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CS 416
Assignment 9-3: Create a Narrative Visualization

World Happiness Visualization

Each year, the World Happiness Report (Helliwell et al., 2022) is published with an assessment of the average life evaluation ("happiness score / index") for a number of countries. My narrative visualization at https://xueyinglin.github.io/happiness/ explores this data in an interactive slideshow. The visualization uses the World Happiness Report data along with population and GDP data published by The World Bank (The World Bank, 2022). The visualization was built only using HTML, JavaScript, and the D3 and d3-annotation (Lu, 2022) libraries. It is hosted on GitHub Pages.

My visualization attempts to describe the relationship between the average life evaluation score for each country and the contributing effect of population size and wealth in the form of gross domestic product (GDP) per capita. Additionally, it seeks to explore the way in which the happiness index and the contributing factors have changed over time. A conclusion which could be drawn from my visualization is that the happiness index is generally significantly higher in countries with more wealth, and that high population correlates inversely with perceived happiness. Furthermore, it demonstrates a significant difference between the most and least happy countries, and shows how the happiness of countries is changing over time.

The overall narrative structure of my visualization is an interactive slideshow consisting of three scenes. A consistent navigation affordance is provided at the top of the visualization which both presents context about the current and surrounding scenes and allows transition by

clicking on back or next buttons. The visualization starts off with a non-interactive exploration of the most and least happy countries, then flows to an animated scene that explores how the most happy countries have changed over a period of seven years. The final scene is interactive and allows drill down exploration of the data.

A consistent visual style as shown in Figure 1 is used for each scene, although every scene explores different data, and provides differing levels of interactivity. The overall visual structure of each scene includes one or more chart areas. These chart areas are given primary space within the scene to draw visual attention. Additionally, vibrant colors are used to represent countries consistently throughout the visualization against a dark overall page design - this helps the viewer to focus on the important data within the scene. An ancillary control area can be used on some scenes to interact with the data. An ancillary detail panel can be used to see detailed information about individual elements within the scene. The consistent placement of navigation buttons and the label provided next to the buttons provides easy transition between scenes, and helps the viewer understand the connection between scenes. Additionally, the scene explanation provided at the bottom of each page provides an optional textual narrative for the scene which can be helpful for providing additional context.

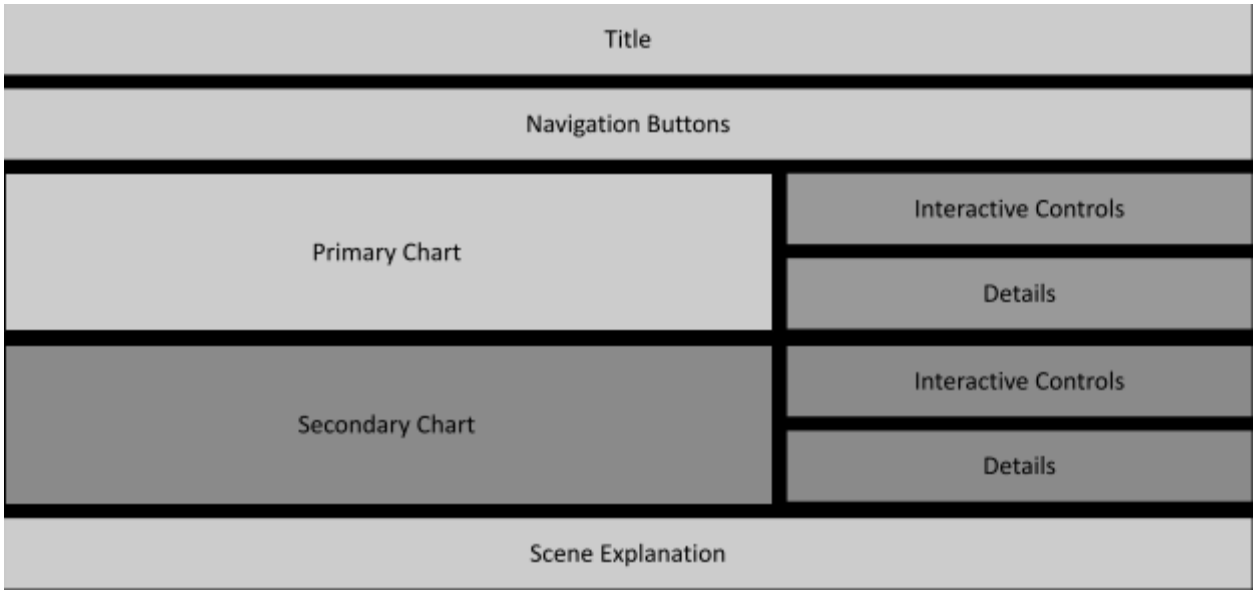

Figure 1: Scene Visual Structure

The three scenes of my visualization are:

Most and Least Happy: a bar chart representation of the five most and five least happy countries according to their average life evaluation score. This scene is not interactive.

Change Over Time: a bar chart representing the top ten most happy countries which uses animated d3 transitions to explore how the ranking of the top ten countries has changed between 2015 and 2022.

Population, GDP, and Happiness: a scatterplot which allows interactive exploration of the relationship between population, GDP (per capita), and the average life evaluation score for each country.

These scenes are ordered to provide progressively more detail. The initial scene is intended as a summary of overall happiness, and serves to introduce the concept of the life evaluation index to the viewer. The subsequent scenes explore the temporal variance in the data, and then further expand into the causative factors that influence the score.

Annotations are used in the third scene. They use the *callout circle* annotation template - this is a perfect template for a scatterplot using circles, since the annotation can encircle the data point, and make it easy to identify even when it's obscured by overlapping entities. Annotations are used to serve the useful purpose of connecting back to the context in previous scenes about the most and least happy countries by making them easy to identify within the scatterplot.

The scatterplot visualization is useful, since it allows the viewer to simultaneously explore the data along three dimensions (population, GDP per capita, and life evaluation score). The annotations support the messaging, since there's a clear correlation between the position of the annotations within the scatterplot and the relationship between wealth (GDP) and happiness. Annotations can be changed within the third scene using the interactive "Annotate" control - in order to show a contrast between the most and least happy countries, these can be annotated separately, and the annotations can be turned off to make it easier to see the whole chart without distraction.

The visualization is controlled by several parameters. The *page* parameter is used for navigation context and identifies which scene is being rendered. Each page follows a standardized layout, and the overall components within the scene are parameterized (e.g. the html content for the description section at the bottom of each page is provided by a parameter). Within the third scene, a number of parameters are used for the interactive elements of the scene: the *year* being displayed, the *gdpPercentile* which is used to track data points to filter based on the percentile of gdp, the *annotation* which is used to switch between annotating the most or least happy countries, or turning annotations off.

The visualization uses triggers on the third scene to control interactive elements. The primary user actions controlled by triggers are:

Clicking on a country. This is a click trigger on the scatterplot circles. When the scene first presents, a textual clue is provided to the viewer in the detail area that encourages them to click on a country to see more detail.

Selecting a year. This is an input trigger on the year selector. The year selector is included in the controls area for the chart, providing a clear affordance for exploring the data over time.

Selecting annotations. This is an input trigger on the annotations selector. This is also included in the controls area. Visually grouping the controls for filtering and adjusting the appearance of the data together in one area makes the options clear to the viewer.

Adjusting the percentile GDP. This is an input trigger on the GDP selector. This is presented as a slider control which immediately adjusts the display of the chart, filtering out bubbles which fall below the percentile threshold. The immediate effect of changing the data on the chart in response to this slider provides a clear tactile affordance to the viewer. Additionally, underneath the slider is a small detail label which allows the viewer to see the currently selected GDP percentile and the US$ value it represents.

This project provided me with an excellent opportunity to explore using d3 to build an interactive slideshow visualization, and significantly expanded my knowledge and understanding both of the tools provided by d3 and the core concepts of data visualization.

References

Helliwell, J. F., Layard R., Sachs, J. D., De Neve, J., Aknin, L. B., & Wang, S. (2022). *World Happiness Report 2022*. https://happiness-report.s3.amazonaws.com/2022/WHR+22.pdf

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