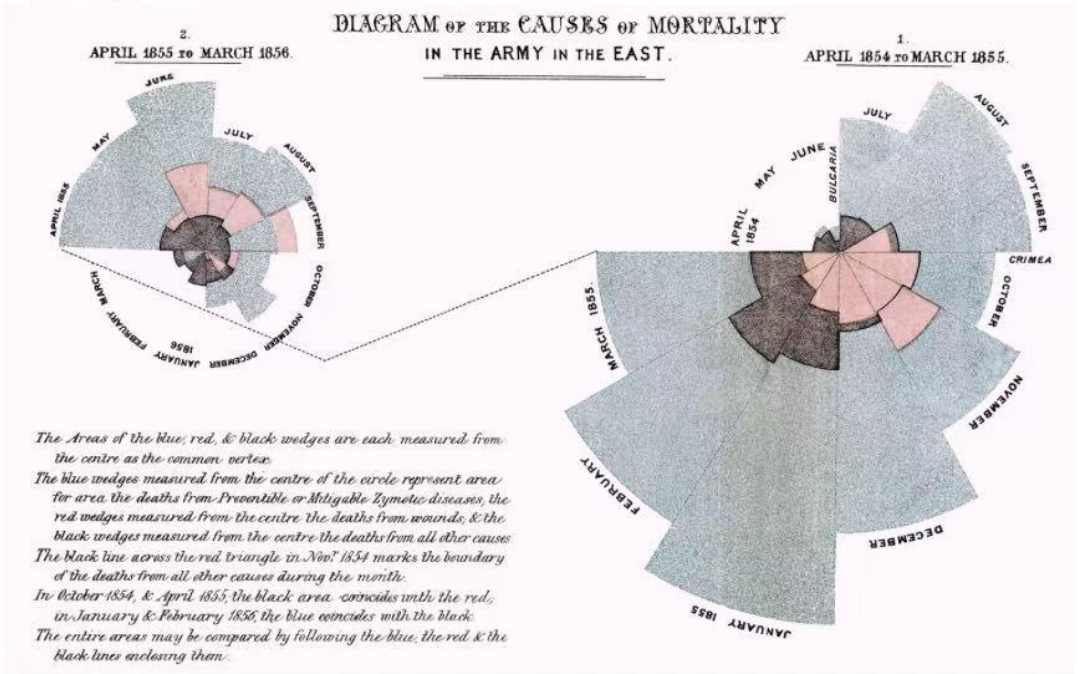
Visualization Assignment 2: Redesigning Nightingale's Coxcomb — A Humanistic Exploration of Health Expenditure and Life Expectancy

1. Introduction

Florence Nightingale's *Diagram of the Causes of Mortality in the Army in the East* (1858) is one of the earliest examples of using data visualization for social reform. As Friendly (2008) notes, her diagram was revolutionary not only in its aesthetic form but in its rhetorical power—it turned statistical evidence into moral persuasion. Building on Nightingale's legacy, this project reimagines her visualization through a **21st-century public health lens**, examining how **government health expenditure (% of GDP)** relates to **life expectancy at birth (years)** using data from the **World Bank (2000–2022)**.

- Nightingale's coxcomb:



Following Manovich's (2011) view of visualization as a cultural expression rather than a neutral scientific tool, my goal is not to "improve" Nightingale's chart but to reinterpret it for a modern audience. The redesign explores how contemporary visualization methods—both static and interactive—can communicate social meaning while acknowledging their interpretive nature.

2. Data and Conceptual Framework

2.1 Data Source and Preparation

The data used for this redesign come from the **World Bank Open Data** repository. Two global indicators were selected:

Indicator	Code	Description
Current health expenditure (% of GDP)	SH.XPD.CHEX.GD.ZS	Total health expenditure as a share of GDP
Life expectancy at birth, total (years)	SP.DYN.LE00.IN	Average years a newborn is expected to live under current conditions

The **original datasets** were downloaded as Excel files from the World Bank database:

- API_SH.XPD.CHEX.GD.ZS.xlsx — *Current health expenditure (% of GDP)*
- API_SP.DYN.LE00.IN.xlsx — *Life expectancy at birth, total (years)*

For this project, I **merged and reformatted** the relevant data into a single file named **Assignment2.xlsx**, which contains two separate sheets:

- *Current health expenditure*
- *Life expectancy at birth*

From these, I selected six representative countries — **Canada, Japan, the United States, China, India, and Brazil** — covering the period **2017–2023** for comparative analysis and visualization in Assignment2.ipynb.
This consolidation simplified the workflow and ensured consistent time coverage between both indicators.

2.2 Conceptual Framework

While these indicators appear objective, Drucker (2011) reminds us that *"all data are capta—taken, not given."*
Every dataset reflects interpretive choices about what to measure, whom to include, and how to define concepts such as "health" or "expenditure."
In this sense, my act of selecting and visualizing these variables already constitutes a **subjective framing** of global well-being.

In contrast to Tufte's (1983) pursuit of visual objectivity, Drucker's humanistic approach emphasizes that visualization is a **co-dependent relationship** between observer and phenomena — an interpretive dialogue rather than a neutral display.

Recognizing this, the following redesign treats visualization as an **interpretive dialogue** rather than a factual mirror.

3. Design Iterations and Rationale

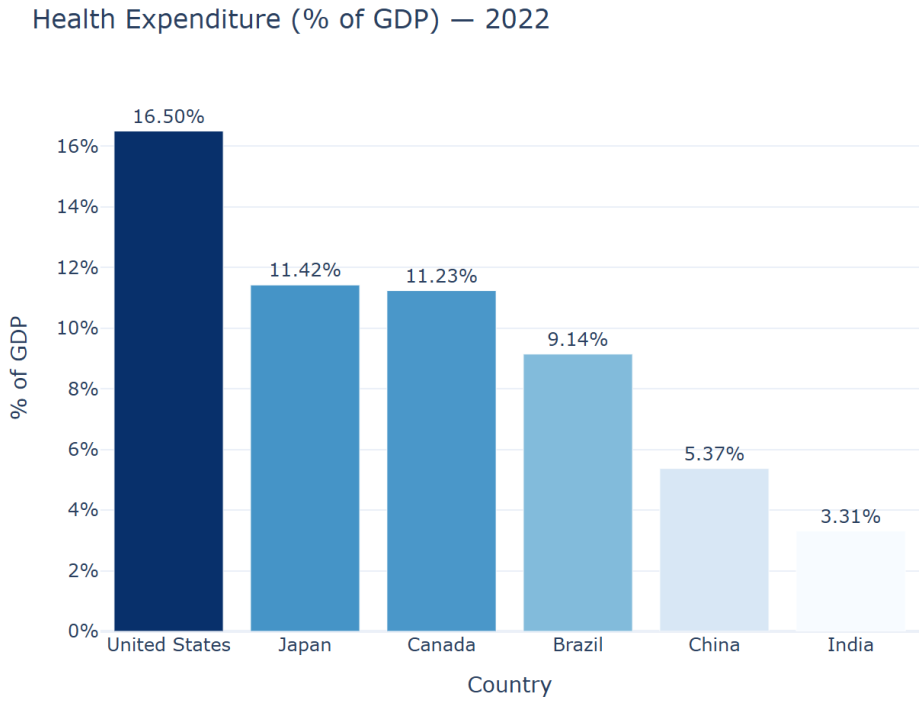
This section documents three iterative versions of the redesigned visualization, following Viégas and Wattenberg's (2011) *Design and Redesign* approach. Each iteration reflects a different purpose, structure, and interpretive stance.

Version 1 — Cross-National Comparison (Bar Chart, 2022)

Description:
This version presents a static bar chart comparing 2022 government health expenditures (% of GDP) across six countries: Canada, Japan, the United States, China, India, and Brazil.

Rationale:
The bar chart prioritizes clarity and comparability, adhering to Tufte's (1983) principle of "visual honesty." It serves as a foundation for subsequent versions, emphasizing the inequality in global health investment.

Figure 1. Government Health Expenditure (% of GDP), 2022



Version 2 — Temporal Trends (Line Charts, 2017–2023)

Description:

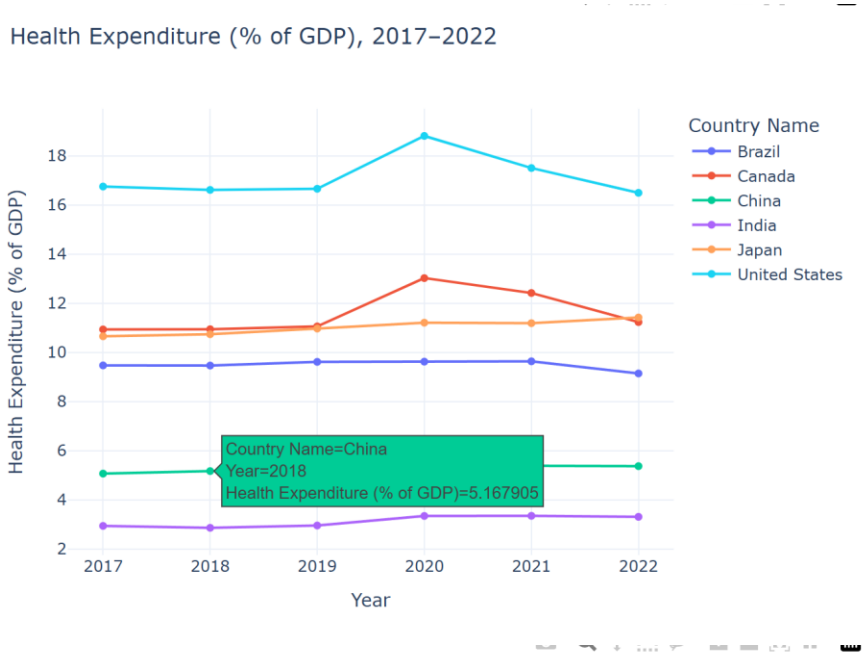
Two line charts visualize trends in health expenditure and life expectancy between 2017 and 2023.

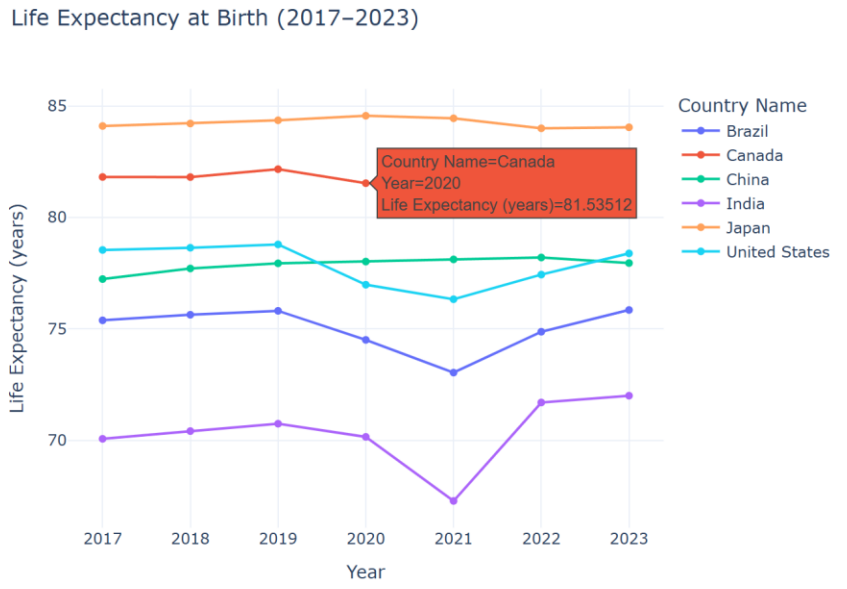
Rationale:

Following Munzner's (2014) multi-level design model, this stage introduces the time dimension to reveal how national health policies evolve.

Figure 2a. Health Expenditure Trends, 2017–2023

Figure 2b. Life Expectancy Trends, 2017–2023





Insight:

The data reveal that while the U.S. consistently spends more, Japan achieves higher life expectancy with lower expenditure—suggesting systemic efficiency differences.

Version 3 — Analytical Polar Chart (2022)

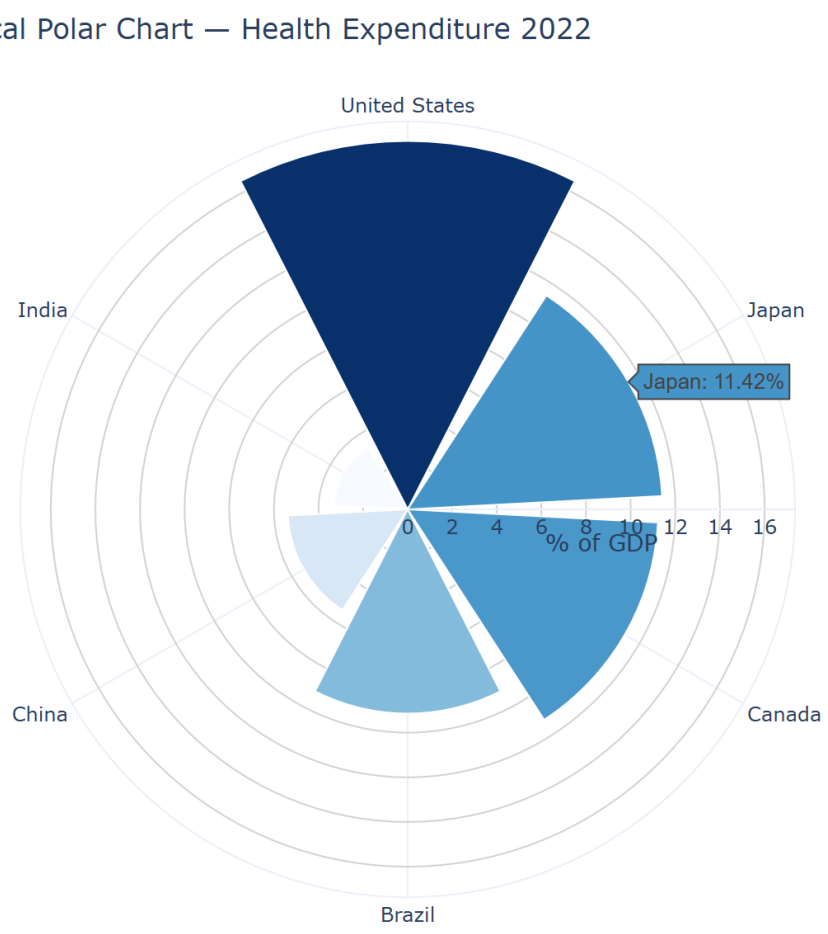
Description:

The third version adopts a circular bar (polar) design, echoing Nightingale's original coxcomb. Each country occupies an equal angular section, with bar length representing expenditure intensity.

Rationale:

This design honors the historical aesthetic while improving quantitative comparability. It visualizes proportional differences in a visually striking yet interpretable form.

Figure 3. Analytical Polar Chart — Health Expenditure (% of GDP), 2022



Version 4 — Interactive 3D Scatter Plot

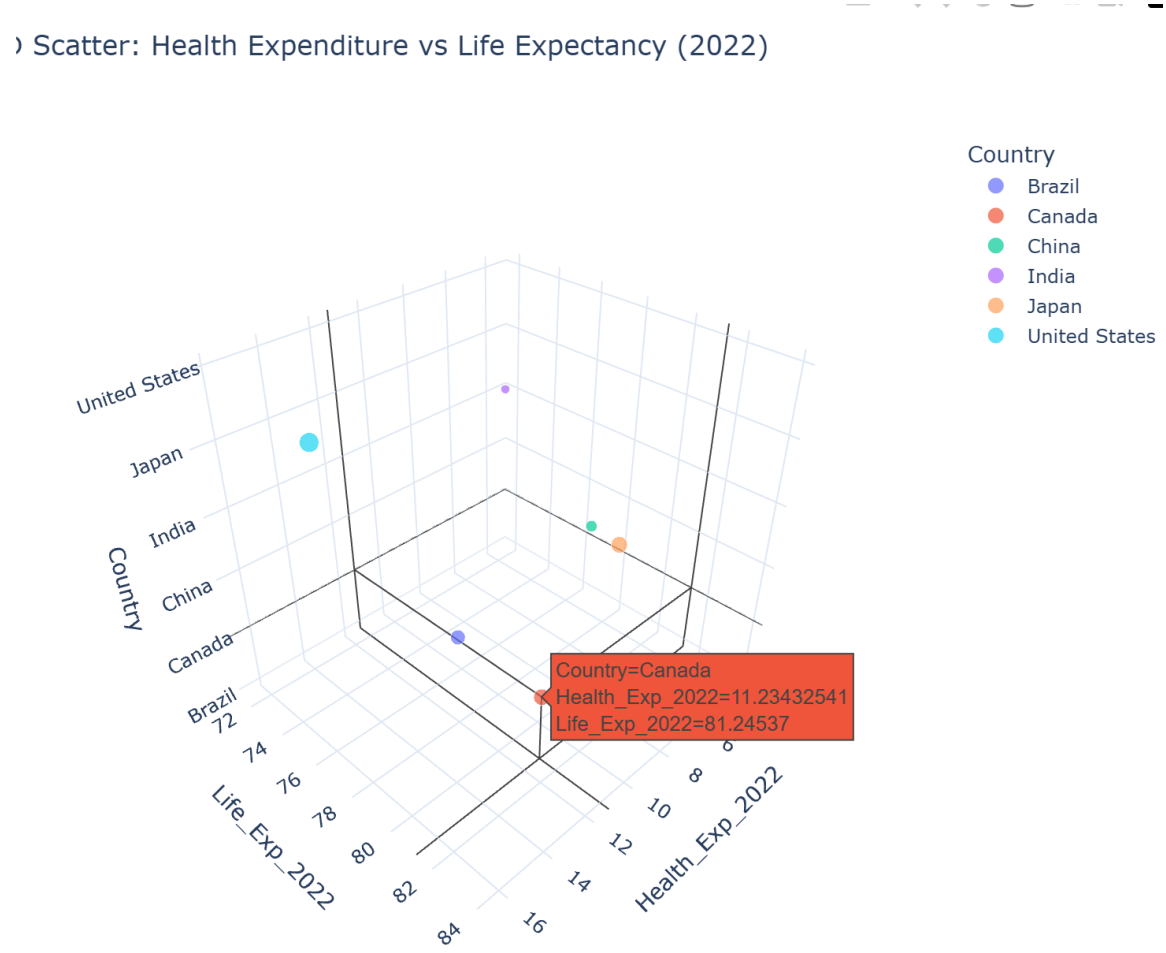
Description:

The final version introduces interactivity and depth by plotting expenditure (X), life expectancy (Y), and country (Z) in a 3D space.

Rationale:

The 3D form transforms the chart from rhetorical to exploratory (Viégas & Wattenberg, 2011). The user can hover, rotate, and zoom to explore complex patterns.

Figure 4. 3D Scatter Plot — Health Expenditure vs. Life Expectancy



4. Discussion: From Persuasion to Exploration

The evolution from static (Version 1) to interactive (Version 4) parallels the shift from 19th-century *persuasive advocacy* to 21st-century *exploratory visualization*.
While Nightingale used data to argue for sanitary reform, this redesign encourages reflection on global disparities in healthcare investment.

As Drucker (2011) asserts, graphical displays should *reveal their constructedness* rather than conceal it. The interactivity in later versions allows viewers to modify parameters and experience their own agency in knowledge construction. Cairo's (2016) principle of "truthful design" guided visual decisions—ensuring differences were visible but not exaggerated.

5. Reflection and Conclusion

This project bridges the historical, technical, and humanistic dimensions of data visualization. Following Drucker's (2011) view that visualization is interpretation, each design decision—data selection, chart type, color, and interaction—constructs meaning rather than merely reveals it.

Manovich (2011) describes visualization as a *cultural act*. In this sense, this redesign extends Nightingale's moral mission using the language of modern interactivity. McCandless (2010) reminds us that *beauty and empathy are part of understanding*, and that spirit informed every visual choice.

Ultimately, this project transforms Nightingale's persuasive diagram into a platform for exploration, inviting users to engage with questions of equity, efficiency, and global well-being.

References

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