CSE 332
Introduction to Visualization

Infographics Design

Klaus Mueller

Computer Science Department
Stony Brook University

Lecture	Topic	Projects
1	Intro, schedule, and logistics	
2	Basic tasks and data types	
3	Data sources and preparation	Project 1 out
4	Notion of similarity and distance	
5	Data and dimension reduction	
6	Visual bias	
7	Introduction to D3	Project 2 out
8	Visual perception and cognition	
9	Visual design and aesthetic	
10	Cluster analysis	
11	High-dimensional data – projective methods	
12	High-dimensional data – scatterplot displays	
13	High-dimensional data – optimizing methods	Project 3 out
14	Visualization of spatial data: volume visualization intro	
15	Visualization of spatial data: raycasting, transfer functions	
16	Illumination and isosurface rendering	
17	Midterm	
18	Scientific visualization	
19	How to design effective infographics	Project 4 out
20	Principles of interaction	
21	Midterm discussion	
22	Visual analytics and the visual sense making process	
23	Visualization of graphs and hierarchies	
24	Visualization of time-varying and streaming data	Project 5 out
25	Maps	
26	Memorable visualizations, visual embellishments	
27	Evaluation and user studies	
28	Narrative visualization, storytelling, data journalism, XAI	

What are Infographics?

A clipped compound of "information" and "graphics"

A graphic visual representations of information, data or knowledge intended to present information
- quickly
- clearly

Can improve cognition by utilizing graphics to enhance the human visual system's ability to see patterns and trends

Design Rules to Consider

Graphical displays should

- show the data
- induce the viewer to think about the substance rather than about methodology, graphic design, the technology of graphic production, or something else
- avoid distorting what the data has to say
- present many numbers in a small space
- make large data sets coherent
- encourage the eye to compare different pieces of data
- reveal the data at several levels of detail, from a broad overview to the fine structure
- serve a reasonably clear purpose: description, exploration, tabulation, or decoration
- be closely integrated with the statistical and verbal descriptions of a data set.

VERY EARLY EXAMPLE

Minard's 1869 map of Napoleon's campaign to Russia
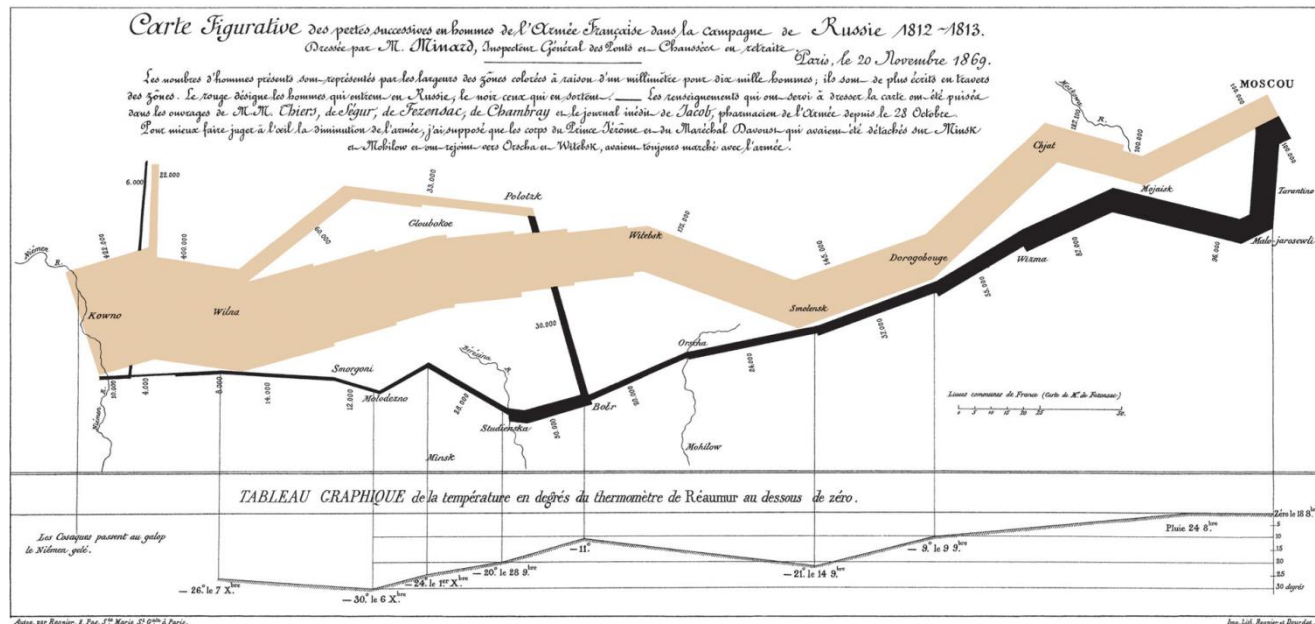
Shows 6 variables in one 2D visualization:
- number of Napoleon's troops, temperature
- distance traveled, direction of travel
- latitude and longitude, location relative to specific dates

# Some More Random Examples …

The Time We Spend on the Internet

ALMOST 5 BILLION videos are watched on Youtube every single day with an average viewing time of 40 minutes.

The average adult spends more than **20 HOURS ONLINE A WEEK...**

We send over **200 MILLION** emails per minute.

...which includes time spent on the Internet at work.

Stress in the Workplace

70% of American workers experience stress-related illnesses.

34% think they'll burn out on the job in the next two years.
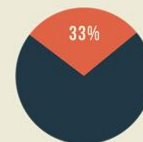
33% more heart attacks are occurring on Monday mornings.

45% of entrepreneurs said they were stressed.

The Average Work Week

Mon Tue Wed Thu Fri Sat Sun

You get **168 HOURS** a week.

The average work week is closer to **50 HOURS** than 40.

Professionals and business leaders who carry mobile devices, like smartphones, tend to work more than **70 HOURS** a week.

The average commute time is **47 MINUTES** round trip.

MATTHEW MCNEW.

Resume

720 220 2307
mmcnew@mines.edu

🎓 Education
Colorado School of Mines

Major:
Computer Science

May 2013

GPA: 3.7

Minor: Electrical Engineering

Minor: Mathematics

🐦 Skills

| Ruby |
| Java |
| C++ |
| HTML & CSS |
| Javascript |
| C |
| PHP |
| SQL |
| Perl |

Decent — Great

Windows   **Linux**   **Mac OS**

Student Body President
Colorado School of Mines
2012-2013

← Campaign Logo

Internships:

2012

PIVOTAL LABS

Ruby on Rails
Agile Development
Pair Programming

2011

CableLabs
REVOLUTIONIZING CABLE TECHNOLOGY

Tested the Effectiveness
of Amazon Kindle's
Silk Browser

Volunteer:

Led A WWOOFing
Trip to Rural Brazil

June 2013 New Grad Position

Projects:

Freelance Programmer

Eagle Ridge Academy
After School Scheduling
PHP and MYSQL

Computer Science Field Session

Symplified

Designed and Implemented
Single Sign On Solution
With ASP.NET and IIS

School:

Graduated High School
2009 as Valedictorian

Interests

Organic Farming   Soccer

Travel   Entrepreneurship   Comedy

➡ ➡
Number of Internships Completed
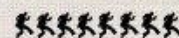
Number of Jobs Employed

Number of Countries Traveled

Math Counts Coach
Tau Beta Pi
Blue Key
Student Government

Activities

WHAT ARE WE EATING?

What the Average American Consumes in a Year

Fats & Oils
85.5 lbs

Red Meat
110 lbs

Poultry
73.6 lbs

Fish & Shellfish
16.1 lbs

Chicken
60.4 lbs

Eggs
32.7 lbs

Cheese
31.4 lbs

Fruits
273.2 lbs

Coffee, Cocoa & Nuts
24 lbs

The Average American

Age: 36.6

Height:
5'9" (m)
5'4" (f)

Weight:
190 lbs (m)
164 lbs (f)

1,996.3 LBS*

Dairy Products
(non-cheese)
600.5 lbs

Vegetables
415.4 lbs

Corn
56 lbs

Corn
Syrup

Beverage Milks
181 lbs

Wheat flour
134.1 lbs

Caloric Sweeteners

EDUCATION AROUND THE WORLD

There are **1.4 Billion** students on Earth.

Only 65.2 Million educators Globally.

THE CHALLENGE:
Too many children remain out of school, and those who are in school aren't learning the skills they need for life and work.

Children leaving school before completing their Primary Education

11.07 Million
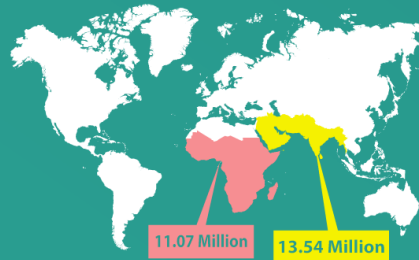
13.54 Million

In the Sub-Saharan, 11.07 million children leave school before completing their primary education. In South and West Asia, that number reaches 13.54 million.

Children out of primary school

61 Million children are still out of primary school.

32 Million of these children are Girls.

1 in 5

15 to 24 years old has not completed primary school and lacks skills for work.

An estimated **250** million children are not able to read or write.

The poorest and most marginalized are the most affected.

In some emerging economies, **3 in 10** youths cannot do basic arithmetic.

Fragile and conflict-affected countries account for more than

30%

of all children not completing primary school

In some developing countries, one quarter to one-half of youth who have graduated from primary school cannot read a single sentence.

OF THE 775 MILLION ILLITERATE ADULTS

TWO-THIRDS ARE WOMEN

Connect. Inspire. Empower.

www.ubuntumail.com

STUDENT BULLYING

STATES WITHOUT BULLYING LAWS

FIRST STATE WITH BULLYING LAW

280,000
STUDENTS ARE PHYSICALLY ATTACKED IN SECONDARY SCHOOLS EACH MONTH

160,000
STUDENTS MISS SCHOOL EACH DAY FOR FEAR OF BEING BULLIED

77%
OF STUDENTS ARE BULLIED MENTALLY, VERBALLY, & PHYSICALLY. CYBER BULLYING STATISTICS ARE RAPIDLY APPROACHING SIMILAR NUMBERS

43%
FEAR HARASSMENT IN THE BATHROOM AT SCHOOL

EFFECTS OF BULLYING

Bullying can have a significant impact on both child and teenage students. Students who are bullied often suffer from anxiety, fear, withdrawal, low self-esteem, and poor concentration. A bullied student will often avoid school, have lower grades, and become socially isolated. There have been numerous reports of suicide due to bullying.

MOST COMMON TYPES OF BULLYING:

PLAYGROUND SCHOOL BULLYING STATISTICS
EVERY 7 MINUTES A CHILD IS BULLIED

bul·lyi·ng
Physical, verbal, or psychological attacks or intimidation against a person who cannot properly defend himself or herself. It includes two key components: 1. Repeated harmful acts 2. Imbalance of power

HITTING, THREATENING, INTIMIDATING, MALICIOUSLY TEASING AND TAUNTING, NAME-CALLING, MAKING SEXUAL REMARKS, AND STEALING OR DAMAGING BELONGINGS OR MORE SUBTLE, INDIRECT ATTACKS (SUCH AS SPREADING RUMORS OR ENCOURAGING OTHERS TO REJECT OR EXCLUDE SOMEONE).

MORE YOUTH VIOLENCE OCCURS ON SCHOOL GROUNDS AS OPPOSED TO ON THE WAY TO SCHOOL

ADULT INTERVENTION: 11%   PEER INTERVENTION: 4%   NO INVERVENTION: 85%

EFFECTS ON BULLIES

Bullying is often a warning sign that children and teens are heading for trouble and are at risk for serious violence. Teens (particularly boys) who bully are more likely to engage in other antisocial/delinquent behavior (e.g., vandalism, shoplifting, truancy, and drug use) into adulthood. They are four times more likely than nonbullies to be convicted of crimes by age 24, with 60 percent of bullies having at least one criminal conviction.

WORST STATES TO LIVE IN FOR BULLYING K-12

1 OUT OF 4
STUDENTS WILL BE ABUSED BY ANOTHER YOUTH

1 OUT OF 5
ADMIT TO BEING A BULLY, OR DOING SOME "BULLYING"

SOURCES:
HTTP://WWW.COPS.USDOJ.GOV
WWW.KEEPSCHOOLSSAFE.ORG
WWW.BULLYPOLICE.ORG

PRODUCED BY:
BUCKFIRE & BUCKFIRE PC
WWW.BUCKFIRELAW.COM

http://bit.ly/studentbullyingfacts

How To Make Effective Infographic

Five steps (from Venngage.com)

1. Outline the goals of your infographic
2. Collect data for your infographic
3. Visualize the data for your infographic
4. Layout your infographic using an infographic template
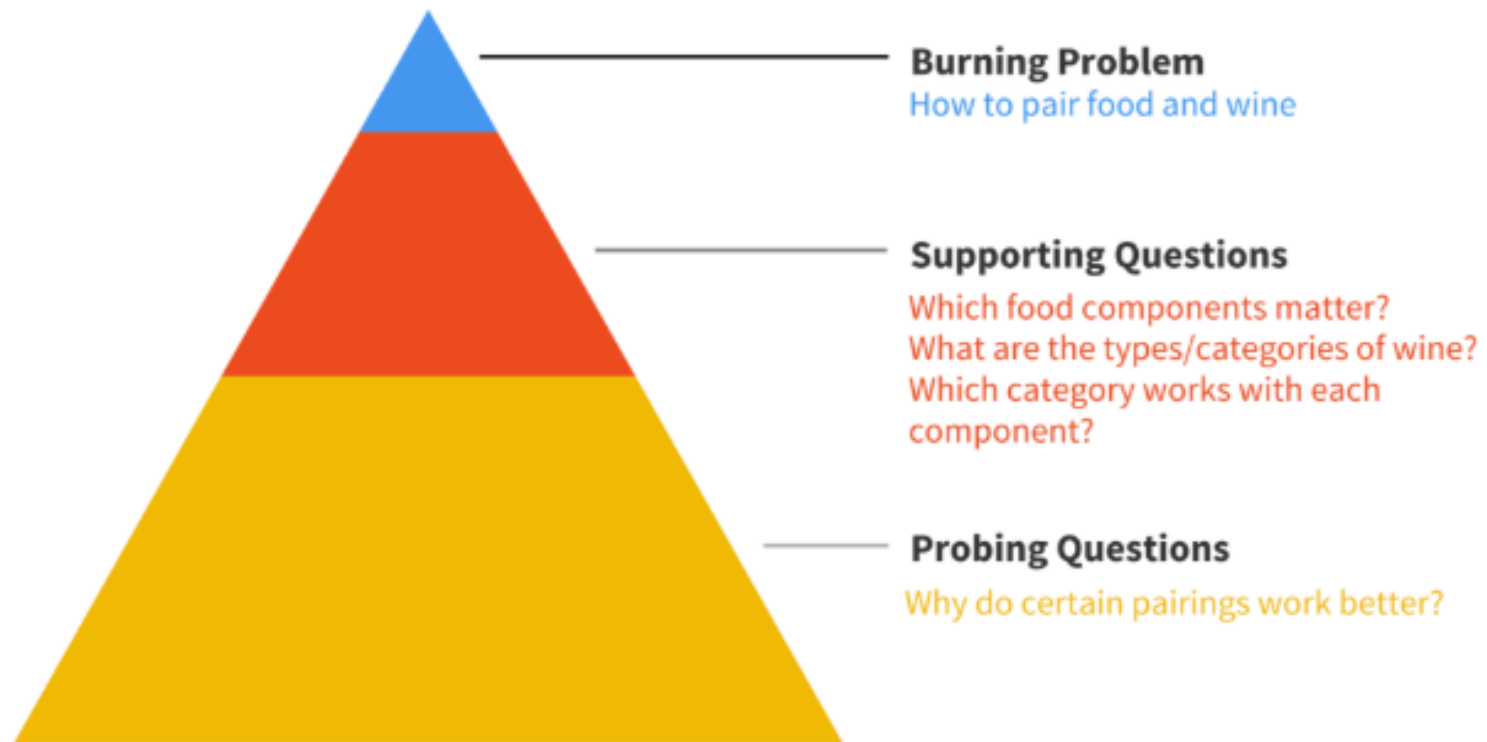5. Add style to your infographic design

STEP 1: OUTLINE YOUR GOALS

Use the question pyramid

Question Pyramid

1 Burning Problem — The main question the infographic will answer.

2-3 Supporting Questions — Questions to provide information (what, which).

1-2 Probing Questions — Questions to provide insight (why).

Venngage.com
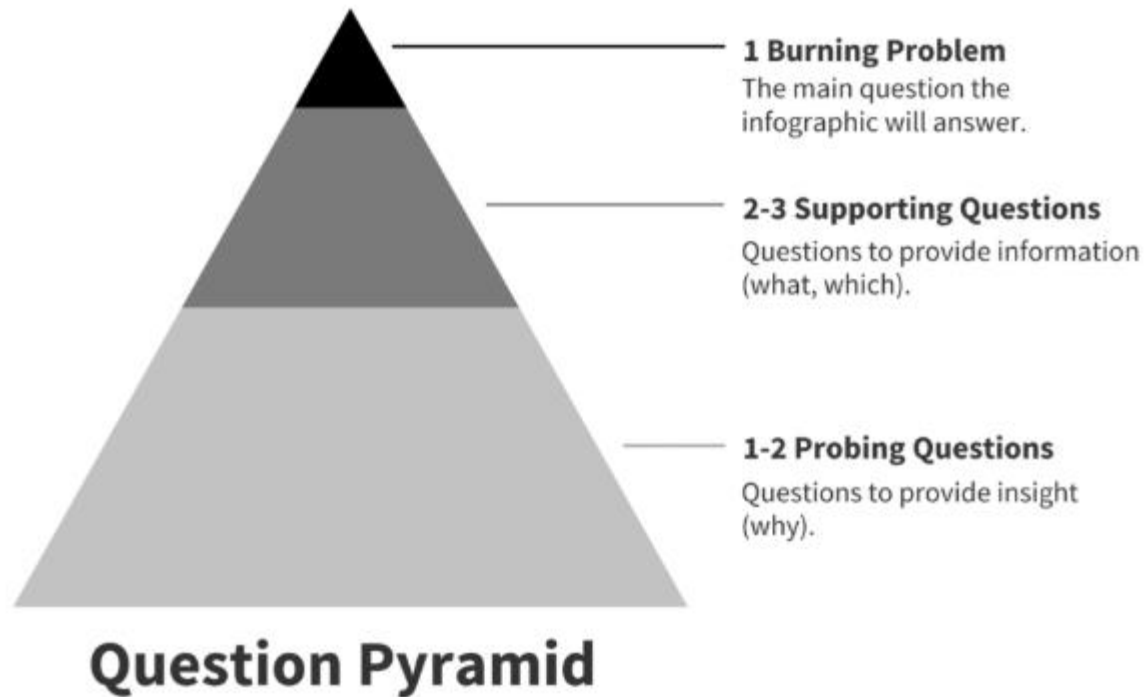
Example: Food – Wine Pairing

Burning Problem
How to pair food and wine

Supporting Questions
Which food components matter?
What are the types/categories of wine?
Which category works with each
component?

Probing Questions
Why do certain pairings work better?

Infographic

Venngage.com

STEP 2: COLLECT THE DATA

We discussed this

Step 3: Visualize the Data

Decide what are your primary goals
- what data aspect do you want to convey

The ICORE method
- **I**nform,
- **C**ompare,
- **C**hange,
- **O**rganize,
- **R**eveal relationships, or
- **E**xplore.

Venngage.com

INFORM

Convey an important message or data point that doesn't require much context to understand

Make a numerical stat stand out with large, bold, colorful text:

The brain makes

700

neural connections per second before the age of 5.

Demand extra attention by pairing icons with text:

4200
VACCINES ADMINISTERED

Highlight a percentage or rate with a donut chart or a pictograph:

25%
WERE CHILDREN

25%
WERE CHILDREN

Venngage.com
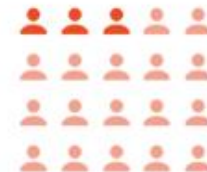
Compare

Show similarities or differences among values or parts of a whole

BAR CHART

COLUMN CHART

BUBBLE CHART

BUBBLE CLOUD

Use a pie chart, donut chart, pictograph, or tree map to compare parts of a whole.

PIE CHART

DONUT CHART

PICTOGRAM

TREEMAP

Use a stacked bar chart or stacked column chart to compare categories *and* parts of a whole.

STACKED COLUMN CHART

STACKED BAR CHART

Use a stacked area chart to compare trends over time.

STACKED AREA CHART

CHANGE

Show trends over time or space

Use a line chart or an area chart to show changes that are continuous over time.

LINE CHART   AREA CHART

Use a timeline to show discrete events in time.

TIMELINE

Use a choropleth map to show spatial data.

CHLOROPLETH MAP

Use a map series to show data that changes over both space and time.

MAP SERIES

ORGANIZE

Show groups, patterns, rank or order

Use a list to show rank or order when you want to provide extra information about each element.

LIST

1 ——
2 ——
3 ——

Use a table to show rank or order when you want readers to be able to look up specific values.

TABLE

Cars	Motorcycles	Phones
BMW	Suzuki	Lenovo
Aston Martin	Yamaha	Samsung
Bentley	Harley Davidson	Huawei

Use a flowchart to show order in a process.

FLOWCHART

Otherwise, show rank or order with a bar chart, column chart, bubble chart, or pyramid chart.

BAR CHART   **COLUMN CHART**   **BUBBLE CHART**   **PYRAMID**

RELATIONSHIP

Reveal more complex
relationships among
things

Use a scatter plot when you want to display two variables for a set of data.

SCATTERPLOT

Use a multi-series plot when you want to compare multiple sets of related data.

MULTI-SERIES PLOT
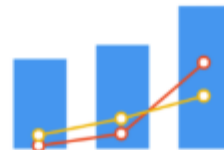
Explore

Add interaction

- filtering, sorting, and drilling down
- can't do with a static chart
- but useful for online infographics displays
- will discuss later

Step 4: layout

Create a natural flow

- could use the question pyramid to guide the layout
- burning question into header
- follow with charts to address the supporting questions
- finish with the probing questions

Use a grid layout

- guides the reader's eye
- symmetrical grid
- consider that people read
  - top to bottom
  - left to right

1 COLUMN   2 COLUMN   3 COLUMN   4 COLUMN

MULTI-ROW   3 SECTION   4 SECTION   5 SECTION

Venngage.com
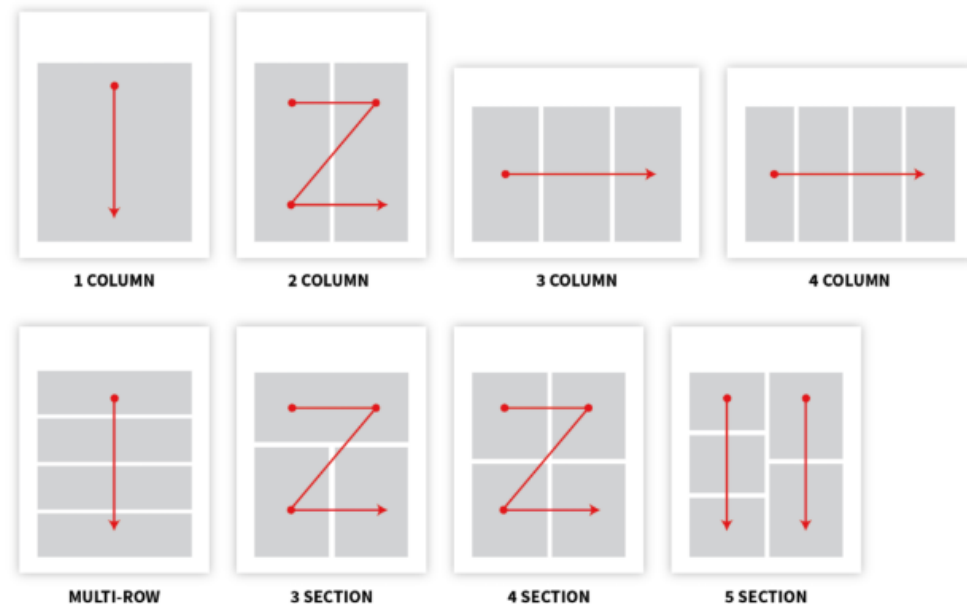
ONE COLUMN FOR LINEAR FLOW

Venngage.com

TWO COLUMNS FOR COMPARISONS

Venngage.com
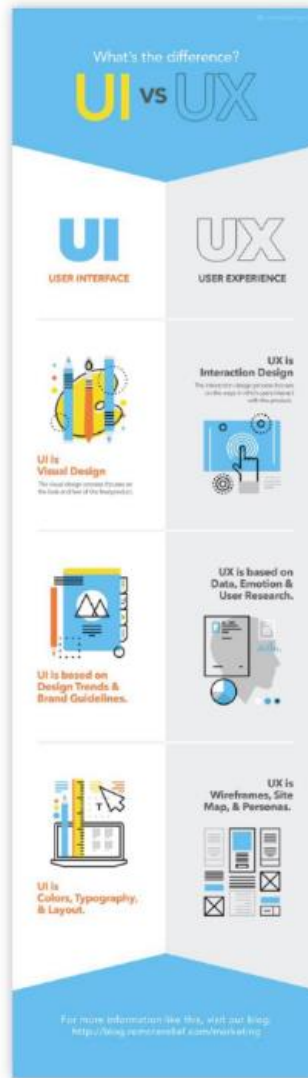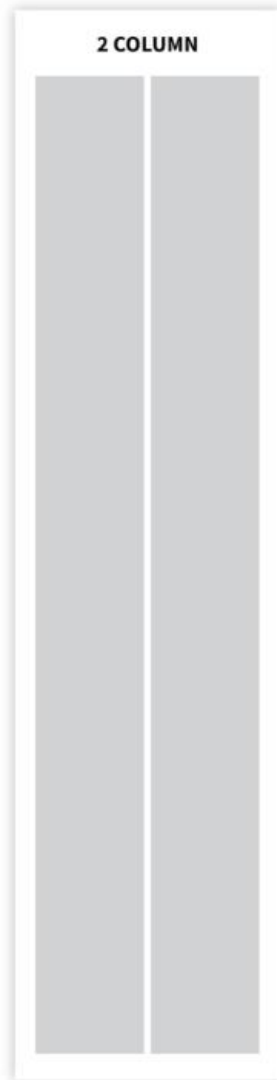
Two Column Example

Who Said What?

Democrats | Republican

Number of times words were used

Democrats
- Character:11
- Jobs:14
- War:9
- McCain:18
- God:6
- Bush:18
- Hurricane:8
- Iraq:12
- Change:24
- Economy:16

Republican
- God:25
- Character:14
- Energy:18
- War:18
- Bush:6
- Economy:18
- Tax(es):22
- Terror:12
- Jobs:8
- Iraq:15
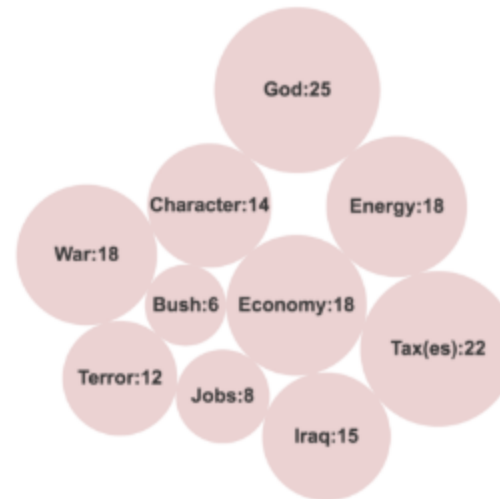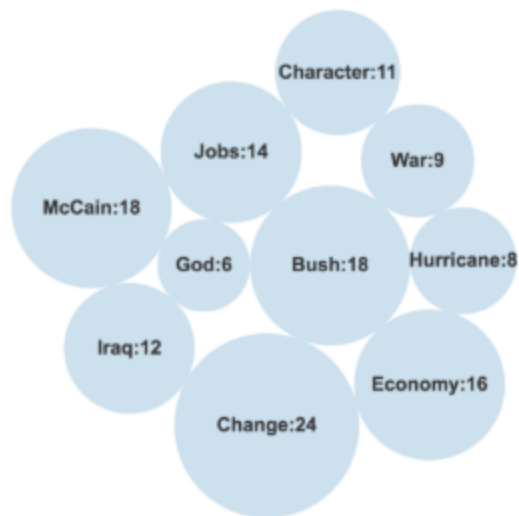
The Words They Used - Graphic - NYTimes.com

THREE COLUMN EXAMPLE

⬤ CLEAN WATER SYSTEMS

2.64 Billion
people around the world do not have access to adequate sanitation

780 Million
people do not have access to improved water sources

Every $1
spent on water and sanitation generates at least $4 in increased productivity

SOURCE

Multi-Section Layout For Random Visual Access

Venngage.com
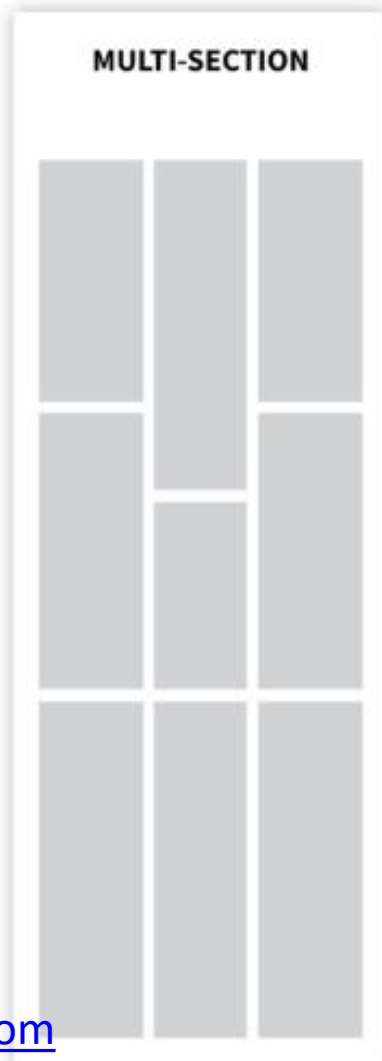
STEP 5: ADD STYLE

Overall goal
- make your infographics aesthetically pleasing
- make it easy to consume and understand

Minimize text
- should supplement the visuals
- short paragraphs (at most) at about a grade six reading level

Use font to point out importance
- readable font for the bulk of the text,
- amp up size and style of your main header, section headers, and data highlights
- make sure that the gist of your infographic is immediately apparent

EXAMPLE

REPETITION, CONSISTENCY, AND ALIGNMENT

Repeat basic shapes to reinforce the underlying grid

Venngage.com
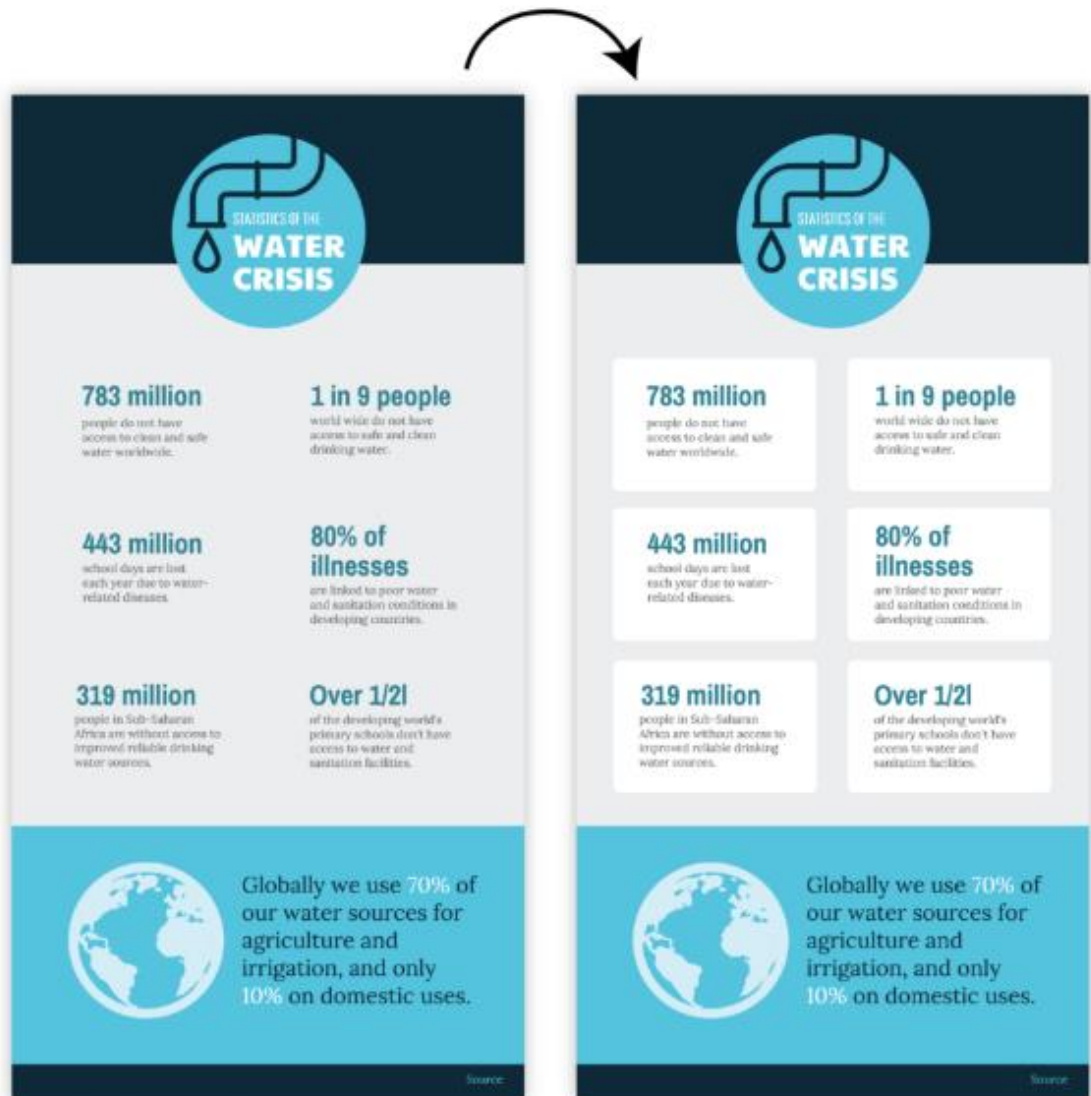
EMPHASIZE USING SHAPES

Use basic shapes to emphasize headers and list elements

Use Icons

Add icons to reinforce important concepts in the text
- keep icon color, style, and size consistent
- pull everything together with extra background shapes
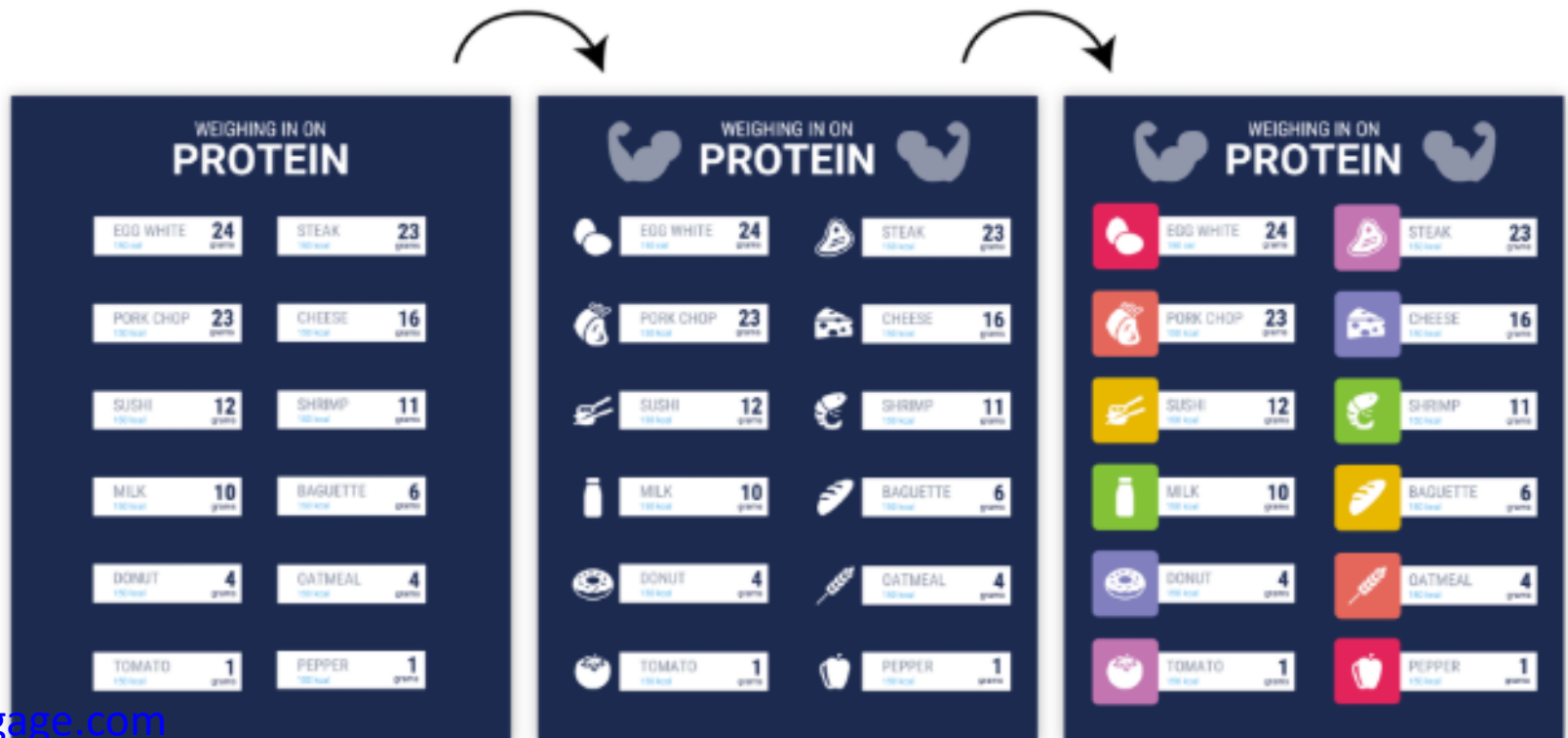
BE Diligent

Make sure the repeated elements you add are aligned!
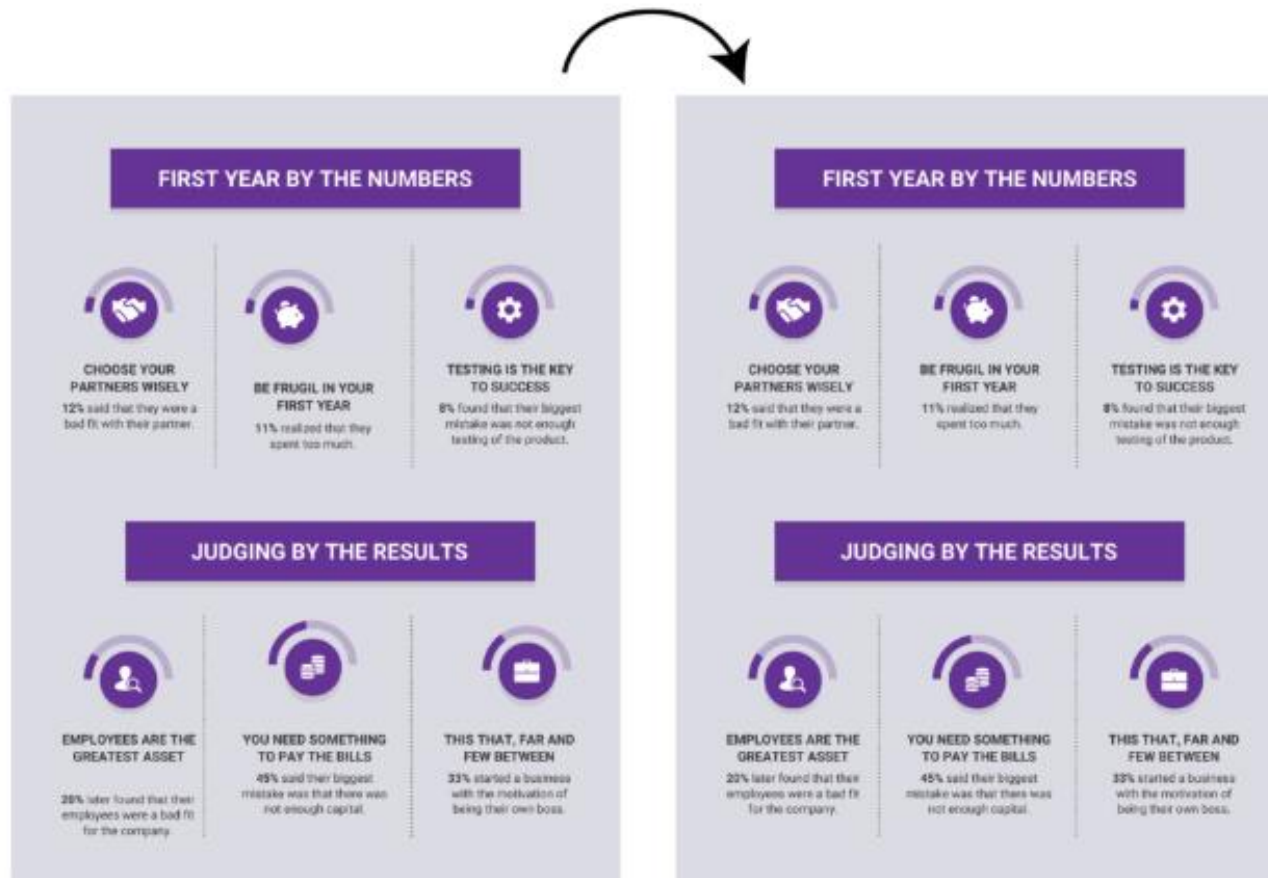
Negative Space

Negative (white) space is often used in advertising

- the space around and between the subject of an image
- helps to define a subject
- helps emphasizing a message

NEGATIVE SPACE IN INFOGRAPICS

Just as important as any other element of a design
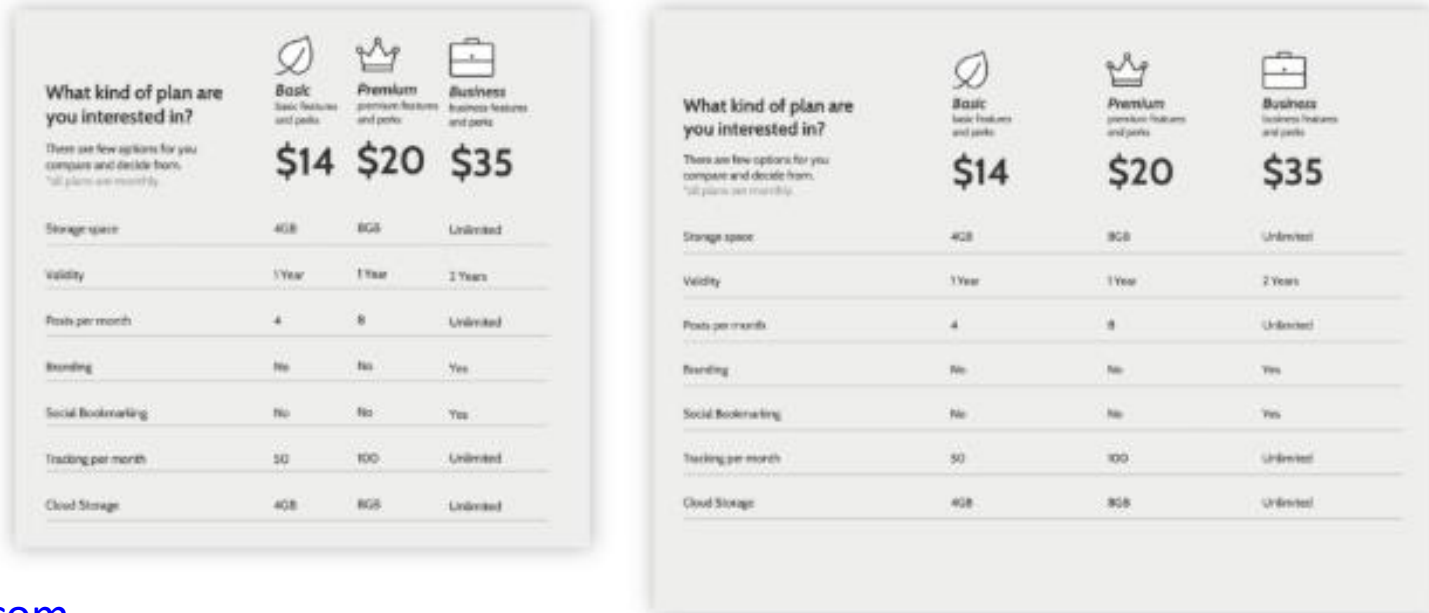
- simplest negative space are margins around the graphics
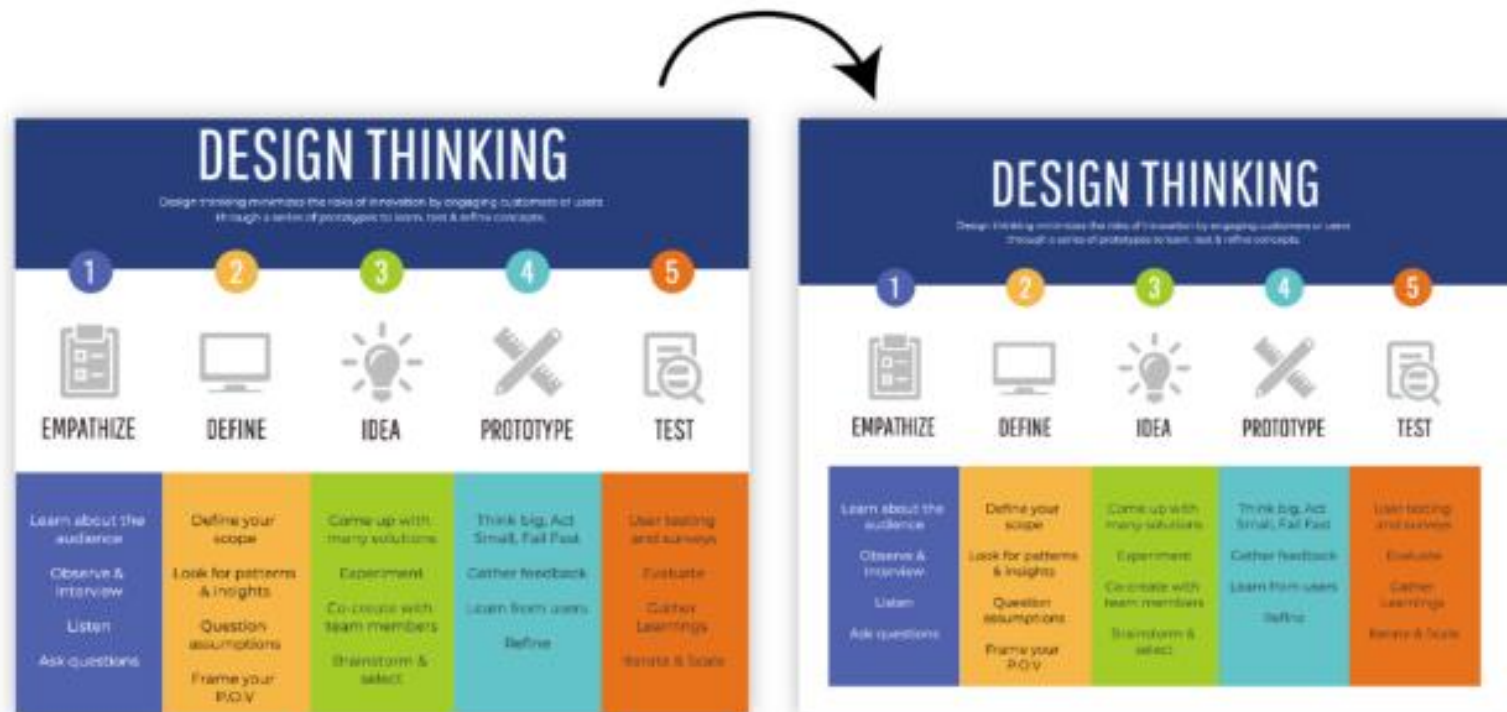
NEGATIVE SPACE: GAPS

Use gaps between unrelated elements

- makes it easier to immediately understand which elements are grouped together

Negative Space: Color Interaction

Much easier to make colors play nicely with each other by adding a little whitespace
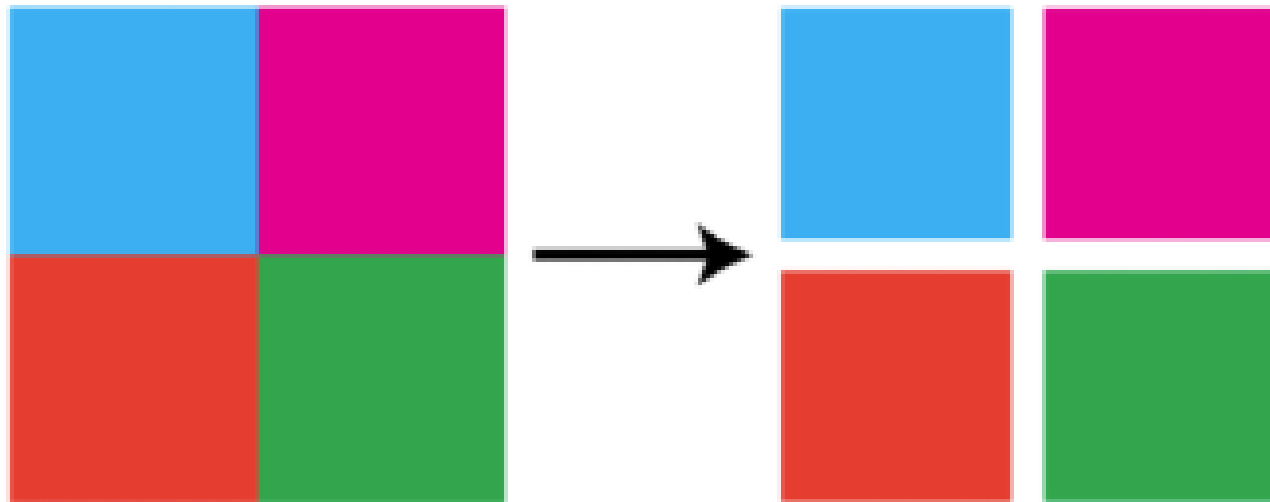
Color for Highlighting

Use color to highlight important information
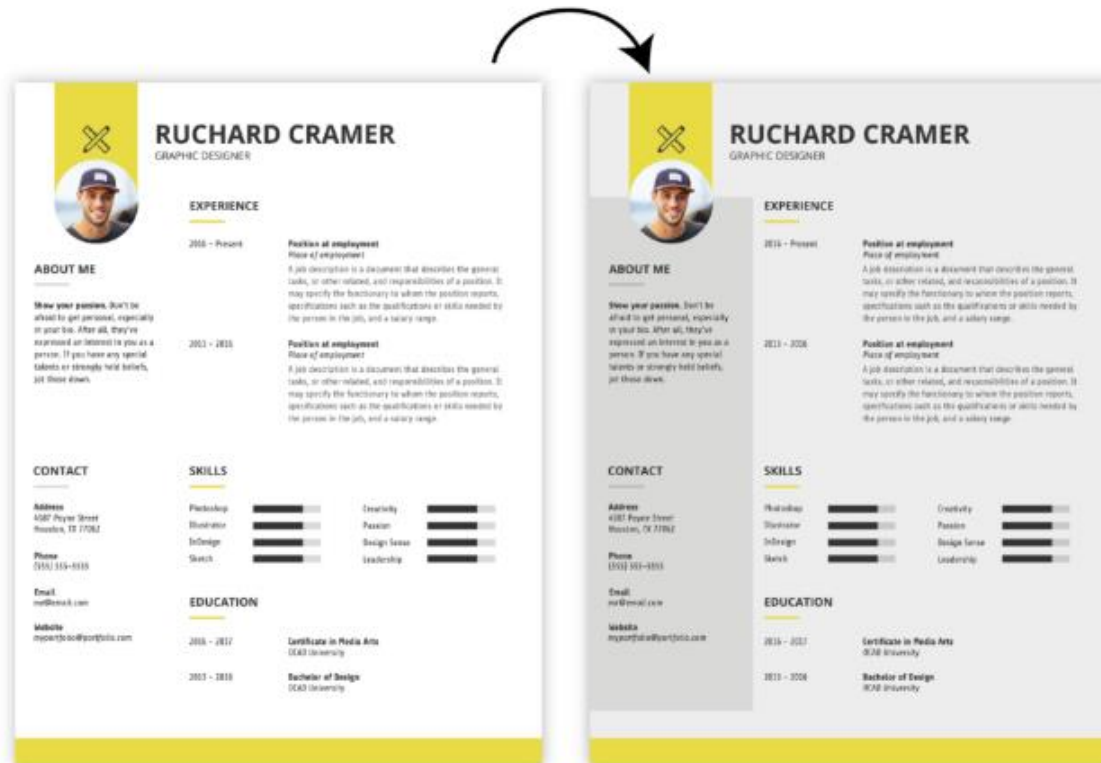
COLOR FOR GROUPING

Use color to group related elements together

NEUTRAL COLORS

Use neutrals to offset bright colors

- helps put together a composition
- can group in a more subtle way

COLOR PALETTES

rich & polished

#B42F32	#DF6747	#E3E3CD	#878D92	#49494D

brilliant blues

#37AFA9	#2D8E87	#0C695D	#E0F2F2	#152329

baroque luxury

#A11E22	#E8A631	#E0C098	#E5E4DA	#BFB0B3

gracefully modern

#FAAC77	#C9C9BD	#F0EFEE	#606B6F	#333C3E

sunny & warm

#DA5526	#F6893D	#FEBC38	#D8C6B4	#697F90

classic & trustworthy

#CA3542	#27647B	#849FAD	#AEC0C9	#57575F

Venngage.com

There are Templates on the Web

Plotly
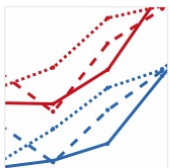
[Plotly](#) is a Python open source graphing library

- not as powerful as D3
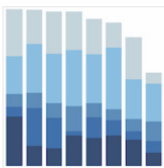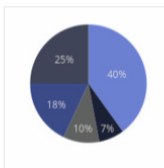- but does not require javascript programming

Basic Charts
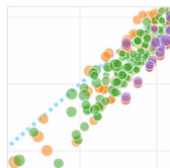
Scatter Plots · Line Charts · Bar Charts · Pie Charts · More Basic Charts

Maps

USA County Choropleth Maps · Bubble Maps · Lines on Maps · Scatter Plots on Mapbox · More Maps
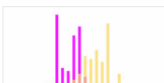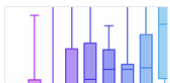
Statistical and Seaborn-style Charts

3D Charts