FIT5147- DATA EXPLORATION AND VISUALISATION

NARRATIVE VISUALISATION REPORT

WORLD HAPPINESS REPORT VISUALISATION

Shruti Jadhav
30743281

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1. Introduction

The world happiness resolution was started by the UN general assembly in 2011, to guide the public policy they invited the member countries to measure the happiness of their people. The first World Happiness Report was released on April 1, 2012 which drew international attention. The report highlighted the state of world happiness through several case studies and explained the reasons for happiness and misery. In 2013 the second happiness report was released and from 2015 it became a annual thing. The report basically uses the Gallup World poll data, and the reports can be viewed on the World Happiness Report website.

The progress of nations is assessed by the experts in fields of psychology, economics, survey analysis and national statistics. The World Happiness report of 2019 ranks 156 countries by their happiness levels. The report specifies three key variables that support well being of the nations. Those six variables are income, social support, freedom, trust, healthy life expectancy and generosity. Each variable measured reveals a populated-weighted average score on a scale running from 0 to 10 that is tracked over time and compared against other countries. These variables currently include: real GDP per capita, social support, healthy life expectancy, freedom to make life choices, generosity, and perceptions of corruption for the 2019 report.

For the purpose of analysis apart from the six variables we have added extra measures of countries like population, population density and literacy to check how if we can derive a relation between these factors and the happiness rank of each nation.

2. Design

2.1 Design Research

The focus of the visualisation is showing information about:

- Showing information about country's happiness score.
- Analysing factors for different countries.
- Comparing different regions for their happiness score.

The visualisation will be for anyone who is interested in viewing details of happiness scores of different countries and learning about different factors that influence the happiness score. The target audience may or may not have detailed information on the topic but to make any decisions they need to have a prior knowledge of the happiness report.

2.2 Design Strategy

The main objective for the visualisation is not only show all the data in visual representations but analyse how different factors affect the happiness score. Objectives of the visualisation are:

- See trends in happiness score and different factors.
- Compare regions for happiness score.
- Relationship between population density, literacy rate and happiness score.
- Comparison between countries.

The users can view map showing the happiness score and can explore how the happiness score is influenced by different factors. Users can see the relation between factors and happiness score and determine the top 10 and bottom 10 countries for each factor using interactive graphs and tooltip.

2.3 Design Exploration

For coming up with final design of the visualisation five design sheets were used to first come up with all the possible options and then finalising on the final layout.

Sheet 1: Brainstorming

In this section, I noted all the possible types of visualisations that can be used to generate the pictorial representation of the message that needs to be conveyed to the users. As the data consists of information about countries, I decided to consider using data map, a bar graph to show factors of countries, filtering data according to different factors, a list for displaying all the countries, etc. I filtered these ideas based on practical implementation and what would be best for representation. After filtering, I categorised these ideas into different potential designs. This process can be seen in the figure 6.

Sheet 2

In this design sheet I added two drop down menus for selection of region and factor. Based on the selected factor the map will display the information for that factor. This will help the user to get an idea about the distribution of that factor across different countries. When the factor is selected it will update two bar graphs showing the top 10 and bottom 10 countries of the selected factor. Hovering on the map will show the information about the countries, like their happiness rank, happiness score,

the numeric data for that factor, etc. This design is easy to articulate to the user and will show all the necessary information that is required. This can be seen in figure 7.

Sheet 3

In this layout, I decided to provide users with option to compare between countries. The comparison can be done based on different factors such as happiness score. This will help the users to get insights regarding the state of two countries from the point of view of different factors. Based on the selected factor the bar graphs will show the top 10 and bottom 10 list of countries. The region filter will help the users to filter countries based on regions. This layout can be useful for comparing the factors between different countries. This layout can be seen in figure 8.

Sheet 4

In this layout the factor-based filter can be applied using tabs. There are tabs for each factor. When the user selects the desired tab for the factor the list of top 10 and bottom 10 countries will be displayed along with their happiness score and happiness rank. And if the user wants all the information regarding one country, then they can select the country from the list, and this will display all the information. This is a very simple design, but it is possible that this can be more descriptive and less pictorial representation. This can be seen in figure 9.

Sheet 5

In the final design I have combined the advantages of all the designs. The layout will be divided into two sections. The first section will have an overview of the happiness scores of the countries in the form of a map. You can also compare the factors of different countries by selecting the factor from the drop down and selecting the countries from the countries drop down. In the next section the user can select the factor from the drop down and based on the factor and the happiness score the scatter plot will be displayed. Based on the selected factor the top 10 and bottom list of countries will be updated. This design can be seen in figure 10.

3. Implementation

Navigation page was finalised as the final layout for designing our shiny application. The application consists of three main tabs, which are 'Rank Finder', 'Rank Comparator' and 'About'. We have implemented the tabs using tab panel functionality on the navigation page.

3.1 Globe Map

Overview of the world happiness score is displayed on the globe. I have used the plot_geo() function from the plotly package to plot the map. I have used orthographic projection to represent the world map as a 3D globe. We have used iso3c country codes to locate the countries on the map. This helps to plot a map when latitude and longitude are not available in the dataset. The hover functionality has been used to show region, country name, happiness rank and happiness score of the hovered country. The event_data function from plotly package is used for listening to the click event. As we must update the radar map according to the country selected by the user. The plotly functionality provides zoom in and zoom out and reset options to increase user interactivity.

3.2 Radar Chart

The radar chart displays variations in happiness score and other factors in the form of a two-dimensional chart of the selected country from the globe map. Scatter polar graph has been used wit the plotly package to build an interactive radar plot with five radii, each for one factor. We have normalised all the values to lie between 0 to 100. Zoom in, zoom out and reset functions are available because of the plotly function.

3.3 Grouped Bar Chart

Grouped bar char is used to compare the factors responsible for happiness score for two selected countries. We have used selectInput to select two countries as an input and draw the bar chart accordingly. By default, the first country selected is India and the second country is Australia. Grouped bar chart is plotted for 6 main factors namely – generosity, GDP per capita, social support, healthy life expectancy, freedom to make life choices and perceptions of corruption. Due to the use of plotly package the group bar chart becomes interactive. Due to the use of group bar chart the comparison between two countries depending on each factor can be easily viewed.

3.4 Scatter Plot

Scatter plot is used to visualise the relationship between the happiness score and the selected factor from the provided radio buttons. The countries within the same region are represented with the same colour. Simple plotly function is used to design a scatter plot in which we can provide interactivity where users can include or exclude some regions along with their respective countries from the representation. From the scatter plot we can see the relationship between selected factor and happiness score of countries in the same region. I have used radio button functionality along with switch cases to change the scatter plots for each factor in a reactive manner. I have implemented the hover functionality to increase the interactivity.

3.5 Bar Graph

To extend functionality further we have potted horizontal bar graph of top 10 and bottom 10 countries based on the selected factor from the radio buttons. By hovering on each bar, we can see the happiness score of that country, as well as the region it belongs to. There are total 8 factors on which we can reactively plot these bar graphs using plotly package.

4. User Guide

4.1 Rank Finder tab

- The globe shows all the countries with happiness scores. The user can hover over the map to see the countries and their details of their name, happiness score, happiness rank and region. The user must click on the country on the map to view the radar chart for that country. The radar chart displays the variations in the values for the factors and happiness score. This functionality can be seen in figure 1.

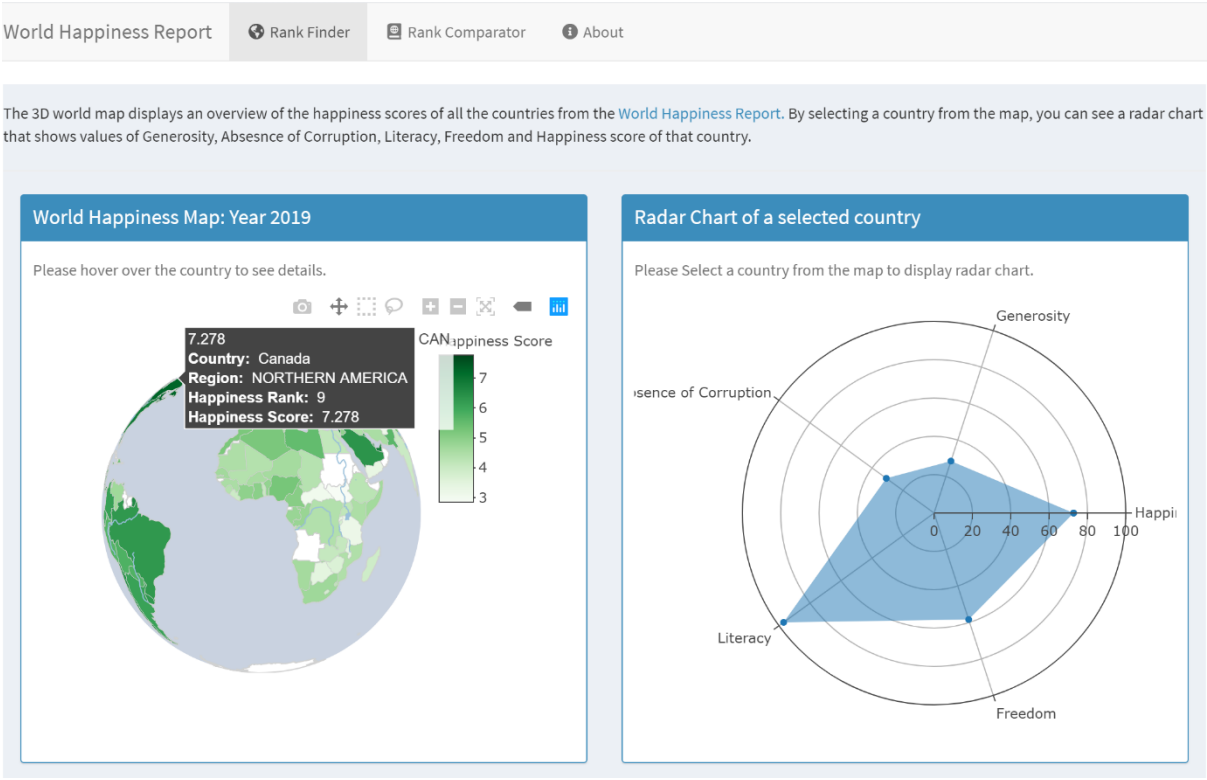

Figure 1 Rank Finder tab globe

- The next row on this tab displays the comparison between two countries. The users must select two countries that they want to compare. The grouped bar chart shows the comparison between the two countries based on the six variables of the world happiness report. This can help users to analyse how different factors of countries vary. The users can hover over the bar chart to get the detail information. This can be seen in figure 2.

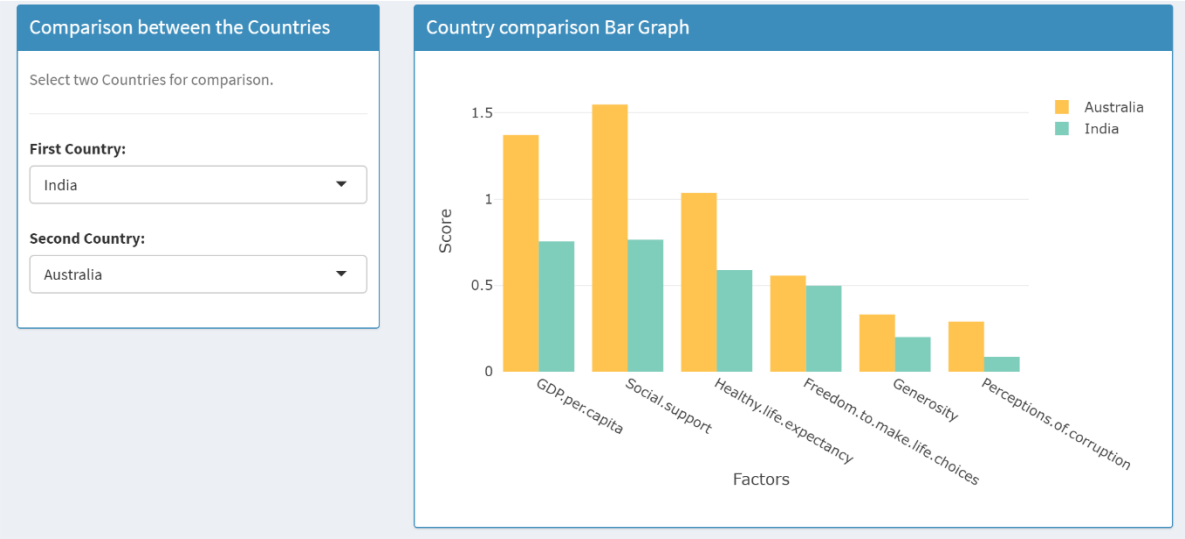

Figure 2 Rank Finder tab comparison

4.2 Rank Comparator tab

- In this tab the users can see the trends between the factors and happiness scores of the countries using a scatter plot. Menu is provided to the user for selection of the desired factor using radio buttons. Users can select the radio button for the factor that they want to view, and this will plot the scatter plot for the selected factor and happiness score. The countries are colour coded based on the regions. This can be seen in figure 3.

Figure 3 Rank Comparator tab scatter plot

- Users can also filter the countries based on the regions. They can deselect the regions from the legend and only view the regions that they want to see. In the figure 4, you can see social support score displayed for the regions of Sub-Saharan Africa and Wester Europe. This can be helpful to see the comparison between the countries of two regions. This is shown in figure 4.

Figure 4 Rank Comparator tab with region selection

- Depending on the factor selected from the menu the bar graph for top 10 and bottom 10 countries will also be updated. With this bar graph you can view the scores of top 10 and bottom 10 countries for the selected factor. You can hover on the bar graph the see the details of the countries. The bar graph can be seen the figure 5.

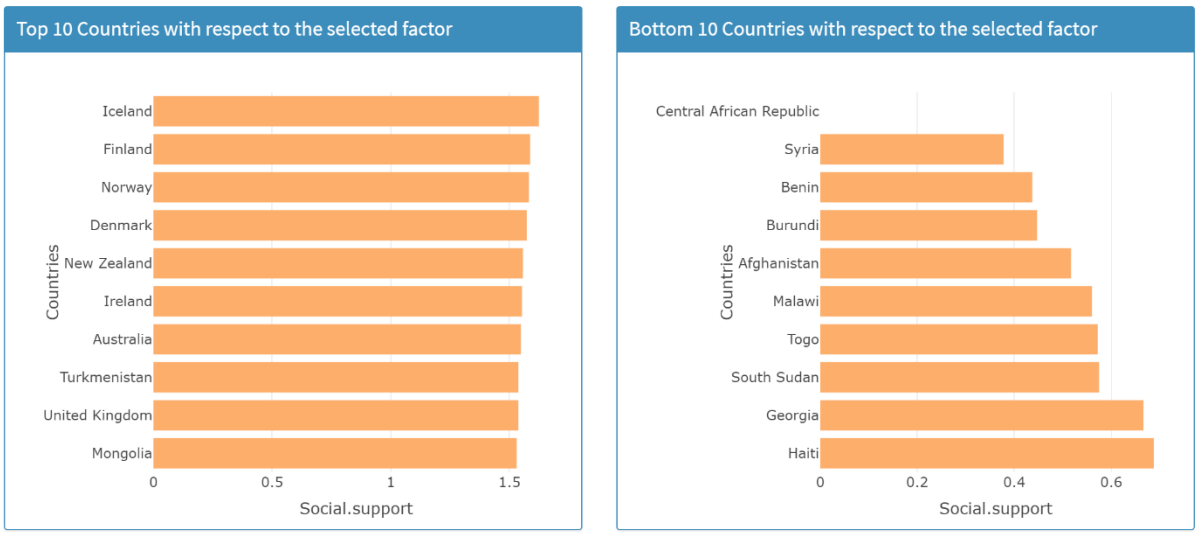

Figure 5 Rank Comparator tab bar graph

5. Conclusion

- The data exploration helped me understand the patterns in the datasets and the design using the five-design sheet helped me to understand the designing process clearly and gave a clear vision for implementing the final visualisation.
- After the implementation of the visualisation using R shiny application helped me to analyse the data more efficiently and derive the following conclusions-
- The countries in Wester Europe like Finland, Sweden, United Kingdom, etc have higher happiness scores as compared to other regions.
- While finding relationship between happiness score and GDP per capita we observed that in Wester Europe where most of the countries are developed, that is first world countries have greater GDP than regions with underdeveloped or developing countries like Sub-Saharan Africa.
- In regions like Asia, Eastern Europe and Near East the happiness scores increases with the increased GDP.
- Social support of Western Europe countries and Oceania region have higher social support scores than other countries and this social support scores affects the overall happiness score positively.
- Life expectancy score in some Asian countries like Hong Kong, Singapore and Japan is more than life expectancy scores of other countries but we can see that the scatter plot that we cannot say the countries are happier on the basis of only life expectancy. May be the other reasons for this factor is that the medical facilities in these countries are much better. On the other hand, we can see that poor life expectancy scores are observed in regions like Sub-Saharan Africa, where medical facilities are not efficient in those regions.
- It difficult to conclude if countries with higher generosity scores have higher happiness scores, because countries like Greece and Indonesia that have almost equal happiness scores have a significant difference in their generosity scores.
- It can be observed that the countries with higher happiness scores have more perception of corruption score or in other wards the people of those countries believe that they have less corruption in their country.
- Lower literacy rate countries can be observed to have lower happiness scores.
- It is difficult to conclude anything with the population density because countries like Hong Kong and Singapore even though when they have highest population densities, their happiness score is also above average.
- It can be observed that the countries in Western Europe have higher happiness scores. And, therefore their scores of other factors are also higher as compared to the countries in other regions.

6. Bibliography

Fry, A. B. (2017). *World Happiness*. Retrieved from http://www.alexanderbastidasfry.com/happy/: http://www.alexanderbastidasfry.com/happy/

https://www.kaggle.com/unsdsn/world-happiness?select=2019.csv

https://www.kaggle.com/fernandol/countries-of-the-world

https://en.wikipedia.org/wiki/Corruption_Perceptions_Index#:~:text=The%20Corruption%20Perceptions%20Index%20(CPI,expert%20assessments%20and%20opinion%20surveys.%22

7. Appendix

7.1 Sheet 1

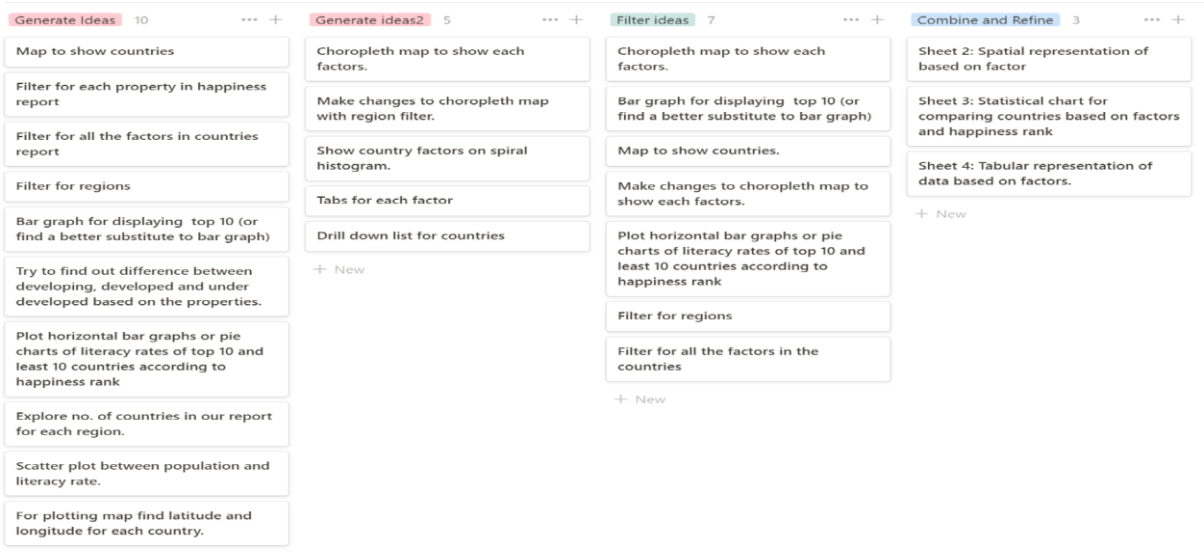

Figure 6 Sheet 1 Brainstorming

7.2 Sheet 2

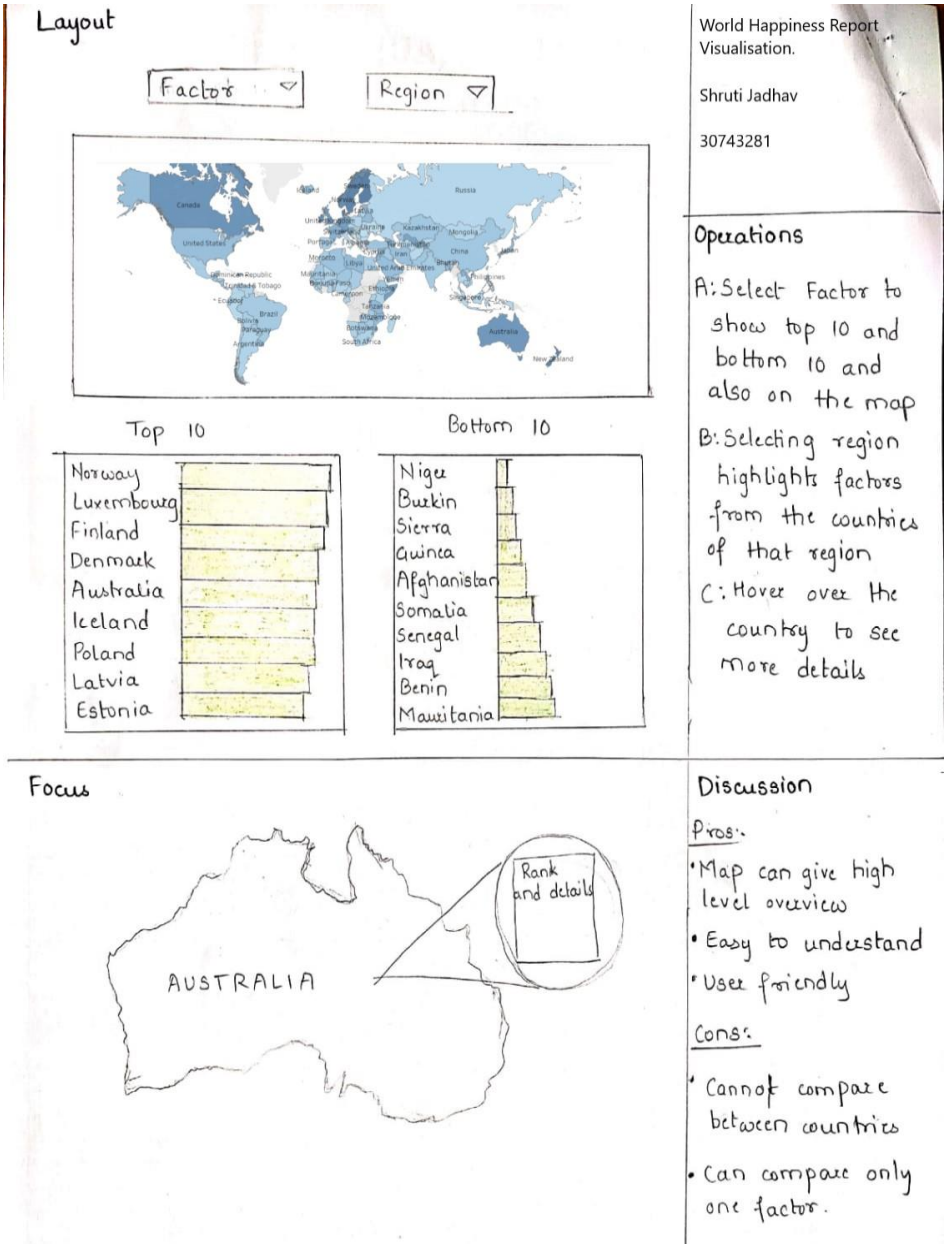

Figure 7 Sheet 2 Design

7.3 Sheet 3

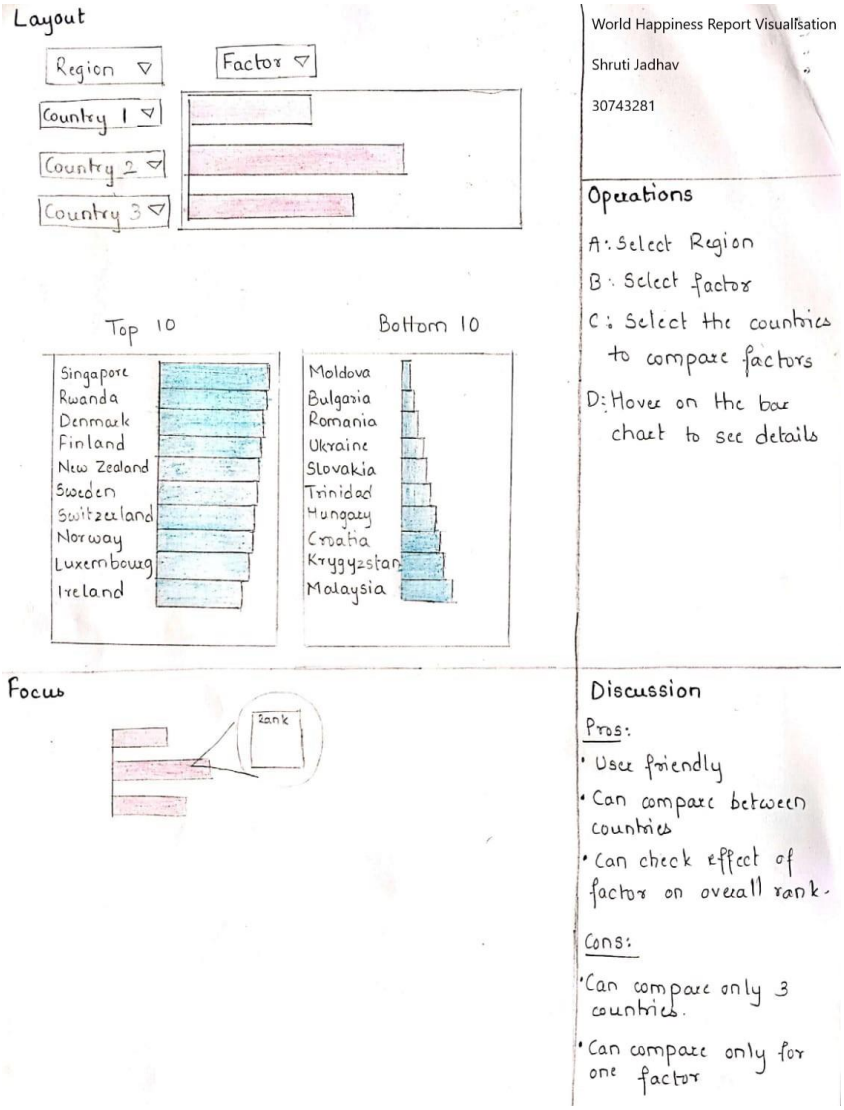

Figure 8 Sheet 3 Design

7.4 Sheet 4

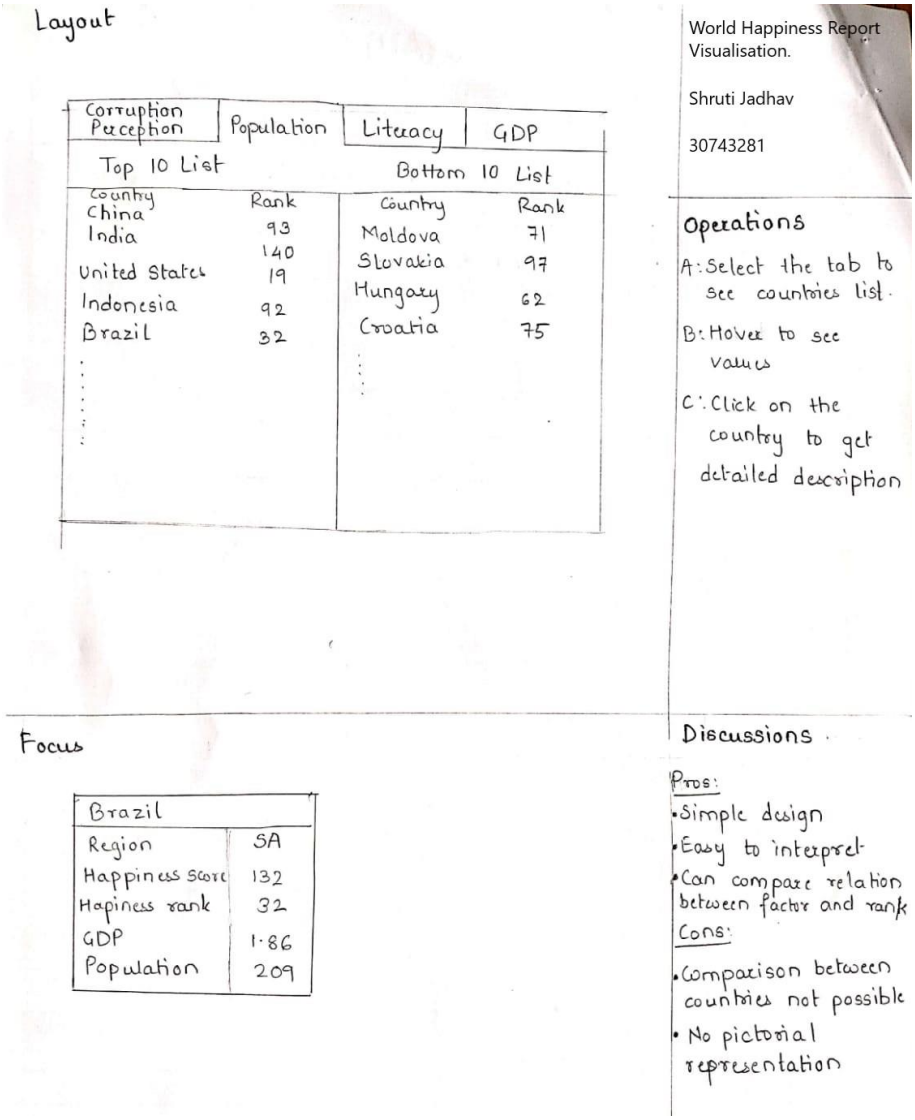

Figure 9 Sheet 4 Design

7.5 Sheet 5

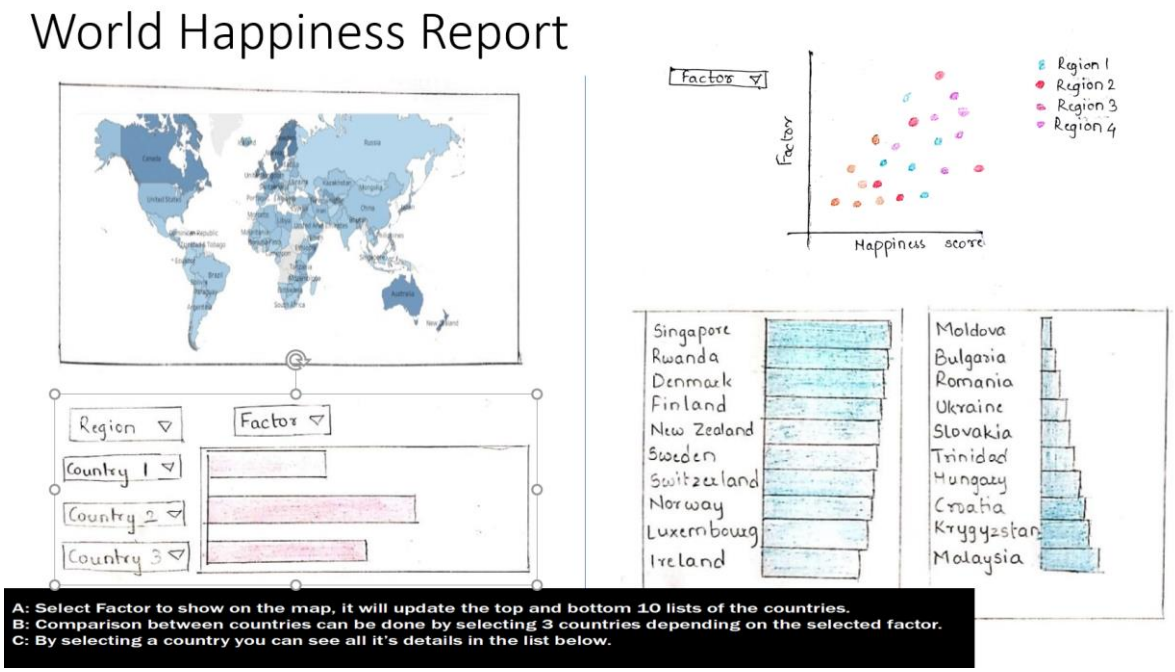

Figure 10 Sheet 5 Final Design