



## Customer Perception on AI-Enabled 3D Graphics in E-commerce Platforms

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The incorporation of AI-enabled 3D graphics is transforming the e-commerce sector by enhancing how customers experience products online. This study investigated customer perception of AI-driven 3D graphics on e-commerce platforms, focusing on their impact on engagement, satisfaction, and purchasing decisions. With features like virtual try-on and interactive 3D product views, e-commerce platforms are addressing traditional online shopping limitations, allowing customers to visualize products more accurately and make informed choices. This research explored how users perceive the benefits of these tools in terms of trust, ease of use, and product understanding. Through a survey-based approach, the study analyzes various factors influencing customer perception, such as the added value of 3D graphics, demographic influences, and previous digital experience. The findings aim to reveal how AI-driven 3D graphics can enhance customer engagement and reduce uncertainty, while also identifying potential limitations related to usability and realism. This paper seeks to provide insights into the role of AI-enabled 3D graphics in improving customer experience and driving higher conversion rates on e-commerce platforms. Recommendations are offered for businesses looking to optimize these tools to meet evolving customer expectations and enhance the digital shopping experience. The rapid advancement of Artificial Intelligence (AI) and 3D graphics technology has transformed the e-commerce landscape, enhancing customer experiences through immersive and interactive visual representations. This study aims to explore customer perceptions of AI-enabled 3D graphics in e-commerce platforms, focusing on their impact on purchasing decisions, engagement, and trust in online shopping. The research investigates key factors such as realism, interactivity, ease of use, and personalization to determine their influence on customer satisfaction. Through a combination of surveys and case studies, this study seeks to provide insights into consumer attitudes, expectations, and potential challenges associated with AI-powered 3D graphics.

**Keywords:** AI-Enabled 3D Graphics in E-Commerce, Customer Perception of AI-Driven 3D Graphics, Virtual Try-On and Interactive 3D Product Views, Trust, Ease of Use, Product Understanding, Added value of 3D Graphics

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## 1. Introduction

The integration of AI-enabled 3D graphics in e-commerce platforms has emerged as a transformative development, aiming to revolutionize customer engagement and enhance shopping experiences. These advancements build on the foundational capabilities of 3D visualization and virtual environments, as illustrated in various studies on web-based 3D content delivery and visualization technologies (15). Recent innovations such as WebGL-based 3D urban data visualization (16) and virtual fitting room simulations (17) and virtual fitting room simulations (16) and virtual fitting room simulations (17). Furthermore, the application of AI in customizing and personalizing such graphics, as seen in tailored e-commerce solutions (17), underscores its value in addressing diverse user expectations.

This research aims to delve into customer perceptions of AI-enabled 3D graphics in e-commerce platforms, with a focus on four key objectives. First, it will analyse the impact of these technologies on customer engagement, drawing from existing evidence on their role in enhancing interactivity and user experience (18). Second, it will evaluate the influence of demographic factors such as age, gender, and technological familiarity on customer acceptance of AI-enhanced 3D tools. Third, the study will compare customer purchase intentions and satisfaction levels when interacting with AI-enabled 3D graphics versus traditional 2D images, referencing usability studies from both domains (19). Lastly, it will identify usability and technical challenges associated with implementing these advanced graphics, addressing insights from previous research on system limitations and user feedback (20).

Through these objectives, the research seeks to provide a comprehensive understanding of the evolving role of AI-enabled 3D graphics in shaping consumer behavior and satisfaction within the e-commerce landscape.

## 2. Literature Review

Virtual try-on (VTO) is an innovative technology that enables customers to try on and mix-match apparel virtually, without using a fitting room. U.S. department stores like Macy's, J.C. Penney, and Nordstrom adopted VTO in the early 2010s to enhance retail experiences, particularly as traditional stores faced challenges from the rise of online shopping [1].

VTO offers significant advantages across retail channels: in physical stores, it eliminates discomfort associated with discussing body size and shape with sales staff, and in online shopping, it compensates for the inability to try on apparel physically. By providing personalized, virtual models of customers' bodies, VTO addresses common issues such as incorrect size and fit, a leading cause of returns [2].

The technology also offers retailers valuable consumer insights by tracking preferences and predicting sales. Moreover, it improves customer satisfaction and loyalty, as shoppers can see their virtual model in multiple angles and check the fit from various perspectives [2]. Despite these advantages, VTO has limitations, including its inability to simulate fabric texture or tactile sensations. Advances such as Microsoft Kinect, 3D scanning, machine learning, GPU-based simulations, and image-based virtual try-on networks have enhanced the realism of VTO [3], [4]-[7]. For instance, Sun et al. (2019) proposed a virtual try-on network that preserves the structural consistency between garments and user images [7].

Virtual fitting, a related technology, differs from VTO in two primary ways. First, it is typically integrated into apparel pattern-making CAD systems like Optitex (Israel), Gerber Scientific (U.S.), and CLO Virtual Fashion (Korea) to simulate how 2D garment patterns fit on 3D body models [8]. Its primary purpose is to refine garment patterns and enhance quality during sample-making. Second, virtual fitting requires more advanced technology to replace conventional sample fittings by realistically depicting silhouettes, fabric drape, and textures [9], [10]. Retailers, particularly manufacturers, value virtual fitting for reducing sample-making time and costs. For instance, Seoul's "Within 24" service enables customers to design and order clothes based on virtual models within 24 hours.

Studies reveal that while virtual fitting can simulate garment size variations and grading samples effectively, it is insufficient to replace designers' physical fitting processes. Discrepancies such as waist location and stress folds in pants are commonly observed [11], [12]. Additionally, consumers with heightened concerns about fit and body satisfaction are more inclined to adopt VTO [13]. The mix-and-match feature of virtual fitting rooms adds a hedonic value, enhancing emotional engagement, purchase willingness, and online store patronage [14].

This feature, coupled with the growing appeal of mobile shopping, illustrates the utilitarian and experiential benefits driving consumer behavior in digital retail [15].

### 3. Materials and Methods

#### Methodology:

##### 1. Research Design

This study employs a **quantitative research design** to examine customer perceptions of AI-enabled 3D graphics in e-commerce. The structured approach ensures a systematic collection and analysis of data to understand key factors such as trust, ease of use, satisfaction, and purchase decisions.

##### 2. Data Collection Methods

- **Survey-Based Approach:** A structured questionnaire was distributed to gather data from 126 respondents.
- **Questionnaire Design:** Questions focused on factors such as:  
Perception of 3D graphics features (e.g., virtual try-on, interactive product views).  
Demographic factors (e.g., age, gender, technological familiarity).  
Behavioral intentions (e.g., trust, purchase decisions, and satisfaction).
- **Likert Scale:** Responses were measured on a 5-point Likert scale to ensure consistent and comparable results.

##### 3. Sampling Technique

- **Sample Size:** 126 respondents.
- **Sampling Method:** Convenience sampling was employed due to time constraints, with participants sourced from the researcher's personal and professional network.
- **Population:** The sample represents e-commerce users in India.

##### 4. Data Analysis Methods

- **Descriptive Statistics:** For summarizing demographic details and general perceptions.
- **Correlation Analysis:** To determine relationships between key variables (e.g., virtual try-on technology and customer confidence).

- **Regression Analysis:**

- **Simple Regression:** To evaluate the influence of customer confidence on online sales.

- **Multiple Regression:** To assess mediation effects, where customer confidence mediates the relationship between virtual try-on usage and online sales.

- **Software:** Statistical tools like SPSS or R were used for analysis.

### 4. Scope of study

This study investigates how AI-enabled 3D graphics compare to traditional 2D visuals in e-commerce platforms, focusing on their effectiveness and customer perceptions. It evaluates their impact on essential consumer behavior metrics such as trust, purchase intention, and satisfaction. The research examines how features such as realism, interactivity, and immersive design influence customer engagement and decision-making.

Furthermore, the study explores the varying effectiveness of AI-enabled 3D graphics across different product categories and levels of involvement, identifying scenarios where 3D graphics create a greater impact on user behavior. Using a quantitative approach with a sample of 126 respondents, this research provides valuable insights into the role of 3D graphics in enhancing the online shopping experience.

The findings aim to guide e-commerce businesses in leveraging AI-enabled 3D graphics effectively, optimizing customer experiences, and staying competitive in the dynamic digital marketplace.

### 5. Limitations

The study was conducted within a limited timeframe, restricting the depth of data collection. Respondents were primarily sourced from the researcher's personal and professional connections. Additionally, the research was confined to Indian respondents, limiting the generalizability of the findings to a global context.

The sample size was relatively small, which may not fully capture the diverse perspectives and behaviors of e-commerce users. These limitations may affect the ability to draw universally applicable conclusions about customer perceptions of AI-enabled 3D graphics in e-commerce platforms.

**Objectives**

1. To assess the impact of virtual try-on technology on customer confidence in purchasing decisions.
2. To evaluate the influence of customer confidence in product fit and style on online sales performance.
3. To investigate whether customer confidence in product fit and style mediates the relationship between virtual try-on technology usage and online sales.

**Hypotheses:**

**Hypothesis 1:**

**H0:** Virtual try-on technology does not significantly enhance customer confidence in their purchasing decisions.

**H1:** Virtual try-on technology significantly enhances customer confidence in their purchasing decisions.

**Hypothesis 2:**

**H0:** Customer confidence in product fit and style does not significantly influence online sales.

**H1:** Customer confidence in product fit and style significantly influences online sales.

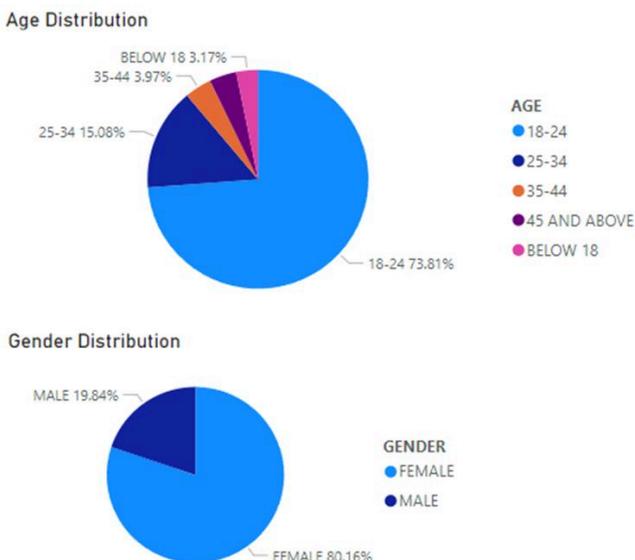
**Hypothesis 3:**

**H0:** Customer confidence in product fit and style does not mediate the relationship between virtual try-on technology usage and online sales.

**H1:** Customer confidence in product fit and style mediates the relationship between virtual try-on technology usage and online sales.

**6. Interpretation and Discussion**

**Frequency Analysis:**



**Hypothesis 1:**

**H0:** Virtual try-on technology does not significantly enhance customer confidence in their purchasing decisions.

**H1:** Virtual try-on technology significantly enhances customer confidence in their purchasing decisions.

**Table 1.1**

Correlations			
		Virtual try on technology	Customer confidence
Virtual try on technology	Pearson correlation	1	.658**
	Sig. (2-tailed)		.000
	N	126	126
Customer confidence	Pearson correlation	.658**	1
	Sig. (2-tailed)	.000	
	N	126	126

The data in Table 1.1 highlights the relationship between Virtual Try-On Technology and Customer Confidence. The Pearson correlation coefficient of **0.658** indicates a moderately strong positive relationship between the two variables. This means that as the adoption or use of Virtual Try-On Technology increases, customer confidence also tends to rise. The positive correlation suggests that these two factors move in the same direction, emphasizing the technology's role in building trust and assurance in customers' purchasing decisions.

The statistical significance of this relationship is further confirmed by a p-value of **0.000**, which is far below the commonly accepted threshold of **0.05**. This indicates that the observed correlation is highly unlikely to be due to chance, making the findings statistically reliable. With a sample size of **126** participants, the analysis is robust enough to generalize the results to similar populations.

These results have important implications for businesses. Virtual Try-On Technology reduces uncertainties by allowing customers to visualize products before purchasing, which can significantly enhance their confidence. This is particularly relevant for industries like fashion, cosmetics, eyewear, and home décor, where seeing how a product fits or looks is critical. By leveraging this technology, businesses can reduce dissatisfaction, minimize product returns, and foster greater customer loyalty.

Moreover, the findings suggest that investing in Virtual Try-On Technology can provide a competitive advantage, especially as digital shopping experiences continue to evolve.

In conclusion, the strong positive relationship and statistical significance underline the value of Virtual Try-On Technology in boosting customer confidence. Businesses adopting such innovations can create more engaging, trustworthy, and satisfying customer experiences, ultimately driving loyalty and sales in the digital marketplace.

**Hypothesis 2:**

H0: Customer confidence in product fit and style does not significantly influence online sales.

H1: Customer confidence in product fit and style significantly influences online sales.

**Model Summary:**

**Table 1.2**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.786a	0.618	0.615	1.4965

**Predictors:** (Constant), Customer confidence

The regression model output provides valuable insights into the relationship between the predictor variable(s) and the dependent variable. The **R-value** of 0.786 indicates a strong positive correlation, meaning as the independent variable(s) increase, the dependent variable also tends to increase. This suggests a strong linear relationship between the variables.

The **R<sup>2</sup> value** is 0.618, which implies that 61.8% of the variation in the dependent variable is explained by the independent variable(s) included in the model. This highlights that the model is effective in accounting for a significant portion of the variability. However, 38.2% of the variability remains unexplained, indicating room for improvement by incorporating additional relevant predictors.

The **Adjusted R<sup>2</sup> value** of 0.615 accounts for the number of predictors in the model and ensures it does not overfit. The small difference between R<sup>2</sup> and Adjusted R<sup>2</sup> suggests that the model is robust and reliable, maintaining generalizability without being overly complex.

The **Standard Error of the Estimate (SEE)** is 1.49648, which measures the average deviation of observed values from the predicted values.

While not zero, this relatively small value indicates that the model provides reasonably accurate predictions with some residual variability.

This regression model shows a strong and reliable fit, with the predictor variable(s) explaining a substantial portion of the dependent variable's variation. To further enhance the model's performance, additional predictors or refinements could be considered to account for the unexplained variability.

**Hypothesis 3:**

**H0:** Customer confidence in product fit and style does not mediate the relationship between virtual try-on technology usage and online sales.

**H1:** Customer confidence in product fit and style mediates the relationship between virtual try-on technology usage and online sales.

**Model Summary:**

**Table 1.3**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.837a	0.7	0.695	1.3315

**Predictors:** (Constant), Customer confidence, virtual, try on technology

The regression model summary highlights a strong relationship between the predictor variable(s) and the dependent variable. The **R-value** of 0.837 indicates a very strong positive correlation, suggesting that as the independent variable(s) increase, the dependent variable also increases significantly. This reflects a strong linear relationship between the variables.

The **R<sup>2</sup> value** of 0.700 shows that 70% of the variability in the dependent variable is explained by the independent variable(s) included in the model. This indicates that the model captures a substantial portion of the variation, making it highly effective. However, 30% of the variability remains unexplained, suggesting that other factors not included in the model or random noise contribute to this variation.

The **Adjusted R<sup>2</sup> value** is slightly lower at 0.695, which accounts for the number of predictors and adjusts for potential overfitting. The minimal difference between R<sup>2</sup> and Adjusted R<sup>2</sup> demonstrates that the model is well-specified and generalizable to other datasets. This ensures that the model remains robust and reliable for prediction.

The **Standard Error of the Estimate (SEE)** is 1.33150, indicating the average deviation of observed data points from the predicted regression line. The relatively low SEE suggests that the model provides accurate predictions with minimal residual error, further confirming its reliability.

This regression model shows strong predictive power, with 70% of the variation in the dependent variable explained by the predictor variable(s). The low standard error and strong correlation underscore the model's effectiveness. While the model is highly reliable, there is room for improvement by exploring additional predictors to account for the unexplained variation. Overall, this model is well-suited for understanding and predicting the dependent variable based on the independent variable(s).

## 7. Findings

- 1. Positive Impact on Customer Confidence:** Virtual try-on (VTO) technology has a strong positive correlation ( $r=0.658$ ) with customer confidence in purchasing decisions, supported by statistically significant results ( $p < 0.01$ ).
- 2. Influence on Online Sales:** Customer confidence significantly influences online sales, explaining 61.8% of the variance in the dependent variable ( $R^2=0.618$ ).
- 3. Mediation Role of Customer Confidence:** Customer confidence mediates the relationship between virtual try-on technology usage and online sales, with a high predictive accuracy ( $R^2=0.700$ ).

## 8. Suggestions

- 1. Enhance the User Experience of VTO Technology**
  - **Streamline Accessibility:** Ensure the VTO feature is easy to access on both desktop and mobile platforms.
  - **High-Quality Visualization:** Invest in high-resolution graphics and realistic simulations to improve the user experience.
  - **Ease of Use:** Simplify the VTO process with clear instructions, intuitive navigation, and minimal loading times.
  - **Customization Options:** Enable personalized options like size adjustments, color variations, or product comparisons.

## 2. Build Trust and Confidence Through Transparency

- **Educate Customers:** Provide detailed guidance on how to use VTO tools and highlight their accuracy.
- **Display Reviews and Testimonials:** Include customer feedback on how the VTO tool helped them make confident decisions.
- **Guarantees and Returns:** Offer satisfaction guarantees or hassle-free return policies to mitigate risks perceived by customers.

## 3. Leverage Data to Optimize Sales Strategies

- **Personalized Recommendations:** Use data from VTO sessions to suggest related or complementary products tailored to individual preferences.
- **Targeted Advertising:** Analyze usage patterns of VTO technology to segment customers and design targeted campaigns for high-conversion groups.
- **Seamless Checkout Experience:** Allow users to add items directly to their cart after trying them virtually.
- **Real-Time Feedback:** Enable live chat or AI-based assistance during the VTO session to answer questions and alleviate concerns.
- **Cross-Selling Opportunities:** Suggest matching accessories or related products based on the virtual try-on.

## 9. Results & Conclusion

- **Improved Engagement:** The interactive nature of AI-driven 3D tools addresses traditional e-commerce challenges, such as the inability to physically examine products.
- **Sales Growth:** Customer confidence emerges as a pivotal factor, mediating the relationship between advanced graphic technologies and online purchase behavior.
- **Strategic Insights for Businesses:** E-commerce platforms should invest in high-quality, user-friendly AI-enabled 3D tools to attract and retain customers. Addressing technical limitations will enhance usability and encourage broader adoption. Tailored strategies targeting younger, tech-savvy users could maximize the impact of these tools.

These findings emphasize the transformative potential of AI-enabled 3D graphics in redefining the e-commerce landscape, offering actionable insights for optimizing customer experiences and achieving competitive advantage.

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