

# VISUALIZATION ABOUT OF WORLD HAPPINESS REPORT

## Members:

<b>Nychol Bazurto Gómez</b>	<b>200816960</b>
<b>Raúl Gutiérrez Villarraga</b>	<b>201528440</b>
<b>Carlos Torres Jimenez</b>	<b>201624280</b>

## STATE OF ART

In the field of visualization there are many different ways to represent data, there are many types of idioms that gave us a wide range of possibilities. The people in charge of making the best representation of the data take a good look of the tools they have before starting drawing pie charts and bars with no sense and once they have a purpose for the visualization in mind, it is time to think about what types of analysis will help to achieve that purpose.

This section tries to build an structured classification of the idioms or visualization used to build a solution to the client of the project. [1] Initially describing each idiom used in the proposed solution and then comparing those solutions to expert solutions exposed by scientist and experts in the field.

Before describing each idiom, it is important to describe the whole screen of visualizations where each chart will be placed. In the Whitepaper visual analysis guidebook [1] they suggest a configuration called Dashboards. Basically the dashboard is the main screen where all the detailed visualizations are placed. It gave us the first view of the problem, the resume of all the situation. The main idea of having aggregated visualizations or a dashboard is to present completely all the information to the user, and to be interactive, and coordinated between each visualization. [1] Dashboards increase the analytical power of the visualization by showing multiple perspectives in the same location. They can also be used to combine multiple types of data in a single location.



**Fig. 1** Coordinated view (Dashboard) while it is being highlighted.

The best practices for making a good dashboard are a number of recommendations that can become helpful when trying to implement a visualization with those characteristics. First, the most important view have to be at the top of the screen, or upper left corner, because the intuitive way for the human to read is beginning left to right, top to bottom, therefore the most important things in the screen must be top left at the first position of the eye path.

The second recommendation is to limit the number of views in the dashboard to three or four. If it has too many views, the big picture can get lost in the details. Another recommendation is to avoid using multiple color schemes, unless there are natural and independent color schemes in your data. Other important thing is that if it have multiple filters, it is better to group them together with a layout container. A light border around them gives a subtle visual cue that they have shared features.[1]

The interactivity it's very important for helping the user know what is the purpose and what is the potential of that visualization. There are several interactions with the view, a couple of those are the highlighting and the click. The highlighting let you quickly show relationships between values in a specific area or category, even across multiple views [1] performing a change of an attribute like color or size, that let the user know which object is selecting. This action, as said before, can be reproduced across multiple view, also changing the color of the data in each view if it is correlated.

Another way to perform interactions with the view are the filters, with them the user can explore the data, go from general to specific stuff and finally find what he's searching for in the visualization. The best practice is to have the filters always the closest to the view it is filtering, and it is better to have a filter for all of the views, finding the searched words into all of the visualizations displayed.

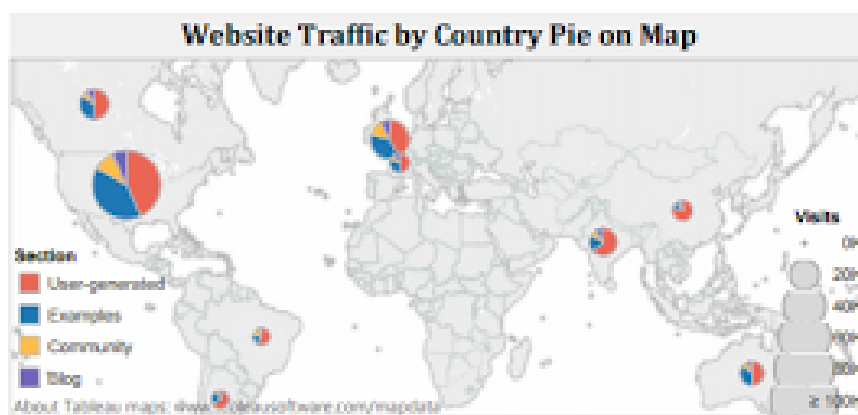
The first visualization analysed is the ranking of countries, it compare and rank countries, regions, based on one or a set of criteria. In many cases, this shows where we are and how are they doing. A bar chart is great for comparison and ranking because it encodes

quantitative values as length on the same baseline, making it extremely easy to compare values. [1] The list of country names are also a visualization of the data, it is a different kind of view and it fulfill the main task that consist of getting the max and min of the countries. there are several consideration about representing a ranking as a list or as a bar chart: one of them is the accuracy of the comparison.



**Fig 2** Ranking comparison as a bar chart.

According to Robert K. most of the embellishments have an adverse effect on the accuracy of reading values when comparing bars. [3] The tests they run showed not terribly surprising results, but it is now backed by actual research: most of the embellishments have an adverse effect on the accuracy of reading values when comparing bars.[3]

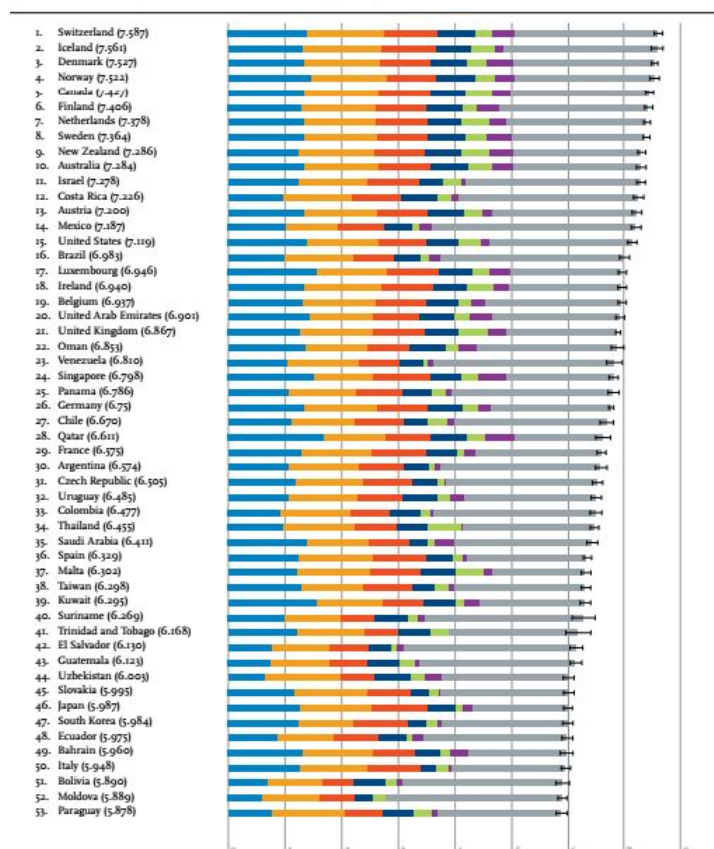


**Fig. 3** Aggregated view of a map and a pie chart of website traffic.

Showing geographical data it's not easy in the expert world, because the map is a restricted area, and the creator of the visualization can't do much for changing it. When it is necessary to show a location, the most common solution is to use a map, just remember that maps are often best when paired with another chart that details what the map displays, such as a bar chart sorted from greatest to least, a line charts showing the trends, or even just a crosstab to show the actual data. Although it is not recommendable pie charts for part-to-whole relationship, using pies on the map gets a rough breakdown view of each country, which can be very useful when complemented by other chart types. [1]

It's important to take into account that the visualization have different perceptions depending on the user watching it. [2] There is a basic generic chart ranking but more specifically in the best visualization know, there are different preferences depending on the area or depending on the theme or the interest of the user. For example a bar chart is not always good for all the users. Bar charts are not good enough for the scientific community users and the infographics [2] but for new media and government visualization is the best for users and it is well received.

Finally there are some recommendations for making a good and “memorable” [2] visualization. Attributes such as color and the inclusion of a human recognizable object enhance memorability. Similar to previous studies, visualizations with low data-to-ink ratios and high visual densities are more memorable than minimal, “clean” visualizations. It appears that the human is best at remembering “natural” looking visualizations, as they are similar to scenes, objects, and people, and that pictorial and rounded features help memorability. Unique visualization types (pictorial, grid/matrix, trees and networks, and diagrams) had significantly higher memorability scores than common graphs (circles, area, points, bars, and lines). [2]



**Fig. 4** Main visualization already made for the report.

Last but not least, the older report of happiness was taken into account, because they have done a lot of failed attempts for getting a good visualization. In the project it was taken all that visualizations in a sort of guide for not repeating the history anymore. [4]

# CHARACTERIZATION

## WHAT:

Our data is the same the last deliver, we identified as dataset type tables which have the next attributes:

### Ordered quantitative sequential attributes

- Healthy life expectancy.
- Social support.
- Freedom to make life choices.
- Generosity.
- Happiness score.
- Perceptions of corruption.
- GDP per capita.
- Dystopia.

### Categorical

- Countries.

Nevertheless, we could identify with the last one a possible geometric dataset, because they have an implicit geometry (countries), and the quantitative attributes are associated with each one (table about each country).

Dataset availability is static.

## WHY

In the last deliver we defined 7 tasks, but talking with the user, we refined them and we choose our four main tasks:

**T1: Discover** happiness **distribution** in the world. The user can interact with each country to obtain details on demand.

**T2: Identify** the happiness score and indexes by country (**features**).

**T3: Locate (knowing the country that I want to find (e.g. my country)** a country and **query** how happy is it and how indexes are in this. (**features**).

**T4: Identify** which countries are happier and which ones less happy (**extremes**).

## SECOND VERSION OF THE SOLUTION (HOW)

The first approach made, it was made using an idiom that is common to any user, without training, which will reuse his knowledge, choosing a "choropleth map".

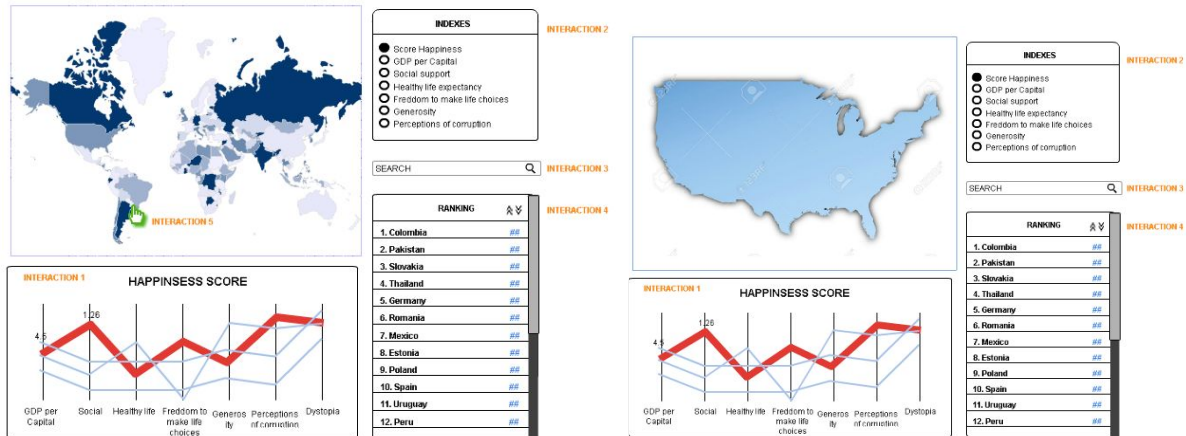
Additionally, we proposed several filters which let the user interacts with the idiom and satisfy defined tasks. In that moment, we discard riskier alternatives given the proposed scope (anyone in the general public).

However, given the feedback from the class, the expert and experience found in the state of the art, it was incorporated for this release coordinated views enriching the user experience,

providing a direct way to display indexes, exploiting a different idiom than traditionally used and which are effective in the main task of ranking (extremes), having:

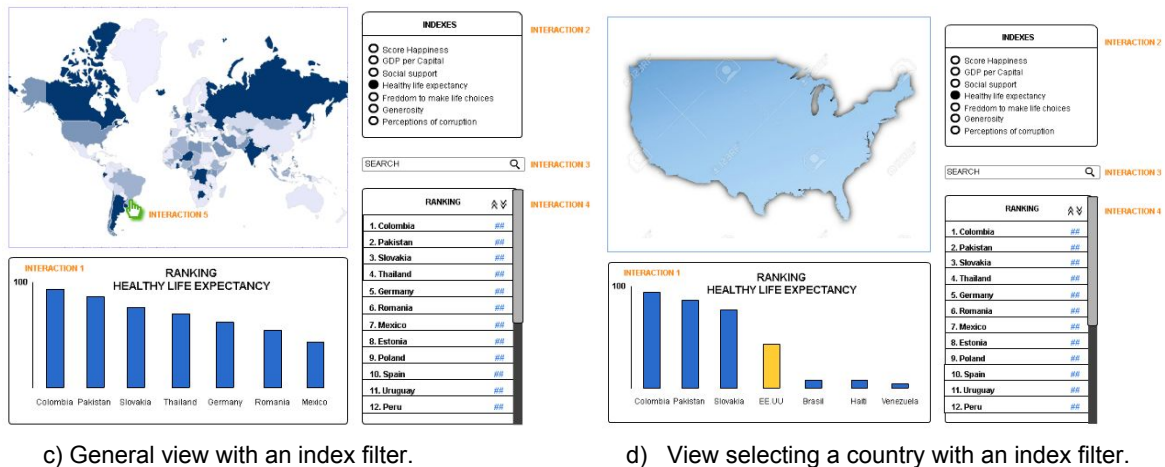
- **Juxtaposed view**, using as idiom parallel coordinates and, which they are **coordinated** and **linked** with choropleth map. When score happiness is selected and a country is selected in the map, parallels coordinates is going to reacts, **highlighting** indexes data about the selected country. Also, it's going to be incorporated a **geometric zoom** of the country, once selected.  
If an index filter is applied (e.g. per capital) , parallel coordinates change by bars, which they show the best 15 countries in that index (Fig 5, part c). When a particular country is **selected**, bars update, locating the country's bar and leaving the extreme bars (Fig 5, part d), in order to user identifies how it's the index of that country, respect to the extremes, this keeping in mind effectiveness of this idiom to compare and ranking , given the used channels and supported by [1].
- Choropleth map idiom is retained, to preserve something familiar to the user and reuse their common knowledge of the world.
- When user just makes a mouseover, it's incorporated like interaction, a pop up with the values about the last rankings (2015,2016...), this thinking in a light solution for the next reports.

In Figure 5, such adjustments are observed.



a) General view with the score happiness filter.

b) View selecting a country with the score happiness filter.



**Fig 5. Second version.**

In general, prioritized tasks are accomplished by the idioms in the next way:

**T1,T3, T4: Idiom Choropleth map.** Using possible geometry with **shapes** as mark and color with saturation or luminescence as channels to represent how happy is a country (a quantitative attribute: happiness score), this in order to respect expressiveness. User can **select** each country to know its happiness score and index values, by the coordinate view.

**T2:** Supported by the parallel coordinates which show indexes by country, using **hue** to **highlight** the selected country, and opacity with the others lines (Fig 4, part b).

**T4:** Supported also by the ranking list with an order function (ascend and descent) to make easier this task. In general is a table (spatially distributed text). The interaction **changes** the order of the list. When the user click over an item of the list, the map will show the **selected** country, and a popup will be show with the information of the country and its indexes. Like a **coordinated view** visualization, the map will **change** its countries color as the user do **mouseover** the map or the same thing in the list, letting the user now what country is **selecting** at that moment in the map, as in the list.

In addition, when user selects an index filter, bars are going to show the best 15 countries in that index and if the user selects a particular country, it's going to see in the bars, how it's that country in relation with the extremes, using hue to highlight the selected country. This idiom supports the task because uses **position** and **length** channel, also are **alignment** and **ordered**, so users can compare easily, accomplishing effectiveness.

## EXPERT ANALYSIS

It was shown to the expert Mario Chamorro two mockups (the first version and the enhanced version taking into account the feedback of the class) developed for making an evaluation and receive feedback from him about the two visualizations. The version of the visualization with the feedback of the class additionally had a juxtaposed parallel coordinates with partially



shared data, where the manipulation of the visualization would be through selecting the choropleth map, highlighting the country data of the coordinate by hue and saturation, respect to others. The use of the map was accepted, reiterating the importance of interactions that provide information to the user. In addition, the possibility of having an embedded view in each of the countries was proposed to the client.

The expert noted that the second version offered something different, flashy, as long as proper interaction that allows filtering via highlighting, for example selecting one of the parallel coordinate lines given the selection of a country.

In addition, the expert asked about the possibility of zooming into the map, to make a selection (filter), showing detailed information and a simple view of the country (the silhouette of the country) that was selected. This observation was taken into account for the design 2.2 that is observed in Figure 5.

Furthermore, a question emerged considering the interaction with the user, to allow the user to make a perspective since the first year of the report, the state of the country back then and now today.

On the other hand, an adjustment about the index of dystopia was made, as was confirmed by the expert, that is not an index that should be used as a filter, since it is an "imaginary" value used to normalize the other values in the formula that calculates the score of happiness.

In general, the expert is satisfied with the second alternative (parallel coordinates), idioms seem appropriate, and he propose the possibility of making controlled experiments with classmates for measuring the usability of the proposed visualization, the effectiveness of the interactions, in addition of guarantee that a general public that has no idea of the topic could be capable of understand it and interpret it.

Also it reaffirms that the proposal fulfills the primary task or the basic problem: Present the ranking of countries and its associations with the indices obtained.

## IMPLEMENTATION PLAN

We defined 5 steps to implementate this proposal:

- Analysis of the implementation: Considering our data, try to do a good design in words of performance.
- Data treatment: Our data are clean but in an excel, so we need to convert it into a format easy to handle, maybe design a little database if it's necessary.
- Develop prototype by parts: We are going to develop the prototype by parts, each member are going to focus in few interaction or views, to do everything faster.
- User tests: Show the prototype and adjust it in relation with the feedback given by the experts and some random users.
- Develop final proposal.



## BIBLIOGRAPHY

- [1] Tableau and Tableau Software. Visual Analysis Best Practices, Simple Techniques for Making Every Data Visualization Useful and Beautiful, 2016
- [2] Michelle A. Borkin, Student Member, IEEE, Azalea A. Vo, Zoya Bylinskii, Phillip Isola, Student Member, IEEE, Shashank Sunkavalli, Aude Oliva, and Hanspeter Pfister, Senior Member, IEEE, What Makes a Visualization Memorable?, 2013
- [3] Drew Skau, Lane Harrison, Robert Kosara, An Evaluation of the Impact of Visual Embellishments in Bar Charts, Computer Graphics Forum (Proceedings EuroVis), vol. 34, no. 3, pp. 221–230, 2015.
- [4] Helliwell, John F., Richard Layard, and Jeffrey Sachs, eds. 2015. World Happiness Report 2015.