Chapter 3

Dashboard Poetry: The Grammar of Graphics as a collection of charts should be considered a symphony of charts

3.1 Abstract:

A chart is similar to a sentence in that it presents a single, straightforward piece of information and visually represents data to facilitate comprehension. For example, a chart could be a bar graph depicting sales over the course of a year, a pie chart illustrating the percentage distribution of a budget, or a scatter plot illustrating the correlation between two variables. In the same way that a sentence expresses a single complete thought, a chart conveys a single data narrative.

In contrast, a dashboard is analogous to a paragraph. It is a collection of charts (similar to sentences) that present a more comprehensive view of the data landscape. Each chart on the dashboard contributes to the overall comprehension of the situation, similar to how each sentence in a paragraph contributes to the larger concept. A dashboard may combine multiple graphs, tables, and metrics to provide an all-encompassing view of a company's per-

formance, a project's development, or market trends.

In contrast, a dashboard integrates these individual 'data stories' to create a multidimensional, comprehensive understanding of a larger data scenario. Charts are the building blocks of dashboards, just as sentences are the building blocks of paragraphs.

This write-up explores the concept of considering an entire dashboard as a well orchestrated collection of charts in data visualization. However, this study proposes a novel approach where the entire dashboard is treated as a single chart, leveraging its interactive and interconnected elements to enhance data visualization and insights.

3.2 Introduction:

The grammar of graphics is a framework for designing and comprehending data visualizations. By decomposing graphics into components such as data, aesthetics, and geometries, the grammar of graphics provides a structured method for conceiving and creating visualizations. It permits a high degree of customization and flexibility in the creation of visualizations. The principles of the grammar of graphics can be applied to dashboard design to create more effective and informative dashboards.

3.3 Related Work:

3.3.1 Dashboard Design

A dashboard is a visual display of the essential information needed to achieve one or more objectives, consolidated and arranged on a single screen

so the data can be monitored at a glance (Few, 2006a). The process of creating visually informative and interactive interfaces that present data and key performance indicators (KPIs) in a consolidated and simple-to-understand format is dashboard design. The objective is to provide users with insights and enable them to make intelligent decisions based on the presented data.

3.3.2 Grammar of Graphics

The central concept of the grammar of graphics is the representation of visualizations as a combination of essential components, including data, aesthetics, geometries, scales, and statistics. These components can be combined in numerous ways to generate a vast array of visual representations. For instance, data is the foundational element, aesthetics map data variables to visual properties, geometries determine the representation of data points, scales map data values to visual values, and statistics transform the data prior to visualization.

While the grammar of graphics provides a powerful theoretical framework for data visualization, there may be research gaps in its application to dashboard design and functionality. Such as the following missing pieces:

Interactivity: Graphics grammar primarily emphasizes static visualizations. However, dashboards are inherently interactive, allowing users to explore the data and interact with it. There is a need for research to determine how to effectively incorporate the principles of the grammar of graphics into interactive dashboards while maintaining a positive user experience and avoiding user overload.

Data Synchronization: Dashboards often present data from multiple

sources or datasets. Ensuring data synchronization across different visualizations and components is critical to maintain accuracy and consistency. Research is needed to investigate methods for handling data updates, refresh rates, and synchronization challenges in dashboard design.

User-Centered Design: The grammar of graphics focuses on data-driven principles, but effective dashboard design also requires a deep understanding of user needs, tasks, and goals. Further research should investigate how to integrate user-centered design practices into the application of the grammar of graphics in dashboard development.

3.4 Dashboard Design as the Symphony of Charts:

Here is how published theory relates graphic grammar to dashboard design:

Data Layer: is the foundation of visualizations in the grammar of graphics. This means that data should drive the dashboard design process. Dashboards should be constructed using accurate, pertinent, and well-organized data that aligns with the dashboard's objectives.

Aesthetics Layer: refer to the mapping of data variables to visual properties such as color, size, shape, and position. Aesthetics play a crucial role in dashboard design for accurately and effectively representing data. Choosing appropriate colors, scales, and shapes for visual elements expedites users' ability to comprehend and interpret data.

Geometries: determine how data points, such as bars, lines, points, or areas, are represented in the visualization. The selection of appropriate geometries is crucial in dashboard design for communicating the intended message.

Various types of charts and graphs may be used to represent various types of data or to illustrate particular relationships.

Composition and Layers: Graphics grammar permits combining multiple layers of data and geometries to generate more complex visualizations. This translates to structuring information hierarchically in dashboard design, utilizing multiple charts, graphs, or elements to present a comprehensive view of the data without overwhelming the user.

Faceting: is the process of dividing data into subsets and displaying them as multiple smaller visualizations. Faceting can be used in dashboard design to display multiple aspects of the data simultaneously, making it easier for users to compare and contrast various parts of the data.

Annotations: as mentioned in the previous response, annotations are a crucial component of statistical graphics and also apply to dashboard design. Annotations strategically placed can aid users in comprehending key insights, provide context, and guide them through the dashboard's narrative.

Using the principles of the grammar of graphics, designers can create visually appealing, informative, and user-friendly dashboards that effectively convey data-driven insights to their audience.

3.5 Experimential Ideas/Methods to test theory:

Testing the effectiveness of a dashboard as a unified chart involves evaluating its usability, user experience, and the effectiveness of conveying information to the target audience. Here are some key steps and methods to test the effectiveness of a dashboard:

Usability Testing: Conduct usability testing with real users to observe how they interact with the dashboard. Use think-aloud protocols, where users vocalize their thoughts while using the dashboard. Observe if users can easily navigate, interpret data, and find relevant information using the collection of charts.

Eye-Tracking: Use eye-tracking technology to understand where users focus their attention on the dashboard. This will reveal if users are drawn to the critical information presented through the collection of charts.

User Interviews and Observations: Conduct interviews with users to gain deeper insights into their experiences and preferences regarding the collection of charts. Observe how users interact with the dashboard in their natural environment.

Chapter 4

Does Color Help?: Testing Variability Ensemble Coding for Enhanced Interpretation of Bland-Altman Plots

4.1 Abstract:

This article presents a method for interpreting Bland-Altman plots based on the principles of variability ensemble coding. The purpose of this study is to evaluate the efficacy of this method, with the hypothesis that employing color coding to represent variability could facilitate intuitive comprehension of data dispersion, thereby enhancing the practical utility of Bland-Altman plots.

4.2 Introduction:

The Bland-Altman plot is a powerful statistical tool for comparing and assessing agreement between two distinct measurement techniques (Bland & Altman, 1986). Due to the density and distribution of data points, understanding and interpreting these plots can be difficult despite their effectiveness. Ensemble coding, a perceptual mechanism that provides a statistical summary of a visual scene (Alvarez, 2011) offers a promising solution to this

issue by facilitating the rapid extraction of variability information.

4.3 Methods:

In this proposed study, we utilize color coding to represent varying levels of variability in Bland-Altman plots. To ensure the universal interpretability of the plots (Ware, 2012), the color palette will be selected with care, taking into account potential issues such as color blindness.

For this study, two Bland-Altman plots will be generated. A traditional plot without color-coding and a plot using the color-coding technique we propose. Both plots will be presented to a group of participants that includes both experts and non-experts in data interpretation and statistics. The participants will be required to interpret the plots and complete a questionnaire to assess their comprehension and speed of interpretation.

For a layer of interactivity in our study, we will generate interactive Bland-Altman plots incorporating ensemble coding of variability through color gradations. Interactivity will be implemented via D3, providing detailed information about each data point when hovered over, as well as zoom features allowing users to zero in on areas of interest.

4.3.1 Design of the User Studies

User studies will be designed to assess the effectiveness of the interactive Bland-Altman plots in conveying information about the variability of data points. The studies will consist of two parts:

Task-based Evaluation: Participants will be given a set of tasks to complete using both the interactive color-coded Bland-Altman plot and a tra-

ditional static Bland-Altman plot. Tasks will involve identifying specific data points, interpreting data variability, and answering questions about the overall data trend. Metrics such as task completion time, success rate, and error rate will be recorded (Rubin & Chisnell, 2008).

Subjective Evaluation: After completing the tasks, participants will be asked to fill out a questionnaire assessing their user experience. The questionnaire will include items related to the perceived ease of use, satisfaction, and preference between the traditional and interactive color-coded Bland-Altman plots.

4.4 Discussion:

We anticipate that the application of ensemble coding for variability will aid in the comprehension of Bland-Altman plots. Based on ensemble coding principles, the color-coded plot should enable faster and more accurate interpretation of data variability (Haberman & Whitney, 2012). This method has the potential to enhance the interpretability and utility of these graphs, making them accessible to a broader audience and facilitating more efficient data communication.