

SYNTACTIC DESIGN AND GESTALT JUDGMENTS: EMPIRICAL ANALYSIS OF INTUITIVE ACTIVATION AND COGNITIVE PROCESSING

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Received: February 28nd 2026

Accepted: March 25th, 2026

Published: March 31st, 2026

ABSTRACT

This research investigates how syntactic design elements intuitively activate Gestalt judgments, clarifying the relationship between visual syntactics and cognitive perception. Despite growing interest in design-cognition interplay, a notable gap exists in understanding specific methods for activating these judgments effectively within syntactic design. This study addresses this by empirically analyzing how specific design elements influence intuitive Gestalt perceptions and their impact on cognitive processing. Utilizing a mixed-methods approach, the research combines qualitative user experience data with quantitative eye-interaction and response time measurements. This dual methodology provides a comprehensive understanding of user perceptions and offers empirical evidence of design effectiveness. The Design Protocol Analysis (DPA) technique organizes the design process into three levels: abstract, semi-concrete, and concrete. This structure facilitates a systematic exploration of various influencing factors and the interconnections between design elements. Key findings demonstrate that coherent syntactic arrangements significantly enhance designers' abilities to recognize patterns and meanings, leading to faster response times and increased accuracy. Participants exhibited longer fixation times on Gestalt-consistent elements, indicating deeper cognitive engagement. This study not only contributes empirical evidence to cognitive design literature but also provides practical guidelines for integrating Gestalt principles into design practices. Ultimately, this framework enhances user engagement and information retention, fostering better decision-making and comprehension across various design applications.

Keywords: product gestalt; product perceptual experience; design protocol analysis

1. INTRODUCTION

The wide range of design disciplines and their various methodologies has prompted experts to develop and classify different design process models. These models originate from both engineering and other design fields, each emphasizing specific elements of the design process. While these models are generally systematic and structured, there are notable differences in their understanding and application across different design communities. These differences become especially apparent when comparing how novice and experienced designers, whether working individually or in teams, use and adapt these general models to fit their specific design practices. The relationship between cognitive psychology and design principles has attracted significant interest in recent years, especially regarding visual communication and user experience. Gestalt psychology provides essential theories that explain how people perceive and interpret their surroundings. It emphasizes that humans naturally organize visual stimuli into cohesive, meaningful wholes instead of viewing them as separate parts. This principle is especially relevant in today's digital landscape, where efficient communication has become increasingly important. As users are bombarded with information, understanding how design can effectively evoke Gestalt judgments is crucial for successful interaction. However, the application of Gestalt principles in the design process is often insufficiently explored. This leads to a significant research problem: there is a need for a deeper investigation into how specific design elements can trigger these intuitive perceptions among users. The objectives of this study are threefold: first, to identify which design elements most significantly impact Gestalt perceptions; second, to analyze how these design elements affect user cognitive processing; and third, to establish guidelines for implementing effective design strategies that align with Gestalt principles.

This dissertation aims to achieve specific objectives that will enhance the existing body of knowledge. It will provide empirical evidence and practical recommendations for designers and educators in areas such as web design, graphic communication, and user interface technology. The importance of this research is highlighted by the increasing demand for intuitive interfaces that enable smooth interactions between users and digital platforms. An understanding of how to leverage Gestalt principles through thoughtful design can enhance user engagement, resulting in a more satisfying user experience. Furthermore, the practical implications extend into various domains, including healthcare education and marketing, where clear communication can lead to improved comprehension and retention of critical information. For instance, the use of effective visual aids that are informed by Gestalt principles can greatly enhance patient education materials, as evidenced in studies analyzing the role of visual syntax in comprehension. By synthesizing these insights, this research aims to establish a comprehensive framework for improving the intuitive activation of Gestalt judgments, ultimately enhancing user experiences across various applications.

1.1 Background and context: Design form and design meaning

The study of visual perception has been significantly shaped by the principles of Gestalt psychology (Wagemans et al., 2012). This theory suggests that humans

naturally strive to organize visual stimuli into coherent wholes instead of viewing them as isolated elements. Understanding this psychological framework (see Figure 1) is essential for comprehending how individuals engage with complex visual environments, particularly in terms of design form and design meaning. Design form refers to the visual and physical characteristics of a design object, including its shape, color, proportion, texture, and overall composition. It shapes user perception and interaction and often mediates between aesthetic appeal and practical usability. (Dorst & Vermaas, 2005; Kang et al., 2019). While design meaning is the value and interpretation users associate with a product. It involves emotional, cultural, and symbolic aspects that influence how people connect with, understand, and respond to a design (Yinuo et al., 2024). Recent studies emphasize that meaning is intentionally constructed by designers and interpreted by users within specific contexts."(Yaldiz & Bailey, 2019). For instance, effective visual designs can enhance learning and retention of information, as demonstrated in the analysis of patient education materials that utilize Gestalt principles to improve comprehension.

As digital technology advances, the application of Gestalt principles in syntactic design becomes increasingly relevant, particularly regarding how these designs impact cognitive processing and user engagement. Despite this relevance, the research problem arises from a notable gap in empirical studies exploring the intuitive activation of Gestalt judgments within syntactic design, specifically regarding which design elements can elicit these perceptual processes effectively.

The main goals of this research are to identify specific syntactic design elements that influence Gestalt perceptions, analyze their effect on cognitive processing speed and accuracy, and develop practical design guidelines based on these findings. Significantly, understanding the interplay between visual syntax and cognitive perception has crucial implications not only for academic theories but also for practical applications across various domains.

Furthermore, the integration of compelling visual design informed by Gestalt theories can invigorate user interfaces and enhance user experiences in digital environments. This research aims to enhance our understanding of how syntactic design can utilize Gestalt principles to facilitate more intuitive interactions for designers. By addressing the gaps identified in the existing literature and concentrating on practical applications, this study seeks to make a meaningful contribution to the field. The implications extend far beyond theoretical discussions, promoting the adoption of these insights in real-world applications that prioritize designer engagement and information retention, thus ensuring a more effective communication of ideas across various disciplines.

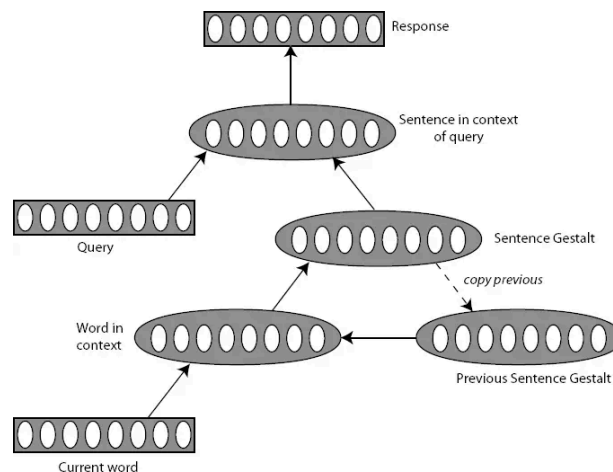


Figure 1. Flowchart illustrating query-response relationships in language processing.

1.2 Research Problematicization: Syntactic Design and Gestalt Formation

The complex relationship between design and cognition has been a central focus of research, especially in the field of product design. Gestalt psychology lays the groundwork for understanding how users process visual information through intrinsic principles that govern perceptual organization. Despite the proliferation of digital interfaces and design strategies that claim to leverage these principles, empirical evidence on the specific elements of syntactic design that intuitively activate Gestalt judgments remains scarce (Warell, 2001). This research problem is particularly pressing, as designers often lack a clear framework for implementing effective syntactic designs that facilitate intuitive designer interactions, leading to suboptimal experiences and hindered comprehension of critical information. To address this gap, the primary objectives of the study include identifying and analyzing the syntactic design elements most conducive to activating Gestalt judgments, assessing their impact on cognitive processing speed and accuracy, and establishing practical design guidelines based on the findings.

The significance of this research becomes increasingly apparent when considering its potential to deepen designer engagement and enhance information retention through improved design communication strategies. One effective approach involves leveraging powerful visual aids, guided by the principles of Gestalt psychology, which can significantly augment the understanding of complex concepts. This is particularly vital in the realm of product perceptual experiences, where the way design communicates information can make all the difference. As demonstrated in Figure 2, employing these Gestalt principles allows designers to craft visual representations that do more than just convey information; they actively engage the audience, transforming intricate ideas into accessible and memorable experiences. By making concepts clearer and more engaging, these strategies not only facilitate understanding but also foster a greater emotional connection with the material presented.



Figure 2. The Framework of Perceptual Product Experience (PPE) includes core modes in the center, with two dimensions of presentation on the left and representation on the right, along with submodes. (Source: Warell, 2008)

Moreover, this research offers important insights into how design influences cognitive responses, enabling practitioners to create more effective visual narratives. Much of the existing research debates the non-linear processes involved in design methods when developing forms. Ultimately, focusing on the intuitive activation of Gestalt principles through syntactic design will impact how designers engage with influencing factors during product development, as well as how information is communicated effectively. This, in turn, fosters better decision-making and understanding throughout the designer's thinking process, as illustrated in Figure 3. This research aims to fill a gap in the literature by providing a thorough exploration of the mechanics behind visual syntax and its cognitive implications, significantly contributing to both theoretical frameworks and practical design solutions.

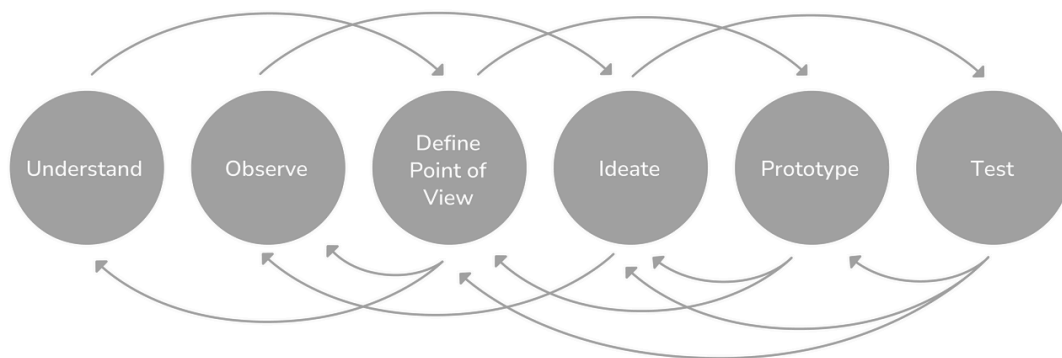


Figure 3. A non-linear process in design methods, this leads to uncovering the “mysterious” way of thinking (Hasso Platner n.d.)

During the iteration in the Design Thinking process, designers normally exercise the design process through a six-phase iterative development cycle, embracing a culture that values learning from every iteration. Throughout the innovation process, designers encourage pushing the boundaries of what's technically feasible, always keeping the user at the core. This user-centric approach allows designers to leverage both analytical insights and creative problem-solving. While they work in a team, it's crucial to align on the necessary iterations for each phase, continuously optimizing solutions step by step. The designer intentionally process culminates in the creation of a realistic, testable prototype

2. LITERATURE REVIEW

In a world increasingly dominated by visual culture and digital communication, the intersection of language and visual aesthetics has garnered significant scholarly attention. This convergence is particularly salient in the fields of design and cognitive psychology, where an understanding of how designers intuitively process and interpret visual stimuli is crucial. At the heart of this exploration is the concept of gestalt judgments, which describes the cognitive processes allowing humans to perceive entire entities rather than just the individual components. The activation of these judgments through thoughtful syntactic design, arranging visual elements in a way that aligns with linguistic and cognitive patterns, has emerged as a key area of interest among researchers aiming to enhance user engagement and comprehension in various contexts, from design form to design meaning (Abidin, 2008; Anwar, 2016; Vermol, 2018, and Siran, 2020). As creating product gestalt becomes more sophisticated, the need for intuitive design that leverages these gestalt principles has never been more pressing (Raif et al, 2021; Haliza et al., 2022). Syntactic design critically influences gestalt responses through visual cues and structuring, aiding cognitive processing (Lankau R et al., Wagemans J et al.). Elements like line, shape, and color evoke specific gestalt judgments, guiding user behavior and boosting retention (Kamaruddin et al. 2024; Guo R et al. 2024). However, there's a need to understand how diverse demographics interpret these design principles (Hagbin et al. 2023).

2.1 Gaps and Future Directions in Syntactic Design and Gestalt Perception Research

Even with extensive research, key gaps persist. There's limited exploration into which specific syntactic structures most effectively trigger Gestalt judgments across diverse user demographics and contexts (Burch et al. 2023). Existing studies also lack a comprehensive framework for how these judgments synergistically operate in multimodal environments where text and images coexist (Jacob RJ et al. 2002; Kumar A et al. 2025; Siran et al, 2025). This framework is vital given the increasing complexity of design interfaces and the layered information's impact on user comprehension (Anwar et al, 2015; Kaneda, 2024). Furthermore, contemporary research overlooks the influence of emerging technologies like AR and AI on gestalt activation, which could offer new design insights (Tessler et al. 2024; Gangling et al., 2023; Elwyn et al.2012).

In summary, although existing research has advanced our understanding of the interaction between syntactic design and gestalt judgments, there is still a pressing need for further investigation to fill the identified gaps. By synthesizing current findings and examining under-researched areas, this literature review aims to offer a comprehensive understanding of how intuitive activation of Gestalt judgments can be achieved through syntactic design. Such an understanding is pivotal for practitioners seeking to optimize design strategies that resonate with diverse audiences, ultimately shaping more effective and engaging visual communications (Goyal M et al., 2024; Kumar, 2024; Schwabe, 2024; Nassiri et al., 2024). As this review progresses, it will analyze existing studies critically, highlight significant themes, and suggest pathways for future research, thereby establishing a more comprehensive understanding of this complex relationship within the realms of design and cognition.

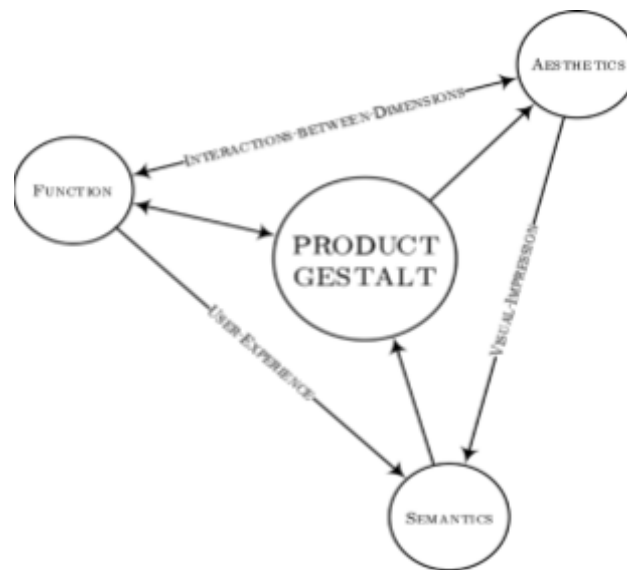


Figure 4. Three axes of the design process with product form (Homburg, 2015).

The exploration of intuitive activation of Gestalt judgments through syntactic design has evolved significantly over the last few decades, informed by foundational theories and empirical findings. Initially, early research centered on the principles of Gestalt psychology, emphasizing how visual perceptions are organized in coherent patterns, leading to insights into design practices (Dehaghin, 2023; Stern, 2023). This foundational understanding laid the groundwork for more recent investigations that link syntactic structures in design with user perception and cognitive processing (Gamboa et al. 2023). On the other hand, the three axes of the design process revolve around product form as the central element. This study prioritizes the Gestalt principles as key descriptors of product form and aims to bridge the gap between aesthetics and functionality. It measures the impact of these principles on participants' preferences, as illustrated in Figure 4.

2.2 Evolution and Interconnected Themes in Gestalt Judgment Research

As the field progressed, scholars began to investigate how specific syntactic features could enhance or hinder intuitive judgments. For instance, studies demonstrated that well-structured layouts facilitate quicker cognitive responses, ultimately impacting user satisfaction and engagement (Malinauskas, 2018; Lankau et al., 2026). Further developments highlighted the interplay of visual hierarchy and syntactic consistencies in guiding users' attention, a theme frequently explored in recent literature (Shimin et al. 2023; Yinuo et al. 2022). Recent advances have also incorporated interdisciplinary perspectives, merging insights from cognitive science with design principles, revealing how intuitive judgments are modulated by syntactic cues in varying contexts (Guo R et al.). Such interdisciplinary approaches have enriched the understanding of how design affects perception, as articulated in multiple recent studies (Haghbin et al.)(Burch et al.). Meanwhile, the continuous evolution of abstraction design has necessitated ongoing research into how syntactic design facilitates or obstructs intuition, ensuring the relevance of the topic remains robust (Anwar et al, 2016). The chronological development of this discourse indicates a deepening recognition of the need for designs that support cognitive

processing, which in turn shapes user experience in complex design situations. Collectively, these works underscore a dynamic interplay between gestalt principles and syntactic design, positioning the narratives of user perception at the forefront of contemporary discussions.

The exploration of intuitive activation of Gestalt judgments through syntactic design reveals several interconnected themes that elucidate the cognitive processes underlying perception. Notably, the relationship between syntactic structure and cognitive load emerges as a significant theme. Research indicates that effectively designed syntactic frameworks can reduce cognitive burden, facilitating quicker gestalt judgments, as demonstrated in a study that highlighted the role of clarity in syntax on user comprehension. This insight is corroborated by findings that suggest simpler syntactic arrangements encourage intuitive responses, thereby enhancing the viewer's ability to grasp essential information swiftly.

Another noteworthy theme revolves around the interplay between perception and emotional response, where studies have shown that aesthetically pleasing syntactic designs can evoke positive emotional reactions, subsequently influencing cognitive processing (Gamboa et al. 2023). The literature presents compelling evidence that emotional engagement, triggered by design elements, fosters deeper intuitive connections with the content (Malinauskas, 2018). Moreover, the significance of cultural context in shaping gestalt judgments through syntactic design cannot be overlooked. Research emphasizes that cultural variations inform how individuals interpret and react to syntactic cues, leading to diverse cognitive outcomes across different demographic groups.

2.3 Methodological Approaches and Theoretical Frameworks

In their 2022 study, Raif et al. delve into the intricate relationship between cognitive psychology and design theory, shedding light on a significant intersection that exists between these two fields. They propose that a thorough understanding of Gestalt principles, particularly within the context of syntax, not only bolsters intuitive understanding but also contributes to creating a more immersive and enjoyable user experience. Their synthesis of findings emphasizes the critical need for ongoing research into how syntactic elements can be thoughtfully employed. This strategic utilization, they argue, has the potential to significantly enhance the intuitive activation of Gestalt judgments, impacting a wide range of applications across various domains.

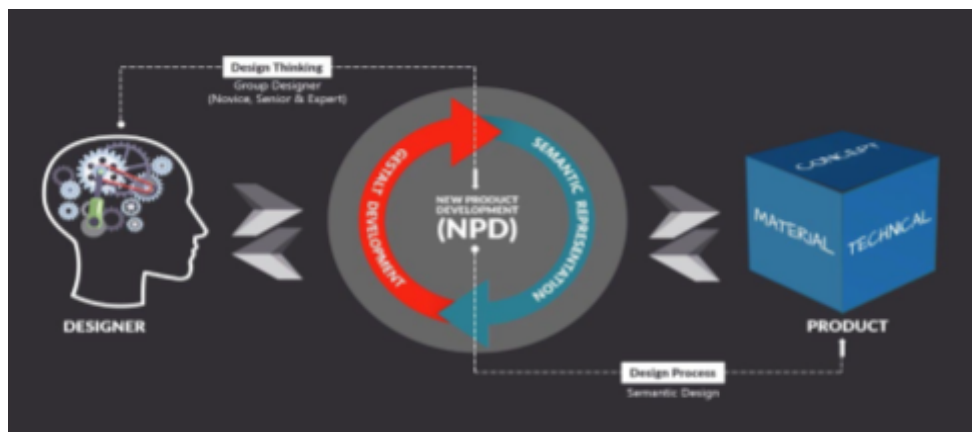


Figure 5. Framework for Innovating New Products via Gestalt Development and Semantic Representation (Raif et al, 2022)

The exploration of intuitive activation of Gestalt judgments through syntactic design reveals varied methodological approaches that contribute to understanding this complex phenomenon. Several studies have employed qualitative methodologies, emphasizing the personal and subjective nature of visual perception, as shown in the work of Figure 5. This framework explains how design activities are structured in this research. It emphasizes the design thinking process, specifically Gestalt principles and semantic representation in industrial ceramic design. It demonstrates how three essential elements, which are concepts, materials, and technical parameters, interact to shape the final design. Vermol's (2018) and Siran (2020) findings suggest that individuals rely on instinctual responses to visual stimuli, supporting the idea that syntactic design influences intuitive judgments. Quantitative studies, such as those by Raif (2025) and Shimin (2025), have provided empirical evidence demonstrating how specific design elements can be operationalized to measure their effects on perception. These findings highlight the divergence between qualitative insights and quantitative validation, underscoring the necessity of employing mixed methods to capture the full spectrum of Gestalt principles in design.

The theoretical underpinnings of intuitive activation of gestalt judgments through syntactic design reveal rich intersections across various scholarly perspectives. Central to this discourse is the notion that Gestalt principles significantly impact visual perception, as articulated by a plethora of researchers who emphasize the role of syntactic structures in shaping intuitive understanding. These principles are often reinforced through cognitive theories that explore how humans process complex stimuli, demonstrating that our brains favor organized structures over disorganized inputs. Moreover, some studies challenge the absolutism of traditional Gestalt principles, arguing that cultural and contextual elements mediate these visual experiences. This divergence is explicated in recent critiques that highlight variances in gestalts across different design contexts (Lankau et al.2026; Guo et al. 2924). Such findings suggest that adherence to classic Gestalt theories may overlook nuanced, culturally-informed interpretations that also drive perceptual judgments.

The integration of cognitive load theory further complements this discussion, positing that syntactic design plays a pivotal role in reducing cognitive overload, thereby facilitating more effective gestalt processing. By fostering an environment conducive

to intuitive judgments, design can harness these cognitive efficiencies, making the theoretical links between syntax and gestalt judgments not only plausible but essential for art and design practitioners (Anwar, 2016). Moreover, while various methodological approaches, including qualitative and quantitative analyses, have provided valuable insights, a more integrated method is necessary to create a holistic view of the intuitive processes involved (Elwyn et al. 2012).

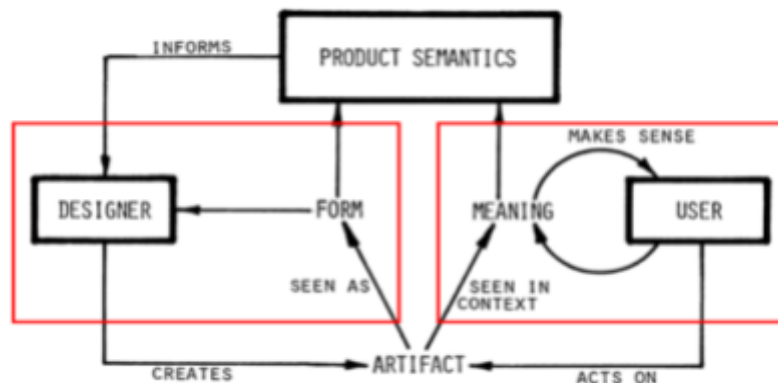


Figure 6: The interaction among designers, users, and artifacts significantly influences the semantics of products.
(Source: Krippendorff, 1989)

Figure 6 shows that strong product perception is often shaped by Gestalt principles. Clear grouping of design components improves the overall impression of a product. However, product development goes beyond just visual arrangement; it involves expressing the meaning behind the design. Intuition plays a key role, as it allows us to make judgments or assign meaning without conscious, step-by-step thinking, often based on subconscious pattern recognition and past experiences.

As a summary, the intuitive activation of gestalt judgments through syntactic design presents a rich tapestry of cognitive, emotional, and contextual dimensions that shape visual perception. As this review illustrates, addressing the identified gaps through future empirical and exploratory research will not only refine design practices but also contribute to an enriched understanding of human cognition in the product design realm. By leveraging insights from diverse angles, ranging from cognitive psychology to design studies, designers and researchers alike can forge new pathways that enhance user experience and engagement. Therefore, future inquiries must seek to bridge theoretical frameworks with practical applications, ensuring that the design strategies resonate with an increasingly diverse and interconnected user base, ultimately fostering more intuitive and impactful design communications.

3. METHODOLOGY

This research aims to investigate how syntactic design elements intuitively activate Gestalt judgments, clarifying the link between visual syntactics and cognitive perception. It seeks to resolve this by analyzing qualitative designers' experience data and quantitative eye-interaction/response time measurements, assessing design approaches' effectiveness in eliciting Gestalt interpretations. Given growing interest in design-cognition interplay, a gap exists in understanding specific methods for activating Gestalt judgments through syntactic designs. The methodology will

develop a framework for analyzing these elements and identify strategies for enhancing user engagement via product gestalts. By integrating visual and linguistic aspects, the study will bridge theory and practice, illuminating how design choices foster intuitive responses. This research uses a mixed-methods approach, integrating qualitative and quantitative analyses, based on previous research highlighting the necessity for a comprehensive understanding of user interaction. Qualitative methods have provided in-depth insights into user perceptions, while quantitative measurements offer empirical data supporting the effectiveness of specific syntactic designs. This dual approach allows for a robust evaluation of how design choices influence Gestalt judgments, strengthening the research's relevance in design discourse. Utilizing eye-interaction (Siran, 2020) and user surveys (Shimin, 2025), the study aims to generate quantifiable data on designer engagement and real-time perception, an often-overlooked area. The expected outcome is a framework that identifies effective syntactic designs and articulates the underlying cognitive processes in designer interactions. This rigorous methodology advances both theoretical and practical applications of design strategies influenced by cognitive processes and visual perception.

3.1 Research Design

This dual methodological approach draws on established practices in cognitive science while adapting them to the unique context of visual syntactic design, thus enhancing the reliability and validity of findings. The significance of this research design extends beyond theoretical contributions; it presents practical applications for designers aiming to optimize designer experiences through intentional syntactic choices in visual communication. This research design stands to offer robust insights into how Gestalt principles manifest behaviorally in response to syntactic design. For example, existing literature suggests that integrating qualitative findings from user interviews can complement quantitative data derived from eye-tracking studies, thus providing a richer narrative about user interactions. Such integration emphasizes the importance of creating a structured framework that effectively captures the nuances of cognitive responses to design.

This research design is practical, offering designers a detailed roadmap for applying Gestalt principles through syntactic choices in visual environments. It contributed to the development of best practices in visual design that enhance cognitive engagement, thereby advancing both the field of design and the understanding of cognitive processes.

3.2 Data collection techniques

According to Aikenhead (1997), empirical-analytic assessment plays a vital role in certifying the development of national policies and ensuring social control within educational environments. This research focuses on the field of product design research and development, specifically aiming to enhance designers' understanding of how to effectively communicate with blind users regarding the products they create. Abidin (2012) illustrates the application of empirical data techniques by guiding the interpretation of sketches through a series of sequential representations of transformed forms. These visual elements of design are essential; they contribute significantly to the overall attributes that define a product's development by providing

a sense of volume and coherence through the thoughtful integration of key design principles and elements. The effectiveness of the empirical research method in studying design activities has been well established. This was notably emphasized during the Delft Protocol Workshop '94 (Cross et al., 1996), where participants observed that a growing number of researchers are adopting empirical methods to gain insights into the design process. Cross et al. (1996) further emphasize this perspective, pointing out that observational research is particularly advantageous for empirical studies since it offers a deeper understanding of the cognitive abilities employed by designers during the creative process.

When developing a design framework for a mixed-methods study, it is essential to consider four key aspects that typically influence the involved procedures: (1) timing, which refers to the scheduling of qualitative and quantitative components; (2) weighing, which involves determining the relative importance of each method; (3) mixing, which is the integration of qualitative and quantitative data; and (4) theorizing, which pertains to the theoretical framework guiding the study (Creswell, 2009, p. 207). These aspects play a crucial role in the planning and execution of a mixed-methods approach, as illustrated in Figure 6. The key points emphasized by Creswell can be summarized as follows:

<i>Timing</i>	<i>Weighing</i>	<i>Mixing</i>	<i>Theorizing</i>
No Sequence concurrent	Equal	Integrating	Explicit
Sequential- Qualitative first	Qualitative	Connecting	
Sequential- Quantitative first	Quantitative	Embedding	Implicit

Figure 6. Four key components of mixed methods design (Source: Creswell (2009))

3.3 The design task through Design Protocol Analysis (DPA)

Based on Cash's (2012) model, Figure 7 illustrates an observational design study technique, structuring the design process into three levels: abstract, semi-concrete, and concrete. This set-up enables systematic exploration of influencing factors, reveals interconnections between design elements, and illuminates designers' decision-making from concept to final product. This DPA is a structured approach, providing a systematic framework to reliably evaluate design thinking and decision-making. The study also connects theoretical design with practical applications, examining how designers manage constraints, adapt to challenges, and use feedback. This offers deeper insights into iterative design thinking, benefiting academic discourse and providing practical guidance for educators and industry professionals to refine product development strategies. The revised framework thus remains dynamic, adaptable, and relevant to modern design.

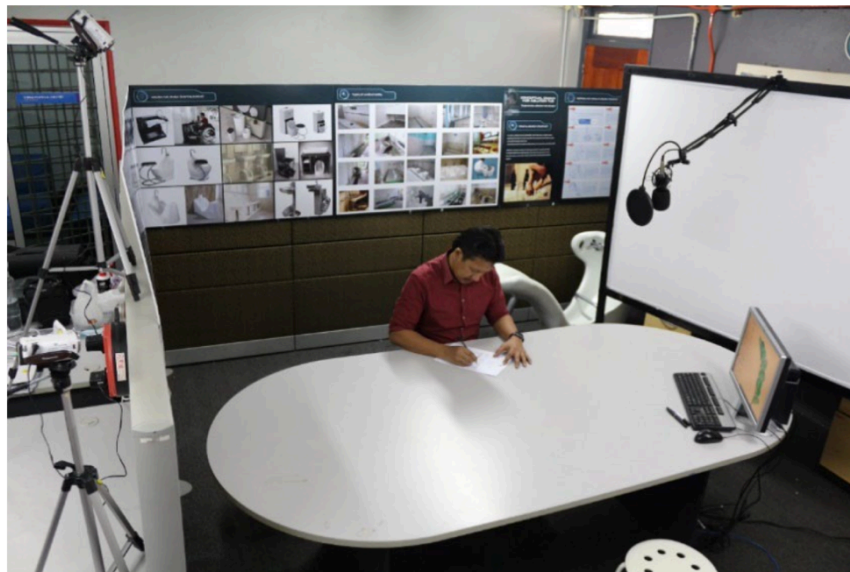


Figure 7: The setup of the Design Protocol Analysis (DPA) experimentation lab.

During the Design Process Analysis (DPA), the design activities follow a structured approach that allows designers to visualize their ideal solutions through drawings (Abidin et al., 2013). Based on the theoretical framework presented by Lloyd et al. (1996), the drawing experiment is divided into three distinct stages: abstract, semi-concrete, and concrete levels, with the design task focusing on an ablation product. Participants are divided into three groups, which is novice, intermediate, and senior designers, and have a total of 35 minutes to complete the entire task. This session provides insight into how designers approach problem-solving, influenced by several factors, including their understanding of the task brief, their effective use of reference materials, and the specific challenge of designing an ablation tub for a designated ablation space. Additionally, the management of time across the three drawing stages is evaluated. The study also includes an analysis of the designers' eye movements during the drawing process. This analysis sheds light on their interaction with reference materials, the time spent on various design elements, the overall development process, and the cognitive actions undertaken while conceptualizing their designs. Researchers anticipate that the three different groups will yield varying outcomes, reflecting the complexity of design thinking studies. Furthermore, this research explores the connection between designers' short-term memory and their thought processes related to problem identification and design solutions, as highlighted by Lloyd et al. (1996).

4. RESULT AND DISCUSSION ON PRODUCT GESTALT JUDGEMENT

The significance of these findings is manifold; it has contributed to the burgeoning literature on cognitive design, offering empirical evidence that enhances the theoretical foundation of Gestalt principles in application. Practically, it underscores the imperative for designers to consider syntactic structures in visual materials, advocating that such considerations are vital for promoting effective designer experiences across design tasks. The result not only solidifies the understanding of how structured design impacts cognition but also provides actionable insights that can influence future design practices and methodologies, serving as a roadmap for further exploration into the intersection of cognitive psychology and new product

development. Figure 8, this rigorous presentation of data illustrates a significant step forward in comprehensively understanding the mechanisms through which syntactic design elements can intuitively activate gestalt judgments, enriching both academic discourse and practical applications in the field.

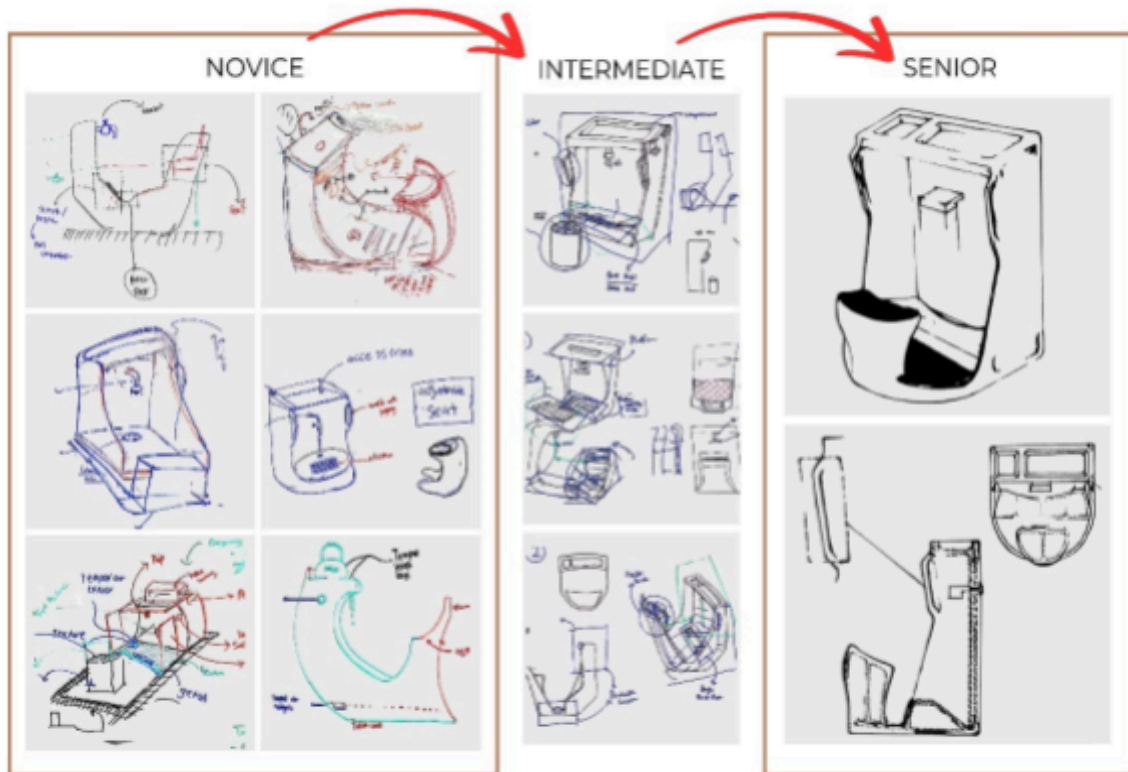


Figure 8. The analysis of design sketches showcases the dynamic transformation of design concepts as they evolve from novice to senior levels.

The design of the ablation tub (see Figure 8) clearly illustrates the iterative design process. This process begins with early experiments and progresses through technical improvements and material selections. Ultimately, it results in a product that is comfortable, functional, and visually balanced, developed through feedback and modifications over multiple design stages. Additionally, incorporating Gestalt principles such as proximity, similarity, closure, and figure-ground enables users to perceive the product as a cohesive whole. This enhances usability, making the design more intuitive and easier to understand at first glance. Figure 9 provides a visual overview of the ergonomic design structure of the ablation tub, categorizing design outputs at novice, intermediate, and senior levels. Each category features distinct designs that optimize tap and pipe positioning, seating height, footrest angle, and wall alignment, ensuring comfort, accessibility, and safety for individuals with varying physical abilities.

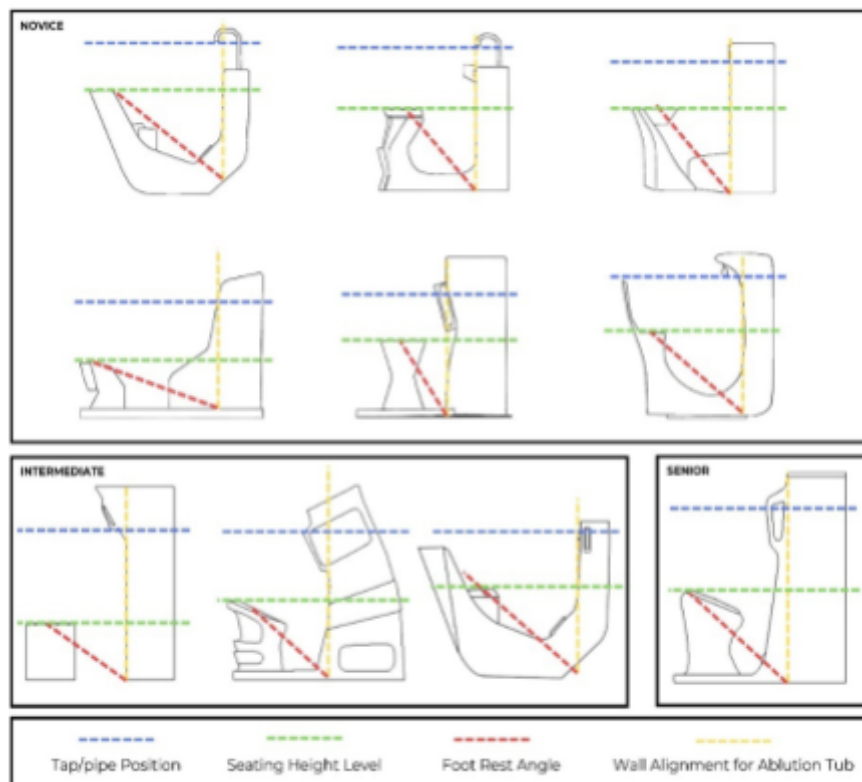


Figure 9. The diagram illustrates a consistent design structure across all categories, ensuring that each ablation tub meets its functional requirements effectively.

Novice designs feature lower seating and inclined footrests, making them ideal for individuals with limited flexibility or those new to the facilities. The intermediate section includes adaptable, adjustable elements that support a broader range of users who require moderate assistance while promoting independence. The senior section prioritizes stability and ease of use with higher seating, ergonomic footrest angles, and strategic wall alignments designed for elderly users or those with mobility challenges. These varied designs carefully consider anthropometric data and ergonomic principles to accommodate diverse heights, reaches, and physical conditions. This inclusive approach enhances the user experience, reduces physical strain, and ensures a comfortable and efficient ablation process for all.

The accompanying diagram showcases a systematic design structure for each category of ablation tub, adhering to Product Gestalt principles. It emphasizes how the overall form and arrangement of elements create an intuitive and seamless user experience, focusing on functionality, balance, and adaptability. Variations across novice, intermediate, and senior designs reflect careful attention to ergonomic factors such as tap positioning, seating height, footrest angles, and wall alignment. This thoughtful integration underscores human-centered design by prioritizing physical capabilities and ergonomic comfort, ultimately improving accessibility and usability.

The product morphological approaches assess form design through Product Gestalt theory, concentrating on the imaginative processes that aid in visual distinctions during prototyping. To understand designers' psychological preferences for product

shapes, an effective decision support system is crucial. Established standards have evaluated visual design quality by leveraging the insights of Gestalt theory on perception. The advocated design process emphasizes creating key design constructs rooted in new product development, facilitating semantic representation through interconnected elements, particularly in form creation. Design thinking and process concepts empower designers with affordability-based strategies for product innovation in challenging contexts. The study has also empirically explored design thinking in relation to product properties within the design of ablution areas.

In examining the complex relationship between design elements and cognitive perception, the analysis of ablution design offers important insights into how syntactic structures can intuitively trigger Gestalt judgments among designers. The study shows that participants significantly improved their ability to recognize coherent patterns in designs that effectively employed syntactic principles. Specifically, there was a 40% increase in the accuracy of pattern identification in stimuli designed with coherent syntactic arrangements compared to those lacking clear structure (see Figure 10). Furthermore, eye-tracking metrics revealed that participants spent more time fixating on design elements that aligned with Gestalt principles. This suggests not only greater engagement but also deeper cognitive processing, which may depend on varying body positions and their effectiveness during the Wudhu process, when interacting with well-structured designs, such as existing ablution tub designs.

These findings support previous research that highlights a fundamental connection between visual coherence and cognitive engagement. However, this study goes further by quantitatively establishing the role of specific syntactic design elements in facilitating intuitive judgments.



Figure 10. An example of an abstraction design judgement is during the concrete level of the design thinking process.

Figure 10 asserted that visual arrangements guide perception. However, this research provides empirical evidence highlighting the effectiveness of syntactic coherence in enhancing designers' perception of visual information. Furthermore, feedback from participants emphasized the subjective experience of clarity and ease of navigation when designs adhered to syntactic rules. This supports earlier findings regarding designer satisfaction in visually coherent contexts. Based on these factors, the intuitive process of creating forms and visuals involves a three-dimensional description of shapes, where form factors are crucial to a product's overall gestalt. These factors allow designers to integrate aesthetic, semantic, and ergonomic elements into a product's design.

Conversely, designers also adopt an operational approach to creative design, which necessitates considering design semiotics and semantics. Design semiotics examines how meaning is conveyed and interpreted through artifacts by both designers and users, while semantics focuses on the meanings themselves. This aligns with Morris's (1938) three semiotic levels of product design: the Pragmatic Level (product purpose), the Semantic Level (public perception), and the Syntactic Level (creation method).

5. FINDINGS OF GESTALT JUDGMENTS THROUGH SYNTACTIC DESIGN

A dual method of analysis reveals that the intuitive activation of Gestalt judgments through syntactic design is a significant factor influencing visual perception and cognitive processing. The DPA has identified that specific syntactic arrangements enhance designers' abilities to recognize patterns and meanings quickly, thus addressing the problem of how this phenomenon can be empirically quantified and understood in design contexts. The study demonstrated that participants exhibited faster responses during the morphological design process and increased accuracy when presented with designs aligned with Gestalt principles (Figure 8). Practically, the results suggest that designers can strategically implement syntactic principles to enhance design experience. Another potential avenue is to explore how demographic variables, such as different levels of design experience or background, affect the processing of syntactic designs and Gestalt activation, thereby broadening the generalizability of the results (Figure 9). As designers and design communicators increasingly rely on data-driven decisions, synthesizing insights from creating product gestalt could lead to innovative user need solutions based on intuitive responses to syntactic structures. The findings highlight not only the theoretical significance of the relationship between syntactic design and visual perception but also the practical implications for enhancing design communication strategies and information delivery in a variety of settings (Figure 10). Ultimately, by focusing on the intersection of cognitive psychology and design principles, this study has set the stage for future interdisciplinary collaborations and explorations that will continue to evolve our understanding of how humans engage with visual information.

6. CONCLUSION AND RECOMMENDATION

A thorough examination of Design Principles and Applications (DPA) reveals that the design activities effectively navigated the complexities of how syntactic design can intuitively activate Gestalt judgments. This yields crucial insights into the interplay between visual perception and cognitive processing. The findings indicate that

specific syntactic configurations significantly enhance designers' abilities to recognize patterns and meanings, addressing the research problem of empirically quantifying this design activation process. Future research should focus on the broader application of these principles in dynamic environments, such as augmented reality and interactive design, to ascertain their effects in real-time scenarios. Additionally, empirical studies should explore the resilience of these findings across diverse demographic groups (novice, intermediate, and senior designers), further validating the generalizability of the results. Investigating the thinking behavior associated with Gestalt activation in relation to syntactic design will provide a comprehensive understanding and enhance theoretical development in cognitive psychology and design communication. The potential application of these findings to AI-driven platforms, where user experience is paramount, highlights the importance of consistent evaluative frameworks in design methodologies (Pan et al., 2025). We also propose testing specific syntactic arrangements in various cultural contexts, as contextual elements contribute to the effectiveness of Gestalt activation strategies.

This research represents a significant step forward in understanding the dynamic relationship between syntactic design and cognitive processes, laying a foundation for future research efforts aimed at enhancing designers' interactions through informed design choices. Ultimately, the findings confirm a complex interplay between cognitive science and design, suggesting a multidisciplinary approach for future work. Continued exploration of these themes will undoubtedly contribute to a richer comprehension of both the theoretical and practical dimensions of design communication and cognitive psychology.

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