

The Impact of 3D Visualisation on Consumer Perception and Purchase Intention

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Abstract—This paper examines the relationship between 2D and 3D visual presentation formats and consumer perception of graphic products. The study was conducted through an online survey involving 138 respondents, primarily university students. Participants evaluated both presentation formats in terms of visual attractiveness, form and design clarity, perceived product quality, consumer trust, and purchase intention. The results indicate that the 3D visual presentation received significantly higher evaluations ($M = 4.70$, $SD = 0.50$) compared to the 2D presentation ($M = 3.21$, $SD = 1.12$). A paired-samples t-test revealed a statistically significant difference between the two formats ($t(137) = 15.25$, $p < 0.001$). Respondents also reported higher purchase intention and stronger trust when exposed to the 3D presentation. The findings suggest that realistic visual presentation is associated with more positive consumer evaluations in digital environments. However, the results should be interpreted with caution, as differences in visual richness between the presented stimuli may have influenced respondents' evaluations.

Keywords—3D visualisation, 2D presentation, consumer perception, purchase intention, product visualisation, visual communication.

I. INTRODUCTION

Graphic products play an important role in conveying information, values, and messages to users. The way a product is visually presented directly affects how it is perceived, how its quality is evaluated, and how much trust it creates among potential consumers. With increasing market competition and rapid digital development, visual presentation has become an essential factor in differentiating graphic products.

Traditionally, graphic products are presented through two-dimensional (2D) formats such as photographs and technical drawings. However, with the development of 3D technologies, three-dimensional visualisation is increasingly used because it provides a more realistic and detailed representation of product shape, structure, and materials.

3D visualisation allows consumers to better understand the appearance of a product before production or purchase. Unlike traditional 2D presentation, it enables viewing from multiple perspectives and provides a more realistic impression of shape, materials, and proportions. Realistic rendering techniques, including lighting, shadows, and textures, create a stronger sense of product presence and make digital presentation more convincing. In online environments where consumers often rely only on visual information, this type of presentation may influence product evaluation and decision-making.

Previous studies have reported positive relationships between 3D product presentation, consumer trust, perceived quality, and purchase intention. Research conducted in online retail, advertising, and architectural communication suggests that realistic visualisation can enhance product understanding and reduce uncertainty during decision-making. However, despite the growing body of literature, relatively few studies have examined these effects in the context of graphic products and packaging design, particularly among younger consumers exposed to digital media on a daily basis.

The present study contributes to this area by examining consumer evaluations of the same graphic product presented in two different visual formats: a conventional 2D image and a realistic 3D visualisation. The objective is not only to compare consumer responses to the two presentation formats, but also to explore how visual presentation is associated with perceived attractiveness, product quality, consumer trust, and purchase intention. By focusing on graphic product packaging and contemporary digital presentation methods, the study provides additional evidence regarding the role of visual communication in shaping consumer perceptions in digital environments.

II. RELATED WORK

Recent studies confirm that 3D visualisation has a significant impact on consumer perception and purchase intention compared to traditional 2D presentation. Rohden et

al. [1] found that low-immersive 3D digital content significantly increases consumer satisfaction and purchase intention compared to 2D presentation, while Kim et al. [7] showed that rotatable product images generate higher purchase intention than static 2D images. Miralles et al. [15] also reported that products displayed in 3D are perceived as more attractive than those shown on standard 2D screens.

Several authors have highlighted the role of trust and perceived value in 3D product presentation. Algharabat [2], [8] demonstrated that interactive control, such as rotating and zooming products, increases consumer trust and improves product evaluation. Li et al. [4] found that 3D advertising enhances virtual presence and positively affects product knowledge and brand attitude, while Jiang and Benbasat [5] reported that richer product visualisation reduces uncertainty during online purchasing. Similar conclusions were reported by Kim and Lennon [6], Algharabat and Abu-ElSamen [9], and Peng and Ke [10], who found that stronger trust in 3D environments positively influences purchasing decisions.

Research also shows that 3D visualisation improves understanding of product characteristics and creates richer visual experiences. Vasquez [3] confirms that realistic 3D product presentation increases consumer interest and purchase motivation. Staelens et al. [11] note that 3D environments create stronger immersion than traditional 2D formats, while Jeffrey et al. [20] emphasize that 3D models improve interpretation of form and spatial relationships. Isaacs et al. [16] further show that 3D visualisation helps users better understand complex visual information. The application of 3D visualisation extends beyond product marketing into advertising, architecture and retail systems.

Chehimi et al. [17] showed that interactive 3D advertising creates stronger user engagement, while Katrandjiev and Velinov [18] found that 3D product images improve consumer attitudes in online shopping. Berg et al. [19] demonstrated that advanced digital formats generate higher engagement than standard 2D and 3D images alone. In architectural presentation, Cui et al. [12], Timofeev [13], and Dübel et al. [14] confirm that 3D visualisation provides clearer, more realistic and more informative presentation than conventional 2D drawings.

Three-dimensional visualisation is also widely applied in architectural presentation, where it provides clearer and more realistic representation than traditional 2D drawings. In real estate and architectural practice, 3D presentation helps users better understand spatial layout, materials, and atmosphere, making the final appearance easier to imagine before construction or furnishing is completed. Cui et al. [12] state that 3D visualisation improves real estate presentation by combining spatial models, graphic data, and property information into one integrated visual system, making presentation more precise and informative.

Fig. 1 presents a comparison between a traditional 2D interior sketch and a realistic 3D visualisation of the same apartment space. The 3D model was first developed in SketchUp based on the original floor sketch, then rendered in Lumion using realistic lighting, textures, and materials. The final rendered image was additionally refined using Adobe Photoshop to enhance photorealism and improve presentation quality.



Fig. 1. Comparison of traditional 2D interior sketch and realistic 3D architectural visualization.

Although previous studies consistently report positive relationships between 3D visualisation, consumer trust, and purchase intention, several research gaps remain. Much of the existing literature focuses on online retail, virtual environments, or interactive product visualisation, while fewer studies examine static 3D promotional presentations in the context of graphic products and packaging design. Furthermore, many studies investigate technologically advanced visualisation systems, whereas less attention has been given to how consumers respond to realistic 3D promotional renders commonly used in contemporary graphic communication.

The present study addresses this gap by examining consumer evaluations of a graphic product package presented through a conventional 2D image and a realistic 3D promotional visualisation. By focusing on graphic product presentation and consumer perception, the study provides additional evidence regarding the role of visual communication in influencing perceived attractiveness, trust, product quality, and purchase intention.

III. RESEARCH METHODOLOGY

This study investigates the relationship between visual presentation format and consumer perception of graphic products. The main objective was to examine whether differences exist in the evaluation of products presented through a conventional 2D image and a realistic 3D visualisation. The study focused on four dimensions of consumer evaluation: visual attractiveness, perceived product quality, consumer trust, and purchase intention.

A quantitative research approach was adopted using an online survey. The study employed a within-subject design, where all participants evaluated the same product presented in two different visual formats. The visual stimuli consisted of a gaming mouse package shown as a standard 2D image and as a realistic 3D promotional render. Respondents evaluated both formats using the same measurement instrument.

The research was conducted using a convenience sampling approach. A total of 138 valid responses were included in the final statistical analysis. Although a larger number of questionnaire submissions were initially collected, only complete responses were retained for further analysis. The survey was distributed electronically through Google Forms using official student communication channels of the University Student Assembly of UKLO. Participation was voluntary and anonymous.

The demographic structure of the sample included 94 females (68.1%) and 44 males (31.9%). Regarding age distribution, 41 respondents (29.7%) were aged 20 years or younger, 77 respondents (55.8%) were between 21 and 25 years old, 5 respondents (3.6%) were between 26 and 30 years old, and 15 respondents (10.9%) were older than 30 years. The sample primarily consisted of university students, representing a population frequently exposed to digital media and contemporary visual communication formats.

TABLE I. DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

Variable	Category	Frequency	Percentage (%)
Gender	Female	94	68.1
Gender	Male	44	31.9
Age	≤20 years	41	29.7
Age	21-25 years	77	55.8
Age	26-30 years	5	3.6
Age	>30 years	15	10.9

The questionnaire measured four key variables: visual attractiveness, perceived product quality, consumer trust, and purchase intention. Responses were collected using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Additional comparative questions were included to determine which presentation format respondents considered more professional, more persuasive, and more effective in communicating product value.

The collected data were analysed using IBM SPSS Statistics. Descriptive statistics were used to calculate mean values (M) and standard deviations (SD). Internal consistency of the measurement scales was evaluated using Cronbach's alpha coefficient. To determine whether statistically significant differences existed between evaluations of the two presentation formats, a paired-samples t-test was performed.

It should be noted that the 3D stimulus used in the experiment included realistic lighting, shadows, textures, and post-processing effects, which made it visually richer than the corresponding 2D image. Consequently, the observed differences between the two formats may reflect not only the effect of dimensionality itself but also the influence of enhanced visual realism and presentation quality.

IV. RESULTS AND DISCUSSION

The analysis of the collected data shows clear differences in respondents' evaluations depending on the type of visual presentation. In order to compare perception between formats, respondents were shown the same product in two visual forms: a standard 2D image and a realistic 3D promotional render. The product used in the survey experiment was gaming mouse packaging, selected as a representative example for comparing visual presentation styles.

The left side of Fig. 2 shows the product as a conventional 2D image, while the right side presents the same product as a realistic 3D promotional render. Both visualisations represent the same packaging design and served as the experimental stimuli used in the survey. Respondents evaluated each format using identical questionnaire items in order to compare differences in perception, trust, perceived quality, and purchase intention.



Fig. 2. Comparison of 2D and 3D visual presentation used in the survey experiment.

TABLE II. RESPONSES RELATED TO 2D VISUAL PRESENTATION

Statement	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Visual attractiveness	11.8	9.7	26.4	31.9	20.1
Form and design clarity	7.0	12.0	21.8	25.4	33.8
Perceived product quality	11.2	11.9	21.0	30.1	25.9
Consumer trust	19.6	17.5	26.6	21.7	14.7
Purchase intention	20.3	25.2	25.9	14.0	14.7

Table II presents the distribution of responses related to the 2D visual presentation. The results show that the highest positive evaluations were recorded in clarity of form and design, where respondents found the product understandable in its basic shape and structure.

However, lower evaluations were observed in trust and purchase intention, suggesting that although the 2D format provides necessary visual information, it has a weaker persuasive effect.

TABLE III. RESPONSES RELATED TO 3D VISUAL PRESENTATION

Statement	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Visual attractiveness	0.7	0.7	2.8	10.4	85.4
Form and design clarity	0.0	0.0	4.9	13.9	81.3
Perceived product quality	0.0	2.1	7.6	14.6	75.7
Consumer trust	0.0	1.4	8.4	17.5	72.7
Purchase intention	0.0	0.0	6.3	19.4	74.3

Table III presents respondents' evaluations of the 3D visual presentation. Compared to the 2D format, the results show significantly stronger positive responses across all measured variables. The highest percentages are concentrated in category 5 ("strongly agree"), especially in visual attractiveness and clarity of product form, confirming the stronger impact of realistic 3D presentation.

For the 2D visual presentation, the overall mean score across all evaluated variables was $M = 3.21$ ($SD = 1.12$), indicating a moderate level of agreement. In contrast, the 3D presentation achieved considerably higher evaluations, with an overall mean score of $M = 4.70$ ($SD = 0.50$).

These findings indicate that respondents evaluated the 3D presentation more positively in terms of attractiveness, clarity, perceived quality, and trust. However, these results should be interpreted as differences in evaluation rather than

direct evidence of behavioural effects, since the study measured self-reported perceptions and purchase intentions rather than actual purchasing behaviour.

A similar trend was observed across all individual variables. Respondents reported stronger impressions of visual attractiveness, higher trust, and greater willingness to consider purchasing the product when it was presented in 3D format. The reliability of the survey instrument was tested using Cronbach's alpha coefficient. The results showed high internal consistency for both scales: $\alpha = 0.91$ for the 2D presentation scale and $\alpha = 0.86$ for the 3D presentation scale. Since both values are above the recommended threshold of $\alpha \geq 0.70$, the instrument can be considered reliable for further statistical analysis.

TABLE IV. COMPARISON BETWEEN 2D AND 3D PRESENTATION FORMATS

Evaluation Category	2D (%)	3D (%)
More professional presentation	4.2	95.8
Better product value presentation	1.4	98.6
Stronger purchase motivation	3.5	96.5

Table IV presents the direct comparison between the two presentation formats. The results show a very strong preference for the 3D format in all evaluated categories. The largest difference appears in the perception of product value, where almost all respondents selected the 3D presentation. These findings suggest that respondents perceived the 3D presentation as more professional and persuasive than the traditional 2D presentation.

To determine whether the observed differences between the two formats were statistically significant, a paired-samples t-test was conducted. The analysis revealed a statistically significant difference between evaluations of the two presentation formats ($t(137) = 15.25$, $p < 0.001$). Respondents consistently assigned higher ratings to the 3D presentation across all evaluated dimensions. In addition, the effect size was very large (Cohen's $d = 1.71$), indicating a substantial practical difference between the evaluations of the two presentation formats.

These findings suggest a positive association between realistic 3D presentation and more favourable consumer evaluations.

While the observed differences favour the 3D presentation format, the results should be interpreted with caution. The 3D stimulus incorporated realistic rendering characteristics such as lighting, shadows, textures, and post-processing effects, making it visually richer than the corresponding 2D image. Therefore, the higher evaluations may reflect the combined influence of dimensionality and enhanced visual realism rather than the effect of dimensionality alone. Future studies should employ more strictly controlled visual stimuli in order to isolate the specific contribution of three-dimensional presentation.

The findings suggest that respondents perceived the 3D presentation as a more informative and engaging format. However, additional research involving controlled stimuli and broader consumer samples is required before drawing stronger conclusions regarding the influence of presentation format on consumer decision-making.

V. CONCLUSION

The primary aim of this study was to examine differences in consumer evaluations of graphic products presented through conventional 2D images and realistic 3D visualisations. The analysis focused on four dimensions of consumer perception: visual attractiveness, perceived product quality, consumer trust, and purchase intention.

The results indicate that respondents evaluated the 3D presentation more positively across all measured variables. Higher mean scores were observed for the 3D format ($M = 4.70$, $SD = 0.50$) compared to the 2D presentation ($M = 3.21$, $SD = 1.12$). In addition, the paired-samples t-test revealed a statistically significant difference between the two presentation formats ($t(137) = 15.25$, $p < 0.001$), suggesting that respondents expressed more favourable evaluations when exposed to the 3D visualisation. The observed effect size was very large (Cohen's $d = 1.71$), further supporting the practical significance of the observed differences.

The findings support previous research highlighting the importance of visual presentation in digital communication and product marketing. Within the context of graphic product packaging, the study suggests that realistic visual presentation is associated with higher levels of perceived attractiveness, trust, product quality, and purchase intention.

However, several limitations should be acknowledged. The study was conducted using a convenience sample consisting primarily of university students, limiting the generalisability of the findings to broader consumer populations. Furthermore, the 3D stimulus used in the experiment incorporated realistic lighting, textures, shadows, and post-processing effects, making it visually richer than the corresponding 2D image. Consequently, the observed differences may reflect the combined influence of dimensionality and enhanced visual realism rather than dimensionality alone.

Future research should employ more strictly controlled visual stimuli, larger and more diverse samples, and alternative experimental designs in order to better isolate the specific effects of presentation format on consumer perception and behaviour.

Despite these limitations, the study provides additional evidence regarding the relationship between visual presentation and consumer evaluation of graphic products, contributing to the understanding of contemporary visual communication practices in digital environments.

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APPENDIX A

SURVEY QUESTIONNAIRE USED IN THE STUDY

Responses to Questions 1-10 were recorded using a five-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree).

A. Evaluation of 2D Visual Presentation

1. The 2D visual presentation appears visually attractive.
2. Through the 2D presentation, I can clearly understand the form and design of the packaging.
3. The packaging presented through the 2D visual format appears to be of high quality.
4. I trust the product based on the 2D visual presentation.
5. I would consider purchasing the product if it were presented only through a 2D visual presentation.

B. Evaluation of 3D Visual Presentation

6. The 3D visual presentation appears visually more attractive.
7. Through the 3D presentation, I better understand the form and details of the packaging.
8. The packaging presented in 3D form appears to be of higher quality.
9. The 3D visual presentation creates greater trust in the product.
10. I am more likely to purchase the product when it is presented through a 3D visual presentation.

For Questions 11-13, respondents were asked to select the presentation format they considered more appropriate according to each criterion.

C. Comparative Evaluation

11. Which presentation format appears more professional?
12. Which presentation format better communicates the value of the product?
13. Which presentation format would motivate you more to purchase the product?