# Optimizing Business Analytics: The Role of Gestalt Principles in Designing Business Intelligence Dashboards

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**Abstract:**
*In the evolving landscape of Business Intelligence, effective data visualization plays a critical role in transforming raw information into actionable insights. Microsoft Power BI dashboards serve as powerful tools for this purpose but their effectiveness depends largely on how intuitively they present complex datasets. Gestalt principles rooted in cognitive psychology provide a structured approach to organizing visual information in a way that aligns with natural human perception. This study explores how these principles influence the clarity, usability and efficiency of Business Intelligence dashboards with a focus on key financial metrics for sales processes. While previous research emphasizes the importance of visual structure in analytics there is limited exploration of how systematically applying Gestalt principles can enhance dashboard functionality. To bridge this gap, the study models a data warehouse in Power BI, tailored for developing multiple dashboard each employing different Gestalt principles. Their impact on data interpretability and decision-making effectiveness is then evaluated through a comparative analysis. These insights demonstrate that a well-designed dashboard based on cognitive science can significantly enhance Business Intelligence capabilities, making data interpretation faster and more intuitive. By integrating theoretical foundations with practical implementation this research contributes to the optimization of business analytics offering a structured framework for designing Power BI dashboards that maximize usability and decision-making efficiency. The findings provide valuable guidance for analysts and business professionals aiming to improve their visualization strategies ensuring that dashboards are not just informative but also aligned with human cognitive processing for greater clarity and impact.*

**Keywords**: Gestalt Principles, Business Intelligence Dashboards, Data Visualization, Power BI, Decision-Making Efficiency, User Experience

## Introduction

In today's digital landscape, Business Intelligence (BI) has shifted from being a competitive advantage to becoming an essential requirement. The large volume of data created each day has transformed how businesses operate, placing data analysis and visualization at the heart of modern decision-making. As organizations seek to navigate increasingly complex environments, the ability to turn raw data into clear, meaningful insights has become essential as discussed by Toic et al. (2022). BI tools respond to this need by providing structured methods to explore data, uncover patterns, and support strategic choices. Among these tools, Microsoft Power BI has gained wide recognition for its flexibility, accessibility, and powerful visual capabilities as demonstrated by Patrick et al. (2023).

The value of BI lies not only in data processing but also in how information is presented. Dashboards serve as visual interfaces that simplify complex data and make it easier to understand. When designed effectively, they help decision-makers quickly assess performance, track goals, and respond to changes in real time. However, if poorly designed, even the most detailed dashboard can become overwhelming and obscure important insights. This is where design rooted in human perception becomes critical. By applying Gestalt principles dashboard design can become more intuitive, reducing mental effort and helping users focus on what matters most, says Grabinger et al. (2022). These principles, originally developed in the field of psychology, explain how humans naturally group visual elements, as studied by Sarasso et al. (2022). When applied to data visualization, they help structure content in a way that aligns with how the brain processes information. Gonçalves et al. (2023) have shown that dashboards based on these principles enhance clarity, guide attention, and improve interpretation speed.

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Despite the proven benefits of using BI tools and effective visual design, adoption remains limited, especially among small and medium-sized enterprises. Many businesses, argue Toic et al. (2022) continue to make decisions based on instinct, even when data is available.

This research focuses on the practical application of these principles in a real business setting. The study uses data provided by a premium retailer in Bucharest specializing in luxury tiles, furniture, and interior design products. In a market defined by high-value transactions and detailed financial oversight, having a clear and functional dashboard is vital.

The paper explores four dashboard designs, each built around one Gestalt principle, and compares them to a non-structured version used as a baseline. Through critical, author-led analysis, the study examines how each layout influences clarity, usability, and interpretability. Unlike studies that focus purely on performance metrics or technical features, this work takes a human-centered approach, evaluating the dashboards based on how naturally and efficiently they support understanding.

This study is guided by the central question of how different Gestalt principles influence the interpretability and usability of Power BI dashboards when applied to financial data in a business context. The aim is to understand how visual structure, rooted in perceptual psychology, shapes the way users interact with and interpret data in a practical setting. To explore this, four hypotheses were developed.

*H1. Dashboards structured using Gestalt principles offer clearer interpretation than unstructured designs.* This approach allows information to be visually grouped in ways that align with how the human mind naturally organizes what it sees. As studied by Grabinger et al. (2024), the structure feels more intuitive and helps users understand the content more quickly.

*H2. Clear and well-organized dashboards reduce cognitive effort and help users identify key trends and anomalies more efficiently.* When information is presented in a way that highlights connections and reduces clutter, Law et al. (2020) show that users can interpret it more quickly and with greater ease.

*H3. Visually optimized dashboards support more accurate and confident financial assessments.* When data is well-arranged, users can focus directly on insights instead of trying to make sense of scattered elements, as demonstrated by Granitto and Murthy (2025).

Each of these hypotheses reflects key requirements of dashboard design: clarity, usability, efficiency, and impact. The study does not only test whether these principles work in isolation but also investigates how their thoughtful integration enhances the overall analytical experience. The underlying idea is that good design is not just about aesthetics but shapes the way people think, process information, and act on data in meaningful ways, according to Grabinger et al. (2024).

This work contributes to the evolving conversation around BI by demonstrating how good design, grounded in the science of perception, can enhance even the most advanced analytics platforms for performance analysis. The findings aim to help designers and analysts build dashboards that are not only technically sound but also visually meaningful, supporting smarter and faster decision-making in any business environment. The paper opens with a review of key concepts in BI and visual design, then outlines the dataset, tools, and methods used. It presents a comparison of dashboard models, discusses the results in relation to the hypotheses, and ends with a summary of contributions and future directions.

## Literature review

Gestalt principles, rooted in cognitive psychology, provide a structured way to organize visual data so that users can process and interpret complex information more efficiently (Kasai, 2021). These principles, such as proximity, similarity, closure, and continuity, influence how we naturally group visual elements, shaping the way we extract meaning from dashboards and reports (Withagen, 2025). Recent research has shown that applying Gestalt principles to data visualization can dramatically improve clarity and usability. For example, Guo et al. (2023)

found that using figure-ground segmentation, considered a core Gestalt principle, helped layer multiple dimensions of data in a single two-dimensional visualization, making it easier for users to draw insights without feeling overwhelmed. Similarly, Lin et al. (2021) demonstrated how spatial proximity, color similarity, and structural consistency play a major role in helping users quickly locate relevant information in infographic-style visualizations.

BI dashboards serve as decision-making hubs, yet their effectiveness often depends on how intuitively they present information (Lu, et al., 2020). A cluttered, hard-to-read dashboard can slow down decision-making, while a well-structured one can highlight key insights at a glance, as shown by Toic et al. (2022). Studies suggest that dashboards built around Gestalt principles can reduce cognitive load and help users spot patterns more quickly. For instance, Grabinger et al. (2022) explored how Gestalt-based designs impact causal graphs in data visualization. Their study, which used eye-tracking methods, found that users could process information more accurately and efficiently when elements were grouped according to Gestalt rules like proximity and similarity. Withagen (2025) examined how affordance-based visual cues, such as color contrasts and intuitive layout designs, can make dashboards more engaging and user-friendly.

Subsequently, the way we process and interpret visual information is deeply influenced by Gestalt principles. White (2022) explored how attention and perceptual organization affect the way we mentally structure complex data, showing that Gestalt-based designs allow for faster, more intuitive understanding. Trujillo and Holler (2023) extended this idea into multimodal communication, explaining how Gestalt principles help us integrate visual and verbal information seamlessly, which is highly relevant for dashboards that mix graphs, charts, and text. These findings suggest that intuitive grouping mechanisms can make dashboards significantly easier to navigate and understand. Yet, despite these insights, many BI dashboards still fail to take full advantage of these principles.

While previous research has highlighted the benefits of Gestalt-based visualization, there's still a major gap when it comes to BI dashboards. Most existing studies focus on static graphics, but BI dashboards are highly interactive, and we still don't fully understand how Gestalt principles influence real-time data interpretation. Moreover, while proximity and similarity have been well-studied, principles like closure, continuity, and common fate remain underexplored in the context of dashboard design. This study seeks to fill this gap by developing and testing multiple dashboard layouts, each incorporating different Gestalt principles, to see which designs maximize usability and decision-making efficiency.

By combining cognitive psychology with real-world dashboard applications, this research aims to create a clear, structured framework for designing highly intuitive BI dashboards. These principles were selected based on their relevance to visual perception and their frequent use in design theory. The aim is to help create dashboards that feel intuitive, reduce mental effort, and support faster, more confident decisions.

## Methodology

After reviewing the relevant literature on Gestalt principles and dashboard design, the research applies a practical approach to explore how visual structure affects usability in BI dashboards. Using financial data, the study combines quantitative analysis with critical reasoning to explore how design impacts clarity, cognitive effort, and decision accuracy. The study is built around a real-world dataset of financial transactions from 2022 to 2024, which is imported from MS Excel and integrated into a Data Warehouse developed in Power BI. This Data Warehouse was then harnessed to design four dashboards serving as the testing ground for different data visualization strategies, and allowing the examination of their impact on interpretability, cognitive load, and decision efficiency.

The dataset consists of detailed sales invoices, business partners, locations, product categories, employees, and operational centers, first collected using Microsoft Excel. These records provide a comprehensive view of financial activity, making them an ideal foundation for assessing how different visualization techniques affect user performance. Each invoice includes essential details such as product type, quantity sold, cost, and profit margins, while partner and location data provide context on the geographical and organizational aspects of the transactions. Similar studies conducted by Guo et al. (2023) on data visualization and human cognition have shown that structured information presentation improves user comprehension and decision accuracy. However, little research has explored these effects in interactive BI dashboards, which are widely used in financial decision-making environments. The data was thoroughly cleaned and prepared before being brought into Power BI. As noted by Gonçalves et al. (2023), data preparation is not just a technical task but a foundation for meaningful and accurate Business Intelligence.

To test the effectiveness of Gestalt-based design, the Power BI dashboards were developed with multiple versions, each applying different visualization techniques. The study specifically integrates enclosure, similarity, symmetry and proximity to create clearer data groupings, reduce visual clutter, and improve user focus. These principles are applied in chart layouts, color schemes, and data hierarchies to ensure that the most relevant financial insights are instantly recognizable. The performance of these dashboards is compared against traditional tabular and unstructured visualizations to measure whether Gestalt-based designs provide a measurable advantage in user efficiency.

The research followed the three main hypotheses introduced earlier, centered on how dashboard design influences clarity, mental effort, and the accuracy of financial interpretation when guided by Gestalt principles. All data processing and visualization were performed using Microsoft Excel and Power BI. No additional software or statistical tools were required, as the analysis was based solely on structured comparisons and a focused evaluation of visual clarity and functional usability.

While past research, including that conducted by Guo et al. (2023) and Lin et al. (2021), has demonstrated the benefits of Gestalt-based visualization in static graphics, such as infographics and causal diagrams, this study extends these insights into the dynamic, real-time business environment of BI dashboards. Prior work by Grabinger et al. (2022) showed that structured visual layouts reduce cognitive strain and improve decision-making speed, supporting the idea that Gestalt-based dashboard design could significantly enhance financial data interpretations. By testing these concepts in a real-world financial setting, this study provides a practical framework for optimizing BI dashboards, ensuring that they are not only visually clear but also cognitively efficient.

## Results

This research explored how different Gestalt principles influence the usability and effectiveness of BI dashboards. Four distinct dashboard designs were tested, each based on a specific principle: Enclosure, Similarity, Symmetry, and Proximity. The goal was to determine which approach enhances financial data interpretation, improves user experience, and accelerates decision-making. The study combined critical analysis with performance metrics to assess how well each principle supported clarity and efficiency in data visualization.

Before exploring how Gestalt principles improve dashboard usability, it is important to first examine an example that demonstrates what happens when those principles are missing. At first glance, the dashboard illustrated in Figure 1 contains several well-designed individual charts. However, when viewed together as a complete interface, it lacks cohesion and fails to communicate insights effectively. Instead of guiding users through key financial trends, the disjointed arrangement makes it difficult to extract meaningful information at a glance.


**Figure 1. Non-example of Power BI Dashboard**

Source: Author's own research

One of the most noticeable issues is the absence of a clear structure that organizes data logically. Key financial metrics such as total revenue, profit margins, and sales distribution are scattered across the interface rather than grouped in a way that highlights their relationships. Users must search for connections between relevant data points, which increases the effort required to interpret trends. The dashboard also presents a variety of chart types, including scatter plots, bar graphs, pie charts, and a Sankey diagram, all competing for attention without a consistent flow. Instead of creating a seamless experience, this design forces users to shift between different visual formats, making interpretation more mentally demanding and the comparisons more difficult than they should be. Another challenge comes from the excessive reliance on color to distinguish information. While color coding can be an effective tool, it does not provide enough support on its own. Without additional labels or structural elements that guide the eye, users may struggle to differentiate between categories, especially if they have visual impairments or are viewing the dashboard in less-than-ideal conditions. The filters and selection panels also take up valuable space, but instead of enhancing clarity, they contribute to a cluttered appearance that distracts from the most important data points.

This dashboard serves as an example of how a lack of structure and organization can undermine the effectiveness of even well-designed individual charts. While each visualization may function independently, the absence of a clear framework leaves users with an interface that feels overwhelming and difficult to navigate. The following sections will explore how each of these principles enhances dashboard usability, making financial data more actionable and decision-making more efficient.

The first dashboard, as shown in Figure 2, applied the principle of Enclosure, which visually separates related data by grouping them within defined boundaries. This technique aimed to make financial relationships clearer and reduce visual clutter. Enclosure helps organize complex financial metrics by making key sections stand out. However, excessive enclosures can make the interface feel crowded, leading to slightly longer response times when extracting information.


**Figure 2. Enclosure Principle-Based Power BI Dashboard**

Source: Author's own research

These findings align with research by Grabinger et al. (2022) which found that while segmentation improves clarity, too many enclosed sections can disrupt natural scanning patterns and create unnecessary cognitive load. The conclusions of Guo et al. (2023), which showed that enclosures are beneficial in structuring multi-dimensional data are also supported, but must be used in moderation to avoid overwhelming the viewer. Unlike the cluttered and disorganized layout seen in the ineffective dashboard, the Enclosure-based design brought a sense of order by grouping financial data into clearly defined sections. In the poorly structured example, information was spread across the interface without any logical flow, forcing users to search for connections between related figures. This lack of structure made it harder to recognize patterns and slowed down the decision-making process. By contrast, the Enclosure-based design created distinct visual boundaries that naturally guided the user's attention, making it easier to navigate through key financial metrics and understand how they relate to one another. While this principle clearly helps with visual hierarchy, designers should ensure that enclosed areas do not become excessive, as this may inadvertently complicate data interpretation (Kasai, 2021).

The second dashboard used the principle of Similarity, which categorizes related information through color and shape consistency, as displayed in Figure 3. Financial performance indicators such as revenue, profit, and sales figures were color-coded, allowing users to quickly associate related data. The consistent use of colors played a significant role in guiding the user's attention and facilitating pattern recognition. The role of grouping related data visually is to make trends easier to spot, minimizing the mental effort needed to compare and interpret financial metrics.

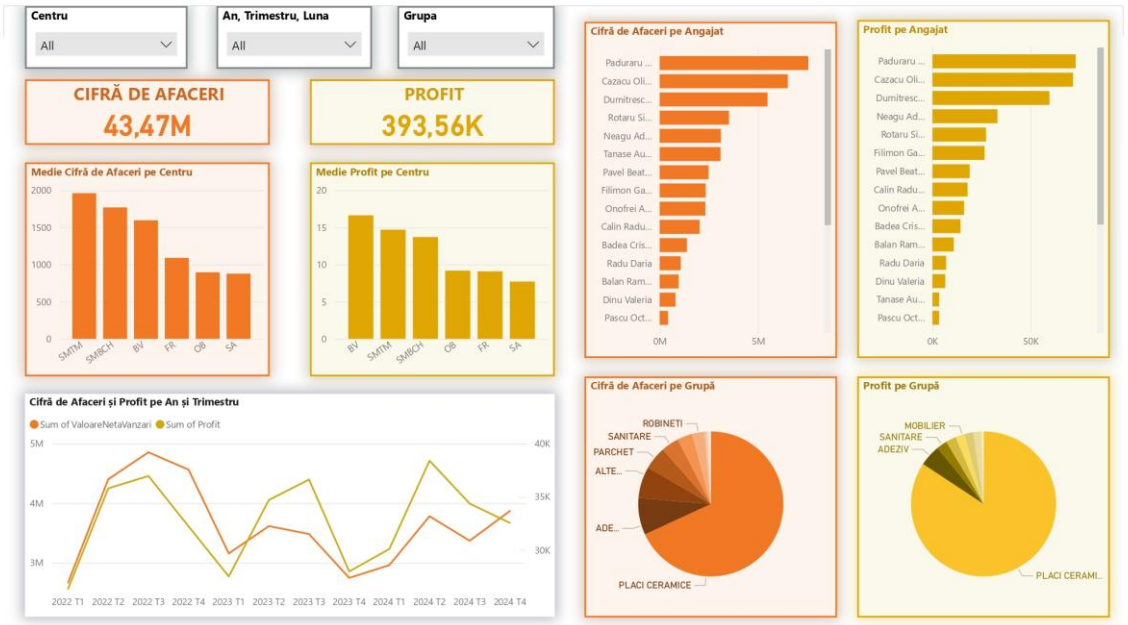


**Figure 3. Similarity Principle-Based Power BI Dashboard**

Source: Author's own research

This aligns with findings from Lin et al. (2021), who demonstrated that color-based grouping significantly enhances data recall and recognition in visual analytics. Color-based grouping improved recall and made patterns clearer. Unlike the non-example, where inconsistent colors created confusion, the Similarity-based dashboard used deliberate color associations for better organization. However, relying solely on color posed challenges in low-contrast settings and for visually impaired users. The non-example amplified this issue, forcing manual searches for related data. Similar concerns were raised in the study by White (2022), which emphasized that while color is a powerful tool for grouping information, it should be paired with additional indicators like text labels or icons for broader accessibility. Despite this limitation, Similarity proved to be one of the most effective principles, enabling users to process financial information faster and more intuitively.

The third dashboard is presented in Figure 4 and was built using the principle of Symmetry, where visual elements were evenly distributed to create a balanced and harmonious layout. This design was intended to enhance readability by making the dashboard more aesthetically pleasing. The structured design aimed to bring visual order to the interface, reducing clutter and guiding the eye more effectively.


**Figure 4. Symmetry Principle-Based Power BI Dashboard**

Source: Author's own research

Symmetry added visual balance, creating a clean and orderly appearance, but it did not contribute meaningfully to understanding the financial data. Aligning elements in a mirrored structure gave the impression of structure, yet it often softened or concealed the natural irregularities found in real financial trends. These subtle shifts and fluctuations are often the most important indicators in performance analysis, and when symmetry dominates the layout, they become harder to detect. Compared to the disorganized non-example, where confusion stemmed from a lack of coherence, the symmetry-based design created a different kind of barrier, where visual neatness came at the cost of insight. This reinforces the point made by Guo et al. (2023), who noted that rigid symmetry in complex visualizations can hide essential variations. It also supports Grabinger et al. (2022), who emphasized that visual balance should never override the clarity needed to reveal key data points and unusual patterns.

The fourth dashboard shown in Figure 5 applied Proximity, which groups related data close together to indicate connections. This design significantly improved how users processed financial metrics, as placing key data points near each other reduced the need for excessive scrolling and scanning. This dashboard design should allow users to extract insights more quickly than any other design.

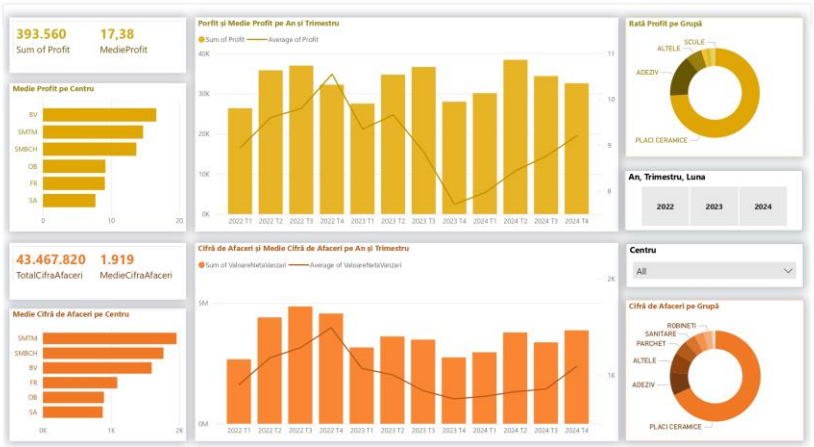


**Figure 5. Proximity Principle-Based Power BI Dashboard**

Source: Author's own research

The results clearly showed that Proximity was essential in making the dashboard easier to understand. When related financial values were placed near each other, the information could be followed effortlessly, without wasting time searching across different sections. This simple arrangement helped create a natural path for the eye to follow, allowing patterns to emerge more quickly and clearly. In the non-example dashboard, this structure was missing. The data was scattered and disconnected, leaving users to piece things together on their own. That extra effort made interpretation slower and less accurate. These observations are consistent with the findings of White (2022), who pointed out that information is processed faster when elements are positioned closely. They also align with Lin et al. (2021), who recognized proximity as one of the most effective ways to improve both the speed and accuracy of data interpretation.

The findings from this study confirm the core research hypotheses. The idea that dashboards built using Gestalt principles improve interpretability was strongly supported, with designs based on Similarity and Proximity resulting in faster data recognition and smoother navigation. The prediction that these two principles would help users detect trends more effectively was also validated, as they provided clearer visual groupings and reduced the effort required to connect related metrics. The expectation that Gestalt-based layouts would reduce cognitive load was partially supported. While the use of Proximity and Similarity clearly minimized mental effort, the Enclosure design, when overused, introduced a level of visual clutter that made some sections harder to scan. The final hypothesis, which proposed that users would make more accurate financial assessments when working with well-structured dashboards, was also confirmed. This was particularly evident in the Proximity-based layout, where accuracy in identifying key financial patterns improved significantly.

## Discussions

The results of this study confirm all three initial hypotheses. Dashboards designed with Gestalt principles were noticeably easier to interpret than the non-structured version. Proximity and Similarity stood out as the most effective. Proximity allowed related data to be placed close together, making relationships easier to spot. Similarity uses consistent colors and shapes to guide the eye and organize content naturally. Together, these principles helped users follow the information more smoothly. The second hypothesis, which focused on reducing cognitive effort, was also supported. Dashboards using Proximity and Similarity required less mental processing, as users could quickly recognize patterns without searching across unrelated sections. Enclosure, while useful in separating content, was less effective when overapplied. Too many boundaries disrupted the visual flow and made interpretation harder. The third hypothesis, regarding accuracy and confidence in financial assessments, was clearly confirmed. Users performed better when the dashboard layout supported logical grouping and visual clarity. Proximity, in particular, helped improve the recognition of trends and key figures.

The findings show that the best results came from combining these principles rather than using them in isolation. Proximity and Similarity worked best together. Enclosure adds structure when used with care. Symmetry offered balance but had less influence on understanding. When used intentionally, these principles turned raw data into visuals that felt clear, easy to read, and aligned with how people naturally process information.

## Conclusion

This study explored how Gestalt principles can improve the design and usability of BI dashboards. Four core principles were examined: Proximity, Similarity, Enclosure, and Symmetry. Each was applied to a dashboard model and compared to a deliberately unstructured version to highlight both strengths and weaknesses. Rather than relying on user feedback, the analysis focused on a critical assessment by the author, aiming to understand how each principle supports or hinders clarity, comprehension, and the overall effectiveness of a visual layout.

Among the principles explored, Proximity and Similarity proved the most effective in improving how financial data was understood. Proximity made relationships easier to see by placing related values close together. Similarity, using consistent colors and shapes, helped group information in ways that felt intuitive. When used together, they created a layout that was both clear and easy to follow. Enclosure was helpful for separating content but needed to be used in moderation. Too many enclosed areas made the layout feel crowded and harder to read. Symmetry added a sense of visual order but did not strongly improve understanding, especially when the data was uneven. The main insight is that the best results came from combining principles with intention. No single method worked best on its own. When applied thoughtfully, these design elements supported both clarity and focus, making dashboards easier to read and more useful for decision-making.

This study comes with a few limitations that point to clear opportunities for further research. The dashboards were developed using financial data, which shaped how each principle functioned in practice. Exploring how these same visual strategies perform in other fields, such as healthcare or education, could lead to different insights. The analysis relied on visual interpretation rather than direct input from users. Future work could include usability testing that measures how quickly users understand the data, how accurately they interpret it, and how they interact with different layouts. Techniques like eye-tracking could offer valuable observations. Accessibility is another important area that was not covered here. While the study focused on clarity, it did not examine how people with different visual or cognitive needs experience these dashboards. A next step could be creating a design guide informed by user testing, offering adaptable visual strategies that support clarity and ease of use across a range of real-world settings.

In summary, this research shows that thoughtful visual design, grounded in how people naturally perceive and process information, can transform complex dashboards into tools that are not only easy to read but also meaningful and actionable. When visual clarity aligns with cognitive ease, data becomes something users can truly understand, trust, and use.

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