Motivation:

Using our visualization, users can examine Earthquake data from 2020 – 2025. Users can explore a global map marking where Earthquakes happened, explore a line chart to examine the frequency of earthquakes over time, and explore a bar chart to examine the percentage of earthquakes within certain magnitude and depth grouping.

Data:

The data used include all the recorded earthquakes on Earth starting on March 28th, 2020 and ending on March 29th, 2025.

Link to the Data: <https://github.com/tranjtGCP/data-vis-project-2/blob/main/data/2020-2025.csv>

Link to Where the Data was Sourced: <https://earthquake.usgs.gov/earthquakes/search/>

Components:

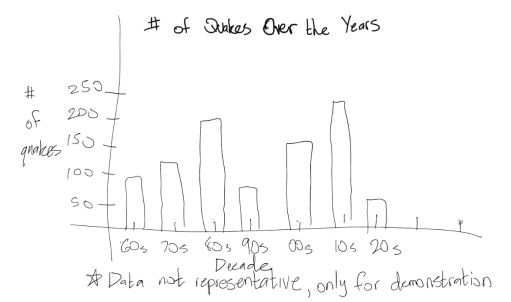
* Map
  + The map shows the location of the earthquakes from the dataset.
  + Interactions
    - Panning and Zooming
      * The user can click and hold to pan across the map.
      * The user can use the scroll wheel or the “+” and “-“ buttons in the top left of the map to zoom in.
      * Because the complete dataset is particularly large, panning and zooming may be resource intensive and cause the application to act slower.
    - “Lock” button
      * The user can use the button with the lock icon to prevent zooming with the scroll wheel.
    - “Map Pan Mode” and “Map Brush Mode”
      * The user can select one or the other to switch between panning mode and brushing mode.
      * One of the two MUST be selected.
    - Tooltip
      * The user can hover over an earthquake circle to display information about the earthquake.
    - Map Background
      * In the top right of the map, the user can select between 3 different backgrounds for the map. They can choose from Satellite, Topographic, and Street Map.
    - Color By
      * In the bottom right of the map, the user can select to color the earthquakes by magnitude, year, or depth.
      * The legend above the dropdown will update to show the new colors.
    - Map Brushing
      * When the map brush mode is selected, the user can draw a brush on the map to only display earthquakes within the brushed area.
      * When a brush is applied to the map, all 3 visualizations will update to only include the earthquakes within the brushed area.
      * The “Reset Map Brush” button can be used to reset the brush of the map to the original.
    - Stepping through time
      * When animation mode is enabled or checked, the points on the map will be emptied except for one, with a start and end date displayed, showing that the map is currently displaying the first point of the time range shown.
      * Buttons marked “< Step backward” and “Step forward >” allow the user to iterate through the days, showing where and when certain earthquakes occurred within the current timeframe
      * Unchecking the animation mode box will put all point of the selected timeframe back on the map
* Line Chart
  + The Line chart will show the user how many earthquakes happened each day within the time frame.
  + Interactions
    - Tooltip
      * The user can hover over the line to show the date being hovered over and how many earthquakes happened on that day.
    - Brushing
      * The user can brush across the line chart to limit the timeframe shown.
      * When the user uses the brush, all 3 visualizations will be updated to only include the earthquakes within the brushed time frame.
      * The “Reset Time Brush” button can be used to reset the brush of the line chart to the original.
* Bar Chart
  + The user can use the bar chart to examine what percentage of earthquakes fall within a range of either magnitude or depth.
  + Interactions
    - Tooltip
      * The user can hover over a bar to show the number of earthquakes and percentage of earthquakes that fall within the category.
      * If the bar is too small to hover over consistently or if there is no bar at all, the user can hover in the area above the bar or where the bar would be to view the tooltip.
    - Bar Chart Data
      * The user can use the dropdown in the top right of the bar chart to change which data is being viewed on the bar chart. The options are Magnitude and Depth.
    - Brush
      * The user can brush certain bars to limit the earthquakes shown by magnitude or depth depending on what is selected in the bar chart data dropdown.
      * When the brush is used, all 3 visualizations will update to only include the earthquakes of the brushed bars.
      * To use the brush, the user must start with their mouse in the area between two bars. The entire bar must also be included within the brushed area.
      * The “Reset Brush” button in the top left can be used to reset the brush of the bar chart to the original.

Sketches:

**A black line drawing of a rectangle

AI-generated content may be incorrect.**

This is a rough sketch of what we envisioned scrolling through time to look like, but due to time constraints it had changed slightly for the final product.



This is a rough sketch of how we wanted to visualize earthquakes in time. Gradually we changed it to a line graph to go along with the temporal aspect of the visualization.

Design Justification:

* Map
  + Different colors were used for the “Color By” option. Shades of blue and red were chosen for magnitude and depth to show which earthquakes fall within which magnitude/depth range. For the year option, distinct colors were chosen for each year so the circles would be easily identifiable.
  + A Brush mode and Pan mode switch was added to allow for both brushing and panning on the map. Since both operations involve clicking down on the mouse, both could not be done at the same time.
  + A zoom lock button was added due to all 3 visualizations not fitting on 1 static page. If the user wants to scroll down or up on the page and the map was the last thing they interacted with, the map will involuntarily zoom in/out.
* Line Chart
  + A kind of line chart was chosen to display the number of earthquakes over time. The chart is filled in with color that makes it easy to tell when there are peaks and dips in the number of earthquakes over time.
  + We chose to plot every day on the chart. This makes it easy to see periods of unusual seismic activity within the time frame. While this makes it difficult to look at smaller time frames within the chart, the user can simply use the brush to shorten the time frame shown.
  + We chose to use the color teal for this visualization. We wanted a color distinct from the blue/red of the magnitude/depth on the map and bar chart.
* Bar Chart
  + We chose to go with a simple bar chart for displaying the earthquakes by magnitude/depth. The bar chart is simple, yet effective when trying to view how many earthquakes fall within a certain range of magnitude/depth.
  + The issue with the bar chart is when the bars are too small to effectively view. For that case, an invisible hitbox was added above the bars so the user could still easily activate the tooltip for smaller bars.
  + We decided to use the same blue/red colors as the map for coloring the bar by magnitude/depth. This makes it easy to compare the data between the map and the bar chart.

Discover:

Our application allows users to discover all types of things about the Earth’s earthquakes from 2020 – 2025. The user can use the brushes from the 3 visualizations to narrow down the earthquakes to look at specific areas of data. For example, the user can use the brush to view earthquakes that happened in Japan in 2022 that are between 5.0 6.0 in magnitude.

The user can also use the line chart to look at the frequency of earthquakes over a time frame. For example, the user can look at the full timeline and see that there are multiple spikes in the number of earthquakes at seemingly random days. The user can then see that in the days around those spikes, there is also an unusually high number of earthquakes compared to the average day.

Process:

* Code
  + Structure
    - The code was structured so that each visualization used a different file. The map uses leafletMap.js, the line chart uses linechart.js, and the bar chart uses barchart.js.
    - Common code, like brush management and data processing was done in a common file, main.js.
    - A single style.css file was used to style every component of the 3 visualizations.
  + Libraires used
    - D3.v6.min.js
    - Leaflet.js

Link to the Application Website: <https://data-vis-project-2-teal.vercel.app/>

Video: <https://www.youtube.com/watch?v=pW0v7kqahAc>

Who Did What:

* Justin
  + Some of the Map
  + Most of the Line Chart
  + All of the Animation
  + Some of the documentation
  + Demo video
* Nate
  + Most of the Map
  + All of the bar chart
  + Some of the line chart
  + Brushing and linking across the 3 visualizations
  + Most of the Documentation