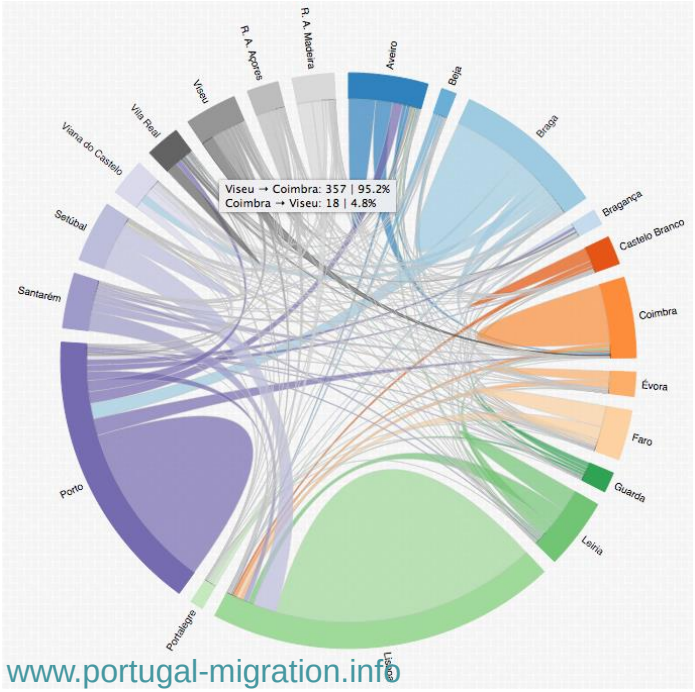
Universidade de Aveiro
Departamento de Electrónica,
Telecomunicações e Informática

Introduction to Information Visualization



- **What is Visualization?**

- "Is a method of Computing. It transforms the symbolic in the geometric, enabling researchers to observe simulations and computations … providing scientific insight through visual methods"*(McCormick et al., 1987)*

- "Is concerned with exploring data and information graphically in such a way as to gain understanding and insight into the data" *(Brodlie et al., 1992)*

- "Means the study, development and use of graphics representation and supporting techniques that facilitate the visual communication of knowledge" *(Keller & Keller, 1993)*

- "A computationally intense visual thinking" *(Rhyne, 2002)*

What is Information Visualization?

Information visualization *(InfoVis)* is the communication of abstract data through the use of interactive visual interfaces. (Keim et al., 2006)

Information visualization *(InfoVis)* produces (interactive) visual representations of abstract data to reinforce human cognition; enabling the viewer to gain knowledge about the internal structure of the data and causal relationships in it (www.infovis-wiki.net)

Abstract data refers to (heterogenous) data that has no inherent spatial structure; thus it does not allow for a straightforward mapping to any geometry

This course:

InfoVis

after

an introduction to: Data/Info Visualization
Computer Graphics
Visual perception

http://sweet.ua.pt/bss

some materials in Moodle

Outline:

Introduction to Data and Information Visualization

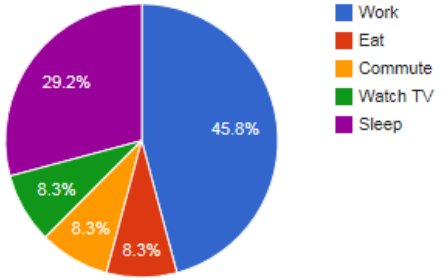
Introduction to Computer graphics:
- Geometric transformations (2D, 3D) and Visualization (2D, 3D)
- Introduction to visibility, illumination, surface rendering and color models

Visual Perception

Information Visualization:
- Main issues
- Data and Design
- Representation
- Presentation
- Interaction
- Evaluation

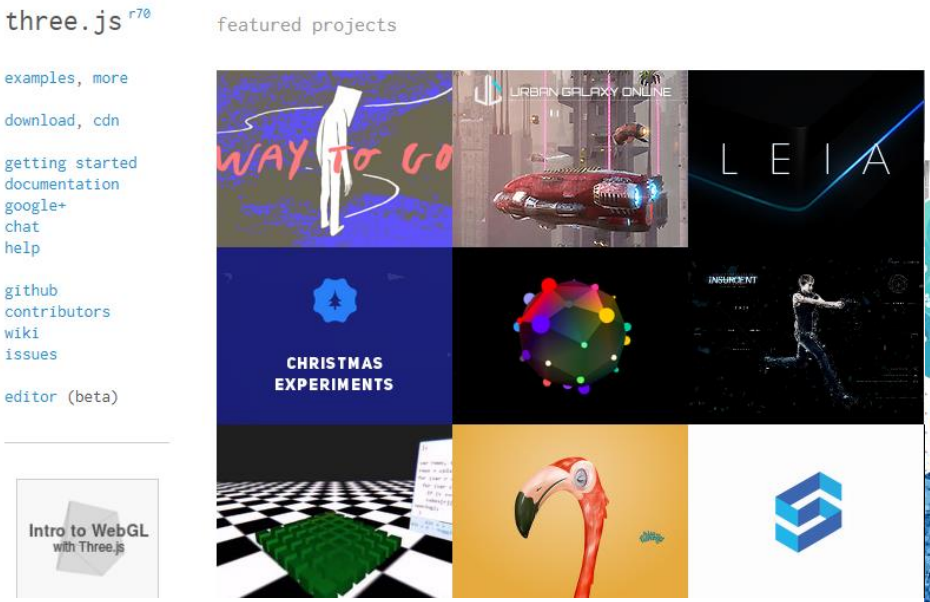
Beatriz Sousa Santos + Paulo Dias

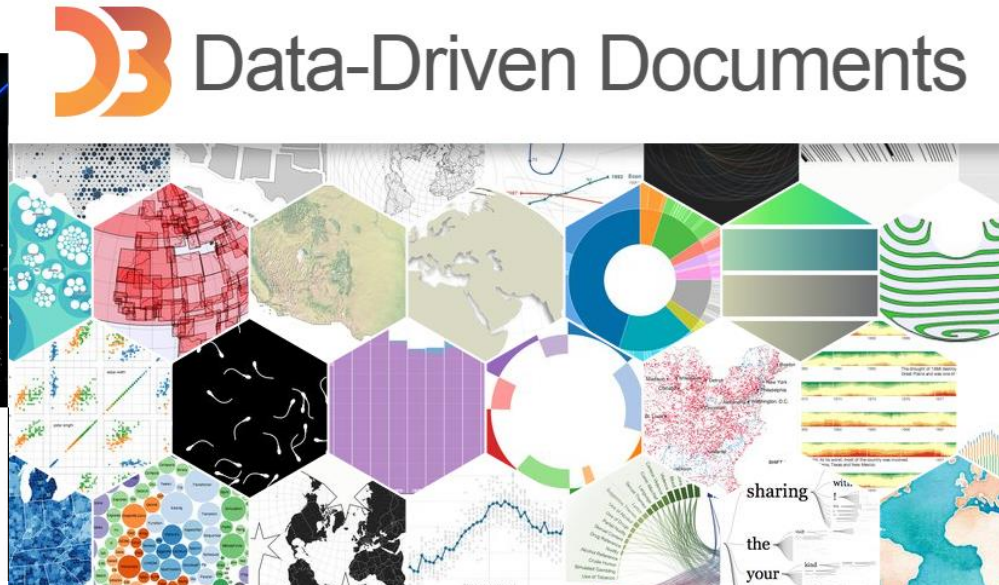
Lab Classes



- SVG, Three.js

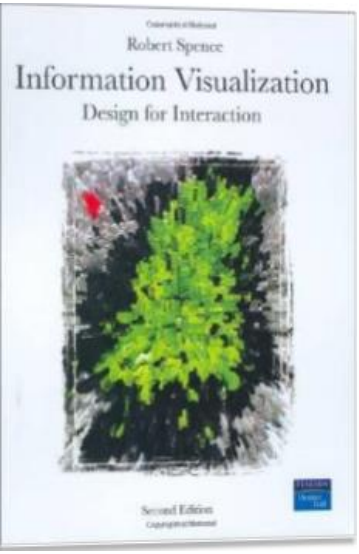
- Visualization tools (Google Charts, D3, …)

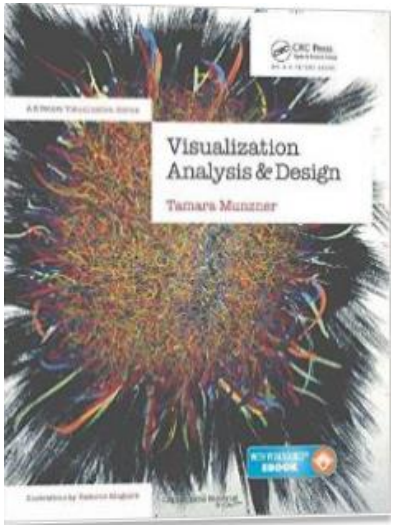


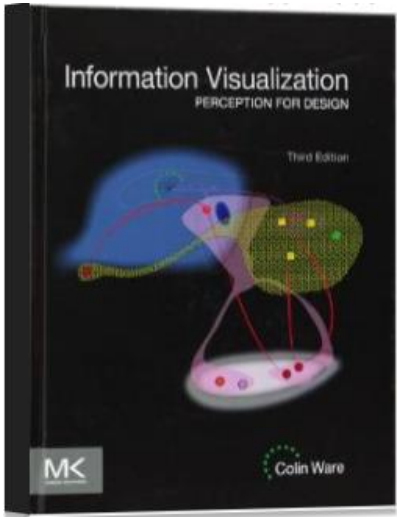


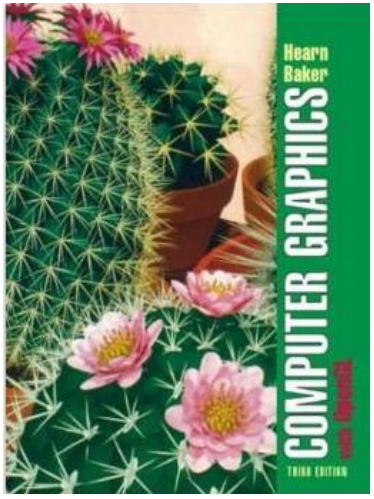
Main Bibliography

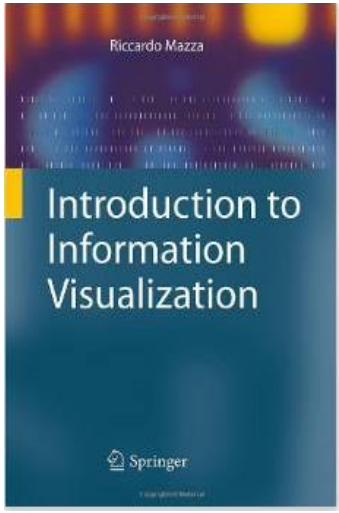
- **Spence, R., *Information Visualization, Design for Interaction*, 2nd ed., Prentice Hall, 2007**
- **Munzner, T., *Visualization Analysis and Design*, A K Peters/CRC Press, 2014**
- **Mazza, R.*, Introduction to Information Visualization***, Springer, 2009
- **Ware, C., *Information Visualization, Perception to Design***, 3nd ed.,Morgan Kaufmann, 2012
- **Hearn, D., M. Pauline Baker, *Computer Graphics with OpenGL*,** 3rd ed., Prentice Hall, 2004











Other Bibliography

- Bederson, B. , B. Shneiderman, *The Craft of Information Visualization: Readings and Reflections*, Morgan Kaufmann, 2003
- Card, S., J. Mackinlay, and B. Shneiderman, *Readings in Information Visualization: Using Vision to Think,* Morgan Kaufmann, 1999
- 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", 2008
- Foley, J., A. van Dam, S. Feiner, J. Hughes, R. Phillips, *Introduction to Computer Graphics*, Addison Wesley, 1993
- 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
- InfoVis Wiki http://www.infovis-wiki.net/
- Papers and sites

Sessions: Thursday – 11h-13h; Thursday – 14h-16h

(subject to minor adjustments)

1 (12/02/15) - Introduction to the course

2 (12/02/15) - Introduction to the lab classes; Google Charts

3 (19/02/15) - Introduction to DataVis and InfoVis

4 (19/02/15) – Google Charts

5 (26/02/15) – Introduction to CG

6 (26/02/15) – Introduction to three.js

7 (05/03/15) - Introduction to CG (cont.) (paper presentation)

8 (05/03/15) – Introduction to three.js

9 (12/03/15) – Visual Perception (paper presentation)

10 (12/03/15) – Introduction to three.js, 1rst assignment

11 (19/03/15) – Main issues in InfoVis

12 (19/03/15) - Introduction to three.js, 1rst assignment

13 (26/03/15) – Representation: coding of value (paper presentation)

14 (26/03/15) - 1rst assignment

15 (09/04/15) – Representation: coding of value (cont) (paper presentation)

16 (09/04/15) – Introduction to SVG

17 (16/04/15) – Representation: coding of relation (paper presentation)

18 (16/04/15) - Introduction to SVG

19 (23/04/15) – Presentation of the 1rst assignment

20 (23/04/15) – Presentation of the 1rst assignment

21 (30/04/15) – Evaluation in Visualization (paper presentation)

22 (30/04/15) – Assignment on evaluation

23 (7/05/15) – Introduction to D3, 2nd assignment

24 (7/05/15) – Introduction to D3, 2nd assignment

25 (21/05/15) – Presentation and Interaction (paper presentation)

26 (21/05/15) – Introduction to D3, 2nd assignment

27 (28/05/15) – Experiment on evaluation

28 (28/05/15) – Experiment on evaluation

29 (4/06/15) - Presentation and Interaction (cont) (paper presentation)

30 (4/06/15) – 2nd assignment

Assessment

- paper analysis, presentation and discussion – 10%

- assignment on evaluation – 10%

- exam – 30%

- 1rst programming assignment – 20%

- 2nd programming assignment– 30%

Assignments

- 1rst programming assignment – three.js, SVG
- 2nd programming assignment - D3, …
- Assignment on evaluation

Assignment on evaluation:

- **“**Naïve critique” of a visualization example
- Evaluation using an analytical method
- Presentation of findings
- Participating in evaluation sessions

Analyzing and presenting an Info Vis paper

IEEE Computer Graphics and Applications

- Each student must:

- Select an InfoVis paper from:
  - Vis2014 http://ieeevis.org/year/2014/info/call-participation/infovis-papers
  - IEEE Computer Graphics and Applications
  - IEEE Transactions on Visualization and Computer Graphics

- Propose it until 27/2/2015 to bss@ua.pt
  Indicating preferences concerning presentation date

- Read the presentation guidelines

- Make a 20 minute presentation and submit the slides

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

- Students who work must contact the lecturer during the two first weeks to establish evaluation details
    - Students profile?
    - Any doubts, questions?

Bibliography-papers

- Rhyne, T. M., "Does the Difference between Information and Scientific Visualization Really Matter?“, *IEEE Computer Graphics and Applications*, May/June, 2003, pp. 6-8

- Rhyne, T. M., “Scientific Visualization in the Next Millennium”, *IEEE Computer Graphics and Applications*, Jan./Feb., 2002, pp. 20-21

- Hibbard, B., “ Top Ten, Visualization Problems”, *SIGGRAPH Computer Graphics Newsletter, VisFiles*, May 1999, Vol. 33, N.2

- Johnson, C., “Top Scientific Visualization Research Problems”, *IEEE Computer Graphics and Applications: Visualization Viewpoints*, July/August, 2004, pp. 13-17

- Eick, S., "Information Visualization at 10," *IEEE Computer Graphics and Applications*, vol. 25, no. 1, Jan/Feb, 2005, pp. 12-14

- Keefe, D., “Integrating Visualization and Interaction Research to Improve Scientific Workflows”, *IEEE Computer Graphics and Applications*, vol. 30, no. 2, Mar/April, 2010, pp. 8-13

Interesting links

- http://www.infovis-wiki.net/
- http://www.visualcomplexity.com/vc/
- http://selection.datavisualization.ch/

- Until February, 28:
  - Select from the list the papers you prefer
  - Think about the presentation dates you prefer

Send to bss@ua.pt

http://www.infovis-wiki.net/

Good luck with your work !