

# The Visualisation Design Process

CM4125 – Topic 3

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

# Announcements

- Questions from the previous lectures and labs
  - Did you plot on one (or more, or any!) tool?
  - Were you able to run wikidata/data scraping labs
- Events in the city
  - 7 October – Aberdeen Data Meetup – TBC
  - 8 October – Aberdeen Python User Group – TBC
  - 9 October – **AI Builders – Aberdeen Mini Sprint #1** [Book here](#)

# Data Vis Foundations

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# 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.)

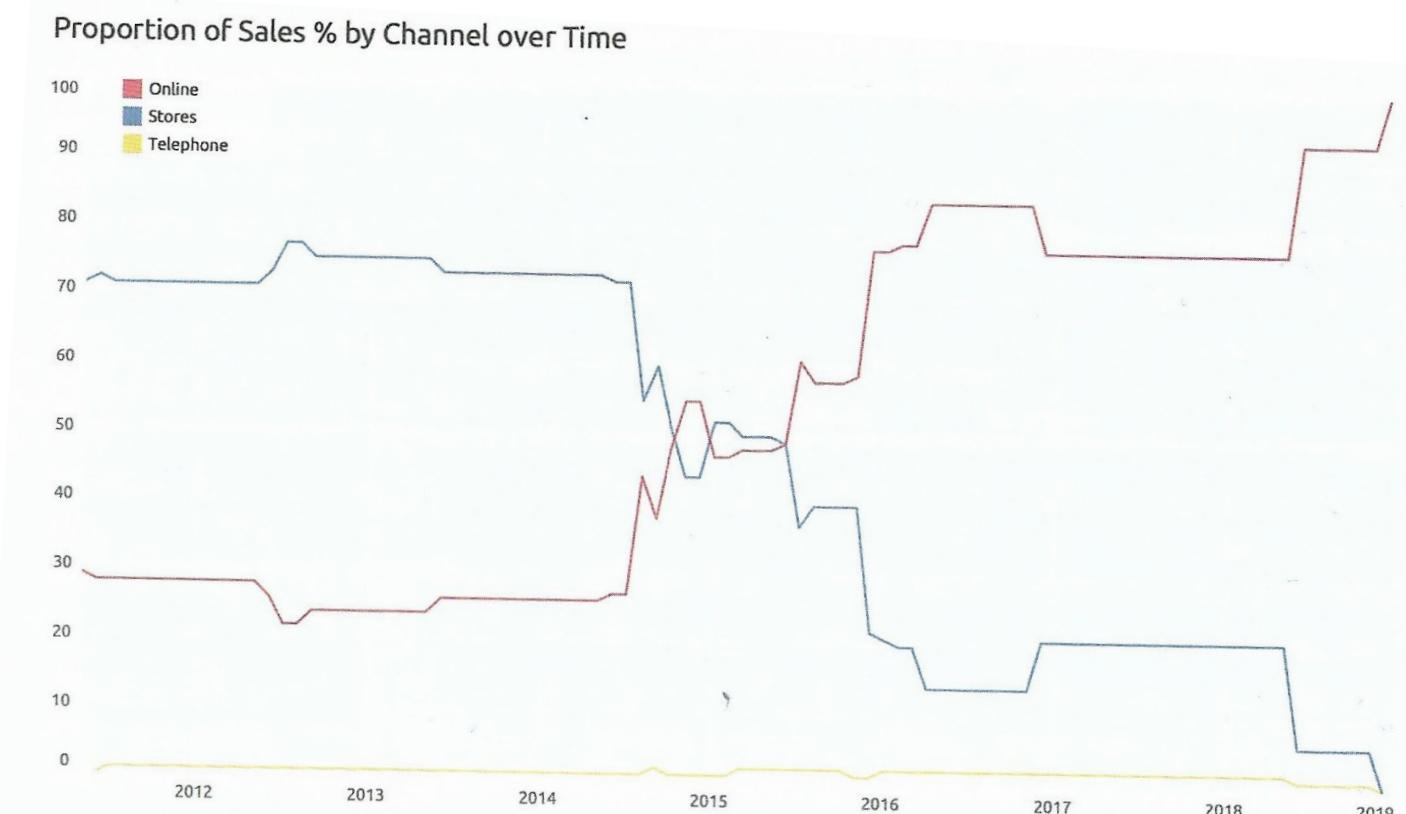
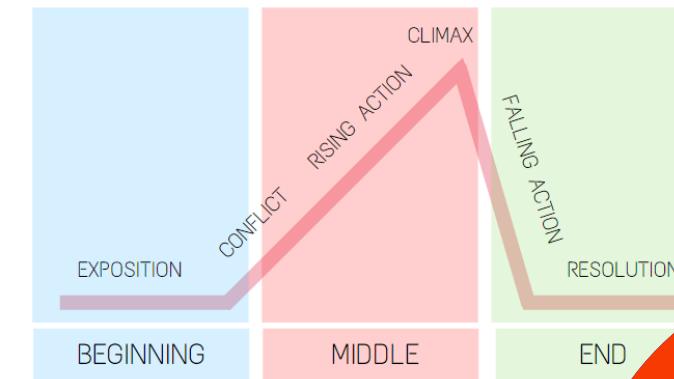
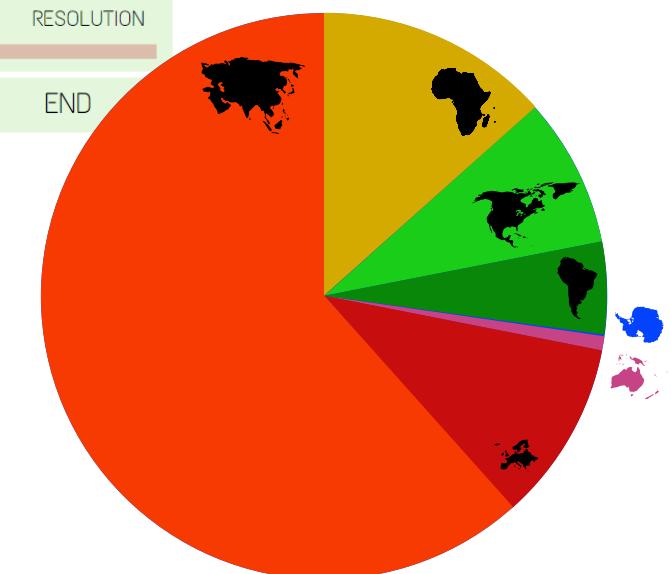


Figure 1.3 Proportion of Sales Percentage by Channel over Time

- 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

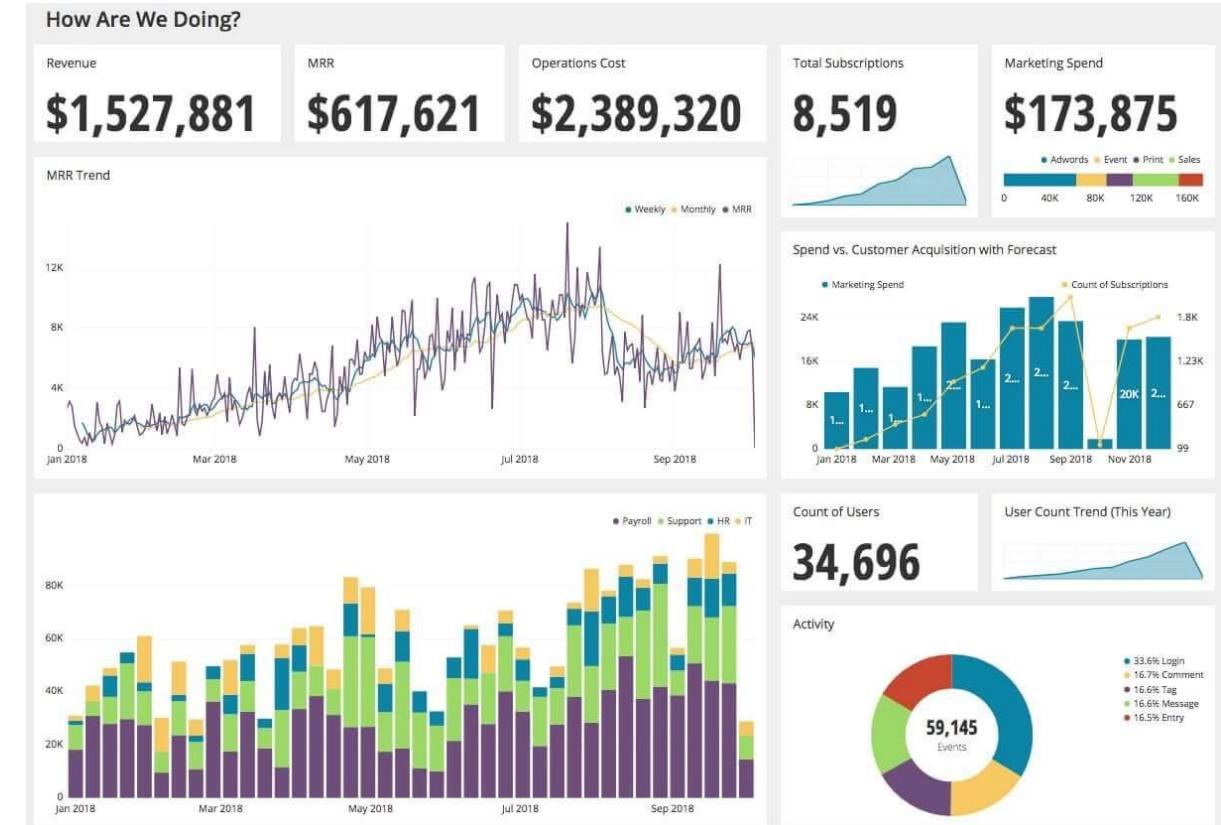
We don't have a bullet-proof answer for why we yawn. Instead, we only have a set of theories.

- 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?

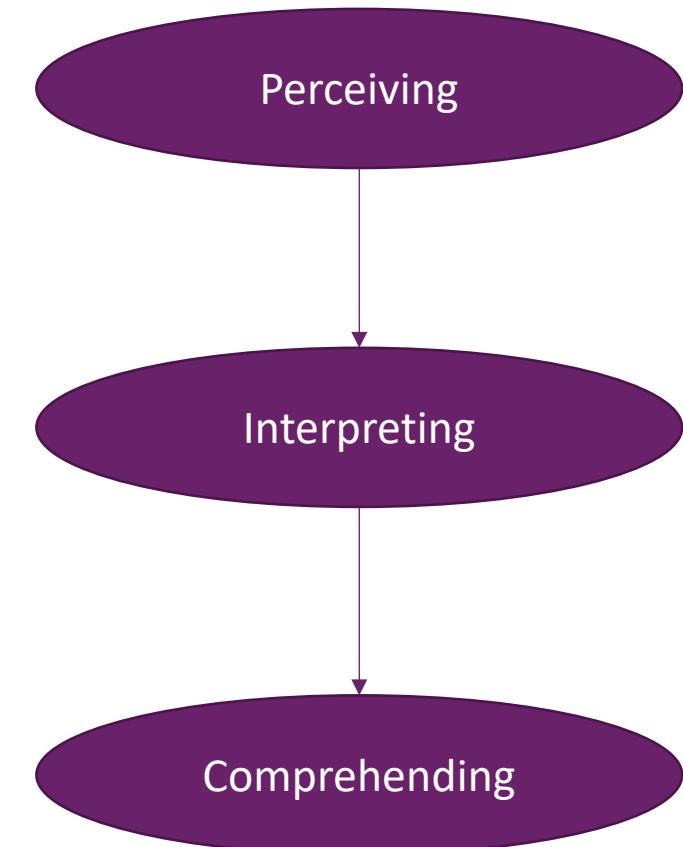
- We take a very deep breath
- Our muscles stretch and flex, along with our joints
- Our lungs expand, taking in a large amount of oxygen
- Our facial muscles stretch, forcing more blood to flow to those areas (including the brain)

- 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.)



# 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 management.
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)

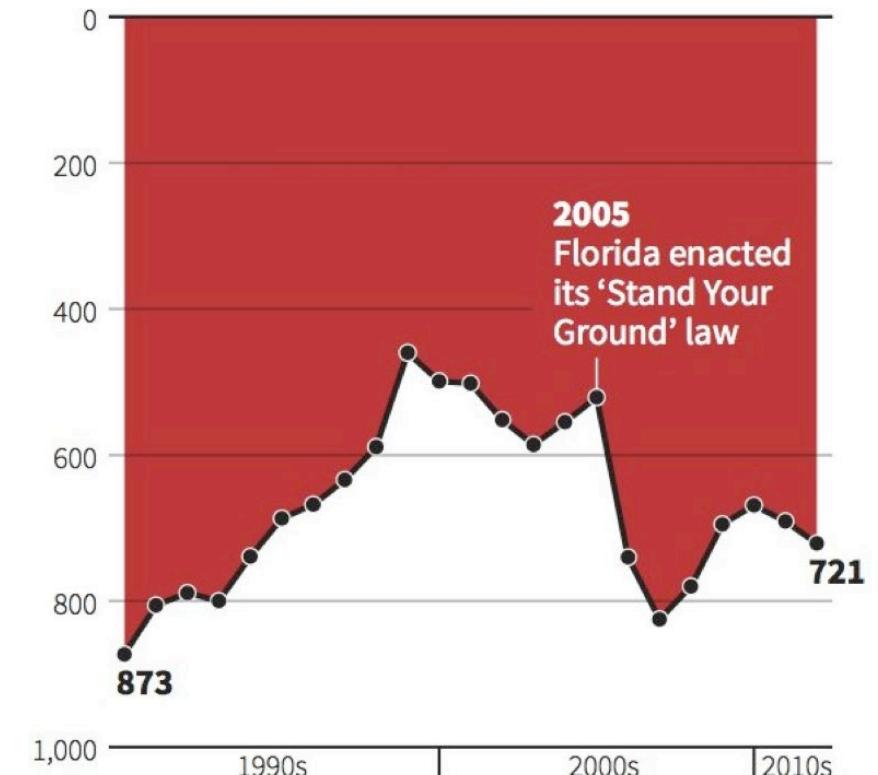
- innovative
- useful
- aesthetic
- understandable
- unobtrusive
- honest
- long-lasting
- thorough to the last detail
- environmentally friendly
- AS LITTLE DESIGN AS POSSIBLE!

# 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

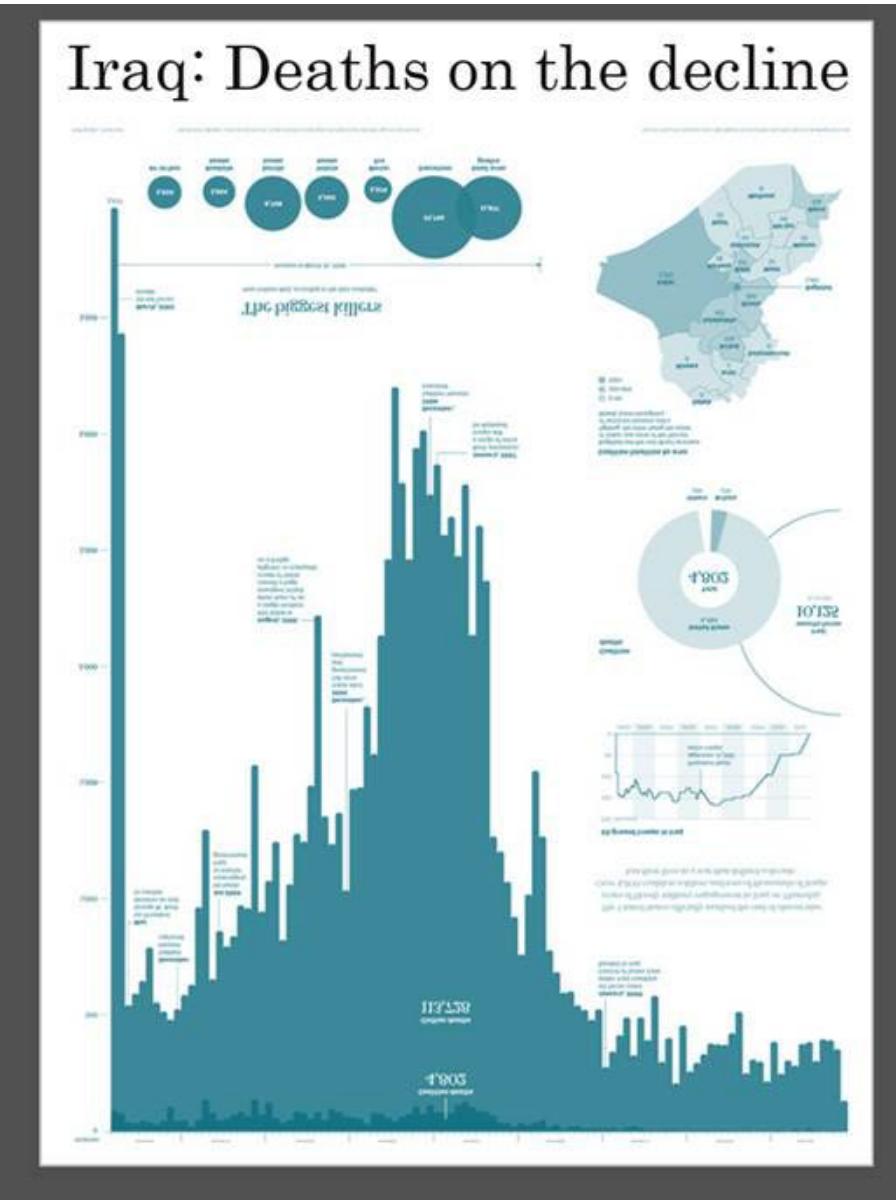
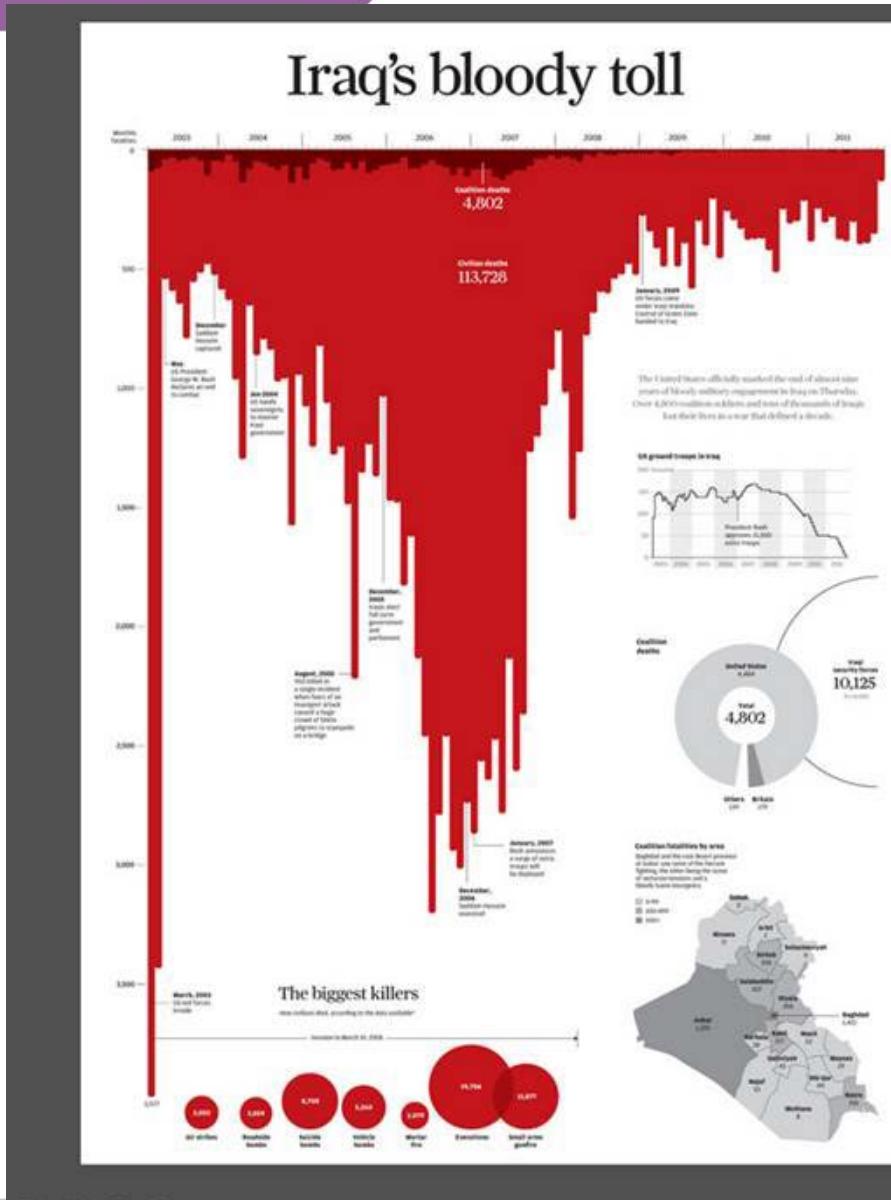
Number of murders committed using firearms



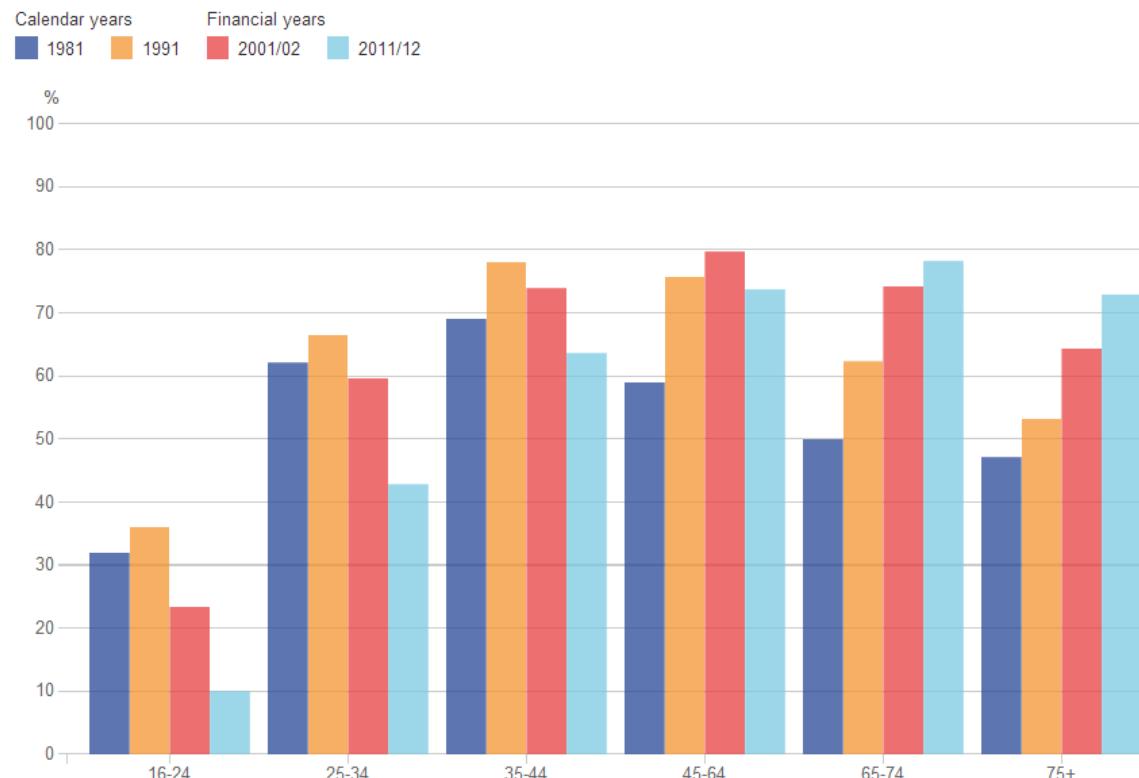
Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

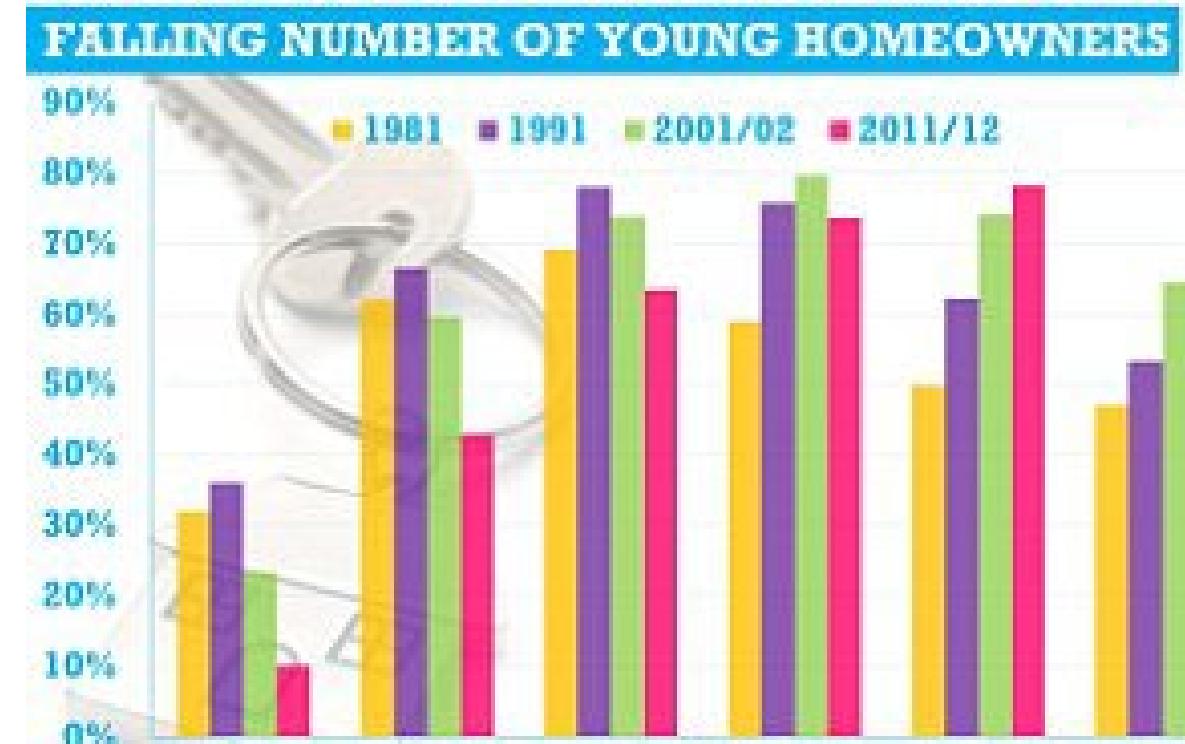
REUTERS



Percentage of each age group that are home owners<sup>5</sup>, England, 1981 to 2012



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



## 2. Accessible

- Understanding the subject
  - Simple ≠ Easy (Clear)
  - Complicated ≠ Complex
- 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 can handle a COMPLICATED subject!



What is shokunin?

Shokunin (職人) is a Japanese term that embodies the essence of a skilled artisan or craftsman, and it goes beyond a mere job description. Shokunin represents a cultural and philosophical concept deeply ingrained in Japanese society, reflecting a commitment to mastery, craftsmanship and a profound connection to one's work.

## 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)



About the Beamer class in presentation making  
A short story

A. B. Arthur<sup>1</sup> J. Doe<sup>2</sup>

<sup>1</sup>Faculty of Physics  
Very Famous University

<sup>2</sup>Faculty of Chemistry  
Very Famous University

Very Large Conference, April 2021

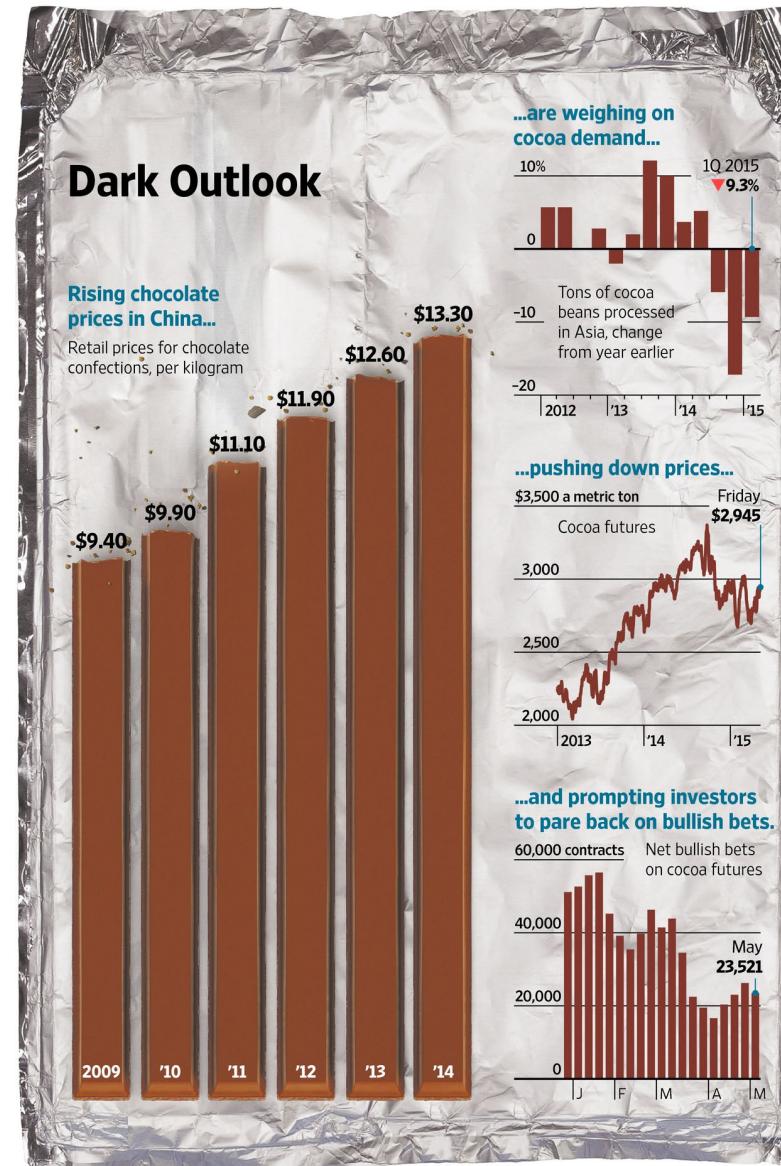


## 3. Elegant

- 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

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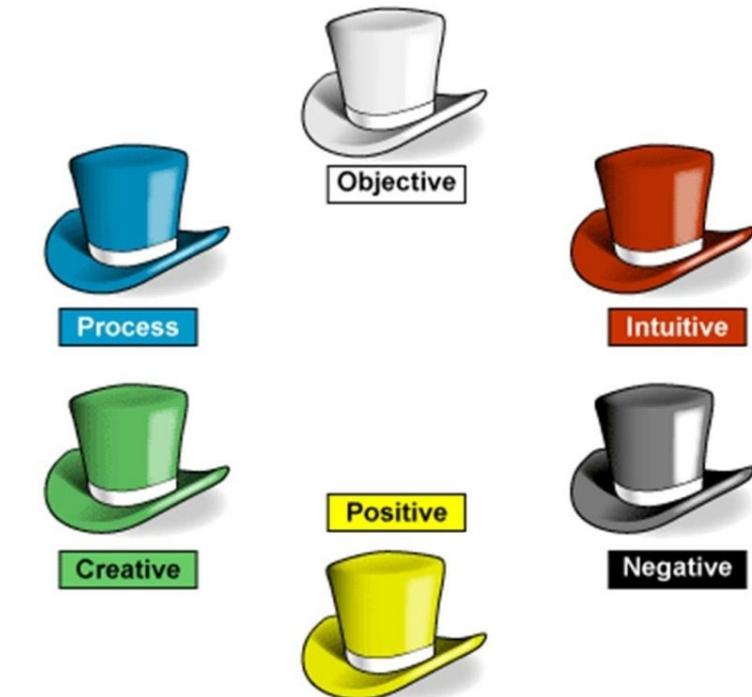
Step 1: Formulating your brief

# What is the motivation curiosity?

- Some original 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'

# Or eight!



# Constraints

- Timescales
- Pressures
- Design
- Technological

# Deliverables

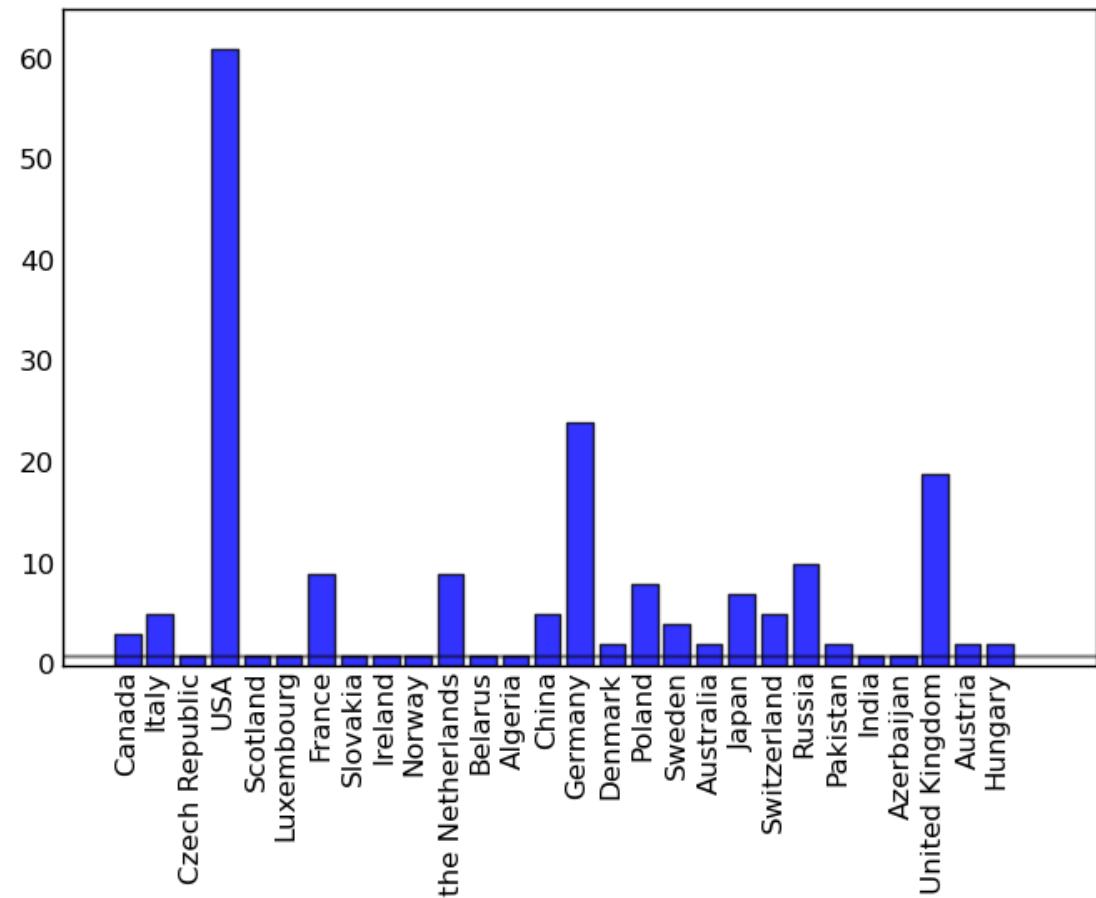
- Setting
- Medium
- Quantity
- Frequency

# Defining your project's vision

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

# Reading Tone

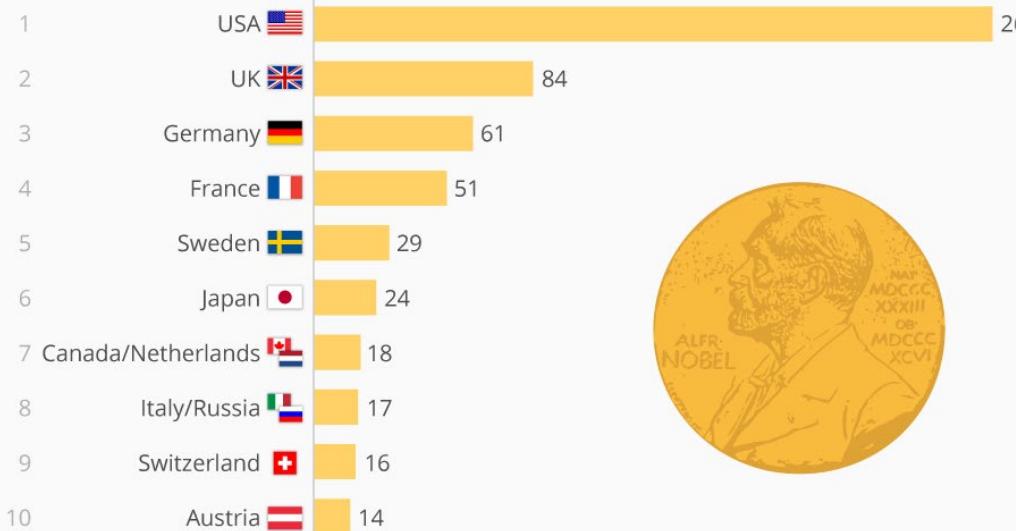
- Optimise the precision and efficiency to perceive the represented data
- Pragmatic, analytical, conservative, utilitarian, boring(?)
- Bar charts are the reading tone choice by excellence!



# 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

Attribution

Non-Commercial

Share Alike

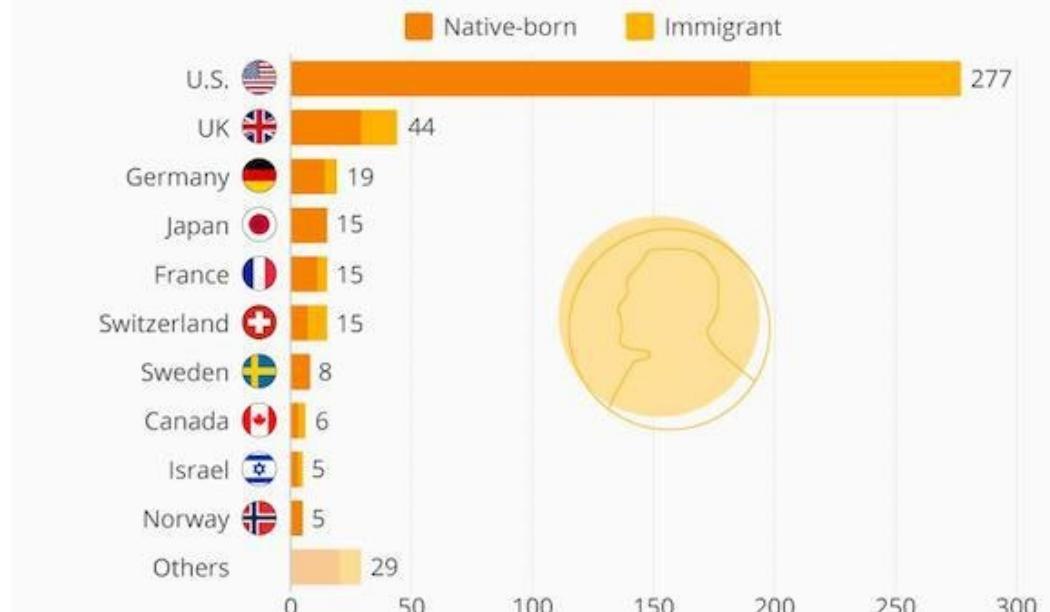
Statista

Source: Nobel Foundation

statista

## Immigrants' Share of Nobel Prizes in the Sciences

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



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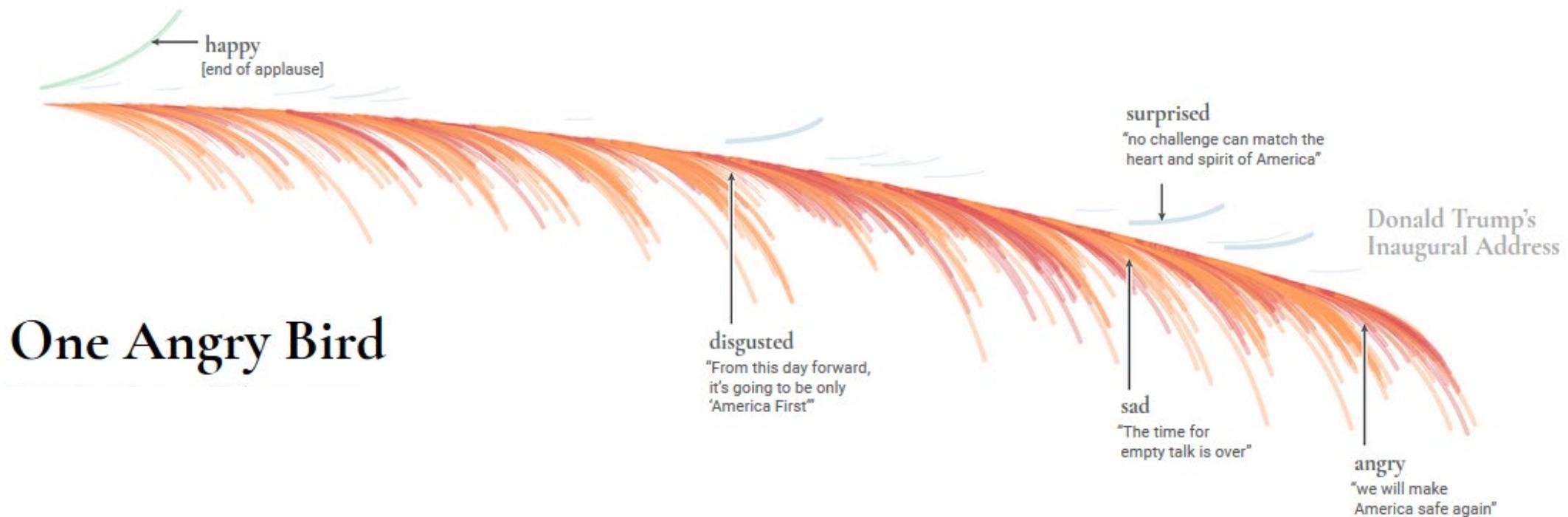
\* Immigration status determined by place of birth and affiliation at at time of win

Source: Nobel Prize Foundation

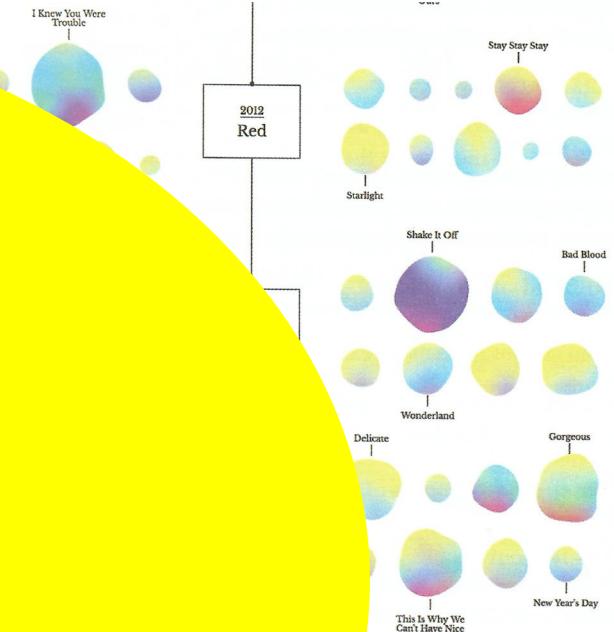
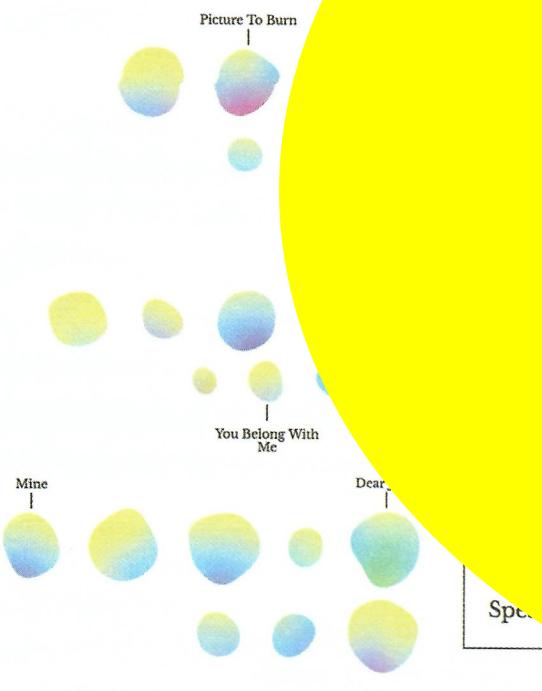
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# Feeling Tone

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



Taylor Swift is  
quite often  
and occa





Here are 120 million Monopoly pieces, roughly one for every household in the United States.

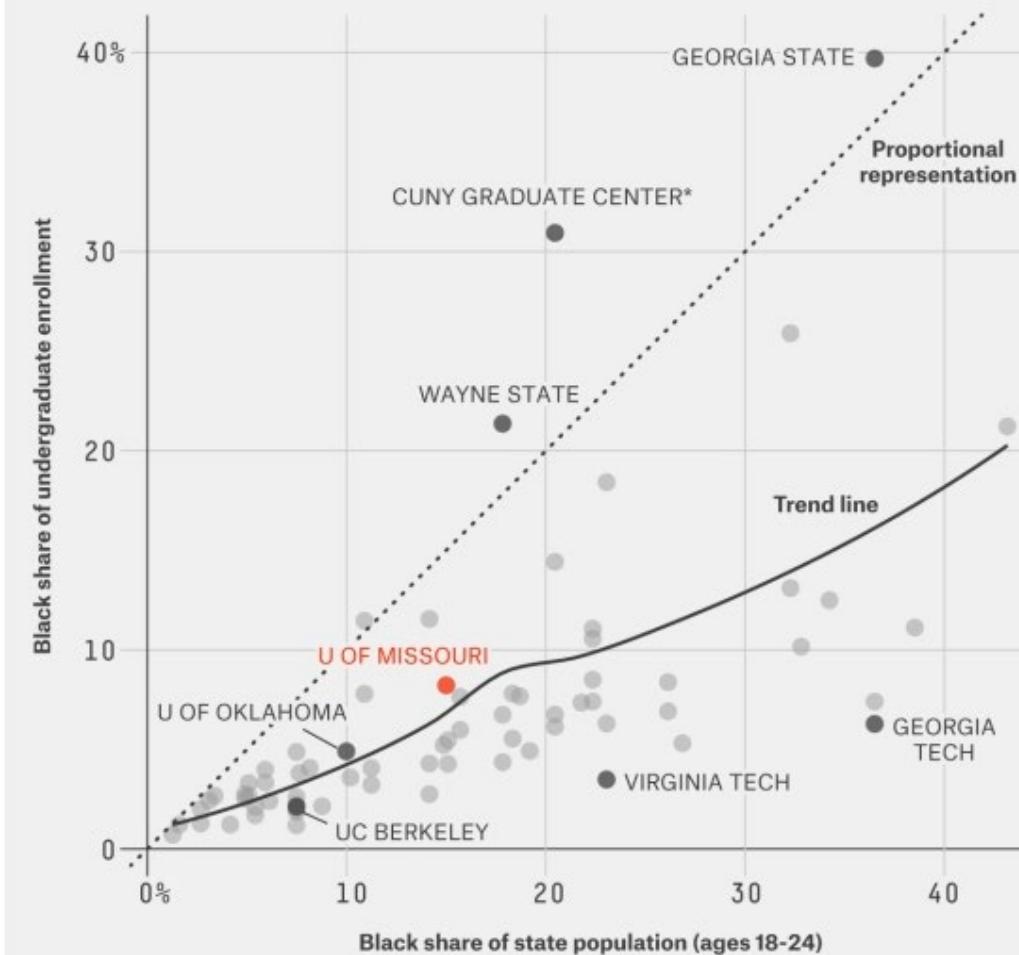
# Experience

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

# Explanatory

## Black Students Are Underrepresented On Campus

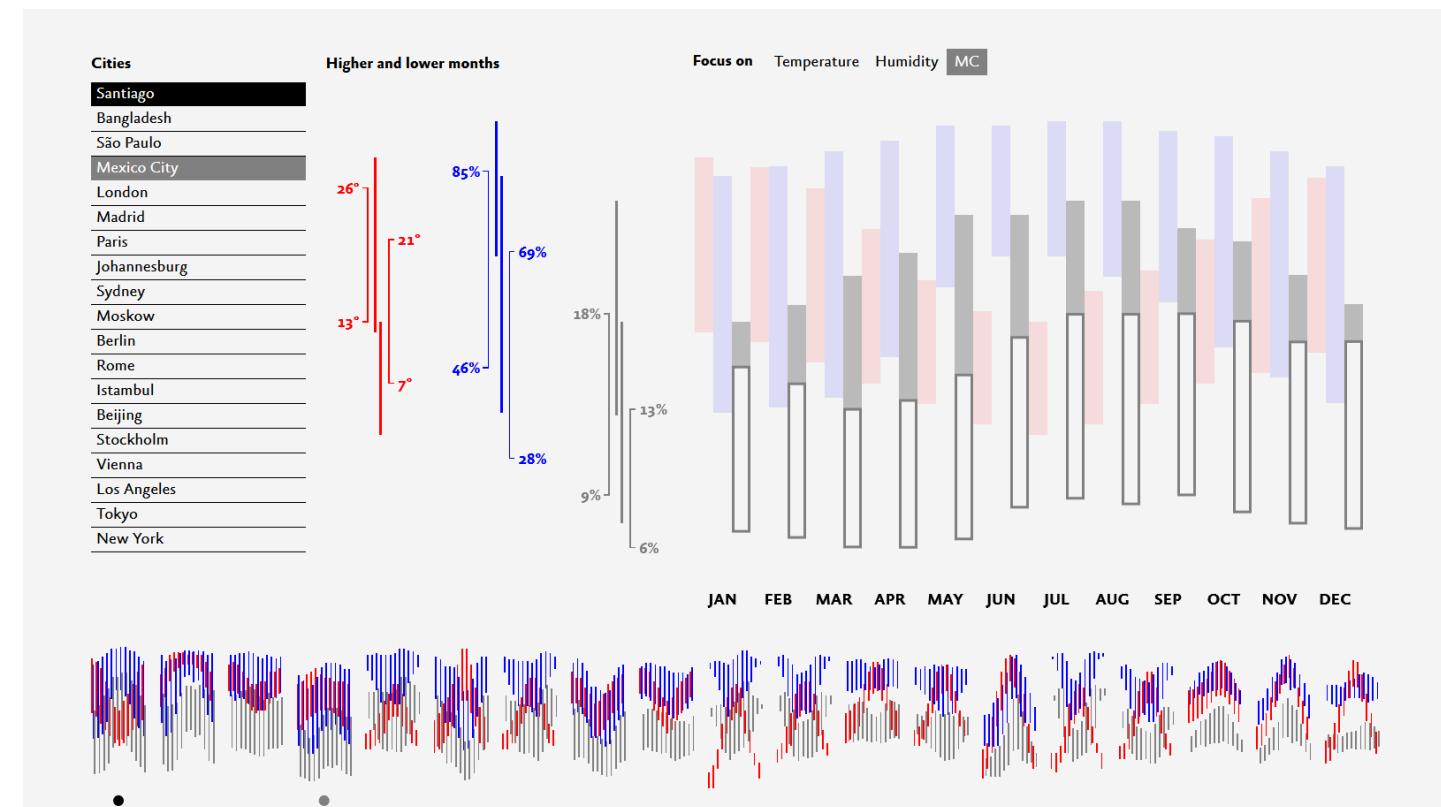
Black enrollment at public research universities vs. black college-age state population, 2013



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

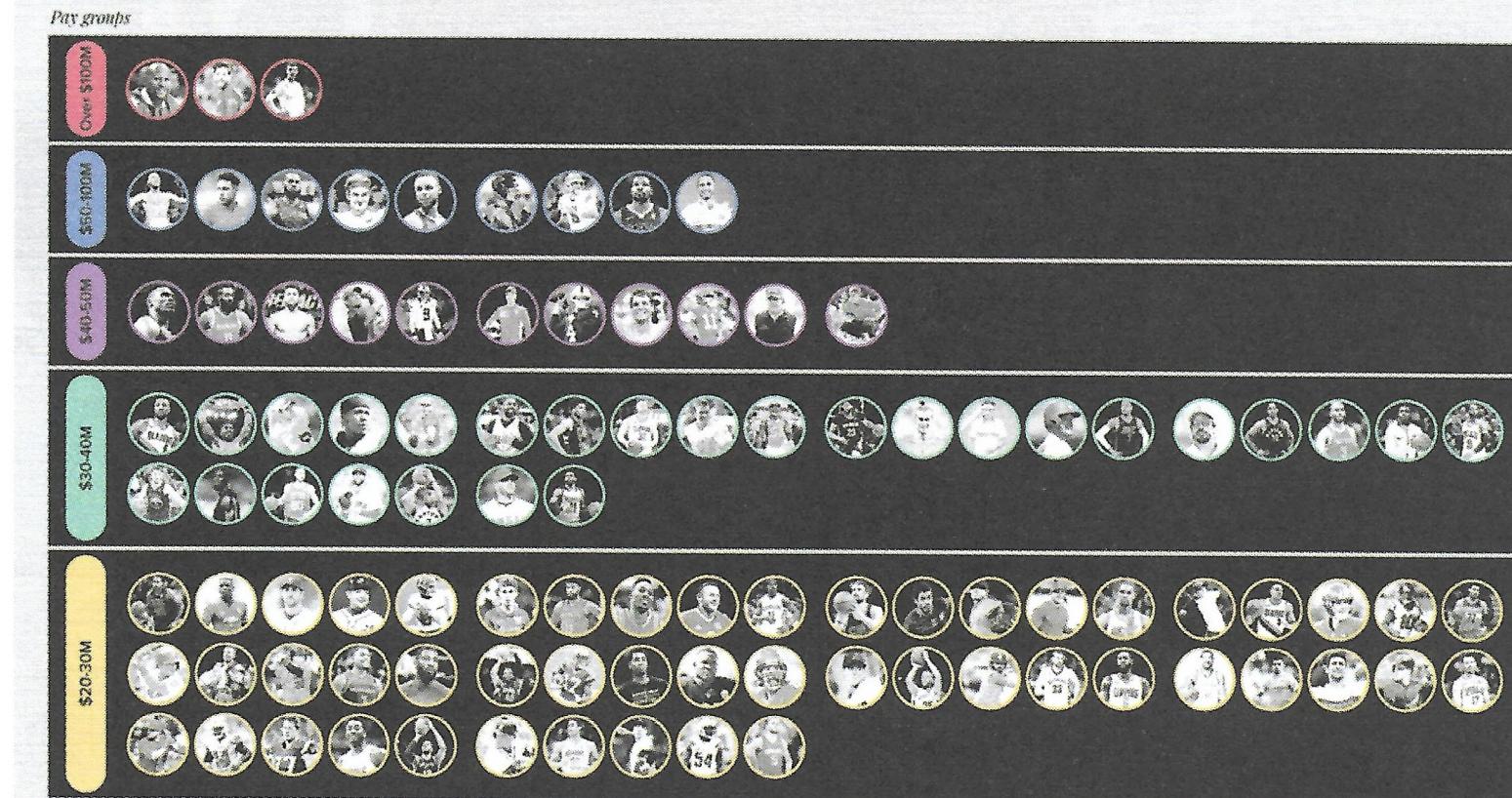
# Exploratory

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



# Exhibitory

## *Forbes: The World's 100 Highest-Paid Athletes*

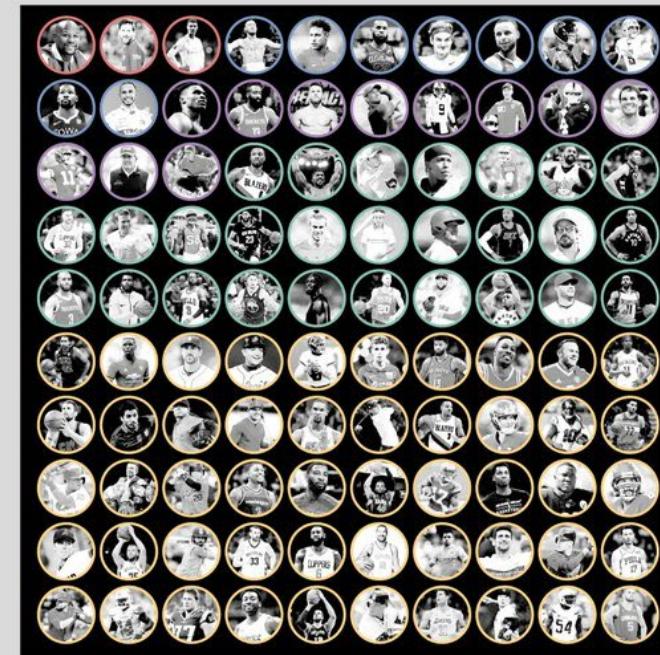


Data and images from <https://www.forbes.com/athletes/list/>

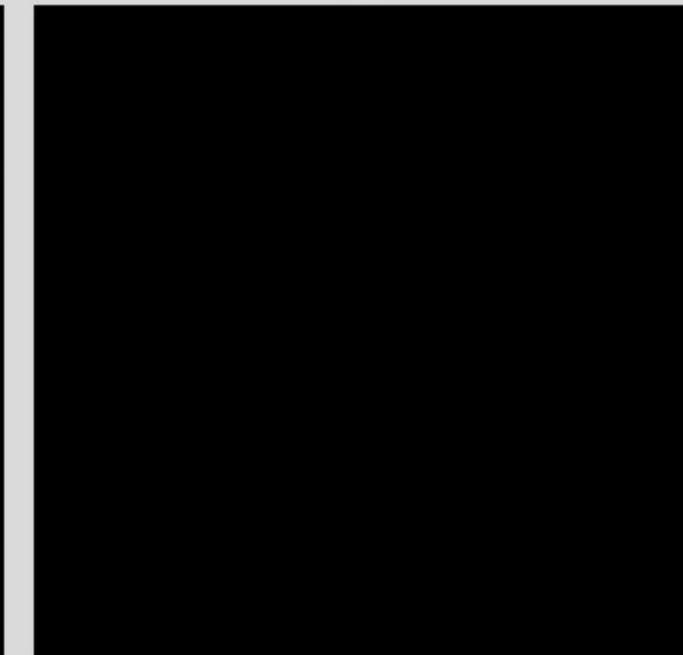
# (even more) Exhibitory

## *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

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