

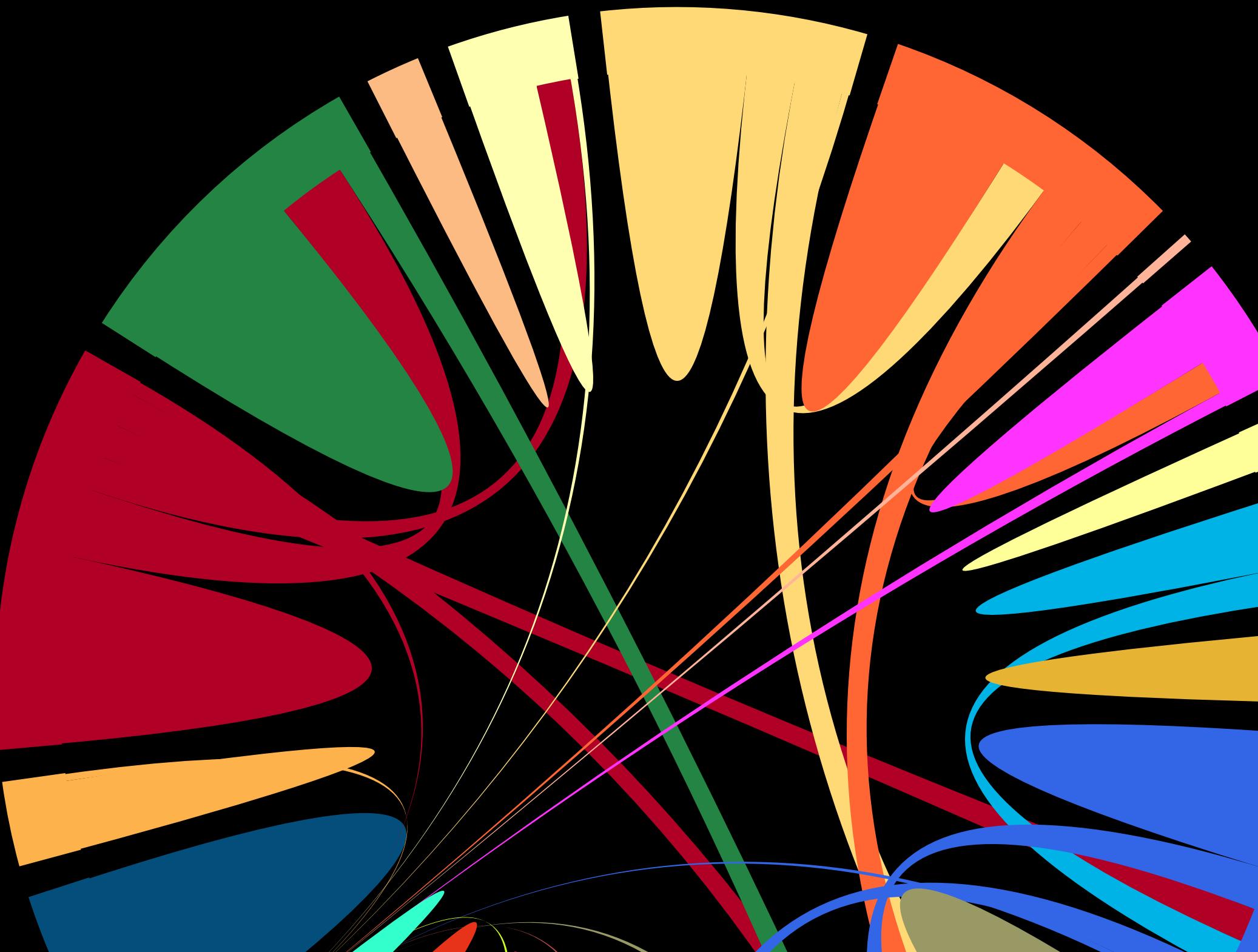
Information Visualization

INFO250

Chapter 1:

- Introduction to the course
- What is Information Visualization
- Real-world Examples

Luís Cruz - l.cruz@tudelft.nl



Course Description

- Introduces the **foundation** and the **state of the art** of information visualization. Explores and reflects on the **design**, **application**, and **evaluation** of a variety of common **data and graph types**. Exposure to some basic visualization tools.
- Credits: 3.0
- Repeat Status: Not repeatable for credit
- College/Department: College of Computing and Informatics
- Pre-requisite: None
- Downstream Dependency: INFO 350 Visual Analytics (INFO 250 as pre-requisite [min D])
- This course does not have a required textbook.
- Requirements: basic knowledge of Python.

Lecturers

- **Luís Cruz** - l.cruz@tudelft.nl – <https://luiscruz.github.io/>
- **Rui Zhou** - zr@lzu.edu.cn
- Email for course communications: course.infovis2020@gmail.com



Full Stack
developer

2011



2013

BSc+MSc
in Software Engineering



Visiting
Researcher

2015



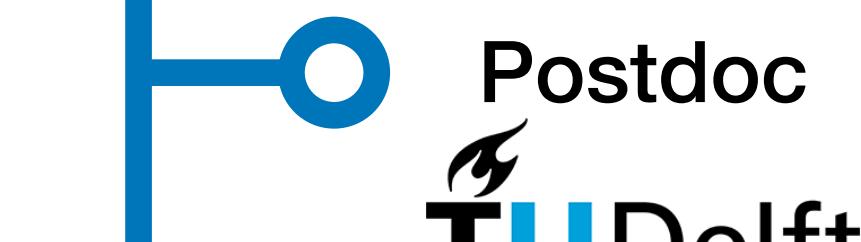
2018

Mobile Developer
+ ML Engineer



Assistant Prof.

2019



Ph.D. in Computer Sc.
Energy Efficiency of
Mobile Apps

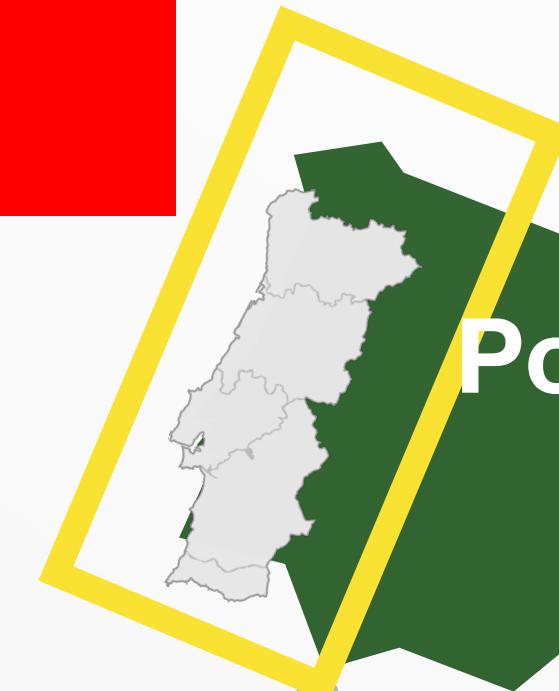


2020

Europe



Europe



Portugal



Netherlands

Delft University of Technology

- Established on 8 January 1842
- Largest technical university in the Netherlands
- More than 25.000 students

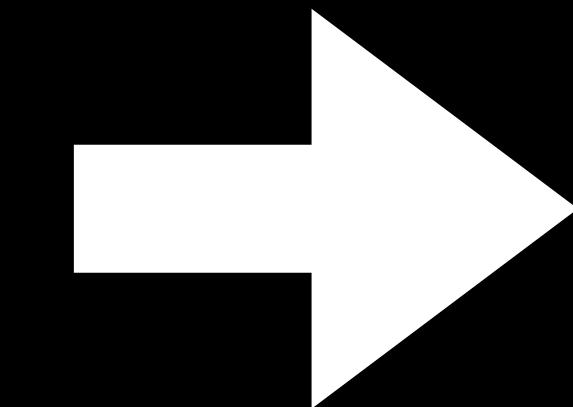


Course Outcome

Information Visualization

- Upon successful completion of this course, you will be able to:
 - **Explain fundamental principles** of information visualization
 - **Understand basic terms** related to information visualization
 - Design and implement visual representations from raw datasets of common data types
 - Evaluate the quality of information visualizations

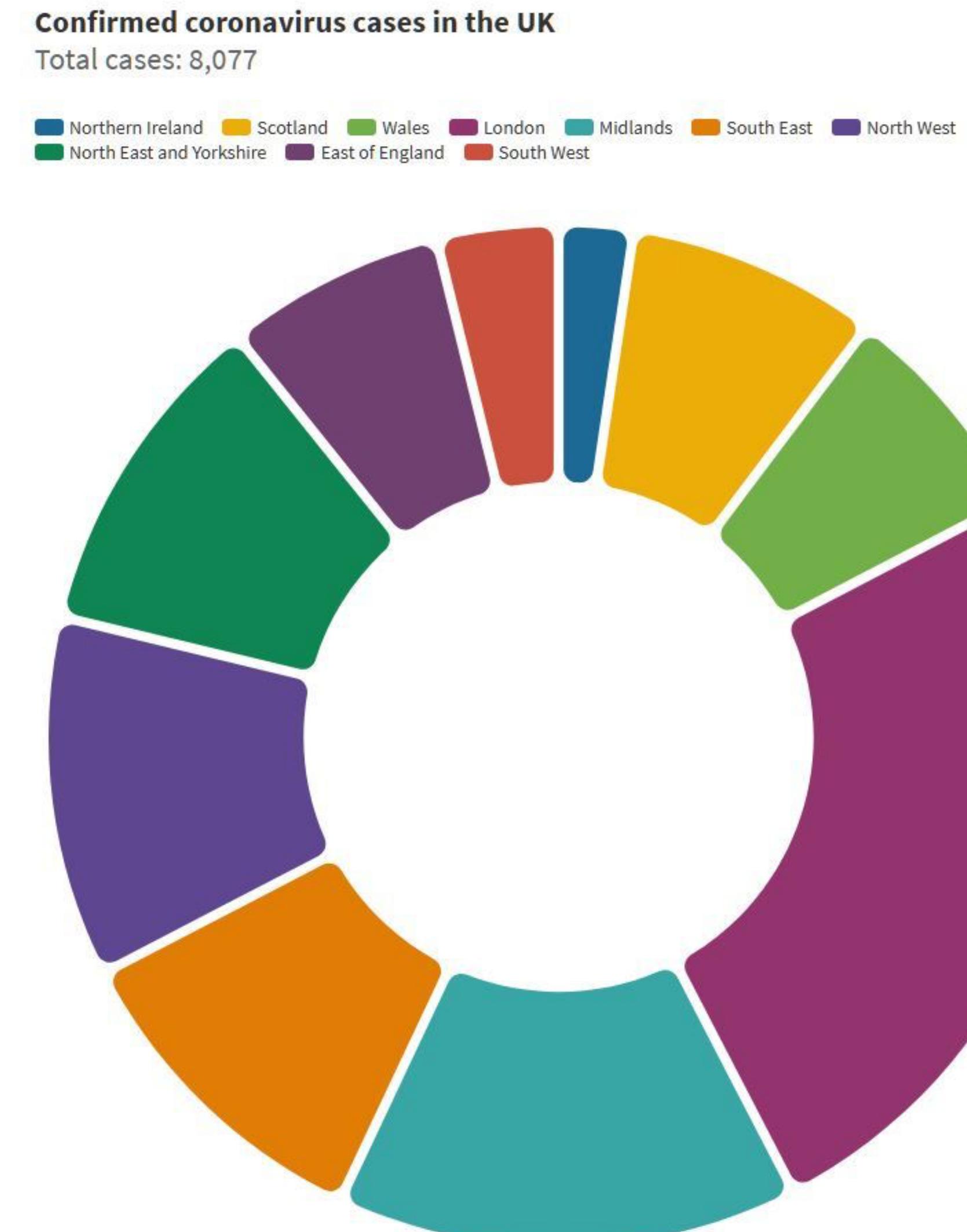
What does it take to be a visualization professional?



[PolIEv.com/luiscruz071](https://poliev.com/luiscruz071)

[View Results](#)

Examples of Visualizations



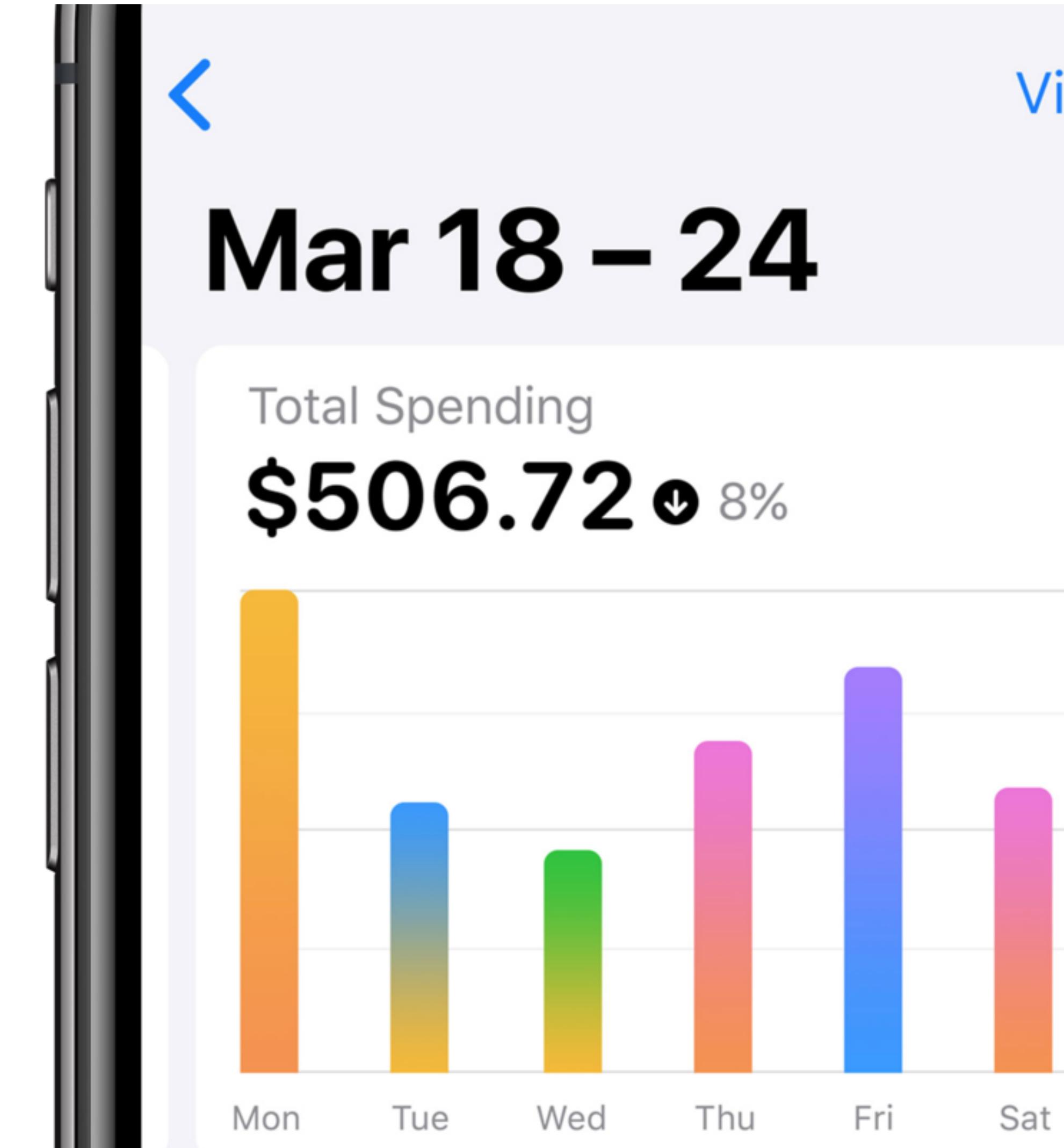
(by Yahoo)

Examples of Visualizations

Those same colors show up in your spend summaries. See lots of orange? That's Food and Drinks. Pink? That's Entertainment. Looks like a fun weekend.

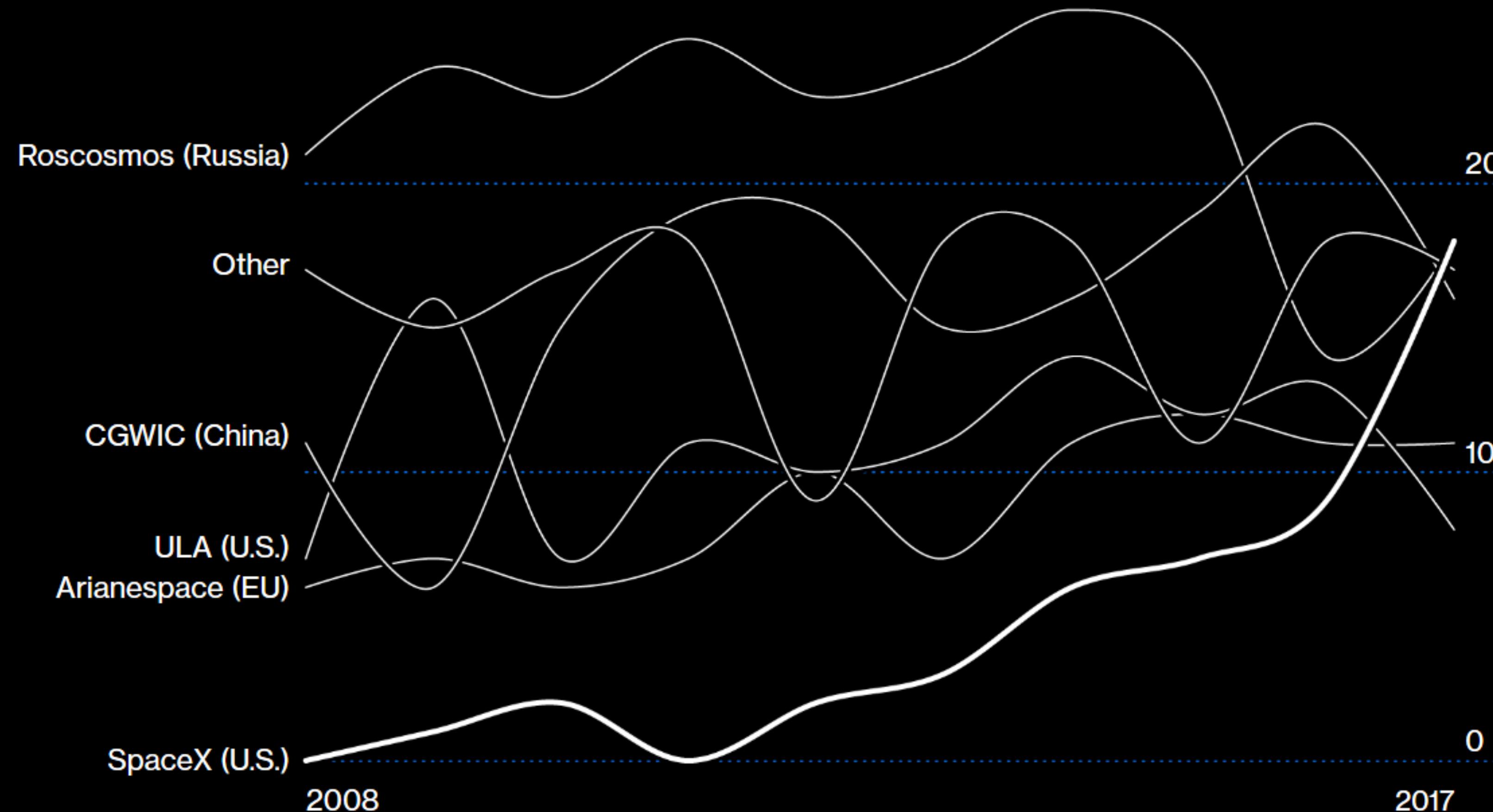
[Learn more](#)

Apple took it to another level: 🤢
Gradient bar charts



Examples of Visualizations

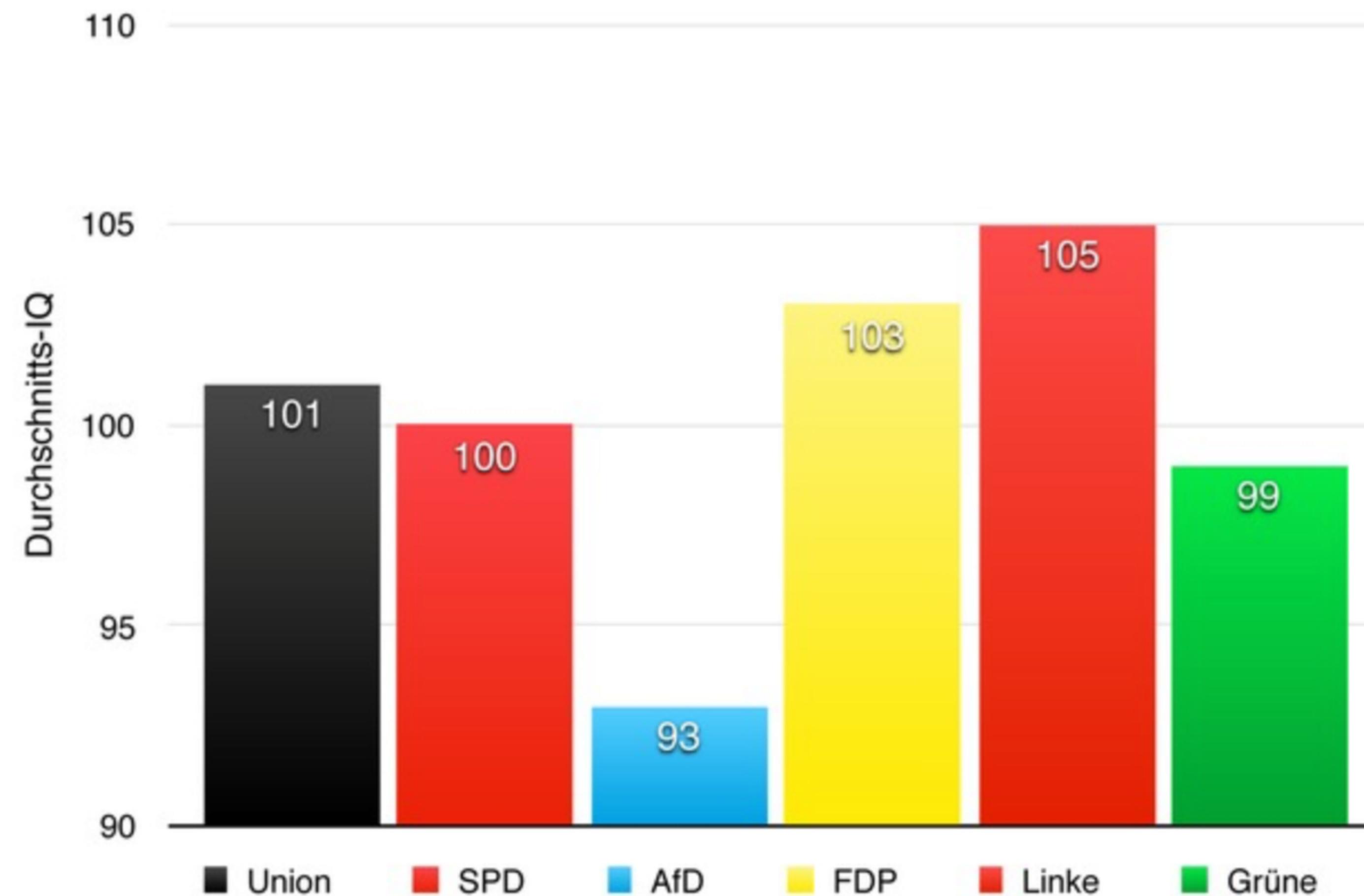
Number of Rocket Launches



Data: Northern Sky Research

Source: <https://www.bloomberg.com/news/features/2018-07-26/she-launches-spaceships-sells-rockets-and-deals-with-elon-musk>

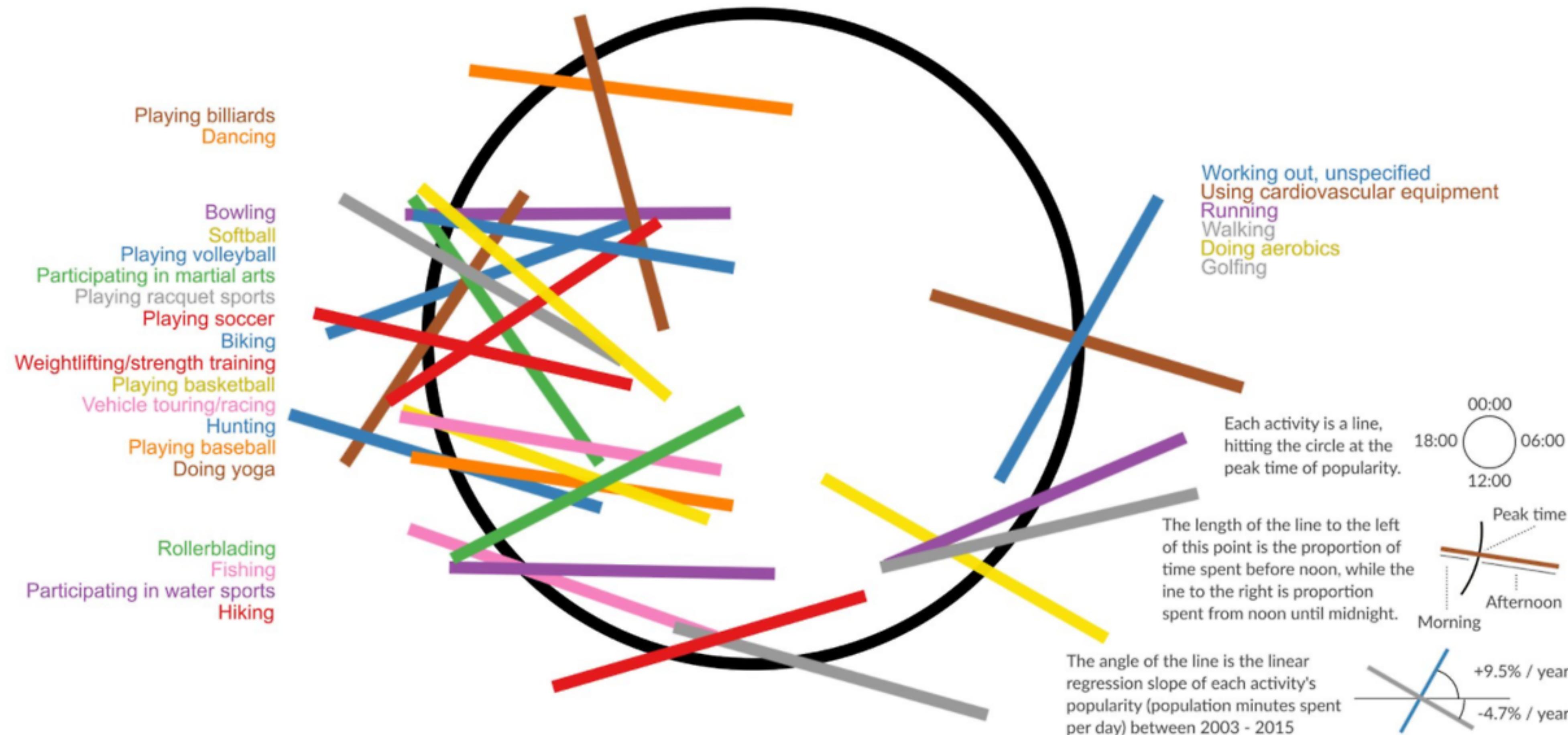
Examples of Visualizations



Examples of Visualizations

Peak time for sports and leisure

@hnrikndbrg | Source: American Time Use Survey



Course Work – Structure of the class

- Every class is a combination of lectures, discussions, and labs.
- Some weeks will be more focused on labs. But in general, the software used for the assignment will be discussed previously and throughout subsequent classes (where you will have the chance to practice and ask questions).
- In every session, I will show you some examples of visualizations, which you will talk about to practice your skills in observation and constructive criticism.
- Most sessions will have an assignment that you have to finish in the class.

Course Work – Structure of the class

(Typical class example)

Theoretical class

- Lecture (25min)
- Exercise (20 min)
- *Break*
- Lecture (20 min)
- Assignment (20 min)
- Wrap-up (5 min)

Lab class

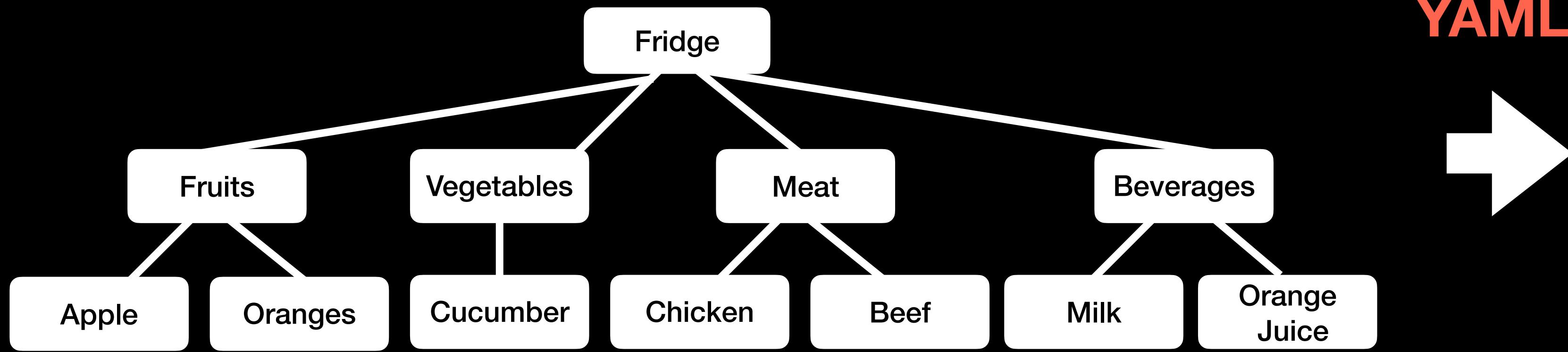
- Intro (5 min)
- Assignment (40 min)
- *Break*
- Assignment (40 min)
- Wrap-up 5 min

Course Work – Assignments

- All assignments will be discussed in the first class of the week and be due by the end of the Sunday.
- Individual Assignments: many sessions will have a short assignment (mandatory).
- Mid-term – Exam done in the 6th week (Nov 18)
- 2 projects – work with one other student
- Participation (20%)
 - Includes assignments and participation in the class.
 - You will get five free passes for the class. Beyond the five passes, for every class that you miss, you will lose 0.5 point in the final credit.
 - If you cannot come for other reasons, please notify me at least 24 hours before the class.

YAML submissions

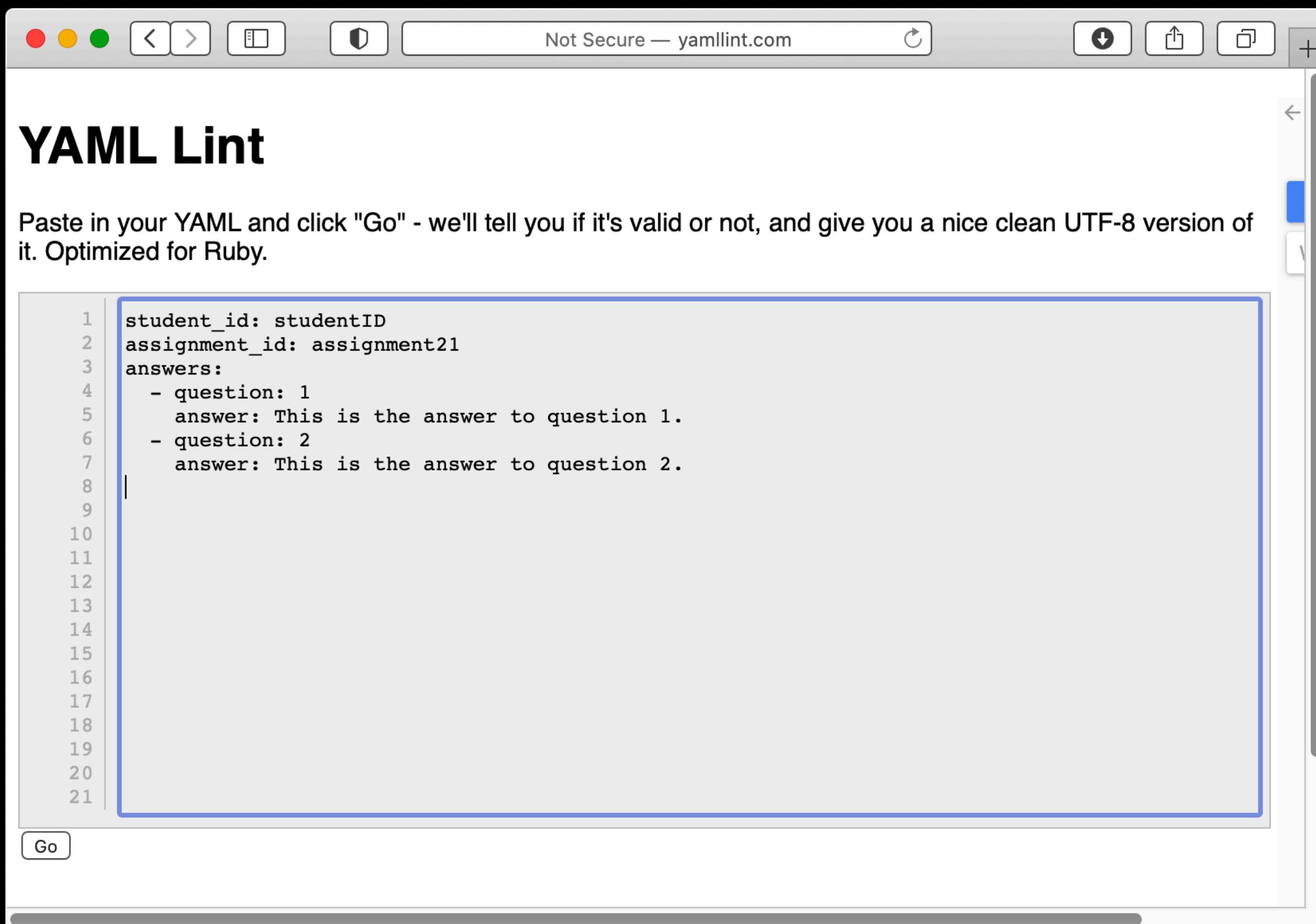
- YAML is a serialization language
- Allows organizing structured data in a **human-readable format**.
- Most submissions will be done using this format.



```
Fridge:  
  Fruits:  
    - Apple  
    - Orange  
  Vegetables:  
    - Cucumber  
  Meat:  
    - Chicken  
    - Beef  
  Beverages:  
    - Milk  
    - Orange Juice
```

YAML linter

<http://www.yamllint.com>



Tools to Write YAML

- **Any text or code editor.**

Examples:

- Notepad
- Notepad++
- Visual Studio Code
- Atom
- Sublime
- ...



Technologies

- Python
- Jupiter Notebook
- Matplotlib

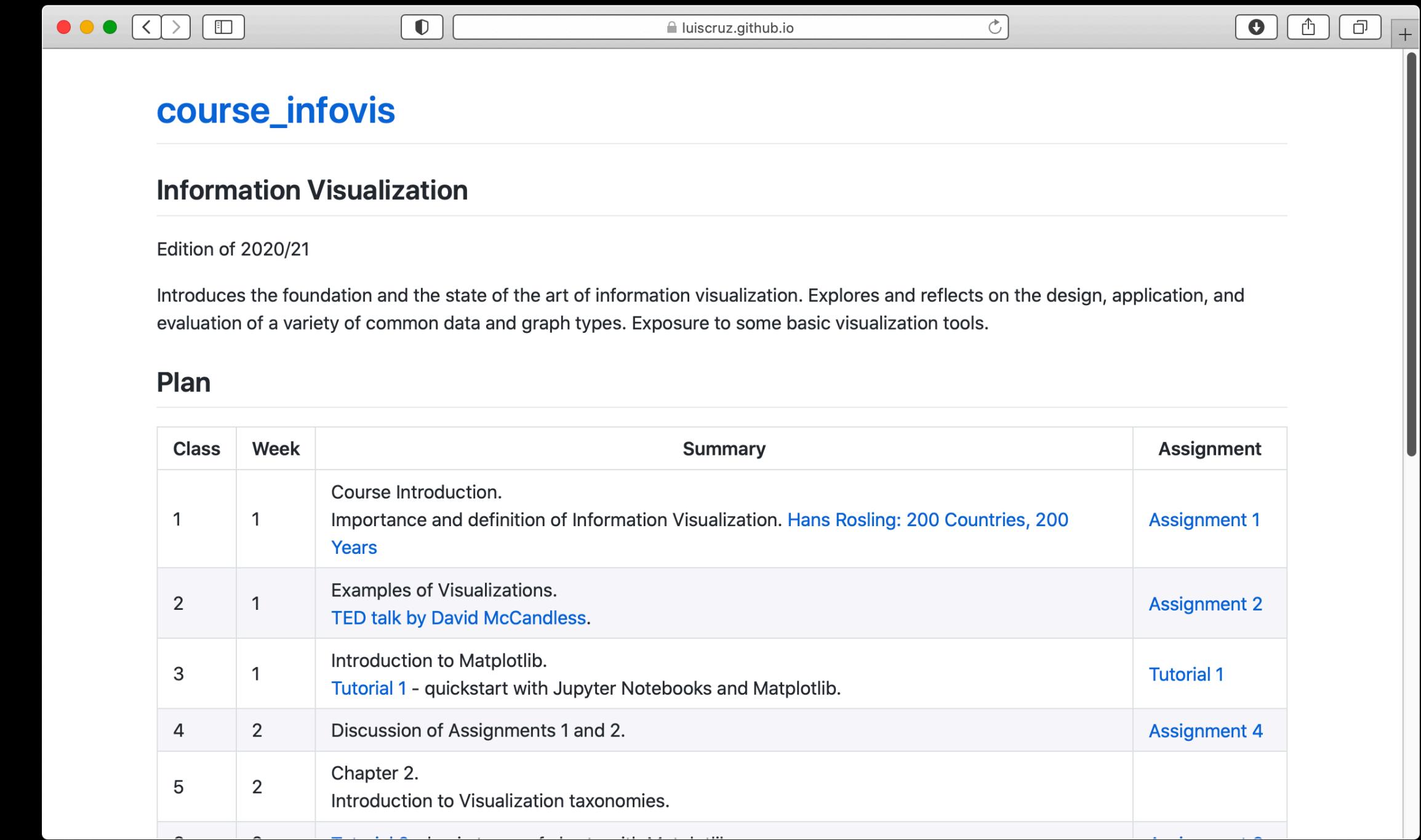


Course Materials

- This course will have no required textbook.
- All slides will be shared in the website of the course after the class.
- Online classes are recorded. All videos will be shared in the website.
- **Website:** https://luiscruz.github.io/course_infovis/

Website

- https://luiscruz.github.io/course_infovis/
- Summaries, assignments, slides, etc.



The screenshot shows a web browser window with the URL luiscruz.github.io in the address bar. The page title is "course_infovis". Below the title, there is a section titled "Information Visualization" with the subtitle "Edition of 2020/21". A descriptive text states: "Introduces the foundation and the state of the art of information visualization. Explores and reflects on the design, application, and evaluation of a variety of common data and graph types. Exposure to some basic visualization tools." Below this is a section titled "Plan" which contains a table with five rows, each representing a class and its summary and assignment details.

Class	Week	Summary	Assignment
1	1	Course Introduction. Importance and definition of Information Visualization. Hans Rosling: 200 Countries, 200 Years	Assignment 1
2	1	Examples of Visualizations. TED talk by David McCandless .	Assignment 2
3	1	Introduction to Matplotlib. Tutorial 1 - quickstart with Jupyter Notebooks and Matplotlib.	Tutorial 1
4	2	Discussion of Assignments 1 and 2.	Assignment 4
5	2	Chapter 2. Introduction to Visualization taxonomies.	

Communication

- Via WeChat.
 - Prof. Rui created a group for this course.
- Exceptionally, communications may be made via **email**:

course.infovis2020@gmail.com

Always add **[InformationVisualization]** as a prefix in the **subject** of the email.

Evaluation

Participation

20%

Project 1

15%

Midterm Exam

30%

Project 2

35%

Course Policies

- Late project submission policy
 - All submissions will be done via email. Late submissions will be graded as soon as possible, although delays should be expected. If you have reasons that are beyond your control, you may request for being excused for the late penalty by emailing your request to the instructor for consideration prior to the deadline.
 - Penalties for late submissions:
 - Reduction of 20% per day after the deadline
- Incomplete policy
 - Incomplete grades are contingent upon instructor approval and will only be considered in extenuating circumstances beyond a student's control. The instructor is under no obligation to offer an incomplete grade. At least 70% of the graded coursework must have already been completed in order for an incomplete grade to be considered (per the recommendation of the Provost's Office). An incomplete contract with due date for delivery of the completed work should be completed by the student and the instructor. It can be found here: <https://drexel.edu/~media/Files/provost/policies/pdf/incomplete.ashx?la=en>.

Academic integrity, plagiarism and cheating policy

The official version of policies related to academic dishonesty can be found in the link below. It is your responsibility to read the policy carefully.

http://www.drexel.edu/provost/policies/academic_dishonesty.asp

<http://www.drexel.edu/studentlife/judicial/honesty.html>

Once it can be established that an academic dishonest act has been conducted in connection to any of the coursework in this class, **a two-letter grade reduction** will be applied to the overall course grade as a penalty. The identified incidence will be reported to the University. As the ultimate penalty, the University may withdraw a degree as a result of academic dishonesty.

Students with disability statement

<http://www.drexel.edu/oed/disabilityResources/students/>

Course drop policy

http://www.drexel.edu/provost/policies/course_drop.asp

http://www.drexel.edu/provost/policies/course_withdrawal_policy.asp

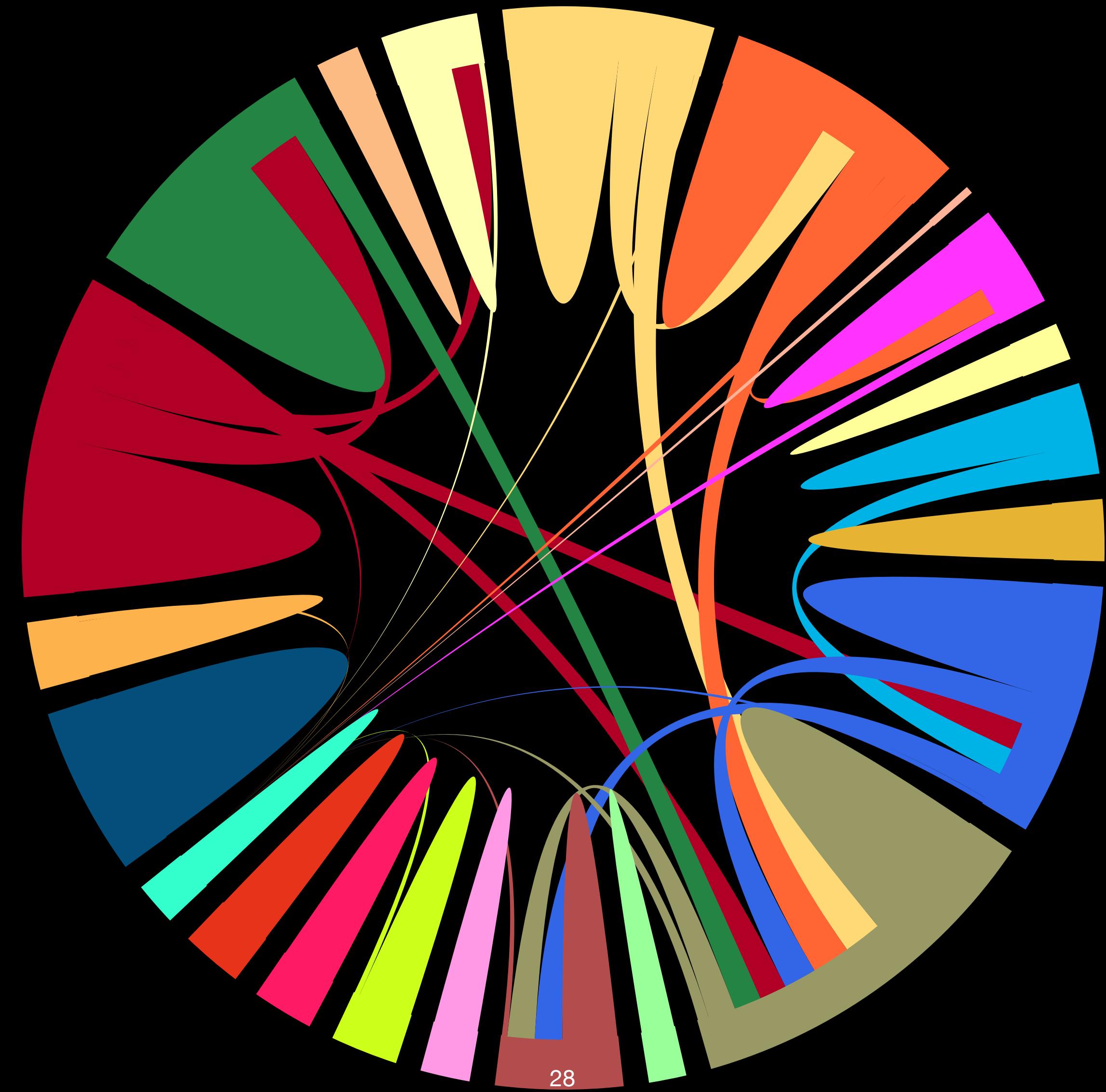
Course change policy

The content of the course is subject to change during the term at the discretion of the instruction. Details of change will be announced on the course webpage as soon as decisions of such change are made.

Intellectual property

http://www.drexel.edu/provost/policies/patent_policy.asp

Visualizations are fun 😎



Hans Rosling: 200 Countries, 200 Years



What is Information Visualization?

A few definitions

Visualization or **visualisation** is any technique for creating images, diagrams, or animations to communicate a message. **Visualization** through visual imagery has been an effective way to **communicate** both abstract and concrete **ideas** since the dawn of humanity.

Wikipedia

What is Information Visualization? (I)

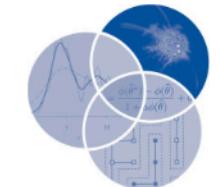
Chaomei Chen, 2010

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- It must present information and associated patterns **rigorously, accurately, and faithfully**.

Overview

Information visualization

Chaomei Chen*



This overview introduces the key structure of the field of information visualization, a number of influential exemplars in the field, and challenging as well as promising directions of future developments. The focus is on explaining some of the most fundamental concepts, prominent approaches, and commonly held criteria. The overview also aims to point out theoretical and practical challenges that the community as a whole has been addressing. © 2010 John Wiley & Sons, Inc. *WIREs Comp Stat* 2010 2 387–403 DOI: 10.1002/wics.89

Keywords: information visualization; visual analytics; interactive dynamic graphics/interactive; visual thinking; visual design; human perception

The term *information visualization* refers to computer generated interactive graphical representations of information. In this article, it also refers to the process of producing information visualization representations. The field of information visualization refers to the scientific community of researchers and practitioners who are contributing or have contributed to the field of study. This overview article aims to provide a brief introduction to information visualization. The overview is primarily intended for the audience who are not familiar with the field. The introduction will focus on core motivations and ambitions of information visualization, landmark and exemplar work in the field, emerging trends and promising directions of further growth. Specialized fields such as geovisualization, software visualization, and visual analytics are discussed briefly. For comprehensive coverage of these specialized fields, interested readers are referred to materials listed in the resources.

OVERVIEW

Information visualization is concerned with the design, development, and application of computer generated interactive graphical representations of information. This often implies that information visualization primarily deals with abstract, nonspatial data. Transforming such nonspatial data to intuitive and meaningful graphical representations is therefore of fundamental importance to the field. The transformation is also a creative process in which designers assign new meanings into graphical patterns. Like art, information visualization aims to communicate

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DOI: 10.1002/wics.89



What is Information Visualization? (III)

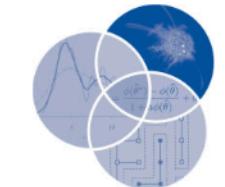
Chaomei Chen, 2010

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complex ideas to its audience and inspire its users for new connections. Like science, information visualization must present information and associated patterns rigorously, accurately, and faithfully.¹

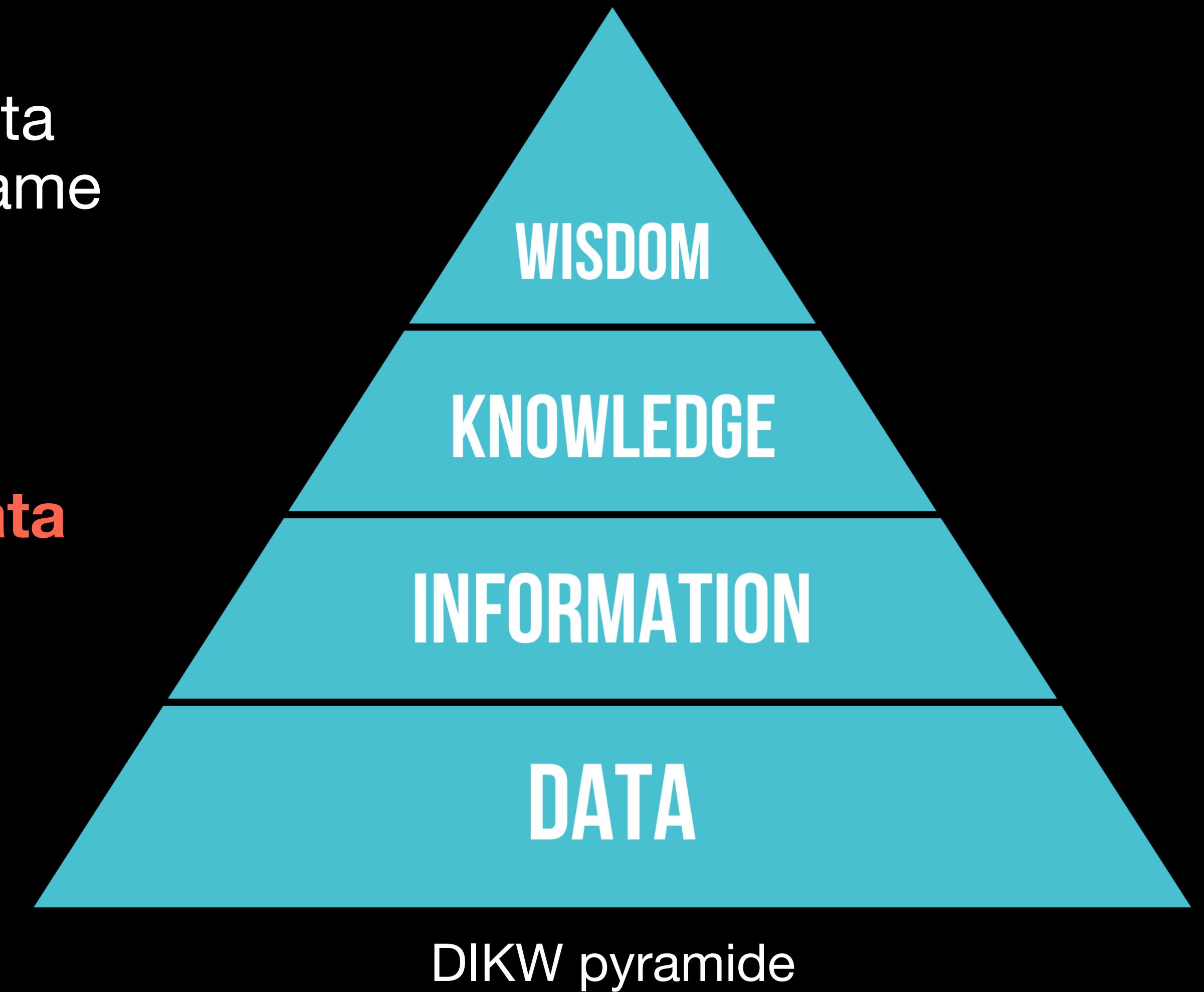
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First, is the original data numerical? Graphical depictions of quantitative information are often seen in the fields of data visualization, statistical graphics, and cartography. For example, is a plot of daily temperatures of a city for the last 2 years qualified as information visualization? The answer to this question may depend on another question: how easy or straightforward is it for someone to produce the plot? As Michael Friendly and Daniel J. Denis put it,² *unless you know its history, everything might seem novel*. By the same token, what is complex and novel today may become trivial in the future. A key point to differentiate information visualization from data visualization and scientific visualization is down to the presence or absence of data in quantitative forms and how easy one can transform them to quantitative forms. This is why researchers emphasize the ability to represent nonvisual data in information visualization.²

Second, if the data is not spatial or quantitative in nature, what does it take to transform it to something that is spatial and visual? This step involves visual design and the development of computer algorithms. It is this step that clearly distinguishes information visualization from its nearest neighbors such as quantitative data visualization. In a more formal terms, this step can be found in an earlier taxonomy

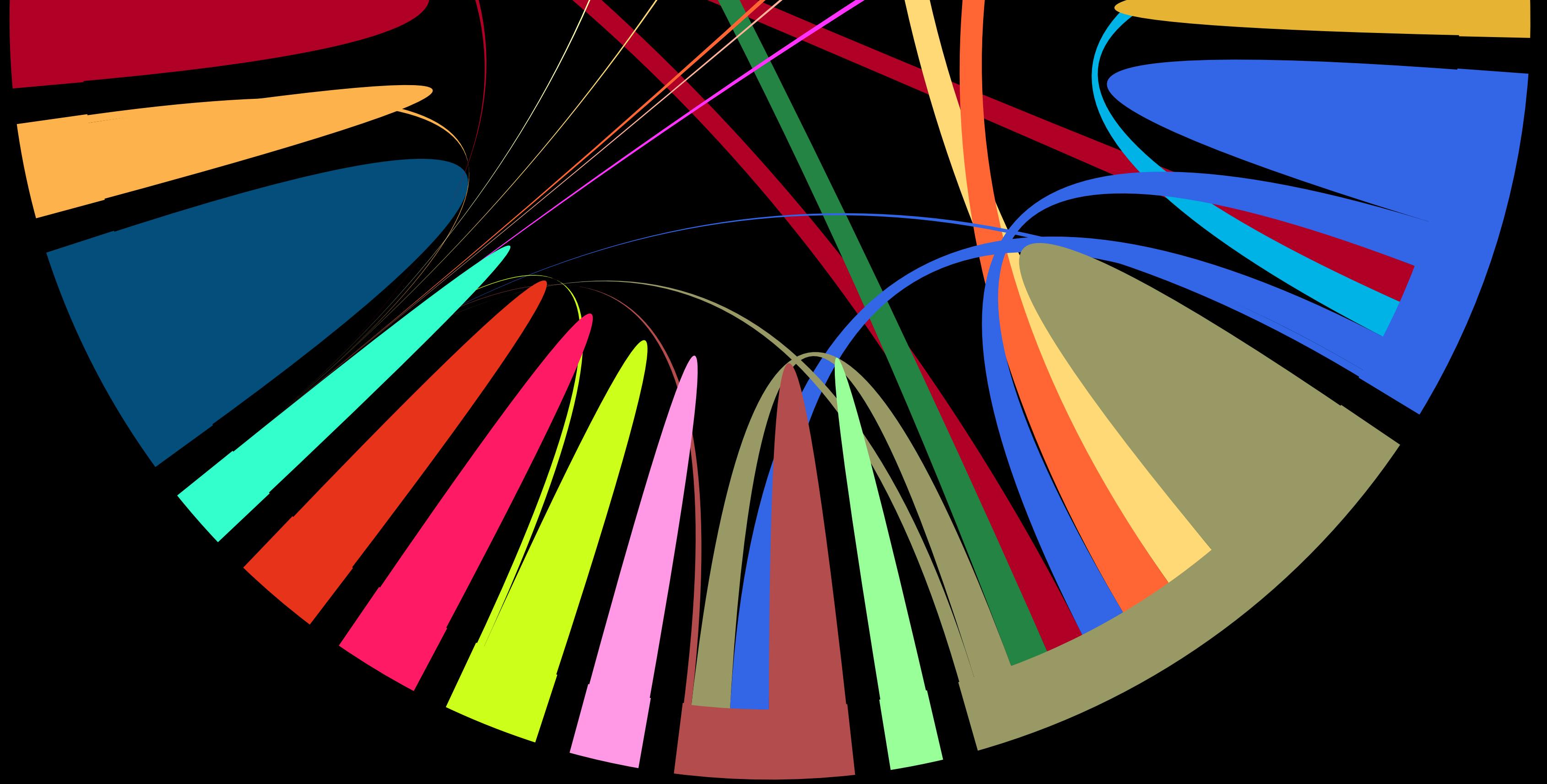
Information vs Data

- Both information visualization and data visualization basically describe the same thing:
 - **Data** is the **source**
 - **Information** is the **insight from data**



Assignment 1

- https://luiscruz.github.io/course_infovis/assignments/assignment1
- Submission YAML
- Via email: course.infovis2020@gmail.com
- Email subject: *[Information Visualization] <studentid>_assignment1*



A complex arrangement of overlapping geometric shapes in various colors (red, orange, yellow, blue, green, pink, purple) against a black background. The shapes include triangles, rectangles, and irregular polygons, some with thin white outlines.

Wrap-up!

Information Visualization

INFO250

Chapter 1, Lesson 2

Luís Cruz - l.cruz@tudelft.nl

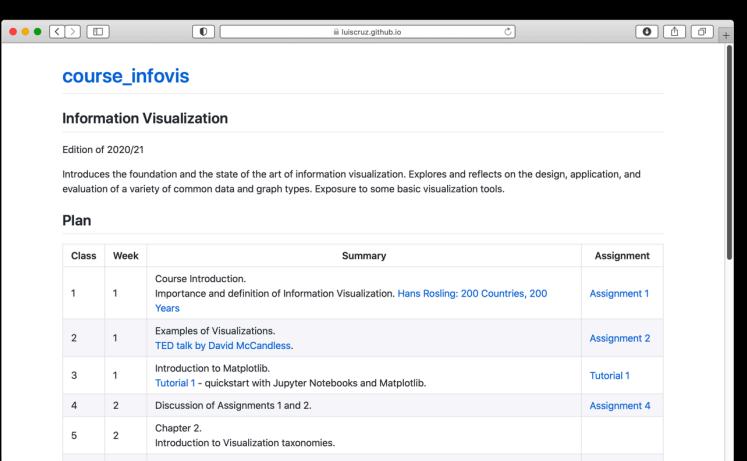


Previous Class



Website

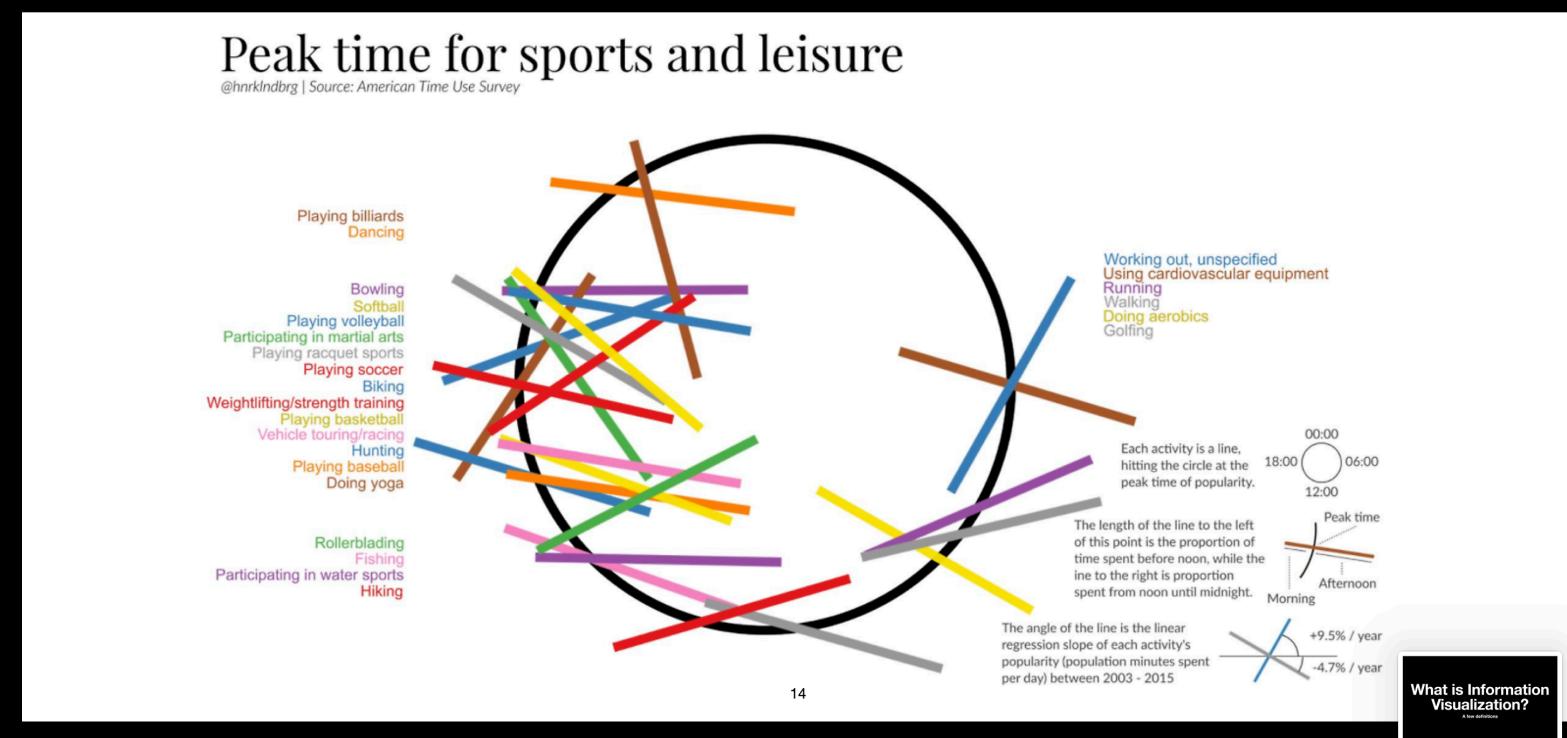
- https://luiscruz.github.io/course_infovis/
 - Summaries, assignments, slides, etc.



What is Information Visualization?

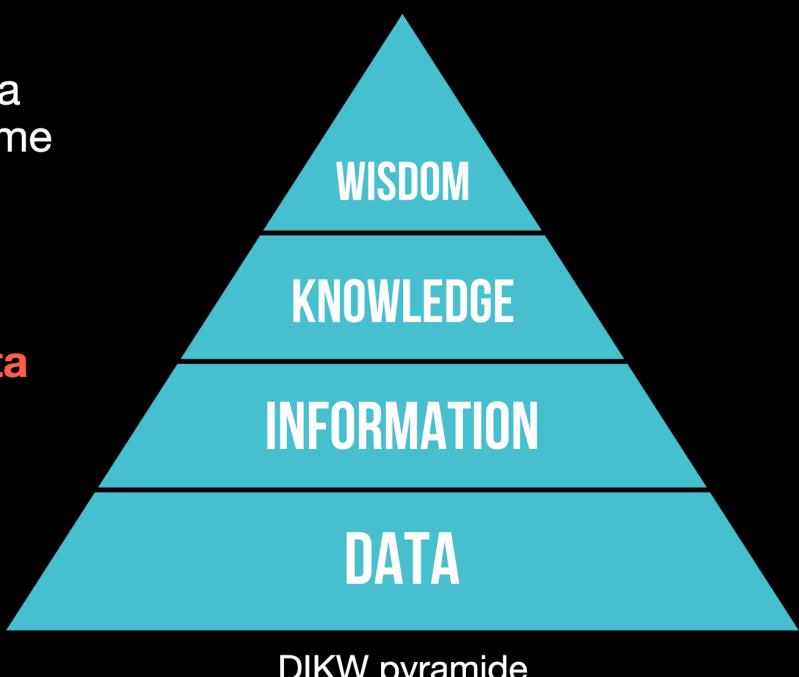
A few definitions

Examples of Visualizations



Information vs Data

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Today's Agenda

More definitions of Information Visualization

What Makes a Good Visualization?

Historical examples of Good Visualizations

The beauty of data visualization

Assignment 2

What is Information Visualization? (I)

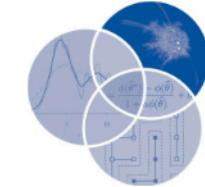
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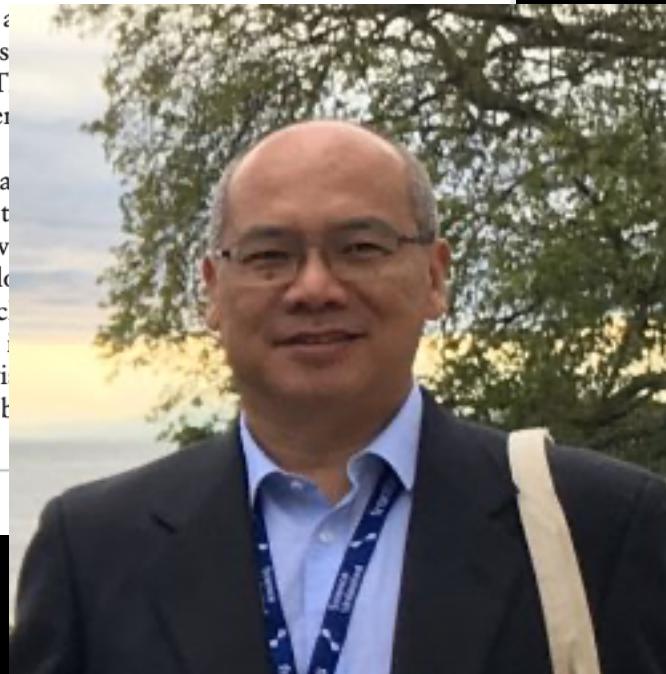
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Second, if the data is quantitative, what does it tell us? That is spatial and visual. How does it relate to design and the development of the field? It is this step that characterizes information visualization from data visualization. In terms of quantitative data visualization, this step can be

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What is Information Visualization? (II)

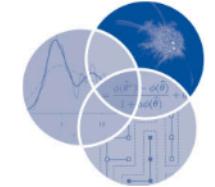
Chaomei Chen, 2010

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Second, if the data is quantitative, what is its nature, what does it tell us? Is it spatial or nonspatial? Is it categorical or continuous? Is it temporal? Design and the development of information visualization are based on these characteristics. It is this step that converts quantitative data visualization from a scientific discipline to a design discipline. In terms of this step, this step can be called the “transformation of quantitative data visualization”.

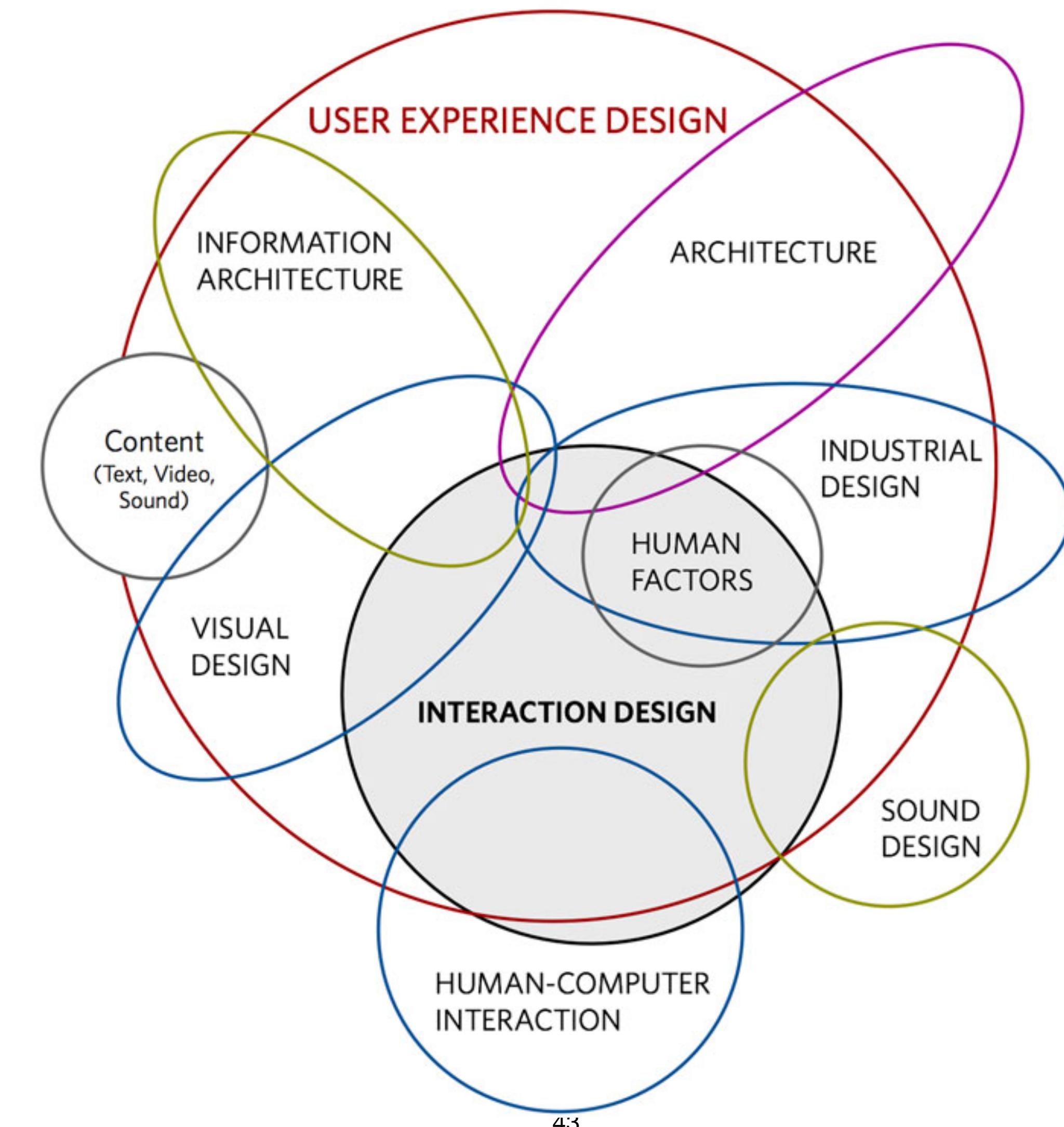
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DOI: 10.1002/wics.89



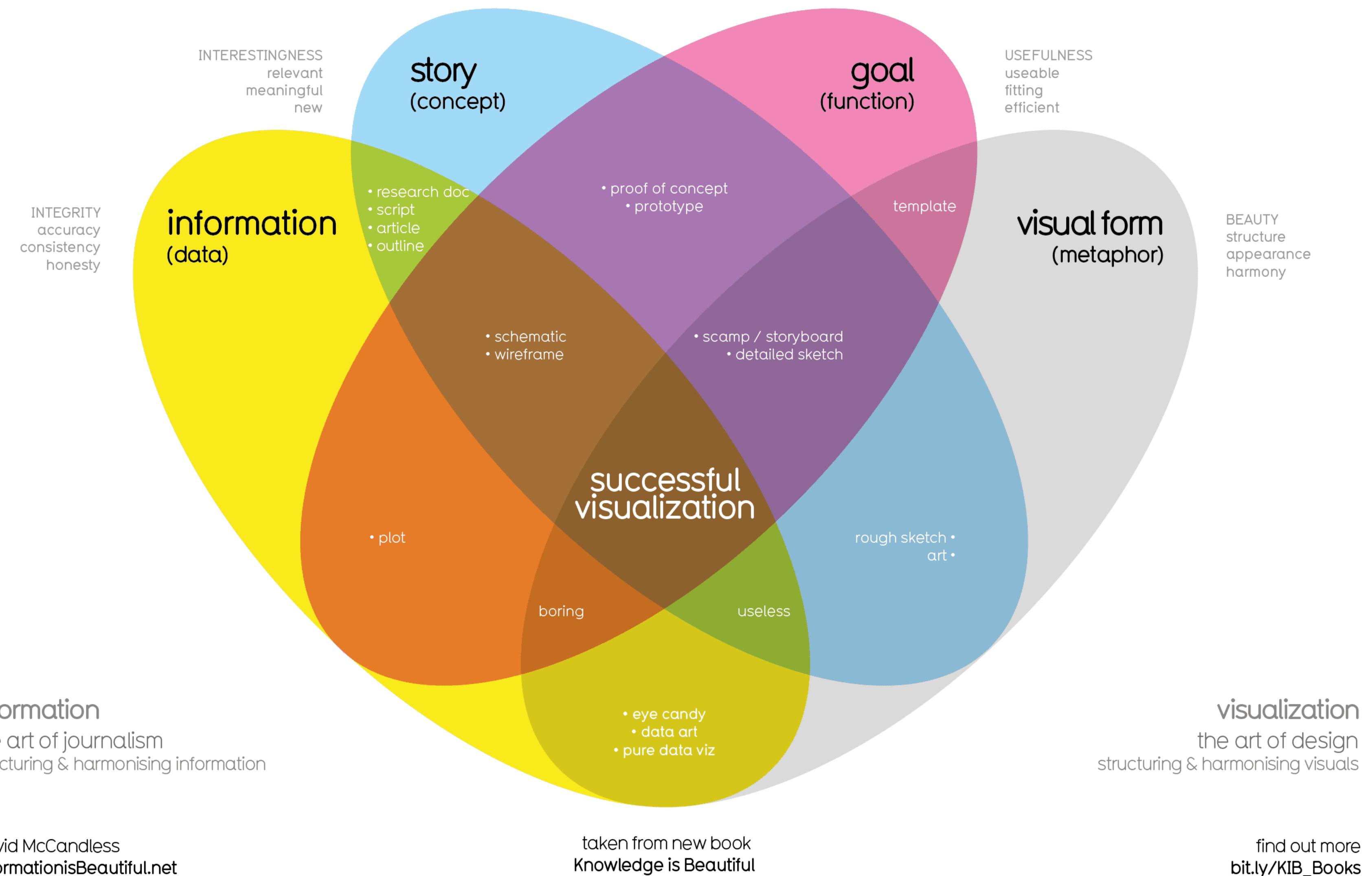
Context of Visualization Matters!

- Such contexts include:
 - **Purpose:** What will be the graph used for? (Exploratory vs Descriptive?)
 - **Readership:** Who are the readers?
 - **Media:** In what media will the graph be presented?
 - **Visual guides:** What other visual guides are offered to the readers?
- All these factor will need to be thought about during the design of visualization.

A Fancy Visualization



What makes a good visualization?



Gallery of Information Visualizations

The beauty of data visualization (assignment 2)

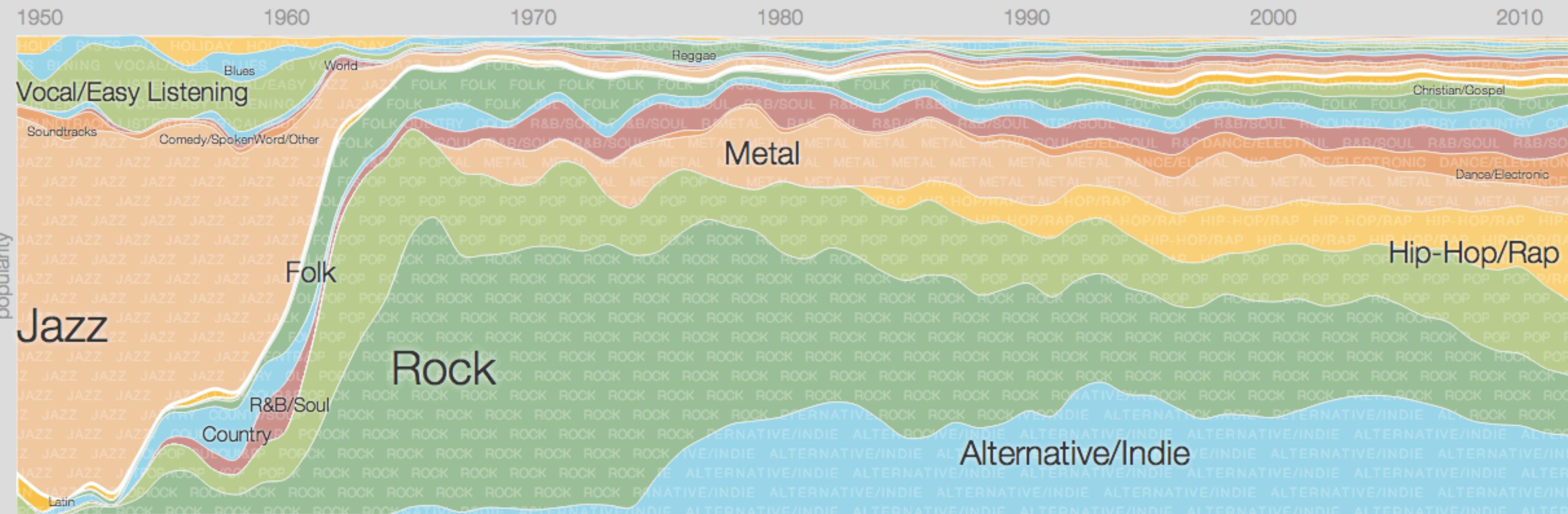
David McCandless



Music Timeline

Album or artist: Search...

[FAQ](#)



The Complete Ella Fitzgerald Song Books
Ella Fitzgerald



Lady Day: The Complete Billie Holiday
Billie Holiday



Come Away With Me
Norah Jones



The Definitive Collection
Louis Armstrong



Crazy Love
Michael Bublé

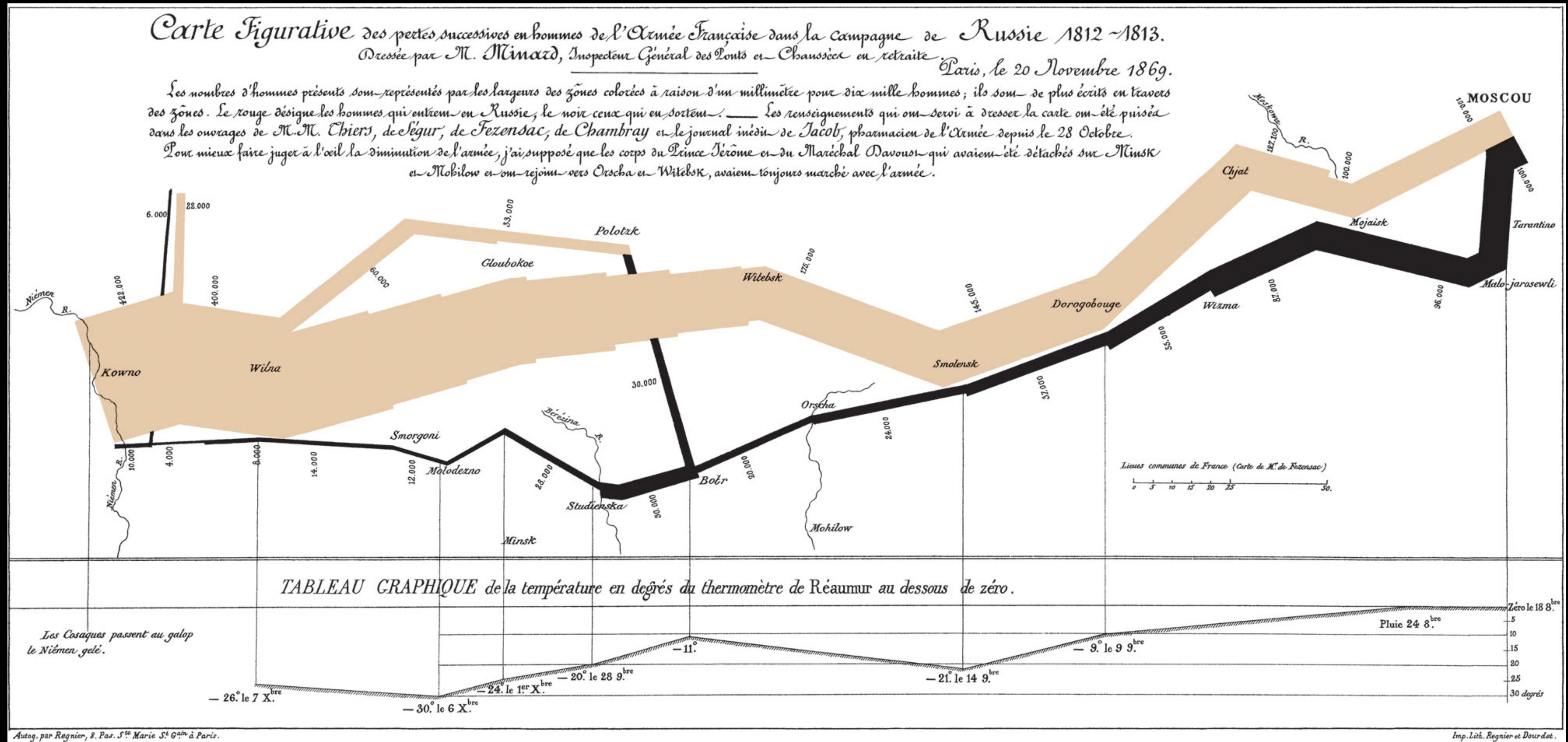


Kind Of Blue
Miles Davis



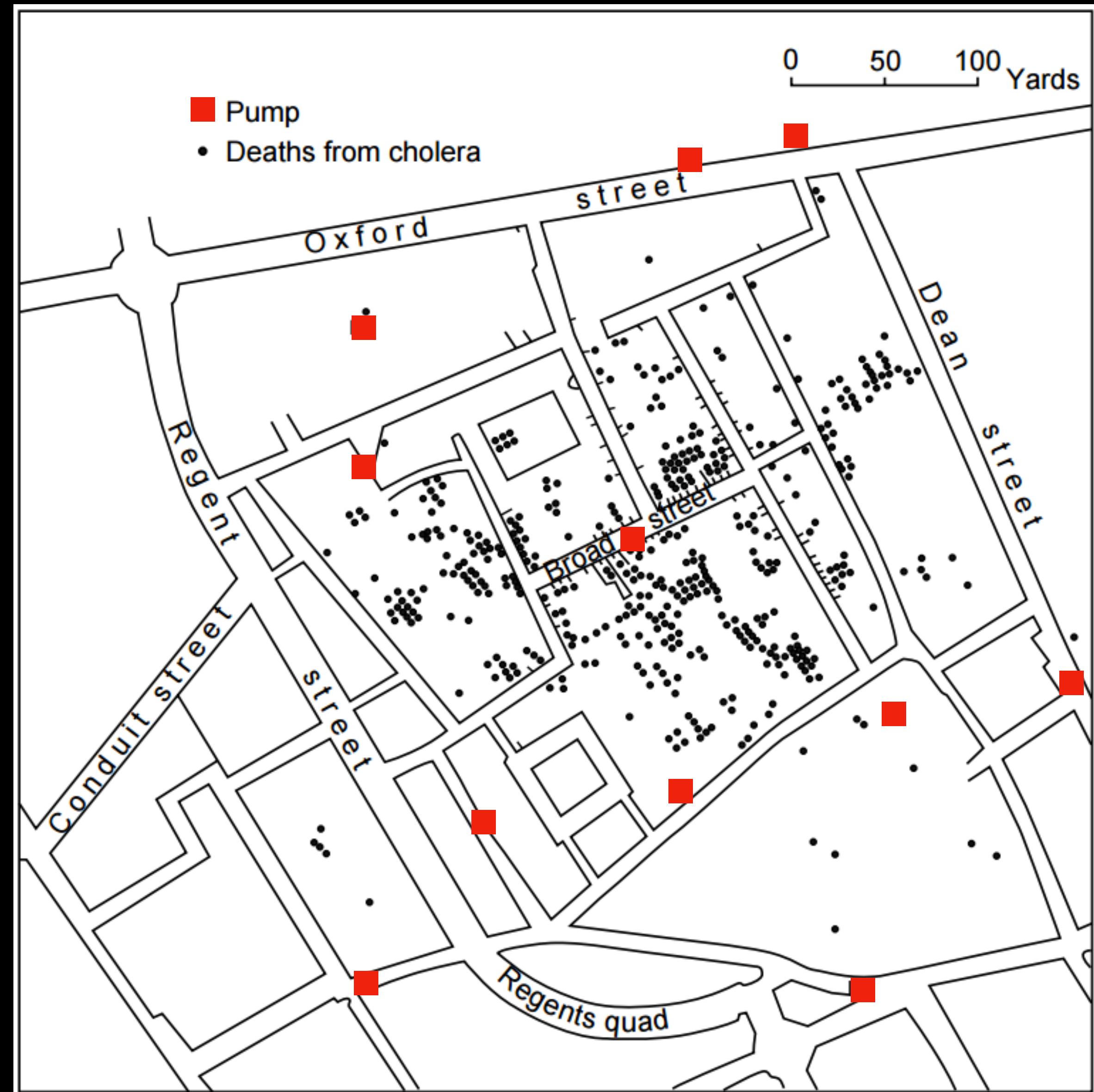
Sinatra: Best Of The Best
Frank Sinatra

French Invasion of Russia, 1812



Map of Cholera in London, 1854

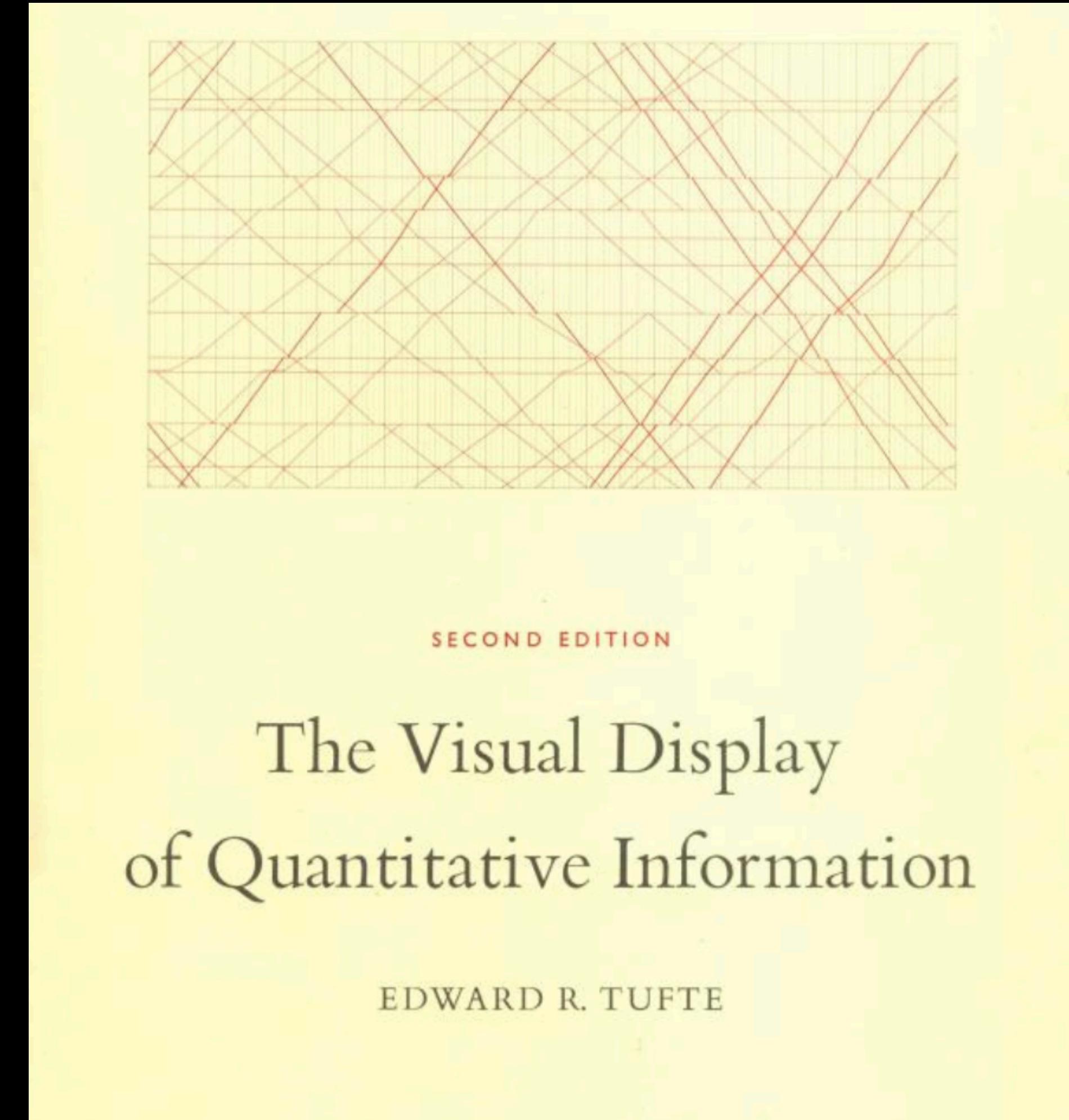
- Original map made by John Snow in 1854.
- Outbreak in Broad Street
- Cholera cases/**deaths** are highlighted with **black dots**.
- **Water pumps** are highlighted with **squares**.



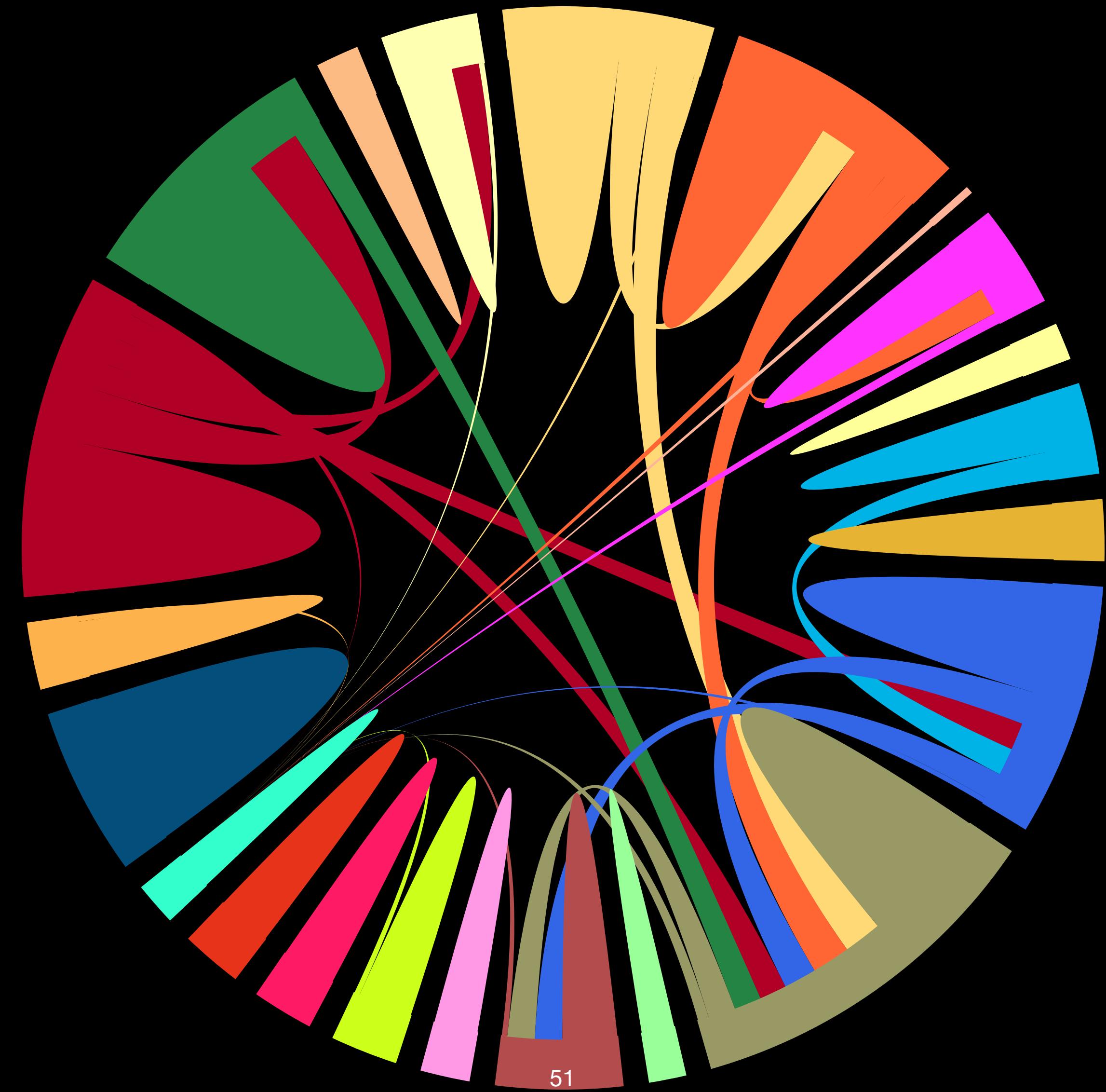
The visual Display of Quantitative Information

Edward Tufte

- Old school visualization examples
- Timeless visualization principles



Visualizations are fun 😎



Some other sources

- NYTimes Research and Development group: <https://nytlabs.com/>
- FlowingData: <https://flowingdata.com/>
- WTF Visualizations: <https://viz.wtf/> (**assignment 2**)

Assignment 2

- https://luiscruz.github.io/course_infovis/assignments/assignment2
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