

The Visualisation Design Process

CM4125 – Topic 2

Based on Chapter 1-3 of Andy Kirk's “Data Visualisation” book

Data Vis Foundations

Basic Definitions

- Data vis encompasses the representation and presentation of data to facilitate understanding
- It's building blocks are marks and attributes:
 - Marks: Points, lines or shapes used to represent the items of data
 - Attributes: Visual variations of the marks (scales, sizes, colours, etc.)

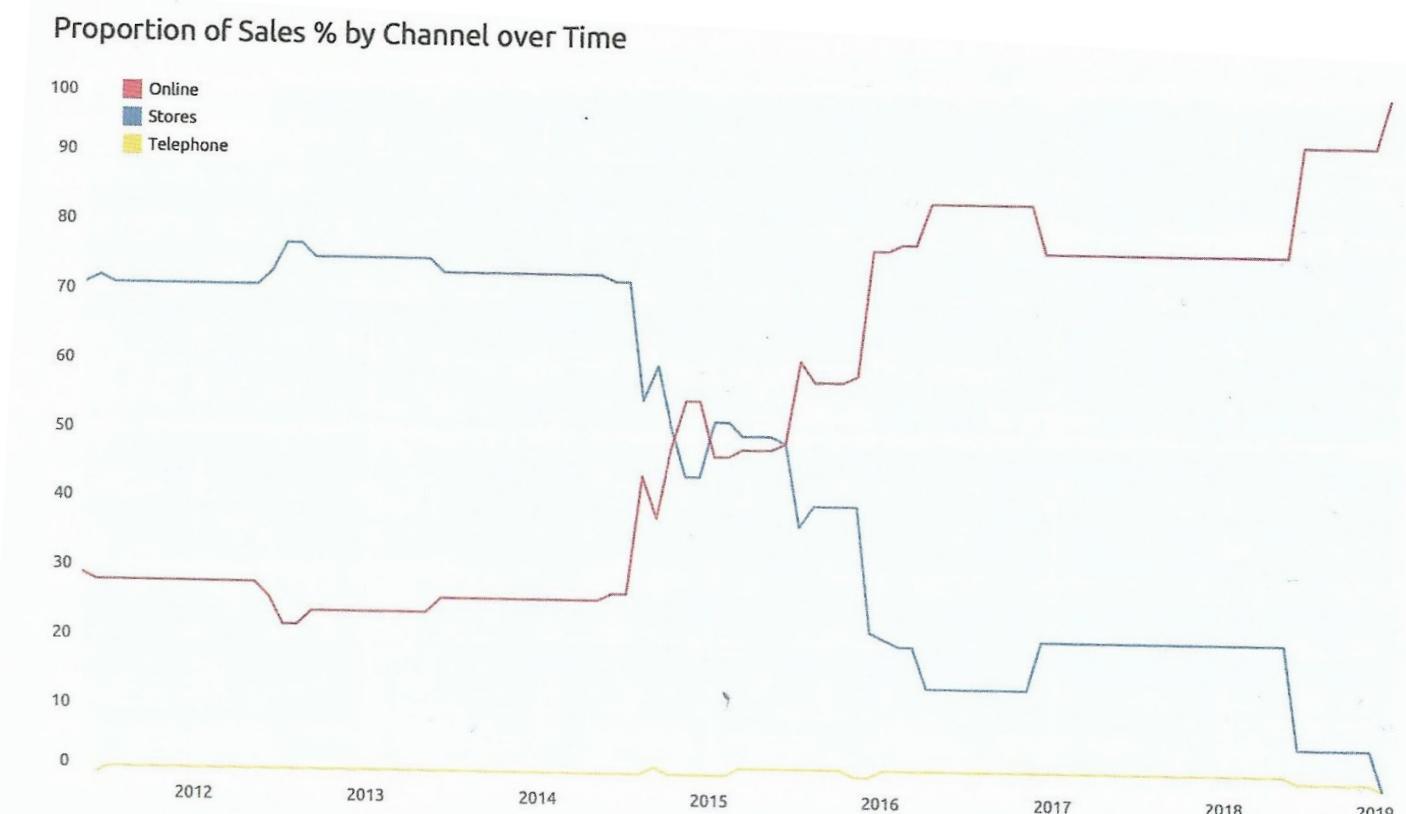
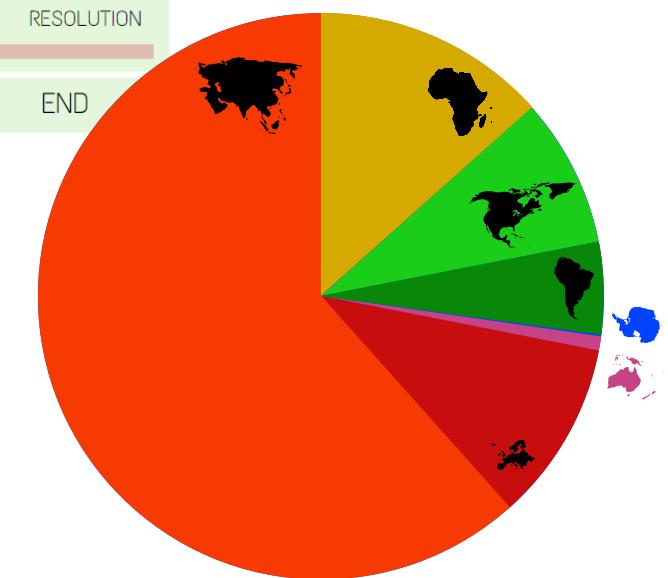
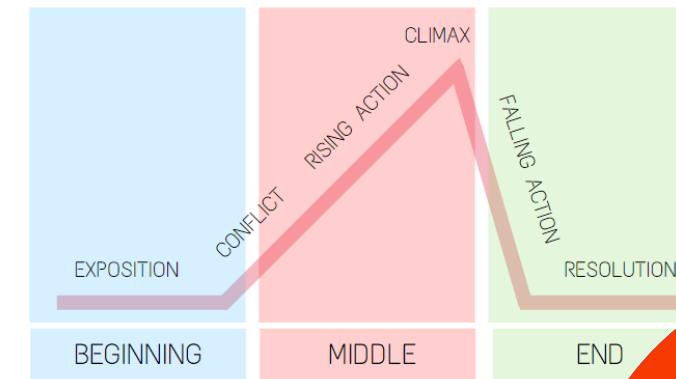


Figure 1.3 Proportion of Sales Percentage by Channel over Time

- Number story: Any type of visual representation that informs an audience based on statistical data
 - A plot
 - A phrase
 - An image
 - etc.



DID YOU KNOW?
Every 35 days, your skin replaces itself and your body makes new cells based on the foods you eat.

- Infographic:
 - A collection of images, charts and “minimal” text that gives an easy-to-read overview of a topic.
 - A visual representation of information or data (Oxford Dict.)
- It is a **STILL** representation, so data and visualisations must be chosen carefully.
- There are many online tools that help you design them e.g. Piktochart, Infograpia, etc.



The yawn
/yawn/
verb

The Mystery of Yawning

Involuntarily open one's mouth wide and inhale deeply due to tiredness or boredom. We all do it, humans and animals alike. We wake up, we yawn and straight and make strange noises. In the middle of the day, hunched over our computer monitors, typing away. At night, halfway through our Netflix show. But why do we yawn, does it have an effect on us, and what should we do if we keep yawning?

The Many Theories

We don't have a bullet-proof answer for why we yawn. Instead, we only have a set of theories.

- 1 Yawning helps your body bring in more oxygen.
- 2 Yawning helps your body get rid of excess carbon dioxide.
- 3 Yawning is evolutionary and a form of prehistoric man intimidating predators.
- 4 Yawning was a sign that a change in activities is needed.
- 5 Yawning is a result of feeling bored.
- 6 Yawning cools the brain, allowing for clear thinking (the current theory).

What Happens When We Yawn?

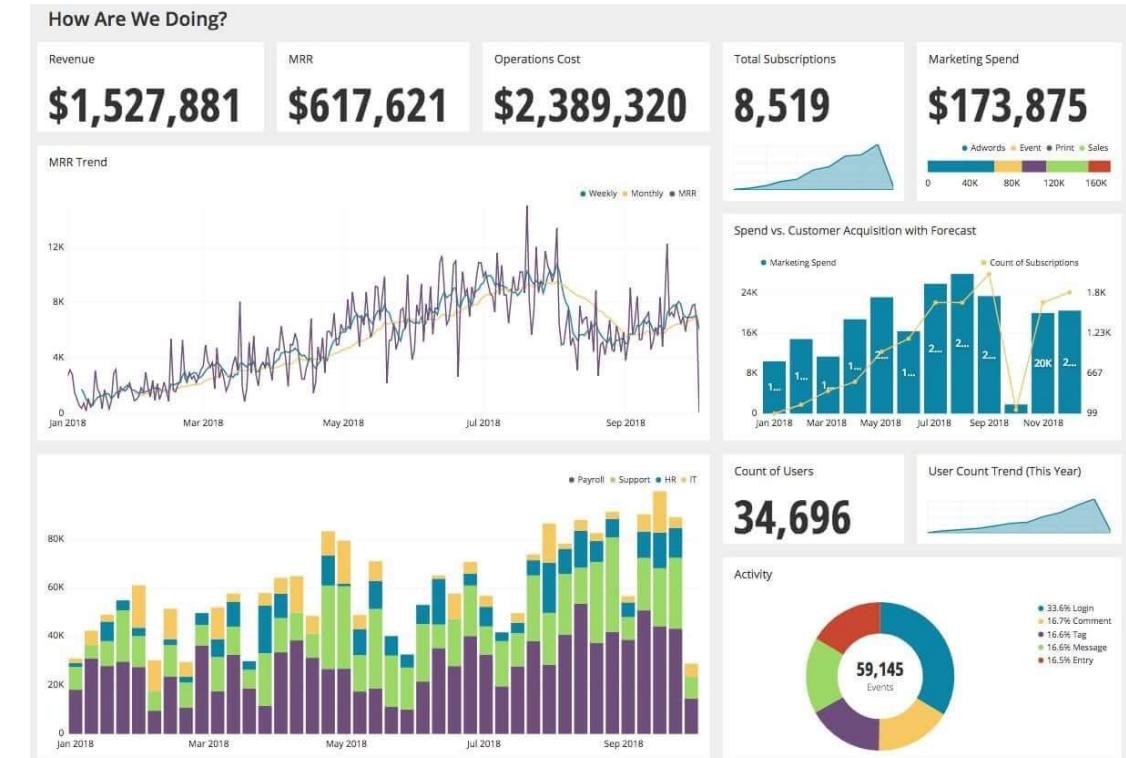
We take a very deep breath

Our muscles stretch and flex, along with our joints

Our lungs expand, taking in a large amount of oxygen

Our facial muscles stretch, forcing more blood to flow to those areas (including the brain)

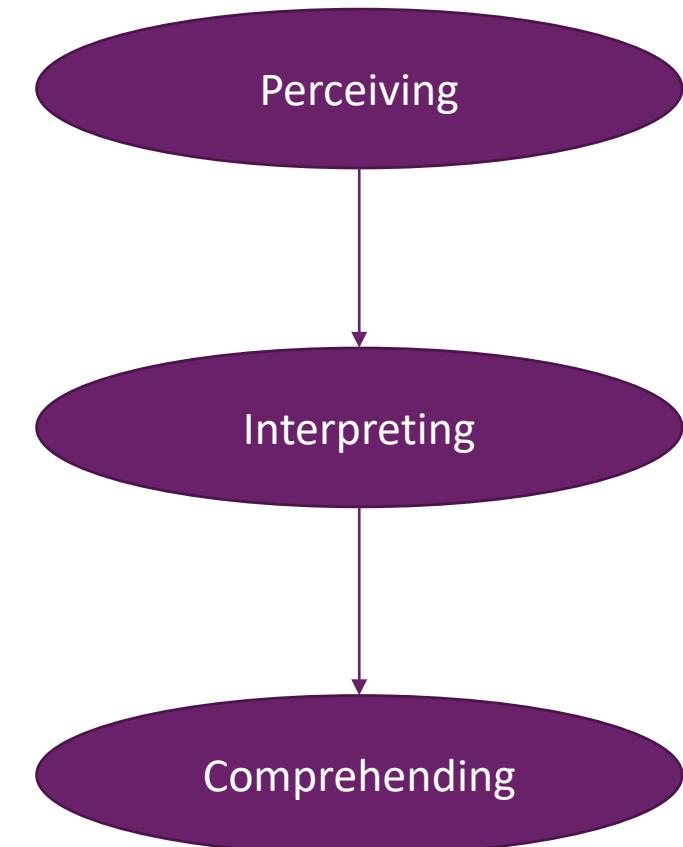
- Dashboard:
 - An information management tool used to track, analyse and display **key performance indicators (KPIs)**, metrics and data points related a specific issue
- Customisable reports
- Dynamic and with minimal text
- Require more idea of what the user may need to see/understand
- Still, many tools to do them! (e.g. Python, Tableau, PowerBi, etc.)



VDP

Presentation

- How we choose to package the visualisation
 - Interactivity
 - Features or annotations
 - Colour usage
 - Composition of the work
- Connection between presentation and representation!
- Facilitate understanding



Lionel Messi At 30 - Season-By-Season Club Record



Total sightings of Winglets and Sprungles



Coming back to the first example...

Forecasted % Chance of Winning Presidency (US Election, 8th November 2016)

Data from <https://projects.fivethirtyeight.com/election-night-forecast-2016/>

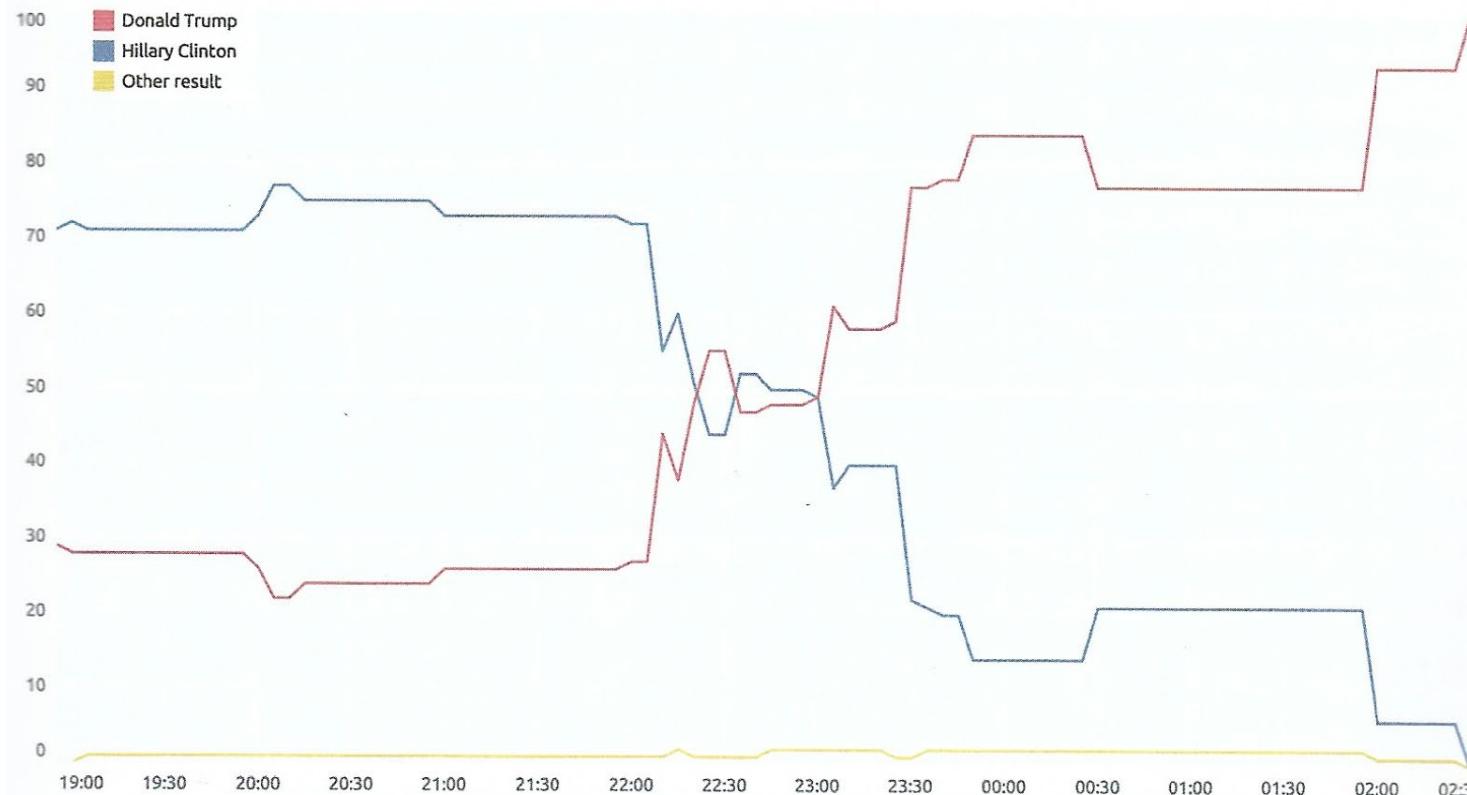


Figure 1.7 Forecasted % Chance of Winning Presidency (US Election, 8 November 2016)

The perfect vis doesn't exist!

- It is an iterative process
- It may never please everyone
- Effective decisions efficiently made



Some observations (the 12 steps?)

1. Reducing the randomness of your approach
2. Every project is different
3. Adaptability
4. Protect experimentation
5. The first occasion, not the last (unless you are doing your coursework at 11 pm one day before the deadline)
6. Time mgmt.
7. Mindsets
8. Documenting
9. Communication
10. Attention to detail
11. Kill your darlings
12. Learn

The 3 Principles of Design

- Good visualisation is **trustworthy**
 - Is it reliable?
- Good visualisation is **accessible**
 - Is it usable?
- Good visualisation is **elegant**
 - Is it aesthetic?

Put in other words by Dieter Rams
(German designer)

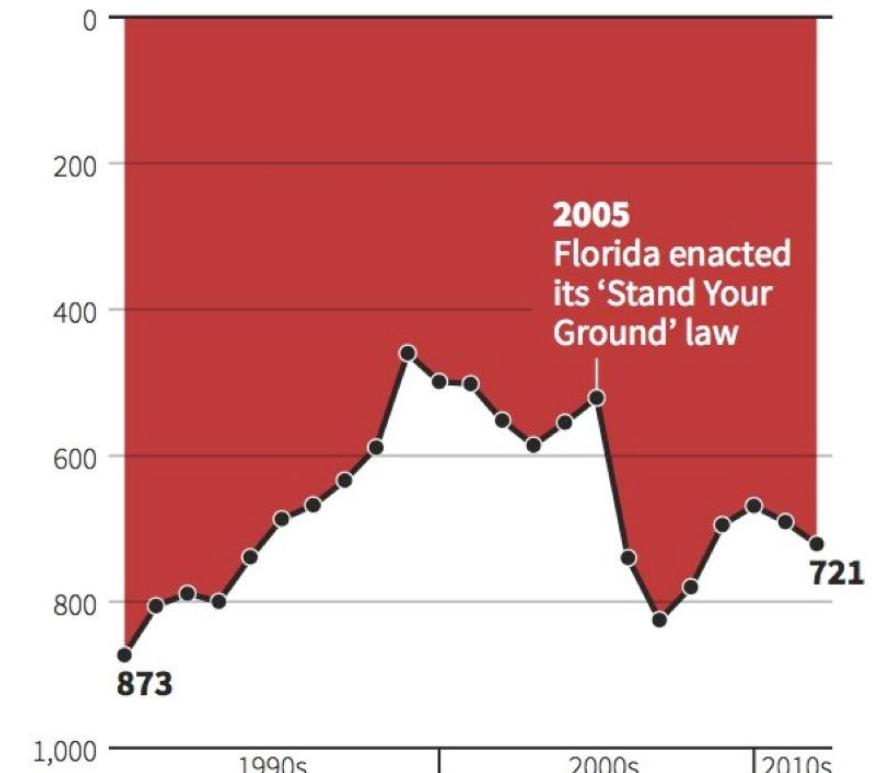
- innovative
- useful
- aesthetic
- understandable
- unobtrusive
- honest
- long-lasting
- thorough to the last detail
- environmentally friendly
- AS LITTLE DESIGN AS POSSIBLE!

1. Trustworthy

- Trust ≠ truth
- Achieving trust is an aim, presenting truth is an obligation!
- *“Trust arrives on foot and leaves in horseback.” (Dutch proverb)*
- Mostly, this can be achieved by avoiding “bullsh*t” (as we will see in topic 3)

Gun deaths in Florida

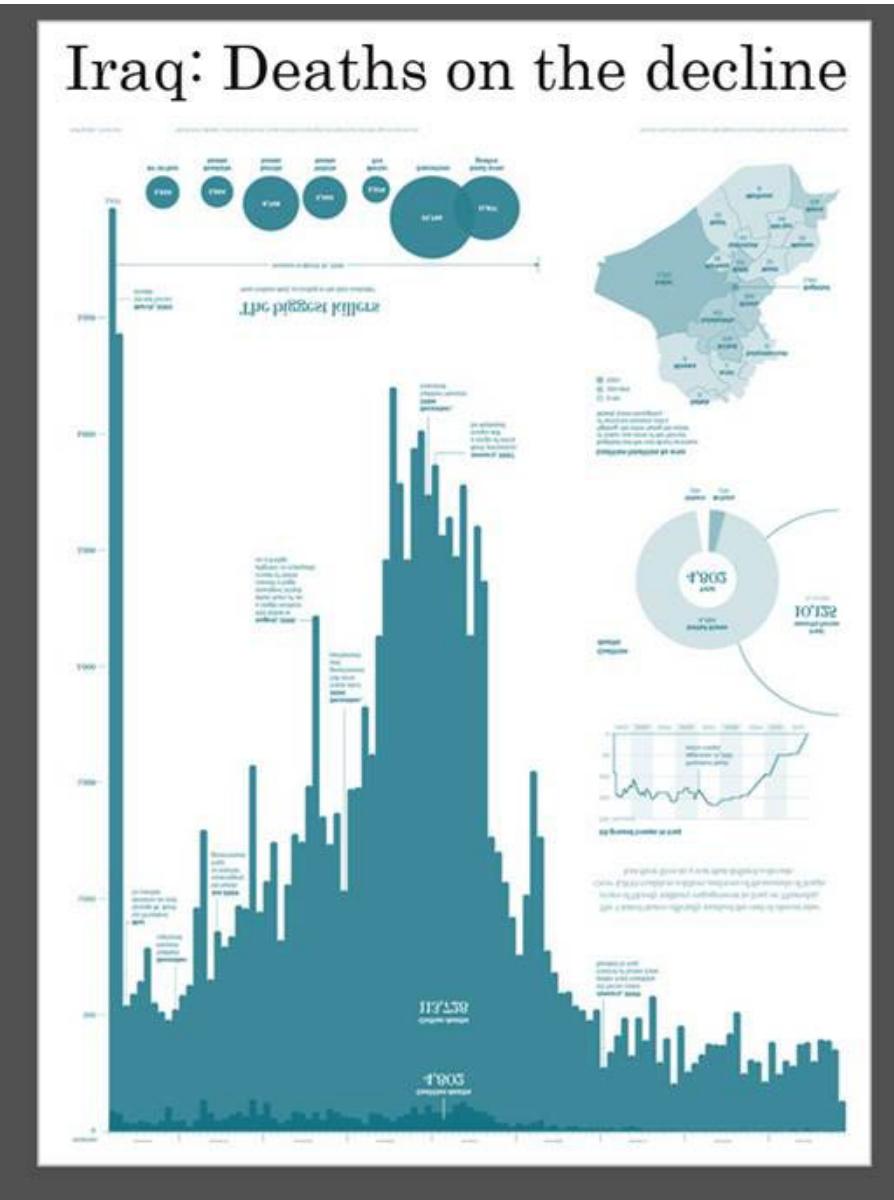
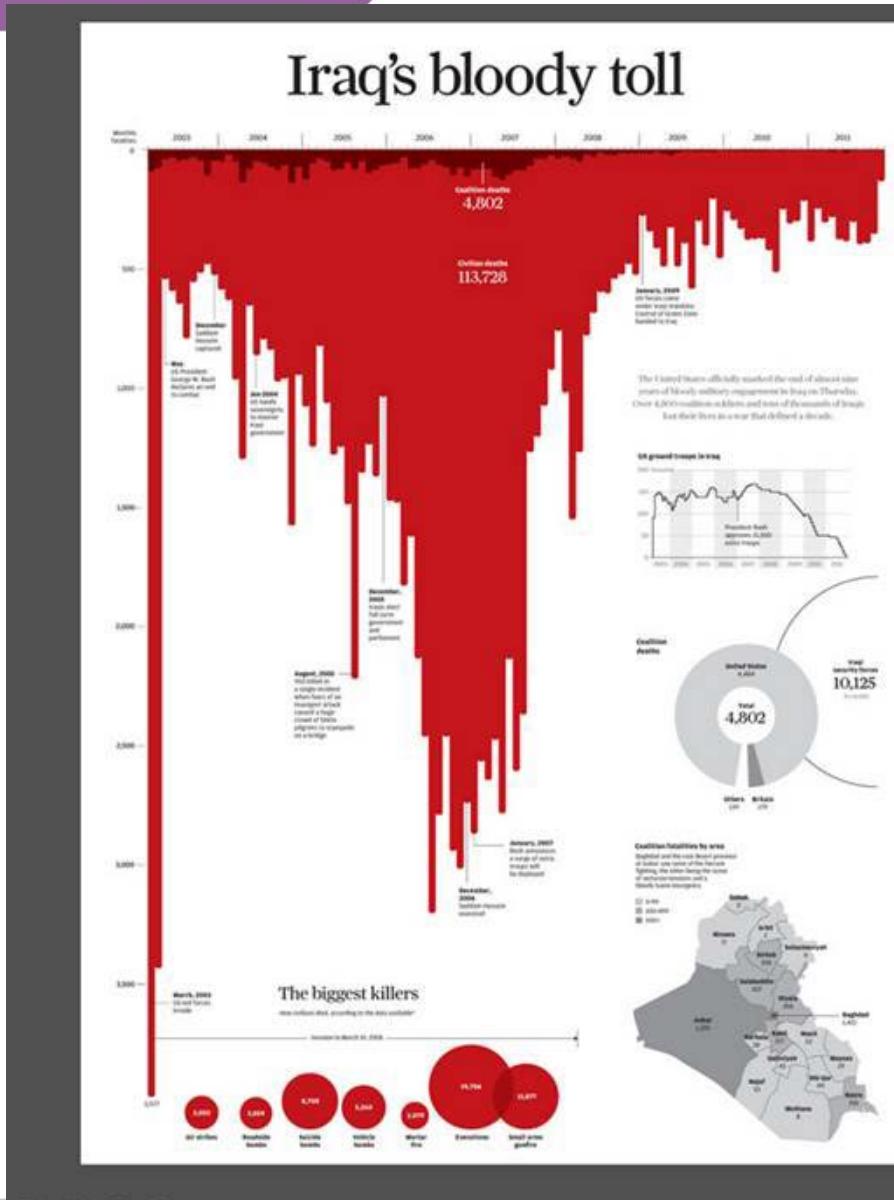
Number of murders committed using firearms



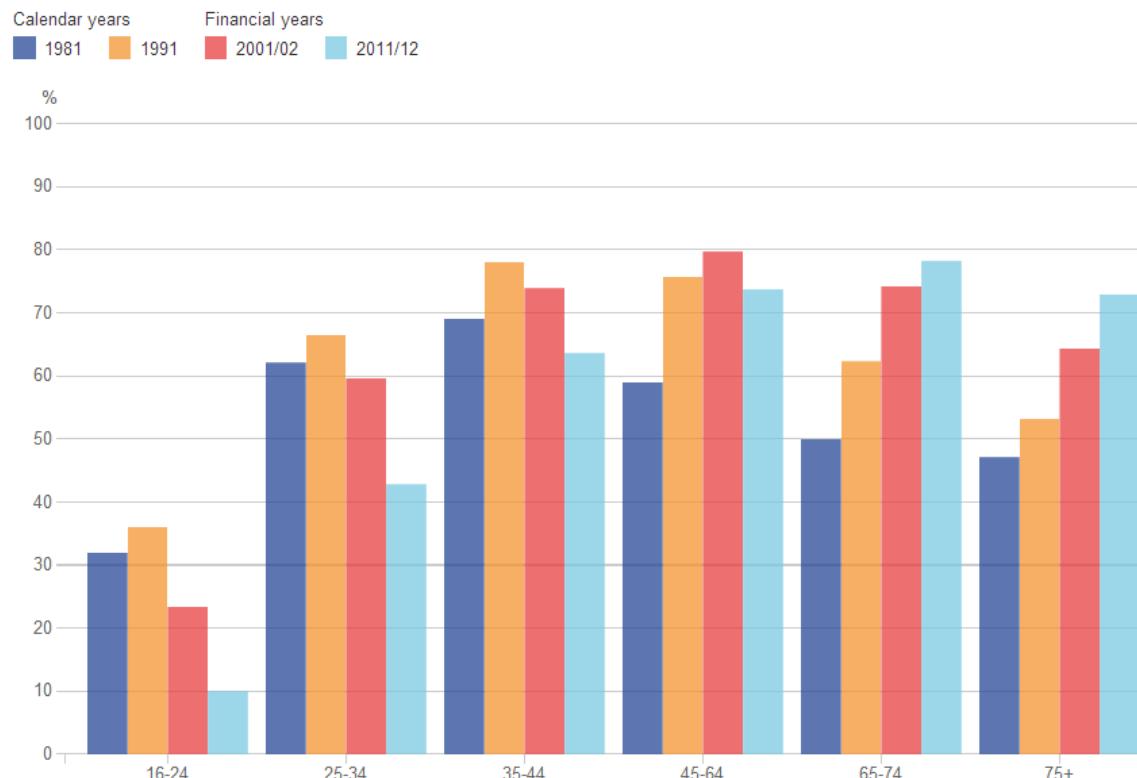
Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

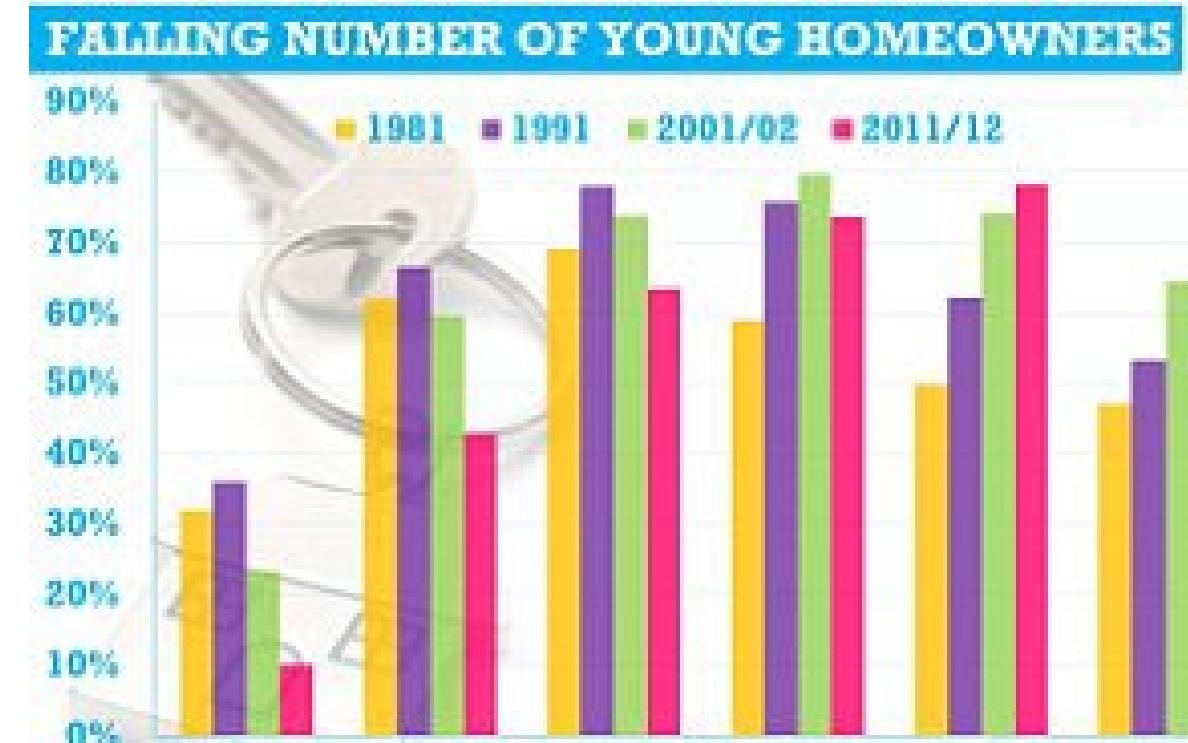
REUTERS



Percentage of each age group that are home owners⁵, England, 1981 to 2012



Source: English Housing Survey (EHS) 2012 to 2013, Table FC2101, DCLG ; EHS 2001/02, Table S106, DCLG



2. Accessible

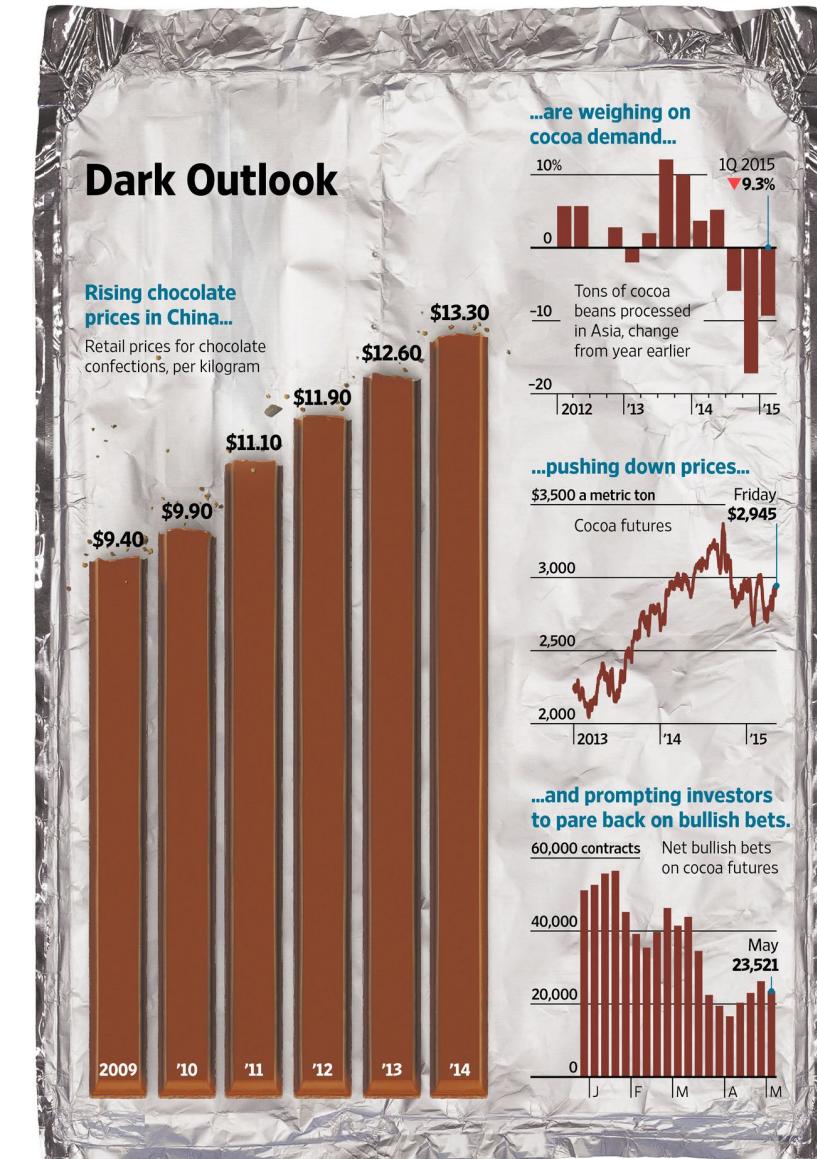
- Relevance
 - You may not have the answer, but you may be able to guide the audience into it
- Suitability
 - Minimum friction (with the audience)
- Understanding of the subject
 - Complicated
 - Complex (not the same as the one before!)
 - Simple
- SIMPLIFY when the audience doesn't have the knowledge or capacity to handle a complicated subject!
- CLARIFY when the audience doesn't have the knowledge, but have the capacity to handle a complicated subject!

3. Elegant

- Is the design appealing?
 - *“Do not make something unless it is both necessary and useful; but if it is both, do not hesitate to make it beautiful!” (Frank Chimero, author)*
- Eliminate the arbitrary ≠ Make it minimalistic
- Decoration should be additive, not negative!



- Innovative
- Long-lasting
- Environmentally friendly!



The Hidden Thinking

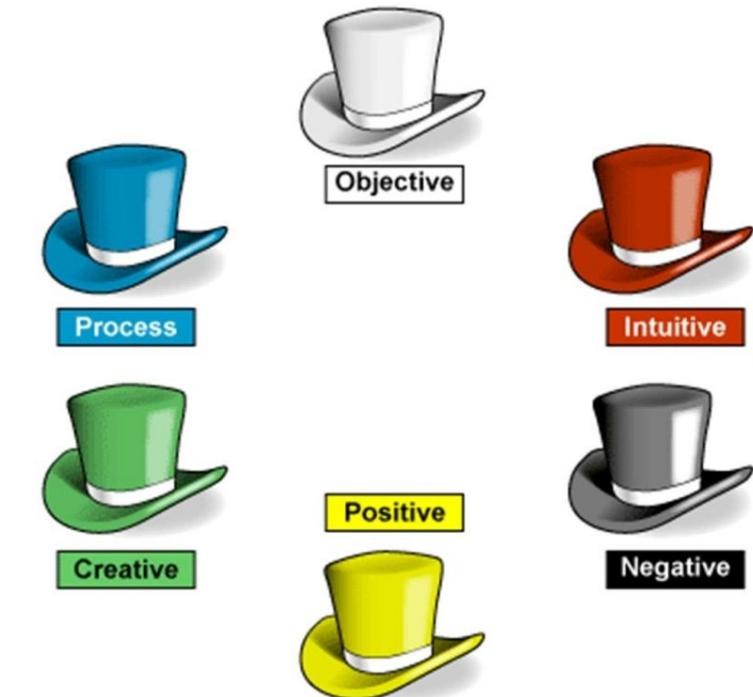
Step 1: Formulating your brief

What is the motivation curiosity?

- Some origin interest held by someone about a subject
- You don't (only) create a vis because you happen to have data, but also because there is a desire for you to understand something!
- Do you have pet/passion projects?
- About what do you want to **facilitate understanding?**

Identifying Project Circumstances

- Frictions and freedoms that are imposed on you or determined by you
- Think about...
 - Stakeholders
 - Audience
 - Visualisers



The seven visualiser thinking hats

DIRECTOR | The coordinator, overseeing the project

Initiates and leads on gathering and understanding requirements
Identifies and establishes the project's key circumstances
Defines the purpose of the project based on desired outcome
Manages progress through the process and keeps it cohesive
The primary decision maker, often needing to compromise
Pays strong attention to detail
Gets things done: checks, tests, finishes tasks

COMMUNICATOR | The broker between all people

Helps to define the perspective of the audience
A good listener with the humility to defer to domain experts
Has a 'thick skin': needs patience, empathy and diplomacy
A confident communicator with laypeople and non-specialists
Possesses strong copy-editing abilities
Manages expectations and presents possibilities
Launches and promotes the final solution

JOURNALIST | The reporter, pursuing the scent of enquiry

Driven by a desire to help others understand
Defines the origin curiosity of the project
Has an instinct to research, learn and discover
Possesses or is able to acquire salient domain knowledge
Understands the essence of the subject's data
Has empathy for the interests and needs of an audience
Defines the editorial angle, framing and focus

DATA ANALYST | The wrangler, handling the data work

Has strong data and statistical literacy
Possesses technical skills to acquire data from multiple sources
Examines the physical properties of the data
Undertakes initial descriptive analysis
Transforms and prepares the data for its purpose
Undertakes exploratory data analysis
Has database and data modelling experience

SCIENTIST | The thinker, providing scientific rigour

Brings a strong research mindset to the process
Understands the science of visual perception
Understands visualisation, statistical and data ethics
Understands the influence of human factors
Verifies/validates the integrity of all data and design decisions
Demonstrates a systems thinking approach to problem solving
Undertakes reflective evaluation and critique

TECHNOLOGIST | The developer, constructing the solution

Possesses a repertoire of software and programming capabilities
Has an appetite to acquire new technical solutions
Possesses strong mathematical knowledge
Can automate otherwise manually intensive processes
Has the discipline to avoid feature creep
Works on the prototyping and development of the solution
Undertakes pre and post-launch testing, evaluation and support

Figure 3.3 The Attributes that Comprise the 'Seven Hats of Visualisation Design'

Constraints

- Timescales
- Pressures
- Design
- Technological

Deliverables

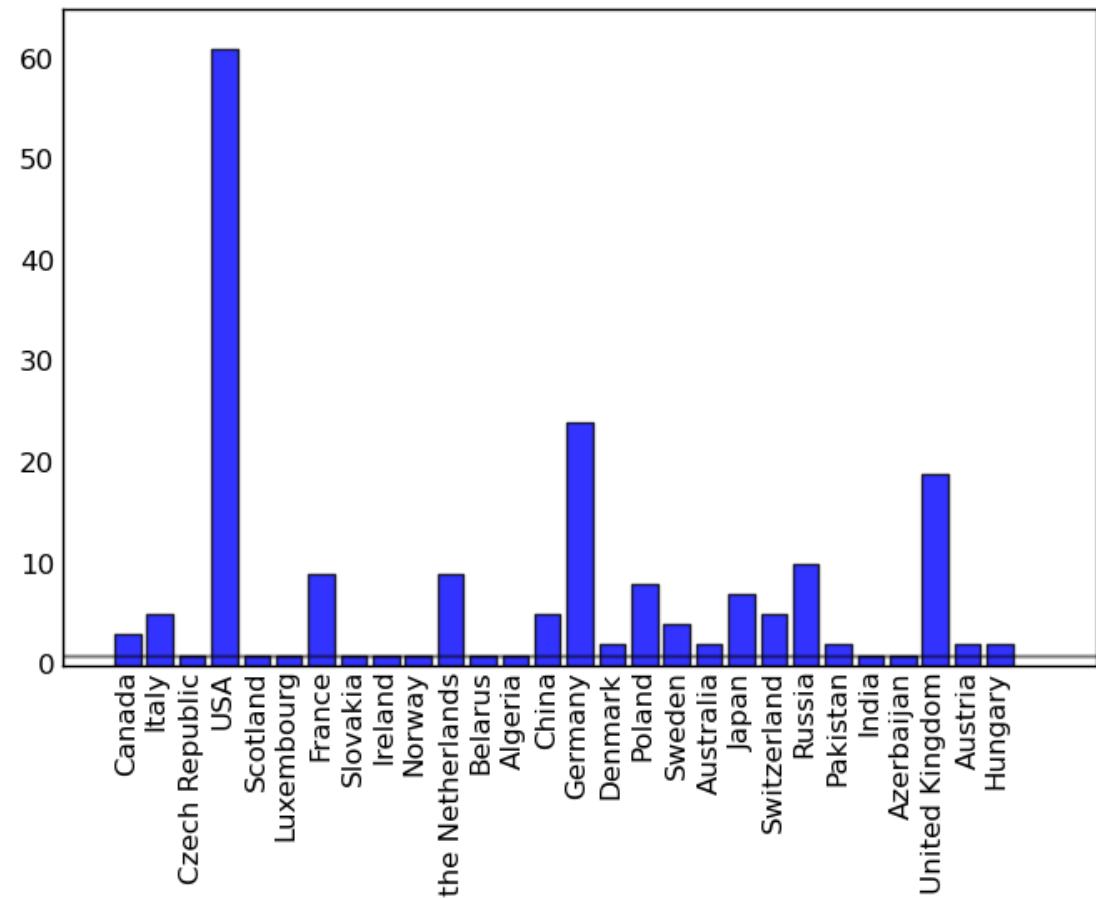
- Setting
- Medium
- Quantity
- Frequency

Defining your project's vision

- Mission ≠ Vision
- Two significant design characteristics
 - Tone: **Read or Feel**
 - Experience: **Explain, Exhibit or Explore**

Reading Tone

- Optimise the precision and efficiency to perceive the represented data
- Pragmatic, analytical, conservative, utilitarian, boring(?)
- Bar charts are the reading tone choice by excellence!



Moving slightly to the “feel” area

USA leads the way in the Nobel Prize

The Top 10 Nobel Prize Winners by Country of Birth



cc

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ShareAlike

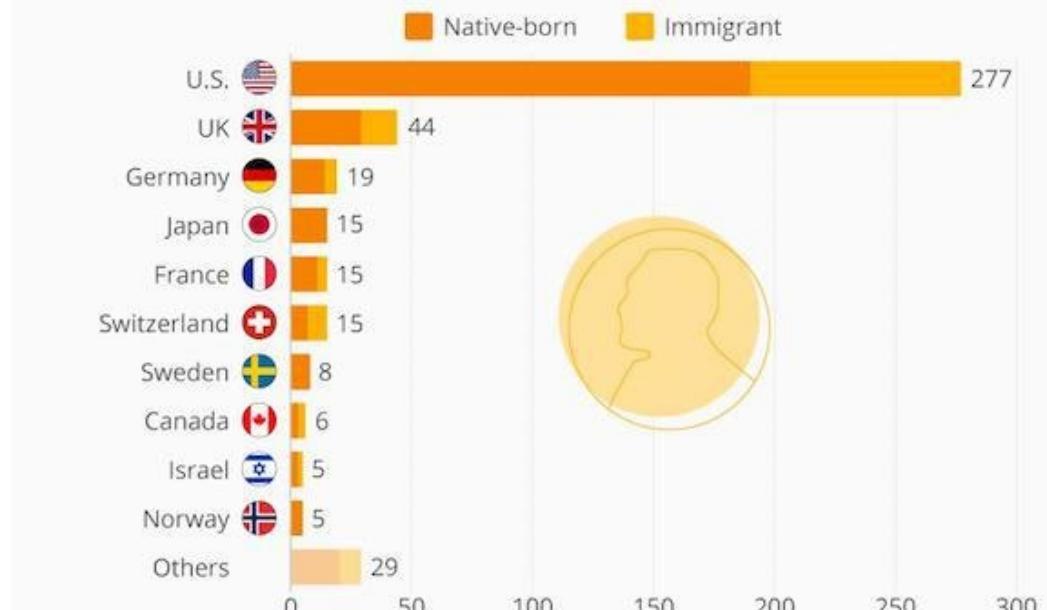
Statista

Source: Nobel Foundation

statista

Immigrants' Share of Nobel Prizes in the Sciences

Number of Nobel laureates (physics, chemistry, medicine, economy) per country 1969-2019*



Non-Commercial

ShareAlike

Statista

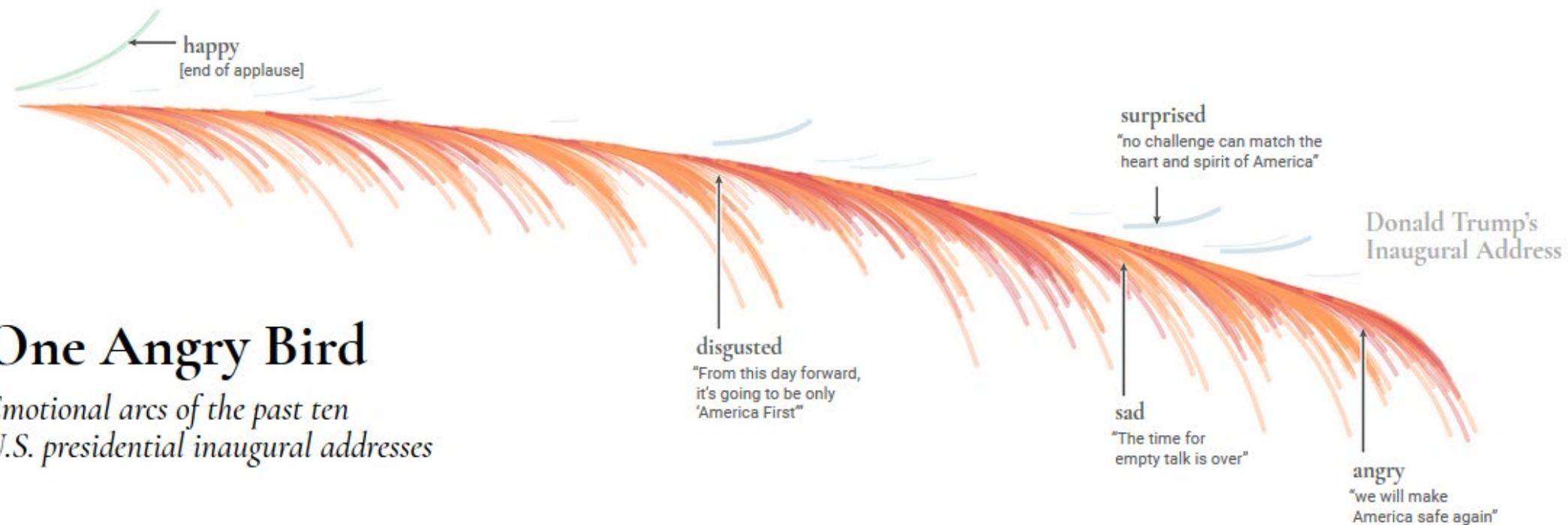
* Immigration status determined by place of birth and affiliation at time of win

Source: Nobel Prize Foundation

statista

Feeling Tone

- Emotive, figurative, seductive, big-picture, fun and dramatic
- Needs more in-depth analysis
- But that doesn't mean that you can have a glance!



One Angry Bird

*Emotional arcs of the past ten
U.S. presidential inaugural addresses*

Taylor Swift is mostly **happy**,
quite often **sad**, sometimes **mad**,
and occasionally **really scared**.*

*according to IBM Watson

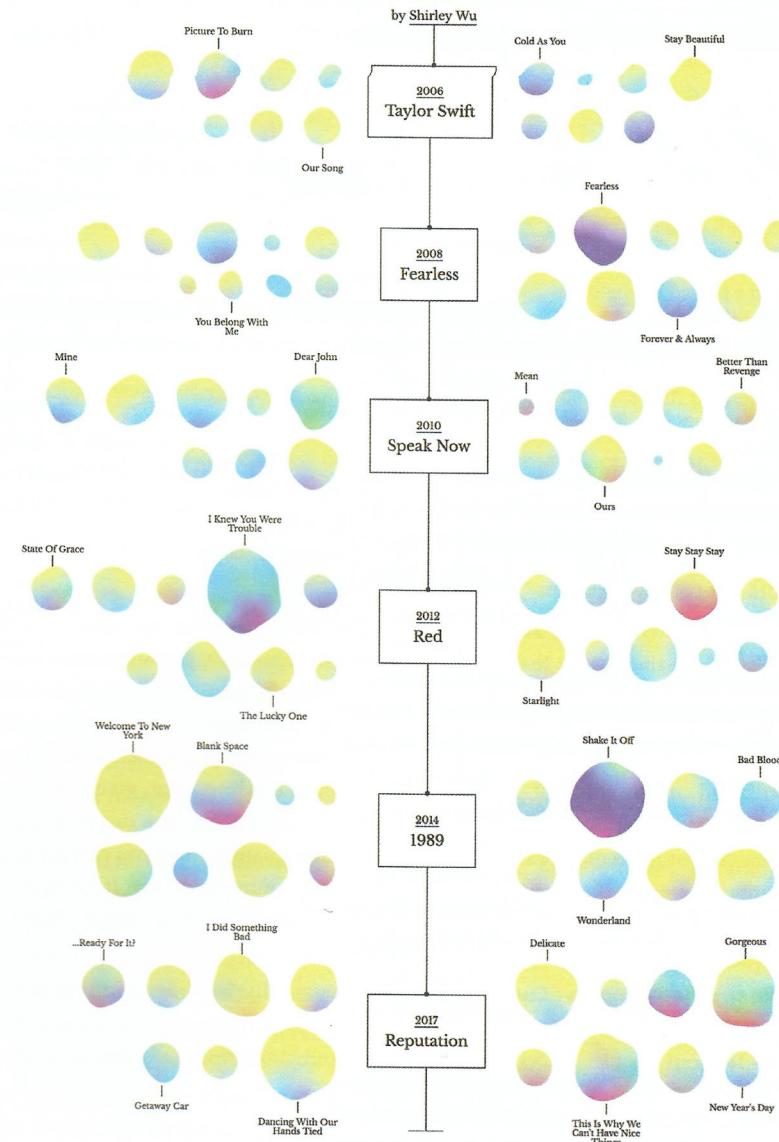


Figure 3.8 Taylor Swift is Mostly Happy, Quite Often Sad, Sometimes Mad, and Occasionally Really Scared, by Shirley Wu



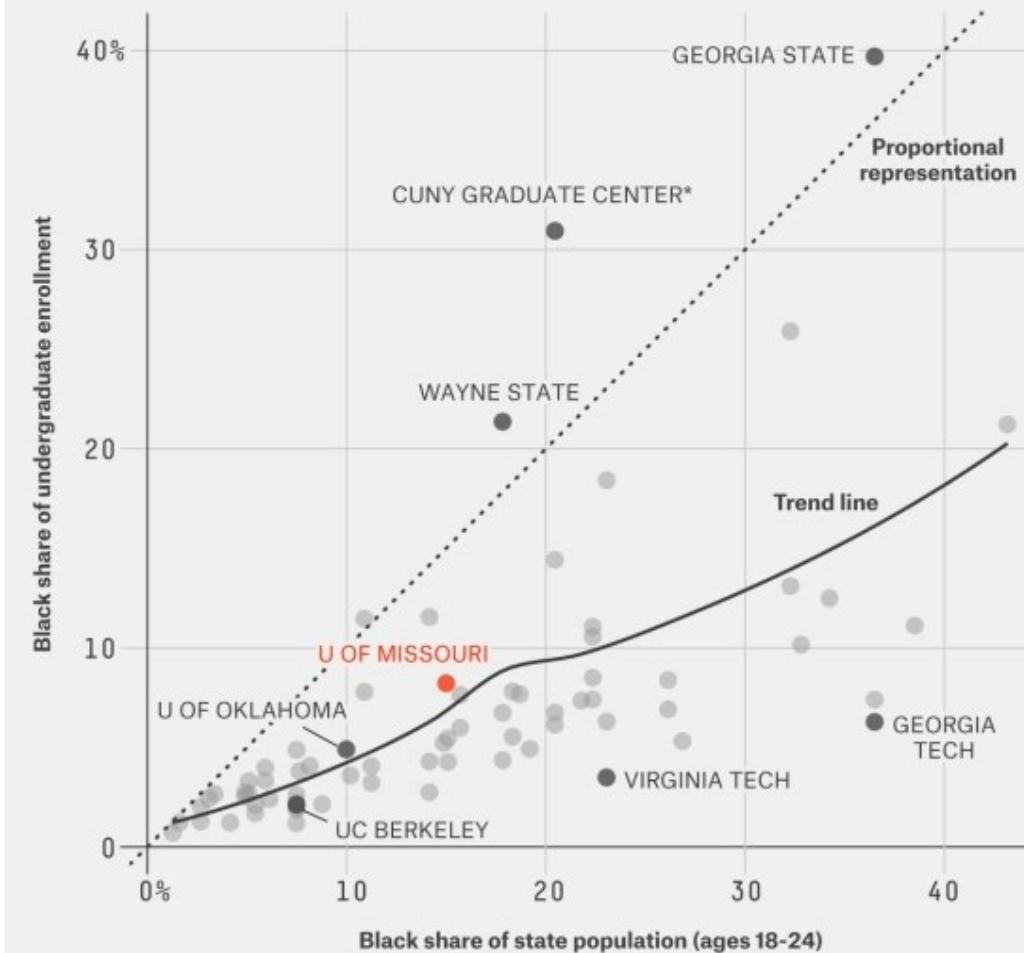
Experience

- Different methods of enabling interpretation
 - Explanatory
 - Exploratory
 - Exhibitory

Explanatory

Black Students Are Underrepresented On Campus

Black enrollment at public research universities vs. black college-age state population, 2013



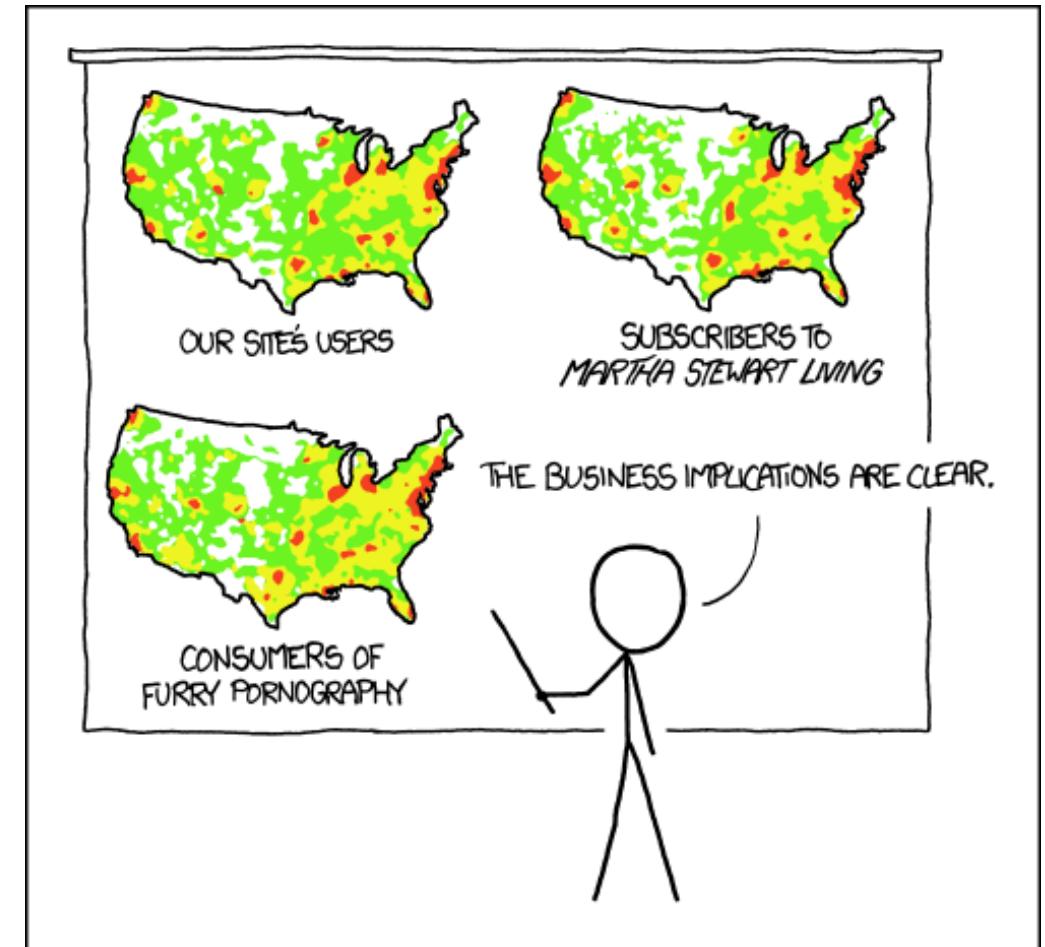
*The CUNY Graduate Center primarily grants doctorates but has a small undergraduate population.

 FIVETHIRTYEIGHT

SOURCE: U.S. DEPARTMENT OF EDUCATION

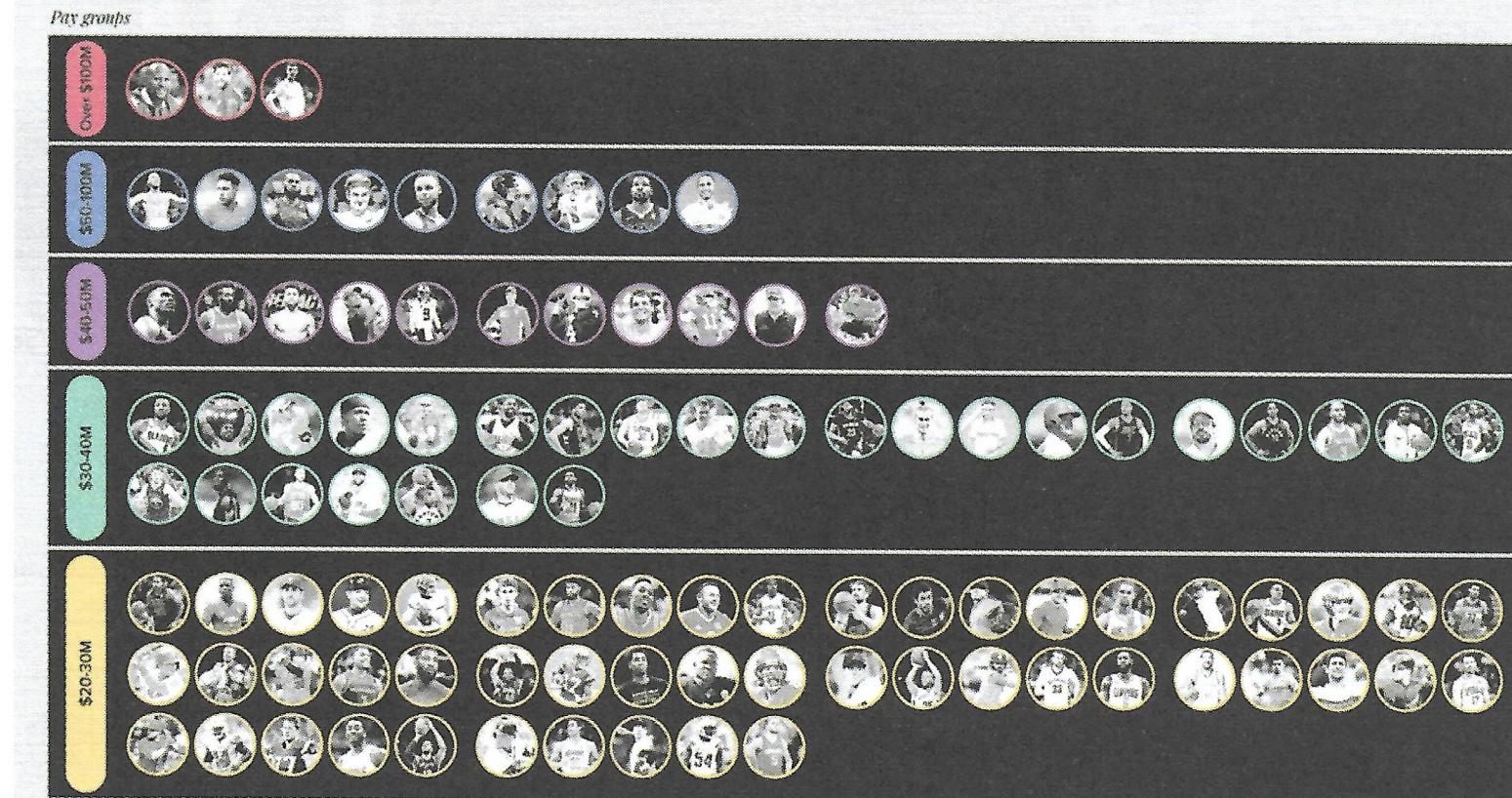
Exploratory

- Focused on helping the viewers discover and form their own interpretations
- Simple interpretation and manipulation of data
- An good example?
 - <https://luiscarli.com/2012/09/01/wood-changes/>



Exhibitory

Forbes: The World's 100 Highest-Paid Athletes

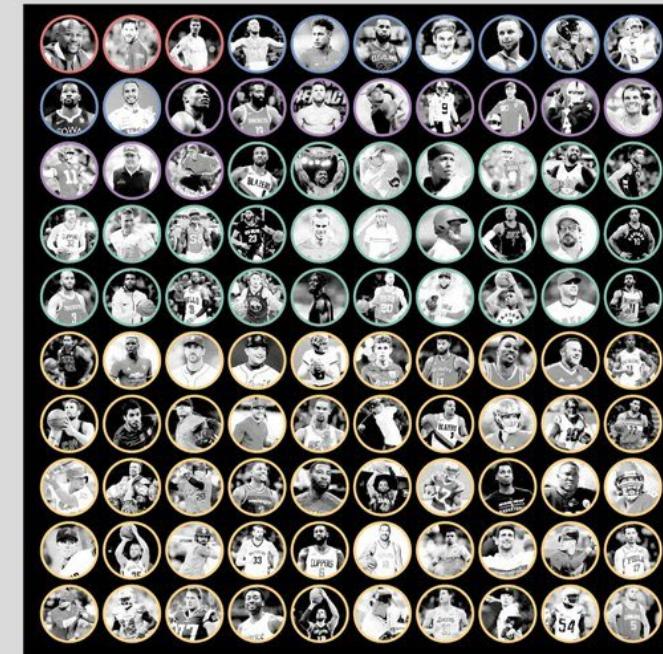


Data and images from <https://www.forbes.com/athletes/list/>

(even more) Exhibitory

Forbes: The World's 100 Highest-Paid Athletes

Male



Female



Pay groups Over \$100M \$50-100M \$40-50M \$30-40M \$20-30M

Data and images from <https://www.forbes.com/athletes/list/>

Another example:

<https://informationisbeautiful.net/visualizations/the-billion-dollar-o-gram-2009/>

Conclusions
