# The Study of Gestalt and Cognitive Psychological Theory Influences the Creation of User Interfaces and User Experiences

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## Abstract

*In the rapidly advancing realm of digital technology, the imperative of creating innovative and user-centric interfaces cannot be overstated. This research undertakes a comprehensive exploration of Human-Computer Interaction (HCI), with a specific focus on harnessing the insights derived from gestalt and cognitive psychological theories to redefine the art of user interface (UI) design and elevate user experiences to new heights. One of the pressing challenges in contemporary digital design lies in the unsettling uniformity that characterizes many UIs. The research methodology comprises four distinct phases. The initial phase involves the meticulous crafting of an ideal UI prototype for an e-commerce platform. The second phase entails an exhaustive review and synthesis of UI design theories grounded in Gestalt and Cognitive psychology. The third phase is marked by the assimilation of these theories into the UI design process. Finally, the fourth phase involves the integration of user feedback, a critical step in validating and comparing the ideal UI prototype against the newly developed UIs infused with psychological principles. In conclusion, this research underscores the vital importance of transcending the ordinary in UI design. By harnessing the potential of Gestalt and Cognitive psychological theories, we aspire to dismantle the shackles of design uniformity, providing users with interfaces that are not just personalized but also harmonized with the intricacies of human cognition. In this pursuit, we anticipate a paradigm shift in HCI, where engagement and user-centricity reign supreme, ultimately elevating user satisfaction, productivity, and the overall quality of the digital experience.*

***Keywords: Human Factors, Gestalt Psychology, Cognitive Psychology, User Interface, User Experience***

## I. INTRODUCTION

User interface (UI) design refers to the process of designing the visual and functional components of a digital product or service that enable users to interact with it. The UI design focuses on creating an interface that is intuitive, user-friendly, and aesthetically pleasing. The goal of UI design is to make it easy for users to navigate and interact with the product, ensuring that they have a positive experience. UI design involves the use of various design elements such as typography, color, layout, and imagery to create a visual interface. It is essential to create an interface that is clear, concise, and easy to understand. This means using visual cues that help users navigate the interface and understand what actions they can take. The interface should also be consistent across all pages and screens to provide a cohesive experience.

UI design also involves creating an interface that is responsive and adapts to different devices and screen sizes. This ensures that users can interact with the product regardless of the device they are using. UI designers should also consider accessibility when designing interfaces. This means designing the interface in a way that is accessible to users with disabilities. For example, using color contrast and font sizes that are easy to read.

Human-computer interaction (HCI) has become increasingly complex in the modern world, and the need for effective user interfaces has never been greater. The objective of a designer when creating an interface is to create a system that users of all skill levels can use efficiently and without investing a lot of time in learning how to use it. User interfaces should be created in accordance with human capabilities and limits to achieve this purpose Guidelines and criteria for UI design are not straightforward recipes. Identifying rule applicability and precedence as well as balancing trade-offs when competing rules are necessary for their effective application. Unfortunately, those who create and assess user interfaces sometimes acquire design principles without being aware of their psychological

foundations (John J. Dudley et al., 2018). To address this issue, it is essential to understand the psychological concepts behind human behavior, including how people make decisions, how they think, and how to apply these theories to real-world scenarios to create user interfaces that provide good user experiences. Gestalt and cognitive psychology have a significant role in human behavior, including how people make decisions, how they think, and beyond that how to apply these theories to real-world scenarios and how to design user interfaces (Vitevitch et al., 2019 and Purcell et al., 2011). With the growing complexity of human-computer interaction (HCI), designers are shifting towards self-personalization in User Interface (UI) design. However, current UI design still lacks effective and efficient user experiences, especially for novices. Designers need to create UI systems that users of all skill levels can use efficiently without investing a lot of time in learning how to use them. To achieve this objective, UI design must be based on human capabilities and limitations. Gestalt and cognitive psychology provide insights into how humans perceive, learn, remember, and solve problems, which can help designers create an interface that users can understand well. Pamudyaningrum et al., (2020) study concluded that the UX process in gamification comprises the tangible user interface, constructive and useful feedback, content and storytelling, and how to appreciate the user.

The main objective of this research is to design a user interface that is efficient UI design for users of all skill levels and the application of Gestalt psychology and cognitive theory enhances the user experience and productivity.

## II. RELATED LITERATURE

### A. User Interface Design

The article "A Review of User Interface Design for Interactive Machine Learning" by John J Dudley et al., (2018) explores Interactive Machine Learning (IML), aiming to make machine learning more accessible by involving users in the training process. It highlights the importance of effective interface design for IML but notes a lack of consolidated principles. Network science techniques from cognitive psychology can shed light on various aspects of human cognition, as outlined in "Network Science in Cognitive Psychology" edited by Michael S. Vitevitch (2019). Oded Arazy and Ofer López Claudia (2015) emphasize the efficiency of public persona UI design in "Character Architecture at the

Human Factor Factors in Computing Systems. Sampada S. Marathe's research (2009) delves into UI modifications and their effects on system function. Alena Stadler's study (2018) explores how psychological components influence user behavior in UX and UI design.

### B. Cognitive Psychology Theory for Design Process

The creative cognition approach examines how the human mind generates creative ideas by leveraging basic mental processes. Research within this approach identifies factors like motivation, expertise, and cognitive processes such as divergent thinking. The article on design elements in residential settings for older adults and Alzheimer's patients aims to enhance navigation and well-being using insights from cognitive psychology (Sweller, Ayres and Kalyuga, 2011). Cognitive load theory, discussed by John Sweller et al., (2019), focuses on how learning tasks affect cognitive processing and instructional design. A study on interface modifications and cognitive load by T. Purcell et al., (2012) investigates the impact of interface changes on user performance. This theory underlines the importance of managing cognitive load for effective learning environments. The use of cognitive psychology in studying deep neural networks is explored in a research paper. It adapts a developmental psychology analysis to DNNs, shedding light on their computational properties.

### C. Psychology Theories for Design Process

Purcell et al., (2011) proposed an integration of creativity tools from engineering design and cognitive psychology. This integration can enhance innovation in design processes. Another study explores the role of drawings in design processes, emphasizing the importance of these forms of representation for creativity and innovation. A case study explored the principles of environmental and social psychology in UI/UX design for metaverse social games. This aims to provide a designer with in-depth insights and guidance with metaverse social game interfaces that align with user needs and societal adaptability (Gao B. et al.,2024).

### D. Gestalt Psychology Theory for Design Process

Sarsam et al., (2020) investigate user happiness with UI and suggest altering interface layouts

based on users' personality traits. Sani et al., (2016) explain the use of Gestalt-based design for websites, emphasizing how it reduces uncertainty and enhances user engagement. Paay et al., (2007) apply Gestalt principles to understand the user experience of location-based services. The article "What should a corporate website look like?" discusses how Gestalt principles and visualizations impact user acceptance and recommendation of websites (Ritter, S. et al., 2017). The use of Gestalt theory in instructional screen design is outlined in another article. Gestalt principles are shown to be valuable for organizing information effectively.

In summary, most research on Gestalt and cognitive theories focuses on static interfaces. However, modern UI/UX designs increasingly involve dynamic, interactive elements (e.g., animations, transitions). More research is needed on how Gestalt and cognitive principles apply to dynamic interfaces and how users perceive and interact with such elements in real-time. Creating effective user interfaces is to understand the psychological concepts behind human behavior and apply these principles to UI design. By focusing on the overall structure of the interface, supporting cognitive processes, and personalizing the interface to the user's preferences, designers can create user interfaces that are both efficient and effective for all users.

### III.    METHODOLOGY

The primary objective of this research is to design a user interface that is efficient UI design for users of all skill levels and the application of Gestalt psychology and cognitive theory enhances the user experience and productivity. The application of this concept into the software industry, specifically in web development and mobile applications. The research focuses on designing a user interface (UI) and gathering user feedback to refine and evaluate the effectiveness of the UI.

The methodology can be divided into four core parts:

#### A. First Step - Designing the Initial User Interface:

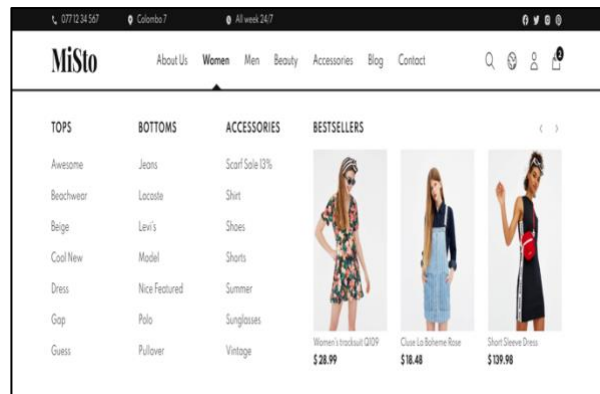The initial UI design for the e-commerce website follows conventional standards (Figure 1).



Figure 01:  Nav menu User Interface module 1

#### B.    Second Step - Incorporating Design Theories:

Combining concepts of Gestalt and cognitive psychology with marketing psychology and basic psychological principles.
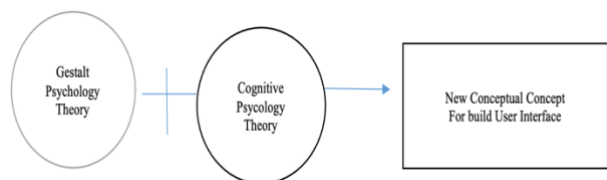


Figure 02:  Incorporating design theories

#### C.  Third Step - Refining the Interface:

The research plan involves incorporating design theories from Gestalt and cognitive psychology into the First Step- Designing the initial user interface. The design team will then collaborate with five developers to further refine the interface based on their ideas about user interface design.
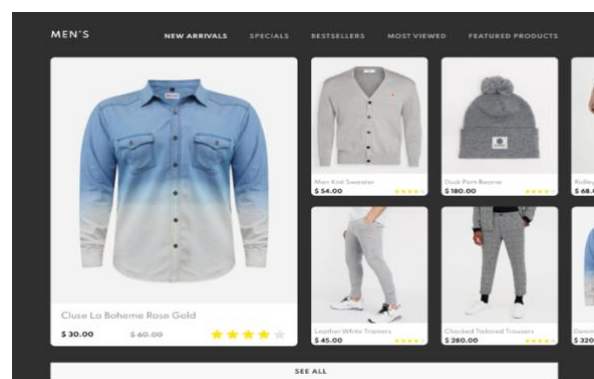


Figure 03:  Gestalt theory proximity

### D. Fourth Step - Gathering Feedback:

In this stage, we aim to gather feedback from users to determine which interface is more effective and accurate. To achieve this, we have created two types of questionnaires.

- UI/UX Questionnaire with Gestalt Psychology Principles: This questionnaire assesses participants' perceptions of visual design elements and usability based on Gestalt psychology principles, such as proximity, similarity, closure, and figure-ground relationship. Seek feedback on how well the UI design aids users in information organization, task completion, and overall user experience.

- Cognitive Concepts Questionnaire with Face-to-Face Conversation: Face-to-face conversations are conducted to delve deeper into participants' cognitive experiences. Open-ended questions explore attention, memory, and decision-making processes. Provide explanations about cognitive concepts, such as attention span, memory encoding and retrieval, and decision-making heuristics, and ask participants to reflect on how these concepts influenced their experience with the UI. Use questionnaires to gather quantitative data, such as ratings or Likert-scale responses, on participants' perceptions of cognitive aspects, including cognitive load, mental effort, and task comprehension.

- By combining these two questionnaires, we can obtain a comprehensive understanding of participants' experiences and perceptions regarding both the visual design and cognitive aspects of the UI. The face-to-face conversation allows for more in-depth exploration of participants' cognitive processes, while the questionnaires provide quantitative data for analysis. This approach enables you to gain valuable insights into how Gestalt psychology principles and cognitive concepts impact the UI design and user experience.

### E. Data analysis method

Google's data analytics program transforms form data. The data was then utilized to create bar charts and pie charts, among other descriptive statistics. The study's objectives were met since the statistical analysis results validated the study's findings, supported its hypotheses, and shed light on its questions.

### F. Population and Sampling

The university students in Sri Lanka are considered in this research study as the population. We use random sampling methods.

## IV. RESULTS AND DISCUSSION

This section presents the results obtained from user and developer feedback through questionnaires, along with an analysis of the findings in the context of Gestalt and cognitive psychology principles. By incorporating these psychological principles into the user interface (UI) design, the research aims to enhance both user satisfaction and overall usability.

The results from the first questionnaire, which gathered responses from 100 participants, revealed that 65% of users responded positively to the methodology employed in the UI design (Table 01). The approach focused on applying Gestalt psychology principles like proximity, similarity, and closure, which were generally well-received because they made the interface easier to understand and navigate.

### A. User Feedback on Color Schemes and Visual Design

One of the most prominent findings from the user questionnaire was the strong preference for light mode over dark mode. As shown in Table 02, 58% of users preferred a light color scheme, while only 26% preferred a dark mode and 16% expressed no preference. This preference emphasizes the importance of high contrast and readability in digital interfaces, particularly in varying lighting conditions.

Moreover, the psychological impact of color schemes became evident, as 66% of users acknowledged that color schemes influenced their purchase decisions (Table 01). This finding indicates that color choices are not only aesthetic but also functional, affecting user engagement, emotional responses, and decision-making processes, especially on e-commerce platforms. The psychological influence of color was further substantiated by 46% of users feeling more confident when interacting with interfaces that aligned with their color preferences, and 38% reporting that color influenced their emotions and mood. These insights suggest the necessity for designers to consider both the aesthetic and emotional effects of color when crafting a user interface

### B. Gestalt Principles: Most Favored and Criticized Aspects

The results also highlighted user feedback on the application of Gestalt principles:

- Proximity and Closure: 70% of users appreciated the use of these principles, as they helped in organizing the interface more logically, enhancing ease of use (Table 01).
- Similarity Principle: However, 25% of users critiqued the overuse of similarity, as it made differentiating between interactive areas difficult.

## C. Impact on Emotions and Behavior

Users indicated that UI colors influenced their emotions and behavior. As noted earlier, 46% felt more confident and 38% pointed out that color had a significant effect on their mood (Table 01). 66% of users reported that the color scheme influenced their purchasing decisions. This finding underscores the importance of aesthetic choices in e-commerce platforms.

## D. Background Color and Usability

58% of users agreed that background color significantly impacted readability and usability, emphasizing the need for designers to carefully select background colors that enhance content visibility (Figure 04).

Table 01: First Questionnaire Results and Discussion

| Question | Results | Discussion |
|---|---|---|
| 1:Color Scheme Preference | Light Mode – 58% Dark Mode - 26% No Preference – 16% | Substantial portion of users prefer a light color scheme |
| 2: Influence of Color Scheme | Influences their purchase decisions -66% | Significance of color choices in UI design. |
| 3: Influence on Purchasing Behavior | Feel more confident – 46% Influence their emotions and mood – 38% | Psychological impact of color on user behavior |
| 4: Matching Color Scheme with Brand Identity | Agreed – 31% Disagreed – 44% Unsure – 22% | No overwhelming consensus on this aspect, suggesting that further exploration and consideration of the brand's specific context may be necessary |
| 5: Background Color Impact on Readability and Usability | Agreed – 58% Disagreed – 22% Unsure – 20% | Emphasizing the importance of selecting background colors that enhance content visibility and usability |

| 6 – 15: Comparing User Interface Designs | a strong preference among users for certain design options, highlighting the importance of considering user feedback in the UI design process. | |

## E. Developer Feedback on UI Design

The second questionnaire, which gathered responses from developers, provided insights into satisfaction rates and preferences. 60% of developers found the UI design "average," and 40% were satisfied. The balanced feedback shows that developers had mixed opinions, with some favoring certain UI elements while others suggested improvements (Table 3).

## F. Necessity of Sections in UI

A 50-50 split was observed among developers regarding the necessity of certain sections in the UI (Table 03). This suggests a division of opinion on which sections are vital versus unnecessary in user interface design.

Table 02: Question 1 Color Scheme Preference Result

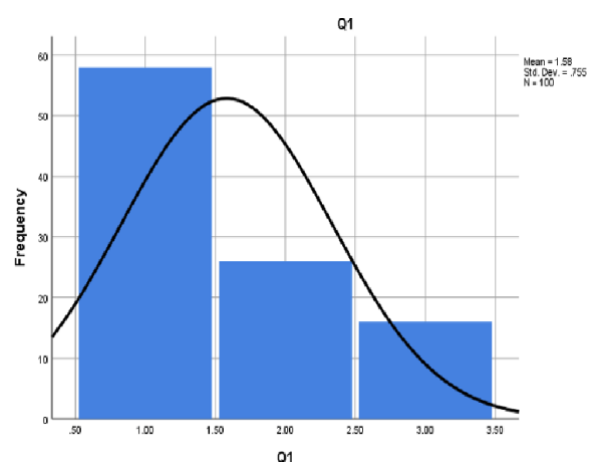| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Light mode | 58 | 58.0 | 58.0 | 58.0 |
| | Dark Mode | 26 | 26.0 | 26.0 | 84.0 |
| | I have no preference | 16 | 16.0 | 16.0 | 16.0 |
| | Total | 100 | 100.0 | 100.0 | 100.00 |



Figure 04: Explains the Table 2 Data in the Bar chart Format

## G. Background Color Preference

80% of developers preferred the green background color, reflecting a preference for environmentally friendly and visually appealing designs (Table 03). This finding aligns with the user's feedback, further emphasizing the importance of background color in both usability and aesthetic appeal.

The overall satisfaction and usability feedback indicated that UI Design 02 was more highly regarded than UI Design 01 in terms of usability. 70% of developers found UI Design 02 to be more usable than UI Design 01, pointing to its superior layout and ease of use. This highlights that developers preferred UI Design 02 due to its intuitive interface, better functionality, and user-friendly design elements. The overall satisfaction rate regarding design elements hovered around 70%, showing that while developers generally favored UI Design 02, there was still a portion who either found it average or believed further refinements were necessary.

Table 03: Developer Feedback on UI Design

| Question | Results | Discussion |
|---|---|---|
| 1: Satisfaction Rate | Satisfy: 40% Average: 60% | 60% prefer "Average" in this aspect of UI design. |
| 2: Necessity of Certain Sections | Good to have unnecessary Section - 50% Necessary Section - 50% | A 50-50 split between these two options. |
| 3: Necessity | Yes - 60% No - 40% | 60% believe it's necessary, 40% say it's not. |
| 4: Division of Opinion | Yes - 50% No - 50% | An equal division in responses. |
| 5: Background Color Preference | Background green Color - 80% Middle Picture - 20% | 80% prefer "Background green color." |
| 6: General Agreement | Yes - 30% No - 70% | 70% say "No" and 30% say "Yes." |
| 7: Image Comparison | Image 1 - 70% Image 2 - 30% | 70% favor "Image 1" in this comparison. |
| 8: Ui Design Preference 1 | UI Design 01 - 20% UI Design 02 - 80% | 80% prefer "UI Design 02." |
| 9: UI Design Preference 2 | UI Design 01 - 80% UI Design 02 - 20% | 80% favor "UI Design 01." |
| 10: UI Design Preference 3 | UI Design 01 - 50% UI Design 02 - 50% | An equal split between "UI Design 01" and "UI Design 02." |

| | | |
|---|---|---|
| Overall Satisfaction and Usability | | UI Design 02 has 70% better usability than UI Design 01. The overall satisfaction rate with the design elements was around 70%, indicating diverse preferences and sentiments among developers regarding the design elements discussed during face-to-face conversations. |

## V. CONCLUSION

This research embarked on a comprehensive exploration of Human-Computer Interaction (HCI), with a specific focus on harnessing insights derived from Gestalt and Cognitive psychological theories to redefine the art of user interface (UI) design and elevate user experiences to unprecedented levels. This research has successfully met its main objective, which was to design a user interface that is efficient and user-friendly, catering to users of all skill levels. By leveraging principles from Gestalt and Cognitive psychology, we've managed to enhance the user experience and productivity. Our investigation was driven by a profound commitment to harness the rich resource of Gestalt psychology, which elucidates how the human mind organizes and interprets information. Additionally, we sought to leverage insights from Cognitive psychology, especially in the domains of attention and memory, to engineer UIs that are not just efficient but also aligned with the cognitive processes of users.

REFERENCES

Arazy, O., Nov, O. and Kumar, N. (2015) "Personalization: UI Personalization, Theoretical Grounding in HCI and Design Research". AIS Transactions on Human-Computer Interaction, 7(2), pp. 43-69.

Gao, B., Xie, H., Wang, Y. and Xie, Z. (2023) "Principles of environmental and social psychology in UI/UX design for metaverse social games: A case study of Horizon Worlds". Environment and Social Psychology, 9(1), pp. 1-16. doi: 10.54517/esp.v9i1.1871.

John, J. D. and Per Ola Kristensson. (2018) "A Review of User Interface Design for Interactive Machine Learning". ACM Trans. Interact. Intell. Syst. 8, 2, Article 8 (June 2018), 37 pages. doi: org/10.1145/3185517.

Marathe, S.S. (2009) "Investigating the psychology of

task-based and presentation-based UI customization". In Conference on Human Factors in Computing Systems - Proceedings, pp.3129-3132.

Paay, J. and Kjeldskov, J. (2007) "A Gestalt theoretic perspective on the user experience of location-based services". In Australasian Computer-Human Interaction Conference, OZCHI'07, pp.283-290.

Pamudyaningrum, F.E. (2020) "UI/UX Design for Metora: A Gamification of Learning Journalism Interviewing Method". E3S Web of Conferences, 188(6), DOI: 10.1051/e3sconf/202018800008.

Purcell, T. and Gero, J.S. (2011) "Creativity tools in engineering design and cognitive psychology". Design Studies, 32(3), pp.278-289.

Purcell, T. and Gero, J.S. (2012) "Interface modifications and cognitive load". Cognitive Psychology Journal, 55(4), pp.420-433.

Ritter, S., et al. (2017) "Cognitive psychology for deep neural networks: A shape bias case study". 34th International Conference on Machine Learning (ICML), 6, pp.4510-4519.

Sani, S.M. (2012) "Minimalism in designing user interface of commercial websites based on Gestalt visual perception laws (A case study of three top brands in technology scope)" In 2016 2nd International Conference on Web Research, ICWR 2016, pp.115-124.

Sarsam, S.M. (2018) "A First Look at the Effectiveness of Personality Dimensions in Promoting Users' Satisfaction With the System", SAGE Open, 8(1).

Stadler, A. (2022) "How psychology can be used to influence user behavior in UI and UX design. Journal of Design and Innovation", 34(2), pp.41-50.

Sweller, J., Ayres, P. and Kalyuga, S., (2011). Cognitive Load Theory. Springer.

Sweller, J., et al. (2019) "Cognitive Architecture and Instructional Design: 20 Years Later". Educational Psychology Review, 31(2), pp.261-292, doi:10.1007/s10648-019-09465-5.

Vitevitch, M.S. (2019). Network Science in Cognitive Psychology. Routledge, doi:10.4324/9780367853259.