CS 416 Final Project - Narrative Visualization

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URL:

Website: https://gputcha2.github.io/CS416FinalProject/
Repo: https://github.com/gputcha2/CS416FinalProject

Messaging:

In this narrative visualization, I will try to investigate the potential factors contributing to a country's happiness score - exploring the relationship between happiness and several factors that could affect it such as the economy, life expectancy and corruption in the government. This will be done using an introduction followed by 4 visualization scenes. In each scene, I will explore a different potential contributing factor and analyze the relationship with the happiness score.

The data for happiness scores are from the World Happiness Report which was released at the United Nations. These "happiness scores" for each country use data from the Gallup World Poll. The primary question informing these scores is called the Cantril Ladder. This question has respondents evaluate their current life with a score from 0 to 10.

By the end of the visualization, the user should have a clear understanding of the different factors contributing to a country's happiness score and how they are related.

Along the way, three countries (USA, Zimbabwe and Poland) will be highlighted in all of the scatterplots to help support the analysis done on each page.

Narrative Structure

The narrative structure chosen was the Martini Glass structure (linear ordering narrative structure followed by user interactivity and reader-driven content). The narrative visualization I have built follows this structure by first presenting the information to the user in an author-driven format (prescribed path from scene to scene) and then opening up the data to the user for further examination at the end. This allows the user to drill down on any specific metric and to filter the data based on any of the x or y-axis fields as well as by continent.

Visual Structure

- The narrative visualization follows a consistent visual structure.

  The interactive visualization portion of a scene (with labeled x and y axes) is always placed on the left-hand side of the screen and the right side contains information on what is being shown on the left. Hovering the mouse pointer over the data points in the scatterplots reveals more information to the user on specific countries. Each scene also contains navigation buttons for proceeding to the next scene, previous scene or home/title page. Additionally, each page comes with some user controls to adjust the visualization. For scenes 1,2 and 4 contain a basic checkbox to remove the annotations on the visualizations for a more in-depth experience for the user. Scene 5 contains more advanced user controls for a deep dive into the data for user-driven insights.

  Even on the last scene (5) in which the user can make their own discoveries in the data, the structure is maintained with the visual (scatterplot) on the left side with all of the filtering controls on the right side along with instructions. This structure ensures that the viewer can easily understand the data with all of the elements presented on a single view along with the user's ability to hover over data points on the various scatterplots to get a clearer picture. On several scenes, such as the first two scatterplot scenes as well as the bar chart, there are animations showing trendlines and annotations to bring the attention of the viewer to the crux of the information being presented as well as the important takeaways.

- Each scene has a title as well as a subtitle giving an overview of what is being presented. Each scene also has some text indicating what is going to be presented next- giving the viewer a sense of continuity and how the data being presented relates with what will be presented and how all of it fits together to present the bigger picture.

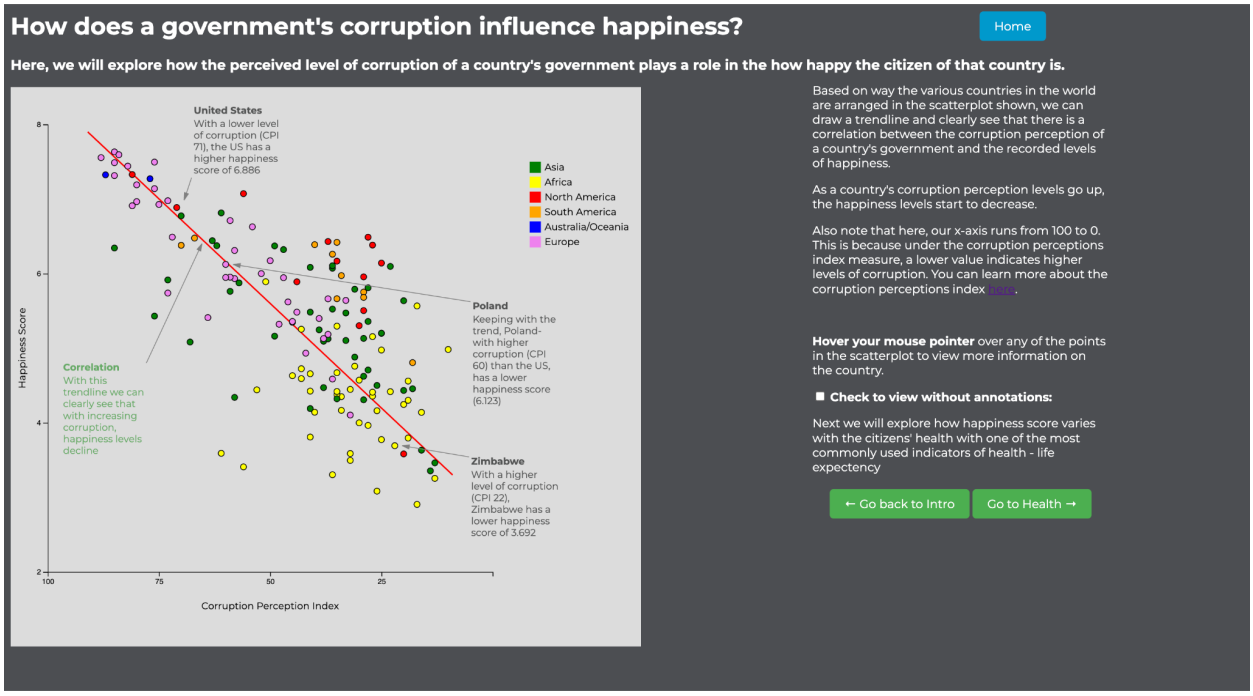
- Additionally, all of the data points in the scatterplot were color-coded by continent. This visual structure is maintained throughout all of the scenes and there is also a clear consistency in the color scheme used throughout.

Scenes

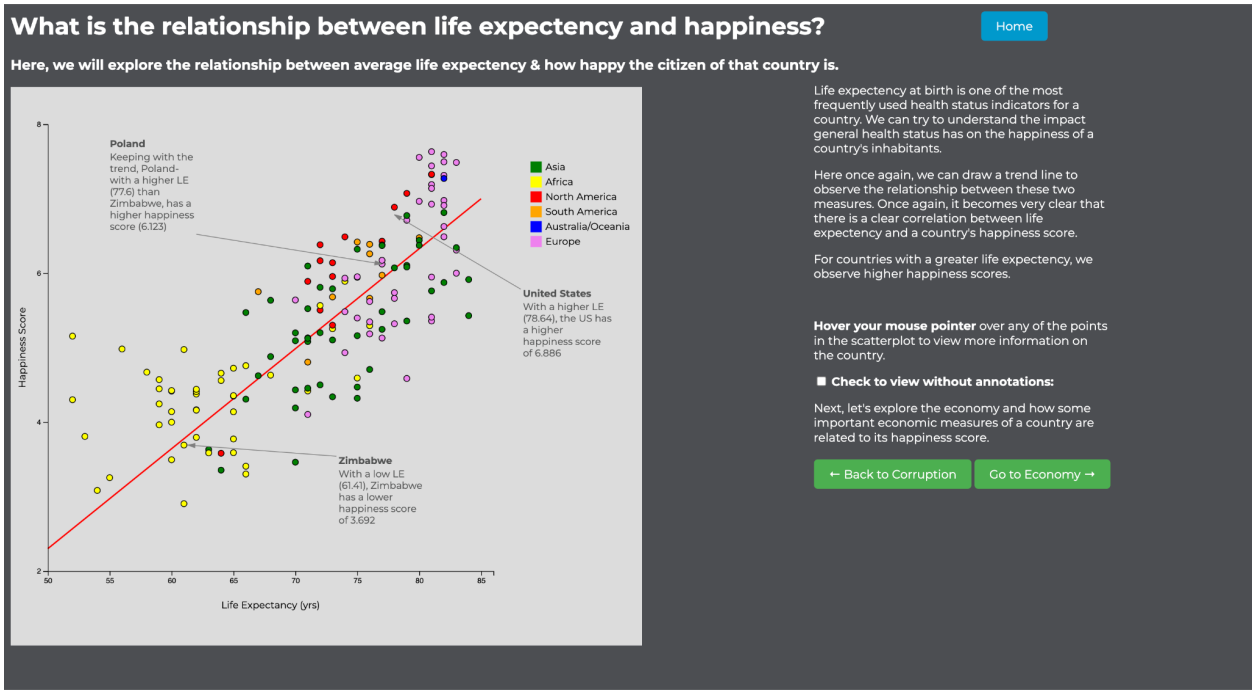
This narrative visualization consists of five scenes. To start off the experience, a title page and an introduction page are presented to the user giving a brief overview of what will be presented on the 3 key factors that could be potentially driving the happiness scores of countries. The viewer is also introduced to the fact that throughout the visualization, the author-driven content will follow the story of 3 separate countries to help support the findings on each metric. Followed by the introductory material- viewers are guided through 5 scenes.

- The first scene shows the first factor being considered - corruption perception of a government and its relationship with happiness score. A trendline is shown to bring the

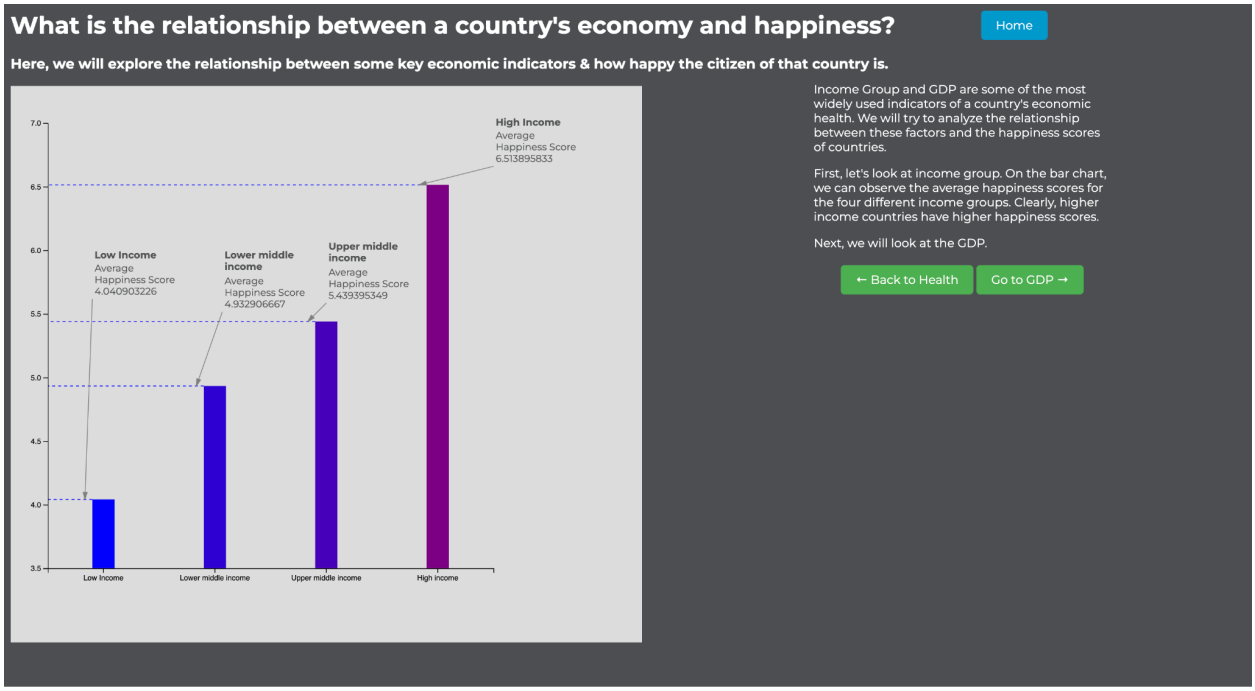
correlation in the data to the attention of the viewer. The trendline uses a d3 transition to be drawn onto the graph with a smooth animation. The graph is annotated with the 3 countries being followed in the author-driven content: USA, Poland and Zimbabwe. An additional annotation is provided to bring the correlation to the attention of the viewer. The viewer can interact with the graph by hovering their mouse over the data points to activate the tooltip that provides information on the specific country. There is also a checkbox to hide the annotations if the user chooses to do so.



- The second scene shows the next factor being considered - health. The indicator used to explore the general health of countries is the life expectancy measure. Once again, a trendline is shown to demonstrate the correlation between life expectancy and the happiness scores. The viewer sees a smooth animation on the screen as the trendline is drawn. Like the first scene, annotations are made for the three countries being followed and can be optionally hidden. Also like the first scene, hovering over the data in the graph reveals the tooltip with relevant information.

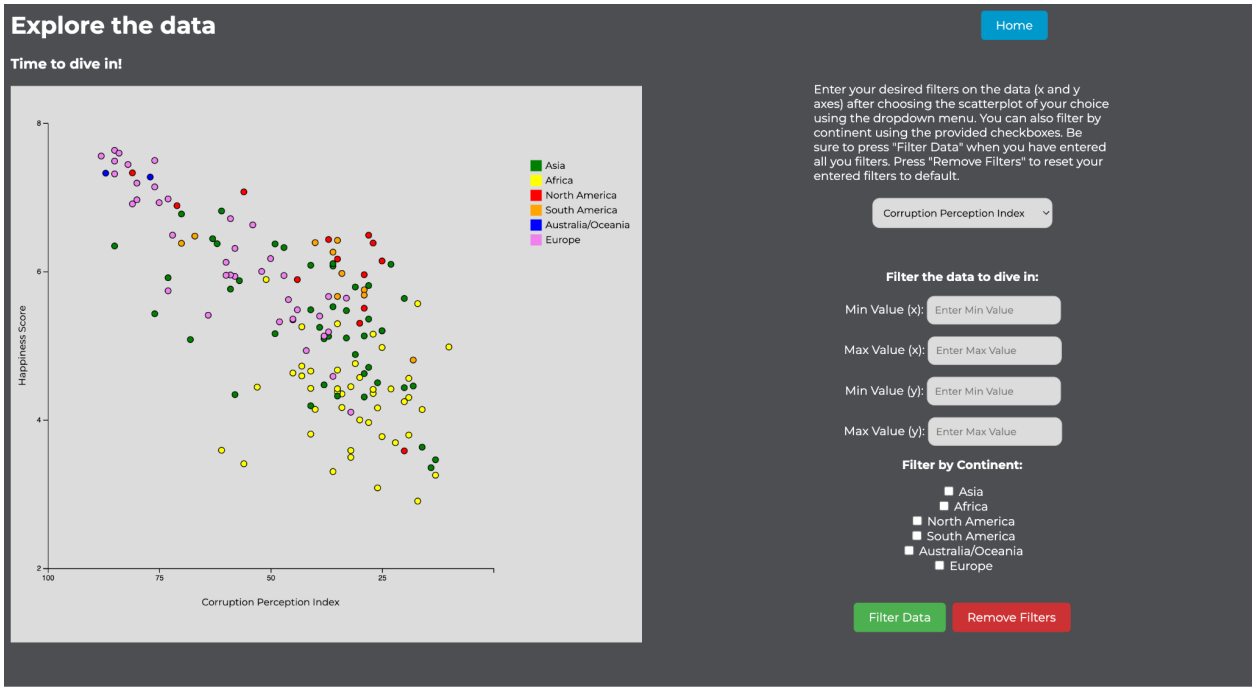


- The third scene shows the relationship between a country's economy and the happiness score using the income group indicator. For all of the countries in each of the four income groups, the average happiness score is plotted on a bar graph. The bars on the chart are animated smoothly to highlight their relative difference without overwhelming the user. The bar chart is annotated with the precise average values of happiness score for each category.



- The fourth scene is another scatter plot demonstrating the relationship between GDP per capita and happiness score for various countries. The GDP per capita is used here as another metric to demonstrate economic factors potentially at play in determining the happiness scores. The x-axis scale chosen here is a logarithmic scale to help spread out the data and promote visual understanding.

- Finally, the last scene allows the user to dive into the data and perform their own analysis. This scene offers users an interactive dashboard-style visualization with the following features:
    - The ability to choose the measure being studied (i.e. Corruption Perception Index, Life expectancy or GDP per capita).
    - The ability to filter on the values in the plot to reveal a subset of the countries on the chart within the numerical constraints specified by the user.
    - The ability to filter by continent and even combine the numeric filters with the continent filter to reveal a filtered-down version of the plot to allow the user to drill down on further information/trends.
    - Similar to previous plots, the ability to hover over data to use the tooltip functionality.



The scenes are ordered in this way keeping in mind the Martini Glass narrative structure. Scenes 1 to 4 provide the user with author-driven content and try to paint a picture of the various factors that are at play in determining the happiness scores of various countries. As stated in the introduction section of the website, the author-driven content explores these factors one-by one: corruption, health and economic factors. Scene 5 allows the user to perform their own exploration by opening up avenues for interactivity in terms of filtering and context switching within the same scene.

Annotations

The d3-annotation library was used to annotate the different graphs presented in the narrative visualization. The annotations are used for messaging to the viewer some samples of data as well as helping the viewer follow along with the 3 small-scale case studies of countries done throughout the presentation.

The annotations follow a consistent visual structure. The annotations follow the same form throughout the scenes- text with a dropped line and an arrow pointing to the data point being referenced. In scene 1, we see one of the annotations in green. The user is informed in the introduction section that general observations made throughout the scenes would be annotated in green while annotations referencing specific data/number would be made in black.

In scenes 1,2 and 4 we see the 3 “case-study” countries being annotated with information on the specific numbers while driving the statistical conclusions that can be generally made. In scene 3 we can see that the bar-chart is annotated with specific numbers for the average happiness scores for various income groups. Overall, the annotations are used to support the messaging by informing the user of the trends we see in the data for each metric using strong examples.

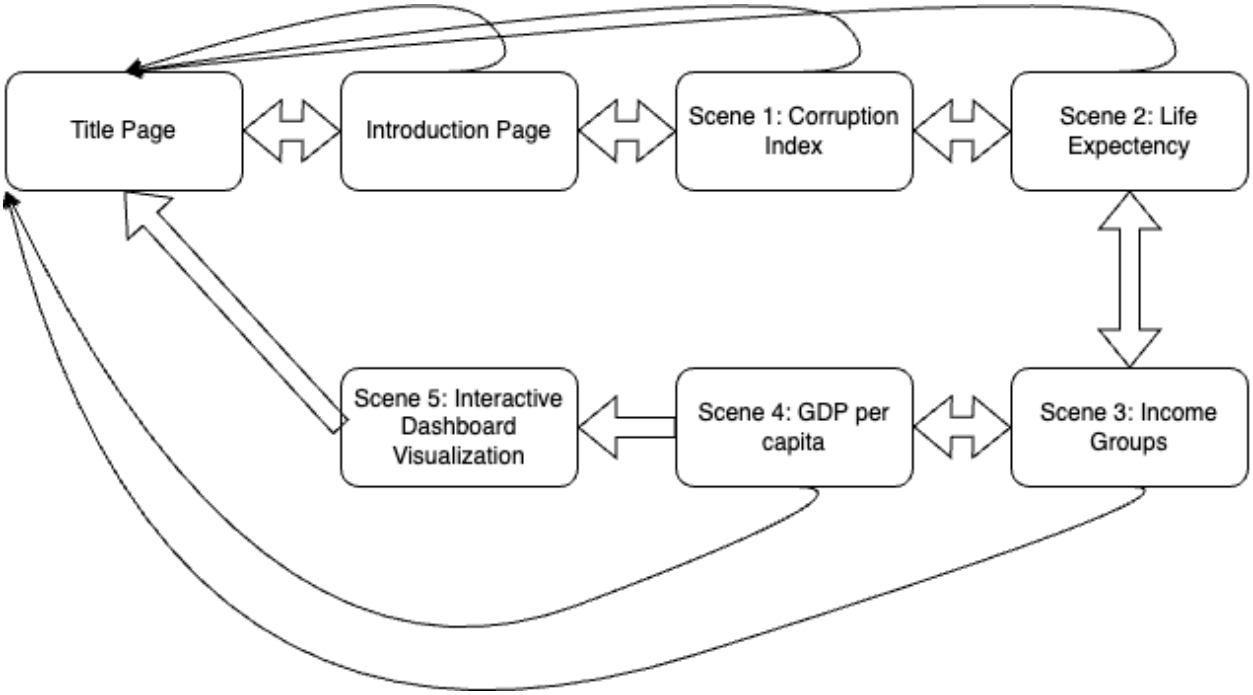
Throughout the narrative visualization, the annotations remain static within each single scene with the exception of the on-hover tooltip. When the user hovers over a data point on any of the scatter plot graphs, a tooltip is revealed with detailed information on the country.

Parameters

Some of the parameters used by this narrative visualization are the following:

- The scene number. This would indicate the current slide the user is on.
- Whether or not to show the annotations
- A variable for the minimum x-value the user desires to filter on
- A variable for the minimum y-value the user desires to filter on
- A variable for the maximum x-value the user desires to filter on
- A variable for the maximum y-value the user desires to filter on
- The continent(s) the user desires to filter on
- A variable to select the metric to plot with the happiness scores on the final dashboard
- Whether or not to show the tooltip on visualizations based on mouse-hover.

The states of the narrative visualization include the different scenes and how they are connected. Other states include filtered forms of all of the scatter plots (on the final scene) or even a user hovering their mouse over a point on any of the scatter-plots would bring up states of the tooltip being present. Here is a broad visual representation of the different scene states a user can go through in this narrative visualization.



The parameters listed above are used to define various aspects of the different states and scenes of the visualization. For example, within any scenes with annotations, the user is given the option to remove annotations and that is controlled by a parameter. In the final scene with the interactive dashboard-style visualization, several parameters control the state of the visualization. These would be the filters applied by the viewer to adjust the points shown on the plot. Another example would be hovering the mouse pointer over any of the data points. This would use the parameter related to the showing of the tooltip.

Triggers

These would be the connections between the parameters listed in the previous section. Some of the triggers in this narrative visualization would be:

- Each page in the visualization is provided with navigation buttons. The top right section of all pages has a “home” button. This redirects the user to the title page of the visualization allowing them to restart their journey. All of the other pages have navigation buttons to either go to the previous or next page. The final scene only allows the user to go back to the home page.
- Scenes 1, 2 and 4 have a checkbox that allows the user to remove the annotations so that the chart is more open for exploration.
- On scenes 1,2,4 and 5 the user can hover their mouse pointer over any of the data points to reveal a tooltip that provides detailed information.
- In the final scene, the user is presented with several options with the following triggers:

- A dropdown menu to select the metric being analyzed on the chart being shown on the left side of the screen. A selection on this menu will adjust the data on the chart.
- A filter data button that would apply all of the user's selected filters to the chart and show the filtered data. These filters include x and y minimum and maximum values and one or more continents.
- A "Remove Filters" button that removes all of the user's selected filters and resets all of the data points on the graph to have no filters applied.

All of these triggers work in conjunction with the DOM to provide the user with an interactive visualization experience