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Project Milestone 1: Study Goals and Literature Review

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Section1: Modality Decision, Motivations, and Goals

Our project, guided by the Design Studio modality, focuses on a demographic dataset from Kaggle regarding international students in the US. Its primary clients are the international student offices of the U.S. higher-educational institutions and prospective international students.

For higher educational institutions, the project aims to highlight the invaluable contributions of international students by illustrating their distribution across various academic disciplines, countries of origin, funding sources, and academic levels. These insights are intended to aid in developing more effective recruitment strategies, support services, and academic programs specifically tailored to meet the needs of international students. This endeavor enriches the educational environment and strengthens the institutions' global presence and competitiveness.

Simultaneously, the project's visualizations offer a user-friendly interface for prospective international students, who often encounter challenges in navigating their

educational pathways abroad. This platform enables them to explore academic programs by field of study, discover funding opportunities, and understand the geographical distribution of their peers. Such tools are designed to assist in their decision-making process, making it easier for them to plan their academic and personal journey in the U.S.

The project is motivated by the essential role that international students have in enhancing the cultural and intellectual diversity of U.S. higher-educational institutions, as well as their considerable economic impact. It seeks to utilize the Design Studio approach to convert static data into engaging narratives, making complex information more accessible and appealing to a wide audience. Ultimately, by bridging two target groups through informed insights and interactive visualizations, the project facilitates mutual understanding and fosters a supportive ecosystem for international students and the institutions that host them.

With the above motivations and goals in mind, our key visualization tasks are:

- a. field of study preferences: highlighting trends in popular disciplines.
- b. funding sources: revealing how students finance their U.S. education.
- c. student origins: mapping where students originate to identify key regions.
- d. academic level: detailing enrollment by academic level to reveal preferences.
- e. genders overview: displaying gender distribution to support diversity initiatives.
- f. interactive features: enabling personalized exploration by state, field, or origin.

Section2: Literature Review

Our project utilizes a demographics dataset for data visualization.

Demographic data is oftentimes large and hard to summarize [6]. This section reviews relevant literature and R methodologies underpinning our project's approach to creating impactful visualizations for international student demographics.

Gurpreet Saluja's visualization of demographic data on international students in the US is an impressive display. It features a color-coded map that illustrates population distribution and a bar graph that presents data on active students [7]. However, the map lacks interactivity, limiting the data density that could be presented. Additionally, the bar graph is restricted to showcasing statistics from a specific point in time and cannot extend over longer periods. While aesthetically pleasing, its design struggles with the density of larger datasets, suggesting a need for alternative design principles. Subsequent discussions will explore various compelling designs, aiming to extract pertinent elements that could enhance the conceptualization of advanced visualization tools in this domain.

International student population by state (March 2023)

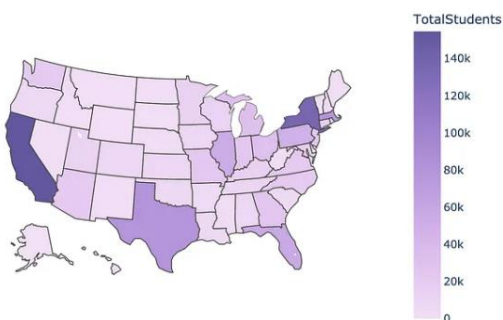


Fig 1-1

Top 5 countries by number of active students (March 2023)

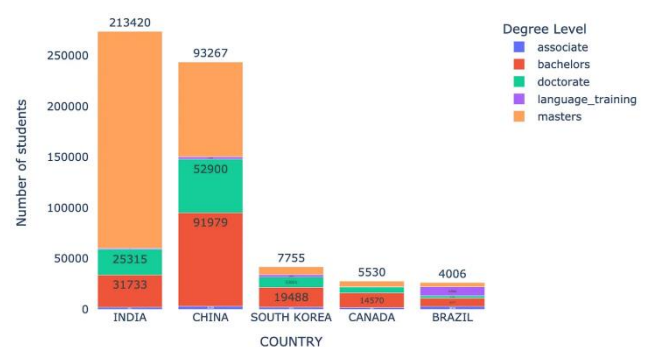


Fig 1-2

The Taoisigh of Ireland Timeline graph employs a combined visualization technique: a pie chart delineates with distinct color assignments for each party, and a horizontal timeline tracks the individual terms of Taoisigh [8]. The strategic use of color enhances differentiation and provides at-a-glance insights into political shifts over time. Integrating this dual-chart approach could offer our project a sophisticated and layered analytical framework, capitalizing on the intuitive grasp of temporal patterns and party dominance.

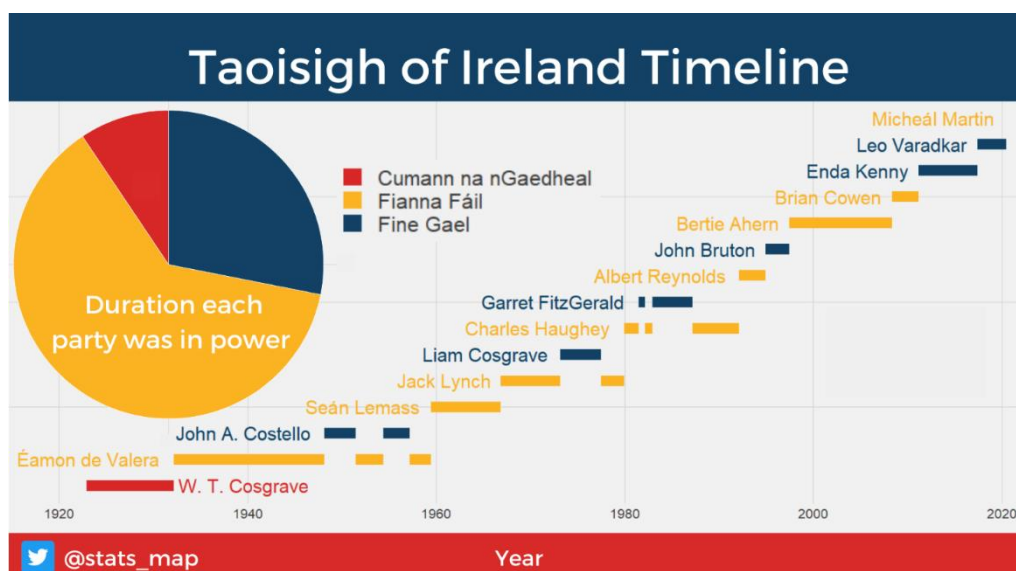


Fig 2. Irish Political Leadership and Party Dominance Over Time

Gapminder harnesses the Bubbles technique to dynamically represent complex statistical data, where each bubble's size and position illustrate various demographic and economic indicators [3]. This interactive approach provides a clear snapshot of each country's status on these indicators, enabling users to track temporal changes through an interactive timeline. Using color coding to differentiate between categories further enhances intuitive understanding and engagement, making complex

information accessible and captivating. Therefore, incorporating an interactive timeline and effective color coding would be highly beneficial for our project.

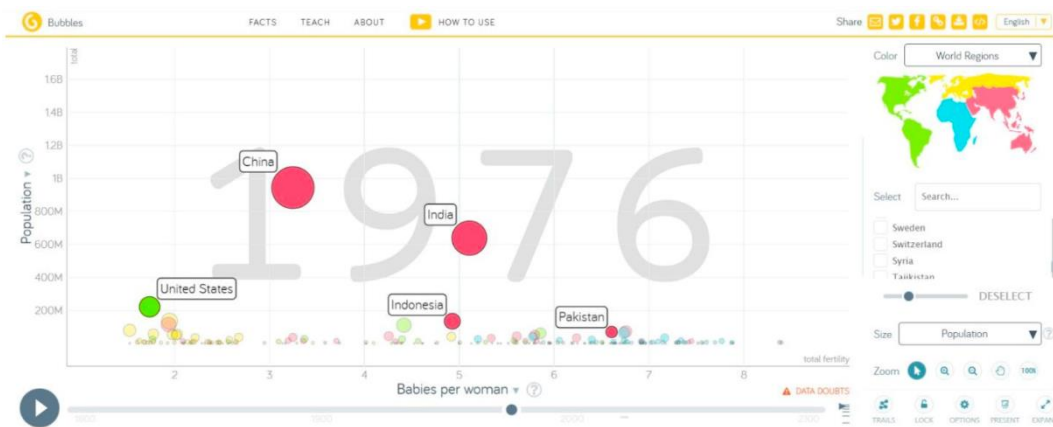


Fig 3. Total Birth Rate across Different Countries

Mode.com emphasizes the significance of filters in data visualization, allowing users to tailor data exploration according to specific criteria [9]. This feature promotes a detailed examination of datasets, making identifying trends obscured within broader data sets easy. Filters thus play a crucial role in deepening analytical depth and personalizing the data exploration experience.

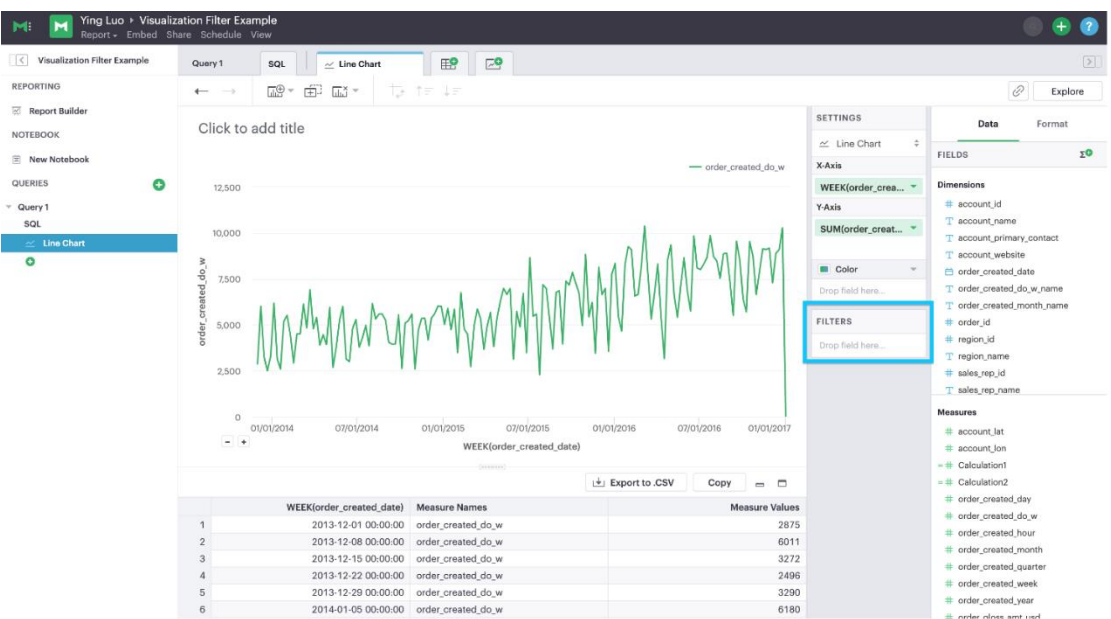


Fig 4. Mode.com's visualization filter panel, highlighted with a blue box for emphasis

The Atlas of Urban Expansion's representation of Chicago integrates maps and filters, providing a comprehensive view of the city's growth. Interactive elements encourage user participation, turning a simple viewing experience into an immersive investigation [2]. Notably, it uses some filters associated with the color on the map to help the user view specific types of urban content. Implementing an interactive map with strategic color use and filter options will significantly enhance the effectiveness of our project.

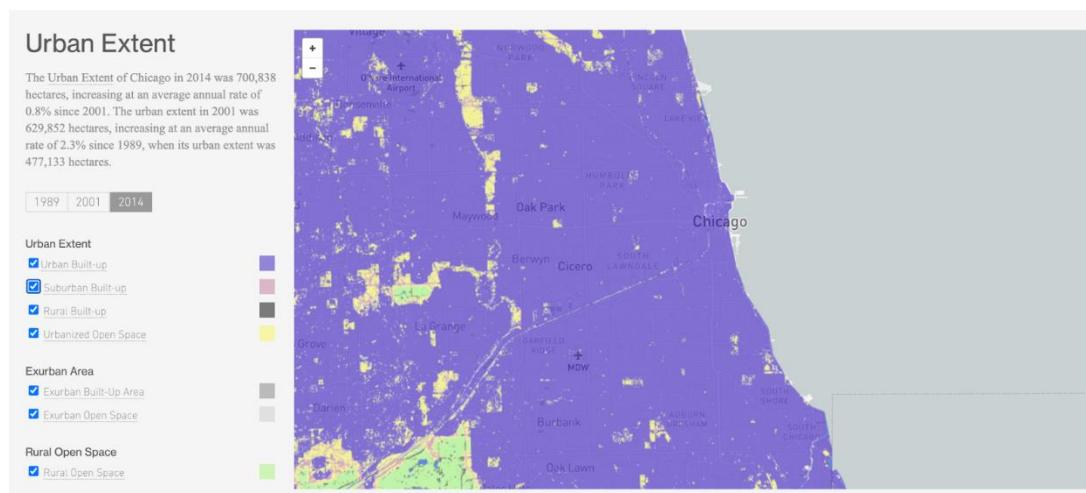


Fig 5. Urban extent Development of Chicago

Section3: Techniques for Effective Data Visualization

Plotly for R is an interactive graphing library that allows users to create visually appealing and interactive charts [5]. It integrates seamlessly with R and its core plotting package, ggplot2, providing a rich set of features that enable users to turn static plots into interactive visualizations. It offers more advanced visualizations and even 3D WebGL-based charts, with functionalities like subplots and multiple axes.

Leaflet for R is a powerful, open-source package allowing users to create interactive maps. It is designed to integrate well with the R ecosystem, enabling users to easily turn their data into rich, interactive visualizations with minimal coding [4]. Leaflet maps are mobile-ready, embeddable in R Markdown documents, and can be extended with numerous plugins, making it a versatile tool for geographic data visualizations.

According to Arockia [1], Plotly distinguishes itself through its simplicity and efficiency, enabling users to quickly generate charts from spreadsheet data, making it an ideal tool for fast data visualization tasks. In contrast, Leaflet offers a valuable solution for displaying events in sequential timelines. It requires users to format their data into a timeline template before visualization, ensuring quick and effective results for timeline data visualization tasks. By utilizing these two tools appropriately, we should possess the necessary capabilities to execute the project successfully.

Section4: Conclusion

Our project aims to enhance comprehension and recognition of the international student community, aiding in developing improved recruitment tactics and support mechanisms tailored to their distinct requirements and goals. Furthermore, we seek to equip students with the essential information to make well-informed choices regarding their overseas academic pursuits. By employing advanced visualization techniques and interactive features inspired by the reviewed literature, we plan to create an engaging and informative platform. Using tools such as Plotly and Leaflet for R, combined with strategic design principles drawn from various successful projects, will enable us to present complex demographic data in an accessible and compelling manner.

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