

Nobel Prize Visualization

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1 Project Goal

The Nobel Prizes, awarded annually for outstanding achievements in Physics, Chemistry, Medicine, Literature, Peace, and later Economics, represent pinnacles of human intellect and endeavor. Vast amounts of data exist about laureates, yet accessible and engaging visual tools to comprehensively explore this rich history are often limited.

Our project, "MOMO - Nobel Prize Visualization," aims to fill this gap. We seek to develop a user-friendly, interactive web platform that allows users to explore the fascinating world of Nobel laureates. The primary goals are:

- visually map the geographical distribution (birth country, organization country) of Nobel laureates over time.
- enable analysis of trends based on prize category, year, gender, and age at the time of award.
- provide insights into migration patterns of laureates.
- present this information through a compelling narrative, guiding users from a general overview to specific details.

2 Dataset

The foundation of our project is the "Nobel Prize Winners: 1901 to 2023" dataset in .csv format, sourced from Kaggle and originally curated from the official Nobel Foundation website. The dataset comprises approximately 1000 laureates, including both individuals and organizations, spanning from 1901 to 2023. For our visualizations, we primarily utilized: year, category, fullName, gender, born, bornCountry, organizationName, and organizationCountry.

While largely clean, the dataset required some preprocessing, which including calculating the age of laureates at the time of the award and mapping various country names to consistent identifiers.

3 Exploratory Data Analysis

3.1 Missing Values and Special Considerations

We conducted an analysis of the missing values in the dataset. It is important to note that the Nobel Peace Prize category exhibits missing values for the country of birth. This occurs because, in some cases, the laureate is not an individual but an organization. As a result, the absence of country information is directly relevant to our analysis, whereas missing values in other attributes are less critical.

3.2 Award Distribution Insights

The Nobel Prize in Economic Sciences was only introduced in 1969. Consequently, the number of laureates in this category is significantly lower compared to the other prize categories.

3.3 Interesting Insights

- Spatial Distribution: Recipients with U.S. nationality far outnumber those from other countries.
- Temporal Trends: We find that the average prize share has increased over time. This trend reflects a shift in the scientific paradigm towards greater collaboration, which is essential for driving innovation across experimental fields.

4 Designs

Our design philosophy centered on creating an intuitive, informative, and aesthetically pleasing experience.

4.1 Website Layout & Navigation

We opted for a two-page structure ("Home" and "Analysis Sections") to separate the overview/dashboard experience from more focused analytical views, which uses a sticky top navigation bar (Figure 1) ensuring constant access to these main sections. This helps manage complexity and guide user exploration.

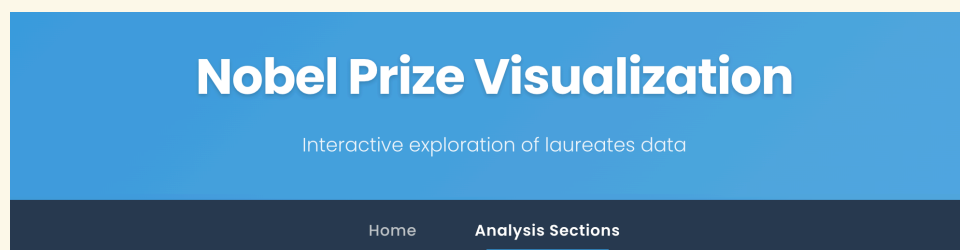


Figure 1: Navigation Bar

Content within each page is organized into clear, titled sections, often using a card-based layout for individual visualizations, promoting a clean and modular design.

4.2 Color Scheme & Styling

We utilized a modern color palette with a dominant blue (`--primary-color: #3498db`), complemented by cool greys, a contrasting accent for highlights, and very light backgrounds for main content areas. This choice aimed for a professional, trustworthy, and calm aesthetic suitable for the Nobel Prize theme. The Poppins font was used for headings and body text to ensure readability and a contemporary feel. Visual consistency was maintained through common styling for interactive elements, tooltips, and modals. Hover effects provide visual feedback.

4.3 Interactivity

The world map on the "Home" page acts as the primary driver for the auxiliary charts, allowing users to click a country and see its specific data reflected immediately. And tooltips are extensively used across all charts to provide detailed information on demand without cluttering the main view.

A combination of sliders (for timeline), dropdowns (for categories), checkboxes, and radio buttons offers intuitive and flexible data filtering options in the general statistics page.

5 Visualization

Our website features a range of interconnected visualizations, each designed to tell a part of the Nobel Prize story. All charts were implemented using AmCharts 5.

5.1 World Map Visualization

To provide a geographical overview of Nobel laureate distribution by birth country, we implemented a choropleth map where countries are colored based on the cumulative number of laureates up to the selected year and category (Figure 2). A clear legend explains the color scale. Users can pan and zoom. Hovering over a country displays its name and total laureate count. Clicking a country selects it, zooms in, and filters the four auxiliary charts below. To provide better interactivity towards users, we added a fading-in-out notification to suggest that the statistics below have been updated when a click event happens.

Besides the map, there is a timeline slider (1900-2023) and a category dropdown (Physics, Chemistry, etc., including "All Categories") filter the data displayed on the map and influence connected charts.

5.2 Statistics Charts below the Map

Our target audience includes students, researchers, educators, policymakers, and anyone curious about the history and patterns of Nobel Prize achievements. To facilitate their navigation and learning, we provide charts that display our data on 3 different aspects for a specific country or globally:

The winners-over-time bar chart is displayed to show the trend of Nobel laureates for a selected country (or globally) over the years. It displays the number of winners on

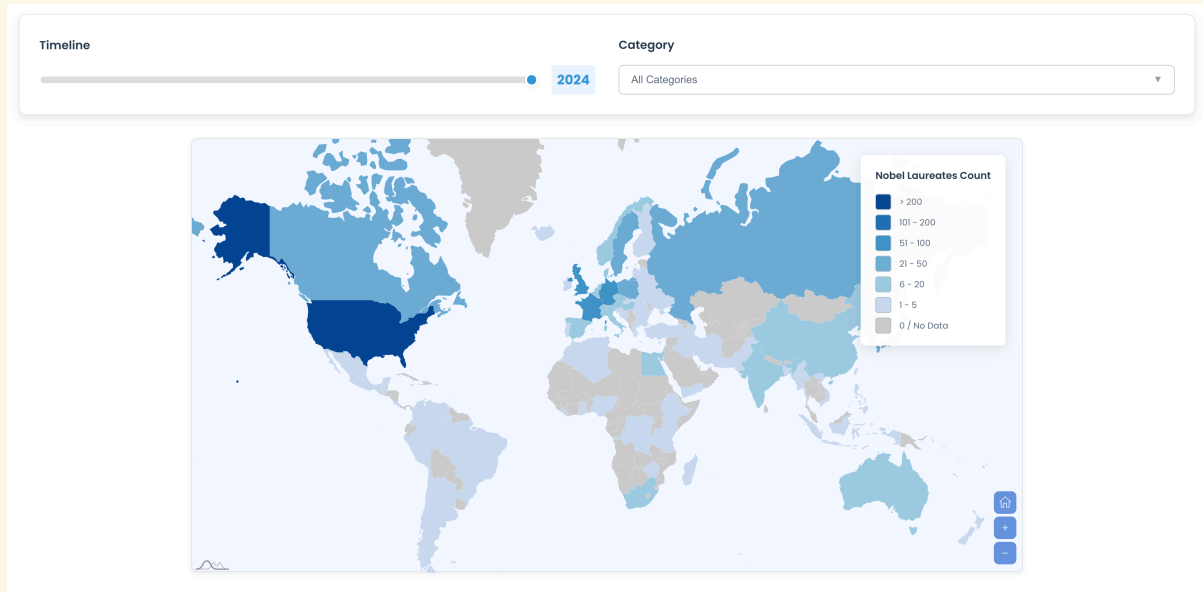


Figure 2: World Map Visualization

the Y-axis against years on the X-axis and is updated dynamically based on the country selected on the world map and the category chosen in the map's filter.

The category-distribution-pie chart shows the proportion of prizes in each Nobel category to illustrate the breakdown of Nobel Prizes by category for a selected country (or globally). It is also updated based on the country selected by users on the world map.

To show the gender representation among laureates for the selected country and category, we display Displays proportions for "Male" and "Female" in the gender-distribution pie chart.

We also implement the age-at-award histogram to show the age distribution of laureates when they received the Nobel Prize. Bars represent the count of laureates within specific age bins (e.g., 30-39, 40-49).

5.3 General Analysis Sections Visualization

We have implemented 3 kinds of graphs to display the general statistics of all data to gain a comprehensive view.

The Nobel-prize-trends over time line chart has multiple lines on it, with the X-axis representing years (1900-2023) and the Y-axis representing the number of prizes (Figure 4). Users can toggle the visibility of lines for different categories using checkboxes to see the evolution of prize awarding across all categories and for the total number of prizes per year.

Besides, we have an age analysis scatter plot to explore the age of laureates at the time of award, across different categories and genders (Figure 5). Each dot represents a laureate, positioned by their age (X-axis) and their prize category (Y-axis, with jitter for better visibility). Dots are color-coded by gender (male/female). An average age line is displayed. Hovering over a dot shows detailed information. Clicking a dot opens a modal with more extensive details. Radio buttons allow filtering by Nobel category.

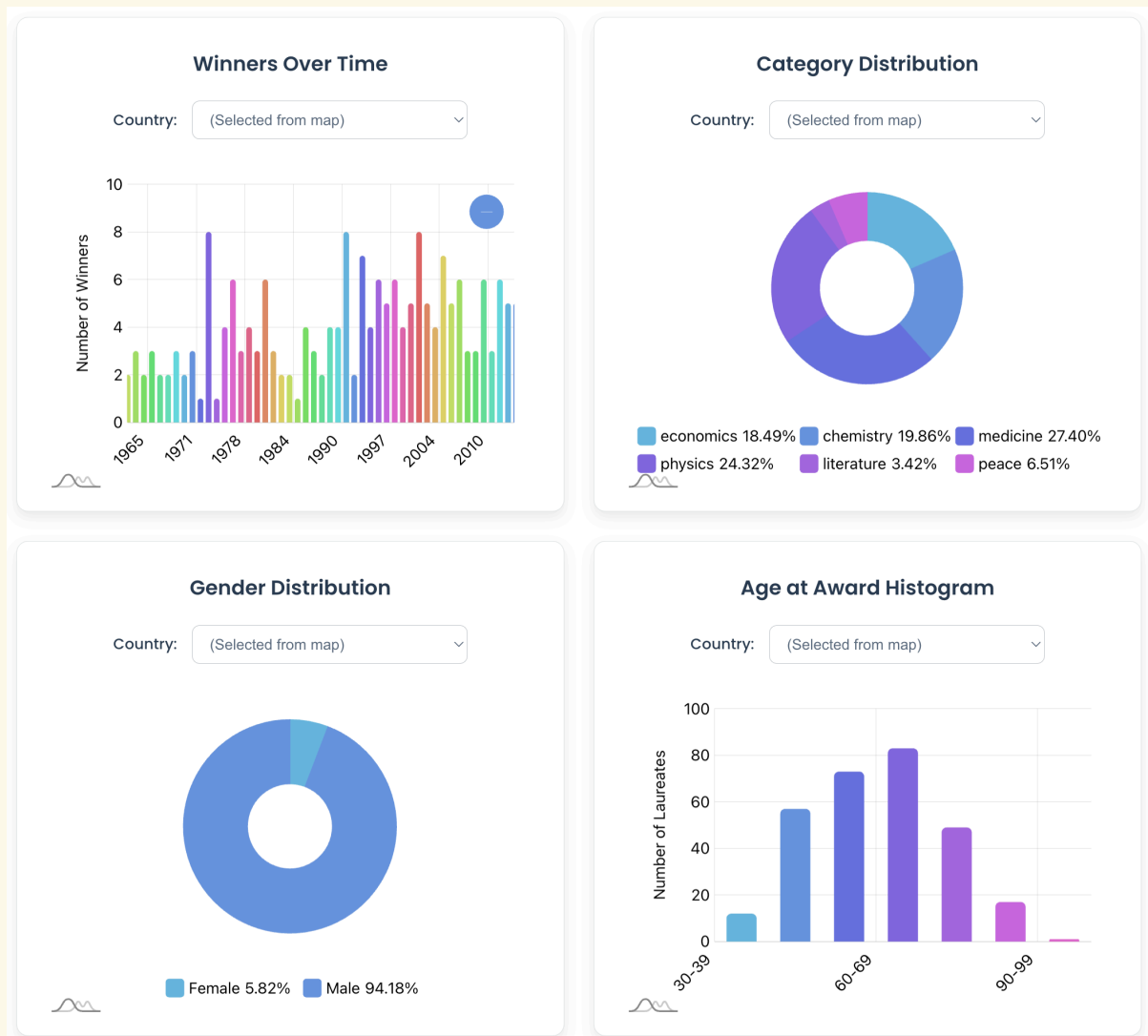


Figure 3: Per Country Statistics

To visualize the migration patterns of Nobel laureates, illustrating the flow from their birth country to the country of their affiliated organization at the time of the award, we displayed the country-flow Sankey diagram (Figure 6). The thickness of the flow lines is proportional to the number of laureates. Major countries are highlighted, while others are grouped to maintain clarity.

6 Storytelling

Our website aims to tell multiple stories from the Nobel Prize data, allowing users to uncover patterns, make comparisons, and understand the multifaceted history of the Nobel Prizes in an engaging way:

- **Geographical Dominance and Shifts:** The "Home" page, with its central world map, immediately invites users to explore which countries have produced the most Nobel laureates. The timeline slider allows users to see how these geographical patterns have evolved cumulatively since 1901.

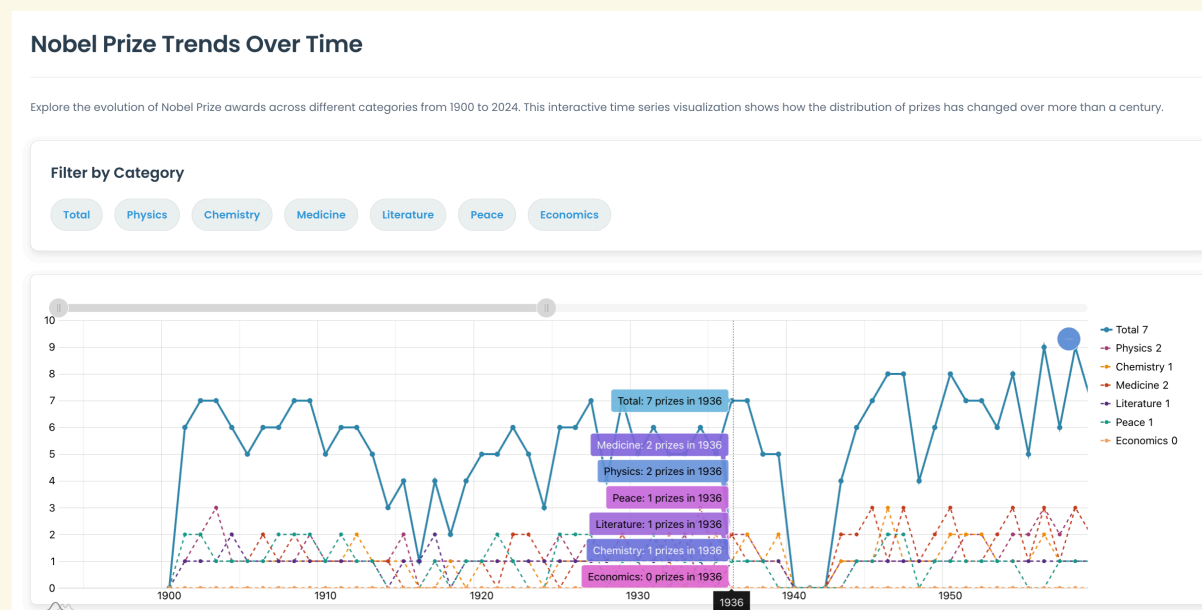


Figure 4: Time Trend of Winners

- **Country-Specific Deep Dive:** By clicking on a country, users transition from a global view to a national one. The auxiliary charts update to tell the story of that specific nation’s Nobel achievements: its historical performance (Winners Over Time), its strengths in various fields (Category Distribution), the gender balance of its laureates (Gender Distribution), and the typical age of its winners (Age Histogram). This creates an interactive narrative driven by user curiosity.
- **Overall Prize Trends:** The “Nobel Prize Trends Over Time” line chart in the “Analysis Sections” tells the story of how the awarding of prizes in different categories (and overall) has fluctuated over more than a century, highlighting periods of growth or decline in specific fields.
- **The Laureate’s Journey:** The “Age Analysis” scatter plot provides a more personal look at laureates, showing when they received their awards in their careers, how this varies by field, and comparing male and female laureates. The modal pop-up for each laureate provides their specific achievement.
- **Global Talent Flow:** The “Birth vs. Organization Country Flow” Sankey diagram tells the story of intellectual migration, showing which countries are net attractors or contributors of Nobel-level talent.

7 Technology & Challenges

7.1 Technology Stack

Data Parsing	Visualization Library	Main Language	Styling	Deployment
PapaParse (.csv)	AmCharts 5	JavaScript (ES6)	CSS3	Github Pages

Table 1: Used Technology Frameworks

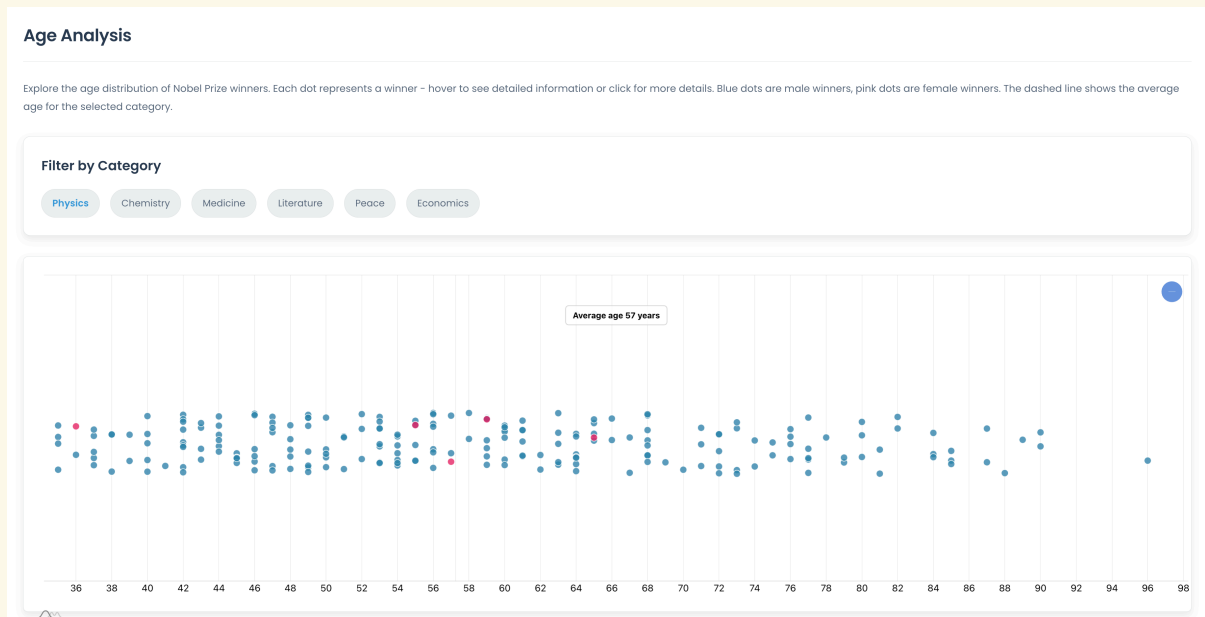


Figure 5: Age Scatter Plot of Winners

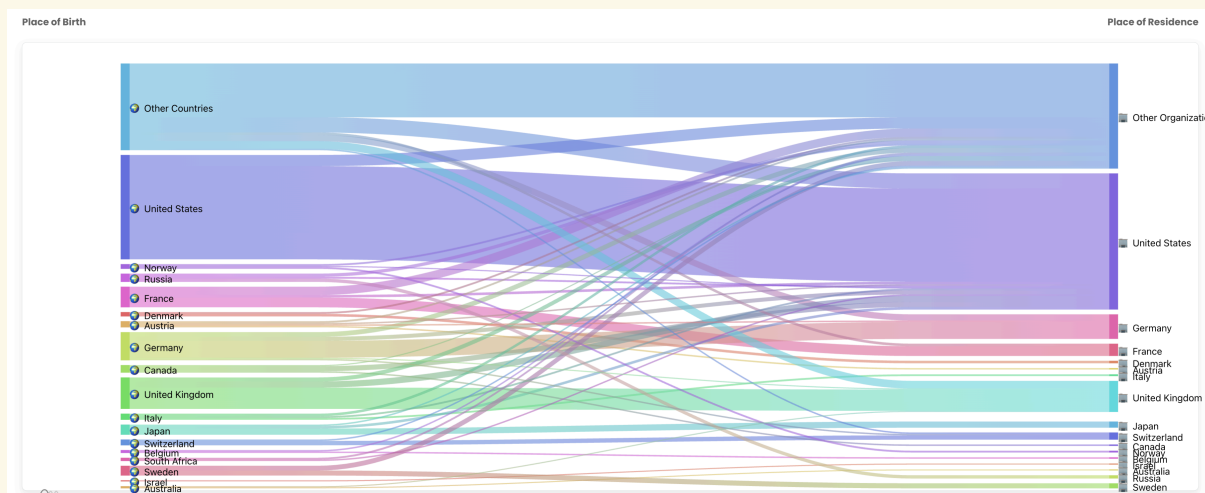


Figure 6: Place Flow of Winners

7.2 Challenges & Solutions

7.2.1 Name Mapping

Country names in the dataset were not always consistent or directly usable as IDs for the amCharts world map (e.g., "USA" vs. "United States of America," or historical names). To solve this, we implemented a mapping system in `world_map.js` combining amCharts' internal name-to-ID mapping with a manual override map (`manualBornToIdMap`) to ensure correct geographical representation.

And in the country-flow graph, the raw country names have prefixes like "Residence_" which would decrease the readability and beauty of the visualization to users. We replace the prefixes with emojis to avoid maintaining another display naming mapping for each country or institution, and also express the direct "birth place" or "work institution" ideas.

7.2.2 Inter-Chart Interactivity

Ensuring that selections on one chart (e.g., the world map or its category filter) correctly filter and update multiple other charts on the "Home" page is more difficult than just displaying an independent chart. A `chart_controller.js` was implemented to manage these cross-chart updates. Global JavaScript variables (e.g., `window.selectedMapYear`, `window.selectedCountry`) were used to maintain the current filter state, which chart update functions would then read.

7.2.3 Visualization Design Choices

For the Sankey diagram, displaying all country flows would result in a cluttered and unreadable chart. So instead, we decided to highlight a list of `FOCUS_COUNTRIES` known for significant Nobel achievements and grouped all other countries into "Other Countries" or "Other Organizations" categories. This maintained clarity while still showing the primary migration patterns.

And in the Age Analysis scatter plot, many laureates might have the same age and category, leading to overplotting. We introduced a small amount of random vertical "jitter" to the Y-position (category) of each dot, spreading them out slightly for better visual distinction.

8 Conclusion

The "MOMO - Nobel Prize Visualization" project successfully transformed a rich historical dataset into an engaging and interactive platform. Users can now explore trends and patterns in Nobel laureates' achievements across multiple dimensions—time, geography, prize category, age, and gender. The map-centric dashboard on the "Home" page provides an intuitive entry point, while the "Analysis Sections" offer opportunities for more focused investigation.

Through this project, we navigated challenges in data mapping, inter-chart communication, and visualization design to create a tool that we believe effectively tells the complex and fascinating story of over a century of Nobel Prizes.

9 Peer Assessment

- Jingxuan Sun: Implement the world map visualization and its inter-chart logic with the statistics graphs below in the "Home" page.
- Tianle Chu: Implement the remaining 3 general statistics charts on the "Analysis Sections" page.
- Yuchen Ouyang: Implement the page separation logic, beautify the overall styles, write the process book, and record the screencast.