

Geo-Viz: Interactive Travel Planning Visualization

Process Book - COM-480 Data Visualization

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1 Introduction

Modern travelers are faced with an overload of information when planning trips. Tourism statistics, climate data, cultural attractions, and environmental impact data exist in isolation, making comprehensive trip planning challenging.

Geo-Viz addresses this by integrating multiple data sources into an interactive world map, enabling users to explore destinations through various lenses while maintaining environmental awareness.

1.1 Target Audience

Our visualization targets eco-conscious tourists, trip planners considering multiple factors, and data enthusiasts who appreciate data-driven decision-making.

1.2 Project Goals

- Create an intuitive interactive world map
- Enable destination comparisons
- Integrate CO2 footprint calculations
- Provide actionable travel insights
- Display details of interest for tourism, like cultural and natural sites

2 Data Integration

2.1 Dataset Selection

We integrated four key datasets:

1. **Tourism Statistics** (Kaggle): Foreign guests, expenditure per capita, arrivals per 1000 people
2. **Climate Data**: Monthly temperatures (1940-2024)
3. **UNESCO Sites**: World Heritage locations and metadata
4. **Population Data**: For per-capita normalization

2.2 Pre-processing Challenges

Country Identifiers: Different datasets used various naming conventions. We created a unified ISO code mapping.

Temporal Alignment: Datasets covered different periods. We identified overlapping years and dropped missing values. The Covid years weren't included as they heavily impacted tourism which would skew the insights provided by our website.

Dataset files format: Some files were CSV, other were XML. One goal of pre-processing was to convert every file to easily accessible formats.

Missing information: Parts of what we wanted to show weren't directly present in the data, and had to be computed. For instance, trip budgets were inferred from global expenditures and number of tourists.

3 Design Evolution

3.1 Conceptual Journey

Our design process began with exploring three main concepts:

1. **Dashboard Layout:** Traditional multi-panel approach - rejected for lack of narrative flow and visual interest.
2. **3D Globe:** Visually pleasing but impractical for data comparison. We needed to see the whole world at once.
3. **Interactive Flat Map:** Selected for optimal balance of aesthetics and usability. In particular, even though not very accurate, we chose the Mercator projection for its visual appeal.
4. **Sketches:** We provided some sketches of the prototype in figures 1 and 2 at the end of the document. There you will be able to see what we had in mind before even starting to code. Figure 1 shows the world view where the user can click on the destination and source country, with multi-hop flights and a floating data view.

3.2 Interaction Design

We implemented a two-click selection pattern:

- First click: Select home country
- Second click: Select destination

Additionally a single click on the ocean allows the user to reset the selection and the zoom.

3.3 Visual Encoding

Color schemes were carefully chosen, with color conventions in mind:

- Temperature: Diverging scale from Blue (cold) to Red (hot)

- Number of tourists (Popularity): Blue gradient
- Average Budget: Diverging scale from Green (low) to Red (high)
- Hotel Occupancy: Orange gradient
- UNESCO cultural sites: Purple gradient
- UNESCO natural sites: Green gradient

4 Technical Implementation Challenges

API Integration: The initial CO2 API that we considered was a subscription-based service. Furthermore, we didn't find any satisfying dataset about the CO2 emissions for travelling between two countries. For this reason, we chose to make an approximation computed based on the distance between the two countries.

Country selection: We wanted the country selection to be as intuitive as possible to allow easy interaction with our visualization. We chose to make the user first click on their departure country and then click where they want to go. The switch between source and destination is automatic, but can be changed with the click of a button.

Formatting: Fitting everything on the screen has proven challenging due to the sheer amount of information. This is why we decided to separate the data into different maps and zoom levels. On the one hand the zoomed out view is perfect for global statistics. On the other hand, clicking a country zooms in to display UNESCO World Heritage Sites, and more specific informations are written in a side panel. A button allows to get additional details below the main map.

Map projections Working with maps meant using projections, which had to be modified when zooming, and taken into account when placing points.

5 Individual Contributions

5.1 Raphael Fluckiger

Led the design process and implemented core interaction features.

Conceptual Design: Created initial sketches, facilitated design discussions, and established the visual language.

Country Selection: Implemented the two-click selection pattern with visual feedback.

CO2 API Integration: Researched about MyClimate API but since it was complicated to ask for an API key. Therefore, we chose to go with approximation computations.

Screencast: Recorded and edited the screencast.

Process book: Participated in the writing of the process book.

5.2 Paul Guillon

Mainly worked on the implementation of the website and its data visualizations aspects.

Data Pre-processing: Pre-processed the different datasets using jupyter notebooks and pandas.

Choropleth maps: Implemented the different choropleth maps with their legends.

UNESCO Sites: Implemented the placement and visualizations of the UNESCO World Heritage Sites.

Additional Details: Implemented the additional details page.

Screencast: Participated in the script writing of the screencast.

Process book: Participated in the writing of the process book.

5.3 Rached Toukko

Participated in the project design.

Search bar: Implemented the country search bar.

6 Results & Impact

6.1 Achievements

- Interactive world map with intuitive controls.
- Country comparison, CO2 integration
- Responsive on mobile horizontal mode
- Integration of UNESCO sites with thumbnails

7 Conclusions

Geo-Viz successfully integrates multiple data sources into a cohesive travel planning tool. The project demonstrates how thoughtful visualization design can make complex data accessible and actionable.

7.1 Future Work

Short-term enhancements could include:

- Additional transport modes for CO2 calculations
- Improved mobile experience
- VISA requirements data for traveling to each country

The visualization provides value by enabling data-driven, environmentally conscious travel decisions through an intuitive interface.

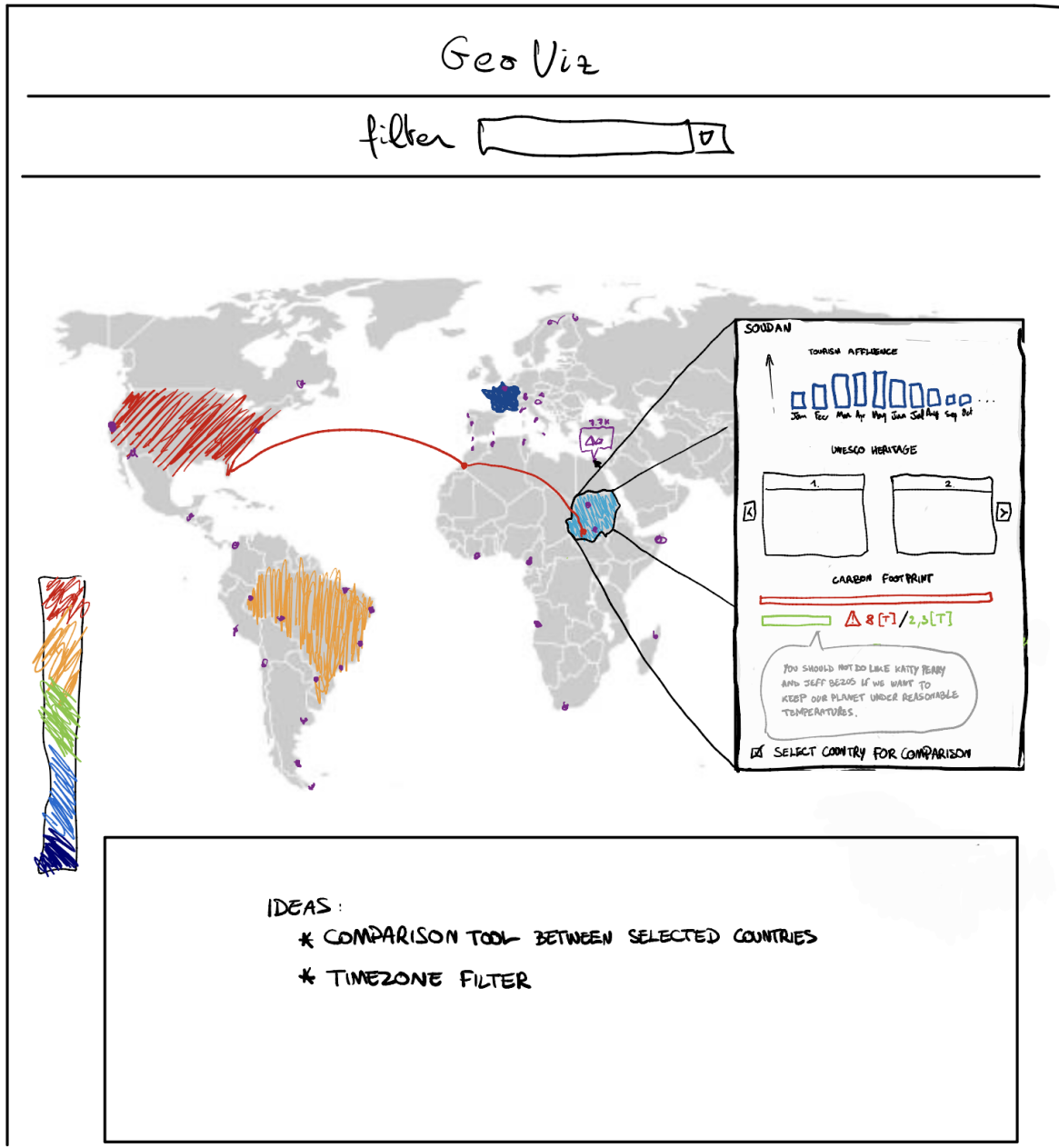


Figure 1: Your image caption

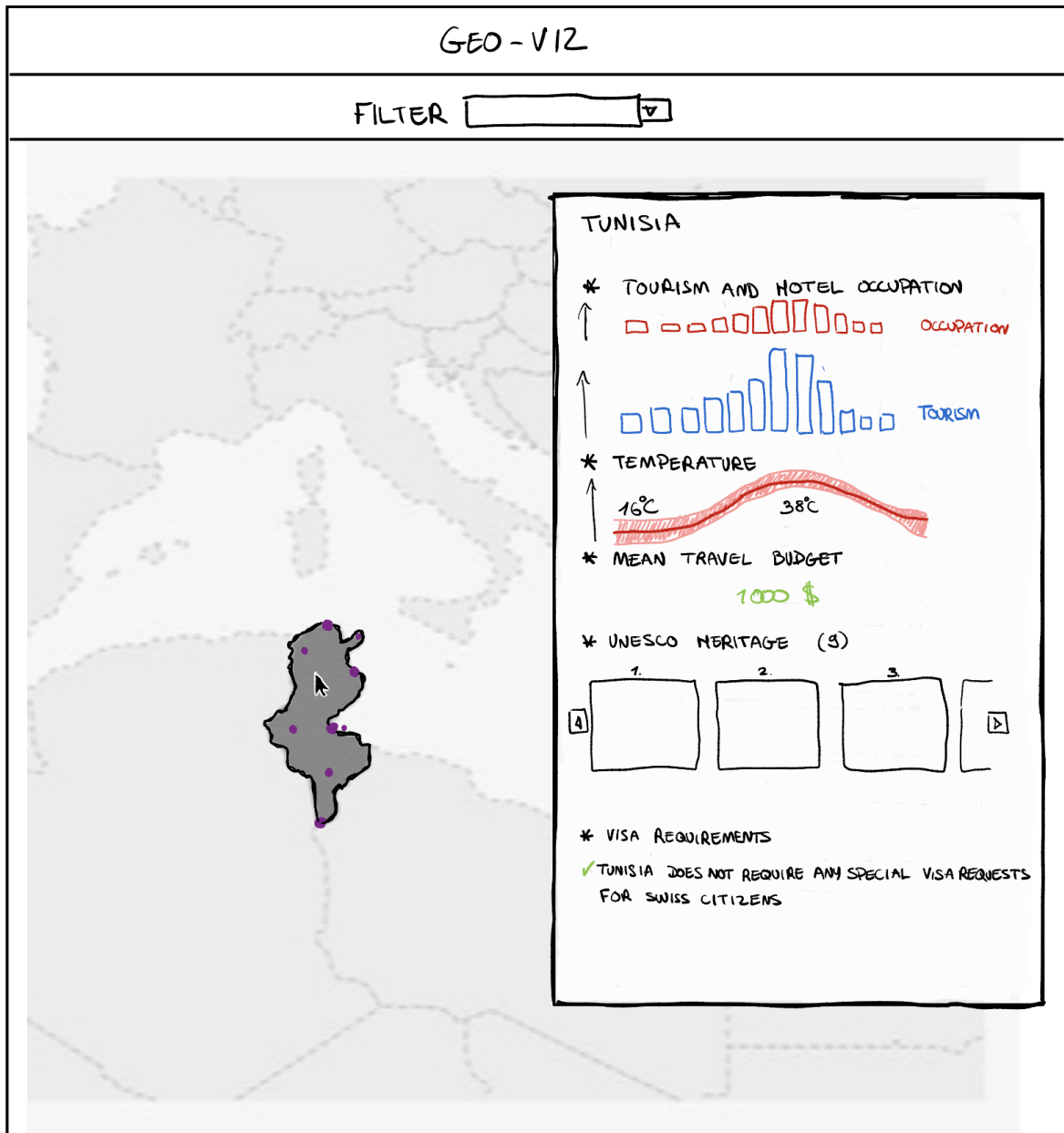


Figure 2: Your image caption