Visualization Dashboard Process Book
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Overview and Motivation:

Our project visualizes nutritional supply trends in North and South America using Food and Agriculture Organization Statistical Database (FAOSTAT) data. Our main goal is to enable users to compare nutrient levels across countries and observe how these values change over time. The dashboard begins with a scatterplot that provides a high-level overview by comparing nutrient values in 2010 and 2022 for all countries, allowing users to explore differences between countries and overall nutrient supply changes. From this overview, users can select any point on the scatterplot, which identifies a specific country and nutrient and updates the three visualizations below.

The dumbbell chart then shows a detailed breakdown of how individual nutrients within the selected nutrient group changed between 2010 and 2022. Users can select a specific nutrient factor in this chart to trigger two additional views: a bar chart showing which food groups contribute most to that nutrient in 2022, and a line chart illustrating how that nutrient has changed over time. Together, these coordinated visualizations allow users to evaluate total nutrient change from 2010 to 2022, examine yearly trends, and understand which food groups contribute most to the selected nutrient.

We chose to focus on nutrient supply because of how these values can vary widely across countries within North and South America. Nutrient supply data can reveal important patterns in food availability, dietary quality, and changes over time. FAOSTAT provided an extensive nutrient dataset, but the initial Excel file or table is difficult to interpret without visualizations due to the amount of data. Our dashboard aims to make understanding this data and analyzing trends more accessible by helping users explore broad patterns and nutrient-specific changes.

Related Work:

Our dashboard design was primarily guided by ideas we learned from class resources, especially Shneiderman's Visual Information-Seeking Mantra (starting with a lot of information and then reducing cardinality). This shaped our dashboard since the initial scatterplot fit this mantra by being largely unaggregated and showing all marks for chosen years. It acts as the overview, and by clicking a point, users are provided with more details in the additional three visualizations.

We also employed basic visualization principles from the course lectures. Scatterplots work well for comparing two numerical values, dumbbell charts are effective for comparing two values across many categories, bar charts are useful for comparing categorical contributions, and line charts are best for showing trends and changes over time. These examples from our lectures

helped us choose chart types that would work well with our data and best support the interactions we needed.

Questions:

Our project began with broad questions because it started with the scatterplot, which covered the entire dataset. As we explored the data and created additional visualizations, our questions became more focused and helped shape the design of each visualization.

Initial Questions
- How have nutrition supply trends in the Americas changed from 2010 to 2022?
- How do nutrient levels compare across countries?
- Which nutrients changed the most between 2010 and 2022?

Evolving Questions
- How does a specific country's nutrient supply change across all years from 2010 to 2022?
- Which food groups contribute most to protein levels?
- How do changes in nutrient values between 2010 and 2022 differ across nutrient types, and which nutrients show the biggest increases or decreases for each country?

Data:

The dataset we chose includes nutrient supply indicators such as protein supply, energy supply, and other dietary components that were reported annually for each country. We downloaded the dataset directly from FAOSTAT as a CSV file and used it in our visualizations. Since the original file contained multiple years and indicators, we filtered the data to focus only on the years 2010 and 2022 for the scatterplot and dumbbell chart, while the line chart used all the available years. The dataset was limited to countries in North and South America, and we selected only the nutrient indicators relevant to our analysis. Minor cleanup steps included renaming some columns for clarity and adjusting the field names to match those in our D3 code.

Exploratory Data Analysis:

We began our exploratory data analysis (EDA) by loading the FAOSTAT dataset and examining the years, countries, and nutrients that it included. Our initial goal was to see how nutrient supply values varied across the Americas and whether there were clear changes over time. Since there were so many categories (country, nutrient, year), we decided to create the

scatterplot in Figure 1, which compares nutrient supply values in 2010 and 2022 for all nutrients and countries with the marks color coded by nutrient type. We found this was a good way to look for general trends within a very large dataset without employing a lot of aggregation.

This initial scatterplot showed several important insights that helped to shape our later visualizations. We noticed that many points were clustered close to the diagonal reference line which indicates that several nutrient values remained stable across 2010 and 2022. However, we also noticed some outliers where nutrient values changed significantly between the two years. From

Figure 1: Initial EDA Scatterplot

this initial visualization, we were able to observe some very general, high-level trends, but were unable to examine year-to-year behavior or explain why some nutrient values may have changed between the two years.
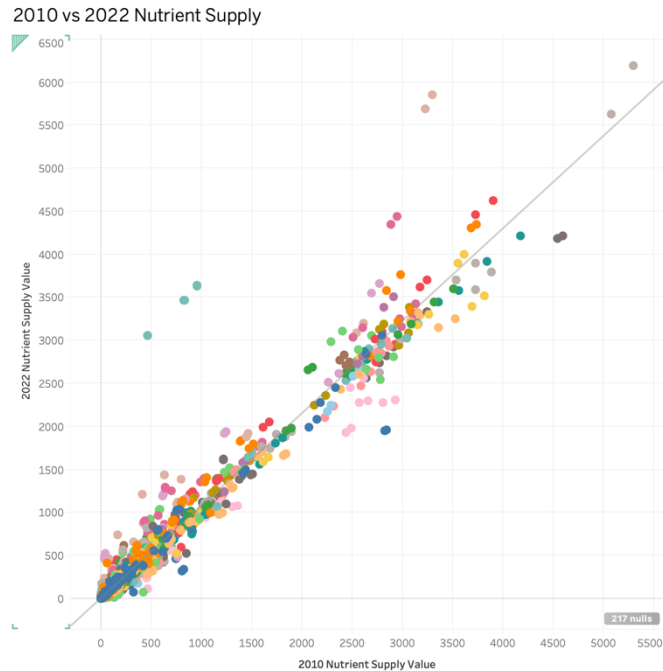
Overall, our EDA gave insight into very general trends and helped answer some of our initial questions, but more detailed analysis was needed for our full dashboard.

Design Evolution:

Our design evolved significantly as we explored the dataset and received feedback from the various checkpoints this semester. The earliest version of the scatterplot our dashboard was based on (Figure 1) attempted to show every nutrient type in a different color for each country. We implemented this into our
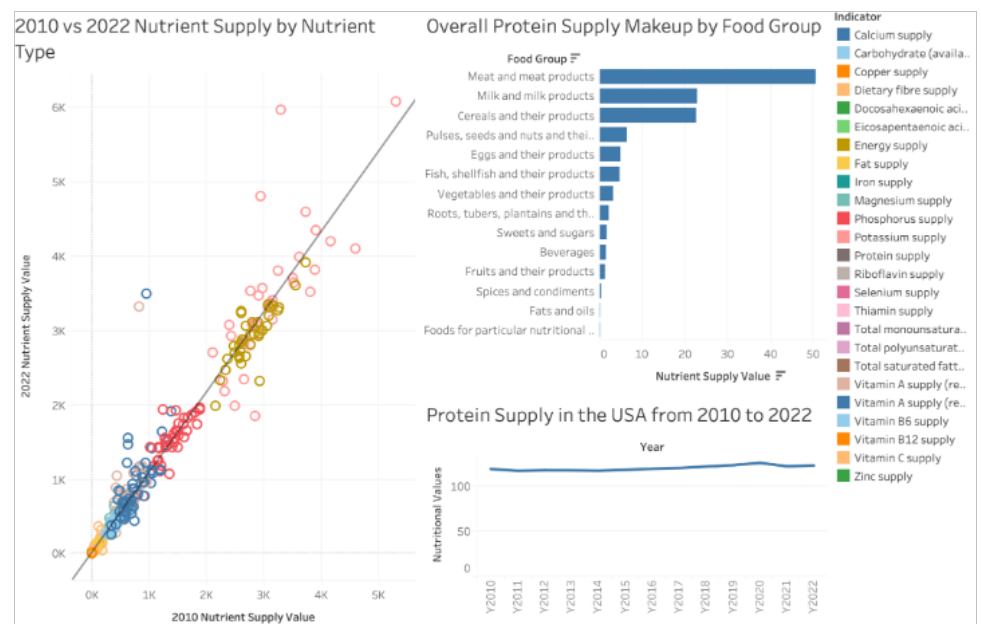

Figure 2: Initial Tableau Prototype Dashboard

first dashboard prototype in Tableau (Figure 2), however, it was very cluttered and difficult to interpret due to the overlapping categories and large amount of color variance. To improve clarity, we simplified the scatterplot to just one nutrient type (Figure 3) but felt this limited the amount of data in the plot too much. After getting feedback, we opted to group the nutrient types into larger groups such as vitamins and macronutrients to help make the scatterplot easier to read while displaying a large amount of information.

We also created and refined two secondary visualizations. Initially, we created two separate charts focused on protein: a line chart for trends and a bar chart for food groups. These were implemented in our initial Tableau dashboard (Figure 2). This approach did not clearly connect to the scatterplot and limited the user to only seeing that information for protein. After getting feedback, we redesigned both charts to allow selection of both a nutrient and country, making it more flexible and better aligned with the rest of the dashboard.

Figure 3: Scatterplot with one nutrient type

During our in-class presentation, we discovered from feedback that our scatterplot didn't fully connect to the details in the bar and line charts, creating a disconnect. To address this, we introduced a dumbbell chart (Figure 4) that displays how individual nutrients within a nutrient group changed between 2010 and 2022 for the selected country. This chart helped bridge the gap between the broad overview in the scatterplot and the more detailed breakdowns in the line

Figure 4: Dumbbell Chart

and bar charts, establishing a smoother flow between visualizations and a better experience for the user.

Implementation:

After presenting our initial proposal, we revisited our design based on the feedback provided. The main concerns involved the second and third visualizations, which both focused
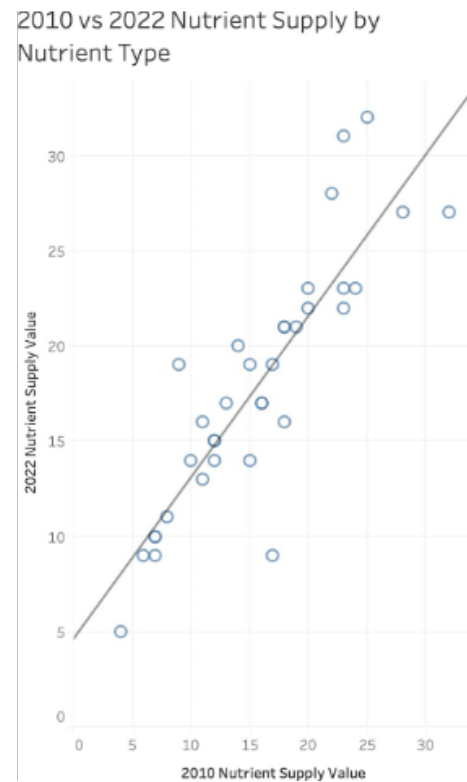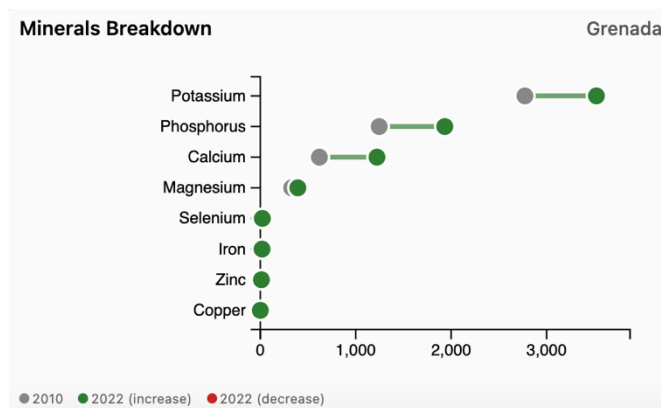
heavily on protein supply and needed clearer interaction design. In addition, the final visualization required rethinking to better clarify its role within the dashboard.

One of the first technical issues we addressed was the use of too many colors in the original scatterplot. Each nutrient type was assigned a different color, which overwhelmed the graphic and made many points indistinguishable due to overlapping categories. Although we maintained the overall structure of the scatterplot, we removed the color-coded indicator to improve readability. We ended up adjusting this and sorting nutrients into larger groups for our final dashboard.

We also updated our prototype to function correctly on GitHub Pages by reorganizing the file structure and fixing how the data was loaded. The dataset was renamed for simplicity, and the scatterplot code was revised to match the new CSV name, correct column labels, and apply proper filtering. After these adjustments, the scatterplot rendered correctly from GitHub Pages.

The line chart and bar chart were implemented in later stages. Initially, both relied on dropdown menus: the line chart allowed users to select a country and nutrient to view trends over time, while the bar chart showed protein supply by food group for a selected country. However, during development for the presentation, we realized that our first visualization had become unintentionally aggregated because of the nutrient dropdown. To resolve this, we removed the dropdown and displayed all nutrient–country points for the selected years directly. Color encoding for nutrient groups was later reintroduced in a controlled way to support comparison without overwhelming the chart.

We also addressed limitations with the dropdown-based interactions in the bar and line charts. These controls made the dashboard feel disconnected, since users interacted with the visualizations indirectly rather than through the data itself. To improve this, we replaced the dropdowns with direct interactions: clicking a point on the scatterplot now selects a specific country and nutrient, which updates both the bar chart and the line chart automatically. The selected point is outlined in black for visibility.

The updated interaction flow works as follows:

- **Scatterplot:** Displays all nutrient values for all countries in 2010 and 2022. Clicking a point selects a country and nutrient.
- **Bar Chart:** Updates to show the 2022 food group contributions for the selected country.
- **Line Chart:** Updates to display the 2010–2022 nutrient trend for the same country and nutrient.

While the dashboard maintained the same chart types (scatterplot, bar chart, and line chart), these revisions made the visualizations fully linked and eliminated the need for dropdown

menus. We then presented this version of our dashboard to the class (Figure 5), and received valuable feedback for shaping our final dashboard (Figure 6).
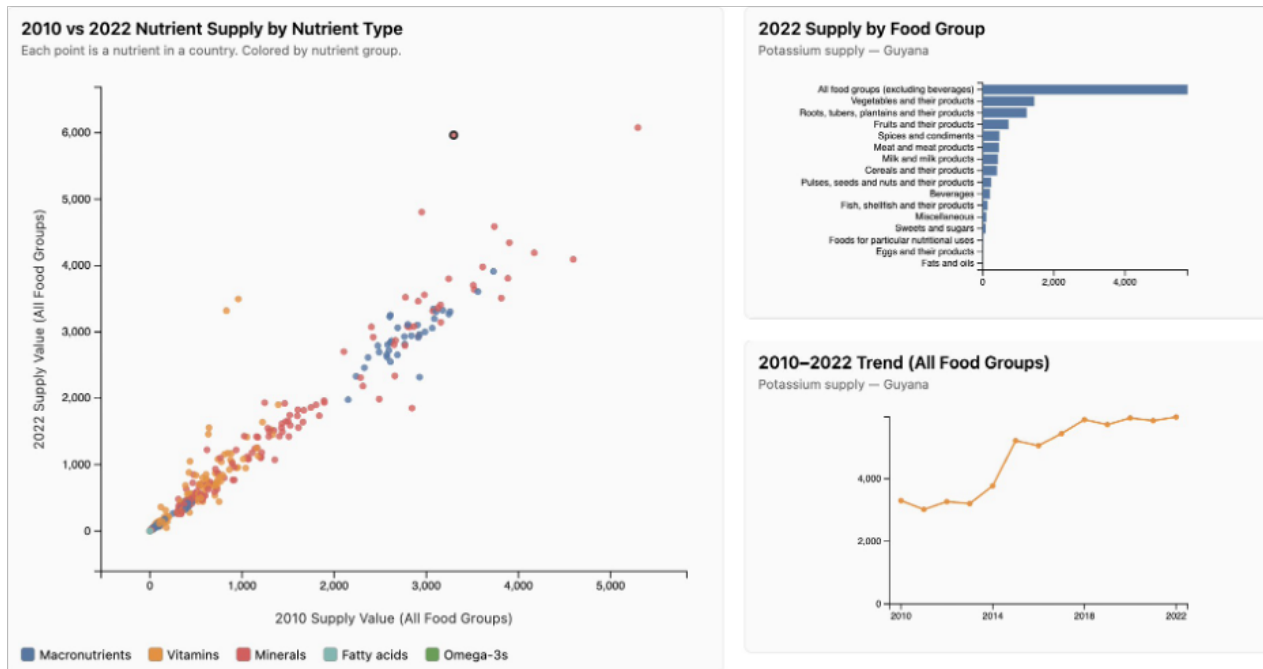

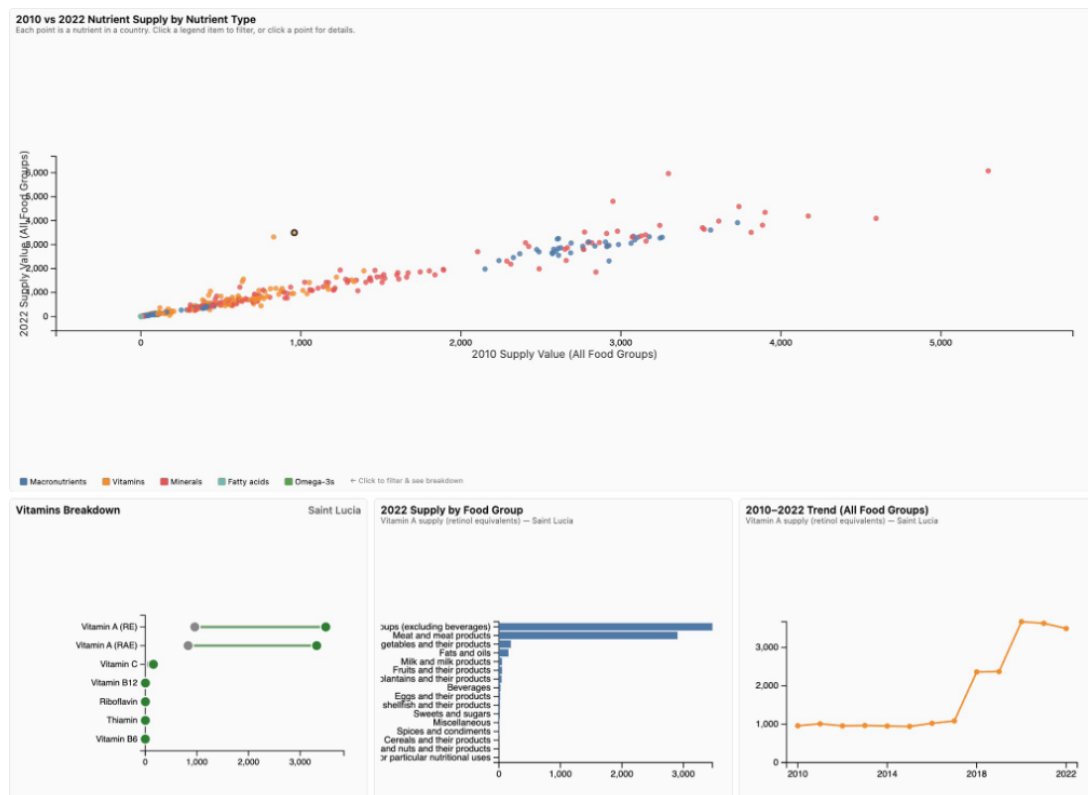Figure 6: Dashboard Prototype presented to the class

Figure 5: Final Dashboard

Based on presentation feedback, we strengthened the connection between the scatterplot and the more detailed visualizations. Previously, only the bar and line charts updated based on user interaction, while the scatterplot felt isolated. To address this, we added a dumbbell chart that displays the difference between nutrient values in 2010 and 2022 for the selected country. This chart mirrors the comparison made in the scatterplot but focuses on a single nutrient group, making the transition from overview to detailed analysis more coherent. This addition better aligns the dashboard with Shneiderman's Visual Information-Seeking Mantra (starting with a broad overview and progressively reducing cardinality).

Evaluation:

Through the milestones, our group gained a clearer understanding of how nutrient supply differs across countries and how these values change over time. The three main visualizations worked together effectively: the scatterplot provided a clear overall picture, and clicking on a point revealed additional detail in the bar chart and line chart. This interaction made it easier to explore individual countries and nutrient types during the presentation.

We added the dumbbell chart in the final version to bridge the gap between the scatterplot and the more detailed visualizations. It highlighted changes from 2010 to 2022 for each nutrient within a group, helping users transition from the high-level overview to more specific nutrient and food-group patterns. This addition improved the overall interaction flow and made the dashboard feel more connected.

Across the milestones, several limitations became clear. The original scatterplot used too many colors, making it difficult to distinguish between categories. The second milestone relied on dropdown menus, which limited interactivity because users were not interacting directly with the data. During the presentation milestone, a disconnect emerged between the scatterplot and the other charts, which led to restructuring the interaction flow and replacing dropdowns with click-based interactions.

Some limitations still remain in the final version. Certain food group labels in the bar chart are long and become slightly cut off, and the layout spacing could be refined further. However, overall, the final dashboard effectively supports our main questions and enables users to explore nutrient patterns across countries and over time through a clear and cohesive set of linked visualizations.