Topic: Visualizing Seattle Traffic Accident Patterns

Team: Afshan Ijaz, Reddy Khaja Valluru, Hari haran Suresh kumar

Synopsis:

This project aims to track accidents in the city of Seattle and explore different factors which might result in an increased frequency of collisions. The goal of the project is to visualize any patterns or insights linking the frequency of accidents in different locations of the city to the weather, road and visibility conditions, time of the day and whether it is a weekend or a weekday. This visualization can help city planning officials identify accident hotspots and take preventative measures like reducing speed limits or installing warning signs and additional lighting etc.

The dataset (SDOT-collisions-all-years) is available on the Seattle Department of Transportation website, and it includes the locations and attributes of collisions which occur within Seattle. The data ranges from 2006 to 2024 but for the purpose of this project, the timeframe between 2020 and 2024 will be considered. There are 50 variables including location, severity, and type of collision, number of people and vehicles involved, weather and road conditions, light conditions, and whether speeding was involved. Relevant variables will be filtered to fulfil the scope of the project over several iterations.

The project will include a geospatial heatmap of Seattle with interactive features for the user to explore how weather, time of day, and road conditions impact collision frequency in different parts of the city. Bar and pie charts will be used to highlight conditions which result in a higher number of collisions.

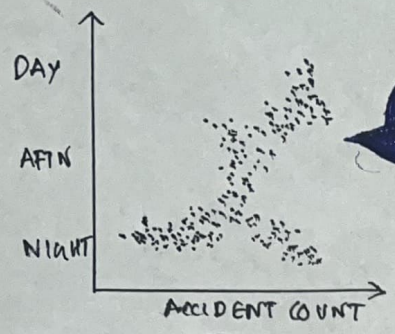
Reflection:

The five-sheet activity gave us an opportunity to get together as a team. The design sheet allowed us to conceptualize the scope of the project individually. All of us brought something different to the discussion afterwards and we pondered over each idea to evaluate if it would add value to the final deliverable. Once these details were straightened out, we set individual tasks for each member of the team, but continuously collaborated as a team to move from one sheet to the next in the process of combining and refining our visualizations. The process allowed us to listen to each other and provide feedback and opinions about the direction of the project. The resulting visualization design incorporates our efforts as a team to tell the story of how different factors affect the number of accidents in Seattle.

Reddy Khaja Valluru

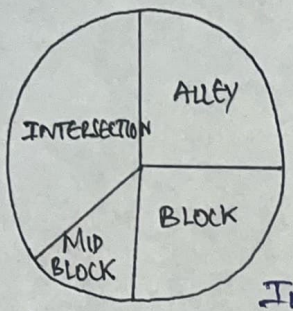
IDEAS

HARI HARAN SURESH KUMAR

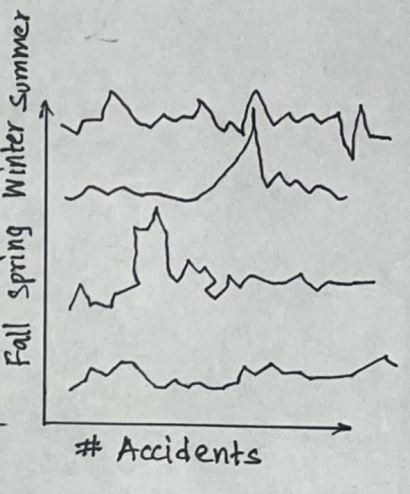


WHAT CAUSE ACCIDENTS?

- Road rage
- Alcohol / Drug consumption
- Bad Weather
- Speeding / racing
- Brake failure / machine issue
- Heavy traffic
- Letharginess in driving
- Distracted driving
- Fatigue (Drowsy driving)
- Inexperience and Ignoring traffic rules.



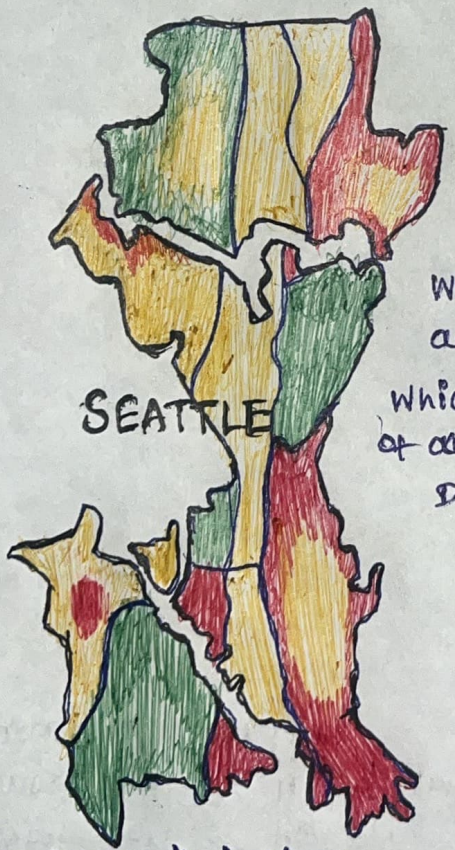
ROAD TYPES

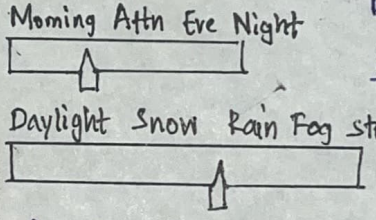


OTHER FACTORS

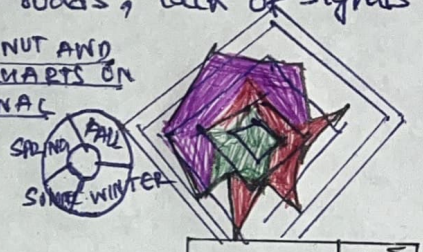
Animal crossings, poorly Lit roads, lack of signals
Construction Zones

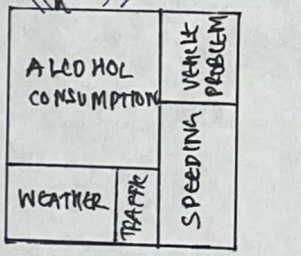
Heatmap of Seattle





DOUGHNUT AND RADAR CHARTS ON SEASONAL EFFECT





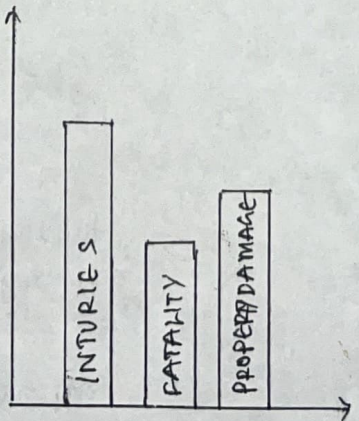
CAUSE OF ACCIDENTS

ACCIDENT TRENDS IN SEATTLE

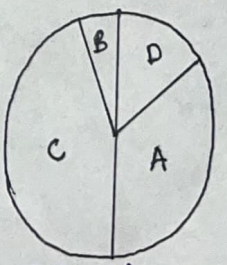
What vehicles do mostly get into accidents?

Which part of the day most number of accidents are recorded?

Do these accidents happen due to traffic?



Vehicle type



- A - Truck
- B - Bicycle
- C - Four wheelers
- D - Bus

This heatmap that shows areas that have most number of accidents recorded, tells people which places are ~~Safe~~ and places that are not Safe.

Do Speeding and alcohol consumption affect the occurrence of road collisions? How does accidents and traffic relate?

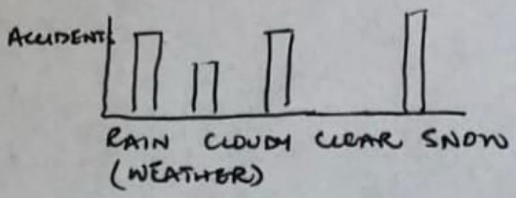
SEATTLE TRAFFIC ACCIDENTS

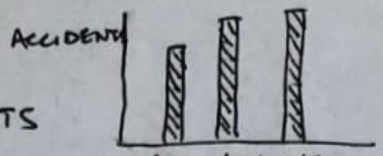
AFSHAN IJAZ.

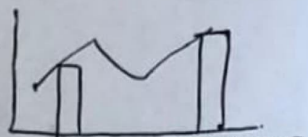
IDEA SHEET

REASONS

- SPEEDING
- WEATHER
- VISIBILITY
  (LIGHT CONDITIONS, WEATHER)
  TIME OF DAY.
- LOCATION (LACK OF STREET LIGHTS
  TRAFFIC VOLUME
  LACK OF WARNING SIGNS)
- ALCOHOL INTOXICATION.

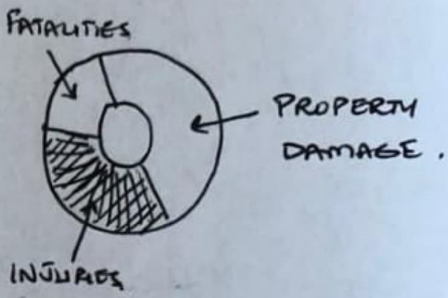




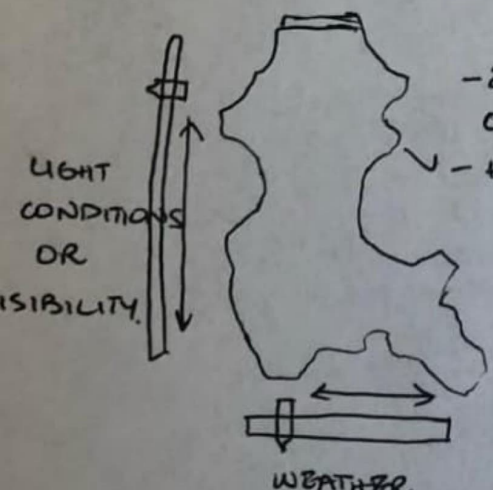


CONSIDER: SEVERITY OF ACCIDENTS.

- FATALITIES → PASSENGERS, PEDESTRIANS CYCLISTS.
- INJURIES
- CARS DAMAGED.



HOW TO SHOW LOCATIONS WITH MOST ACCIDENTS.



MAP

- ZONE BY NEIGHBORHOOD OR
- HEATMAP

INTERACTIVITY

- SLIDERS
- ZOOM IN / ZOOM OUT
- LOOK AT DATA FOR INDIVIDUAL ACCIDENT OR PARTICULAR YEAR.

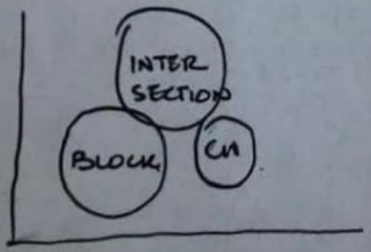
CONSIDER:

ALCOHOL??
SPEEDING??
TRAFFIC VOLUME??

MORE ACCIDENTS ON WEEKDAYS OR WEEKENDS??

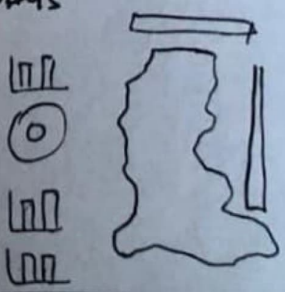
CAN WE PINPOINT HOTSPOTS??

RED LIGHTS
CROSSWALKS.
INTERSECTIONS
BLOCKS.



BUBBLE CHART.

FINAL DASHBOARD. →



1. Ideas 2020 - 2024

- ✓ Time of the day
- ✓ Weather.
- ✓ Day of the Week (Weekday/weekend)
- ± Season
- ✓ Road ~~Height~~ Conditions (dry, wet, icy...).
- ± Road types
- ± Traffic Volume
- ✓ Accident Severity (~~based~~ # of fatalities) Property damage, injuries
- ✓ Accident type (Parked Car) speeding,
- ✗ Alcohol involvement
- ✓ light Conditions (Daylight/Dark)....
- ± Speeding (Yes/No)

2. Filter

Attributes to filter on

— Time of the day	Heat map
— Weather	Heat map, Barchart
— Day of the week	Bar chart
— Road Conditions	Heat map, Barchart
— light Conditions	Barchart
— Accident Severity	Pie chart
— Accident involvement Summary - (speeding, pedestrian, bicycle, parked car, vehicle count)	Table

3. Categorize

The heat map overlays on the Seattle city map to highlight accident hotspots, showing variations in accident frequency based on the time of day, weather and road surface conditions.

The bar charts indicate the frequency of accidents depending on weather, road and light conditions. They also compare whether more accidents occured during weekdays or weekends.

The pie chart visualizing accident severity helps us understand which category - fatalities, property damage, or injuries has the greatest impact.

The table provides a clear summary of accident involvement, organizing key attributes such as speeding, pedestrian and bicycle involvement, parked cars, and other vehicles, count into an easily interpretable format.

4. Combine and Refine

Combine: The dashboard includes four main visvolizations to analyze traffic accident patterns in Seattle. At the center a heat map overlays the Seattle city map, highlighting accident hotspots and showing variations in accident frequency based on time of day, weather, and road conditions.

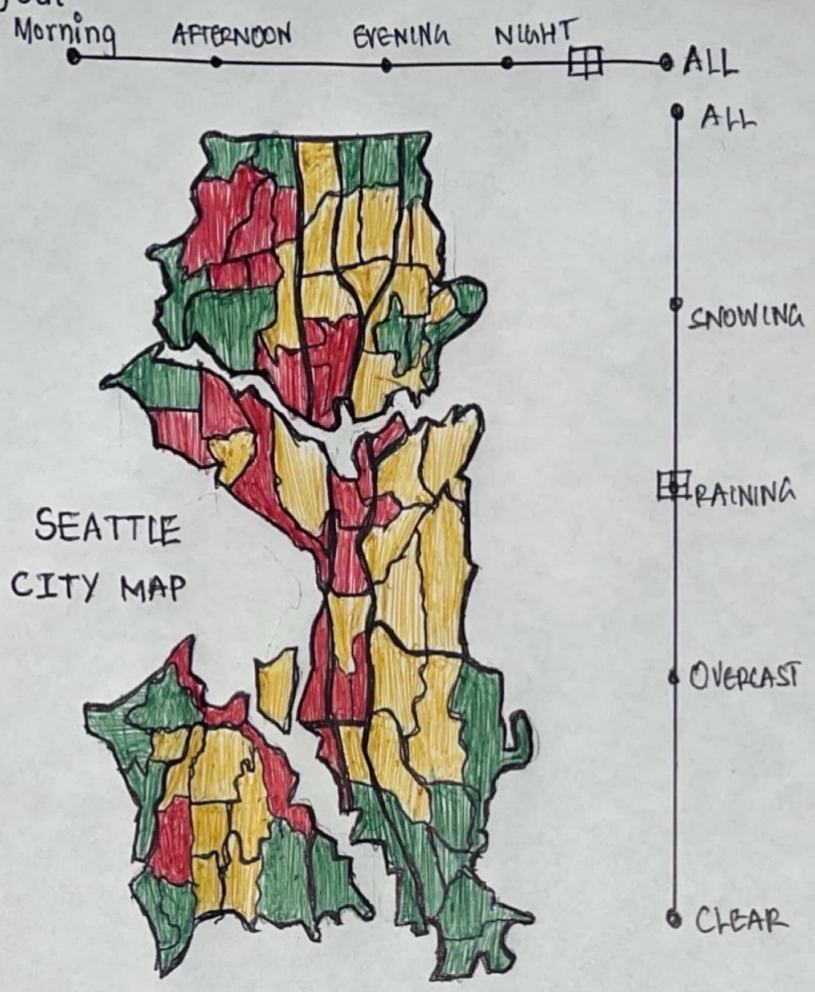
Around the heat map: A pie chart displays accident severity categories. A table summarizes accident involvement factors, such as speeding, pedestrian, bicycle, and parked car involvement, along with total vehicle count. Multiple bar charts display accident frequency based on weather, light conditions, road conditions and weekday versus weekend.

Refinement: We removed road conditions from the heat map, as both weather and road conditions can create visual clutter when layered. Now, the heat map focuses on time of day and weather also reducing redundancy since road conditions are indirectly related to weather.

5. Question

What trends and patterns are observed in accidents in the city of Seattle with respect to time, location and other factors.

Layout



Title:	Traffic Accident Visualization by Weather and Time of Day
Auther:	Afshan, Khaja, Hari
Date:	05/11/12
Sheet:	Sheet 02
Task:	Develop a heatmap visualization to explore the relationship between traffic accidents, weather conditions, and time of day across Seattle.

Operations

The central heat map of Seattle displays accident hotspots, with interactive filters for time of day and weather conditions through two sliders beneath the map.

1. Weather Condition Slider: This slider allows users to select between different weather conditions: Clear, Overcast, Raining, Snowing, or All. When a specific weather condition is selected, the heat map dynamically updates to show accident hotspots under the chosen weather, highlighting areas most affected by accidents during that condition. Choosing All displays the combined data across all weather conditions, providing a comprehensive view of accident hotspots without weather-specific filtering.

2. Time of Day Slider: This slider lets users filter by Morning, Afternoon, Evening, Night, or All. When users select a specific time period, the heat map adjusts to display accident hotspots relevant to that time of day. Selecting All includes data from all times of day, giving an overview of general accident patterns across Seattle, unaffected by time-specific data.

These sliders give users control over the map's data display, helping them focus on specific conditions to identify trends and patterns in accident frequency.

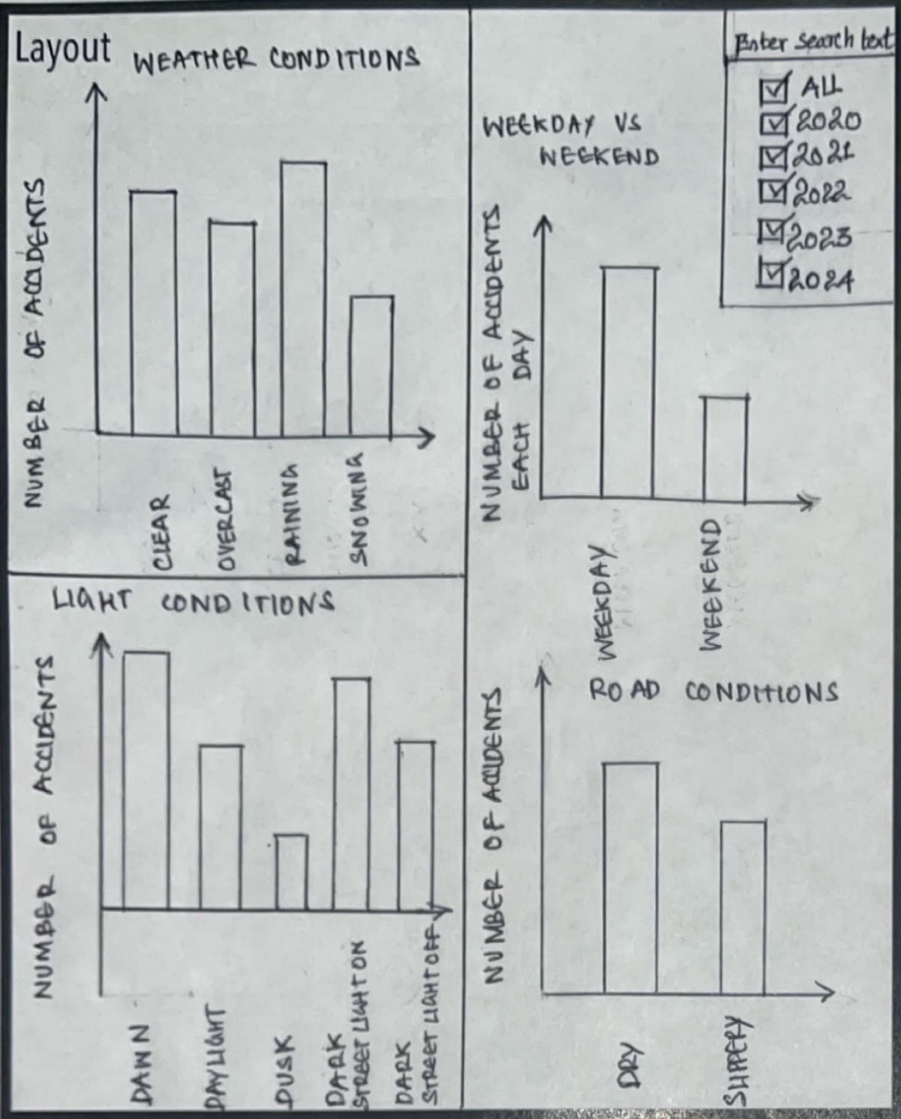
Focus

This visualization aims to explore links between traffic accidents in Seattle and conditions under which they occurred. The core visualization is a heatmap which will show accident locations superimposed on a geospatial map of Seattle. There will be interactive features for the user to explore how weather and time of day (both factors affecting visibility) impact the number of accidents. By shifting the sliders, we can see how the frequency of accidents changes when the weather is clear, rainy, or overcast or when it is daytime or dark. The user will also be able to zoom in and see in which part of the city the accident happened and if it was in an accident prone area. An option will be available to see all accidents which occurred under all conditions.

Discussion

The heatmap will effectively show the multivariate representations that we are trying to convey to the audience. We discussed how to set up our sliders for the weather and time of day variables. There were 13 categories of the weather variable (null, blowing sand/dirt, blowing snow, clear, fog/smog/smoke, other, overcast, partly cloudy, raining, severe crosswind, sleet/hail/freezing rain, snowing, and unknown). Some categories did not have meaningful data so they will be dropped. These would include null, other, and blowing sand/dirt. The slider will be graded according to visibility so some categories could be merged (overcast would include partly cloudy, snowing would include blowing snow etc.) The final scale would grade weather conditions as: clear à overcast à raining à snowing. Similarly, the time of day scale would have four stages: morning (5:00 am – 12:00 pm), Afternoon (12:00 pm – 5:00 pm), Evening (5:00 pm – 9:00 pm), Night (9:00 pm to 5:00 am). Both scales will culminate in showing all the data i.e. all accidents under all conditions.

Layout



Title:	Accident Conditions and Frequency Dashboard
Auther:	Afshan, Khaja, Hari
Date:	05/11/12
Sheet:	Sheet 03
Task:	Examine how various conditions—such as weather, light, and road conditions—affect the frequency of accidents.

Operations

The 4 bar charts provide insights into the frequency of accidents under various conditions and days of the week, with interactive elements for a tailored analysis.

1. Year Filter Dropdown:
- Action: Users select a specific year (2020, 2021, 2022, 2023, 2024, or All) from the dropdown menu.
- Result: The bar charts dynamically update to display accident data only for the selected year, allowing users to analyze how accidents vary over time. Choosing All displays the combined accident data across all years.

2. Hover Tooltips:
- Action: Users hover over a bar within any of the four charts (Weather, Light Conditions, Road Conditions, Weekday vs. Weekend).
- Result: A tooltip appears, displaying the exact count of accidents, percentage of total accidents, and any other relevant details. This interaction gives users immediate access to data specifics without additional clicks, aiding quick, detailed analysis.

These interactions ensure that users can effectively filter, interpret, and compare accident data across different conditions and timeframes, enhancing the overall utility of the bar charts in the dashboard.

Focus

There will be 4 bar charts which will show accident frequency under different weather conditions, road conditions, light conditions, and whether the accident occurred on a weekday or the weekend. These bar charts will provide the user with instant quantitative information about which conditions have the most accidents without having to discern that information from the heatmap. This will reduce the cognitive load for the users as they will be able to glean insights from the data immediately. A common drop-down menu will also enable the users to track accidents through the years (2020 – 2024) with conditions updated for each year simultaneously.

Discussion

The first three bar charts will have the count of accidents on the y-axis. The first will compare accidents under different weather conditions (clear, overcast, raining, snowing) on the x-axis. The second bar graph will have road conditions on the x-axis with dry and slippery as the two independent variables. Since the datapoints for icy conditions and others like “oil” etc were too few and happened infrequently through the year, it was more meaningful to compare dry and slippery. The third bar graph would compare traffic accidents under light conditions including dawn, daylight, dusk, dark (streetlights on), dark (streetlights off/no streetlights). The fourth bar chart will display the average accident counts per day on weekdays vs. weekends to highlight differences in accident frequency between these two periods. Using a per-day average helps account for the difference in the number of weekdays versus weekend days, providing a fair comparison of accident frequency.

Layout PIE CHART ON ACCIDENT SEVERITY

FATALITIES
INJURIES
PROPERTY DAMAGE

Enter Search text

- ALL
- 2020
- 2021
- 2022
- 2023
- 2024

ACCIDENT INVOLVEMENT SUMMARY

INVOLVEMENT TYPE	SPEEDING	PEDESTRIAN INVOLVED	BICYCLE INVOLVED	PARKED CAR INVOLVED	VEHICLES INVOLVED
ACCIDENT COUNT (OUT OF TOTAL NUMBER OF ACCIDENT)	[COUNT]	[COUNT]	[COUNT]	[COUNT]	[COUNT]

Title: Accident Severity Analysis
Auther: Afshan, Khaja, Hari
Date: 06/11/12
Sheet: Sheet 04
Task: Explore accident severity by fatalities, injuries, and property damage through a pie chart, with a summary of accident involvement types in a table.

Operations

Pie Chart Interactions

1. Year Filter Dropdown:
 * Action: Users select a specific year from the dropdown to view data for that year only.
 * Result: The pie chart updates to display the breakdown of accident severity (fatalities, injuries, property damage) specifically for the selected year, allowing users to analyze how accident severity distribution changes over time.
2. Hover to Display Actual Numbers:
 * Action: Users hover over each category in the pie chart.
 * Result: While the pie chart normally displays percentage values for each severity category, hovering over a category reveals the actual count, such as "8,000 fatality collisions out of 35,000 accidents." This provides a more precise understanding of accident severity proportions.

Table Interaction

1. Year Filter Dropdown:
 • Action: Users select a specific year from the dropdown to filter table data.
 • Result: The table updates to show accident involvement details (speeding, pedestrian, bicycle, parked car, and vehicle involvement) only for the selected year, making it easy to see trends in accident involvement types over time.

Focus

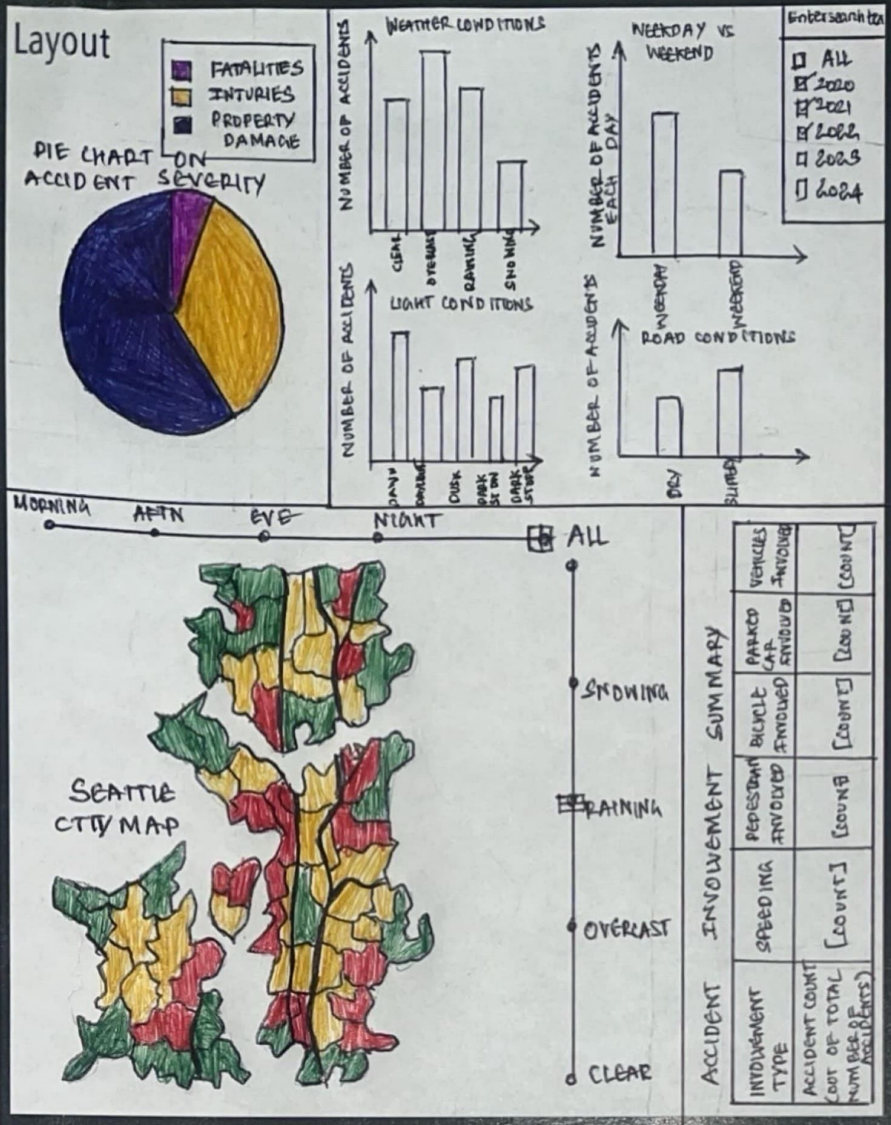
The data for accident severity will be shown on a pie chart. The categories include accidents resulting in fatalities, injuries, and property damage. The pie chart will be labelled with percentages, but the user would be able to hover on a specific category and see information about the total proportion of that category, for example, total fatalities in total number of accidents. This would give an added perspective on how many accidents result in loss of life, injury, or damage to cars or other property. There will be a drop down option to filter for a specific year. A text table will present facts of general interest to the user from the entire dataset. It would list the number of accidents in which speeding was as issue, in which vehicles, pedestrians, and cyclists were involved, and in which parked cars were hit. This table would also have an option to filter for a specific year.

Discussion

The accident severity variable includes three distinct categories: fatalities, injuries, and property damage. Since the dataset treats each category separately and does not account for any overlap (e.g., accidents involving both fatalities and injuries), we used a pie chart to represent the proportion of accidents in each category. This visualization effectively conveys which category most accidents fall into at a glance.

For the text table, we focused on five key involvement types—speeding, pedestrian involvement, bicycle involvement, parked car involvement, and vehicle involvement—because these factors provide insight into the primary contributors to accident scenarios. Each involvement type highlights a different dimension of road safety without implying direct relationships between th

Layout



Title:	Visualizing Seattle Traffic Accident Patterns
Auther:	Afshan, Khaja, Hari
Date:	06/11/12
Sheet:	Sheet 05
Task:	Combine visualizations from sheets 2, 3, and 4 to create an interactive Tableau dashboard visualizing Seattle traffic accident patterns from 2020 to 2024.

Operations

1. Heat Map:
 • Weather Condition Slider: Allows user to track accidents through different weather conditions ranging from clear, Overcast, Raining, or Snowing. Selecting All displays combined data across all weather conditions
 • Time of the Day Slider: Allows user to track accidents across all times of the day starting from Morning and going through afternoon, evening, and night. Selecting All displays combined data from all times of the day.
2. Bar and Pie Chart:
 • Year Filter Dropdown: User can filter data for specific year
 • Hover tooltips: Display actual numbers.
3. Text Table:
 • Year Filter Dropdown: User can filter data for specific year.

Focus

The final dashboard brings all the visualizations together to tell a story. The heat map is the main feature where the user can explore how the weather conditions and time of the day impact the number of accidents in Seattle. The interactive options would provide the user control over filtering for a specific year, and use sliders to track the impact of weather conditions and time of the day on the number of accidents. If interested in more quantitative information, the user can glean information from the bar and pie charts and the text table. Here again, the user will be able to filter over specific years and hover to look at exact figures. Overall, the aim is to educate under which conditions most accidents occur and if there are specific hotspots for accidents in the city.

Detail

• Tableau Desktop is used for dashboard design, with Tableau Prep handling data preparation, including:
1. Retaining essential columns: location (latitude and longitude), time of accident (date and time), weather condition, light condition, road condition, accident severity, and involvement details (speeding, pedestrian, bicycle).
2. Transforming columns, e.g., extracting the year from the date for filtering by 2020–2024.
Data is cleaned in Tableau Prep, then imported into Tableau Desktop for visualization. The dashboard can be published to Tableau Server or Tableau Online for wider access. Tableau's interactive features enhance data integration, manipulation, and visualization.

Visualization Methods and Algorithms:
 • Heat Map: Displays accident hotspots on a Seattle city map using color intensity to indicate accident frequency based on location, time of day, weather, and road conditions.
 • Bar Charts: Visualize accident data across conditions (weather, light, road, weekday vs. weekend) with aggregated data presented as bars.
 • Pie Chart: Shows accident severity (fatalities, injuries, property damage) as a percentage of the total, with each category as a slice of the pie.
 • Table: Provides details on accident involvement (speeding, pedestrian, bicycle, parked car, vehicle) by counting occurrences and displaying them in tabular format.