


## REVIEW

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# Consumer behavior in immersive virtual reality retail environments: A systematic literature review using the stimuli-organisms-responses (S-O-r) model

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## Abstract

With the rising popularity of immersive virtual reality (iVR) technologies, retailers are increasingly seeking innovative ways to create unique digital shopping experiences for their consumers. However, existing literature lacks a unified and comprehensive review that examines the interplay between virtual stimuli and consumer behavior in iVR shopping environments. To fill this gap, we conducted a systematic literature review, employing the Stimulus-Organisms-Responses (S-O-R) model as the underlying theoretical framework. This review analyzed empirical research on consumer behavior in iVR retail environments by focusing on experimental studies. Following the thematic analysis, we categorized the outcomes into descriptive themes to better comprehend consumer behavior within each theme. Our findings provide valuable insights for retailers and marketers aiming to enhance the consumer shopping experience using iVR technologies and suggest directions for future research.

## 1 | INTRODUCTION

Virtual reality (VR) offers users a realistic and interactive computer-generated environment that provides them with unique experiences in various settings, including marketing. Technological development of VR continues its relentless journey towards heightened immersion and realism, incorporating a multitude of lifelike elements, including the elusive sense of smell, which had previously remained beyond the realm of computer imitation (Liu et al., 2023). VR is anticipated to occupy a pivotal position in the lives of individuals, playing a profound role in diverse aspects of human existence (Hamad & Jia, 2022). As these advancements unfold, the significance of VR as an influential medium is set to expand in shaping the future of human experiences. A report by McKinsey (2022) has emphasized the transformative capacity of the metaverse and has projected a potential value generation of \$5 trillion by the year 2030. This estimation highlights the

extensive economic opportunities of VR, implying it has the potential to reshape industries, establish novel markets, and revolutionize the dynamics of technology, commerce, and social interactions. The ever-evolving technological landscape and changing consumer preferences are therefore making it increasingly crucial for businesses to invest in digital technologies and look for ways to enhance virtual experiences. While consumers seek to access products and services from the comfort of their homes, retailers seek to identify ways to remain competitive and thrive in the emerging technological environment. This includes targeted investments in online shopping platforms, including immersive virtual reality (iVR) technologies which can address some of the limitations of e-commerce and physical retail establishments (Martínez-Navarro et al., 2019). The strategic choice to concentrate on iVR in retail is underscored by its numerous competitive advantages. iVR elevates consumer engagement, a critical element that strongly correlates with heightened sales and customer loyalty

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(Lee, 2020). Furthermore, it enhances product visualization by providing consumers with a three-dimensional perspective enabling an understanding of product features more accurately, especially for those items where fit and functionality are essential (Wölfel & Reinhardt, 2019). Furthermore, iVR allows for the personalization of shopping experiences by enabling retailers to tailor their product interactions to individual consumer preferences. This capability not only improves customer satisfaction but also provides retailers with deep insights, essential for refining marketing strategies and optimizing product selections (Papagiannidis et al., 2017). Moreover, iVR introduces innovative retail formats, such as virtual showrooms and interactive product demonstrations, which can significantly differentiate a retailer from its competitors (Meißner et al., 2020; Yoon et al., 2015; Zhang & Wen, 2023). These features highlight iVR's potential in retail, positioning it as a strategic priority in this research study. By providing consumers with an immersive and interactive shopping experience, iVR can offer a unique value proposition that combines the convenience of e-commerce with the sensory and emotional appeal of physical retail. However, to fully realize the potential of iVR retail, it is essential to first gain a deeper understanding of consumer behaviors and the underlying motivations that drive them. Despite the growing interest in iVR retail and its potential to significantly transform the shopping experience, existing research is limited in scope, often examining only one specific aspect of consumer behavior in iVR environments. While some studies focus on purchase decisions (Branca et al., 2023; Chen et al., 2022; Han et al., 2020; Martínez-Navarro et al., 2019; Meißner et al., 2020), others explore emotional responses (Alkarney & Almakki, 2022; Bin Kim & Jung Choo, 2023; Loureiro et al., 2021; Sina & Wu, 2023) or navigation patterns (Liang et al., 2019; Schnack et al., 2019). As a result, there is a lack of a unified research that considers these diverse elements together.

The Stimulus-Organisms-Responses (S-O-R) model is a widely used theoretical framework in consumer behavioral research to examine the cognitive and emotional processes involved in the perception and evaluation of VR stimuli, as well as the behavioral responses they elicit. The model posits that stimuli (S) from the environment trigger cognitive and affective organism (O) that in turn lead to behavioral responses (R) (Mehrabian & Russell, 1974). The S-O-R model has provided the underlying framework for our systematic literature review as we seek to identify the stimuli that influence consumer behavior in iVR retail environment. This model is particularly effective in iVR environments where sensory inputs are critical in eliciting specific psychological outcomes (Jin et al., 2021). Unlike the Technology Acceptance Model (TAM) or the Theory of Planned Behavior (TPB), which primarily focus on cognitive processes, the S-O-R model integrates emotional responses, offering a deeper understanding of consumer interactions in VR where emotional engagement is crucial (Choi, 2019; Fikri et al., 2019). Empirical research supports the S-O-R model's ability to capture the dynamic interplay between virtual stimuli and consumer behavior, demonstrating its relevance in advanced retail technologies (Chen et al., 2022; Jin et al., 2021; Loureiro et al., 2021). The S-O-R model provides a holistic view of how virtual

environments impact consumer decisions thereby making it an ideal choice for iVR retail studies. Furthermore, the choice of this model is based on its ability to identify key factors influencing consumer behavior and their interactions. This can inform how the design of iVR retail environments can be optimized to meet consumers' needs and preferences. For instance, understanding which stimuli are most effective in influencing consumer behavior can help retailers create more engaging and satisfying shopping experiences. Additionally, by understanding the underlying cognitive and emotional processes that drive consumer behavior in iVR retail environments, retailers can optimize their marketing strategies to better influence consumers' attitudes and intentions. For example, by targeting consumers with personalized VR experiences that cater to their individual preferences, retailers can increase consumer loyalty and repeat purchases (Shanahan et al., 2019; Tyrväinen et al., 2020). Finally, by gaining insights into consumer behavior in iVR retail environments, retailers can identify new opportunities for innovation and differentiation that can help them stay ahead of competitors. Studies utilizing the S-O-R framework have predominantly concentrated on exploring individual or a limited set of consumer behaviors (Chen et al., 2022; Jin et al., 2021; Loureiro et al., 2021); consequently, developing a cohesive and generalized understanding of consumer behavior in iVR shopping is much needed. In an attempt to address this limitation, Xi and Hamari (2021) made a noteworthy contribution by categorizing stimuli found in previous VR shopping studies. However, their analysis primarily focused on identifying which stimuli were present in these studies without delving into the specific consumer behaviors evoked by these stimuli, and the subsequent relationships between the organism and responses.

To bridge this research gap, our literature review adopts a methodical examination and synthesis of empirical studies focused on consumer behavior within the current iVR retail environments. The S-O-R framework provided a guiding lens as it offered a nuanced and interconnected understanding of specific aspects of consumer behavior. It provided clarity in unearthing the intricate dynamics between a diverse range of S-O-R elements, to help present a unified and insightful perspective on consumer behavior in the captivating realm of iVR retail. This study therefore seeks to answer the following research questions:

**RQ1.** How can the S-O-R framework be effectively deployed in immersive virtual reality (iVR) retail environments?

**RQ2.** How do specific factors within iVR environments influence and shape consumer behavior?

This article is structured as follows. In the next section, we provide an overview of our underlying theoretical background, namely, immersive interventions in VR and how such interventions have been examined with the S-O-R model to provide explanations of consumer behavioral nuances in retail environments. Then our systematic review methodology, including search strategy, inclusion and exclusion

criteria, and quality assessment process are described. In the subsequent section, findings are presented with discussions regarding the stimuli that often influence consumer behavior in iVR retail, as well as the mediating factors that explain how these stimuli elicit different responses. The gaps identified in the current literature have led to the formulation of 15 research questions alongside a roadmap of new avenues that may shape future research. These pave the way for new iVR designs based on evolving consumer needs and preferences and further showcase upcoming marketing opportunities that retailers can exploit to optimize their customer shopping experiences. Our study limitations are put forth, followed by the concluding section that briefly outlines our theoretical contributions and practical implications in the emergent iVR retail space.

## 2 | THEORETICAL BACKGROUND

While online platforms have revolutionized the way we shop, these platforms have some inherent limitations that hinder consumer satisfaction, including relatively lower levels of immersion, limited scope for consumer interaction, and downsized product representations that may impede effective evaluation (Kim & Ha, 2021). To address these shortcomings, retailers are increasingly turning to innovative technologies such as VR, augmented reality (AR), and mixed reality (MR) to create interactive environments that can offer higher levels of engagement and immersion (Vakulenko et al., 2019). VR, in particular, has shown potential for enhancing consumer experiences and increasing profitability by providing consumers with a highly accurate, three-dimensional view of products (Kim & Ha, 2021).

### 2.1 | Immersion levels in VR environments

Understanding the varying levels of immersion in VR systems is crucial for maximizing the potential of VR in the retail sector. Immersion, which refers to the technical capability of a system, and presence, which represents the subjective measure of immersion, are closely intertwined. As noted by Slater and Sanchez-Vives (2016), when VR participants experience natural movement within a virtual world, their perceptual system is inclined to interpret the perceived surroundings as their actual environment. Building upon this understanding, VR systems can be classified into three broad categories based on their degree of immersion: fully immersive, semi-immersive, and low to non-immersive. Fully immersive systems utilize head-mounted displays (HMDs) to provide a 360° field view that is closer to a real-world environment. In contrast, semi-immersive systems use cave automatic virtual environments, and non-immersive systems utilize desktop screens (Gutierrez et al., 2008). Highly immersive systems like HMDs provide greater interactivity and immersion, which can lead to more enjoyable consumer experiences and improved purchasing outcomes (Peukert et al., 2019). iVR can substantially enhance the sensory shopping experience, leading to heightened consumer telepresence and impulsivity in purchases due to the interactive and

vivid nature of the virtual environment (Chen et al., 2022). Moreover, the immersive aspect of iVR has been shown to positively affect consumers' purchase behaviors, with a noted increase in variety-seeking and decreased price-sensitivity compared to more traditional online shopping environments (Meißner et al., 2020). The immersive and interactive nature of VR systems, particularly those that are fully immersive, provides consumers with a unique shopping experience that can be accessed from anywhere at any time, making it a flexible and convenient way to engage with the retail environment (Jin et al., 2021; Peukert et al., 2019). It is anticipated that immersive iVR will become widespread and coexist alongside other purchasing channels (Alcañiz et al., 2019). This integration will strengthen the emerging omni-channel retailing landscape, creating a more unified and seamless shopping experience (Lemon & Verhoef, 2016).

Taking all these factors into account, understanding consumer behavior in iVR retail environments is critical for retailers and marketers who wish to leverage the unique value proposition of this technology and provide consumers with a truly engaging and satisfying shopping experience. To better understand consumer behavior in iVR retail environments, we have employed the S-O-R model. This model provides a comprehensive framework for analyzing the impact of environmental stimuli on consumer behavior. Retailers and marketers can leverage this model to gain insights into consumer behavior in iVR environments, enabling them to deliver a truly engaging and satisfying shopping experience.

### 2.2 | S-O-R model

The S-O-R model is a psychological framework utilized to explain how humans respond to environmental stimuli, proposed by Mehrabian and Russell (1974). It operates on the premise that external factors trigger internal organismic processes that lead to observable responses. The stimulus denotes any outside force that can affect an individual's actions, which can take the form of an object, an occurrence, or any environmental aspect that influences the individual. The organism pertains to the internal processes that take place within the individual as a reaction to the stimulus. These internal processes can encompass cognitive and emotional activities such as attention, perception, motivation, and affect. The response corresponds to the discernible behavior or conduct that an individual exhibits as a reaction to a stimulus and related internal organismic activities. Its effectiveness lies in its previous use in examining consumer responses in both online and offline shopping contexts, as well as in its ability to offer a layered perspective for understanding the mechanisms that drive consumer experience into behavioral nuances. By considering an individual's reactions to external and internal stimuli and their cognitive and emotional states, this model can help us identify potential catalysts in virtual shopping experiences that can impact consumers' behavior, such as perceived playfulness, telepresence, and perceived diagnosticity (Chen et al., 2022). It can also assist in explaining how a Metaverse brand experience can impact consumer brand responses in both virtual and physical worlds, with mediating variables like brand

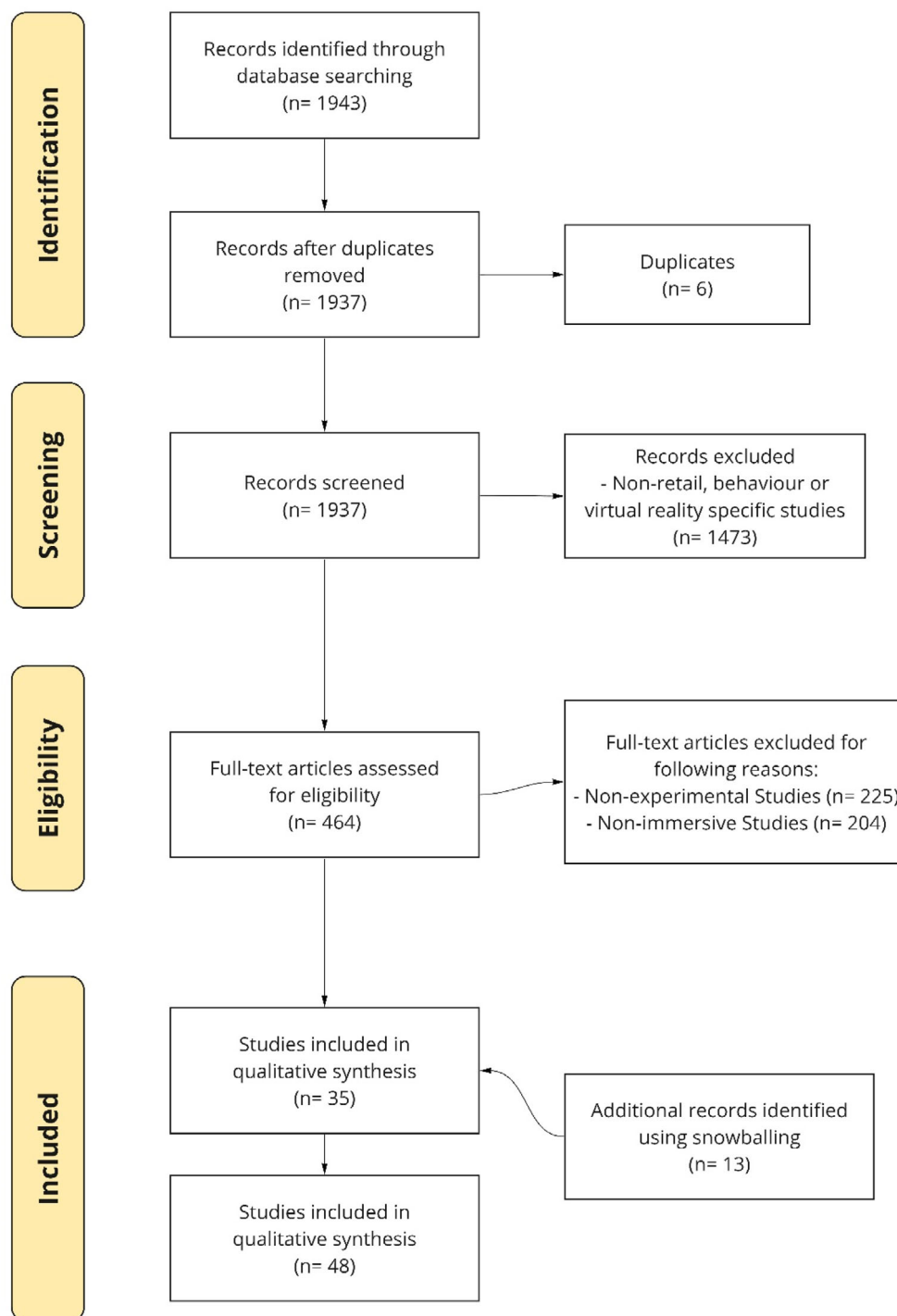
**FIGURE 1** Study selection procedure.

image perception (Wongkitrungrueng & Suprawan, 2023). Moreover, the S-O-R model has been extensively employed in studying the influence of store atmospherics, advertising stimuli, and emotional responses on shopping behavior, including store attractiveness, pleasure, arousal, satisfaction, dominance, and attitudes (Jin et al., 2021; Loureiro et al., 2021). A text-mining analysis conducted by Loureiro et al. (2019) shows the S-O-R model as the most common theoretical framework for VR and retail marketing studies. All in all, the S-O-R model offers a robust framework for analyzing consumer behavior in iVR retail environments. It can assist retailers and marketers in

identifying the key factors that drive consumer behavior in virtual shopping environments and provide insights into the cognitive and emotional states that influence shopper responses, ultimately helping to enhance the consumer shopping experience.

### 3 | METHODOLOGY

Our next step was to synthesize knowledge by following adequate methodological guidelines to understand the current body of

literature from prior research publications in this domain. Therefore, a systematic literature review was conducted. We first identified a search strategy that was tailored to detect relevant research articles on consumer behavior in virtual shopping using iVR technology. The primary database for the literature search was selected as Scopus; this database provides a comprehensive coverage of peer-reviewed publications, covers multidisciplinary research sources with up-to-date information, and has robust search capabilities (Pranckutė, 2021), ensuring it as a reputable foundation for ongoing research. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) protocol facilitated accuracy and brought transparency to the conduct of our systematic literature review (Moher et al., 2009). This protocol recognizes the iterative nature of identifying, screening, checking eligibility, and critically appraising relevant research articles, as research methodologies and outcomes from diverse studies are combined as seen in Figure 1.

A literature search limited to peer-reviewed articles in journals and conference papers published between 2013 and 31st December 2023 in the Scopus database was initiated. Starting the search from 2013 is meaningful because that is when iVR technologies gained significant traction. In that year, Oculus VR released the first available VR headset, Oculus Rift DK1 (Development Kit 1). This marked the beginning of serious attention towards VR, especially when Microsoft introduced the mixed reality HoloLens headset and Oculus showcased their VR headset at CES in 2013 (Bajarin, 2019). Things escalated in 2014 when Facebook acquired Oculus, and Sony announced a VR headset for use with the PlayStation 4 (Barnard, 2023). After these events, VR headsets began to enter mainstream awareness. By initiating the search from 2013, we aim to capture a mature phase of research where foundational concepts were explored.

We used a search string consisting of the terms “virtual,” “VR,” “iVR,” “immersive,” “reality,” “shopping,” “store,” “retail,” “customer,” “consumer,” “shopper,” “behavior,” and “experience.” Both British English and American English spellings were searched across abstracts, keywords, and titles of papers. The Scopus database was queried using the following search string: TITLE-ABS-KEY (virtual OR vr OR ivr) AND TITLE-ABS-KEY (reality OR immersive OR shopping OR store OR retail) AND TITLE-ABS-KEY (customer OR consumer OR shopper) AND TITLE-ABS-KEY (behavio\* OR experience) AND PUBYEAR >2012 AND PUBYEAR <2024 AND (LIMIT-TO (SRCTYPE, “j”) OR LIMIT-TO (SRCTYPE, “p”)) AND (LIMIT-TO (DOCTYPE, “ar”) OR LIMIT-TO (DOCTYPE, “cp”)). The search was limited to peer-reviewed articles in journals and conference papers published and written in English. The query yielded 1943 records that met the inclusion criteria. Duplicate articles were removed yielding 1937 articles.

Constrained snowball sampling (Lecy & Beatty, 2012) was next used to narrow down the filtered papers to determine the relevant articles. A total of 1473 non-retail-specific VR studies that did not specifically look at consumer behavior were excluded. This screening resulted in 464 articles. Of these, non-experimental studies were excluded from the analysis ( $n = 225$ ). In our search, we focused on experimental studies conducted in various scenarios. Incorporating only experimental studies in a systematic review of iVR in retail is

justifiable on multiple grounds. Firstly, experimental studies are essential for establishing causal relationships, allowing researchers to manipulate VR elements and directly observe their impact on consumer behavior (Papagiannidis et al., 2017). Additionally, the controlled environments of these studies enable a clear understanding of how specific VR components affect retail experiences, minimizing confounding variables and giving more accurate insights into consumer behaviors, such as, by examining their thoughts and reactions in controlled settings (Meißner et al., 2019; Morales et al., 2017). This control enhances the reproducibility of the research, a critical factor for verifying results and building a robust scientific foundation (Van Kerrebroeck et al., 2017b). Furthermore, experimental studies are apt for testing innovative technologies, providing insights that are pivotal for advancing retail practices (Taufik et al., 2021). Thus, focusing on experimental studies yields a comprehensive, reliable, and applicable understanding of iVR's impact on retail dynamics. Also, non-immersive studies ( $n = 204$ ) were excluded from the analysis. The study exclusively focused on iVR because research shows that high-immersive experiences significantly impact consumer behaviors and enhance the shopping experience (Erensoy et al., 2022). Compared to non-immersive VR technology, the iVR has a 360-degree field of view and provides users with a closer-to-real-world experience, leading to more pleasant interactions and improved shopping outcomes (Peukert et al., 2019). This focus on immersive studies stems from the belief that iVR technology holds great promise for shaping the future of shopping experiences (Erensoy, 2022). Finally, the data synthesis resulted in 48 publications on the use of iVR in retail settings. Figure 1 depicts the study selection procedure.

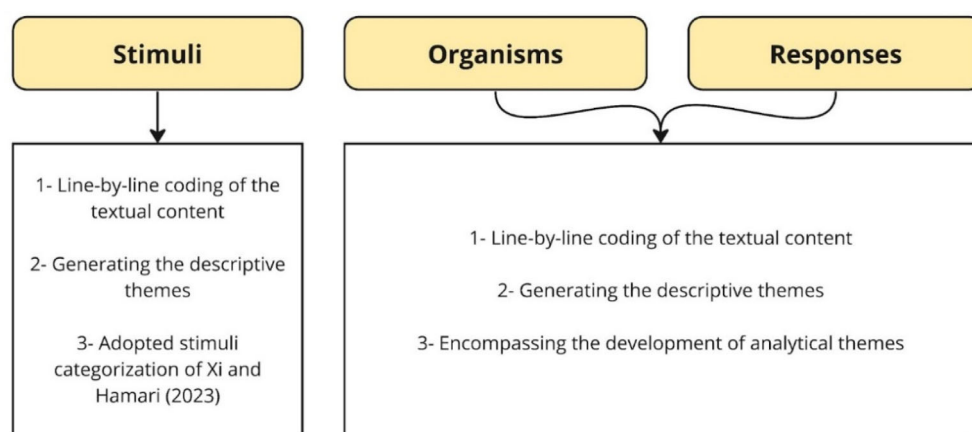
Upon completing the study selection process, a comprehensive examination of the 48 studies chosen for qualitative synthesis was examined to discover S-O-R elements in these studies. Our overarching objective, centered on elucidating consumer behavior in iVR shopping in a more accessible manner amid the complexities of the findings, further prompted us to employ a thematic analysis approach. In the next section, the thematic analysis process is explained in detail.

In our qualitative research using triangulation, we managed inter-coder reliability (ICR) by adopting a meticulous approach (Patton, 2002). We selected an appropriate ICR method tailored to our project needs, ensuring alignment with the specific requirements of our study. We developed a coding scheme, which was refined based on coder feedback and initial coding outcomes to clarify any ambiguities. Coders were trained, and continuous recalibrations were conducted to maintain consistency (Nili et al., 2020).

## 4 | FINDINGS

Thematic analysis helped to distill key themes and patterns, allowing us to focus on the most significant aspects of consumer behavior in iVR. This brought more clarity and enabled us to grasp the essential viewpoints from our systematic literature review. This section responds to the first research question (RQ1), which seeks to





**FIGURE 2** Thematic analysis procedure of the stimuli, organisms and responses (steps adopted from Thomas and Harden (2008)).

uncover facets of the S-O-R framework that have been the focal points of prior studies related to iVR retail environments for enhancing our scholarly understanding and practical application.

#### 4.1 | Thematic analysis process

Thematic analysis stands as a qualitative analysis method commonly applied in primary research and systematic reviews (Purssell & Gould, 2021). Broadly, it can be characterized as a technique for recognizing, examining, and presenting patterns (themes) within datasets (Braun & Clarke, 2006). The process of thematic analysis within a systematic review involves three key stages. Initially, researchers engage in a meticulous line-by-line coding of the textual content present in the selected papers. This is followed by the second stage, where descriptive themes are generated and intricately connected to the included studies. The final stage encompasses the development of analytical themes, enabling authors to extend beyond the study results and formulate novel interpretations, explanations, or hypotheses (Thomas & Harden, 2008). Figure 2 describes the thematic analysis procedure applied to identify the S-O-R concept in our study.

In initiating the thematic analysis of the iVR shopping data, a comprehensive approach was undertaken. The process commenced with repeated readings of selected academic papers on iVR shopping, to establish a foundational understanding of the subject matter. Immersion in the content was complemented by note-taking, focusing on key concepts, recurring themes, and notable patterns related to consumers' behavior. Active questioning and reflection were integral to the process, involving the identification of potential biases, consideration of contextual nuances, and the formulation of preliminary hypotheses or emerging theories. Subsequently, the data was systematically segmented, ranging from paragraphs to individual words. An inductive approach was adopted, enabling codes to naturally emerge from the data. Constant comparison of data segments ensured the systematic generation of codes, and the process unfolded iteratively through multiple revisitation of the data.

In the subsequent phases of the thematic analysis, the focus shifted towards searching for overarching themes within the coded

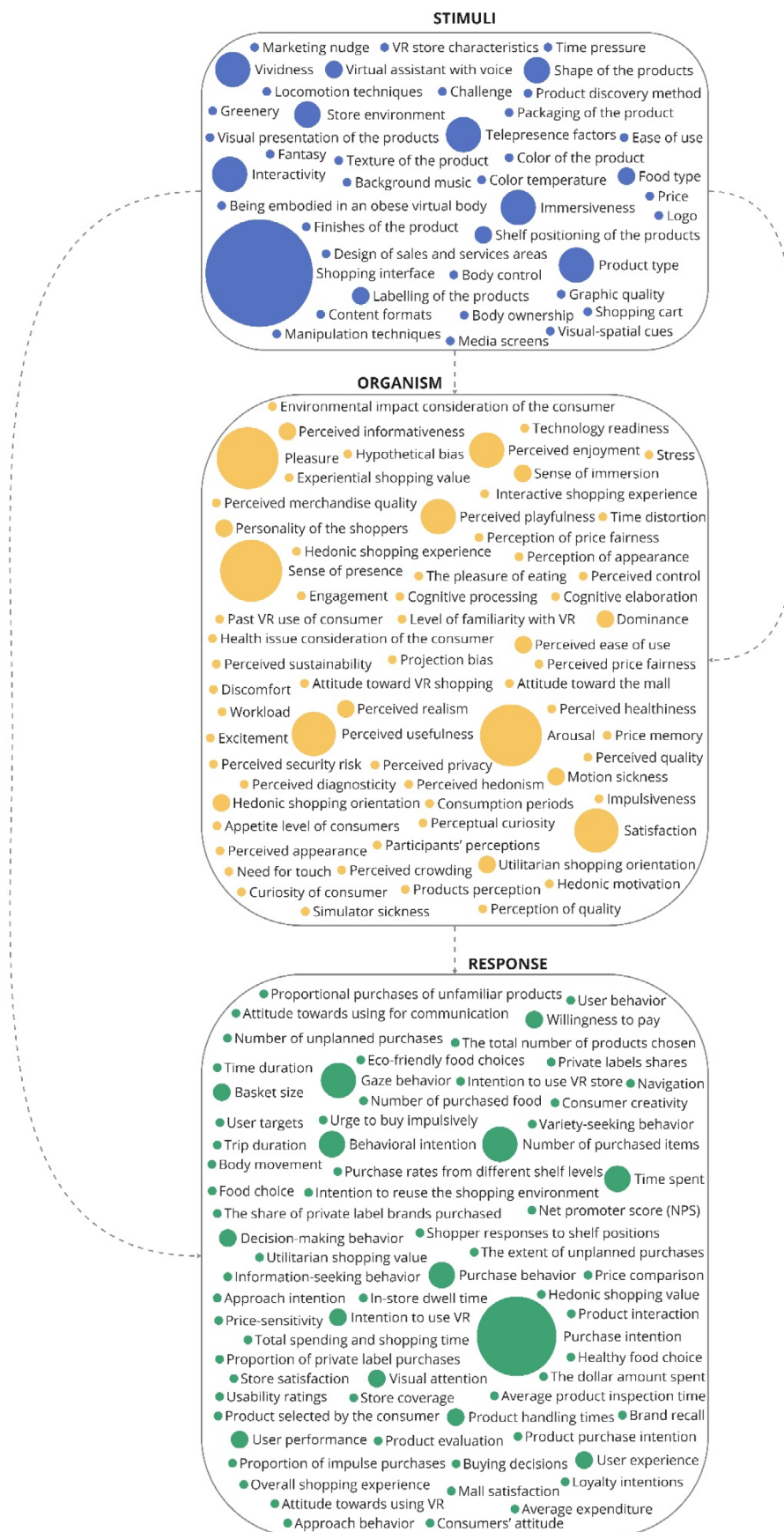
data. Following the generation of initial codes, a process of grouping codes based on shared characteristics or meanings was undertaken, giving rise to potential descriptive themes. These themes, representing abstract patterns within the iVR shopping data, played a crucial role in organizing and synthesizing the emergent concepts. Subsequently, a review and refinement of these themes were conducted to ensure their accuracy and alignment with the underlying data. This iterative process involved revisiting the raw data to assess the fit and relevance of the identified themes, contributing to the precision and validity of the thematic analysis. Finally, the identified S-O-R codes were systematically organized into descriptive themes. This categorization served as an initial layer of abstraction, enabling a clearer and more accessible representation of the underlying patterns and relationships within the dataset.

Moving beyond the descriptive layer, the subsequent step involved the development of analytical themes. These analytical themes were conceived by extracting deeper insights and patterns from the previously established descriptive themes. Our analytical themes for the stimuli exhibited remarkable similarity to the categorization utilized by Xi and Hamari (2021). Recognizing the alignment between our findings and their established conventions for stimuli, we deliberately adopted their approach in our study. This harmonization not only ensured consistency within the broader literature but also enhanced the comparability of our results with existing research in this specific aspect. However, in recognition of the unique nature of organisms and responses, distinctive analytical themes were formulated to capture the inherent characteristics and intricacies within these dimensions.

##### 4.1.1 | Line-by-line coding of the textual content

The aim of line-by-line coding of textual content in our study was to systematically analyze the collected material and identify patterns, themes, and key concepts. Through repeated readings, we achieved a nuanced understanding of the intricacies of iVR shopping. Subsequently, employing a systematic approach, we generated initial codes. These codes played an important role in capturing key concepts. This

**FIGURE 3** Illustration of line-by-line coding of stimuli, organisms, and responses.



method allowed us to highlight intriguing features within the iVR shopping dataset, laying the foundation for subsequent analysis phases.

In Figure 3, an illustrative depiction unfolds, encapsulating the codes of S-O-R discerned through our comprehensive analysis of publications. The varying sizes of the circles within the representation offer insight into the frequency of investigations into each stimulus, organism, or response. Dotted lines trace the intricate relationships within the S-O-R framework. While traditionally stimuli may give rise to an organism, and this organism subsequently induces a response, our findings illuminate that in certain instances, the S-O-R components interact without a predetermined sequence, underscoring the complexity inherent in these relationships. This outcome substantiates the revised iteration of the S-O-R model proposed by Jacoby (2002), reinforcing the validity and applicability of the reconsidered framework. Table A.1 (in Appendix A) offers a comprehensive list of S-O-R, including the corresponding studies.

Our examination of research papers reveals a significant focus on the shopping interface that emerged as the most extensively studied stimulus ( $n = 12$ ) (Alzayat & Lee, 2021; de-Magistris et al., 2022; Jacobsen et al., 2022; Lau & Lee, 2019; Lombart et al., 2020; Martínez-Navarro et al., 2019; Park et al., 2018; Park & Kim, 2021; Pizzi et al., 2019; Schnack et al., 2019; Schnack, Wright, & Holdershaw, 2021; Siegrist et al., 2019). These investigations compare the iVR shopping interface with both traditional web-based and physical stores. Moreover, immersiveness (Bin Kim & Jung Choo, 2023; Jang et al., 2019; Lombart et al., 2020; Meißner et al., 2020), telepresence factors (Alkarney & Almakki, 2022; Fang et al., 2021; Jang et al., 2019; Loureiro et al., 2021), interactivity (Chen et al., 2022; Jang et al., 2019; Kang et al., 2020; Lau et al., 2014), vividness (Chen et al., 2022; Jang et al., 2019; Lau et al., 2014; Loureiro et al., 2021), and product type (Alzayat & Lee, 2021; Chen et al., 2022; Khatri et al., 2022; Siegrist et al., 2019) command substantial attention, each featuring in four studies. The store environment and product shape are explored in three studies each, while virtual assistants with voice and shelf positioning of products are subjects of investigation in two studies each. Various other stimuli are individually addressed, contributing to the diverse landscape of stimuli research.

Shifting the focus to organisms, the analysis uncovers a pronounced emphasis on investigating “sense of presence” in the reviewed papers ( $n = 8$ ) (Attar et al., 2022; Bin Kim & Jung Choo, 2023; Chen et al., 2022; Martínez-Navarro et al., 2019; Park et al., 2018; Schnack et al., 2019; Verhulst et al., 2017; Wu, Wang, et al., 2019). Pleasure (Bin Kim & Jung Choo, 2023; Branca et al., 2023; Loureiro et al., 2021; Martínez-Navarro et al., 2019; Park et al., 2018; Zhao et al., 2018) and arousal (Bin Kim & Jung Choo, 2023; Branca et al., 2023; Kim & Lee, 2021; Loureiro et al., 2021; Martínez-Navarro et al., 2019; Park et al., 2018; Zhao et al., 2018) closely follow, each explored in seven studies. This observation aligns with expectations, given the frequent application of the S-O-R model in relevant studies. Additionally, satisfaction (Alkarney & Almakki, 2022; Fiorentino et al., 2022; Meißner et al., 2020; Sina & Wu, 2023; Zhao et al., 2018), perceived usefulness (Alkarney &

Almakki, 2022; Han et al., 2020; Holdack & Lurie-Stoyanov, 2021; Morotti et al., 2020; Peukert et al., 2019) and perceived enjoyment (Chen, 2023; Holdack & Lurie-Stoyanov, 2021; Morotti et al., 2020; Morotti et al., 2022; Peukert et al., 2019) are subjects of exploration in five studies each, while perceived playfulness (Chen et al., 2022; Han et al., 2020; Holdack & Lurie-Stoyanov, 2021; Kang et al., 2020) garners attention in four studies. Recognizing the well-established influence of emotional states on shopping decisions, this concentrated research on organisms underscores its significant relevance in the literature. Notably, it highlights the importance of understanding the impact of these psychological factors on consumer behavior within the context of iVR shopping experiences. Other organisms receive varying degrees of attention, with some investigated twice and others once, contributing to the broader understanding of organisms in iVR shopping.

Our scrutiny of literature revealed that purchase intention takes the forefront as the most extensively studied consumer response ( $n = 10$ ) (Chen, 2023; Holdack & Lurie-Stoyanov, 2021; Kang et al., 2020; Lau & Lee, 2019; Lombart et al., 2020; Martínez-Navarro et al., 2019; Park et al., 2018; Park & Kim, 2021; Sina & Wu, 2023; Zhao et al., 2018). Notably, gaze behavior (Khatri et al., 2022; Kim & Lee, 2021; Melendrez-Ruiz et al., 2021; Melendrez-Ruiz et al., 2022) and the number of purchased items (Attar et al., 2022; Jacobsen et al., 2022; Khatri et al., 2022; Verhulst et al., 2017) emerged as recurrent themes, each appearing in four studies. Purchase behavior (Lombart et al., 2019; Siegrist et al., 2019; Verhulst et al., 2018), behavioral intention (Han et al., 2020; Loureiro et al., 2021; Morotti et al., 2022), and time spent (Park et al., 2018; Verhulst et al., 2017; Zhao et al., 2018) in iVR shopping experiments are each explored in three instances. The inclusion of these response metrics aligns with traditional and online commerce research trends, underlining their continued relevance in the iVR shopping domain. The remaining responses are addressed twice or once, contributing to the nuanced understanding of consumer behaviors within iVR shopping environments. This provides a comprehensive view of S-O-R codes that have been explored in the context of iVR shopping experiences.

#### 4.1.2 | Generation of descriptive themes

The purpose of the generation of descriptive themes stage in our study was to systematically organize and group the coded data into descriptive themes closely linked to the content of the included studies. This step involved analyzing the coded data, conducting examinations to unveil patterns, similarities, and relationships within diverse instances of S-O-R. Our objective was to distill meaningful insights and establish coherent themes that would form the basis for the subsequent analytical phases in our investigation of consumer behavior in iVR shopping. These themes were not predetermined but emerged organically from the data through an inductive process, allowing for a nuanced exploration of the diverse S-O-R encountered in iVR shopping.



**TABLE 1** Analytical themes were identified for stimuli.

%	Analytical themes	Descriptive themes	Codes from line-by-line coding
17.33	In-store-related	Communication factors	Logo signature, media screens
		Display factors	Design of sales and services areas, Shopping cart
		Environmental factors	Background music, color temperature, fantasy elements, greenery, store atmosphere, store environment, VR store characteristics
29.33	Product-related	Pricing and promotions	Marketing nudge, price, time pressure
		Product features	Color of the product, features richness, finishes of the product, food type, product type, shape of the product, texture of the product
		Product presentation	Labelling, packaging, product discovery method, shelf positioning, visual presentation of the products
4.00	Shopper-related	Embodiment and control	Being embodied in an obese virtual body, body control, body ownership
2.67	Social-related	Virtual assistant	Virtual assistant with voice
10.67	System-related	User interaction and navigation	Challenge, ease of use, interactivity, locomotion techniques, manipulation techniques
36.00	Technology-related	Sensory engagement factors	Immersiveness, telepresence factors, vividness
		Shopping medium	Shopping interface
		Visual experience factors	Content formats, graphic quality, visual-spatial cues

As a result of the research, 12 descriptive themes were identified to characterize the diverse stimuli in the iVR shopping context. Table B.1 (in Appendix B) provides an overview of these themes and the specific stimuli codes associated with each category. Following the research, we identified 16 descriptive themes to delineate the varied organisms within the iVR shopping context. Table B.2 (in Appendix B) offers a summary of these themes along with the corresponding organism codes linked to each category. As a culmination of the research, we pinpointed 13 descriptive themes that define the array of responses within the iVR shopping context. Table B.3 (in Appendix B) gives a simple overview of these themes and the specific codes associated with each type of response.

#### 4.1.3 | Development of analytical themes

This phase allowed us to develop analytical themes that offer a more profound understanding of consumer behavior in iVR shopping, going beyond surface-level observations. Tables 1–3 (shown in the subsequent sections) delineate the coverage of descriptive themes within each analytical theme. They provide insights into the stimuli that compose these themes and the percentage of these themes explored in the reviewed papers.

##### Stimuli

Through a detailed examination of stimuli, we adopted a categorization suggested by Xi and Hamari (2021). This classification resulted in

the grouping of various descriptive themes under six distinct analytical categories, which are: (1) in-store-related; (2) product-related; (3) shopper-related; (4) social-related; (5) system-related and (6) technology-related stimuli, as delineated in Table 1.

Table 1 reveals that the most extensively examined analytical theme for stimuli was technology-related (36.00%), followed by product-related (29.33%). The analytical themes investigated next were in-store-related (17.33%) and system-related (10.67%). Finally, shopper-related (4.00%) and social-related (2.67%) themes emerged as the least researched categories in terms of stimuli.

The six analytical themes for stimuli were categorized based on how these were described in the retail environments: “In-store-Related” focused on physical elements like communication, displays, and environmental factors shaping the sensory experience; “Product-Related” included pricing, promotions, features, and presentation influencing consumer preferences and purchasing decisions; “Shopper-Related” pertained to elements directly impacting shopper behaviors, encompassing embodiment and control; “Social-Related” involved elements linked to social interactions, including virtual assistants fostering community engagement; “System-Related” covered operational aspects, with user interaction and navigation affecting system efficiency; and “Technology-Related” encompassed innovations like sensory engagement, shopping interfaces, and visual experiences, emphasizing their reliance on technological advancements to enhance the retail experience.

**TABLE 2** Analytical themes were identified for organisms.

%	Analytical themes	Descriptive themes	Codes from line-by-line coding
35.58	Cognitive	Cognitive processing and consideration	Cognitive elaboration, cognitive processing, environmental impact consideration of the consumer, health issue consideration of the consumer, hypothetical bias, price memory, utilitarian shopping orientation
		Immersive experience	Experiential shopping value, interactive shopping experience, perceived telepresence, sense of immersion, sense of presence, social presence
		Physical discomfort	Motion sickness, simulator sickness, workload
		Shopping attitudes and preferences	Appetite level of consumers, attitude toward the mall, attitude toward VR shopping, consumption periods of consumers, fashion involvement of consumers, projection bias
		Temporal factors	Time distortion
		VR engagement and knowledge	Curiosity of consumer, level of familiarity with VR, Past VR use of consumer, technology readiness
1.77	Cognitive, emotional	Individual characteristics	Personality traits of the shoppers
30.77	Emotional	Negative emotional states	Discomfort, stress
		Positive emotional states	Arousal, dominance, engagement, excitement, pleasure, satisfaction, the pleasure of eating
		Shopping motivation	Hedonic motivation, hedonic shopping experience, hedonic shopping orientation, impulsiveness, shopping motivation
40.38	Perceptual	Environmental and social impact perception	Perceived healthiness, perceived sustainability
		Perceived emotions	Perceived enjoyment, perceived hedonism, perceived playfulness
		Perceptions during product evaluation	Perceived appearance, perceived diagnosticity, perceived merchandise quality, perceived price fairness, perceived quality, perception of appearance, perception of price fairness, perception of quality, perceptual curiosity, product perception
		Shopping environment perceptions	Participants' perceptions, perceived crowding, perceived realism
		Usability and information perception	Perceived ease of use, perceived informativeness, perceived usefulness
		User control and safety perceptions	Need for touch, perceived control, perceived privacy, perceived social approval, perceived security risk

### Organisms

By carefully analyzing various descriptive themes, we identified three main analytical themes related to organisms, which are: (1) cognitive; (2) emotional; and (3) perceptual organisms. The categorization presented herein also aligns with the concept/definition of organism defined by Mehrabian and Russell (1974), as it encompasses various emotional, perceptual, and cognitive factors that shape consumers' experiences. Table 2 provides a detailed breakdown of analytical themes along with the descriptive themes they incorporate.

Table 2 indicates that the most thoroughly examined analytical theme for organisms was perceptual, making up 40.38%, followed by cognitive at 35.58%. The emotional theme emerged as the least explored category, accounting for only 30.77% in terms of organisms. Notably, the research on personality traits of shoppers that align with both cognitive and emotional categories accounts for 1.77%.

The analysis categorized descriptive themes within the retail environment into three main categories: "Cognitive Organisms," highlighting the integral connection of cognitive processes and biases shaping consumer decisions; "Emotional Organisms," delving into negative and positive emotional states, motivational factors, and their influence

on the shopping experience; and "Perceptual Organisms," emphasizing the direct association of perceptual aspects that shape consumer behavior.

Personality could be linked to the components of the "cognitive self," impacting social interactions, and traits might be connected to self-regulation styles that mold emotional responses (Matthews, 2012). Due to this connection, individual characteristics are incorporated into both categories rather than being exclusively labeled as either cognitive or emotional.

### Responses

A thorough examination of descriptive themes helped us to pinpoint three analytical themes: (1) buying and transactions; (2) consumer loyalty and feedback; and (3) shopping engagement and preferences. This classification aligns with existing consumer behavior and retail literature. These dimensions are recognized as fundamental aspects of understanding and influencing consumer behavior within the retail context. Scholars and researchers in the field often emphasize the significance of these areas in creating a consumer-centric retail environment, increasing revenue, and maintaining competitiveness. Insight

**TABLE 3** Analytical themes were identified for responses.

%	Analytical themes	Descriptive themes	Codes from line-by-line coding
50.00	Buying and Transactions	Impulsive shopping behavior	Number of unplanned purchases, proportion of impulse purchases, the extent of unplanned purchases, urge to buy impulsively
		Product choice behavior	Basket size, eco-friendly food choices, food choice, healthy food choice, number of purchased food, number of purchased items, private labels shares, product selected by the consumer, the total number of products chosen
		Purchase behavior	Average expenditure, buying decisions, proportional purchases of unfamiliar products, proportion of private label purchases, purchase behavior, purchase intention, purchase rates from different shelf levels, the dollar amount spent, the share of private label brands purchased, total spending, user behavior, willingness to pay
		Shopping time	In-store dwell time, shopping time, time duration, time spent, trip duration
21.88	Consumer loyalty and Feedback	Consumer creativity and performance	Consumer creativity, user performance
		Consumers' attitude	Approach behavior, attitude towards using VR, attitude towards using VR for communication, consumers' attitude
		Intention to use VR store	Approach intention, behavioral intention, intention to reuse the shopping environment, intention to use VR, intention to use VR store, product purchase intention
		Loyalty and satisfaction	Loyalty intentions, mall satisfaction, net promoter score (NPS), Store satisfaction, VR store satisfaction
31.25	Shopping engagement and Preferences	Gaze behavior	Gaze behavior, visual attention, visual attention to the store and product area
		Navigation and body movement	Body movement, navigation, and store coverage
		Overall shopping experience	Hedonic shopping value, overall shopping experience, user experience, utilitarian shopping value
		Product evaluation and decision-making behavior	Brand recall, decision-making behavior, information-seeking behavior, price comparison, price-sensitivity, product evaluation, variety-seeking behavior
		Product interaction	Average product inspection time, product handling times, product interaction, shopper responses to shelf positions, user's targets

into shopping preferences allows for tailoring experiences, optimizing operations, and adapting to evolving market trends (Grossman & Rachamim, 2024; Hitka et al., 2024; Wang, Jiang, Gong, et al., 2023; Wang, Jiang, Guan, et al., 2023). Analyzing transaction habits enables strategic marketing approaches, promoting effective resource allocation and fostering innovation in retail practices (Egorova et al., 2022; Gulfranz et al., 2022; Park et al., 2023; Yin et al., 2022). Consumer loyalty investigations provide essential information for building lasting relationships, while feedback offers actionable insights for continuous improvement (Doniec et al., 2020; Meyer-Waarden et al., 2023; Thakur, 2016, 2018).

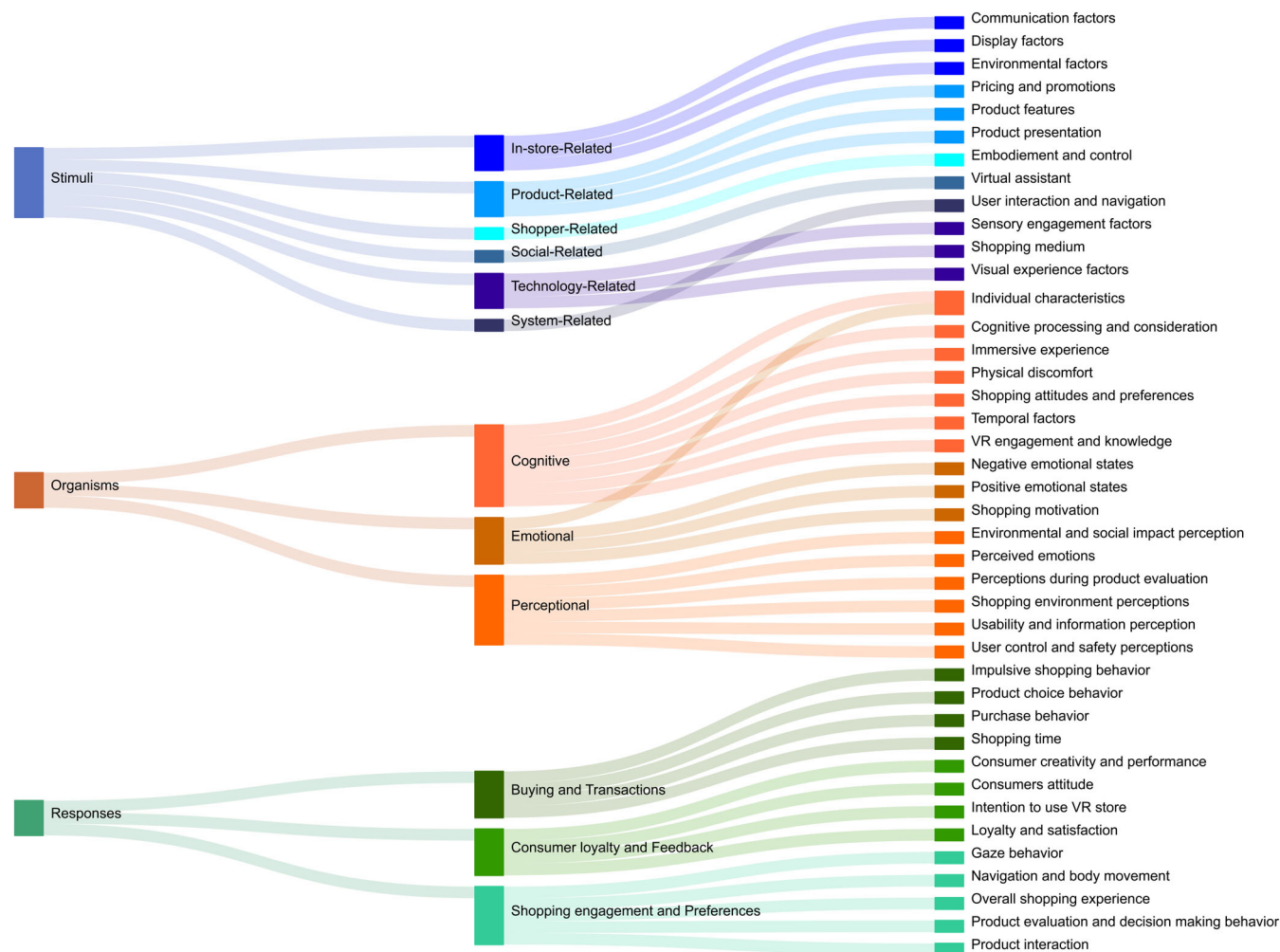
Ultimately, this comprehensive exploration of these three dimensions is essential for creating a consumer-centric retail environment, increasing revenue, and maintaining competitiveness in the dynamic marketplace. The emphasis on tailoring experiences, optimizing operations, and building lasting relationships through these dimensions resonates with established literature, highlighting their importance in shaping successful retail strategies. Table 3 offers a comprehensive breakdown of analytical themes alongside the descriptive themes they encompass.

Table 3 highlights that the most extensively investigated analytical theme for responses was buying and transactions, constituting

50.00%, followed by shopping engagement and preferences (31.25%) and consumer loyalty and feedback (21.88).

Descriptive themes within the “Buying and Transactions” category focus on various aspects of consumer purchasing behavior, covering impulsive shopping tendencies, product choice influences, purchase patterns, and shopping time engagement. The themes grouped under “Shopping Engagement and Preferences” directly relate to consumer interaction within the retail context, including gaze behavior, navigation, overall shopping experience, product evaluation, and decision-making processes. The classification under “Consumer Loyalty and Feedback” is based on their direct connection to loyalty, incorporating measures of creativity, attitudes towards technology, intentions to use VR in shopping, and overall satisfaction levels, providing a comprehensive understanding of consumer loyalty and feedback in the retail landscape.

Figure 4 illustrates the intricate relationships between various stimuli (such as in-store, product, shopper, social, technology, and system-related factors), the resultant cognitive, emotional, and perceptual organismic processes, and the consequent consumer responses including buying behavior, loyalty, feedback, and engagement preferences in iVR retail environments.



**FIGURE 4** Stimuli, organisms and responses in iVR shopping.

## 5 | DISCUSSIONS

This section addresses the second research question 2 (RQ2) which elucidates the relationships between the S-O-R elements. The aim is to unravel how specific factors within iVR environments exert influence and mold consumer behavior. By unraveling these intricate connections, this study aims to contribute to a deeper understanding of the mechanisms that underlie consumer behavior in iVR settings, shedding light on the nuanced interplay between S-O-R within the realm of iVR retail experiences.

Tables 4–6 provide a comprehensive overview of the impact on consumer behavior in iVR shopping environments, consolidating insights from the examined papers.

### 5.1 | Buying and transactions

The findings from the literature review and thematic analysis shed light on various aspects of consumers' behavior related to buying and transactions, encompassing impulsive shopping behavior, product

choice behavior, purchase behavior, and shopping time. Table 4 provides a summary of the findings of consumer behavior according to these descriptive themes.

#### 5.1.1 | Impulsive shopping behavior

The research emphasizes the impact of immersive and vivid iVR shopping environments on impulsive buying tendencies. The study by Chen et al. (2022) and Schnack, Wright, and Elms (2021) indicates that consumers are more prone to making unplanned purchases when immersed in such environments. Interestingly, the allure of private-label brands consistently correlates with impulsive buying (Schnack et al., 2020). Emphasizing the role of emotions over cognitive processes, Chen et al. (2022) suggest that fun and engaging settings contribute to heightened impulsive shopping urges. However, the teleportation method within the VR space appears to have no significant effect on the frequency of impulsive purchases (Schnack, Wright, & Elms, 2021). In essence, these findings advocate for a strategic blend of sensory engagement and

**TABLE 4** Overview of consumer behavior related to buying and transactions.

Descriptive themes	Consumer behavior–buying and transactions
Impulsive shopping behavior	<ul style="list-style-type: none"> <li>• People tend to make more unplanned purchases when shopping in immersive and vivid iVR shopping environments (Chen et al., 2022; Schnack, Wright, &amp; Elms, 2021).</li> <li>• Shoppers, particularly drawn to private-label brands, demonstrate a consistent tendency for unplanned purchases (Schnack et al., 2020).</li> <li>• The likelihood of impulsive buying goes up in fun and engaging settings where consumers feel deeply involved. Emotions play a bigger role than cognitive processing in prompting impulsive shopping urges (Chen et al., 2022)</li> <li>• - Teleportation within the VR space doesn't seem to affect how often people make impulse purchases (Schnack, Wright, &amp; Elms, 2021).</li> </ul>
Product choice behavior	<ul style="list-style-type: none"> <li>• Consumers easily navigate food selection in iVR stores with user-friendly features (Attar et al., 2022).</li> <li>• In highly immersive VR environments, consumers tend to explore a wider array of products (Meißner et al., 2020).</li> <li>• When it comes to decision-making, shoppers quickly choose familiar items but invest more time in deciding on other products (Melendrez-Ruiz et al., 2022).</li> <li>• The inclusion of front-of-pack environmental labels in iVR shopping raises consumer awareness and motivates eco-friendly food choices (Arrazat et al., 2023).</li> <li>• Consistent nudges for healthy food choices influence consumers to make healthier selections, regardless of their conscious awareness of the nudges (Blom et al., 2021).</li> </ul>
Purchase behavior	<ul style="list-style-type: none"> <li>• Consumers' personalities don't have a significant impact on shopping metrics (Schnack, Wright, &amp; Elms, 2021).</li> <li>• When consumers feel more present in a virtual space, they're more likely to buy things in iVR because it feels less risky, and they can better understand the products (Chen, 2023).</li> <li>• This sense of being there also helps them remember the brand more (Martínez-Navarro et al., 2019)</li> <li>• In interactive and playful shopping environments, consumers are more likely to want to buy things, because of the positive emotions and enjoyable experiences they get (Han et al., 2020; Kang et al., 2020; Lau &amp; Lee, 2019; Martínez-Navarro et al., 2019).</li> <li>• Putting similar products together makes consumers more likely to want to buy them (Wölfel &amp; Reinhardt, 2019).</li> <li>• Whether you're shopping in real life or virtually doesn't affect how willing people are to spend money (Branca et al., 2023).</li> <li>• Even though fruits and veggies might seem just as real in a virtual store, people still end up spending more on them (Lombart et al., 2020), no matter how they look (Lombart et al., 2019; Verhulst et al., 2017)</li> <li>• When people are hungry, they tend to buy more food in virtual stores (de-Magistris et al., 2022).</li> <li>• Shoppers often go for store brands, especially in less exciting product categories (Schnack et al., 2020).</li> <li>• If consumers get a virtual touch from a shop assistant, they might end up spending more money (Zhao et al., 2018).</li> <li>• The way people move around in a virtual store doesn't affect what they buy or how much they spend (Schnack, Wright, &amp; Holdershaw, 2021).</li> </ul>
Shopping time	<ul style="list-style-type: none"> <li>• Consumers' personalities and the teleportation method that they use don't impact the time they spend shopping in iVR stores (Schnack, Wright, &amp; Elms, 2021; Schnack, Wright, &amp; Holdershaw, 2021).</li> <li>• When shoppers receive a virtual touch from a shop assistant, they tend to linger longer in the VR store (Zhao et al., 2018).</li> <li>• On the contrary, consumers who are not familiar with the technology may spend less time in the iVR store than expected, possibly due to the discomfort they feel (Fiorentino et al., 2022).</li> </ul>

emotional appeal to optimize the impulsive buying potential in virtual shopping experiences.

### 5.1.2 | Product choice behavior

Concerning product choice behavior, the integration of user-friendly features in iVR stores, as emphasized by Attar et al. (2022), not only simplifies navigation but also ensures a more enjoyable and efficient food selection process. Meißner et al. (2020) observation of the highly immersive nature of VR environments speaks to the potential of virtual platforms to stimulate curiosity, prompting consumers to diversify their product exploration. The nuanced decision-making dynamics, as outlined by Melendrez-Ruiz et al. (2022), suggest an opportunity for businesses to tailor strategies that accommodate both swift choices for familiar items and more deliberative processes for other products. Moreover, the positive impact of environmental labels, as indicated by

Arrazat et al. (2023), presents a compelling avenue for promoting eco-friendly choices within the iVR shopping landscape. Finally, the effectiveness of consistent nudges, as demonstrated by Blom et al. (2021), underlines the potential for virtual environments to actively guide consumers toward healthier selections. In essence, these findings suggest that optimizing user-friendly interfaces and leveraging immersive experiences can not only enhance the overall shopping journey but also steer consumers towards more informed and sustainable product choices.

### 5.1.3 | Purchase behavior

Consumer personalities playing a limited role in shopping metrics, as indicated by Schnack, Wright, and Elms (2021), suggests that virtual environments might offer a more standardized experience irrespective of individual traits. The findings of Chen et al. (2023) about the



**TABLE 5** Overview of consumer behavior related to consumer loyalty and feedback.

Descriptive themes	Consumer behavior–Consumer loyalty and feedback
Consumer creativity and performance	<ul style="list-style-type: none"> <li>When shoppers engage in iVR shopping environments, they find themselves feeling creative and curious (Bin Kim &amp; Jung Choo, 2023).</li> <li>Consumers notice an enhancement in their performance when they use the freehand-gesture-based interaction technique (Wu, Wang, et al., 2019).</li> </ul>
Consumers' attitude	<ul style="list-style-type: none"> <li>When consumers encounter product displays that provide informative content, it significantly shapes their attitude towards VR technology, encompassing the associated hardware and immersing themselves in a playful virtual shopping environment positively influences their attitudes towards VR (Holdack &amp; Lurie-Stoyanov, 2021).</li> <li>Expressing positive attitudes and preferences for VR glasses is closely tied to perceiving them as both useful and enjoyable, serving as a crucial factor in driving consumer enthusiasm and willingness to engage with the technology (Holdack &amp; Lurie-Stoyanov, 2021).</li> <li>The impact of a VR experience on consumers' attitudes is contingent upon the perceived level of crowding within the virtual store—higher perceived crowding enhances the positive effects (Van Kerrebroeck et al., 2017a).</li> </ul>
Intention to use VR store	<ul style="list-style-type: none"> <li>Consumers are more inclined to use VR stores when the environments are vivid, interactive, and highly immersive, fostering a strong sense of presence (Alkarney &amp; Almakki, 2022; Loureiro et al., 2021; Peukert et al., 2019).</li> <li>The intention to use VR stores is positively influenced by the combination of playfulness and usefulness (Alkarney &amp; Almakki, 2022; Han et al., 2020).</li> <li>The presence of calm music is associated with a positive inclination to visit VR stores. During the shopping experience, consumers' perceptions of usefulness, ease of use, control, telepresence, as well as their emotions like satisfaction and hedonic motivation, all contribute positively to their intention to use VR stores (Alkarney &amp; Almakki, 2022).</li> <li>Consumers' attitudes towards VR significantly influence their intentions to utilize the technology in the future (Lombart et al., 2020).</li> </ul>
Loyalty and satisfaction	<ul style="list-style-type: none"> <li>When consumers try out iVR shopping in different situations, they express a high level of satisfaction (Pizzi et al., 2019; Speicher et al., 2018; Van Kerrebroeck et al., 2017a).</li> <li>When it comes to how they interact, consumers like the freehand-gesture-based approach, rating it as the most satisfying overall (Wu, Wang, et al., 2019).</li> <li>For consumers, where they focus their eyes in the virtual store matters too – paying attention to the store area boosts satisfaction, and this effect changes based on why they're shopping in the first place (Jang, 2023).</li> </ul>

correlation between a sense of presence and increased buying tendencies underscore the potential for virtual spaces to bridge the gap between risk perception and product understanding. The profound impact of positive emotions on purchase desire, highlighted by Han et al. (2020) and others, emphasizes the importance of creating engaging and enjoyable interactive shopping experiences. Wölfel and Reinhardt (2019) insight into product placement influencing consumer willingness to purchase suggests the significance of thoughtful virtual store layouts. The finding that the virtual environment doesn't significantly affect spending, as noted by Branca et al. (2023), challenges assumptions about the direct relationship between the immersive nature of virtual spaces and financial commitment. Additionally, de-Magistris et al. (2022) observation regarding hunger influencing virtual shopping sheds light on the potential impact of physiological states. In conclusion, these insights imply that while virtual shopping environments can shape consumer purchase behavior, their influence is nuanced and multifaceted, requiring a holistic approach for effective implementation.

### 5.1.4 | Shopping time

The absence of significant influences from consumers' personalities and teleportation methods on shopping time, as noted by Schnack, Wright, and Elms (2021) and Schnack, Wright, and Holdershaw

(2021), suggests that virtual shopping durations are less impacted by individual traits or movement methods. The findings of Zhao et al. (2018) show that a virtual touch from a shop assistant extends shopping time and emphasizes the potential of interpersonal elements even in virtual settings. Fiorentino et al. (2022) findings indicate that unfamiliarity with technology may lead to shorter shopping durations highlighting the need for user-friendly virtual interfaces. In summary, these insights underscore the importance of a balanced approach that incorporates both technological sophistication and human-centric elements to optimize consumers' shopping time.

In conclusion, the amalgamation of these themes highlights the intricate and nuanced nature of consumers' behavior in virtual shopping environments, with factors like immersion, emotional triggers, and environmental cues playing pivotal roles in shaping their buying decisions and overall shopping experience.

## 5.2 | Consumer loyalty and feedback

The examination of consumers' behavior related to consumer loyalty and feedback reveals valuable insights across four distinct themes: consumer creativity and performance, consumers' attitudes, intention to use iVR stores, and loyalty and satisfaction. Table 5 offers a synopsis of the results pertaining to consumer behavior based on the descriptive themes provided.

**TABLE 6** Overview of consumer behavior related to shopping engagement and feedback.

Descriptive themes	Consumer behavior-Shopping engagement and preferences
Gaze behavior	<ul style="list-style-type: none"> <li>• When consumers are shopping, their personality types don't have a significant impact on how much time they spend inspecting products (Schnack, Wright, &amp; Elms, 2021).</li> <li>• Individuals generally spend less time examining familiar brands (Schnack et al., 2020).</li> <li>• Consumers exhibit different levels of attention toward various food items, influenced by factors such as shelf placement and food category (Melendrez-Ruiz et al., 2021).</li> <li>• When individuals exhibit a strong interest in fashion, their exploration within the store tends to cover diverse areas. Interestingly, heightened engagement in casual browsing might lead to a reduced focus on the specific products within the store. Conversely, a targeted search for particular items prompts more extended attention to the product displays (Jang, 2023)</li> <li>• Consumers demonstrate a visual inclination towards specific features within the store. They show a particular interest in evaluating environmental and display elements present in the sales area. Additionally, when navigating the service area, their attention is notably directed towards media screens and seating arrangements (Kim &amp; Lee, 2021).</li> </ul>
Navigation and body movement	<ul style="list-style-type: none"> <li>• When consumers explore a VR store, their method of locomotion plays a crucial role in shaping their interactions and navigation through the virtual environment. How they move around influences how they engage with products, potentially causing them to bypass specific sections of the virtual shelves. Notably, utilizing upper body movements emerges as an effective strategy for maintaining a natural and immersive feel within the virtual world (Schnack, Wright, &amp; Holdershaw, 2021).</li> <li>• - During shopping, consumers are not just standing still, they actively explore, shifting from sitting to standing and taking a close look at products (Fiorentino et al., 2022).</li> <li>• When consumers are in a VR shopping situation, whether they're casually exploring or on a mission to find something specific, VR applications come in handy. It seems like these applications work well for both scenarios, where consumers randomly browse and shop in a virtual environment or have a specific item in mind (Park &amp; Kim, 2021).</li> </ul>
Overall shopping experience	<ul style="list-style-type: none"> <li>• Consumer engagement becomes higher as the leverage of benefiting from photorealistic rendering, advanced display technologies, and sophisticated control devices increases (Lau et al., 2014).</li> <li>• The enjoyable facet of the consumer experience augments when the incorporation of interactivity and visual-spatial cues in VR environments, (Kang et al., 2020).</li> <li>• iVR provides shoppers with a profound sense of immersion and facilitates more natural interactions, intensifying the authenticity of the entire process (Schnack et al., 2019).</li> <li>• The tangible interaction with virtual products amplifies consumers' sense of presence, contributing to a more immersive and fulfilling shopping experience. Consumer engagement in iVR shopping is notably influenced by factors such as encountering new technology, experiencing a sense of ownership, and maintaining control, all of which collectively impart a playful and utilitarian dimension to their shopping endeavors (Han et al., 2020)</li> <li>• The perceived ease of use of VR wearables positively influences consumers' perceptions of informativeness and playfulness in iVR shopping (Holdack &amp; Lurie-Stoyanov, 2021).</li> <li>• When iVR is applied to specific product categories, such as tools, the focus shifts from mere practicality to the enjoyment derived from the shopping experience (Alzayat &amp; Lee, 2021).</li> <li>• Positive emotions, encompassing pleasure, arousal, and vividness, exert a substantial influence on consumer behavioral patterns, with the accompaniment of music serving as an augmenting element for a positive experiential outcome (Loureiro et al., 2021).</li> <li>• Consumers' positive attitudes toward virtual stores emerge as a crucial factor in fostering enjoyable and entertaining experiences in the iVR shopping realm (Alkarney &amp; Almakki, 2022).</li> <li>• Turning attention to the interactive aspect, the utilization of hand gestures in iVR proves to be highly effective, offering ease of use and a heightened sense of presence in the virtual environment (Wu, Wang, et al., 2019)</li> <li>• The combination of pointing gestures and abstract cart concepts in iVR emerges as the optimal approach for enhancing user experience (Speicher et al., 2018).</li> <li>• Consumers exhibit a positive inclination towards virtual environments featuring retail greenery, attributing a favorable response, and the incorporation of cool lighting further enhances the overall pleasure and perceived merchandise quality in the iVR shopping landscape (Sina &amp; Wu, 2023)</li> <li>• Consumers tend to present a more positive overall evaluation of their iVR shopping experience when they experience tactile interactions with a virtual shop assistant (Zhao et al., 2018).</li> <li>• The integration of voice assistants with iVR holds the potential to create engaging and user-friendly virtual shopping experiences, particularly appealing to consumers seeking convenience (Morotti et al., 2020)</li> <li>• With the infusion of voice assistants in iVR, consumers experience heightened immersion, contributing to an even more enriched VR encounter (Morotti et al., 2022)</li> </ul>

(Continues)

TABLE 6 (Continued)

Descriptive themes	Consumer behavior-Shopping engagement and preferences
Product evaluation and decision-making behavior	<ul style="list-style-type: none"> <li>• As consumers find comfort in the VR environment, their decision-making becomes more authentic, moving beyond hypothetical responses (Fang et al., 2021).</li> <li>• The perceived utility of a VR application hinges on its informativeness, leading consumers to rely on the virtual information provided (Holdack &amp; Lurie-Stoyanov, 2021).</li> <li>• Interactivity and visual-spatial cues boost how people see the information (Kang et al., 2020).</li> <li>• While casual browsing prompts consideration of information, individuals on specific missions focus more on habits and attention triggers (Park &amp; Kim, 2021).</li> <li>• Purchase decisions are shaped by familiarity with brands, established habits, and attention allocation, collectively enhancing the perceived importance of a product (Melendrez-Ruiz et al., 2022).</li> <li>• Immersing themselves in a fantastical VR shopping world introduces an element of curiosity, influencing the decision-making process (Branca et al., 2023).</li> <li>• When people find the experience playful, they tend to lean toward products that provide hedonic benefits (Kang et al., 2020).</li> <li>• Consumers maintain consistent price memory across physical and virtual stores, yet within the VR realm, prices play a more prominent role in evaluating perceived value, with appearance taking relatively lesser precedence (Lombart et al., 2020).</li> <li>• In highly immersive VR experiences, individuals become less sensitive to price considerations (Meißner et al., 2020).</li> <li>• - The visual aesthetics and quality perception of deformed produce are influenced, particularly when the degree of deformity is moderate (Lombart et al., 2019; Verhulst et al., 2017).</li> <li>• The presence or absence of nudges does not significantly alter decision-making processes (Blom et al., 2021).</li> <li>• In VR environments with a health-oriented focus, consumers exhibit heightened attention to nutritional information compared to scenarios emphasizing taste (Siegrist et al., 2019).</li> </ul>
Product interaction	<ul style="list-style-type: none"> <li>• Consumers express a strong desire for advancements in iVR technology to enhance the visual realism of virtual products, particularly in the realm of product inspection and interaction (Schnack et al., 2019).</li> <li>• Shoppers' inclination to manipulate viewpoints and actively engage with virtual objects underscores a pronounced preference for a realistic and immersive experience (Fiorentino et al., 2022).</li> <li>• When dedicating time to explore products in the virtual space, consumers tend to allocate more attention to items that may not necessarily evoke a high level of pleasure (Schnack et al., 2020).</li> <li>• The heightened sense of presence, where consumers feel truly immersed in the virtual environment, correlates positively with increased interaction and engagement with virtual products (Jacobsen et al., 2022).</li> <li>• Various facets of consumers' personality traits can be effectively inferred by analyzing their exploration patterns and task handling within the virtual context (Khatri et al., 2022).</li> </ul>

### 5.2.1 | Consumer creativity and performance

The reported heightened feelings of creativity and curiosity in iVR shopping environments, as highlighted by Bin Kim and Jung Choo (2023), suggest that virtual platforms have the potential to transcend conventional shopping experiences, tapping into users' imaginative capacities. Furthermore, the observed enhancement in consumer performance associated with freehand-gesture-based interaction techniques, as per Wu, Wang, et al. (2019), underscores the transformative impact of interactive technology on user engagement. These insights advocate for the continual exploration and integration of innovative interaction methods in iVR shopping to cultivate a more immersive and performance-driven consumer experience.

### 5.2.2 | Consumers' attitude

The significant influence of informative content on consumers' attitudes towards iVR technology, as outlined by Holdack & Lurie-Stoyanov, 2021, highlights the pivotal role of educational and engaging displays in shaping positive perceptions. Moreover, the strong connection between positive attitudes and preferences for VR glasses,

as driven by perceptions of usefulness and enjoyment (Holdack and Lurie-Stoyanov (2021), underscores the need for a user-centric approach in developing VR technologies. The observed impact of perceived crowding on the VR experience and subsequent attitudes, as noted by Van Kerrebroeck et al. (2017a), accentuates the importance of creating immersive yet comfortable virtual environments. In essence, these findings advocate for a holistic approach that combines educational content, user-friendly design, and an optimal sense of space to foster positive consumer attitudes toward VR technology.

### 5.2.3 | Intention to use VR store

The amalgamation of factors influencing the intention to use VR stores, as identified by Loureiro et al. (2021), Peukert et al. (2019), Alkarney and Almakki (2022), and others, underscores the multifaceted nature of consumer decision-making in virtual environments. The observed positive impact of playfulness and usefulness, noted by Han et al. (2020) and Alkarney and Almakki (2022), highlights the need for a balanced and enjoyable user experience. Additionally, the array of elements contributing to the intention to use VR stores, including music, perceived usefulness, and hedonic motivation (Alkarney &

Almakki, (2022), emphasizes the importance of addressing diverse consumer preferences. Lombart et al. (2020) insight into the significant influence of attitudes on future technology use further reinforces the notion that cultivating positive perceptions is pivotal for sustained adoption. In essence, these findings advocate for a comprehensive approach that prioritizes engagement, usability, and individual preferences to foster positive intentions and prolonged utilization of VR stores.

## 5.2.4 | Loyalty and satisfaction

The consistently high levels of consumer satisfaction in iVR shopping experiences, evident across diverse situations (Pizzi et al., 2019; Speicher et al., 2018; Van Kerrebroeck et al., 2017a), point to the inherent appeal and versatility of virtual retail platforms. The preference for the freehand-gesture-based approach, as highlighted by Wu, Luo, et al. (2019), suggests that interactive methods significantly contribute to consumer contentment. Jang (2023) insight into the impact of visual focus on satisfaction, contingent on consumers' shopping motives, emphasizes the need for personalized and intuitive virtual interfaces. In summary, these findings highlight the pivotal role of user satisfaction, interaction techniques, and personalized visual experiences in fostering consumer loyalty and positive feedback in the realm of iVR shopping.

In conclusion, these thematic insights collectively contribute to a comprehensive understanding of consumers' behavior in the context of consumer loyalty and feedback within iVR shopping environments.

## 5.3 | Shopping engagement and preferences

The synthesis of findings from the literature review and thematic analysis reveals significant insights into consumers' behavior related to shopping engagement and preferences, encompassing gaze behavior, navigation and body movement, overall shopping experience, product evaluation and decision-making behavior, and product interaction. Table 6 presents an overview of the findings related to consumer behavior as outlined in these descriptive themes.

### 5.3.1 | Gaze behavior

The observation that consumers' personalities have minimal impact on product inspection time in iVR shopping, as noted by Schnack, Wright, and Elms (2021), suggests a standardized engagement pattern within virtual environments. The reduced scrutiny of familiar brands, according to Schnack et al. (2020), implies that brand recognition may influence attention levels. Melendrez-Ruiz et al. (2021) findings regarding varying attention based on shelf placement and food category highlight the importance of strategic product positioning in virtual stores. Jang (2023) identification of distinct engagement patterns in fashion underlines the need for tailored approaches to cater to diverse

shopping behaviors. Additionally, Kim and Lee (2021) insight into consumers' visual inclinations towards specific store features emphasizes the potential to enhance engagement through thoughtful design elements in iVR shopping environments. In essence, these findings provide valuable insights into optimizing virtual shopping experiences by understanding and accommodating diverse consumer behaviors.

### 5.3.2 | Navigation and body movement

The observed impact of locomotion methods on interactions and navigation within virtual shopping environments, particularly the positive influence of upper body movements noted by Schnack, Wright, and Holdershaw (2021), suggests the potential for more intuitive and immersive experiences. The findings of Fiorentino et al. (2022) regarding consumers actively shifting between sitting and standing during shopping underline the dynamic nature of virtual interactions. The versatility of VR applications for both random browsing and targeted shopping, according to Park and Kim (2021), reinforces the adaptability of virtual platforms to cater to varied consumer preferences. In summary, these insights highlight the importance of user-friendly and flexible locomotion methods to enhance overall accessibility.

### 5.3.3 | Overall shopping experience

The profound influence of technological elements like photorealistic rendering and advanced display technologies, as emphasized by Lau et al. (2014), indicates the pivotal role of cutting-edge features in shaping the overall shopping experience in iVR. Kang et al. (2020) recognition of the positive impact of interactivity and visual-spatial cues on consumer engagement underscores the importance of incorporating such elements for a more immersive experience. Schnack et al. (2019) findings regarding the contribution of immersion to a more authentic shopping experience further advocate for prioritizing technologies that enhance the sense of presence. Loureiro et al. (2021) and Alkarney and Almakki (2022) insights into the significant impact of positive emotions, music, and attitudes on the enjoyment of iVR shopping highlight the holistic nature of creating an enjoyable virtual environment. Finally, Zhao et al. (2018), Morotti et al. (2020), and Sina and Wu (2023) collectively suggest that incorporating tactile and voice interactions, as well as elements like greenery, contributes positively to overall evaluations, emphasizing the need for diverse and engaging features in iVR shopping platforms.

### 5.3.4 | Product evaluation and decision-making behavior

The emphasis on consumer comfort in the VR environment as a catalyst for authentic decision-making, highlighted by Fang et al. (2021), points to the significance of creating user-friendly and immersive

virtual experiences. The pivotal role of informativeness in shaping the perceived utility of VR applications, as noted by Holdack and Lurie-Stoyanov (2021), underscores the importance of providing relevant and valuable information. Insights of Kang et al. (2020) into the influence of interactivity and visual-spatial cues on information perception further emphasize the need for engaging and informative virtual interfaces. The findings of Melendrez-Ruiz et al. (2022) on the impact of familiarity, habits, and attention allocation on consumer decision-making highlight the nuanced factors influencing choices within VR environments. Additionally, the observed prominence of prices in evaluating perceived value in VR, noted by Lombart et al. (2020) and Meißner et al. (2020), emphasizes the need for transparent pricing strategies. Lastly, Blom et al. (2021) and Siegrist et al. (2019) collectively suggest that nudges and health-oriented focuses can effectively guide attention toward nutritional information, indicating avenues to promote healthier choices in virtual shopping environments.

### 5.3.5 | Product interaction

The expressed desire for technological advancements in iVR, focusing on visual realism as indicated by Schnack et al. (2019), underlines the importance of continually improving the immersive aspects of virtual shopping. The observation of Fiorentino et al. (2022) that shoppers actively engage with virtual products reinforces the notion that realistic and immersive experiences are central to user satisfaction. The findings of Jacobsen et al. (2022) linking an increased sense of presence with heightened interaction and engagement suggest that enhancing the sense of being in a virtual environment can positively impact user engagement. Furthermore, insights of Khatri et al. (2022) into inferring personality traits through exploration patterns highlight the potential for tailoring virtual experiences based on individual preferences, offering a personalized and engaging shopping environment in iVR.

In conclusion, these findings collectively build on the multidimensional nature of consumers' behavior in virtual shopping environments.

Consumer behavior studies have thus indicated that buying and transaction behaviors in iVR environments have a multifaceted landscape that is shaped by various factors. While teleportation, a key technological feature, does not significantly impact impulsive purchases, brand familiarity emerges as a notable driver of impulsive buying. The interplay of vividness and interactivity in VR platforms proves pivotal in influencing impulse buying tendencies, emphasizing the importance of technological immersion. Additionally, the nuanced dynamics of factors such as hunger levels and the effectiveness of nudging strategies add complexity to the understanding of impulsive shopping within iVR contexts. On the front of consumer loyalty and feedback, the immersive experience in iVR environments showcases its impact on creativity and performance, with the freehand-gesture-based interaction technique standing out for its positive influence. Attitudes toward virtual stores are significantly enhanced in iVR, and positive responses to voice assistant integration underscore the potential of these technologies. Loyalty and satisfaction exhibit a

complex relationship with VR, moderated by factors like perceived assortment size. Finally, exploring shopping engagement and preferences reveals a rich tapestry of factors shaping consumer behaviors, from gaze behavior influenced by product unfamiliarity to the intricate dynamics of product evaluation and decision-making. Overall, these insights highlight the intricate interplay of technological features, individual characteristics, and consumer behaviors within iVR retail settings.

In conclusion, designing an iVR shopping environment requires careful consideration of the S-O-R, which can significantly affect the consumer experience and sales metrics. The present study synthesized the extant literature on this topic and proposed a roadmap for academicians and professionals to design iVR shopping environments that are engaging, immersive, and personalized. The findings of the present study can inform the design of iVR shopping environments that cater to the needs and preferences of consumers, creating a positive shopping experience that can boost sales metrics and consumer satisfaction.

## 6 | LIMITATIONS AND FUTURE RESEARCH AGENDA

Our review of consumer behavior in iVR retail has been informed by 48 research papers sourced from Scopus databases published from 2013 to 2023. While this study effectively represents the current literature on consumer behavior in iVR retail, future research could broaden inclusion criteria by employing alternative keywords or exploring databases beyond those considered in our search strategy (Vrontis et al., 2021). Our investigation has focused exclusively on experimental studies to enable the exploration of consumer behaviors within the iVR retail settings. This methodological choice was driven by the need to understand the direct effects of specific stimuli under controlled conditions. However, this approach may limit the generalizability of our findings across broader retail contexts that could benefit from more varied research designs. Future research could bring about new understanding by incorporating a diverse array of studies, including survey-based and qualitative research analyses, to provide a more comprehensive overview of consumer behavioral aspects within iVR settings.

This study has provided some noteworthy insights in response to the posed research questions. Relationships between the various S-O-R elements have been corroborated by empirical evidence gathered in prior experimental studies. We encourage researchers to use this study's synopsized findings (as outlined in Figure 4) to explore emergent relationships for enhancing iVR retail experiences by posing new research questions and establishing suitable hypotheses. For instance, these findings can be examined in different cultural and cross-country contexts to further our understanding of how retail customers are influenced by iVR scenarios. Futuristic research agendas that emerged from our exploration and synthesis of iVR (shown in Figure 4) led to three overarching groups, namely, buying and transactions, customer loyalty and feedback, and shopping engagement and consumer



**TABLE 7** Potential future research avenues.

Research avenues	Consumer behaviors	Organisms	Stimuli	Potential research questions
Buying and transactions	Impulsive shopping behavior	Emotional cognitive	Social-related	PRQ1—What role does the presence of social elements, such as virtual shopping companions play in triggering impulsive purchases in iVR environments?
	Product choice behavior	Emotional	Product-related	PRQ2—How do consumers' values influence consumer product choice behavior?
		Perceptual	Product-related	PRQ3—How does the design of the product influence consumer product choice behavior?
	Purchase behavior	Emotional perceptual	In-store-related	PRQ4—How does the incorporation of gamified elements (e.g., reward systems, virtual treasure hunts) or adding fantasy elements in iVR shopping affect consumers' purchase behavior?
		Emotional perceptual	Social-related	PRQ5—How can social and influencer marketing strategies be effectively implemented in VR shopping environments, and what are their impacts on consumer behavior compared to traditional and omnichannel approaches?
	Shopping time	Emotional perceptual	Shopper-related	PRQ6—Would the presence of customer-reflective avatars in shopping environments increase time spending during iVR shopping?
Consumer loyalty and feedback	Consumer creativity and performance	Emotional perceptual	Social-related	PRQ7—How does storytelling in iVR retail environments impact consumer creativity and performance?
	Consumers' attitude	Emotional Perceptual	In-store-related	PRQ8—How does brand communication influence consumer attitudes in iVR shopping environments?
	Intention to use VR store	Emotional cognitive	Social-related	PRQ9—How can online reviews in iVR retail environments be leveraged to generate consumer data and increase purchase intentions, considering the role of trust?
	Loyalty and satisfaction	Emotional perceptual cognitive	Shopper-related	PRQ10—What impact does personalized marketing (e.g., targeted ads based on previous shopping behavior) within iVR environments have on consumers' loyalty and satisfaction?
Shopping engagement and preferences	Gaze behavior	Emotional Cognitive	Technology-related	PRQ11—How can AI and eye-tracking technology be integrated to predict gaze behavior and create personalized layouts in VR retail environments?
	Navigation and body movement	Emotional Perceptual Cognitive	System-related	PRQ12—What are the best practices for onboarding in iVR retail environments, and how do they impact user confidence, navigation, and overall experience for consumers?
	Overall shopping experience	Emotional Perceptual	In-store-related	PRQ13—What are the key principles and guidelines for designing UX and UI in iVR shopping environments to enhance the overall shopping experience?
	Product evaluation and decision-making behavior	Emotional Perceptual Cognitive	In-store-related	PRQ14—What specific in-store factors, such as lighting, music, and textures, influence different stages of decision-making (e.g., attention, evaluation, purchase) in iVR stores?
	Product interaction	Emotional Perceptual Cognitive	System-related	PRQ15—How can the design and placement of intuitive and easily recognizable icons be optimized to guide user interactions?

preferences. These are put forth in Table 7 and discussed in the next sub-sections.

## 6.1 | Buying and transactions

Six potential research questions (PRQ1 to PRQ6) have been identified in this research agenda group. Impulse purchase behavior, characterized by a sudden desire to buy without much evaluation, can be leveraged by social-related stimuli. In physical stores, people often shop

with family and friends to avoid loneliness which can affect their shopping decisions (Borges et al., 2010; Cardoso & Pinto, 2010). Chen et al. (2021) suggest that the nature of the shopping companion and individual factors such as age, gender, income, education and emotional susceptibility can influence impulse purchases. PRQ1 therefore considers the role of virtual shopping companions for triggering impulsive purchase behavior.

Khan and Mohsin (2017) utilized the consumption values theory (Sheth et al., 1991), which includes functional value (price/quality), social value, conditional value, epistemic value, and emotional value.

They found that emotional value significantly impacts customers' product choices. PRQ2 considers this aspect in studying consumer choices in iVR retail environments.

Arrazat et al. (2023) delved into how environmental labels influence people's choices for healthy food, while Branca et al. (2023) looked at how manipulating packaging materials in VR affects eco-friendly choices and willingness to pay. Schnack et al. (2020) investigated the impact of private labels on impulsive shopping. It is known that creative, simple, and authentic marketing has a positive effect on consumer purchase decisions and brand choices (Shukla et al., 2022; Wang, Jiang, Gong, et al., 2023; Wang, Jiang, Guan, et al., 2023). The visual appeal and accessibility of labels and product packaging help shape the consumer experience, however, none of the papers reviewed in our study examined this aesthetic influence. Therefore, the impact of product packaging perception in VR environments on customer product choice behavior remains unexplored, and PRQ3 emerges as a natural progression.

Games create immersive experiences, wherein people experience the enjoyment of fantasy and playfulness (Molesworth, 2006), however, the technical feasibility of incorporating fantasy elements into iVR remains largely unexplored. Our review found studies to be mainly focused on replicating physical shopping environments in iVR except for one study. Bin Kim and Jung Choo (2023) delved into a fantasy-based condition and explored how fantasy spaces like underwater and desert stores in iVR shopping impact perceptual curiosity and consumer creativity. PRQ4 therefore articulates the study of iVR shopping environments featuring gamified elements, along with an investigation of how consumers respond to these experiences.

Social commerce and influencer marketing play crucial roles in enhancing brand awareness, driving sales, and strengthening brand image (Venciute et al., 2023). Researchers have extensively studied various aspects, including the design of e-commerce and social media platforms, the language used, the impact of influencers on purchase behavior, and omnichannel integration (Chen et al., 2024; Laradi et al., 2024; Wang, Xu, et al., 2023; Yin et al., 2022). Kim et al. (2024) studied the impact of virtual influencers' form realism, both alone and with behavioral realism, on consumer ambivalence, specifically regarding perceptions of eeriness and coolness. They found that the realism of a virtual influencer's form significantly influences these perceptions. However, the implementation of social and influencer marketing within VR shopping environments is understudied and leads to PRQ5.

Finally, the amount of time spent in shopping environments can influence consumers. Using an avatar to represent a product brand in the virtual world can enhance the sense of being together and influence more interactions between the product and the consumer (Foster et al., 2022). Avatars, as user representations, play a significant role in shaping an individual's identity, encouraging investments in appearance and digital personality (Ko & Park, 2021; Procter, 2021). While theoretical studies on consumer avatar usage in VR shopping exist (Silva & Campos, 2024), there is a huge opportunity for further exploration through experimental studies. Investigating the interactions between shoppers and their avatars in iVR environments can

contribute towards valuable insights and lead to further research directions (PRQ6).

## 6.2 | Consumer loyalty and feedback

This section has led to the formulation of four potential research questions (PRQ7–PRQ10). Storytelling recognized as a naturally creative human activity, is proven to enhance creativity in service design (Chen et al., 2023). Sung et al. (2022) demonstrated that storytelling through digital humans effectively boosts social media word-of-mouth, while Yang (2023) showed it has a positive impact on user experience in immersive environments. Bin Kim and Jung Choo (2023) add that when shoppers are engaged in immersive shopping environments, then often experience heightened creativity. Given storytelling's effectiveness in immersive settings and its potential to enhance engagement and creativity, researching its effects in iVR retail environments is a compelling area for study (PRQ7).

Brand communication plays a crucial role in retail (Stäbler et al., 2023). Numerous studies have demonstrated that various factors within brand communication, such as agency-communion orientation, message length (Lu et al., 2021), the use of uppercase or lowercase letters (Teng et al., 2021), brands and celebrities (Zhu et al., 2019) can influence consumer attitudes significantly. However, while these studies have extensively covered physical and online shopping contexts, there remains a gap in understanding these dynamics within the context of iVR shopping. Accordingly, PRQ8 is built upon this reasoning.

Online reviews have become one of the most dominant forms of consumer feedback due to their flexibility, expressiveness, and user-friendliness (Qiu & Zhang, 2024). The type of endorser, whether artificial intelligence (AI) or human, significantly impacts purchase intentions. Qiu and Zhang (2024) view AI endorsers as effective enablers for stimulating consumers' purchase intentions when recommending search products. Conversely, real celebrity endorsers have a greater marketing impact on experience products, resulting in stronger purchase intentions (Song et al., 2024). Given these insights, exploring how online reviews in iVR retail can generate consumer data and increase purchase intentions remains a promising area for future research and led to the formulation of PRQ9.

Retailers can boost consumer loyalty and repeat purchases by offering personalized VR experiences tailored to individual preferences (Shanahan et al., 2019; Tyrväinen et al., 2020). Surprisingly, none of the studies we examined delved into personally customized experiences, whether in marketing campaigns or in-store design. For example, just like how online stores quickly adjust their appearance and recommend products based on what consumers like, in VR shopping, researchers can experiment with personalized ads and product placements. Additionally, in VR shopping, integrating features like incorporating the consumer's favorite songs based on their mood from music platforms like Spotify or Apple Music can be explored (Szocs et al., 2023). Understanding the emotions evoked and how this

integration influences purchasing behavior is another potential area for investigation (leading to PRQ10).

### 6.3 | Shopping engagement and preferences

Understanding consumer preferences and keeping shoppers engaged is crucial for relationship building in digital settings and has led to the formulation of four potential research questions (PRQ11–PRQ15).

AI is predicted to significantly impact retailing across various channels, including physical, online, and VR retail (Eggenschwiler et al., 2024; Grewal et al., 2023; Guha et al., 2021; Hagtvædt & Chandukala, 2023; Vhatkar et al., 2024). In VR retail, AI can be especially transformative when combined with eye-tracking technology, which provides fine-grained data crucial for understanding and predicting shopping behaviors (Nordfält & Ahlbom, 2024). The integration of built-in eye-tracking devices in HMDs offers VR retail a distinct advantage over physical and online retail. However, whether AI and eye-tracking can predict gaze behavior and utilize this information to present a personalized layout in VR environments remains an area for further research. This guides us to frame PRQ11.

Navigation and body movement must be intuitive and natural in iVR, especially in retail, to ensure a seamless and user-friendly experience (Bozgeyikli et al., 2017; Schnack et al., 2019). However, first-time users of VR shopping environments often find these interactions confusing, which can detract from their overall experience (Lewis & Sauro, 2021). This highlights the critical role of effective onboarding in iVR retail. A well-designed onboarding process can boost users' confidence in navigating the VR environment, leading to a more enjoyable experience. Despite its importance, the best practices for onboarding in iVR retail and its effects on users remain underexplored and warrant further research (PRQ12).

Creating a positive shopping experience in iVR relies heavily on user experience (UX) and user interface (UI) design (Kim & Ha, 2021). However, unlike traditional shopping environments, there is a lack of established UX/UI guidelines for VR shopping. Questions regarding the optimal placement of logos, the distance at which objects should be positioned relative to the user, and other key design considerations remain unanswered. The absence of clear guidelines means that many aspects of UX/UI in VR stores are still unexplored and may require iterative testing and experimentation to find effective solutions. Understanding how to design UX/UI in iVR stores is an area ripe for research, with the potential to significantly enhance the overall shopping experience in virtual environments. This leads us organically to PRQ13.

The overall ambiance and mood of a store, encompassing factors like lighting, music, and textures, play a significant role in shaping product evaluations and decision-making behaviors (Bohl, 2012). However, in the context of immersive virtual reality (iVR) stores, the specific in-store factors that influence different stages of decision-making remain largely unexplored. Understanding which in-store factors impact each stage of the decision-making process in iVR stores,

such as initial attention, product evaluation, and final purchase decisions, is an area that awaits thorough investigation. Henceforth, PRQ14 is formulated.

Intuitive and easily recognizable icons play a crucial role in helping users understand how to interact in new environments. These icons serve as effective guides, especially in iVR environments, where users may be unfamiliar with the interface (Macaranas et al., 2015). Icons such as arrows, buttons, information symbols, progress indicators, and feedback icons are commonly used in e-commerce and mobile apps to signify different actions or states. However, the effectiveness of these icons in iVR shopping environments is still a largely unexplored research area. Testing these icons in iVR shopping environments with users can provide valuable insights into their usability and effectiveness. This research can help refine the design and placement of icons to ensure they are intuitive and enhance user interactions in iVR retail settings. This guides us to frame PRQ15.

The research questions provided represent a strategic roadmap for advancing the field of iVR in retail contexts. The future research directions derived from these questions provide a comprehensive guide for researchers and practitioners interested in the burgeoning intersection of technology and consumer behavior. Future research in iVR retail may pivot towards exploring the social and psychological dimensions of shopping. This includes examining how the presence of friends or shopping companions influences purchasing decisions, understanding the role of avatars in creating deeper brand connections and assessing the impact of packaging aesthetics on consumer emotions and behavior. Additionally, the incorporation of personalized elements, such as music preferences from streaming services, warrants investigation for its potential to enhance consumer loyalty. Lastly, there is a call to explore cultural factors that tailor iVR experiences to diverse audiences.

## 7 | CONCLUSION

This systematic literature review has provided a comprehensive analysis of the empirical literature on consumer behavior in iVR retail environments. By using the S-O-R model as our underlying framework, we have identified important factors that influence consumer behavior in iVR retail, such as visual and auditory stimuli, haptic feedback, social presence, and immersive features. Our review has further highlighted the importance of mediating factors such as attention, perception, memory, emotion, and presence in the relationship between stimuli and response. Further, purchase intention, exploration, satisfaction, and behavioral intentions are considered as the main responses of interest in existing literature.

Our findings have important implications for both researchers and practitioners in the field of consumer behavior and marketing. For researchers, the S-O-R model provides a useful framework for designing studies that address gaps in knowledge and contribute to a more comprehensive understanding of consumer behavior in iVR retail. For practitioners and stakeholders, our review can inform the design and implementation of iVR retail interventions and strategies that aim to

enhance the consumer experience, increase sales, and improve consumer satisfaction.

Overall, this review has highlighted the potential of iVR technologies to transform the consumer shopping experience and indicated the importance of continued research in this area to fully realize the benefits of this upcoming technology.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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## APPENDIX A

**TABLE A.1** Overview of studies using the S-O-R framework.

Author(s) & year	Stimuli	Organisms	Responses
Chen et al. (2023)	Features richness	Perceived telepresence, Social presence, Perceived risks, Perceived product diagnostics, Perceived shopping enjoyment, Perceived social approval	Purchase intention
Jang (2023)	Store atmosphere	Fashion involvement of consumers, shopping motivation	VR store satisfaction, visual attention to the store and product area
Arrazat et al. (2023)	Labelling of the product	–	Eco-friendly food choices
Bin Kim and Jung Choo (2023)	Immersiveness, fantasy	Perceptual curiosity, pleasure, arousal, sense of presence	Consumer creativity
Branca et al. (2023)	Packaging of the product	Perceived sustainability	Willingness to pay
Sina and Wu (2023)	Greenery, color temperature	Pleasure, arousal, satisfaction, hedonic shopping orientation, utilitarian shopping orientation, perceived merchandise quality	Purchase intention
Alkarney and Almakki (2022)	Ease of use, telepresence factors	Satisfaction, hedonic motivation, attitude toward VR shopping, Perceived control, perceived usefulness, Perceived security risk, perceived privacy	Intention to use VR store
Attar et al. (2022)	Store environment	Sense of presence	The total number of products chosen, Purchase behavior (purchased items)
Chen et al. (2022)	Interactivity, vividness, product type	Sense of presence, perceived diagnosticity, Playfulness, impulsiveness	Urge to buy impulsively
de-Magistris et al. (2022)	Shopping interface	Consumption periods, appetite level of consumers, projection bias	Average expenditure, number of purchased food
Fiorentino et al. (2022)	Color of the product, texture of the product, finishes of the product	Satisfaction, perceived realism, level of familiarity with VR	Time duration, user behavior, user targets
Jacobsen et al. (2022)	Shopping interface	Price memory	Price comparison, purchase behavior (purchased items)
Khatri et al. (2022)	Product type, price	Personality of the shoppers	Gaze behavior, navigation, body movement, product interaction, purchase behavior (purchased items)
Melendrez-Ruiz et al. (2022)	Food type (animal-based, pulses, starches, and vegetables)	Health issue consideration of the consumer, environmental impact consideration of the consumer, the pleasure of eating	Gaze behavior, food choice
Morotti et al. (2022)	Virtual assistant with voice	Perceived ease of use, Enjoyment	Attitude towards using for communication, Behavioral intention
Alzayat and Lee (2021)	Product type, shopping interface	Need for touch	Hedonicshopping value, Utilitarian shopping value
Blom et al. (2021)	Marketing nudge, time pressure	–	Decision-making behavior, Healthy food choice (The total number of healthier products chosen)
Holdack and Lurie-Stoyanov (2021)	Store environment	Perceived enjoyment, Perceived ease of use, perceived usefulness, Perceived playfulness, perceived informativeness, past VR use of consumer, curiosity of consumer	Attitude towards using VR, intention to use VR, product purchase intention
Kim and Lee (2021)	Design of sales and services areas, logo signature, media screens	Arousal	Visual attention, gaze behavior

(Continues)

TABLE A.1 (Continued)

Author(s) & year	Stimuli	Organisms	Responses
Loureiro et al. (2021)	Background music, telepresence factors (vividness)	Pleasure, arousal, dominance, cognitive processing	Behavioral intention
Melendrez-Ruiz et al. (2021)	Food type (animal-based, pulses, starches, vegetables), Shelf positioning of the products	–	Visual attention, gaze behavior
Park and Kim (2021)	Shopping interface, product discovery method (browsing, searching)	Cognitive elaboration	Purchase intention
Schnack, Wright, and Elms (2021)	Shopping interface	Personality of the shoppers	Average product inspection time, Proportion of private label purchases, Proportion of impulse purchases, Basket size, The dollar amount spent, In-store dwell time
Schnack, Wright, and Holdershaw (2021)	Locomotion techniques (controller-based instant teleportation, motion-tracked walking)	Engagement, excitement, and stress	Basket size, amount spent, trip duration, proportional purchases of unfamiliar products, purchase rates from different shelf levels, store coverage, private labels shares, product handling times, number of unplanned purchases
Fang et al. (2021)	Visual presentation of the products (text, picture, VR)	Hypothetical bias	Willingness to pay
Han et al. (2020)	Telepresence factors, challenge, body ownership, body control	Playfulness, usefulness, technology readiness, time distortion	Behavioral intention
Kang et al. (2020)	Interactivity, visual–spatial cues, graphic quality (3D, 2D)	Playfulness, informativeness	Product evaluation, purchase intention
Lombart et al. (2020)	Shape of the products, shopping interface, Immersiveness	Perceived hedonism, perceived appearance, perceived quality, perceived price fairness, perceived healthiness	Consumers' attitude, purchase intention
Meißner et al. (2020)	Immersiveness	Satisfaction	Variety-seeking behavior, price-sensitivity
Morotti et al. (2020)	Virtual assistant with voice	Usefulness, enjoyment	Net promoter score (NPS)
Schnack et al. (2020)	Labelling of the product	–	The share of private label brands purchased, Shopper responses to shelf positions, Total spending and shopping time, The extent of unplanned purchases, Product handling times
Jang et al. (2019)	VR store characteristics (vividness, interactivity), telepresence factors	Experiential shopping value	Approach intention
Lau and Lee (2019)	Shopping interface	Hedonic shopping experience, Interactive shopping experience	Purchase intention
Lombart et al. (2019)	Shape of the products	Perception of appearance, perception of quality, perception of price fairness	Purchase behavior
Martínez-Navarro et al. (2019)	Shopping interface, content formats	Discomfort, sense of presence, pleasure, dominance, arousal, affective appraisal	Brand recall, purchase intention
Peukert et al. (2019)	Immersiveness	Perceived product diagnosticity, perceived usefulness, perceived telepresence, perceived enjoyment	Intention to reuse shopping environment
Pizzi et al. (2019)	Shopping interface	Hedonic shopping orientation, utilitarian shopping orientation, perceived assortment size	Store satisfaction
Schnack et al. (2019)	Shopping interface	Sense of presence	Usability ratings



TABLE A.1 (Continued)

Author(s) & year	Stimuli	Organisms	Responses
Siegrist et al. (2019)	Shopping interface, Product type (healthy, tasty)	–	Product selected by the consumer, Purchase behavior, Information-seeking behavior
Wölfel and Reinhardt (2019)	Shelf positioning of the products, Store design	Consumers' perceptions	Buying decisions
Wu, Wang, et al. (2019)	Interactive techniques (user-defined gestures, virtual handle controller, ray casting)	Sense of presence	User performance, User experience
Park et al. (2018)	Shopping interface	Pleasure, arousal, sense of presence, perceived realism, attitude toward the store, simulator sickness	Purchase intention, time spent
Speicher et al. (2018)	Manipulation techniques (grabbing, pointing), shopping cart (realistic, abstract)	Workload, sense of immersion, motion sickness	User performance, user experience
Verhulst et al. (2018)	Being embodied in an obese virtual body	Products perception	Purchase behavior
Zhao et al. (2018)	Virtual assistant	Pleasure, arousal, and satisfaction	Time spent, purchase intention, overall shopping experience
Van Kerrebroeck et al. (2017a)	Store environment	Attitude toward the mall, perceived crowding	Approach behavior, mall satisfaction, loyalty intentions
Verhulst et al. (2017)	Shape of the products	Sense of presence, participants' perceptions (impression, quality and price)	Number of purchased items, time spent
Lau et al. (2014)	Interactivity, telepresence, vividness	Sense of immersion, motion sickness	Decision-making behavior

## APPENDIX B

**TABLE B.1** Descriptive themes were identified to characterize the stimuli.

Descriptive themes	Codes from line-by-line coding
Cognitive processing and consideration	Cognitive elaboration, cognitive processing, environmental impact consideration of the consumer, health issue consideration of the consumer, hypothetical bias, price memory, utilitarian shopping orientation
Environmental and social impact perception	Perceived healthiness, perceived sustainability
Immersive experience	Experiential shopping value, interactive shopping experience, perceived telepresence, Sense of immersion, sense of presence, social presence
Individual characteristics	Personality traits of the shoppers
Negative emotional states	Discomfort, stress
Perceived emotions	Perceived enjoyment, perceived hedonism, perceived playfulness
Physical discomfort	Motion sickness, simulator sickness, workload
Positive emotional states	Arousal, dominance, engagement, excitement, pleasure, satisfaction, The pleasure of eating
Perceptions during product evaluation	Perceived appearance, perceived diagnosticity, perceived merchandise quality, perceived price fairness, perceived quality, perception of appearance, perception of price fairness, perception of quality, perceptual curiosity, product perception
Descriptive themes	Codes from line-by-line coding
Shopping attitudes and preferences	Appetite level of consumers, attitude toward the mall, attitude toward VR shopping, consumption periods of consumers, fashion involvement of consumers, projection bias
Shopping environment perception	Participants' perceptions, perceived crowding, perceived realism
Shopping motivation	Hedonic motivation, hedonic shopping experience, hedonic shopping orientation, impulsiveness, shopping motivation
Temporal factors	Time distortion
Usability and information perception	Perceived ease of use, perceived informativeness, perceived usefulness
User control and safety	Need for touch, perceived control, perceived privacy, perceived social approval, perceived security risk
VR engagement and knowledge	Curiosity of consumer, level of familiarity with VR, Past VR use of consumer, technology readiness

**TABLE B.2** Descriptive themes were identified to characterize the organisms.

Descriptive themes	Codes from line-by-line coding
Communication factors	Logo signature, media screens
Display factors	Design of sales and services areas, shopping cart
Embodiment and control	Being embodied in an obese virtual body, body control, body ownership
Environmental factors	Background music, color temperature, fantasy elements, greenery, store atmosphere, store environment, VR store characteristics
Pricing and promotions	Marketing nudge, price, time pressure
Product features	Color of the product, features richness, finishes of the product, food type, product type, shape of the product, texture of the product
Product presentation	Labelling, packaging, product discovery method, shelf positioning, visual presentation of the products
Sensory engagement factors	Immersiveness, telepresence factors, vividness
Shopping medium	Shopping interface
User interaction and navigation	Challenge, ease of use, interactivity, locomotion techniques, manipulation techniques
Virtual assistant	Virtual assistant with voice
Visual experience factors	Content formats, graphic quality, visual-spatial cues

**TABLE B.3** Descriptive themes were identified to characterize the responses.

Descriptive themes	Codes from line-by-line coding
Consumer creativity and performance	Consumer creativity, user performance
Consumers' attitude	Approach behavior, attitude towards using VR, attitude towards using VR for communication, consumers' attitude
Gaze behavior	Gaze behavior, visual attention, visual attention to the store and product area
Impulsive shopping behavior	Number of unplanned purchases, Proportion of impulse purchases, the extent of unplanned purchases, urge to buy impulsively
Intention to use VR store	Approach intention, behavioral intention, Intention to reuse the shopping environment, intention to use VR, Intention to use VR store, product purchase intention
Loyalty and satisfaction	Loyalty intentions, mall satisfaction, net promoter score (NPS), store satisfaction, VR store satisfaction
Navigation and body movement	Body movement, navigation, store coverage
Overall shopping experience	Hedonic shopping value, overall shopping experience, usability ratings, user experience, utilitarian shopping value
Product choice behavior	Basket size, eco-friendly food choices, food choice, healthy food choice, number of purchased food, number of purchased items, private labels shares, product selected by the consumer, the total number of products chosen
Product evaluation and decision-making behavior	Brand recall, decision-making behavior, information-seeking behavior, price comparison, price-sensitivity, product evaluation, variety-seeking behavior
Product interaction	Average product inspection time, product handling times, product interaction, shopper responses to shelf positions, user's targets
Purchase behavior	Average expenditure, buying decisions, proportional purchases of unfamiliar products, proportion of private label purchases, purchase behavior, purchase intention, purchase rates from different shelf levels, the dollar amount spent, the share of private label brands purchased, total spending, user behavior, willingness to pay
Shopping time	In-store dwell time, shopping time, time duration, time spent, trip duration