



WORLD HAPPINESS

VISUALIZATION REPORT

Authors: Chris Moran, John Costello, Deepthi Ranganath
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1 BACKGROUND

1.1 WORLD HAPPINESS DATA

1.1.1 HAPPINESS SCORE

The world happiness report ranks 155 countries based on their reported happiness levels. The scores are based on standardized polling conducted within each country by the Gallup World Poll, using a method known as the Cantril ladder. Respondents are asked to think of a ladder with the best possible life for them, with the best step being 10 and the worst 0. They are asked to rate their own lives on this 10-point scale. National samples are weighted to make the scores representative.¹

1.1.2 VARIABLES CONTRIBUTING TO HAPPINESS

For each country, the report includes seven additional variables. Two of these variables, GDP and Healthy Life Expectancy, were calculated from Organization for Economic Co-operation and Development (OECD) Economic Outlook data and data from the World Health Organization (WHO), respectively. Four variables are survey-based and proportionally weighted, using the same Cantril-ladder method as the Happiness measurement: Social Support/Family, Freedom, Generosity, and Government Trust/Corruption. The seventh field is known as the Dystopia Residual. The data is mostly a survey of people's perceptions of their own country. (1)

1.1.3 RESPONDENTS BY COUNTRY

For most countries, respondents numbered around 1000. Norway, Germany, and Russia had 2000 respondents each. Haiti and Iceland had 504 and 529 respondents. China had 4373 respondents, and India had 3000 respondents. The surveys were evaluated using statistical analysis to account for margins of error. (1)

1.1.4 WHAT IS THE DYSTOPIA RESIDUAL?

The report authors defined an imaginary country, Dystopia, by taking the worst scores for all 155 countries in terms of GDP, Healthy Life Expectancy, Social Support/Family, Freedom, Generosity, and Government Trust/Corruption. No one real country scores worst in all categories, which means that even the 155th happiest country is happier than Dystopia. The Dystopia Residual is the amount of happiness that cannot be attributed to the other six variables. We define the Dystopia Residual as "happiness due to not living in the worst country, Dystopia." (1)

1.1.5 DATA SETS

The World Happiness Report is an annual publication which started in 2012 with the latest publication in 2017. The report was not published for the year 2014. We chose 2017 report to focus our main attention on the latest conditions of the world but we also chose datasets from 2015 and 2016 to analyze and depict changes over time. The three datasets contain same or similar variables which will help us in drawing correlations. We chose these three datasets as these were currently available for data exploration at the below mentioned data source.²

1.1.6 DATA SOURCE

Source: <https://www.kaggle.com/unsdsn/world-happiness>

Link to the data sets: <https://www.kaggle.com/unsdsn/world-happiness/data>

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1.2 OUR MOTIVATION

Our main motivation is to draw visual insights from the 2017 World Happiness Report dataset. We want to provide our audience with a visual tool on their individual journey to:

See the distribution of happiness rank among countries

Compare the most happy and least happy countries and factors contributing to happiness/sadness

Draw conclusions from comparisons among countries with highest and lowest scores

2 TARGET AUDIENCE

2.1 IDENTIFYING OUR AUDIENCE

2.1.1 OVERVIEW

Our general audience includes all people who want to understand worldwide differences in happiness and the variable categories that contribute to the sense of happiness among a country's citizens. However, we recognized the need to narrow the scope of our audience. We focused on several personas, including members of the public, academics, political activists, economists, and government officials. This makes it difficult to create one visualization to focus on their needs. Additionally, the happiness data provides a jumping off point for deeper examination, but does not answer a number of underlying questions about the nature of the variables. Corruption in one country may differ in quality, as well as quantity, from corruption found in another country.

We intend to use the World Happiness Report to show readers a picture of the world, with relevant information to guide their closer examination of specific countries. They can identify how happiness relates to health care, family bonds, economy, and other factors.

2.1.2 FOCUSED AUDIENCE

We also wanted to choose an audience that we could access through our existing networks. We decided to focus on a subset of the general public, rather than policy makers. Narrowing our approach, we chose people with an implicit or explicit interest in politics: Immigrants to or emigrants from the U.S. and political activists. Immigration and emigration place the migrant in a new political environment, one where they may have no power in the political process.

Our primary users consisted of current graduate students at the iSchool, including immigrants from other countries; an iSchool graduate who travels abroad and is considering emigrating; and a recent college graduate who is a political activist. These five people mapped to our four personas, listed below.

2.2 PERSONAS AND THEIR MOTIVATIONS

2.2.1 US WOMAN TRAVELING WITH CHILD

Name: Jodi Age: 42 Occupation: Senior IT Manager Location: San Jose, CA

Jodie works for a large company and seeks activities to engage her son, Eliot, 10. She plans to transfer to one of her company's regional offices for 3 months to gain work experience. She will take Eliot with her, but her wife, Maria, cannot take the time off. She's told Eliot that he can make an argument in favor of visiting a country, although she and Maria will have the final say in their destination. She's teaching Eliot to challenge his own assumptions about the data and other cultures and critically inquire into information.

2.2.2 INDIAN GRADUATE STUDENT RESIDING IN THE U.S.

Name: Akhilesh Age: 27 Occupation: Student Location: Seattle, WA

Akhilesh is finishing his graduate degree and intends to find a job in the U.S. His technical background makes him highly employable. Due to the political climate and changes to U.S. immigration, he is considering whether to move to a different country. He owns few possessions in the U.S. and has the financial resources to move almost anywhere. One of his friends thinks he should move to Brazil, while another has been working in Kazakhstan. If he can't find a job in the U.S., he would like to move to Canada or France. All of his friends have opinions about which country is best. He wants to examine the happiness index to understand factors that make countries happy. He would like to find visualization that present happiness information to him in interesting ways.

2.2.3 INDIAN WOMAN, MEMBER OF THE PUBLIC AND POTENTIAL MIGRANT

Name: Aparna Age: 31 Occupation: Software Engineer Location: Bangalore, India

Aparna commutes four hours a day and works eight hours a day, five days a week. During her commute, she has noticed that numerous road works remain incomplete after five years. In the newspaper, she reads that about government corruption and poor spending on public works projects. Her long commute leaves her with no time to spend with her family, an imbalance that is leading to dissent and unhappiness. She wonders if the happiness report can tell her at a glance which countries are the happiest and have the best governments. She is considering whether to move to another country so that she can reclaim her life and be happy.

2.2.4 POLITICAL ACTIVIST

Name: James Age: 25 Occupation: Political Activist Location: Shoreline, WA

James is a political activist who works on local, progressive campaigns and is involved in his community. When he was in college, he actively participated in student government and was a member of multiple clubs. He enjoys discussing and arguing topics, and he seeks data to be informed about the state of the world. While he does not want to travel at this time, he does want data and visualization to show why other countries are happy and healthy, and why they are unhappy. He is focused on a health bill that is on the local ballot, and he wants to connect healthy life expectancy with happiness. He also wants to challenge others' perceptions so that they understand how their own decisions affect their own happiness.

3 RESEARCH QUESTIONS

We generated our questions by considering our target audience, the data we have, and the motivations a user may have to look at this data. Because the survey covers a very large number of high-impact factors and represents them in broad, simple indexes, we discovered that it was best to focus on 'big picture' information and give the user guidance towards looking for more specific information. We created two categories of questions based on those that we generated.

3.1 QUESTIONS THE DATA ANSWERS

These questions can be examined through the data provided in the World Happiness Report. These questions provided the main goals for what to include in our visualization.

Which countries are happiest?

What factors make happy countries happy?

What factors make sad countries sad?

Which countries have the most freedom? Which are repressive?

3.2 QUESTIONS WHERE THE DATA CAN OFFER GUIDANCE

The World Happiness Report data does not directly answer these questions, but can provide insight for further inquiry. For example, we cannot predict which country a user wishes to visit or the current status of a country. Nations may experience epidemics, economic problems, or changes in government that are not represented in even the most recent survey. We can, however, point our audience to a country's health rating, its GDP, and the measure of trust that the citizens have in the government.

These questions serve as examples of information our audience might seek guidance in understanding. We will provide examples but not detailed analysis of this information.

Which countries have poor health outcomes?

Which countries have good government?

How does a country's economy drive happiness?

Does a country offer strong social support?

4 ITERATIONS

We iterated through several sketches for our visualizations and our one-page brochure.

4.1 INITIAL SKETCHES

Our initial iterations were sketches to represent global and regional information to our audience. We began with a sketch of the world map, showing happy and unhappy countries with color code of green to represent prosperity and red to show adversity.

World Happiness

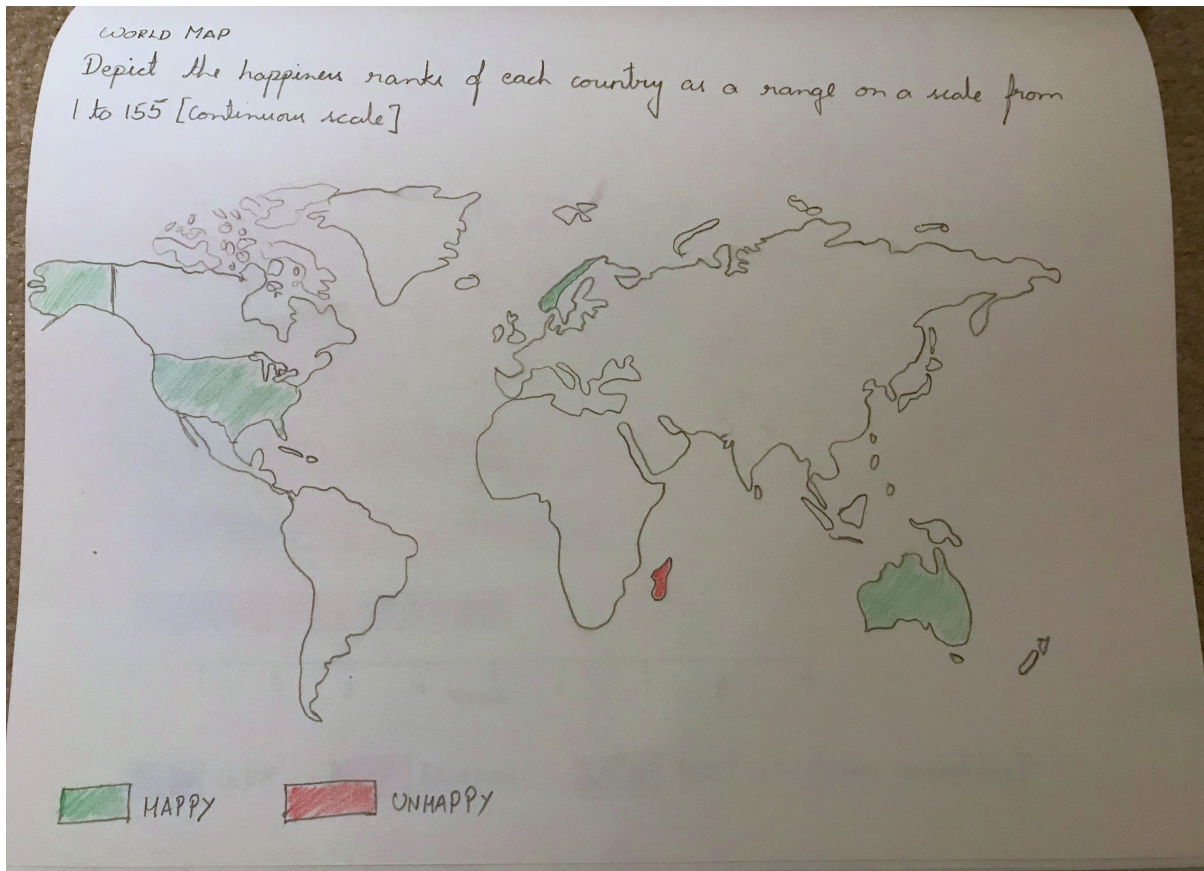


Fig. 1. World map showing happiness and unhappiness.

We then created time-series charts, which showed changes of certain categories over time for specific countries. We thought it would be useful to pick countries from various places on the happiness chart and show changes to one of the categories contributing to happiness. In Figure 2 (below), we show the three-year GDP changes for Norway and Freedom changes for Belize.

World Happiness

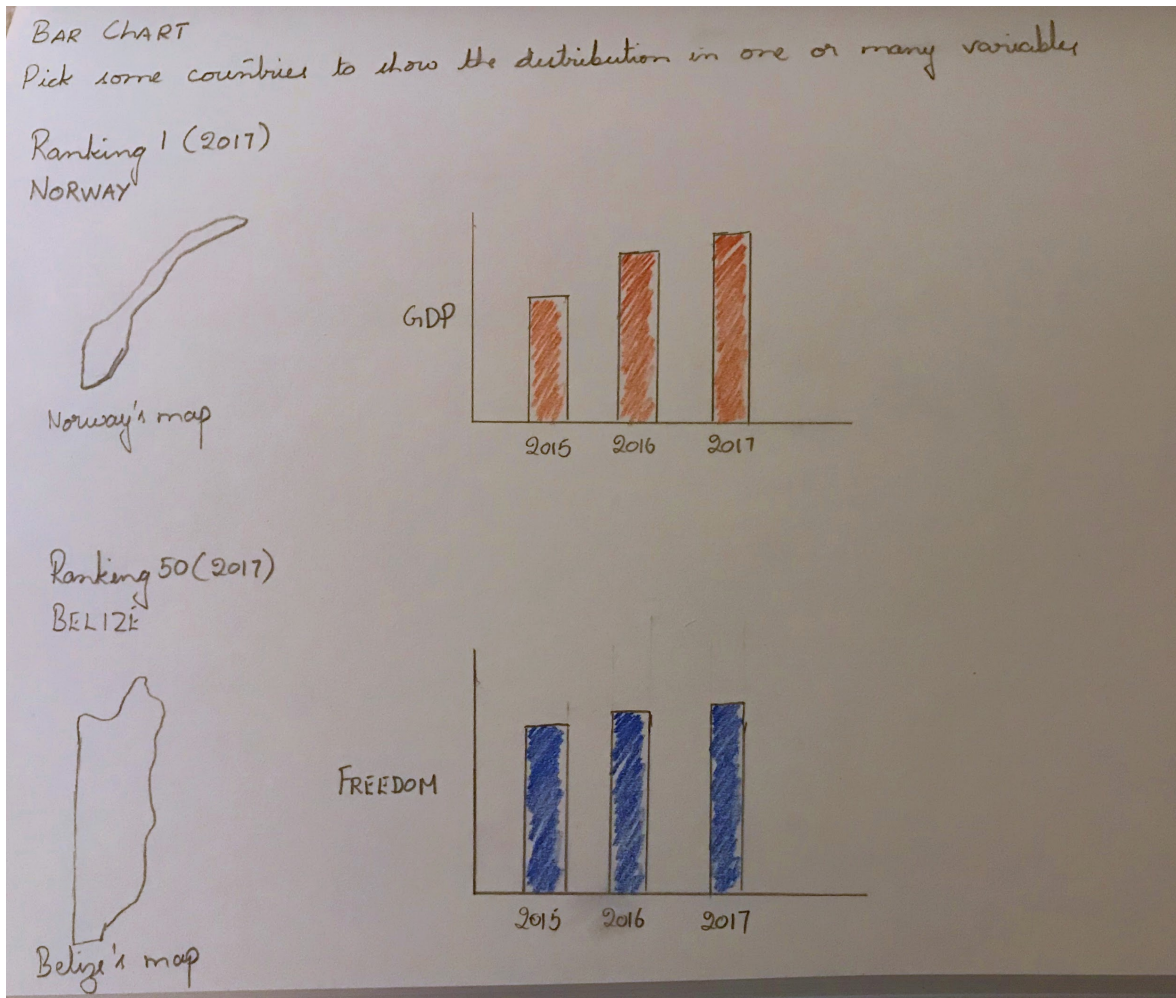


Fig. 2. Bar charts for specific factors in a given country over several years.

We also considered whether to use stacked bar charts, as a way to show the comparisons of relative category levels among countries. In Figure 3, below, the countries aren't specified, leaving open whether we would show the top 10, middle 10, or some other combination of countries. We could have included those countries with the highest Freedom relative to their GDP and Government Trust/Corruption.

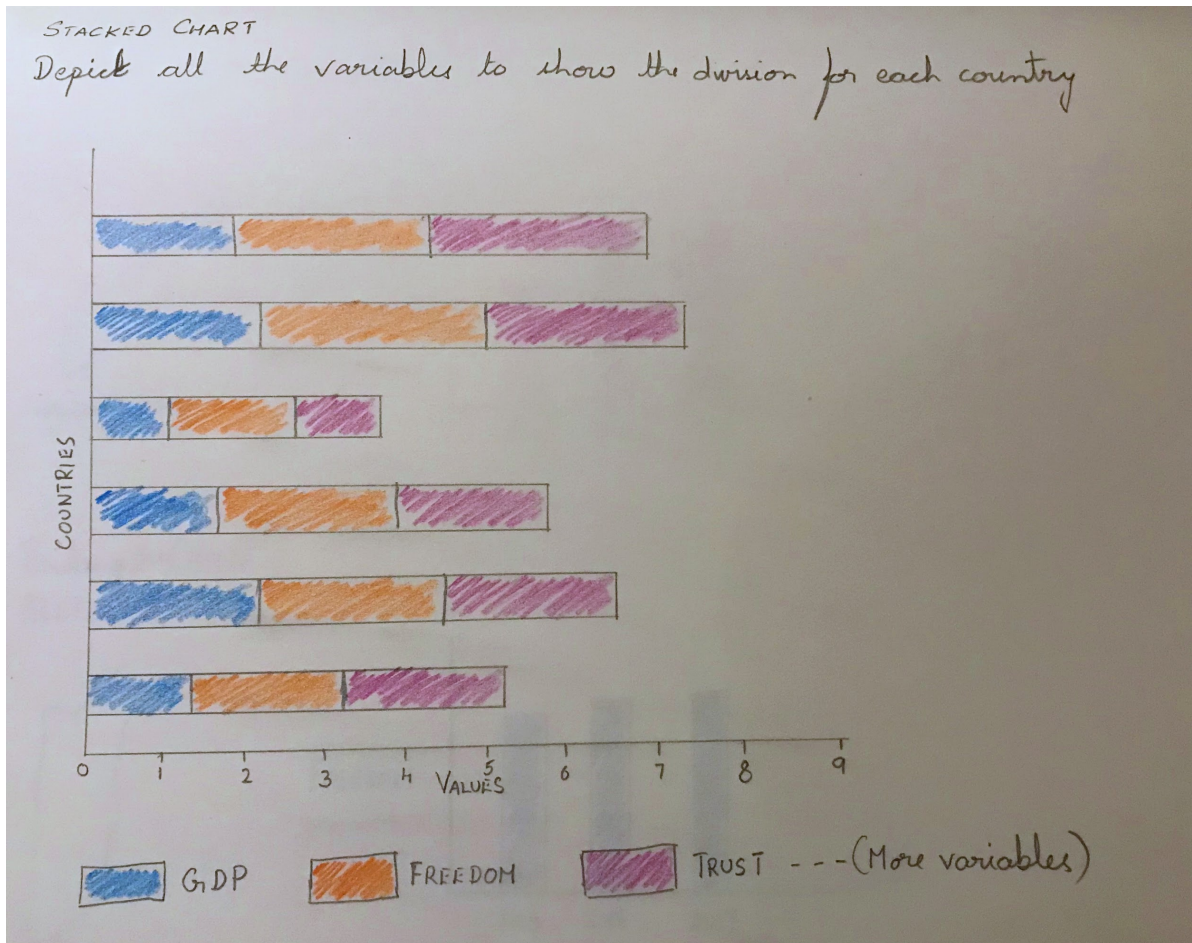


Fig. 3. Stacked bar chart showing visual comparison of three values for several countries.

We worked on sketches and early graphs to discover what we could represent, and then chose more specific concepts based on our audience analysis. This exploration into visualization helped us better consider our audience as part of our iterative exploration.

4.2 INITIAL CHARTS

4.2.1 TOOLS USED

We started constructing our charts using R programming language aided by mostly ggplot2 package. We then refined our charts in adobe illustrator and Inkscape.

4.2.2 SELECTION PROCESS

We experimented with various charts, including many that were not kept for our primary user evaluation.

One rejected chart is shown in Figure 4, featuring the ten happiest countries by region. Two users commented that the stacked bars did not have meaningful sizes, and that the information was fairly easy to observe in other maps.

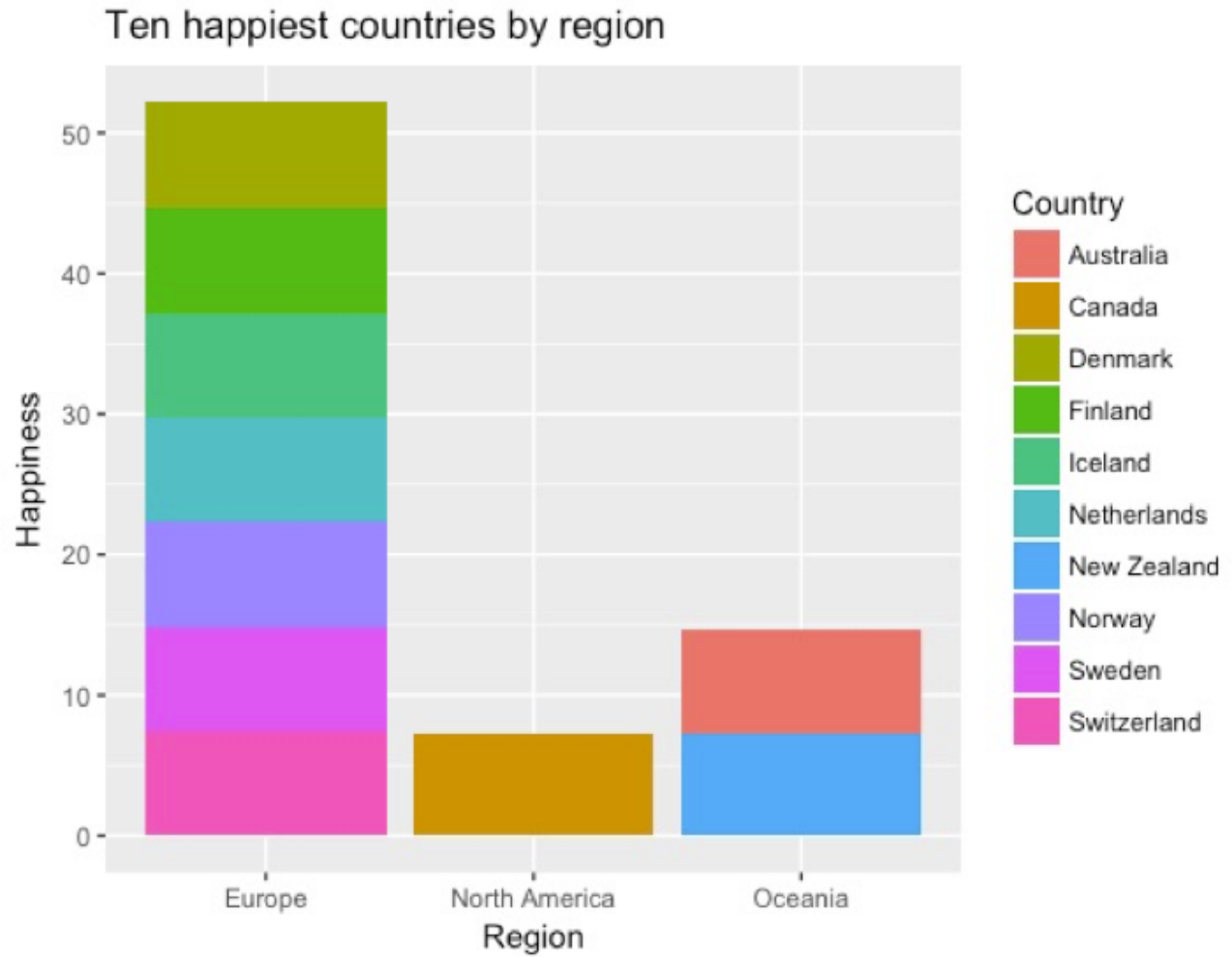


Fig. 4. Ten happiest countries by region.

We also showed countries with the highest Dystopia Residuals, grouped by region, as seen in Figure 5.

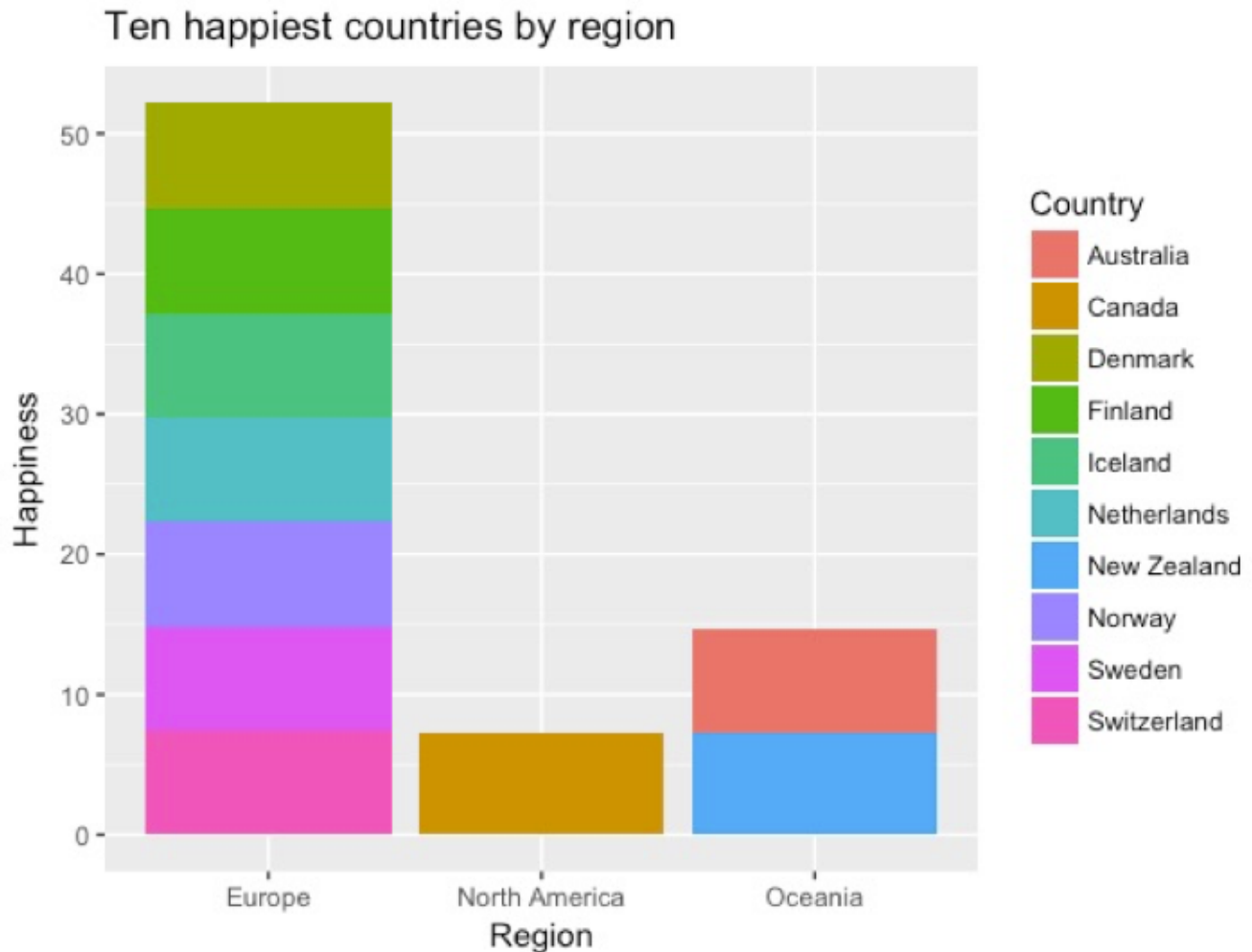


Fig. 5. Countries with highest Dystopia Residuals. The chart title was a problem.

Our chart of average happiness showed little change over three years, leading 2/3 users to complain that such a short time span was meaningless. However, 2/3 of the same users provided an emotional response, and observed a significant, unchanging gap between the highest and lowest ranked countries. Users wanted to see a longer time span or different time span. The World Happiness Report only extends four years, so creating a more meaningful visualization may have to wait for subsequent surveys to be conducted. See Figure 6 below.

Average Happiness Scores

Changes between individual countries varies by year. This chart shows the average Happiness Score of the top 10, bottom 10, as well as the average for all countries surveyed in a given year, regardless of previous rankings. The overall Happiness of the world, and the difference between the happiest and least happy countries remains stable.

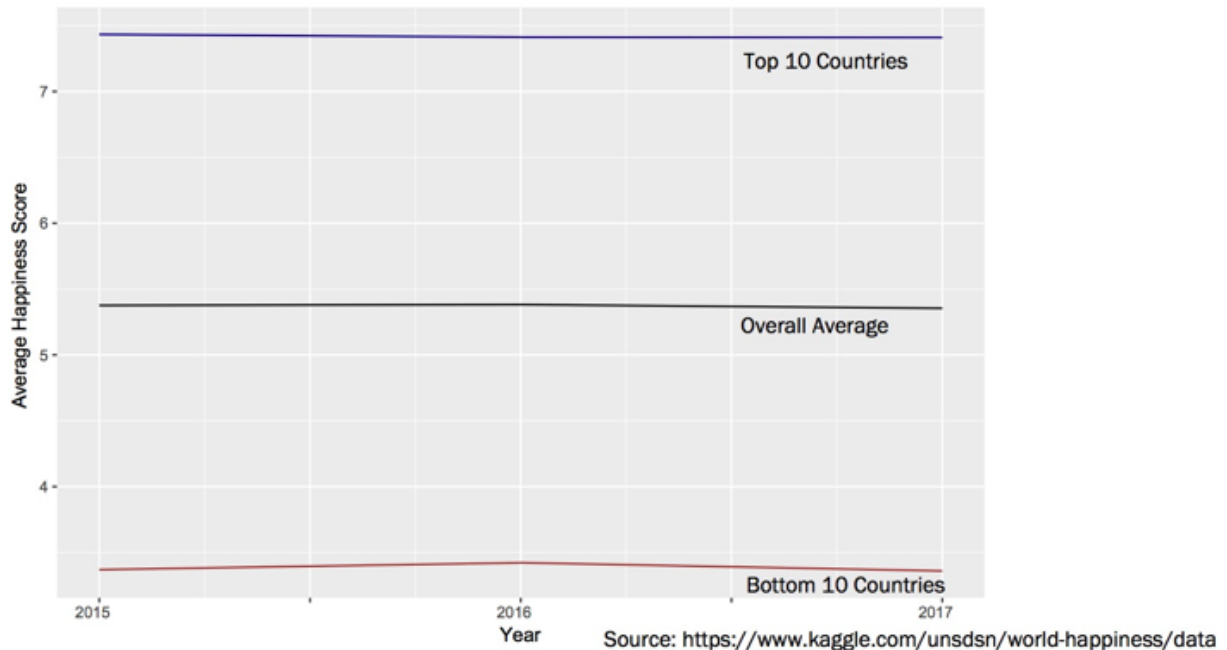


Fig. 6. Changes in average happiness scores over a three-year period.

We iterated across different versions of stacked bar charts, world maps, and radar charts. The following charts are close to the versions we used for user evaluations.



Fig. 7. A radar chart, comparing the values for Norway (#1) and Central African Republic (#155).

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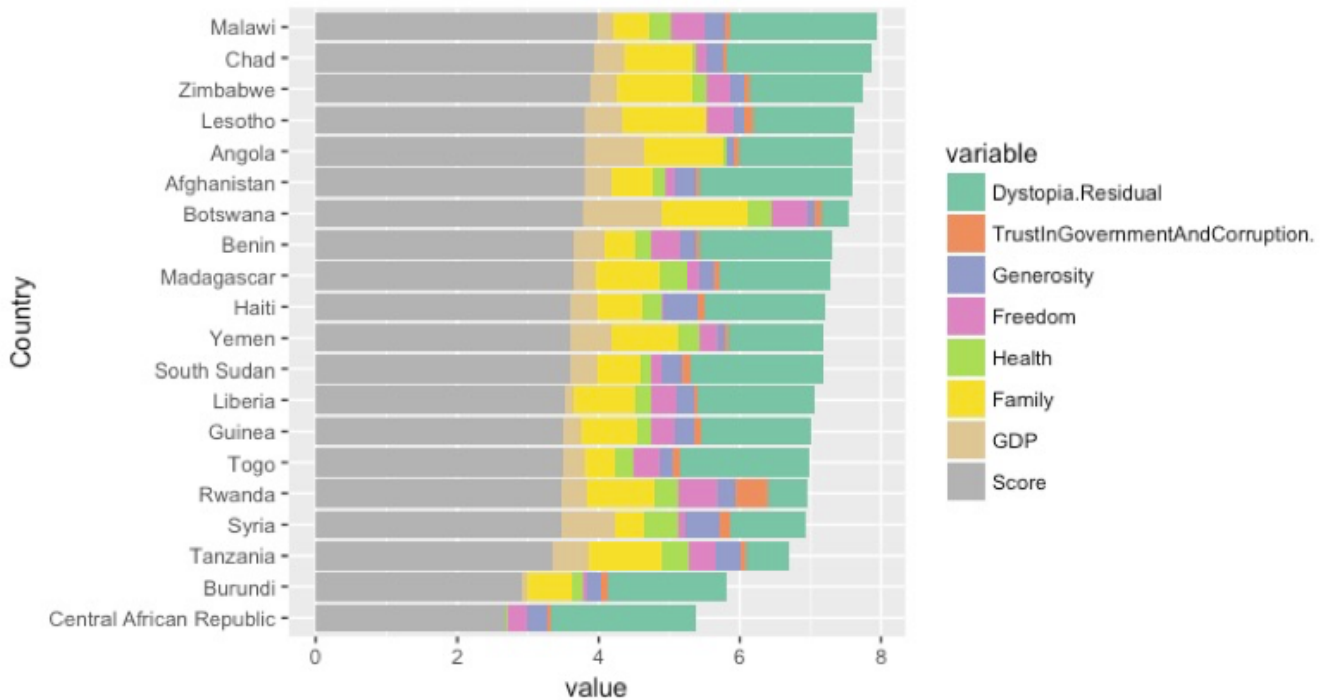


FIG. 8. A stacked bar chart that shows the variables for the 20 countries with lowest Happiness Score.

4.3 CHARTS USED FOR TESTING

We refined our charts and chose five charts to use in our user testing. The charts were chosen for their ability to tell a story in response to our motivations and our audiences' anticipated questions. See the next section, Evaluation, for the charts and the results of testing.

5 EVALUATION

5.1 TEST PLAN

We performed think-aloud tests with our 5 users. Users were given a chart and told to describe their thought processes as they interpreted each chart. We believe that asking users to articulate their thoughts will give us insights into the information presented by the charts, areas of clarity, and where the charts are confusing. The qualitative results will help us improve our visualizations.

5.1.1 QUESTIONS

We asked each user, "Please look at this visualization and describe what you think as you interpret the chart. You may refer to the previous charts. These charts are drafts, and we understand that they need to be improved."

5.1.2 MEASURES

We employed qualitative measures of silent observation, facial expression evaluation, and body language evaluation. We responded to user questions but refrained from intervening, to keep the invasion minimal. We did not ask explicit questions during the observation process.

5.1.3 PROCEDURES

We kept the observation informal. Users were tested in casual settings at homes or in quiet study areas. Each of us conducted tests separately with users, and we took notes on user responses.

5.1.4 RECRUITMENT

Users were recruited through convenience sampling by reaching out to people we know who fall into one of the following categories:

1. Have migrated temporarily or permanently to another country.
2. Are in the process of migrating temporarily or permanently to another country.
3. Have a strong interest in global and/or local politics.

5.1.5 INCLUSION/EXCLUSION CRITERIA

Inclusion Criteria: Our users should have the following characteristics:

- Politically interested or aware
- Current or potential migrant, regardless of country of origin or destination

Exclusion Criteria: Test users who do not meet the inclusion or recruitment criteria stated.

5.1.6 DATA COLLECTION

Data was recorded through note taking. Additionally, we collected demographic information and general information about user interest in other countries, politics, and travel, as part of the informal getting-to-know process.

During observation: We collected data during the course of observation by recording explicit statements and through implicit observation.

After observation: We reviewed our notes to draw inferences from the users about their qualitative reaction to the visualizations.

5.1.7 DURATION OF TEST PROCESS

We divided our time as follows

- Planning the observation - 4 Hours
- Recruitment - 2 Hours
- Observation - .5 - 1 Hours per user
- Data Analysis - 4 Hours
- Total - Approx. 15 Hours

5.1.8 DEFINITION OF COMPLETE

We are still evaluating visualizations and the final brochure. We will declare our evaluation complete when:

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- All test users have been observed
- All data has been collected
- No outstanding questions remain for test users
- The test users can be informed about the completion of recruitment need

5.2 TEST EXECUTION

5.2.1 TEST USER DESCRIPTION

TEST USER	DESCRIPTION	STRENGTHS	WEAKNESSES
User 1	• Female, 44, U.S. citizen • MLIS graduate, Intranet Manager at a law firm • Studied Latin American politics, potential migrant	• Better informed about politics and global affairs than our public persona • Visual design background • Strong analytical skills	• Older than our graduate student persona • Will skim information if it doesn't capture her attention
User 2	• Male, 39, U.S. citizen • Business Analyst at Hasbro • Mid-career MSIM student	• Strong analytical skills • Reasonably informed member of the public	• Doesn't pay particular attention to world affairs • Discounts his knowledge of geography
User 3	• Male, 32, U.S. citizen • Political activist • Recent college graduate	• Pays attention to reports and studies • Researches media sources • More experienced than public persona	• Focused heavily on negative outcomes and assumptions
User 4	• Male, 32, Indian citizen living in U.S. since 2008 • Works at Microsoft • Graduate of U.S. university	• Somewhat informed about global affairs • Interested member of the public	• Unlike our personas, he is not planning to move to another country
User 5	• Female, 27, Indian citizen living in U.S. • Recent graduate from U.S. university • Looking for jobs in the U.S.	• Interested member of the public • Somewhat aware of global affairs	• Like our Indian graduate persona, she hopes to stay in the U.S.

5.3 INITIAL TEST RESULTS

5.3.1 WORLD MAP

We began by showing our users the world map, Figure 9.

- 5/5 users wanted countries visibly differentiated in some way. Parts of South America and North America blurred together, causing confusion among the testers.
- 3/5 users wanted happiness calculations explained.
- 0/5 users commented that happiest was the darkest color and unhappiness was the lightest color.
- 2/5 users were confused by the gray coding for Greenland and “those islands above Australia” (Papua New Guinea).

COUNTRIES OF THE WORLD BASED ON HAPPINESS RANK IN 2017

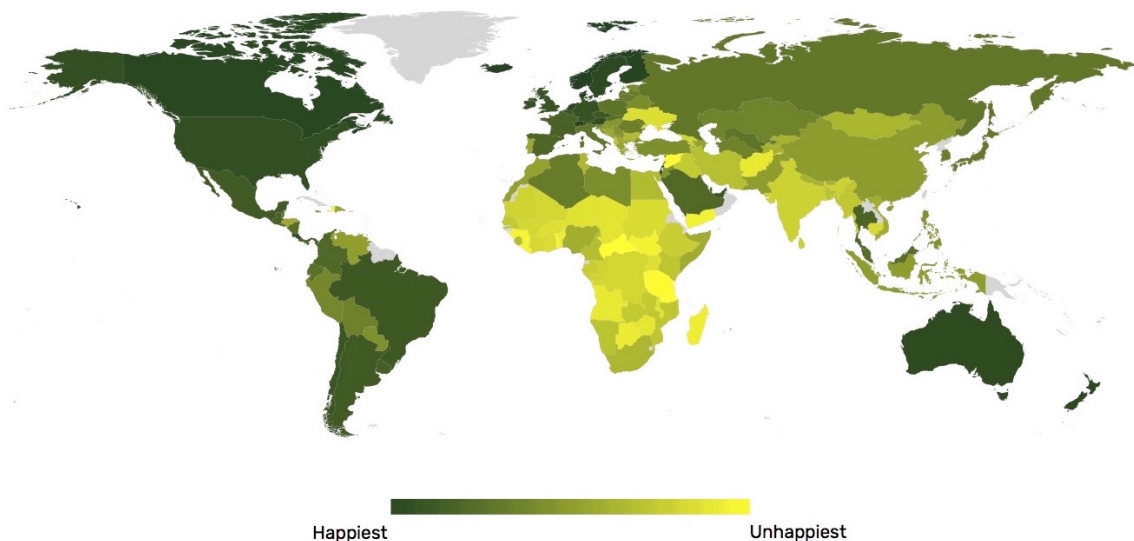


Fig. 9. World map showing countries of the world based on happiness rank in 2017.

5.3.2 STACKED BAR CHART

Next, we showed users the stacked bar chart, Figure 10, containing all variables for the top 10 and bottom 10 countries.

- 5/5 users were confused by the x-axis.
- 4/5 users wanted the categorical variables and stacking explained.
- 4/5 users liked the comparisons.

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TOP 10 AND LAST 10 COUNTRIES - HOW THEY COMPARE ON HAPPINESS VARIABLES

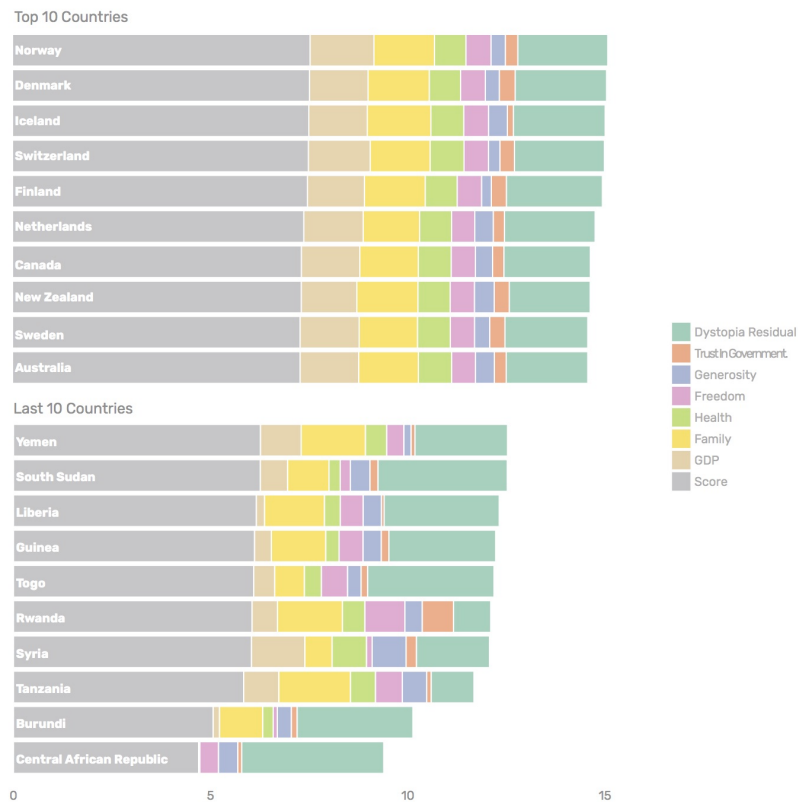


Fig. 10. Stacked bar charts showing the top 10 and last 10 countries, with a comparison of Happiness and all variables.

5.3.3 RADAR CHART - NORWAY AND CENTRAL AFRICAN REPUBLIC

Users were shown a radar chart that compared the values for Norway (#1) and Central African Republic (#155), the first and least happiest countries in 2017, shown in Figure 11.

- 3/5 users cited issues with the scale of Score (happiness) relative to the other categories.
- 2/5 users were surprised by the similarities, given the difference in ranking, of several categories between the two countries.
- 2/5 users noted issues with the legend.

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COMPARISON BETWEEN RANK 1 AND RANK 155 IN 2017

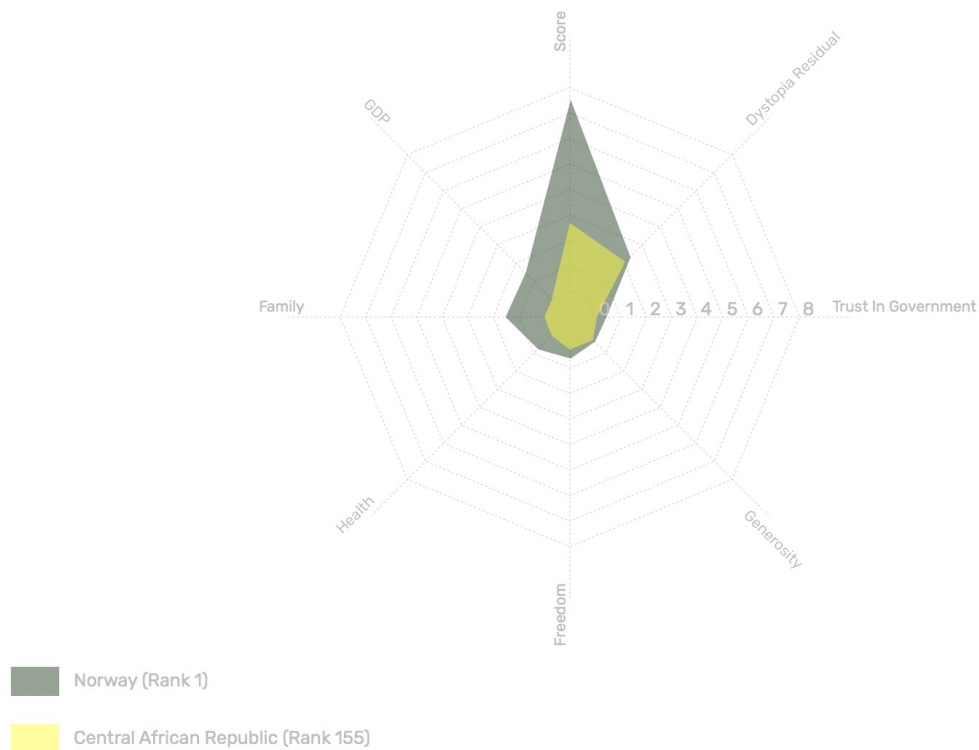


Fig. 11. Radar chart comparing Norway and the Central African Republic.

Based on user reactions (and non-reactions), we decided that this chart was not a successful visualization for our users.

5.3.4 HIGHEST HAPPINESS

The next chart contained an explanation of the content, but users consistently skipped the legend and failed to comment on it. This may have occurred due to the minimal text on the first three visualizations shown to users. See Figure 12.

- 4/5 users wanted colors next to each country on the legend to make it easier to determine which line corresponds to which country.
- 2/5 users noted that the y-axis covers a very narrow range (about 0.5) of happiness.
- 2/5 users caught our mistake of including 2016 twice on the x-axis.

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Highest Happiness Scores

Each country portrayed in this chart ranked in the top 10 at some point in the last three surveys. Although their rankings may change, the difference between them can be very slight. These changes represent increases or decreases in the quality of life in these regions. These may be driven by various events, and each individual country appears to be going through a higher degree of change. In general, these changes are small compared to other countries surveyed.

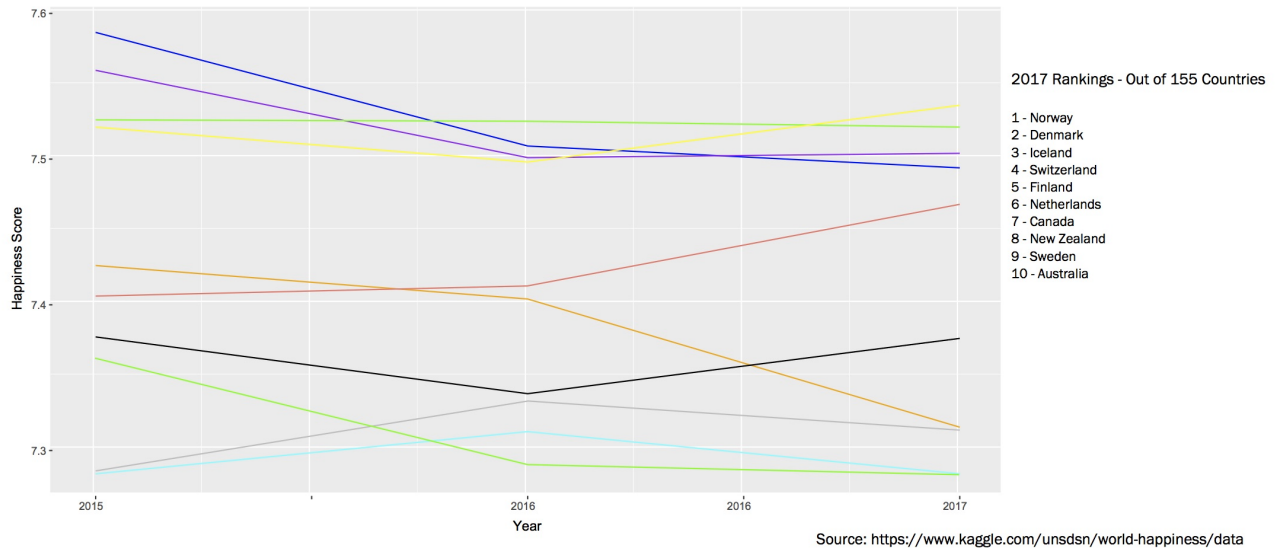


Fig. 12. 10 Countries with the highest happiness scores.

5.3.5 LOWEST HAPPINESS

The next chart contained an explanation of the content, but most users consistently skipped the description and failed to comment on it. This may have occurred due to the minimal text on the first three visualizations shown to users. See Figure 13.

- 5/5 users were confused by the line colors and lack of color legend, similar to what was reported for the “HIGHEST HAPPINESS” chart.
- 5/5 users wanted color added to the legend.
- 3/5 users noticed that this chart and the “HIGHEST HAPPINESS” chart used a different scale. All 3 of these users wanted the two charts to use the same scale.
- 1/5 users thought that the description at the top was too long.

Lowest Happiness Scores

Each country portrayed in this chart ranked in the bottom 10* at some point in the last three surveys. Their rankings may have changed significantly. These changes represent increases or decreases in the quality of life in these regions. These may be driven by various events, and each individual country appears to be going through a higher degree of change.

*Central African Republic, currently ranked 155, is not included as it was not included in the 2016 Survey.

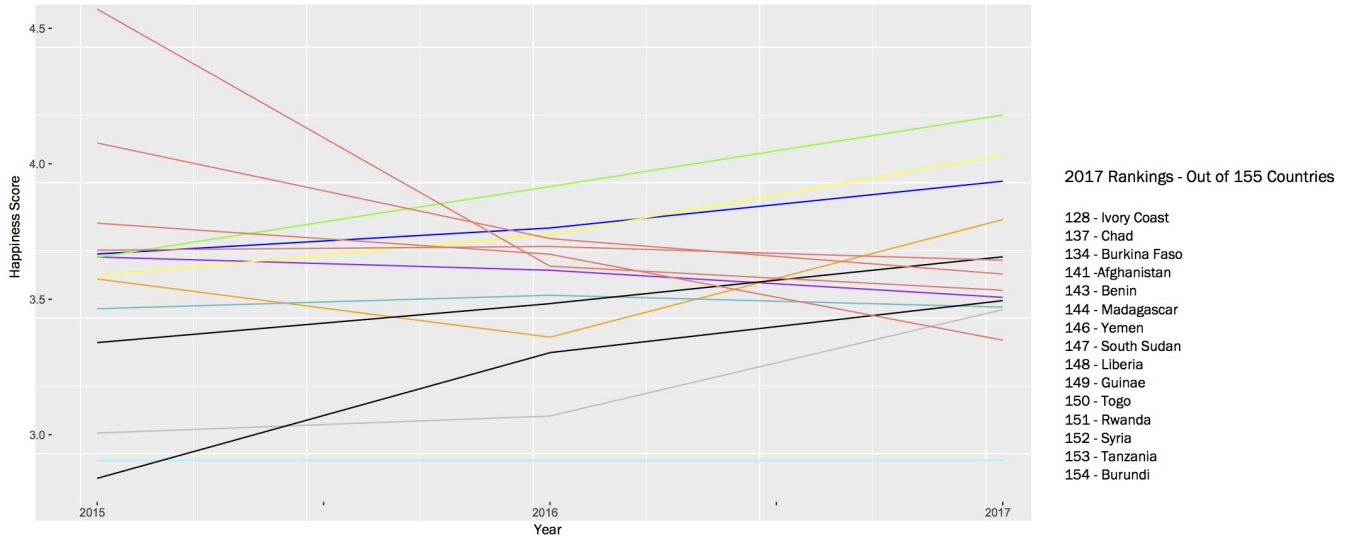


Fig. 13. Countries that occupied one of the lowest 10 happiness spots at any point from 2015-2017.

5.3.6 Tri-fold Brochure

We struggled to fit the content into a tri-fold brochure, in part because of the size of the visualizations and in part because of the restrictions presented by the tri-fold format, shown in Figure 14 (front) and Figure 15 (back). Our peer groups fit into several of our user categories, including graduate students from other countries, students who are considering migrating to another country, and informed members of the public.

Based on responses from our class peers, we observed:

- 4/6 peers expressed issues with the legibility of the text and font mismatches.
- 4/6 peers observed that the stacked bar chart will be cut by the fold.
- 3/6 peers noted that the design was complex and confusing.
- 3/6 peers said that they struggled with the color contrasts within the charts and compared to the background colors.
- 1/6 peers were confused by the Dystopia Residual.

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Lowest Happiness Scores

Each country participated in this report started in the bottom 127th at some point in the last three years. These rankings may have changed significantly. These changes represent increases or decreases in the quality of life in these regions. These may be driven by various events, and each individual country's unique situation. The bottom 127 countries are ranked by their 2013 score. The 2013 survey, "Country African Republic, country ranked 125, is not included in the 2013 survey."

2013 Ranking - Out of 180 Countries

Country	2013 Ranking
127	Lowest
128	Lowest
129	Lowest
130	Lowest
131	Lowest
132	Lowest
133	Lowest
134	Lowest
135	Lowest
136	Lowest
137	Lowest
138	Lowest
139	Lowest
140	Lowest
141	Lowest
142	Lowest
143	Lowest
144	Lowest
145	Lowest
146	Lowest
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160	Lowest
161	Lowest
162	Lowest
163	Lowest
164	Lowest
165	Lowest
166	Lowest
167	Lowest
168	Lowest
169	Lowest
170	Lowest
171	Lowest
172	Lowest
173	Lowest
174	Lowest
175	Lowest
176	Lowest
177	Lowest
178	Lowest
179	Lowest
180	Lowest

What do these scores mean?

Respondents from each country are asked to think of a ladder, with the best possible life being a 10 and the worst a 0, and rate their current lives on that scale. Scores are weighted to be representative of the country's population.

Six additional scores—GDP, Family, Healthy Life Expectancy, Freedom, Government Trust/Corruption, and Generosity—estimate how much each of six factors contribute to making life evaluations higher in a country than in a hypothetical country, Dystopia.

Dystopia has values equal to the world's lowest factor in all six factors. A country's Dystopia Residual is the difference between that country's six factors and Dystopia's.

These six factors have no impact on the total Happiness score reported for each country, but they do explain why some countries rank higher than others.

The bases for GDP and Life Expectancy are calculated using global data. The bases for Freedom, Government Trust, Family, and Generosity are derived from country-specific surveys on a ladder scale similar to the Happiness survey methodology.

The highest scoring countries experience much lower changes in happiness year-to-year than the lowest scoring countries. Although some show both remarkable improvements and declines, the lower ranking countries tended to have much more volatile scores in the last few years.

Based on Gallup Polling, the World Happiness Rankings compare the perspective of individuals in countries around the world.

Survey respondents rank their country's happiness on a number of factors, including Economy, Family, Governmental Trust, Health Care, Freedom, and Generosity.

For more information, please visit: <http://worldhappiness.report>

Fig. 14. Tri-fold brochure front.

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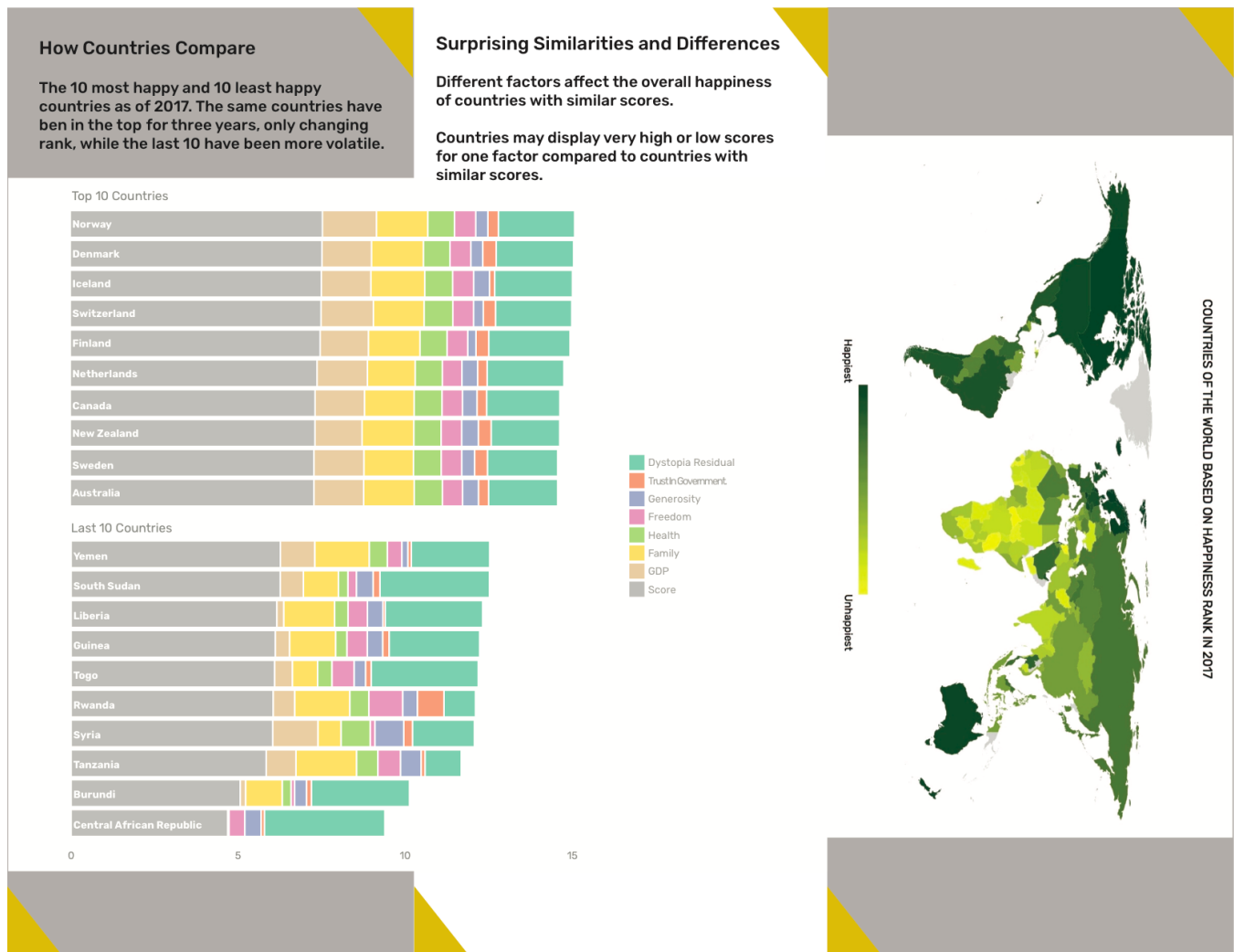


Fig. 15. Tri-fold brochure back.

5.3.7 OUTCOMES OF INITIAL TESTS

Based on user feedback, we made the following revisions to our visualizations:

- Provided context for scores and categories
- Chose colors with stronger contrasts
- Added specific numeric guides to charts
- Added color legends to highest/lowest happiness visualizations
- Test new iterations

Additionally, we decided to move away from our plan to create a tri-fold brochure. We decided to create a brochure using portrait layout.

5.4 TESTS OF FINAL VISUALIZATIONS AND BROCHURE

We tested the final visualizations and brochure using the same methods as above. Due to time constraints with both our group and users, we did not manage to schedule as many tests as with our prior visualizations. We have accounted for this in our next steps.

5.4.1 RESULTS OF FINAL VISUALIZATION/BROCHURE TESTS

USER 1 said that the brochure was bright and appealing, and that she liked the smiling multicultural people. She said that the chart colors had clear meaning. She thought that the explanations were good, and that the brochure told a clear story about overall world happiness. She declared that the brochure was very clear and concise and made sense. She didn't have any questions or recommendations for changing the brochure.

6 FINAL VISUALIZATIONS

6.1 REFINEMENTS

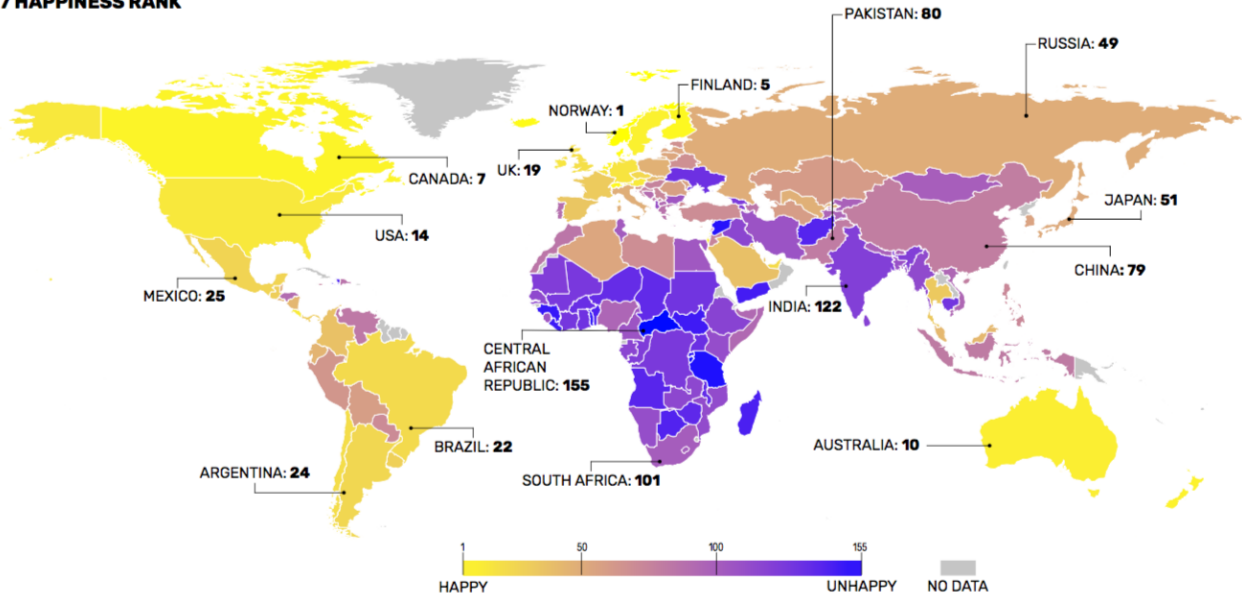
Our final visualizations were refined using user feedback. We included definitions of the Happiness Score, better explanations of the categories and terms, more distinct colors and boundaries, and color codes for the highest/lowest happiness charts. Our visualizations have very minimal annotations with an intention to reduce clutter and a foresight of including them on the brochure with text explanations.

6.1.1 WORLD MAP

The world map (Figure 16) provides a comprehensive first glance. We incorporated peer review feedback and changed the color gradient from yellow to blue with yellow representing happiness and blue representing unhappiness. We incorporated a scale with clear demarcation for ranks at regular intervals. We thought mentioning that it represents rank would have been redundant since it was already indicated in the title of the chart. We also included certain countries of interest to annotate on the map with a fair mix of countries for each continent. These countries were chosen because they sampled from various points on the happiness report, and they included countries where our audience might be traveling from or wish to visit. If we had added any more countries, it would have clouded the map with decreased visual appeal. Both from our user testing and peer review, we received feedback that the grey countries were confusing, and we added a legend to give meaning to that "no data" color.

World Happiness

2017 HAPPINESS RANK



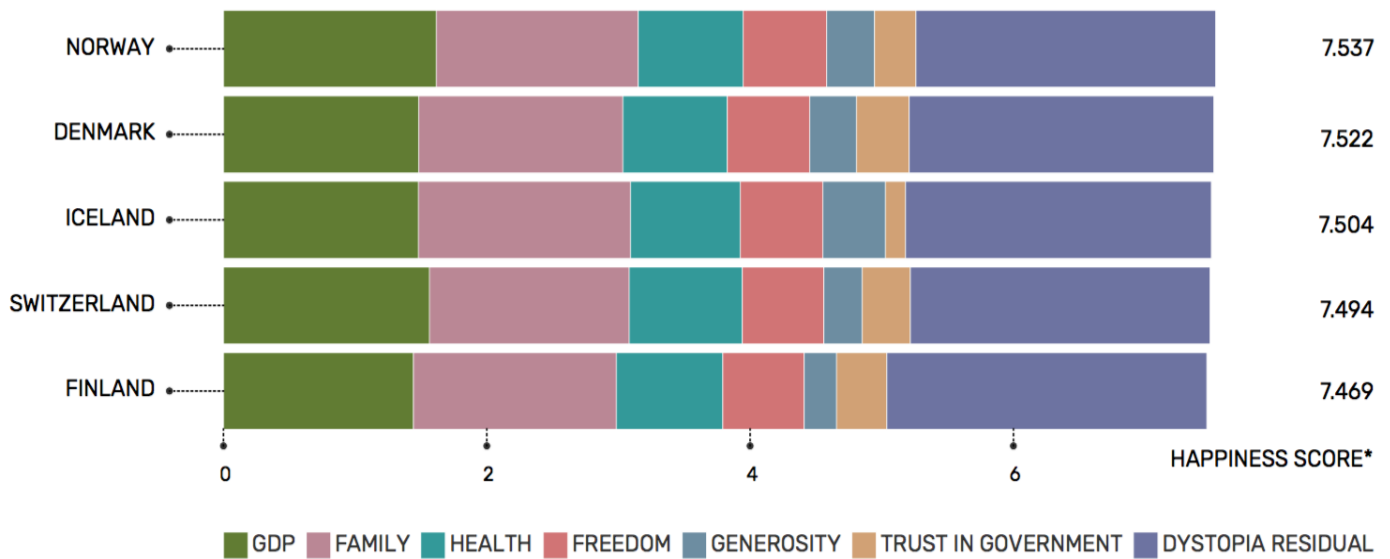
Source: www.kaggle.com/unsdsn/world-happiness

Fig. 16. World Map for 2017 Happiness Ranks.

6.1.2 TOP AND BOTTOM HAPPIEST COUNTRIES FOR 2017, STACKED

These two charts show the distribution of categories for 2017. Figure 17 shows the top five countries, while Figure 18 shows the bottom five countries. Initially, we had Happiness Score depicted as a bar along with other categories. With users not understanding how the categories related to happiness score and the confusing scale on X-Axis, we decided to remove the bar for happiness score. We included the values for happiness score beside the stacked bars for each country. Since the values of the top and bottom countries do not vary greatly, we reduced the number of countries from 10 to 5. A secondary reason for reducing the number of countries is that the change made clearer to our users that happy countries are consistent in their category scores, while unhappy countries are quite inconsistent. Removal of the stack for happiness score allowed us to depict that other categories add up to happiness score eventually. We further approximated the values for happiness score and mentioned the same on the visualization. We also incorporated a discrete palette with complementary colors to show the divisions clearly.

2017 HAPPINESS SCORE FOR TOP FIVE COUNTRIES

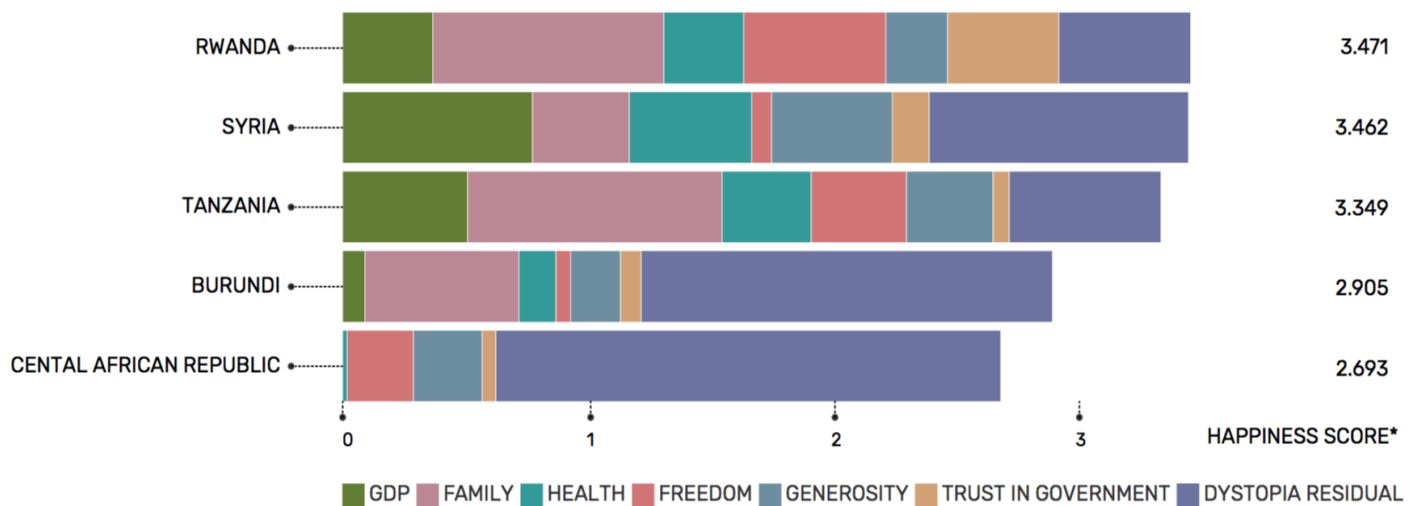


* Happiness Scores are approximated to three decimal points

Source: www.kaggle.com/unsdsn/world-happiness

Fig. 17. Stacked Bar Chart for Top Five Countries.

2017 HAPPINESS SCORE FOR BOTTOM FIVE COUNTRIES



* Happiness Scores are approximated to three decimal points

Source: www.kaggle.com/unsdsn/world-happiness

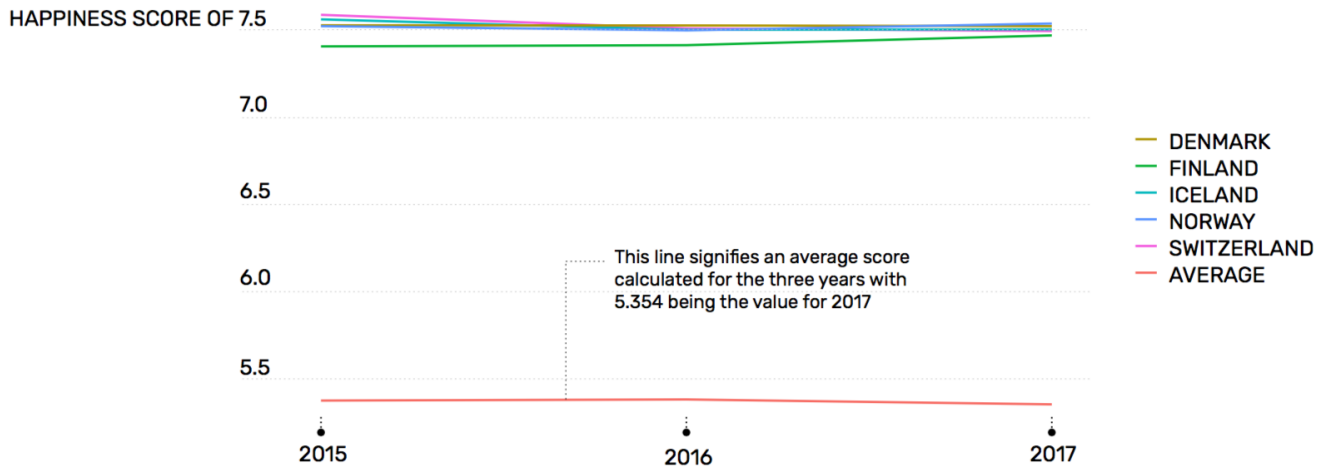
Fig. 18. Stacked Bar Chart for Bottom Five Countries.

World Happiness

6.1.3 LINE GRAPHS, TOP AND BOTTOM HAPPIEST

These two charts show the three-year averages for the top happiest (Figure 19) and bottom happiest (Figure 20) countries. We reduced the number of countries in the final visualization in order to reduce user confusion. We believe that using the 5 countries listed in 2017 represented the patterns of high and low ranking countries just as well as using 10+ countries. We also responded to user feedback requesting a more accurate legend, larger/more distinct elements. We added an average line as measure of comparison for top countries and bottom countries to compare against.

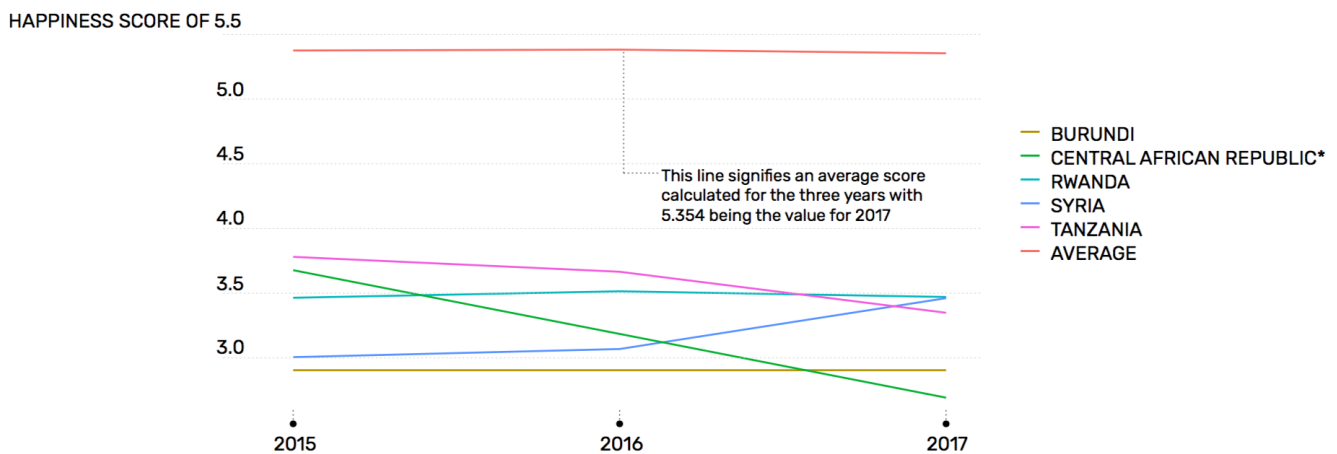
2015 TO 2017 - AVERAGE HAPPINESS SCORE FOR TOP FIVE COUNTRIES



Source: www.kaggle.com/unsdsn/world-happiness

Fig. 19. Line graph showing the Happiness score for top Five countries between 2015 and 2017.

2015 TO 2017 - AVERAGE HAPPINESS SCORE FOR BOTTOM FIVE COUNTRIES



*Data for the Central African Republic was missing in the 2016 Survey.
An average value between 2015 and 2017 has been used to normalize the country's score line

Source: www.kaggle.com/unsdsn/world-happiness

Fig. 20. Line graph showing the Happiness score for bottom Five countries between 2015 and 2017.

7 ONE-PAGE BROCHURE

Our intention for the brochure was to tell a story, a story of happiness distribution across the world. We wanted to funnel down to the smallest subsets yet show contrasts between top and bottom countries. We wanted to make this brochure a tool for our audience in their quest to understand how happiness was distributed for 2017. While each of our personas and users has different motivations for viewing the happiness data, our chart serves as a good starting point. We also wanted to give our audience multiple visuals to compare and contrast between various categories and years. Our audience can discover the happiest countries, see countries that are close in happiness, and identify that the happiest countries have consistent qualities. The audience also can identify the variations in categories for the least happy countries, a comparison that invites further inquiry into the details underlying the data. Below is a snapshot of the front side of our one-page brochure. We have included our two-sided brochure as a separate attachment along with this report and recommend viewing the full brochure or printing out a copy.

Note: Brochure looks the best when viewed at a zoom of 150% or more.



The World Happiness Report is based on in-country surveys of the citizens of 155 countries, conducted by the Gallup Poll organization. Respondents are asked to imagine the best possible life and then rate their happiness on a scale from 1-10. The weighted surveys determine a country's overall happiness score.

Fig. 21. Front side of the one page brochure.

8 NEXT STEPS

We intend to continue user testing of our visualizations, especially our one-page brochure. Based on this testing, we will refine the layout and design of both the overall visualization and the individual graphics. We may also further refine our user profiles based on statistical research, and make changes if necessary to respond to discrepancies in our user data. Our peer review included feedback that our users were not based on sufficient research, and we will address this in future iterations.

Our ultimate goal is to address user feedback in a meaningful way, and create a brochure that reliably fulfills our users' needs. Ideally, this final brochure will also scale from a flier-sized handout to a poster-sized print.

9 REFERENCES

1 n.d. *Overview*. <http://worldhappiness.report/overview/>.

2 Sustainable Development Solutions Network. n.d. *World Happiness Report*.
<https://www.kaggle.com/unsdsn/world-happiness>.