Interactive Visualization of Artists and Exhibitions: A Geospatial and Temporal Analysis

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1 Introduction

The early 20th century was a pivotal period in the art world, marked by significant movements, the emergence of modernist art, and dynamic shifts in cultural landscapes. This project leverages the *ArtVis* dataset, which encompasses information on approximately 14,000 modern painters and their exhibitions between 1905 and 1915.

By designing an interactive visualization, we aim to facilitate an in-depth exploration and analysis of this extensive dataset. The visualization integrates both geospatial and temporal dimensions, allowing users to discern patterns in gender representation, track temporal trends in exhibition activities, and identify geographical concentrations of artistic endeavors.

The multidimensional structure of the dataset, which links artists to multiple exhibitions across various locations and times, presents an opportunity to explore complex relationships and uncover hidden patterns that might not be immediately apparent through traditional analysis.

The project aims to provide valuable tools for art historians, museum curators, cultural analysts, and enthusiasts to engage with the data interactively and derive meaningful conclusions.

2 Exploratory Analysis

2.1 Data Quality

The dataset is largely complete with manageable missing values. Some birth and death dates lack complete month and day information, and minor inconsistencies in latitude and longitude data were addressed during cleaning.

- **Artist Information:** Gender, birth and death dates, nationality, birthplace, and deathplace.
- **Exhibition Information:** Title, venue, start date, type (group, solo, auction), country, city, latitude, longitude, and the number of paintings exhibited.

2.2 Gender Distribution of Artists

An analysis of the gender distribution revealed a significant imbalance:

As shown in Figure 1, the majority of artists in the dataset are male, indicating a gender disparity in the art exhibitions during this period.

2.3 Temporal Distribution of Exhibitions

Examining the number of exhibitions over time provides insights into trends and historical contexts:

Figure 2 illustrates fluctuations in exhibition activity between 1905 and 1915, with potential influences from historical events impacting the art world.

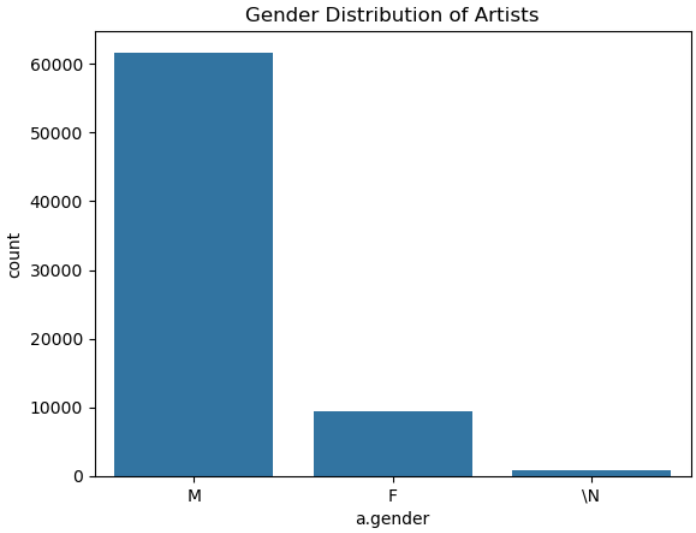

Figure 1: Gender Distribution of Artists

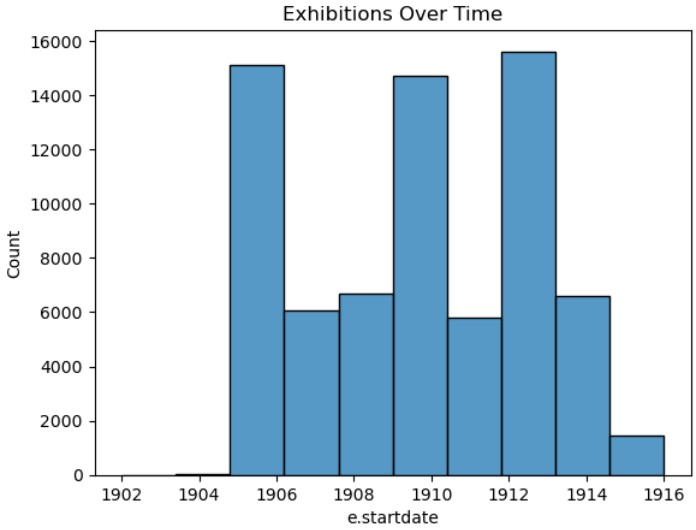

Figure 2: Number of Exhibitions Over Time

2.4 Geographical Distribution of Exhibitions

Mapping the exhibitions highlights the geographical hubs of artistic activity:

Figure 3 displays the locations of exhibitions, revealing concentrations in major cultural centers, suggesting significant regional influences on art trends.

Exhibitions appear to be concentrated in the European continent, as well as the east coast of the North American continent. Major cities like Munich (8 479 exhibitions), London (8 136 exhibitions), and Berlin (6 143 exhibitions) are the most common locations of exhibitions, as displayed in Figure 4.

2.5 Exhibition Types

Analyzing the types of exhibitions provides insights into the organizational patterns of the art community:

Figure 5 shows that group exhibitions were the most common (71 222 exhibitions), followed by auctions (481 exhibitions) and solo (375 exhibitions), indicating prevalent collaborative displays during the era.

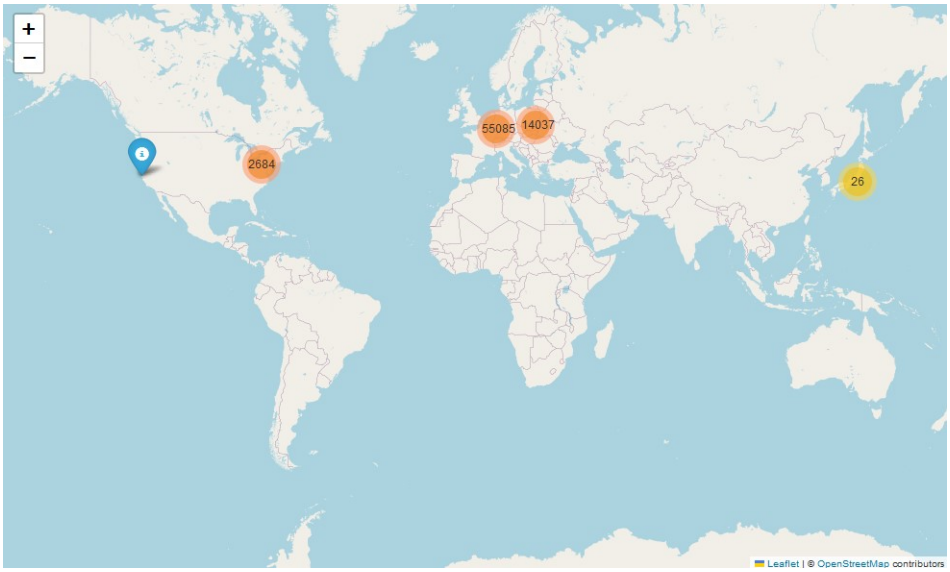

Figure 3: Geographical Distribution of Exhibitions

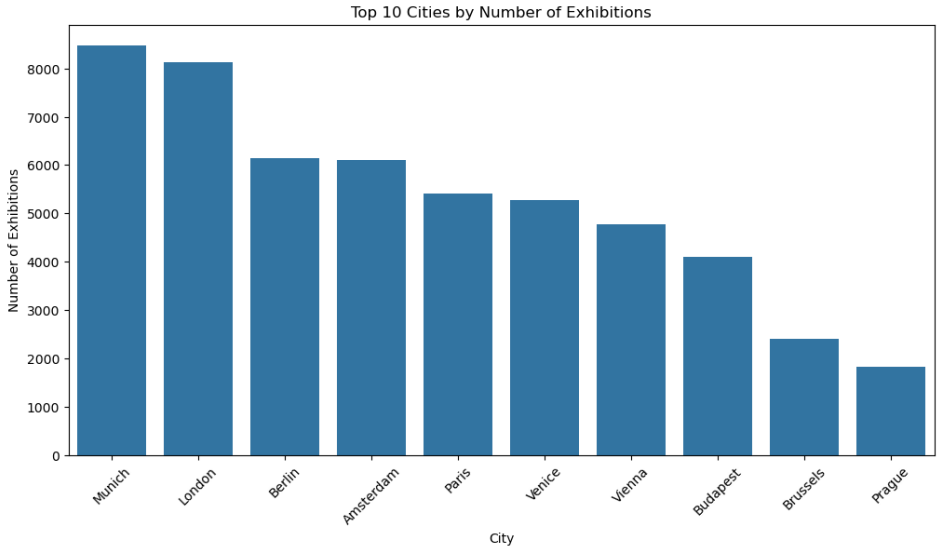

Figure 4: Geographical Distribution of Exhibitions

2.6 Number of Paintings per Exhibition

Most exhibitions feature a modest number of paintings, with some outliers showcasing large collections. Paintings per exhibition range from 1 to 20, with an average of 5.

3 Data Description

3.1 Parameters

The dataset contains the following parameters:

1. **Artist Information:**
   - `a.id`: Unique identifier for each artist.
   - `a.firstname`: First name of the artist.

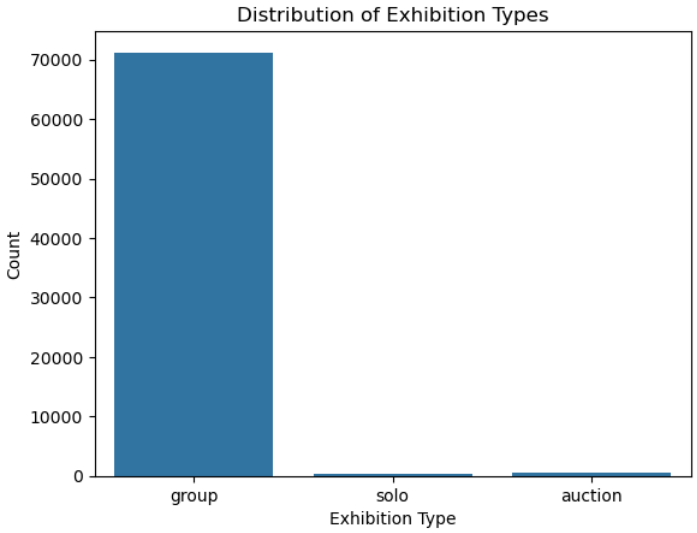

Figure 5: Distribution of Exhibition Types

- `a.lastname`: Last name of the artist.
- `a.gender`: Gender of the artist (`"M"` for male or `"F"` for female).
- `a.birthdate`: Birthdate of the artist (`YYYY-MM-DD`, usually with missing months and days).
- `a.deathdate`: Death date of the artist (`YYYY-MM-DD`, usually with missing months and days).
- `a.birthplace`: Birthplace of the artist.
- `a.deathplace`: Place where the artist died.
- `a.nationality`: Nationality of the artist.

2. **Exhibition Information:**

- `e.id`: Unique identifier for each exhibition.
- `e.title`: Title of the exhibition.
- `e.venue`: Venue where the exhibition was held.
- `e.startdate`: Start date of the exhibition.
- `e.type`: Type of exhibition (`"group"`, `"solo"`, or `"auction"`).
- `e.paintings`: Number of paintings the artist exhibited.
- `e.country`: Country where the exhibition took place.
- `e.city`: City where the exhibition took place.
- `e.latitude`: Latitude of the exhibition location.
- `e.longitude`: Longitude of the exhibition location.

3.2 Data Types

- **Nominal (Categorical):**
  - `a.id`, `a.firstname`, `a.lastname`, `a.gender`, `a.birthplace`, `a.deathplace`, `a.nationality`, `e.id`, `e.title`, `e.venue`, `e.type`, `e.country`, `e.city`
  - `a.gender` is (also) binary nominal variable (`"M"` or `"F"`).
- **Discrete (Quantitative):**
  - `e.paintings`

  - Represents count data (number of paintings exhibited), which is discrete and numeric.

- **Continuous (Quantitative):**
  - `a.birthdate`, `a.deathdate`, `e.startdate` (Dates can be treated as continuous variables when using numerical representations (e.g., years)).
  - `e.latitude`, `e.longitude` (geographical coordinates are continuous numeric data).

- **Binary:**
  - `a.gender` can also be considered a binary variable.

3.3 Data Structures

- **Multidimensional Data:** The dataset is multidimensional, combining attributes from artists and exhibitions. Each record links an artist to an exhibition with various attributes.
- **Time-Oriented Data:** Variables like `a.birthdate`, `a.deathdate`, and `e.startdate` introduce a temporal dimension, which enables chronological analysis of events and lifespans.
- **Network/Graph Structure:** The data can be represented as a bipartite graph connecting artists and exhibitions. Exhibitions may feature multiple artists, and artists participate in multiple exhibitions.
- **Geospatial Data:** Includes geographical coordinates (`e.latitude`, `e.longitude`), which allow for mapping and spatial analysis of exhibition locations.

3.4 Specifics

- **Multiple Entries per Artist:** Artists appear multiple times, once per exhibition they participated in. This makes itmNecessary to handle duplicates when analyzing artist-level data.
- **Date Uncertainty:** Birth and death dates usually (if not always) have missing months and days, using only the year component for consistency could be wise.
- **Data Quality Considerations:** Careful parsing of dates and coordinates is required, foe example, paying attention to the format of `e.latitude` and `e.longitude` for correctness is important to avoid mapping errors.
- **Rich Analytical Potential:** Combining personal, temporal, spatial, and event data has the potential for demographic studies, trend analysis, network modeling, and geospatial visualization.
- **Data Relationships:** The data displays many-to-many relationships between artists and exhibitions.

4 Use and Domain

In this section we will take a look at the different uses and target groups based on various aspects.

4.1 Users of the Visualization

The user group of the dataset may vary based on the use case:

- **Art Historians and Researchers**: Those who research art history, connections between artists or exhibition trends in time and space.
- **Museum Curators**: Experts who are interested in exhibition trends, geographical and temporal distribution of exhibitions, and historical evolution of gender representation.
- **Art Enthusiasts and Collectors**: People who search patterns in art exhibitions and art data out of personal interest or to enhance their collections.

- **Cultural Analysts**: Analysts who research migration of artists, global artist movements or cultural trends.
- **General Audience**: Users who are interested in interactive art historical visualizations.

4.2 Target Group Characteristics

The characteristics of the target group depend on the user base:

- **Art Historians and Researchers**: Academics or experts who possess deep knowledge in this area, and need detailed and accurate information. They prefer the possibility of filtering the data and analyzing the data patterns.
- **Museum Curators**: The focus on the data connected to the exhibitions, for example trends in locations and art demographics. They prefer easily and intuitively usable interfaces.
- **Art Enthusiasts and Collectors**: They are less technically oriented, but they are interested in visually appealing, easy-to-explore display of data.
- **Cultural Analysts**: They need tools that highlight characteristics of certain spaces and times in art history, and offer advanced visual representations for deeper analytics.
- **General Audience**: They have less technical experience, therefore they need simple, spectacular and intuitive user interface.

4.3 Various Visualizations

- **Art Historians and Researchers**: They typically have deep understanding and experience in interpreting geographical maps, timelines and categorical data visualizations
- **Curators and Analysts**: Experienced in using interactive dashboards, heat maps and trend visualizations with temporal settings
- **General Audience**: Usually less experienced, but they are comfortable using well designed interactive tools, for example map based visualizations

4.4 Application Domain

The application domain is **the art history and exhibition analysis**. This domain includes:

- The study of biographical and demographical data of the artists (eg. gender, nationality, etc.)
- The analysis of temporal and geographical trends
- The study of historical data of art movements, collaborations, cultural effects

4.5 Nature of the Application Domain

- **Temporal dimension**: Time and dates are crucial to understand trends and certain developments.
- **Spatial focus**: Origin of artists, exhibition locations and the overlap of these.
- **Gender**: Highlighting the developments of gender representation.
- **Scalability**: Handling of different levels of data intensity (many artists from the same location; higher amount of paintings in a single exhibition)
- **User expectations**: Demand for spectacular, easy-to-use tools to explore connections and data patterns.

4.6 Goals and Insights

The users can explore temporal and spatial patterns in the data, such as the birthplaces and deathplaces of artists or the locations where they exhibited their works. They also aim to understand how diverse art movements spread. Additionally, they may wish to analyze changes in artistic diversity and its spatial and temporal evolution. Furthermore, they seek to identify patterns in exhibition types (group or standalone) and variations in scale.

5 Mockups

The mockups apply several visualization techniques. The primary visualization is a bubble map, where the size of each bubble represents the density of results (e.g., artists or exhibitions) at a geographic location. A timeline slider at the bottom allows users to select a specific range of years to display data. Filters on the side panel enable further refinement by artist attributes such as gender, birth/death data, and exhibitions.

Data variables are mapped to visual variables as follows: the density of results is mapped to the size of the bubbles, while geographic locations are mapped to the positions on the map. The timeline slider maps the selected range of years to the displayed subset of data, dynamically updating the visualization.

Users can interact with the visualization through several methods. The timeline slider allows them to explore temporal data by adjusting the range of years. The filters support dynamic querying, enabling users to refine the displayed dataset by criteria such as gender or exhibition type. Clicking on a bubble reveals a condensed list of artists associated with that region and time range. From this list, users can drill down further into an artist's detailed view, which includes personal details, birthplace, deathplace, and a list of venues where their work was exhibited.

The design supports user tasks by providing interactive feedback and layered detail. The bubble map gives a high-level overview, while the detailed artist view allows for in-depth exploration. Users can navigate through the data spatially, temporally, and by attribute, combining these methods for dynamic exploration.

Improvements could include adding color-coding to bubbles to represent additional data dimensions, enabling map zoom functionality for granular exploration, and introducing search capabilities for specific artists or venues. Other enhancements might involve linking shared history between artists and venues, adding filters for nationality or medium, and allowing multi-select to compare artists side-by-side. These extensions would make the visualization more comprehensive and user-friendly.

5.1 Mockup 1

The first mockup illustrates the design of the interactive artist map. At its center, a world map features bubbles representing the density of results. On the right, filters allow users to refine their selection by criteria such as artists, exhibitions, and artist gender. At the bottom, a slider enables users to specify a range of years. Clicking on a bubble reveals a condensed list of artists associated with that area.

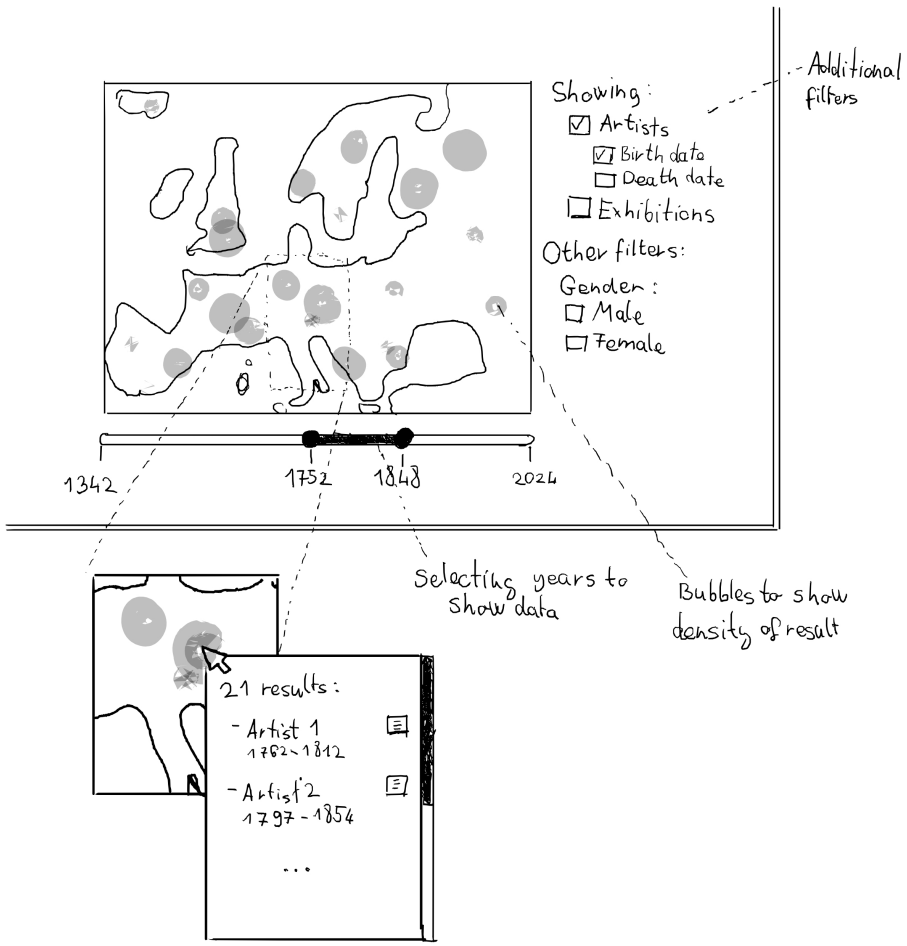

Figure 6: Mockup of an Interactive Artist Map.

5.2 Mockup 2

The second mockup provides a more detailed view of an artist, highlighting additional information such as their birthplace, deathplace, and nationality. It also displays a comprehensive list of venues where the artist's work was showcased, including the venue dates, cities, types of events, and the number of paintings associated with each venue.

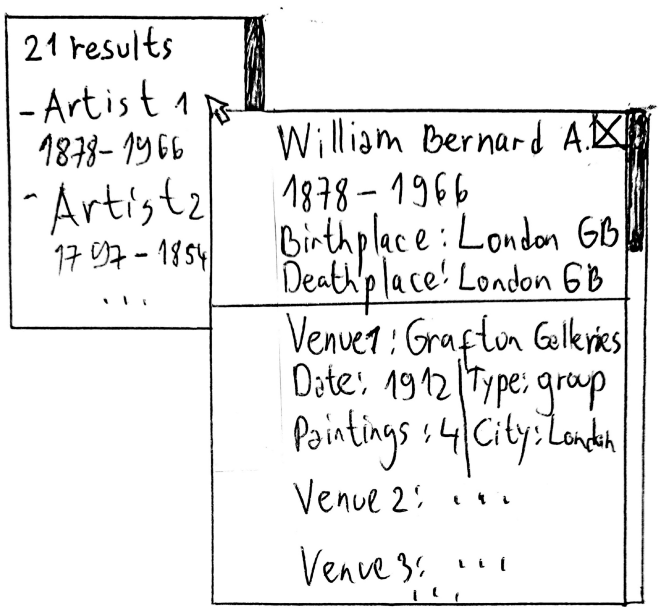

Figure 7: Mockup of an Artist Detail View

6 Conclusion

The exploratory analysis of the *ArtVis* dataset has brought to attention several key insights of the early 20th-century art world: the significant gender imbalance, with a predominance of male artists, and the fluctuations in exhibition activities. Geospatial visualization highlighted major cultural centers as focal points of artistic activity, such as Munich, London and Berlin, and the distribution of exhibition types indicated a strong preference for group exhibitions.

In conclusion, the development of an interactive visualization for analyzing artists and exhibitions serves as a pivotal tool in uncovering intricate patterns within the art historical domain. While the initial phases of the project have focused on data collection, cleaning, and exploratory analysis, the upcoming efforts will concentrate on implementing the designed mockups. By integrating them, the visualization platform will offer enhanced functionalities such as interactive maps, dynamic filtering options, and responsive design elements that cater to diverse user needs.