

Does Country's Happiness Index (HI) affect Suicidal Deaths?

DATA EXPLORATION AND VISUALISATION

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3. Introduction

Deaths by suicide has become the leading reason globally among various age groups and various ethnic and diverse communities (or, demography). The main motivation behind proceeding with this project is to find any sort of relationship between suicidal tendencies and happiness index (HI) of a country. Here, users with help of linear regression line can find the inter-dependencies among different variables. As a result, users will be able to under three questioning areas:

- 1) Is there any effect on the rate of deaths by suicide by the components like GDPI and the Mental Health Disorder Index of a country?
- 2) Does economy of a country depend on the happiness index of a country?
- 3) Is there any link between how happy a citizen thinks themselves to be and the rate of suicides? Or in simpler words, the relation between Suicidal Death rates and the Happiness Index of a country.

Below mentioned are the 8 variables to understand its role in their happiness index ratings.

- HappinessRank - Ranks of countries with order of happiness. Rank 1 signifies the happiest country.
- Happiness Score - Score (from 0 to 10) assigned to a country in terms of its happiness. Higher score means more happier a country is.
- Economy (GDP per Capita) - GDP of a country per capita (from 0 to 2). 0 being lowest and 2 being highest.
- Family- Score of Family's contribution to Happiness Score calculations (from 0 to 2). 2 being the most contribution of the family for Happiness Score.
- Healthy (Life Expectancy) - The country-specific ratios for the longer and healthy life expectancy are applied to other years to generate healthy life expectancy.
- Freedom (to Make Life Choices) - The national average of binary responses to the question "Are you satisfied or dissatisfied with your freedom to choose what you do with your life?"

There are 5 variables in these two datasets. Below mention are the variables used for this application.

- Country - This has been the country name in the world
- Continent - There are different continents as Asia, Americas, Europe, Africa and Oceania. Africa has lowest data from the countries. (User can ignore Africa data if they wish)
- Suicide rate - This the number of suicides per 100k happen within the country.
- Suicide no. - Number of suicides in a given year and given country.
- Mental health - Total number of mental health patients in a given year and given country.

Users at the end of this project will be able to understand the Suicide vs Happiness relationship. This project is aimed for research purposes and also for social and economic purposes of a country.



4. Design

First step to build this project is to think what all can be the key elements to measure the dependency of suicides and happiness index of a country.

The key elements are:

- Suicide Rate
- Mental Health
- Continents
- GDP of a country

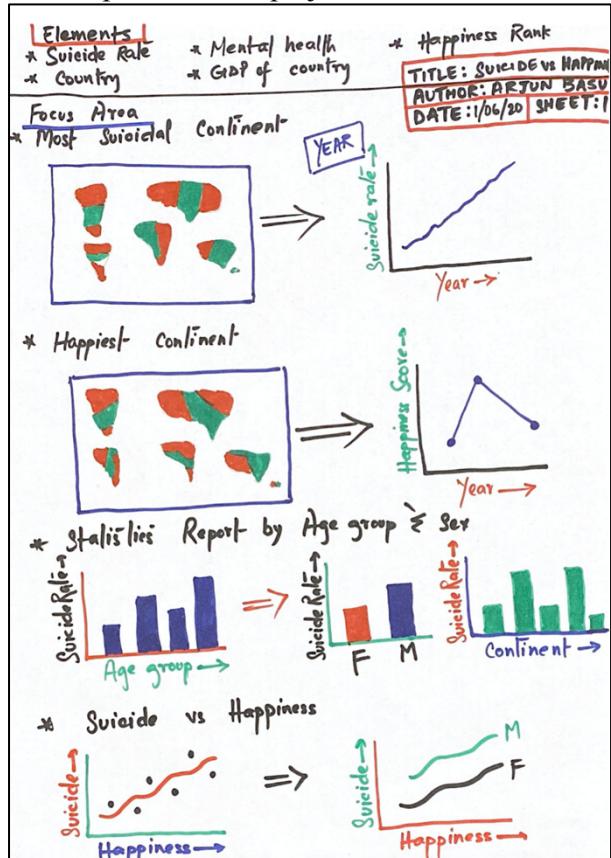


Figure 1: Five Sheet Design sheet 1

We can analyse the relationship of suicide and happiness index from different perspectives like:

- Which continent is the happiest (from Happiness Rank/Score) and which has the most suicide rates?
- Statistical report of the suicide rates by age group.
- Statistical report of suicide rates by sex.
- Plotting the happiness score vs suicide rates to see if there is any relationship.

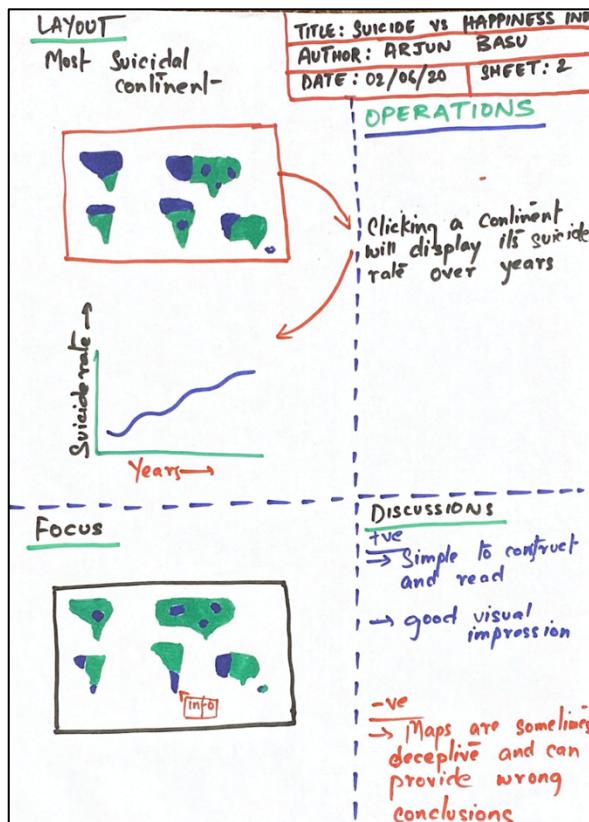


Figure 2: Five Sheet Design sheet 2

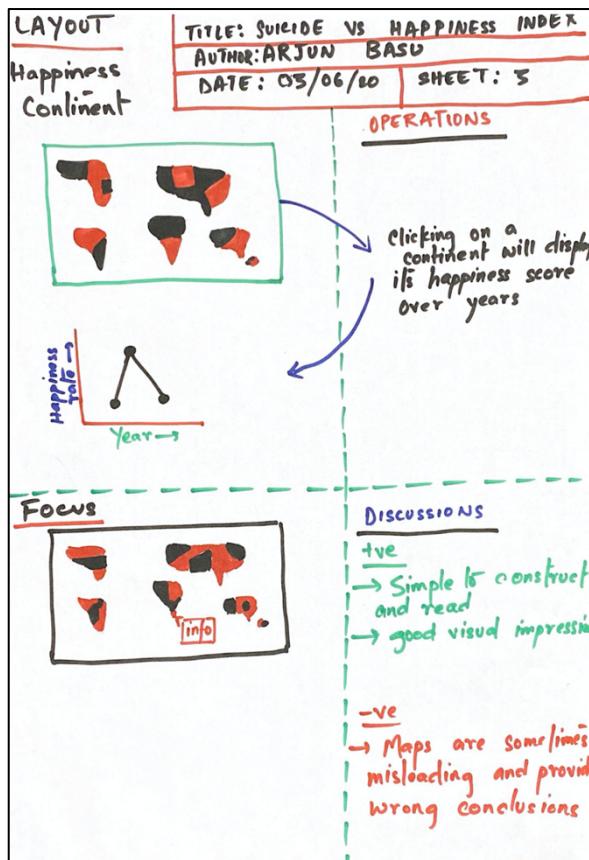


Figure 3: Five Sheet Design sheet 3

We need to analyse the suicide rates of the continents. To do so, we can build a world map and clicking on each continent will display the suicide rates of that continent over the years.

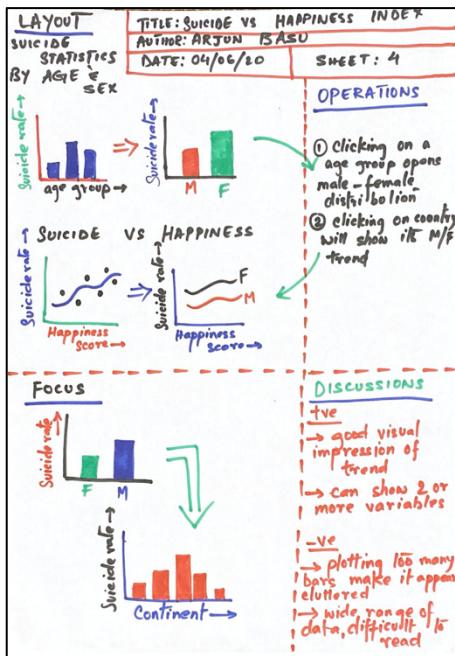


Figure 4: Five Sheet Design sheet 4

Finally, I have chosen the following operations/design for this project:

- Clicking on any continent from the map will open up the statistics of its happiness scores and suicide rates over the years.
- Clicking on age group vs suicide rates bar chart will open up the male and female distribution of the suicide rates of that age group over the years.
- By clicking on any country, it will show the trend of the male vs female suicide rates over the years for that country.

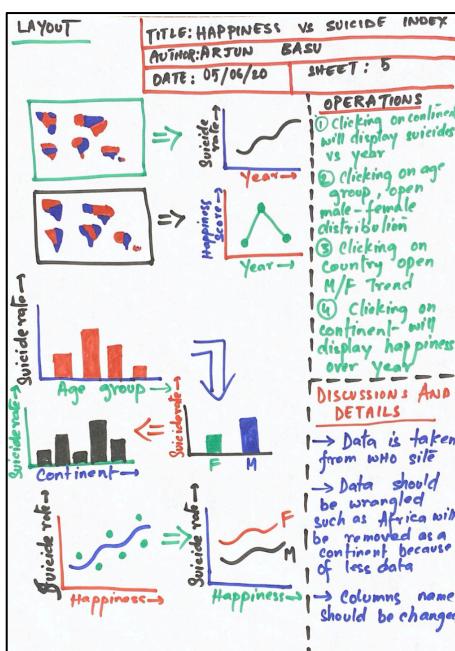


Figure 5: Five Sheet Design sheet 5

Now, the cons of creating a map is that sometimes it is deceptive in providing information. Hence, we move forward with analysis of the statistical reports of suicide rates among different age group and sex. Clicking on the age group will open up the distribution of the male and female suicides rates of that age group. Also, if we click on a country, we can get the trend of the suicides rates of male and female beings of that country.

5. Implementation

The project was implemented in R with basic five sheet design by hand. It includes various visualisation plots and creation of an interactive webpage for better understanding of the project's end results. The data set used for this project are from Kaggle and ourworldindata.org.

Let begin with the understanding of the libraries used in R:

- Shiny: For easier creation of interactive apps on webpage and building dashboards.
- Maps: With more and more advent packages like rgeos, rgdal, etc, Maps make it easier to create simple outlines of maps (with latitude-longitude plotting and paths). For example, map2SpatialPolygons was used to convert the map objects according to our needed object
- Leaflet: Used directly from R console/studio, Leaflet can be used for interactive maps creation. For example, leafletOutput was used to output the interactive world map.
- Plotly: With the use of the function selectInput(), it can be used to select the x and y parameters for the interactive graph.
- Shinyjs: With useShinyjs() function, it helps us to call any Shiny JS function from anywhere inside UI.
- ScatterD3: ScatterD3() function being used for scatter diagramsFor using scatterD3 widget, with help of the function scatterD3Output(), it helped to output function within Shiny app.
- Scales: For scaling the data.
- Shinythemes: shinytheme("spacelab") was selected for this project with Shinythemes package.

The whole project was implemented with R Shiny and D3. I published the D3 visualizations on the webpage. In my project, I Implemented the designs from the five-sheet design shown above. As I am publishing the visualizations on webpage, I used the function of fluidPage() to design the different pages in the web.

For example in the home page, I used titlePanel() to show the heading and the image of my website on the top. I used navbarPage() for different tabs in different pages.

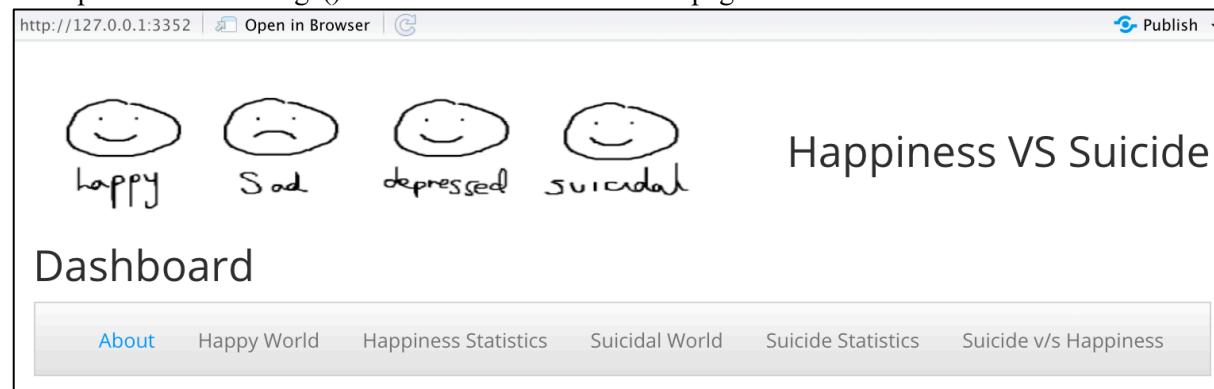


Figure 6: Title of the webpage

Now after that I created the server function for the different visualizations. The visualisations are in line with the five-sheet design.

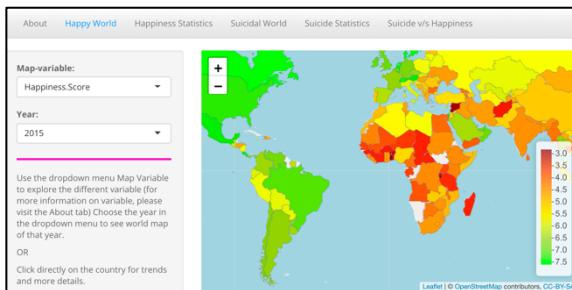


Figure 7: Happy World Tab

In the second and fourth tabs (Happy World and Suicidal World), I created the world maps with suicide numbers and happiness index respectively across different years.



Figure 8: Suicidal World Tab

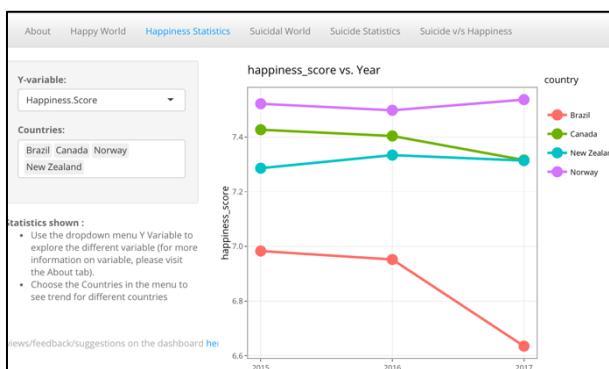


Figure 9: Happiness Statistics Tab

Now, we can directly go the second tab “Happiness Statistics” to see the line plot of any of the 8 variables of Happiness (HappinessRank, Happiness Score, Economy(GDP per Capita), Family, Healthy (Life Expectancy) and Freedom (to Make Life Choices)) vs year for different countries. Also, if we click on any country in the world map present in the tab “Happy World”, it will automatically throw you to the tab “Happiness Statistics” showing the happiness_score vs. Year plot for the country you selected. Also, in this tab, you select more than one country for more comparison.

Similarly, from “Suicidal World” Tab, we can go directly to the “Suicide Statistics” tab to see the country vs suicide plot for the country we selected in the “Suicidal World” Tab. Also, in this tab, we can see the following four plots:

- Sex vs Suicide
- Age group vs Suicide
- Continent vs suicide
- Country vs suicide

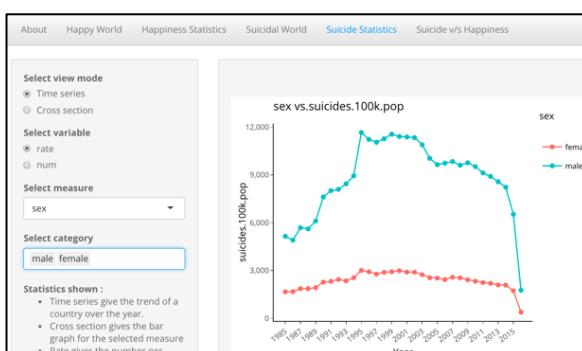


Figure 9.1: Suicide Statistics Tab (sex vs suicide)

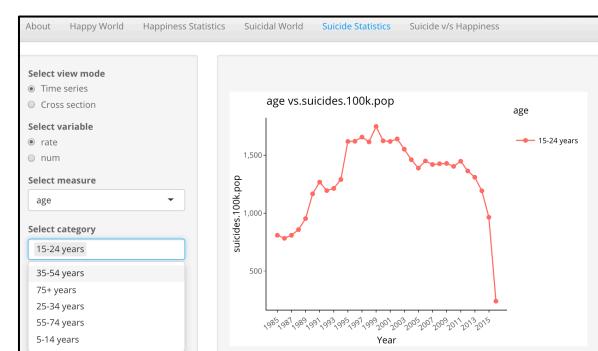


Figure 9.2: Suicide Statistics Tab (age vs suicide)

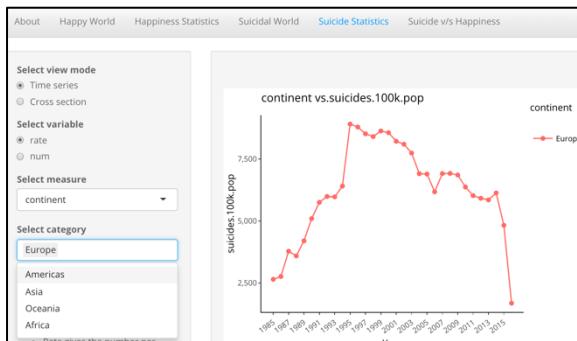


Figure 9.3: Suicide Statistics (continent vs suicide)

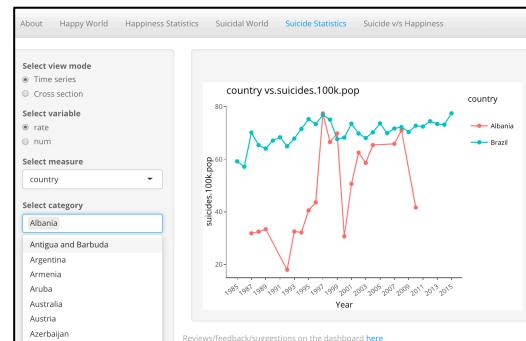


Figure 9.4: Suicide Statistics (country vs suicide)

Now, if we observe the “Happiness Statistics” and “Suicide Statistics” tabs, we can see the Happiness Score variable in different years and the Suicide variables plot for a particular country Brazil, we can observe:

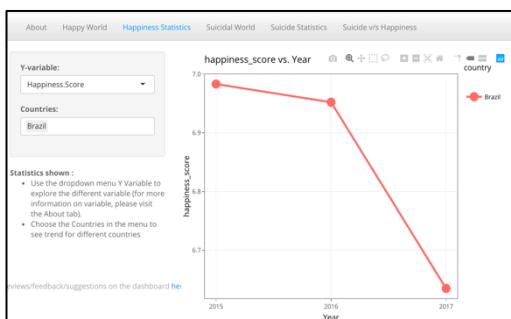


Figure 10: Happiness Score vs Year for Brazil

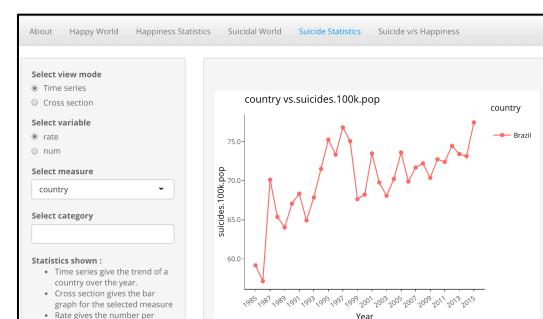


Figure 11: Suicide/100k population vs Year for Brazil

- Happiness Score for Brazil is decreasing gradually with every year
- At the same moment, the suicide rates/100k population for Brazil is increasing with years

Hence, it clearly shows a correlation between the Happiness Score (or Index) vs Suicide Rates. However, to observe the correlation (between different variables of Happiness and different variables of Suicide) carefully with visual plots for different continents and subsequently different countries, my final plot will be useful.

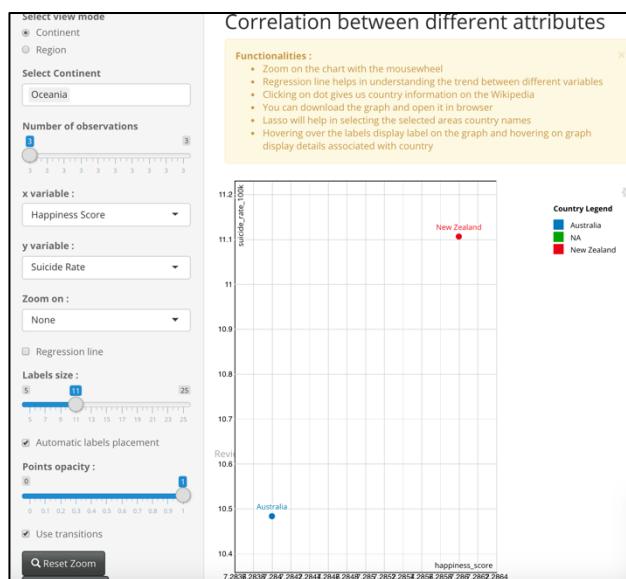


Figure 12: Suicide v/s Happiness Tab

Here, in this final plot, we can easily find the correlation between various variables of Happiness and Suicide for each continent. Once, we choose a continent, we can display as much countries we want (few or all countries) of that continent.

My code can be sub-grouped into following parts:

- Creation of a world map with the names with the help of the map package
- Loading the data (csv format of three files)
- Creating the main UI of the application:
 - In all page, creating the title of the webpage along with the image.
 - Creating the navigation panels for all the pages.
 - From second page onwards, creating the interactive graphs.
 - Creating server function.

It is a user-friendly interface for exploring and understanding the relationship between the happiness and suicide data for the world. Few countries and/or continents were removed from the project due unavailability of enough data.

6. User Guide

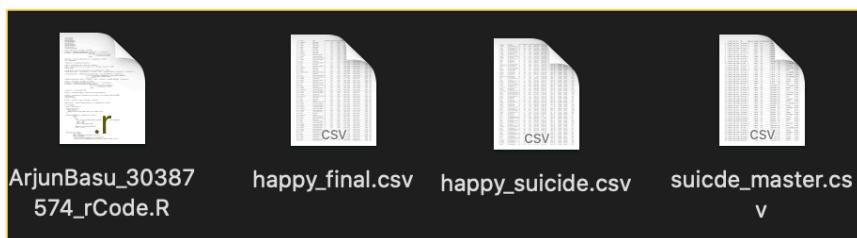


Figure 13: R codes and the dataset

For running this project, you need the below 4 files:
The datasets:

- happy_final.csv
- happy_suicide.csv
- suicide_masters.csv

The code file:

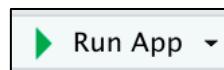
ArjunBasu_30387574_rCode.R

Please make sure the above four files are all in the same directory before running the programming. Also please make sure you have installed R Studio installed in your PC and also the following libraries in R:

```
library(shiny)
library(maps)
library(leaflet)
library(maptools)
library(plotly)
library(shinyjs)
library(scatterD3)
library(scales)
library(shinythemes)
```

Figure 14: The R libraries

After opening R file, click on → situated at Top Right.



After running the app, you will get this below page (home page):

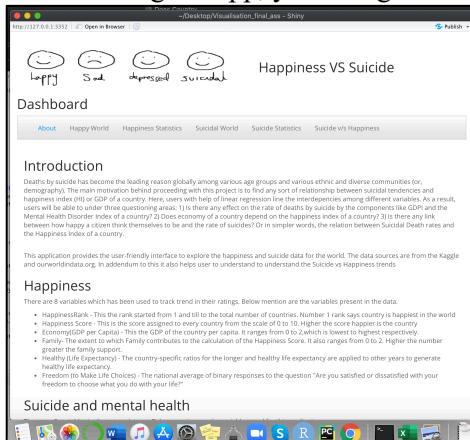


Figure 15: Suicide vs Happiness webpage

You can see the different tabs where you can hover to:

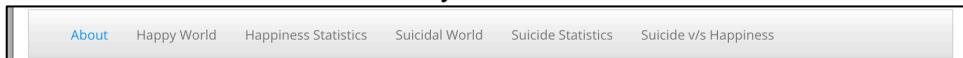


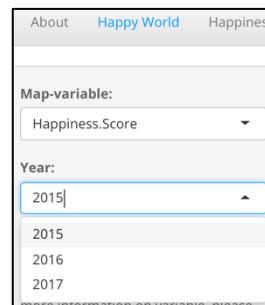
Figure 16: The tab sections

Recommendation: Before proceeding further to the different tabs, please go through the home page ('About Section') to understand the concept behind this project.



Figure 17: Map-variable tab under 'Happy World'

Now in the second tab "Happy World", you can click on 'Map-Variable' tab to click the different Happiness variable you would like to display in the world map.



Now, you can also select the different years you want to display on the world map.

Figure 18: Year selection under 'Happy World'



Figure 19: Y-variable selection under 'Happiness Statistics'

In the third tab "Happiness Statistics", you can select different Y-variables. Also, you can select different countries:



Figure 20: Country selection under 'Happiness Statistics'

In the fourth tab ‘Suicidal World’, you can select different years you want to see in the world map.

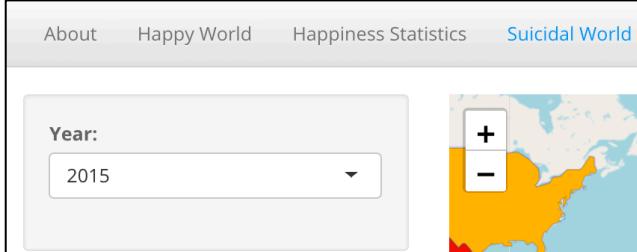


Figure 20: Year selection under ‘Suicidal World’

In the fourth tab ‘Suicide Statistics’ you can choose the following options:

- Select view mode
 - Time series
 - Cross section



Figure 21: View Mode under ‘Suicide Statistics’

- Select variable
 - rate
 - num



Figure 22: Variable selection under ‘Suicidal World’

- Select measure
 - Sex
 - Age
 - Continent
 - Country



Figure 23: Measure selection under ‘Suicidal World’

- For different measure, you can select different category
 - For the measure Sex: Male/Female
 - For the measure Age: Different age groups
 - For the measure Continents: Europe/America/Asia/Africa/Oceania
 - For the measure Countries: Different countries

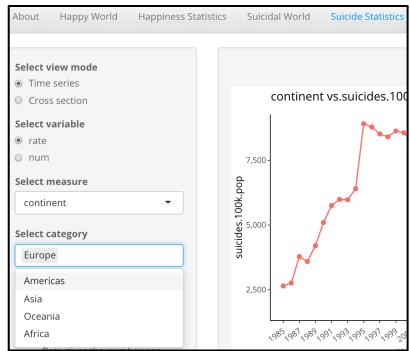


Figure 24: Measure's category selection under 'Suicidal World'

In the final tab 'Suicide v/s Happiness', following options can be selected:

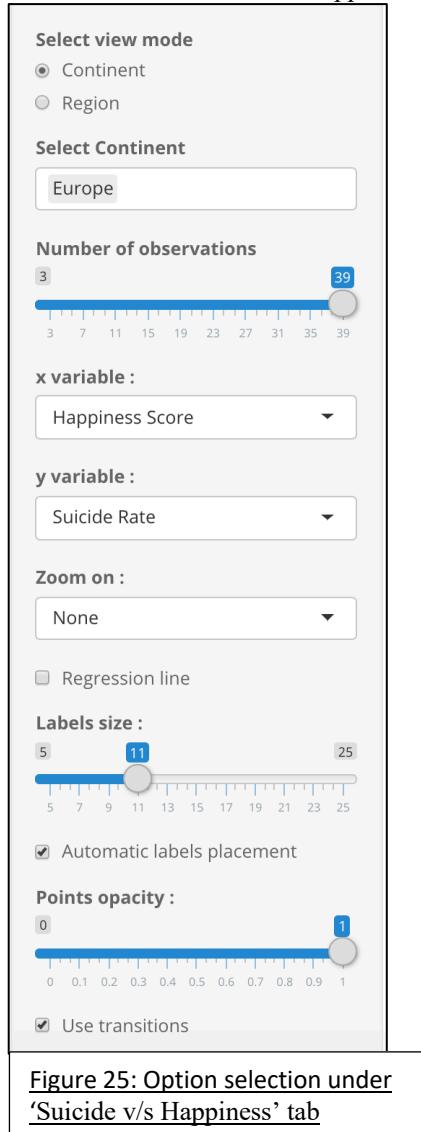


Figure 25: Option selection under 'Suicide v/s Happiness' tab

- Select view mode:
 - Continent
 - Region
- Select Continent/Region:
 - According to the selection of the first option, you can select here different continent or different countries accordingly.
- Select number of observations:
 - Number of continents/countries you want to see in the correlation plot.
- Select x-variable:
 - Happiness Score
 - GDP_per_capita
 - Family
 - life_expectancy
 - Freedom
 - Trust in Government
 - Generosity
 - Suicide Rate
- Mental Health Select y-variables:
 - Happiness Score
 - GDP_per_capita
 - Family
 - life_expectancy
 - Freedom
 - Trust in Government
 - Generosity
 - Suicide Rate
 - Mental Health
- Label Size:
 - Between 5 to 25 (increase or decrease the size of the labels)
- Point Opacity:
 - Between 0 to 1 (increase or decrease the size of the points on the correlation plot)

7. Conclusion

At the very beginning of this project, I had a very simple idea that happiness is inversely proportional to mental sickness (or suicidal tendency). But it is not that simple phenomenon. We observed for some countries, like Brazil, that when the happiness score was increasing over the years, the number of suicide rates was decreasing. So, this clearly shows that happiness is inversely proportional to suicide rates. However, when I observed for the country USA, I saw that as the happiness score was decreasing over the years, the number of suicide rates was also decreasing. Through the project analysis I observed that more the GDP of a country is, more will be the suicide rate, which of course seems strange. Another interesting aspect was found that there is no strong evidence to support the relation between mental (emotional) health of a person for the suicide and GDP of a country. However though, happiness score of country largely depends on the life expectancy and family and generosity. But, Trust has very little impact on happiness score. The correlation plot at the very end will help you even more in understanding the correlation between the factors affecting happiness and suicide rates. One cannot jump directly to a conclusion that suicide rates will be higher in a country where the happiness index will be low. There are many other factors deciding the relationship between the happiness index and suicide rate of a country, like its GDP, life expectancy, trust on government, etc. To conclude I can firmly say that ultimately wealth is not going to give you happiness and peace (for example, there are n number of suicides among rich people) and rather people should find peace in non-materialistic aspects of life (like, family, love) which will surely further decrease the suicide rates.

7.1. Reflection

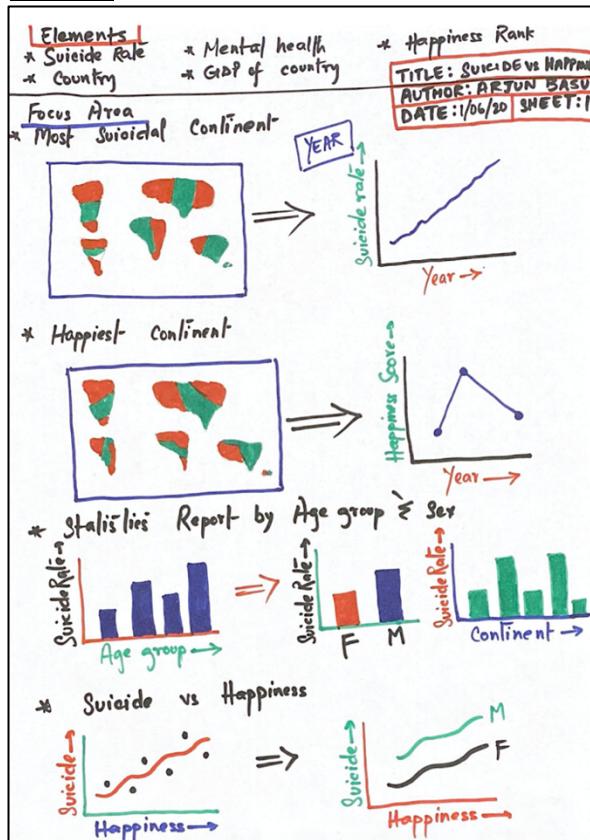
- I learned the various usage of the tool R shiny and D3.
- I found out that the real art of storytelling is through your visual plots and hence, it is very essential to have clear and simple visualisations, so that the audience understands the whole picture.
- I learned that for correct analysis and findings, one must wrangle the data properly. The whole analysis and the conclusion will depend hugely on the quality of wrangling done on the data.
- I have learned the real usage of visualisation. I have learned how a graph can tell us more about the data and giving us a clear picture as you create more and fine-tuned plots. I have learned the usage of different kinds of plots and choose the best plot which fits best.
- I have found the usage of my thinking skills. This is one area which cannot be trained by anyone. It segregates you from an average tech person. It completely depends on us as how to move forward with the analysis and it can only be achieved if you keep on asking questions from the project to yourself.
- The analysis still needs to be revised if provided with a fine-tuned data set. For example, statistics from different countries separately. Also, I believe that I could have searched more for a more recent dataset.
- Overall, it was a very interesting project to do, I am happy to share the information received from this project with my fellow classmates, friends and family on how Suicide Rate varies with Happiness Index of a country.

8. Bibliography

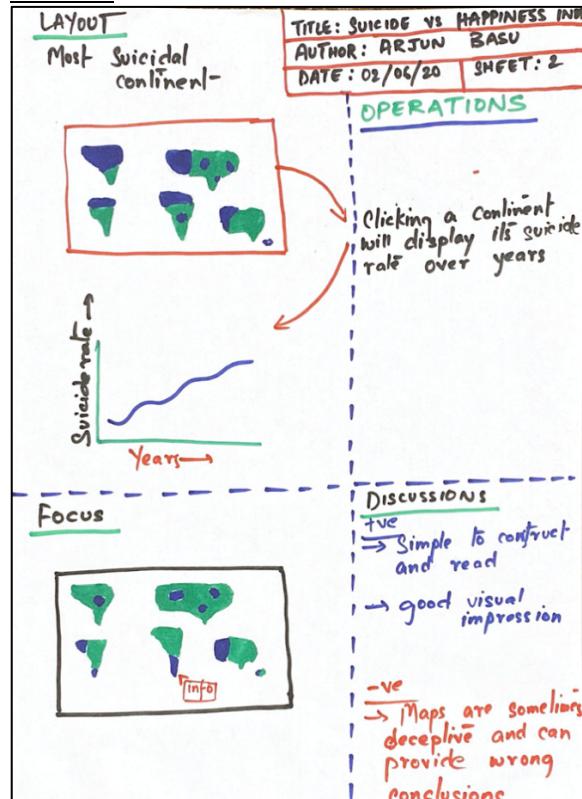
1. <https://ourworldindata.org/mental-health#link-between-mental-health-and-suicide>
2. <https://www.kaggle.com/unsdn/world-happiness>
3. [https://www.kaggle.com/russellyates88/suicide-rates-overview-1985-to-2016\(master.csv\)](https://www.kaggle.com/russellyates88/suicide-rates-overview-1985-to-2016(master.csv))
4. <http://www.sthda.com/english/wiki/ggplot2-quick-correlation-matrix-heatmap-r-software-and-data-visualization>
5. <https://rdrr.io/rforge/rworldmap/man/mapCountryData.html>
6. <https://www.kaggle.com/crizzi/are-happy-people-really-happy>
7. <https://www.rdocumentation.org/packages/car/versions/3.0-2/topics/scatter3d>
8. <https://www.kaggle.com/ashkash247/who-suicide-statstics-aesthetic-eda>
9. <https://www.kaggle.com/hanyan/visualizing-happiness>
10. <https://www.kaggle.com/ksvrd1/cluster-analysis-on-suicide-victims>
11. <https://blog.rstudio.com/2018/10/05/r2d3-r-interface-to-d3-visualizations/>

9. Appendix

Sheet 1:



Sheet 2:





Sheet 3:

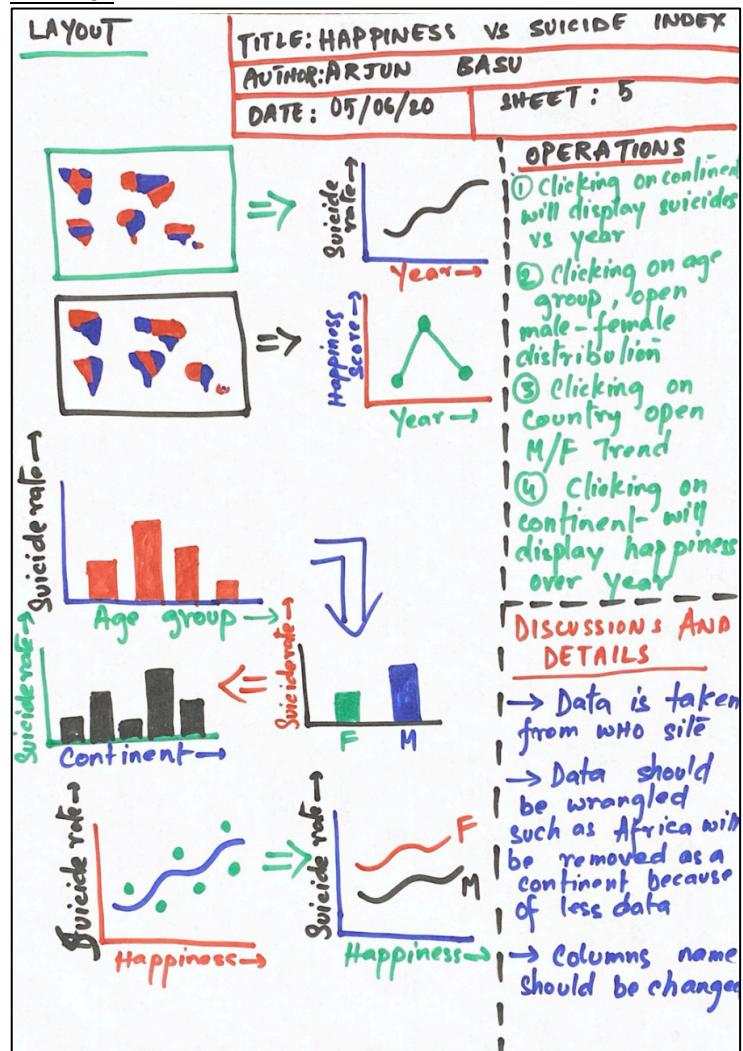
LAYOUT		TITLE: SUICIDE VS HAPPINESS INDEX AUTHOR: ARJUN BASU DATE: 03/06/20 SHEET: 3	
Happiness Continent		OPERATIONS	
		Clicking on a continent will display its happiness score over years	
		Focus	
		Discussions	
		+ve	<ul style="list-style-type: none"> → Simple to construct and read → good visual impression
		-ve	<ul style="list-style-type: none"> → Maps are sometimes misleading and provide wrong conclusions

Sheet 4:

LAYOUT		TITLE: SUICIDE VS HAPPINESS INDEX AUTHOR: ARJUN BASU DATE: 04/06/20 SHEET: 4	
SUICIDE STATISTICS BY AGE & SEX		OPERATIONS	
		<ul style="list-style-type: none"> ① Clicking on a age group opens male-female distribution ② clicking on country will show its M/F trend 	
1 SUICIDE VS HAPPINESS			
		Focus	
		Discussions	
		+ve	<ul style="list-style-type: none"> → good visual impression of trend → can show 2 or more variables
		-ve	<ul style="list-style-type: none"> → plotting too many bars make it appear cluttered → wide range of data, difficult to read



Sheet 5:



THANK YOU