

INTERACTIVE VISUALIZATION OF G20 COUNTRIES' CONTRIBUTIONS TO GLOBAL METRICS

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1 Introduction

The objective of this assignment was to design and implement an interactive visualization that enables users to explore the contributions of G20 countries across various global metrics. By utilizing a treemap layout, the visualization provides a clear and intuitive representation of each country's share in selected metrics, facilitating comparative analysis and deeper insights into global economic and environmental dynamics.

2 Research Questions

The primary questions guiding this visualization include:

1. How do G20 countries contribute to key global economic indicators such as GDP, GDP per capita, merchandise exports, and imports?
2. What is the distribution of G20 countries' contributions to global metrics like carbon emissions, electricity generation, patent applications, and population distribution?
3. How does the collective contribution of G20 countries compare to the rest of the world (ROW) in these metrics?

3 Data Description

The dataset used for this visualization is contained within the 'data.json' file. It encompasses a range of global metrics relevant to economic, environmental, and technological domains. The key topics include:

- G20 GDP Contribution as % of Global Total
- G20 GDP Per Capita as % of Global Contribution
- G20 Merchandise Exports as % of Global Total
- G20 Merchandise Imports as % of Global Contribution
- G20 Patent Applications as % of Global Total
- G20 Countries Land Area as % of Global Landmass
- Global Internet Usage
- G20 Population Distribution 2024
- Global Carbon Emissions
- G20 Electricity Generation as % of Global Total

Each topic includes country-specific data, with contributions expressed as percentages relative to the global total.

3.1 Data Sources

The data for this visualization was sourced from two primary origins:

1. **World Bank:** Metrics such as GDP, GDP per capita, merchandise exports and imports, patent applications, land area, and electricity generation were obtained directly from the World Bank databases. The World Bank provides reliable and up-to-date global economic and environmental data, ensuring the accuracy and credibility of these metrics.

2. **Perplexity:** For metrics not directly available through the World Bank, such as Global Internet Usage and G20 Population Distribution for 2024, data was generated using Perplexity. This involved leveraging advanced data generation techniques to estimate these values based on available information and predictive models.

4 Design Decisions and Rationale

4.1 Treemap Layout

The treemap layout was selected for its ability to effectively display hierarchical data and compare proportions among categories. In this visualization, each rectangle represents a G20 country, with the area corresponding to its contribution to the selected metric. This approach allows users to quickly assess the relative sizes of contributions and identify leading countries in each domain.

4.2 Color Mapping

A distinct color is assigned to each G20 country using the 'countryColors' mapping in 'script.js'. This color differentiation enhances visual recognition and aids users in distinguishing between countries at a glance. Consistent coloring across different metrics ensures that users can easily track a specific country's performance across various datasets.

4.3 Dropdown Menu for Topic Selection

A dynamic dropdown menu (`<select id="topic-select">`) allows users to choose different metrics to visualize. Populating the dropdown from the JSON data ensures scalability and ease of updating the available topics. This interactive feature empowers users to tailor the visualization to their specific interests and research needs.

4.4 Responsive Design

Ensuring that the visualization is responsive guarantees accessibility across a range of devices and screen sizes. By adjusting the treemap dimensions based on the window size, the visualization maintains its integrity and usability, providing a consistent user experience whether viewed on a desktop, tablet, or mobile device.

4.5 Feedback Mechanism

Incorporating a Google Form for user feedback fulfills the extra credit requirement and facilitates a user-centered design approach. Gathering feedback on usability and effectiveness allows for iterative improvements and ensures that the visualization meets user needs and expectations.

5 Interaction Methods

The interactive visualization incorporates several techniques to enhance user engagement and data exploration:

5.1 Topic Selection via Dropdown

Users can select different global metrics from the dropdown menu to update the treemap accordingly. This interaction modifies the data being visualized, allowing users to switch between various dimensions such as GDP, carbon emissions, or population distribution seamlessly.

5.2 Dynamic Treemap Update

Upon selecting a new topic, the treemap re-renders to reflect the chosen metric. This dynamic update eliminates the need for page refreshes and provides an immediate visual response to user input, facilitating an efficient exploration process.

5.3 Tooltip on Hover

Hovering over a country's rectangle triggers a tooltip that displays the full country name and its specific contribution to the selected metric. This feature offers detailed information on demand without cluttering the visualization, enabling users to obtain precise data points effortlessly.

5.4 Responsive Layout Adjustment

The treemap automatically adjusts its layout in response to window resizing events. This ensures that the visualization remains legible and well-organized across different screen dimensions, enhancing accessibility and user experience.

6 Strengths and Weaknesses

6.1 Strengths

- **Clarity and Intuitiveness:** The treemap layout provides a clear and immediate understanding of each country's contribution relative to others.
- **Interactivity:** Features like the dropdown menu and tooltips allow users to engage with the data dynamically, fostering a deeper exploration.
- **Responsiveness:** The visualization's ability to adapt to various screen sizes ensures broad accessibility.
- **Color Differentiation:** Distinct colors for each country enhance visual differentiation and recognition.

6.2 Weaknesses

- **Limited Detail:** While tooltips provide basic information, more complex interactions (e.g., filtering or zooming) could offer deeper insights.
- **Color Accessibility:** Relying solely on color differentiation may pose challenges for users with color vision deficiencies.
- **Scalability:** As more metrics are added, the dropdown menu and treemap may become cluttered, potentially impacting usability.
- **Static "Rest of the World" Category:** Including a ROW category provides context but may oversimplify the diversity within non-G20 countries.

7 User Feedback

7.1 Feedback Summary

The feedback collected from users indicates a generally positive experience with the interactive visualization. Users consistently found the information they were seeking, as evidenced by all responses rating their ability to find information as "5." However, navigation ease received an average rating of "3," suggesting moderate satisfaction with the interface's usability.

Specific suggestions for improvement focused on enhancing readability and color differentiation. Users recommended making the text bolder and larger to improve clarity. Additionally, there were concerns about the similarity of colors used in the chart, which can make it difficult to distinguish between closely colored countries.

- **Findings from Feedback:**
 - All respondents rated their ability to find the information they were looking for as "5," indicating that the visualization effectively presents the desired data.
 - Navigation ease received a rating of "3" from all respondents, highlighting areas for potential improvement in the user interface.

- **Usability Insights:**

- Users found the current features adequate but suggested enhancing text visibility by making it bolder and larger.
- There is a need to improve color differentiation to prevent confusion between similarly colored country blocks.

- **Suggested Improvements:**

- *Text Enhancements:* Increase the font size and weight of text within the treemap to improve readability.
- *Color Differentiation:* Adjust the color palette to ensure that adjacent colors are sufficiently distinct, reducing the likelihood of confusion.
- *Additional Features:* Although some users were satisfied with the current features, others suggested incorporating more advanced interaction techniques.

7.2 Feedback Questions

The following questions were included in the embedded Google Form to gather user feedback:

1. Were you able to find the information you were looking for in the visualization?
2. How easy was it to navigate the visualization?
3. What additional features would improve your experience?
4. Do you have any other feedback or suggestions?
5. Give suggestions for more metrics.

8 Conclusion

The interactive treemap visualization effectively showcases the contributions of G20 countries across various global metrics, providing users with a versatile tool for data exploration and comparative analysis. Through thoughtful design decisions and the implementation of key interaction techniques, the visualization achieves clarity, responsiveness, and user engagement. Future enhancements based on user feedback will further refine the tool, addressing current limitations and expanding its analytical capabilities.