INSIGHTS OF CRIME RATE: COMPARISION BETWEEN CITIES USING D3.JS

PROJECT BY:

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ABSTRACT

This project aims to create a web-based visualization using d3.js that presents crime rate and safety index data in an easy-to-understand and user-friendly way. The visualization will utilize bubble maps to allow users to explore the data visually and gain insights into patterns and trends in crime rates and safety indices across different countries. The crime index will be calculated based on data related to various types of crimes, including violent crimes and property crimes. The safety index will consider various factors that contribute to safety, such as crime rates, traffic accidents, natural disasters, and the quality of healthcare and emergency services. By presenting this information in an interactive and dynamic format, users will be able to better understand the state of safety and crime rates in different countries, helping them to make informed decisions about travel, relocation, and other important life decisions.

The project will leverage publicly available data sources, including official government statistics, independent research studies, and publicly available datasets from international organizations such as the United Nations and the World Health Organization, to gather data for a wide range of countries. The visualization will be designed with a focus on accessibility and inclusivity, ensuring that users of all abilities and backgrounds can engage with the data and gain meaningful insights.

Overall, this project seeks to provide an intuitive and visually appealing resource for individuals and organizations seeking to understand the state of crime and safety across different countries. By presenting the data in an interactive and customizable format, the project aims to promote greater awareness and understanding of these important issues and to help users make informed decisions about travel, relocation, and other important life decisions.

INTRODUCTION

In recent years, advancements in technology have provided us with vast amounts of data on crime rates and safety indices across different countries. However, this data is often presented in complex formats that can be difficult for users to comprehend. Through this project, we aim to leverage the power of d3.js and bubble maps to simplify the visualization of crime and safety data, making it more accessible and understandable to users.

In addition to its practical applications, this project also has broader implications for society. By providing a clearer picture of crime and safety patterns across different countries, this visualization may help to reduce fear and anxiety surrounding these issues. It may also promote a greater understanding of the root causes of crime and safety concerns, which can lead to more effective policies and interventions. Ultimately, this project seeks to promote greater awareness and understanding of global crime and safety issues and to contribute to the development of a safer and more secure world.

DATASET

The dataset used in this project is sourced from Kaggle and includes data on crime rates and safety indices of various cities worldwide from 1960-2020. The dataset attributes include the Rank, Crime Index, Safety Index, City, Country, and geographical coordinates (latitude and longitude). The highest crime index in the dataset is for Caracas, Venezuela, and the lowest for Abu Dhabi, UAE. There is an inverse relationship between the Crime Index and Safety Index in the data.

PRE-PROCESSING OF THE DATASET

The dataset we tried to make use of in the beginning had many inconsistencies. A significant part of the time that we have allotted to our project was taken for data preprocessing. The dataset previously had missing crime index and safety index values for the cities. We had to manually identify each of them and replace them with the actual value. It took a lot of time. Also, we needed latitude and longitude values of the cities to be able to plot them on the world map for further visualization. Once after collecting the latitude and longitude values from another dataset that consisted of more than required information by separating the necessary information, we still were able to see a lot of oppositely signed values of the former. This resulted in wrong plotting of the places. That is when we had to manually identify them and change them to their actual signs to be able to plot the cities. Once we did that, it was already a lot of time from the start of project reviewing. That is why we were able to implement a basic version of what we had to implement.

VISUALIZATION DESIGN

The design of the visualization was centered on interactivity and user-friendliness. We created a world map displaying major cities, with each city's crime rate and safety index represented by bubbles. The color and size of the bubbles indicate the intensity of crime and safety levels. Furthermore, a mouseover feature highlights the city under the cursor, and clicking on a city zooms into the area, providing a more detailed view. This design was chosen because it allows users to engage with the data actively, encouraging exploration and aiding comprehension.

WHY ONLY BUBBLE MAP?

Bubble maps are accessible to a wide range of people since they are simple to interpret and aesthetically intuitive. Users can rapidly understand the relative relevance of various data points since the size of the bubble correlates to the magnitude of the data item being displayed.

Geographical data: Bubble maps make it possible to depict geographic data, which is crucial for many different forms of data analysis. Users can spot geographic trends and patterns by superimposing data on a map that would not be obvious in other forms of representations.

Bubble maps may be made interactive, enabling users to personalize their viewing experience and dig deeper into the information. Users can, for instance, focus on areas or filter data according to several categories.

Bubble maps may be created with colorful and aesthetically pleasing bubbles to make the data more appealing to users and increase engagement.

Many variable representations: By combining many variables into a single visualization, such as a bubble map, consumers are given the opportunity to compare various facets of the data. Users might view the correlation between the two variables by overlaying data on the safety index and crime rate on the same map, for instance.

SUMMARIZING THE NEED OF USING BUBBLE MAP

Bubble maps offer several advantages as a visualization tool. Firstly, they are easy to interpret and aesthetically intuitive, allowing a wide range of people to understand the data being presented. Secondly, bubble maps allow for the representation of geographical data, which can reveal patterns and trends that may not be apparent in other forms of data visualization. Thirdly, bubble maps can be made interactive, allowing users to customize their viewing experience and explore the data in greater detail. Fourthly, they can be designed with visually appealing bubbles to engage users. Finally, bubble maps can represent multiple variables in a single visualization, allowing users to compare different aspects of the data.

More importantly, we used bubble map specifically to convey the intensity of the plotting value which here was either safety index or crime index at that area with that bubble. If a particular area or its adjacent areas had more of the safety index or crime index, then more bubble would probably overlap each other which can convey about the clumsiness at that area from a distance. If at all the user who'd like to interact with the visualization feels to understand more about those insights, then he/she can use the zoom in and zoom out feature.

IMPLEMENTATION

1. The code starts by declaring the width and height of the visualization as variables **w** and **h**.

2. It then sets the projection of the map to equirectangular using the **d3.geo.equirectangular()** function and creates a GeoPath function using the **d3.geo.path()** function with the projection.

3. An SVG element is created with the specified width and height, and a rectangle is appended to it with white fill.

4. An empty placeholder **g** element is appended to the SVG which will contain the geometry elements.

5. The TopoJSON file is loaded using **d3.json()** function and the data is passed as a parameter along with a callback function. If there is an error, it is logged to the console.

6. The country data is added to the visualization by appending a **path** element to the **g** element, using the **topojson.feature()** function to convert the TopoJSON object into a GeoJSON object, and then setting the **d** attribute of the **path** element using the GeoPath function.

7. A zoom behavior is created using the **d3.behavior.zoom()** function and is applied to the SVG element using **svg.call(zoom)**.

8. The Crime dataset is loaded from a CSV file using the **d3.csv()** function and the data is passed as a parameter along with a callback function. If there is an error, it is logged to the console.

9. The minimum and maximum values of the 'Rank' property in the **crime_data** array are obtained using the **d3.extent()** function and stored in the variable **nMinAndMax**.

10. The output range of circle radius is defined using variables **rMin** and **rMax**.

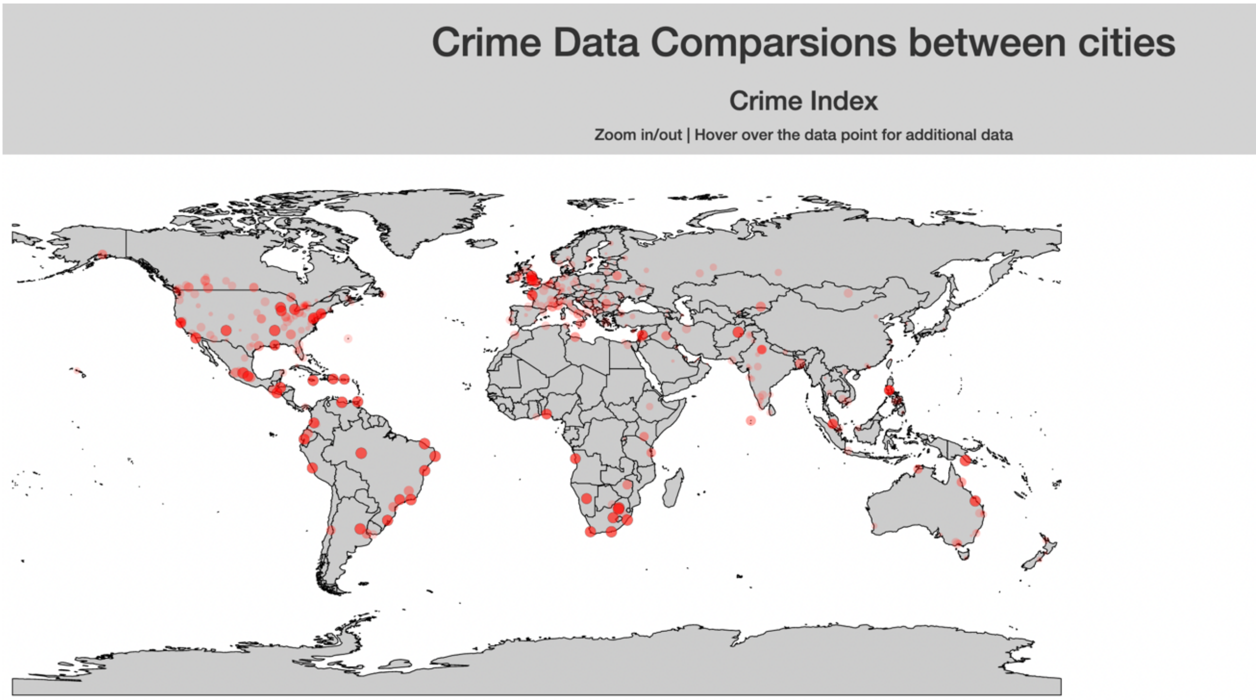
11. A function **nToRadius** is defined to map input values to output values, by calculating the proportion of input value in the domain, the span of the output range, and then mapping the proportion to the output range.

12. A selection of circles is created using the **g.selectAll('circle')** function and bound to the **crime_data** array using the **data()** method.

13. Circle elements are appended using **enter()** method and their **cx**, **cy**, **r**, **fill**, **stroke**, **stroke-width**, and **fill-opacity** attributes are set using the **attr()** method, and the circle elements are positioned using the **projection()** function to convert the longitude and latitude coordinates of each data point into screen coordinates.

14. The **mouseover** and **mouseout** events are added to the circles to show and hide a tooltip containing the city name and crime index of each data point, and to change the fill color of the circle upon mouseover.

CRIME INDEX VISUALIZATION



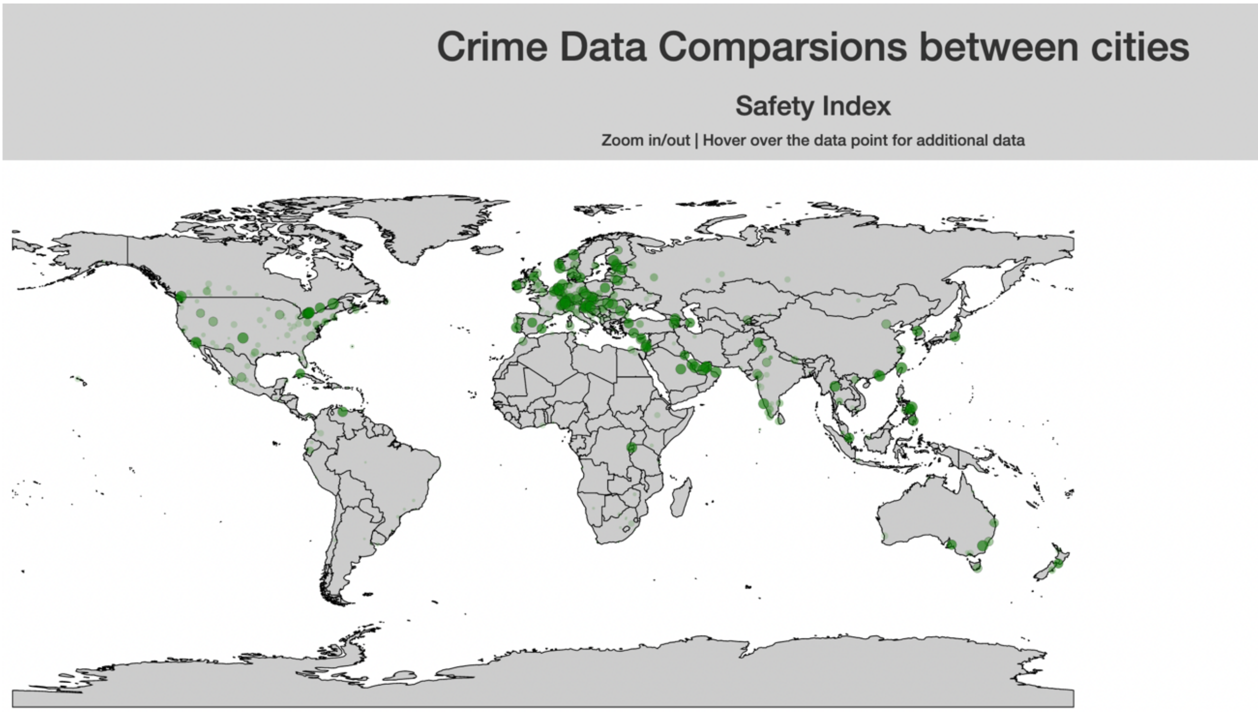
INSIGHTS THAT CAN BE DRAWN FROM THE ABOVE –

The above picturization is of the crime index visualization. It depicts the bubble map plotted upon the world map. The crime index of most of the major cities in the world are considered, which are then plotted. Once the plotting is done, we try to create bubbles by considering the crime index values of respective cities. This can make the adjacent areas with large crime index values to look clumsier. This clumsiness can, at times, be beneficial. More clumsy area depicts about more crime rate in the above visualization.

WHY RED COLOR –

There is a sensible reason behind using red color to visualize the crime index. In the current days, more than being aware about the safety, being more cautious about the crime rate at any place has become important. Also, red color has the maximum wavelength among all the other colors. High wavelength captures the attention of the user more quickly.

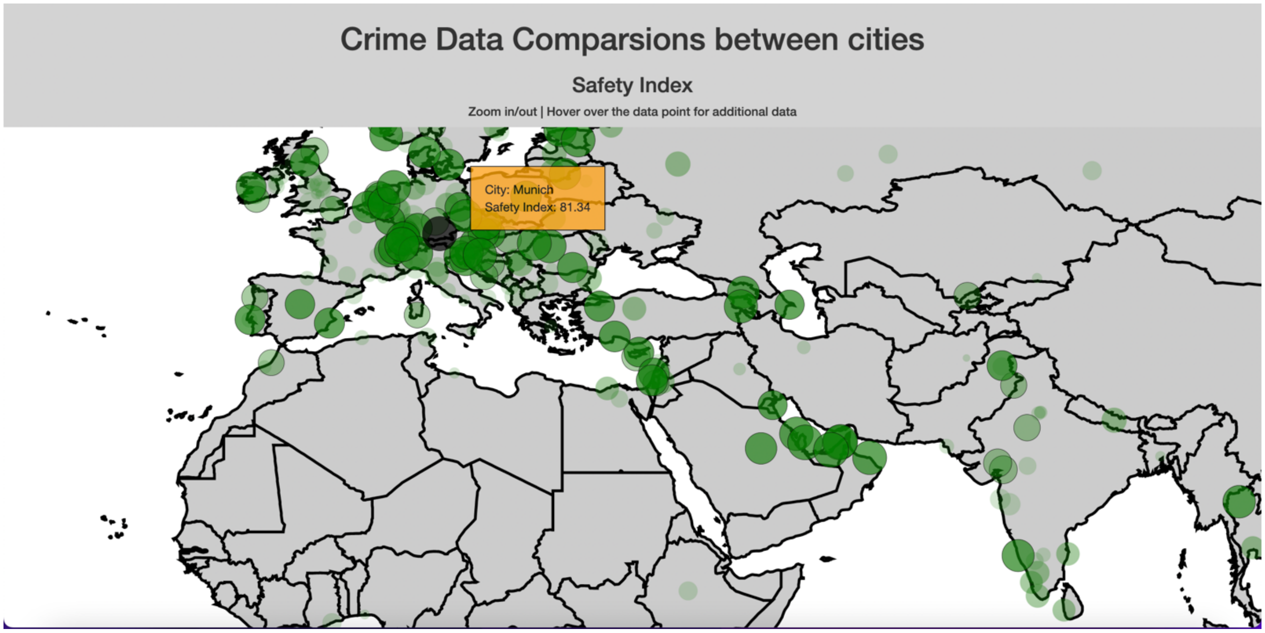
SAFETY INDEX VISUALIZATION



INSIGHTS THAT CAN BE DRAWN FROM THE ABOVE –

The above picturization is of the safety index visualization. It depicts the bubble map plotted upon the world map. The safety index of most of the major cities in the world are considered, which are then plotted. Once the plotting is done, we try to create bubbles by considering the safety index values of respective cities. This can make the adjacent areas with large safety index values to look clumsier. This clumsiness can, at times, be beneficial. More clumsy area depicts about more crime rate in the above visualization.

DEEPER INSIGHTS THAT COULD BE DRAWN



The visualization of global crime rates was an informative and insightful analysis that provided valuable insights into crime trends and patterns across the world. By mapping crime rates in different cities and regions, the visualization was able to highlight several noteworthy patterns and trends.

One of the most striking observations was the clear divide between crime rates in developing versus developed countries. The visualization revealed that cities with higher crime rates were predominantly located in developing nations, whereas cities with lower crime rates were concentrated in developed countries. This finding is consistent with prior research on crime patterns, which suggest that socio-economic factors play a significant role in determining crime rates.

Moreover, the visualization enabled a comparison of crime rates and safety indices across different regions, highlighting disparities between regions. For example, the dense cluster of cities near European countries indicated a higher safety index, which can be attributed to the effective law enforcement systems and robust social infrastructures prevalent in these developed nations.

Finally, the visualization revealed temporal trends, showing changes in crime rates and safety indices over time. This aspect of the analysis is particularly useful for policymakers and law enforcement officials, as it can inform decision-making and resource allocation.

Overall, the visualization of global crime rates was a comprehensive and insightful analysis that shed light on important crime patterns and trends worldwide. By highlighting disparities between regions and identifying temporal trends, the visualization can inform policy decisions and promote greater awareness of crime patterns.

The high crime rates observed near Mexican countries may also be influenced by other factors, such as drug trafficking and organized crime activities. These factors can contribute to a complex web of social and economic challenges, leading to higher rates of violent crime. Additionally, the proximity of these regions to other high-crime areas, such as Central America, may also play a role in the clustering observed in the visualization. Understanding these complex factors is crucial for developing effective strategies to address crime rates and improve safety in these regions.

CONCLUSION

The project demonstrates the potential of using data visualization to communicate complex information and provide actionable insights. It showcases the importance of leveraging the power of data to address global challenges such as crime and safety. With the increasing availability of data, there is a growing need for effective data visualization techniques that can help individuals and organizations make better-informed decisions.

Moreover, future work could focus on integrating other relevant factors that could affect crime rates and safety, such as population density, income levels, or demographic characteristics. By incorporating more data sources, the visualization could provide a more comprehensive view of crime rates and safety indices and enable users to identify the underlying causes of crime and potential interventions. Additionally, the visualization could be extended to provide more interactivity and allow users to customize the view of the data according to their needs. By continually improving the visualization and incorporating more data, we can develop a more nuanced understanding of global crime and work towards creating safer communities worldwide.