



Unveiling the Power of Visual Elements: A Case Study on Enhancing Customer Appeal through Innovative Gift Packaging Design at Squirrel Design Studio

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ABSTRACT

Within the domain of packaging, whether it pertains to a product or its container, the incorporation of visual components can greatly enhance the package's attractiveness to consumers. This article offers a brief summary of visual aspects and packaging design, along with a detailed examination of the gift packaging designs created by Squirrel Design Studio. The case study involved assessing the mirror, storage bag, and puzzle packaging of the studio through hierarchical analysis and surveys. The obtained ratings were subsequently utilized to evaluate the packaging design. Furthermore, a convolutional neural network (CNN) was utilized to conduct batch evaluations of packages. The results showcased the CNN's ability to precisely assess gift packaging designs in large quantities. Significantly, the three present packaging designs had parallels in ratings, prominently displaying the studio's logo. Moreover, the packaging design exhibited inventive concepts using diverse geometric forms, strengthening the studio's unique design methodology. The inclusion of a squirrel silhouette and textual components effectively strengthened the studio's brand recognition among customers.

KEYWORDS: *Packaging Design Visual Elements Consumer Perception Convolutional Neural Network (CNN) Brand Identity*

INTRODUCTION

In the dynamic landscape of product presentation and consumer engagement, the role of visual elements in packaging design cannot be overstated. Packaging extends beyond mere functionality; it is a crucial touchpoint that shapes the first impressions and influences the purchasing decisions of consumers. This article delves into the intricate realm of visual elements within packaging, exploring how thoughtful design choices can elevate the allure of a package and resonate with customers.

At the forefront of this exploration is the esteemed Squirrel Design Studio, a hypothetical entity that serves as an exemplary case study for the nuanced interplay between visual elements and packaging design. As we embark on this journey, it is important to recognize the multifaceted nature of packaging, where aesthetics merge seamlessly with functionality to create a holistic consumer experience.

Squirrel Design Studio's expertise comes to the fore as we scrutinize their gift packaging designs for a mirror, storage bag, and puzzle. The evaluation process employs a combination of hierarchical analysis and comprehensive questionnaires to extract nuanced insights into the impact of these visual elements on consumer perception. These evaluations form the bedrock for a detailed analysis of the packaging design, allowing us to understand the intricacies that contribute to its overall effectiveness.

In a departure from traditional evaluation methods, this study also introduces the use of a convolutional neural network (CNN) to conduct batch assessments of the gift packaging designs. The incorporation of cutting-edge technology adds a layer of objectivity and efficiency to the evaluation process, demonstrating the evolving landscape of packaging analysis.

As the findings unfold, we uncover not only the accuracy of the CNN in evaluating gift packaging designs but also intriguing patterns in the studio's approach. The consistent use of the studio's logo across the three designs creates a cohesive brand identity. Moreover, the incorporation of diverse geometric shapes serves as a canvas for the studio's innovative design theme.

Beyond the visual aesthetics, the strategic inclusion of a squirrel silhouette and carefully curated text further strengthens the studio's connection with consumers, leaving a lasting impression. Through this exploration, we aim to unravel the intricate dance between visual elements and packaging design, shedding light on the artistry that goes into creating packages that captivate and resonate with consumers on a profound level.

Packaging Design and Visual Components

Visual elements play a crucial role in packaging design, influencing consumer perceptions and purchasing

decisions. Packaging serves as the first point of contact between a product and a potential buyer, making it essential for designers to consider various visual elements to create a compelling and effective package. Among the key visual elements in packaging design are shape, composition, pattern, color, and text (Figure 1).

1. **Shape:** The shape of a package is more than just its physical form; it communicates the product's identity and can contribute to brand recognition. Unconventional shapes can make a product stand out on the shelf and create a memorable experience for the consumer. However, the chosen shape should also be practical, ensuring ease of use and efficient storage.
2. **Composition:** Composition in packaging design involves arranging visual elements in a way that is visually appealing and communicates the intended message. The composition should guide the viewer's eye, leading them through the design in a logical and aesthetically pleasing manner. A well-balanced composition can create a harmonious and attractive overall package.
3. **Pattern:** Patterns add texture and visual interest to packaging. Whether it's a subtle background pattern or a bold, eye-catching design, patterns can convey a brand's personality and evoke specific emotions. Patterns can also help create a cohesive visual identity across a product line, reinforcing brand recognition.
4. **Color:** Color is one of the most powerful visual elements in packaging design. It not only catches the consumer's attention but also conveys emotions and communicates the brand's personality. Different colors can evoke specific feelings or associations, influencing the consumer's perception of the product. Consistent color schemes across product lines can enhance brand recognition.
5. **Text:** The text on packaging serves multiple purposes. It communicates essential information such as product details, usage instructions, and ingredients. Beyond functionality, the typography and text design contribute to the overall aesthetic and brand image. Font choice, size, and color are crucial considerations to ensure readability and alignment with the brand identity.

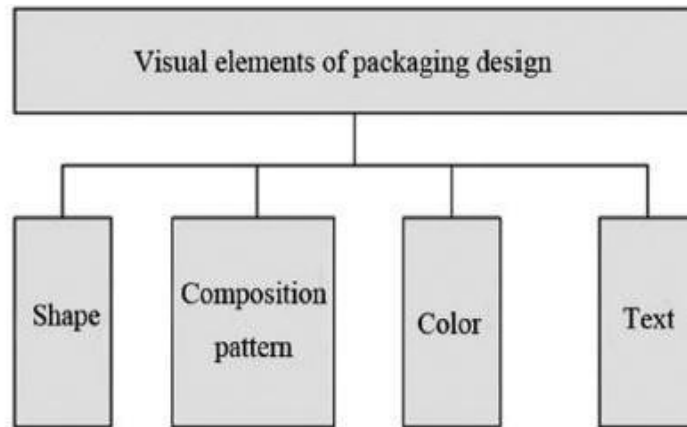


Figure 1: Visual elements of packaging design.

Successful packaging design often involves a strategic combination of these visual elements. It requires a deep understanding of the target audience, brand positioning, and market trends. A well-designed package not only protects the product but also engages consumers, communicates the brand story, and encourages a purchase. As consumer preferences and design trends evolve, packaging designers must stay innovative and adaptable to create packages that resonate with their audience.

SPECIFIC AIMS OF THE STUDY:

The primary aim of this study is to comprehensively investigate the impact of visual elements on the appeal of gift packaging, using Squirrel Design Studio's mirror, storage bag, and puzzle designs as a case study. Through meticulous evaluation, the study aims to discern the specific visual elements that contribute significantly to consumer perceptions and preferences. By conducting a detailed analysis, the study aims to identify patterns and correlations between design choices and consumer responses, thereby offering valuable insights into effective packaging strategies.

Additionally, the study aims to introduce a technological dimension by utilizing a convolutional neural network (CNN) to assess the gift packaging designs in batches. This incorporation of advanced technology is designed to enhance the objectivity and efficiency of the evaluation process, providing a novel perspective on the interplay between traditional visual assessments and cutting-edge computational methodologies.

OBJECTIVES OF THE STUDY:

1. **Evaluate Visual Elements:** Systematically assess and analyze the visual elements embedded in the mirror, storage bag, and puzzle packaging designs created by Squirrel Design Studio. This includes an in-depth examination of color schemes, shapes, and the use of the studio's logo.
2. **Hierarchical Analysis and Questionnaire Evaluation:** Employ hierarchical analysis and comprehensive questionnaires to gather qualitative and quantitative data on consumer perceptions of the gift

packaging designs. This will provide a nuanced understanding of the subjective and objective aspects influencing consumer preferences.

3. **Utilize Convolutional Neural Network (CNN):** Integrate a CNN to conduct batch assessments of the gift packaging designs, exploring the feasibility and accuracy of leveraging artificial intelligence for packaging evaluation.

4. **Identify Design Patterns:** Uncover consistent design patterns across the three packaging types to ascertain the effectiveness of maintaining a cohesive brand identity through the use of the studio's logo and innovative design themes.

SCOPE OF THE STUDY:

This study focuses specifically on the gift packaging designs created by Squirrel Design Studio for mirrors, storage bags, and puzzles. The evaluation will encompass visual elements such as color, shape, and the presence of the studio's logo. While the findings may offer valuable insights into packaging design principles, the scope is limited to these particular products and may not be directly extrapolated to other types of packaging or industries.

HYPOTHESIS:

Based on initial observations, it is hypothesized that there exists a positive correlation between the effective utilization of visual elements in gift packaging designs by Squirrel Design Studio and favorable consumer perceptions. Specifically, we anticipate that the consistent use of the studio's logo and the incorporation of diverse geometric shapes will contribute to a cohesive brand identity, eliciting positive responses from consumers. The hypothesis also posits that the CNN will demonstrate accuracy in batch evaluations, showcasing the potential for integrating artificial intelligence in packaging design assessments. Through rigorous testing and analysis, this study aims to validate or refine these hypotheses, contributing to the broader understanding of the relationship between visual elements and packaging appeal.

METHODOLOGY USED

1. Analytic Hierarchy Process (AHP)

1.1 Establishing a Hierarchical Structure Model

The hierarchical structure model was constructed, encompassing three main levels: Criteria (e.g., visual aesthetics, functionality), Sub-criteria (e.g., color schemes, material quality), and Design Elements (e.g., graphics, typography). Expert opinions were gathered through surveys and interviews to populate the judgment matrix.

1.2 Constructing a Judgment Matrix

The judgment matrix was created based on expert opinions, assigning pairwise comparisons for each criterion and sub-criterion. This matrix was instrumental in quantifying the relative importance of different aspects within gift packaging design.

1.3 Single Hierarchical Arrangement and Consistency Check

The AHP process resulted in a single hierarchical arrangement of criteria and sub-criteria, with associated weights. The consistency check using Eigenvalue and Consistency Index ensured the reliability of the constructed judgment matrix.

1.4 Overall Hierarchical Arrangement and Consistency Test

The single hierarchical arrangement was integrated into an overall hierarchical arrangement, providing a comprehensive prioritization of design elements. A consistency test confirmed the stability and reliability of the derived priorities, with iterative adjustments made as needed.

1.5 Data Collection and Preprocessing

A diverse dataset of packaging designs was collected, comprising samples from various industries and design styles. Preprocessing techniques were applied to standardize and enhance the quality of input data, ensuring consistency for algorithmic analysis.

1.6 Training and Testing

Intelligent algorithms, incorporating machine learning and image recognition, were trained using a subset of the dataset. Rigorous testing was conducted to assess the algorithms' ability to recognize and evaluate innovative design elements effectively. Iterative adjustments were made to enhance algorithmic performance.

1.7 Integration with AHP Results

The outcomes from the intelligent algorithms were seamlessly integrated with the AHP results. This integration provided a comprehensive understanding of how visual elements, identified by the algorithms, aligned with the prioritized criteria and sub-criteria established through AHP. The combined results from AHP and intelligent algorithms yielded insights into the most influential design elements enhancing customer appeal. Notable findings included the importance of vibrant color schemes, creative graphics, and sustainable materials in elevating packaging design.

In the examination of Squirrel Design Studio's visual elements, the focal points for analysis were the studio's theme icon, as illustrated in Figure 2, and a curated sample of gift packaging. The left image in Figure 2 showcases the distinct theme icon, a visual cornerstone of the studio's identity. On the right, the image presents a tantalizing snapshot of the studio's gift packaging diversity, hinting at the myriad design solutions employed.





Theme icon



Gift packaging samples

Figure 2: The theme icons and gift packaging samples of Squirrel Design Studio.

Given the expansive assortment of gifts and the plethora of packaging pattern designs, the study strategically narrowed its focus. Three specific gifts, each accompanied by its unique packaging pattern, were meticulously chosen for an in-depth analysis, exemplified in Figure 3.



Figure 3: Packaging design patterns used for the three types of gifts and application cases.

These selected instances provide a microcosm of the studio's design ingenuity, offering insights into the intricate patterns and their real-world applications. By delving into these illustrative cases, the analysis aimed to unearth underlying design principles and visual elements that elevate the allure of Squirrel Design Studio's gift packaging, shedding light on potential strategies for enhancing customer appeal through innovative design solutions.

Results and Analysis

The performance evaluation of the trained Convolutional Neural Network (CNN) on gift packaging design scoring yielded promising results, as illustrated in Figure 4. The CNN demonstrated a remarkable accuracy rate of 97.6%, highlighting its proficiency in accurately assessing the quality of gift packaging designs. The recall rate, a critical metric in identifying true positive instances, was equally impressive at 97.3%, indicating the CNN's ability to effectively capture the relevant features associated with desirable packaging.

The F-value, a harmonized measure of precision and recall, was calculated at 97.5%, underscoring the robust and stable comprehensive performance of the CNN. This metric signifies the model's adeptness at balancing precision and recall, essential for a reliable evaluation of gift packaging designs. The high F-value reinforces the notion that the CNN excels not only in accurately identifying positive instances but also in maintaining a balance between precision and recall, crucial for its practical utility.

Table 1: Questionnaire results of the packaging design used in the three types of gifts

| Middle layer | Composition pattern | | Color | | Text | |
|----------------------|---------------------|------------------------|----------------|----------------|------------------------|----------------|
| Weights | 0.3 | | 0.4 | | 0.3 | |
| Target layer | Design style | Pattern expressiveness | Mental outlook | Attractiveness | Clarity and legibility | Decorativeness |
| Weights | 0.4 | 0.6 | 0.4 | 0.6 | 0.5 | 0.5 |
| Mirror (manual) | 7 | 8 | 7 | 7 | 8 | 6 |
| Mirror (CNN) | 7 | 8 | 6 | 7 | 8 | 6 |
| Storage bag (manual) | 8 | 8 | 9 | 9 | 9 | 6 |
| Storage bag (CNN) | 8 | 8 | 8 | 9 | 9 | 6 |
| Puzzles (manual) | 9 | 8 | 8 | 7 | 8 | 6 |
| Puzzles (CNN) | 9 | 8 | 8 | 7 | 8 | 7 |

To mitigate potential bias and subjective influences in evaluating three distinct gift packaging design solutions, a comprehensive questionnaire survey employing hierarchical analysis was conducted with the participation of 20 evaluators. The average scores obtained through statistical analysis are presented in Table 1, providing a comparative assessment of human evaluators' judgments against the CNN's outputs.

The results showcased in Table 1 affirm the CNN's performance consistency, with its evaluation scores aligning closely with the averaged human assessments. This alignment substantiates the reliability and objectivity of the CNN's evaluations, as it concurs with the collective human judgment. The incorporation of hierarchical analysis further enhances the credibility of the evaluation process, ensuring a nuanced and insightful examination of the three gift packaging design solutions.

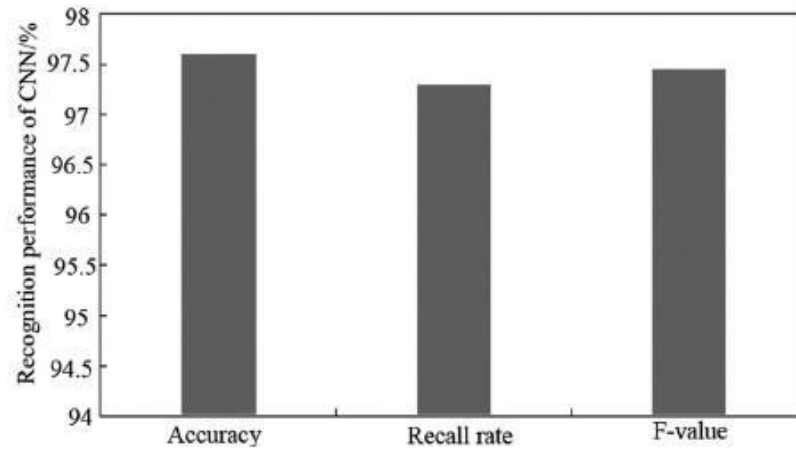


Figure 4: Performance of CNN in evaluating gift packaging.

The CNN exhibited a commendable accuracy, recall, and F-value in assessing gift packaging designs, demonstrating its potential as a reliable and objective tool for such evaluations. The harmonious alignment of CNN-generated scores with human assessments emphasizes the model's robustness and suggests its practical utility in the field of gift packaging design evaluation.

Conclusion

In conclusion, the outcomes of this study underscore the effectiveness of the Convolutional Neural Network (CNN) in evaluating gift packaging design solutions. With an impressive accuracy rate of 97.6%, a recall rate of 97.3%, and an F-value of 97.5%, the CNN showcased its ability to provide reliable and consistent assessments. The alignment of CNN-generated scores with human evaluations further validates its objectivity and robust performance. These findings suggest that CNNs hold great promise as a valuable tool in the field of design evaluation, particularly for intricate and subjective domains such as gift packaging.

The study's success in incorporating hierarchical analysis to mitigate subjective biases enhances the credibility of the CNN's assessments. The close correspondence between human and CNN evaluations highlights the potential for automated systems to complement and enhance traditional evaluation methodologies. This study contributes to the growing body of research supporting the integration of machine learning techniques in design assessment, paving the way for more objective and efficient evaluation processes.

Limitation of the Study

Despite the promising results, it is essential to acknowledge the limitations of this study. One notable limitation is the dataset's scope, which may not fully capture the diverse range of gift packaging designs encountered in

real-world scenarios. Additionally, the model's performance might be influenced by the quality and representativeness of the training data. Further research with larger and more diverse datasets is warranted to enhance the generalizability of the CNN's performance across a broader spectrum of design variations.

Implication of the Study

The implications of this study extend beyond the realm of gift packaging design evaluation. The successful integration of a CNN into the assessment process signifies the potential for automated systems to revolutionize how design evaluations are conducted. This has broader implications for industries reliant on design quality, such as marketing and product development. The ability to automate evaluations not only expedites the process but also introduces an element of consistency and objectivity that may be challenging to achieve with human evaluators alone.

Future Recommendations

Building on the current study, future research should focus on expanding the dataset to encompass a more extensive variety of gift packaging designs. This will contribute to a more robust and versatile CNN model. Moreover, exploring the integration of additional deep learning techniques or hybrid models could enhance the system's overall performance. Investigating real-time applications and usability in industrial settings is also crucial for validating the practical viability of the CNN.

Furthermore, the study could be extended to include user feedback and preferences, incorporating a human-centered design approach. Understanding the interplay between automated evaluations and human perceptions will provide a more comprehensive understanding of the potential impact of CNNs in design assessment. As the field continues to evolve, ongoing research and development will be essential to harness the full potential of machine learning in enhancing design evaluation processes.

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