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THE ROLE OF EMBODIMENT, PRESENCE, AND INTERACTIVITY IN SHAPING CONSUMER EXPERIENCE IN VIRTUAL SPACES AND DIGITAL SERVICES

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Purpose: The purpose of this paper is to examine the role of immersive technologies in shaping consumer experience in virtual spaces and to identify the significance of embodiment, presence, and interactivity for the development of modern digital services.
Design/methodology/approach: The study is based on a quantitative research approach conducted among users of immersive technologies. Data were collected through a structured questionnaire and analyzed using descriptive statistics, correlation analysis, and regression analysis. The theoretical framework is grounded in the EPI model (Embodiment, Presence, Interactivity) and contemporary consumer experience theory.
Findings: The results indicate that immersive technologies significantly contribute to the quality of consumer experience in virtual environments. Interactivity demonstrated the broadest associations with consumer experience components and appears to play an integrative role in shaping the overall experience. Presence was most strongly related to the emotional component and also showed substantial associations with sensory and cognitive experiences. Embodiment was primarily linked to emotional and cognitive aspects of consumer experience.
Research limitations/implications: Its main limitations relate to the size and structure of the research sample, as well as the focus on selected immersive technologies. Future research should involve larger and more diverse samples, compare different types of virtual environments to provide a more comprehensive understanding of immersive consumer experiences.
Practical implications: The findings provide valuable insights for companies developing digital services, e-commerce platforms, and virtual environments. Understanding the factors that shape consumer experience may support the design of more engaging, personalized, and effective digital interactions.
Social implications: The growing adoption of immersive technologies may transform the way consumers interact with digital services, culture, education, and entertainment. The study highlights the increasing importance of virtual environments in everyday consumer experiences and social interactions.
Originality/value: The paper contributes to the growing body of knowledge on consumer experience in virtual spaces by integrating the EPI model with the context of modern digital services. It provides empirical evidence on the role of immersive technologies and offers practical recommendations for organizations operating in the digital economy.

Keywords: immersive technologies, consumer experience, EPI model, interactivity, digital services.
Category of the paper: research paper**.**

1. Introduction

The digital transformation has significantly influenced the development of the e-commerce and innovative digital services sectors, reshaping the nature of consumer–brand interactions and creating new opportunities for customer engagement in virtual environments (Vargo et al., 2024; Soto Setzke et al., 2023; Mazurek, 2018). Contemporary e-commerce often relies on new technologies, transforming it from sales channels into digital ecosystems and are a central element of an organization's digital transformation strategy (Verhoef et al., 2021). As online retail environments become increasingly sophisticated, consumer expectations extend beyond functional aspects of the purchasing process and encompass factors such as convenience, personalization, and the quality of the overall shopping experience (Ambika et al., 2025). At the same time, the absence of direct physical interaction with products remains one of the fundamental limitations of online shopping (Rudzewicz, 2010; Bartczak, 2016).

In response to these challenges, companies offering digital services, especially those operating in the e-commerce sector, increasingly employ immersive technologies, including virtual fitting rooms, 3D product configurators, digital showrooms, and augmented reality applications ((Narojczyk, 2025; Çil et al., 2026). These solutions enable consumers to interact with products in more engaging ways and contribute to the creation of enhanced digital experiences. Previous studies have generally shown that immersive technologies positively affect consumer perceptions, engagement, satisfaction, and behavioral intentions in retail environments (Poushneh, Vasquez-Parraga, 2017; Hilken et al., 2017; Jin et al., 2021; Kim et al., 2023).

Recent research suggests that the effectiveness of immersive environments is strongly shaped by the degree to which they evoke a sense of presence, embodiment, and interactivity (Lin et al., 2025; Mansoor et al., 2024; Leveau, Camus, 2023; Orus et al., 2021; Flavian et al., 2019). These dimensions influence consumers' cognitive, emotional, and behavioral responses during digital interactions with products and brands (Di Dalmazi et al., 2024). Furthermore, immersive technologies contribute to enhancing customer experience by facilitating greater engagement, product understanding, and perceived value (Çil et al., 2026).

Despite the growing body of literature on immersive technologies and virtual shopping environments, relatively little attention has been devoted to examining how specific dimensions of immersive experiences influence individual components of consumer experience. Existing studies tend to focus on the technological aspects of immersive solutions or their impact on selected behavioral outcomes, while the relationships between embodiment, presence,

interactivity, and the cognitive, emotional, sensory, pragmatic, lifestyle, and relational dimensions of consumer experience components identified by Gentile et al. (2007), remain insufficiently explored. This research gap is particularly evident in the context of integrated models that explain how virtual environments shape consumer experiences and generate value for digital service providers. Consequently, understanding the characteristics of virtual environments that shape consumer experience has become an important area of research within the fields of digital marketing and consumer behavior.

Therefore, the aim of this paper is to examine the role of immersive technologies in shaping consumer experiences in virtual spaces with particular emphasis on the significance of embodiment, presence, and interactivity in the context of modern digital services. The study refers to the six consumer experience components identified by Gentile et al. (2007): sensory, emotional, cognitive, pragmatic, lifestyle, and relational experience. At the same time, the empirical analysis focuses on four components considered especially relevant to immersive online shopping - sensory, emotional, cognitive, and pragmatic experience - which are examined in relation to the dimensions of the EPI model using correlation and regression analysis. The findings are intended to contribute to a better understanding of how immersive technologies can support the design of innovative digital services and virtual shopping environments.

2. Literature review: The EPI Model as a Framework for Understanding Consumer Experience in Virtual Spaces

Consumer Experience (CX) is commonly defined as a consumer's internal and subjective response to any direct or indirect contact with a company (Meyer, Schwager, 2007). It has also been conceptualized as an interactive process of value co-creation, in which customers actively participate in shaping their own experiences (Gentile et al., 2007). According to Gentile et al. (2007), consumer experience is dynamic in nature, evolving over time as a result of the cumulative interactions between the customer and the brand.

Consumer experience is increasingly recognized as a central element of organizational strategy and, consequently, should be deliberately designed and managed (Zomerdijk, Voss, 2010). More recent conceptualizations describe CX as a complex and longitudinal process involving the subjective and context-dependent interpretation of interactions with stimuli provided by a company (Becker, Jaakkola, 2020). From this perspective, consumer experience develops over time through multiple interactions between customers and a company.

Among the various conceptualizations of consumer experience, the framework proposed by Gentile et al. (2007) is particularly relevant in the context of immersive technologies. By stimulating users' senses, emotions, cognition, and interactions, immersive digital

environments create multidimensional experiences that can be effectively analyzed through the sensory, emotional, cognitive, pragmatic, lifestyle, and relational components identified by the authors.

According to Gentile et al. (2007), a product or service may activate a single experience component or a configuration of multiple components, thereby generating experiences that create hedonic, functional, or symbolic value for consumers. The sensory component refers to experiences that stimulate the senses and enhance perceptual engagement (Gentile et al., 2007). In virtual environments, this component can be activated through visual and audiovisual stimuli, image realism, and the synchronization of sensory cues. These elements contribute to perceived attractiveness and a stronger sense of presence, thereby enhancing sensory engagement (Flavián et al., 2019; Hilken et al., 2017).

The emotional (affective) component encompasses feelings and emotions elicited through interactions with a product, service, or brand, ranging from short-term emotional reactions to more enduring affective attitudes (Gentile et al., 2007). Emotions have long been recognized as a central element of consumption experiences within the experiential view of consumption (Holbrook, Hirschman, 1982), challenging earlier perspectives that emphasized predominantly rational consumer behavior (Bagozzi, 1975; Kotler, 1972). In virtual environments, emotional experiences may be enhanced by the sense of presence, which increases the realism of the experience and intensifies affective responses (Steuer, 1992; Lombard, Ditton, 1997). Furthermore, interactivity and embodiment, through increased perceptions of control over both the environment and one's virtual representation, may foster stronger engagement, more intense experiences, and more positive emotional responses (Javornik, 2016; Flavián et al., 2019).

Another component identified by Gentile et al. (2007) is the cognitive component, which encompasses mental processes such as thinking, learning, analysis, creativity, and problem-solving. This component may be activated when an experience intellectually stimulates consumers or enables them to explore and evaluate available offerings. In virtual environments, perceived information diagnosticity, often facilitated by interactivity and presence (Grohmann et al., 2007; Hilken et al., 2017), can contribute to cognitive engagement. Interactivity, in particular, supports cognitive processing through three-dimensional visualizations, opportunities for product manipulation, and enhanced perceptions of control, all of which increase the depth of information processing (Javornik, 2016; Hilken et al., 2017).

Gentile et al. (2007) further extended earlier multidimensional conceptualizations of experience by introducing the pragmatic component, which refers to the practical aspects of experience, including usability, functionality, and ease of interaction with a product or service. These aspects correspond to the motivations traditionally emphasized in consumer behavior research (Bagozzi, 1975; Kotler, 1972). In the context of immersive technologies, this component may be stimulated through perceived information diagnosticity associated with interactivity and presence, as well as through perceived control facilitated by embodiment (Hilken et al., 2017). By reducing uncertainty and perceived risk, these factors may facilitate

purchase decision-making and positively influence purchase intentions (Huang, Liao, 2017; Hilken et al., 2017).

The lifestyle component reflects consumers' personal values, beliefs, and aspirations, which are often expressed through their behaviors and consumption choices (Gentile et al., 2007). Experiences may activate this component when a product or service serves as a means of expressing values associated with a particular brand or lifestyle to which consumers aspire. In digital environments, the lifestyle component may be expressed through virtual self-representation and personalization features that allow users to align their digital experiences with their values, preferences, and aspirations (Gentile et al., 2007; Flavián et al., 2019). Stronger identification with a virtual representation may also contribute to a greater sense of embodiment (Flavián et al., 2019).

Finally, the relational component concerns an individual's relationships with others and with the broader social environment (Gentile et al., 2007). This component may be activated by products and services that facilitate shared consumption experiences or reinforce a sense of belonging to a social group. Gentile et al. (2007) also highlight the close relationship between the lifestyle and relational components when consumption serves to affirm social identity. In digital environments, relational experiences may emerge through interactions with other users and shared virtual experiences. Virtual spaces that enable communication and collaboration can generate a sense of co-presence understood as the perception of being together with others in a shared environment, which may strengthen the relational component of consumer experience (Schroeder, 2008; Flavián et al., 2019).

The multidimensional nature of the consumer experience framework proposed by Gentile et al. (2007) makes it particularly relevant for the study of immersive technologies. Virtual environments may stimulate various dimensions of consumer experience, including sensory, emotional, cognitive, pragmatic, lifestyle, and relational responses, thereby generating complex experiences that extend beyond purely functional interactions. Consequently, the framework provides a focused basis for examining how the dimensions of the EPI model - embodiment, presence, and interactivity - contribute to the formation of consumer experience in virtual spaces.

According to the literature, a virtual space can be understood as a digitally generated environment that allows users to interact with both virtual objects and other participants within a simulated spatial structure (Schroeder, 2008). Examples of virtual spaces include virtual showrooms, virtual fitting rooms, augmented reality (AR) applications, virtual reality (VR) environments, product configurators, digital twins, and metaverse platforms. Such solutions provide interactive and often three-dimensional environments that facilitate product exploration, evaluation, and customization, thereby replicating the most relevant elements of the shopping experience traditionally associated with physical retail stores (Flavián et al., 2019).

In modern digital services and e-commerce, immersion and interactivity are considered key dimensions of virtual spaces that can be leveraged to shape and enhance consumer experience. Immersion, conceptualized as the objective degree to which a technology isolates users from the physical environment while providing naturalistic sensory input (Slater, 2009), and interactivity are factors influencing the perception and processing of stimuli in digital environments (Steuer, 1992). The literature differentiates between immersion as a property of technology and presence as a psychological state experienced by users within a digital space (Slater, 2009).

A comprehensive framework for understanding experiences in virtual environments is provided by the EPI (Embodiment, Presence, Interactivity) model developed by Flavián, Ibáñez-Sánchez, and Orús (2019). The model conceptualizes users' experiences with immersive technologies through three interrelated dimensions. Earlier studies primarily focused either on the perceptual and psychological aspects of presence (Steuer, 1992) or on the technological characteristics of immersion and interactivity (Mollen, Wilson, 2010). In contrast, the EPI model adopts a more comprehensive perspective, arguing that a truly immersive virtual experience depends on the simultaneous interaction of all three dimensions: presence as a perceptual - psychological state in which individuals perceive themselves as being situated within a mediated or virtual environment rather than in their immediate physical surroundings, embodiment as the sense of having a body and agency within a virtual environment, and interactivity as the behavioral capacity to influence and respond to the digital environment. According to the authors, only the combined effect of these dimensions can fully explain the quality and intensity of users' experiences in virtual spaces.

The authors argue that embodiment can enhance the immersive quality of XR experiences and stimulate users both sensorially and emotionally, thereby increasing their level of engagement (Flavián et al., 2019, 2020). As a result, embodiment may foster greater interest in brand-related content, encourage interaction with digital environments (Flavián et al., 2019), and contribute to higher levels of experience satisfaction (Flavián et al., 2019), which may subsequently translate into stronger purchase intentions (Flavián et al., 2016, 2019).

Presence has been associated with a higher quality of consumer experience by increasing user engagement, facilitating the mental simulation of product use, and enhancing visual appeal, all of which may positively influence purchase intentions (Orús et al., 2021). Previous studies have also shown that presence can increase technology acceptance (Huang, Liao, 2017) and improve consumers' confidence in decision-making processes (Hilken et al., 2017). Furthermore, presence may enhance the perceived diagnosticity of information, thereby facilitating more accurate evaluations of product value (Hilken et al., 2017).

According to Flavián et al. (2019), interactivity enhances user engagement and overall experience quality, indirectly fostering stronger purchase intentions. Furthermore, higher levels of interactivity are associated with greater perceived control, increased information

diagnosticity, and more positive product evaluations (Grohmann et al., 2007; Hilken et al., 2017).

The EPI model proposed by Flavián et al. (2019) conceptualizes immersive digital experiences as emerging from the interaction of three dimensions: embodiment, presence, and interactivity. As such, it provides a useful framework for examining modern digital services and e-commerce environments. By enhancing these dimensions, XR technologies can help overcome key limitations of online shopping, including the lack of physical product contact, limited interaction opportunities, and difficulties in imagining product use in real-life situations (Hilken et al., 2017).

3. Methods

The study adopts a quantitative research approach aimed at examining the relationships between the dimensions of the EPI model of virtual spaces - embodiment, presence, and interactivity - and the components of consumer experience proposed by Gentile et al. (2007). The conceptual framework assumes that immersive technologies influence consumer experience through mechanisms associated with the perception of one's virtual representation, the sense of being present in a virtual environment, and the level of interaction with digital content.

To systematically present the assumed relationships, a matrix was constructed illustrating the connections between the EPI dimensions and the consumer experience components (Table 1). This matrix served as the basis for the development of research questions, and the subsequent empirical analysis.

The primary objective of the study is to identify which dimensions of the EPI model are most strongly associated with individual components of consumer experience in e-commerce environments and digital services settings. To achieve the research objectives, the following research question was formulated:

RQ1: How are the dimensions of the EPI model (embodiment, presence, and interactivity) associated with the components of consumer experience in e-commerce and digital services settings?

This research question addresses the theoretical objective of the study by exploring the relationships between the characteristics of immersive technologies and the dimensions of consumer experience. At the same time, the analysis provides practical implications for digital commerce and virtual environment design by identifying which features of immersive technologies are most relevant for shaping positive consumer experiences.

Table 1.
Relationships between EPI Dimensions and Consumer Experience Components

EPI Model Dimensions	Findings form the Literature	Consumer Experience Components (potentially activated)
Embodiment	Integration of perception and movement enhances body ownership, sensory stimulation, and product engagement.	Sensory
Embodiment	Embodiment intensifies users' emotional involvement and experience intensity.	Emotional
Embodiment	Perceived control resulting from embodiment reduces uncertainty and purchase risk.	Pragmatic
Embodiment	Identification with a virtual representation may strengthen self-expression and identity construction.	Lifestyle
Presence	The feeling of "being there" increases realism, affective responses, and engagement.	Emotional
Presence	Presence facilitates mental simulation of product usage.	Cognitive
Presence	Realistic virtual environments enhance the perception of sensory stimuli.	Sensory
Presence	The perception of others' presence in virtual environments supports social experiences.	Relational
Interactivity	Product interaction increases information diagnosticity and depth of information processing	Cognitive
Interactivity	Perceived control and system responsiveness enhance usefulness and reduce purchase risk.	Pragmatic
Interactivity	Social and metaverse-based interactions facilitate relationship building among users.	Relational

Source: Flavián et al. (2016, 2019, 2020), Orús et al. (2021), Gentile et al. (2007), Steuer (1992), Lombard, Ditton (1997), Hilken et al. (2017), Javornik (2016).

Based on the literature review, a conceptual model was developed linking the three dimensions of the EPI model with consumer experience framework proposed by Gentile et al. (2007), which includes sensory, emotional, cognitive, pragmatic, lifestyle, and relational experience. The model assumes that embodiment, presence, and interactivity function as independent variables, while the consumer experience dimensions constitute dependent variables.

However, due to the exploratory and pilot character of the research, the in-depth statistical analysis focuses on four components considered most directly related to immersive online shopping: sensory, emotional, cognitive, and pragmatic experience. These dimensions were selected because immersive technologies primarily affect consumers through multisensory stimulation, emotional engagement, cognitive evaluation, and perceived usefulness in the shopping process. Lifestyle and relational experience, although important, are discussed at the conceptual level of the study and are not included in the in-depth statistical analysis at this stage, as they require broader contextual and longitudinal investigation.

Data were collected through an online survey questionnaire. The study employed non-probability purposive sampling with elements of snowball sampling. Respondents were expected to have experience with online shopping and potentially with immersive technologies, such as virtual reality (VR), augmented reality (AR), mixed reality (MR), or virtual shopping environments. The questionnaire consisted of measurement scales adapted from validated

instruments reported in previous studies. Responses were recorded using a 7-point Likert-type scale, ranging from 1 = strongly disagree to 7 = strongly agree. The variables were operationalized by calculating the mean values for individual scales corresponding to the dimensions of the EPI model - embodiment, presence, and interactivity - as well as to the components of consumer experience as conceptualized by Gentile et al. (2007). Prior to the empirical analysis, the reliability of the measurement scales was assessed. Internal consistency was evaluated using Cronbach's alpha (α), with values above 0.70 considered indicative of satisfactory reliability.

The collected data were analyzed using statistical methods appropriate to the exploratory character of the study and the structure of the variables. Descriptive statistics, including the mean, median, and standard deviation, were calculated to characterize the main measurement scales and respondents' evaluations of the analyzed constructs. In addition, cross-tabulation and percentage distribution analysis were applied to identify patterns between selected demographic variables, online shopping behavior, and the use of immersive technologies. To examine the relationships between the key research constructs, Pearson's correlation analysis and regression analysis were conducted. These methods were used to assess the strength, direction, and significance of the relationships between the EPI dimensions and consumer experience components. Statistical significance was assessed at the $p < 0.05$ level.

The adopted analytical approach enabled the identification of those features of immersive technologies that were most strongly associated with positive consumer experiences in virtual shopping environments. At the same time, considering the exploratory nature of the study and the limited sample size, the results of the regression analysis should be interpreted as preliminary and viewed within the context of these methodological constraints.

4. Results

The initial sample consisted of 100 respondents. Nevertheless, after applying the screening question, only participants who had prior experience with immersive tools in e-commerce were included in the final analysis. As a result, the analytical sample comprised 46 respondents. The relatively small analytical sample should be interpreted in the context of the exploratory and pilot character of the study. The research constitutes the first stage of a broader project on the role of immersive technologies in shaping consumer experience in virtual shopping environments. In this initial stage, the analysis was limited to respondents with actual prior experience using immersive e-commerce tools, which reduced the final sample size but increased the substantive relevance of the responses, as the analysis was based only on responses from users capable of evaluating embodiment, presence, and interactivity in virtual shopping environments.

Consequently, the results should be treated as preliminary and indicative rather than fully generalizable. They provide a foundation for subsequent stages of the research, which will include a larger sample and a broader assessment of the remaining dimensions of consumer experience. The distribution of respondents by age and online shopping frequency in relation to the use of immersive technologies is presented in Tables 2 and 3.

Table 2.
Respondents' Age Distribution by Use of Immersive Technologies

Age	I have not used immersive technologies such as AR/VR	I have used immersive technologies such as AR/VR
<18	25%	75%
18-24	49%	51%
25-30	53%	47%
31-40	57%	43%
41-50	59%	41%
51-60	62%	38%
>60	100%	0%

The analysis of the collected data indicates that the use of immersive technologies, particularly AR and VR, varies by age. The highest share of users was recorded among respondents aged under 18, with 75%, and 18-24, with 51% of this group declaring prior experience with such technologies. A decreasing trend was observed with age: in the 25-30, 31-40, 41-50, and 51-60 age groups, the corresponding shares were 47%, 43%, 41%, and 38%, respectively. Among respondents aged over 60, no participants reported having used immersive technologies, while shopping online. Respondents with prior experience using immersive technologies most frequently indicated AR-based product try-on tools (28%), virtual fitting rooms (18%), and 3D configurators (12%). The least frequently reported form of experience was contact with 3D showrooms (10%).

Table 3.
Respondents' Online Shopping Frequency by Use of Immersive Technologies

Online Shopping Frequency	I have not used immersive technologies such as AR/VR	I have used immersive technologies such as AR/VR
Several times a week or more often	21%	79%
Once a week	33%	67%
Several times a month	58%	42%
Once a month	86%	14%
Once every 2–3 months	75%	25%
Less often than once every 3 months	60%	40%

The table 3 presents the relationship between online shopping frequency and the use of immersive technologies, including AR/VR tools. The analysis of respondents' declared answers indicates that such tools are used more frequently by consumers who shop online several times a week or more often (78.57%) and by those who use e-commerce once a week (66.67%). As the frequency of online shopping decreases, the share of respondents using AR/VR

technologies also declines. Among respondents who shop online once a month, only 14% reported such experience. However, in the group of respondents who shop online less often than once every three months, 40% declared experience with this type of technology.

The statistical analysis began with an examination of the descriptive statistics for the research variables included in the EPI model and the consumer experience components (Tab. 4).

Table 4.
Descriptive Statistics of the Research Variables

Variable	Mean	Median	Standard Deviation
Embodiment	4.25	4.42	1.57
Presence	3.60	3.50	1.68
Interactivity	4.28	4.00	1.66
Sensory	3.87	3.67	1.83
Emotional	3.83	3.67	1.80
Cognitive	4.44	4.33	1.74
Pragmatic	4.77	4.83	1.70
Lifestyle	3.83	3.67	1.76
Relational	3.34	3.17	1.81

The analysis indicates a moderately varied level of evaluations of the EPI model dimensions and consumer experience components during the use of virtual spaces. Among the analyzed variables, the pragmatic component received the highest mean score (M = 4.77, Me = 4.83, SD = 1.70). A relatively high mean value was also recorded for the cognitive component (M = 4.44, Me = 4.33, SD = 1.74). Similar mean values were obtained for embodiment (M = 4.25, Me = 4.42, SD = 1.57) and interactivity (M = 4.28, Me = 4.00, SD = 1.66). The presence dimension was rated notably lower than the other elements of the EPI model (M = 3.60, Me = 3.50, SD = 1.68). Among all analyzed variables, the relational component received the lowest score (M = 3.34, Me = 3.17, SD = 1.81).

The analysis of standard deviations, ranging from 1.57 to 1.83, indicates a moderate variability of responses across all variables. The lowest standard deviation was observed for embodiment, which may suggest a relatively consistent perception of this aspect among respondents. Higher standard deviations for the sensory, emotional, and relational components suggest greater variability in respondents' evaluations, which may be related to the more subjective nature of these aspects of consumer experience.

The results may indicate that elements such as functionality, cognitive evaluation of information, active interaction, and a sense of control over the experience are rated more favorably by consumers in the context of digital environments. Respondents rated the presence dimension relatively lower, which may suggest that the analyzed tools do not generate a strong sense of immersion in the virtual environment. However, drawing stronger conclusions in this regard would require further in-depth analysis. The analyzed solutions may also be insufficient in evoking the relational component of consumer experience, which may result from the

specific nature of e-commerce, where the experience is often more individual than socially oriented.

Table 5.
Reliability of the Research Scales (Cronbach's Alpha)

Measured Construct	Number of items	*Cr*onbach's Alpha (α)
Embodiment	4	0.91
Presence	4	0.87
Interactivity	4	0.90
Sensory	3	0.92
Emotional	3	0.95
Cognitive	3	0.93
Pragmatic	3	0.88
Lifestyle	3	0.86
Relational	3	0.94

The reliability of the measurement scales was assessed using Cronbach's alpha coefficient. All scales achieved high reliability values ($\alpha > 0.85$), indicating very strong internal consistency of the measurement scales. The highest internal consistency was observed for the emotional component ($\alpha = 0.95$), while the lowest, although still very high, was recorded for the lifestyle component ($\alpha = 0.86$). Subsequently, Pearson's correlation analysis was conducted between the dimensions of the EPI model and the selected components of consumer experience. The results are presented in Table 6.

Table 6.
Correlations Between the EPI Model Dimensions and Consumer Experience Components (Pearson's r)

EPI model dimension	Sensory	Emotional	Cognitive	Pragmatic
Embodiment	r=0.69	r=0.79	r=0.75	r=0.62
Presence	r=0.78	r=0.84	r=0.71	r=0.59
Interactivity	r=0.80	r=0.79	r=0.80	r=0.76

Note. All correlations are statistically significant at $p < 0.001$. Values represent Pearson correlation coefficients.

The analysis indicates positive and statistically significant associations across all examined relationships. The results presented in the table show that the dimensions of the EPI model are strongly associated with the components of consumer experience. However, the strength of these relationships varies, suggesting that individual EPI dimensions are related to different aspects of consumer experience to varying degrees. The strongest correlations were observed for interactivity. Interactivity was strongly associated with the sensory component ($r = 0.80$), the cognitive component ($r = 0.80$), the emotional component ($r = 0.79$), and the pragmatic component ($r = 0.76$). The highest correlations with the sensory and cognitive components suggest that the possibility of actively interacting with the tool, controlling the view, exploring the product, or modifying its features may be related to stronger experiential responses associated with perception and information processing. The strong associations between interactivity and both the cognitive and emotional components may indicate that interactivity

is linked to the way consumers process and emotionally respond to stimuli in virtual shopping environments.

The strongest relationship among all analyzed correlations was observed between presence and the emotional component (r = 0.84). This result may indicate that the sense of being present in a virtual environment is strongly associated with the emotional perception of the experience. Presence was also highly correlated with the sensory component (r = 0.78) and the cognitive component (r = 0.71). This may suggest that a stronger sense of presence in a virtual space is related to a more intensive perception of stimuli and a more favorable cognitive evaluation of the experience.

For embodiment, the strongest correlation was observed with the emotional component (r = 0.79). A similar relationship was found between embodiment and the cognitive component (r = 0.75), while a slightly lower correlation was observed with the sensory component (r = 0.69). These results suggest that the sense of embodied control in a digital environment may be associated with a more engaging experience, particularly at the emotional and cognitive levels.

The lowest correlation values in the table concern the relationships between embodiment and the pragmatic component (r = 0.59), as well as between presence and the pragmatic component (r = 0.62). Both correlations are positive and statistically significant. These findings suggest that the pragmatic dimension of consumer experience is more strongly associated with interactivity, whereas embodiment and presence appear to be more closely related to the emotional component of consumer experience. To extend the interpretation of the strongest correlation results, simple linear regression analyses were also conducted.

Table 7.
Results of Simple Linear Regression Analysis

Independent Variable	Dependent Variable	β	R^2	Significance
Embodiment	Emotional Component	0.79	0.62	$p < 0.001$
Presence	Emotional Component	0.84	0.70	$p < 0.001$
Interactivity	Cognitive Component	0.80	0.64	$p < 0.001$

Note. β = standardized regression coefficient; SE = standard error of the standardized coefficient; R^2 = coefficient of determination. All models are statistically significant at $p < 0.001$

The results presented in Table 7 indicate that all analyzed regression models were statistically significant ($p < 0.001$). The values of the standardized beta coefficients and R^2 suggest strong positive predictive relationships between the selected EPI dimensions and the corresponding components of consumer experience. The highest explanatory power was observed for the model in which presence predicted the emotional component of consumer experience ($\beta = 0.84$, $R^2 = 0.70$), indicating that presence accounted for 70% of the variance in the emotional component. Interactivity explained 64% of the variance in the cognitive component, while embodiment explained 62% of the variance in the emotional component. These results suggest that individual dimensions of the EPI model may be associated with different aspects of consumer experience to varying degrees.

With regard to the emotional component of consumer experience, both embodiment ($\beta = 0.79$; $R^2 = 0.62$) and presence ($\beta = 0.84$; $R^2 = 0.70$) showed statistically significant predictive relationships. The results indicate that both dimensions explain a substantial proportion of the variance in users' emotional responses, although a stronger relationship was observed for presence. A statistically significant predictive relationship was also found between interactivity and the cognitive component of consumer experience ($\beta = 0.80$; $R^2 = 0.64$). This result suggests that interactivity is strongly associated with the aspect of user experience related to information processing, explaining 64% of its variance.

The figures below illustrate positive associations between the EPI model dimensions and the consumer experience components for which these dimensions obtained the highest correlation values. As the levels of embodiment, presence, and interactivity increase, higher evaluations of specific CX components can be observed. The distribution of points indicates a clear upward trend, although some variability in respondents' answers is also visible, suggesting that the relationships are not perfectly linear. The trend lines and the values of the coefficient of determination confirm statistically significant and relatively strong predictive relationships between the analyzed variables.

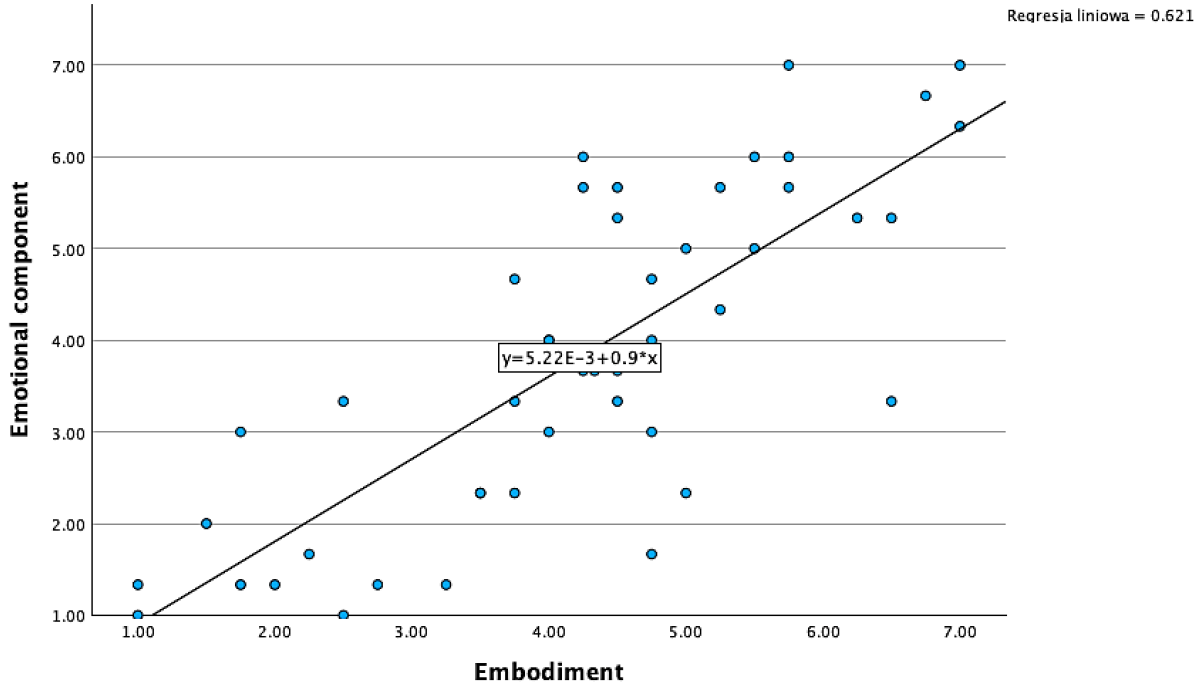

Figure 1. Relationship Between Embodiment and the Emotional Component.

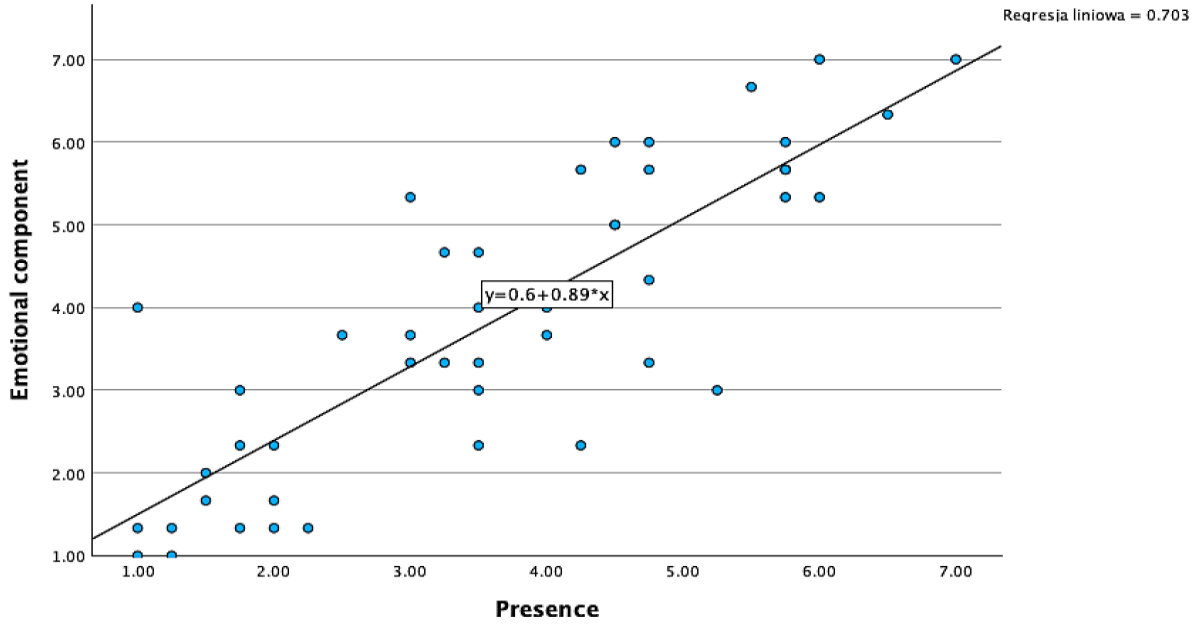

Figure 2. Relationship Between Presence and the Emotional Component.

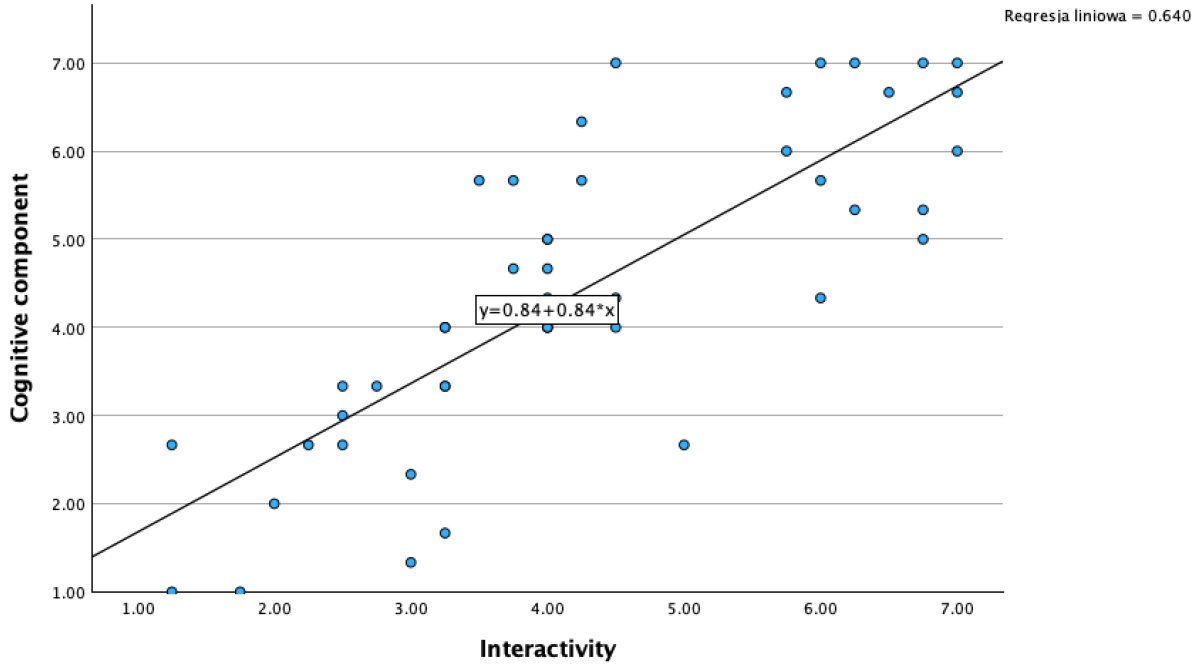

Figure 3. Relationship Between Interactivity and the Cognitive Component.

To provide a more comprehensive understanding of the mechanisms shaping consumer experience in virtual shopping environments, the relationships between the dimensions of the EPI model were also examined using Pearson's correlation analysis. This additional analysis made it possible to assess the extent to which embodiment, presence, and interactivity are interrelated and jointly contribute to the formation of immersive consumer experiences.

Table 8.
Correlations Between the EPI Model Dimensions (Pearson's r)

EPI model dimension	Embodiment	Presence	Interactivity
Embodiment	X	r=0.82	r=0.77
Presence	r=0.82	X	r=0.72
Interactivity	r=0.77	r=0.72	X

Note. All correlations are statistically significant at $p < 0.001$. Values represent Pearson correlation coefficients.

Table 8 presents the results of the correlation analysis between the dimensions of the EPI model. All correlations were positive, statistically significant, and strong. The highest correlation was observed between embodiment and presence ($r = 0.82$), while the lowest, although still strong, was found between presence and interactivity ($r = 0.72$). The results may indicate that all EPI dimensions are closely interrelated. These findings provide valuable insights for companies developing digital services, e-commerce platforms, and virtual environments. Understanding the factors that shape consumer experience may support the design of more engaging, personalized, and effective digital interactions.

5. Discussion

The analysis of the research results presented in this article allows for the verification of assumptions found in the literature regarding immersive technologies in e-commerce and contributes to the growing body of knowledge on consumer experience in virtual environments. Embodiment is understood as the integration of perception and movement, leading to a sense of body ownership and a more intense experience of digital stimuli. Previous studies suggest that AR-based product fitting can increase sensory stimulation and user engagement (Flavián et al., 2019b, 2020). Presence, in turn, refers to the subjective sensation of "being there" in a mediated environment and has been associated with consumers' ability to mentally simulate product use (Orús, Ibáñez-Sánchez, Flavián, 2021). Based on these findings, relationships were expected between embodiment and the sensory component of consumer experience, and between presence and the cognitive component.

However, the findings revealed a somewhat different pattern. Embodiment was more strongly associated with the cognitive component than with the sensory component, while presence showed a stronger relationship with the sensory component than with the cognitive component. One possible explanation is that the realism of the virtual environment, which is a key antecedent of presence (Flavián et al., 2019), may enhance the perception of sensory stimuli and their attractiveness, thereby strengthening the sensory dimension of the experience. At the same time, the immersive tools examined in this study, such as virtual fitting rooms, may have encouraged consumers to evaluate product fit, appearance, and functionality more carefully, thus supporting information processing and cognitive assessment. Similar

observations have been reported in studies indicating that AR-based product visualization facilitates product evaluation and decision-making processes (Hilken et al., 2017).

The literature also emphasizes the subjective nature of presence. Even technologically advanced solutions cannot fully guarantee a high level of presence because individual psychological predispositions influence how users experience virtual environments (Lombard, Ditton, 1997; Slater, 2009; Flavián et al., 2019). Moreover, technologies characterized by lower levels of immersion, such as smartphones or laptops, may be less effective in creating a strong illusion of being physically located in a virtual environment than fully immersive VR systems (Flavián et al., 2019). The findings are broadly consistent with this interpretation. Presence received the lowest mean score among the EPI dimensions (M = 3.60), which may be related to both the characteristics of the examined solutions and the devices used by respondents.

The study also demonstrated strong positive relationships among all three dimensions of the EPI model, supporting the conceptual assumptions proposed by Flavián et al. (2019). These authors argue that embodiment, presence, and interactivity coexist within immersive experiences and jointly contribute to users' perceptions of virtual environments. While the strongest relationship identified in the present study was between embodiment and presence, a high correlation was also observed between embodiment and interactivity. This finding suggests that, within the examined context, the dimensions may reinforce one another rather than operate independently.

According to the EPI framework, interactivity may strengthen users' sense of control and engagement, thereby supporting the experience of embodiment and presence (Flavián et al., 2019). The present findings revealed strong associations between interactivity and the remaining EPI dimensions. However, the results do not provide direct empirical evidence for the moderating role of interactivity proposed in the conceptual model, as such a mechanism would require a different analytical approach. Instead, the findings suggest that the three dimensions are closely interconnected and may contribute differently to specific aspects of consumer experience.

Interactivity demonstrated relatively strong associations with a broad range of consumer experience components, particularly the pragmatic component. Nevertheless, all relationships involving the pragmatic dimension were weaker than those observed for sensory, emotional, and cognitive experience. Similar observations have been reported in previous research on immersive consumer experiences, which suggests that higher levels of immersion do not necessarily translate into greater perceptions of functionality or usefulness.

6. Summary

The aim of this study was to examine the role of immersive technologies in shaping consumer experiences in virtual spaces and to identify the significance of embodiment, presence, and interactivity for the development of modern digital services. To achieve this objective, the study investigated the relationships between the dimensions of the EPI model of virtual spaces - embodiment, presence, and interactivity - and the components of consumer experience proposed by Gentile et al. (2007). The findings confirmed that all three EPI dimensions are significantly associated with consumer experience, although their roles differ. These results underscore the significance of embodiment, presence, and interactivity as important factors shaping consumer experiences in virtual environments and provide valuable insights for the design and development of innovative digital services.

Interactivity demonstrated the broadest associations with consumer experience components and appears to play an integrative role in shaping the overall experience. Presence was most strongly related to the emotional component and also showed substantial associations with sensory and cognitive experiences. Embodiment was primarily linked to emotional and cognitive aspects of consumer experience. These results indicate that immersive technologies influence consumer experience through multiple interconnected mechanisms, contributing to the creation of a comprehensive and multidimensional customer experience.

The study also provides practical implications for the design of immersive e-commerce environments and modern digital services. The findings emphasize the importance of interactivity as a key driver of consumer experience. Features enabling product exploration, manipulation, personalization, and active user participation should be prioritized, as they support consumer engagement, facilitate product evaluation, and strengthen the perceived value of digital interactions. At the same time, designers should focus on creating emotionally engaging experiences through realistic visualization, compelling digital environments, intuitive interfaces, and user-centered interaction design. These elements may increase the attractiveness of virtual environments and support the development of more effective, personalized, and competitive digital services.

Although the study offers valuable insights, its limitations should also be acknowledged. The main limitations are related to the size and structure of the research sample, the focus on selected immersive technologies, and the exploratory and pilot character of the research. Due to these methodological conditions, the in-depth statistical analysis focused only on four components of consumer experience considered most directly related to immersive online shopping: sensory, emotional, cognitive, and pragmatic experience. Lifestyle and relational experience, although important for a comprehensive understanding of consumer experience, were discussed at the conceptual level of the study and were not included in the in-depth statistical analysis at this stage. These dimensions require broader contextual and longitudinal

investigation, as they may develop over time and depend on wider social, cultural, and behavioral conditions. Therefore, the results may not fully reflect the diversity and complexity of consumer experiences across all types of virtual environments.

Future research should include larger and more diverse samples, compare different types of immersive technologies and virtual environments, and incorporate lifestyle and relational dimensions into more advanced statistical analyses. Such studies could provide a more comprehensive understanding of how embodiment, presence, and interactivity influence consumer perceptions, attitudes, behaviors, and long-term relationships with digital services.

Overall, the findings demonstrate that consumer experience in virtual environments is complex, multidimensional, and shaped by several interconnected mechanisms. The dimensions of the EPI model are closely associated with the structure of consumer experience and reinforce one another in shaping user perceptions. One of the key lessons learned from the study is that immersive technologies should not be considered only as technical tools, but also as experience-shaping environments that influence emotional, cognitive, sensory, and behavioral aspects of consumer interaction. Therefore, the design of immersive e-commerce solutions and digital services should adopt a holistic approach that simultaneously considers embodiment, presence, interactivity, and the interdependencies among consumer experience components.

The study contributes to the growing body of research on consumer experience in virtual spaces by integrating the EPI model with contemporary consumer experience theory and the context of modern digital services. The new knowledge provided by the study concerns the differentiated role of embodiment, presence, and interactivity in shaping specific components of consumer experience. In particular, the findings show that interactivity plays an integrative role in the overall experience, presence is especially important for emotional engagement, and embodiment is strongly connected with emotional and cognitive dimensions. This contributes to a better understanding of the mechanisms through which immersive technologies influence consumer perceptions and behaviors.

The importance of the research extends beyond the e-commerce context. As immersive technologies are increasingly used in digital commerce, education, culture, entertainment, tourism, and other service sectors, understanding how users experience virtual environments becomes essential for both researchers and practitioners. The findings may be further used in future studies on immersive consumer behavior, virtual service design, and digital transformation. They may also support organizations in developing more engaging, personalized, user-centered, and socially relevant digital solutions. In this way, the study highlights the broader significance of immersive technologies for the future development of digital services and consumer interactions in virtual spaces.

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