

CSE 564

VISUALIZATION & VISUAL ANALYTICS

INFOGRAPHICS DESIGN

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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

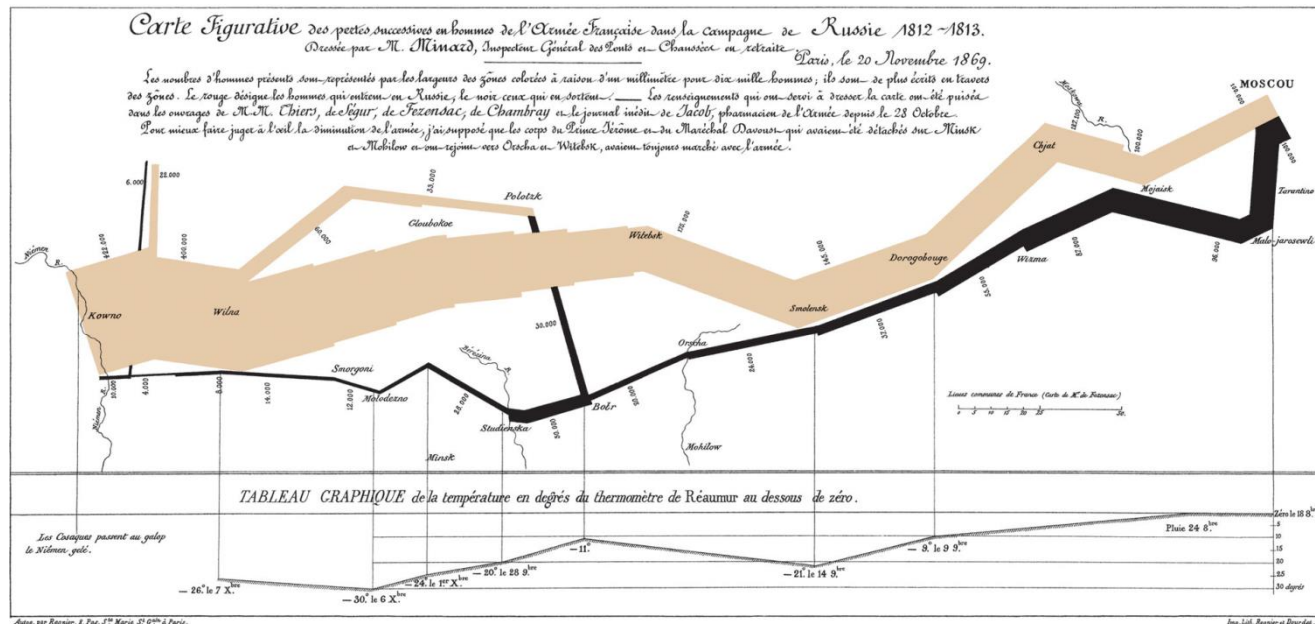
DESIGN RULES TO CONSIDER

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 ...

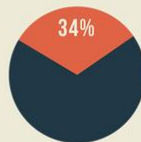
The Time We Spend on the Internet



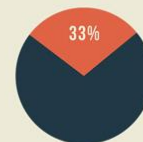
Stress in the Workplace



of American workers experience stress-related illnesses.



think they'll burn out on the job in the next two years.



more heart attacks are occurring on Monday mornings.



of entrepreneurs said they were stressed.

The Average Work Week



MATTHEW MCNEW.

720 220 2307
mmcnew@mines.edu

Resume



Education

Colorado School of Mines

Major:
Computer Science

May
2013

GPA:
3.7

Minor:
Electrical Engineering

Minor:
Mathematics

Student Body President

Colorado School of Mines
2012-2013



Campaign Logo

Skills



Decent

Great

Windows

Linux

Mac OS

Internships:

2012

PIVOTAL LABS

Ruby on Rails
Agile Development
Pair Programming

2011

CableLabs
RECOMMENDING CABLE TECHNOLOGY

Tested the Effectiveness
of Amazon Kindle's
Silk Browser

Volunteer:

Led A WWOOFing
Trip to Rural Brazil



Projects:

Distance Programmer

Eagle Ridge Academy
After School Scheduling
PHP and MYSQL

Symplified

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

School:

Graduated High School
as Valedictorian

Math Counts Coach

Tau Beta Pi

Blue Key

Student Government

Activities

Interests

Organic Farming

Soccer

Travel

Entrepreneurship

Comedy



Number of Internships Completed



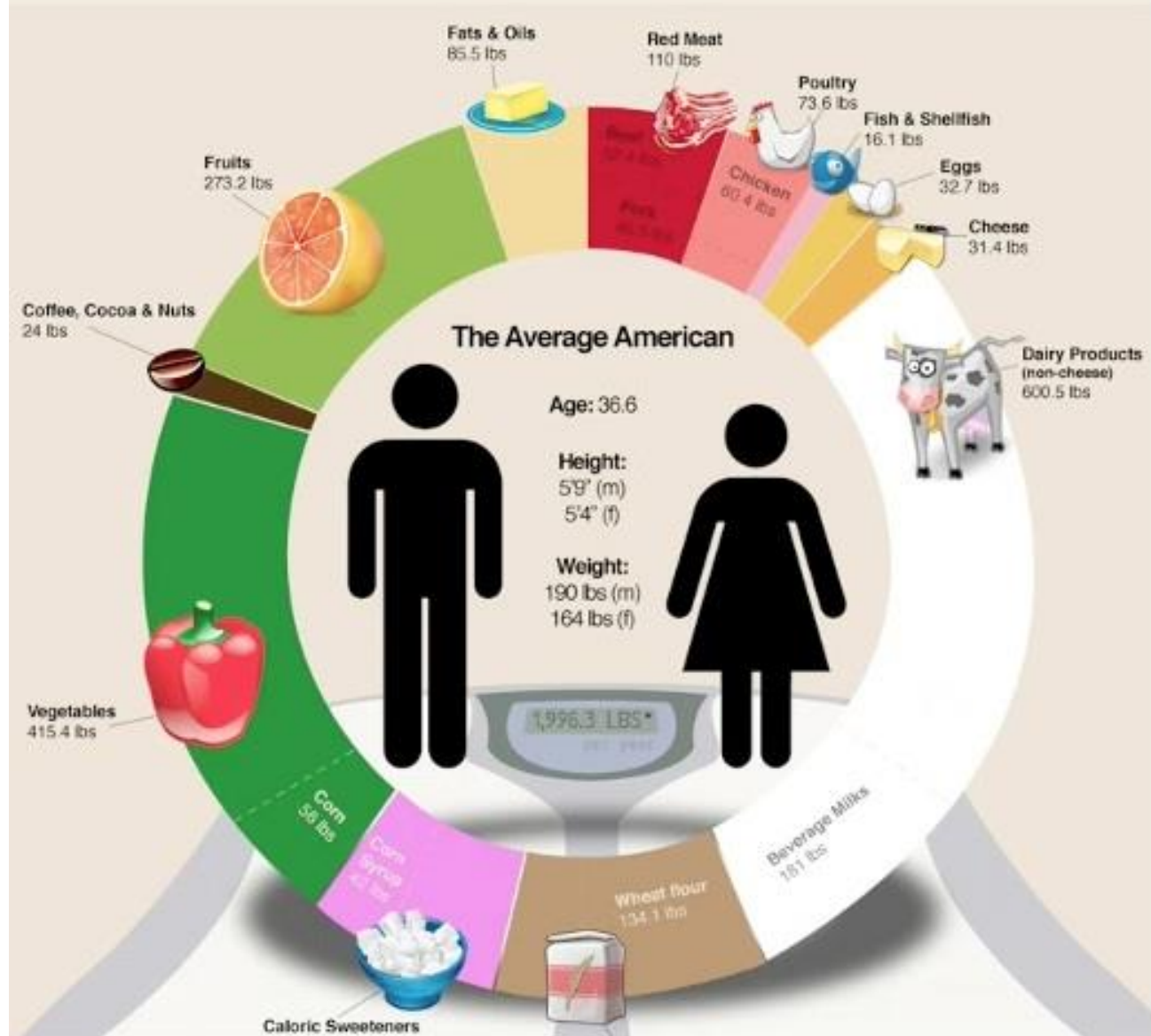
Number of Jobs Employed



Number of Countries Traveled

WHAT ARE WE EATING?

What the Average American Consumes in a Year



EDUCATION AROUND THE WORLD

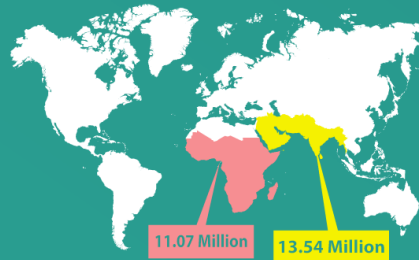
There are **1.4 Billion** students on Earth.



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



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





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

STUDENT BULLYING

bul·ly·ing

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



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.

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.

MOST COMMON TYPES OF BULLYING:

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).

PLAYGROUND SCHOOL BULLYING STATISTICS
**EVERY 7 MINUTES
A CHILD IS BULLIED**

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



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



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](http://www.cops.usdoj.gov)
[WWW.KEEPSCHOOLSSAFE.ORG](http://www.keepschoolssafe.org)
[WWW.BULYPOLICE.ORG](http://www.bulypolice.org)

PRODUCED BY:
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[WWW.BUCKFIRELAW.COM](http://www.buckfirelaw.com)

<http://bit.ly/studentbullyingfacts> ©

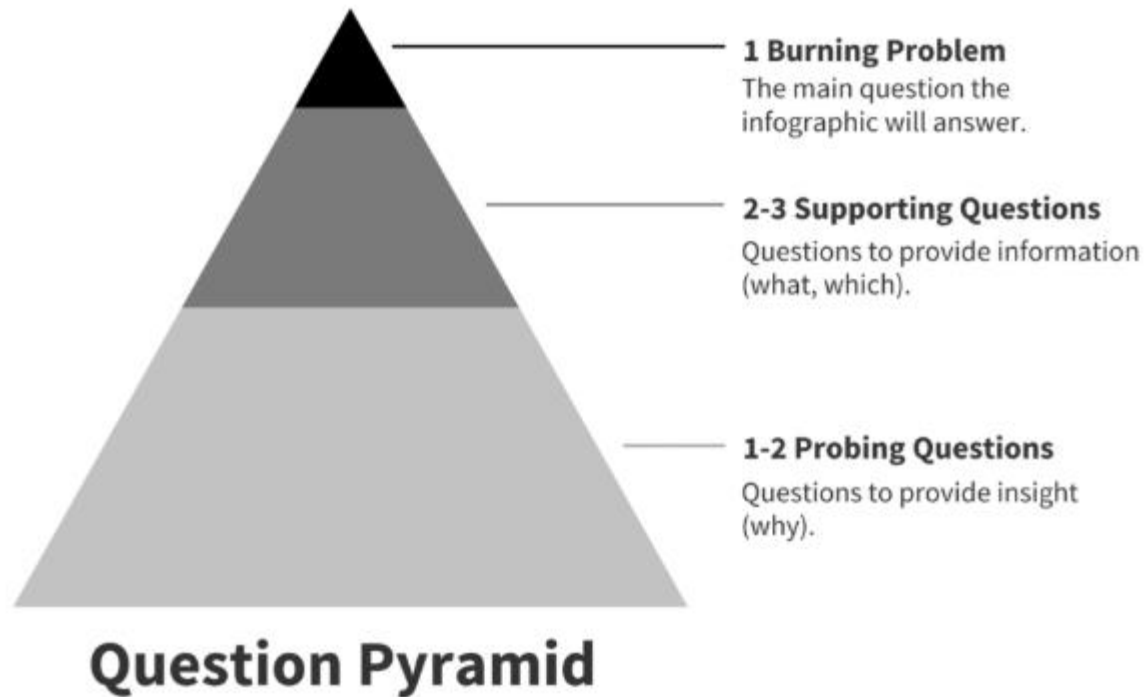
HOW TO MAKE EFFECTIVE INFOGRAPHIC

Five steps (from [Venngage.com](https://venngage.com))

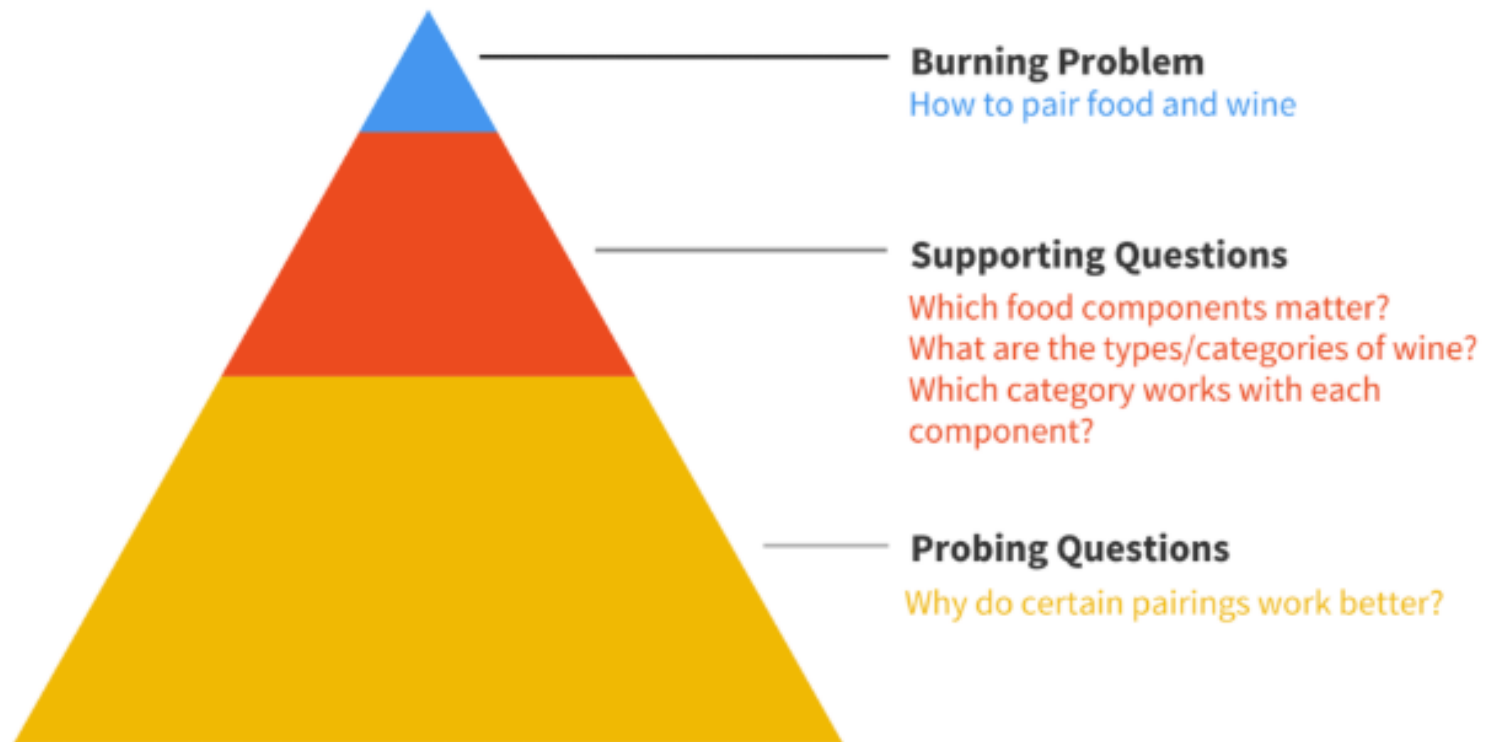
1. Outline the goals of your infographic
2. Collect data for your infographic
3. Visualize the data for your infographic
4. Layout your infographic using an infographic template
5. Add style to your infographic design

STEP 1: OUTLINE YOUR GOALS

Use the question pyramid



EXAMPLE: FOOD – WINE PAIRING



INFOGRAPHIC



FOOD & WINE PAIRING METHOD

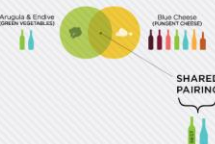
DIGITAL EDITION

DIGITAL EDITION IS FREE TO SHARE - ENJOY

EXAMPLES OF HOW TO USE

TWO INGREDIENT PAIRING

Angula and Endive Salad with Blue Cheese



INGREDIENT + PREP METHOD PAIRING

Black Pepper Steak



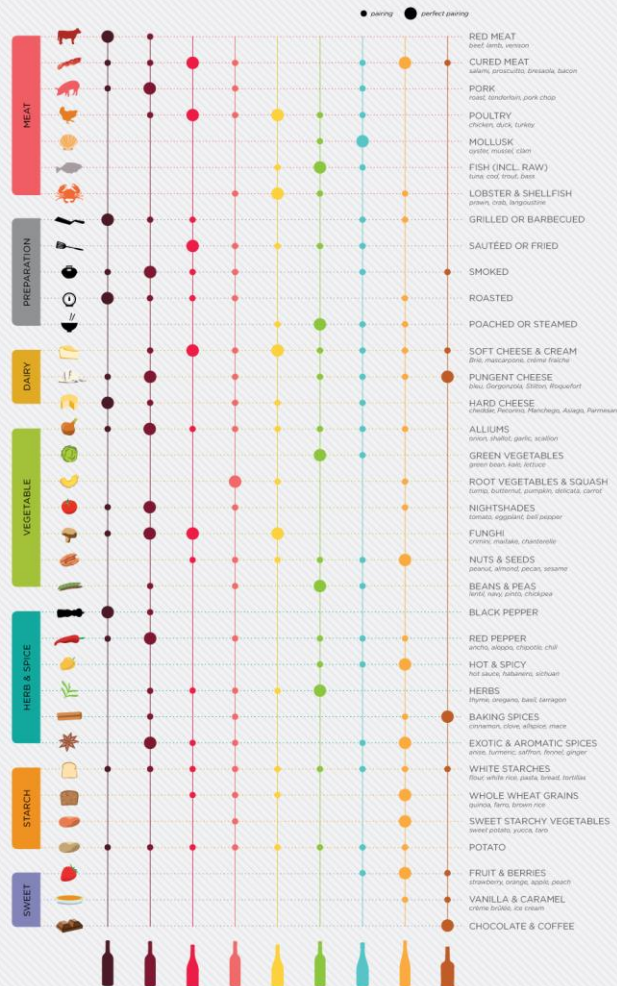
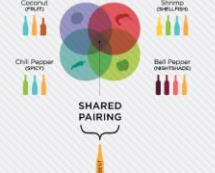
MULTI-INGREDIENT PAIRING

Mushroom Risotto



ADVANCED PAIRING

Spicy Red Curry with Shrimp



Bold Red	Medium Red	Light Red	Rose	Rich White	Light White	Sparkling	Sweet White	Dessert
Malbec Syrah / Shiraz Merlot Pinotage Petite Sirah Touriga Nacional Cabernet Sauvignon Bordeaux Blend Meritage	Merlot Sangiovese Zinfandel Cabernet Franc Tempranillo Nebbiolo Barbera Cotes du Rhone Blend	Pinot Noir Grenache Gamay St. Laurent Carnation Counoise	Provencal Rose White Zinfandel Loire Valley Rose Pinot Noir Rose Syrah Rose Garnacha Rosado Bandol Rose Tempranillo Rose Saignee Method Rose	Chardonnay Sémillon Viognier Marsanne Roussanne	Sauvignon Blanc Albariño Pinot Blanc Vermentino Mén de Bourgogne Garganega Trebbiano Pinot Gris / Pinot Grigio	Champagne Prosecco Crisant Cava Metitico Classico Sparkling Wine Sparkling Rose	Moscato Gewürztraminer Late Harvest Whites Alsatian Pinot Gris	Port Sherry Madeira Vin Santo Muscat PX (Pedro Ximénez)



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.

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:



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



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



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

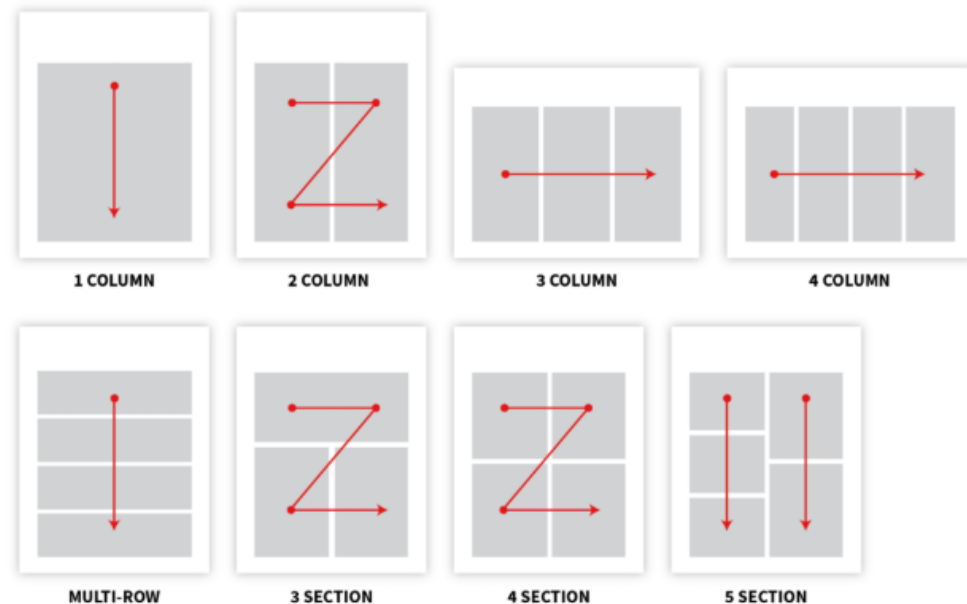
STEP 4: LAYOUT

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

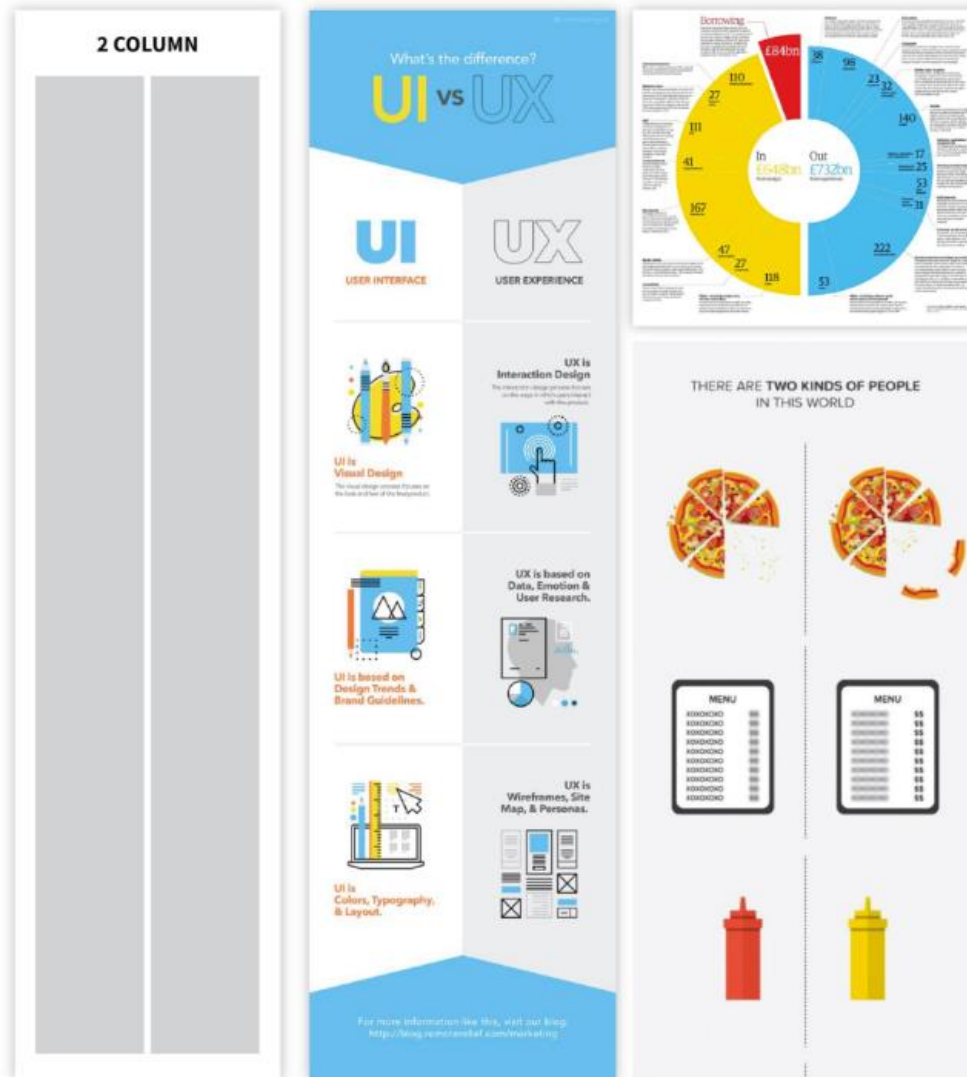
- guides the reader's eye
- symmetrical grid
- consider that people read
 - top to bottom
 - left to right



Venngage.com



TWO COLUMNS FOR COMPARISONS



TWO COLUMN EXAMPLE

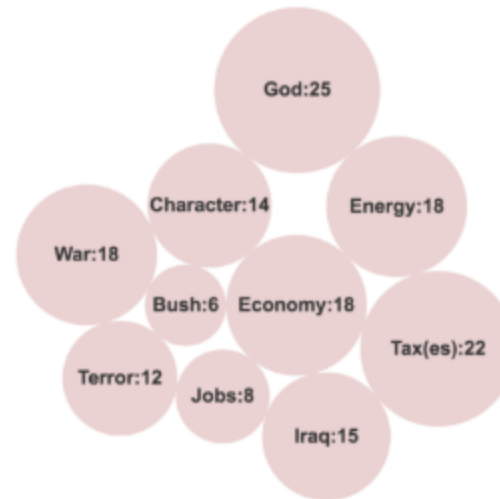
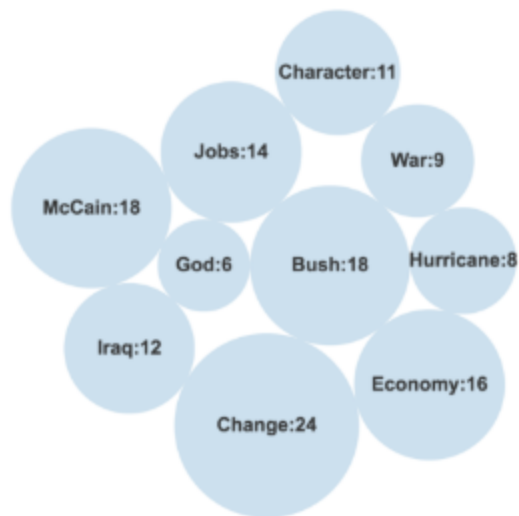
Who Said What?

Democrats



Number of times
words were used

Republican

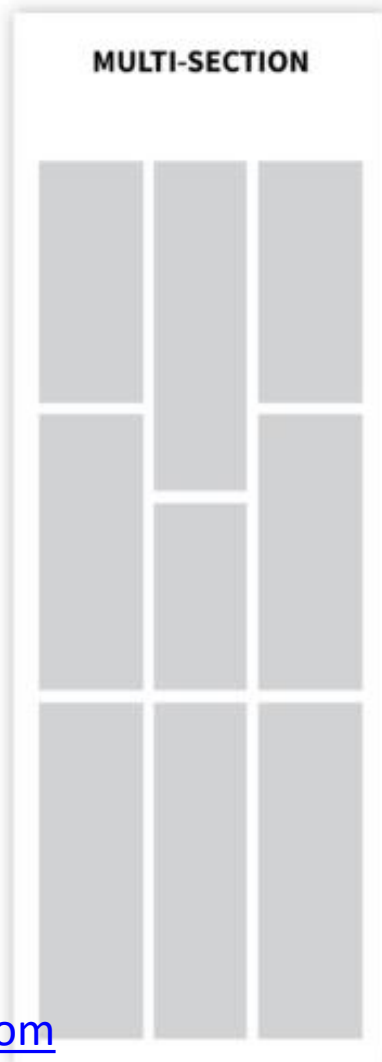


The Words They Used - Graphic - NYTimes.com

THREE COLUMN EXAMPLE



MULTI-SECTION LAYOUT FOR RANDOM VISUAL ACCESS



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

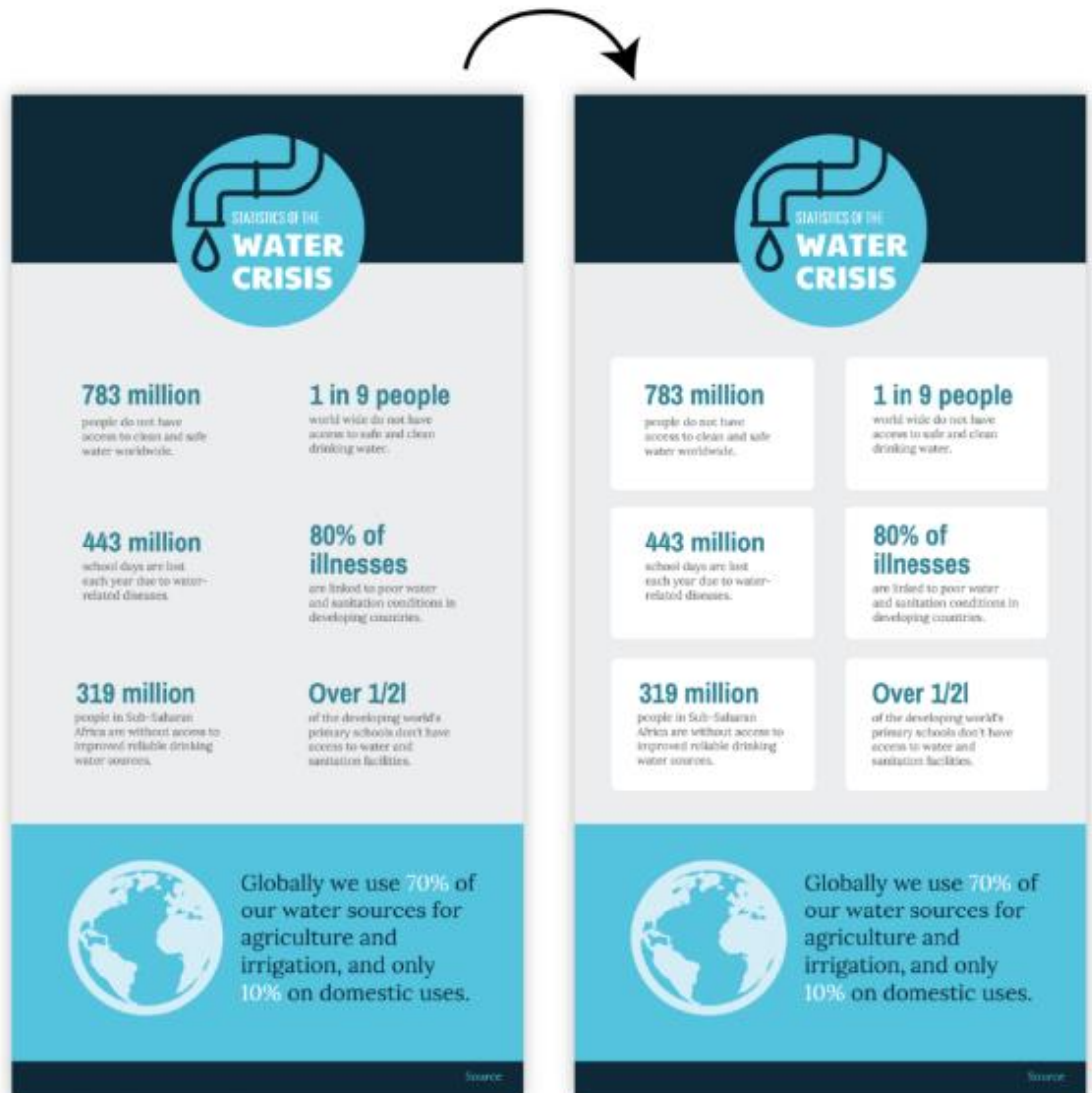
- readable font for the bulk of the text,
- amp up size and style of your main header, section headers, and data highlights
- make sure that the gist of your infographic is immediately apparent

EXAMPLE



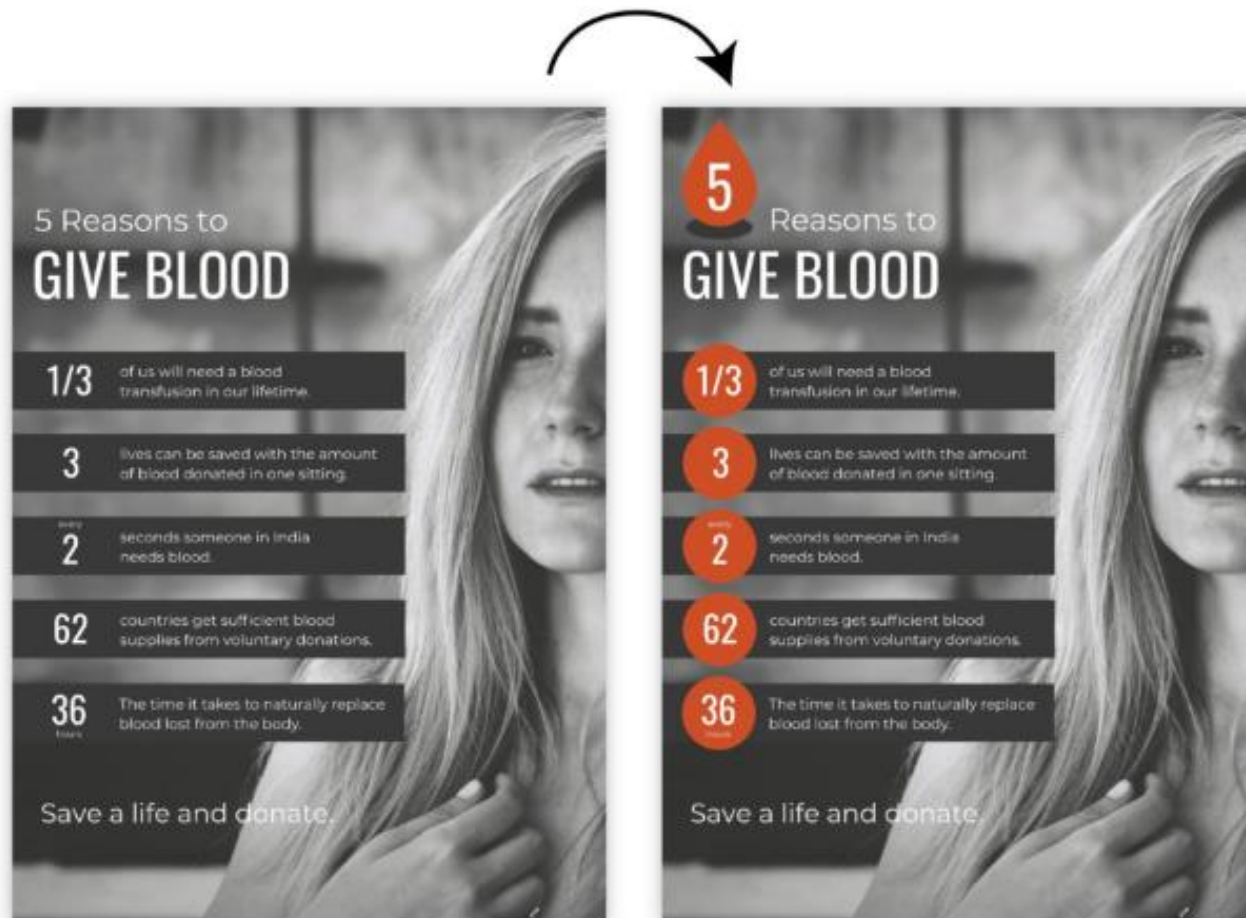
REPETITION, CONSISTENCY, AND ALIGNMENT

Repeat basic shapes to reinforce the underlying grid



EMPHASIZE USING SHAPES

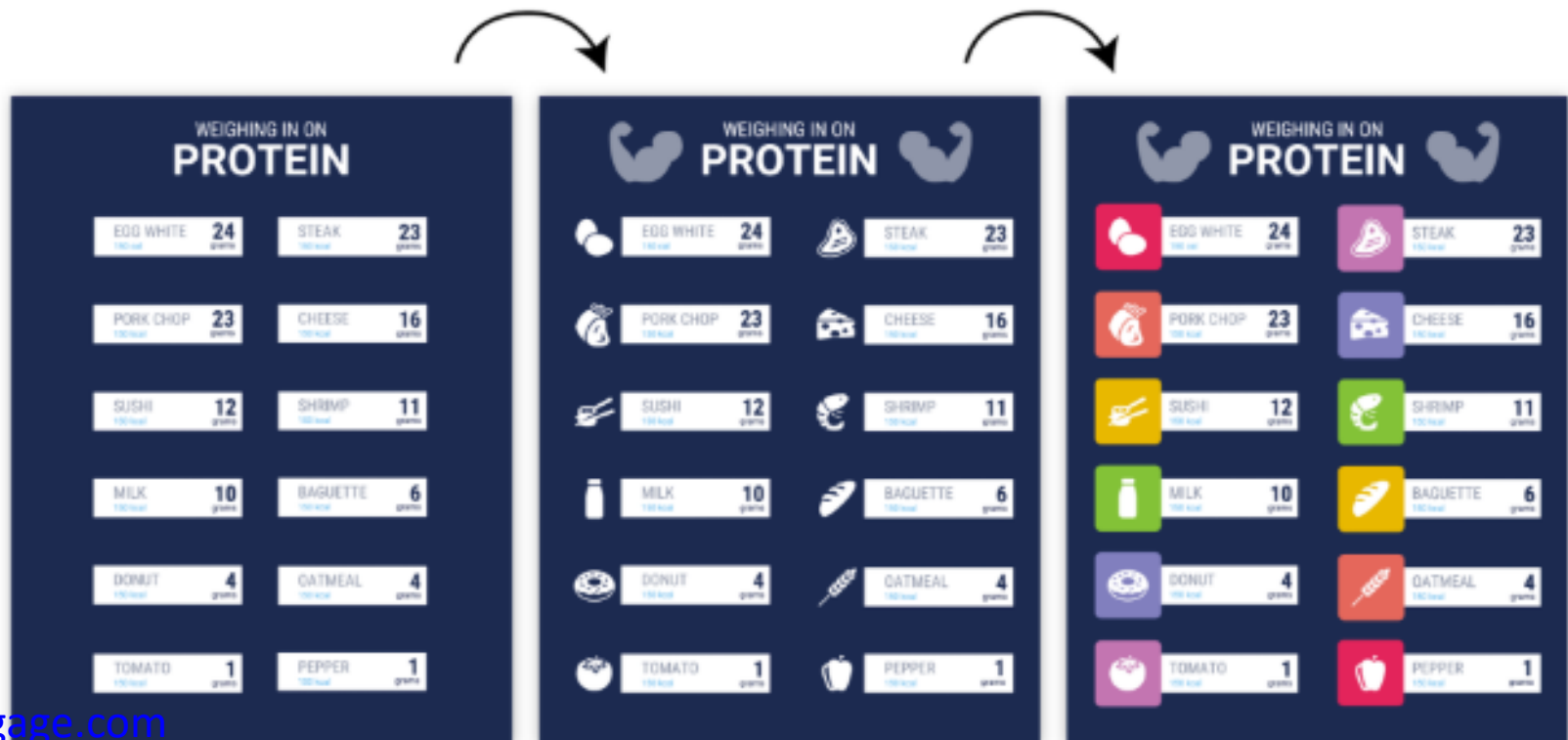
Use basic shapes to emphasize headers and list elements



USE ICONS

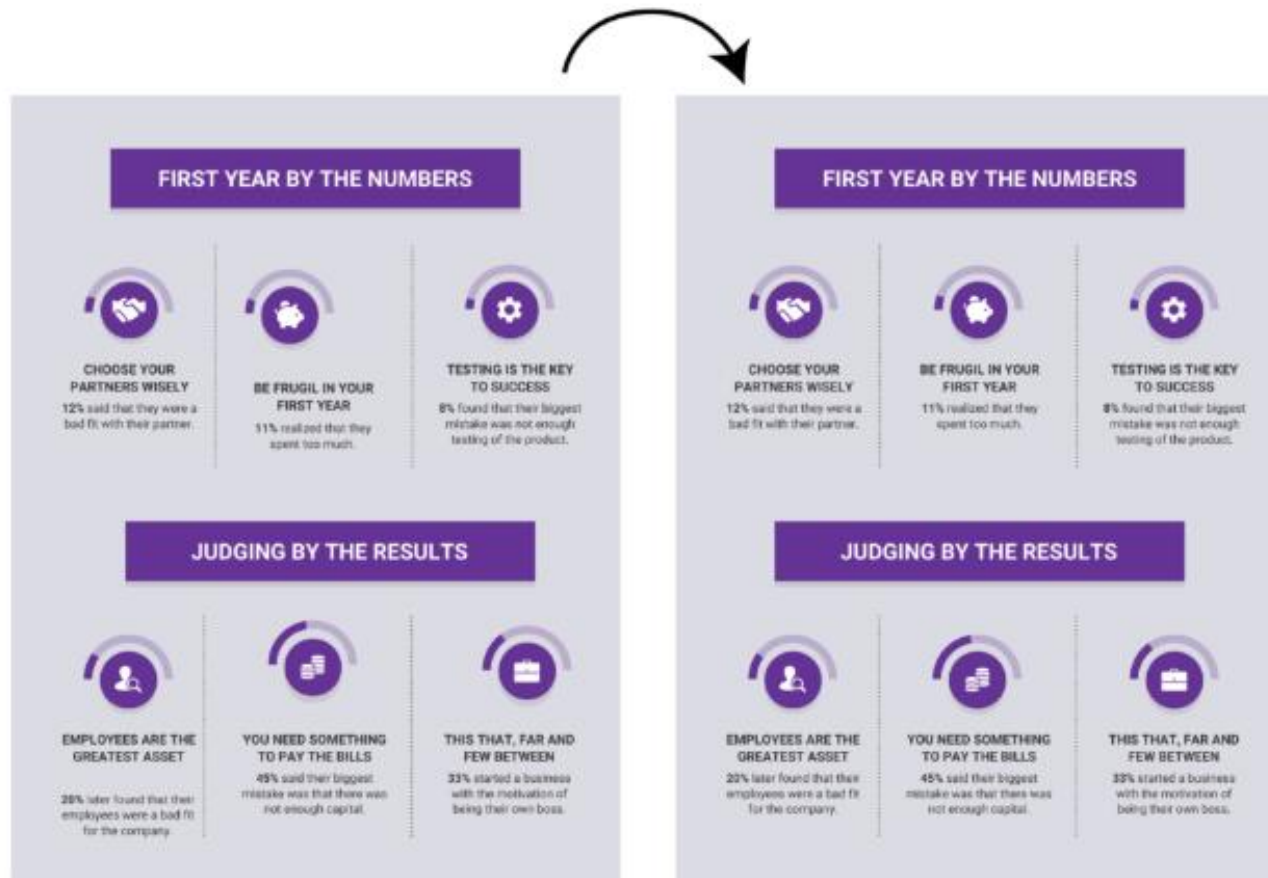
Add icons to reinforce important concepts in the text

- 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

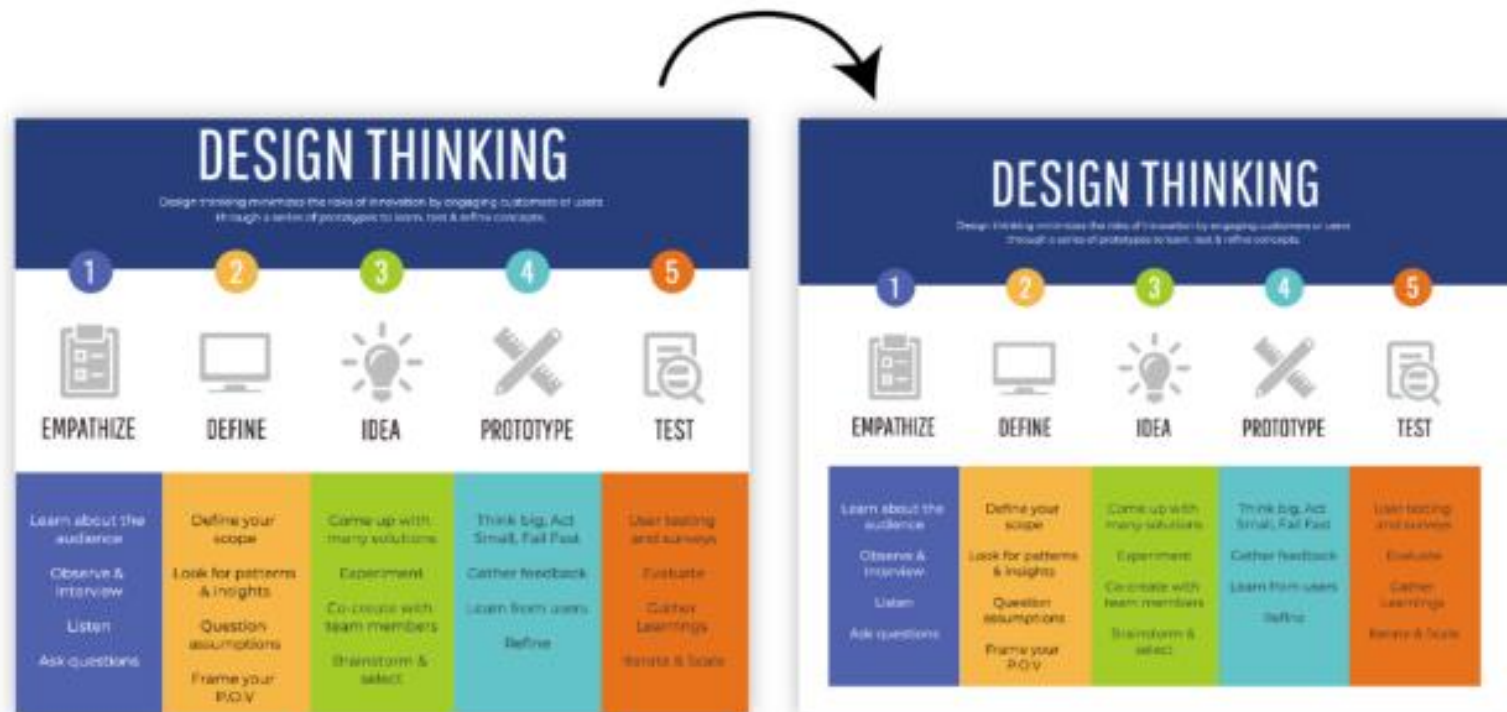
- the space around and between the subject of an image
- helps to define a subject
- helps emphasizing a message



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



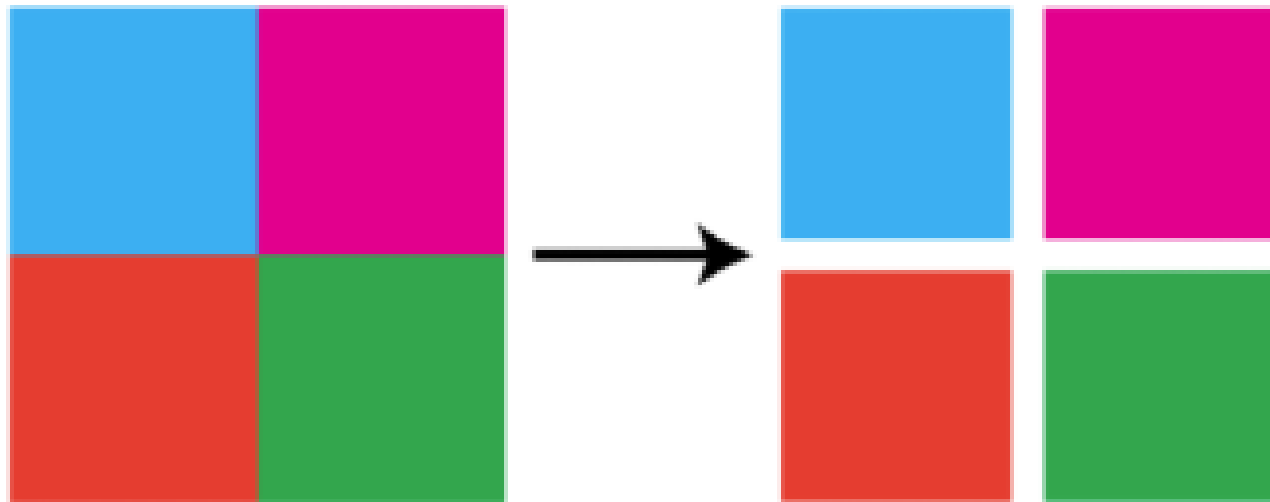
The diagram illustrates the use of negative space in pricing tables. A curved arrow points from a cluttered version on the left to a clean version on the right. The left version has icons and labels for each plan, while the right version uses only icons and prices, with labels placed below the price column.

What kind of plan are you interested in?	 Basic Basic features and perks	 Premium Premium features and perks	 Business Business features and perks
	\$14	\$20	\$35
Storage space	4GB	8GB	Unlimited
Validity	1 Year	1 Year	2 Years
Posts per month	4	8	Unlimited
Branding	No	No	Yes
Social Bookmarking	No	No	Yes
Tracking per month	50	100	Unlimited
Cloud Storage	4GB	8GB	Unlimited

What kind of plan are you interested in?	 Basic Basic features and perks	 Premium Premium features and perks	 Business Business features and perks
	\$14	\$20	\$35
Storage space	4GB	8GB	Unlimited
Validity	1 Year	1 Year	2 Years
Posts per month	4	8	Unlimited
Branding	No	No	Yes
Social Bookmarking	No	No	Yes
Tracking per month	50	100	Unlimited
Cloud Storage	4GB	8GB	Unlimited

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

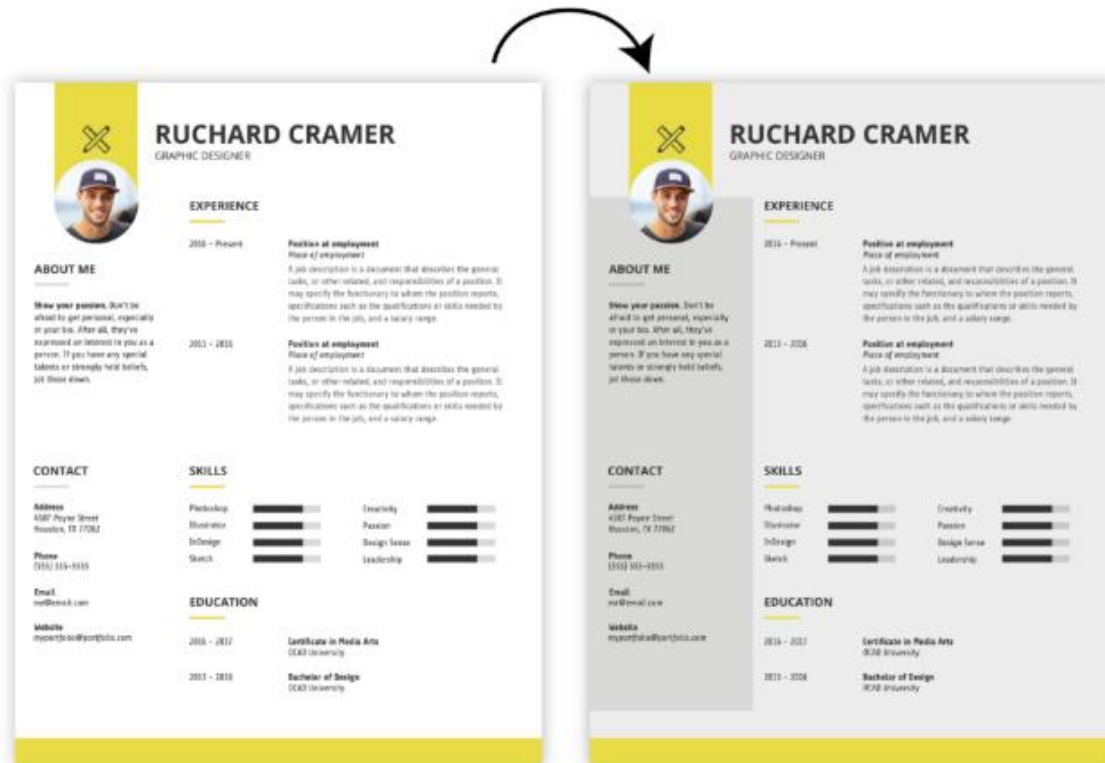
Use color to group related elements together



NEUTRAL COLORS

Use neutrals to offset bright colors

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



COLOR PALETTES

rich & polished



brilliant blues



baroque luxury



gracefully modern



sunny & warm



classic & trustworthy

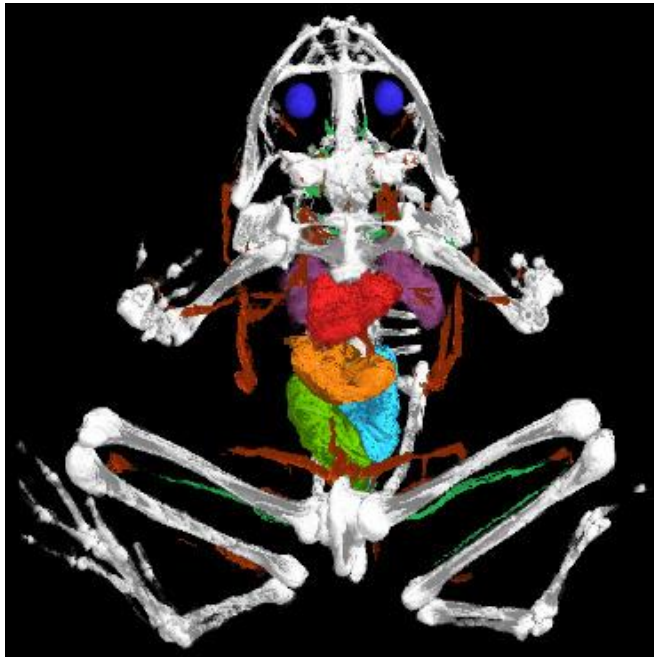


THERE ARE TEMPLATES ON THE WEB

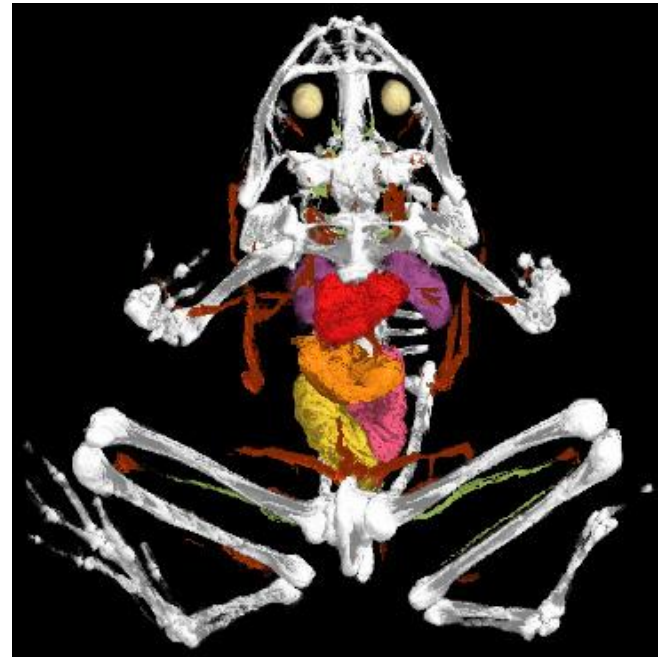


Color Harmony

Non-harmonic colors



Harmonic colors



Hue wheel:

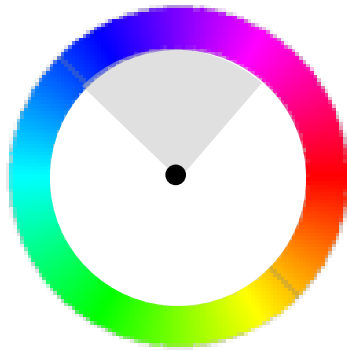


Harmonic Color Schemes

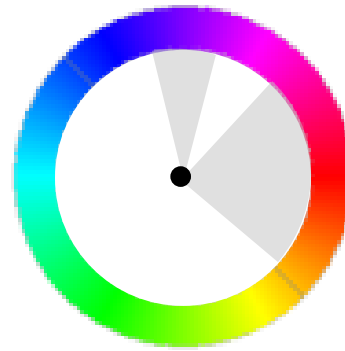
i type



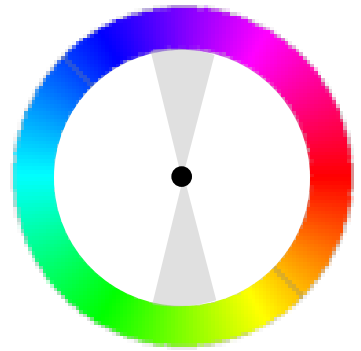
V type



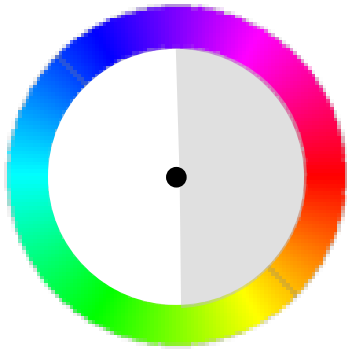
L type



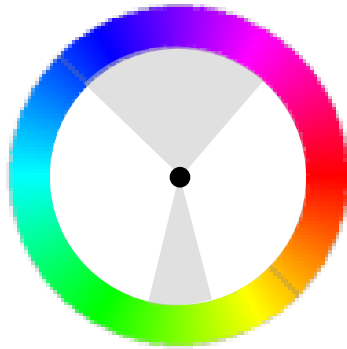
I type



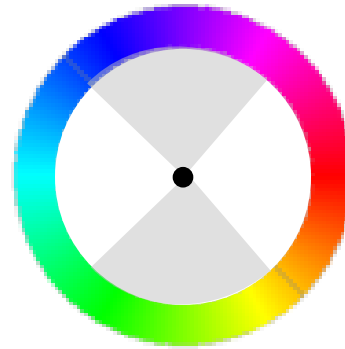
T type



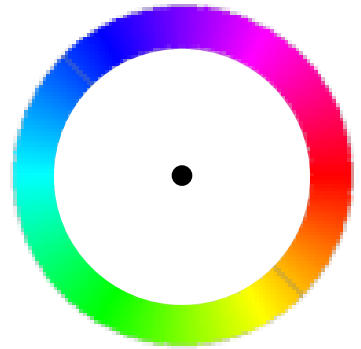
Y type



X type



N type



COLOR HARMONIZATION PROCEDURE (1)

Given arbitrary hue histogram $H(p)$ for image X , find the closest harmonic template T_m

- minimize the distance of the histogram to template coverage (delineated by template edges E)
- use an optimization procedure for this
- also find the orientation angle α

$$F(X(m, \alpha)) = \sum_{p \in X} \|H(p) - E_{T_m(\alpha)}(p)\| \cdot S(p)$$



non-harmonic



harmonized

COLOR HARMONIZATION PROCEDURE (2)

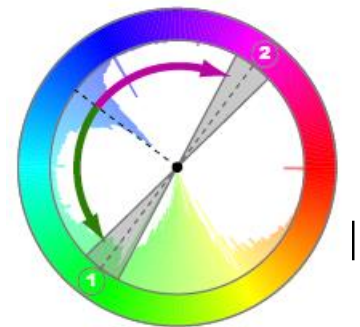
Given closest template and α has been found (user may specify other template)

- shift all hues $H(p)$ to the closest harmonic template position $H'(p)$ with width w
- a Gaussian G controls the clustering of the hues around the sector mean C of the template (greater σ clusters more, we use $w/2$)

$$H'(p) = G(p) + \frac{w}{2} (1 - G_{\sigma}(\|H(p) - C(p)\|))$$

This may break up coherent regions into disjointly colored regions

- to avoid this, may embed a graph-cut labeling into the shifting procedure



Color Harmonization: Example

Collage harmonization (from Cohen '06):

interaction
face 2B0ST0N6



interaction
face 2B0ST0N6



non-harmonic



harmonized (T type)



COLOR HARMONIZATION: EXAMPLE

Collage harmonization (from Wang '08):

