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The Influence of Visual Elements and Color Sensitivity on Product Image Selection

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Abstract

This study investigates how visual elements of product images on online flea market platforms influence impression formation and purchasing decisions. As online flea markets grow with diverse user demographics, individual sellers often struggle to effectively present products due to a lack of standardized guidelines. While anonymous transactions and flexible image settings attract users, inconsistent presentation quality impacts sales success. Visual elements like exposure, contrast, saturation, color temperature, and sharpness are crucial in conveying product appeal, yet their effects remain underexplored. Particularly, how these factors influence quick impression formation is not well understood. This study experimentally examines these visual parameters to clarify their impact on purchasing motivation. The findings aim to provide evidence-based guidelines to enhance product presentation, ultimately improving sales outcomes for both new and struggling sellers on online flea market platforms.

Keywords: Product Image, Image evaluation, impression evaluation, Color Sensitivity, E-commerce.

1 Introduction

This study focuses on product images featured on online flea market platforms and experimentally investigates how visual elements influence impression formation and purchasing decisions within a short time frame. In recent years, the widespread adoption of flea market platforms has led to a rapid increase in peer-to-peer transactions. With the growing prevalence of smartphones and improvements in internet infrastructure, the user base of these platforms has become increasingly diverse, encompassing not only younger users but also middle-aged and older demographics. Moreover, the entry of corporate sellers has further contributed to the ongoing expansion of the market.

A key attraction of flea market platforms is the ease with which individuals can sell unnecessary items such as daily necessities, clothing, and hobby-related goods. The ability to conduct anonymous transactions and conveniently ship products, along with the potential to sell items at higher prices compared to second-hand shops, has sustained strong user demand. Consequently, the number of users and transaction volume continue to grow annually.

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However, unlike professional sellers, individual users often lack standardized methods for presenting product information, leading to substantial variation in product listings. In particular, the quality of product descriptions and images is believed to significantly impact purchasing decisions, yet there is a lack of empirical research that scientifically validates these effects. Many sellers struggle to attract buyers or to sell products at desired prices, potentially due to insufficient knowledge or experience in photography and image editing.

Additionally, while current flea market platforms offer considerable flexibility by allowing sellers to freely configure product images, the absence of standardized guidelines results in a strong dependence on individual judgment and intuition. To effectively communicate the appeal of a product, it is essential to appropriately adjust visual parameters such as exposure, contrast, saturation, color temperature, and sharpness. However, few studies have systematically analyzed the impact of these visual factors on consumer decision-making, particularly in the context of rapid impression formation.

The objective of this study is to clarify the effects of visual elements in product images—considered one of the most critical components of product listings—on purchasing decisions in online flea markets. Specifically, experimental methods are employed to evaluate how adjustments to parameters such as exposure, contrast, saturation, warm/cool color tones, and sharpness influence users' purchasing motivation [1][2][3].

2 Related Work

Previous research on the impact of product images on consumer purchasing behavior has primarily concentrated on key visual elements such as color, contrast, and lighting conditions [4][5]. For instance, Maeda et al. [6] demonstrated that the color of product packaging significantly influences consumers' impression formation, showing that certain hues can effectively enhance their purchasing motivation. In a similar vein, Tomita et al. [5] revealed that the colors used in convenience store bento packaging impact consumers' perceived tastiness of the product. However, despite the widespread adoption and increasing popularity of online flea market platforms in recent years, research that applies eye-tracking technology to analyze consumer behavior in this particular digital retail context remains scarce. Specifically, studies that investigate how product images contribute to rapid impression formation under time-constrained viewing conditions are still considerably limited.

3 Methods

3.1 Visual Condition Settings

Each product image was modified based on the following visual parameters to examine which conditions elicited the strongest reactions from participants [1]

(1) **Exposure** (+1.5, +3, -1.5, -3, etc.): to examine how variations in image brightness affect user impressions.

(2) **Contrast** (+100, -100, +50, -50, etc.): to assess how image clarity influences purchasing motivation.

(3) **Saturation** (+100, -50, etc.): to investigate how the intensity and vividness of colors

affect perception.

(4) **Warm/Cool Tones** (+50, -50, etc.): to analyze the effect of color temperature on visual impressions.

(5) **Sharpness** (+100, -100): to evaluate how image clarity impacts purchasing motivation and gaze concentration.

To evaluate the impact of these 18 parameter variations, the same product was used across all image conditions. A pair of black boots, representative of typical items sold on flea market platforms, was photographed. A white cloth was used as the background, and the lighting was set to a color temperature of 6600K. The photographs were taken using an OLYMPUS OM-D E-M1 Mark II camera equipped with an M.Zuiko DIGITAL ED 45mm F1.2 PRO lens. The image designated as the "standard condition" was exported as a JPEG from unprocessed RAW data with no parameter adjustments. An overview of all 18 product image variations and their layout is shown in Figure 1.

Figure 1: Overview of the 18 product image variations used in the experiment

3.2 Image Selection Using Mockups

To simulate a realistic user experience, a mockup was developed using Figma to replicate the interface of a flea market application (Figure 2). The mockup allowed for interactive browsing like actual app behavior. The experiment was conducted with 20 participants consisting of third- and fourth-year undergraduate students and graduate students. Participants were asked to complete a task in which they selected the product image they most

wanted to purchase from the image list.

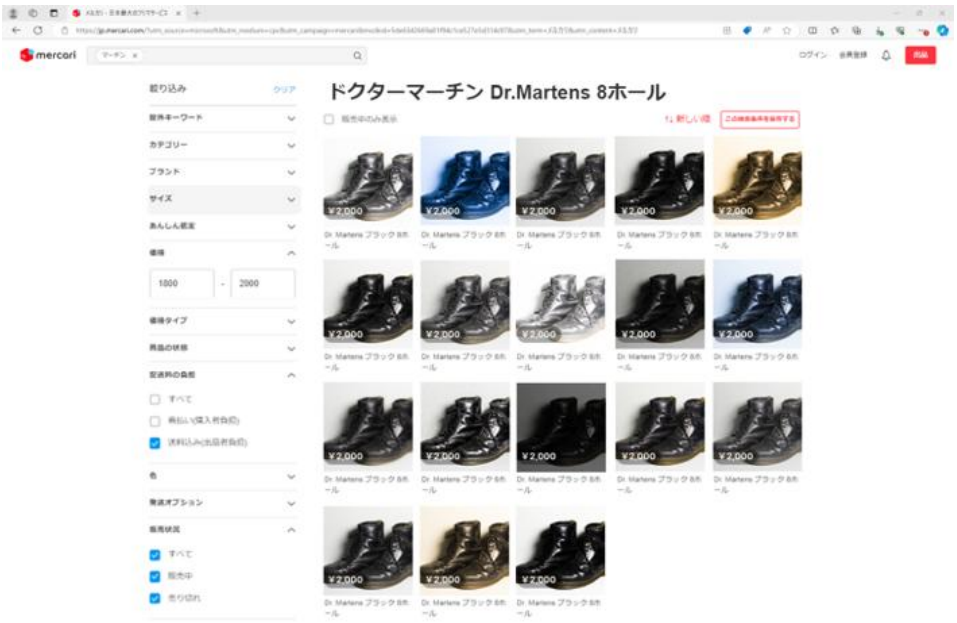

Figure 2: Product image selection screen in the mockup environment

3.3 Post-Experiment Questionnaire

Following the product image selection task, participants were asked to complete a detailed post-experiment questionnaire designed to evaluate both their cognitive load and psychological engagement during the experiment. The questionnaire followed of multiple items derived from two well-established theoretical frameworks: Cognitive Load Theory [6] (CLT) and Flow Theory[7].

Items based on CLT were developed to distinguish and quantify two key components of mental effort experienced during the task—intrinsic cognitive load and extraneous cognitive load. Intrinsic load pertains to the complexity and inherent difficulty of the task itself, such as evaluating numerous images with subtle visual differences. In contrast, extraneous load reflects the mental effort required due to external factors such as the structure of the interface or the clarity of image presentation.

Meanwhile, the portion of the questionnaire informed by Flow Theory focused on measuring participants' psychological immersion and concentration during the task. These questions examined whether participants were fully engaged, experienced time distortion, or found the task to be inherently rewarding.

The combination of these two theoretical lenses enabled a multi-dimensional assessment of participants' mental and emotional states, helping to determine whether visual variations in product images imposed cognitive strain or influenced subjective engagement. This approach also provided a clearer understanding of how visual complexity interacts with usability and emotional involvement in e-commerce environments.

3.4 Color Sensitivity Test

After completing the post-experiment questionnaire, participants were asked to take a color sensitivity test. This test was developed based on past questions from the official Color Certification Examination in Japan [8][9]. Participants responded to 30 questions related to color, as shown in Table 1, following the product image selection experiment. Each question was assigned to a specific area of color knowledge, and in principle, two questions were prepared for each category.

The questions were categorized as follows:

- Questions 1 and 2: Traditional Japanese color names
- Questions 4 and 5: PCCS (Practical Color Co-ordinate System)
- Questions 6 and 7: Gradation
- Questions 8, 9, and 10: Color imagery
- Questions 11 and 12: Color combinations
- Question 13: Relationship between light and color
- Questions 14 and 15: Structure of the eye
- Questions 16 and 17: Lighting and color perception
- Questions 18 and 19: Color mixing
- Questions 20 and 21: Color classification and the three attributes of color
- Questions 22 and 23: Psychological effects of color
- Questions 24 and 25: Visual effects of color
- Questions 26 and 27: Color harmony
- Question 28: Color scheme imagery
- Question 29: Interior design
- Question 30: Fashion and color coordination

Table 1: Color Perception Test Questions

Abbreviations	Word
Question 1	Select the most appropriate description for the color “Ocher Yellow”
Question 2	Select the most appropriate description for the color “Sky Blue”
Question 3	Which color attribute has the strongest influence on the perception of expansion and contraction?
Question 4	Choose the most appropriate statement regarding color coordination using PCCS from options 1–4 for each item A–F.
Question 5	Choose the most appropriate statement regarding color coordination using PCCS from options 1–4 for each item A–F.
Question 6	Select the correct image that shows a gradation in brightness (lightness).
Question 7	Select the correct explanation of the characteristics and effects of the color gradation identified in Question 6.
Question 8	Select the color that is generally associated with imagery such as “flashy,” “passionate,” or “dangerous.”
Question 9	Select the color most appropriately associated with impressions such as “calm,” “subdued,” or “reserved.”

Question 10	Select the color most appropriately associated with impressions such as “gloomy,” “serious,” or “masculine.”
Question 11	In tone classification, which of the following is the most appropriate combination of colors within the same tone range?
Question 12	Select the most appropriate combination of colors that share similar hues.
Question 13	Fill in the blank in the provided image based on your knowledge.
Question 14	In the diagram below, part 11 is called the retina and is the area where incoming light forms an image.
Question 15	In the diagram below, part 8 is called the cornea and refracts incoming light to focus it within the eyeball.
Question 16	Regarding fluorescent lamps (daylight type), select the most inappropriate statement from the choices below.
Question 17	Select the option that is not considered artificial light.
Question 18	The process of mixing two or more colors to create a new color is called . Select the correct term to complete the sentence.
Question 19	Select the correct combination of the three primary colors used in additive color mixing.
Question 20	In the image showing tops and shoes, what is the main color attribute that changes as you move to the right?
Question 21	Select the three attributes that define color from the options below.
Question 22	Select two appropriate impressions that are generally associated with the color “white.”
Question 23	Based on the diagram below, select the most appropriate explanation.
Question 24	Regarding the central square in the diagram below, select the most appropriate description.
Question 25	Regarding the central square in the diagram below, select the most appropriate description. Note: The hue of all central squares is identical.
Question 26	Select the most appropriate explanation of the diagram below regarding color harmony.
Question 27	Select the most appropriate explanation of the diagram below regarding color harmony.
Question 28	Select the most appropriate explanation of the term “Casual” in the context of color image coordination.
Question 29	Based on the interior photograph provided, select the most accurate interpretation.
Question 30	Fashion coordination refers to the styling of not only tops, bottoms, and jackets, but also shoes, bags, and other accessories.

Additionally, Figure 3 was utilized across multiple questions in the color sensitivity test to visually support a range of color theory concepts being assessed. Specifically, this identical figure was presented in three distinct contexts within the questionnaire to examine participants’ interpretive and analytical skills. First, in both Questions 4 and 5, the figure was employed to evaluate participants’ comprehension of the Practical Color Co-ordinate System

(PCCS), a widely used framework in Japanese color education. These particular questions required participants to carefully review six descriptive statements, labeled from A through F, each of which pertained to different aspects of color harmony and tone coordination. For each statement, respondents were asked to choose the most appropriate interpretation from four provided answer choices. The correct responses identified through expert consensus and test criteria were Option 4 for Question 4 and Option 1 for Question 5, confirming proper understanding of PCCS-based design logic.

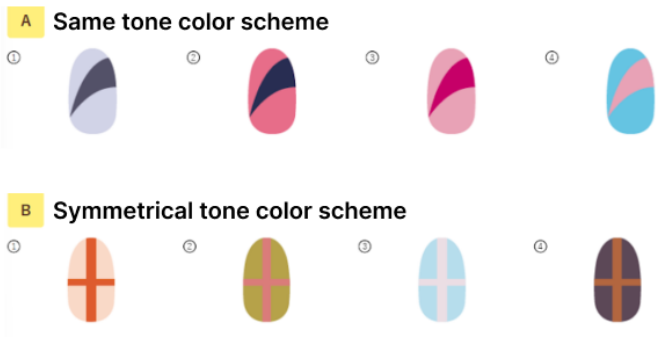

Figure 3: Images of Questions 4 and 5

Second, Figure 4 was reused in Questions 9 and 10, which assessed color imagery. Question 9 asked participants to identify the color that best represents impressions such as “calm,” “subdued,” and “reserved,” for which the correct choice was Option 4. Question 10 focused on identifying the color most closely associated with “gloomy,” “serious,” and “masculine” traits, with Option 2 being the correct answer.

Figure 4: Images of Questions 9 and 10

Finally, Figure 5 was also applied in Question 24, which examined participants’ knowledge of visual effects of color, particularly brightness contrast. Despite all central squares in the image having identical luminance, participants were asked to determine which square appeared brighter due to surrounding context. The correct response was Option 3, which indicated that square (b) appears brighter than square (a) as a result of contrast with a

darker background.

These applications demonstrate the versatility and pedagogical value of the image in assessing a wide range of color-related knowledge areas, from technical coordination systems to perceptual and psychological aspects of color interpretation.

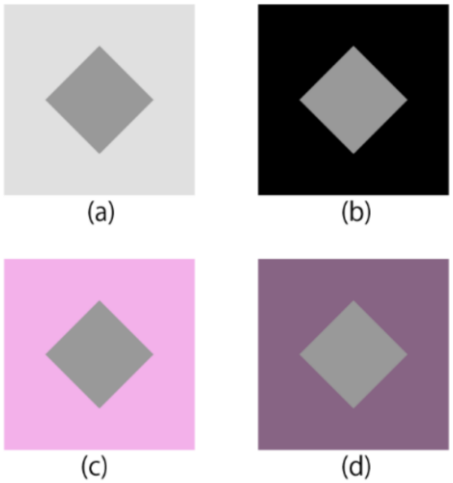

Figure 5: Images of Questions 24

4 Results

4.1 Most Preferred Product Image

The findings from the experiment revealed that the product image with a saturation level increased by +100 was the most frequently selected as the image participants most desired to purchase (Figure 6). This image stood out among the 18 variations, suggesting that higher saturation may enhance visual appeal and perceived product quality.

offline, the image with reduced exposure set at -50 was most identified as the least desirable option (Figure 7). Participants appeared to avoid this image, likely due to its insufficient brightness, which made it difficult to discern surface details and evaluate the product accurately. Images with extremely low exposure levels, such as -3, obscure visual information essential for purchase decisions—such as texture, wear, and condition—making them ineffective in a retail context.

Although high exposure can improve visibility of fine details, it may also unintentionally emphasize imperfections like scuffs or scratches, thereby diminishing the image's overall attractiveness. In contrast, images with satisfying saturation tend to present the product in a more vivid, colorful, and seemingly newer condition. The rich and vibrant appearance may have contributed to positive impressions and enhanced purchase motivation, regardless of the actual product state.

These findings suggest that among various visual parameters, saturation has a particularly strong influence on consumer preference in a short viewing period. It appears that color richness not only draws attention but also positively biases viewers' assessments of product desirability. This insight can inform visual optimization strategies for individual sellers aiming to improve their listing effectiveness on flea market platforms.

Figure 6: Product image with saturation +100

Figure 7: Product image with exposure -3

4.2 Result of the Color Sensitivity Test

Following the color sensitivity test, participants were categorized into two distinct groups according to their test performance. The average score served as a threshold: those scoring above the mean were classified as participants with high color sensitivity, while those scoring below the mean were identified as having low color sensitivity. This grouping enabled subsequent comparisons of behavioral and cognitive differences based on color perception ability.

With regard to the image with saturation +100—the image most frequently chosen as the strongly preferred product—25% of participants in the high color sensitivity group selected this image. Meanwhile, a higher percentage, 40%, of participants from the low color sensitivity group also selected it as their top choice. This slight divergence suggests that even participants with lower sensitivity to color nuances were influenced by the vividness of the image.

To further understand whether cognitive load varied between these two groups, Welch's t-tests were conducted to compare intrinsic and extraneous cognitive load scores. The results of these statistical analyzes are illustrated in Figure 8. No significant differences were found between the groups, indicating that task-related and externally imposed cognitive loads were regardless similar of color sensitivity level. This consistency implies that color sensitivity does not significantly alter users' cognitive strain when evaluating product images.

These findings also support the notion that product images with increased saturation appeal universally, bridging perceptual differences across user types. Both groups were able to engage with the content similarly, suggesting that enhancements in color vibrancy can serve as a low-barrier strategy to improve product attractiveness without increasing mental effort for users with varying perceptual abilities.

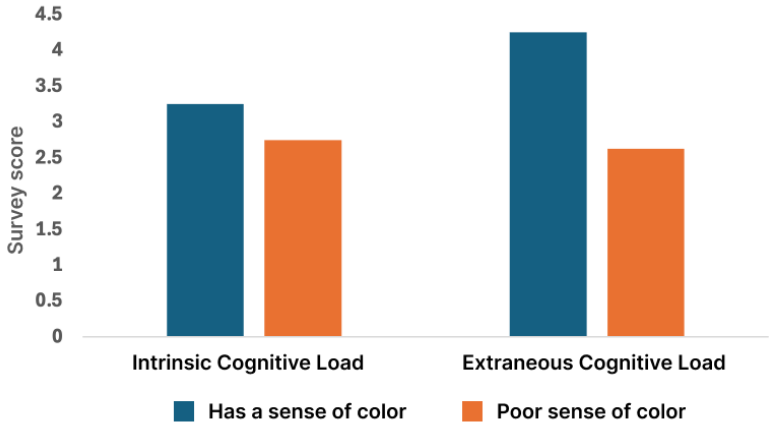

Figure 8: Comparison of cognitive load between groups for the saturation +100 image

Next, the comparison of intrinsic and extraneous cognitive load between the two groups was conducted, and the results are shown in Figure 9.

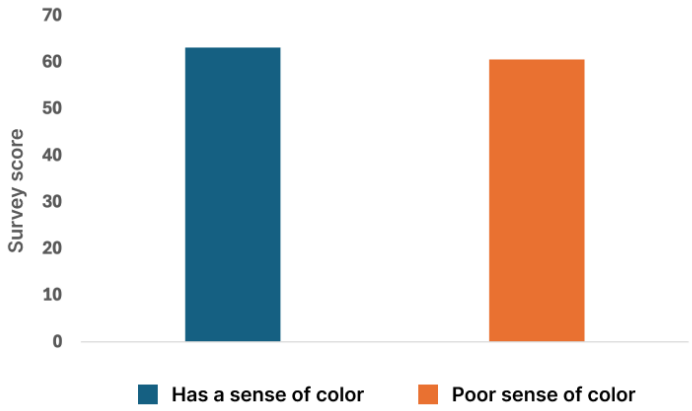

Figure 9: Comparison of flow-related concentration between groups for the saturation +100 image

As with the previous analysis, Welch's t-test was used, and again, no significant difference was found between the groups. These findings indicate that there was no substantial variation in task engagement or concentration during the experiment based on participants' color sensitivity.

4.3 Discussion

The results clearly indicate that participants' level of color sensitivity did not affect cognitive load or task concentration during the experiment. Moreover, the product image with saturation +100, which was selected most frequently as the image participants wanted to purchase, was chosen by both groups—those with high and low color sensitivity.

Users on flea market platforms often aim to purchase products at the lowest possible cost, while sellers seek to maximize the amount they can earn. Since the color sensitivity of individual users is unknown, product images must be appealing regardless of these individual differences. The findings of this study suggest that the image with saturation +100 was favorably selected across both participant groups and did not lead to significant differences in cognitive load during image comparison. Therefore, it can be concluded that product images with a saturation level of +100 are likely to be broadly appealing to a diverse range of users.

5 Conclusion

This study experimentally examined the impact of visual elements in product images on impression formation and purchasing decisions in the context of online flea market platforms. The results indicated that images with increased saturation, particularly those with a saturation level of +100, were most frequently selected by participants as the images they would most like to purchase. This trend was observed regardless of participants' level of color sensitivity, suggesting that enhancing saturation may be an effective strategy to appeal to a broad range of users. These findings also imply that in-creasing saturation can enhance the perceived vibrancy and attractiveness of a product, thereby capturing user interest more effectively.

Furthermore, results from the post-experiment questionnaire, based on Cognitive Load Theory and Flow Theory, revealed no significant differences in intrinsic or extraneous cognitive load between participants with high and low color sensitivity. This suggests that visual adjustments, such as saturation enhancements, do not impose additional cognitive burden or negatively affect user concentration during the decision-making process. Consequently, visual tuning of product images can be an effective means of influencing purchase decisions without compromising the overall user experience.

The findings of this study provide a foundation for developing evidence-based guidelines for presenting product images on online flea market platforms. In particular, the effectiveness of saturation adjustments can serve as a practical recommendation for new sellers or those struggling to achieve successful sales. Additionally, platform operators may benefit from these insights by improving the usability and visual presentation standards across the platform, thereby enhancing the overall user experience.

Future research should further investigate the effects of other visual elements, such as exposure, contrast, color temperature, and sharpness.

In sum, this study aims to support both sellers and platform operators by identifying effective strategies for visual presentation, ultimately contributing to improved user engagement and transaction success on online flea market platforms.

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