International Journal of Human–Computer Interaction

ISSN: 1044-7318 (Print) 1532-7590 (Online) Journal homepage: www.tandfonline.com/journals/hihc20

How Perceived Informativeness of Virtual Reality Affects Consumers' Perceived Quality in Co-Production: The Role of Perceived Realism and Product Knowledge

Yan Shi & Xue Yang

To cite this article: Yan Shi & Xue Yang (08 Jul 2025): How Perceived Informativeness of Virtual Reality Affects Consumers' Perceived Quality in Co-Production: The Role of Perceived Realism and Product Knowledge, International Journal of Human–Computer Interaction, DOI: 10.1080/10447318.2025.2526585

To link to this article: https://doi.org/10.1080/10447318.2025.2526585

INTERNATIONAL JOURNAL OF HUMAN–COMPUTER INTERACTION
https://doi.org/10.1080/10447318.2025.2526585

How Perceived Informativeness of Virtual Reality Affects Consumers' Perceived Quality in Co-Production: The Role of Perceived Realism and Product Knowledge

Yan Shi[a] and Xue Yang[b]

[a]Alibaba Business School, Hangzhou Normal University, Hangzhou, China; [b]School of Management, Zhejiang University of Finance and Economics, Hangzhou, China

ABSTRACT

This study investigates the impact of virtual reality (VR) in home decoration scenarios, where consumers actively participate in the co-production process. An online survey was conducted to collect data from 259 Chinese consumers with prior experience in using VR for home decoration. The results show that perceived realism mediates the effects of perceived informativeness on perceived quality in co-production. Intriguingly, the results also demonstrate that perceived informativeness and product knowledge exhibit substitutability in their influence on perceived realism. Even if consumers possess limited product knowledge, they can still attain a realistic experience provided that the VR offers adequate informational support. This study broadens the horizons of VR research by investigating its application within co-production contexts. This study specifically uncovers the psychological mechanisms that play a crucial role in shaping consumers' perceived quality within VR-enhanced co-production environments.

KEYWORDS

Virtual reality; perceived informativeness; perceived realism; product knowledge; perceived quality

1. Introduction

Virtual reality (VR) has revolutionized the way consumers engage with products and services by providing an immersive experience (Chen et al., 2023). Consumers can interact with products in a virtual environment, gaining a deeper understanding of their features, functionalities, and benefits (Kozinets, 2023; Peukert et al., 2019). This not only enhances the consumer's overall experience but also allows companies to effectively showcase their offerings in a visually captivating manner (Ülker et al., 2024). Moreover, VR enables consumers to explore virtual environments and manipulate objects as if they were interacting with them in real life (Çolakoğlu et al., 2024). This level of interactivity provides a unique opportunity for consumers to evaluate the suitability of a product or service for their specific needs before making a purchase decision (Chen et al., 2024). In recent years, there has been a surge in interest surrounding VR as a tool for creating immersive and engaging experiences (Schiopu et al., 2022). However, much of the existing research has focused on its application in gaming, education, tourism, and retailing industries (Hoang et al., 2023). This study seeks to bridge this gap by investigating the implications of VR in home decoration contexts where consumers actively participate in co-production processes. The results of this study can provide insights into the ways in which VR can facilitate consumer participation and contribute to the co-creation of value. It is vital for companies looking to leverage VR technology effectively for product customization or service personalization initiatives. By recognizing consumers' psychological mechanism, companies can better design immersive experiences that meet consumer needs while fostering positive judgments toward their offerings.

Co-production refers to a collaborative approach where consumers are involved in various stages of product or service development (Etgar, 2008). This concept emphasizes the active involvement of consumers at various stages, from conceptualization and design to testing and refinement. By participating in co-production, consumers can provide valuable feedback and insights, which can lead to products and services that are more aligned with their needs and preferences (Nadeem & Salo, 2024). This study suggests that VR revolutionizes consumer co-production process while fostering an immersive environment where both consumers and producers work together toward developing products. The utilization of VR has elevated the co-production process by enabling consumers to actively contribute ideas, virtually test prototypes, and offer real-time feedback. This enhanced level of engagement not only empowers consumers with a deeper understanding of the product development journey but also allows them to make more informed decisions. Perceived informativeness refers to the degree to which VR provides comprehensive information that enhances the co-production process (Qin et al., 2021). By providing access to detailed information about the product, it empowers consumers with additional resource that helps them align their preferences with relevant considerations. The integration of relevant and sufficient information delivered

CONTACT Xue Yang yangxue@zufe.edu.cn School of Management, Zhejiang University of Finance and Economics, 18 Xueyuan Street, Hangzhou 310018, China

through VR plays an instrumental role in empowering consumers engaged in co-production activities. It not only enriches their decision-making process but also fosters collaboration among stakeholders throughout various stages of production.

Perceived informativeness plays a significant role in shaping consumers' perceptions of co-production process. When consumers perceive the VR technology as providing useful and relevant information, it enhances their overall evaluation of the co-production process. This study aims to explore whether such perceptions indirectly influence consumers' evaluations through their perception of how realistic a co-produced offering appears. Perceived realism is an essential factor that determines how closely the virtual world resembles the real world (Daassi & Debbabi, 2021). It reflects individuals' judgment on the authenticity and believability of a VR environment. Understanding the mediating effect of perceived realism is crucial as it helps us comprehend why and how consumers form judgments about the quality of co-production process. Furthermore, it is worth noting that consumers with a higher level of familiarity with the product may also benefit more from using VR technology. On one hand, this is because their existing knowledge allows them to better process, understand, and interpret the information presented in the VR environment (Eisingerich & Bell, 2008; Xu et al., 2014). On the other hand, those with limited product knowledge may struggle to fully grasp and appreciate the details presented in VR, which could impact their overall perception and understanding of the product or service being showcased. Therefore, it is important for companies to consider their target consumer's level of product knowledge when developing VR experiences to maximize its effectiveness. Therefore, this study proposes the following research questions: whether and how perceived realism of VR mediates the effects of perceived informativeness on perceived quality in co-production.

This study has three theoretical implications. First, it expands the scope of VR research by exploring its application in co-production scenarios. The findings highlight the significance of delivering relevant and sufficient information through VR to empower actively engaged consumers. Second, it contributes to existing co-production literature by uncovering the underlying mechanisms that influence perceived quality. By examining consumers' perceptions of the realism of VR, this study provides valuable insights into how these perceptions shape their overall evaluation of its quality. Third, the results also show that perceived informativeness and product knowledge exhibit substitutability in their influence on perceived realism. Even with limited product knowledge, consumers can still achieve a realistic experience if VR provides adequate informational support.

2. Literature review

2.1. Virtual reality

VR is a computer-generated simulation that fully immerses the user, allowing them to experience it through multi-dimensional senses such as vision, hearing, and touch (Kozinets, 2023). It enables users to interact with the simulated reality in a way that closely resembles real-life experiences. One of the most remarkable aspects that determines the quality of VR experiences is the level of realism they offer. Perceived realism refers to the extent to which consumers perceive the VR-based environment as being realistic and immersive (Daassi & Debbabi, 2021). It includes various elements such as graphics, sound effects, haptic feedback, and physics simulations (Wedel et al., 2020). When these components are seamlessly integrated into a VR experience, users can feel like they have been transported to another place (Pizzi et al., 2020). The level of realism perceived by users significantly impacts their flow experience when interacting with the virtual environment (Chen & Lin, 2022).

The application of immersive technologies, such as VR, spans across diverse industries, including gaming, education, tourism, retailing, and beyond. The application of immersive technologies has revolutionized the gaming industry, offering gamers immersive and enjoyable experiences (Shin, 2022). Players are now able to immerse themselves in virtual worlds and engage in gameplay that is more realistic than ever before (Park & Ko, 2022). In the field of education, immersive technologies offer a new dimension to learning by creating simulated environments that enhance students' understanding and learning gains (Chen & Wang, 2024; Georgiou & Kyza, 2021). Tourism has also greatly benefited from immersive technologies as it allows people to virtually visit destinations that they may not have the opportunity to travel to physically (Çolakoğlu et al., 2024). Through virtual tours, travelers can experience iconic landmarks, cultural sites, and natural wonders from the comfort of their own homes (Yoon & Nam, 2024). Retailers are leveraging immersive technologies to enhance consumer experiences (Brannon et al., 2021; Muhammad et al., 2023). Shopping in VR stores allows consumers to visualize products in a more immersive way before making purchasing decisions (Peukert et al., 2019). This immersive experience helps bridge the gap between online browsing and physical shopping (Jiang et al., 2023).

2.2. Co-production

The potential for consumers to actively engage in customizing their own world has been long emphasized (Firat et al., 1995). Co-production is a collaborative approach where consumers are involved in various stages of product or service development (Etgar, 2008). This concept underscores the importance of consumer participation throughout the life-cycle of a product or service, starting from the initial conceptualization and design phases, through to testing and refinement. For example, consumers are no longer limited to choosing from a pre-determined selection of products; instead, they can actively participate in the design process by customizing colors, sizes, and even adding personalized pattern. This study focuses on the co-production process involving the collaboration between the consumer and the employees during the production process. Consumers actively participate in providing feedback, suggestions, and

preferences throughout the production journey (Vargo et al., 2024). Their input serves as valuable insights for employees who are responsible for translating these requirements into tangible products or services (Chang & Taylor, 2015). This collaboration fosters a sense of satisfaction among consumers while empowering employees with a deeper understanding of consumer needs (Assiouras et al., 2019).

With the advancement of immersive technology, such as VR, consumers now have more opportunities than ever to articulate their unique ideas and customize their experiences (Zaki et al., 2023). One of the most well-established applications of VR in co-production is product design and customization. VR allows consumers to engage in tailored virtual environments that cater to their specific interests. It not only enhances consumer engagement but also drive meaningful collaboration between consumers and designers. The increased connectivity allows for real-time interactions where ideas can be shared instantaneously across geographical boundaries (Füller et al., 2009). Consumers have the capability to engage in both visual and physical interaction with VR environments, as well as participate in collaborative design processes with designers through virtual methods (Kim, 2025). Co-production in VR environment allows for a deeper understanding of the design process and enables consumers to provide valuable feedback that can directly impact the final product (Buhalis et al., 2023). By participating in co-production, consumers feel a sense of ownership and connection to the products they are engaging with, leading to increased loyalty (Auh et al., 2007). Additionally, this collaborative approach fosters innovation and creativity as designers gain insights from consumer perspectives, ultimately resulting in more impactful designs.

VR has been increasingly utilized in service innovation, especially within the tourism and hospitality sectors (Guttentag, 2010). Previous research has demonstrated that VR can enhance consumer experiences by offering immersive previews of services (Sousa et al., 2024). In the tourism sector, VR has been utilized to offer virtual tours of destinations, allowing potential travelers to explore locations remotely before making travel decisions (Çolakoğlu et al., 2024). Studies have shown that VR-based virtual tourism significantly enhances destination attractiveness by enabling users to experience realistic simulations of travel sites (Rasul et al., 2024). This not only increases consumers' enjoyment but also influences their travel intentions (Tussyadiah et al., 2018). Similarly, in the hospitality industry, VR has been employed to offer virtual hotel tours, enabling consumers to explore hotel rooms and facilities in a highly immersive environment before booking (McLean & Barhorst, 2022). This approach has been found to improve consumers' satisfaction and intention to stay (Lim et al., 2024). By allowing prospective guests to experience the hotel environment beforehand, VR helps bridge the gap between consumer expectations and actual service delivery, thereby reducing dissatisfaction and post-purchase dissonance. Similarly, a study by Wu et al. (2025) demonstrated that virtual hotel tours significantly enhance mental imagery and perceived value, leading to higher booking intentions.

While VR research has expanded across various domains, its application in the home decoration industry remains relatively underdeveloped. Most existing studies on VR in product design and service innovation primarily emphasize its impact on overall user experience and purchase intention. However, these studies may overlook the deeper psychological mechanisms that influence consumer perceptions in VR environments. Specifically, there is limited research on how VR-generated experiences, such as perceived informativeness and realism, shape consumers' evaluations of product quality in a co-production setting. Understanding these psychological mechanisms is crucial for optimizing VR applications in home decoration, as it can help businesses create more immersive and effective tools that enhance consumer satisfaction. By addressing this gap, our study aims to provide valuable insights into the role of VR in facilitating consumer co-production, bridging the intersection between VR technology and the home decoration industry.

3. Hypotheses

Perceived informativeness refers to the degree to which VR provides comprehensive information that enhances the co-production process (Qin et al., 2021). When consumers perceive the resources provide by the VR as highly informative, they tend to associate it with higher quality (Jayaswal & Parida, 2023; Rese et al., 2017). First, sufficient information not only enhances consumers' understanding of the product but also facilitates the attainment of co-production objectives. When consumers possess a clear understanding of what they can expect from a co-production process, it becomes easier for them to actively participate and contribute toward achieving the desired outcomes. Furthermore, providing rich and detailed information to consumers plays a crucial role in minimizing uncertainties that may arise during co-production processes (Holdack et al., 2022; Smink et al., 2019). When consumers are equipped with rich information about the product which they are involved in producing, they gain a better picture of how their contributions will impact the outcome. Thus,

H1: Perceived informativeness is positively related to perceived quality.

Perceived realism indicates how closely the virtual world resembles the real world (Daassi & Debbabi, 2021). This perception includes various elements, including visual fidelity, audio quality, haptic imagery, and overall coherence within the virtual world (Cowan & Ketron, 2019). When users interact with virtual objects, their perception of realism is determined by how closely these objects resemble their real-world counterparts and how accurately they respond to user actions (Yoon & Nam, 2024). The high level of perceived realism indicates that the virtual objects exhibit realistic behavior when manipulated or touched by users. If users are provided with abundant information in VR, they are allowed to explore products or environments in a more detailed and realistic manner. They can examine every

aspect from different angles, zoom in on specific details, and even interact with virtual objects, resulting in a realistic experience. Thus,

H2a: Perceived informativeness is positively related to perceived realism.

As perceived realism reflects the extent to which virtual objects exhibit realistic behavior when manipulated or touched by users, it plays a crucial role in enhancing the user experience in VR environments. For example, physics simulation can enhance user experience by accurately representing how objects move and interact with each other within the virtual environment (Zuo & Shen, 2024). Furthermore, spatial audio adds another layer of realistic user experience by providing realistic sound cues based on the user's position and orientation (Hennig-Thurau et al., 2023). In addition to simulating the physical world visually and audibly, haptic feedback technology is also integrated into VR to improve user experience (Huang & Liao, 2017). The realism of multi-dimensional sensory experiences contributes to a more immersive co-production environment and a better user experience, thereby enhancing consumers' perceived quality. Thus,

H2b: Perceived realism is positively related to perceived quality.

Consumers can integrate their existing knowledge with external information and resources during the co-production process (Vargo & Lusch, 2004). According to cognitive load theory, individuals have limited cognitive processing capacity, and the efficiency of learning depends on how well new information aligns with pre-existing cognitive schemas (Sweller, 1988). In the co-production process, VR enables consumers to actively interact with the environment, connecting prior knowledge with new information. Consumers with high product knowledge experience lower intrinsic cognitive load, allowing them to process and integrate VR-provided information more efficiently than those with limited knowledge. Their well-established mental schemas enable them to filter, interpret, and apply new information with ease, leading to a more immersive and realistic experience.

Conversely, consumers with low product knowledge may experience higher cognitive load due to the unfamiliarity of the information presented. Without a strong cognitive framework to structure and assimilate new inputs, these consumers may struggle with information overload, reducing the effectiveness of the VR experience. However, when VR delivers well-structured and sufficiently detailed information, it can serve as an external cognitive aid, mitigating cognitive load and supporting the learning process (Figure 1). Thus,

H3: Product knowledge positively moderates the effects of perceived informativeness on perceived realism. The effects of perceived informativeness on perceived realism are stronger when product knowledge is high.

4. Method

4.1. Data collection

In this study, the market research company Credamo was employed to collect data. The data collection process lasted from October 2023 to December 2023. This study employed purposive sampling, a non-probability sampling technique. The data collection process began with a pilot survey designed to identify respondents with specific characteristics, those who have prior experience using VR for home decoration. The initial step involved sending an online survey randomly to the respondents in Credamo's panel pool. These respondents were then asked whether they had experience with VR in the context of home decoration. Once this subgroup was identified, those who met the criteria (i.e., had prior VR experience) were purposefully selected to participate in the main survey.

The home decoration sector was chosen as the research context for this study due to its nature as a typical co-production scenario. The consumers and designers collaborate to complete the home decoration and the VR facilitate this co-production process. To avoid the common method bias, the data of perceived informativeness, perceived realism, and product knowledge were collected in the 1st stage of the survey, and the data of perceived quality were collected in the 2nd stage of the survey (one month after the 1st stage). Finally, after deleting the respondents who did not pass the attention check, a total of 259 respondents complete the whole survey. To ensure an adequate sample size, an *a priori* statistical power analysis was conducted using G*Power 3.1. The results indicated that a minimum of 119 participants was required to achieve sufficient power.

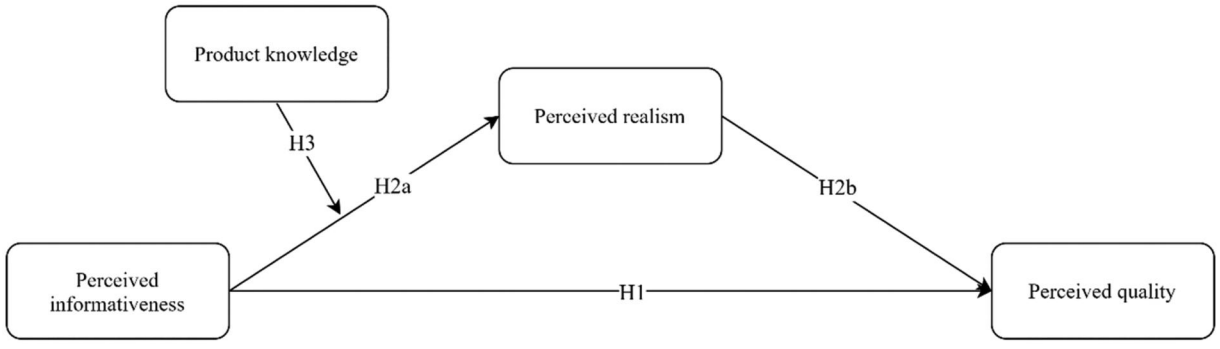

Figure 1. Research model.

Table 1. Respondents' demographic profiles.

Demographics	Categories	Frequency	%
Gender	Male	110	42.5
	Female	149	57.5
Age	18–29	95	36.7
	30–39	132	51.0
	30–49	21	8.1
	>50	11	4.2
Education	High school and below	4	1.5
	College	18	6.9
	Bachelor's	190	73.4
	Master's and above	47	18.1
Occupation	Student	20	7.7
	Full time employment (non-professional)	228	88.0
	Professional	9	3.5
	Others	2	0.8
Income	<¥3000	21	8.1
	¥3001–¥6000	30	11.6
	¥6001–¥9000	70	27.0
	¥9001–¥12,000	53	20.5
	>¥12,000	85	32.8

Given that this study collected 259 valid responses, the sample size meets the recommended threshold. The respondents' demographic profiles are shown in Table 1.

4.2. Measurements

The measurements used in this study were all taken from previous research. The items used to measure perceived informativeness, perceived realism, product knowledge, and perceived quality were drawn from Rese et al. (2017), Daassi and Debbabi (2021), Laroche et al. (2003), and Chen et al. (2022), respectively. All items were measured on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

Harman's one-factor test was applied to assess the presence of common method variance (Podsakoff et al., 2003). The first component with the largest eigenvalue accounts for 35.84% of the variances, suggesting that the common method bias is not an issue in this study.

5. Results

5.1. Measurement model

As shown in Table 2, reliability and convergent validity were assessed (Fornell & Larcker, 1981). The CR values ranging from 0.792 to 0.926 exceed the threshold of 0.7. All the factor loadings and AVEs were above the cutoff of 0.7 and 0.5, respectively. Furthermore, the discriminant validity was assessed. As shown in Table 3, the square root of AVE for each construct was greater than all the corresponding correlations. Table 4 demonstrates that the HTMT values ranging from 0.212 to 0.797 were all less than 0.85 (Henseler et al., 2015). Thus, reasonable reliability, as well as convergent and discriminant validity were validated.

5.2. Structural model

The PROCESS macro was used to conduct the moderated mediation analysis, with Model 7 specified (Hayes, 2022). Specifically, this study examined whether perceived realism mediates the relationship between perceived informativeness and perceived quality, while also assessing the moderating role of product knowledge in this mediation process.

As shown in Figure 2, first, the results show that perceived informativeness has a positive significant impact on perceived quality ($\beta = 0.171$, $p < 0.01$). Thus, H1 is supported. Second, perceived informativeness is positively related to the perceived realism ($\beta = 0.319$, $p < 0.001$), and perceived realism is positively related to perceived quality ($\beta = 0.474$, $p < 0.001$). Thus, H2a and H2b are supported. Third, contrary to the expectation, product knowledge negatively moderates the effects of perceived informativeness on perceived realism ($\beta = -0.090$, $p < 0.05$). Thus, H3 is not supported.

5.3. Robust tests

Table 5 shows the conditional effects of perceived informativeness on perceived realism. First, when consumers have a low level of product knowledge (mean − 1SD), perceived informativeness is positively related to the perceived realism ($\beta = 0.506$, $p < 0.001$). Second, when consumers have a moderate level of product knowledge (mean), perceived informativeness is positively related to the perceived realism ($\beta = 0.388$, $p < 0.001$). Third, when consumers have a high level of product knowledge (mean + 1SD), perceived informativeness is positively related to the perceived realism ($\beta = 0.269$, $p < 0.01$).

Figure 3 shows the effects of perceived informativeness on perceived realism at different levels of product knowledge. First, regardless of the level of product knowledge, perceived informativeness positively influences the perception of realism. According to this cognitive load theory, individuals have a limited cognitive capacity, and the amount of mental effort required to process new information depends on their prior knowledge (Sweller, 1988). These findings align with cognitive load theory, which posits that individual with lower domain-specific knowledge experience higher cognitive load when processing unfamiliar information. VR-provided informativeness reduces cognitive effort by offering structured guidance, allowing consumers to construct a coherent mental model of the product. As a result, even consumers with low product knowledge can develop a heightened sense of realism when VR delivers sufficient informational support. Second, the results show that perceived realism is lowest when both perceived informativeness and product knowledge are low. This can be explained by the lack of pre-existing cognitive schemas, which forces individuals to engage in extensive cognitive processing without adequate informational support. The absence of both internal knowledge and external guidance leads to cognitive overload, impairing the ability to mentally simulate a realistic experience. Third, the findings highlight that the highest level of perceived realism occurs when both perceived informativeness and product knowledge are high. This suggests that when consumers possess strong domain knowledge, their cognitive load is reduced, allowing them to

Table 2. Reliability and validity.

Constructs	Items	Loadings	CR	AVEs
Perceived informativeness (Rese et al., 2017)	*INF1*: The information about the home decoration provided by the VR was highly detailed.	0.725	0.792	0.560
	INF2: The VR provides detailed information about the home decoration.	0.744		
	INF3: The VR provides the complete information about the home decoration.	0.776		
Perceived realism (Daassi & Debbabi, 2021)	*REA1*: My experience in the VR environment seems consistent with my real-world experience.	0.781	0.853	0.592
	REA2: The things that happen in VR environment look like the things that happen in real life.	0.721		
	REA3: In comparison with the real world, the VR environment seemed real.	0.816		
	REA4: This VR experience was like real-world experience.	0.756		
Product knowledge (Laroche et al., 2003)	*PRK1*: In general, my knowledge of home decoration is: (very weak to very strong).	0.904	0.926	0.807
	PRK2: Would you consider yourself uninformed or informed about home decoration: (very uninformed to very informed)?	0.905		
	PRK3: Compared to my friends and acquaintances, my knowledge of home decoration is: (weaker to stronger).	0.887		
Perceived quality (Chen et al., 2022)	*QUA1*: The VR for home decoration is valuable.	0.723	0.793	0.561
	QUA2: The VR for home decoration offers very high quality.	0.765		
	QUA3: The VR for home decoration is very reliable.	0.758		

Table 3. Fornell–Larcker criterion.

	Perceived informativeness	Perceived realism	Product knowledge	Perceived quality
Perceived informativeness	0.748			
Perceived realism	0.466	0.769		
Product knowledge	0.259	0.440	0.898	
Perceived quality	0.392	0.554	0.382	0.749

The square roots of the AVEs for each construct are on the diagonal, and correlations are on the off-diagonal.

Table 4. Heterotrait–monotrait ratio (HTMT).

	INF	REA	PRK	QUA	INF* pRK
Perceived informativeness					
Perceived realism	0.683				
Product knowledge	0.356	0.533			
Perceived quality	0.640	0.797	0.520		
Perceived informativeness* Product knowledge	0.587	0.400	0.212	0.345	

INF, REA, PRK, and QUA denote, perceived informativeness, perceived realism, product knowledge, and perceived quality respectively.

efficiently integrate VR-provided information with their existing mental representations.

6. Discussion

6.1. Summary of results

This study investigates how perceived informativeness of VR affects consumers' perceived quality in co-production. First, the results show that perceived informativeness is positively related to perceived quality in co-production. The findings align with prior research that underscores the significance of VR functionality (Muhammad et al., 2023; Peukert et al., 2019). One of the salient characteristics of VR lies in its capacity to provide extensive informational support (Cowan & Ketron, 2019; McLean & Barhorst, 2022). Previous research suggests that resource integration plays a crucial role in the co-production process (Agrawal & Rahman, 2015; Etgar, 2008). This study further demonstrates that consumers can synergistically combine their own resources with the comprehensive information provided by VR to effectively achieve co-production. The higher the level of informational support achieved by consumers in VR, the higher their perceived quality.

Second, the results show that perceived realism mediates the effects of perceived informativeness on perceived quality. The perceived informativeness of consumers is positively associated with the perception of realism, which in turn influences the perceived quality. Previous research has demonstrated that the critical advantages of VR lie in its ability to provide consumers with immersive and interactive experiences (Kim & Ko, 2019; Kozinets, 2023). This study further posits that the incorporation of realistic experience in VR serves as an additional determinant influencing consumers' evaluation. When consumers' VR experience aligns with their real-world encounters, they can seamlessly accomplish their co-production objectives, thereby enhancing their perception of VR's efficacy in co-production.

Third, the results also indicate that perceived informativeness and product knowledge serve as substitutable factors in shaping perceived realism. Consumers with limited product knowledge often experience a high intrinsic cognitive load due to their unfamiliarity with the product (Sweller, 1988). This cognitive load can hinder their ability to effectively participate in the co-production process, making it difficult for them to articulate preferences and engage meaningfully with co-production partners. However, VR can mitigate this challenge by providing structured and interactive informational support, reducing extraneous cognitive load. By offering

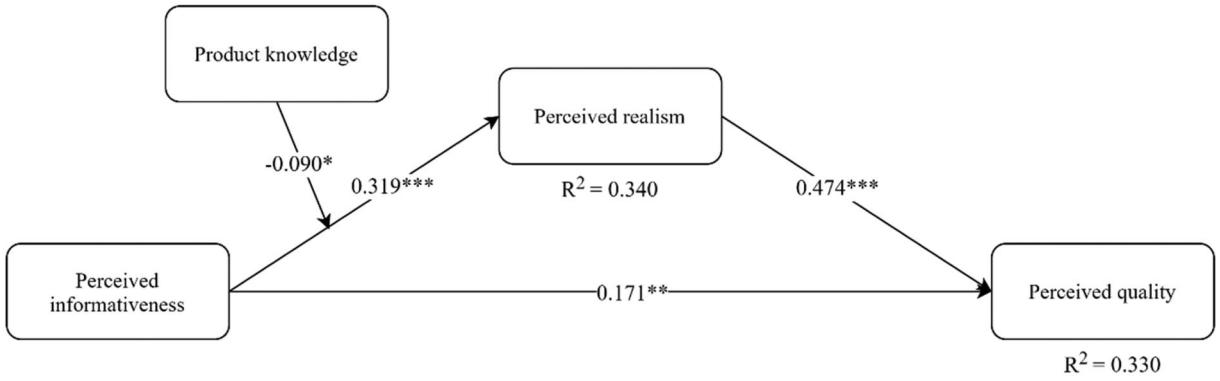

Figure 2. PLS results. ***$p < 0.001$, **$p < 0.01$, and *$p < 0.05$.

Table 5. Conditional effects of perceived informativeness on perceived realism.

Product knowledge	β	SE	T	p	LLCI	ULCI
2.911	0.506	0.067	7.534	0.000	0.374	0.639
3.768	0.388	0.072	5.395	0.000	0.246	0.529
4.625	0.269	0.102	2.638	0.009	0.068	0.470

immersive, real-time, and visually rich information, VR allows consumers to bridge knowledge gaps and process complex information more efficiently. On the other hand, for consumers with higher product knowledge, VR can serve to enhance germane cognitive load, allowing them to integrate their pre-existing knowledge with new virtual experiences more effectively. This flexibility in processing information leads to deeper engagement and a heightened sense of realism during co-production. Thus, the study suggests that VR not only compensates for a lack of prior knowledge but also optimizes cognitive resources for experienced consumers, ultimately fostering a more realistic and immersive co-creation experience.

6.2. Theoretical implications

This study has three theoretical implications. First, this study extends the scope of VR research by exploring its application in co-production scenarios, thereby bridging the gap between VR technology and value co-production literature. While VR has gained growing academic attention, there is a continued call for research exploring its impact across both digital and brick-and-mortar contexts (e.g., Kannan & Li, 2017). Addressing this gap, the present study provides valuable insights into the effectiveness and influence of VR in co-production processes. By examining how VR can be utilized in settings such as collaborative design or service customization, this research offers both scholars and practitioners a deeper understanding of its potential applications. Specifically, the study highlights that delivering relevant and sufficient information through VR plays a pivotal role in empowering consumers who actively participate in co-production activities.

Second, this study adds to the existing body of co-production research by shedding light on the underlying mechanisms that influence perceived quality. Specifically, this study identifies the mediating role of perceived realism in the relationship between perceived informativeness and perceived quality. By examining consumers' perceptions of the realism of a specific co-produced product presented in VR, this study provides valuable insights into how these perceptions shape their overall evaluation of its quality. This study contributes significantly to our knowledge about co-production by elucidating the role perceived realism played as a mediator between perceived informativeness and perceived quality.

Third, this study demonstrates the substitutability between perceived informativeness and product knowledge, revealing that even consumers with limited product knowledge can achieve a high sense of realism if VR systems provide sufficient informational support. Previous research points out that consumers with limited product knowledge may encounter challenges during the co-creation process (Yang, 2023). Specifically, they often struggle to articulate their needs and may demonstrate cognitive biases when engaging in discussions with co-production partners. This study suggests that VR has the potential to facilitate consumers' journey in the co-production process (Kim, 2025). The informative nature of VR can compensate for consumers' lack of product knowledge and it can also enhance sophisticated consumers' flexibility in utilizing their existing product knowledge, thus leading to a realistic experience in co-production.

6.3. Practical implications

This study has three practical implications. First, this study finds that perceived informativeness is positively associated with perceived quality in co-production. The relevant and sufficient information delivered through VR plays a critical role in empowering consumers engaged in co-production. Thus, managers should design VR systems with features that enhance information accessibility and relevance.

For instance, they can integrate interactive elements such as clickable hotspots, 3D models, or annotated visuals within the VR environment to provide real-time, context-specific information. Providing an intuitive user interface that allows consumers to easily navigate and retrieve detailed product specifications, customization options, or usage scenarios is critical. Additionally, incorporating voice guidance or multilingual support can cater to diverse user preferences and

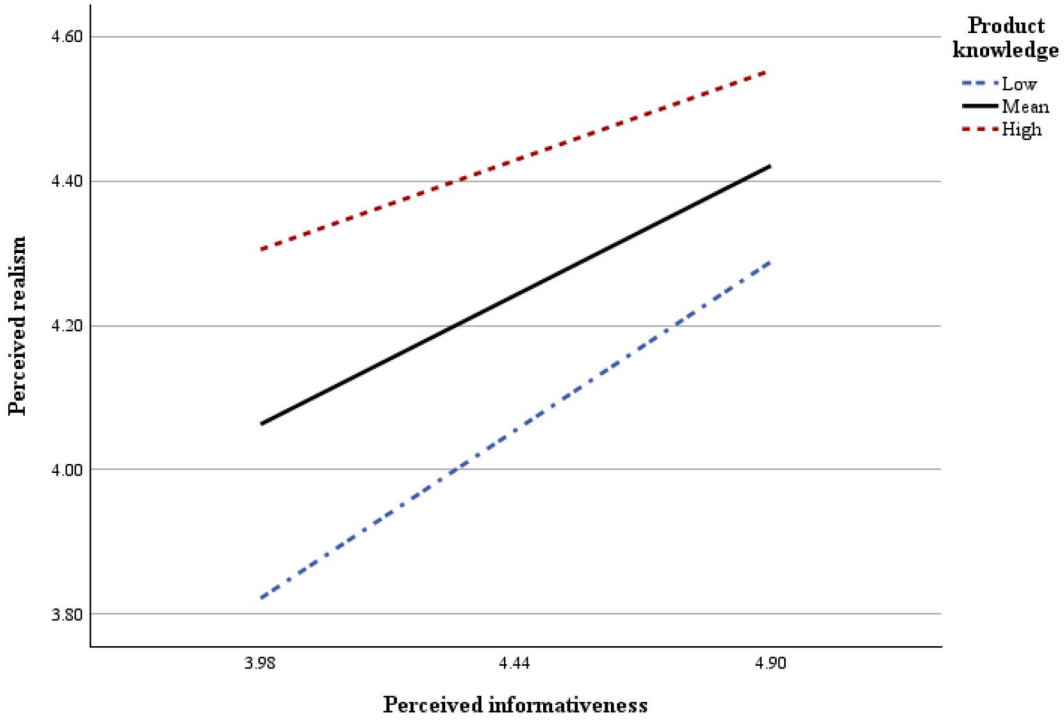

Figure 3. The effects of perceived informativeness on perceived realism at different levels of product knowledge.

expertise levels. To ensure effective collaboration among stakeholders, managers should also enable real-time communication tools within the VR system, such as virtual chatrooms or collaborative design spaces where consumers and designers can share feedback instantly. These tools not only facilitate seamless integration of consumer inputs but also enhance the co-production experience by fostering transparency and engagement throughout the process. By adopting these strategies, companies can ensure that VR systems empower consumers and contribute to higher perceived quality in co-production scenarios.

Second, the results of this study show that the effects of perceived informativeness on perceived quality are mediated by perceived realism. The level of realism experienced in VR significantly influences consumers' perceived quality. To enhance perceived realism, managers should prioritize creating VR experiences that closely mimic real-world interactions and environments. For example, companies can utilize advanced rendering techniques to create high-resolution, photorealistic visuals and realistic lighting effects that mirror real-world conditions. Incorporating dynamic elements, such as moving objects or adaptive environments, can further increase immersion. Additionally, leveraging technologies like haptic feedback can provide tactile sensations, such as vibrations, pressure, or texture feedback, when users interact with virtual objects, making the experience feel more authentic. Beyond technical enhancements, managers should also consider aligning the VR experience with consumers' expectations of real-world interactions. This includes ensuring that the scale, proportions, and physics in the virtual environment are accurate. For instance, in the context of home decoration, consumers should be able to visualize how furniture fits within a space, adjust layouts in real-time, and perceive the textures and colors of materials as they would appear in natural lighting conditions. By focusing on these design elements, companies can create VR experiences that are not only engaging but also deliver a high level of realism, ultimately enhancing consumers' perceived quality in co-production scenarios.

Third, this study finds that perceived informativeness and product knowledge are substitutable in influencing perceived realism. Consumers can experience the highest level of perceived realism when both perceived informativeness and product knowledge are high. However, even if consumers possess limited product knowledge, they can still attain a realistic experience provided that the VR offers adequate informational support. Thus, managers should adopt differentiated strategies based on consumers' levels of product knowledge. First, conducting pre-engagement surveys or utilizing consumer data analytics can help companies segment consumers according to their prior product knowledge. For consumers with limited product knowledge, VR systems should prioritize offering comprehensive, easy-to-understand informational support. For instance, incorporating guided tutorials within the VR environment can walk users through the key features and functionalities of the product. These tutorials can include interactive walkthroughs, step-by-step instructions, or embedded explanatory videos tailored to the co-production process. In addition, managers could implement customizable informational layers in VR systems. For example, consumers with high product knowledge might prefer minimal guidance and more advanced customization options, while those with less expertise could benefit from detailed explanations and simplified interfaces. Companies might also provide optional training programs or workshops, which are accessible through online platforms or directly within the VR experience, to empower consumers with the necessary knowledge before they engage in co-

production activities. By tailoring informational strategies to different consumer segments, companies can ensure that all consumers, regardless of their initial product knowledge, can achieve a highly realistic and satisfying co-production experience.

6.4. Limitations and future research

This study has four limitations. First, this study specifically focuses on a single co-production scene, namely home decoration. Although this study has provided valuable insights into the co-production, future research is recommended to generalize the findings of this study to a broader context. Future research could explore how VR facilitated co-production works in different contexts such as healthcare, tourism, education or even government services. Second, cross-cultural comparative research would be particularly valuable in exploring how cultural differences influence consumer behaviors. Future studies could further enhance our understanding of how VR facilitates co-production in diverse cultural settings. Third, this study specifically examines the critical informational aspects associated with the characteristics of VR. Future research could explore additional essential attributes of VR, such as interactivity and vividness, to provide a more comprehensive understanding. Fourth, the study employed the cross-sectional data. Future research could adopt a longitudinal design to explore the role of VR at different stages of the co-production process.

Acknowledgements

ChatGPT was utilized to identify grammar mistakes. The authors proofread the final manuscript and take full responsibility for the content of the publication.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the National Natural Science Foundation of China (72302072), Hangzhou Key Research Base of Philosophy and Social Sciences "Research Center for Innovation and Development of Platform Economy", and Zhejiang Provincial Philosophy and Social Sciences Planning Project (24NDQN118YBM).

ORCID

Xue Yang http://orcid.org/0000-0003-3449-4849

References

Agrawal, A. K., & Rahman, Z. (2015). Roles and resource contributions of customers in value co-creation. *International Strategic Management Review*, *3*(1–2), 144–160. https://doi.org/10.1016/j.ism.2015.03.001

Assiouras, I., Skourtis, G., Giannopoulos, A., Buhalis, D., & Koniordos, M. (2019). Value co-creation and customer citizenship behavior. *Annals of Tourism Research*, *78*, 102742. https://doi.org/10.1016/j.annals.2019.102742

Auh, S., Bell, S. J., McLeod, C. S., & Shih, E. (2007). Co-production and customer loyalty in financial services. *Journal of Retailing*, *83*(3), 359–370. https://doi.org/10.1016/j.jretai.2007.03.001

Brannon, J. B., McLean, G., Shah, E., & Mack, R. (2021). Blending the real world and the virtual world: Exploring the role of flow in augmented reality experiences. *Journal of Business Research*, *122*, 423–436. https://doi.org/10.1016/j.jbusres.2020.08.041

Buhalis, D., Lin, M. S., & Leung, D. (2023). Metaverse as a driver for customer experience and value co-creation: Implications for hospitality and tourism management and marketing. *International Journal of Contemporary Hospitality Management*, *35*(2), 701–716. https://doi.org/10.1108/IJCHM-05-2022-0631

Chang, W., & Taylor, S. A. (2015). The effectiveness of customer participation in new product development: A meta-analysis. *Journal of Marketing*, *80*(1), 1–77.

Chen, H., Chen, H., & Tian, X. (2022). The impact of social shopping feature richness on buying intention: A product perspective. *Internet Research*, *32*(4), 1378–1400. https://doi.org/10.1108/INTR-05-2021-0313

Chen, H., Li, H., & Pirkkalainen, H. (2024). How extended reality influences e-commerce consumers: A literature review. *Electronic Commerce Research and Applications*, *65*, 101404. https://doi.org/10.1016/j.elerap.2024.101404

Chen, J. V., Ha, Q. A., & Vu, M. T. (2023). The influences of virtual reality shopping characteristics on consumers' impulse buying behavior. *International Journal of Human–Computer Interaction*, *39*(17), 3473–3491. https://doi.org/10.1080/10447318.2022.2098566

Chen, S., & Wang, J. (2024). Virtual reality human–computer interactive English education experience system based on mobile terminal. *International Journal of Human–Computer Interaction*, *40*(13), 3560–3569. https://doi.org/10.1080/10447318.2023.2190674

Chen, Y., & Lin, C. A. (2022). Consumer behavior in an augmented reality environment: Exploring the effects of flow via augmented realism and technology fluidity. *Telematics and Informatics*, *71*, 101833. https://doi.org/10.1016/j.tele.2022.101833

Çolakoğlu, Ü., Anış, E., Esen, Ö., & Tuncay, C. S. (2024). The evaluation of tourists' virtual reality experiences in the transition process to metaverse. *Journal of Hospitality and Tourism Insights*, *7*(3), 1475–1500. https://doi.org/10.1108/JHTI-09-2022-0426

Cowan, K., & Ketron, S. (2019). A dual model of product involvement for effective virtual reality: The roles of imagination, co-creation, telepresence, and interactivity. *Journal of Business Research*, *100*, 483–492. https://doi.org/10.1016/j.jbusres.2018.10.063

Daassi, M., & Debbabi, S. (2021). Intention to reuse AR-based apps: The combined role of the sense of immersion, product presence and perceived realism. *Information & Management*, *58*(4), 103453. https://doi.org/10.1016/j.im.2021.103453

Eisingerich, A. B., & Bell, S. J. (2008). Perceived service quality and customer trust: Does enhancing customers' service knowledge matter? *Journal of Service Research*, *10*(3), 256–268. https://doi.org/10.1177/1094670507310769

Etgar, M. (2008). A descriptive model of the consumer co-production process. *Journal of the Academy of Marketing Science*, *36*(1), 97–108. https://doi.org/10.1007/s11747-007-0061-1

Firat, A. F., Dholakia, N., & Venkatesh, A. (1995). Marketing in a postmodern world. *European Journal of Marketing*, *29*(1), 40–56. https://doi.org/10.1108/03090569510075334

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Füller, J., Mühlbacher, H., Matzler, K., & Jawecki, G. (2009). Consumer empowerment through internet-based co-creation. *Journal of Management Information Systems*, *26*(3), 71–102. https://doi.org/10.2753/MIS0742-1222260303

Georgiou, Y., & Kyza, E. A. (2021). Bridging narrative and locality in mobile-based augmented reality educational activities: Effects of semantic coupling on students' immersion and learning gains.

International Journal of Human–Computer Studies, *145*, 102546. https://doi.org/10.1016/j.ijhcs.2020.102546

Guttentag, D. A. (2010). Virtual reality: Applications and implications for tourism. *Tourism Management*, *31*(5), 637–651. https://doi.org/10.1016/j.tourman.2009.07.003

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis* (3rd ed.). Guilford Press.

Hennig-Thurau, T., Aliman, D. N., Herting, A. M., Cziehso, G. P., Linder, M., & Kübler, R. V. (2023). Social interactions in the metaverse: Framework, initial evidence, and research roadmap. *Journal of the Academy of Marketing Science*, *51*(4), 889–913. https://doi.org/10.1007/s11747-022-00908-0

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hoang, S. D., Dey, S. K., Tučková, Z., & Pham, T. P. (2023). Harnessing the power of virtual reality: Enhancing telepresence and inspiring sustainable travel intentions in the tourism industry. *Technology in Society*, *75*, 102378. https://doi.org/10.1016/j.techsoc.2023.102378

Holdack, E., Lurie-Stoyanov, K., & Fromme, H. F. (2022). The role of perceived enjoyment and perceived informativeness in assessing the acceptance of AR wearables. *Journal of Retailing and Consumer Services*, *65*, 102259. https://doi.org/10.1016/j.jretconser.2020.102259

Huang, T. L., & Liao, S. L. (2017). Creating e-shopping multisensory flow experience through augmented-reality interactive technology. *Internet Research*, *27*(2), 449–475. https://doi.org/10.1108/IntR-11-2015-0321

Jayaswal, P., & Parida, B. (2023). The role of augmented reality in redefining e-tailing: A review and research agenda. *Journal of Business Research*, *160*, 113765. https://doi.org/10.1016/j.jbusres.2023.113765

Jiang, Q., Gu, C., Feng, Y., Wei, W., & Tsai, W. C. (2023). Study on the continuance intention in using virtual shoe-try-on function in mobile online shopping. *Kybernetes*, *52*(10), 4551–4575. https://doi.org/10.1108/K-12-2021-1346

Kannan, P. K., & Li, H. (2017). Digital marketing: A framework, review and research agenda. *International Journal of Research in Marketing*, *34*(1), 22–45. https://doi.org/10.1016/j.ijresmar.2016.11.006

Kim, D., & Ko, Y. J. (2019). The impact of virtual reality (VR) technology on sport spectators' flow experience and satisfaction. *Computers in Human Behavior*, *93*, 346–356. https://doi.org/10.1016/j.chb.2018.12.040

Kim, Y. (2025). Not just for play: Why the metaverse should be leveraged for co-creation. *Business Horizons*, *68*(1), 45–54. https://doi.org/10.1016/j.bushor.2023.11.002

Kozinets, R. V. (2023). Immersive netnography: A novel method for service experience research in virtual reality, augmented reality and metaverse contexts. *Journal of Service Management*, *34*(1), 100–125. https://doi.org/10.1108/JOSM-12-2021-0481

Laroche, M., Bergeron, J., & Goutaland, C. (2003). How intangibility affects perceived risk: The moderating role of knowledge and involvement. *Journal of Services Marketing*, *17*(2), 122–140. https://doi.org/10.1108/08876040310467907

Lim, W. M., Mohamed Jasim, K., & Das, M. (2024). Augmented and virtual reality in hotels: Impact on tourist satisfaction and intention to stay and return. *International Journal of Hospitality Management*, *116*, 103631. https://doi.org/10.1016/j.ijhm.2023.103631

McLean, G., & Barhorst, J. B. (2022). Living the experience before you go … but did it meet expectations? The role of virtual reality during hotel bookings. *Journal of Travel Research*, *61*(6), 1233–1251. https://doi.org/10.1177/00472875211028313

Muhammad, R., Jafar, S., Ahmad, W., & Sun, Y. (2023). Unfolding the impacts of metaverse aspects on telepresence, product knowledge, and purchase intentions in the metaverse stores. *Technology in Society*, *74*, 102265. https://doi.org/10.1016/j.techsoc.2023.102265

Nadeem, W., & Salo, J. (2024). Does value co-creation matter? Assessing consumer responses in the sharing economy. *Information Technology & People*, *37*(3), 1279–1304. https://doi.org/10.1108/ITP-08-2022-0601

Park, J., & Ko, D. (2022). Catch me if you can: Effects of AR-enhanced presence on the mobile game experience. *Internet Research*, *32*(4), 1235–1263. https://doi.org/10.1108/INTR-10-2020-0557

Peukert, C., Pfeiffer, J., Meißner, M., Pfeiffer, T., & Weinhardt, C. (2019). Shopping in virtual reality stores: The influence of immersion on system adoption. *Journal of Management Information Systems*, *36*(3), 755–788. https://doi.org/10.1080/07421222.2019.1628889

Pizzi, G., Vannucci, V., & Aiello, G. (2020). Branding in the time of virtual reality: Are virtual store brand perceptions real? *Journal of Business Research*, *119*, 502–510. https://doi.org/10.1016/j.jbusres.2019.11.063

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Qin, H., Peak, D. A., & Prybutok, V. (2021). A virtual market in your pocket: How does mobile augmented reality (MAR) influence consumer decision making? *Journal of Retailing and Consumer Services*, *58*, 102337. https://doi.org/10.1016/j.jretconser.2020.102337

Rasul, T., Lim, W. M., O'Connor, P., Ahmad, A., Farhat, K., de Oliveira Santini, F., & Junior Ladeira, W. (2024). Immersive virtual reality experiences: Boosting potential visitor engagement and attractiveness of natural world heritage sites. *Asia Pacific Journal of Tourism Research*, *29*(5), 515–526. https://doi.org/10.1080/10941665.2024.2332993

Rese, A., Baier, D., Geyer-Schulz, A., & Schreiber, S. (2017). How augmented reality apps are accepted by consumers: A comparative analysis using scales and opinions. *Technological Forecasting and Social Change*, *124*, 306–319. https://doi.org/10.1016/j.techfore.2016.10.010

Schiopu, A. F., Hornoiu, R. I., Padurean, A. M., & Nica, A.-M. (2022). Constrained and virtually traveling? Exploring the effect of travel constraints on intention to use virtual reality in tourism. *Technology in Society*, *71*, 102091. https://doi.org/10.1016/j.techsoc.2022.102091

Shin, D. (2022). The actualization of meta affordances: Conceptualizing affordance actualization in the metaverse games. *Computers in Human Behavior*, *133*, 107292. https://doi.org/10.1016/j.chb.2022.107292

Smink, A. R., Frowijn, S., van Reijmersdal, E. A., van Noort, G., & Neijens, P. C. (2019). Try online before you buy: How does shopping with augmented reality affect brand responses and personal data disclosure. *Electronic Commerce Research and Applications*, *35*, 100854. https://doi.org/10.1016/j.elerap.2019.100854

Sousa, N., Alén, E., Losada, N., & Melo, M. (2024). Influencing wine tourists' decision-making with VR: The impact of immersive experiences on their behavioural intentions. *Tourism Management Perspectives*, *51*, 101235. https://doi.org/10.1016/j.tmp.2024.101235

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

Tussyadiah, I. P., Wang, D., Jung, T. H., & Tom Dieck, M. C. (2018). Virtual reality, presence, and attitude change: Empirical evidence from tourism. *Tourism Management*, *66*, 140–154. https://doi.org/10.1016/j.tourman.2017.12.003

Ülker, S. V., Sümer, B. N., Sönmez Kence, E., & Hızlı Sayar, F. G. (2024). Psychophysiological investigation of the effects of virtual reality, the new dimension of retail shopping, on generation Z. *International Journal of Human–Computer Interaction*, *41*(7), 3926–3939. https://doi.org/10.1080/10447318.2024.2344150

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, *68*(1), 1–17. https://doi.org/10.1509/jmkg.68.1.1.24036

Vargo, S. L., Fehrer, J. A., Wieland, H., & Nariswari, A. (2024). The nature and fundamental elements of digital service innovation. *Journal of Service Management*, *35*(2), 227–252. https://doi.org/10.1108/JOSM-02-2023-0052

Wedel, M., Bigné, E., & Zhang, J. (2020). Virtual and augmented reality: Advancing research in consumer marketing. *International*

Journal of Research in Marketing, *37*(3), 443–465. https://doi.org/10.1016/j.ijresmar.2020.04.004

Wu, X., Lai, I. K. W., & Chen, J. (2025). How hotel VR photography previews enhance customers' immediate booking intention through mental imagery and perceived value. *Journal of Hospitality and Tourism Technology*, *16*(3), 409–428. https://doi.org/10.1108/JHTT-10-2023-0328

Xu, J., Benbasat, I., & Cenfetelli, R. T. (2014). The nature and consequences of trade-off transparency in the context of recommendation agents. *MIS Quarterly*, *38*(2), 379–406. https://doi.org/10.25300/MISQ/2014/38.2.03

Yang, X. (2023). The effects of AI service quality and AI function-customer ability fit on customer's overall co-creation experience. *Industrial Management & Data Systems*, *123*(6), 1717–1735. https://doi.org/10.1108/IMDS-08-2022-0500

Yoon, S., & Nam, Y. (2024). Metaverse engagement and Korea travel intentions: Understanding affordances, presence, and place attachment among Brazilian ZEPETO users. *Journal of Destination Marketing & Management*, *31*, 100865. https://doi.org/10.1016/j.jdmm.2024.100865

Zaki, H. O., Fernandez, D., Dastane, O., Aman, A., & Sanusi, S. (2023). Virtual reality in digital marketing: Research agenda based on bibliometric reflection. *Marketing Intelligence & Planning*, *41*(4), 505–524. https://doi.org/10.1108/MIP-12-2022-0568

Zuo, M., & Shen, Y. (2024). How features and affordances of a metaverse portal engage users? Evidence from exergames. *Internet Research*, *34*(1), 239–261. https://doi.org/10.1108/INTR-08-2022-0618

About the authors

Yan Shi is an associate professor at the Alibaba Business School, Hangzhou Normal University. Her research focuses on product development. She has recently published in journals such as Technology in Society, Review of Managerial Science, among others. Additionally, she has received the Best Paper award from AOM.

Xue Yang is an assistant professor at School of Management, Zhejiang University of Finance and Economics. Her research interests include human–computer interaction and social media marketing. She has published articles in journals such as Information & Management, Computers in Human Behavior, and Information Technology and People, among others.