



ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

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## Milestone 2

COM-489 Data Visualization

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# 1 Introduction

Our project's goal is to build an interactive web-based platform that presents a dynamic narrative of global historical events. Using data visualization, we aim to provide users with a temporal and spatial journey, allowing them to explore and understand the context and impact of significant events throughout human history.

## 2 Visualizations sketches

The main page of our website will contain an **interactive 3-D globe visualization**, which will allow users to visually explore the geographic and temporal distribution of historical events on a 3D globe. Users can rotate the globe with the widget below it. Events are marked with pins that vary in color to represent different sentiment (positive or negative effects on population). Users can click on a pin to obtain a textual description of the specific event. For simplicity, we sketched the globes in a 2-D map form.

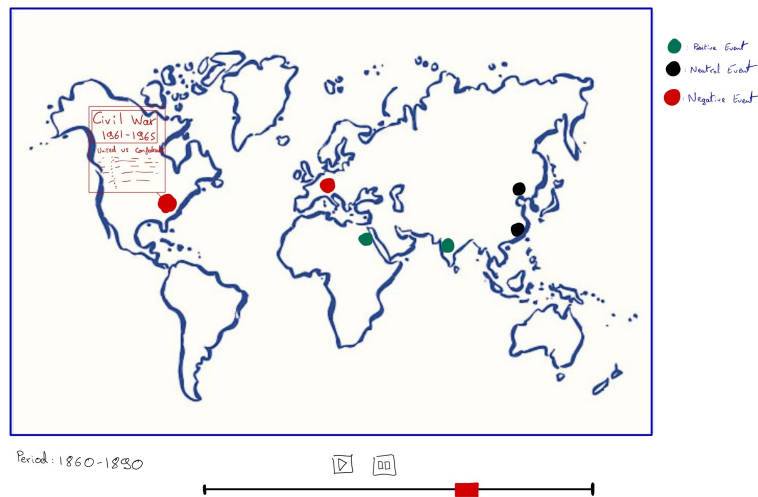


Figure 1: Interactive event map

Additionally, a **heat map overlay** on the globe will highlight regions with high concentrations of events, giving a visual representation of historical activity levels across the globe. For simplicity, the sketch is also in 2-D map form.

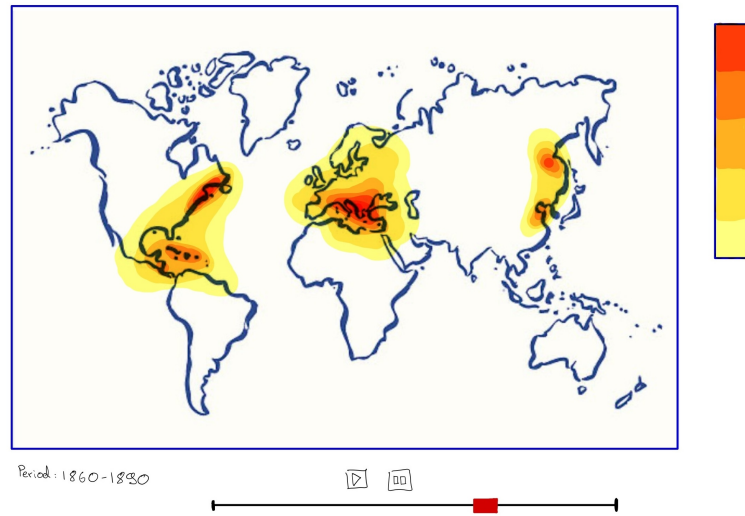


Figure 2: Event Concentration Heatmap

For top countries where most events are recorded, an additional feature will allow the user to display **evolutionary plots** that track the frequency of positive, negative, and neutral events over time.

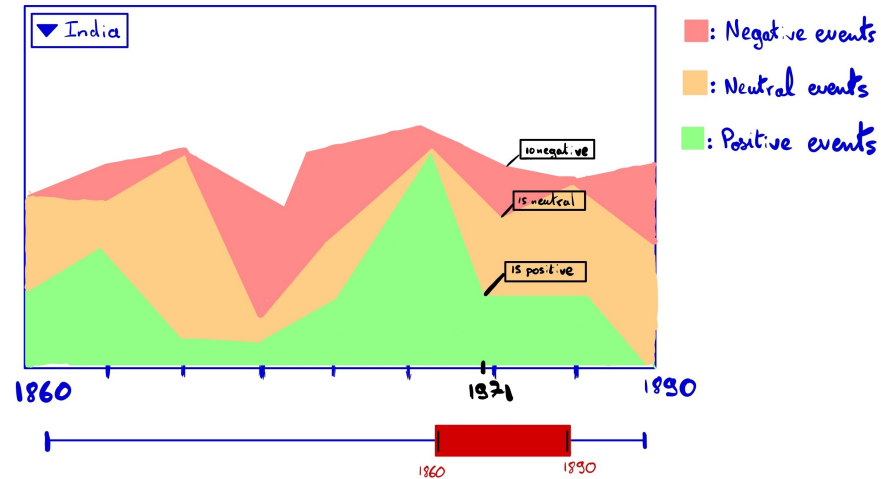


Figure 3: Sentiment analysis of events accross time and by country

We also plan to add a **dynamic race chart visualization**, which allow users to pause, rewind, and fast-forward through the timeline, enabling an exploration of event trends and how they shift from one country to another.

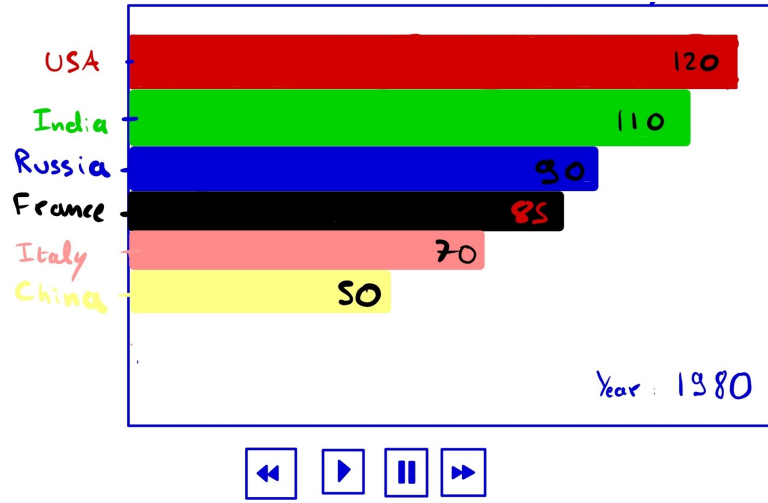


Figure 4: Dynamic Race Chart of Events by Country Over Time

Finally, and if time allows, we hope to add a **bubble graph** to categorize events and display their frequency visually, making it easy to understand the prevalence of different types of events, as well as an **event-types relationship graph** where events are plotted within a circular framework categorized by principal event types. Text analysis techniques are used to link events closely with their descriptions to relevant categories, enhancing interaction and comprehension.

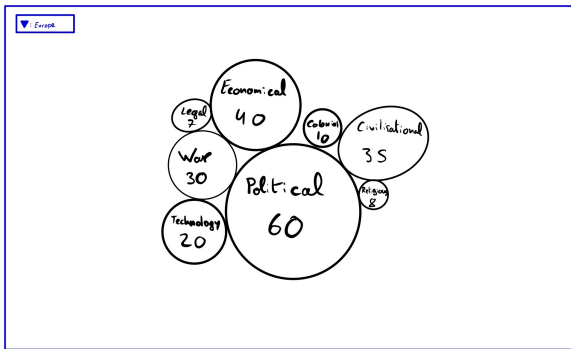


Figure 5: Bubble graph for event types

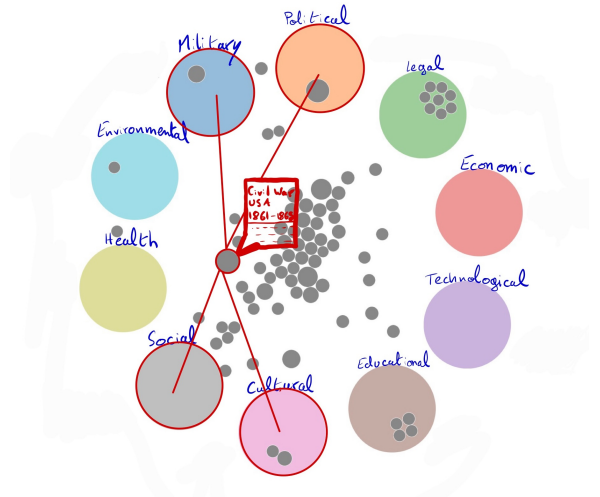


Figure 6: Event-types relationship graph

### 3 Tools

For our project, we have selected several tools that will support our goal of building a dynamic, interactive platform for visualizing historical events:

- **Python, Pandas and NumPy:** These libraries will be useful for data cleansing and preprocessing, offering powerful data manipulation capabilities to handle large datasets and ensure clean, structured data for accurate analysis.
- **Google Maps API:** Serves as our primary tool for precisely geolocating historical events, embedding detailed, context-rich maps on our interactive 3D globe. Since our dataset does not contain coordinates of countries where events happen, we will need to do some queries in order to get that.
- **globe.gl library:** A WebGL-powered framework designed for creating, interactive 3D visualizations of globes, which will be crucial for our main visualization.
- **fullPage.js:** Used to facilitate fluid navigation on our page, and to create a full-screen scrolling website.
- **d3.js:** For crafting animated, responsive graphs, we will rely on d3.js, a JavaScript library known for its flexibility and wide range of graphical tools.

## 4 Task breakdown

Below is the breakdown of tasks for the development of each feature, highlighting the specific functionalities and visual elements we aim to incorporate.

### 4.1 Interactive Globe Visualization (MVP)

#### Task1: Globe Rotation and Time Control

- ☐ Implement an interactive 3D globe that users can rotate manually, with smooth motion controls and zoom capabilities.
- ☐ Develop a timeline slider widget that, when adjusted, rotates the globe to the specific period, showcasing the distribution of events across time.

#### Task2: Event Categorization with Pins

- ☐ Get the localization coordinates of different countries that appear in the data.
- ☐ Design distinct color pins to represent different sentiment of historical events, and integrate them onto the globe.

#### Task 3: Pop-Up Event Descriptions

- ☐ Create an interactive feature where clicking on a pin triggers a pop-up text box. This box will provide a concise description of the event, its impact, and any relevant details.

**Task 4: Heat Map Overlay on Globe**

- ☐ Create a heat map layer to overlay on the 3D globe, indicating the frequency and intensity of historical events.
- ☐ The color intensity on the map will correlate with the concentration of events, providing a visual representation of the most historically active areas.

**4.2 Additional visualizations****Task 5: Sentiment time-series**

- ☐ Develop an interface with buttons labeled with the names of the countries. Each button, when clicked, will bring forth the visualizations pertinent to that region.
- ☐ For the selected country, display a time-series plot that illustrates the number and sentiment of events over different periods.

**Task 6: Race chart visualization**

- ☐ Feature a race chart visualization that dynamically displays the fluctuating number of events for each country as they unfold over time.
- ☐ Design the chart to allow users to observe trends and shifts in the frequency of events, providing a temporal comparison between nations.

**4.3 If time allows...****Task 7: Representing categories of events frequencies in bubbles**

- ☐ Develop a bubble graph where the size of each bubble corresponds to the number of times each type of event occurs.

**Task 8: Event-types relationship graph**

- ☐ Present an interactive graph that plots individual events within a circular framework of principal event types.
- ☐ Utilize advanced text analysis, employing embedding to determine the closeness of each event's impact and description to our predefined event types.
- ☐ Upon hovering over an event point, display the event's description, highlight its relevant types, and draw connections to those categories.