The Impact of Visual Elements and Design Principles of Design Systems on Design Decisions

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ABSTRACT

This study investigates the impact of visual elements (color, typography, icons, and layout) and design principles (consistency, simplicity, reusability, and accessibility) within design systems on designers' decision-making processes. A survey of 24 interaction designers with varying levels of experience was conducted to assess how these factors influence decision consistency and efficiency.Results show that color and layout are crucial in design decisions, while consistency and simplicity enhance decision-making efficiency. Designer experience significantly affects the emphasis placed on these elements, with senior designers prioritizing color, consistency, and simplicity, and junior designers focusing on reusability. The findings highlight the need for design systems to be adaptable to different experience levels to optimize design workflows and user experience.

Keywords: Design systems, Visual elements, Design principles, Interaction design, UX design

INTRODUCTION

In the fast-evolving design industry, design systems are essential for enhancing efficiency and ensuring consistency, becoming integral to enterprises and design teams (Kholmatova, 2017). Beyond offering unified interface elements and component libraries, modern design systems integrate visual design principles and best practices that shape designers' decision-making (Nguyen, 2018). While these systems streamline workflows, their precise impact and effectiveness warrant deeper exploration.

Key visual elements (e.g., color, typography, icons, layouts) and design principles (e.g., consistency, simplicity, reusability) significantly influence design decisions. Standardizing visual elements reduces cognitive load, enabling more efficient and rational decision-making (Zhuang, 2018), while principles guide consistency, fostering a standardized approach within teams (Konaté, 2018). Despite existing research, comprehensive studies on the specific effects of these elements and principles on design decisions remain limited.

This study investigates how visual elements and design principles in design systems shape designers' decision-making processes. Using quantitative methods, it evaluates their influence on decision consistency and rationality, uncovering the practical role of design systems in optimizing design workflows.

VISUAL ELEMENTS AND DESIGN PRINCIPLES IN DESIGN SYSTEMS

Design systems are systematic frameworks aimed at improving design efficiency, ensuring consistency, and enhancing user experience through standardized visual elements and design principles. Core components typically include visual elements (color, typography, icons, layouts) and design principles (consistency, simplicity, reusability, accessibility), which shape decision-making and foster systematic thinking among designers.

Visual elements form the foundation of user interfaces and brand identity (Majumdar, 2023). Standardization ensures a cohesive visual experience across platforms and products (Puranen, 2023).

1. Color: A key factor in emotional communication, brand positioning, and usability. Design systems like Material Design provide standardized palettes and contrast guidelines to enhance readability and depth (Abdi, 2020).
2. Typography: Critical for readability and aesthetics, typography guidelines define fonts, spacing, and sizes. For example, "Roboto" in Material Design ensures clarity and compatibility across devices (Visnapuu, 2023).
3. Icons: Icons facilitate user interaction by balancing aesthetics and functionality. Unified icon styles, as seen in Fluent Design, enhance recognition and interaction through visual coherence (Abdi, 2020).
4. Layout: Layout organizes visual elements, directing visual flow and ensuring consistency. Grid systems like Material Design's 4–12 column framework streamline alignment and improve efficiency.

Design principles guide decision-making by promoting consistency, clarity, and usability in complex tasks.

1. Consistency: Ensures uniformity across platforms, reducing cognitive load and facilitating user adaptation. Material Design emphasizes consistency in both visual style and interactions (Visnapuu, 2023).
2. Simplicity: Simplifies visual hierarchy and interactions to prevent overload, as demonstrated by Ant Design's clean, functional style.
3. Reusability: Encourages component reuse to save time and resources. Modular libraries like those in Fluent Design and Ant Design enable rapid interface development.
4. Accessibility: Ensures inclusivity through standards for contrast, font sizes, and interactive elements, guided by WCAG (Web Content Accessibility Guidelines).

By integrating these elements and principles, design systems optimize workflows and foster effective, user-centric designs.

EXPERIMENTAL DESIGN

Participants

This experiment plans to recruit 24 designers with experience in interaction design or interface design. Participants will be classified based on their years of experience in interaction design. The classification will be divided into the following three groups:

(a) Interaction Design Students (with Internship Experience): Participants with a foundational understanding of design theory and relevant internship experience, capable of applying design theory and practice to some extent.
(b) Junior Designers (1–3 years of interaction design experience): Designers who are proficient in design tools and methods, with some practical project experience.
(c) Senior Designers (4–6 years of interaction design experience): Designers typically able to independently manage complex design projects, familiar with design systems, and capable of making quick decisions and adjustments during the design process.

Survey Design and Content

The core of this experiment involves collecting data through a quantitative survey. The survey will focus on the evaluation of visual elements in design systems, the influence of design principles on design decisions, and the consistency and rationality of design decisions. The survey design is structured into the following sections:

Evaluation of Visual Elements

This section primarily assesses designers' perceptions and evaluations of the visual elements in a design system, including color, typography, icons, and layouts. Designers will rate the role of each visual element in design decisions using a Likert five-point scale (1: Very Unimportant, 5: Very Important), based on their practical experience. Each of the following four topics contains three questions:

(a) Color: The role of color in visual effects and emotional communication in interface design.
(b) Typography: The impact of typography on clarity, readability, and hierarchy in design.
(c) Icons: The contribution of icons to user interaction fluidity and usability.
(d) Layout: The effect of layout on interface neatness, user guidance, and information conveyance efficiency.

Through these questions, the survey will evaluate how designers assess these visual elements in real-world projects and how they influence their design decisions.

Influence of Design Principles and Best Practices

This section will evaluate designers' recognition and implementation of design principles (such as consistency, simplicity, reusability) and best practices in design systems. Participants will rate the following statements using a Likert five-point scale (1: Strongly Disagree, 5: Strongly Agree). Each of the following four topics contains three questions:

(a) Consistency: Does the consistency in the design system help improve the accuracy of design decisions?
(b) Simplicity: Does the principle of simplicity help designers make faster and more accurate design decisions?
(c) Reusability: Does the availability of reusable components in the design system reduce repetitive work for designers, thus enhancing work efficiency?
(d) Usability: Does the usability of the design system effectively reduce decision time and complexity in the design process?

Through these questions, the survey will assess designers' agreement with design principles, exploring how design systems improve decision consistency and rationality during the design process.

RESULTS AND ANALYSIS

Descriptive Statistical Analysis

First, we conducted a descriptive statistical analysis of the ratings from all designer groups (interaction design students, junior designers, and senior designers). Specifically, we calculated the mean, standard deviation, minimum, and maximum values for each rating. These statistics help us understand the overall evaluation trends of each visual element and design principle within the designer groups.

Below are the descriptive statistics for each visual element and design principle (all ratings based on a Likert five-point scale, where 1 represents "very unimportant" and 5 represents "very important").

From Table 1, it is evident that designers generally consider color to be the most important visual element in design, with a mean of 4.35 and a standard deviation of 0.65, indicating a high level of agreement regarding its role in design. In contrast, icons have a lower mean score of 3.8 and a higher standard deviation of 1.02, suggesting a greater divergence in designers' evaluations of the role of icons in interaction design.

Table 1: Ratings of visual elements (color, typography, icons, layout) by designers.

Visual Elements	Mean	Standard Deviation	Rating Range
Color	4.35	0.65	2-5
Typography	4.0	0.72	3-5
Icons	3.8	1.02	2-5
Layout	4.25	0.91	3-5

From Table 2, it is clear that consistency (4.28) and simplicity (4.28) are considered the most important principles by designers, reflecting the strong influence of these principles on design decisions within design systems. In contrast, reusability (3.95) and usability (3.89) received relatively lower evaluations, indicating that their impact in the design decision-making process may not be as pronounced as expected.

Table 2: Ratings of design principles (consistency, simplicity, reusability, usability) by designers.

Design Principles	Mean	Standard Deviation	Rating Range
Consistency	4.28	0.64	2-5
Simplicity	4.28	0.49	3-5
Reusability	3.95	0.44	3-5
Usability	3.89	0.40	3-5

Statistical Significance

To further investigate whether the background of designers (e.g., years of experience) affects their evaluation of visual elements and design principles, we performed a one-way analysis of variance (ANOVA) for significance testing. We hypothesized that designers from different backgrounds would show significant differences in their evaluations of visual elements and design principles. The significance level for the experiment was set at $p < 0.05$. Below, we present the significance analysis for various design factors, including color, consistency, simplicity, and reusability.

The ANOVA results in Table 3 show significant differences in the evaluation of the "importance of color in visual effects" across designer categories ($F(2, 21) = 4.07$, $p = 0.032$). Post-hoc tests (Tukey HSD) reveal that senior designers rated the importance of color significantly higher than students and junior designers ($p < 0.05$). This result indicates that with increased experience, designers' recognition of color's role in visual effects improves. Specifically, senior designers place greater emphasis on color's contribution to visual appeal and brand development, reflecting a deeper understanding and application of color in design decisions.

Table 3: Importance of color in visual effects.

	Designer Years of Experience (M±SD)			F	p	Tukey HSD
	1. Interaction Design Students	2. Junior Designers	3. Senior Designers			
Color	4.075±0.72	4.15±0.70	4.81±0.17	4.07	0.032*	3>2>1

Note: * indicates significance at $0.01 < p < 0.05$; ** indicates $p < 0.01$.

The ANOVA results in Table 4 show significant differences in the evaluation of "the impact of consistency on design decisions" across designer categories ($F(2, 21) = 4.76$, $p = 0.002$). Post-hoc tests (Tukey HSD) show that senior designers rated the importance of consistency in design decisions significantly higher than students and junior designers ($p < 0.05$). This

result suggests that as designers gain more experience, their recognition of consistency's role in design decision-making deepens, particularly in terms of enhancing design accuracy, reducing decision biases, and avoiding design conflicts. Senior designers believe that consistency in design systems effectively promotes a unified experience across projects and platforms, reducing errors and biases in the design process.

Table 4: Impact of consistency on design decisions.

	Designer Years of Experience (M±SD)			F	p	Tukey HSD
	1. Interaction Design Students	2. Junior Designers	3. Senior Designers			
Consistency	4.0±0.69	4.08±0.64	4.78±0.17	4.76	0.002**	3>2>1

Note: * indicates significance at $0.01 < p < 0.05$; ** indicates $p < 0.01$.

One-way ANOVA ($F(2, 21) = 4.68$, $p = 0.021$) in Table 5 shows significant differences in the evaluation of "the impact of simplicity on decision efficiency" across designer categories. Post-hoc tests reveal that senior designers rated the effect of simplicity on decision efficiency significantly higher than students and junior designers ($p < 0.05$). This phenomenon is likely due to more experienced designers' tendency to eliminate redundant information and simplify design elements in actual projects, thereby improving design process efficiency. Senior designers streamline design content and optimize decision-making paths, reducing unnecessary complexity and enabling faster decisions and improved design efficiency.

Table 5: Impact of simplicity on decision efficiency.

	Designer Years of Experience (M±SD)			F	p	Tukey HSD
	1. Interaction Design Students	2. Junior Designers	3. Senior Designers			
Simplicity	3.99±0.55	4.22±0.44	4.64±0.24	4.68	0.021*	3>2>1

Note: * indicates significance at $0.01 < p < 0.05$; ** indicates $p < 0.01$.

Regarding "the impact of reusability on design efficiency," the ANOVA results in Table 6 ($F(2, 21) = 7.99$, $p = 0.0026$) show significant differences in the importance ratings of reusability across designer categories. Post-hoc tests reveal that junior designers rated the importance of reusability significantly higher than students and senior designers ($p < 0.05$). This result may be related to junior designers' frequent use of reusable components from design systems in projects, which helps reduce repetitive work and enhances design efficiency and consistency. For senior designers, although reusability remains important, they may focus more on deep optimization and efficient execution of design systems rather than relying heavily on reusable components.

Table 6: Impact of Reusability on Design Efficiency.

	Designer Years of Experience (M±SD)			F	p	Tukey HSD
	1. Interaction Design Students	2. Junior Designers	3. Senior Designers			
Reusability	3.60±0.48	4.29±0.23	3.96±0.26	7.99	0.0026**	2>3>1

Note: * indicates significance at 0.01 < p < 0.05; ** indicates p < 0.01.

Regarding "the impact of usability on the design decision process," the ANOVA results in Table 7 (F(2, 21) = 3.89, p = 0.034) indicate significant differences in the ratings of usability among different designer groups based on years of experience. Further analysis indicated that, as design experience accumulates, designers' ratings of usability gradually increase. Specifically, senior designers exhibited slightly higher recognition of usability than junior designers, while junior designers scored significantly higher than interaction design students. This trend suggests that more experienced designers are better able to understand and apply the usability features of design systems, such as reducing time consumption and cognitive load in complex decision-making scenarios. These results highlight the applicability of design systems across different levels of experience, indicating that students need more practical support to fully grasp the potential of design systems, while senior designers are more adept at leveraging usability principles to optimize the design process and enhance team collaboration efficiency.

Table 7: Impact of usability on the design decision process.

	Designer Years of Experience (M±SD)			F	p	Tukey HSD
	1. Interaction Design Students	2. Junior Designers	3. Senior Designers			
Usability	3.60±0.48	4.00±0.25	4.06±0.28	3.89	0.034*	3>2>1

Note: * indicates significance at 0.01 < p < 0.05; ** indicates p < 0.01.

DISCUSSION

In terms of visual elements, the high mean score for color (4.35) indicates its crucial role in design decision-making, which is closely related to its direct impact on information readability and interface aesthetics. Designers generally recognize that color not only enhances visual appeal but also plays a key role in distinguishing the functional aspects of interface elements and in conveying brand identity and emotions. In contrast, the mean score for icons is relatively lower (3.8) with a large standard deviation (1.02), reflecting a certain degree of divergence in designers' evaluations of the role of icons. This could be attributed to the challenges icons present in balancing aesthetic unity with functional usability, as different designers have varying understandings and priorities regarding how icons can better guide user interaction. The high mean scores for fonts (4.0) and layouts (4.25) further emphasize their significance in design. The appropriate selection of fonts ensures accurate information transmission, enhances the professionalism and overall aesthetics of the design, while layout plays a critical role in organizing

information and guiding the visual flow, contributing to improved interface clarity and user orientation.

Regarding design principles, consistency (4.28) and simplicity (4.28) are highly valued by designers. The principle of consistency helps to reduce the complexity of design decisions, ensuring coherence across different platforms and interfaces, thereby improving user experience and reducing the learning curve. The principle of simplicity aids designers in focusing on key information amidst numerous design elements, preventing information overload and enhancing design maintainability and decision-making efficiency. However, the scores for reusability (3.95) and usability (3.89) are relatively lower. While reusability is considered a crucial strategy for saving time and resources in design systems, designers of different experience levels place varying degrees of emphasis on it. Junior designers, due to their relatively limited project experience, may rely more on reusable components to quickly build interfaces, while senior designers focus more on optimizing the overall design system and its in-depth customization. Usability, as a fundamental characteristic of design systems, is widely recognized, but there may still be room for improvement in its application. For instance, complex workflows, unclear documentation, or lack of intuitive interface design may affect designers' user experience with the design system. Design teams should address designers' pain points during the usage process, optimize the system's interaction design, and provide detailed and accurate documentation and training resources to improve usability and better support the design decision-making process.

Through comparative analysis of designers with different experience levels, it was found that designer experience significantly influences the evaluation of visual elements and design principles. Senior designers place greater emphasis on color, consistency, and simplicity, which is associated with the experience accumulated from working on complex projects. In terms of color usage, senior designers are more adept at understanding its subtle role in visual effects and brand development. Regarding consistency, they have a deep understanding of its value in cross-project and cross-platform design. As for simplicity, senior designers, drawing on their extensive practical experience, are better able to eliminate redundant elements and optimize the design decision-making process. In contrast, the high recognition of reusability by junior designers reflects their urgent need to improve efficiency and maintain design consistency during the early stages of project execution.

CONCLUSION

This study, through quantitative analysis, reveals the significant impact of visual elements and design principles on design decision-making within design systems. Color is widely emphasized in design, while icon design requires further optimization for balance. Layout and font are critical to visual effects and information communication, and consistency and simplicity are more influential in design decision-making. Reusability and usability vary according to designer experience.

The findings provide valuable insights for optimizing design systems. Design teams should consider the needs of designers at different experience levels and enhance training to improve design efficiency and user experience. However, this study has certain limitations. The sample size is relatively small, which may affect the generalizability of the results. The research methodology relied solely on surveys, lacking in-depth analysis of actual design cases and long-term follow-up studies. Additionally, the study did not fully account for the potential impact of different cultural backgrounds on designer evaluations, which may overlook the importance of cultural factors in the application of design systems. Future research can expand and refine these areas to deepen the understanding of the relationship between design systems and design decision-making.

REFERENCES

Abdi, M. (2020). Fundamentals of Design Systems. Master's thesis, Department of Computer Engineering, School of Technology and Management.

Konaté, A. (2018). Design Systems at Work: Optimizing design processes and aligning design work to company identity. Master's thesis, Collaborative and Industrial Design, School of Arts, Design & Architecture, Aalto University.

Kholmatova, A. (2017). Design Systems: A Practical Guide to Creating Design Languages for Digital Products.

Majumdar, A. (2023). Designing the Digital Experience: Exploring the Vital Role of Graphic Design in User Interface (UI) Design for the Modern Era. In: Proceedings of International Conference on "Innovation in Visual Arts" (ICIVA'23). pp. 100–106.

Nguyen, G. (2018). Design system: A tool for scaling product design in large technology companies. Haaga-Helia.

Puranen, E. (2023). Evaluating the Global Design System in Its Early Development Phase. Master's thesis, Software and Service Engineering, Master's Programme in Computer, Communication and Information Sciences, Aalto University.

Visnapuu, K. (2023). Consistency, Efficiency, and scalability in Design systems: A comparative Analysis of Material Design, Apple's Human Interface Guidelines, and IBM Design Systems. Independent thesis, Department of Informatics and Media, Uppsala University.

Zhuang, K. L. (2018). Cognitive Load and Decision Accuracy: A Study of Visual Complexity in Data Presentation. International Journal of Business Management and Visuals, 1 (2), 6–9.