

# Investigating Visual Preferences in Data Visualization Design

## Background

In the realm of data visualization, the power of visual elements to communicate insights is undeniable. The choices made in visual design, encompassing color palettes, typography, chart types, and layout, can profoundly influence how audiences perceive and interact with data. As data-driven decision-making continues to gain prominence across domains, a critical question emerges: What are the visual design elements that resonate most with users? Delving into this query can unlock a treasure trove of knowledge that enriches data visualization practices.

## Problem Specification

This project endeavors to delve deep into the realms of users' visual preferences in data visualization design. As design choices multiply, we must understand which elements draw users' attention, foster comprehension, and kindle engagement. By systematically studying users' preferences across design variations, we seek to discern not just mere inclinations but fundamental tendencies that wield an impact on data visualization effectiveness.

Different types of visual design elements that can be considered for this study could be different color palettes, chart types (e.g., bar charts, line charts, scatter plots, pie charts, etc.), layout and typography, backgrounds and contrast, etc.

## Suggested Method

Select a visualization framework (e.g., Python Matplotlib, Python Seaborn, etc.) and select a number of visual design elements from the list above and/or from the literature. Sample visual elements include but not limited to:

- Different chart types for similar tasks (e.g., bar charts vs. line charts vs. scatter plots),
- Different color palettes (e.g., saturated colors, dimmed colors, monochrome, grayscale, etc.),
- Font types and colors,
- Interaction between the foreground color (i.e., markers) and background color,
- Effect of using different axis styles, grid styles, etc.

As the main task of this project is to find out how/which visual elements resonate with users, user studies are needed. To facilitate easier user preference capturing, create a database of data visualization stimuli (e.g., *in the form of images*) using the selected visualization framework. Conduct user studies with a reasonable number of participants (e.g., 20-40), and collect user preferences for the prepared stimuli (i.e., quantify user preferences). Conduct statistical data analysis and hypothesis testing methods to compare the generated stimuli and the selected visual design elements. Report your findings and present in an accessible manner for other area experts.

## Relevant Articles

- [1] Chen, C. (2010). Information visualization. *Wiley interdisciplinary reviews: computational statistics*, 2(4), 387-403.
- [2] Liu, X., Alharbi, M. S., Chen, J., Diehl, A., Rees, D., Firat, E. E., ... & Laramee, R. S. (2023). Visualization Resources: A Survey. *Information visualization*, 22(1), 3-30.

- [3] Quispel, A., & Maes, A. (2014). Would you prefer pie or cupcakes? Preferences for data visualization designs of professionals and laypeople in graphic design. *Journal of Visual Languages & Computing*, 25(2), 107-116.
- [4] Quispel, A., Maes, A., & Schilperoord, J. (2016). Graph and chart aesthetics for experts and laymen in design: The role of familiarity and perceived ease of use. *Information Visualization*, 15(3), 238-252.
- [5] McGurgan, K., Fedoroksaya, E., Sutton, T. M., & Herbert, A. M. (2021). Graph Design: The Data-ink Ratio and Expert Users. In *VISIGRAPP (3: IVAPP)* (pp. 188-194).
- [6] Parsons, P. (2021). Understanding data visualization design practice. *IEEE Transactions on Visualization and Computer Graphics*, 28(1), 665-675.
- [7] Setzer, J. C., & Cui, Z. (2022). Communicating Measurement Outcomes with (Better) Graphics. *Educational Measurement: Issues and Practice*, 41(3), 5-13.

### Useful Tools

- Any visualization framework that you wish to use. A few examples might be Matlab, or other python-based frameworks such as [Matplotlib](#), [ggplot2](#), [Seaborn](#), etc.
- A useful toolbox for analyzing pairwise comparison data - <https://github.com/mantiuk/pwcmp>
- It might be nice to check [ITU-T Recommendation P.910](#) (page 12) to understand the pair comparison method for user preference data collection.