

# Consumer responses to 3D experiences: the role of enjoyment, surprise, and augmentation quality

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**Abstract**

Brands employ various content types to create immersive consumer experiences. While prior research predominantly examines highly immersive contexts involving virtual reality devices, this study compares the effects of 2D and low-immersive 3D digital content on consumer satisfaction and purchase intentions. Across two between-subjects experimental studies (N = 339), findings confirm that 3D content significantly enhances satisfaction and purchase intentions compared to 2D content. Mediation analyses highlight the critical roles of surprise, enjoyment, and perceived augmentation quality in shaping consumer responses. These insights evidence the strategic value of integrating immersive digital experiences into marketing efforts. Notably, even without augmented or virtual reality devices, 3D content fosters positive brand outcomes in online settings. Furthermore, this study demonstrates the potential of 3D videos to evoke positive emotions and influence consumer behavior.

**Keywords:** customer experience, computer-mediated communication, advertisement, online consumer behavior.

## 1. Introduction

New technologies continue to provide consumers with increasingly interactive and vivid experiences, even in digital environments (Hilken *et al.* 2017; tom Dieck *et al.* 2023).

Immersive experiences are enabled by tools such as virtual and augmented reality, stereoscopic 3D content, facial recognition, holography, ultra-haptics, wearables, touchscreen, and geo-location technologies. These innovations significantly influence consumer behavior by enhancing shopping enjoyment and strengthening brand engagement through sensory and aesthetic elements (Lombart *et al.* 2020; Hagtvedt and Chandukala 2023).

While 3D experiences are defined by their spatial characteristics, interactivity, and navigational freedom (Nah *et al.* 2011), they can vary significantly in immersion depending on whether virtual reality (VR) devices are used. Highly immersive 3D content typically requires VR devices, whereas low-immersive 3D content is accessible via standard computer or mobile screens (Meißner *et al.* 2020). This study focuses on the impact of digital content formats—specifically two-dimensional (2D) versus low-immersive three-dimensional (3D) formats—on consumer experiences.

The consumer experience refers to the individual's journey during a marketing interaction (Chun *et al.* 2017). Understanding this journey has become crucial for grasping consumer behavior, as it can enhance brand awareness, foster brand loyalty, and trigger positive consumer responses (Mishra *et al.* 2021). Innovations in consumer-technology interactions, including immersive content like 3D or VR content, have been shown to improve consumer attitudes, behavioral intentions, and satisfaction (Pantano and Servidio 2012; Rohden and Espartel 2024).

Specifically, video advertisements have become a cornerstone of digital marketing, and the incorporation of innovative 3D content in such campaigns—whether through VR applications, video advertisements, or virtual spaces—has shown significant promise as a

branding tool (Bialkova and Barr 2022; Van Kerrebroeck *et al.* 2017; Wu *et al.* 2022). Prior research suggests that 3D content is perceived as more vivid and realistic, yielding higher consumer satisfaction (Hudson *et al.* 2019; Kim and Ko 2019) and stronger purchase intentions (Van Kerrebroeck *et al.* 2017; Wu *et al.* 2022). These outcomes are often attributed to emotional responses, such as enjoyment and surprise (Feng 2018; Yim *et al.* 2017), and enhanced perceptions of augmented quality (Hilken *et al.* 2017; Rauschnabel *et al.* 2019; Yoo *et al.* 2024).

Despite the growing interest in immersive digital content, existing literature on 3D experiences has predominantly focused on highly immersive VR environments, with applications in domains such as advertising (Wu *et al.* 2022), museum engagement (Shahab *et al.* 2023), virtual stores (Kang *et al.* 2020; Sina and Wu 2019), training and relaxation (Chittaro *et al.* 2024), and healthcare (Lee *et al.* 2023). Research on low-immersive 3D experiences accessible on standard devices remains scarce, and direct comparisons between 2D and 3D content in such contexts are limited (Lombart *et al.* 2020; Meißner *et al.* 2020; Wu *et al.* 2022).

To address these gaps, this study investigates the impact of 2D and 3D content formats in low-immersive digital environments, such as viewing on desktops or mobile devices without VR aids. By exploring emotional responses (e.g., surprise and enjoyment) and perceptions of augmented quality, this research seeks to uncover the mechanisms driving consumer satisfaction and purchase intentions.

Two experimental studies were conducted to achieve these objectives, simulating a living room environment where participants interacted with either 2D or 3D content. The findings reveal that low-immersive 3D content significantly enhances consumer satisfaction and purchase intentions compared to 2D formats. Mediation analyses demonstrate that the effects of 3D content are driven by heightened surprise, enjoyment, and perceived augmented

quality. These results underscore the strategic potential of low-immersive 3D content as an effective tool to foster consumer engagement and generate positive brand outcomes in digital marketing.

## **2. Theory and hypotheses**

### **2.1. *Consumer responses: satisfaction and purchase intentions***

Satisfaction is defined as the consumer's evaluation of the product received compared to their expectations, with higher satisfaction occurring when expectations are positively exceeded (Babin and Griffin 1998). Immersive experiences tend to increase satisfaction due to their impact on perceptions of flow and involvement (Hudson *et al.* 2019; Kim and Ko 2019). In marketing contexts, 3D content can evoke higher satisfaction than 2D formats, as it provides richer, more engaging interactions. Hence, the following hypothesis is proposed:

**H1:** 3D content has a more positive effect on consumer satisfaction than 2D content.

Similarly, immersive content influences purchase intentions (Yim *et al.* 2017; Li *et al.* 2024), which reflects consumer's willingness to buy a product or brand after interacting with marketing stimuli. Strategies such as advertisement, discounts, store ambiance, or immersive shopping experiences can enhance these intentions (Lombart *et al.* 2020; Sina and Wu 2019). The vividness of 3D experiences, particularly when compared to 2D formats, positively influences purchase intentions (Van Kerrebroeck *et al.* 2017). Following the perspective that immersive content, such as 3D videos, can enhance experiences, it is anticipated that this format will elicit intentions to purchase the displayed products. Based on this reasoning, the following hypothesis is proposed:

**H2:** 3D content has a more positive effect on purchase intention than 2D content.

## 2.2. *The role of emotions: surprise and enjoyment*

Surprise arises when individuals encounter unexpected events that challenge their existing expectations (Derbaix and Vanhamme 2003). This emotion is often triggered by improbable or incongruous stimuli and can significantly influence attention, memory, attitudes, and behaviors (Loewenstein 2019). Due to the reinforcing nature of surprise, consumer responses are expected to be more intense when preceded by surprise than when it is absent (Izard 1977).

Communication and digital content have the potential to evoke surprise in consumers (Hutter and Hoffman 2014). When marketers successfully surprise customers, this reaction can stimulate curiosity and, in turn, increase satisfaction (Berman 2005). Previous research suggests that individuals who experience pleasant surprises in brand interactions report higher satisfaction levels compared to those who encounter similar experiences without the element of surprise (d'Astous and Gagnon 2007). Moreover, surprise elicited by advertisements across various media formats has been shown to positively influence attitudes and purchase intentions (Hutter and Hoffman 2014).

Although few studies have thoroughly examined surprise as a result of human interaction with emerging technologies (Ameen *et al.*, 2021), it is anticipated that the surprise generated by immersive content, namely 3D videos, will foster positive consumer responses. Accordingly, the following hypotheses are proposed:

**H3a:** Surprise elicited by 3D (vs. 2D) content mediates the relationship between the type of visual stimuli and satisfaction with the experience.

**H3b:** Surprise elicited by 3D (vs. 2D) content mediates the relationship between the type of visual stimuli and purchase intentions.

Enjoyment refers to the level of pleasure or fun experienced during an interaction, regardless of the product's functional performance (Holdack *et al.* 2022; Jo and Park 2023). It plays a critical role in enhancing consumer satisfaction with the service provided (Pereira and Tam 2021). VR has been tested as a tool to elicit user enjoyment, which, in turn, influences positive user responses not only in gaming settings (Jang and Park 2019; Jo and Park 2023) but also in retailing situations (Kim *et al.* 2021). Playfulness, associated with the joy of using VR devices, has been shown to positively affect purchase intentions (Kang *et al.* 2020). The novelty and vividness of various types of media can enhance immersion, further influencing enjoyment (Yim *et al.* 2017). Additionally, enjoyment linked to more immersive media is connected to a heightened sense of presence and realism (Han *et al.* 2023; Nah *et al.* 2011). Finally, interaction with 3D content has been suggested to elicit enjoyment perceptions, which increases purchase intentions (Wu *et al.* 2022). Hence, the following hypotheses are proposed:

**H4a:** Enjoyment elicited by 3D (*vs.* 2D) content mediates the relationship between the type of visual stimuli and satisfaction with the experience.

**H4b:** Enjoyment elicited by 3D (*vs.* 2D) content mediates the relationship between the type of visual stimuli and purchase intentions.

### **2.3.        *The role of perceived augmentation quality***

Perceived augmentation quality refers to the extent to which consumer perceive content as authentic, realistic, and seamlessly integrated into their environment (Rauschnabel *et al.* 2019). The type of media used by a company in advertisements and other consumer interactions significantly influences these perceptions. For instance, virtual reality experiences result in a heightened sense of presence and arousal (Han *et al.* 2023).

Overall, higher perceived augmentation quality translates into better experiences and more positive consumer responses (Hilken *et al.* 2017). More immersive and dynamic virtual environments tend to increase spatial presence (Shin *et al.*, 2019) and promote visual imagery elaboration (Yoo *et al.* 2024). The perception of environmental embeddedness facilitated by a more realistic experience, improves cognitive fluency, which influences purchase intentions (Fan *et al.* 2020). Furthermore, the sense of flow associated with augmented experiences can positively influence satisfaction (Hudson *et al.* 2019). Since 3D media types are usually perceived as more immersive and vivid (Kim and Ko 2019), it is expected that 3D content will offer higher perceived augmentation quality, resulting in positive outcomes. Therefore, the following hypotheses are proposed:

**H5a:** Perceived augmentation quality elicited by 3D (vs. 2D) content mediates the relationship between the type of visual stimuli and satisfaction with the experience.

**H5b:** Perceived augmentation quality elicited by 3D (vs. 2D) content mediates the relationship between the type of visual stimuli and purchase intentions.

Figure 1 presents the conceptual model based on the proposed hypotheses.

FIGURE 1 HERE

### 3. Method

Two experimental studies were conducted to test the hypotheses, both employing a between-subjects single-factor design. Study 1 aimed to test hypotheses H1, H3a, and H4a, while Study 2 tested all proposed hypotheses. The context chosen for these experiments involved a furniture video displaying various products for decorating a living room (e.g., sofa, lamp,

table, rug). This choice was motivated by the predominance of existing consumer behavior research focusing on food and beverage categories (e.g., Branca *et al.* 2023; Lombart *et al.* 2020). Using 3D content in the furniture industry offers consumers inspiration and helps them visualize products within their homes (Rauschnabel *et al.* 2019). Additionally, the furniture sector has increasingly adopted 3D and immersive content to assist consumers in the decision-making process (Kang *et al.* 2020).

### **3.1. Study 1**

#### *3.1.1. Design and procedures*

A causal approach was adopted and operationalized through a between-subject single-factor experiment. Participants were recruited from Prolific in exchange for a small fee.

Respondents were screened based on location (UK) and language proficiency (English) and were randomly assigned to one of the two conditions: 2D content or 3D content.

The manipulation of immersive content involved a video shown on participants' devices, without sound, and lasting 51 seconds. The video demonstrated a living room interior where furniture pieces appeared consistently throughout the viewing. In the 3D condition, the elements exhibited dynamic effects such as flying over the image edges and rotating, mimicking a 3D environment. In contrast, the 2D condition presented static images of the same living room and furniture without movement or 3D elements. Following the video, participants completed a questionnaire covering manipulation checks, control measures, and demographic information.

#### *3.1.2. Measurements*

The constructs were measured using validated scales for satisfaction (Babin and Griffin 1998), surprise (Izard 1977), and enjoyment (Kowalczyk 2018). Familiarity with the content

type was assessed using a control question. All responses were recorded on 7-point Likert scales.

A pretest was conducted to evaluate the manipulation and identify potential issues with the questions. The manipulation worked as expected, although a minor adjustment was made to one of the questions assessing respondents' perceptions. Consequently, the main study's manipulation check asked respondents to classify the video on a bipolar scale ranging from "2-dimensional" to "3-dimensional".

### *3.1.3. Results*

A total of 131 valid responses were collected, with 65 respondents assigned to the 3D video content and 66 to the 2D content. There were no outliers or missing data, and the sample followed a normal distribution. Demographic analysis indicated that most respondents were women (66%), with an average age of 40 years, ranging from 18 to 73 years. Reliability analysis confirmed acceptable levels for satisfaction ( $\alpha=0.897$ ), surprise ( $\alpha=0.855$ ), and enjoyment ( $\alpha=0.927$ ).

The manipulation check results were significant ( $t= -3.34$ ,  $p=0.01$ ), confirming that participants in the 2D condition perceived the content as such ( $M= 4.35$ ,  $SD= 0.26$ ), while those in the 3D condition found the scenario more immersive ( $M= 5.50$ ,  $SD = 0.23$ ). The t-test further demonstrated a significant main effect of visual stimuli on consumer satisfaction ( $t = -3.44$ ,  $p = 0.001$ ). Satisfaction levels were lower in the 2D condition ( $M= 4.16$ ,  $SD =1.28$ ) compared to the 3D condition ( $M= 4.86$ ,  $SD = 1.03$ ), indicating that interacting with 3D content positively impacted satisfaction, supporting H1.

Surprise levels also differed significantly between conditions ( $t = -5.170$ ,  $p = 0.001$ ), with the 3D video eliciting higher surprise ( $M= 4.10$ ,  $SD = 1.35$ ) than the 2D stimuli ( $M=$

2.97, SD = 1.12). Similarly, enjoyment levels were higher in the 3D condition (M= 5.38, SD = 1.06) than in the 2D content (M= 4.43, SD = 1.31;  $t = -4.420$ ,  $p = 0.001$ ).

Mediation analysis confirmed that the effect of visual stimuli on surprise was significant ( $\beta = 1.126$ ,  $t(1,129) = 5.172$ ,  $p = 0.001$ ). Additionally, surprise significantly influenced satisfaction ( $\beta = 0.514$ ,  $t(1,129) = 7.435$ ,  $p = 0.001$ ), indicating that higher levels of surprise led to higher satisfaction. The direct effect of visual stimuli on satisfaction was also significant ( $\beta = 0.702$ ,  $t(1,129) = 3.443$ ,  $p = 0.008$ ), as shown by the t-test. Interestingly, when surprise was included in the model, the direct effect of visual stimuli on satisfaction became non-significant ( $\beta = 0.122$ ,  $t = 0.653$ ,  $p = 0.514$ ). The mediation analysis revealed that the impact of 3D technology on satisfaction was fully explained by the indirect effect ( $\beta = 0.477$ , CI 0.282 to 0.686), confirming the full mediation of surprise on satisfaction and supporting H3a.

#### TABLE 1 HERE

The mediation effect of enjoyment was tested using a similar approach. The type of content significantly impacted enjoyment levels ( $\beta = 0.923$ ,  $t(1,129) = 4.426$ ,  $p = 0.001$ ). As expected, enjoyment positively influenced consumer satisfaction ( $\beta = 0.697$ ,  $t(1,129) = 11.485$ ,  $p = 0.001$ ). When considering the indirect effect of enjoyment on the dependent variable ( $\beta = 0.529$ , CI 0.314 to 0.739), the direct effect was no longer significant ( $\beta = 0.052$ ,  $t = 0.383$ ,  $p = 0.702$ ), confirming full mediation and supporting hypothesis H4a. Table 1 summarizes these mediation results, considering path *a* (independent variable to the mediator), path *b* (mediator to the dependent variable), as well as the direct and indirect effects.

## 3.2. *Study 2*

### 3.2.1. *Design and procedures*

Study 2 aimed to test all proposed hypotheses, expanding the impact of content type (2D vs. 3D) also on purchase intentions and including the mediating role of perceived augmented quality. Participants were recruited from Prolific, selected based on their location (UK) and language (English), and were randomly assigned to one of two conditions: 2D content or 3D content. This between-subjects, single-factor design manipulated only content type, using the same scenarios as Study 1.

### 3.2.2. *Measurements*

Participants' purchase intentions were measured using a 3-item scale adapted from Kang *et al.* (2020). Perceived augmentation quality was assessed using items from Hilken *et al.* (2017) and Rauschnabel *et al.* (2019). Familiarity with the content ("How frequently do you interact with this kind of content") and attention paid to the content ("I carefully examined the design and style of the products") were included as control variables. All other constructs and demographic measures were consistent with those employed in Study 1. Responses were recorded using a 7-point Likert scale.

### 3.2.3. *Results*

A total of 208 valid responses were collected, with 105 participants in the 2D condition and 103 in the 3D condition. The sample was 50% female, with a mean age of 41 years. Participants were generally familiar with the content ( $M= 3.19$ ,  $SD= 1.58$ ) and paid considerable attention to it ( $M= 4.72$ ,  $SD= 1.55$ ). Familiarity ( $t= -0.808$ ,  $p= 0.420$ ) and attention ( $t= -1.551$ ,  $p= 0.122$ ) did not differ significantly between scenarios.

Cronbach's alpha confirmed acceptable levels of internal consistency for satisfaction (0.921), purchase intentions (0.951), surprise (0.872), enjoyment (0.942), and perceptions of augmentation quality (0.890). The manipulation yielded significant results ( $t = 7.045$ ,  $p = 0.001$ ), with respondents in the 2D condition perceiving the content as such ( $M = 5.11$ ,  $SD = 1.96$ ) compared to their peers who saw the 3D content ( $M = 6.59$ ,  $SD = 0.88$ ). Respondents also perceived the 2D scenario as static ( $M = 2.11$ ,  $SD = 1.58$ ) and the 3D scenario as having objects in motion ( $M = 6.72$ ,  $SD = 0.71$ ).

The t-test revealed significant main effects for satisfaction ( $t = -5.753$ ,  $p = 0.001$ ) and purchase intentions ( $t = -2.223$ ,  $p = 0.027$ ). Participants exposed to the 3D content reported higher satisfaction ( $M = 5.17$ ,  $SD = 1.41$ ) and a greater willingness to purchase the furniture ( $M = 3.63$ ,  $SD = 1.44$ ) compared to those who viewed the 2D content ( $M_{\text{sat}} = 3.92$ ,  $SD = 1.71$ ;  $M_{\text{pur}} = 3.15$ ,  $SD = 1.66$ ). These results supported H1 and H2.

Analysis of the impact of content type on surprise ( $t = -4.174$ ,  $p = 0.001$ ) and enjoyment ( $t = -4.895$ ,  $p = 0.001$ ) confirmed significant results, consistent with findings from Study 1. Respondents interacting with the 3D content reported higher levels of surprise ( $M = 3.48$ ,  $SD = 1.48$ ) than those exposed to the 2D stimuli ( $M = 2.63$ ,  $SD = 1.44$ ). Similarly, the 3D experience was rated as more enjoyable ( $M = 4.71$ ,  $SD = 1.47$ ) compared to the 2D content ( $M = 3.63$ ,  $SD = 1.69$ ). As hypothesized, the 3D content provided enhanced augmentation perceptions ( $t = -2.805$ ,  $p = 0.003$ ), with respondents perceiving higher quality augmentation in the 3D video ( $M = 3.89$ ,  $SD = 1.61$ ) than in the 2D video ( $M = 3.26$ ,  $SD = 1.56$ ).

Mediation analysis demonstrated that the effect of visual stimuli on surprise was significant ( $\beta = 0.847$ ,  $t(1,206) = 4.175$ ,  $p = 0.001$ ). Surprise positively influenced satisfaction ( $\beta = 0.558$ ,  $t(2,205) = 8.750$ ,  $p = 0.001$ ), indicating that greater surprise increased satisfaction with the experience. The direct effect of content type on satisfaction was significant ( $\beta = 0.774$ ,  $t(1,206) = 4.003$ ,  $p = 0.001$ ), as was the total effect ( $\beta = 1.248$ ,  $t = 5.743$ ,  $p = 0.001$ ). The

indirect effect of surprise on satisfaction ( $\beta= 0.281$ , CI 0.147 to 0.418) confirmed partial mediation and supported H3a.

The influence of content type on enjoyment was also significant ( $\beta= 1.074$ ,  $t(1,206) = 4.888$ ,  $p=0.001$ ), with enjoyment positively impacting satisfaction ( $\beta= 0.761$ ,  $t(2, 205) = 17.263$ ,  $p=0.001$ ). Both the direct effect ( $\beta= 0.430$ ,  $t= 2.929$ ,  $p= 0.004$ ) and the total effect ( $\beta= 1.248$ ,  $t= 5.743$ ,  $p=0.001$ ) were significant, while the indirect effect ( $\beta= 0.486$ , CI 0.292 to 0.673) confirmed mediation, supporting hypothesis H4a.

The effect of content type on augmentation quality was significant ( $\beta= 0.636$ ,  $t(1,206) = 2.804$ ,  $p=0.005$ ). Augmentation quality, in turn, positively influenced satisfaction ( $\beta= 0.542$ ,  $t(2,205) = 9.836$ ,  $p=0.001$ ). Both the direct effect of content on augmentation ( $\beta= 0.903$ ,  $t= 4.935$ ,  $p=0.001$ ) and the total effect of the model ( $\beta= 1.248$ ,  $t= 5.743$ ,  $p=0.001$ ) were significant. The indirect effect further confirmed the mediation ( $\beta= 0.205$ , CI 0.059 to 0.354), indicating that 3D content enhances augmentation perceptions, which subsequently improve satisfaction, and support H5a.

Mediation effects were also tested for purchase intentions. The effect of surprise on purchase intentions was confirmed ( $\beta= 0.597$ ,  $t(2,205) = 9.731$ ,  $p=0.001$ ). As the direct effect of content type on purchase intentions was not significant ( $\beta= -0.027$ ,  $t= -0.145$ ,  $p=0.885$ ), the indirect effect was fully mediated by feelings of surprise ( $\beta= 0.322$ , CI 0.168 to 0.485), supporting H3b.

Moreover, enjoyment significantly influenced purchase intentions ( $\beta= 0.678$ ,  $t(2,205) = 13.700$ ,  $p=0.001$ ), and the total effect was also significant ( $\beta= 0.479$ ,  $t= 2.220$ ,  $p=0.028$ ). Interestingly, when enjoyment was included in the model, the direct effect of content type on purchase intentions was no longer significant ( $\beta= -0.249$ ,  $t= -1.515$ ,  $p=0.131$ ). The indirect effect ( $\beta= 0.464$ , CI 0.276 to 0.662) confirmed full mediation and supported H4b.

TABLE 2 HERE

Additionally, augmentation perceptions were found to influence purchase intentions ( $\beta = 0.576$ ,  $t(2,205) = 10.897$ ,  $p = 0.001$ ). Full mediation was again confirmed, with a significant indirect effect ( $\beta = 0.233$ , CI 0.068 to 0.410) and the absence of a direct effect between the main variables ( $\beta = 0.112$ ,  $t = 0.642$ ,  $p = 0.522$ ), supporting H5b. Table 2 provides a detailed overview of the mediation effects observed in Study 2.

#### **4. Conclusion**

This research employed two experimental studies in a furniture purchase context to investigate how the type of content (2D or 3D) impacted consumer satisfaction with the experience and intentions to purchase the product. Additionally, three mediators – surprise, enjoyment, and perceived augmentation quality – were tested to uncover the mechanisms behind these effects. Participants interacted with either 2D or 3D video content simulating a living room environment, contrasting static 2D images with dynamic and immersive 3D elements.

The findings revealed that 3D content significantly enhanced both consumer satisfaction and purchase intentions compared to 2D content. Mediation analyses revealed that surprise, enjoyment, and perceived augmentation quality were pivotal in explaining these effects. These results underscore the value of leveraging immersive content in marketing to elicit positive emotional responses and create engaging purchase experiences. Furthermore, these findings provide insights into how companies can deploy new technology strategies to create more vivid, immersive, and joyful purchase experiences.

##### **4.1. *Theoretical implications***

This research advances the theoretical understanding of how 3D content influences consumer behavior by exploring its impact on satisfaction and purchase intentions within a low-immersive, non-VR context. While some previous studies have compared 2D and 3D content in contexts like human resources and recruitment experiences (Bialkova and Ros 2021), most research in the retail context has focused on face-to-face shopping experiences (Pantano and Servidio 2012), and recent studies on the digital consumer journey have concentrated on purchase behaviors and variety-seeking (Meißner *et al.* 2020) or product try-on technologies (Bialkova and Barr 2022). In the field of advertising, emotional responses to more immersive content have been discussed, though without exploring specific feelings (Feng 2018).

The primary theoretical contribution of this study lies in directly comparing the impact of 3D and 2D content on consumers without the use of virtual or augmented reality devices. Understanding the impact of low-immersive 3D experiences is critical from a theoretical standpoint, as it expands the scope of research on digital consumer engagement beyond highly immersive technologies like virtual and augmented reality. While existing literature has extensively explored the effects of high-immersion environments (e.g., Lombart *et al.* 2020; Van Kerrebroeck *et al.* 2017), the role of low-immersive 3D content—such as interactive 3D images and videos—remains underexamined. Theoretical frameworks in consumer psychology suggest that sensory richness and interactivity influence cognitive and emotional engagement. This study provides insights into how low-immersive 3D content influences consumer engagement, particularly in digital marketing and e-commerce. Our findings highlight that key perceptual factors, such as realism and augmentation quality, play a significant role in shaping consumer responses, even in the absence of specialized VR or AR devices. This extends existing research on digital experience design by demonstrating that interactivity and sensory richness in low-immersive settings can enhance consumer satisfaction and purchase intentions.

Unlike prior studies that primarily focus on high-immersion environments, our research underscores the accessibility and effectiveness of low-immersive 3D content in engaging consumers. Given its seamless integration into digital platforms, social media, and e-commerce websites, brands can leverage this content to create more compelling marketing experiences without the barriers associated with fully immersive technologies. These findings suggest that optimizing low-immersive 3D content can enhance user experience and drive purchase behaviors, offering practical implications for marketers seeking cost-effective yet impactful digital strategies.

By linking consumer perceptions of augmentation quality with emotional responses, this study also advances theoretical discussions on digital consumer engagement. Specifically, we demonstrate that the surprise element elicited by 3D content fosters positive emotions, which in turn enhances satisfaction and purchase intentions. Our findings advance previous research on surprise extends research on consumer surprise (Hutter and Hoffman 2014) by suggesting that low-immersive 3D content evokes positive emotions, such as surprise, which subsequently enhances perceived satisfaction and willingness to purchase the showcased products.

Furthermore, this study expands the literature on enjoyment in interactions with technology. While previous research has explored enjoyment as a consequence of vivid and realistic interactions (Han *et al.* 2023; Yim *et al.* 2017), this study adds value by distinguishing between immersive and non-immersive experiences, specifically comparing 2D and 3D content. This is an important aspect of content marketing strategies and inbound marketing. These insights refine our understanding of how digital realism affects consumer behavior, contributing to a broader discourse on the psychological mechanisms underlying interactive media consumption.

Finally, this research contributes to the understanding of perceived augmentation quality, particularly in non-immersive 3D environments. Existing literature has focused more on augmented reality technologies (Hilken *et al.* 2017; Yoo *et al.* 2024), but this study demonstrates that augmented quality also manifests in low-immersive 3D images. Moreover, we confirm the positive impact of augmented quality on satisfaction and purchase intentions elicited by more realistic digital experiences.

#### **4.2.        *Managerial implications***

The managerial implications of this study highlight the potential of 3D content to increase consumer engagement and drive sales (Pauwels *et al.* 2023). Based on our findings, marketers should consider integrating more 3D content into their digital strategies. 3D content can evoke emotions like surprise and enjoyment, which in turn enhance consumer satisfaction and purchase intentions. This suggests that even subtle changes in digital content, for example in e-commerce experiences, can have a significant impact on consumer engagement and foster positive word-of-mouth.

For brands participating in events, such as trade fairs, using 3D content could be an effective way to create more immersive and engaging experiences for attendees. Moving from traditional 2D content to 3D could help attract attention, improve brand perception, and enhance audience engagement.

In retail settings, adopting immersive in-store experiences, such as expanded reality, smart mirrors, and service robots, can improve the perception of enjoyment and immersion during the shopping journey. While this was not the specific focus of the study, such technologies could contribute to increased consumer satisfaction and, consequently, higher sales. This strategy not only draws customers to physical locations but also fosters brand loyalty.

Additionally, understanding the role of surprise and augmentation quality in shaping consumer perceptions allows brands to craft more compelling narratives and differentiate themselves in competitive digital environments. As the demand for immersive yet accessible content grows, companies that effectively leverage low-immersive 3D experiences will be better positioned to capture consumer attention and foster brand loyalty.

#### **4.3. *Research limitations and future studies***

This study has some limitations that could be addressed in future research. First, the presentation of 3D content was limited to videos viewed on personal devices, which restricted the depth of engagement with the 3D experience. Special effects were the primary means of conveying immersion, but the format used may not fully capture the experience offered by more immersive technologies like virtual reality. Additionally, the study was conducted in a controlled lab setting, where participants interacted with content on their mobile devices, potentially introducing distractions. Future research could consider more natural field settings where consumers engage with 3D content organically. It would also be interesting to test the impact of using VR devices to enhance the realism of the scenarios.

Moreover, the use of neuromarketing tools, such as EEG, could provide more detailed insights into the emotional and cognitive responses evoked by immersive technologies. Neurophysiological data collection could help understand the underlying mechanisms of consumer reactions to 3D content. Future research could also explore how perceptions of vividness and immersion influence consumer behavior, testing these factors as mediators or antecedents of purchase intentions. Since 3D content is often perceived as more realistic, these factors could enhance our understanding of how different types of video content affect consumer responses.

Additionally, future studies could assess the impact of 3D content in specific contexts, such as paid media strategies (Pauwels *et al.* 2023) or live streaming and social commerce environments (Li *et al.* 2024). Evaluating the impact of 3D content in these settings could provide new perspectives on the effectiveness of immersive content in modern marketing practices.

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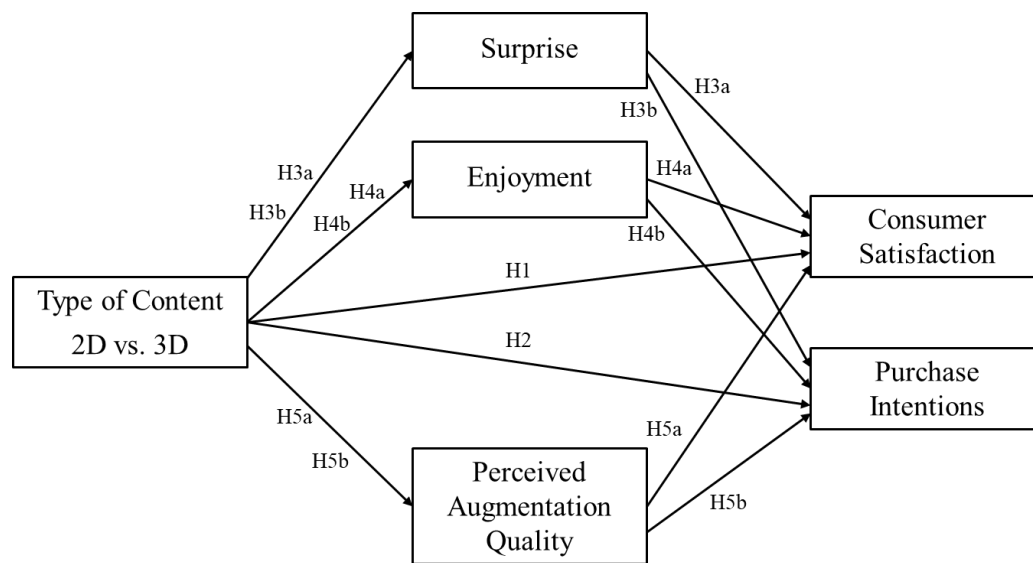
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**Figure 1.** Conceptual Model



**Table 1.** Mediation Effects of Study 1

Mediator	DV	IV on mediator (path a)	Mediator on DV (path b)	Direct effect	Total effect	Indirect effect	LLCI	ULCI	Mediation
Surprise	Satisfaction	5.171 (1.126)*	7.435 (0.514)*	0.653 (0.122)	3.443 (0.702)*	0.477	0.282	0.686	Full
Enjoyment	Satisfaction	4.426 (0.923)*	11.485 (0.697)*	0.383 (0.059)	3.443 (0.702)*	0.529	0.314	0.739	Full

Note: \* corresponds to significant effect ( $p < 0.05$ ).

**Table 2.** Mediation Effects of Study 2

Mediator	DV	IV on mediator (path a)	Mediator on DV (path b)	Direct effect	Total effect	Indirect effect	LLCI	ULCI	Mediation
Surprise	Satisfaction	4.175 (0.847)*	8.750 (0.558)*	4.003 (0.774)*	5.743 (1.248)*	0.281	0.147	0.418	Partial
	Purchase Intention		9.731 (0.597)*	-0.145 (-0.027)	2.220 (0.479)*	0.322	0.168	0.485	Full
Enjoyment	Satisfaction	4.888 (1.074)*	17.263 (0.761)*	2.929 (0.430)*	5.743 (1.248)*	0.486	0.292	0.673	Partial
	Purchase Intention		13.700 (0.678)*	-1.515 (-0.249)	2.220 (0.479)*	0.464	0.276	0.662	Full
Perceived Augmentation	Satisfaction	2.804 (0.636)*	9.836 (0.542)*	4.935 (0.903)*	5.743 (1.248)*	0.205	0.059	0.354	Partial
	Purchase Intention		10.897 (0.576)*	0.642 (0.112)	2.220 (0.479)*	0.233	0.068	0.410	Full

Note: \* corresponds to significant effect ( $p < 0.05$ ).