Universidade de Aveiro
Departamento de Electrónica,
Telecomunicações e Informática

Information Visualization course 2023
Introduction

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What is Visualization?

- Visualization is a field of Computing focused on how to **visually represent and explore large amounts of data**
- Taking advantage of the **human visual system capacities**
- Providing "**insights**" concerning the phenomenon behind the data

What it **is not**:

- just "pretty pictures"!

This course:

- an introduction to: Data and Information Visualization
  Computer Graphics

- Information Visualization

Course web page: http://sweet.ua.pt/bss/courses/InfoVis/IV-home.htm

all materials are available in Moodle

Outline:

Introduction to Data and Information Visualization

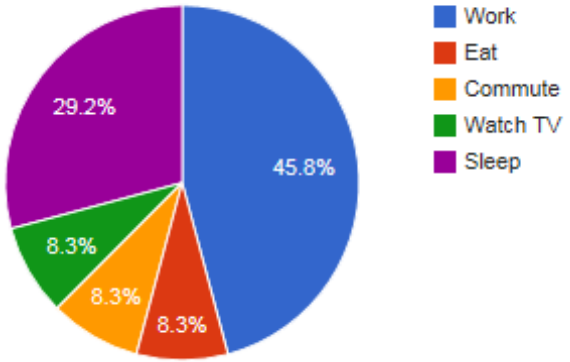
Information Visualization:

- Main issues
- Data and Design
- Representation
- Presentation
- Interaction
- Evaluation

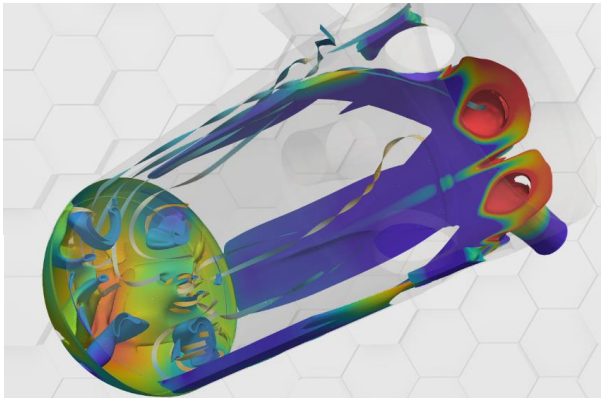
Introduction to Computer graphics:

- Primitives, Geometric transformations (2D, 3D) and Visualization (2D, 3D)
- Introduction to visibility, illumination, surface rendering and color models

In Lab Classes we will use



- Visualization: Google Charts, D3
- Computer Graphics: SVG, Three.js, VTK



VTK

Data-Driven Documents

three.js r70

examples, more

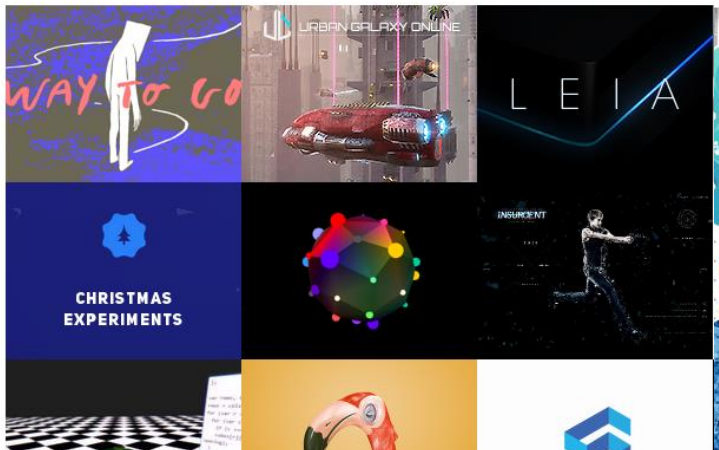
download, cdn

getting started
documentation
google+
chat
help

github
contributors
wiki
issues

editor (beta)

featured projects



Sessions

(subject to minor adjustments)

1 - Introduction to the course and to DataVis and InfoVis

1Lab – Introduction to Labs

2 - Introduction to DataVis and InfoVis

2Lab – Introduction to Google Tool Charts

3 – Main issues in InfoVis (Data and Design cycle) (select a paper)

3Lab – Evaluation of a Vis application

4 - Representation: coding of value

4Lab – Introduction to SVG (mini-project topics)

5 - Evaluation methods + Paper presentation

5 Lab -Introduction to D3.js

6 – Representation: coding relation + Paper presentation

6Lab – Introduction to D3.js – (select a mini-project topic)

7 – Follow-up of the mini-project

7Lab - mockup evaluation

8 – Presentation + Paper presentation

8Lab - D3.js; mini-project

9 - Interaction + Paper Presentation

9Lab – D3.js mini-project

10 – Introduction to Computer Graphics + Paper presentation

10Lab – D3.js; mini-project

11 - Presentation and demo of the mini-project

11Lab – Presentation and demo of the mini-project

12 – Introduction to Computer Graphics + Paper presentation (Select CG assignment)

12Lab – Introduction to Three.js

13 – Introduction to Computer Graphics + Paper presentation

13Lab – Three.js exercises, CG assignment

14 – Introduction to Computer Graphics + Paper presentation

14Lab – Three.js exercises, CG assignment

Dates to submit CG assignment TBA

Assessment

- Exam – 40%

- Mini-project - design, implementation and evaluation of a visual data exploration application – 40% (groups of two students)

- Computer Graphics assignment – 10%

- Paper presentation – 10% (groups of two students)

Notice: Working Students must contact paulo.dias@ua.pt until **October 2** to discuss their practical assessment deadlines

Assignments

- Are performed in groups of two students

- Paper presentation

  9/Oct/2023– select a paper and a presentation date (links in Moodle)

- Design, implementation and evaluation of a Visual Data Exploration application using UCD, with the following deliverables:

  18, 23/Oct/2023 - select a topic

  LFP usability test

  Follow-up – presentation and submission of requirement analysis and proposed design (15 slides)

  Presentation and demo of the application

  date TBA – submission of the application

- Computer Graphics exercises

  date TBA - submission of Three.js exercises

Design and implementation of a Visual Data Exploration Application Using a Human-Centered approach:

- Select a Data set to visualize
- Characterize target users, scenarios and identify interesting questions
- Propose a conceptual model for the application (including visualization idioms and interaction styles)
- Develop and evaluate a low fidelity prototype with users
- Develop the application using D3 (or other platform, subject to approval)
- Evaluate the application using at least an analytical method

Analyzing and presenting a paper:

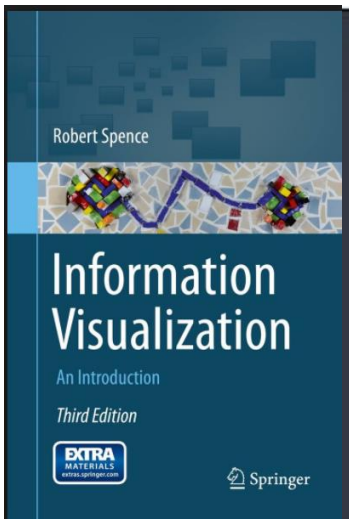
VIS 2022
the premier forum for advances in visualization and visual analytics

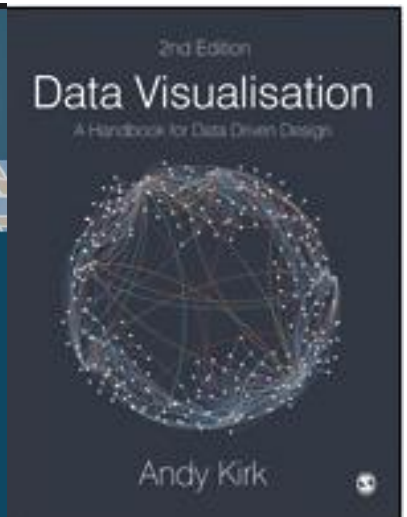
- Each group of two students must:
- Select an **InfoVis** long paper from:
  - IEEEVis2022
  - EuroVis2023
  - Or from another recent conference or journal issue (subject to approval)
- Propose it until 9/Oct/2023 to bss@ua.pt
  Indicating preferences concerning presentation date
- Read the presentation guidelines
- Make a presentation and submit the slides

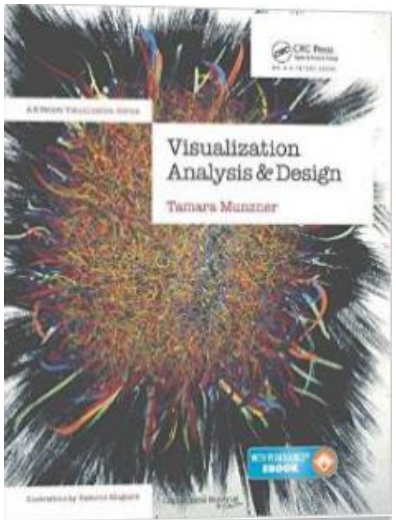
Help:
Laramee, R. S. (2011). How to Read a Visualization Research Paper: Extracting the Essentials. *IEEE Computer Graphics and Applications*, *May/June*, 78–82.
https://ieeexplore.ieee.org/document/5754296

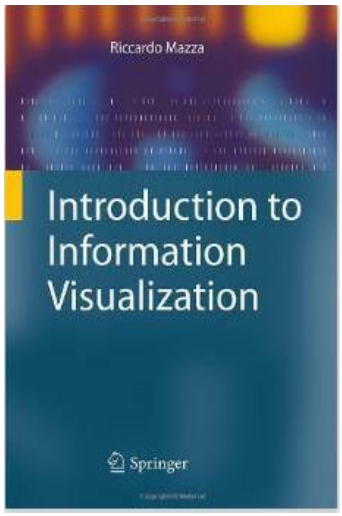
Main Bibliography - Visualization

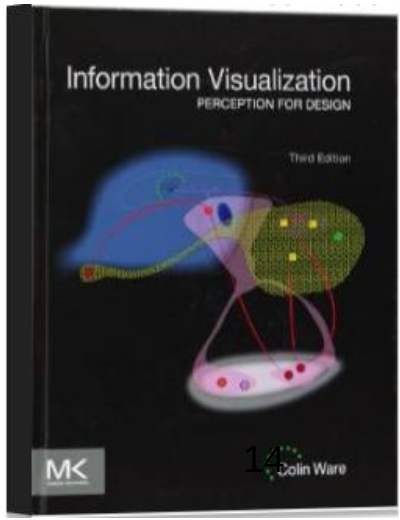
- Spence, R., *Information Visualization, An Introduction*, Springer, 2014
- Munzner, T., *Visualization Analysis and Design*, A K Peters/CRC Press, 2014
- Kirk, A., Data VisualisationA Handbook for Data Driven Design, 2nd. Ed., Sage, 2019
- Mazza, R., *Introduction to Information Visualization*, Springer, 2009
- Ware, C., *Information Visualization, Perception to Design*, 3nd ed.,Morgan Kaufmann, 2012
- Explore other books available at the playlist: https://learning.oreilly.com/playlists/74bfec5e-4346-48ff-82b4-657fda6922b6











Other Bibliography

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  https://books.google.pt/books/about/Data_Visualization.html?id=I4qBVLfD3t4C&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false
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Other Bibliography

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- Tufte, E., *The Visual Display of Quantitative Information*, Graphics Press, 1983
- Tufte, E., *Envisioning Information,* Graphics Press, 1990
- Friendly, M., "Milestones in the history of thematic cartography, statistical graphics, and data visualization", 2009
- Few, S*.,* "Data Visualization for Human Perception". In: Soegaard, M. and Dam, R. (eds.). *The Encyclopedia of Human-Computer Interaction*, 2nd Ed. The Interaction Design Foundation https://www.interaction-design.org/encyclopedia/data_visualization_for_human_perception.html
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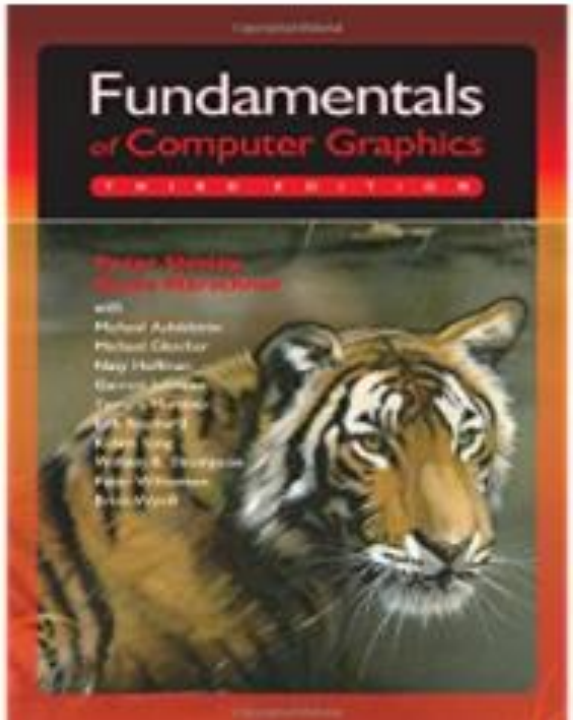
- Heer, J., M. Bostock, M., & V. Ogievetsky,. "A tour through the visualization zoo". *Communications of the ACM*, vol *53*, no. 6, pp. 59-79, 2010.

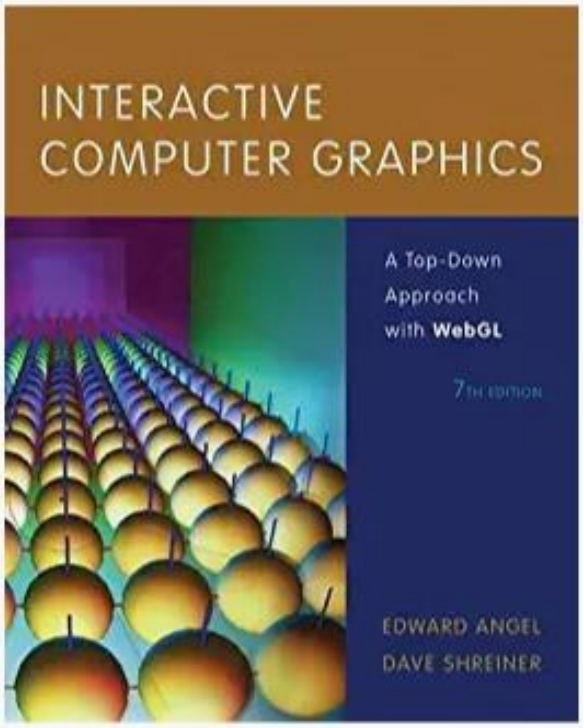
Bibliography – Computer Graphics

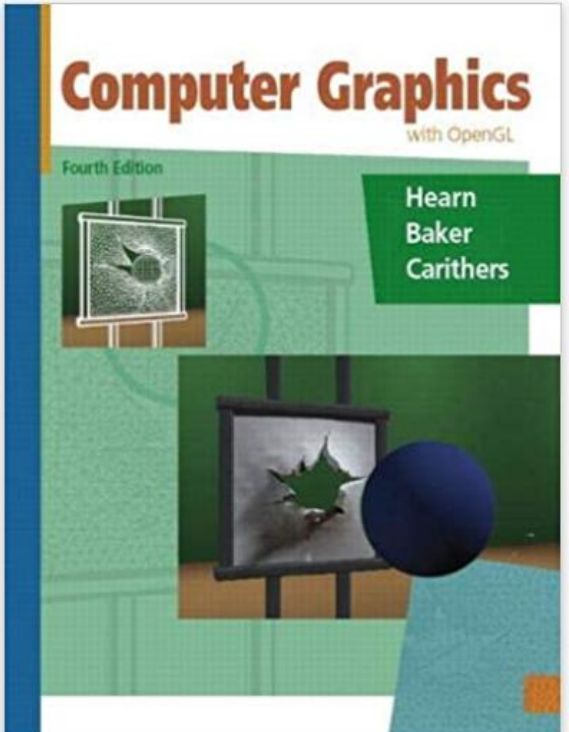
- Shirley, P. M. Ashikhmin, S. Marschner, *Fundamentals of Computer Graphics*, 3rd Edition, 3rd ed., A K Peters/CRC Press, 2021

- Angel, E., D. Shreiner, *Interactive Computer Graphics: A Top-Down Approach with WebGL*, 7th ed, Pearson, 2014

- Hearn, D., M. P. Baker, W. Carithers*, Computer Graphics with OpenGL*, 4th ed., Prentice Hall, 2010







To probe further
Scientific Journals/Conferences

IEEE Transactions on Visualization and Computer Graphics

IEEE Computer Graphics and Applications

Computer Graphics Forum

Computers and Graphics

Information Visualization

IEEE Vis (http://ieeevis.org/)

Eurovis

A selection of Visualization books to read online:
https://learning.oreilly.com/playlists/f68d0022-1b58-4374-9af5-280d221d4c7e/

On-line courses

Information Visualization - NYU

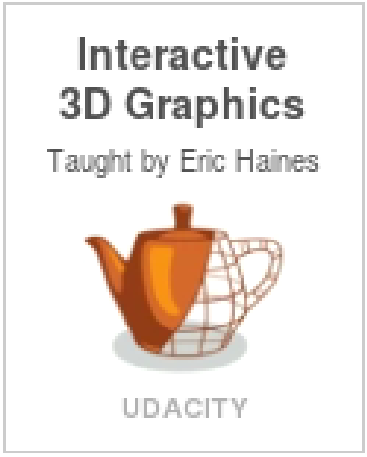
https://www.coursera.org/specializations/information-visualization

Data Visualization and D3.js

https://www.udacity.com/course/data-visualization-and-d3js--ud507

Interactive 3D Graphics, by Eric Haines

https://www.udacity.com/course/interactive-3d-graphics--cs291

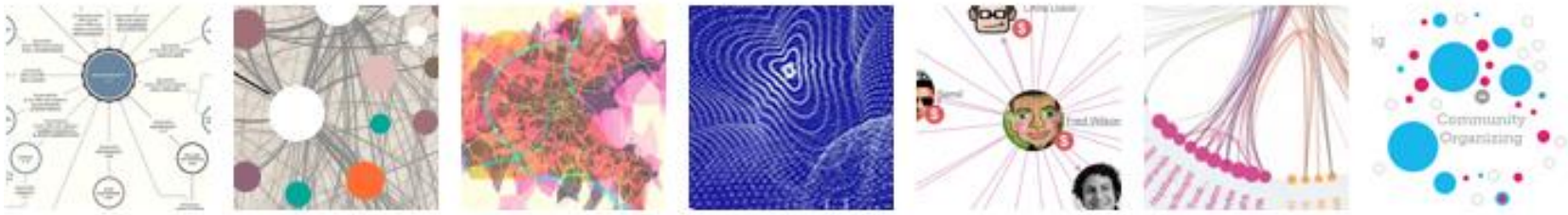


Interesting links

- http://www.infovis-wiki.net/
- https://eagereyes.org/
- http://www.perceptualedge.com/
- http://www.thefunctionalart.com/
- https://www.edwardtufte.com/tufte

Interesting links

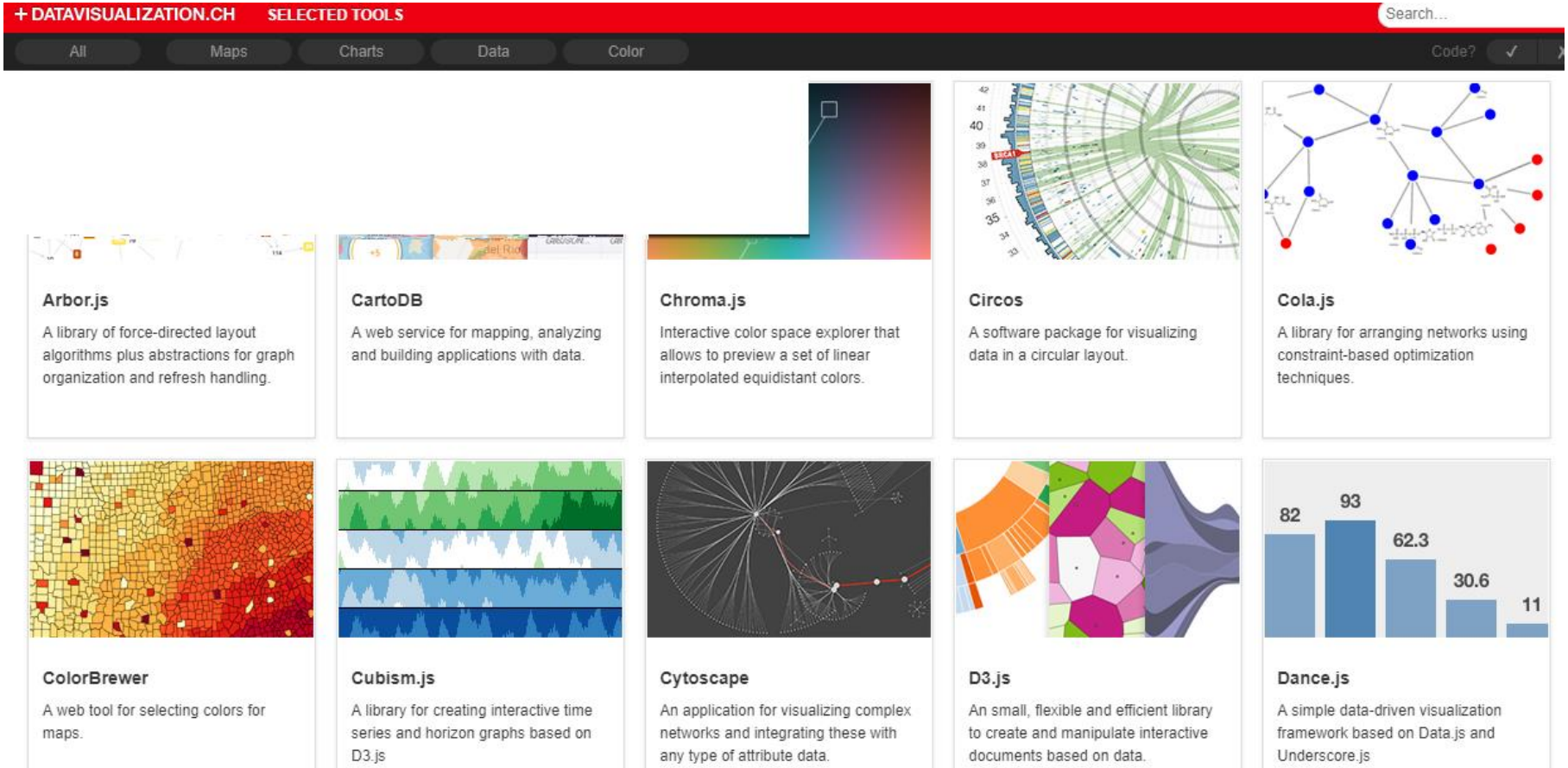
- https://medium.com/multiple-views-visualization-research-explained
- http://seeingdata.org/
- https://flowingdata.com/about
- http://www.visualcomplexity.com/vc/



Visualization Tools

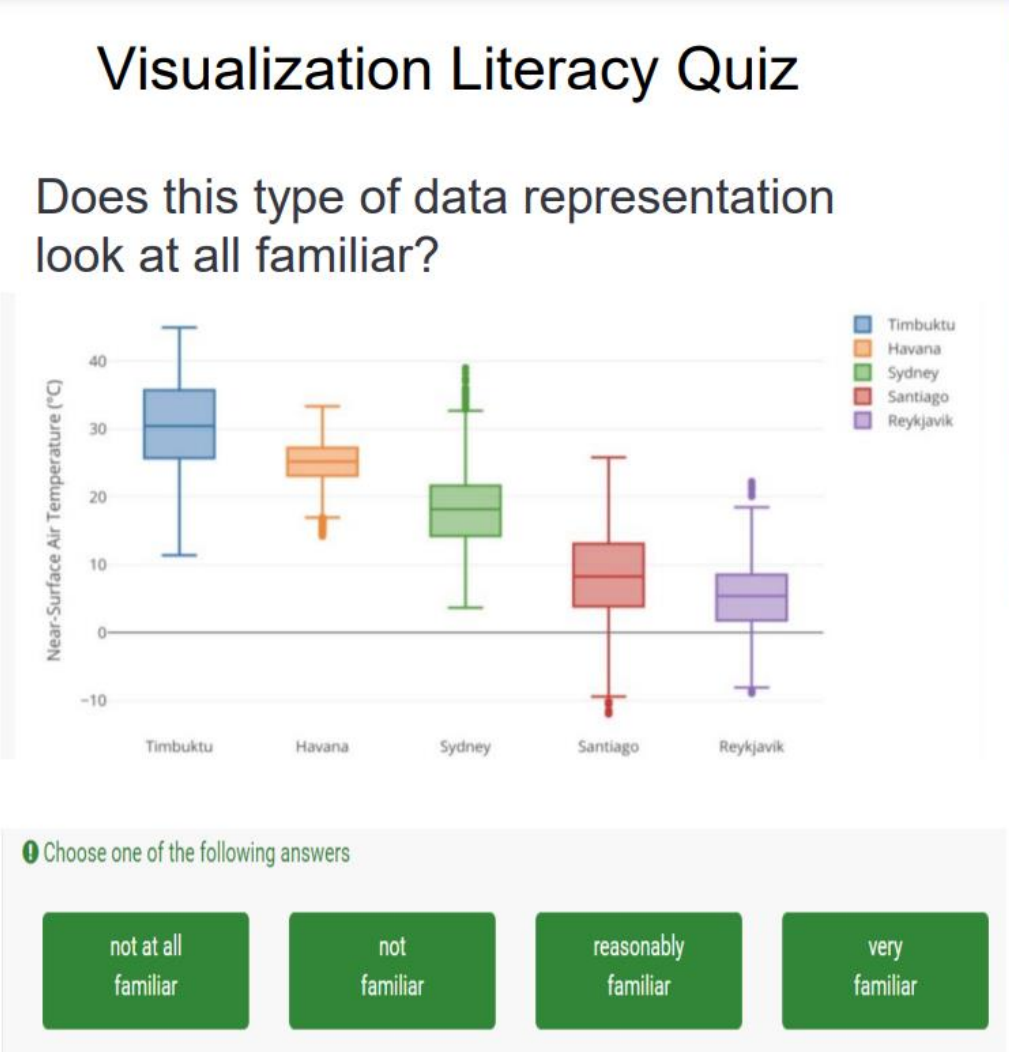
- There are a lot, of different types and with different purposes

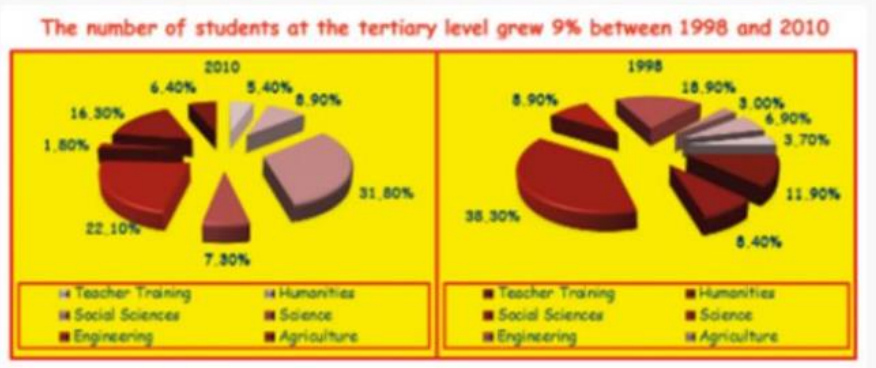
  (see e.g. http://selection.datavisualization.ch/)



2023 Gartner Magic Quadrant
for Analytics and Business Intelligence Platforms

Visualization Literacy Quiz





- https://forms.ua.pt/index.php?r=survey/index&sid=127657&lang=en