

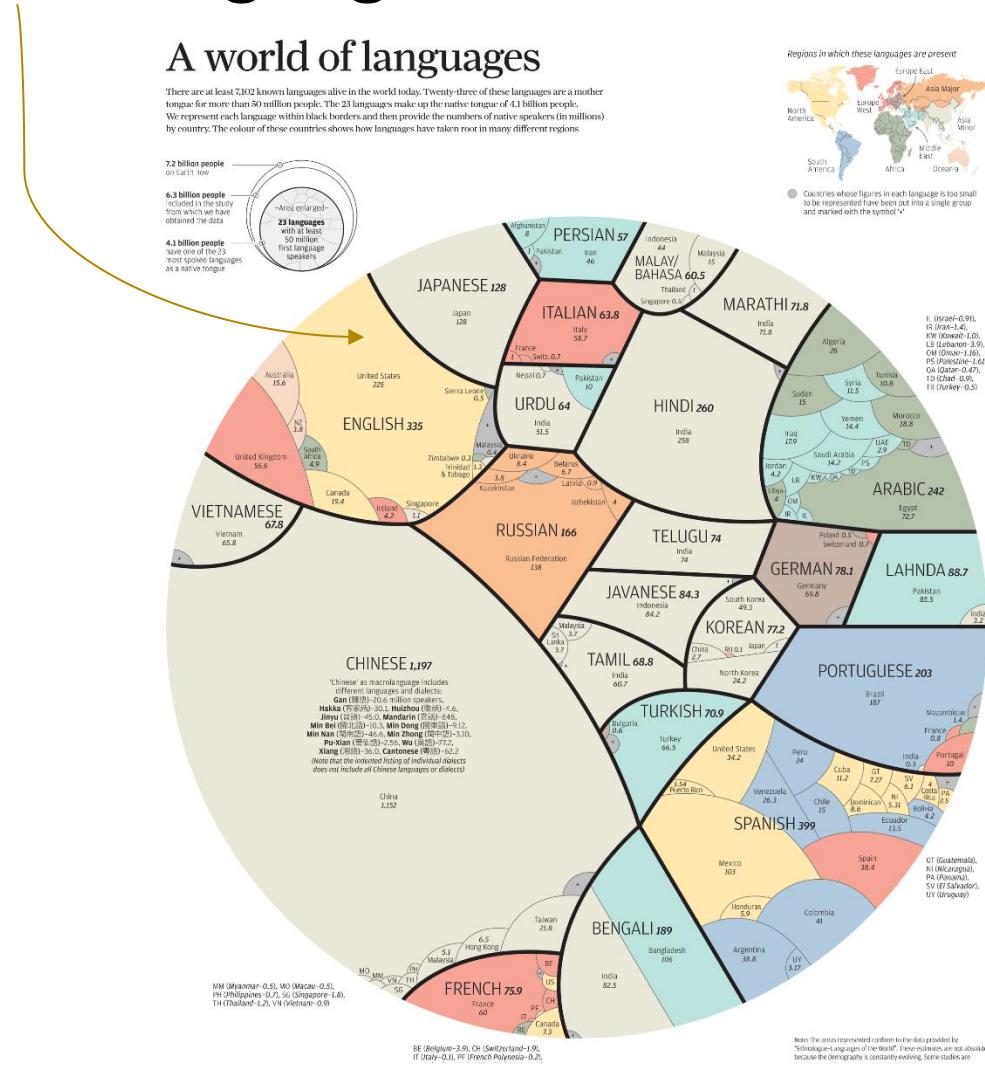
# Data Visualization

## Introduction

perception  
interaction  
Python  
information  
tidyverse  
data  
R  
communication  
storytelling

# Some practicalities

We use the English language in all written material



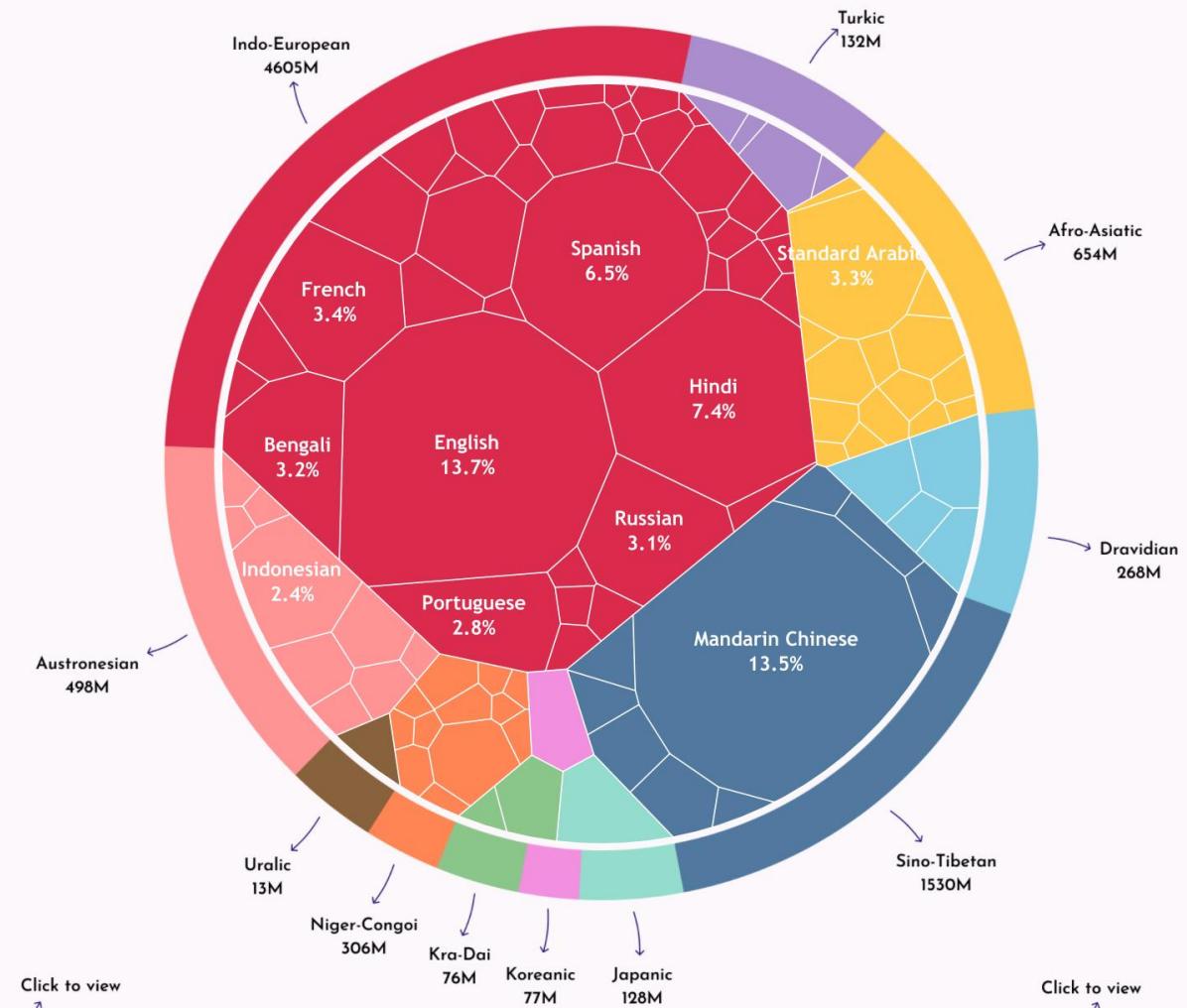
## Some practicalities

Our spoken language will be defined according to necessity and preference

### 100 Most Spoken Languages Around The World

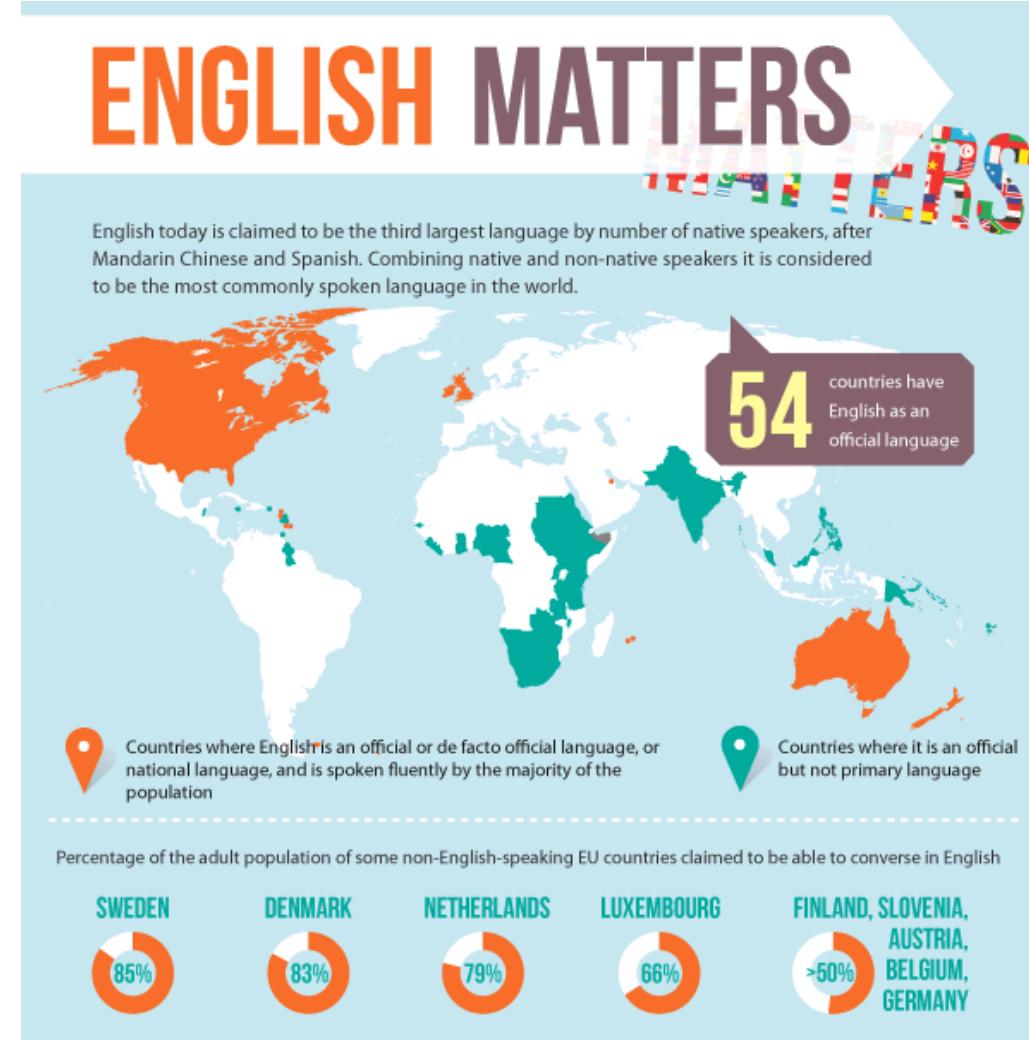
Around the world, there are more than 7,000 regularly spoken vernaculars. Here's the 100 most spoken languages in the world, the number of total speakers for each language, and the origin tree that each language has branched out from.

The data comes from the 22nd edition of Ethnologue, a database covering a majority of the world's population, detailing approximately 7,111 living languages in existence today. The data was published on February 15, 2020.



# Some practicalities

## We use the English language



## Some practicalities

---

- E-mail: [mroussou@di.uoa.gr](mailto:mroussou@di.uoa.gr)
- Class day, time
  - every Wednesday, 18:00 – 21:00
- Presence sheet\*

(\*) attendance is important, but not mandatory. Part of your grade will be based on your in-class / e-class participation

## Round-the-room introductions

---

- 2-minute introduction about you:
  - studies/background
  - goals and expectations from this course

# Course structure

---

13 weeks of:

- Lectures
- Individual assignments
  - ~3-4 on a variety of tools and methods
- Group project (in groups of 2-3)
  - to create an interactive visualization of a dataset (of your choice),
  - present it live, and document it on video

## Course assessment

---

- Individual effort ~40%
  - In-class and e-class participation: ~10%  
Your contributions to in-class and online discussions will be a significant portion of your class participation grade.
  - Individual exercises & assignments: ~30%
- Group Project ~60%
  - Design & implementation: ~50%
  - Final Presentation & documentation: ~10%

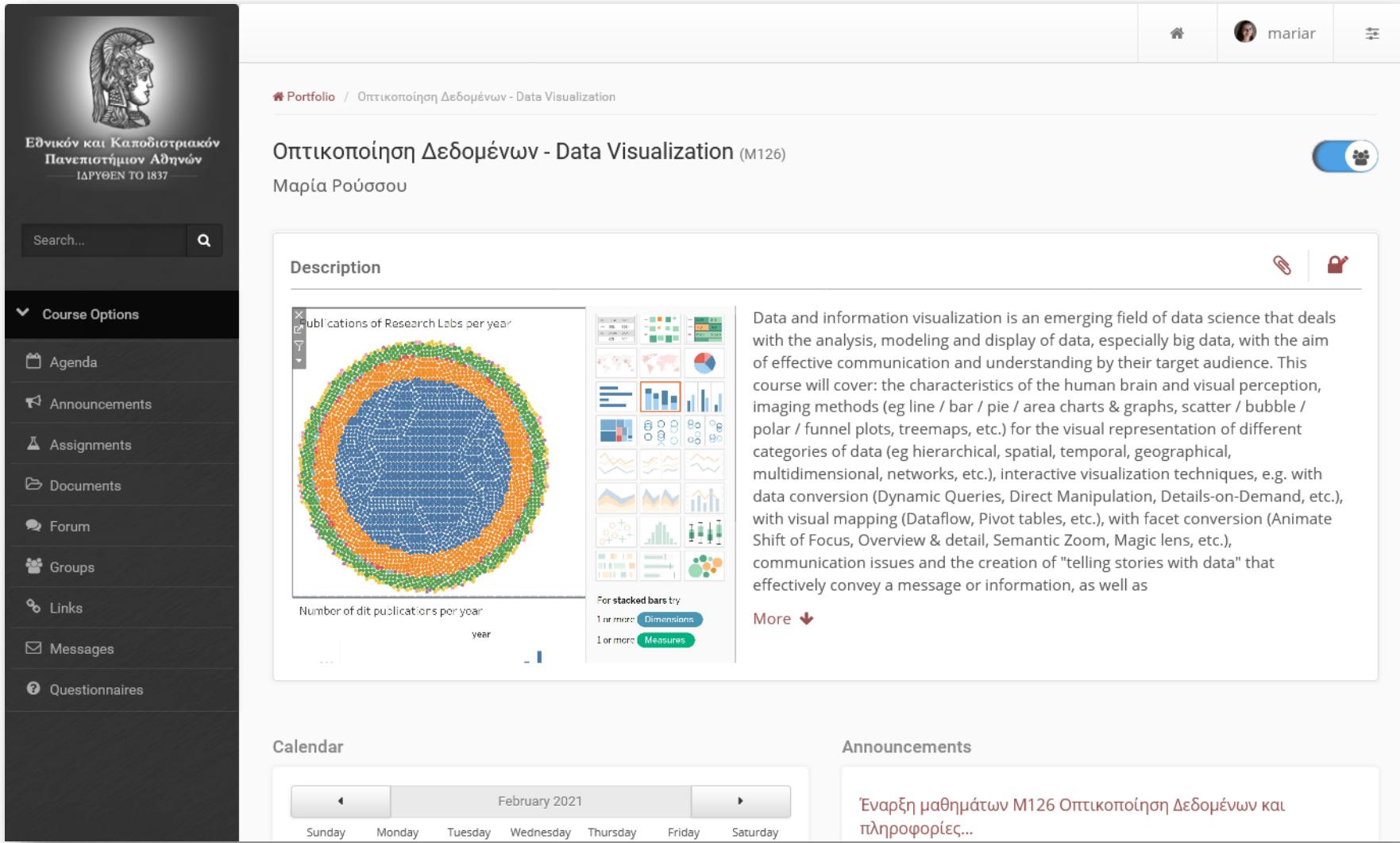
## Course style

---

- **Interactive & participatory**: active participation is a must!
- **By example**: real-world case studies
- **Up-to-date**: constantly abreast of new developments
- **Critique**: other work and our own
- **Research**: be prepared to spend significant amounts of time researching examples and reading papers

# Course announcements, material, assignments

- e-class - <https://eclass.uoa.gr/courses/DI453/>



The screenshot shows the e-class course interface for the course M126 Data Visualization. The top navigation bar includes a home icon, a user profile for 'mariar', and a menu icon. The main content area displays the course title 'Οπτικοποίηση Δεδομένων - Data Visualization (M126)' and the student name 'Mariá Roussou'. A large circular bubble chart titled 'Publications of Research Labs per year' is shown, with the x-axis labeled 'Number of publications per year' and the y-axis labeled 'year'. To the right of the chart is a grid of icons representing various data visualization types. The 'Description' section contains a detailed text about the course, mentioning data science, analysis, modeling, and communication. Below the description is a 'More' button. At the bottom, there are sections for 'Calendar' and 'Announcements', with a message in Greek: 'Έναρξη μαθημάτων M126 Οπτικοποίηση Δεδομένων και πληροφορίες...'.

# Course agenda

- e-class - <https://eclass.uoa.gr/courses/DI453/> > Agenda

Εθνικόν καὶ Καποδιστριακόν  
Πανεπιστήμιον Αθηνῶν  
ΙΔΡΥΘΕΝ ΤΟ 1837

Search...

Course Options

Agenda

Announcements

Assignments

Documents 1

Forum

Groups

Links

Messages 1

Questionnaires

Portfolio / Οπτικοποίηση Δεδομένων - Data Visualization / Agenda

Οπτικοποίηση Δεδομένων - Data Visualization (M126)

Agenda

July 2022

[13] Final Group project presentations - Παρουσιάσεις εργασιών (Duration: 3:00 hours)  
Friday July 1, 2022 (hour: 18:00)

May 2022

[12] Data Viz tools (D3) (Duration: 3:00 hours)  
Wednesday May 25, 2022 (hour: 18:00)

[11] Group project proposal presentations (Duration: 3:00 hours)  
Wednesday May 18, 2022 (hour: 18:00)

... [1] Data viz Group project proposal  
Tuesday May 17, 2022 (hour: 23:55)

[10] Data Viz tools (R - shiny & D3) (Duration: 3:00 hours)  
Wednesday May 11, 2022 (hour: 18:00)

[09] Data Viz tools (R - RStudio - ggplot2 - plotly - shiny) (Duration: 3:00 hours)  
Wednesday May 4, 2022 (hour: 18:00)

April 2022

[08] Interaction (cont'd) & assignment #2 presentations (Duration: 3:00 hours)  
Wednesday April 13, 2022 (hour: 18:00)

... [1] assignment #2 - dataset visualization using Tableau  
Sunday April 10, 2022 (hour: 23:55)

[07] VR Interaction (Duration: 3:00 hours)  
Wednesday April 6, 2022 (hour: 18:00)

March 2022

[06] Representation (cont'd) (Duration: 3:00 hours)  
Wednesday March 30, 2022 (hour: 18:00)

[05] Representation (intro) & Tableau seminar (Duration: 3:00 hours)  
Wednesday March 23, 2022 (hour: 18:00)

... [1] assignment #1 - build an HTML, CSS website  
Sunday March 20, 2022 (hour: 23:55)

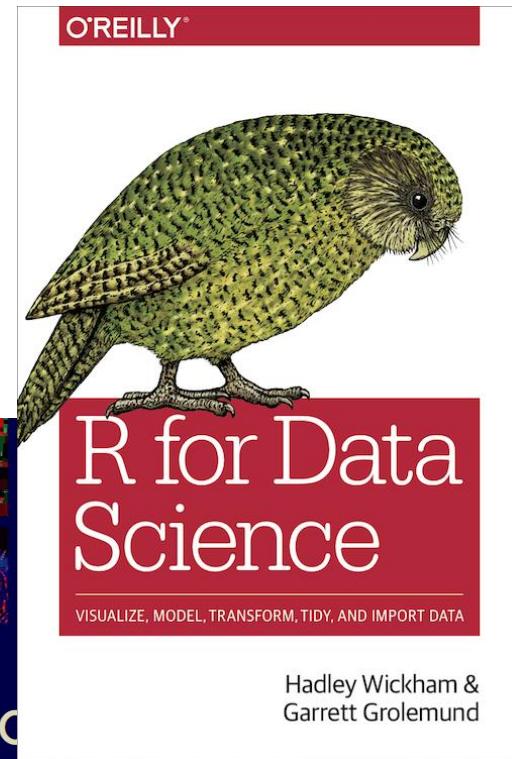
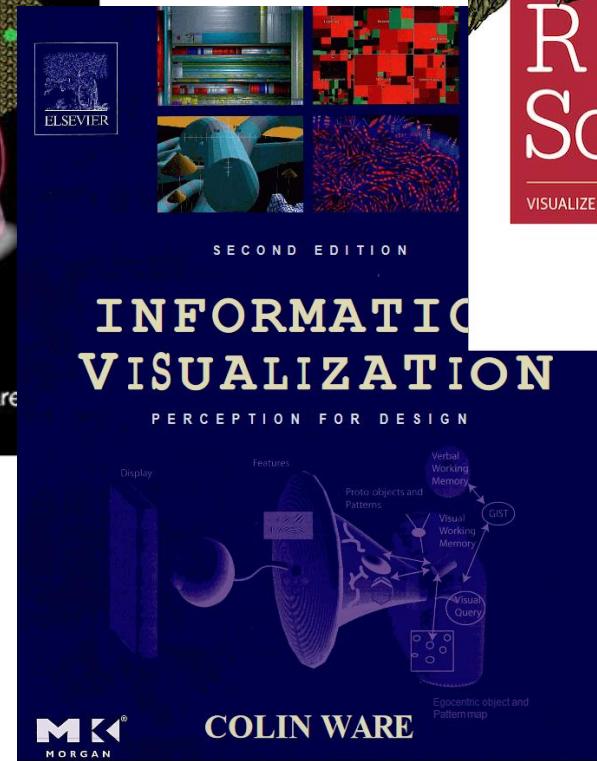
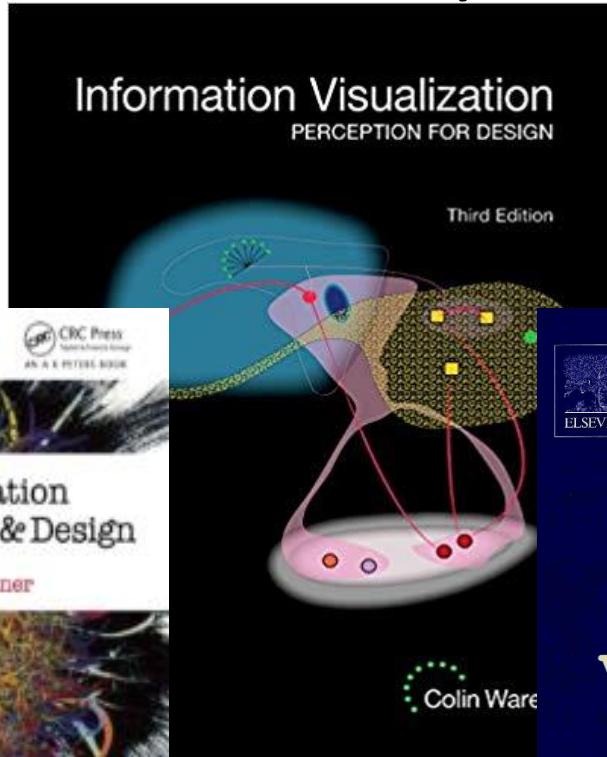
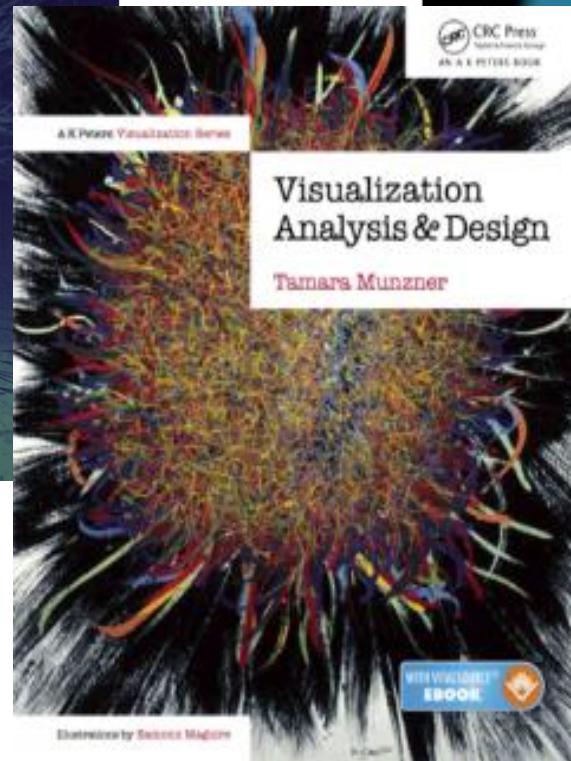
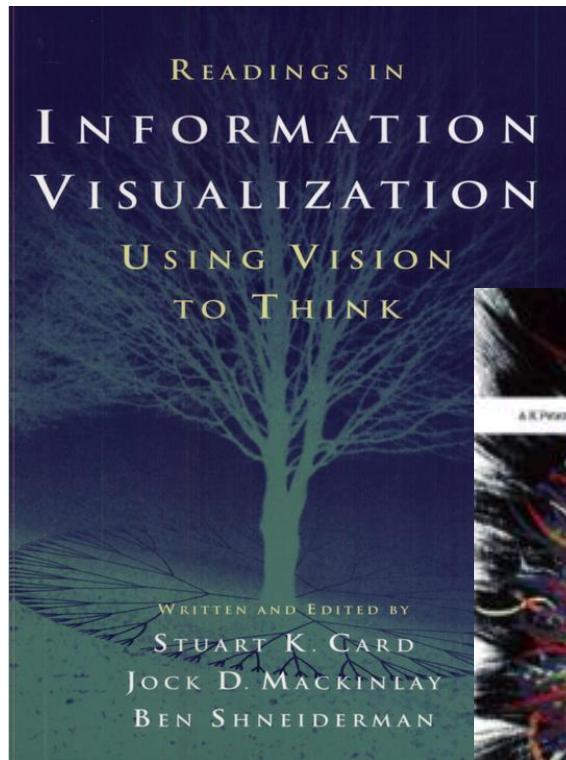
[04] Perception - part 2 (Duration: 3:00 hours)  
Wednesday March 16, 2022 (hour: 18:00)

[03] Perception - part 1 (Duration: 3:00 hours)  
Wednesday March 9, 2022 (hour: 18:00)

[02] What is Visualization and Why (Duration: 3:00 hours)

# Course references

- No obligatory course book, but many to draw from



Hadley Wickham &  
Garrett Grolemund

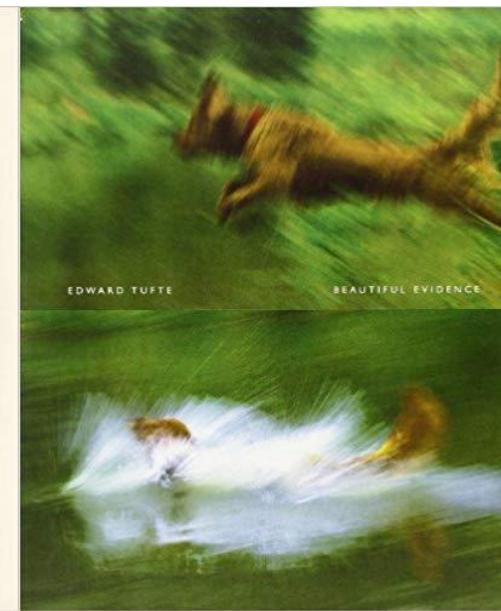
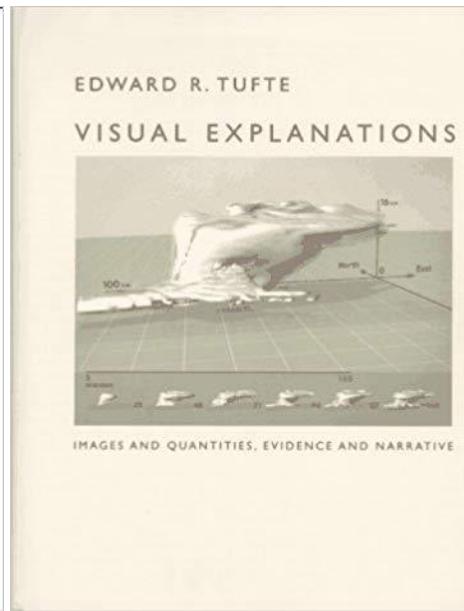
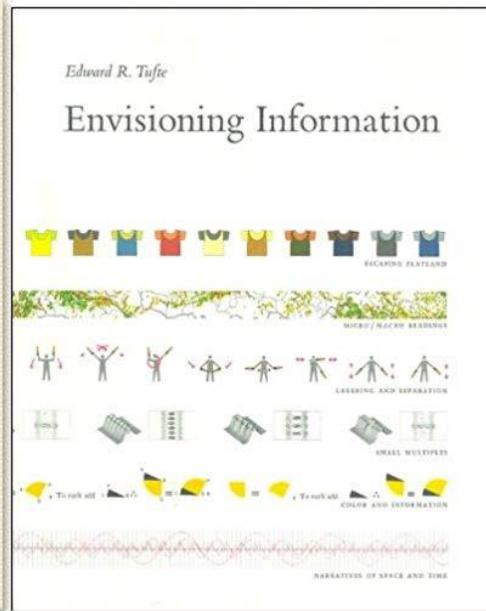
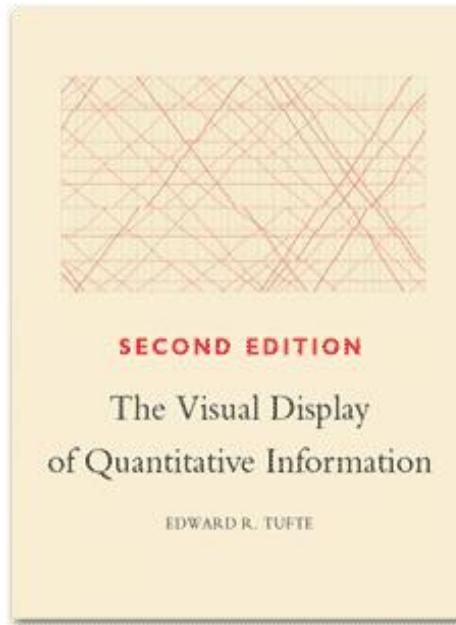
## References (books)

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- Bederson, B. B., & Shneiderman, B. (2003). *The Craft of Information Visualization: Readings and Reflections*. Morgan Kaufmann Publishers.
- Card, S. K., Mackinlay, J., & Shneiderman, B. (1999). *Readings in Information Visualization: Using Vision to Think*. (S. K. Card, J. Mackinlay, & B. Shneiderman, Eds.). Morgan Kaufmann.
- Munzner, T. (2014). *Visualization Analysis and Design*. CRC Press, A. K. Peters Visualization Series. Ch.1: What's Vis, and Why Do It?
- Murray, S. (2017). *Interactive Data Visualization for the Web* (2nd ed.). O'Reilly Media.  
<https://alignedleft.com/tutorials/d3/>
- Spence, R. (2014). *Information Visualization: An Introduction* (3rd Editio). Springer International Publishing Switzerland.
- Ware, C. (2013). *Information Visualization: Perception for Design* (3rd Edition). Morgan Kaufmann.
- Grolemund, G., & Wickham, H. (2017). *R for Data Science*. O'Reilly Media. Retrieved from <https://r4ds.had.co.nz/>

## References (books)

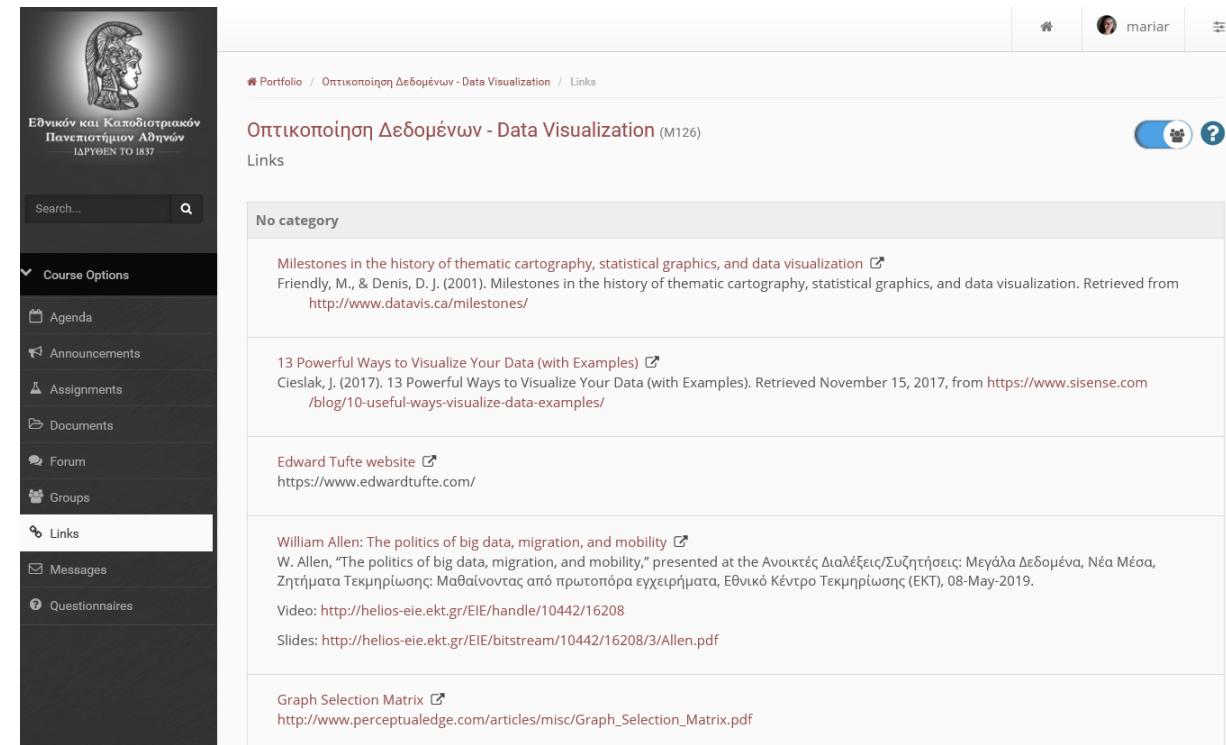
- Tufte, E. R. (2001). *The Visual Display of Quantitative Information* (2nd ed.). Graphics Press.
- Tufte, E. R. (1990). *Envisioning Information* (4th ed.). Graphics Press.
- Tufte, E. R. (1997). *Visual Explanations: Images and Quantities, Evidence and Narrative*. Graphics Press.
- Tufte, E. R. (2006). *Beautiful Evidence* (1<sup>st</sup> ed.). Graphics Press.



<http://www.edwardtufte.com/tufte/>

# Other resources

- Websites with examples (e.g., [Flowing Data](#))
- Data / datasets (e.g., [Kaggle](#))
- Videos (e.g., Hans Rosling's talks)
- Conferences (e.g., [IEEE Vis](#))
- Tools (e.g., Tableau)



Portfolio / Οπτικοποίηση Δεδομένων - Data Visualization / Links

Οπτικοποίηση Δεδομένων - Data Visualization (M126)

Links

No category

Milestones in the history of thematic cartography, statistical graphics, and data visualization ↗  
Friendly, M., & Denis, D. J. (2001). Milestones in the history of thematic cartography, statistical graphics, and data visualization. Retrieved from <http://www.datavis.ca/milestones/>

13 Powerful Ways to Visualize Your Data (with Examples) ↗  
Cieslak, J. (2017). 13 Powerful Ways to Visualize Your Data (with Examples). Retrieved November 15, 2017, from <https://www.sisense.com/blog/10-useful-ways-visualize-data-examples/>

Edward Tufte website ↗  
<https://www.edwardtufte.com/>

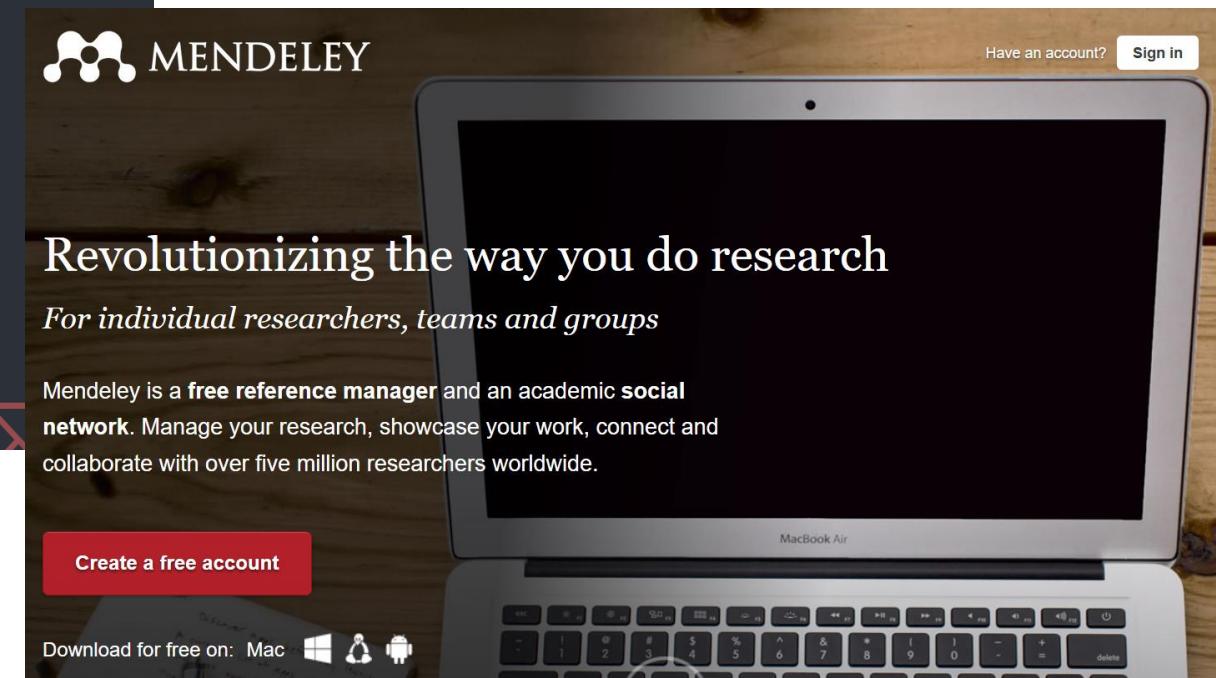
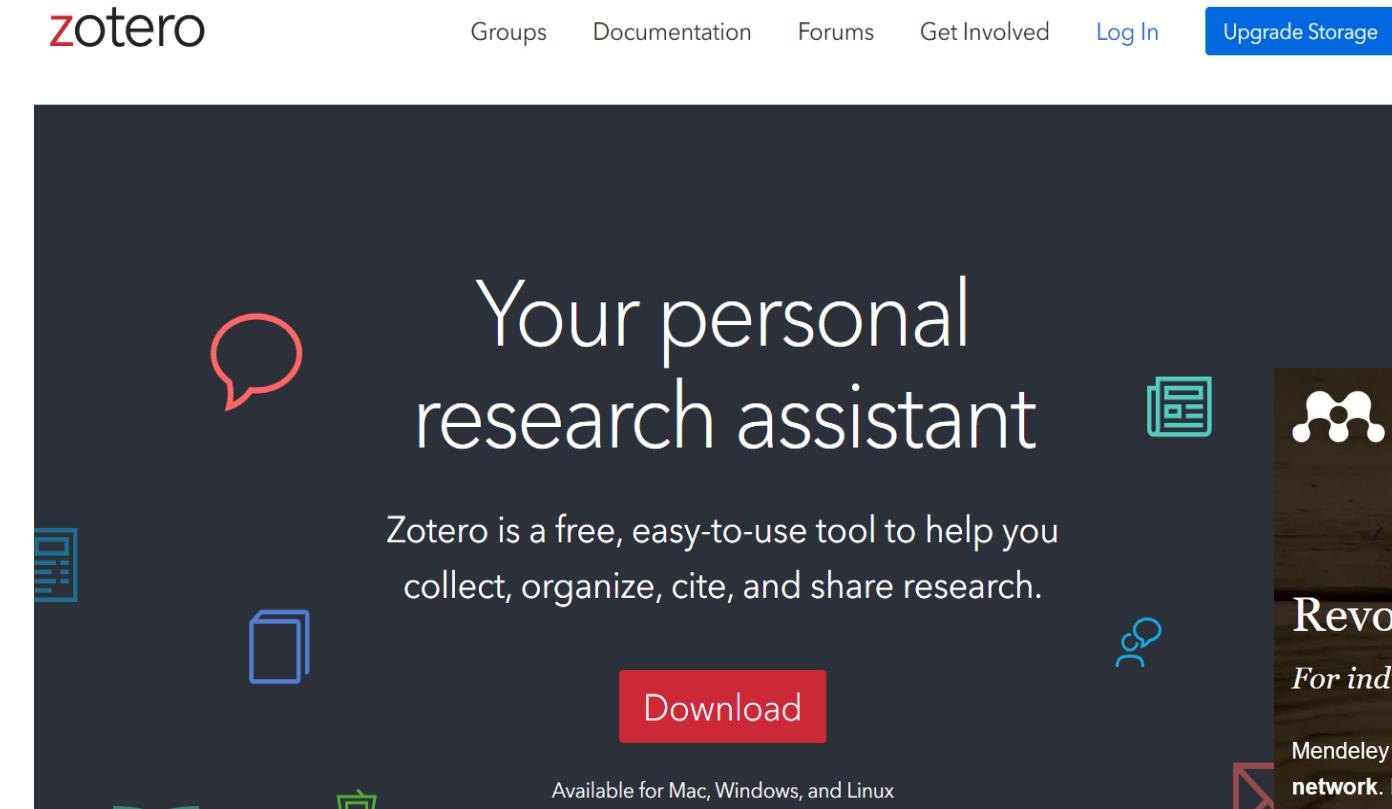
William Allen: The politics of big data, migration, and mobility ↗  
W. Allen, "The politics of big data, migration, and mobility," presented at the Ανοικτές Διαλέξεις/Συζητήσεις: Μεγάλα Δεδομένα, Νέα Μέσα, Ζητήματα Τεκμηρίωσης: Μαθαίνοντας από πρωτόπορα εγχειρήματα, Εθνικό Κέντρο Τεκμηρίωσης (EKT), 08-May-2019.  
Video: <http://helios-eie.ekt.gr/EIE/handle/10442/16208>  
Slides: <http://helios-eie.ekt.gr/EIE/bitstream/10442/16208/3/Allen.pdf>

Graph Selection Matrix ↗  
[http://www.perceptualedge.com/articles/misc/Graph\\_Selection\\_Matrix.pdf](http://www.perceptualedge.com/articles/misc/Graph_Selection_Matrix.pdf)

# Course material - Get organized

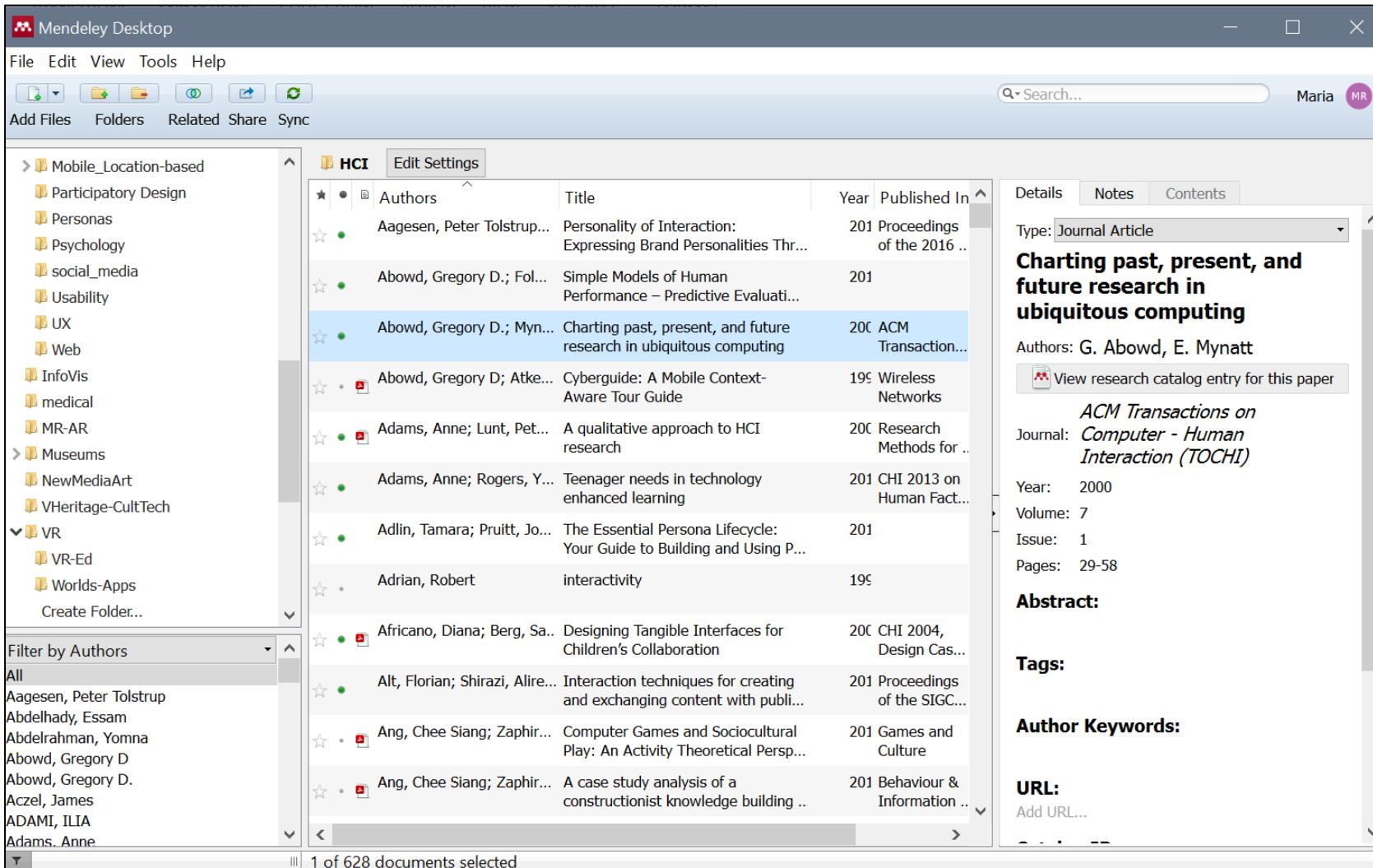
- <https://www.zotero.org/>, <https://www.mendeley.com/>

**zotero**



# Course material - Get organized

## ■ Get organized: example Mendeley Desktop



The screenshot shows the Mendeley Desktop application interface. The left sidebar displays a hierarchical library structure with categories like Mobile\_Location-based, HCI, VR, and others. The main pane shows a list of research papers in the HCI field, with one paper selected: "Charting past, present, and future research in ubiquitous computing" by Abowd, Gregory D.; Mynatt, Elizabeth. The right pane provides detailed information about the selected paper, including the journal (ACM Transactions on Computer-Human Interaction (TOCHI)), year (2000), volume (7), issue (1), and pages (29-58). It also shows the abstract, tags, author keywords, and URL.

**Charting past, present, and future research in ubiquitous computing**

Authors: G. Abowd, E. Mynatt

View research catalog entry for this paper

ACM Transactions on Computer-Human Interaction (TOCHI)

Year: 2000

Volume: 7

Issue: 1

Pages: 29-58

**Abstract:**

**Tags:**

**Author Keywords:**

**URL:**  
Add URL...

# Course content

---

- **Introduction & definitions**
  - Getting-to-know-us and practicalities
  - What is DataViz and why do it
  - Examples
- **Perception**
  - visual channel characteristics, color, size, shape, spatial layouts, etc., how human perception relates to creating effective data visualizations
- **DataViz Principles – Representation**
  - Raw data & data types, representation techniques (charts, lines, etc.)
- **Presentation**
  - Scrolling, flipping, context and detail, focus, zooming, etc.
- **Interaction**
  - Dynamic queries, Direct walk, Details-on-demand, Brushing, etc.

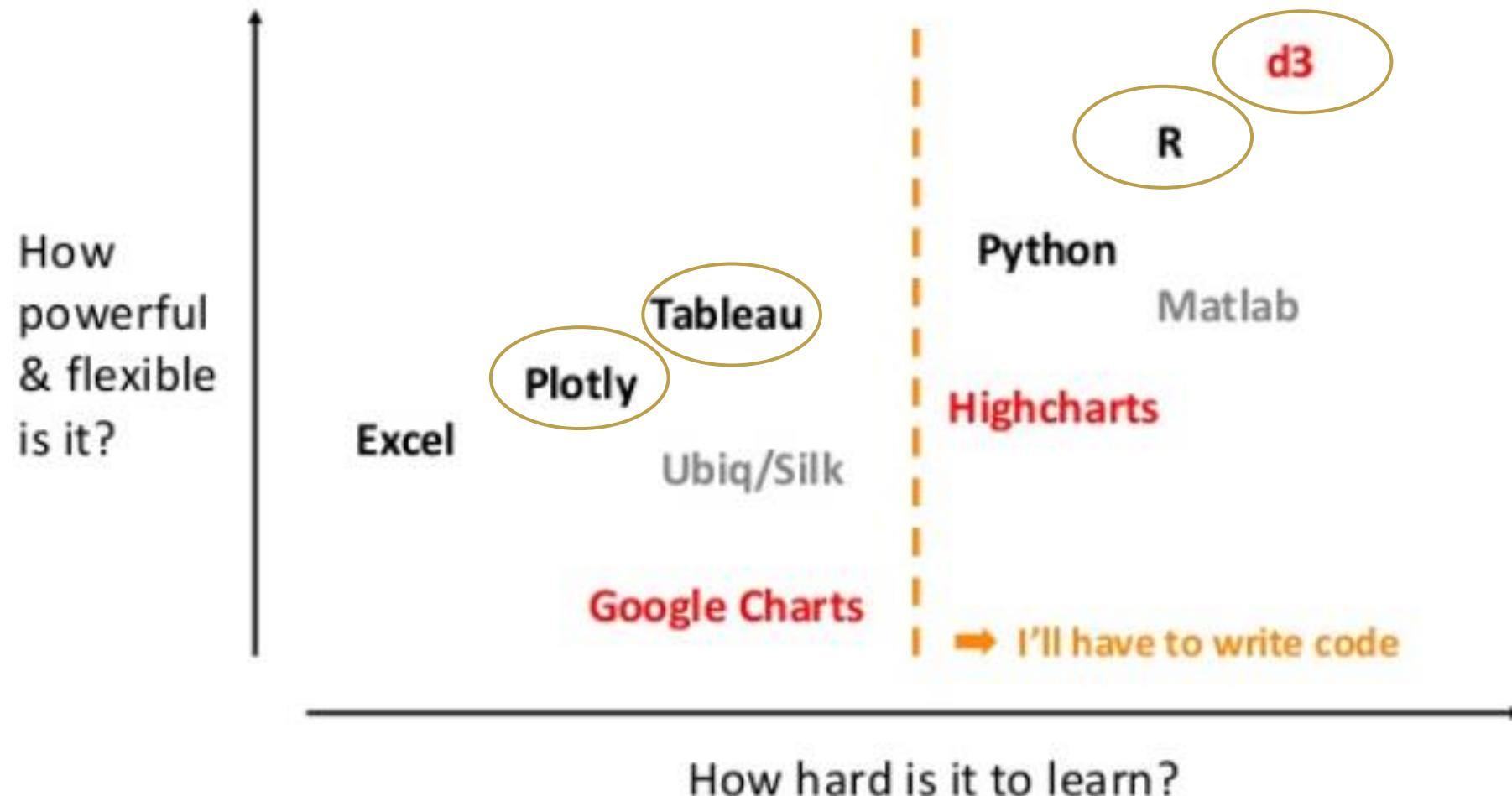
# Course content

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- Visualization Tools
  - (Excel)
  - Tableau
  - R (using tidyverse which includes ggplot, Shiny...)
  - D3 (via [Observable](#))
  - (Python)

# Course content

## ▪ Visualization Tools



## Course content

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- What is data visualization?
- What are the main purposes of data visualization?
- What are the major advantages of data visualization?
- What are the criteria of good visualizations?
- What kind of strengths of human visual system we should exploit for data visualization?
- What kind of weaknesses of human visual system we should avoid for data visualization?

## What this course is NOT about

---

- It is not a graphic design course
- It is not a course to learn tools

*but*

- Exposure to a number of visual design concepts & tools
- Support by experts

## Assignments

---

- ~Week 3: individual assignment (Html5, CSS,...)
- ~Week 7: individual assignment (Tableau)
- ~Week 9: individual assignment (*tbd*, R)
- ~Week 11: individual assignment (*tbd*, D3)

- ~Week 13: Final Project Presentation
- ~Week 16: Project documentation

(see eClass agenda for due dates)

## Group Project

---

- To visualize effectively a dataset
- Main phases of work:
  - Conceptualization - design
  - Implementation
  - Presentation (& documentation)

<https://tinyurl.com/m126-projects>

# Final Group Projects 2023-2024

## ▪ 2023-2024 Group projects

<https://t.ly/4b3G3>

### 1. Visualizing Spotify Music Streaming Trends

<https://spotifyviz.vercel.app/>



### 2. MobiliCity

<https://eirkyr.github.io/MobiliCity/>



### 3. «Are we done with Airbnb yet? Alternative: Rents VS Airbnb, FIGHT!»

<https://m126-visualizations-project.000webhostapp.com/M126-Template/>

### 4. Visualizing the Environmental Impact of Electric Vehicles

<https://wheelygoodair.ovh/>

### 5. Visualizing Economic Indicators for Global Education (Connecting Education & Finance)

<https://evankos.netlify.app/>

### 6. Visualizing Athens Airbnb Trends Insights for Hosts and Travelers

<https://sophiaross26.github.io/Airbnb-project/>

### 7. Visualising Greece's Demographic Downturn

<https://kostantinostheo.github.io/vizginius/>

### 8. Αμβλώσεις: Οπτικοποίηση της έρευνας και των στατιστικών στοιχείων για τις αμβλώσεις

<https://nikpnevmatikos.github.io/Data-Visualization-Abortion-Laws/>

### 9. Wanna EU Relocate?

<https://nikoletos-k.github.io/Wanna-EU-Relocate-DataViz-2024/>

### 10. Visualizing the Humanitarian Crisis in Palestine

<https://zazos.github.io/DataViz-website>



### 11. Talk is cheap; show me the code

<https://jimtsiob.github.io/data-viz-comp-prog/>

# Final Group Projects 2022-2023

## ■ 2022-2023 Group projects

<https://tinyurl.com/m126-2023>



How Personality, Health Problems and Height affect dog's Longevity



Visualizations | About | Credits

### The Data Science Journey Roadmap: Salaries & Insights

#### Data Science Positions Popularity

The chart displays the top 12 positions in terms of popularity within the data industry and provides a valuable overview of the most sought-after roles.

It is worth noting that data-oriented positions, such as Data Engineers, Data Scientists, and Data Analysts, are the most prevalent.



Home Language learning difficulty Language population Video Credits

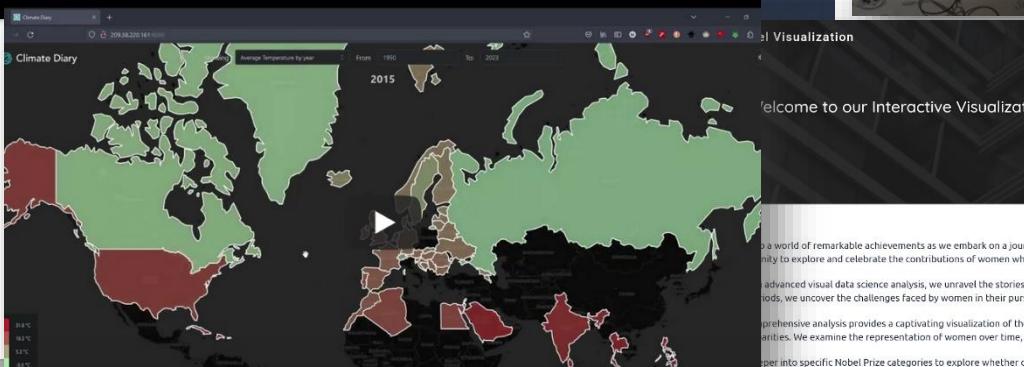
Φ7Φ

### Language Learning Difficulty

Brief information

How long does it take to learn a foreign language? Unfortunately, providing a precise answer to this question is impossible due to various factors that influence language learning. These factors include an individual's learning ability, motivation, learning environment, intensity of instruction, and prior experience with foreign languages. Additionally, the similarity between the target language and the learner's native language or previously acquired languages plays a role. Lastly, the desired level of proficiency also affects the time required for mastery. Furthermore, it is important to note that proficiency in a language is not a one-size-fits-all concept. It is typically evaluated based on four essential skills: speaking, reading, listening, and writing.

The levels of languages are influenced by various factors. Linguistic distance refers to the differences between languages and their evolution. Languages from the same language family like French, Spanish, and Italian have similarities, while languages from different families, such as German and Mandarin, are more linguistically distant. The farther your native language is from the language you're learning, the more challenging it may be. Grammar rules can also affect difficulty, as different languages have unique grammar structures. Pronunciation plays a role, with tonal languages like Mandarin requiring precise pronunciation and intonation. Writing systems vary, with some languages using the Latin alphabet, others having their own unique alphabets, and some based on distinct writing systems.



**The Nobel Prize (1901 - 2016)**  
**How difficult is to win one?**  
A comprehensive investigation

Home Dashboard Presentation About Credits

Welcome to our website! Through our investigation we delve into the realm of the Nobel Prize—a symbol of unparalleled prestige in the world of scientific achievement. Since its inception, the Nobel Prize has remained the pinnacle of recognition, fueling the aspirations and dreams of countless scientists across the globe. But how easy is it for someone to win this coveted prize? Is it merely a matter of luck, or does it require an extraordinary

ΑΡΧΙΚΗ ΟΠΤΙΚΟΠΟΙΗΣΗ ΣΥΓΧΡΟΜΑΤΑ ΚΑΙ ΒΙΝΤΕΟ ΠΗΓΕΣ

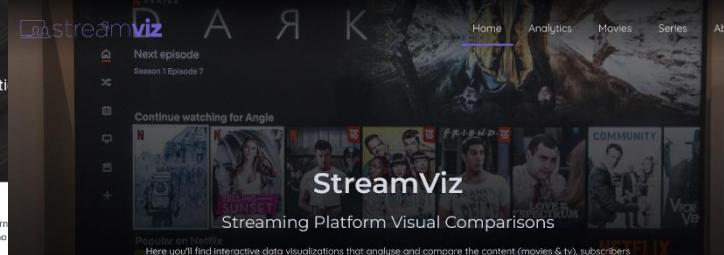
## Κίνδυνος Φτώχειας & Κοινωνικού Αποκλεισμού στην Ελλάδα

Οπτικοποίηση Λεζημάνων M126

Start

### Project Movies Visualization

Are you a movie enthusiast? This is the perfect site for you!



Streaming Platform Visual Comparisons

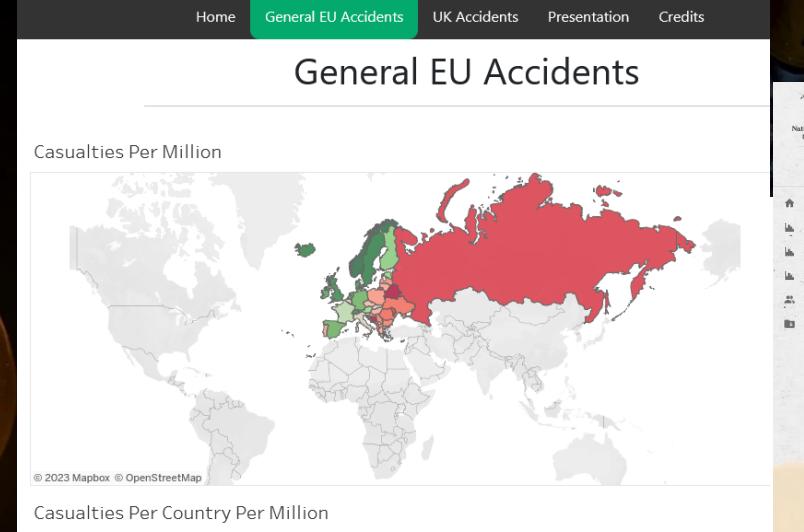
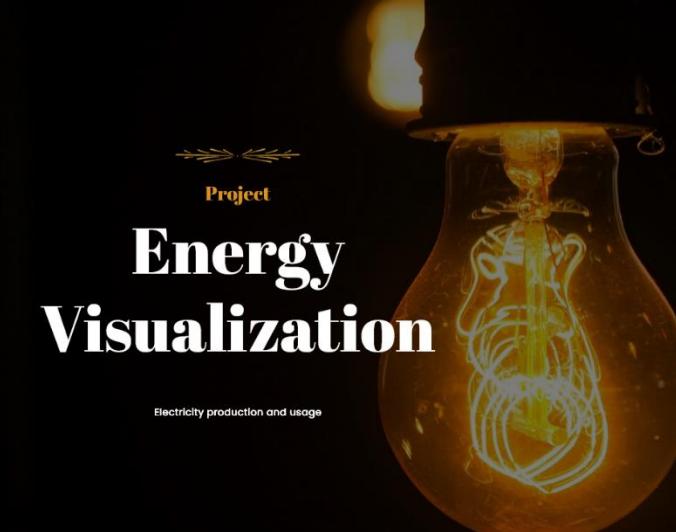
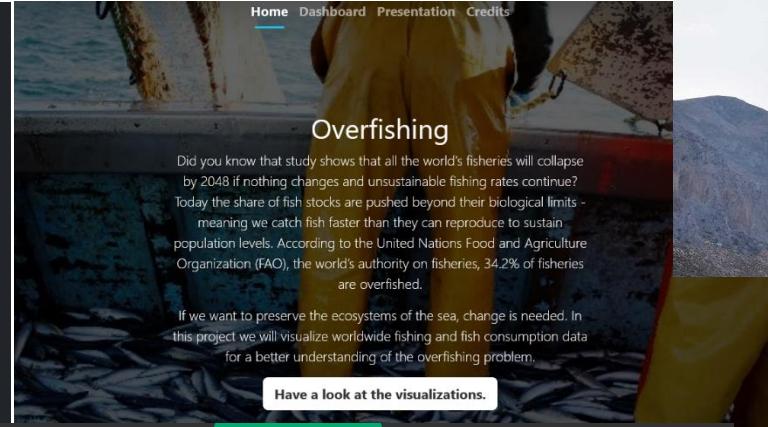
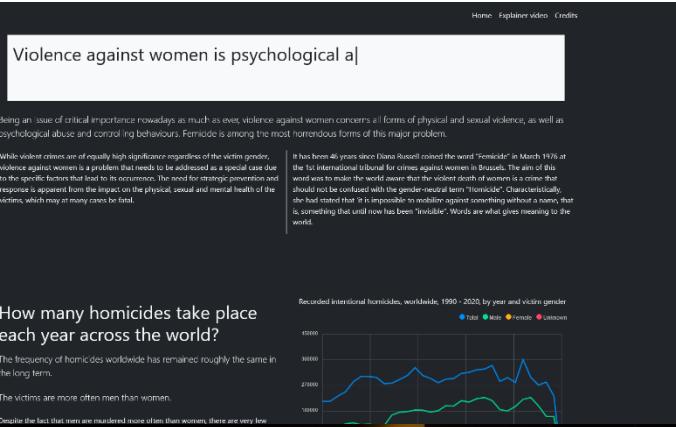
Here you'll find interactive data visualizations that analyse and compare the content (movies & tv), subscribers and revenue of the most popular streaming platforms today!

The Idea

# Final Group Projects 2022-2023

## ■ 2021-2022 Group projects

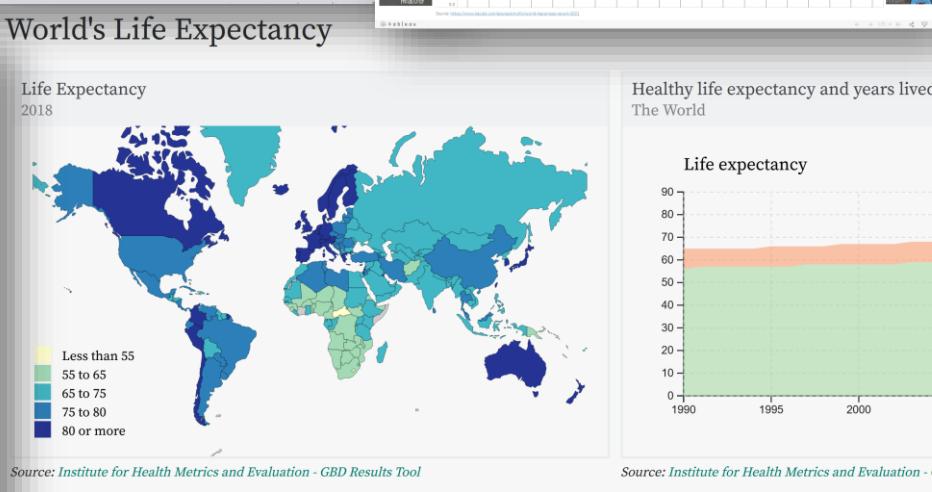
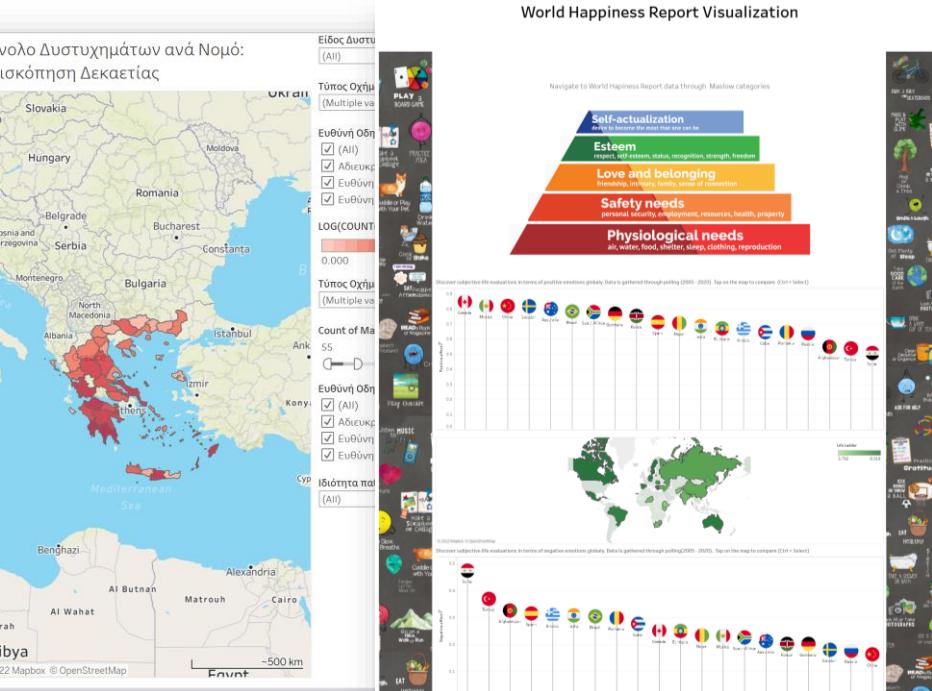
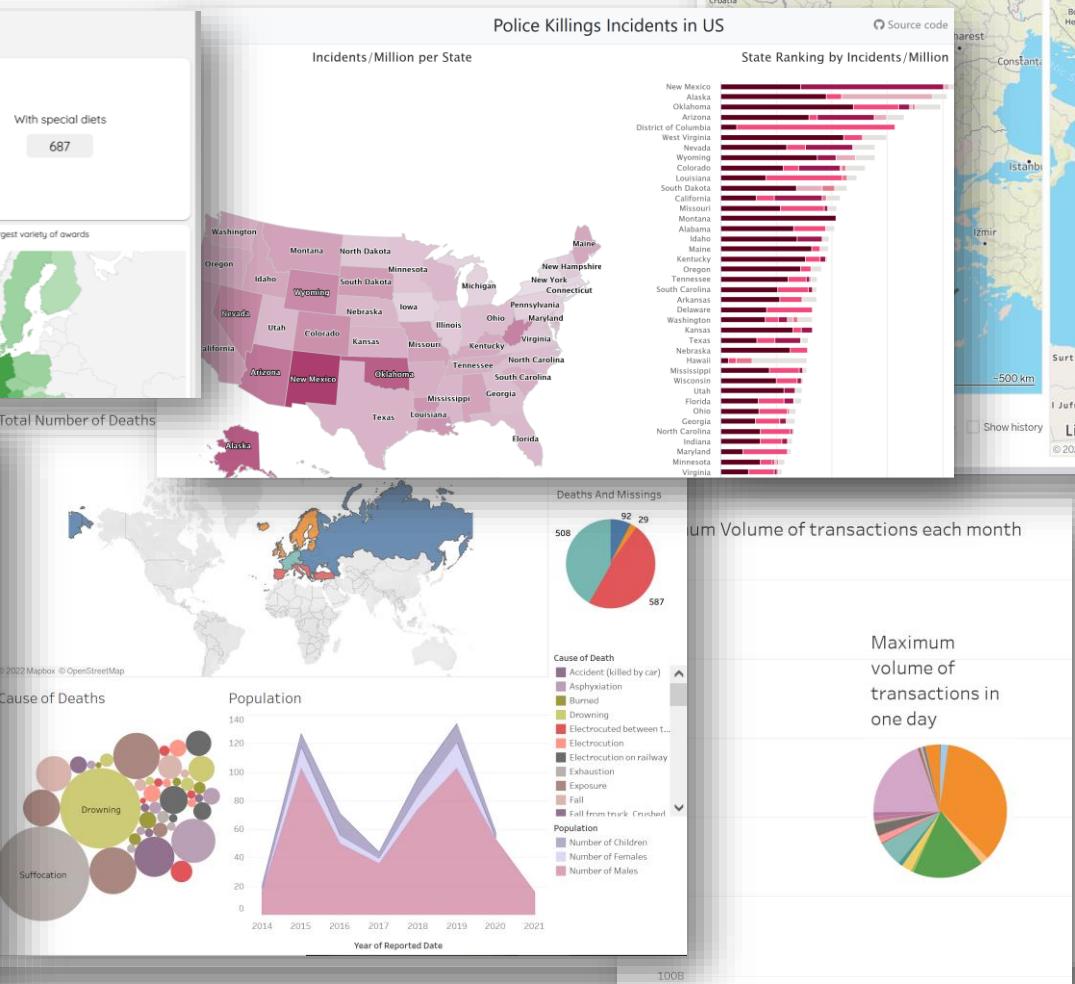
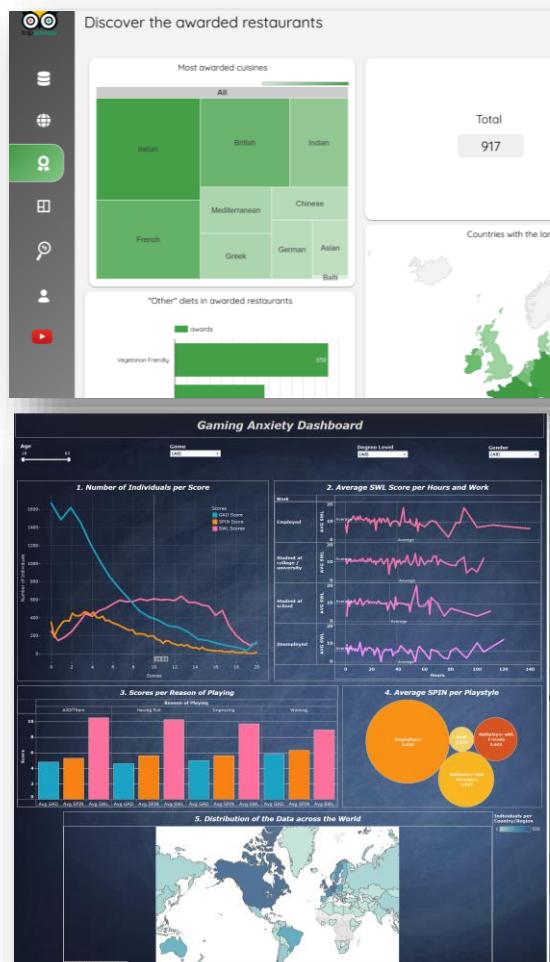
<https://tinyurl.com/328sxwe7>



# Final Group Projects 2020-2021

## ▪ 2020-2021 Group projects

<https://tinyurl.com/8tr3xms5>



# Final Group Projects 2020-2021

---

## 1. Restaurants in Europe: A Visualization Analysis

Site: <https://datastudio.google.com/u/0/reporting/d9941ae3-5460-43d1-ae10-4db6416db2a3/page/3nn6B>

Video: <https://youtu.be/PtcYpt6As1Y>

## 2. Cryptocurrencies

Site: <https://datavisualisation2021.github.io/Cryptocurrency/>

Video: <https://datavisualisation2021.github.io/Cryptocurrency/credits.html>

## 3. Εξαφάνιση Προσφυγικών Ροών 2014-2021

Site: <https://elenapashali.github.io/DataProjectGroup3/>

Video: <https://youtu.be/uJANgP5s41o>

## 4. Οδική Ασφάλεια

Site: <http://users.uoa.gr/~ic1200016/m126/index.html>

# Final Group Projects 2020-2021

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## 5. World Happiness Report Visualization

Site: <https://ippokratoys.github.io/world-life-happiness-visualization/>

Video: [https://youtu.be/Mizq\\_obRqvY](https://youtu.be/Mizq_obRqvY)

## 6. Gaming Anxiety

Site: [https://mikemitsios.github.io/Gaming\\_Anxiety/index.html](https://mikemitsios.github.io/Gaming_Anxiety/index.html)

Video: <https://www.youtube.com/watch?v=taYprdbYI0E>

## 7. World's Life Expectancy

Site: <https://lefkothea-bianca.github.io/Data-Visualization-Project.github.io/>

Video: <https://youtu.be/QKzmGfvBxus>

## 8. Police Killings Incidents in US

Site: <https://jbalasis.github.io/dataVisualization/dashboard>

Video: <https://jbalasis.github.io/dataVisualization/video>

## 9. Students' Performance

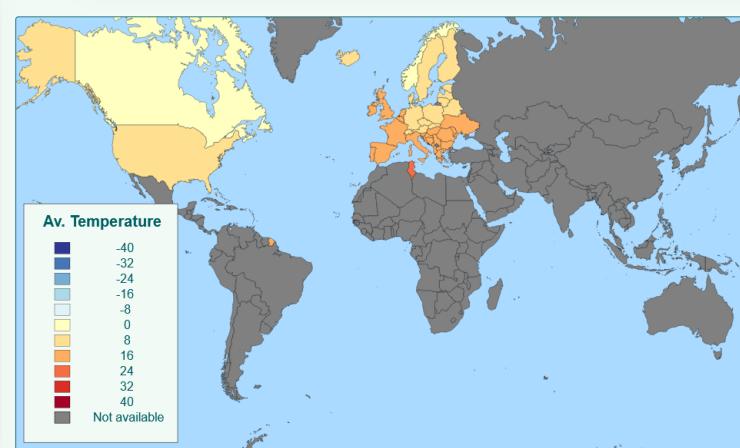
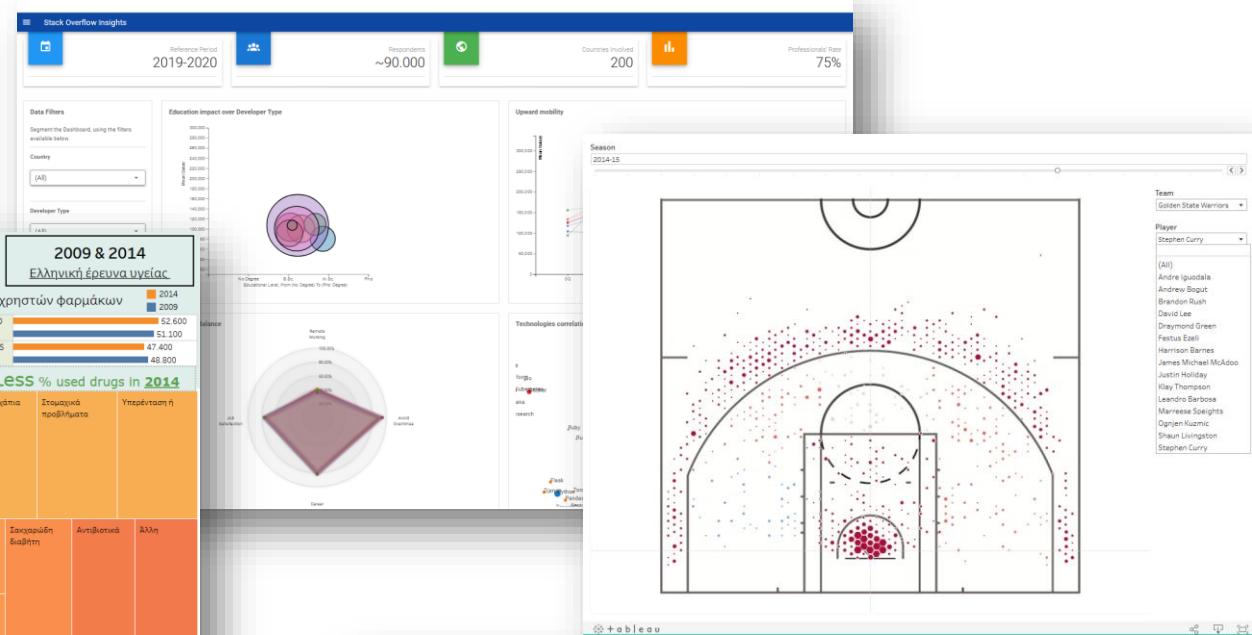
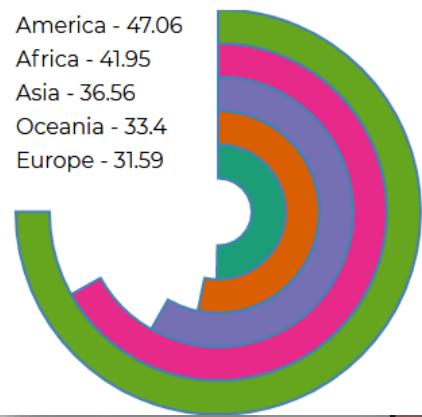
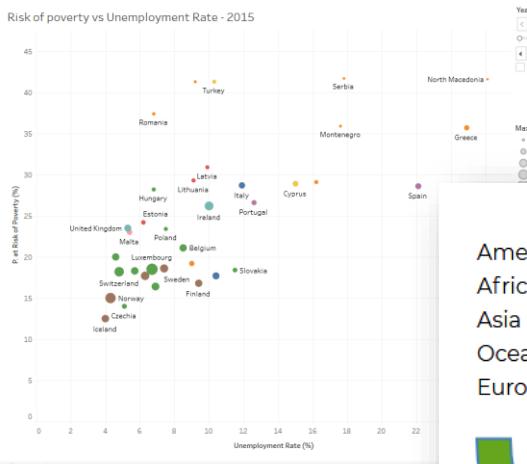
Site: <https://app.powerbi.com/groups/me/apps/cc52c2b9-b854-42b1-99cf-f873e3d6c20c/reports/34c779d7-9c5b-42a2-b0b8-847e33c6fc03/ReportSection>

Video: [https://drive.google.com/file/d/13RX7\\_iuDjaj9Ek0DpQ2CzOJb\\_PytmSTP/view](https://drive.google.com/file/d/13RX7_iuDjaj9Ek0DpQ2CzOJb_PytmSTP/view)

# Final Group Projects 2019-2020

## ▪ 2019-2020 Group projects

<https://tinyurl.com/y76394h2>



# Final Group Projects 2019-2020 (1/2)

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## 1. Health data visualizations in Greece

Site: <https://vnansi.github.io/dashboardabouthealth>

Video: [https://youtu.be/\\_qVkE7krq5I](https://youtu.be/_qVkE7krq5I)

## 2. Netflix Data Visualisation

Site: <https://kleanthi7.shinyapps.io/NetflixDataVisualisation>

Video: <https://www.kapwing.com/videos/5f0b66a3dce446001502e5c8>

## 3. The Big Screen Visualization

Site: <https://xkitsios.github.io/DataVizProject/>

Video: <https://youtu.be/7j08kc5-c6E>

# Final Group Projects 2019-2020 (1/2)

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## 4. NBA Shot Evolution

Site: <https://in7ictus.github.io/m126/>

Video:

<https://github.com/in7ictus/m126/blob/master/assets/presentation.mp4>

## 5. Stack Overflow Insights

Site: <https://stackoverflow-viz-app.github.io/stackoverflow-developers-insights/>

Video: <https://youtu.be/wSOmzuOE2eA>

## 6. World Income inequality

Site: <https://income-inequality-dv.herokuapp.com/dashboard>

Video: <https://income-inequality-dv.herokuapp.com/video>

## Final Group Projects 2019-2020 (2/2)

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### 7. Social Inequalities between EU students

Site: <https://jvardas.github.io/group-7-dataviz/>

Video: <https://vimeo.com/437672319>

### 8. Movie Data Visualization

Site: [http://83.212.107.231/#main\\_dashboard\\_graphs](http://83.212.107.231/#main_dashboard_graphs)

Video: <https://www.dropbox.com/s/kp6ia864v0yydbp/2020-07-12%2018-49-15.mkv?dl=0>

### 9. Global Warming

Site: <https://kostis30fyllou.github.io/climate-change/>

Video: <https://www.youtube.com/watch?v=OwR-5u2MhfI&feature=youtu.be>

- See

**“The Role of Big Data Visualization in an Era of Pandemics”**

Open Conference, November 2020

<https://youtu.be/xP257qHKcME>

Next

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# Data Visualization: What and why?

## Homework assignment

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“Build a basic website about yourself using HTML5, CSS, SVG, Javascript, jQuery”

The website must include at least 3 interlinked webpages containing:

- 1-2 paragraphs about yourself and a picture of yourself
- CSS to style the pages, with specific styles for at least 5 elements
- On one page, a **data-driven visualization image** that you found on the web, with a one paragraph explanation of why you chose it
- On one page give credit to all the sources you have used to build the website (e.g. jQuery License: MIT and jQuery License)

## Homework assignment

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- One of the pages must include an SVG showing at the same time three animated (moving in time) and colored geometric shapes
- Must allow the user to click on the animated shapes and in response perform some action on the shapes (disappear them, freeze/unpause them, etc).

## Homework assignment

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Start by completing:

- [codecademy.com HTML and CSS tutorials](https://www.codecademy.com/learn/learn-html)
- [codecademy.com JavaScript and jQuery tutorials](https://www.codecademy.com/learn/learn-javascript)
- [W3schools SVG tutorial](https://www.w3schools.com/html/html_svg.asp)

Alternatively,

- [W3schools HTML](https://www.w3schools.com/html/html5.asp)
- [Dive Into HTML5 – Homepage](https://diveintohtml5.org/)
- [Dive Into HTML5 - Canvas](https://diveintohtml5.org/canvas.html)
- Links for visualization examples, feel free to browse through [bloomberg.com](https://www.bloomberg.com), [nytimes.com](https://www.nytimes.com), [nasa.gov](https://www.nasa.gov), ... (see eClass **Resources**)

Thank you!

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<https://eclass.uoa.gr/courses/DI453/>

Discord: <https://tinyurl.com/m126-discord-25>