Information Visualization - Project Report

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# INTRODUCTION

# One of the first things we are taught in school is how to read. And it is this knowledge that allows us to get most of the information in our lives. When learning, most of the time the way we gather the information we need is either through reading books, or in the present times, by reading articles on the internet and searching information through websites (i.e. Wikipedia).

# Not only is reading important when studying, but also, when reading books in our daily lives, and this is because reading helps us develop skills that are important to our wellbeing. It helps to improve your self-expression capabilities since you are extending your vocabulary, it can teach you how to deal with certain obstacles you find in life or help you to learn a new skill.

# Our desired outcome is understanding how different these habits are between different countries throughout Europe, and also try to find whether are correlations between them or not. if it has an impact in the overall picture of the demographics indicators such as the level of dropout or even high achievement in education system.

# Initially there were many questions about the subject that we wanted to answer through the visualizations, but after further study of the topic, we realized that there was a need to narrow our scope that would be feasible given our data limitations, and only to focus on the most important questions.

With this in mind, we decided to come out with the questions below, that should be answered by correlating reading habits metrics and some demographic indicators.

Possible Tasks

This visualization will allow to:

*Search*

* Add information related to tasks available in the idioms

*Identify*

* Add information related to tasks available in the idioms

*Explore*

* Add information related to tasks available in the idioms

*Years*

* Add information related to tasks available in the idioms

*Compare*

* Add information related to tasks available in the idioms

**Example Questions**

1. How many hours, in average, do the countries in EU spend reading?
2. What is the average income for education for level?
3. What is country reading habit and dropout rate?
4. Household expenditure in books?

## RELATED WORK

Regarding the inspiration and motivation for this work, it all began with our desire to present a work that could corelate important subjects and perhaps, untapped trends. However, theoretical lectures were also very helpful to gather useful information that guide us to structure the idea of how to encode the data, and what types of idioms to use in order to get the most out of available tools.

For our research subject specifically, we use different sources as websites, and scientific articles, to gather the highest amount of information, and data to support our subject, but most precisely reading habits across Europe. This led us to information like, time spent reading books.

Uma imagem com captura de ecrã

Descrição gerada automaticamente

Figure . Example of visualization of time spent reading books in Europe

In regard to implementation, we had good hints and useful examples from Eurostat, which in addition to the data, provides some visualizations on it. For example they had implemented a visualization of time spent reading books in bar chart, so it did not allow for a good assessment of the difference in terms of minutes, as the interval between minutes was too small, and it did not make a good differentiation between the colors used. However, it was a good example of what we should not do for our project.

We also like to mention that during laboratory presentations, whenever others groups presented their works, we learn and look carefully to their approach and sometimes we asked them to share the source of the code, so we could implement something similar.

**THE DATA**

Our main source of was the site Eurostat, which is the statistical office of the European Union. Its mission is to provide high quality statistics for Europe. It also provides allowed us to get the necessary information to fulfill our purpose of comparisons between countries data.

**Raw** **Data**

Originally our dataset was composed by about 10 different .csv and .xlsx files (approximately 614 KB of crude data), related to multiples countries from a time period of roughly from 2002 to 2016 – however, the most complete period of time in terms of data was approximately from the 2009 to 2018.

We face few challenges of acquiring and processing the data. Because at the beginning we wanted to compare time spent reding books with other metrics like rate of dropout, underachievement of students in reading, mathematics and science, average incoming by education level. But the lack of data with variables that could relate these domains, in way that the comparisons could make a really sense, and provide valuable information for the project, made us change a bit and focus only on the accurate data acquired and exploit them.

**Missing Values, and Data Cleaning**

Assuming that we had multiple data files with heterogenous format, gathered from the same source, but with different domains. It was challenging to standardize them.

To ensure the quality of the data needed to answer raised questions, it was necessary to attend a process of cleaning, that involved eliminate unwanted columns with unnecessary attributes to keep the coherency of the data. Also, there was a lot of empty cells, that we had to decide the best approach to address this problem. Therefore, for the case of some countries that were in a conflict or got divided along the years, we assign value “0” to cells that were empty and when we could not add a value, we erased the country.

In the other hand, most of data initially had column named value, which represented a value, for example, a percentage or minutes spent reding. It was necessary to rename each of value attribute with a name that identifies the domain that we were addressing.

None less important, we standardize the name of countries with the abbreviations of them, having in mind that we would use it to represent in graphs.

The process above described was possible by using Pentaho Data Integration as the main tool. Using transformations and other resources available on Pentaho Data Integration. The entire data in different formats were processed, and transformed to .json files, for later use in D3.

## VISUALIZATION

## In this section we will demonstrate our visualization implementation and discuss the idioms and the way they interact each other.

## What is your solution? Start with an overview of the system (layout, etc.), how it works (how data can be filtered, selected, etc) and then move on to describing the different visualization techniques, showing how each works and gets the job done.

**Rationale**

## Why did you think your techniques would work? What visual encodings did you use and why (and why not others)? What alternatives did you consider, even if they turned out not to work? Especially, discuss how you managed the complexity of real data, and matters of scalability. Also, include in your discussion the evolution of the prototype, from the initial sketches to the last version highlighting what you learned from version to version and how that influenced your design.

**Demonstrate the Potential**

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**IMPLEMENTATION DETAILS**

What challenges did you find and overcome? How did you implement the links between the views (incl. brushing, etc.)? What algorithms did you use? What techniques did you adapt, or implement, from scratch? (instead of just copying & pasting them from the D3 examples page...)

Figure 1. Use high-resolution images, 300+ dpi, legible if printed in color or black-and-white. Number all figures and include captions below, using Insert, Caption.

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# CONCLUSIONS AND FUTURE WORK

What did you learn? Were you able to address all the questions? If you were to start over, what would you have done differently? Also, if you now had 1 more month and €3000 do spend on this, what else would you do to enrich your solution?

The heading of a section should be in Arial 9-point bold, all in capitals (Heading 1 style). Sections should not be numbered.

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# ACKNOWLEDGMENTS

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