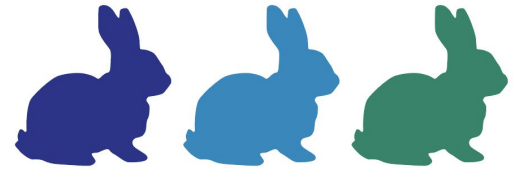
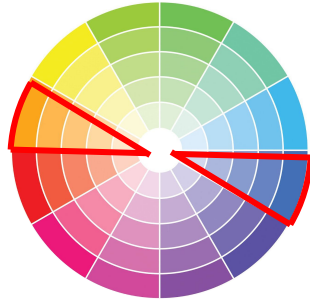
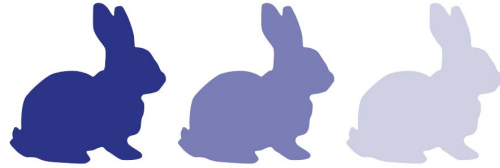


P

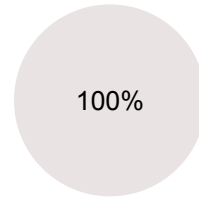
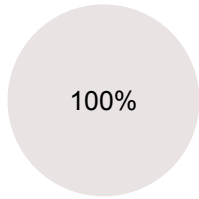
Points scored

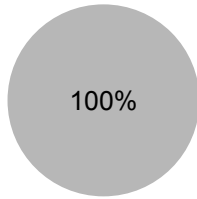


Monochromatic, complementary, & analogous colors

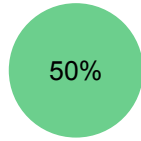


Form



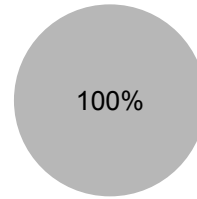


100%

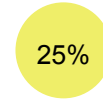


50%

$\frac{1}{2}$ area



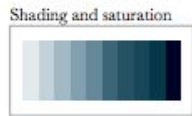
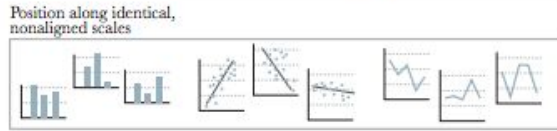
100%



25%

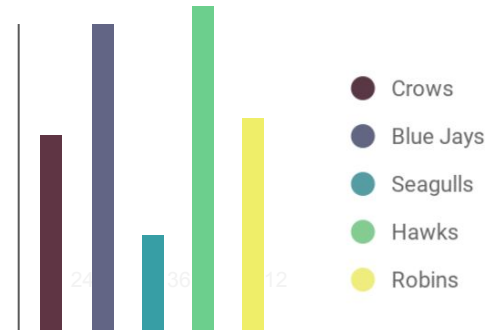
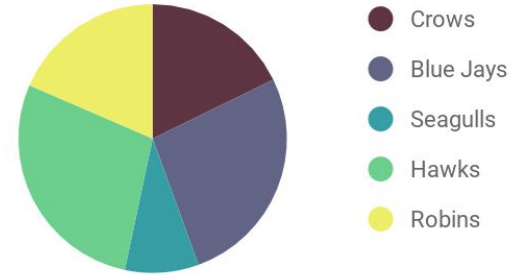
$\frac{1}{2}$ radius

Enable accurate estimates



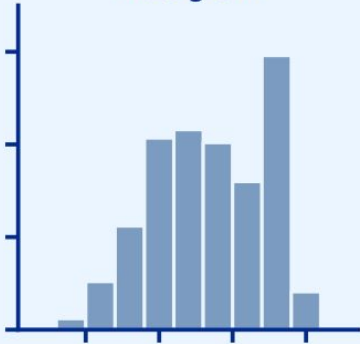
Choose form based on the desired purpose of your visualization.

Points scored

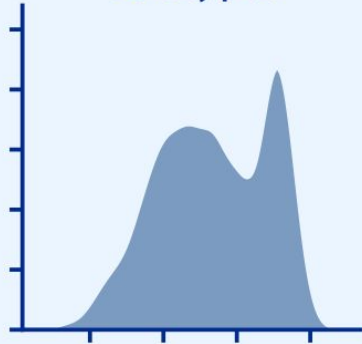


Distributions

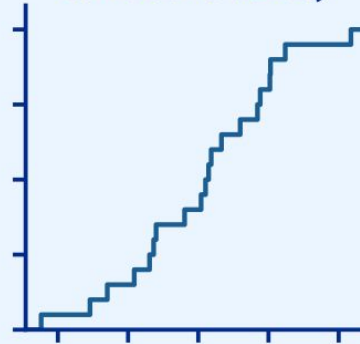
Histogram



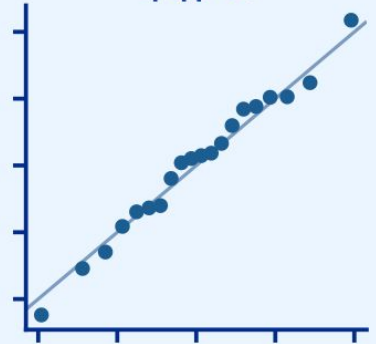
Density plot



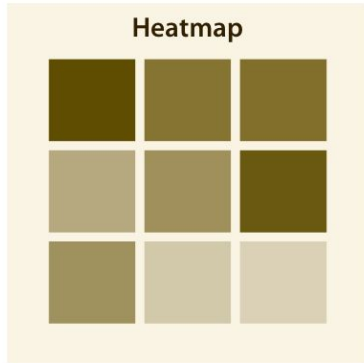
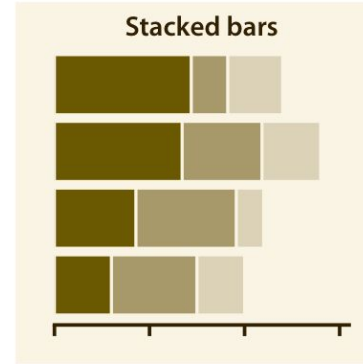
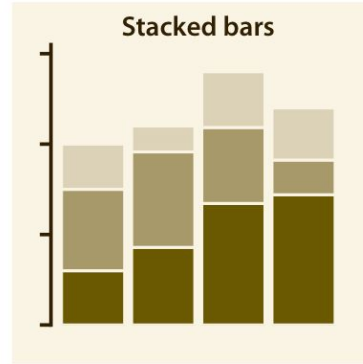
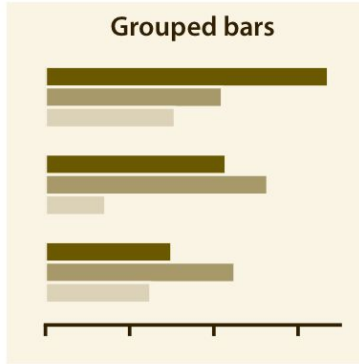
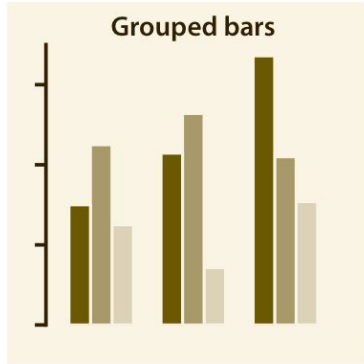
Cumulative density



q-q plot



Comparisons

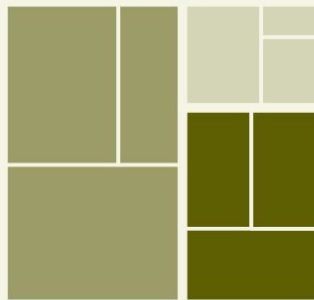


Proportions

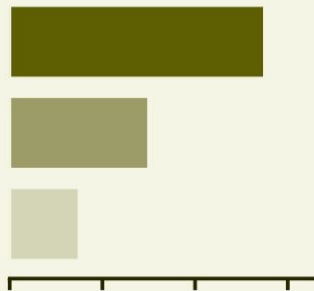
Pie chart



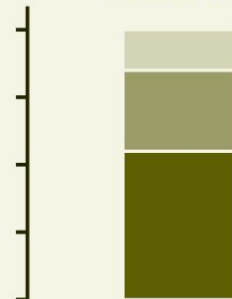
Treemap



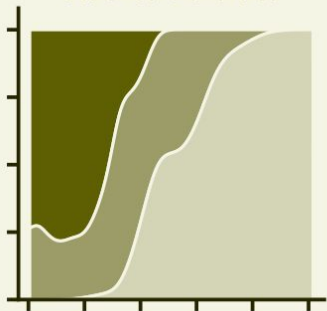
Bars



Stacked bars

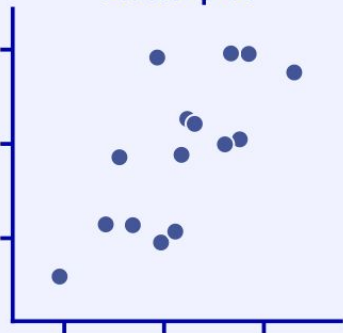


Stacked densities

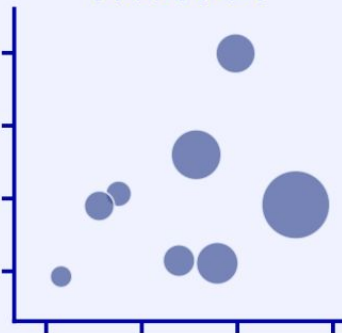


x-y relationships

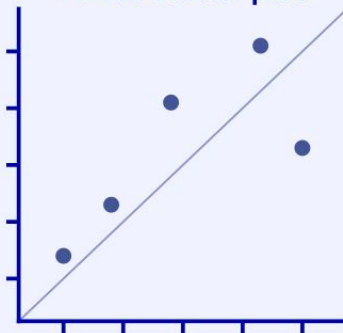
Scatter plot



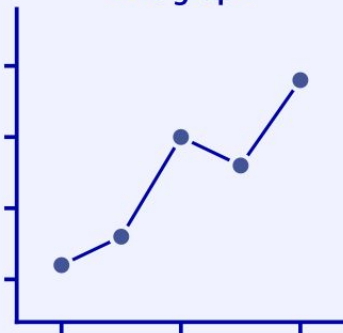
Bubble chart



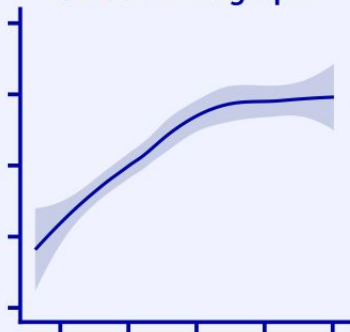
Paired scatter plot



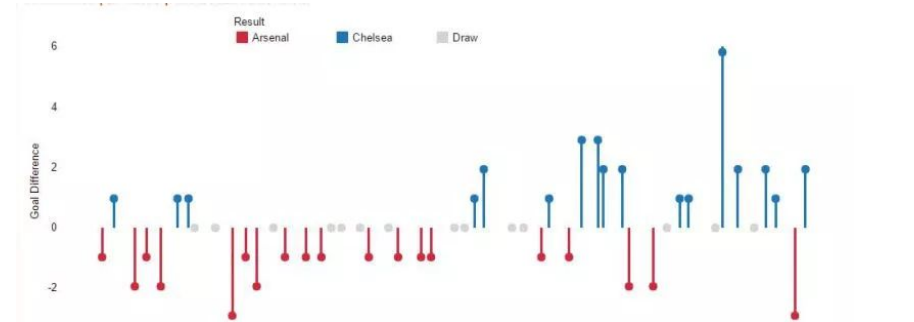
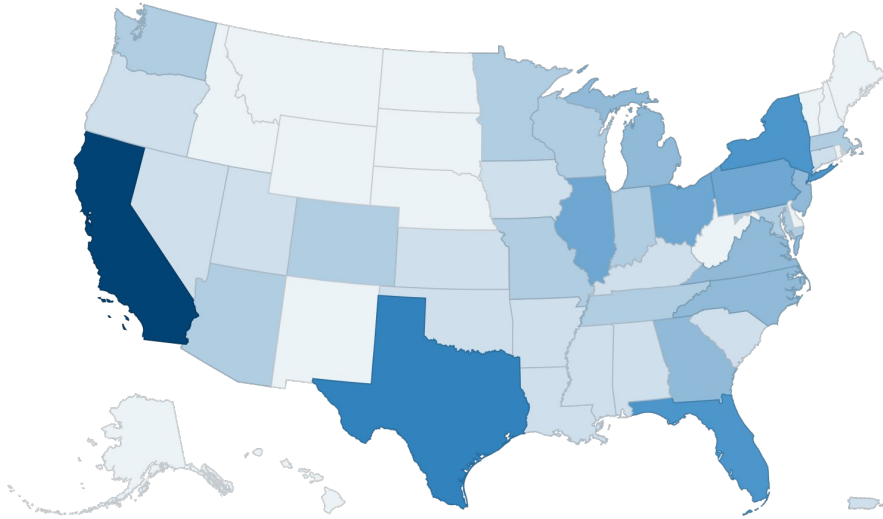
Line graph



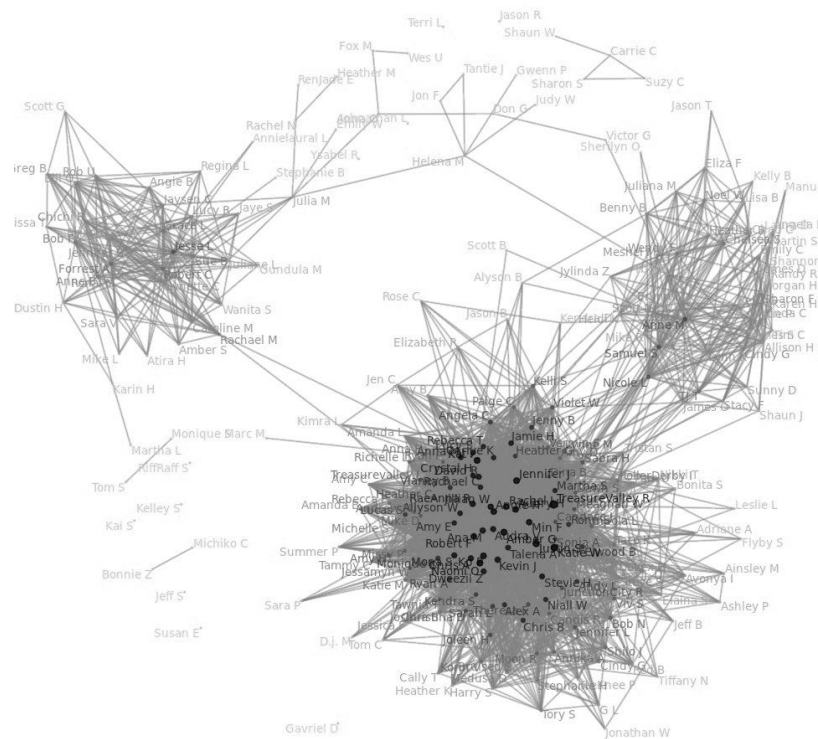
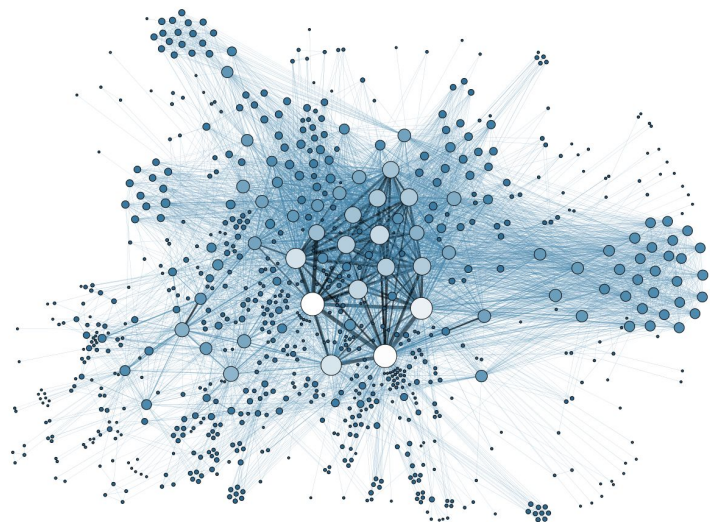
Smooth line graph



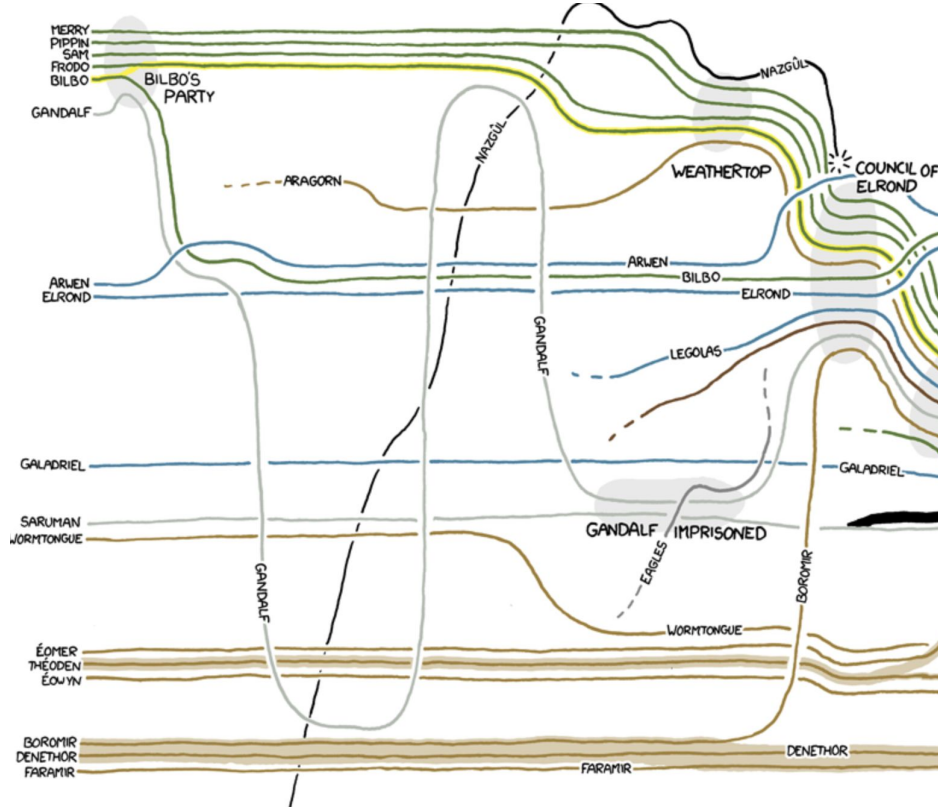
Geospatial and chronological



Network



Or something else entirely

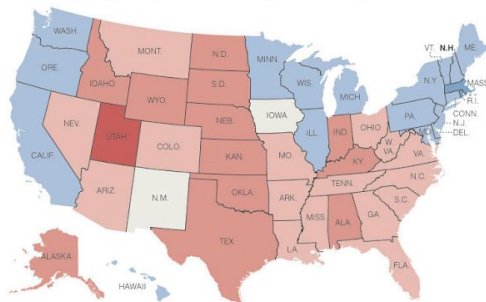


Some examples

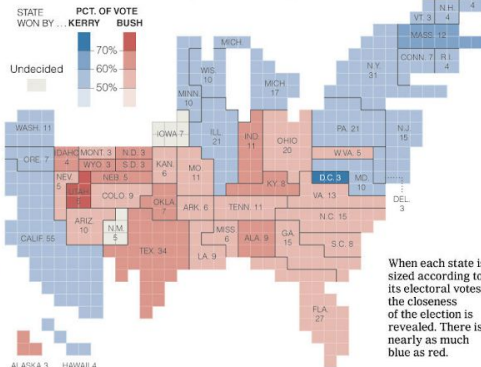
Two Views of the Electoral Vote

By Geography

Using the typical map of the United States, vast swaths are painted red.



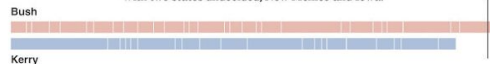
By Electoral Weight



When each state is sized according to its electoral votes, the closeness of the election is revealed. There is nearly as much blue as red.

The Electoral Results

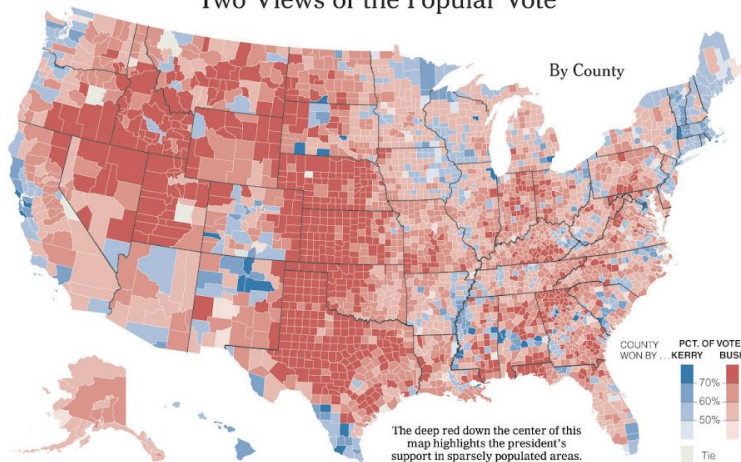
With two states undecided, New Mexico and Iowa.



Sources: 2004 results from the Associated Press, except for Alaska from the state's Division of Elections; population density from LandScan 2001

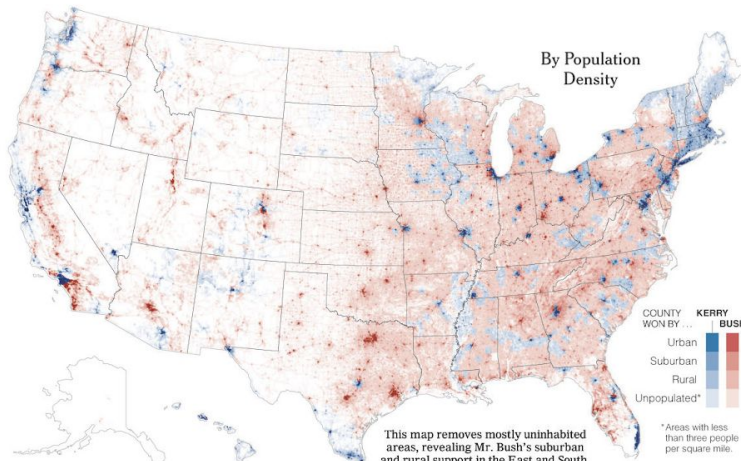
Two Views of the Popular Vote

By County



The deep red down the center of this map highlights the president's support in sparsely populated areas.

By Population Density

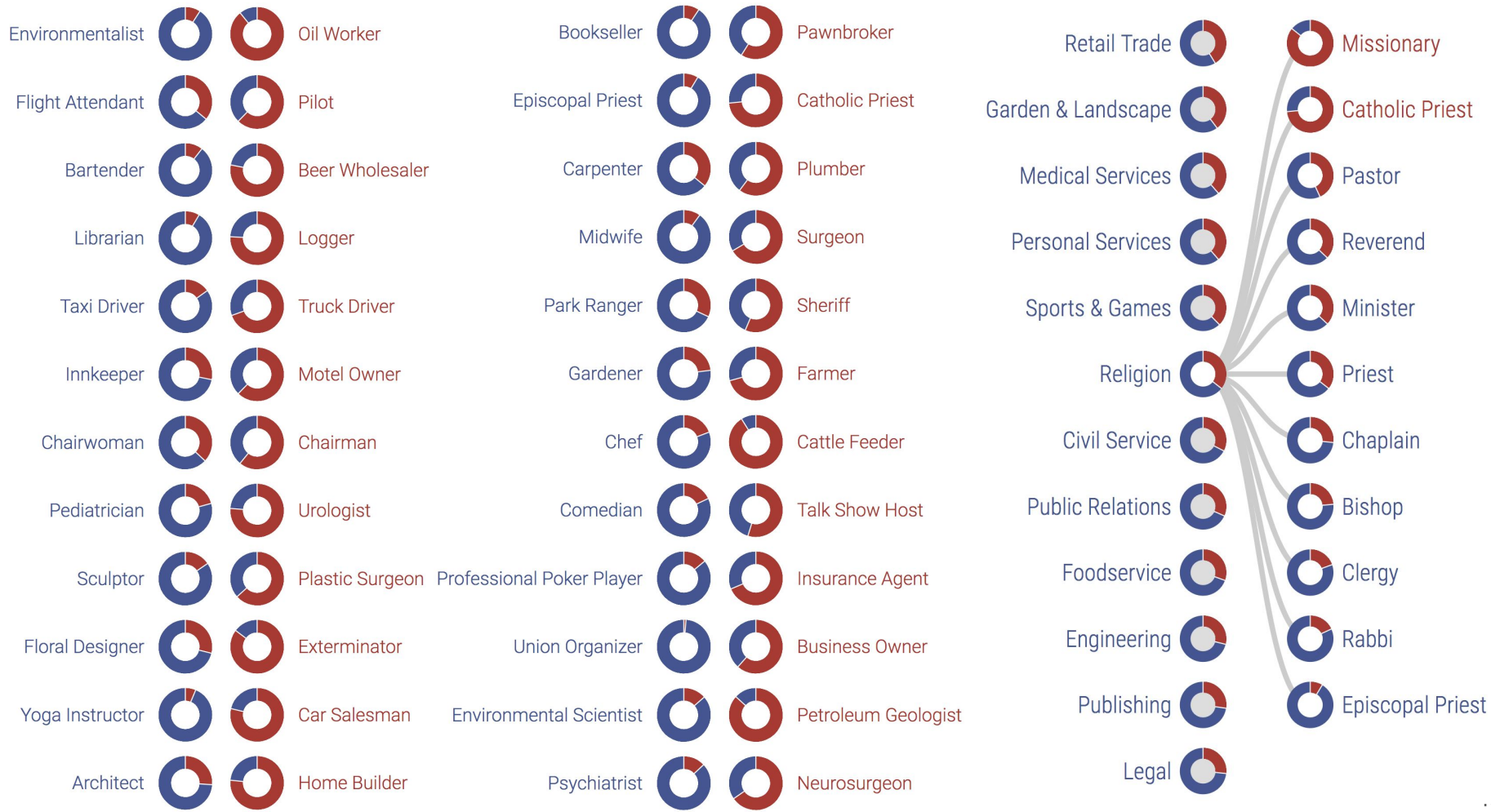


This map removes mostly uninhabited areas, revealing Mr. Bush's suburban and rural support in the East and South.

COUNTY WON BY ...
KERRY
BUSH
Urban
Suburban
Rural
Unpopulated*

*Areas with less than three people per square mile.

Matthew Ericson, William McNulty and Archie Tan/The New York Times



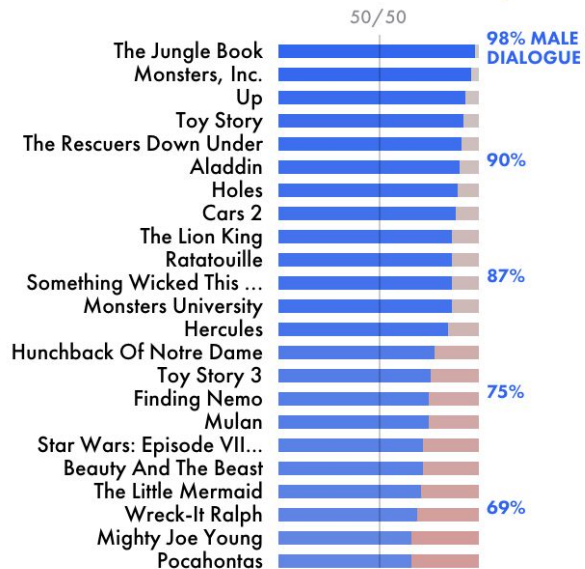


Screenplay Dialogue, Broken-down by Gender

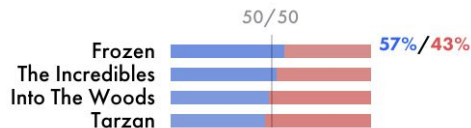
2,000 Screenplays: Dialogue
Broken-down by Gender

Only High-Grossing Films: Ranked in
the Top 2,500 by US Box Office*

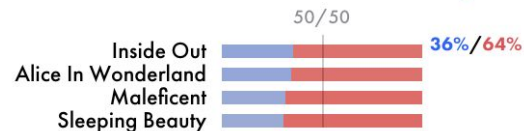
Men have 60%+ Dialogue



Gender Balance, +/- 10%



Women have 60%+ Dialogue

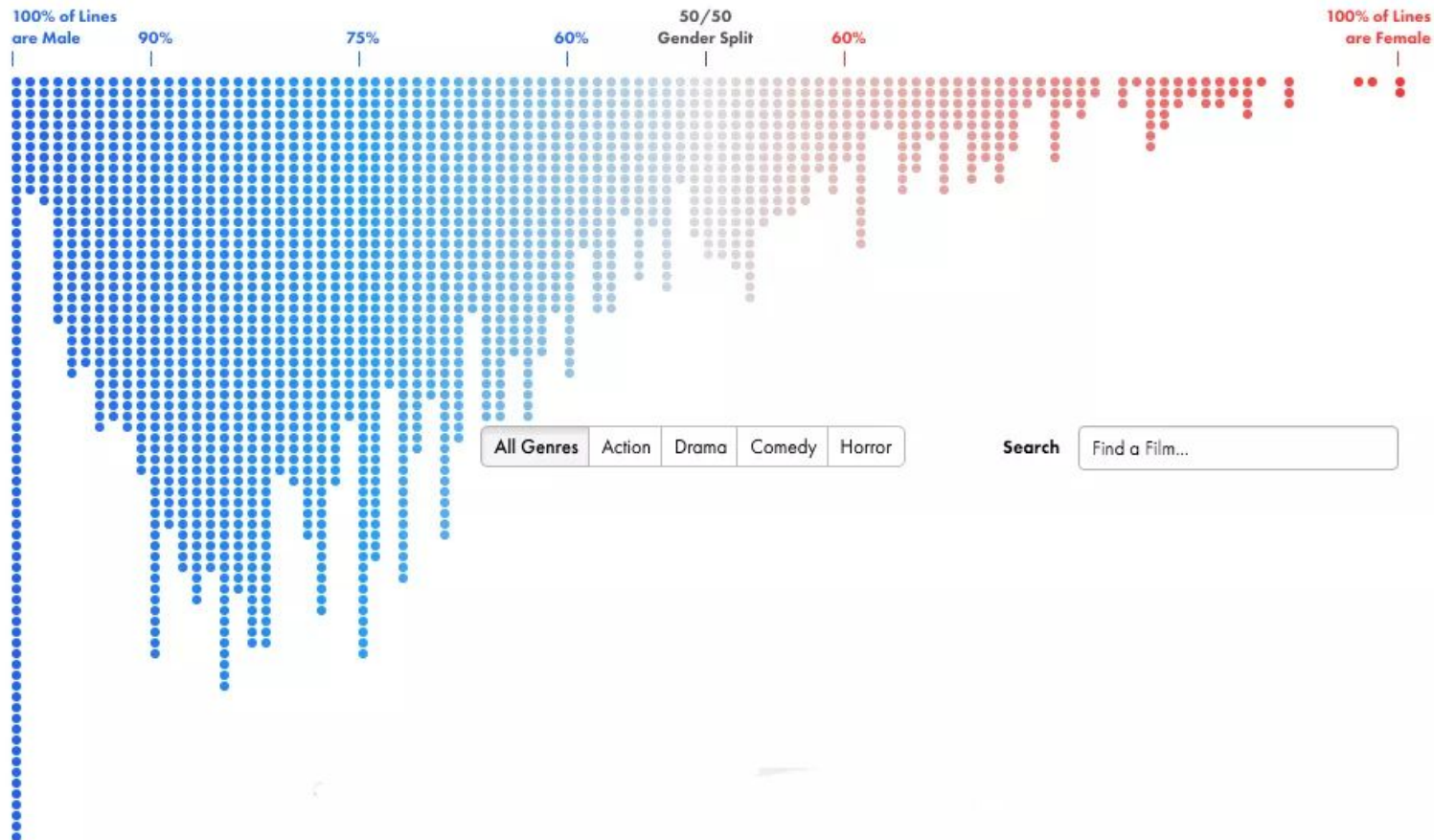




Screenplay Dialogue,
Broken-down by Gender

2,005 Screenplays: Dialogue
Broken-down by Gender

Only High-Grossing Films: Ranked in
the Top 2,500 by US Box Office *



Diagram

NEWS IN PERSPECTIVE

ROAD TO SANCTITY

How the canonization process works

Sources: Santa Casa Curitiba, Catholic - thecrucible.org

1 Diocesan phase
A postulator is appointed to organize the required documentary evidence and witnesses. To become a saint, a person must have died at least five years before the opening of proceedings. At this point, the candidate is regarded as a Servant of God.

At this stage testimonials of those who witnessed the life, virtues, and reputation of holiness are collected. The material is delivered to the **Congregation for the Causes of Saints** at the Vatican.

2 Roman Phase
A commission of cardinals and bishops analyze the documents. If approved, the candidate is declared Venerable by the Pope.

To become a **beatus** (someone worshiped by a particular group of believers), a venerable must have a miraculous cure proven. A martyr doesn't need to have a proven miracle to be beatified. It is just necessary to demonstrate that he or she died in the name of the faith.

The **canonization** occurs when a second miracle is proven. It must happen after beatification. The Pope issues a decree that the candidate must be worshiped by the entire Catholic Church.

Waiting For Sanctity

Why Brazil, even as the country with the largest Catholic population, has so few saints.

Eliseu Barreira Júnior, Alberto Cairo, and Marco Vergotti

IN HIS THIRD VISIT to Brazil, in 1991, Pope John Paul II said that the country needed a lot of saints. Since then, there have been only two: Mother Paulina, in 2002, and Frei Galvão, in 2007. But the number of candidates has not stopped growing. There are nearly 70 Brazilian candidates for canonization on the waiting list, sent to the Vatican by local dioceses. The list below includes the 36 most well-known cases, along with their state of origin.



Do not forget that there are candidates who were born outside of Brazil, but who spent their lives in the country.



UNEQUAL DISTRIBUTION

The size of the circles is proportional to the number of people canonized since 1978, during the papacies of John Paul II and Benedict XVI. Comparing the map with the graphics below, it is possible to see that having a large number of Catholics doesn't guarantee that a country will have a proportional number of saints. According to experts consulted by Epoca, this can be due to the lack of people trained to present Canonization cases to the Vatican in Brazil.



Countries with largest Catholic populations (Millions of adherents)



Percentage that declare themselves Catholic



79%

of Brazilians say they are Catholics in the world, there are 50 million whose populations are at least 50% Catholic.

Number of priests per country (Thousands of people)



SAINTS PER POPE

Pope John Paul II canonized twice the number of saints than did the nine previous Popes together. He canonized more people than any other Pope in the last 400 years.



©1 Based on the Catholic Church's list of saints before 1919 to October 2009.

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FIGURES

US\$400,000

Average cost of a canonization process. The team responsible for the process has 25 people: 7 judges, 8 theologians, 5 cardinals, and 5 bishops.

378 years

is the time that it took to have Father Anchieta beatified.

10,000

is the number of documents that led to the canonization of Frei Galvão.

3,000

canonization and beatification processes are currently under review in the Vatican.

Countries with largest Catholic populations (Millions of adherents).



Percentage that declare themselves Catholic:



79%

of Brazilians say they are Catholics in the world, there are 50 nations whose populations are at least 50% Catholic.

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Pope John Paul II canonized twice the number of saints than did the nine previous Popes together. He canonized more people than any other Pope in the last 400 years.



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.

Title

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

TITLE

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things.

How about an advertisement?

- The best ad ever
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- It's really the best
- Check it out



How about an advertisement?



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

Course Name Syllabus

Instructor

Enter Instructor Name

Phone

Enter Phone

Email

Enter Email

Office Location

Enter Building, Room

Office Hours

Enter Hours,

Days

Course Overview

You might love the look of the classic, professional first in this syllabus as much as we do. But it's also easy to get exactly the look you want. On the Design tab of the ribbon, check out the **Form** gallery to preview options right in your document and then click to apply one you like.

Required Text

Publication Name, Author Name

Course Materials

Need a heading or a bullet? On the Home tab, in the Styles gallery, choose from all styles used in this syllabus.

- Click here to add text.
- Click here to add text.

Resources

To edit the semester and year, just double-click the footer area on the page.

- Click here to add text.
- Click here to add text.

Course Schedule

Week	Subject	Practice Problems
Week 1	Enter subject	Enter practice problems
Week 2	Enter subject	Enter practice problems
Week 3	Enter subject	Enter practice problems
Week 4	Enter subject	Enter practice problems

Exam Schedule

Week	Subject
Week 1	Enter subject
Week 2	Enter subject
Week 3	Enter subject
Week 4	Enter subject

Homework Policy

Want to add more tables to your document that look like the Course Schedule and Exam Schedule? No problem. On the Insert tab, click **Table** and create a table in any size you want. It will automatically get inserted in the same style as the ones in the rest of this syllabus.

Additional Information

Select "Semester and Year" in the footer, update the text and it will automatically change on all following pages.

Semester and Year

Page 2

Course Name Syllabus

About The Course



Instructor

Name
Phone
Email
Office Hours:

Classes

Days, times

Location

Course Description

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Learning Goals

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- Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.

Course Values

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Resources and Tools

Librarian

Name
Email
Office Hours:

Saw Mentor

Days, times

Location

Course Materials

REQUIRED:

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SUPPLEMENTAL:

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Assignments and Grading

Grading

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Assignments

Name	Dates	Description
Responsive Essay 1	Due Feb 2	Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.

Additional information, eg rubrics, images

Responsive Essay 2 1	Due Feb 20	Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.
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Additional information, eg rubrics, images

Midterm Paper	Drafts due March 20 Peer editing Marcy 22	Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus.
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Semester and Year

Page 2

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.

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Elasticsearch

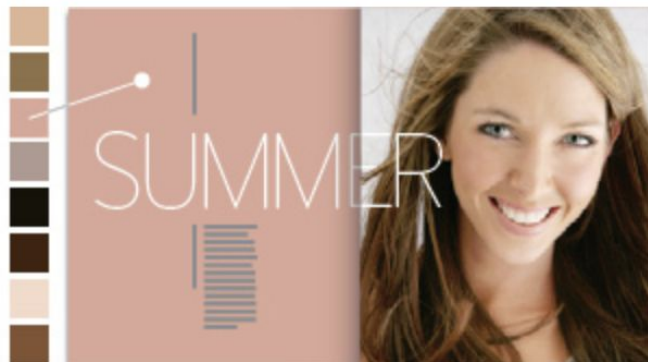
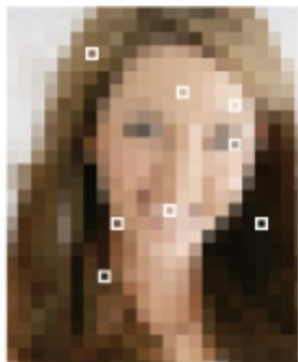


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Who is eligible to vote

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 pope's death may enter the conclave. Those over 80 may participate in preliminary meetings.

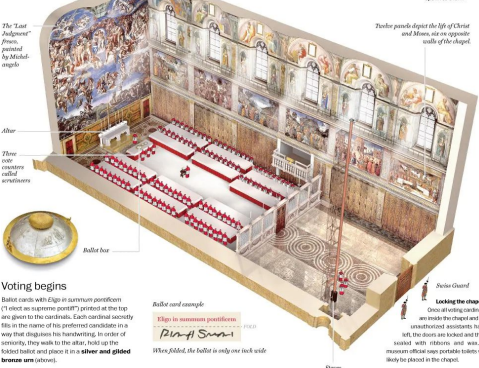
Cardinals who are under age 80 and will be voting



About the 115 electors
Forty-eight cardinals were appointed by Pope John Paul II. Sixty-seven were appointed by Pope Benedict XVI. They come from 48 countries. The average age is 72.

Conclave rules

- The chapel is swept to be cleaned, vacuumed, before and during the conclave.
- 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 assistants.
- Cardinals and assistants wear an coat of absolute secrecy. Leaving information would result in excommunication.
- The cardinals are not permitted any contact with the outside world. No cellphones, no newspapers, television, messages, letters or signals.
- Observers can see the cardinals only when they stand between their lodging and the chapel.
- Vatican City workers who encounter them are not allowed to speak to them.



- Ballots are counted**
The Cardinal Camerlengo and his three assistants tally the ballots and read aloud the name of the cardinal who received most votes. The ballots and any votes are then burned. A second is kept for the Vatican archives.
- How balloting takes place**
Voting begins the first afternoon. If no one presents the required two-thirds of ballots next, voting takes place twice each morning and afternoon. If after the third no pope is elected, a seventh ballot for prayer can be taken. This process repeats after every seven votes.
- Determining a winner**
A two-thirds majority of the cardinals present is required to win. After 23 ballots, a runoff will occur between the top two winners, according to a book in the rules made by Pope Benedict XVI.
- A new pope is announced**
Smoke signals after seven voting sessions, all ballots, tally sheets and notes are burned in a small stove just off the chapel. An official record of the voting is issued and put in the Vatican archives.
- Black:** If no one has been elected, black smoke from the burning papers signals an inconclusive vote to the waiting cardinals.
- White:** When a cardinal is elected, the papers are burned with chemicals that cause white smoke. Balls of St. Peter's Basilica also ring to clear up any confusion over smoke color.

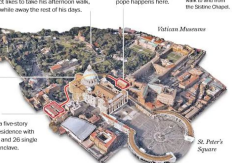
The pope is introduced

Once a cardinal has received the required number of votes, the dean of the College of Cardinals calls him to the apostles, and he receives a ring. The cardinals then pledge their obedience to the new pope. The pope puts on white cassock and skullcap, vestment, and is led on horse. The senior deacon of the cardinal's house enters the main hallway of the Vatican and declares "Materiam papam" – "We have a pope."



INSIDE VATICAN CITY

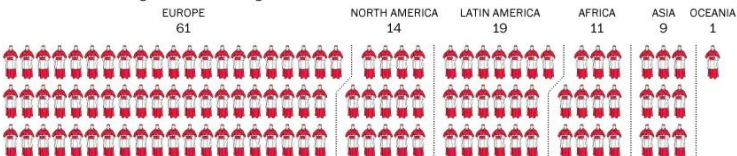
- Benedict's retirement home**
Mater Ecclesiae monastery. The 4,600-square-foot complex on a hill, not far from the gardens where Benedict likes to take his afternoon walks, is where he goes to write away the rest of his days.
- Accommodations**
St. Marcellus' House – The cardinal lives in a two-story building, a Vatican residence with 100 bedrooms and 20 single rooms, during the conclave.
- Location of conclave**
Sistine Chapel – The election for a new pope happens here.
- Map**
Cardinals walk to and from the Sistine Chapel.
- Vatican Museums**
- St. Peter's Basilica**
- St. Marcellus' House**
- St. Peter's Square**



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 pope's death may enter the conclave. Those over 80 may participate in preliminary meetings.

Cardinals who are under age 80 and will be voting:



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

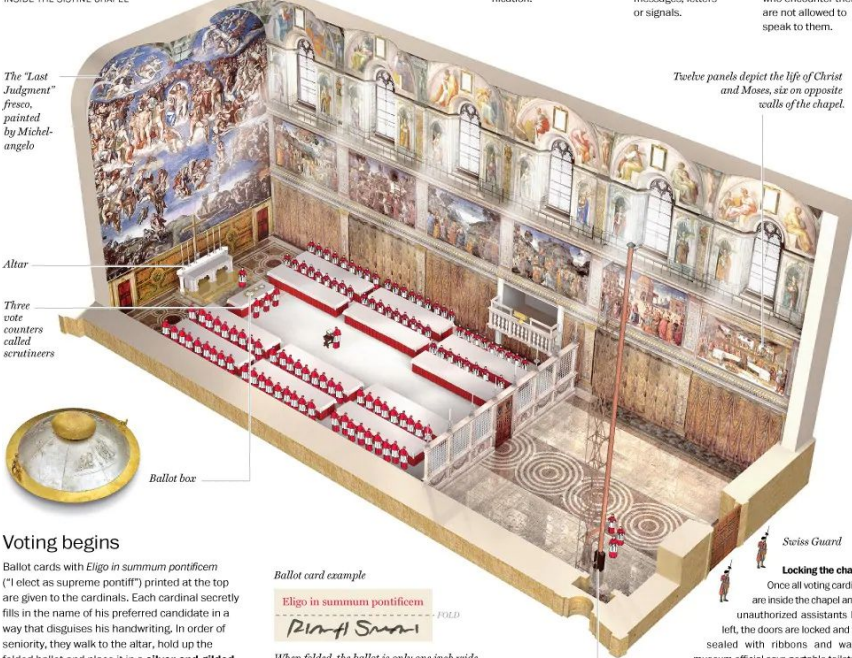


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Observers can see the cardinals only when they travel between their lodging and the chapel. Vatican City workers who encounter them are not allowed to speak to them.

INSIDE THE SISTINE CHAPEL



The "Last Judgment" fresco, painted by Michelangelo

Altar

Three vote counters called scrutineers

Ballot box

Twelve panels depict the life of Christ and Moses, six on opposite walls of the chapel.

Swiss Guard

Voting begins

Ballot cards with *Eligo in summum pontificem* ("I elect as supreme pontiff") printed at the top are given to the cardinals. Each cardinal secretly fills in the name of his preferred candidate in a way that disguises his handwriting. In order of seniority, they walk to the altar, hold up the folded ballot and place it in a silver and gilded bronze urn (above).

Ballot card example

Eligo in summum pontificem
Ramón Saura FOLD

When folded, the ballot is only one inch wide

Stoves

Locking the chapel:

Once all voting cardinals are inside the chapel and all unauthorized assistants have left, the doors are locked and then sealed with ribbons and wax. A museum official says portable toilets will likely be placed in the chapel.



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 notes are then burned. A record is kept for the Vatican archives.



How balloting takes place

Voting begins the first afternoon. If no one receives 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 one-day break for prayer can be taken. This process repeats after every seven votes.



Ballots are threaded and tied together to form a necklace before being burned in the stove.

Stoves



Since two votes are burned at the same time, black smoke will appear twice a day until a pope is elected.



White: When a candidate is elected, the papers are burned with chemicals that cause white smoke. Bells of St. Peter's Basilica also ring to clear up any confusion over smoke color.

The pope is introduced

Once a cardinal has received the required number of votes, the dean of the College of Cardinals asks him if he accepts, and he chooses a name.

The cardinals then pledge their obedience to the new pope. The pope puts on a white cassock and skullcap; various sizes are kept on hand.

The senior deacon of the cardinals steps onto the main balcony of the Vatican and declares: "Habemus papam" — "We have a pope."

The central balcony at St. Peter's Basilica overlooks the square.



INSIDE VATICAN CITY

Benedict's retirement home

Mater Ecclesiae monastery

The 8,600-square-foot complex on a hill, not far from the grotto where Benedict likes to take his afternoon walk, is where he plans to while away the rest of his days.

Location of conclave

Sistine Chapel

The election for a new pope happens here.



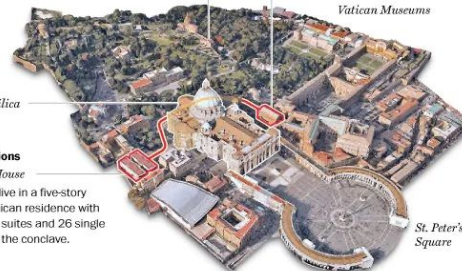
Map: Cardinals walk to and from the Sistine Chapel.

St. Peter's Basilica

Accommodations

St. Martha's House

The cardinals live in a five-story building, a Vatican residence with 105 two-room suites and 26 single rooms, during the conclave.



Vatican Museums

St. Peter's Square

Questions?

...I'm happy to help!

Jessica Cohen-Tanugi

jessica_cohen-tanugi@harvard.edu

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

Image sources

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Ware, Colin. *Information Visualization*, Third Ed. San Francisco, CA: Morgan Kaufmann, 2012. Slides 18, 25, 28.

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Hassan, Umar. ["Making Timeline Charts in Tableau Step-by-Step."](#) Slide 40.

Grandjean, Martin (2014). ["La connaissance est un réseau"](#). Les Cahiers du Numérique 10 (3): 37-54. CC-BY-SA. Slide 41.

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KennyLJ. ["Drug Testing Example."](#) Slide 29.

M. C. Hansen et al. ["High-Resolution Global Maps of 21st-Century Forest Cover Change."](#) Slide 29.

Hannah Anderson and Matt Daniels. ["Film dialogue from 2,000 Screenplays, broken down by gender and age."](#) Slides 46-47.

McWade, John. [Color palette picker visual](#), *Before and After Magazine*. Slide 55.

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](#)

Zhang, Samantha. "Finding the Right Color Palettes for Data Visualizations." GraphicIQ, 2015. [Link here](#).

Simmon, Robert. "The subtleties of color." NASA Earth Observatory, 2013. [Link here](#).

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!)

Cairo, Alberto. *The Functional Art: An Introduction to Information Graphics and Visualization*. Berkeley, CA: New Riders, 2012. (Available online through Hollis).

Graphic Design:

Williams, Robin. *Non-Designer's Design Book, Fourth Ed.* San Francisco, CA: Peachpit Press, 2014. (Available online through Hollis).