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# VISUALIZATION PROJECT

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A REPORT ON US MASS SHOOTINGS



**APRIL 6, 2018**  
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## Introduction:

A mass shooting is generally defined as an incident involving four or more victims of guns related violence. When we hear the word mass shootings, United States is the first thing which comes to the mind. The country which has the highest number of mass shootings in the history is the United States. Between the year 1966-2018, the United States has witnessed more than 328 mass shootings that resulted in more than 1477 deaths and 2025 injured. The worst mass shooting in the history of United States is the Las Vegas Shooting which occurred on October 1<sup>st</sup>, 2017 that resulted in 59 deaths and more than 527 people injured. The number of people injured in this incident is more than the number of people injured in all attacks of 2015 and 2016 combined. On an average, 8 shootings occurred every year in the last 50 years that took 35 lives and 47 injured per year. These incidents happen very rarely around the world and whenever I read it on the internet or watch it in the news, my heart gets shattered into pieces. I just wonder why anyone would commit such activities and was curious to know what their objectives were. The Las Vegas Shooting which happened in the year 2017 was a historic tragedy.

The objective of this report is to find out what are the reasons behind the mass shootings in the United States. What are the causes of attacks? Which states are more prone to these attacks? What is the age group of the individual who commits these activities and what reasons provoke him/her to indulge in these activities? This is achieved by visualizing data findings of US Mass Shootings from 1966 to 2018 using D3.js. The intended audience is the USA police department.

## Design:

The five-design sheet methodology is a way of approaching final design based on the client requirements. The five design sheets required for this project are mentioned below in detail.

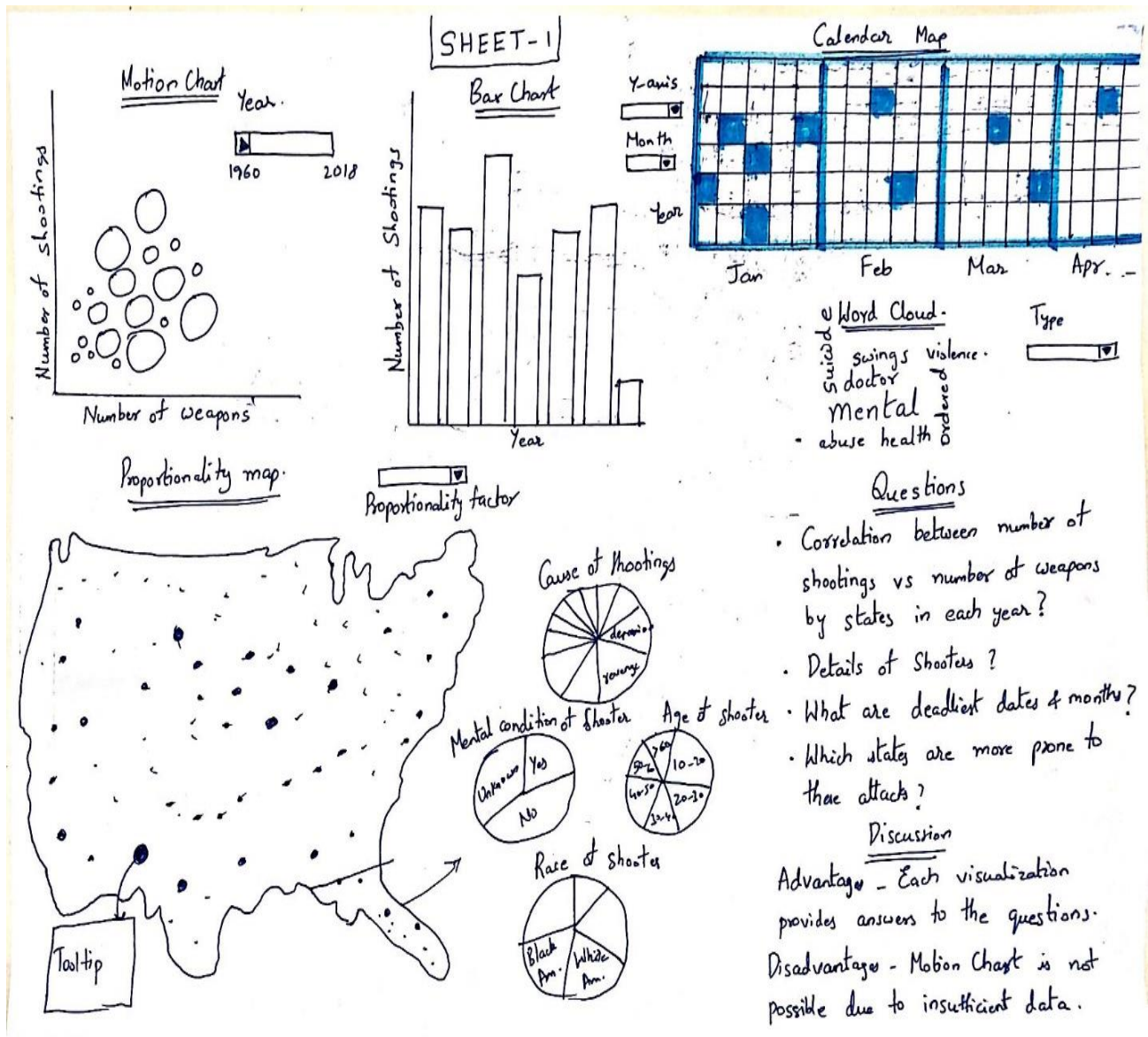
### Sheet-1: The Ideas Sheet

This sheet consists of all the possible ideas for the design and selects few of them which are feasible. The ideas I have thought about for this project are shown in the below figure. The possible ideas for the design are Motion Chart, Bar chart, Pie charts, and a proportionality map.

The proportional map depicts the location of the incidents. In this kind of map, the location is provided by a circle symbol. The size of the circle is proportional to the data value. The user can select any one of the three data values provided in the proportionality factor box such as Total Victims, Injured, and Fatalities. By clicking on the state, the pie charts should change and provide the causes of attack and details of the shooters.

The bar chart depicts the number of total victims, number of people injured and number of fatalities in these attacks in each year. The Y-axis can be changed by using the toggle button provided. The calendar map depicts the dates of these incidents in each month and year. By clicking on the year in the bar chart, this can be achieved.

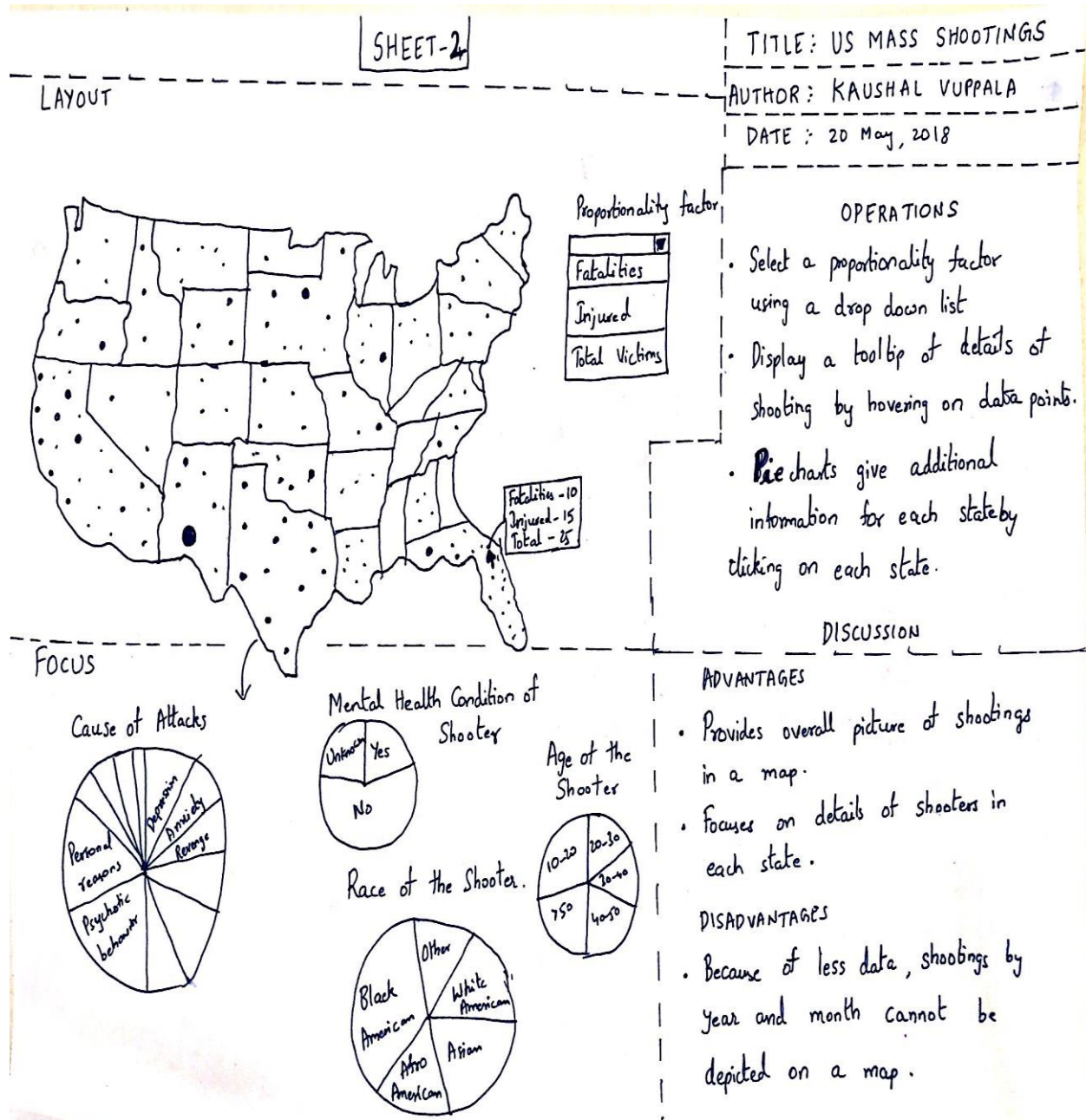
The motion chart depicts the relation between the number of shootings and number of weapons in each state by year. The word cloud depicts the textual content in the data and highlights the key information behind these attacks.



The refined final designs are a proportional map, bar chart, and pie charts. Let's discuss each of the designs in detail in the next sheets.

### Sheets-2,3,4:

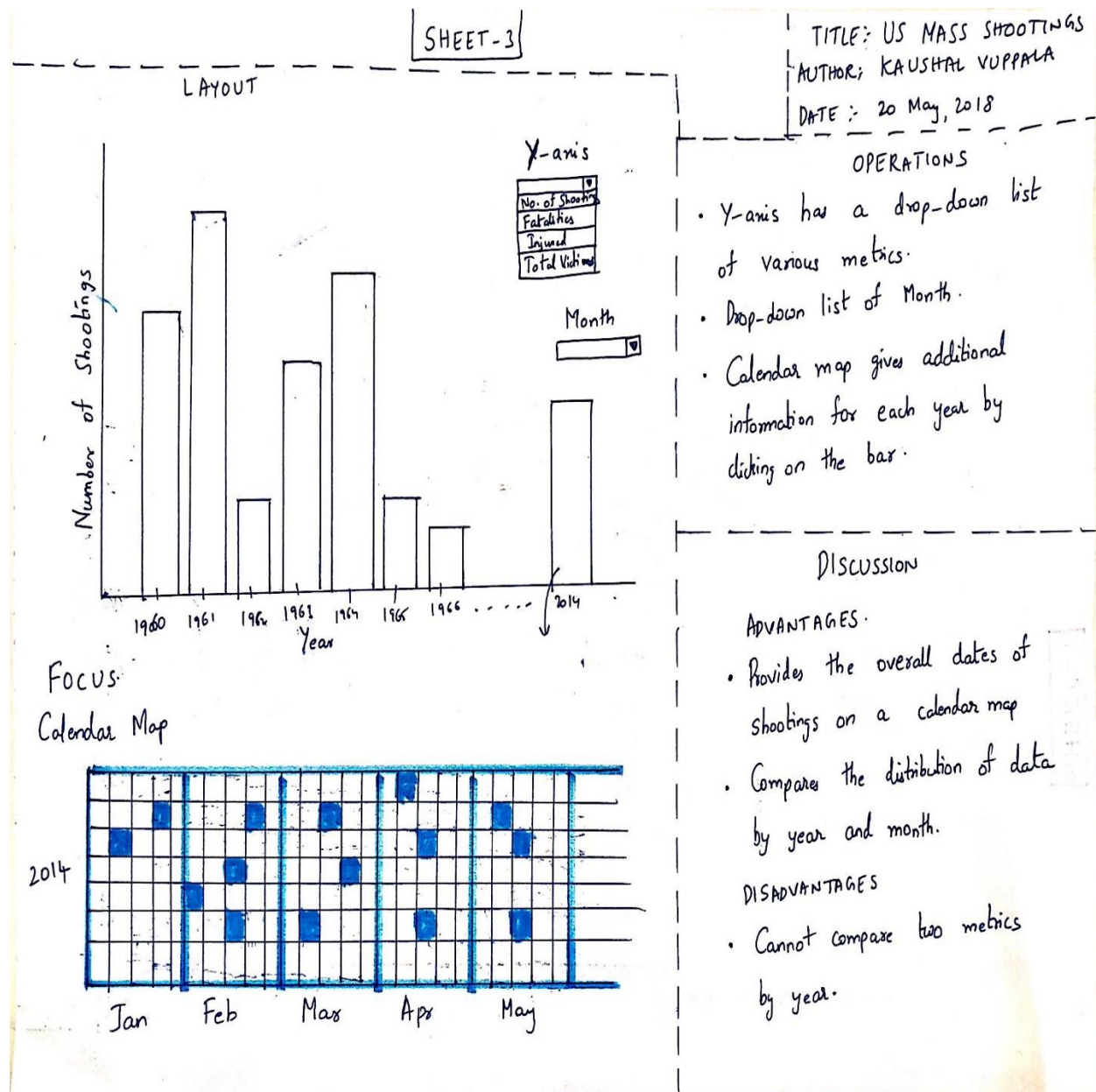
These sheets consist of the final designs of the project. The first design of a proportional map and pie charts are shown in the below figure.



In this design, a proportional map is designed along with the pie charts. The map depicts the locations of the shootings occurred in the past 50 years. A toggle button is provided to select the type of data value. The data values are number of total victims, injured, fatalities. The locations are shown by small circles which is a proportional factor of the data value. A tooltip is added as a

feature which gives us the number of total victims, injured, and fatalities of that incident. When a user hovers the mouse on the circles, a tooltip appears with the details of the attack. The user can also click on each state to find out the main causes of these attacks, race, mental health condition, and age-group of the individuals who commit these activities from pie charts.

In the below figure, the design of the bar chart and calendar map is shown. The bar chart depicts the details of the shootings across years. A toggle button to change the data value of Y-axis is provided. The toggle button consists of number of total victims, injured, and fatalities. A user can select the desired Y-axis by selecting an option from the buttons provided. When a user clicks on the bar, a calendar map of that year appears on the screen. It consists of the dates of these incidents. We could find out the deadliest months and days in the history of the United States.





There is also additional feature provided as a drop-down list consisting of month names. It filters the data and depicts the data on calendar map and bar chart.

In the below figure, a word cloud is designed to find the key information of textual data. A toggle button for the type of the word cloud is provided. The toggle button consists of mental health details, incident area, Summary of the attacks, Types of weapons, and Causes of Shootings.

SHEET - 4

TITLE : US MASS SHOOTINGS

AUTHOR : KAUSHAL VUPPALA

DATE : 21 MAY, 2018

### LAYOUT

### Word Cloud Selection

Mental Health Details ▼

Incident Area

Summary of Attacks

Types of Weapons

Causes of Shootings

### OPERATIONS

- Select a word cloud using the drop-down list.

### DISCUSSION

#### ADVANTAGES

- This visualization is helpful to find out the reasons behind these attacks.
- Focuses on several aspects of data which is not numerical.
- Size of a word highlights the key information in the data.

#### DISADVANTAGES

- A lot of unnecessary words in the design even after removal of stop words.
- Word cloud often doesn't provide important information needed as the design depends on word count.
- Focuses on one aspect at a time.

### Sheet-5:

The designs described in the sheets 2, 3, and 4 are clubbed together into a final design web page. The final design of the project consists of the proportional map, pie charts, toggle buttons, and bar chart. The calendar map and the word cloud have been removed from the final design due to the lack of appropriate data and the calendar map was not possible especially due to its complexity in

D3.js. The final design of this project focuses on the distribution of these attacks across the states by year and provides the details of attacks and the individuals who commit these activities. In the below figure, description of software requirements, dependencies, and data resources are shown.

#### SHEET-5

- The data which is required to create interactive visualizations is already cleaned and formatted.
- Dimensions of layout - 1200 width x 4500 height.
- ' Using D3.js, HTML, CSS to create visualizations
- The required time to finish the designs is approximately 1 week including the report.
- Data Resources -
  - 1) US Mass Shootings - Kaggle.com
  - 2) Mother Jones' Investigation - US Mass Shootings.
- Data Type - Tabular, Spatial data.
- Target Audience - USA police department.

### Implementation:

The final design of this project is designed using D3.js, HTML, and CSS. The steps for the designs are mentioned below.

- The CSS script consists of the dimensions of the body of HTML, the color of the map, hovering color, and tooltip dimensions.
- The HTML script consists of the title, heading, paragraphs, and the sources of the java scripts used.
- In total, there are 6 java-script files used for this project. They are bar-chart.js, constants.js, fatality-toggler.js, fatality-toggle-bar-chart.js, pie.js, and us-state-map.js.
- The fatality-toggler.js is used to design the toggle buttons, which filters the data on the USA map.
- The bar-chart.js and fatality-toggle-bar-chart.js are used to design the bar chart and the toggle buttons, which filters the bar plot.

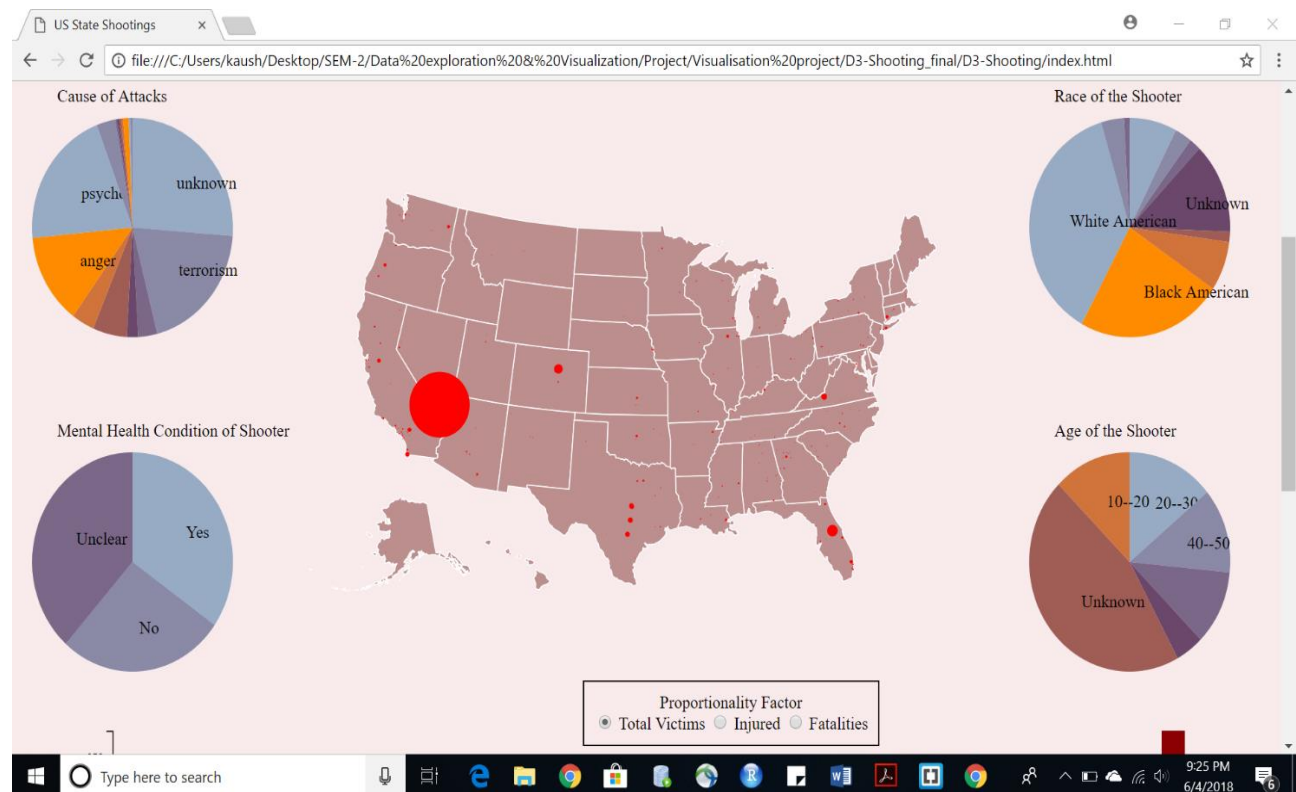
- The constants.js consists of the details of the US states.
- The pie.js consists of the class pie which is used to design the pie charts.
- The us-state-map.js is used to design the US-States map and pie charts.

This project was difficult to implement using D3.js because of the complexity of the data structures and elements in D3. It was very difficult to create a web page because I have non-programming background.

## User Guide:

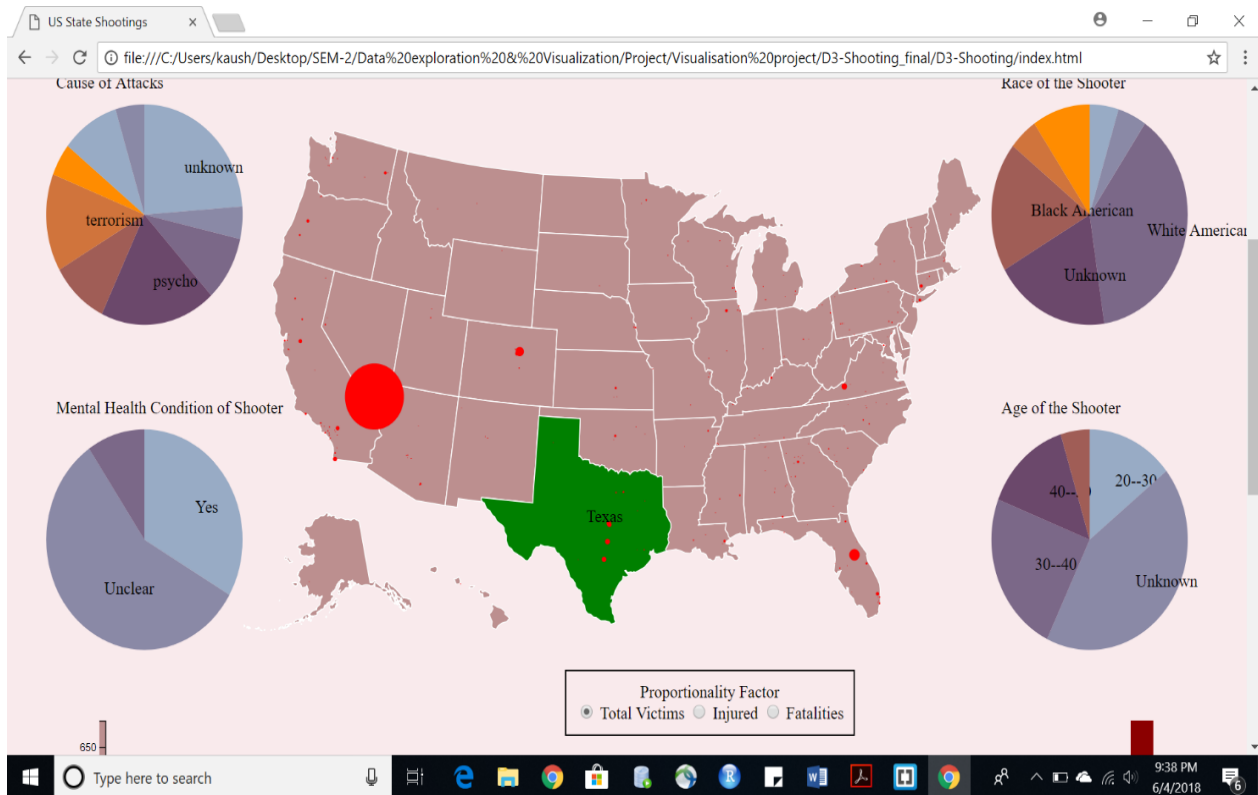
In this section, the guidelines required for the user to utilize the web page of this project are provided. The users must strictly follow the instructions mentioned in this section.

- Initially, when a user opens the web page, he can see the introduction of the topic and top statistics of the data. Underneath the content, the map and pie charts are positioned.
- The map consists of the locations of the shootings occurred, and the pie charts details are for the entire data which is shown in the below figure.
- The user can find out the distribution of these incidents across states and a tooltip appears for each state by hovering on the states.

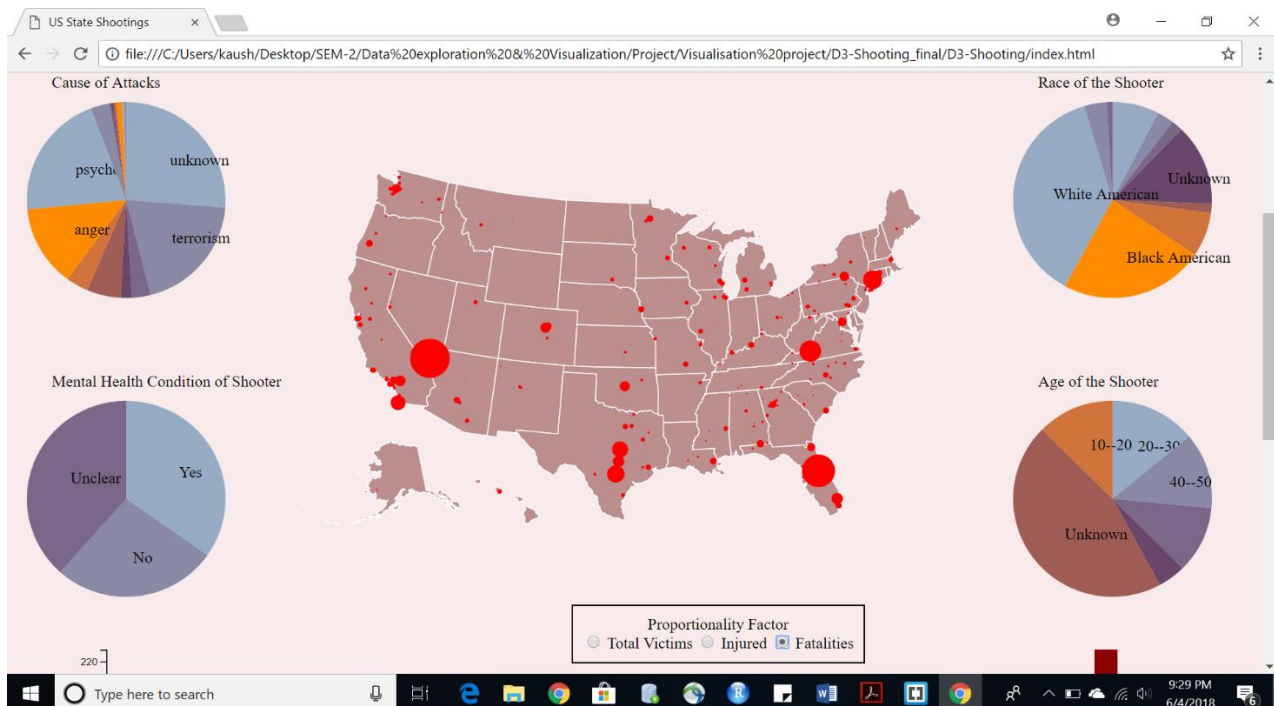


- The user can hover on the map and can click on any state. The color changes to green and the pie charts focuses on the details of each state. He can check the patterns for each state by clicking any of the states which is shown in the below figure.

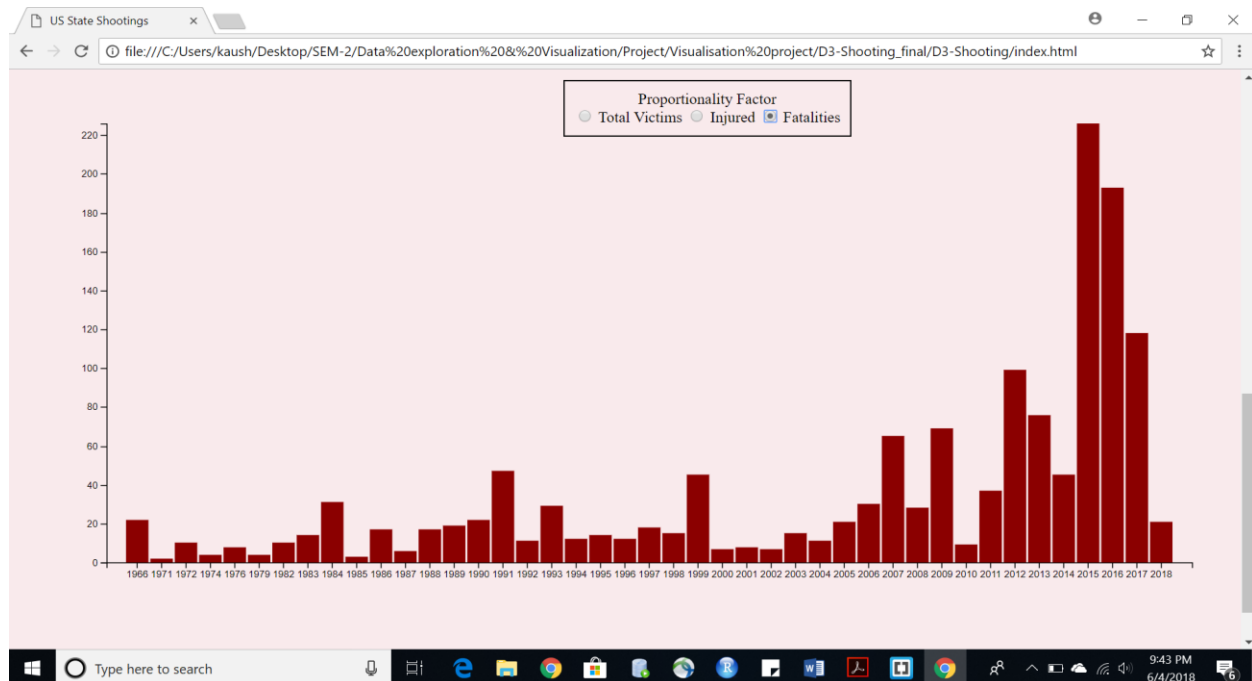




- There is an additional toggle button positioned below the map. The toggle button consists of three buttons which are Total Victims, Injured, and Fatalities. By default, Total Victims is selected in the toggle button. The user can switch it to other buttons by clicking on them to change the size of the circles on the map which is shown in below figure.



- The user can also use the toggle buttons to change the Y-axis of the bar chart provided below the toggle buttons which is shown in the below figure. The X-axis consists of year.



- To unselect the selected data, the user must refresh the page to reset everything back to original.

## Conclusion:

The following findings are from both of the exploration and visualization projects. The frequency of shootings has not decreased although the number of guns in America decreased over the time. Surprisingly, the frequency of mass shootings is tripled in the last few years. On an average, 8 shootings occurred every year in the last 50 years that took 35 lives and 47 injured per year. The states which have the highest number of mass shootings are California, Florida, and Texas whereas the states with the least number of mass shootings are Alaska, Delaware, and Hawaii.

The number of mass shootings in a state is directly proportional to the number of weapons owned by individuals in that state. This trend is similar for most of the states in the country. By exploring the data, we inferred that the months of January, February, and October are the deadliest months in the history of the United States. We also observed that more than 50% of the shooters are suffering from mental health conditions and the most causes of the shootings are psychotic behavior, revenge, and terrorism. The primary targets in these attacks are random strangers, co-workers, family members, students, and teachers. More than 70% of the shooters are American natives and these attacks are committed by the individuals of the age group between 10 and 20. The median age of the shooter is 15 years, which infers that individuals at a young age are turning into killers. The insights from the data were able to answer most of the questions mentioned above except the prediction of these attacks in future. There is no specific pattern to predict such kind of attacks in future. To put a check to such kind of attacks in future, the government of the United States must reform the gun laws like Australia did in 1996 and monitor constant background checks of the citizens in the country.

I was really motivated to do this project. This project has enhanced my technical aspects in exploring and visualizing the data. I have improved my technical skills in using HTML and D3.js. I am overall satisfied with the visualizations I have performed but it would have been better if I had more time and in-depth knowledge of programming.

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