Visualizing Global Happiness and its Contributing Factors

Xiaohang LI, Pei Xuan LIM, Jia Xian GOH

Abstract—Traditionally, a country's well-being has been measured on economic variables like GDP or unemployment rate. However, no institution, nation or group of people can really be properly understood without also factoring in a number of other elements. One of these key elements, is happiness. What contributes to a country's happiness? Why are some countries happier than others? Are there any trends or patterns we can discern from the available data? With reference to the World Happiness Report, we designed and developed an interactive dashboard to allow for exploration of historical Happiness Index Scores and its components worldwide. Utilising the visualizations, we showcase some potential insights gathered, enabling a deeper analysis of the events that lead to fluctuations in a country's happiness.

Keywords—World Happiness, World Happiness Index.

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1 INTRODUCTION

In the age of rapid development on all frontiers, the world as we know it is constantly changing. While economic growth has been the focus of world leaders and used as an indicator of a country's success, there are other factors that should be taken into account as economic success may not always equate to overall well-being. The World Happiness Report sheds light on an alarming trend, that global happiness is in decline despite sustained economic growth[1]. This presents an interesting phenomenon, as wealth and overall happiness tend to be viewed with direct correlation. Rich people are happier than poorer people on average, and richer countries are happier than poorer countries. Despite this, growing national wealth is not always accompanied by growing national happiness[2]. This is known as the Easterlin Paradox, which caused some controversy amongst scholars when it was published. The equation of GDP to a country's welfare could well be a fallacy[3], and happiness needs to be independently analysed in order to properly evaluate a country's overall well-being.

"Happiness" is a loosely used term that encompasses a myriad of factors. While there is no hard and fast rule when it comes to evaluating happiness, the most comprehensive dataset available comes from The World Happiness Report - a landmark survey of the state of global happiness released annually since 2012[4]. While the report conducts meaningful analysis of the implications of global happiness focusing on different aspects annually, the main takeaways most people are concerned with are the overall rankings. The report contains granular data of the metrics measured that are aggregated to produce the rankings, but a lack of interactivity in the static charts and tables make it difficult for the layman to explore. To address this issue and facilitate exploration and analysis of the data, we built the Happiness Watch Dashboard.

This paper documents the design process in creating the Happiness Watch Dashboard - a visualization tool based on the raw data provided within the World Happiness Report. Through the dashboard, we hope to enable a more in-depth analysis into the

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factors that contribute to happiness with an intuitive and interactive interface.

2 MOTIVATION AND OBJECTIVES

We were motivated by a general lack of understanding and concern with respect to The World Happiness Report beyond the overall ranking scores, which hold little meaning for comparison. We felt that the data presents an opportunity for anyone to gather insights and better understand the different components that make up the Happiness Index Scores. The static visualizations included in the report are a good starting point but with more than 150 countries' data spanning more than a decade, it can get overwhelming. Through our dashboard, we hope to achieve the following objectives:

1. Identify regions or countries with the highest happiness scores
2. Visualise the happiness scores over time
3. Explore the factors contributing to the happiness
4. Enable comparison of happiness scores and its factors across countries

3 RELATED WORKS

As mentioned, The World Happiness Report contains multiple static visualisations of the Happiness Scores and its components[4]. As seen below, the visualization displays the component breakdown of the Happiness Score, ranked in descending order.
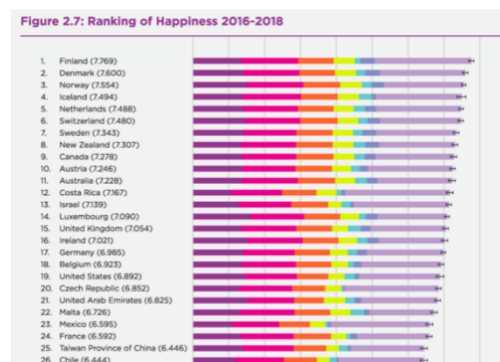

Figure 3.1: World Happiness Report 2019 Stacked Bar Source: Adapted from [4]

While effective in visualizing the overall rankings, it is difficult to discern the component scores relative to each country. We can

overcome this limitation with interactive charts that enable the user to sort the rankings by component.
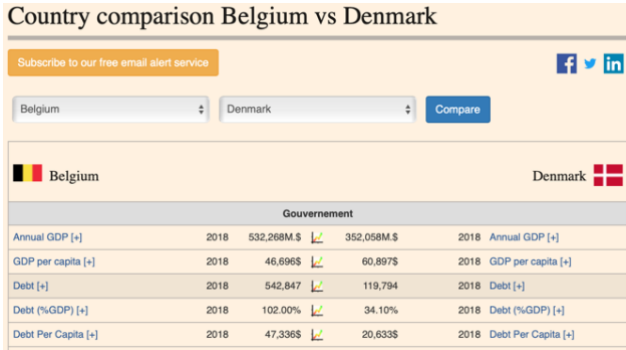

Figure 3.2: Country Comparison Table
Source: Adapted from [5]

In another visualization attempt, an interactive country comparison table was created. It enables the viewer to select two countries for side by side comparison. The tabular format makes it hard to make direct comparisons at a glance. This could be mitigated by utilizing appropriate visualizations for a quick overview at a glance.
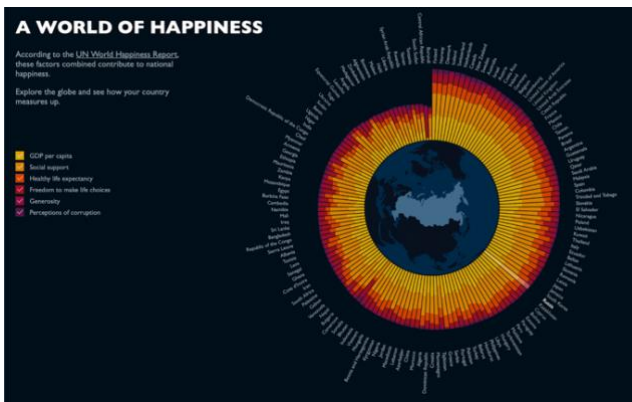

Figure 3.3: Interactive Radial Stacked Bar Chart
Source: Adapted from [6]

The interactive radial stacked bar chart highlights and centres the selected country on a map. The filters allow for sorting on different Happiness Index Components as well. The interactivity makes for an engaging and interesting user experience, but the radial format makes it hard to read the labels and locate specific countries. A simple horizontal Stacked Bar chart would suffice.

4 DATA EXPLORATION & PROCESSING

The aggregated data sheet provided by the World Happiness Report 2019 is generally clean. It consists of 2005 - 2018 happiness index score for available countries, as well as the individual component score for all well-being measures.

Data Exploration Findings

1. The value given for well-being measures are in different scales. For instance, "healthy life expectancy at birth" can range from 50 to 70, while "freedom to make life choices" is a score between 0 to 1. Therefore, min-max normalization is used to standardize all components between 0 to 1.

2. For easier column reference, the dataset columns should be renamed to remove blank spaces.

Data Aggregation

1. Countries are sorted by Happiness Index Scores in descending order.

2. 2019 Happiness Index Scores are added to the vector object generated from the country level shape file. This object is used for choropleth graph plotting.

3. The average Happiness Index Score is generated for each year.

4. The percentage contribution to Happiness Index Score for each well-being measures is calculated.

5 DESIGN CONSIDERATIONS

After understanding the data, we then had a more concrete idea of what we wanted to bring out. We looked into various visualization techniques while keeping in mind the capabilities of R shiny and started conceptualizing our dashboard. Through iterations of storyboarding and consultations with Professor Kam Tin Seong, we gradually developed our application to facilitate visual exploration of the data. We drew inspiration from existing visualizations we found as well as from Professor Kam's suggestions. Below are some of the visualization techniques we shortlisted.

Interactive Stacked Bar

A recurring visualization in the related works (Fig. 3.1 and 3.3), the stacked bar gives an intuitive overview of overall Happiness Index Scores and its components. We seek to implement an improvement over the existing designs by enabling sorting and filtering of the overall score as well as the individual components. Leveraging on Plotly's interactivity, we can also zoom into specific regions of the chart.
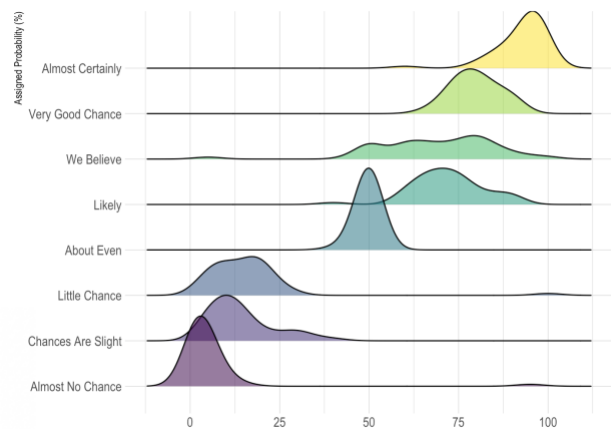
Ridge Plot

Figure 5.1: Country Comparison Table
Source: Adapted from [7]

The ridge plot makes it possible to compare distributions at a glance. Applied to our project, it is ideal for visualization of the components that make up the Happiness Index Scores.
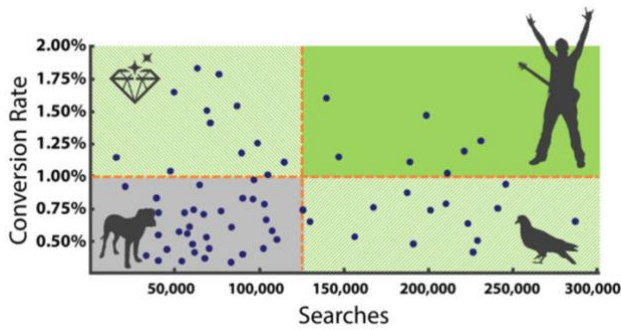
Scatterplot Analysis

Figure 5.2: Scatterplot Analysis
Source: Adapted from [8]

With a scatterplot, we can visualize changes in variables over time by analysing the data points. By plotting 2 years of Happiness Index Scores on each axis, we can quickly identify specific countries with the biggest increase or decrease in Happiness Index Scores across the years.
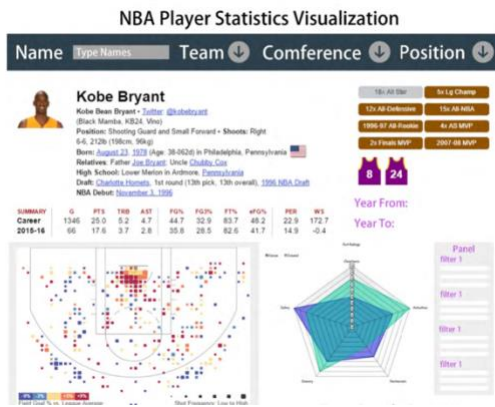
Summary Card

Figure 5.3: NBA Players Summary Card
Source: Adapted from [9]

For a quick overview of multiple variables, multiple charts can be combined to visualize the different components. To compare the breakdowns of different countries, we will be utilising Grouped Bar, Radar and Ridge Plots.

6 APPROACH

The following visualisations were mainly created using the following R Libraries - ggplot2, ggridges, Plotly and Leaflet. To allow users to interact directly with the data, most visualisations were made interactive by using Plotly. This includes the Bar, Scatterplot, Radar and Line charts. However, the ridge plot is relatively new and has no Plotly compatibility. It is hence restricted to a static plot implemented with the ggplot2 and ggridges libraries. To enable users to interact with the dashboard's map, Leaflet was utilised to create the Choropleth map given the library's capability in producing highly interactive map.

With the tidyverse library, we were able to transform the data on the fly for each visualization utilising the same dataset. The visualizations were put together with R Shiny Dashboard to create our final application.

7 DATA VISUALISATION AND WALKTHROUGH

The dashboard was designed using Shneiderman's mantra - Overview first, zoom and filter, then details-on-demand. This allows users to grasp the Happiness Score Index on a global level before zooming into specific countries of interest.

Home Tab

Figure 7.1: Happiness Watch Home Tab

Upon accessing the link, users will first be brought to the dashboard's Home Tab where they will be introduced to the problem that the team aims to tackle and how the dashboard enables them to visualize the factors that contribute to the country's happiness. Additionally, the main objectives of the dashboard are listed here.
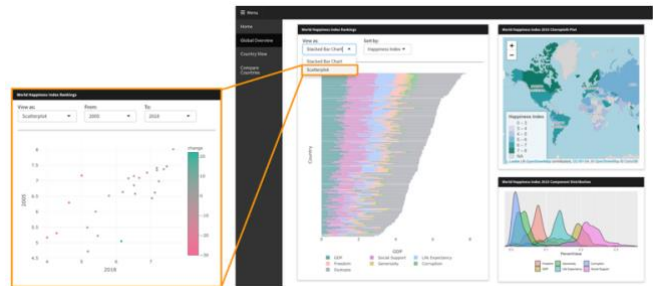
Global Overview Tab

Figure 7.2: Happiness Watch Global Overview Tab

The first tab shows the global overview of the Happiness Index Scores and the component distributions. The Choropleth map enables the user to visualize the Happiness Index Scores at a glance. Users are free to toggle between the stacked bar or scatterplot charts. A selection of a country on one of these charts will centre the country's location on the choropleth map. The ridge plot showcases global Happiness Index Score component distributions.

Country View Tab

Figure 7.3: Happiness Watch Country View Tab

Once the users have found the countries that they are interested to drill into, they can use the Country View tab to study the country's Happiness Index Score over time compared to the global average score. Furthermore, this tab enables users to study how the country's Happiness Index components change over time.
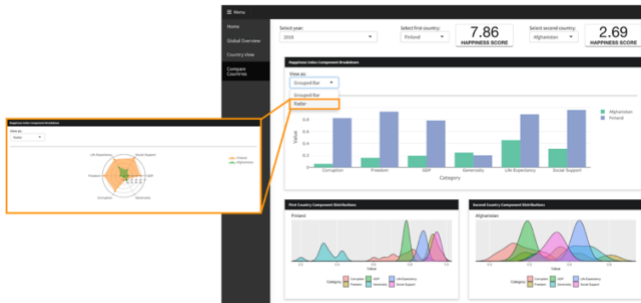
Compare Countries Tab

Figure 7.4: Happiness Watch Compare Countries Tab

Upon analysing the country's performance in the Happiness Index Scores from the previous tab, users can use the Country Comparison tab to make comparison of two countries' Happiness Index Scores and its components in any given year. Users can toggle between the Grouped Bar and Radar charts to visualize the performance of the individual components.

8 KEY FINDINGS AND OBSERVATIONS

Equipped with the interactive dashboard, we explored the data and gained some insights following the top-down approach.
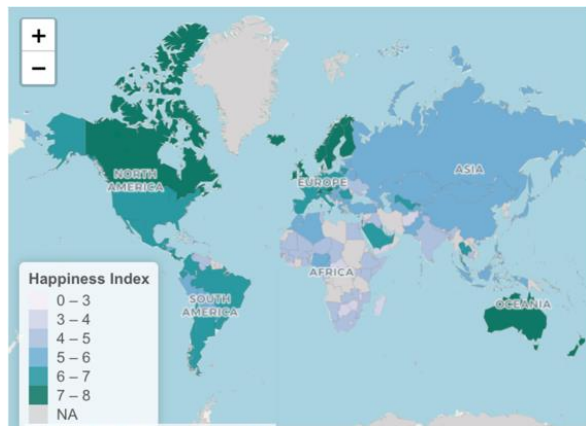

Figure 8.1: Choropleth Map of Happiness Index Scores

We can see that the Americas, Europe and Oceania generally have the highest Happiness Index Scores, with Africa faring the worst.
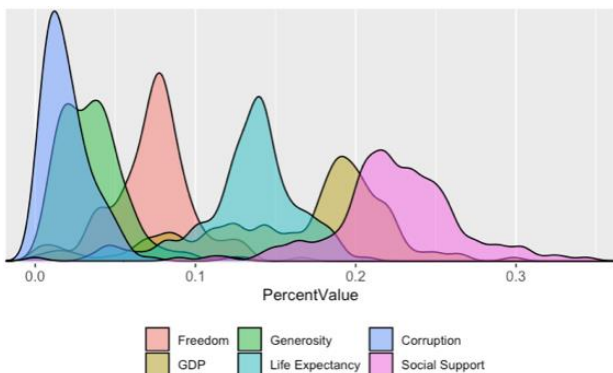

Figure 8.2: Ridge Plot of Global Component Distributions

The consolidated ridge plot of component distribution clearly distinguishes the importance of each component with respect to Happiness Index Scores. We can see that Social Support is the biggest contributing factor, followed by GDP, Life Expectancy, Freedom, Generosity and lastly Corruption.
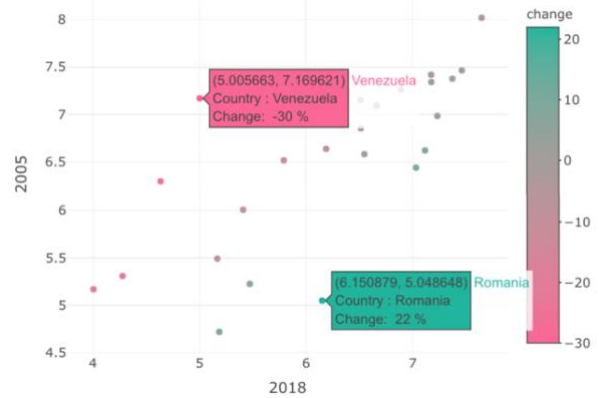

Figure 8.3: Scatterplot of Happiness Index Scores between 2005 and 2018

Comparing Happiness Index Scores from 2005 to 2018, we identified two countries with the biggest decrease and increase in scores over the years - Venezuela and Romania. As these countries represent the most extreme changes, we further explore their data with the dashboard to see if we can gain more insights.
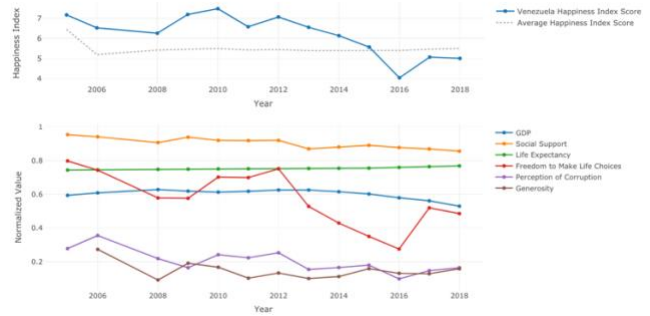

Figure 8.4: Venezuela's Happiness Index Scores over time

From a quick look at Venezuela's scores over time, we can see that they generally fared better than average up until 2010 where they faced a decline, eventually falling below the average in 2016. The component scores over the years actually remained relatively consistent, but "Freedom to Make Life Choices" had fluctuations that mostly mirrors the fluctuations in overall score. Some further research into Venezuela's situation shed light on these changes. Venezuela has been in crisis since 2010, mainly caused by political reasons and a myriad of economic factors[10].
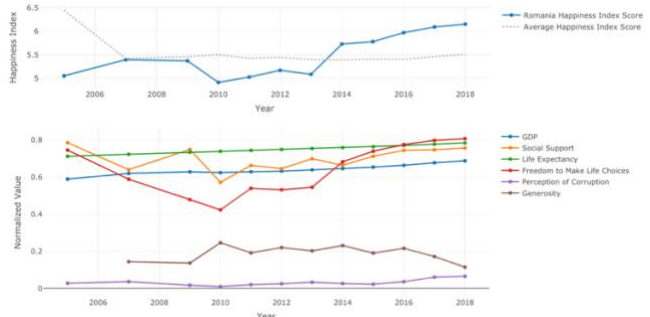

Figure 8.5: Romania's Happiness Index Scores over time

Romania's scores over time are the opposite. After 2013, Romania's Happiness Index Scores have been on the rise, putting them consistently above the global average. Correspondingly, "Freedom to Make Life Choices" has also seen the same increase. A closer look at Romania presents marked improvements in political and economic factors as well[11].
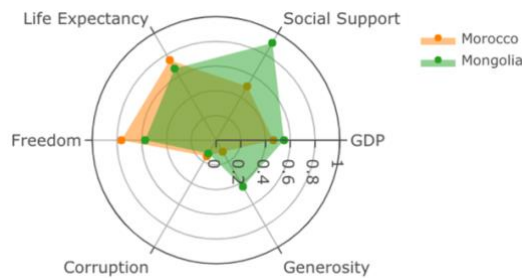

Figure 8.6: Morocco vs Mongolia Component Radar Chart

When comparing countries, more interesting insights can be found. While Social Support is the main contributing factor globally, it may not be the case for every country as different countries have different compositions. In 2017, Morocco and Mongolia had Happiness Index Scores of 5.31 and 5.33 respectively. Looking at the radar chart, we can clearly see that Morocco had higher Life Expectancy, Freedom and Corruption measures while Mongolia fared better in the Social Support, GDP and Generosity measures.
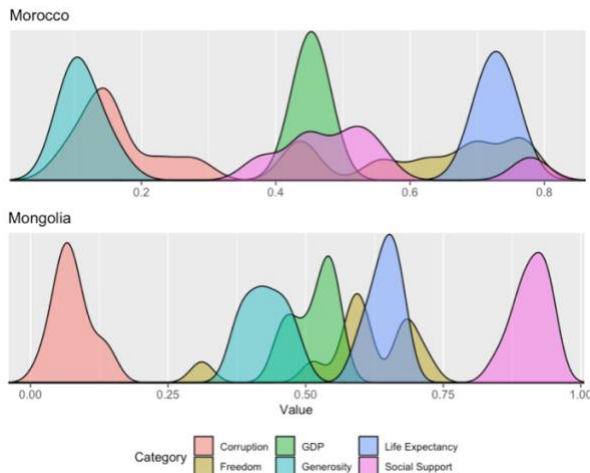

Figure 8.7: Morocco vs Mongolia Component Distribution Ridge Plot

When comparing countries, more interesting insights can be found. While Social Support is the main contributing factor globally, it may not be the case for every country as different countries have different compositions. In 2017, Morocco and Mongolia had Happiness Index Scores of 5.31 and 5.33 respectively. Looking at the radar chart, we can clearly see that Morocco had higher Life Expectancy, Freedom and Corruption measures while Mongolia fared better in the Social Support, GDP and Generosity measures. Likewise, the ridge plot shows that the component contributions of both countries greatly differ from one another.

9   CONCLUSION AND FUTURE WORK

As demonstrated, the Happiness Watch Dashboard facilitates an intuitive top-down analysis of global happiness and its contributing factors. Users can also independently explore countries of interest and easily make comparisons between countries. The dashboard is the first step to a better understanding of happiness to facilitate further research or analysis.

While it is a good initial step forward, we are still limited by the lack of comprehensive data. With more available data, future work could provide a more detailed analysis. Happiness is a measure that is difficult to quantify and is definitely not restricted to the six measures included in the World Happiness Report. In addition, country-level measures are vague and do not account for inequality within a country. The dashboard can also be easily extended to other global use cases where measures are made up of multiple components.

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