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Customer Experience in Immersive Virtual Reality Retail: Exploring Behaviors, Emotions, and Touchpoints Across the Shopping Journey

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“As you start to walk on the way, the way appears.”

-Rumi

Abstract

Immersive Virtual Reality (iVR) is transforming the retail landscape by merging sensory engagement with the personalization and convenience of digital platforms. As part of the rapidly evolving metaverse, iVR has the potential to redefine customer experience (CX) and create immersive, multisensory shopping environments. However, understanding how iVR shapes customer behaviors, emotions, and interactions across the shopping journey remains limited. These gaps hinder businesses from fully optimizing CX in this emerging domain. This research aims to address these challenges by exploring the influence of iVR retail touchpoints on CX and developing frameworks to advance theoretical and practical knowledge in iVR retail.

This study employed a human-centered design methodology, integrating systematic literature reviews, semi-structured interviews with VR design experts, and iVR experiments with end-users. The literature review established a theoretical foundation, identifying challenges and opportunities in iVR retail. Semi-structured interviews with experts explored critical touchpoints, emotions, behaviors, and the design processes underlying iVR environments. Complementing these, VR experiments, card-sorting activities, and end-user interviews captured the behaviors and emotions of participants across the pre-purchase, purchase, and post-purchase stages of the shopping journey.

This study offers significant theoretical advancements by extending the Stimulus-Organism-Response (S-O-R) model to better capture the complexities of CX in immersive virtual environments. It provides a nuanced understanding of how sensory stimuli influence emotional responses and consumer behaviors, particularly within iVR retail contexts. This extension enables a more comprehensive analysis of the relationships between touchpoints, emotions, and shopping processes. Additionally, the study adapts the Double Diamond framework, tailoring it to meet the unique demands of iVR design. This refined framework supports designers in addressing the iterative nature of immersive retail experiences across discovery, definition, development, and delivery phases. Additionally, the key outcome of this research is developing a CX framework that detailed the iVR customer journey, illustrating how user interactions, emotional responses, and behaviors evolve across the pre-purchase, purchase, and post-purchase stages. These findings not only highlight the underlying mechanics of creating positive CX in iVR environments but also identify the drivers of emotional connection and satisfaction, laying the groundwork for further exploration and application in this transformative retail medium.

This research contributes to both theoretical and practical understanding of iVR retail environments. Theoretically, it advances models such as the S-O-R model and refines the Double Diamond framework, aligning them with the complexities of immersive technologies and offering tools for analyzing how iVR reshapes CX. Practically, the study provides actionable design guidelines to address key challenges in iVR retail, including improving usability with intuitive interfaces, enhancing accessibility through features like voice navigation, and fostering emotional engagement via sensory-rich experiences. These guidelines support the creation of inclusive, engaging, and effective iVR shopping environments that serve as a roadmap for future studies for exploring and validating emergent technological innovations in iVR retail.

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CHAPTER 1

Introduction

The current study examines the transformative potential of immersive virtual reality (iVR) in the retail sector, focusing on its implications for customer experience (CX). Immersive virtual reality has emerged as a revolutionary technology, merging sensory engagement with the personalization and convenience of online platforms. As part of the metaverse, which is projected to generate an astonishing $5 trillion in value by 2030 (McKinsey, 2022), iVR is transitioning from a futuristic concept to a practical tool with the potential to redefine commerce, technology, and customer engagement.

Over the past few decades, the retail landscape has undergone significant changes. Traditional brick-and-mortar stores once dominated the sector, offering tactile, sensory-rich experiences that fostered immediate customer engagement with products. Next, the advent of e-commerce, shifted this focus towards convenience and accessibility that allowed customers to shop anytime, anywhere. Now, iVR represents the next phase of this evolution; it can combine the sensory immersion of physical stores with the convenience and efficiency of online shopping with more profound interactions that can be customized. Unlike traditional digital channels or low-immersive virtual reality (VR) technologies that rely on limited sensory inputs through two-dimensional interfaces (Taufik et al., 2021; Wu et al., 2019), iVR leverages advanced technologies, such as head-mounted displays (HMDs), to create multisensory, interactive environments that simulate real-world interactions (Lanier et al., 2019; Zhao et al., 2021).

This research emphasizes that a meaningful and positive CX is critical for achieving sustainable competitive advantage in retail (Lemon & Verhoef, 2016; Pekovic & Rolland, 2020). CX encompasses various dimensions, including cognitive, emotional, behavioral, sensorial, and social responses to the product offerings on display during the customer's entire journey (Lemon & Verhoef, 2016). Each component of CX—such as the customer journey, touchpoints, purchase phases, emotions, and behaviors—plays a pivotal role in shaping how customers perceive and interact with retail environments.

The customer journey represents the sequence of interactions a customer has with a retailer over time and across various stages, including the pre-purchase, purchase, and post-purchase phases (Hollebeek et al., 2020; Lemon & Verhoef, 2016). Each phase is marked by critical touchpoints, which are moments of interaction between the customer and the retail environment that significantly influence the overall CX (Homburg et al., 2017; Martínez-Navarro et al., 2019). Furthermore, emotions and behaviors—such as decision-making patterns, motivations, and purchasing actions—are integral components of CX, highlighting the importance of understanding both the psychological and practical aspects of customer interactions in iVR settings (Alzayat & Lee, 2021; Lau & Lee, 2019).

Despite the growing interest in iVR, gaps remain in understanding how its unique attributes—immersion, interactivity, and multisensory engagement—shape customer behaviors and experiences compared to physical and online retail channels (Chen et al., 2022; Wongkitrungrueng & Suprawan, 2023). Early research has explored aspects like virtual product try-ons, 3D product exploration, and multisensory ambiences, yet most studies have narrow focus on isolated elements rather than adopting a holistic perspective on the entire customer journey (Alzayat & Lee, 2021; Martínez-Navarro et al., 2019). For example, while Hollebeek et al. (2020) examined iVR features across different stages of the journey, they did not fully explore how emotions, behaviors, and touchpoints interact within these stages.

This study addresses these gaps by focusing on how CX evolves dynamically across the customer journey in iVR retail environments. Through this research, I aim to provide a comprehensive understanding of how iVR can be integrated with omnichannel strategies to create an enriched and engaging shopping experience. Using systematic literature reviews, a holistic representation of customer behaviors that are manifested across themes, namely, external stimuli, internal organismic state and observable reactions in iVR retail shopping context are explained. Furthermore, empirical evidence has led to the development of practice-based frameworks to guide businesses in the design of effective virtual retail environments.

In summary, this research has investigated the multifaceted nature of CX in iVR retail, with emphasis on five key components, namely customer journey, touchpoints, purchase phases, emotions, and behaviors. These components have been elucidated with literature and from empirical evidence (VR experts' interviews and user experiments) to lay out the theoretical and practical groundwork for developing user-centered iVR shopping environments. These findings can provide guidance to both the researcher community and businesses in leveraging iVR as a transformative addition while establishing their retail strategies.

1.1 Research Motivations

Despite the burgeoning interest and the transformative potential of immersive virtual reality in retail, the field faces several critical challenges that must be addressed to fully harness its capabilities.

The challenges that have emerged from current literature and industry practices are:

- Lack of holistic understanding of customer behavior and emotions in iVR
- Absence of tailored frameworks for customer journeys and design process of iVR retail
- Need for practical design guidelines to optimize CX in iVR retail.

The motivation of this research study is therefore to bridge existing gaps between theoretical promise and their practical applications. Accordingly, this research is driven towards resolving above mentioned issues, and the research objectives are stated next.

1.2 Research Objectives

The study is guided by the following objectives:

- **To Examine Consumer Behaviors and Emotions in iVR Shopping Environments**

  Investigate how customers interact with, and emotionally respond to immersive stimuli in iVR retail settings, to provide a holistic understanding of the cognitive, emotional, and behavioral dimensions of CX.

- **Identify and Analyze Key Touchpoints in the iVR Shopping Experience**

  Explore the pivotal moments of interaction between customers and the iVR environment, for evaluating their influences on customer engagement, satisfaction, and decision-making processes.

- **To Map the Customer Journey Across Shopping Stages in iVR Retail**

  Develop a comprehensive framework that captures customer interactions, behaviors, and emotional responses across the pre-purchase, purchase, and post-purchase phases of the iVR shopping journey.

- **Create Tailored Frameworks and Providing Design Guidelines for iVR Retail**

  Translate theoretical insights into actionable strategies by developing frameworks and practical design principles that can guide in the creation of user-centered iVR shopping environments, thereby optimizing CX for both designers and retailers.

By achieving these objectives, this study seeks to advance theoretical understanding and practical implementation of iVR technologies in retail, positioning iVR as a transformative element of omnichannel strategies while addressing the dynamic and holistic nature of CX in iVR retail contexts.

1.3 Research Methodology and Thesis Structure

This study adopts the human-centered design (HCD) methodology to ensure that the development of CX frameworks for iVR retail environments is firmly rooted in the needs, behaviors, and perceptions of all stakeholders. HCD is an iterative design approach that prioritizes human assessments throughout the research and development process, aiming to create solutions that are practical, intuitive, and effective (Giacomin, 2014).

The adoption of an HCD approach in this thesis was pivotal to ensuring that the development of CX frameworks for iVR retail environments aligns with the actual needs, behaviors, and emotions of key stakeholders, including academic researchers, VR design experts, and end-users. By placing humans at the core of the design process, HCD offers a structured methodology for exploring how customers interact within iVR retail spaces and for creating solutions that are intuitive, engaging, and effective. This approach directly supports the overarching aim of this research, that is, to enhance CX in iVR retail environments by developing practical, user-centric frameworks and design guidelines.

The decision to adopt HCD was guided by three primary motivations. First, the process of empathizing with both users and designers was deemed essential for capturing the diverse perspectives required to create CX frameworks that are both user-friendly and technically feasible. By prioritizing the needs and challenges of these stakeholders, the research ensured that its outcomes were grounded in real-world applicability (Nguyen Ngoc et al., 2022; van der Bijl-Brouwer & Dorst, 2017). Second, HCD's focus on relevance and usability helped bridge the gap between theoretical insights and practical applications, enabling the development of solutions directly applicable to business and design contexts (Nguyen et al., 2022). Third, the iterative nature of HCD facilitated continuous feedback and refinement, that was critical in addressing the complexities of iVR technologies and retail environments.

The HCD methodology was applied methodically throughout the research process, beginning with systematic literature reviews to understand academic assessments. This initial stage provided a theoretical foundation by identifying key concepts, challenges, and opportunities in CX research. These theoretical underpinnings highlighted existing gaps in literature to inform on the subsequent stages of this study. The next stage involved conducting interviews with VR design experts, who provided invaluable insights into the practical aspects of designing iVR retail environments. Engaging these professionals allowed the research to bridge theory and practice, highlighting the technical and creative considerations that shape iVR design. These expert perspectives enriched the understanding of critical touchpoints, customer behaviors, and the broader design process.

Finally, to capture the end-user perspective, the research employed VR experiments, card sorting and semi-structured interviews. This stage placed users at the center of the investigation, allowing for the direct observation of their behaviors, emotions, and interactions within iVR environments. By gathering and analyzing user feedback, the research was able to refine its ideas and address user preferences and pain points, resulting in a more comprehensive and user-focused understanding of CX in iVR retail.

Figure 1.1 provides a clear and detailed illustration of the methodological flow and structure adopted in this thesis. It highlights the alignment of research aims and key concepts across each chapter, showcasing the progression of the study through its various stages. This visual representation underscores the systematic approach taken in addressing the research objectives, beginning with foundational literature reviews, incorporating expert insights through interviews, and culminating in user-centered experiments. By presenting the interconnected stages of the research process, the figure emphasizes how each phase contributed to building a comprehensive understanding of CX in iVR retail environments.

This thesis is designed as a thesis with publication. All chapters, except Chapter 1 (Introduction) and Chapter 8 (Conclusion), have been developed as standalone publications. Chapter 2, 3, and 4 have already been published, while Chapters 5, 6, and 7 are currently in the submission process.

Each chapter focuses on distinct yet interconnected objectives, beginning with foundational literature reviews to establish theoretical insights (Chapters 2–4), progressing to expert interviews and iterative analyses for practical frameworks (Chapters 5–6), and culminating in user-centered experiments to validate and refine the findings (Chapter 7). The integration of multiple data collection methods, including semi-structured interviews, VR experiments, card

sorting, and questionnaires, reflects the study's commitment to a comprehensive HCD approach (Maguire, 2001). This iterative process ensured the alignment of academic, practitioner, and end-user perspectives, facilitating the development of actionable, user-centric frameworks and guidelines.

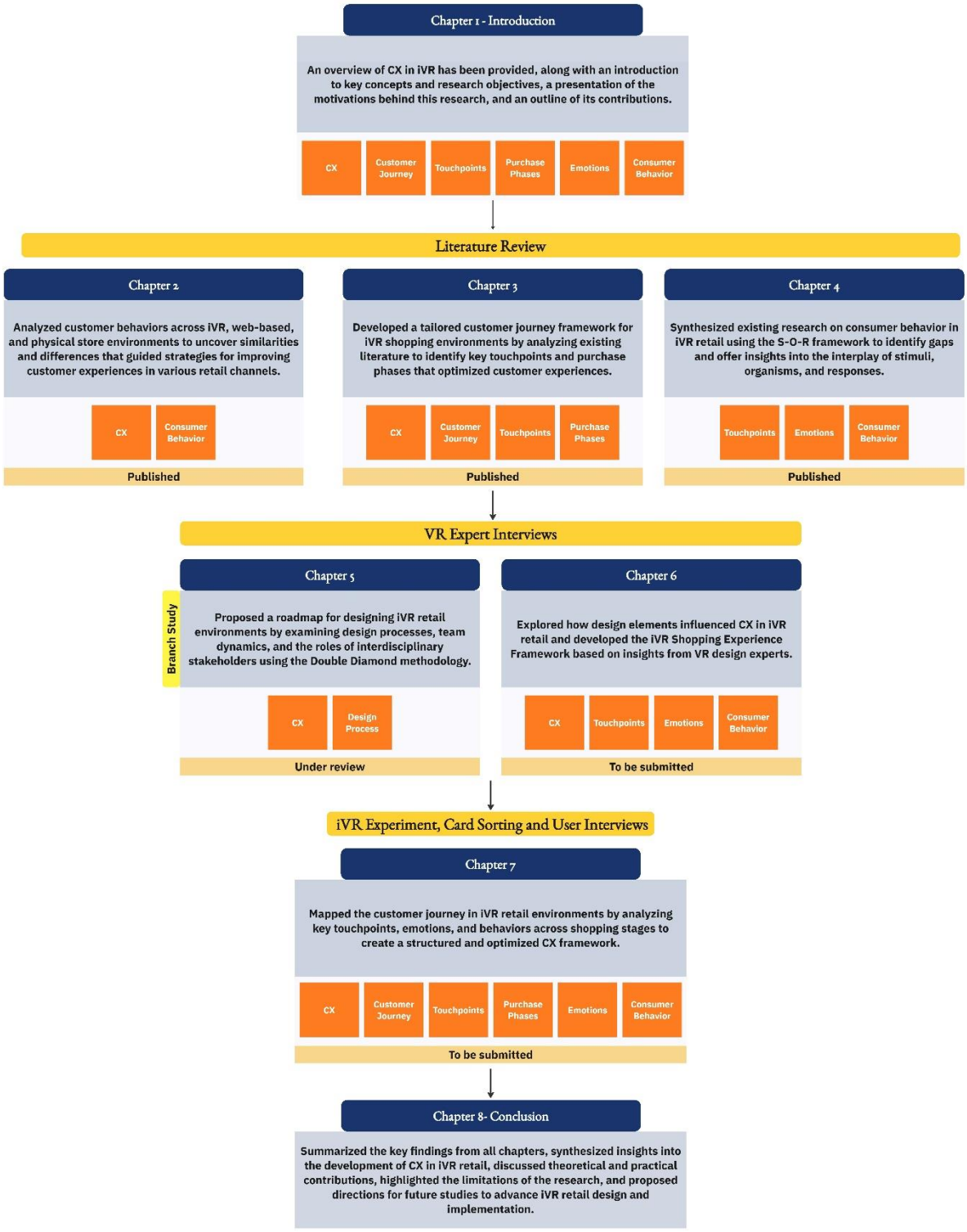

Figure 1.1: Overview of thesis structure and research process

Chapter 1 provides an overview of CX in iVR, introducing key concepts, research objectives, and the motivations behind the study. It outlines the contributions of the research and sets the stage for the subsequent chapters, emphasizing the need for user-centric frameworks in iVR retail.

Chapter 2 investigates customer behaviors across iVR, web-based, and physical store environments through a comprehensive literature review. It identifies similarities and differences across channels, providing foundational insights into how customer experiences vary in diverse retail settings. This review served as a foundational step in the exploratory phase of the research, aiming to develop an initial understanding of customer behavior within iVR shopping environments.

> Full paper published: Comparing Customer Behaviours: Immersive Virtual Reality Store Experiences versus Web and Physical Store Experiences. 2022 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE). https://doi.org/10.1109/CSDE56538.2022.10089288

Chapter 3 develops a tailored customer journey framework for iVR shopping environments by analyzing existing literature. This chapter focuses on identifying key touchpoints and purchase phases that optimize customer experiences in immersive retail contexts.

> Full paper published: Creating a Customer Journey for Immersive Virtual Reality Shopping Environments: Investigating Customer Touchpoints and Purchase Phases Proceedings of the 35th Australian Computer-Human Interaction Conference, Wellington, New Zealand. https://doi.org/10.1145/3638380.3638383

Chapter 4 synthesizes existing research on consumer behavior in iVR retail using the Stimulus-Organism-Response (S-O-R) framework. It identifies gaps in the literature and provides insights into the interplay between stimuli, organisms, and responses in iVR shopping environments.

> Full paper published: Consumer behavior in immersive virtual reality retail environments: A systematic literature review using the stimuli-organisms-responses (S-O-R) model. Journal of Consumer Behaviour. https://doi.org/10.1002/cb.2374

Chapter 5 is a branch study that emerged during interviews with VR design experts, highlighting insights into design processes and team dynamics for iVR retail. Although not directly within the scope of the original study, the inclusion of these findings as a chapter enhances the thesis by offering actionable contributions to the broader field of iVR retail design. Ethical approval for this study was obtained from the Massey University Human Ethics Committee (Low Risk

Notification), and the approval letter is provided in Appendix E1. All participants were informed of their rights, and informed consent was obtained prior to their participation in the interviews.

> Full paper under review: Navigating The Future of Retail: A Roadmap For Immersive Virtual Reality Retail Design

Chapter 6 explores how specific design elements influence customer experiences in iVR retail and introduces the iVR Shopping Experience Framework. Based on VR expert interviews, this chapter offers practical design recommendations for creating immersive, user-centered shopping environments. The participants in this study were the same group of VR design experts interviewed in Chapter 5. These experts were selected for their professional experience in designing immersive virtual retail environments and their insights contributed across both the design process (Chapter 5) and the understanding of customer experience factors (Chapter 6). Their input was segmented and analyzed separately to address the distinct research questions presented in each chapter. Ethical approval for this study was obtained from the Massey University Human Ethics Committee (Low Risk Notification), and the approval letter is provided in Appendix E1. All participants were informed of their rights, and informed consent was obtained prior to their participation in the interviews.

> Full paper to be submitted: Designing Virtual Reality Retail Environments: Insights from Virtual Reality Experts on Optimizing Customer Experience

Chapter 7 maps the customer journey in iVR retail environments by analyzing key touchpoints, emotions, and behaviors across pre-purchase, purchase, and post-purchase stages. Through VR experiments and user interviews, it validates and refines the findings, culminating in a structured and optimized CX framework for iVR shopping. Ethical approval for this study was obtained from the Massey University Human Ethics Committee (Low Risk Notification), and the approval letter is provided in Appendix E2. All participants were informed of their rights, and informed consent was obtained prior to their participation in the interviews.

> Full paper to be submitted: Mapping the Customer Journey in Immersive Virtual Reality Retail: Touchpoints, Emotions, and Behaviors Across Shopping Stages

Chapter 8 synthesizes the findings from all chapters, integrating insights to highlight the development of CX frameworks in iVR retail. It discusses the theoretical and practical contributions of the study, acknowledges its limitations, and provides directions for future research and practical implementation in iVR retail design.

1.4 Contributions

This research makes significant contributions to both the theoretical understanding and practical implementation of CX in iVR retail environments. By employing a HCD methodology, the study bridges existing gaps in the literature and industry practices, offering insights and frameworks that are tailored to the needs of researchers, designers, and businesses. Through a structured investigation aligned with the research objectives, the study bridges critical gaps and delivers actionable strategies for designing user-centered and engaging iVR retail environments. The contributions are grouped according to the objectives (laid out in section 1.3) to provide a connected narrative of the study's impact.

Understanding Consumer Behaviors and Emotions in iVR Retail

The first goal of this research was to delve deeply into how customers behave and emotionally respond to immersive stimuli in iVR retail environments. In doing so, the study uncovered the multidimensional nature of CX—spanning cognitive, emotional, behavioral, sensorial, and social dimensions. By mapping these elements across the pre-purchase, purchase, and post-purchase stages, this research paints a comprehensive picture of how immersive technologies influence decision-making and engagement.

Moreover, the study extended the S-O-R model to the context of iVR retail. This adaptation bridges theoretical understanding with the sensory-rich and interactive nature of virtual environments. By doing so, the study not only validates the relevance of established models but also offers refinements that cater to the unique dynamics of iVR.

Identifying and Shaping Key Touchpoints in iVR Shopping Experiences

The research highlights the pivotal role of touchpoints in shaping the iVR shopping journey, revealing moments of interaction that significantly influence customer engagement, satisfaction, and decision-making. By engaging VR design experts, the study identified and analyzed these critical touchpoints, offering insights into their impact on CX.

These findings informed the creation of a tailored customer journey framework that prioritizes seamless and meaningful interactions across shopping stages. This framework provides a roadmap for businesses and designers to craft immersive shopping experiences that are not only intuitive but also aligned with customer expectations and preferences.

Mapping the iVR Customer Journey Across Stages

Through user-centered experiments and interviews, this research validated and refined its proposed customer journey framework. By examining customer behaviors, emotions, and interactions at each stage—pre-purchase, purchase, and post-purchase—the study developed a structured and optimized CX framework tailored specifically to iVR retail.

The framework addresses the dynamic nature of CX in immersive environments, ensuring that each stage is designed with user needs and preferences at the forefront. This approach not only enhances the shopping experience but also fosters deeper engagement and loyalty.

Developing Frameworks and Guidelines for iVR Retail Design

One of the most impactful contributions of this thesis is the iVR Shopping Experience Framework, which provides actionable strategies for designing user-centered shopping environments. This framework integrates insights from expert interviews and user experiments, offering practical recommendations that emphasize immersion, usability, and emotional engagement.

A unique branch study emerged from interviews with VR design experts, shedding light on design processes, team dynamics, and interdisciplinary collaboration in iVR retail. This study is an offshoot of the main research path and has been included in the thesis due to its emphasis on design thinking principles involving interdisciplinary teams and their contributions to optimize design strategies for iVR environments.

Finally, the research highlights how iVR can be seamlessly integrated into omnichannel retail strategies, merging the sensory engagement of physical stores with the convenience of online shopping. By providing businesses with a roadmap for leveraging iVR, the study positions immersive virtual reality as a transformative addition to the retail landscape.

This thesis weaves together theoretical insights and practical contributions, advancing our understanding of CX in iVR retail while providing the tools needed to design engaging and user-centered environments. It bridges the divide between innovation and application, equipping designers, businesses, and researchers with frameworks and guidelines to navigate the complexities of iVR retail. Ultimately, the study empowers stakeholders to create immersive shopping experiences that are not only innovative but also meaningful, accessible, and commercially viable. By doing so, this research lays the groundwork for shaping the future of retail in the age of immersive technologies.

1.5 Published Work

The author of this thesis has contributed to the following articles published in peer-reviewed journals and presented at conferences. The articles are listed below in chronological order, with the most recent publications appearing first.

- Erensoy, A., Mathrani, A., Schnack, A., Elms, J., & Baghaei, N. (2024). Consumer behavior in immersive virtual reality retail environments: A systematic literature review using the stimuli-organisms-responses (S-O-r) model. Journal of Consumer Behaviour. https://doi.org/10.1002/cb.2374

- Erensoy, A., Mathrani, A., Schnack, A., Elms, J., & Baghaei, N. (2024). Creating a Customer Journey for Immersive Virtual Reality Shopping Environments: Investigating Customer Touchpoints and Purchase Phases Proceedings of the 35th Australian Computer-Human Interaction Conference, Wellington, New Zealand. https://doi.org/10.1145/3638380.3638383

- Erensoy, A., Mathrani, A., Schnack, A., Zhao, Y., Chitale, V. S., & Baghaei, N. (2022, 18-20 Dec. 2022). Comparing Customer Behaviours: Immersive Virtual Reality Store Experiences versus Web and Physical Store Experiences. 2022 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE). https://doi.org/10.1109/CSDE56538.2022.10089288

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CHAPTER 2

Comparing Customer Behaviours: Immersive Virtual Reality Store Experiences versus Web and Physical Store Experiences

Understanding the behaviour of customers and creating a meaningful and positive customer experience is essential for retail businesses to gain sustainable competitive advantage. While immersive virtual reality (iVR) technologies provide new ways for businesses to sell their products or services online, little is known about how customers interact in these simulated environments and the factors that influence their behaviour. However, it is unclear precisely what types of similarities and differences will exist between the customer behaviours shown in this new iVR shopping experience and those in brick-and-mortar stores and e-commerce. It's crucial for businesses to comprehend which shopping channels are ideal for providing their clients with enhanced shopping experiences. In order to give a thorough evaluation of the impacts of shopping experiences across various channels on consumer behaviour and variables that affect customer experience, the research performed a literature review.

Note that the work presented in this chapter has been published: Customer Behaviours: Immersive Virtual Reality Store Experiences versus Web and Physical Store Experiences. 2022 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE). https://doi.org/10.1109/CSDE56538.2022.10089288

2.1 Introduction

To achieve sustainable competitive advantage, retail industries work towards enhancing customer experiences through personalisation strategies. Current trends include online shopping using websites where images of products are displayed, and customers can select and purchase products from these websites. However, it is expected that the next 15 years will revolutionise the online shopping experience with the innovative use of virtual reality (VR) technologies (Berg & Vance, 2017). VR provides users with a realistic and interactive digitized environment that makes use of novel techniques for delivering a unique experience by recreating multi-sensorial experiences, which include virtual sight, sound, and touch (Zhao et al., 2021). Early applications of VR were expensive to produce and focused on mostly use for research and business applications, resulting in only small-scale and highly professional applications; as such consumer VR applications were extremely limited during the early years of VR (Taufik et al., 2021). Nevertheless, as VR technology has progressed, it has become more widely available, easier to use, considered less expensive and is now used across a broader range of real-world scenarios. VR is quickly advancing in terms of technology for presenting consumers with supposedly realistic virtual settings at relatively low costs (Castelvecchi, 2016). Especially, head-mounted displays (HMDs) have changed VR usage away from niche applications to general consumer use (Lanier et al., 2019). The growing availability of immersive Virtual Reality (iVR) gear in private homes too has opened up innovative prospects for online shopping scenarios [29]. The latest research on human-computer interaction (HCI) shows that more affordable and reliable HCI-based solutions are emerging and becoming a part of people's daily life (Katona, 2021). In the field of HCI, VR is a very popular technology that has been commonly utilised for a range of applications in recent years. VR-based online shopping is one of the technologies that has seen significant use in simulating physical presence in real-world circumstances (Wu, Luo, et al., 2019). Numerous studies have been undertaken over the past several years to investigate the possibilities of VR technology for online shopping and examine the effect of VR shopping experience on customers in different contexts. Consequently, a number of VR shopping experiences were created by researchers to analyse consumer behaviour and experience in places like supermarkets (Han et al., 2020; Lombart et al., 2020; Martínez-Navarro et al., 2019; Peukert et al., 2019; Siegrist et al., 2019), convenience stores (Schnack et al., 2019), and various retail stores (Alzayat & Lee, 2021; Kang et al., 2020; Park & Kim, 2021).

Also, Covid-19 has strengthened technology use and widespread adoption of iVR hardware in households (Diez, 2021). According to the results of a survey conducted in the USA, 71% of the participants stated that they spent more time using VR during the pandemic (Clement, 2021). Furthermore, Goldman Sachs predicts that by 2025, the market for artificial intelligence (AI) and VR in retail will reach $1.6 billion (Cowan, 2019). Considering these developments, businesses are investing of digital technologies and the development virtual experiences; more so, since consumers are likely to access more products and services from their homes rather than brick-and-mortar stores (Lee, 2020). However, it is not known exactly what kind of similarities and differences will exist between the consumer behaviours displayed in this new iVR shopping experience and those in physical stores and e-commerce (Grewal et al., 2017). It's important for retailers to understand which ones are the most appropriate to offer engaging shopping experiences. Therefore, the study conducted a literature review to provide a comprehensive assessment of the effects of shopping experience across different channels on customer behaviour.

2.2 Background

2.2.1 Immersive Virtual Reality

iVR is described as technology that provides the user with high-quality or quantity of sensory information (Slater & Sanchez-Vives, 2016). VR systems are divided into three broad categories: fully immersive, semi-immersive, and low to non-immersive. Fully Immersive VR (high-immersive VR) refers to VR systems that use a head-mounted display, semi-immersive use a walk-in-place CAVE-like virtual environment (via a Kinect) and non-immersive VR refers to VR systems that use desktop screens (Gutierrez et al., 2008). In comparison to non-immersive VR, iVR produces a 360-degree view that gives the user a close-to-real-world experience. As a result, it provides customers a more enveloping experience, which could improve their purchasing outcomes (Peukert et al., 2019). HMDs are the most common examples of hyper-immersive VR systems that can provide high immersion and interactivity (Meißner et al., 2020). Presence is a subjective correlate of immersion. If VR participants experience by naturally moving their body, their brain's perceptual system may easily deduce that what is being perceived is the participants' actual surroundings (Slater & Sanchez-Vives, 2016).

2.2.2 Virtual Reality Shopping

Online shopping has increased markedly over recent years, and more so, as a consequence of the COVID-19 pandemic situation. Purchasing of products and services via online platforms has

become commonplace indeed (Kim & Ha, 2021). Retailers are now looking for new ways to enhance customers' shopping experiences by creating more exciting and interactive environments. We find that practically all businesses now offer products and services through their own websites and mobile applications. However, in terms of improving customer purchasing experiences, these web platforms have limitations. In comparison to VR, they are less immersive, do not promote customer interaction, and also the product representations are downsized to fit on a computer monitor/screen, thus making it difficult for consumers to effectively judge items (Kim et al., 2021). As a result, a new form of shopping environment based on emergent technologies like augmented reality, virtual reality, and mixed reality are growing in popularity (Vakulenko et al., 2019). Retailers may use VR technologies to provide more immersive shopping experiences to their consumers as they strive to build more successful and profitable businesses. Unfortunately, none of the currently accessible devices/platforms can give very accurate views of products. However, now 3D environments can reveal finer aspects of the objects displayed, such as the size, texture, and dimensions from various perspectives, allowing consumers to better picture these products in the actual world before making a purchasing decision (Kim & Ha, 2021). One example is eBay's collaboration with Myer, an Australian department store, to build a VR environment on eBay's website that allows customers to visually explore the retail setting (Team, 2016). Also, VR allows customers to experience the retail environment without having to go there (Jin et al., 2021) and to access products anytime since these have no set hours of operation, similar to e-commerce websites (Peukert et al., 2019).

According to Meißner et al. (2020), VR technology can provide various benefits when implemented in a retail context. The first of these is that in comparison to desktop settings, VR environments allow for more natural user interactions via gestures thereby improving user experiences (Bonetti et al., 2018). Wu, Luo, et al. (2019) created a user-defined gestures guide as a result of the experiments they conducted and compared them with virtual handle controller and ray casting. As a result, they found that user-defined motions outperformed the virtual handle controller and the ray-casting method. Second, Cowan and Ketron (2019) affirm that the VR environment provides new chances for user engagement and co-creation, which enterprises may employ to strengthen customer connections. Third, VR shopping might be used by marketing researchers to better understand and anticipate consumer behaviour in actual stores, for example, by testing sensory signals like lighting, colours, music or even scent in VR (Burke, 2018). Also, Zhao et al. (2021) proposed that in their study investigating the presence or absence of avatars as a key component of store atmosphere in a simulated retail setting. This

allows retailers to not only show more accurate, although simulated, three-dimensional renditions of advertised products and ranges, but also to position these things in a highly immersive VR store environment that can be tailored to a shopper's specific requirements and interests. Retailers might, leverage data from purchase records, customer surveys, or social media conversations to develop personalized shopping experiences that increase consumer interaction and, as a consequence, increase sales and store (Schnack, Wright, & Elms, 2021). Lastly, VR shopping has the ability to create more emotionally engaging consumer experiences during the purchasing process. Consequently, developing high-immersive VR shopping applications is promising, but the topic of how companies may effectively employ VR technology in a retail setting remains largely unsolved and needs further research (Grewal et al., 2017).

2.2.3 Research Objectives

Different purchasing channels provide different customer experiences and shopping behaviours [38]. For instance, whereas customers typically shopped from 9 am to 5 pm in traditional stores, they can now get anything they want online delivered straight to their homes the same day. Customers' responses to various stimuli vary throughout these encounters. Retail businesses have to consider any such differences, as they design separate scenarios to enhance customer experiences. Therefore, VR has become popular as a new shopping channel. This has provided researchers with new opportunities to investigate how VR interactions occur across different shopping channels.

This article aims to understand customer behaviours and experiences while interacting with iVR stores. The following two research questions (RQs) have been posed:

RQ1: What are the similarities and differences in customer shopping behaviours and variables that affect the customer experience for immersive virtual reality (iVR) shopping with other shopping channels (web and physical stores)?

RQ2: What are the similarities and differences of customer shopping behaviours and variables that affect the customer experience for fully immersive (high-immersive) virtual reality shopping with low-immersive or non-immersive virtual reality?

2.3 Literature Review Process

A literature review was conducted to gauge the current state-of-research for VR stores. The context of the study relates to VR shopping experiences. The following subsections elaborate on

our review strategy, which involved PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) (Shamseer et al., 2015) to provide a condensed and accurate view of this field of study.

2.3.1 Search Strategy, Search Terms and Eligibility Criteria

First, a search strategy was tailored to find the most relevant publications that have examined customer experience and behaviour in virtual shopping using VR technology. The primary database of material used in this study was Google Scholar. The initial search comprised phrases like 'Virtual Reality' and 'VR' to build a broad literature domain. To narrow the study domain, other terms, such as, 'store', 'supermarket', 'grocery', 'world', 'shopping', and 'retail' were used and we also created phrases with the term 'virtual'. The search phrases were constructed by combining the terms 'shopper', 'customer', and 'consumer' for the target audience and the words 'experience', and 'behaviour' for the desired behaviour in various combinations.

The criteria used to select articles for inclusion comprised: (a) all the search terms must be present in the title of the article (not only in the article body); (b) the article publication year must be within a specific range from 2008 - 2021; (c) the article must be written in the English language. Next, we checked for duplicates in the resulting dataset, and all duplicates were eliminated. Each article underwent a screening process to determine its eligibility against the inclusion criteria, and then full-text publications for those that fulfilled the criteria were again reviewed for their relevancy. Since we are primarily interested in shopper behaviour and experiences in retail markets, all papers that did not mention customer experiences or behaviours during some virtual shopping events were removed. Further, we added more eligibility criteria to make a more focused contribution. The criteria comprised: (a) the article must be an empirical or experimental study (as opposed to an essay, book review, letter, literature review, editorial, opinion, journalistic, or anecdotal article); (b) have focus on retail settings; (c) have investigated some immersive virtual reality context; and (d) have resulted in significant outcomes. If any of these elements were not addressed in the abstract, results or discussion parts of the paper, these articles were removed.

2.3.2 Study Selection

Snowball sampling (Lecy & Beatty, 2012) was used to identify more papers after the eligibility stage. After PRISMA, the snowballing was based on the preceding filtered findings. Google Scholar was used for both backward (reviewing the reference lists of included papers to identify

prior relevant work) and forward (checking newer papers that cited) snowballing. The criteria for inclusion and exclusion were the same as those used in the PRISMA framework.

We conducted two rounds of a thorough evaluation. The first round led to a total of 34 linked publications. These were reviewed one more time and only papers containing comparisons between different shopping channels (i.e., immersive virtual reality, web, and physical stores) were included for the purpose of answering the research questions. Finally, a total of 9 articles were confirmed to have met the eligibility criteria.

2.4 Findings

The findings from the 9 articles are described next in view of the research questions.

2.4.1 Addressing Research Question 1

We created a reliable data extraction procedure, which is described in the earlier section, to address this question. The literature analysis led to the conclusion that thirteen distinct consumer behaviours and variables affecting the customer experience have been compared in the context of iVR with online and physical (offline) retail environments as seen in the Figure 2.1.

The ‘X’ icon seen in the figures indicates that the channel was not compared in the specified research. On the other hand, the shopping experience was compared by specified studies in channels with circle icons. The size of the circle demonstrates that the behaviour or experience described in that channel is higher. If the size of the circle icons are the same, it means that there is no specific difference between the channels for the specified behaviour or experience. The same presentation applies to Figure 2.2.

	Immersive Virtual Reality (iVR)	Web	Physical Stores	Study
Purchase Intention	●	●	X	Park and Kim (2021)
	●	X	●	Martínez-Navarro et al. (2019)
Hedonic Shopping Value	●	●	X	Alzayat and Lee (2021)
Utilitarian Shopping Value	●	●	X	Alzayat and Lee (2021)
Perceived Informativeness	●	●	X	Kang et al (2020)
Perceived Playfulness	●	●	X	Kang et al (2020)
Information Seeking Behavior	●	X	●	Siegrist et al. (2019)
Perceived Telepresence	●	●	X	Schnack et al. (2019)
Usability	●	●	X	Schnack et al. (2019)
Emotions	●	X	●	Martínez-Navarro et al. (2019)
Affective Appraisals	●	X	●	Martínez-Navarro et al. (2019)
Sense of presence	●	X	●	Martínez-Navarro et al. (2019)
Discomfort	●	X	●	Martínez-Navarro et al. (2019)
Brand Recall	●	X	●	Martínez-Navarro et al. (2019)

Figure 2. 1 Comparison of shopping behaviours between VR, web, and physical stores.

Customer behaviour research in retail stores mainly focuses on identifying consumers and their purchasing habits. The goal of these investigations is to figure out who buys what, when, and how. Furthermore, such research aims to understand consumer reactions to sales promotion tools. The findings of these studies may be applied to a variety of marketing issues (Applebaum, 1951). In the context of this study, studies comparing different shopping channels and iVR were

examined. It was discovered that Siegrist et al. (2019) compared information seeking behaviour with physical stores and they found no noticeable differences between the two shopping channels on this specific behaviour. The consumer's inclination to purchase the product or service is known as their purchase intention and this metric is very important for retail businesses (Singla et al., 2022). Park and Kim (2021) compared the purchase intention for both browsing and searching conditions in iVR and the Web. The research demonstrated that for both conditions VR shopping was more effective than shopping on a regular website. Martínez-Navarro et al. (2019) also investigated purchase intention and found that there is a larger likelihood of making a purchase while using VR technology as compared to traditional in-person shopping.

Customer Experience is defined as the "customer's cognitive, emotional, behavioural, sensorial, and social responses to a firm's offerings during the customer's entire purchase journey" (Lemon & Verhoef, 2016). In order to lead to increased sales and performance, companies have to create and enhance a positive customer experience (Burke, 1997). To create a meaningful customer experience and keep purchases up in virtual reality stores, it is vital to acknowledge customers (Pleyers & Poncin, 2020). Within the scope of the study, studies comparing the variables that may affect the customer experience in different shopping channels were examined. The consumers' perceived informativeness, playfulness, telepresence, usability and hedonic shopping value in both iVR and web shopping channels were compared by different studies (Alzayat & Lee, 2021; Kang et al., 2020; Schnack et al., 2019). In the case of iVR, all values were higher. Additionally, iVR and real shop settings for discomfort and brand recall were evaluated, and similar findings were revealed (Martínez-Navarro et al., 2019). However, when the shopping experience is compared in iVR and web, the utilitarian value scores were greater for the web than the iVR condition (Alzayat & Lee, 2021). It was seen that emotions, affective appraisals and sense of presence were compared between iVR and physical shopping channels. In terms of how these variables affected the consumer experience, it was found that there was no discernible difference between the two channels (Martínez-Navarro et al., 2019).

2.4.2 Addressing Research Question 2

Our review further examined fully immersive and low-immersive virtual reality shopping experiences to gauge the similarities and differences in customer behaviours. Seven customer behaviours and variables affecting the customer experience were identified from the literature as seen in the Figure 2.2.

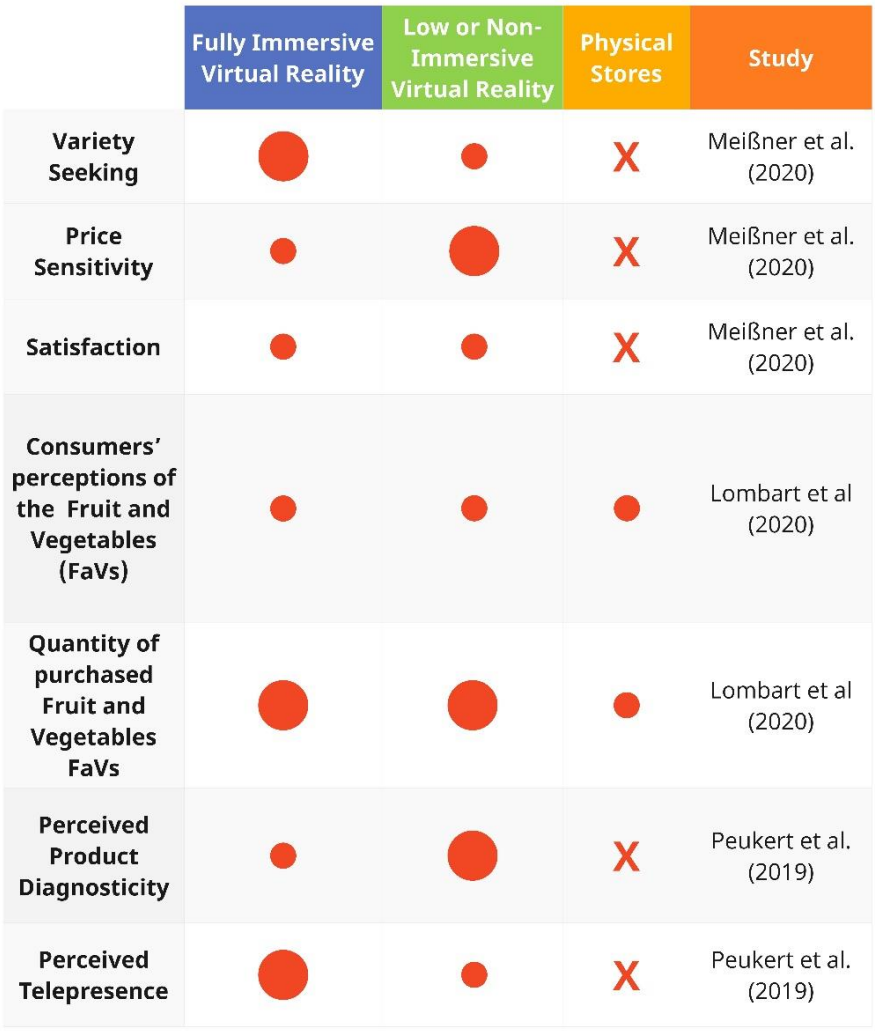

Figure 2. 2 Comparison of shopping behaviours between fully immersive VR, low or non-immersive VR, and physical stores.

When the different studies were examined in terms of behaviours, it was seen that the variety seeking behaviour was higher in the case of fully immersive virtual reality. On the other side, it was shown that price sensitivity was higher in low-immersive or non-immersive virtual reality (Meißner et al., 2020). Also, Lombart et al. (2020) compared iVR, non-immersive VR and physical shopping channels and found that consumers bought more fruits and vegetables (FaVs) in the two virtual stores (i.e., non-immersive and fully immersive) compared to the physical store [23].

Considering the variables that affect the customer experience, the satisfaction and customer perception of fruits and vegetables (FaVs) were not noticeably different in studies comparing fully immersive and low-immersive virtual reality shopping experiences (Lombart et al., 2020; Meißner et al., 2020). Although it was seen that perceived telepresence was higher in the case of fully-immersive virtual reality, perceived product diagnosticity was higher in low-immersive or non-immersive virtual reality (Peukert et al., 2019).

2.5 Discussion

The current study fills a gap in the literature by comparing the iVR shopping experience with web and physical shopping channels and providing a content analysis of other studies on VR usage for retail. The analysis and conclusions hold significant value for practitioners and academics; these demonstrate that, despite some difficulties, iVR may still be a valuable tool for enhancing retail shopping experience.

To begin with, the findings revealed that the immersive VR shopping experience was positively associated with key shopping outcomes such as quantity of purchased fruit and vegetables, and their purchase intention. In addition, many behaviours that could positively affect shopping outcomes were found to be better in the iVR shopping experience, such as hedonic shopping value, perceived informativeness, perceived playfulness, perceived, telepresence, usability and brand recall. By developing an iVR shopping experience, (Lau & Lee, 2019) investigated a correlation between customers' hedonic shopping experience and purchase intention. In their study, most participants characterised their hedonic purchasing experiences in iVR as creative, enjoyable, and exciting. Finally, they found that hedonic shopping experience had a positive effect on purchase intention. Furthermore, hedonic shopping value has a positive influence on customer satisfaction as well (Pizzi et al., 2019). Additionally, research has shown that perceived usefulness, perceived informativeness and playfulness positively influence attitudes towards VR and purchase intention (Han et al., 2020; Holdack & Lurie-Stoyanov, 2021; Kang et al., 2020; Kim et al., 2021). This shows that using VR as a new shopping technique may improve the engagement and experience of customers and increase shopping outcomes for retail businesses. From a practical perspective, companies can easily apply elements to their VR environment that will enable customers to enjoy more while shopping. Apart from this, they can improve the hedonic shopping experience of their customers with gamified marketing campaigns in iVR. Additionally, businesses may use VR to give customers better information. To improve customers' shopping experiences, retailers are always looking for new and improved ways to build exciting interactive environments. Today, practically all merchants offer goods

through their own websites and mobile applications in an effort to enhance the customer experience and build lasting relationships with their customers. However, there are restrictions on how much these platforms may improve the shopping experiences of consumers. Compared to VR, they are less immersive and lack consumer interaction, and because the product visuals are scaled down to fit on a monitor or screen, it is more challenging for customers to judge things effectively. Customers can precisely visualise the size, texture, and proportions of goods from multiple viewpoints in a 3D environment, improving their ability to visualise the products in the real world before making a purchase (Kim et al., 2021).

As a result of this literature review, variety-seeking and perceived telepresence behaviours were found to be higher in immersive virtual reality channel (Meißner et al., 2020; Peukert et al., 2019). It is known that telepresence positively affects perceived enjoyment, perceived playfulness, hedonic shopping value, attitude towards VR and purchase intention (Alzayat & Lee, 2021; Kim et al., 2021; Lau & Lee, 2019; Park & Kim, 2021). In contrast, price sensitivity was higher in low or non-immersive conditions [25]. Due to their low price sensitivity, shoppers may actually spend more money in an immersive shopping experience. Considering all these, it can be said that fully immersive technology creates more opportunities for retail companies.

Last but not least, creating a fully immersive virtual shopping environment requires using HMDs, which can increase discomfort in customers compared to other shopping channels. Although HMDs are less comfortable than other technologies, they offer richer experiences and give better customer responses. Additionally, it is known that discomfort has an impact on brand recall or presence (Martínez-Navarro et al., 2019). We recommend companies that want to create a fully immersive virtual reality shopping experience to consider this situation.

2.6 Conclusion

First, the link between various shopping channels and an immersive virtual reality shopping experience was investigated at in this literature review. Numerous variables that can assist the retail business, including purchase intention, perceived telepresence, and hedonic shopping value, have been found to be greater in the iVR experience. As a result, it was determined that immersive virtual reality technology may be a highly valuable tool for the retail industry, both as a channel for online shopping and as a method of monitoring customer experience.

Moreover, consumer behaviour in low-or non-immersive virtual reality was compared to fully immersive virtual reality. It was found that fully immersive virtual reality shopping can provide

customers with a more satisfying experience and can produce better outcomes for retail businesses.

Finally, it has been made clear that when contrasted to traditional buying channels, HMDs use generates immersive virtual reality that might make shoppers uncomfortable, and this should be considered when creating a virtual reality shopping experience.

This study compared experimental studies conducted to understand customer behaviour and experience. As a result, it seems that immersive VR store settings offer online businesses tremendous chances to design captivating online shopping experiences. However, there are still a number of touchpoints and consumer behaviours to research in order to create a meaningful customer experience. Based on the results of this study, academics can research unexplored customer behaviours in a virtual reality environment or examine the researched behaviours in depth. On the other hand, considering the results of this study, companies can better understand how customers behave in different sales channels and develop marketing strategies accordingly. In this way, they can improve the customer experience and establish long-term customer satisfaction and loyalty.

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CHAPTER 3

Creating a Customer Journey for Immersive Virtual Reality Shopping Environments: Investigating Customer Touchpoints And Purchase Phases

This study explores the development of a comprehensive customer journey framework within the context of immersive virtual reality (iVR) shopping environments. The research question focuses on recommending an effective customer journey that encompasses various touchpoints and purchase phases in iVR retail. A thorough literature review was conducted to identify existing touchpoints in the literature and to recognize additional touchpoints relevant to physical and online retail contexts. The findings led to the formulation of a novel customer journey framework specifically tailored for iVR shopping experiences. The framework emphasizes the integration of diverse touchpoints and purchase phases, enabling retail businesses to enhance customer experiences (CX) and make informed decisions. The practical implications of the customer journey framework lie in its ability to guide retail businesses in optimizing the customer experience in iVR environments. Furthermore, the study contributes to the theoretical discourse surrounding human-computer interaction and customer-centric design. By embracing this customer journey framework, businesses and researchers can collaborate to drive innovation and create more immersive and engaging iVR retail experiences. Overall, this study provides valuable insights and guidance for designing a comprehensive customer journey in the emerging domain of iVR shopping.

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3.1 Introduction

The retail industry has consistently sought to establish a memorable and personalized CX as a means of achieving sustainable competitive advantage (Grønholdt et al., 2015; Roy et al., 2017). Given that CX depend heavily on how businesses use technology (Foroudi et al., 2016), making it crucial for businesses to better understand how customers will engage with emerging technologies like virtual reality (VR) as they develop appropriate strategies. VR holds immense potential in revolutionizing the CX within the retail industry. By leveraging the immersive and interactive nature of VR, businesses can create virtual environments that closely replicate physical stores, allowing customers to explore and interact with products in a virtual space (Bonetti et al., 2018). Such simulations can provide customers with a unique and engaging shopping experience, surpassing the limitations of traditional online shopping (Moorhouse et al., 2018). Furthermore, VR enables businesses to personalize the shopping experience to an unprecedented level. Through VR, customers can virtually try on clothing and accessories (Meng et al., 2010), visualize home decor and furniture in their own spaces (Speicher et al., 2018), and even experience virtual product demonstrations (Lau & Lee, 2019). By providing customers with the ability to interact with products in a virtual environment, businesses can enhance customer engagement, reduce purchase uncertainties, and ultimately increase customer satisfaction (Lau & Lee, 2019; Meng et al., 2010; Speicher et al., 2018).

However, despite the growing popularity of VR, there is limited knowledge regarding its applications for marketing purposes. Hollebeek et al. (2020) recently proposed a framework that includes the customer journey as they encounter various phases of engagement within VR-based environments which defines their overall experience. While this research highlights different stages of the CX (i.e., pre-, intra- and post- VR interactions), more scholarly research is needed to synthesize this growing and complex field of study. Furthermore, CX has become increasingly crucial for organizational success due to its potential to enhance outcomes such as consumer loyalty (Pekovic & Rolland, 2020; Stein & Ramaseshan, 2020) and satisfaction (Domina et al., 2012; Pei et al., 2020). The wide range of CX articles across a wide range of disciplines have resulted in some understanding, however, there still remains a degree of fragmentation and theoretical ambiguity with no proper consensus on the definition of CX (Becker & Jaakkola, 2020). CX is often based on traditional shopping experiences, and common themes that emerge in the literature include concepts such as customer journey, touchpoints and purchase phases (Homburg et al., 2017; Lemon & Verhoef, 2016; Pekovic & Rolland, 2020; Verhoef et al., 2009; Voorhees et al., 2017). The customer journey (Grewal & Roggeveen, 2020;

Kuehnl et al., 2019) and touchpoints (Stein & Ramaseshan, 2020) are frequently studied in conjunction with the CX. With the increasing number and complexity of customer touchpoints, businesses need to consider multiple perspectives to build their relationship with the customer across all touchpoints and think of predictive metrics to measure CX. These in turn will result in improved overall performance.

Therefore, considering the diverse literature in VR shopping environments and further in the absence of comprehensive studies on CX, a systematic review has been undertaken to answer the following research question (RQ):

RQ: How can a comprehensive customer journey be recommended for an immersive virtual reality shopping environment?

The subsequent sections of this paper will review relevant literature on CX in the retail industry, explore the theoretical framework employed in the study, and present the methodology adopted. Furthermore, the findings of this research will be discussed, followed by the implications for businesses and recommendations for future research.

3.2 Theoretical Background

The advent of the Internet has witnessed remarkable advancements in the realm of online shopping, fostering convenience and accessibility for consumers (Kim & Ha, 2021). In recent years, the global outbreak of the COVID-19 pandemic, accompanied by widespread lockdown measures, has further accelerated the adoption of online platforms as primary channels for purchasing products and services (Adibfar et al., 2022; Jensen et al., 2021). As a result, retailers have increasingly recognized the need to augment customer shopping experiences by creating interactive environments that transcend the limitations of traditional online platforms (Billewar et al., 2022; Gilbert, 2021). Although these digital platforms have undoubtedly facilitated online transactions, they inherently exhibit certain limitations that impede the optimization of the CX. In contrast to VR environments, they exhibit lower levels of immersion, fail to facilitate meaningful consumer interaction, and present product representations that are often downsized to accommodate computer monitors or screens. Consequently, these factors pose challenges for consumers in accurately evaluating and assessing items, thereby hindering their ability to make informed decisions (Kim et al., 2021). The static nature of web interfaces and the confined interaction possibilities they offer can restrict customer engagement and diminish the overall shopping experience.

On the other hand, VR enables users to interact with artificially generated three-dimensional environments with the aim of creating more realistic environments that align with the real world (Biocca & Lanier, 1992; Blascovich et al., 2002). VR systems encompass three primary categories: immersive, semi-immersive, and non-immersive. Within these categories, iVR utilizes head-mounted displays that can provide high immersion and interactivity to create an immersive virtual experience (Meißner et al., 2020). In a recent investigation conducted by Erensoy et al. (2022), experimental studies were analyzed to assess the impact of different levels of immersion in VR on shopping experiences. The results of their analysis demonstrated a positive association between iVR shopping experiences and various significant shopping outcomes. This study investigates the retail sector, therefore, we have next examined CX in iVR shopping environments.

VR shopping has been shown to have the potential to create more emotionally engaging CX throughout the purchasing process. While it is currently challenging to replicate the emotional appeal of physical stores, VR shopping has been suggested as a way to engage customers more deeply throughout the purchasing process (Lau & Lee, 2019). Interactive marketing strategies that emphasize consumer interactivity and active customer involvement are seen as key to delivering unique and emotionally meaningful experiences (Kemp et al., 2021). By leveraging VR, retailers can provide an engaging shopping experience that is both memorable and enjoyable to customers. In immersive VR stores, research has shown that the perceived enjoyment of the shopping experience can positively influence attitudes towards VR (Holdack & Lurie-Stoyanov, 2021) , behavioural intention (Kim et al., 2021) and intention to reuse the shopping environment (Peukert et al., 2019). Retailers can use VR to create tailored, engaging experiences for customers, potentially increasing their intention to return to the store and make purchases (Erensoy et al., 2022).

3.3 Methodology

To comprehensively examine the existing body of literature in this field, our research proceeded with a systematic literature review following rigorous methodological guidelines. The aim was to gain insights from prior research publications pertaining to CX in virtual shopping utilizing iVR technology. To ensure precision and relevance, a tailored search strategy was devised for identifying pertinent research articles. The Scopus database was selected as the primary source, and appropriate eligibility criteria were established.

To ensure the accuracy and transparency of this systematic literature review, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) protocol was employed,

as recommended by Moher et al. (2009). This protocol acknowledges the iterative nature of the review process, which involves identifying, screening, determining eligibility, and critically appraising relevant research papers, while considering the diverse research methodologies and outcomes.

The literature search was confined to peer-reviewed articles published in journals and conference papers between 2013 and March 30th, 2023, within the Scopus database. The search string incorporated terms such as "virtual" or "VR," "reality," "shopping," "store," "retail," "customer," "consumer," "shopper," "behavior," and "experience." The inclusion criteria encompassed English-language publications, resulting in an initial pool of 1561 records meeting the specified criteria. Duplicate articles were subsequently removed, leaving 1555 unique articles. To refine the selection, a constrained snowball sampling approach, as described by Lecy and Beatty (2012), was employed to narrow down the articles to those of relevance.

Through this process, 1173 non-retail or non-specific VR studies that did not specifically examine consumer behavior were excluded. Following the screening process, 382 articles remained. However, further analysis involved excluding full-text articles that were non-experimental studies (n = 169), non-immersive studies (n = 153), or those that did not report any significant results and were overly general (n = 26). Ultimately, data synthesis resulted in the identification of 47 interconnected publications that specifically investigated the utilization of iVR technology in retail settings. These publications form the foundation for the subsequent analysis and discussion of our research findings.

3.4 Findings

The present review includes a comprehensive analysis of 47 publications. Prior to addressing the research questions at hand, it is pertinent to provide a comprehensive overview that includes general information regarding the reviewed publications in the iVR retail domain. This contextual background will help establish a solid foundation for the subsequent analysis. Furthermore, the examination of the research questions will be structured under three distinct headings within the CX section. This organizational framework ensures clarity and coherence in addressing the specific inquiries within this research context.

3.4.1Immersive Virtual Reality Retail

Table 3.1 presents a retail context of the various simulated shopping environments that were created using iVR technology. A significant number of the studies (n = 23), 48.94%, employed a

simulated supermarket, convenience store, or grocery store as the experimental setting in their iVR shopping environment. This may be due to the fact that supermarkets are a common type of retail establishment that many consumers are familiar with, making them an easily relatable and applicable context for research on VR and CX. Additionally, supermarkets offer a wide range of products and shopping experiences, making them a useful venue for studying various aspects of customer behavior and experience in a virtual environment.

Table 3. 1 Retail context of the various simulated shopping environments.

Retail Context	Study	%
Supermarket / Convenience store / Grocery Store	Arrazat et al. (2023), Alkarney and Almakki (2022), Attar et al. (2022), de-Magistris et al. (2022), Jacobsen et al. (2022), Khatri et al. (2022), Melendrez-Ruiz et al. (2022), Blom et al. (2021), Melendrez-Ruiz et al. (2021), Schnack, Wright and Elms (2021), Schnack, Wright and Holdershaw (2021), Fang et al. (2020), Han et al. (2020), Khatri et al. (2020), Lombart et al. (2020), Schnack et al. (2020), Lombart et al. (2019), Martínez-Navarro et al. (2019), Pizzi et al. (2019), Schnack et al. (2019), Siegrist et al. (2019), Verhulst et al. (2018), Verhulst et al. (2017)	48.94%
Retail Store /Shop	Bin Kim and Jung Choo (2023), Sina and Wu (2023), Chen et al. (2022), Fiorentino et al. (2022), Morotti et al. (2022), Alzayat and Lee (2021), Kim and Lee (2021), Loureiro et al. (2021), Park and Kim (2021), Kang et al. (2020), Morotti et al. (2020), Jang et al. (2019), Lau and Lee (2019), Wu et al. (2019), Park et al. (2018), Zhao et al. (2018), Lau et al. (2014)	36.17%
Product Shelves	Branca et al. (2023), Meißner et al. (2020), Peukert et al. (2019), Wölfel and Reinhardt (2019)	8.51%
Shop in Apartment	Holdack and Lurie-Stoyanov (2021), Speicher et al. (2018)	4.26%
Shopping Mall	Van Kerrebroeck et al. (2017)	2.13%

Furthermore, 36.17% of the studies (n = 17) in this review involved the creation of iVR stores or shops, with a focus on examining CX within these environments. Many of these virtual stores or shops were designed as apparel stores (n = 12), potentially because clothing is a widely purchased and essential consumer good, making virtual apparel stores a relatable and relevant context for studying customer behaviour and experience in iVR (Alzayat & Lee, 2021; Bin Kim & Jung Choo, 2023; Jang et al., 2019; Lau & Lee, 2019; Lau et al., 2014; Loureiro et al., 2021; Morotti et al., 2020; Morotti et al., 2022; Park & Kim, 2021; Park et al., 2018; Sina & Wu, 2023; Wu et al., 2019). Additionally, the fashion industry has a history of embracing new technologies, and VR may be seen as a tool for enhancing the apparel shopping experience. 4.26% of the studies (n = 2), the virtual retail setting was designed as a metaphor for a shop within an apartment. This design choice may have been made in order to create a more personalized and domestic shopping experience for the iVR environment. One study in this review featured the design of an iVR shopping mall environment.

3.4.2 Customer Experience in Immersive Virtual Reality

A review of the literature on CX reveals that three key concepts are commonly discussed across studies, these include customer journey (Følstad & Kvale, 2018; Hollebeek et al., 2020; Holmlund et al., 2020; Homburg et al., 2017; Hoyer et al., 2020; Kranzbühler et al., 2018; Kuehnl et al., 2019; Lemon & Verhoef, 2016), touchpoints (Becker & Jaakkola, 2020; Følstad & Kvale, 2018; Holmlund et al., 2020; Homburg et al., 2017; Kuehnl et al., 2019; Lemon & Verhoef, 2016; McColl-Kennedy et al., 2015; Stein & Ramaseshan, 2016) and purchase phases (Bueno et al., 2019; El Boudali et al., 2018; Følstad & Kvale, 2018; Grewal & Roggeveen, 2020; Hollebeek et al., 2020; Hoyer et al., 2020; Jain et al., 2017; Lemon & Verhoef, 2016; Stein & Ramaseshan, 2016). In this study, the aforementioned concepts are organized and presented under two distinct headings named customer journey & touchpoints and purchase phases.

3.4.2.1 Customer Journey and Touchpoints

The literature review of this study highlights the frequent examination of the customer journey and touchpoints in relation to the CX. As noted by Lemon and Verhoef (2016), the CX is a rapidly growing area of research, due to the growing number and complexity of customer touchpoints. The iterative and dynamic nature of the customer journey, with its numerous touchpoints and channels, presents opportunities for businesses to improve bottom-line performance by enhancing the CX at various stages. With customers becoming increasingly connected, aware, empowered and engaged, they are also becoming more involved in creating their own experiences and co-creating them with businesses. Hoyer et al. (2020) in their research underline the role of new technologies on the customer journey and suggest that VR can be a powerful tool to provide a better CX at every stage of the journey, from pre-purchase to post-purchase. Additionally, Becker and Jaakkola (2020) highlighted the importance of considering the impact of new technologies on the customer journey. In the studies reviewed in this research, the touchpoints considered in determining the layout of the store were identified through the textual descriptions or visual representations of the virtual store provided in the papers. In this research, the touchpoints were categorized into five main groups to enhance the comprehension of the customer journey. As seen in Table 3.2, these groups include touchpoints associated with shopping, communication, environment, display and social factors. The five categories of touchpoints were developed through thematic synthesis of reviewed literature. Each study identified various interaction moments within simulated retail environments, which were then coded and grouped according to their functional role in the customer experience.

These thematic groupings allowed for a structured comparison of how iVR-specific touchpoints map across different purchase phases.

Table 3. 2 Comprehensive overview of the touchpoints examined in the reviewed publications.

Shopping- Related Touchpoints	37.26%
Check-out counter / Cashier desk	Alkarney and Almakki (2022), Attar et al. (2022), de-Magistris et al. (2022), Jacobsen et al. (2022), Jacobsen et al. (2022), Schnack, Wright and Elms (2021), Schnack, Wright and Holdershaw (2021), Fang et al. (2020), Morotti et al. (2020), Schnack et al. (2020), Lau and Lee (2019), Lombart et al. (2019), Siegrist et al. (2019), Zhao et al. (2018), Verhulst et al. (2017)
Order page	Holdack and Lurie-Stoyanov (2021)
Product	Arrazat et al. (2023), Bin Kim and Jung Choo (2023), Branca et al. (2023), Sina and Wu (2023), Alkarney and Almakki (2022), Attar et al. (2022), Chen et al. (2022), de-Magistris et al. (2022), Fiorentino et al. (2022), Jacobsen et al. (2022), Khatri et al. (2022), Melendrez-Ruiz et al. (2022), Morotti et al. (2022), Alzayat and Lee (2021), Blom et al. (2021), Holdack and Lurie-Stoyanov (2021), Loureiro et al. (2021), Melendrez-Ruiz et al. (2021), Park and Kim (2021), Schnack, Wright and Elms (2021), Schnack, Wright and Holdershaw (2021), Fang et al. (2020), Kang et al. (2020), Han et al. (2020), Khatri et al. (2020), Lombart et al. (2020), Meißner et al. (2020), Morotti et al. (2020), Schnack et al. (2020), Jang et al. (2019), Lau and Lee (2019), Lombart et al. (2019), Martínez-Navarro et al. (2019), Peukert et al. (2019), Pizzi et al. (2019), Schnack et al. (2019), Siegrist et al. (2019), Wölfel and Reinhardt (2019), Wu et al. (2019), Park et al. (2018), Speicher et al. (2018), Verhulst et al. (2018), Zhao et al. (2018), Verhulst et al. (2017), Lau et al. (2014)
Shopping basket / Shopping cart	Arrazat et al. (2023), Alkarney and Almakki (2022), Attar et al. (2022), Blom et al. (2021), Schnack, Wright and Holdershaw (2021), Fang et al. (2020), Lombart et al. (2020), Morotti et al. (2020), Schnack et al. (2020), Lau and Lee (2019), Lombart et al. (2019), Schnack et al. (2019), Siegrist et al. (2019), Wu et al. (2019), Speicher et al. (2018), Verhulst et al. (2017)
Shopping list	Blom et al. (2021), Schnack et al. (2020), Lau and Lee (2019)
Communication- Related Touchpoints	19.34%
Attribute window	Wu et al. (2019)
Brand label	Wu et al. (2019)
Logo signage	Kim and Lee (2021)
Media screen	Kim and Lee (2021)
Price tag	Arrazat et al. (2023), Alkarney and Almakki (2022), Attar et al. (2022), de-Magistris et al. (2022), Jacobsen et al. (2022), Khatri et al. (2022), Alzayat and Lee (2021), Holdack and Lurie-Stoyanov (2021), Schnack, Wright and Holdershaw (2021), Fang et al. (2020), Khatri et al. (2020), Lombart et al. (2020), Meißner et al. (2020), Schnack et al. (2020), Lau and Lee (2019), Lombart et al. (2019), Peukert et al. (2019), Pizzi et al. (2019), Wu et al. (2019), Speicher et al. (2018), Zhao et al. (2018), Verhulst et al. (2017)
Product informations label	Arrazat et al. (2023), Alkarney and Almakki (2022), Attar et al. (2022), de-Magistris et al. (2022), Jacobsen et al. (2022), Alzayat and Lee (2021), Holdack and Lurie-Stoyanov (2021), Fang et al. (2020), Lombart et al. (2020), Morotti et al. (2020), Jang et al. (2019), Lau and Lee (2019), Siegrist et al. (2019), Speicher et al. (2018)
Wishlist	Holdack and Lurie-Stoyanov (2021)
Environment-Related Touchpoints	20.28%

Ceiling	Fiorentino et al. (2022), Kim and Lee (2021)
Changeable visual features	Lau and Lee (2019)
Entrance / Exit	Jacobsen et al. (2022), Fang et al. (2020), Jang et al. (2019), Lombart et al. (2019), Park et al. (2018), Zhao et al. (2018), Verhulst et al. (2017)
Facade	Kim and Lee (2021)
Floor / Aisles	de-Magistris et al. (2022), Jacobsen et al. (2022), Khatri et al. (2022), Morotti et al. (2022), Kim and Lee (2021), Loureiro et al. (2021), Schnack, Wright and Holdershaw (2021), Pizzi et al. (2019), Schnack et al. (2019), Siegrist et al. (2019), Zhao et al. (2018)
Greenery	Sina and Wu (2023)
Lighting	Chen et al. (2022), Lau and Lee (2019), Pizzi et al. (2019)
Mirror	Sina and Wu (2023), Verhulst et al. (2018)
Music / Background noise	Jacobsen et al. (2022), Loureiro et al. (2021), Lau and Lee (2019), Zhao et al. (2018), Van Kerrebroeck et al. (2017)
Spaces	Pizzi et al. (2019)
Store decoration	Holdack and Lurie-Stoyanov (2021)
Surrounding	Wölfel and Reinhardt (2019), Van Kerrebroeck et al. (2017)
Wall	Fiorentino et al. (2022), Morotti et al. (2022), Kim and Lee (2021), Loureiro et al. (2021)
Window	Alkarney and Almakki (2022), Verhulst et al. (2018)
Display-Related Touchpoints	19.34%
Product List / Catalog	Attar et al. (2022), Fiorentino et al. (2022), Kang et al. (2020)
Coffee table	Sina and Wu (2023)
Display table	Kim and Lee (2021)
Fridges and frezeer	Schnack, Wright and Holdershaw (2021)
Magazine rack	Schnack, Wright and Holdershaw (2021)
Mannequin	Morotti et al. (2022)
Prop	Kim and Lee (2021)
Seating / Couch	Kim and Lee (2021), Sina and Wu (2023)
Shelves	Arrazat et al. (2023), Sina and Wu (2023), Alkarney and Almakki (2022), Attar et al. (2022), de-Magistris et al. (2022), Jacobsen et al. (2022), Khatri et al. (2022), Melendrez-Ruiz et al. (2022), Morotti et al. (2022), Alzayat and Lee (2021), Loureiro et al. (2021), Melendrez-Ruiz et al. (2021), Schnack, Wright and Elms (2021), Schnack, Wright and Holdershaw (2021), Khatri et al. (2020), Meißner et al. (2020), Morotti et al. (2020), Schnack et al. (2020), Lombart et al. (2019), Peukert et al. (2019), Pizzi et al. (2019), Schnack et al. (2019), Siegrist et al. (2019), Wölfel and Reinhardt (2019), Verhulst et al. (2018), Zhao et al. (2018), Verhulst et al. (2017)
TV	Sina and Wu (2023), Verhulst et al. (2018)
Wall fixture	Kim and Lee (2021)
Social-Related Touchpoints	3.77%
Other customers	Jacobsen et al. (2022)
Visual assistant/ Staff / Cashier	Jacobsen et al. (2022), Morotti et al. (2022), Schnack, Wright and Holdershaw (2021), Lombart et al. (2020), Morotti et al. (2020), Schnack et al. (2020), Zhao et al. (2018)

In the context of this research, shopping-related touchpoints encompass the various touchpoints that CX while engaging in the act of shopping, such as interacting with the check-out counter, order page, browsing and purchasing products, utilizing a shopping basket, and creating a shopping list. These touchpoints play a significant role in determining the customer's overall experience and can greatly influence their perception of the business. The research reviewed in this study consistently emphasized the design of products (n = 45), as would be expected in a retail setting. Among the touchpoints discussed, the check-out counter (n = 15) and shopping-related items such as shopping carts and baskets (n = 16) were frequently noted. Additionally, a small number of studies also included the design of a shopping list as a touchpoint (n = 3). The findings of this study indicate that, to date, iVR shopping experiences have primarily been modelled after real-world retail environments.

In this study, communication-related touchpoints refer to the various points of interaction or engagement between a customer and a business that involve the exchange of information. These touchpoints include, but are not limited to, attribute windows, brand labels, logo signage, media screens, price tags, product information labels and wishlists. The research reviewed in this study indicates that there was a notable emphasis on the price tags (n = 22) and product information labels (n = 14) as compared to other communication-related touchpoints. Designing price tags and product information labels is important in iVR shopping environments because it allows customers to easily access and understand the necessary information about the products they are considering purchasing. This can greatly impact the customer's perception of the business by providing them with clear and accurate information, which can help to increase trust in the business and ultimately lead to higher sales. Additionally, the proper design of these touchpoints can also help to improve the overall CX by making the shopping process more efficient and user-friendly.

Environment-related touchpoints refer in this study to the various physical elements or design features of the store that a customer interacts with and that can affect their experience, such as the ceiling, changeable visual features, entrance and exit, facade, floor, greenery, lighting, mirror, music, spaces, store decoration, surrounding, wall and window. The studies reviewed in this research have approached the concept of store design in different ways. Some have considered it as a general touchpoint, while others have examined specific design elements individually. Among these elements, floor and aisles (n = 11) and entry/exit (n = 7) were found to be the most commonly mentioned in the studies reviewed. The flooring in a store can greatly affect the level of comfort and safety customers feel, while the entry/exit point is often the first and last impression customers have of the store.

Display-related touchpoints refer in this study to the various points of interaction or engagement that a customer has with a business that involve the presentation or display of products or information, such as display tables, fridges and freezers, magazine racks, props, seating, shelves, TV's and wall fixtures. The manner in which products are presented and displayed can greatly influence a customer's decision-making process and ultimately their satisfaction with their purchase. These touchpoints are important to consider when designing and managing a iVR shopping environment. In the studies reviewed, shelves (n=27) were found to be one of the most frequently mentioned touchpoints in the context of VR shopping. The importance of shelf positioning in retail is demonstrated in the literature reviewed in this study, where it was frequently mentioned as a key touchpoint. The concept of "shelves" should not be confined to the traditional shopping context alone. Instead, it is imperative to adopt a broader perspective that encompasses the diverse ways in which products are presented to customers. Recognizing the significance of this factor is vital in understanding the overall CX and optimizing retail environments. By appreciating the multifaceted nature of product presentation, retailers can strategically design and arrange their displays to engage and captivate customers, ultimately enhancing their satisfaction and fostering stronger connections between consumers and the showcased merchandise. By making products more visible and accessible to customers, the likelihood of them being purchased is increased. Additionally, thoughtful placement of products can also enhance the aesthetic appeal of the store, thus contributing to the overall CX.

Social touchpoints refer to individuals with whom customers engage socially during their shopping experience. Extensive literature review highlights the significant influence of visual assistants or cashiers as key factors that garner considerable attention (n=7). However, limited research has explored the inclusion of simulated fellow customers, like non-player characters (NPCs) in games, within iVR shopping environments. Shopping, being inherently social in nature, can benefit from the presence of other customers, whether they are computer-generated entities or real individuals, in order to enhance the overall shopping experience. This can provide shoppers with a sense of comfort and familiarity, especially when accompanied by their friends or social groups, thereby potentially elevating customer satisfaction and enriching their interactions with the retail environment.

3.4.4.2 Purchase Phases

The CX is often divided into phases in literature, similar to the customer's decision-making process during the purchase. Researchers such as Lemon and Verhoef (2016) have separated the customer journey into pre-purchase, purchase and post-purchase stages, while Følstad and

Kvale (2018) have defined it as pre-service, service and post-service in the context of tourism. Grewal and Roggeveen (2020) proposed that the purchasing process is composed of three stages that combine technology, branding and the human factor. They evaluated each stage by considering cognitions, emotions and behaviours. Many studies on iVR shopping have also developed similar classifications, with Hollebeek et al. (2020) grouping the customer journey as pre-VR, intra-VR and post-VR experience, and Hoyer et al. (2020) classifying it as pre-transaction, transaction and post-transaction. The literature on CX and touchpoints has consistently presented a similar categorization of the customer journey, dividing it into distinct stages such as pre-purchase, purchase, and post-purchase. This study aligns with this framework, with the purchase phases covered by the studies included being grouped accordingly. The works of Lemon and Verhoef (2016) have been used as a reference for this categorization. Table 3.3 provides a comprehensive overview of the purchase phases examined in the reviewed publications.

Table 3. 3 Comprehensive overview of the purchase phases examined in the reviewed publications.

Purchase Phase	Study	%
Pre-purchase	Arrazat et al. (2023), Bin Kim and Jung Choo (2023), Branca et al. (2023), Sina and Wu (2023), Alkarney and Almakki (2022),Attar et al. (2022), Chen et al. (2022),de-Magistris et al. (2022), Fiorentino et al. (2022), Jacobsen et al. (2022), Khatri et al. (2022), Melendrez-Ruiz et al. (2022), Morotti et al. (2022), Alzayat and Lee (2021), Blom et al. (2021), Holdack and Lurie-Stoyanov, (2021), Kim and Lee (2021), Loureiro et al. (2021), Melendrez-Ruiz et al. (2021), Park and Kim (2021), Schnack, Wright and Elms (2021), Schnack, Wright and Holdershaw (2021), Fang et al. (2020), Han et al. (2020),Kang et al. (2020), Khatri et al. (2020), Lombart et al. (2020), Meißner et al. (2020), Morotti et al. (2020), Schnack et al. (2020), Jang et al. (2019), Lau and Lee (2019), Lombart et al. (2019), Martínez-Navarro et al. (2019), Peukert et al. (2019), Pizzi et al. (2019), Schnack et al. (2019), Siegrist et al. (2019), Wölfel and Reinhardt (2019), Wu et al. (2019), Park et al. (2018), Speicher et al. (2018), Verhulst et al. (2018), Zhao et al. (2018), Van Kerrebroeck et al. (2017), Verhulst et al. (2017), Lau et al. (2014)	54.88
Purchase	Alkarney and Almakki (2022), Attar et al. (2022), Chen et al. (2022), de-Magistris et al. (2022), Jacobsen et al. (2022), Khatri et al. (2022), Blom et al. (2021), Holdack and Lurie-Stoyanov (2021), Loureiro et al. (2021), Schnack, Wright and Elms (2021), Schnack, Wright and Holdershaw (2021), Fang et al. (2020), Kang et al. (2020), Khatri et al. (2020), Lombart et al. (2020), Meißner et al. (2020), Morotti et al. (2020), Lau and Lee (2019), Lombart et al. (2019), Martínez-Navarro et al. (2019), Pizzi et al. (2019), Schnack et al. (2019), Siegrist et al. (2019), Verhulst et al. (2018), Zhao et al. (2018), Van Kerrebroeck et al. (2017), Verhulst et al. (2017)	31.71
Post-purchase	Alkarney and Almakki (2022), Chen et al. (2022), Morotti et al. (2022), Holdack and Lurie-Stoyanov (2021), Kang et al. (2020), Lombart et al. (2020), Schnack et al. (2020), Martínez-Navarro et al. (2019), Pizzi et al. (2019), Zhao et al. (2018), Van Kerrebroeck et al. (2017)	13.41

The majority of the literature reviewed in the current study pertains to the CX during the pre-purchase phase, as evidenced by a total of 45 studies that were examined. This is not surprising

given that customers' behavior during this phase has a significant impact on the purchase and post-purchase phases.

Additionally, a number of studies were also reviewed in the context of the purchase phase (n = 26). The purchase period refers to the phase in which customers make a decision to buy a product or service. This phase is characterized by the customer's evaluation of different options, negotiation of terms, and final decision to make a purchase. During this phase, retailers can use various techniques such as sales promotions, discounts, and special offers to encourage customers to make a purchase.

The post-purchase period refers to the phase that starts after a customer has made a purchase and continues until the customer's next purchase. This phase is critical for retailers as it can have a significant impact on customer loyalty and repeat business. During this phase, retailers can use various techniques such as follow-up emails, surveys, and customer service to ensure customer satisfaction and gather feedback. Additionally, retailers can use this phase to gather information about customer's usage of the product or service, which can be used to identify new opportunities for product development, marketing, and sales. Furthermore, this phase can be used to build a sense of loyalty and brand advocacy by providing excellent customer service, follow-up and after-sales support. However, comparatively fewer studies have been conducted on the post-purchase phase, with a total of only 11 studies being examined. There could be several reasons for the relatively limited number of studies conducted on the post-purchase phase. One reason may be that the post-purchase phase is more difficult to study than the pre-purchase and purchase phases. The post-purchase phase is typically characterized by a lack of customer engagement and interaction, making it challenging to gather data and observe customer behaviour. Additionally, the post-purchase phase is often perceived as less important than the pre-purchase and purchase phases, which may lead to less research being conducted in this area. Another reason could be the focus of the current research on the use of technology, big data, analytics, which are more relevant to the pre-purchase and purchase phase. Retailers and researchers may be more interested in understanding how technology can be used to influence customer behaviour during these phases, rather than in the post-purchase phase. Finally, a lack of understanding of the importance of post-purchase phase and its effects on customer loyalty and repeat business may lead to less research being conducted in this area. Retailers may not realize the importance of post-purchase phase and how it can be used to drive repeat business and increase customer loyalty, leading to less research in this area.

3.4.2.3 Suggested Touchpoints

In addition to the touchpoints identified within the existing literature, this study recognizes the significance of touchpoints that have demonstrated importance in physical and online retail contexts. While these touchpoints were not specifically addressed in the analyzed publications, their relevance has been acknowledged through an examination of physical and online shopping dynamics. By incorporating insights from these established retail domains, this study expands the understanding of touchpoints and their role within the overall customer journey framework.

When considering shopping-related touchpoints, particular attention should be given to the design of the payment page, ensuring its effectiveness in facilitating seamless transactions and building customer trust. A well-crafted payment page should offer diverse payment methods and shipping options to cater to individual customer preferences (Liang & Lai, 2002; Saleem et al., 2019). Furthermore, the strategic implementation of promotions holds significant importance. Incorporating limited-time offers (Soni & Koshy, 2016; Sugden et al., 2019) and personalized discounts (Pizzi et al., 2022; Strycharz et al., 2019; Zhao et al., 2015) have been demonstrated to exert a positive influence on customer behavior, leading to desirable shopping outcomes. In the evaluation of communication-related factors, the significance of the first impression holds true across various shopping channels. In online shopping, the initial encounter with a welcoming and trustworthy home page contributes to a superior CX and promotes increased engagement (Flavian et al., 2009; Garett et al., 2016). Making a good first impression is essential in iVR retail settings too. Due to the novelty of iVR, particular consideration should be paid to the onboarding procedure so that users can rapidly adjust and feel comfortable in the virtual setting. For the purpose of encouraging user adoption, facilitating navigation, and boosting user confidence, thoughtful onboarding tactics are crucial (Chauvergne et al., 2023). By prioritizing the onboarding experience, retailers can effectively enhance user satisfaction and maximize engagement in the evolving realm of iVR retail. Following a shopping experience, user-generated reviews and ratings have been demonstrated to have a considerable impact on the willingness of customers to buy products online (He et al., 2020; Liu et al., 2013; Stouthuysen et al., 2018). This touchpoint is extremely significant in the world of online purchasing since it gives potential customers access to important information. A crucial element that regularly appears in both offline and online purchasing situations is individuals' propensity to promote a product or an online merchant to their friends or acquaintances named net promoter score (NPS). This recommendation component, which indicates societal approval and dependability, plays an essential role in creating better CX (Eger

& Mičík, 2017). When display-related touchpoints are investigated in retail content, it is seen that the most customized recomendations and the development of the search engine positively affect the CX (Lee & Kwon, 2008; Liang & Lai, 2002; Yoon et al., 2013). The facilitation of essential social interactions, such as keeping friend lists (Grange et al., 2019) and sharing experiences with others, should receive a lot of attention in the context of social-related touchpoints since these activities promote a feeling of community. Additionally, offering consumers membership options (Lee et al., 2018) and letting them design unique avatars (Freeman & Maloney, 2021; Freeman et al., 2020) helps them feel exclusive and in control, which improves customer engagement. Together, these elements provide a stronger sense of engagement and connection. Implementing loyalty programmes promotes continuous involvement and long-term client loyalty, further strengthening this engagement. Retailers may build a thriving and active consumer base by comprehending the significance of these social touchpoints and carefully integrating them into the shopping experience.

By carefully considering and optimizing these touchpoints, retailers can enhance the overall shopping experience, encourage customer satisfaction, and foster long-term customer loyalty in iVR retail environments as well. Considering environment-related touchpoints, it is noteworthy that similar touchpoints have been identified and extensively explored within the existing research. As a result, it is not recommended to introduce new or distinct touchpoints in this category. The identified touchpoints in previous studies sufficiently cover the environmental aspects relevant to the retail context.

3.5 Discussion

To address the research question at hand, an extensive analysis of experimental studies within the literature was conducted, focusing on CX and behavior in iVR retail environments. Specifically, the investigation aimed to identify the prevailing retail contexts explored in these studies. This analysis holds crucial importance in gauging the inclusiveness of the proposed customer journey framework. As seen in Table 3.1, findings revealed that a significant majority, accounting for 85.11% of the examined research, centered around supermarkets and traditional retail stores. The remaining 14.89% delved into CX related to product shelves, shopping within apartments, and shopping malls. Consequently, the recommended customer journey framework is expected to be most applicable and accurate for individual iVR retail stores. However, it is worth noting that there remains a limited body of research available to establish comprehensive customer journeys and identify touchpoints within shopping malls and shop-in-apartment settings.

As indicated in Table 3.2, the initial analysis involved the identification and categorization of touchpoints incorporated in the iVR environments across the examined publications. This systematic process allowed for a comprehensive understanding of the touchpoints present within these studies, which were subsequently classified based on their content. Additionally, touchpoints that were deemed significant in physical and online retail contexts, yet were not specifically addressed in the analyzed publications, were also identified. These touchpoints were subsequently categorized using the same classification for the existing touchpoints. This comprehensive approach ensured consistency and comparability between the established touchpoints from the reviewed literature and the additional touchpoints identified for potential relevance within the iVR retail context.

Figure 3.1 presents a comprehensive overview of touchpoints examined in experimental studies within the literature, as well as additional touchpoint suggestions, which have been collated and organized into broader categories. Notably, touchpoints such as ceiling, façade, floor, spaces, surrounding, and wall, all fall under the category of store design, emphasizing their interconnectedness and relevance to the overall retail environment. By consolidating these touchpoints under cohesive categories, the figure provides a visual representation of the various elements that contribute to the CX. This categorization facilitates a holistic understanding of the diverse touchpoints within the retail setting, enabling researchers and practitioners to identify key areas for investigation and optimization.

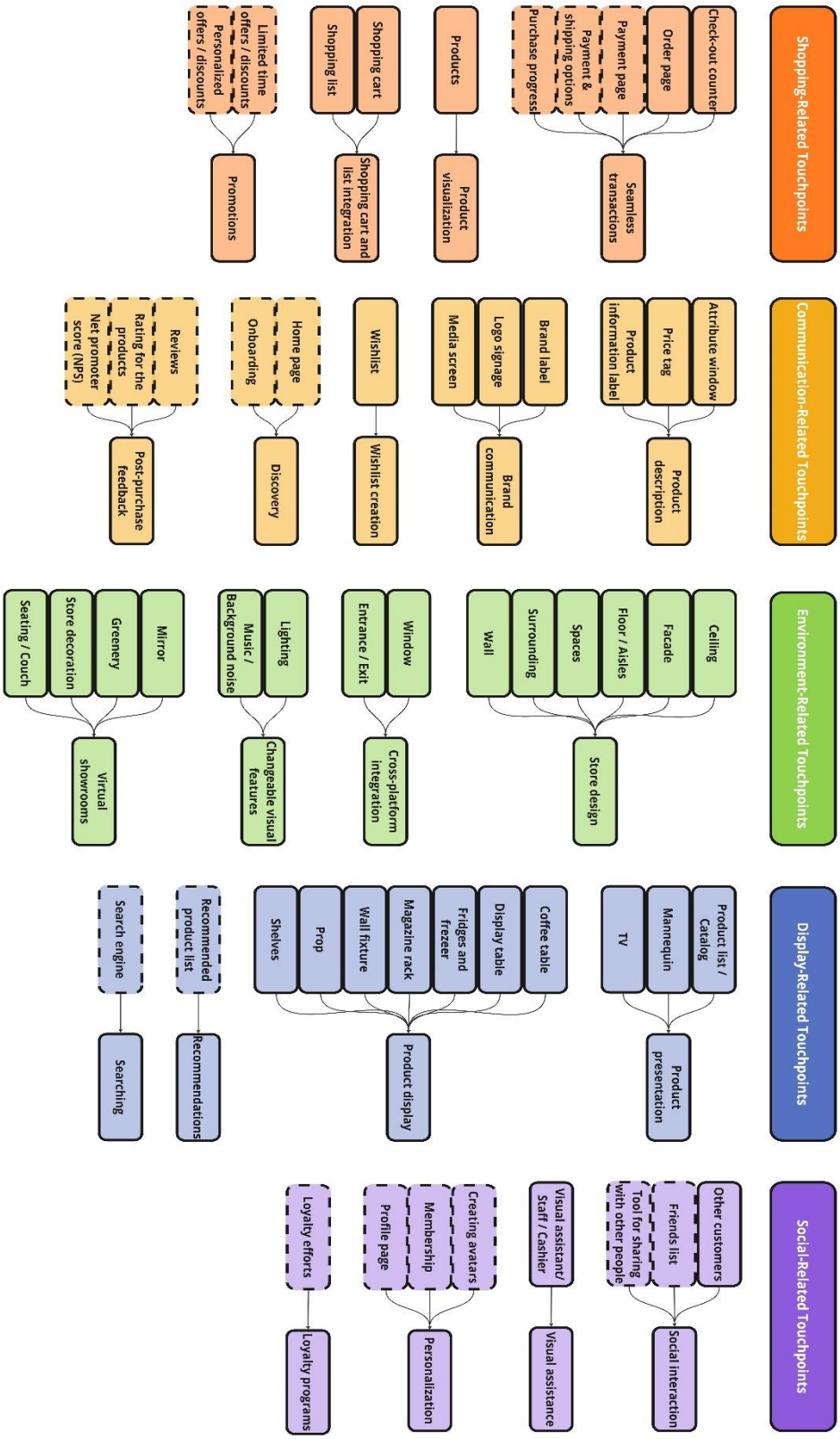

Figure 3. 1 Comprehensive overview of touchpoints examined in experimental studies within the literature, as well as additional touchpoint suggestions.

To create a comprehensive customer journey in iVR shopping environments, the identified touchpoints are further organized into distinct phases: pre-purchase, purchase, and post-purchase. This grouping enables a structured framework that aligns with the sequential stages of the customer's shopping journey as seen in Figure 3.2.

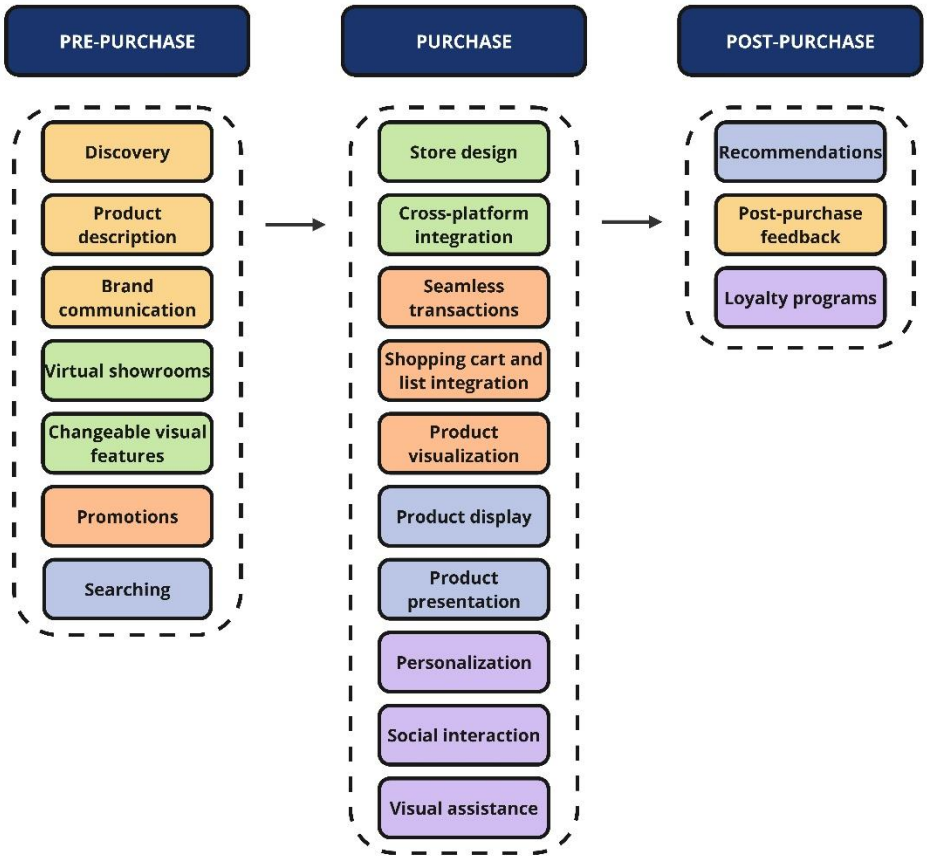

Figure 3. 2 Customer journey framework for immersive virtual reality shopping environments.

By associating touchpoints with specific phases, researchers and practitioners can gain valuable insights into the different interactions and experiences that customers encounter at each stage. This customer-centric approach allows for a more nuanced understanding of the iVR shopping experience, facilitating targeted improvements and optimizations to enhance customer satisfaction and engagement throughout the entire shopping process.

3.6 Limitations and Future Research

This study presents a novel customer journey framework in iVR shopping environments, encompassing diverse touchpoints and purchase phases. However, it is important to acknowledge certain limitations within this research. Firstly, while the majority of customer touchpoints have been derived from experimental studies in the literature, the study does not

provide specific design guidelines for the suggested touchpoints in iVR environments. Further exploration is needed to understand the optimal design considerations for these additional touchpoints in the iVR context. Secondly, the study acknowledges a lack of information regarding the relative importance of the touchpoints identified within the purchase phases. Additional experimental studies are required to gain deeper insights into the significance and impact of these touchpoints on the respective purchase phases. Addressing these limitations through further research endeavors will contribute to a more comprehensive understanding of the design and significance of touchpoints in iVR shopping environments.

In light of the findings of this study and the identified areas of research deficiency, a future research agenda has been established to provide a direction for future studies in this field.

- Further exploration is needed to delve into the specific design elements, user interface considerations, and interactive features that would maximize the effectiveness and UX of these touchpoints in the iVR environment. Conducting empirical studies, user testing, and iterative design processes can help uncover insights and guidelines for effectively incorporating these touchpoints into the iVR shopping experience. By addressing this research gap, researchers and practitioners can contribute to the development of more immersive and engaging iVR retail environments that enhance customer satisfaction and drive positive outcomes.
- The majority of the studies reviewed in this study pertain to the retail context of supermarkets, convenience stores and grocery stores. Though other retail stores were also included, further research is needed to fully capture the diversity of this category. Notably, only one study was identified that pertained to VR shopping centres. Future studies could benefit from investigating different retail contexts, allowing for the comparison of results with previous research in order to gain a more comprehensive understanding of CX across various retail settings.
- The touchpoints identified in this study have not been directly examined in relation to their impact on CX. Investigating the effects of these touchpoints on CX within the customer journey is a crucial area of research that remains to be explored.
- The majority of the research reviewed in this study has focused on the CX in the pre-purchase and purchase phases. However, the post-purchase phase holds a significant place in the customer journey and requires further investigation. Conducting further research on this subject and utilizing diverse research methods in addition to questionnaires may reveal important insights for the literature.

- The CX encompasses various dimensions, each of which is equally important. The majority of studies reviewed in this study have focused on the cognitive and emotional dimensions. However, the sensorial, behavioural and social dimensions, which are essential components of the CX, have not been sufficiently examined. Further research is required in these areas to gain a comprehensive understanding of CX and to create a meaningful experience in VR shopping environments.

3.7 Conclusion

This study presents a novel customer journey framework tailored specifically for iVR shopping environments, incorporating diverse touchpoints and purchase phases. In conclusion, the customer journey framework presented in this study has both practical and theoretical implications. It empowers retail businesses to optimize the CX, while also contributing to the broader academic discourse surrounding human-computer interaction and customer-centric design. By embracing this customer journey framework, businesses and researchers can collaboratively drive innovation and create more immersive and engaging iVR retail experiences.

3.7.1 Managerial Implications

The managerial implications of this framework provide valuable insights for retail businesses, enabling them to better understand customer behavior and decision-making processes. By leveraging this understanding, businesses can make informed decisions to enhance the overall CX. Furthermore, this framework offers guidance to UX and VR designers, highlighting key areas of focus when designing immersive experiences for customers.

3.7.2 Theoretical Implications

The theoretical contributions of this study are twofold. Firstly, by integrating customer touchpoints and purchase phases, it bridges a significant gap in the existing literature, presenting a comprehensive customer journey specific to the iVR context. This framework contributes to the theoretical understanding of CX by illustrating the interplay between various components within the customer journey. Secondly, the identified research gaps shed light on promising avenues for future studies in areas such as human-computer interaction, user-centered design, and CX. This study serves as a roadmap for researchers, providing direction for further investigations to enhance the understanding and application of customer journeys in iVR settings.

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CHAPTER 4

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

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.

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4.1 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 (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.

4.2 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).

4.2.1 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.

4.2.2 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 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.

4.3 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 4.1.

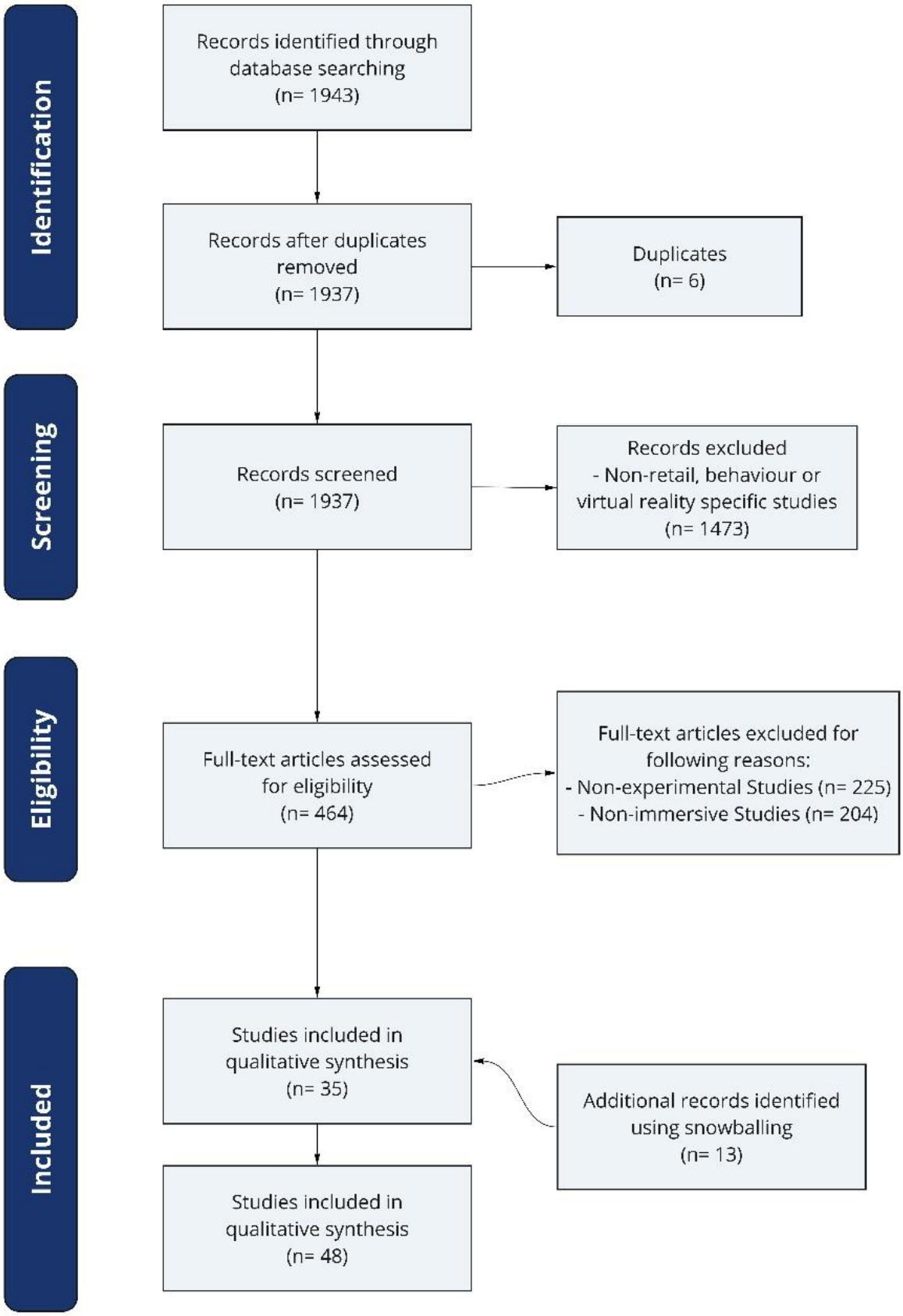

Figure 4. 1 Study selection procedure.

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 4.1 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).

4.1 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 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.

4.4.1Thematic 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 4.2 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 revisitations of the data.

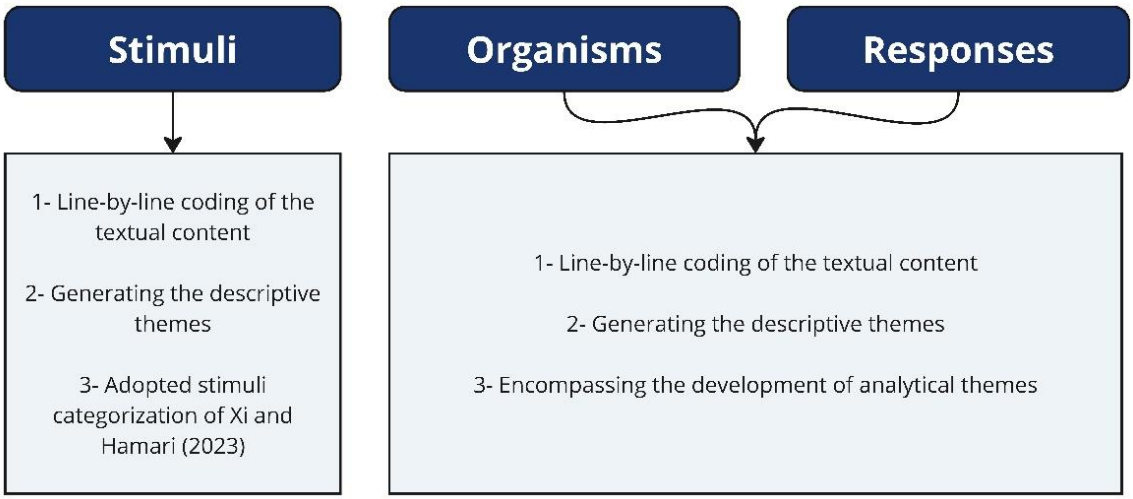

Figure 4. 2 Thematic analysis procedure of the stimuli, organisms and responses.

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.

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

In Figure 4.3, 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.

Figure 4. 3 Illustration of line-by-line coding of stimuli, organisms, and responses.

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.

4.4.1.2 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.

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.

4.4.1.3 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 4.1–4.3 (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 4.1.

Table 4.1 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 4. 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

Organisms

By carefully analyzing various descriptive themes, we identified three main analytical themes related to organisms, which are: (1) cognitive; (2) emotional; and (3) perceptional 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 4.2 provides a detailed breakdown of analytical themes along with the descriptive themes they incorporate.

Table 4.2 indicates that the most thoroughly examined analytical theme for organisms was perceptional, 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%.

Table 4. 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	Perceptional	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

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 “Perceptional 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 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; Gulfraz 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 4.3 offers a

comprehensive breakdown of analytical themes alongside the descriptive themes they encompass.

Table 4. 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, 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

Table 4.3 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 4.4 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. 4 Stimuli, organisms and responses in iVR shopping.

4.5 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 4.4–4.6 provide a comprehensive overview of the impact on consumer behavior in iVR shopping environments, consolidating insights from the examined papers.

4.5.1 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 4.4 provides a summary of the findings of consumer behavior according to these descriptive themes.

Table 4. 4 Overview of consumer behavior related to buying and transactions.

Descriptive themes	Consumer behavior - Buying and Transactions
Impulsive shopping behavior	- People tend to make more unplanned purchases when shopping in immersive and vivid iVR shopping environments (Chen et al., 2022; Schnack, Wright, & Elms, 2021). - Shoppers, particularly drawn to private-label brands, demonstrate a consistent tendency for unplanned purchases (Schnack et al., 2020). - 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) - Teleportation within the VR space doesn't seem to affect how often people make impulse purchases (Schnack, Wright, & Elms, 2021).
Product choice behavior	- Consumers easily navigate food selection in iVR stores with user-friendly features (Attar et al., 2022). - In highly immersive VR environments, consumers tend to explore a wider array of products (Meißner et al., 2020). - 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). - The inclusion of front-of-pack environmental labels in iVR shopping raises consumer awareness and motivates eco-friendly food choices (Arrazat et al., 2023). - Consistent nudges for healthy food choices influence consumers to make healthier selections, regardless of their conscious awareness of the nudges (Blom et al., 2021).
Purchase behavior	- Consumers' personalities don't have a significant impact on shopping metrics (Schnack, Wright, & Elms, 2021). - 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). - This sense of being there also helps them remember the brand more (Martínez-Navarro et al., 2019) - 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 & Lee, 2019; Martínez-Navarro et al., 2019). - Putting similar products together makes consumers more likely to want to buy them (Wölfel & Reinhardt, 2019). - Whether you're shopping in real life or virtually doesn't affect how willing people are to spend money (Branca et al., 2023). - 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) - When people are hungry, they tend to buy more food in virtual stores (de-Magistris et al., 2022). - Shoppers often go for store brands, especially in less exciting product categories (Schnack et al., 2020). - If consumers get a virtual touch from a shop assistant, they might end up spending more money (Zhao et al., 2018). - The way people move around in a virtual store doesn't affect what they buy or how much they spend (Schnack, Wright, & Holdershaw, 2021).

Shopping time	- Consumers' personalities and the teleportation method that they use don't impact the time they spend shopping in iVR stores (Schnack, Wright, & Elms, 2021; Schnack, Wright, & Holdershaw, 2021). - When shoppers receive a virtual touch from a shop assistant, they tend to linger longer in the VR store (Zhao et al., 2018) - 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)

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

4.5.1.2 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.

4.5.1.3 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 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.

4.5.1.4 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.

4.5.2 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 4.5 offers a synopsis of the results pertaining to consumer behavior based on the descriptive themes provided.

Table 4. 5 Overview of consumer behavior related to consumer loyalty and feedback.

Descriptive themes	Consumer behavior – Consumer loyalty and feedback
Consumer creativity and performance	- When shoppers engage in iVR shopping environments, they find themselves feeling creative and curious (Bin Kim & Jung Choo, 2023). - Consumers notice an enhancement in their performance when they use the freehand-gesture-based interaction technique (Wu, Wang, et al., 2019).
Consumers' attitude	- 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 & Lurie-Stoyanov, 2021). - 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 & Lurie-Stoyanov, 2021). - 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., 2017)
Intention to use VR store	- Consumers are more inclined to use VR stores when the environments are vivid, interactive, and highly immersive, fostering a strong sense of presence (Alkarney & Almakki, 2022; Loureiro et al., 2021; Peukert et al., 2019). - The intention to use VR stores is positively influenced by the combination of playfulness and usefulness (Alkarney & Almakki, 2022; Han et al., 2020). - 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 & Almakki, 2022). - Consumers' attitudes towards VR significantly influence their intentions to utilize the technology in the future (Lombart et al., 2020).
Loyalty and satisfaction	- 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., 2017). - 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). - 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).

4.5.2.1 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.

4.5.2.2 Consumer's 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.

4.5.2.3 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.

4.5.2.4 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.

4.5.3 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 4.6 presents an overview of the findings related to consumer behavior as outlined in these descriptive themes.

Table 4. 6 Overview of consumer behavior related to shopping engagement and feedback.

Descriptive themes	Consumer behavior – Shopping engagement and Preferences
Gaze behavior	- When consumers are shopping, their personality types don't have a significant impact on how much time they spend inspecting products (Schnack, Wright, & Elms, 2021). - Individuals generally spend less time examining familiar brands (Schnack et al., 2020). - 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). - 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) - 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 & Lee, 2021)
Navigation and body movement	- 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, & Holdershaw, 2021). - 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). - 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 & Kim, 2021).

Overall shopping experience	- Consumer engagement becomes higher as the leverage of benefiting from photorealistic rendering, advanced display technologies, and sophisticated control devices increases (Lau et al., 2014) - The enjoyable facet of the consumer experience augments when the incorporation of interactivity and visual-spatial cues in VR environments, (Kang et al., 2020) - 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). - 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) - The perceived ease of use of VR wearables positively influences consumers' perceptions of informativeness and playfulness in iVR shopping (Holdack & Lurie-Stoyanov, 2021). - 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 & Lee, 2021). - 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). - Consumers' positive attitudes toward virtual stores emerge as a crucial factor in fostering enjoyable and entertaining experiences in the iVR shopping realm (Alkarney & Almakki, 2022). - 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) - The combination of pointing gestures and abstract cart concepts in iVR emerges as the optimal approach for enhancing user experience (Speicher et al., 2018). - 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 & Wu, 2023) - 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). - 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) - With the infusion of voice assistants in iVR, consumers experience heightened immersion, contributing to an even more enriched VR encounter (Morotti et al., 2022)
Product evaluation and decision-making behavior	- As consumers find comfort in the VR environment, their decision-making becomes more authentic, moving beyond hypothetical responses (Fang et al., 2021). - The perceived utility of a VR application hinges on its informativeness, leading consumers to rely on the virtual information provided (Holdack & Lurie-Stoyanov, 2021). - Interactivity and visual-spatial cues boost how people see the information (Kang et al., 2020). - While casual browsing prompts consideration of information, individuals on specific missions focus more on habits and attention triggers (Park & Kim, 2021). - 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). - Immersing themselves in a fantastical VR shopping world introduces an element of curiosity, influencing the decision-making process (Branca et al., 2023) - When people find the experience playful, they tend to lean toward products that provide hedonic benefits (Kang et al., 2020). - 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). - In highly immersive VR experiences, individuals become less sensitive to price considerations (Meißner et al., 2020). - 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) - The presence or absence of nudges does not significantly alter decision-making processes (Blom et al., 2021) - In VR environments with a health-oriented focus, consumers exhibit heightened attention to nutritional information compared to scenarios emphasizing taste (Siegrist et al., 2019).
Product interaction	- 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). - 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). - 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). - 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). - 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)

4.5.3.1 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.

4.5.3.2 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.

4.5.3.3 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.

4.5.3.4 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.

4.5.3.5 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.

4.6 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 4.4) 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 4.4) led to three overarching groups, namely, buying and transactions, customer loyalty and feedback, and shopping engagement and consumer preferences. These are put forth in Table 4.7 and discussed in the next sub-sections.

Table 4. 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?
		Perceptional	Product-related	PRQ3 - How does the design of the product influence consumer product choice behavior?
	Purchase Behavior	Emotional Perceptional	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 Perceptional	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 Perceptional	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 Perceptional	Social-related	PRQ7 - How does storytelling in iVR retail environments impact consumer creativity and performance?
	Consumers' Attitude	Emotional Perceptional	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 Perceptional 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?

	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 Perceptional 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?
Shopping engagement and Preferences	Overall Shopping Experience	Emotional Perceptional	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 Perceptional 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 Perceptional Cognitive	System-related	PRQ15 - How can the design and placement of intuitive and easily recognizable icons be optimized to guide user interactions?

4.6.1 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).

4.6.2 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).

4.6.3 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; Hagtvedt & 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.

4.7. 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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Appendix A

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

Author(s) & Year	Stimuli	Organisms	Responses
Chen (2023)	Features Richness	Perceived telepresence, Social presence, Percived 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, vegetables)	Health issue consideration of the consumer, Environmental impact consideration of the consumer,The	Gaze behavior, Food choice

		pleasure of eating	
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	Hedonic shopping 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 screns	Arousal	Visual attention, Gaze behavior
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, 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.	Interactivity, Visual-spatial cues, Graphic	Playfulness, Informativeness	Product evaluation, Purchase intention

(2020)	quality (3D, 2D)		
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
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, Satisfaction	Time spent, Purchase intention, Overall shopping experience
Van Kerrebroeck et al. (2017)	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
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 2 Descriptive themes were identified to characterize the organisms.

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
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 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

CHAPTER 5

Navigating The Future of Retail: A Roadmap for Immersive Virtual Reality Retail Design

This study dives into the transformative world of Virtual Reality (VR) in retail, unveiling the design processes and team dynamics crucial for crafting immersive VR (iVR) shopping experiences. Adopting the Double Diamond methodology, we have created a detailed framework encompassing four key phases for VR retail: Discover, Define, Develop, and Deliver. Qualitative interviews with 20 VR design experts helped showcase the power of multidisciplinary collaboration and outline the vital tasks and roles within each phase of development. This research guides companies looking to refine their processes in iVR retail and provides a starting point for designers. Theoretically, our work extends design thinking into the iVR realm by clearly laying out the foundational design principles in achieving iVR's potential, while practically, it has provided clear, actionable strategies for industry professionals. For managers, our study underscores the importance of strategic iVR investments, building diverse teams, leveraging consumer data, and embracing iterative design. This research provides a solid groundwork for the future of iVR in retail; it proposes a dynamic blueprint for creating engaging, user-centric shopping experiences that can redefine consumer interaction and offers more aspects of the design thinking process.

Note that the work presented in this chapter is under review: Navigating The Future of Retail: A Roadmap For Immersive Virtual Reality Retail Design

5.1 Introduction

In the continuously evolving landscape of retail, technological innovations have long been catalysts for transformation. Among these innovations, Virtual Reality (VR) has emerged as a powerful medium, offering immersive experiences that redefine how consumers interact with products and brands within both digital and physical retail spaces (Hoyer et al., 2020; Xi & Hamari, 2021). As fully immersive systems, often referred to as immersive Virtual Reality (iVR), gain traction, they present unique opportunities to reshape consumer engagement by providing 360-degree environments that closely mimic real-world experiences (Peukert et al., 2019). However, despite the growing potential of iVR to revolutionize the retail sector, there remains a considerable gap in our understanding of the design processes necessary to implement iVR systems effectively.

Existing research of iVR retail predominantly focuses on the technological aspects of iVR (Alkarney & Almakki, 2022; de-Magistris et al., 2022; Fang et al., 2021), its influence on consumer behavior, such as how it enhances engagement or influences purchasing decision (Arrazat et al., 2023; Chen, 2023; Fang et al., 2021; Melendrez-Ruiz et al., 2022) or technology adoption of consumer (Lee et al., 2022; Peukert et al., 2019). While these studies provide valuable insights, they often overlook the design methodologies and interdisciplinary team dynamics that are critical to developing successful iVR retail environments. The successful design of iVR retail environments involves more than technological expertise; it requires a user-centered, iterative process that integrates both creative and technical elements (Howard et al., 2008). Building on this insight, this study adopts the design thinking methodology, which emphasizes user-centered problem-solving and iterative development (Brown & Katz, 2011). A key structure for this approach is the Double Diamond (DD) framework, developed by the Design Council (2005), which organizes the design process into four phases: Discover, Define, Develop, and Deliver. This framework is particularly suitable for iVR retail design, where an initial exploration of possibilities is followed by a convergence toward focused, actionable solutions Through the application of the DD framework, we provide a clearer understanding of how designers move from broad problem exploration to bring about precise, effective solutions in the context of iVR retail.

The complexity of iVR design demands an interdisciplinary collaborative network across fields involving VR design, UX/UI design, and project management. Felder et al. (2023) add that emerging technologies like iVR bring diverse challenges that needs better articulation of mapping design principles with organizational strategies to facilitate design thinking. This study

has therefore sought insights via interviews from VR experts to understand their approach towards addressing these complexities in their design of iVR retail environments. Specifically, we examined aspects of how interdisciplinary teams navigate the challenges of iVR retail design and focussed on the roles and contributions of different stakeholders at various phases of the design process. This research puts forth three key questions:

RQ1: How do experts in iVR retail perceive its future development and the challenges of integrating VR into retail environments?

RQ2: What are the essential steps in the design process for developing immersive iVR retail environments?

RQ3: Who are the key stakeholders involved in the design of immersive iVR retail environments, and what roles do they play at different phases of the design process?

In answering these research questions, this study provides a forward-looking view of iVR's role in retail design. It advances design thinking practice by sharing rich insights on design processes, interdisciplinary team dynamics, and stakeholder roles, thereby building a foundation for future research applications in the iVR field.

The rest of the paper is structured as follows. The background section explores the evolution of retail, emphasizing the integration of design thinking and the DD framework within iVR retail environments. The methodology outlines the Delphi technique and qualitative approaches used to capture expert insights into the design processes and team structures in iVR. The findings section presents the perspectives of these experts, addressing the future of iVR in retail, essential design steps, and the roles of interdisciplinary teams. The discussion contextualizes these findings within the broader design literature when highlighting strategic insights for industry professionals. Finally, the conclusion reflects on the study's contributions, acknowledges limitations, and proposes directions for future research.

5.2 Background

The integration of iVR into retail has introduced new possibilities for consumer engagement, allowing customers to interact with products in fully immersive 3D environments that closely mimic real-world shopping experiences (Hoyer et al., 2020). It enables retailers to create visual and interactive environments that surpass the capabilities of traditional e-commerce by providing users with an experiential and engaging platform for brand interaction (Xi & Hamari, 2021). The complex demands of iVR design has emphasis on user-centeredness, diversity,

visualization, and iterative development that promotes design thinking strategies (Cai et al., 2023). Moreover, the design of rich immersive environments requires a high degree of interdisciplinary collaboration among various stakeholders.

5.2.1 Design Thinking and the Double Diamond Framework

At the core of this study is the design thinking methodology, a human-centered approach developed by IDEO in the 1990s that has since become fundamental to problem-solving across diverse fields (Denning, 2013). Structured to incorporate human values, concerns, and needs into the design process, design thinking is particularly well-suited to iVR retail, where understanding user experiences and expectations is crucial (Buhl et al., 2019). By encouraging rapid prototyping, testing, and refinement, design thinking promotes flexibility and responsiveness to evolving user insights and technological demands (Brown & Katz, 2011). This iterative approach allows designers to explore a wide range of solutions before converging on the most effective, making it highly adaptable to iVR's complex and dynamic design requirements.

An essential component of design thinking, the DD framework, was introduced by the British Design Council in 2005 to structure the design process into four phases: Discover, Define, Develop, and Deliver (British Design Council, 2005). Unlike traditional linear frameworks, this framework comprises dual phases of exploration and refinement that encourages designers to separate idea generation from evaluation to promote lateral thinking and creative practice (Howard et al., 2008; Osborn, 1953). In the Discover phase, designers understand the problem space as they frame the problem setting. This is refined in the Define phase, where different perspectives and insights are synthesized into clear, actionable problem statements. During the Develop phase, teams engage in ideation, prototyping, and iterative testing, using divergent thinking to explore a wide range of solutions. The Deliver phase then narrows the focus through convergent thinking, testing, refining, and implementing the most viable solution (Kochanowska et al., 2022). The DD framework therefore provides an adaptable yet structured roadmap that infuses design thinking with dynamic experiences that inform the final deliverable.

While the DD framework is widely used, research on its adaptation to the interactive and immersive demands of iVR retail is limited. This study builds on the DD framework to understand how the user-centered design approaches in iVR retail are aligned with the iterative feedback loops and experimental learning for enhancing the overall reliability and applicability. This further provides a visual representation of our insights to both academic and professional audiences and supports the practical application of our research in iVR retail.

5.2.2 The Importance of Interdisciplinary Collaboration

The creation of iVR retail environments is inherently interdisciplinary, requiring the expertise of fields such as design, psychology, computer science, and project management (Cowan & Ketron, 2019). In practice, this collaboration involves iVR designers, UX/UI specialists, developers, and project managers, each bringing essential skills that enhance the project from concept to implementation. VR designers develop immersive spaces that align with users' intuitive interactions, UX/UI designers ensure navigation and accessibility, developers build the technical foundations, and project managers coordinate these inputs to maintain clear communication and effective teamwork (van der Bijl-Brouwer & van der Voort, 2014).

The DD framework's collaborative structure supports this interdisciplinary approach, facilitating teamwork across all the four phases (Felder et al., 2023). Team members contribute their insights within a shared, structured framework, enabling them to explore the iVR design's varied technological, psychological, and experiential dimensions. This integration of different perspectives aligns with design thinking principles, fostering a shared understanding of end-user needs and further enhances the team's problem-solving attitude in reaching an innovative solution.

While interdisciplinary collaboration is widely recognized as essential in iVR retail design, few studies provide detailed guidance on the specific roles and interactions within design teams. Existing literature often lacks practical insights from iVR practitioners on how collaboration unfolds in real-world projects, particularly within iterative frameworks like the DD framework. This research addresses this gap by examining the roles of different stakeholders in iVR design and illustrating how interdisciplinary collaboration shapes each phase of the DD framework. This approach not only enables the creation of user-centered, technically sound environments but also supports best practices for developing cohesive and innovative solutions in complex iVR retail projects.

5.3 Methodology

Our study adopted the Delphi technique to investigate key design principles in iVR retail environments. Delphi method provides a structured approach to forecast technological trends as it builds on collective human intelligence (Linstone & Turoff, 1975). It leverages on subjective judgments and facilitates communication flow among participants to build consensus on specific topics (Hsu & Sandford, 2007; Okoli & Pawlowski, 2004). The Delphi method is especially advantageous for its adaptability to emerging, high-uncertainty fields, making it ideal for an area as novel and data-scarce as iVR retail (Winkler et al., 2015). Moreover, it is effective in contexts with limited empirical data, where expert insights are often the most reliable source of information (Rowe & Wright, 1999). It enables insights that surpass individual evaluations by combining diverse expert perspectives to enhance accuracy and understanding compared to standard interview or group evaluation methods (Dalkey & Helmer, 1963; Landeta, 2006).

In light of iVR retail's nascent stage, the Delphi method offered us a logical way to synthesize expert insights and create a forward-looking perspective on design practices in this domain. Both quantitative assessments, such as Likert scales, and qualitative feedback in the form of detailed reasoning were gathered (Hsu & Sandford, 2007). Through a round-based, iterative design, participants were encouraged to engage, reflect, and reassess their responses, to cultivate a collaborative and evolving consensus (von der Gracht, 2012). Figure 5.1 illustrates the research methodology employed in this study. In the first round of semi-structured interviews, data was collected and analyzed to identify preliminary findings. In the second round, experts reviewed these initial insights and provided feedback on an early version of the proposed framework.

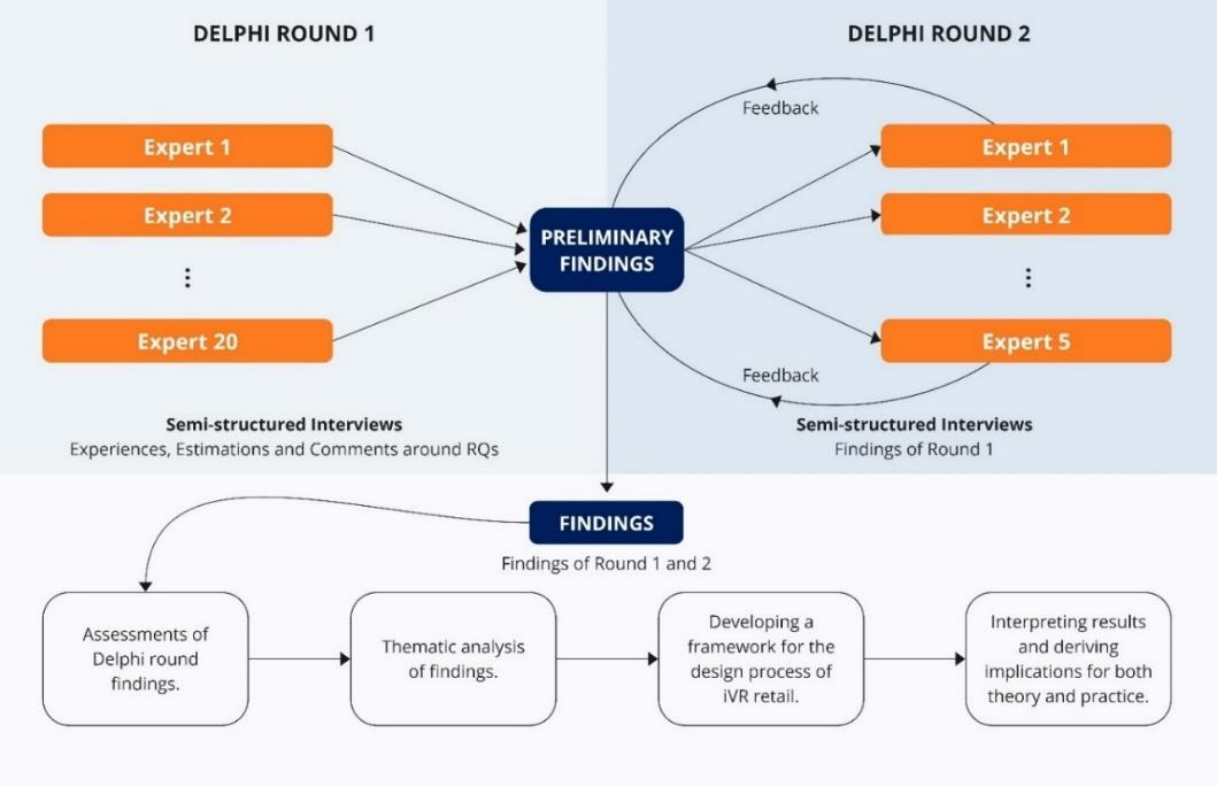

Figure 5. 1 Research structure .

In-depth, semi-structured interviews served as the primary data collection method as qualitative responses brought focus on thematic depth over broad generalizations (Richards, 2020) and provided rich, context-sensitive insights (DiCicco-Bloom & Crabtree, 2006). A combination of pre-planned questions from an interview guide and additional questions or probes that organically developed during the interaction (DiCicco-Bloom & Crabtree, 2006) were used. Accordingly emergent themes based on participants' experiences and expertise (Adeoye-Olatunde & Olenik, 2021; Deterding & Waters, 2021) helped in capturing contextually relevant data. Next, thematic analysis furthered us in identifying and interpreting patterns within qualitative data (Braun & Clarke, 2006).

5.3.1 Sampling Strategy and Recruitment

Purposeful sampling strategies were used to establish an information-rich participant pool and gain deep insights (Palinkas et al., 2015; Patton, 2002) as explained next. A "Convenience Sampling" approach using a LinkedIn premium recruiter account to access a broad base of professionals in the iVR sector was initially applied. Searches using the keyword "VR designer" yielded 1104 profiles, later narrowed to 476 profiles based on practical iVR design experience. This refinement aligns with "Criterion Sampling," wherein specific criteria helped filter participants with practical expertise. To further ensure participant expertise, we used “Intensity

Sampling" to focus on those who had advanced beyond junior-level roles, with a minimum of four years of iVR experience—a benchmark derived from industry job postings. "Maximum Variation Sampling" was also used to capture a broad spectrum of experiences within the iVR design domain. Ultimately, 163 participants with significant iVR design experience were invited to participate, with 28 expressing interest and 20 completing the first-round interviews. Data saturation was considered reached when additional interviews no longer yielded new themes or insights. In this study, after 20 expert interviews, no novel codes emerged during the final rounds of analysis, indicating thematic saturation. This was assessed through ongoing comparison and coding consistency across participant responses. This combination of purposeful sampling techniques provided a credible and nuanced examination of iVR design expertise.

For the second Delphi round, we employed "Intensity Sampling" to focus on the ten most experienced experts from the initial participant pool, to deepen the analysis with insights from highly knowledgeable individuals. Further "Criterion Sampling" ensured that these participants held substantial expertise. By engaging with the most experienced experts, this approach aligned with confirmatory sampling strategies, refining and validating initial findings. Ultimately, five of these ten experts participated in the second Delphi round.

5.3.2 Participants

The study's participant pool consisted of 20 professionals from diverse regions, including Australia, Denmark, Finland, Greece, India, Japan, New Zealand, Spain, the UK, and the USA, all with direct experience in iVR design and varying job titles. For the second round, experts P1, P3, P4, P13, and P16, each with over 15 years of iVR experience, provided additional feedback. Their extensive knowledge contributed to refining the study's framework. Table 5.1 summarizes key information about these participants.

With an average experience of 11.35 years, this diverse cohort brought a broad range of perspectives. Participants had backgrounds in multinational companies like Unity, Ubisoft, and Starbucks, as well as VR-specific firms and research institutions. This diversity added depth to the analysis, capturing the varied practices in iVR retail design.

Table 5. 1 Details of the interview participants.

No	Gender	Job Title	Country	Organization Type	VR Experience
1	Male	Design researcher	New Zealand	Design consultation company	15 years
2	Male	Interaction designer	Australia	Research lab	8 years
3	Male	VR designer/ Project manager	USA	Multinational company	30 years
4	Female	Instructional designer	USA	Multinational company	10 years
5	Male	VR developer	Australia	Multinational company	11 years
6	Male	VR project lead	Spain	VR company	9 years
7	Male	VR consultant	USA	Multinational company	8 years
8	Female	Director	USA	VR company	20 years
9	Female	Technical artist	New Zealand	VR company	6 years
10	Male	UX designer	India	Multinational company	5 years
11	Male	VR developer	Japan	VR company	7 years
12	Male	VR designer	USA	VR company	6 years
13	Male	VR project lead	USA	VR company	20 years
14	Male	UX designer	Denmark	VR company	4 years
15	Male	VR developer	Greece	Research lab	5 years
16	Female	VR designer	USA	VR company	19 years
17	Male	VR quality engineer	USA	VR company	5 years
18	Male	VR designer	Finland	Multinational company	10 years
19	Male	Interaction designer	USA	Multinational company	14 years
20	Female	Service designer	UK	Multinational company	15 years

5.3.3 Data Collection

Following the best practices to enhance response quality and validity, as recommended by Creswell and Poth (2016), and in line with Gray et al. (2020) guidelines for conducting qualitative interviews via Zoom, the study's objectives were first explained and consent taken before commencing the online interviews. Data collection process involved two rounds of in-depth, semi-structured interviews conducted via Zoom. Appendix F1 shows the skeleton questions for the interviews. Round one occurred between May and July 2023, and round two between

February and March 2024. The interviewer dedicated ample time to establish rapport with the participant, following which the actual interview was conducted (Oliffe et al., 2021). On average, each interview lasted 40 minutes. At the commencement of the interview, participants were invited to provide a brief introduction about themselves. In cases where this information was not spontaneously shared, participants were prompted to discuss their role in relation to iVR and the duration of their involvement in this role.

In the first round of interviews, participants explored their experiences with iVR design, describing the design steps they commonly followed and detailing their roles within the design team. They also offered insights into the future potential of iVR in the retail sector, sharing examples from relevant projects they had worked on. Toward the end of the interviews, participants were encouraged to reflect on and consolidate their perspectives based on the discussion, providing a holistic view of iVR design practices and their application in retail.

During the second interview round, the experts reviewed the preliminary findings from the first round, specifically those related to the design process and team dynamics. They were also introduced to an initial version of the proposed framework and invited to give feedback.

5.3.4 Data Analysis

Following each interview, recordings were transcribed using a Python script with the OpenAI Whisper model, an advanced automatic speech recognition (ASR) system (Introducing Whisper, 2023). The verbatim transcription of the semi-structured interviews from each round enabled familiarity with the content and in establishing initial ideas and recurring patterns. This engagement with the raw data provided a more nuanced understanding of the participants' responses and in capturing the depth and richness of their insights. Next, thematic analysis approach informed by Thomas and Harden (2008) was undertaken. Thematic analysis is a widely adopted qualitative approach to provide holistic in both primary research and systematic reviews (Purssell & Gould, 2021). It involves coding, categorizing, and synthesizing participant voices to extract meaningful patterns within the textual data (Braun & Clarke, 2006).

We undertook a detailed line-by-line coding of the textual content that helped generate descriptive themes. These themes led to further development of analytical themes and helped in extending the study results and propose new interpretations, explanations, or hypotheses (Thomas & Harden, 2008). Subsequently, the codes were grouped into broader thematic categories, representing significant aspects of the research questions. Themes emerged organically as similar ideas, concepts, and experiences were combined. For example, codes

related to innovative design and conceptual development were clustered under the theme "Creative," highlighting the role of creativity within the design process. These candidate themes were then reviewed to ensure coherence, with further refinement or merging conducted as necessary. Each theme was clearly defined and named to convey its essence accurately.

The identified themes underwent a rigorous review and refinement process, involving ongoing discussions among the research team to ensure that each theme accurately represented participants' perspectives. Finally, the findings were documented, interweaving analytical narratives with illustrative quotes from participants to provide a rich, detailed representation of each theme. Drawing from these themes, a conceptual framework has been developed to systematically organize and structure the key insights and show the relationships between the identified elements in the iVR design process. This framework reveals emergent patterns and trends in iVR retail design, contributing to both theoretical and practical advancements in the field.

5.4 Future of iVR Retail

At the outset of our research study, we sought experts perspectives on the future of iVR retail. As we discussed the emergent technological space, a consensus that emerged among the industry experts is that iVR is poised to augment the retail landscape rather than supplant it. Experts perceived that the advent of iVR in the retail sector heralds a transformative shift in how consumers will interact with products and brands. The following subsections presents themes (accompanied by illustrative quotes from participants) in response to the first research question (RQ1).

5.4.1 iVR as a Complementary Channel to Traditional Retail

A key theme that emerged is the role of iVR as a complementary channel rather than a replacement for traditional retail. Of the 20 experts interviewed, 90% (18 participants) agreed that while iVR holds substantial potential for enhancing customer engagement, it will not supplant brick-and-mortar or e-commerce platforms entirely. Instead, it will add value to particular segments of the retail experience, especially those that benefit from immersive, interactive environments.

> That might be a good way for a brand to convey some of the soft aspects like story of the brand... But it might not necessarily be the most functional place to sell products. It might be great for expressing the brand values and giving people a rich experience that they might not get on a mobile phone. (P1)

The experts emphasized iVR's ability to create rich, immersive brand experiences that can allow retailers to communicate intangible elements like brand story and values in ways that other digital platforms cannot achieve. Therefore, iVR is seen as an enhancement rather than a replacement for functional, transactional aspects of retail, such as product sales.

5.4.2 Consumer Technology Adoption: A Critical Factor

The success of iVR in retail depends heavily on widespread consumer adoption of the technology. Two experts (P7 and P18) highlighted that market readiness of consumers is a key barrier to iVR's mainstream success. The adoption of iVR headsets must reach a critical mass before the technology can fulfill its potential in the retail sector.

> I think the central challenge is a lot like a consumer market. It's a market where a lot of people don't have headsets. Most people aren't going to buy a headset only for shopping, they have to get the headset through something else. (P7)

> Things tend to evolve, that's for sure, but the pace depends on a bunch of factors, especially the tech challenges we're dealing with. (P18)

Once mainstream adoption occurs, experts anticipate a paradigm shift whereby iVR retail will empower companies with unparalleled insights into user behavior. The immersive nature of iVR promises an analytic depth that traditional retail spaces cannot match, offering a granular understanding of consumer interactions and preferences.

> You can get pretty accurate information as their gender, their age, their height, you can probably even take a stab at their weight, how mobile they are etc. And then by using front cameras of headsets, you can see what your consumers have in their living rooms. You can say pretty quickly if they have cat or dog or children. (P3)

As these quotes suggest, the future of iVR retail is tightly linked to consumer technology adoption, much like the adoption of smartphones in the early 2000s. Once iVR headsets become more common, a paradigm shift could occur, opening new possibilities for retailers.

5.4.3 iVR's Potential for Exclusive Experiences and Overcoming Barriers

One of the unique advantages of iVR is its ability to bridge geographical barriers, providing access to products and experiences that may otherwise be out of reach. Some participants noted that iVR can provide opportunities for creating exclusive, premium shopping experiences, transforming the act of shopping into an immersive event.

> VR shopping is useful especially if you don't have access to the product, let's say product that you want to buy is in overseas markets ...It gets us there and minimizes the risk for buyer. (P2)

> I think it can be good for exclusive experiences like galleries. VR can take you to places that you can't access easily. Any brand or products that are related to those values can easily find a place in VR, but I can't imagine myself buying some groceries in VR. (P6)

While iVR has significant potential for luxury and exclusive experiences, its utility for everyday shopping, such as groceries, remains limited. The technology's strength lies in creating memorable, immersive experiences that engage consumers beyond the functional act of purchasing.

5.4.4 Key Sectors Poised for iVR Success: Fashion, Furniture, and Home Goods

Certain sectors are particularly well-suited for iVR retail, notably fashion, furniture, and home goods. Multiple participants (P3, P7, P8, P13, P17) highlighted how iVR's spatial and aesthetic capabilities enable customers to try on clothes or visualize furniture in their homes with greater ease and accuracy than other mediums.

> For instance, when it comes to configuring furniture in a virtual environment, especially for home selling purposes, VR applications become valuable. They allow users to visualize how furniture would look in a specific setting and help plan their purchases effectively. (P13)

> Now, not every retail aspect would be good for VR, but I see fashion, furniture, home goods, and home improvement as a great space for VR, especially when you want to learn how to do, you know, maybe electrical work on something or plumbing. (P17)

These quotes demonstrate that iVR holds promise for sectors that rely heavily on visual representation and spatial awareness, such as fashion and home design. Customers can interact with products in ways that are difficult or impossible through traditional e-commerce channels.

5.4.5 Limitations of iVR Retail: Unsuitability for Perishable Goods

While iVR has advantages in certain sectors, its application is not universal. Participants highlighted that iVR might not be ideal for everyday products, especially perishable goods like groceries, where the experience doesn't add significant value compared to other shopping platforms.

> Let's say I'm just buying groceries, then I don't think VR grocery shopping would be much more useful than buying stuff online through the web browser. So, it really depends on what you're selling it needs to be something that you can't experience by just browsing the internet. (P10)

This reinforces the idea that iVR is best suited for experiential and high-engagement products, while less relevant for items that require immediate, functional purchases.

5.4.6 The Need for Consumer Training in iVR Retail

Several participants (P1, P3, P7, P12, P20) highlighted a significant challenge in iVR retail design: the need for consumer training, especially for those unfamiliar with the technology. Onboarding and usability design will play a crucial role in ensuring a smooth consumer experience.

> People don't know what to do in VR. The controllers in their hand but how do they use them? So, you have to teach this new thing to them. So you have to have a well-designed onboarding. (P20)

The lack of familiarity with iVR environments requires retailers to invest in effective onboarding processes, ensuring that consumers can fully engage with the technology and its potential benefits.

5.4.7 The Need for UX/UI Standards in iVR Retail

Another challenge identified by participants (P3, P5, P6, P10, P11, P12, P14) is the lack of established UX/UI standards for iVR retail. Unlike traditional e-commerce platforms, where users are familiar with navigation and interactions, iVR currently lacks universal design conventions. The main challenge is the lack of standards in UX. This highlights the need for industry-wide standards to provide consistent, intuitive user experiences in iVR environments, which will be crucial for widespread adoption.

> It's still new and we don't have universal interactions. For example, when people go to a website, they know what they need to do, when they will find information or so on but in VR, we don't have this kind of universal knowledge. Everyone interacts and moves through VR in a different way. (P6)

In conclusion, experts anticipate that iVR will build upon traditional shopping models, adding an immersive layer for high-engagement products while facing limitations with perishable goods. To fully realize iVR's potential, consumer training, UX/UI standards, and sector-specific adoption will be essential. Ultimately, as iVR technology matures and adoption increases, its ability to enhance consumer discovery, engagement, and purchasing experiences will likely redefine retail.

5.5 Design Process for iVR Retail Environments

This section addresses RQ2 by examining the iVR design process through expert interviews, structured around the DD framework to elucidate its core phases, activities, and considerations. Using thematic analysis from the first Delphi round, we identified key codes and themes that represent the foundational steps in iVR retail design. The analysis illuminated how designers transition from initial research and problem definition to prototyping and refinement, showcasing a process that integrates user-centered design principles with iterative testing.

In the final stage of analysis, we developed analytical themes from descriptive themes, which closely aligned with the DD framework. Most participants explicitly referred to the DD framework and design thinking in their work, while others, though not specifically mentioning these methodologies, naturally followed similar design thinking principles. This alignment reinforced our initial assumption regarding the framework's relevance and suitability for iVR retail design:

> In shaping my design process, I find it valuable to embrace the Double Diamond methodology. (P1)
>
> I adhere to the design thinking process, incorporating a design-based research approach. In this iterative and agile process, I proactively inform clients or participants that our journey is dynamic, emphasizing that there are no 'wrong' actions. (P8)
>
> I adopt an eclectic approach to my design process, drawing inspiration from design thinking for its ergonomic principles while occasionally integrating specific frameworks and methodologies inspired by the world of video games. (P18)

Table 5.2 provides a visual representation of the initial codes, descriptive themes, and the final analytical themes. The transition from descriptive themes to analytical themes involves grouping related descriptive themes into broader categories that capture overarching concepts and relationships within the data. Each "x" indicates a participant's mention or emphasis on a specific theme or code, showing alignment with key aspects of the design process.

The DD framework was applied to organize descriptive themes into four phases—Discover, Define, Develop, and Deliver—each addressing distinct aspects of the iVR retail design process. Figure 5.2 visually represents this design process, detailing the journey from identifying an initial need to delivering a refined solution.

Table 5. 2 The initial codes, descriptive themes, and the final analytical themes of the design process.

Analytical Themes	Descriptive Themes	Initial codes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
Discover	Understand	Problem	x	x	x	x	x	x	x	x	x			x	x	x	x		x	x	x	x
		Objectives	x															x	x	x	x	x
		Challenge	x							x												
		Stakeholder Expectation				x		x														
		Brand Identity				x					x											
	Research	Consumer	x				x	x	x		x	x		x	x	x		x				x
		Market	x										x		x							x
		Competitors						x				x	x		x							
Define	Conceptualize	Scope of the Project			x			x														
		Success Metrics		x																		
		Risks																	x			
		Security & Privacy Concerns													x			x				
	Plan	Personas										x			x			x				
		Consumer Journey										x						x				
		Narrative		x	x	x					x				x	x		x		x	x	
		Basic Functions															x	x	x			
		Basic Interactions		x		x		x	x	x			x						x	x	x	
		Onboarding	x		x	x							x									x
Develop	Ideate	Brainstorm	x				x				x	x							x	x	x	
		Design Documents			x		x		x						x							
		Sketching		x							x							x				
		Interaction Diagram				x		x	x													
		Moodboard																			x	
		Storyboards				x															x	

	Create	Sound Design		x	x		x			x			x		x	x			x						x
		Avatar Design		x	x			x		x			x		x	x		x		x	x			x		
		Instruction Design			x						x															
		Wireframe		x												x										
Deliver	Prototype	Paper Prototype				x																	x			
		Boxing Prototype													x	x		x	x							
		Low-fidelity Prototype	x	x					x							x					x			x		
		High-fidelity Prototype	x	x					x			x									x					
	Test	System Usability										x		x												
		Quality Assurance	x											x	x											
		A/B Testing														x										

The process begins with recognizing a need, which diverges into the Discover phase to explore and analyze the problem, objectives, and intended audience. In the Define phase, the team converges on a focused vision and plan, addressing essential elements such as security, privacy, project scope, and success metrics. The Develop phase then broadens to include ideation and the creation of design elements, with the team exploring a variety of options through brainstorming, moodboards, storyboards, and interaction diagrams. Finally, in the Deliver phase, these ideas converge into functional prototypes that undergo rigorous testing to ensure they meet performance and usability standards. This phase emphasizes high-fidelity and low-fidelity prototypes, boxing prototypes, and paper prototypes, supplemented by comprehensive testing strategies such as A/B testing, usability testing, and quality assurance.

The design process is inherently iterative, with ongoing feedback loops that facilitate continual refinement and adaptation even after initial development. These feedback loops are essential for integrating new insights and ensuring that the design evolves in line with user expectations and market needs. Ultimately, this iterative approach results in a thoughtfully crafted, user-centered iVR retail experience. Each phase (in Figure 5.2) is elaborated upon in the following sections and is supported by participant voices to provide depth and context.

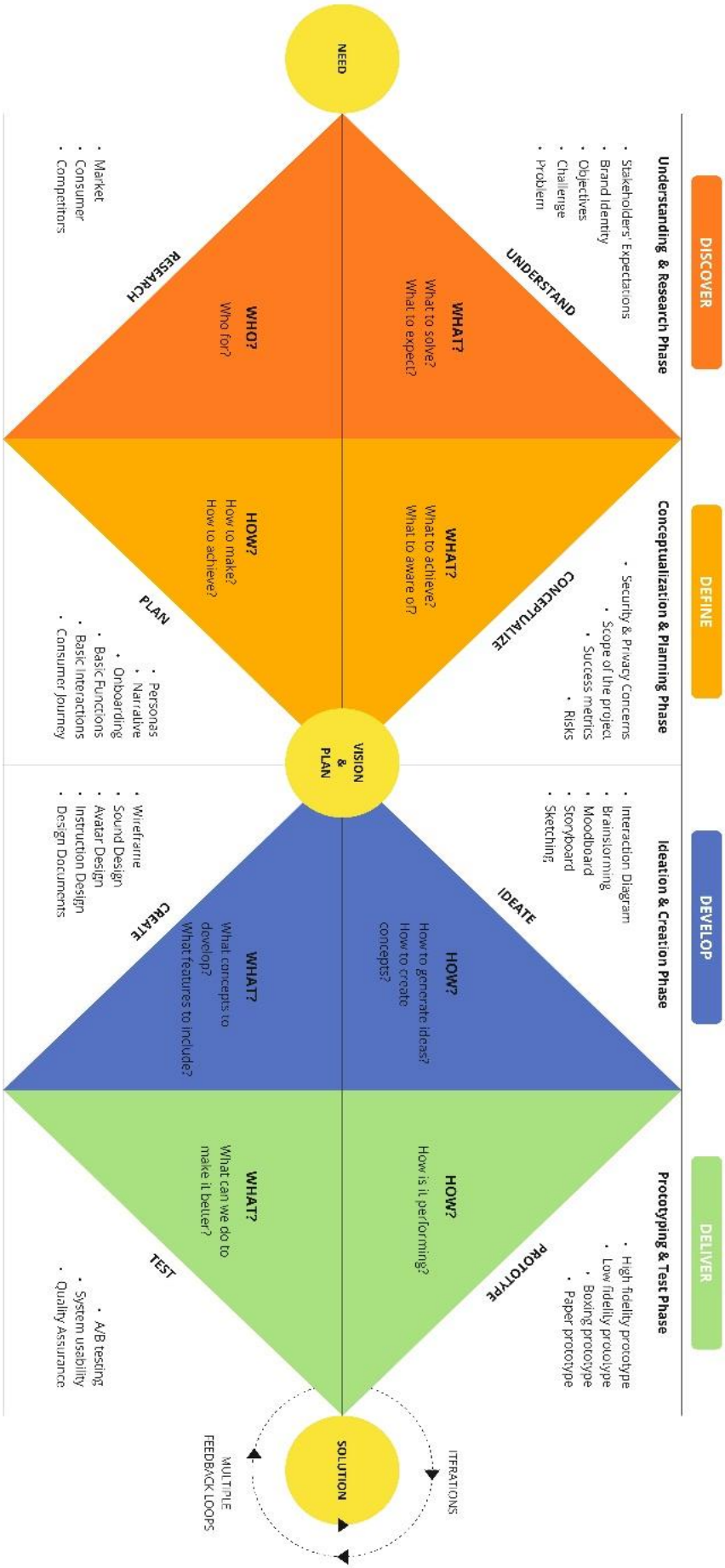

Figure 5. 2 Preliminary design process.

5.5.1 Discover: Unrevealing the Problem Landscape and Consumer Needs

The Discover phase is the initial phase in the DD framework, aimed at gaining an understanding of the problem space and gathering essential insights. This phase sets the foundation for the design process, where the emphasis is on exploration so as to gain comprehensive understanding of the external forces and the end-users and be able to pinpoint potential innovation needs (Dell'Era & Verganti, 2010; Seidel & Fixson, 2013). Designers conduct research of the market, consumers, and the competition to establish a clear foundation for the design project. The key questions guiding this phase are "What needs to be solved?" and "Who is the design for?". These questions ensure that the team starts with a well-defined problem and has a deep understanding of the target audience.

5.5.1.1 Understand

In the initial phases of the iVR design process, understanding core project elements is essential. Through our interviews with iVR design experts, we identified several critical themes—namely, "Problem," "Objectives," "Challenges," "Stakeholders' Expectations," and "Brand Identity." Experts consistently highlighted the importance of clarifying these foundational elements to ensure the project begins with a well-defined problem space and achievable goals. This initial step involves answering the fundamental questions: "What needs to be solved?" and "What are the expected outcomes?" These insights establish clarity and provide direction from the outset. The emphasis on understanding the problem and expected outcomes is not merely procedural but strategic, as it aligns the project with the needs of both stakeholders and end-users:

> Our first step is always to dive deep into the problem—understanding not just what the client wants but also what the end-user truly needs. (P17)

Further exploration of the problem space allows designers to create a solution that is both relevant and impactful. Observing users within real-life contexts further refines this understanding, enabling practitioners to define a structured problem and solution space that genuinely reflects user needs (Carlgren et al., 2016; Zheng, 2018). This involves not only grasping the client's stated issues but also uncovering underlying reasons.

> Identifying the problem is like solving a puzzle. You need to dig deep to understand the real issues and opportunities. At the outset, figuring out what is the exact problem that I'm trying to solve. (P12)

Setting clear goals and objectives is equally crucial, as it defines the direction of the iVR retail design and anchors the project around a specific purpose. These goals serve as guiding principles throughout the design process, helping the team stay aligned with both the vision and the intended impact of the final product.

> I'm first thinking the overall goal. What do I want the person to get out of the experience? (P16)

Assessing the broader context, including potential challenges, is integral to this phase. Navigating the complexities of design practices in iVR requires addressing core challenges from both user and technology perspectives (Dorst, 2011). Participants added that understanding challenges also holds valuable insights, as this makes them aware of technical limitations and remain attuned to the experiential and functional needs of the user:

> The foundational principle is to study the environment, to study the barriers and the challenges to entry. Not from a technology side, but from the user side. (P8)

Moreover, aligning the design decisions with stakeholder expectations is critical for ensuring that practices are consistent with the organizational objectives. Building a shared understanding between the design team and stakeholders sets a clear reference point for evaluating progress and making joint assessments.

> Stakeholder expectations are the compass guiding our design decisions. We need to ensure our VR retail solution meets their vision. (P4)

Finally, establishing and integrating the brand identity within the iVR experience emerged as a key priority. For designers, this involves using brand guidelines (e.g., colors, logos, layouts, and other visual cues) to create a VR interface that not only reflects but also reinforces the brand's essence. This attention to brand identity ensures that the iVR experience aligns with the broader branding strategy, fostering a cohesive and immersive experience for users:

> UI has to work with the brand that you're working with in VR too. In my projects, I would pull their creative resources and use their brand guidelines. You have to know their colors, layouts, logos, whether they have any mascots. (P4)

Overall, the "Understand" phase establishes a comprehensive foundation for iVR retail design by addressing the project's objectives, the user's needs, the organizational context, and the brand's identity. This phase not only sets clear expectations but also ensures that the design process remains aligned with both strategic and experiential goals throughout the project.

5.5.1.2 Research

Gaining insights into the “Market,” “Competitors,” and “Consumers” is crucial for developing a tailored iVR experience. Experts emphasized that by aligning the project with real-world demands, they can ensure that the design resonates with its intended audience. This stage revolves around the key question, "Who?" or more specifically, "Who is the design for?". By clarifying who the target audience is, designers can make informed decisions that cater to specific user needs, behaviors, and preferences. This understanding not only helps refine the iVR experience but also ensures that the final design is relevant and impactful.

The first step in this phase involves gathering market insights to build a foundational knowledge base for the subsequent design process. By analyzing market trends, recognizing consumer demands, and looking out for emerging opportunities, the design team can ensure that the iVR retail experience is not only innovative but is also aligned with current and anticipated industry shifts. This enables the design team to identify gaps and opportunities, as they position the iVR solution to meet the evolving market needs effectively (Pantano & Timmermans, 2014).

> We keep an eye on market trends to spot what's popular and what's up-and-coming. This way, we can create VR experiences that are not just trendy but also have the potential to really shake things up in the industry. (P1)

In addition, competition analysis plays a crucial role in strategically positioning the iVR retail experience. Designers can learn valuable benchmarks and identify areas where their project will stand out by offering unique value propositions to end-users. This comparative analysis informs strategic decision-making and encourages innovation by highlighting areas where the iVR experience can surpass existing solutions. Analyzing competitors’ strengths and weaknesses not only guides the design direction but also creates a distinctive, competitive edge for enhancing the overall iVR experience (Hatzijordanou et al., 2019).

> We take a close look at our competitors to see what they’re doing well and where they’re falling short. (P6)

Lastly, understanding consumer behavioral preferences, and their pain points is arguably the most vital aspect of this phase. It is fundamental to creating a user-centered design and ensuring that the iVR experience resonates with its audience on a personal level. By grounding the design process with different intuitive, engaging, and satisfying encounters, designers can craft an iVR retail experience that is both functional and emotionally resonant with the target audience (Choy et al., 2024; Hamilton, 2016).

> When developing a product or crafting a VR experience, my foremost consideration is the target audience. It's pivotal to deeply understand whom we're designing for—identifying their pain points, anticipating their expectations, and truly empathizing with their experience. (P16)

This research phase establishes a well-rounded understanding of the external environment and end-user, setting the stage for a more focused and responsive design. It informs the initial direction of the project and provides a foundation for ongoing user-centered adjustments throughout the design process.

5.5.2 Define: Laying the Groundwork for Success

Define phase synthesizes insights garnered from the Discover phase to create clear and actionable problem statements and plans. This stage sets clear boundaries for the project and ensures all team members are aware of the project's goals and constraints. Designers can now focus on conceptualizing the scope of the project, success metrics, security, privacy and associated risks as they start the planning of design personas, narratives, consumer journeys, basic functions, and interactions and onboarding.

5.5.2.1 Conceptualize

This stage forms the backbone of a structured and resilient iVR retail design process. Experts emphasized that setting realistic goals and creating a strategic foundation for the project is vital for the project's success. The guiding question is "What?" or more specifically, "What should be achieved?" and "What potential challenges might arise?" . These drive the team to consider both the project's objectives and the potential obstacles they may face. In doing so, the design team evaluates the feasibility of the project and refines their onward direction, as they align the project's scope with well-defined goals and prepare their next steps with a clear coherent strategy.

The project scope is the first step in outlining a structured space within which the design team can operate effectively. By establishing clear boundaries early on, the team can focus their efforts on achievable deliverables that are in line with the project's vision. The design team is able to allocate resources efficiently and prevent scope creep, all of which helps to keep the project on track and within budget.

> After figuring out what the project needs, I share the details with our team. They then estimate how many hours it will take to complete. This helps me understand the project's scope better. (P6)

Success metrics are defined at this stage; these serve as benchmarks for evaluating the project's effectiveness and impact. Metrics set a clear endpoint for the team in measuring their achievements. Establishing measurable success metrics is crucial for tracking progress and in ensuring that the iVR retail design aligns with user needs and project objectives. The benchmarks guide the team in objectively evaluating their design and in making adjustments if needed.

> Success varies for each user, but generally speaking, it's about whether they can find what they need, pick it up, and then successfully check out. That's how I measure if they've achieved their goal. (P2)

Identifying potential risks early in the process is equally important for safeguarding the project's progress. This foresight allows the project team to develop strategies for mitigating risks and maintaining its trajectory despite other unforeseen difficulties that could arise.

> Next, I'll identify any risks and plan the steps needed to reach our goals, including how long each step will take. (P17)

Security and privacy concerns are also fundamental in iVR retail as user data and personal information could be compromised. Establishing a secure environment and maintaining data privacy are not only legal requirements but are also essential for building user trust and confidence.

> Thinking the privacy concerns as early as possible is great. (P16)

In summary, the conceptualize phase lays a strong foundation for the iVR retail design; it sets the project scope, establishes success metrics, identifies risks, and ensure compliance with legal standards. The design team have a well-defined direction, clear objectives, and a strategy for managing potential challenges to deliver a secure user-centered experience.

5.5.2.2 Plan

In this stage, the participants craft a roadmap on the development process; their focus is on design elements such as user personas, narratives, onboarding processes, consumer journeys, core functions, and interactions. The guiding question is "How?", or specifically, "How to make?" and "How to achieve?". This drives the creation of an actionable and well-structured project plan. The design team outlines clear steps and allocates resources as they lay down a strategic pathway. For example, empathy-driven design steps are charted out, such as, designers first identify prospective user demographics and their lifestyle preferences which are then utilized

for designing of personas. Personas serve as a focal point for design decisions, ensuring that the final product resonates with its intended users.

> In terms of where they live, what type of people and their lifestyle, I think these are the three things to lock in first for target audience. And then you start to get them to, and then you start to create the user persona based on the users you have, I mean the target audience you have. (P10)

The narrative aspect of the iVR experience adds richness, depth and context; it can transform the virtual shopping journey from a simple task into an engaging adventure. Therefore, planning a storyline that allows interaction and makes the product encounter feel purposeful will make the virtual environment more immersive.

> I believe that many of the methods we use in regular stores, especially those that involve emotions, will still apply in VR. This includes how strong the story behind a product is, how we describe it, and how we use colors, sounds, and pictures to present it. I don't think these aspects will change much. (P13)

A well-designed onboarding process is crucial in helping users understand and navigate the iVR retail environment quickly. Effective onboarding addresses the learning curve associated with virtual interactions, ensuring that users can become familiar with the system's features and functionality in a seamless way. Through strategic onboarding, the team enables users to engage with the experience more confidently and effectively.

> Need to consider learning curve and create efficient environments to make people familiar with onboarding (P1)

Mapping the consumer journey is another aspect in planning. This involves visualizing the user's path through the iVR environment to help the design team better understand the flow of interactions and identify new opportunities for enhancing the overall experience from initial engagement to final transaction.

> Next, we need to map out the user's journey. This means figuring out all the steps someone takes from first learning about the app to using it. In UX, this helps us understand how to guide a user from starting point A, like finding out about the app, to point B, which is using it. (P10)

Defining core functions provides a solid foundation for the iVR user experience. By identifying essential features and functionalities, the team ensures that the virtual environment is not only functional but also intuitive and user-friendly. Through careful planning of core functions, the team establishes a coherent structure for user interactions within the virtual space.

> It's important to plan out the functions early on. This helps to make the project work better and gives designers a clear plan. (P15)

Finally, designing intuitive interactions is vital for creating natural touchpoints in the iVR environment. These interactions serve as bridges between users and the virtual world, allowing them to move, select, and interact with elements in ways that feel seamless and instinctive.

> As an interaction designer this is to me that, it's about crafting interactions that are so natural, users feel they've known them all along. (P2)

Together these elements provide a pathway that ensures the iVR design process is user-centered, cohesive, and actionable. From developing personas and narratives to establishing core functions and intuitive interactions, the design team plan a roadmap that guides the execution of an effective and user-friendly virtual retail experience.

5.5.3 Develop: The Playground of Creativity

Develop phase focuses on generating and developing solutions through creative activities. Designers focus on ideating ideas by brainstorming, sketching and using interaction diagrams, moodboards and storyboards amongst others, to help them create design documents, wireframes, sounds, avatars, user instructions, and 3D models. This phase is centered around the questions "How can ideas be generated?" and "What features should be included?" By combining creative exploration with practical considerations, the develop phase ensures that the design solutions are both innovative and feasible.

5.5.3.1 Ideate

Experts frequently mentioned the activities of “Brainstorming”, “Sketching”, and using “Interaction Diagrams”, “Moodboards” and “Storyboards”. These were identified as key components of the ideation process, resulting in the "Ideate" descriptive theme. The key question is "How?" that refers to “How to generate ideas? How to create concepts?”. These questions encourage divergent thinking and creativity and helps teams to explore a wide range of ideas before narrowing down best solutions and development approaches.

> Ideation is where the magic happens; it's where we get to dream up the world we're about to create. (P12)

Experts emphasized the importance of multidisciplinary teams brainstorming together to increase originality and idea value. Collaborative brainstorming sessions can foster a free flow of ideas and encourage creativity. This collaborative approach not only broadens the range of ideas but also enhances the collective problem-solving capabilities of the team.

> Ideally, for me, I like to work with a skeleton crew of five people, you know, a core crew of people that should be multidisciplinary. So, like, having all of the brains in one place and having them brainstorm, I think all of this is extremely important. (P18)

Sketching provides a rapid visual exploration of design concepts, allowing designers to quickly recapitulate ideas without the constraints of making a detailed design. This activity enables fast adjustments and fluid exploration, making it an instrumental tool in concept development.

> Sketching is our visual language, allowing us to quickly communicate and iterate on design ideas. (P9)

Interaction diagrams help the team map out user-system interactions, effectively building the foundational “skeleton” of the user experience. These diagrams aid in visualizing how different features interact and support the structure of the user journey.

> And start building an feature dependency and prioritization matrix. Use this to make a plan and an interaction diagram that shows how everything interacts. This is a basic overview of the process. (P7)

Crafting moodboards visually conveys the desired aesthetic and atmosphere of the iVR retail experience, aligning the project's vision with tangible visuals.

> First of all, I really try to immerse myself in that new world, aiming to understand holistically what will happen outside of the program. It's about grasping how the world will be, the tech habits of people, and what they aim to achieve. Then, from those questions, I create a mood board of what is going to happen, and then I start to design ideas. (P19)

Storyboarding serves as a tool for narrating the user journey, providing a narrative structure that guides the user through the iVR experience. Storyboards outline the key interactions and provide a cohesive flow to the virtual journey.

> So, it's going to involve videos, slides, decks, drawings, storyboards—anything that helps me truly visualize and then communicate my ideas to the higher-ups, to my boss. (P19)

Together, the ideation activities provide a structured yet flexible approach for developing a cohesive iVR retail experience. Designers can translate abstract ideas into actionable design concepts. Structured exploration of creative possibilities allows the design team to refine, expand, and ground their ideas within a clear visual and functional framework. Diverse perspectives are integrated and systematically mapped with user interactions and visual aesthetics, setting the foundation for the next stage of development.

5.5.3.2 Create

Create phase highlights the importance of producing elements that are derived from identified concepts. The guiding question here is "What?" or more specifically “What concepts are to be developed?” and “What features should be included?”. Accordingly, design documents, wireframes, sound designs, avatar designs, and instruction designs are developed to bring the iVR experience to life. Designers focus is on refining and selecting the most promising ideas from the ideation stage, as they work towards developing more detailed features and adding functionalities to portray their storyline.

Design documentation emerged as a fundamental step in capturing and articulating the vision for the iVR retail experience. This comprehensive document serves as a reference point for the design team; it records the rationale behind each design choice made by the team and provides a collective justification basis.

> The design document is like a guide that explains why we made certain choices in our design. It helps everyone understand the thinking behind our decisions. (P13)

Sound design further plays a pivotal role in enhancing the immersive quality of the iVR experience. Designers have to complement the visual elements with the audio ecosystem. By carefully crafting the auditory landscape, designers can add depth to the iVR environment, making it feel more complete and engaging for users.

> Sound design is very important to it's, almost like, 40% of everything. (P9)

Avatar design is another crucial aspect that enables personalization and improves user interaction within the virtual space. Avatars serve as the user's representation in the iVR environment and facilitate a more seamless and engaging interaction. This approach balances personalization with simplicity, enhancing the user experience without overwhelming the user.

> Avatar design is important when it comes to personalization, but we encourage our users start with base avatar or environment to reduce distraction. (P7)

Clear and concise instruction design is vital for helping users navigate the iVR environment effectively. By designing straightforward instructions, users can easily understand the system's features and functionalities, enhancing their overall experience.

> Your message in VR shopping environment must be conveyed clearly and concisely. (P9)

Wireframing rounds out the Create phase by providing the structural foundation for the iVR interface. Wireframes offer a basic layout, bridging the gap between conceptual design and user

interaction. They outline the interface's organization, ensuring that the design is not only visually appealing but also functional and user-friendly.

> We would go through and at least make wireframes of all the menus because that's where a lot of companies haven't done a lot of iVR that is where they'll get lost. They think it's really easy just to draw things in 3D and move around. But you need to have that step-by-step process that shows when you get to this end of this mini tree. (P3)

The Create phase focuses on developing core design assets and organizing the interface to lay a strong foundation for the next phase. This transition from concept to functional experience is achieved through crafting immersive soundscapes, intuitive wireframes, and comprehensive design documentation, all aligned with project goals and user engagement. Each element, from avatars to instructional design, ensures a cohesive and user-centered iVR experience that guides users effectively through the virtual retail space.

5.5.4 Deliver: Ensuring Exceedance of Expectations

Deliver phase involves testing and refining solutions to ensure they meet desired quality and performance standards. This includes creating various prototypes, conducting usability tests, and overseeing quality checks through performance testing and user interaction feedback. This stage is guided by questions like "How well does the design perform?" and "What adjustments can improve the user experience?" The Deliver phase concludes with a thoroughly tested and refined solution ready for the end-user.

5.5.4.1 Prototype

Prototype phase helps designers to transform their conceptual ideas into tangible models by iterative testing and refinement as they assess usability and performance features. Various prototyping methods such as paper prototyping, boxing techniques, and both low- and high-fidelity prototyping, inform the "Prototype" descriptive theme. Each method contributes uniquely to the progression of the iVR retail design. The core question is “How is it performing?”. This assessment is crucial for identifying areas of improvement and ensuring the design aligns with user expectations.

The process often begins with paper prototyping, a cost-effective and flexible approach that allows designers to sketch initial ideas and gain immediate feedback, facilitating rapid iteration and refinement. It also gives designers a foundational understanding of how ideas can be shaped into functional elements within the iVR space.

> We've learned that no matter how good a plan is, it often changes once we start working on it. Even if we think our design is great, we end up making lots of changes because of unexpected issues. We go through many rounds of updates, from the first paper prototype to creating a basic version of the product. (P5)

Boxing techniques, specifically brown, grey, or white boxing, structure the iVR environment by creating a basic spatial framework that focuses on core interactive elements without the distraction of detailed visuals. This step is essential for mapping out the spatial relationships and interaction pathways that will shape the user experience.

> For iVR projects, we start with an empty space, which is just a basic user interface with a floor and a few walls. We add the interactive elements into this space. We might also use a simple boxing prototype, which means we keep it basic and don't add too many details, so the user isn't overwhelmed or distracted by what they see. (P14)

Low-fidelity prototypes are then introduced to incorporate more refined representations of the product, providing an initial framework for functionality without the final visual polish. This stage is valuable for early testing, allowing the team to address potential usability issues before committing to more resource-intensive prototypes.

> We used to go deep into projects, investing time, effort, and money, only to have the customer change their mind later. This was costly for everyone involved. So now, we start with a simple low fidelity prototype to see if the project really fits the customer's needs. The sales team's goal is to make sales, but if a project isn't a good fit, it wastes everyone's resources if the customer decides not to proceed. (P20)

Finally, high-fidelity prototypes bring the design closer to the final product, incorporating both visual and interactive elements that provide a realistic experience for users and stakeholders. This stage is instrumental for final refinements, as it enables detailed evaluation of the user experience and facilitates targeted adjustments that enhance the product's quality and appeal.

> But it will often go as building from a very low fidelity prototype to building slowly, building to a high-fidelity prototype. (P18)

The Prototype phase, therefore, integrates multiple stages of iteration, allowing designers to systematically evaluate and refine each aspect of the iVR experience. By transitioning from simple sketches to complex, interactive models, this phase ensures that the final product is user-centered, functional, and ready for deployment, thus setting a strong foundation for a successful iVR retail solution.

5.5.4.2 Test

The Test phase is a critical step in the iVR design process, focusing on comprehensive evaluation to ensure that the final product meets rigorous quality and usability standards. Designers systematically assess the iVR application through methods like system usability studies, quality assurance testing, and A/B testing. These activities address the core question, "What can we do to make it better?". By emphasizing refinement and quality, this phase helps the team identify improvements to elevate the product's user experience.

System usability studies form a foundational part of the testing process, as they involve observing real users interact with the iVR application. This direct observation offers essential insights into user behaviors and preferences, revealing practical aspects of the interface that may need adjustment to enhance usability.

> In your usability tests, you prompt users to locate specific options, measuring the time it takes for them to navigate through menus. I suggest employing a similar approach when evaluating the user experience in terms of art. (P11)

Quality assurance (QA) testing is essential for optimizing the performance and reliability of the iVR application across different devices. QA involves meticulous, often iterative checks to identify and address potential bugs, technical issues, and compatibility challenges that could interfere with the user experience.

> First, we figure out how many QA testers we need and how much money we have to spend. After that, we move into the early stage of creating the product, called pre-alpha. Here, we quickly put together a basic version without worrying about details like textures or the exact wording, just to show that our idea is possible. (P17)

A/B testing provides a data-driven approach to refining design choices by comparing two versions of a feature or layout to determine which one performs better with users. This methodical process allows designers to optimize the application based on direct user feedback, ensuring that each component effectively enhances the user’s journey through the iVR space.

> Also, A/B testing is our litmus test, helping us identify the most impactful design choices based on user preferences and behaviors So then we will reach out to the people that will be taking the course in the future. (P14)

The Test phase, therefore, combines various evaluation methods that together ensure the iVR application meets high standards of usability, quality, and user satisfaction. Through a blend of system usability studies, quality assurance, and A/B testing, this phase refines the application,

identifying and addressing any remaining gaps to ensure a polished, reliable, and user-centered experience for the end user.

5.5.5 Iterations and Feedback Loop

The iterations and feedback loop phase is a critical component of the iVR design process, fostering a flexible and adaptive approach to development. This phase centers on refining and enhancing the design through continuous cycles of feedback and improvement, allowing designers to adjust to user insights and evolving project requirements. By incorporating iterative feedback loops, the design remains responsive, ensuring the final product meets the highest standards of quality and user satisfaction. Insights from iVR design experts emphasize the significance of this phase in supporting ongoing enhancements and adjustments.

Continuous improvement is central to the iterative process, as participants highlighted how it enables the design to evolve, tackling unforeseen challenges and integrating fresh ideas effectively.

> Iteration is key to our design process. We start with an initial concept and then continually refine it based on user feedback and testing results. This helps us ensure that the final product is not only functional but also user friendly to use. (P6)

Feedback loops are integral to maintaining flexibility and adaptability within this iterative structure. These loops involve regular check-ins with stakeholders, user testing sessions, and internal team reviews, creating a cohesive feedback ecosystem that informs each stage of refinement.

> Feedback loops are essential for keeping everyone aligned and informed. Typically, you also have one or more stakeholders in the project who are going to want to be involved in the process in some way or who you might be using is subject matter experts or who you might be showing versions of things too so that they can reflect on and give feedback on aspects of the design that are relevant to the business. (P13)

The iterative testing process is equally important in evolving prototypes for optimal usability and satisfaction. This involves a staged approach, beginning with testing low-fidelity prototypes to identify broad issues and gather preliminary feedback. Each iteration builds on insights gained, leading to increasingly detailed and refined prototypes that address specific areas for improvement.

> We often go through several rounds of iterations, each time making adjustments based on what we learn from our users. This might involve tweaking the user interface, adding new features, or

> refining existing ones. The goal is to continuously improve the design and ensure it meets our users' needs. (P11)

Overall, the iterations and feedback loop phase emphasizes a culture of continuous improvement, where design enhancements are driven by active feedback collection. By iterating on the design and actively seeking input from users and stakeholders, designers create iVR retail experiences that are not only innovative and engaging but also rigorously tested and approved by end-users. This process ensures that the final product is polished, user-friendly, and capable of delivering exceptional value to both stakeholders and users alike.

5.6 Team Structure for Creating iVR Retail

The third research question (RQ3) enquires about various stakeholders and their roles in the iVR retail design process. Thematic analysis of the interviews from the first Delphi round led to three levels of groupings that eventually led to five key analytical themes in reponse to RQ3. The first grouping revealed initial codes, that were then organized into second level or into descriptive themes. The final grouping led to five analytical themes that reveal the roles and functions of team members involved in iVR design process. Table 5.3 illustrates the initial codes, descriptive themes, and analytical themes that emerged from our analysis.

We first generated initial codes that helped in capturing the fundamental concept groups as voiced by the experts (e.g., expert's views helped reveal six initial codes, namely (i) Objective setting, (ii) Stakeholder alignment, (iii) Project scope, (iv) KPI identification, (v) Resource management, and (vi) Timeline management). Next, the initial codes were further examined in the context of their usage and grouped into second level or descriptive themes. The descriptive themes answered essential questions about each team's strategic roles and their insights. (e.g., (i) Strategic Alignment and Oversight, (ii) Resource and Timeline Management and (iii) were grouped Stakeholder Communication as (a) Strategic Alignment and Oversight while (i) Market analysis, (ii) Understanding consumer behavior, (iii) Competitive analysis, (iv) Data collection, and (v) Customer interviews were grouped as Research.

Finally, these led to the generation of third level of grouping or the final analytical themes. The five analytical themes highlighted five core teams integral to the iVR retail design process: Creative, QA, Research, Strategy & Management, and Technical. Table 5.3 shows more detail on the three grouping levels identified.

Table 5. 3 The initial codes, descriptive themes, and the final analytical themes of the design team and functions.

Analytical Themes	Descriptive Themes	Initial Codes
Creative	Innovative Design and Conceptual Development, Visual Identity and Brand Creation, Detailed Design	Ideation, Concept, Sketching and wireframing, Brand identity, Visual design, Storyboarding
QA (Quality Assurance)	Quality Assurance, Testing, Final Optimization	Bug testing, Usability testing, A/B testing, Quality standards, System optimization
Research	Insight Generation, Customer and Market Understanding, Competitive Landscape Analysis	Market analysis, Understanding consumer behavior, Competitive analysis, Data collection, Customer interviews
Strategy & Management	Strategic Alignment and Oversight, Resource and Timeline Management, Stakeholder Communication	Objective setting, Stakeholder alignment, Project scope, KPI identification, Resource management, Timeline management
Technical	Technical Feasibility and Constraint Analysis, Prototype Development and Iteration, System Integration and Performance Optimization	Feasibility assessment, Technical architecture planning, Prototype development, Coding, Technology integration, Performance optimization

The experts described their own role within these five core teams that have been identified. They also highlighted other critical roles that they have been involved in iVR retail design. Their responses helped to further map various roles to specific analytical themes. Further, experts added another role "External Input" in which they engage with clients, suppliers or other subject matter experts. Table 5.4 presents a detailed view of individual role involvement across multiple projects of all participants (P1 to P20). The number of teams involved varies depending on project size and company resources, ranging from small teams of around five people to larger teams of up to one hundred. Regardless of team size, technical, creative, and management roles are essential to project success.

Table 5. 4 The involvement of various roles in the different teams.

Analytical Themes (Teams)	Role	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
Creative	3D/Visual artist			x	x					x			x	x	x		x		x		
	Audio/Sound designer			x	x									x							
	Content creator				x																x
	Instructional designer				x																
	Interaction designer																			x	
	UX/UI designer			x			x								x						x
	Voiceover artist				x																
QA (Quality Assurance)	QA engineer		x		x										x	x		x			
Research	User researcher	x	x																		x
Strategy & Management	Creative director				x												x	x	x		
	CX / Service designer																				x
	Legal person																				x
	Marketing person	x										x		x			x				
	Producer			x					x											x	
	Product manager	x										x	x	x							
	Project manager				x	x	x	x		x	x			x	x	x	x	x	x	x	x
Technical	Developer	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	VR designer	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
External Input	Client			x	x				x		x			x	x						x
	Subject matter expert				x		x		x						x						

Each team fulfils distinct roles within the four phases of the DD framework—Discover, Define, Develop, and Deliver. In the Discover phase, the teams focus on resource management, stakeholder communication, market understanding, and technical feasibility. During the Define phase, they prioritize strategic alignment, innovative design, and insight generation. The Develop phase emphasizes prototype development, detailed design, and continued strategic oversight, while the Deliver phase centers on quality assurance, system integration, and final optimization. This structured breakdown, as outlined in Figure 5.3, provides an overview of the

collaborative contributions from each team, ensuring that the iVR retail design process meets both strategic objectives and user experience goals.

DISCOVER	DEFINE	DEVELOP	DELIVER
Strategy & Management: Resource and Timeline Management, Stakeholder Communication	**Strategy & Management:** Strategic Alignment and Oversight	**Technical:** Prototype Development and Iteration	**Quality Assurance:** Quality Assurance, Testing, Final Optimization
Research: Customer and Market Understanding, Competitive Landscape Analysis	**Creative:** Innovative Design and Conceptual Development	**Creative:** Detailed Design	**Technical:** System Integration and Performance Optimization
Creative: Visual Identity and Brand Creation	**Research:** Insight Generation	**Strategy & Management:** Strategic Alignment and Oversight	**Strategy & Management:** Strategic Alignment and Oversight, Stakeholder Communication
Technical: Technical Feasibility and Constraint Analysis	**Technical:** Technical Feasibility and Constraint Analysis		

Figure 5. 3 Teams and their functions in the iVR retail design process.

This analysis provided insights into the composition and involvement of various teams, highlighting the specific roles that fall under each team category. The interviews revealed that the number of teams varies based on the size of the projects and companies, ranging from a small team of 5 people to a large team of 100. However, technical, creative, and management roles are fundamentally indispensable.

> On a typical project, it could be as few as five. So that might be that there's two programmers and one artist and one person dealing with the customer and a lot of the paperwork. Other projects I've worked on though have had as many as 100 people. (P3)

> Ideally, for me, I like to work with a skeleton crew of five people, you know, core crew of people that should be multidisciplinary and it's very important. (P18)

In smaller teams, individuals often wear multiple hats and assume various roles. For instance, a developer might also take on responsibilities as a UX/UI designer, researcher, technical artist, and even conduct QA and usability testing.

> ...then you also have a list of sorts of skill sets that are required and then you try and match people up as best as possible. (P13)

In summary, findings have revealed that a detailed and structured team composition is necessary for successful iVR retail design. Each team member plays a crucial role in meeting their responsibilities within the DD framework. While project size and resources influence the number and distribution of roles, the essential involvement of technical, creative, and management roles remains constant across various project scales. Smaller teams often necessitate multifunctional roles, with team members taking on diverse responsibilities to ensure comprehensive project development. In contrast, larger projects benefit from more

specialized roles, allowing for greater focus and depth in each functional area. This multidisciplinary and flexible team structure fosters collaboration, innovation, and strategic alignment, ultimately enhancing the quality and user experience of the iVR retail design. With this foundation, we now delve into the specific roles and functions of each team.

5.6.1 Creative

Creative roles in iVR retail design are responsible for translating research insights into innovative design concepts. This team handles ideation, concept development, visual design, and brand identity to ensure that the final product is functional and visually appealing. The involvement of Creative Directors and CX/Service Designers underscores a focus on strategic creative direction and customer experience. These roles help align the design with brand vision, ensuring it resonates with the intended audience.

> Our creative team takes the research insights and turns them into innovative design concepts and initial sketches. This step is vital because it shapes our design solutions. (P20)

Developing a cohesive visual identity and brand elements ensures that the design aligns with the brand's goals and appeals to the target audience. UX/UI designers' contributions are crucial for projects that prioritize user experience and service design, ensuring that the final product is both visually appealing and user-friendly.

> I handle the leadership and coordination of the entire project, while the other two focus on detailing the features of the simulation. Our team mainly includes UX/UI and VR designers. We use these inputs in creating a visual identity, making sure our designs match the brand's expectations and resonate with the end user. (P6)

5.6.2 Quality Assurance (QA)

The QA team is responsible for maintaining high product standards through rigorous testing. The QA team conducts bug testing, usability testing, and A/B testing to identify and address potential issues, ensuring the product's readiness for launch. QA Engineers, although not involved in all projects, play a crucial role in complex and high-stakes projects. This selective involvement highlights the importance of allocating QA resources based on project needs to ensure that the final product is robust and reliable.

> Once we have everything laid out in grey box and white box, we move into pre-alpha, where we start adding functionality like messaging and UI navigation with hands or controllers, layering features until we reach beta. At this stage, users can try it out and provide feedback on what can

> be improved. This process highlights the need for thorough testing and quality checks to ensure we deliver a robust final product. (P17)

5.6.3 Research

The Research plays a vital role in generating insights that inform design and strategic decisions. By conducting market analysis, studying consumer behavior, and analyzing competitors, the team provides a foundation for data-driven decisions and identifies opportunities for innovation. User Researchers are typically involved in projects requiring in-depth understanding of user behavior, underscoring the importance of generating actionable insights to guide design.

> As a researcher, my job is to help them understand the important things they need to address. For example, it might be that people are very eager to get the product set up quickly. I would need to convey to the design team that the user is impatient and unwilling to read instructions... I bring these insights to life so that when the product is designed, it makes sense and feels right for the user. (P1)

5.6.4 Strategy and Management

The Strategy and Management team plays a pivotal role in guiding the overall direction of the project, ensuring alignment with business goals and stakeholder expectations. This team is responsible for setting objectives, defining the project scope, managing resources, and overseeing timelines to keep the project on track.

> If I have a client that wants to go all the way through the creation of a product, depending on whether they have in-house resources or not, and it's a very low resource environment, we do a lot of the investigation of the need and the dynamics of the environment. My team and I begin to understand the needs. (P8)

Project Managers are universally involved across all projects, reflecting their critical role in coordinating the project lifecycle from conception to delivery. Other roles within Strategy and Management include Creative Directors, CX/Service Designers, Legal Advisors, Marketing Professionals, Producers, and Product Managers. The involvement of these diverse roles highlights the need for strategic oversight, creative direction, legal compliance, marketing strategy, and product planning, all of which facilitate stakeholder communication and ensure alignment with business goals.

5.6.5 Technical

The Technical team is crucial in ensuring the feasibility and implementation of design concepts. They handle technical assessments, prototype development, coding, technology integration, and performance optimization, all of which contribute to creating a seamless user experience. Developers and VR Designers are fundamental to all projects, underscoring the indispensable role of technical expertise in iVR retail design.

> So, the team will typically be split, probably 70-30 or, I guess, 60-30-10. About 60% would be developers/programmers, 30% would be people making 3D art, and the remaining 10% would cover audio, leadership, myself, any narrative work we're going to do, and UX design, which unfortunately fits into that last 10%. (P3)

5.6.6 External Input

Clients and Subject Matter Experts (SMEs) are involved in a subset of projects. Their involvement provides valuable external perspectives and ensures that the project meets client expectations and leverages expert knowledge. The presence of clients and SMEs highlights the importance of incorporating external feedback and expertise to enhance the project's relevance and accuracy.

> I kind of intake it, then it's me and whoever the assigned SME is. This means it could be one person or up to 10 people, depending on who has the expertise and who has been designated. Typically, I've been really lucky to work with only one or two SMEs because that really helps to manage the information, as everyone has an opinion. (P4)

External input wasn't included in Figure 5.3 because the involvement of clients and SMEs varies depending on the project's scope and requirements. Their participation is selective rather than constant, and managing their contributions separately ensures that their input is strategically utilized without disrupting the workflow or overcomplicating the structure of the internal teams.

In summary, the expert interviews offer a comprehensive view of the team structure in iVR retail design. The findings emphasize the central role of technical expertise (Developers and VR Designers), the diverse contributions of the Creative team, the selective yet critical involvement of QA, the focus of the Research team on actionable insights, the essential coordination by the Strategy and Management team, and the valuable perspectives provided by Clients and SMEs. This multidisciplinary approach is essential for successfully delivering iVR retail projects, ensuring that each team's contributions collectively enhance the product's quality, usability, and market relevance.

5.7 Expert Feedback on the Design Process and Teams

In the second round of the Delphi study, five experts reviewed and provided feedback on the design process and team structure findings from the initial round. These experts, selected for their extensive experience, provided insights to enhance the study's reliability, as detailed in the methodology. This section synthesizes their feedback, offering refinements to the iVR retail design framework and identifying the strategic role of team functions.

5.7.1 Expert Feedback on the Design Process

In this round, experts contributed recommendations to refine the design process stages, emphasizing the need to align with project goals and industry practices. Through multiple rounds of feedback, key adjustments were made to various stages of the design process to better align with project goals and industry best practices. These refinements reflect the importance of considering budgetary constraints, platform decisions, and the effective use of resources such as asset stores. Additionally, the integration of critical testing phases and the expansion of feedback loops underscore the iterative nature of design in iVR retail. The following sub-sections outline the specific modifications and enhancements made to the design process based on expert recommendations.

5.7.1.1 Refining the Discover Phase: Integrating Budget and Timeframe Considerations

Experts highlighted that early clarity on budget and timeframe is essential, suggesting these considerations be integrated into the Discover phase. One expert noted that understanding these factors could frame what is achievable from the outset, creating a realistic foundation for project planning.

> It's definitely what you would like to have happen if the budget and timeframe are big enough. These are all the things that I think you would want to have. (P3)

5.7.1.2 Defining the Path Forward: Platform Decisions and Marketing Strategies in iVR Retail

In the Define stage, experts emphasized the necessity of deciding on the platform and device early, as it informs key technical and user experience parameters. Additionally, experts noted the importance of planning marketing strategies at this stage to ensure alignment with corporate and audience expectations.

> How do we talk about that sort of marketing? So if you're a team within a corporation, you have to answer to marketing before you can justify anything. So of course, you can do marketing things early, but a team that's on its own would need to approach it differently. (P13)

> The thing where I feel like there will be a difference is that you might need a different research approach because you can't just assume that someone is going to be able to use it without guidance. (P1)

5.7.1.3 Core Components in iVR Design: 3D Product Modeling and Visual Layout

The Develop phase was expanded to include 3D product modeling and visual layout design, with experts stressing these tasks as foundational for creating realistic and engaging virtual retail environments. High-quality modeling and spatial understanding are essential to replicating real-world retail dynamics in iVR.

> I think if a 3D artist is also a generalist, that's beneficial because they can touch on animation and other aspects, not just 3D modelling. Understanding how to create the environment and spatial relations is really important. (P16)

5.7.1.4 Leveraging Asset Stores: Streamlining the Design Process in iVR Retail

Experts also recommended utilizing asset stores to streamline production, especially for non-product-specific elements like store fixtures. By focusing design efforts on high-detail assets that represent products, designers can achieve a realistic environment efficiently.

> We would focus on creating our 3D assets specifically for the retail design team. So if it was a shoe company, we would spend all of our time making high-quality shoes. If it was furniture, we would make high-quality furniture. The rest of the assets, like walls and ceilings, would be purchased from the asset store. (P3)

5.7.1.5 Testing in the Deliver Phase: User Interaction and Regression Testing

In the Deliver phase, experts underscored the importance of incorporating User Interaction Testing and Regression Testing to ensure functionality and user experience. These tests, although previously underemphasized, are critical for maintaining product quality through iterative improvements.

> You'd have some testers who are not engineers. You'd have people doing user interaction testing, which is completely different from engineering. (P13)

> Regression testing is a type of testing where you're looking at whether any changes break existing functionality. If I add a feature, it shouldn't break anything else. This type of testing is done very regularly and substantially by software teams. (P13)

5.7.1.6 Expanding Feedback Loops: Iteration and Continuous Improvement in iVR Retail

Experts suggested expanding feedback loops in both the Develop and Deliver stages, as iterative refinement remains crucial beyond initial launch. Post-product marketing feedback was highlighted as an opportunity for ongoing improvements.

> I try to iterate as quickly as possible and provide playable demos to the client quickly to get feedback as soon as possible. You may need to argue for more engineers and developers depending on the type of VR you're trying to create. (P3)

> After you've launched it, you go through that cycle again and again, refining the product based on market feedback and it becomes key. (P4)

5.7.2 Expert Feedback on Team Structure

In this section, the insights gathered from experts regarding team dynamics, role flexibility, and the evolving integration of AI in the design process are explored. The feedback provided by the experts sheds light on how small teams manage multiple roles, how functions are strategically distributed across different stages of the design process, and how automation is influencing traditional creative tasks. These insights highlight the importance of adaptability, strategic role assignment, and the balance between automation and personalization in creating effective iVR retail experiences.

5.7.2.1 Role Flexibility: Adapting Functions Across the Design Process

Experts reinforced that small design teams often consist of 5-6 members, with individuals handling multiple roles to fulfill various functions. Regardless of team size, the necessary functions are distributed across project stages to ensure comprehensive execution.

> My estimation is that you would have a team of five or six people, tops on a project like this, on a building. Because that's, and that seems to be about the size of a reasonable team, to me. That's my idea of what a team would be. (P1)

> The second thing is that even in a small team, these functions are going to exist on almost every team, even if it's not a single person performing each function. So a lot of the time you'll find that you'll have one person who’s not only the creative director but also a project manager and doing interaction design. You might have a small team with only five people, but these roles will still be performed by someone because they fit together. (P13)

5.7.2.2 Stage-Specific Roles: Coordinating Team Functions Across the Design Process

Experts also emphasized the value of role distribution across different stages. Including technical roles early in the Discovery phase, for example, was noted as a preventive measure against unrealistic promises and to ensure technical feasibility from the outset.

> It is good that you included technical in the discovery phase. It depends on the quality of the people in strategy and management. If they aren't technical enough to understand what's possible, issues can arise. Often, a team might promise something that can't be delivered because they don't understand the constraints or the system. Therefore, having at least someone who is semi-technical involved from the beginning helps prevent these problems. (P3)

> The role of a product manager, for example, is to listen to all of the stakeholders in the product, from customers to leadership in the company, to then make decisions about what will be added to the product based on everyone else's input. They do a lot of horse trading, so to speak, by listening to people and compromising in the first stage. (P13)

5.7.2.3 Balancing Automation and Personalization: The Evolving Role of AI and Voiceover Artists in iVR Retail Design

With the rise of AI, experts discussed its growing role in tasks traditionally handled by the creative team, such as voiceovers. While AI can replace certain roles for efficiency, experts highlighted that personalization, especially in branding, still requires human touch when specific audience connections are needed.

> You would also probably now get a lot of pressure to use AI-generated assets. Unfortunately, the first place that would get used is the voiceover artist, because that’s usually decent enough to get by, which is unfortunate because it puts people out of work. You might end up having to do some concept art or things like that through AI art...However, if it was a brand that had a specific character they wanted to emulate, then you might need to keep that in. (P3)

However, it was mentioned that if a connection is created with the customer through voice, voiceover artists are hired to create personalized experiences.

> I think the last one would be a voiceover artist. I feel like that's a nice-to-have. I think that's really nice for customization and personalization. I think it's good for branding to have it tailored to whatever you're creating. (P16)

5.7.3 iVR Retail Design Framework

After the second round of feedback, all the results were consolidated to create a roadmap for the final design process, outlining the necessary functions and the ideal team structure. This comprehensive roadmap not only highlights the key phases of the project but also sets clear milestones and tasks to ensure timely progress. Additionally, it identifies the resources required at each stage, enabling efficient allocation and management. Figure 5.4 provides a detailed illustration of this roadmap, showcasing the sequence of activities and the interdependencies between different tasks, ensuring a well-coordinated and cohesive effort towards the project's successful completion.

5.7.3.1 The Jar Analogy: Visualizing the Stages of iVR Retail Design

One expert suggested a metaphorical approach, likening each design phase to a “jar” with a label indicating its contents. With this in mind, we aimed to present everything in the simplest and most understandable way.

> I wonder, above these layers, you need something to describe, like, if these were jars, and this is the lid with the label on it, and this is what's inside the jar. So, what does it say on the label? This jar contains... So, what's inside the jar? The tin might say tomato, coriander, cumin, water, oil, spices. But on the front, it might say everything you need for a cold winter's lunch. (P1)

Based on this analogy, the Discover, Define, Develop, and Deliver headers represent the jar's names. Subheadings like "Understanding and Research Phase" act as labels indicating what awaits us when we open the jar. Tasks such as "Understand the Problem" represent the contents of the jar. These elements were visually designed to reflect the purpose of each stage and its specific functions.

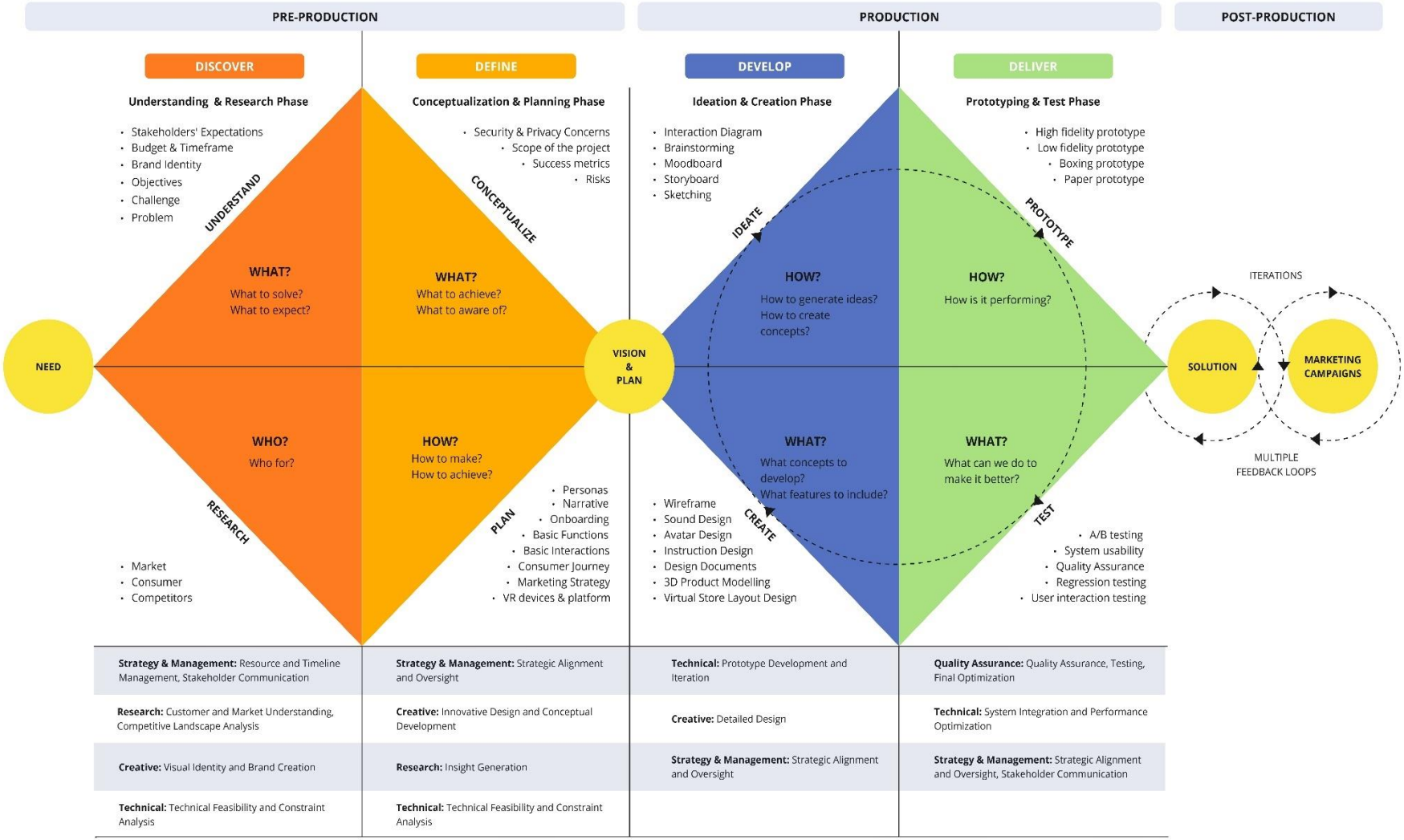

Figure 5. 4 iVR retail design framework.

5.7.3.2 Parallels with iVR Game Production: Adapting Pre-Production, Production, and Post-Production Phases

Experts also drew parallels between the iVR retail design process and game production, with phases aligning closely with pre-production, production, and post-production. This analogy reinforces the systematic, staged nature of iVR retail design, enhancing understanding for stakeholders familiar with gaming or film production. These pre-production, production, and post-production phases are applicable to the any VR design process as well. (Bąk & Wojciechowska, 2020; Li et al., 2022).

> Concept development, pre-production, production, and then post-production... These stages are common in the movie industry and are not uncommon for games and VR where what's being done is relatively well understood. (P13)

In summary, the expert feedback in this second Delphi round informed refinements to the iVR retail design framework, providing deeper insight into optimizing team roles, incorporating iterative feedback loops, and balancing automation with personalization. These enhancements solidify the framework's relevance and utility in the iVR retail sector, positioning it as a comprehensive, adaptable approach to managing complex, cross-functional projects.

5.8 Discussion

The findings of this study have highlighted several critical aspects of the integration of iVR into retail design. It has offered a comprehensive framework that addresses both the design process and the team structures essential for creating compelling iVR retail experiences. This discussion section synthesizes the study's findings, contextualizes them within existing literature, and draws attention to its implications of our study for real-world practice, theory, and in the managerial field. Finally, we present the study limitations, and set forth directions for the next research frontiers in this rapidly evolving study domain.

5.8.1 The Future of iVR Shopping

The future of iVR in retail looks promising, with projections suggesting it will become a significant channel (Xi & Hamari, 2021) and contribute to a $5 trillion industry by 2030 (McKinsey, 2022). Leading companies such as Meta, Ray-Ban, and others are investing heavily in XR technology to leverage iVR as part of the shopping experience (Sag, 2024; Sag, 2023). Metrics such as engagement, conversion rates, and customer satisfaction have shown that iVR can outperform both e-commerce and traditional retail in certain areas, highlighting its potential as a powerful channel. However, VR design experts clarify that iVR will not replace

traditional shopping. Instead, it is poised to complement existing channels—like physical stores, e-commerce, and AR—by enhancing the overall omnichannel experience.

The development of XR glasses by Meta and Ray-Ban, which combine VR with other immersive features, underscores the growing investment in creating an integrated digital shopping landscape. Yet, the adoption of iVR depends largely on user acceptance. Experts emphasize that for iVR to become a routine shopping option, consumers must first become comfortable with the technology. Until then, iVR is more likely to thrive in niches that offer a premium experience or a sense of exclusivity, rather than in everyday retail. Products that users engage with frequently and have strong purchasing habits, such as around groceries (or other items with less shelf-life) may take longer to gain traction in the iVR space.

Furthermore, experts indicate that, even among early adopters, iVR shopping lacks the established UI and UX standards that people are accustomed to in other channels. This unfamiliarity requires retailers to provide training and onboarding to guide customers through the iVR experience. As iVR shopping expands, it is anticipated that more standardized, user-friendly designs will emerge, making the experience more accessible and intuitive for a wider audience.

5.8.2 Unique Aspects of the iVR Double Diamond Framework

In response to the unique challenges of immersive VR design, this study introduces a refined version of the DD framework specifically for iVR retail, addressing the limitations of the original framework for this context. Originally developed by the UK Design Council, the DD framework provides a structured approach to design, guiding practitioners through four stages: Discover, Define, Develop, and Deliver. This framework has been widely adopted across various design disciplines due to its clear, iterative stages that encourage exploration, ideation, and refinement (British Design Council, 2005).

While DD is effective in traditional design processes and has been applied to fields such as product design, service design, and systems thinking, its broad approach can fall short in emerging fields that demand complex spatial and sensory considerations (Clune & Lockrey, 2014; Suoheimo et al., 2022). In traditional applications, the framework has proven useful for guiding design thinking, such as in UX/UI design where the stages provide structure for user research, prototyping, and testing (Bordegoni et al., 2023). However, VR design introduces unique requirements, including spatial navigation, multimodal sensory engagement, and

seamless interaction within a 3D environment, which the traditional DD does not explicitly address.

These limitations have led researchers to explore adaptations of DD to better suit the complexities of immersive media. Studies in immersive environments, for example, have highlighted the need for frameworks that accommodate interdisciplinary collaboration, iterative prototyping specific to spatial layouts, and extended feedback loops that focus on sensory and usability refinement (Zimmerman et al., 2007). Similarly, the integration of human-centered design frameworks in VR research has shown that spatial and interactive design aspects require a more detailed, nuanced approach to ensure user immersion and intuitive navigation (Slater & Sanchez-Vives, 2016).

Through our thematic analysis, we identified the need for enhanced stages and activities within the DD framework to support VR design comprehensively. The Discover phase, for instance, expands to include spatial analysis and empathy-driven research techniques tailored to understanding user behaviors in 3D environments. Additionally, the Develop phase requires iterative testing methods unique to VR, such as boxing techniques and varied prototype fidelities, to systematically refine interactions and spatial coherence. By incorporating these VR-specific elements, the refined DD framework provides a structured approach to address the immersive, user-centric, and interdisciplinary demands of iVR retail design.

5.8.2.1 Support for Spatial and Immersive Design Requirements

iVR environments present unique challenges in terms of spatial coherence and sensory engagement—two aspects that traditional design frameworks (including DD) largely overlook. In VR, users interact within a 3D space that demands careful attention to spatial layout, user movement, and interaction pathways (Jerald, 2015). Research highlights the importance of designing immersive environments that support intuitive spatial navigation and reduce cognitive load, allowing users to seamlessly interact with the virtual space (Slater & Sanchez-Vives, 2016). The refined framework addresses these needs by embedding spatial considerations across all stages of design. From ideation, where spatial dynamics are conceptualized, to prototyping, where layout and user interaction are tested iteratively, this enhancement ensures VR spaces are realistic, navigable, and meet users' expectations for immersion. Given that poorly designed spatial elements can hinder user experience and diminish engagement (Jacucci et al., 2010), our framework emphasizes spatial design as a foundational requirement for creating cohesive VR retail environments.

5.8.2.2 Emphasis on Interdisciplinary Collaboration and Integration of Team Structures

Designing immersive VR experiences requires an integration of expertise across diverse fields, such as UX/UI design, 3D modeling, sound design, and cognitive psychology. Unlike traditional design projects, which may function within linear workflows, VR projects demand seamless collaboration between technical, creative, and experiential elements to achieve a cohesive, intuitive user experience. Conventional design frameworks, including the original DD typically support isolated or sequential activities and may lack the flexibility needed for VR's interdisciplinary demands (Dam & Siang, 2018; Brey, 2017). Our refined framework addresses this gap by embedding interdisciplinary collaboration within each stage where close integration of technical, creative, and experiential perspectives is essential.

Research underscores the value of interdisciplinary teamwork in complex design projects. McCarthy and Wright (2004) argue that combining technical and creative expertise can yield richer, more meaningful user experiences, especially in domains where sensory and emotional engagement are critical, as in VR. This blend of skills enables VR teams to create environments that resonate technically and experientially, aligning with user-centered design principles that enhance engagement and satisfaction (McCarthy & Wright, 2004; Zimmerman et al., 2007).

A notable contribution of this study is the detailed mapping of team roles onto the DD framework, tailored for iVR retail design. By embedding specialized roles within each phase, our framework ensures that appropriate expertise guides the design process. Five key teams—Creative, QA, Research, Strategy and Management, and Technical—contribute specialized knowledge that supports VR's unique demands. For instance, the Creative team develops the visual aesthetics, soundscapes, and narratives that underpin user immersion, while the QA team ensures usability through rigorous testing, a vital component given VR's high standards for seamless, responsive interaction. Research teams offer insights into consumer behavior and trends, informing user-centered design decisions, while the Strategy and Management team oversees resource allocation and aligns the project with stakeholder expectations. Finally, the Technical team manages VR's complex architecture, including software, 3D modeling, and interactive features, ensuring both functionality and performance.

This structured, interdisciplinary approach mitigates the limitations of traditional design frameworks by integrating diverse expertise throughout each phase of DD. Each team's role is well-defined yet adaptable, supporting the iterative, dynamic nature of VR projects and aligning with agile methodologies that emphasize flexibility and continuous improvement (Denning,

2013). This flexibility is critical in VR design, where real-time feedback and rapid iteration allow for refinement of user interactions, enhancing the immersive experience (Jerald, 2015).

5.8.2.3 Contributions from the Second Round of Expert Interviews

The second round of expert interviews contributed valuable depth to this study's findings, offering refined perspectives on the practical application of the iVR DD framework in retail contexts. Experts with extensive VR experience emphasized the need for clarity and simplicity throughout the design process, which led to the development of the "Jar Analogy." This visual tool simplifies complex processes into manageable stages, making the design journey more accessible and comprehensible for interdisciplinary teams. Visual tools such as this are critical in complex projects, as they facilitate clear communication and shared understanding among stakeholders (Basole et al., 2024; Olmo-Extremera et al., 2023). Conceptualizing the design process in a visual form aligns with research suggesting that simplified representations help teams tackle complex design challenges more effectively, particularly in cross-functional environments (Felder et al., 2023).

Additionally, insights from VR experts highlighted parallels between iVR retail design and iVR game production, underscoring the benefits of incorporating structured methodologies from established fields. Game design has a robust foundation in managing user engagement and spatial dynamics, and VR game design techniques offer useful precedents for designing immersive retail experiences (Sadamali Jayawardena et al., 2023; Stecuła, 2024). Cross-industry insights from game production into iVR retail emphasize a systematic approach, allowing for complex, immersive experiences to be created within structured, iterative frameworks. Such a systematic approach, which borrows established methods from fields with strong foundations in immersive media, aligns with findings in design research that recommend adapting best practices across industries to foster innovation and adaptability.

By grounding the iVR retail design process in tested methodologies from other industries, our refined DD framework enables VR teams to leverage established techniques while adapting to the unique needs of the VR retail context. The inclusion of these interdisciplinary insights into the framework strengthens its ability to provide practical guidance and a robust foundation for developing engaging, high-quality VR retail experiences. This approach echoes the design principles that emphasize the importance of cross-pollination of ideas and adaptive reuse of successful strategies in new contexts.

5.8.2.4 Detailed Feedback Loops and Iterative Prototyping

Although the traditional DD framework encourages iteration, it lacks the specificity required for VR, where immersive design demands constant testing and refinement. In VR, user interactions, spatial coherence, and sensory elements require careful adjustment through feedback loops that are more granular than those used in conventional design (Jerald, 2015). Our refined framework introduces multiple prototyping stages, from low-fidelity models to high-fidelity prototypes, incorporating VR-specific techniques like grey boxing, which focuses on spatial testing before adding detailed aesthetics. Research shows that iterative prototyping allows designers to address usability issues unique to VR, creating a more immersive and functional final product (Nebeling & Madier, 2019; Seth et al., 2011; Zimmerman et al., 2007). By embedding feedback loops at every stage, this framework enables designers to refine prototypes methodically, ensuring they meet the high standards of VR environments.

5.8.2.5 Enhanced User-Centric Research for Immersive Design

Traditional research methods within the Discover phase of the DD framework often overlook the specific nuances of immersive environments. In VR, understanding how users engage with a 3D space requires empathy-driven, immersive research methods (Erensoy, 2024; McCarthy & Wright, 2004). Our framework adapts the Discover phase to include techniques such as virtual observation and immersive prototyping, which allow designers to capture user insights specific to VR. Research in immersive design indicates that empathy-driven approaches, such as observing users within VR environments, can significantly improve understanding of user behavior and expectations (Young et al., 2022). By prioritizing immersive research techniques, our framework aligns the design process more closely with users' needs, facilitating the creation of environments that are not only functional but also emotionally engaging and intuitively navigable.

5.8.2.6 Strategic Focus on Technical Feasibility and Resource Allocation

VR projects are often resource-intensive, requiring specific technologies and careful budget management to remain feasible. Traditional design frameworks rarely address these constraints comprehensively, which can lead to projects that are technologically ambitious but ultimately unfeasible (Jerald, 2015). To address these constraints, our framework incorporates checkpoints within each phase to assess technical feasibility and resource allocation, allowing design teams to align project scope with available resources and capabilities. This proactive approach, supported by research on VR development, helps teams manage creative ambition alongside resource limitations, ensuring that the final design is achievable within practical

boundaries (Balzano & Bortoluzzi, 2024). By embedding feasibility checks throughout, the framework supports sustainable VR projects that balance innovation with budgetary and technological realities.

The iVR DD framework advances the traditional framework by embedding VR-specific considerations that address the immersive, interactive, and sensory requirements unique to VR retail design. By structuring each stage to incorporate spatial design, interdisciplinary collaboration, iterative testing, and user-centered research, the framework provides VR practitioners with a comprehensive tool for developing cohesive, high-quality VR experiences. This study demonstrates that adapting the DD framework enhances its applicability in iVR contexts, supporting practitioners in creating impactful, user-centered solutions that meet the specialized demands of immersive retail environments. In doing so, the framework not only fills critical gaps in the existing design process but also establishes a foundation for future research and practice in VR design.

5.8.3 Conclusion

5.8.3.1 Practical Implications

The refined iVR DD framework offers valuable practical insights for businesses aiming to implement VR in retail, focusing on efficiency, user experience, and interdisciplinary collaboration. This framework provides a structured approach tailored specifically to immersive VR environments, equipping design teams with a phased, user-centered framework that addresses the unique challenges of VR retail design. By clarifying the design process and facilitating strategic prioritization, the framework supports businesses in optimizing both resource allocation and design outcomes, ultimately contributing to substantial time and cost savings.

A key strength of this framework lies in its ability to project the design process and identify priority areas early on, which enables teams to allocate resources more effectively to elements that directly impact user experience, such as spatial navigation, immersive sensory engagement, and intuitive UX/UI design. By focusing on high-impact features while avoiding unnecessary over-investment in less significant aspects, businesses can streamline workflows, reduce redundancies, and achieve faster project completion times, all of which contribute to a more efficient and cost-effective design process.

Moreover, the emphasis on interdisciplinary collaboration ensures that the necessary expertise—from technical developers to creative and research specialists—is integrated at

each stage of the project. This clear delineation of roles fosters cross-functional teamwork, minimizes duplication of efforts, and supports agile decision-making, which further enhances productivity and reduces the likelihood of costly redesigns or project delays. The resulting team structure not only promotes a cohesive approach to VR retail design but also ensures that complex VR projects are executed with the appropriate technical rigor and creative insight, leading to high-quality, engaging user experiences that meet the evolving expectations of VR consumers.

In summary, by projecting the design process, prioritizing critical design elements, and fostering an optimized team structure, the iVR DD framework empowers businesses to save time and resources while delivering innovative, user-centered VR retail experiences. This framework not only enhances the design process but also sets a foundation for sustainable, impactful innovation in the rapidly growing field of immersive retail environments.

5.8.3.2 Limitations and Future Research Directions

This study marks a pioneering step in shaping a structured, interdisciplinary approach to iVR retail design, yet several avenues remain unexplored, each offering fresh opportunities for refinement and innovation. One limitation of this study lies in its reliance on a relatively select group of experienced VR professionals whose insights, though deep, may not capture the diversity of perspectives needed to generalize across the rapidly growing VR landscape. Future research could expand upon this foundation by embracing a wider range of voices, from emerging designers to cross-disciplinary thinkers in fields like gaming, architecture, and experiential marketing. By inviting these perspectives, researchers can capture nuances and evolving trends that might otherwise go unnoticed, enriching our understanding of how iVR design principles might flexibly adapt across varied contexts.

The qualitative focus of this study provides a rich narrative of design processes and team dynamics, but it also limits the precision with which we can quantify the framework's impact on metrics like design efficiency, user engagement, or project cost-effectiveness. Future research could layer in quantitative methodologies to measure these dimensions, perhaps by testing the iVR DD framework in live retail projects and tracking outcomes. A mixed-methods approach would allow researchers to demonstrate the tangible value of the framework, giving practitioners data-driven reasons to integrate it into their own design processes.

Another limitation lies in the swift evolution of VR technology. As hardware advances toward more affordable, accessible devices with heightened sensory capabilities, aspects of the framework related to technical feasibility and resource management may require periodic

updating. Future research could take an adaptive approach, continuously revisiting the framework to ensure it aligns with the latest technological innovations—such as AR-VR hybrid systems or haptic interfaces. Tracking these advancements could not only future-proof the framework but also offer insights into how emerging tech reshapes consumer expectations and interaction patterns within iVR environments.

Moreover, while this study emphasizes design and team dynamics, the end-user's perspective remains largely uncharted territory. Understanding how consumers perceive, navigate, and emotionally respond to iVR shopping could unlock critical insights into creating spaces that not only captivate but also cater to the cognitive and sensory needs of diverse user demographics. Future research could integrate direct consumer feedback through experimental designs or behavioral analysis, using tools like A/B testing, biometric feedback, or virtual ethnography to understand what truly engages and delights in iVR shopping experiences.

The parallels between iVR retail and immersive fields like gaming or education present another intriguing area for future exploration. Drawing from fields with well-established user engagement principles could reveal transferable strategies that enhance the framework's effectiveness in iVR. Game design, for example, offers a robust playbook for creating engaging and exploratory spaces, while educational VR has developed practices for immersive, impactful storytelling. Borrowing methods from these disciplines could enrich the iVR DD framework, enabling it to adapt seamlessly across sectors and inspire fresh applications within VR retail.

In summary, this study illuminates a structured path forward in iVR retail design, but its potential grows with each step taken toward deeper, more inclusive research. Expanding participant diversity, layering in quantitative analysis, adapting to technological advances, involving end-user perspectives, and exploring cross-industry insights will all strengthen the foundation set here, paving the way for a dynamic, future-ready approach to immersive retail design. By embracing these research frontiers, we can ensure that iVR retail not only keeps pace with technological innovation but also meets the evolving desires of a new era of consumers, forging spaces that are as engaging as they are transformative.

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CHAPTER 6

Designing Virtual Reality Retail Environments: Insights from Virtual Reality Experts on Optimizing Customer Experience

Immersive virtual reality (iVR) is transforming retail by combining the convenience of e-commerce with the sensory richness of physical stores. This study investigates how design elements in iVR shopping environments influence customer experience (CX). Applying the Stimulus-Organism-Response (S-O-R) framework, we conducted semi-structured interviews with 20 VR design experts to identify key touchpoints, motivational drivers, and consumer behaviors. Thematic analysis of these interviews led to the development of the iVR Shopping Experience Framework, that provides a guide for the design of immersive and user-centered virtual retail spaces. Our findings highlight the importance of enhancing user immersion, facilitating intuitive interaction, offering scalable personalization, improving shopping efficiency, and building trust through transparency and security. The study contributes to theoretical understanding of consumer behavior in immersive environments and further guides practitioners in creating more compelling iVR shopping experiences.

Note that the work presented in this chapter will be submitted for publication: Designing Virtual Reality Retail Environments: Insights from Virtual Reality Experts on Optimizing Customer Experience

6.1 Introduction

The digital marketplace is undergoing significant transformation with innovative technological advancements, such as the use of immersive and interactive computer-generated experiences in virtual reality (VR) retail shopping environments. VR merges the convenience of e-commerce with the sensory engagement of physical retail, creating a new paradigm in consumer experiences (CXs) (Al Khaldy et al., 2023; Jin et al., 2021). More specifically, immersive virtual reality (iVR) environments bring about three-dimensional interactive spaces that can present users with a particularly engaging shopping encounter with different products on display (Erensoy et al., 2022). Although head-mounted displays (HMDs) are not yet widely adopted, advancements in Mixed Reality (MR) glasses such as the Apple Vision Pro and Ray-Ban Meta Smart Glasses are rapidly emerging to bridge this gap, making iVR a realistic and promising shopping channel for the future of retail (Sag, 2024; Sag, 2023). For iVR to become a mainstream shopping platform, it is crucial to explore how design elements within these environments can create meaningful and engaging CXs. Projections suggest that the global market for VR retail could surpass $5 trillion by 2030 (McKinsey, 2022) signaling that optimizing CX in iVR is a strategic priority for retailers aiming to remain competitive.

Businesses use iVR shopping environments to offer unique, personalized CX through features, such as virtual product try-ons, interactive 3D product exploration, multi-sensory ambiences, and tailored shopping journeys. Research has demonstrated that these features help increase customer satisfaction, enhance engagement, and boost brand loyalty (Barta et al., 2024; Brengman et al., 2022). However, as iVR technology continues to evolve, much remains unknown about how to design optimal CX in retail environments. While traditional e-commerce and in-store shopping models provide some guidance, designing for CX in iVR is fundamentally different. Customers interact with a variety of touchpoints—from navigation and product interaction to checkout—and their behaviors in these surroundings may differ from those observed in physical or online shopping. Therefore, it is important to understand how humans adapt their behaviors in highly immersive environments. These interactions often evoke cognitive and emotional responses that ultimately shape customer behaviors (Jin et al., 2021).

Despite the growing interest in iVR, current literature lacks a cohesive understanding of how the various design elements work together in shaping the overall customer journey. Previous studies have explored isolated aspects of consumer behaviors, such as emotional responses (Bin Kim & Jung Choo, 2023) or usability (Liang et al., 2019); however, studies often focus on specific stimuli without considering how multiple elements interact to create a seamless,

positive CX. Moreover, majority of experimental studies have been conducted in controlled settings, thereby limiting the applicability of their findings to real-world iVR shopping environments. Existing literature reviews (Erensoy et al., 2024a; Hollebeek et al., 2020) have identified gaps with empirical investigations being limited to controlled experiments, which restricts the generalizability of the findings (Chen et al., 2022; Wongkitrungrueng & Suprawan, 2023). They call for qualitative analyses to gain a deeper understanding of technological immersion strategies, by investigating iVR shopping contexts, including touchpoints, user motivations, product engagement, and purchase behaviors.

The Stimulus-Organism-Response (S-O-R) model, developed by Mehrabian and Russell (1974), has been widely applied in consumer behavioral research to examine how external stimuli (e.g., navigation aids, checkout processes) impact consumers internal psychological states or organisms (e.g., emotional and cognitive feelings) leading to observable behaviors or responses (e.g., product interaction, purchase intent) (Choi, 2019; Erensoy, 2024b). This comprehensive framework has been applied in our study for understanding how design choices are made within iVR environments to influence customer behavior. We have interviewed twenty VR design experts with much hands-on experience in designing iVR shopping environments to gain their perspective on the influences of various design elements on customer motivations and behaviors. We pose the following three research questions (RQs):

RQ1: Which key touchpoints do VR design experts prioritize to enhance CX in iVR shopping?

RQ2: What are the primary motivations driving users to shop in iVR stores?

RQ3: How do VR design experts track and evaluate customer behaviors to improve CX in iVR shopping?

The experts' responses provided us with real-world insights on iVR retail design for understanding consumer nuances, such as, how humans adapt their behaviors in immersive shopping environments. Their practice-driven perspectives have contributed towards the development of an iVR shopping experience framework. Thematic analysis strategies helped align their VR design strategies with the S-O-R framework to consolidate our framework. Our proposed framework presents key touchpoints and motivational drivers that influence consumer behaviors, to contribute towards both theory and practice for VR designers and retailers. It provides directions for future research studies in identifying design considerations for enhancing CX in iVR retail environments.

The rest of the paper is structured as follows. The theoretical background section explores the application of the S-O-R framework in understanding customer behavior in iVR environments and discusses the significance of designing for immersive customer experiences. The methodology outlines the qualitative research approach, including semi-structured interviews with VR design experts, and details the thematic analysis process used to extract insights. The findings section addresses the three research questions, presenting expert perspectives on key touchpoints, motivational drivers, and consumer behaviors in iVR shopping. The discussion contextualizes these findings within existing literature, highlighting practical implications for VR retail design and theoretical contributions to CX and HCI research. Finally, the conclusion reflects on the study's contributions, outlines limitations, and suggests directions for future research.

6.2 Theoretical Background

iVR has redefined the digital landscape by offering users highly immersive, interactive, and sensory-rich environments that closely simulate real-world experiences. By leveraging advanced technologies such as HMDs, iVR systems showcase 360-degree virtual spaces, enabling realistic interactions with virtual objects and environments (Slater & Sanchez-Vives, 2016). Unlike the traditional e-commerce platforms that offer two-dimensional browsing, users are presented with a dynamic shopping experience where they can interact with products in ways that closely mimic physical stores (Alzayat & Lee, 2021). The multi-sensory environment enables users to virtually try on products, manipulate 3D objects, and experience enhanced product visualizations, making it especially suitable for industries like fashion, furniture, and home decor, where physical interaction and spatial awareness are critical to consumer decision-making (Bonetti et al., 2018). 2023). Through iVR, retailers can therefore provide a more immersive and experiential shopping journey, which, in turn, fosters deeper emotional engagement to enhance the CX.

Despite the growing interest in iVR for retail, there remains a gap in the literature concerning how iVR environments can be designed to optimize the overall CX. While prior research has focused on isolated concepts—such as user satisfaction, navigation ease, or emotional engagement (Bin Kim & Jung Choo, 2023; Liang et al., 2019)—few studies have examined how various stimuli can be used for building interaction within a cohesive iVR shopping space. This underscores the need for a holistic investigation into how design elements in iVR environments influence CX, particularly by examining critical touchpoints and their role in shaping the customer journey.

6.2.1 Customer Experience in iVR Shopping

The concept of CX is fundamental in contemporary marketing research and practice. CX encompasses a wide range of interactions between customers and businesses throughout the customer journey, influencing cognitive, emotional, behavioral, sensory, and social responses (Lemon & Verhoef, 2016). In the context of retail, creating a memorable and personalized CX is often seen as a key competitive advantage (Grønholdt et al., 2015; Roy et al., 2017). As technology evolves, understanding how customers engage with emerging technologies like iVR becomes increasingly important for retailers aiming to optimize their strategies and create more meaningful customer experiences (Foroudi et al., 2016).

VR's immersive capabilities provide opportunities for retailers to recreate the in-store experience digitally, allowing customers to interact with products and explore virtual environments as though they were physically present (Bonetti et al., 2018). This transforms how businesses design CX, offering opportunities to simulate real-world touchpoints in virtual environments. However, understanding how these touchpoints impact the overall customer journey in iVR shopping environments remains largely underexplored. The literature on CX has emphasized touchpoints as critical components of the customer journey (Becker & Jaakkola, 2020; Følstad & Kvale, 2018; Homburg et al., 2017). However, there is limited empirical research on how touchpoints within iVR environments contribute to shaping CX, particularly across different stages of the customer journey (Hollebeek et al., 2020). Erensoy et al. (2024) conducted a comprehensive literature review on iVR shopping and proposed a shopping framework that highlights the importance of touchpoints at various stages of engagement. The study calls for more empirical investigation on direct examination of the impact of iVR touchpoints on CX, especially from the perspective of VR design experts who create these virtual spaces.

This study responds to this gap by identifying key touchpoints that VR design experts consider when developing iVR retail environments. Experts' perspectives on how various touchpoints shape CX further provide rich actionable insights on strategies for optimizing a customer's journey in virtual shopping environments.

6.2.2 The Stimulus-Organism-Response (S-O-R) Framework

The S-O-R framework, introduced by Mehrabian and Russell (1974), provides a foundational guideline for examining how environmental stimuli influence consumer behavior by affecting their internal psychological and emotional states (organisms), which then drive observable

behaviors (responses). This framework has been widely utilized in research on consumer behavior, customer experience, and immersive virtual reality environments, offering valuable insights into how various stimuli—whether in physical or digital spaces—shape decision-making processes and engagement (Choi, 2019; Kakaria et al., 2023; Koronaki et al., 2023). However, many of the existing studies have relied on experimental and controlled settings in iVR retail contexts, thereby limiting their ability to capture the nuances and complexities of real-world consumer behavior. There is a growing recognition in recent literature for more qualitative studies on understanding how VR design experts conceptualize and implement iVR touchpoints to enhance CX. A qualitative approach will focus beyond controlled experiments to offer richer insights on specifics of design elements that influence consumers outlook.

This research adopts a qualitative stance with the theoretical underpinnings of the S-O-R framework. That is, we have called upon VR design experts to share aspects of their user design considerations for creating more immersive and personalized iVR shopping experiences. Specifically, we have inquired about those critical touchpoints in the customer journey that ensure that the iVR shopping experience is both immersive and tailored to individual user needs. The S-O-R framework helped lay the foundation of our inquiry. VR experts were queried on strategies used for enhancing the overall CX in virtual shopping environments, that is, which external incitement (or stimuli) are considered to evoke emotional and cognitive responses (like gain the customer's attention) and shape observable behaviors (e.g., lead to interaction with the product).

6.3 Methodology

This study adopted a qualitative research methodology to explore the relevant touchpoints, motivational drivers, and consumer behaviors in iVR retail projects. We utilized semi-structured interviews with twenty VR design professionals. This approach is widely employed in qualitative research for its effectiveness in capturing detailed and contextually rich data, and helped in understanding the intricate dynamics of iVR retail environments (DiCicco-Bloom & Crabtree, 2006). Semi-structured interviews were chosen as the primary mode of data collection because they offer a balanced combination of structure and flexibility. This method involves using a predetermined set of questions from an interview guide while allowing for the exploration of additional topics that emerge organically during the conversation (Deterding & Waters, 2021). Such flexibility enables a deep exploration of research objectives and ensures responsiveness to emergent themes, all while maintaining a systematic approach (Adeoye-Olatunde & Olenik, 2021). In addition to interviews, other qualitative techniques such as document analysis and

the review of audio-visual materials were employed to enrich the data collection process (Creswell & Poth, 2016). By engaging directly with VR design experts, we were able to delve deeply into their experiences and viewpoints. This approach not only facilitated a nuanced understanding of the subject matter but also allowed us to uncover new insights that might have been overlooked using more rigid data collection methods.

Prior to semi-structured interviews, an interview guide was developed; this aligned with the S-O-R framework (Mehrabian & Russell, 1974) and served as a starting point to our investigation. Comprising open-ended questions, the guide explored key touchpoints (stimuli), motivational drivers (organisms), and consumer behaviors (responses) that VR design experts consider when creating iVR shopping environments. By grounding the questions in the S-O-R framework, we ensured strong alignment between the research questions and data collection instruments, facilitating a comprehensive exploration of how design elements influence CX. The development of the interview guide involved reviewing existing literature on iVR retail design and consumer behavior, alongside collaborative discussions within the research team to refine the questions. This process ensured the questions were relevant and capable of eliciting detailed expert insights.

6.3.1 Participant Recruitment and Sampling

To ensure a robust and diverse sample, we employed a purposive sampling strategy, focusing on identifying VR designers with substantial experience in the field (Patton, 2002). Using LinkedIn's premium recruiter features, we initially identified 1104 profiles matching the keyword "VR designer." Through a systematic screening process, which involved both criterion and intensity sampling techniques, we narrowed the pool to 476 individuals with verifiable practical experience in VR design. To further ensure the depth of expertise, we selected participants who had progressed beyond junior roles and possessed a minimum of four years of relevant experience, reflecting common industry standards observed in job postings.

Out of this refined pool, 163 designers were identified as having significant expertise in iVR retail projects, of which 28 finally agreed to participate. Before extending the interview invitations, screening questions were asked to confirm their eligibility. After the dropouts, 20 interviews were conducted, with participants representing a diverse range of geographic regions and industry backgrounds, including multinational companies and specialized VR firms. Data saturation was achieved after these interviews, indicating that no new themes were emerging, thus affirming the sufficiency of the sample size. Detailed information about these designers is provided in Table 6.1.

Table 6. 1 Details of the interview participants.

No	Gender	Job Title	Country	Organization Type	VR Experience
1	Male	Design researcher	New Zealand	Design consultation company	15 years
2	Male	Interaction designer	Australia	Research lab	8 years
3	Male	VR designer/ Project manager	USA	Multinational company	30 years
4	Female	Instructional designer	USA	Multinational company	10 years
5	Male	VR developer	Australia	Multinational company	11 years
6	Male	VR project lead	Spain	VR company	9 years
7	Male	VR consultant	USA	Multinational company	8 years
8	Female	Director	USA	VR company	20 years
9	Female	Technical artist	New Zealand	VR company	6 years
10	Male	UX designer	India	Multinational company	5 years
11	Male	VR developer	Japan	VR company	7 years
12	Male	VR designer	USA	VR company	6 years
13	Male	VR project lead	USA	VR company	20 years
14	Male	UX designer	Denmark	VR company	4 years
15	Male	VR developer	Greece	Research lab	5 years
16	Female	VR designer	USA	VR company	19 years
17	Male	VR quality engineer	USA	VR company	5 years
18	Male	VR designer	Finland	Multinational company	10 years
19	Male	Interaction designer	USA	Multinational company	14 years
20	Female	Service designer	UK	Multinational company	15 years

The 20 participants in the interviews, representing diverse regions such as Australia, Denmark, Finland, Greece, India, Japan, New Zealand, Spain, UK and the USA; all participants had direct experience in iVR design and held various job titles. Fifty percent of the interviewers possessed over 10 years of experience, resulting in an average experience of 11.35 years among the participants. Among the participants, a portion had employment history in multinational companies such as Unity, Ubisoft, and Starbucks, while others had worked in VR companies like SkillsVR, WaveXR, design consultation company like Bowmast consulting and research labs such as Deakin University VR Lab, Centre for Research & Technology Hellas (CERTH).

6.3.2 Data Collection

Prior to commencing data collection, ethical approval was secured from Massey University's Human Ethics Committee, ensuring adherence to institutional guidelines and ethical research standards. To obtain informed consent, a detailed consent form was emailed to each potential participant. Participants were asked to read the form carefully and reply with "I agree" to confirm their willingness to participate. This process ensured that explicit consent was individually obtained from each participant before the interviews began. In line with best practices for enhancing response quality and validity in qualitative research (Creswell & Poth, 2016) and following guidelines for conducting qualitative interviews via Zoom (Gray et al., 2020), the interviewer provided a clear explanation of the study's objectives to each participant before initiating the virtual interviews. This transparency aimed to establish trust and ensure that participants were fully informed about the purpose and scope of the research.

The data collection involved in-depth, semi-structured video interviews conducted via the Zoom platform between May and July 2023. The choice of Zoom was due to its widespread accessibility, user-friendly interface, and reliable recording features, which are conducive to conducting high-quality qualitative interviews (Archibald et al., 2019). The interviewer dedicated ample time at the beginning of each session to establish rapport with the participant—a practice essential for eliciting rich, authentic data (Oliffe et al., 2021). This rapport-building phase involved informal conversation and mutual sharing to create a comfortable and open communication environment. Each interview lasted approximately 40 minutes. At the outset, participants were invited to provide a brief introduction about themselves. If this information was not spontaneously offered, they were gently prompted to discuss their role related to iVR and the duration of their involvement in this field. This approach not only facilitated rapport but also provided valuable contextual background essential for interpreting their insights.

During the interviews, participants delved into their experiences with iVR design. They outlined the touchpoints they consider when designing iVR shopping environments, discussed the motivational drivers influencing users, and described the consumer behaviors they observed as a result of these design elements. The semi-structured format allowed for flexibility, enabling the interviewer to probe deeper into emergent themes while ensuring that key research questions were addressed (Deterding & Waters, 2021). Appendix F2 demonstrates the skeleton questions for the interviews.

All interviews were recorded with the participants' consent using Zoom's built-in recording feature. The recordings were securely stored on password-protected devices to maintain

confidentiality and data security. Transcription was carried out using a combination of automated transcription software and manual verification to ensure accuracy. This meticulous approach to data handling aligns with ethical guidelines and best practices in qualitative research (Creswell & Poth, 2016), guaranteeing that participants' information was protected throughout the research process.

6.3.3 Data Analysis

The qualitative data from the semi-structured interviews were analyzed using thematic analysis, a method well-suited for identifying, analyzing, and reporting patterns within qualitative data sets. This method was chosen for its ability to capture the complexities of iVR design processes and to provide a rich, nuanced understanding of the participants' experiences (Braun & Clarke, 2006). Recognizing the inherent subjectivity in interpreting qualitative data, we implemented measures to enhance the rigor and credibility of our analysis. Multiple researchers independently reviewed the transcripts, assigned initial codes, and engaged in regular discussions to reconcile differences and reach consensus on emerging themes. This collaborative approach minimized individual biases and ensured a balanced interpretation of the data, enhancing the trustworthiness of our findings.

The data analysis process began with verbatim transcription of all interviews, facilitated by the OpenAI Whisper model (Introducing Whisper, 2023), allowing us to immerse ourselves in the data and note initial ideas and patterns. Detailed line-by-line coding was conducted to identify significant segments related to our research questions, with codes assigned to capture their essence. We used Miro, a collaborative visual workspace, to manage and organize these codes efficiently. The initial codes were collated into potential first-order themes. Then second-order themes are created by grouping related first-order themes under broader categories reflecting significant aspects of the research questions. Through iterative discussions, we developed aggregate dimensions, examining relationships between them and considering the underlying meanings and implications of the participants' responses (Thomas & Harden, 2008). Candidate themes were rigorously reviewed, refined, or merged to ensure they formed coherent patterns and accurately represented the participants' perspectives. Throughout the analysis, we engaged in reflexivity, continually reflecting on our assumptions and potential biases. Regular team meetings facilitated consensus-building and enhanced the credibility of the findings.

The following section presents the thematic analysis of expert interviews, organized under specific headings to address the research questions and fulfill the research objectives. Each theme is accompanied by insightful quotes from participants, highlighting their perspectives

and providing a comprehensive understanding of the factors shaping CX in iVR shopping environments. Participant numbers were used to attribute quotes, maintaining confidentiality while allowing a clear connection between opinions and contributors.

6.4 Findings

The analysis of interviews with VR design experts revealed key themes that offer valuable insights into the design and optimization of iVR shopping environments. Organized around the S-O-R framework, this study explores the critical touchpoints that enhance customer experience, the core motivations driving user engagement, and the consumer behaviors that experts monitor to improve the overall shopping experience.

The findings illustrate how specific design elements within iVR shopping environments shape users' emotional and cognitive responses, leading to observable behaviors. By examining these interconnections, the study provides a comprehensive understanding of how VR designers create immersive and meaningful CX. This research contributes to understanding consumer behavior in immersive environments, offering practical insights for enhancing user engagement and interaction in virtual shopping contexts.

6.4.1 Understanding the Consumer

Understanding the consumer plays a pivotal role in the design process, providing essential insights that shape user experiences to be more intuitive, engaging, and satisfying (Choy et al., 2024; Hamilton, 2016). Nearly all VR designers interviewed stressed the importance of deeply understanding the consumers they are designing for.

> When developing a product or crafting a VR experience, my foremost consideration is the target audience. It's pivotal to deeply understand whom we're designing for—identifying their pain points, anticipating their expectations, and truly empathizing with their experience. (P16)

To achieve this level of understanding, designers typically focus on several key factors, including the consumer's demographics, interests, and technological adaptability. These elements help ensure that the iVR shopping experience is not only immersive but also personalized to meet the specific needs and preferences of each user. Additionally, designers leverage the voice of the customer (VoC) from various channels, such as surveys, interviews, and social media, to refine their designs and ensure they resonate with real-world user expectations.

> We rely heavily on the voice of the customer to guide our design decisions. Feedback from surveys, user interviews, and even social media interactions gives us a clear picture of what

> users expect. This input is invaluable in refining and improving the VR experience to meet real consumer needs. (P12)

Demographics play a foundational role in shaping how users interact with virtual environments. VR designers can tailor experiences that cater to different user groups, ensuring inclusivity and accessibility.

> Understanding the demographic profile of our users is foundational. Age, cultural background, and even their comfort with technology influence how they interact with the virtual environment. A younger audience might be more adventurous with features, while an older demographic might need a more streamlined and simplified approach. (P7)

In addition to demographics, user interests are crucial for creating engaging VR experiences.

> We always factor in user interests when designing VR experiences. Knowing what excites or intrigues them helps tailor the experience in a way that resonates. For example, if a user is drawn to immersive storytelling, we prioritize narrative-driven interactions within the virtual shopping space. (P10)

Technological adaptability is another important factor that influences design decisions. Not all users have the same level of comfort with technology, and it is important to accommodate a wide range of tech-savviness.

> Not all users are tech-savvy, so adaptability is crucial. Some are early adopters, comfortable with complex interactions, while others need more intuitive designs. We have to strike a balance, ensuring the experience is accessible to everyone, no matter where they fall on the tech spectrum. (P5)

6.4.2 Key Touchpoints (Stimuli)

This section addresses the first research question by presenting the key touchpoints and dimensions identified through expert interviews that contribute to positive CX in iVR shopping environments. Thematic analysis revealed twenty-four touchpoints, derived from first-order concepts consistently expressed by participants. These touchpoints were then grouped into five overarching dimensions: Enhancing User Immersion, Facilitating User Interaction, Personalization and Customization, Improving Shopping Efficiency, and Brand Communication and Marketing. These categories encapsulate how various design elements influence CX within iVR shopping environments. Figure 6.1 illustrates the process used to identify these touchpoints and the aggregate dimensions. The five dimensions are discussed next.

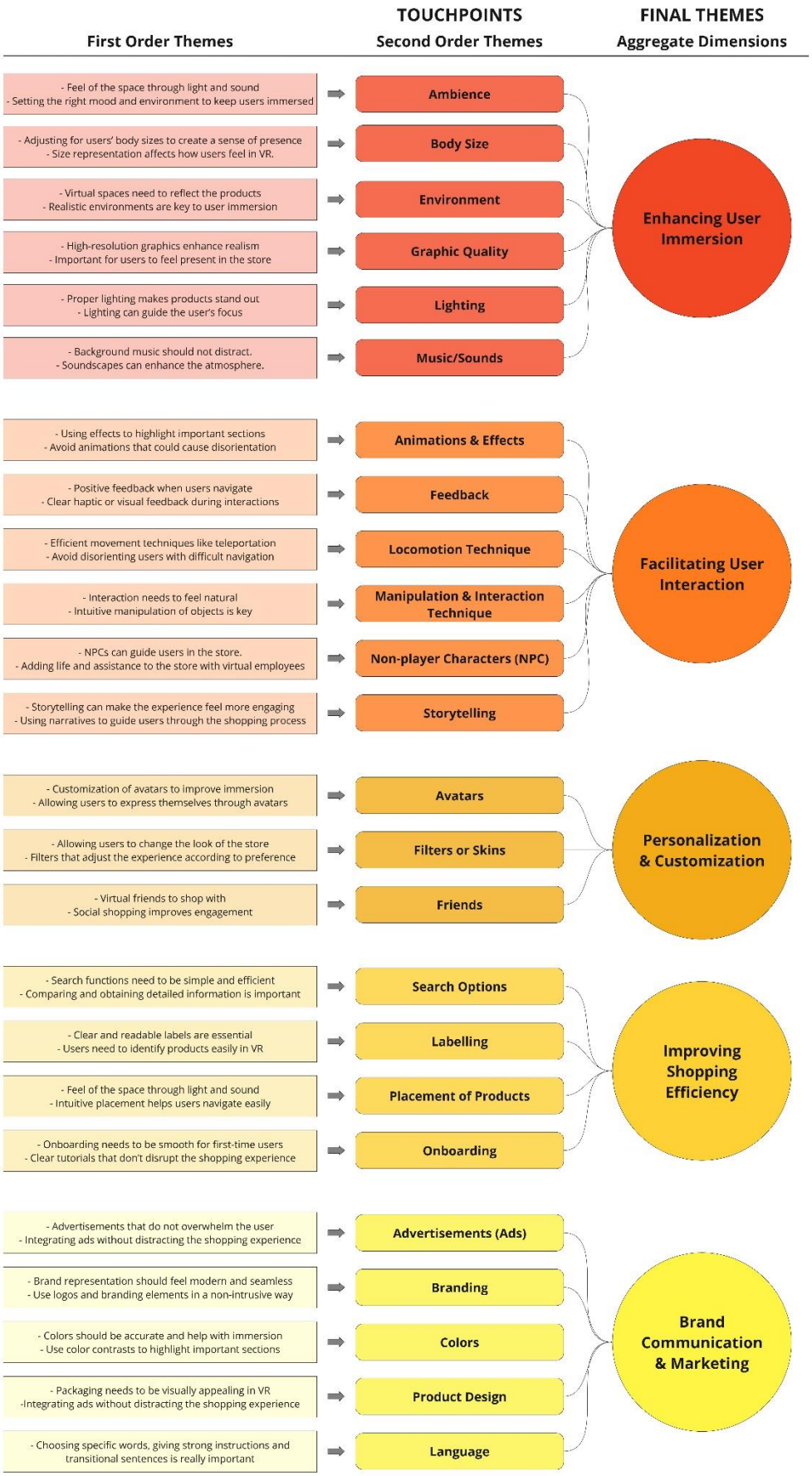

Figure 6. 1 Thematic analysis of touchpoints.

6.4.2.1 Enhancing User Immersion

Immersion in iVR environments is widely acknowledged as a key factor in delivering engaging and realistic virtual experiences (Slater & Wilbur, 1997; Steuer, 1992). In this study, VR design experts underscored the importance of various ambient factors—lighting, sound, and environmental realism—in fostering emotional engagement and cultivating a sense of presence. One expert emphasized how sensory elements can be utilized to guide users' attention and maintain focus within the virtual environment.

> The feel of the space through light and sound is critical for immersion; lighting can guide the user's focus. (P9)

Additionally, emotional comfort was highlighted as a vital component of maintaining user engagement, with experts noting how a well-designed ambiance can significantly impact users' emotional responses.

> A positive ambiance helps people feel comfortable and triggers positive emotions that enhance the experience. (P16)

In parallel, the representation of users' body size in VR plays a crucial role in creating a sense of presence, further reinforcing the immersive quality of the experience.

> Size representation affects how users feel in VR, helping create a presence. (P4)

However, immersion in iVR is not solely about sensory elements; technical execution is equally critical. The quality of graphics and overall visual experience is essential to prevent user discomfort. Poorly designed graphics or glitches can severely disrupt the immersive experience.

> You can really screw up someone's day if you give them an unpleasant experience in VR, and that could be everything from designing navigation wrong to a graphics glitch that results in something twisting or moving in such a way that someone finds uncomfortable. (P13)

Ensuring smooth performance through maintaining high frame rates is another essential factor for user comfort, particularly to avoid motion sickness. Several participants emphasized the importance of frame rate in sustaining user immersion.

> Framerate is king. So, you need to have a fast framerate. And that's especially important in VR where you can make people motion sick if you don't have sufficient framerate. (P3)

> Number one is framerate... that's probably the biggest thing we have to keep on top of. (P5)

Sound design also plays an integral role in enhancing the immersive quality of iVR environments, with one expert noting the significant impact of audio on the overall CX.

> Sound design is very important too, it's almost like 40% of everything. (P9)

In addition to sensory and technical aspects, the way user interface (UI) elements are integrated into the iVR environment is crucial. Traditional flat UI designs, commonly used in 2D interfaces, may not be suitable for immersive 3D spaces. As one expert noted, UI elements must be adapted to feel more natural within the virtual world.

> In VR design, the traditional approach to displaying persistent elements like points or clocks at the top of the screen may not translate well due to the immersive and 3D nature of the environment. A flat UI element can feel unnatural in VR. (P18)

Furthermore, the readability of text in iVR environments remains a challenge.

> The text information about a product is important, but VR is probably not a great choice there unless the ability to read text in virtual environments improves dramatically. (P13)

These findings demonstrate that VR designers focus on adjusting sensory cues and environmental design to enhance user immersion, aiming to trigger positive emotional responses and facilitate a more engaging virtual shopping experience.

6.4.2.2 Facilitating User Interaction

Effective user interaction was identified by the experts as essential for creating seamless and intuitive experiences in iVR environments. Participants highlighted the importance of navigation aids, interaction techniques, and real-time feedback to ensure users remain engaged and comfortable. One participant emphasized the necessity of clear feedback during navigation to maintain user engagement.

> Positive feedback during navigation, like clear haptic or visual cues, helps users feel more connected. (P11)

Teleportation, as a movement technique, was particularly noted for reducing user disorientation and allowing users to navigate efficiently within virtual spaces.

> Movement techniques such as teleportation reduce disorientation and help users navigate efficiently. (P3)

The familiarity of interaction techniques also plays a critical role in user satisfaction. Several experts stressed the value of using familiar methods, which reduce cognitive load and make the experience more approachable, particularly for users new to iVR.

> Rather than introducing new methods, it’s better to go for something that is already tested and familiar to people. (P10)

However, in iVR, designers have a unique opportunity to go beyond replicating traditional store layouts or interactions. While familiar elements are important, the ability to reimagine how users interact with spaces can enhance the iVR experience. One expert highlighted how iVR allows for more dynamic, user-centered designs that differ from the physical constraints of real-world stores.

> Physical stores are designed strategically. You have to walk through the things you want to get to what you need. In VR, I don't have to walk through other things to get where I want to go. I'm not restricted by those physics. If they still designed the store that way, it would be really annoying. In VR, more likely things would come to me. (P7)

This flexibility in iVR design opens up new possibilities for user interaction, allowing stores to do away with unnecessary physical movement.

> One of the things that makes shopping easier in VR is that you don't have to walk all the way across the store to get to another department. However, some experiences still require this kind of movement, which isn't necessary in VR. The store should move, not the consumer. (P8)

At the same time, iVR provides an opportunity to rethink traditional behaviors. While some real-world shopping behaviors can be integrated into iVR, they should be adapted rather than replicated.

> We should think about how we can bring the behaviors that people do in real life into VR but make it different. We don't have to replicate everything. We can create things from scratch, but we also need to take human behavior into consideration. (P20)

To facilitate smoother interactions, virtual assistants and non-player characters (NPCs) can help guide consumers through the iVR shopping environment. These artificial intelligent (AI)-driven assistants can enhance navigation, recommend products, and provide a personalized shopping experience.

> Virtual assistants would be great, particularly to help you navigate. (P7)

Another expert expanded on the potential of AI-driven virtual assistants to enhance shopping experiences by tailoring recommendations based on users' preferences and browsing history.

> Shopping experiences in VR must be very social and AI-driven. That's why AI-driven virtual assistants are a good idea. You want the things they're looking for, or searching for, to pop up in their VR space, so they can be like, ‘Okay, I could use that right now’. (P7)

In addition to interaction techniques and navigation aids, storytelling remains a powerful tool for engaging users in iVR, just as it does in traditional retail. One participant noted that many

emotional methods used in physical stores, such as storytelling and visual presentation, can still apply in iVR shopping to encourage deeper customer interaction.

> I believe that many of the methods we use in regular stores, especially those that involve emotions, will still apply in VR. This includes how strong the story behind a product is, how we describe it, and how we use colors, sounds, and pictures to present it to encourage customer interaction. (P13)

These findings suggest that VR designers must focus on implementing intuitive, familiar interaction methods while also taking advantage of the unique possibilities that VR offers, such as removing unnecessary physical movements and using AI-driven virtual assistants. Storytelling, combined with personalized and adaptive interaction techniques, can further enhance user engagement and satisfaction in virtual shopping environments.

6.4.2.3 Personalization and Customization

Personalization was identified as a key touchpoint that enhances user immersion by allowing users to express their identity and preferences within the virtual space. Participants emphasized the role of customizable avatars in increasing user connection to the environment.

> Allowing users to customize avatars adds immersion, as they feel more connected to the space. (P3)

However, experts also warned that too many customization options could overwhelm users, particularly during initial interactions.

> It’s already hard enough getting someone into a system; giving them too many options up front can take up all their time customizing their avatar. (P7)

These insights show that VR designers aim to strike a balance between offering personalization options and maintaining usability, ensuring that customization enhances rather than complicates the user experience.

Participants also highlighted how personalization in iVR environments needs to accommodate different user needs and preferences. Younger, tech-savvy users tend to favor more customization options as a means of expressing their identity.

> Younger people want a very good interface, they want to be able to select easily their choices as tech savvies. They want quick, easy search in everything... Where the personalization from people that maybe aren't as familiar with VR or with immersive technologies... they will stay in the same avatar for years and don’t care. (P8)

On the other hand, older users or those unfamiliar with iVR technology may prefer a more streamlined experience, focusing on functionality rather than customization. This difference reflects varying user expectations and highlights the importance of offering a scalable degree of personalization to match individual preferences.

Customization also plays a critical role in ensuring accessibility for users with different needs, as one participant pointed out the importance of designing for inclusivity.

> The other priority is you better remember every user is different. Some people may, for example, experience epilepsy but can still use VR as long as you don't have flashing things going on. So I would give them a choice to reduce animations and focus on comfortability. (P17)

Furthermore, participants discussed how iVR shopping environments could benefit from a social component, such as shopping with friends in a virtual mall, which adds another layer to personalization by creating shared experiences.

> Virtual malls don't exist. I would imagine a social experience where you're at the virtual mall together with friends remotely, checking out 3D models of things we might buy. (P7)

These insights emphasize the importance of flexible, user-centered personalization strategies in iVR shopping environments. Designers should consider varying levels of customization to cater to different user groups, ensuring that personalization enhances engagement without overwhelming the user, while also factoring in inclusivity and social experiences.

6.4.2.4 Improving Shopping Efficiency

Efficiency in navigating the shopping process was identified by participants as another critical touchpoint in creating a seamless iVR shopping experience. VR designers focused on features like intuitive search functions, clear product labeling, and smooth onboarding processes to reduce friction and improve decision-making. One participant highlighted the importance of streamlined search mechanisms.

> Search functions need to be simple and efficient, allowing users to find exactly what they want without difficulty. (P8)

Clear product labeling was also emphasized as essential for helping users navigate and compare products.

> In VR, clear labeling and legible fonts are especially important. (P4)

These findings suggest that VR designers prioritize improving shopping efficiency through intuitive navigation tools, aiming to minimize barriers and promote a smoother shopping experience.

In addition to search and labeling, participants underscored the significance of designing for eye-level interaction. In physical retail environments, people naturally reach for items at a comfortable height. The same principle applies to iVR shopping environments, but with the added flexibility that products can be positioned at an ideal height for user comfort.

> It's important to design experiences so somebody could reach for the box without having to really stretch, or more importantly, without having to bend over. (P3)

Another participant emphasized the importance of making items easily visible.

> I would say try to keep everything at a proper height, that would be helpful. Bring the things to the user rather than having them bend down or reach up to grab things because it's not really necessary. (P10)

This focus on eye-level design is crucial, as users in VR environments tend to engage with the first direction they are guided toward.

> Most people don't really look 360 degrees. Everything that should be important should be front, center, and right at eye-level. (P18)

By ensuring that products and important elements are positioned within the user's natural line of sight, VR designers can streamline the shopping experience, making it more efficient and reducing the physical and cognitive strain often associated with navigating large virtual environments.

These insights suggest that shopping efficiency in iVR is heavily reliant on thoughtful design that reduces unnecessary movements and ensures ease of access. By prioritizing intuitive navigation, clear labeling, and eye-level interactions, VR designers can improve the overall shopping experience, minimizing friction and promoting a more efficient and user-friendly environment.

6.4.2.5 Brand Communication and Marketing

Brand communication in iVR offers opportunities for subtle engagement without disrupting the immersive experience. Participants noted that branding elements need to be incorporated carefully to maintain user engagement while still promoting brand recall.

> Subtly incorporating the brand into 3D models in the scene with the logo—nothing too big or flashy—helps users remember the brand without disrupting their experience. (P10)

Experts also raised concerns about the responsible use of advertisements in VR environments, particularly regarding their potential impact on user well-being.

> You're responsible for what you show in VR. User health is something you need to consider more seriously, especially when placing ads. (P11)

In addition to branding, clear and concise instructional design plays a crucial role in guiding users effectively through the iVR shopping environment. Instructions should be designed to improve user understanding and ease of use, ensuring a seamless shopping experience.

> Your message in a VR shopping environment must be conveyed clearly and concisely. (P9)

These findings suggest that VR designers should employ subtle, non-intrusive branding strategies, combined with clear instructional design, to ensure a positive user experience. By balancing branding efforts with ethical considerations and improving usability through concise messaging, iVR shopping environments can create engaging, trust-building experiences for users.

6.4.3 Motivational Drivers (Organisms)

This section addresses the second research question by presenting the motivational drivers identified through expert interviews; we asked the VR design experts which design factors enthused consumers and influenced the CX within iVR shopping environments. Thematic analysis revealed twelve motivational drivers, derived from first-order concepts consistently expressed by participants. These drivers were then grouped into four overarching dimensions, Emotional Engagement and Comfort, Trust and Security, Familiarity and Ease of Use, and Scarcity and Urgency. These dimensions encapsulate how consumers feel, decide, and what they seek to experience in order to create meaningful and engaging CX in iVR shopping environments. Figure 6.2 illustrates the process used to identify these motivations and dimensions.

Figure 6. 2 Thematic analysis of motivational drivers.

6.4.3.1 Emotional Engagement and Comfort

Emotional engagement and comfort are core components of a consumer's psychological experience in iVR environments, with stimuli designed to elicit positive emotions and minimize discomfort. VR design experts frequently highlighted arousal as a motivational driver in virtual shopping, understood as heightened attention or engagement:

> I would use 'arousal' in a broader sense, where it means you're simply paying attention. Arousal encompasses being engaged, paying attention, recognizing your surroundings, and being aware that you're looking to buy something that will make you feel different. (P3)

This reinforces the role of arousal in capturing users' attention and engagement in the immersive environment. Comfort also emerged as a crucial factor for sustaining engagement, with experts stressing the importance of designing environments that make users feel at ease:

> A positive ambiance helps people feel comfortable and triggers positive emotions. (P16)

Comfort was viewed as a facilitator of emotional engagement, helping users transition smoothly from their physical surroundings into the virtual space. Another key motivator was the confidence users could build within VR, as they are not subject to external judgments:

> Confidence, it's really easy to build confidence inside of VR because you're not surrounded by reminders or people that you see reacting to you... there's a huge emotional bridge, and if you design for making them feel good, it's not just that they feel good. It could be the only time they have ever felt good inside their bodies. (P12)

This reflects the potential for iVR to create a unique, immersive environment where users feel emotionally secure and more confident, encouraging longer engagement with the platform. These findings suggest that VR designers should focus on creating experiences that foster positive emotional states to promote sustained interaction and a sense of comfort.

6.4.3.2 Trust and Security

Trust emerged as a critical factor in influencing user behavior within iVR shopping environments, particularly in contexts involving personal data and transactions. Experts consistently mentioned concerns about privacy and the handling of user data, as trust is easily compromised when consumers feel their data is not being adequately protected.

> I value my privacy just as much as I value the privacy of the users I work with. If my information is being collected without a clear purpose that benefits only the company, I would not feel comfortable using it. It's a matter of great importance to me. (P2)

Participants stressed that perceived security was pivotal in fostering trust. VR designers must address these concerns to ensure users feel safe engaging in virtual environments.

> The first thing that should be good is aiming for a good user experience in terms of security. People need to feel safe in VR. (P11)

Experts also mentioned the importance of perceived quality in virtual product interactions, linking it to consumer trust. For users to feel confident making a purchase, they must trust the quality of the virtual products.

> When you shop in VR, it will not be real products, but you need to perceive something about their quality... The perception of something in VR gets really connected to the trust of the end user. (P8)

This suggests that VR designers must focus on building trust by addressing security concerns and enhancing the perceived quality of virtual products, which will likely lead to greater user engagement and purchase intent.

6.4.3.3 Familiarity and Ease of Use

Familiarity is another motivational driver that plays a key role in enhancing CX, particularly for first-time iVR users. Experts pointed out that using familiar interaction techniques can reduce cognitive load and improve the CX by making the environment more intuitive.

> In order to get a successful VR experience, the interaction must not be very novel from what people know at the moment. For example, swiping through objects on a virtual shelf should feel familiar, like swiping photos on a phone. (P10)

This finding aligns with research on cognitive ease, where familiar tasks reduce the mental effort required to interact with the environment (Kakaria et al, 2023). Experts also highlighted the need to address discomfort—specifically motion sickness—as a key barrier to user adoption of iVR.

> When users feel motion sickness and discomfort, they are not going to like using VR... It's really hard to get rid of this bias in the future, and it will affect their willingness to use VR again. (P6)

The emphasis on reducing discomfort reflects the importance of designing iVR experiences that minimize sensory mismatches, as stress caused by unfamiliar or overwhelming interactions was also mentioned.

> Sometimes if it's the first time that users use VR, they can feel stress. They need a little bit of adaptation time and to normalize that kind of experience. (P6)

These findings suggest that VR designers should prioritize intuitive design and user-friendly interfaces that promote ease of use and minimize stress, particularly for new users. This will help users feel more comfortable and confident, encouraging them to engage for longer periods.

6.4.3.4 Scarcity and Urgency

Perceived scarcity is a powerful motivator in both traditional and iVR shopping environments. Experts noted that creating a sense of scarcity, whether real or simulated, can drive purchasing behavior by increasing urgency.

> Perceived shortage, whether it's real or not, is another way to get people to buy things... perceived shortage might be another way to move more products. (P3)

This reflects a broader strategy employed in consumer behavior, where perceptions of scarcity can lead to accelerated decision-making and higher purchase intent. In iVR, the ability to simulate scarcity through mechanisms such as countdown timers or limited edition virtual products can enhance emotional responses like urgency, motivating users to act quickly.

These findings indicate that VR designers can leverage scarcity and urgency as effective motivators to increase engagement and drive sales. By carefully incorporating these elements into the shopping experience, they can encourage users to make faster purchasing decisions, thereby improving overall CX.

6.4.4 Consumer Behaviors (Responses)

This section addresses the third research question by presenting the consumer behaviors and dimensions identified through expert interviews that VR experts consider crucial for measuring and improving CX in iVR shopping environments. Thematic analysis revealed eleven key behaviors, derived from first-order concepts consistently expressed by participants. These behaviors were then grouped into three overarching dimensions: Analyzing Consumer Interactions, Optimizing User Experience, and Maximizing Engagement and Loyalty. These categories encapsulate how consumers behave within virtual shopping environments and how VR designers interpret these behaviors to create meaningful and impactful CX. Figure 6.3 illustrates the process used to identify these behaviors and their related dimensions.

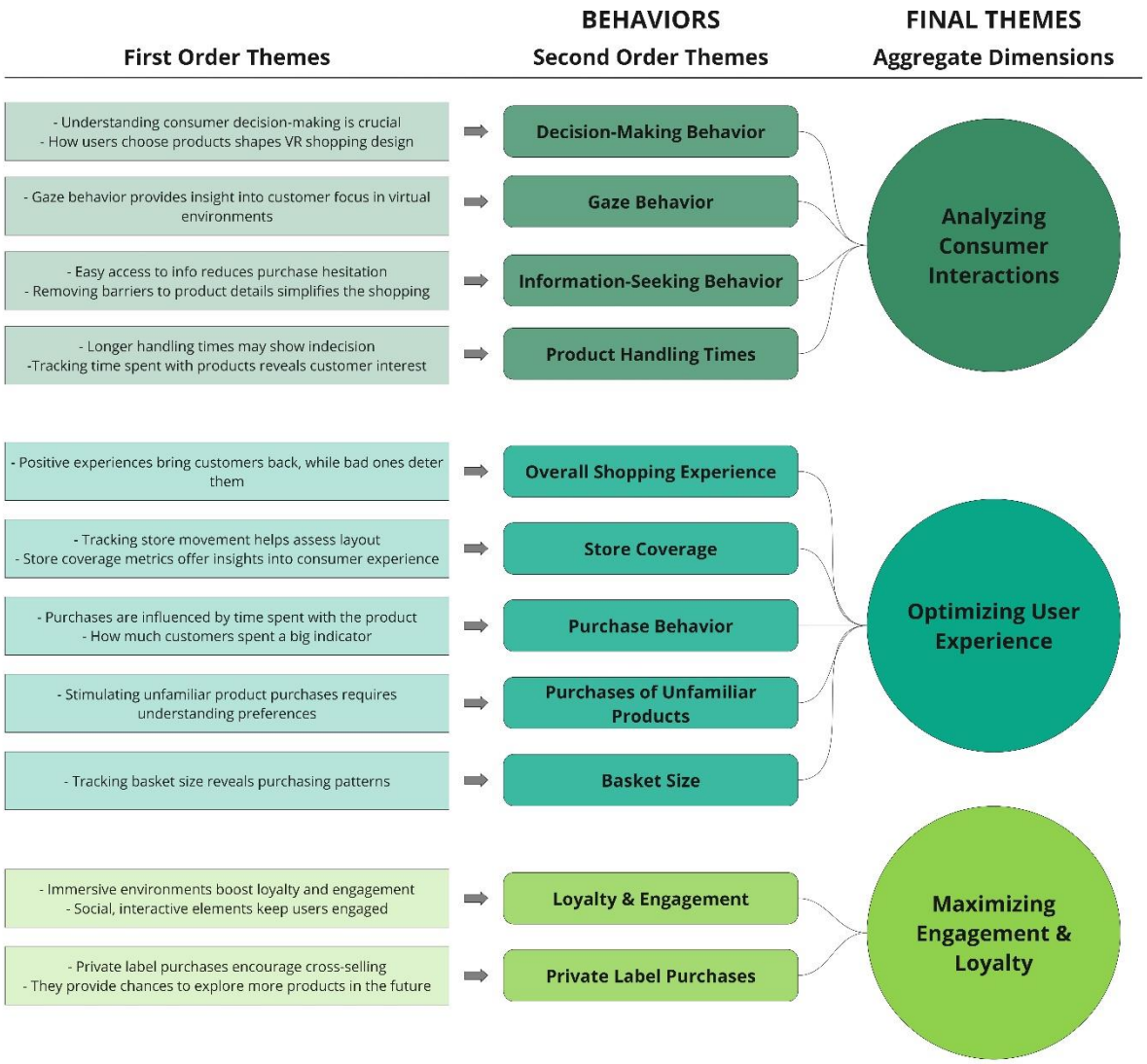

Figure 6. 3 Thematic analysis of consumer behaviors.

6.4.4.1 Analyzing Consumer Interactions

Understanding consumer interactions in virtual environments is essential to improving the CX and fostering engagement. Participants highlighted several key behaviors related to decision-making, gaze behavior, information-seeking, and product handling that provide insights into consumer behavior within iVR shopping environments.

Decision-making was identified as a critical behavior by multiple experts.

> Understanding decision-making behavior is crucial, regardless of the situation or context. (P1)

Another expert emphasized the challenges consumers face in making decisions in iVR environments.

> For the designer, I think decision-making behavior would be at the top... Is it consumer fatigue, or are they buying things due to the effort involved in trying? (P3)

This highlights the importance of understanding how consumers navigate choices in iVR settings, where decision-making can become more complex due to the immersive nature of the environment.

Gaze behavior was another important area of focus. VR experts pointed out that tracking where users focus their attention can offer valuable insights into their interests and preferences.

> We are trying to use where they are generally looking to determine what they are focusing on (P10).

Participants viewed gaze behavior as an important tool for analyzing consumer attention in iVR environments, helping designers optimize product placement and interface elements based on where users focus.

Information-seeking behavior was frequently mentioned, especially in relation to consumers who require additional product details before making a purchase decision. Participants emphasized the need to streamline access to product information in iVR to reduce barriers to purchase, as information-seeking behaviors reflect consumers' efforts to ensure their decisions are informed.

> The information-seeking behavior that I think is going to show up more for cautious consumers... Removing any friction, like unclear product information, is essential to making a sale (P3).

Product handling times in iVR were also viewed as a potential indicator of consumer interest.

> Product handling times might show why someone is spending so much time on something. Are they more likely or less likely to buy it? (P3)

The duration of time consumers spends engaging with virtual products was seen as a measure of interest, and participants considered it a behavior worth monitoring for insights into purchase intent.

6.4.4.2 Optimizing Shopping Experience

Optimizing the overall shopping experience in iVR was seen as essential for ensuring repeat engagement. Participants highlighted consumer behaviors related to store navigation, purchase patterns, and interactions with unfamiliar products as key indicators of user satisfaction.

Participants consistently emphasized the role of positive shopping experiences in influencing future engagement.

> A good experience usually means they had a good interaction, but if a shopper has a bad experience, they won't return. (P17)

Store navigation was viewed as a critical behavior for understanding how consumers explore virtual environments.

> If it's my dream project, we'll have the ability to capture some metrics and heat maps. (P3)

Tracking how users move through iVR stores was highlighted as a valuable tool for optimizing store layouts and product placements, encouraging users to explore more products.

Purchases of unfamiliar products were seen as an important behavior to monitor, as guiding users toward unfamiliar items could expand their engagement with the platform.

> In the strategy to stimulate purchases of unfamiliar products, understanding and leveraging consumer preferences is critical. (P1)

Participants discussed how consumer behaviors in unfamiliar contexts, such as being guided through the selection process, could be influenced by design elements like personalized recommendations.

6.4.4.3 Maximizing Engagement and Loyalty

Fostering long-term engagement and loyalty was seen by experts as a crucial component of successful iVR shopping environments. Consumer behaviors related to engagement, loyalty, and private label purchases were frequently discussed.

Building sustained engagement through immersive and interactive experiences was seen as essential to encouraging users to return. Experts consistently highlighted the role of immersive environments in driving repeat engagement, with the goal of creating experiences that are compelling enough to draw users back.

> It needs to be something they can't get anywhere else... it has to be engaging enough to make them want to return to the headset. (P12)

Private label purchases were another indicator of consumer trust and brand loyalty.

> The proportion of private label purchases is pivotal when aiming to cross-sell and upsell, encouraging customers to explore offerings beyond their initial intent. (P1)

Participants viewed private label purchases as an important behavior that could signal consumer trust in the brand, which could, in turn, be leveraged to encourage further exploration of the store's offerings.

6.5 Discussion

Experts' voices have offered critical insights into the design iVR shopping environments. They emphasize the pivotal role that sensory immersion, interaction design, personalization, and trust play in shaping CX. Together, these elements provide a comprehensive view of how consumers behave in iVR settings and identify the key motivational drivers that influence their engagement and purchasing decisions. To bring these insights into focus, we propose an iVR shopping experience framework that integrates the essential touchpoints, motivational drivers, and resulting consumer behaviors identified in this research. This framework serves as a practical framework for both VR designers and retailers, offering a structured approach to optimizing CX by aligning design strategies with consumer motivations and behaviors. At the core of the framework is the S-O-R framework, which provides a cohesive lens for understanding how sensory inputs, emotional engagement, and user interactions combine to influence purchase decisions and foster long-term consumer loyalty.

6.5.1 Proposed iVR Shopping Experience Framework

The iVR shopping experience framework presented in Figure 6.4 visually encapsulates the core insights derived from this study, offering a structured approach to understanding how iVR environments shape CX within the context of iVR retail. Central to this framework is the consumer, who serves as the focal point around which all design decisions revolve. According to the expert interviews, understanding the consumer is paramount for VR designers, and the framework underscores this by positioning consumer-related insights—such as demographics, technology adaptation, interests, and the VoC—at the core of the design process. These factors guide the creation of touchpoints and the overall customer journey, ensuring that the VR shopping experience is tailored to user needs and preferences.

These consumer insights guide the creation of touchpoints and the overall customer journey, ensuring that the iVR shopping experience is not only immersive but also personalized to individual user needs. (Erensoy, 2024) emphasizes the critical role of S-O-R processes in iVR shopping environments and highlights the need for practice-oriented qualitative research for understanding S-O-R dynamics in iVR retail environments. Their review calls for getting a real-world perspective on understanding the intersection of immersive technologies with consumer behavior. Our proposed framework (shown in Figure 6.4) expands on the iVR shopping experience from a design standpoint; it consolidates VR design expert perspectives into a layered approach, where the consumer is the focus of all design considerations.

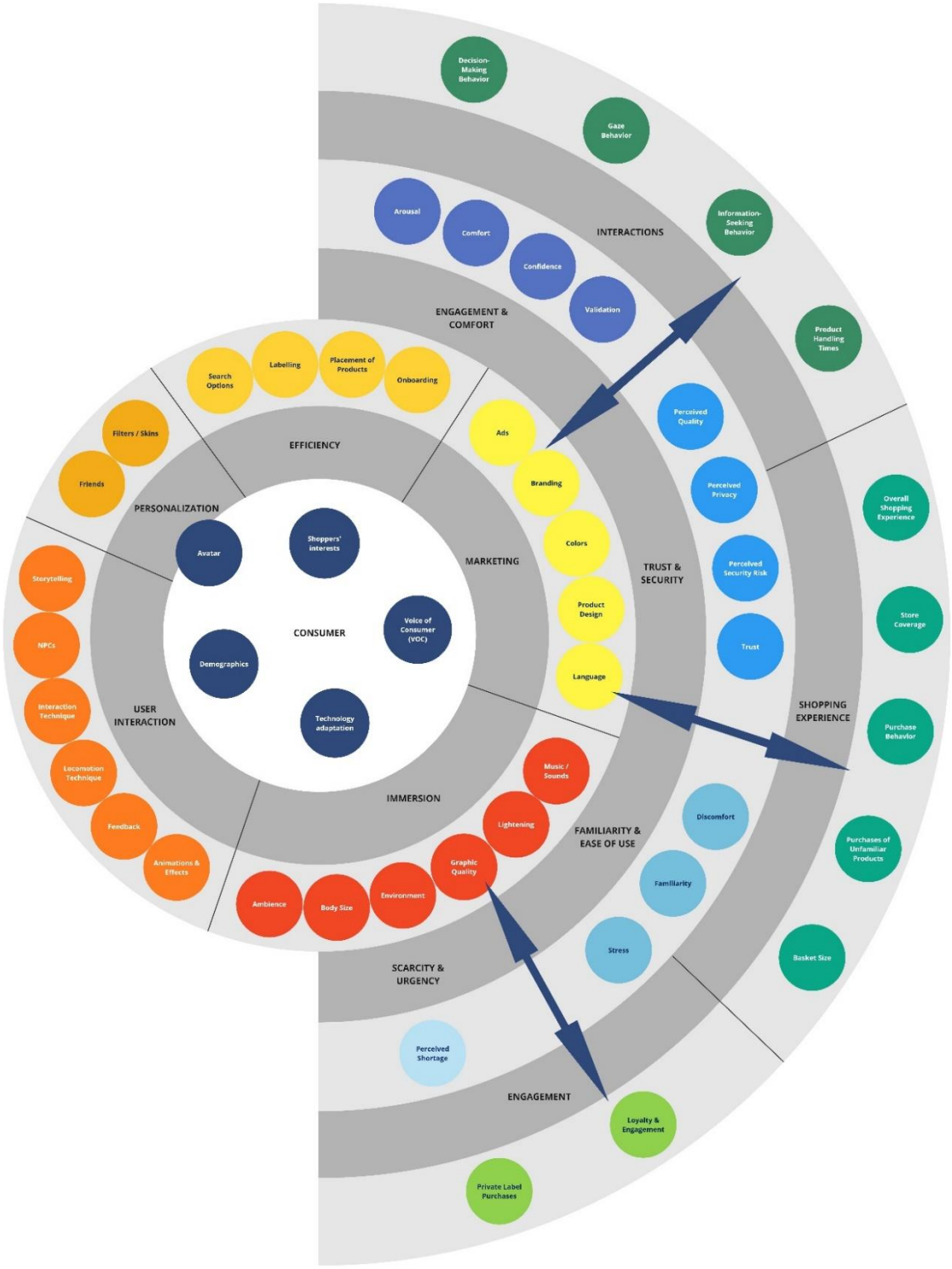

Figure 6. 4 The iVR shopping experience framework.

6.5.1.1 Touchpoints in VR Shopping: A Layered Approach

Surrounding the consumer, the framework's first layer emphasizes the touchpoints that VR designers and retailers create to foster meaningful interactions within the virtual environment. These touchpoints are grouped into five key categories: Enhancing User Immersion, Facilitating User Interaction, Personalization and Customization, Improving Shopping Efficiency, and Brand Communication and Marketing. These categories reflect core design principles in both HCI and CX design, where immersive environments are increasingly seen as multifaceted experiences that integrate sensory, cognitive, and emotional elements (Keiningham et al., 2020).

6.5.1.2 Motivational Drivers: Aligning Touchpoints with Internal States

The second layer of the framework delves into the motivational drivers that emerge from the designed touchpoints. These drivers, grouped into Emotional Engagement and Comfort, Trust and Security, Familiarity and Ease of Use, and Scarcity and Urgency, represent the internal states and motivations that influence user behavior in iVR environments. Research in iVR has long acknowledged the importance of emotional engagement in fostering deeper user immersion and interaction, particularly in environments where sensory stimuli trigger positive cognitive and emotional responses (Chen, 2023). The framework highlights how each touchpoint is crafted to align with these internal motivations, making the shopping experience both satisfying and efficient.

6.5.1.3 Consumer Behaviors: A Feedback Loop for Iterative Design

Finally, the outer layer of the framework captures observable consumer behaviors that result from the interplay between the designed touchpoints and the motivational drivers they create. These behaviors are divided into three main categories: Consumer Interactions, Shopping Experience, and Engagement and Loyalty. As previous studies have shown, understanding consumer interactions in iVR—such as gaze behavior, decision-making, and product handling times—provides valuable insights into user preferences and attention (Melendrez-Ruiz et al., 2021). These behavioral insights are key to optimizing product placement, navigation paths, and interaction strategies, allowing VR designers and retailers to create more engaging, consumer-friendly environments.

The feedback loop represented by the arrows in the visual framework demonstrates how consumer behaviors inform future design iterations. This continuous cycle of improvement reflects the dynamic nature of CX in iVR settings, where real-time data from user behaviors can be analyzed to refine and enhance touchpoints, driving both short-term engagement and long-term consumer loyalty. By linking touchpoints to motivational drivers and using observed

behaviors as a basis for design adjustments, the framework ensures that iVR shopping environments remain responsive to user needs and adaptive to evolving trends in consumer behavior.

6.5.2 Design Strategies for Enhancing CX in iVR Retail

The findings of this study offer several actionable insights for designers looking to create compelling and user-friendly iVR shopping environments. By focusing on the balance between immersion, ease of use, personalization, and consumer behavior, designers can optimize the CX and encourage greater user engagement and purchasing behavior.

6.5.2.1 Immersive Experience as a Cognitive and Emotional Driver in iVR Shopping

In the context of iVR shopping, immersion extends beyond sensory engagement to form deep cognitive and emotional connections. Sensory elements—such as lighting, sound, and the tactile realism of objects—play a pivotal role in fostering a heightened sense of presence and cognitive processes (Mostafavi et al., 2023; Nolé Fajardo et al., 2023; Szita et al., 2024). This presence encourages prolonged interaction with products and reinforces emotional connections that drive purchase decisions (Sina & Wu, 2023).

In addition to sensory elements, storytelling has emerged as a powerful tool for triggering cognitive and emotional engagement. As Gabriel (2000) highlighted, storytelling can evoke deep emotional and cognitive responses, transforming passive audiences into active participants. This has made storytelling an increasingly popular concept in academic discourse (Holt et al., 2004). In the marketing and retailing field, storytelling is particularly valued for its ability to transform information into engaging and persuasive content. In today's digital era, marketers are progressively using narrative techniques to captivate and influence their audiences (van Laer et al., 2019). However, despite its widespread use across various fields, research on the combined impact of sensory cues and storytelling within iVR retail environments remains limited. Although storytelling has been used effectively in iVR to promote behavior change in areas such as environmental awareness (Levstek et al., 2024) and health (Tintarev et al., 2016), its potential to shape consumer behavior in retail contexts is still largely unexplored.

A novel contribution of this study is the finding that emotional immersion, when enhanced through storytelling and strategically aligned sensory cues, significantly amplifies user engagement. By weaving emotional narratives around products—whether through evocative soundscapes, visual storytelling, or interactive experiences—designers can transform the virtual shopping experience from a functional, transactional activity into a meaningful and

personalized journey. Personalizing these narratives based on users' preferences and previous interactions allows the shopping experience to evolve, making it more dynamic and responsive to individual needs. This approach not only increases engagement but also deepens the emotional connection between the consumer and the virtual retail space, offering a richer, more memorable experience.

Integrating storytelling into sensory design has the potential to foster stronger emotional ties with consumers, guiding their behavior in ways that extend beyond the typical retail experience. This synergy between narrative and sensory immersion opens up new avenues for future research and innovation in iVR retail, where the focus shifts from mere product presentation to creating emotionally resonant, immersive shopping journeys.

6.5.2.2 Balancing Familiarity and Novelty in User Interaction

One of the key challenges in designing iVR shopping environments is finding the right balance between familiar interaction techniques and the novelty that iVR offers. Familiarity is particularly important for reducing cognitive load (Nori et al., 2023), especially for users who are new to VR (YiFei & Othman, 2024). Interaction methods such as teleportation and intuitive navigation tools help users engage with the environment without feeling disoriented (Schnack et al., 2021). The use of such familiar methods is a well-established principle in HCI, as it reduces cognitive strain and encourages exploration.

However, this study highlights that too much familiarity may underutilize the unique affordances of iVR. Designers must introduce novel interaction techniques to fully leverage the immersive potential of virtual environments. One significant insight is that iVR allows designers to move beyond traditional retail constraints, such as physical store layouts. For instance, iVR retail environments should be designed to adapt to the user, eliminating unnecessary physical movement and ensuring that the shopping experience is centered around user convenience. This approach shifts the design focus from replicating physical spaces to creating a more dynamic, user-centered virtual environment. These findings suggest that a balanced approach—using familiar methods to ease navigation while incorporating novel interactions—will optimize user engagement in iVR shopping environments.

6.5.2.3 Personalization as a Continuous, Dynamic Experience

Personalization plays a crucial role in ensuring customers are presented with the most relevant products at the right time and place to enhance their shopping experience (Wu et al., 2021). It offers advantages for both retailers and consumers by tailoring products, services, and interactions to individual preferences, which increases consumer appeal (Desai, 2019).

Additionally, personalization provides flexibility in transactions, better-targeted advertising through banners and websites, and more refined product recommendations (Strycharz et al., 2019). In the context of iVR, the ability to customize avatars and environments through options, filters and skins further enhances the shopping experience by creating a highly personalized and immersive environment (Ki et al., 2025; Szocs et al., 2023). The varied preferences for avatar designs emphasize the significance of personalization in iVR social interactions (Fraser et al., 2024).

While customization options enhance user immersion by allowing individuals to express their identities within the virtual space, an overload of personalization options can overwhelm users, especially during their initial interactions (Zhou et al., 2023). The concept of progressive personalization emerges as a strategic solution, where customization options are introduced gradually as users become more familiar with the environment. This approach ensures that personalization enhances rather than detracts from the overall CX.

The study also points to the importance of tailoring personalization based on demographic differences. Younger users, who tend to be more tech-savvy, are likely to seek extensive customization options as a means of expressing their identity, while older users or those less familiar with iVR may prefer a more streamlined, functional experience (Daradkeh et al., 2024). This suggests that VR designers must offer scalable personalization options that cater to different user groups, ensuring inclusivity and accessibility for all. Accessibility refers to the practices that ensure environments, products, and services are understandable, usable, and functional for all individuals and goes beyond addressing the needs of people with disabilities; it encompasses a wide range of individuals with varying temporary, situational, or long-term functional limitations (Burova et al., 2023). This includes those with reduced mobility due to aging, pregnancy, or accidents. Accessibility empowers individuals with disabilities to live independently and participate fully in society by ensuring equal opportunities for all. Leveraging new technologies is crucial in creating inclusive shopping experiences that allow everyone to shop autonomously, without the need for assistance (Pantano et al., 2022). In this context, iVR offers significant advantages, providing tailored solutions that cater to diverse needs, making shopping more accessible and equitable for all users (Dudley et al., 2023). This means that personalization in iVR shopping environments should not only focus on customization but also prioritize user comfort and accessibility. Features such as adjustable flashing lights, customizable animations, eye-level product placement, and eye-tracking controls should be incorporated to accommodate users with specific needs, such as those prone to epilepsy or individuals with mobility limitations. A key gap in the current understanding of VR shopping

environments is how accessibility features are integrated and tested across diverse demographic groups. While personalization in iVR has been explored, there is limited research on ensuring that these personalized experiences remain inclusive and adaptable for users with varying functional needs, such as those with temporary, situational, or long-term disabilities. Additionally, the impact of accessibility-focused features, such as adjustable flashing lights, customizable animations, etc. on CX remains largely unexplored. This presents a critical area where further investigation is needed to better understand how to design iVR retail experiences that cater to a broad spectrum of users.

Furthermore, social customization in iVR presents a unique opportunity for engagement (Rzeszewski & Evans, 2024). Shared virtual shopping experiences, where users can interact with friends or avatars, amplify personalization by introducing social elements into the shopping experience. The ability to recommend products to others, or even virtually "try on" products together, creates a collaborative and immersive environment that mirrors real-world interactions in new and innovative ways.

6.5.2.4 Efficiency as a Pillar of User Retention

Efficiency in iVR shopping environments is critical to increasing purchase intention and sustaining user engagement (Zhang et al., 2024). While immersion is key to creating an emotional connection with the environment, users still expect the convenience they find in traditional e-commerce platforms. Streamlined search functions, clear product labeling, and intuitive navigation are essential to maintaining a smooth shopping experience (Arrazat et al., 2023; Schnack et al., 2021). Experts emphasize the importance of designing for eye-level interaction, ensuring that products are positioned for easy access without causing unnecessary physical strain. Optimizing the layout and placement of items helps reduce both cognitive and physical effort, creating a more fluid and engaging shopping journey. While previous studies on product placement in iVR have largely focused on replicating real-world environments, shelf positioning, and customer behavior, there is room for more innovative approaches (Wölfel & Reinhardt, 2019). For instance, methods like eye-level pop-up searches could enhance user engagement by simplifying product access and eliminating physical inconveniences, such as bending or reaching, that are typically experienced in real-world shopping environments.

In addition to optimizing the layout, integrating practical tools such as voice-activated search functions and gesture-based interactions can significantly enhance the efficiency of iVR shopping environments while also providing consumers with a sense of safety and control. These tools not only simplify navigation but also create a secure and intuitive experience,

ensuring that users feel confident and comfortable as they interact with the virtual environment. (Calahorra-Candao & Martín-de Hoyos, 2024) . These tools should be seamlessly woven into the immersive experience, ensuring that they do not disrupt the overall engagement while simultaneously providing users with a sense of control and safety. For instance, virtual assistants can help guide users through the shopping process, offering suggestions or answering questions in real time, further reducing friction and decision fatigue.

Rather than viewing efficiency and immersion as competing priorities, this study suggests that they can complement each other, creating a more engaging and user-friendly CX. By preserving the sensory depth of the virtual environment, while also allowing for quick and intuitive navigation, designers can strike the perfect balance between a compelling and practical user journey. Predictive systems that remember user preferences can further enhance this experience by automatically suggesting preferred items, minimizing cognitive load and offering personalized, efficient interactions. This user-first approach ensures that iVR shopping remains both immersive and accessible, even as users explore expansive virtual environments.

6.5.2.5 Trust and Transparency in a Multi-Sensory Virtual Retail Environment

Trust is a fundamental driver of user engagement and purchase intent (Stouthuysen et al., 2018; Thakur, 2018), and it plays a particularly significant role in iVR shopping environments. In immersive settings, where users may feel more vulnerable, trust extends beyond concerns about financial security to include issues such as data privacy and the perceived quality of virtual products. Users must feel confident that their personal information is protected and that the virtual products they are engaging with are accurately represented. Although it is well-established that virtual and voice assistants can impact trust in iVR environments (Calahorra-Candao & Martín-de Hoyos, 2024; Huang et al., 2024; Sun & Botev, 2021), there is a lack of sufficient research in the iVR literature specifically addressing the factors that foster consumer trust in iVR shopping. It remains unclear which elements contribute to building or eroding trust throughout the customer journey in iVR, and how these factors may positively or negatively influence the overall shopping experience. Filling this gap would provide valuable insights into how trust can be enhanced in virtual retail settings, particularly in terms of privacy, security, and product representation.

The study points to the importance of clear communication and transparency in building this trust. Designers and retailers must provide users with visual cues or interactive product features that simulate the tactile experience of handling physical goods, ensuring that users feel secure in their purchases. Integrating blockchain technology into iVR retail could offer

transparency by allowing users to verify the origin and authenticity of virtual products. Additionally, clear and ethical data practices should be prioritized to foster trust in iVR environments, especially since users may not have the same level of control over their personal data as they do in traditional e-commerce settings.

6.5.2.6 Deep Consumer Insights and Predictive Behavioral Models

Finally, this study highlights the importance of understanding and analyzing consumer behavior in iVR shopping environments. Decision-making in iVR can be more complex than in traditional shopping due to the immersive nature of the experience. Designers must carefully manage decision fatigue by limiting the number of choices presented at any given time, simplifying the decision-making process, and encouraging more focused user engagement.

In addition, advanced technologies like heatmap, eye-tracking and product handling analysis provide actionable data for optimizing product placement and interface design (Grande et al., 2024). Moving forward, integrating predictive behavioral models that anticipate user needs based on past interactions could elevate the CX. Such systems could adapt in real time, offering personalized product recommendations by using predictive AI models before users begin searching, thereby enhancing CX. A significant research gap lies in the development of predictive models and datasets that can accurately forecast user behavior in iVR shopping environments. While current studies have explored various aspects of user interaction and product engagement, there is still a lack of comprehensive predictive tools that can anticipate consumer preferences and behaviors. Addressing this gap would enable designers and retailers to create more tailored, efficient, and immersive shopping experiences, with real-time personalization that adapts to individual needs and preferences. Future research is needed to explore how these models can be effectively developed and applied in iVR retail settings.

6.5.3 Theoretical Contributions

This study makes significant theoretical contributions to the fields of CX, HCI, and VR retailing. By applying the S-O-R framework to iVR shopping environments, we have developed a layered iVR shopping experience framework. By incorporating design-oriented insights gathered from VR design experts, we have expanded on the conception of various touchpoints and their impact on the overall customer journey. Touchpoints ensure that the iVR shopping experience is not only immersive but is much personalized to individual user needs. The S-O-R framework guided our framework and provided a more nuanced understanding of how stimuli in iVR environments can influence consumer motivations and behaviors.

Secondly, the development of the iVR Shopping Experience Framework represents a significant theoretical advancement. This framework integrates key touchpoints, motivational drivers, and consumer behaviors identified through expert interviews, offering a comprehensive framework for understanding CX in iVR shopping environments. By centering the consumer and highlighting the interplay between design elements and user motivations, the framework contributes to the theoretical discourse on CX design in immersive technologies.

Thirdly, the study sheds light on the importance of emotional engagement, trust, personalization, and efficiency in shaping consumer behavior within iVR environments. It contributes to the broader literature by showing how traditional consumer motivations and behaviors are adapted and transformed in immersive virtual settings. Specifically, emphasizing the balance between familiarity and novelty in user interaction and the role of trust and transparency provides new theoretical insights into how consumers navigate and make decisions in iVR shopping contexts.

Lastly, by focusing on the perspectives of VR design experts, the research addresses a critical gap in the literature. Prior studies have often concentrated on consumer perspectives or controlled experimental settings. Incorporating the practical insights of professionals actively designing iVR shopping environments offers a unique theoretical contribution that bridges the gap between theory and practice. This enriches the theoretical understanding of iVR shopping by integrating real-world design considerations, thus providing a more holistic view of how immersive technologies impact consumer behavior.

6.5.4 Practical Implications

The touchpoints identified in the iVR Shopping Experience Framework can serve as actionable guidelines for designing more immersive and engaging virtual retail spaces. Firstly, by enhancing user immersion through sensory cues like lighting and sound, designers can foster emotional engagement and a sense of presence, which are critical for sustained user interaction and increased purchase intent.

Secondly, balancing familiarity and novelty in user interaction is essential. Practitioners should integrate intuitive navigation and interaction techniques that users are accustomed to while introducing innovative elements unique to iVR shopping. This balance reduces cognitive load for new users, enhances platform usability, and encourages repeat engagement.

Thirdly, personalization and customization emerge as key strategies for enhancing user engagement. Retailers and designers can implement scalable personalization options, allowing

users to customize their avatars and shopping environments to suit their preferences. By gradually introducing customization features, they can cater to both tech-savvy users seeking extensive personalization and those preferring a straightforward experience. Incorporating social elements, such as shared shopping experiences, can further enhance engagement and customer satisfaction.

Fourthly, improving shopping efficiency is highlighted as a pillar of user retention. Practical steps like optimizing product placement at eye level, streamlining search functions, and reducing unnecessary physical movements within the iVR environment can enhance the CX. Making the shopping process more intuitive and less physically demanding reduces friction and increases the likelihood of purchase.

Lastly, the study emphasizes the critical role of trust and transparency. Practitioners must prioritize data security and transparent communication regarding data usage to build consumer trust in iVR shopping environments. Ensuring that virtual products are accurately represented and providing clear transaction information can alleviate consumer concerns, fostering trust and encouraging purchase behavior.

6.5.5 Limitations and Directions for Future Research

While this study provides valuable insights into the design of iVR shopping environments, it is not without limitations. One limitation is that the research is based on qualitative interviews from a sample of twenty VR design experts. Therefore, the findings may not be generalizable to all VR designers or consumer populations. To enhance generalizability, future research could expand the sample size and include a more diverse range of experts from different cultural and industry backgrounds.

Another consideration is the inherent subjectivity involved in interpreting qualitative data through thematic analysis. Acknowledging this, we took deliberate steps to enhance the rigor and credibility of our analysis. Multiple researchers participated in the coding process, engaging in regular discussions to reconcile differences and reach consensus on emerging themes. This collaborative effort helped minimize individual biases and ensure a more balanced interpretation of the data. Despite these measures, some degree of subjectivity is inevitable in qualitative research, which may affect the generalizability of the findings. Future studies could further mitigate this limitation by incorporating mixed method approaches or additional validation techniques to strengthen the validity of the results. Additionally, the study focuses on the perspectives of VR design experts rather than actual consumers. While expert insights are

invaluable for understanding design considerations, they may not fully capture end-users' experiences and preferences. Incorporating consumer-based studies, such as user testing and consumer interviews, in future research would help validate and refine the iVR Shopping Experience Framework from the consumer's viewpoint.

The rapidly evolving nature of iVR technology continues to present a challenge regarding the applicability of the findings over time. Technological advancements may introduce new capabilities and interaction methods not considered in this study. Ongoing research is necessary to keep pace with these technological changes and to explore how emerging technologies, such as augmented reality (AR) and mixed reality (MR) may influence consumer behavior in virtual shopping environments. Continual adaptation will ensure that theoretical models and practical strategies remain relevant.

Moreover, the study did not extensively examine cultural, social, and economic factors that may influence consumer behavior in iVR shopping. These factors can significantly impact how consumers interact with virtual environments and what they expect from their shopping experiences. Future research should consider cross-cultural studies and the impact of socioeconomic variables to provide a more comprehensive understanding of consumer behavior in diverse contexts. Such studies could reveal important differences in consumer expectations and interactions across different demographics.

Finally, the study identified several gaps in the current literature, such as the integration of accessibility features in iVR shopping environments and the development of predictive behavioral models. Further exploration on how to design inclusive iVR retail experiences that cater to users with varying abilities and needs is another venue for future research. Moreover, investigating the potential of predictive analytics and AI-driven personalization in iVR shopping could provide deeper insights into consumer behavior and enhance the effectiveness of virtual retail strategies.

6.6 Conclusion

This study advances the understanding of how iVR shopping environments influence consumer behavior and CX. By applying the S-O-R framework and integrating qualitative insights from VR design experts, we have developed the iVR Shopping Experience Framework, that offers a comprehensive system for designing user-centered virtual retail spaces. Our key findings highlight the critical roles of sensory immersion, intuitive interaction, personalization, efficiency, and trust in shaping consumer motivations and behaviors in iVR settings.

Enhancing sensory immersion fosters emotional engagement and a sense of presence, vital for sustained interaction and increased purchase intent. Balancing familiarity with novelty in user interactions reduces cognitive load and encourages repeat engagement. Scalable personalization caters to diverse user preferences, while improving shopping efficiency reduces friction and enhances the likelihood of purchase. Prioritizing trust and transparency builds consumer confidence in virtual shopping environments.

These insights have broader implications for retailers and designers aiming to create engaging and effective iVR shopping experiences. By aligning design strategies with consumer motivations, practitioners can significantly enhance CX and drive engagement in virtual retail settings. Our findings also contribute to the theoretical discourse on HCI and consumer behavior in immersive environments. As iVR technology continues to evolve, it presents both opportunities and challenges. Future research should incorporate consumer perspectives, explore emerging technologies like augmented and mixed reality, and address accessibility and inclusivity to meet the needs of a diverse user base.

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CHAPTER 7

Mapping the Customer Journey in Immersive Virtual Reality Retail: Touchpoints, Emotions, and Behaviors Across Shopping Stages

In the evolving landscape of retail, immersive virtual reality (iVR) offers transformative potential to enhance customer experience (CX). This study maps the customer journey in iVR retail environments, focusing on key touchpoints, emotional responses, and behaviors across the pre-purchase, purchase, and post-purchase phases. Using a mixed-methods approach, we conducted an iVR shopping experiment with 30 participants, employing card sorting to categorize touchpoints and semi-structured interviews to delve into participant experiences. Our analysis identified critical touchpoints which can significantly influence emotional engagement and shopping behaviors that are unique at each phase. These comprise intuitive store navigation and sensory-rich environments in the pre-purchase phase, interactive product engagement during purchase, and efficient checkout systems in the post-purchase phase. A CX framework has been developed that consolidates actions, touchpoints, emotions, and opportunities into a unified structure for iVR retail. The study advances theoretical understanding by extending traditional CX frameworks into the iVR domain and further offers practical guidance for designing effective, user-centered iVR retail experiences. These findings underscore iVR's potential to revolutionize retail, emphasizing the importance of immersive technologies in crafting the future of shopping.

Note that the work presented in this chapter will be submitted for publication: Mapping the Customer Journey in Immersive Virtual Reality Retail: Touchpoints, Emotions, and Behaviors Across Shopping Stages

7.1 Introduction

In today's competitive marketplace, customer experience (CX) has emerged as a critical determinant that drives customer satisfaction, loyalty, and long-term value creation for organizational success. Defined as an all-inclusive multidimensional response of customers interactions with various touchpoints, CX encompasses cognitive, emotional, behavioral, sensorial, and social dimensions (Lemon & Verhoef, 2016). Businesses seek to differentiate themselves through CX innovation; as such immersive virtual reality (iVR) technologies have the potential to transform how customers interact with products, brands, and services (Hollebeek et al., 2020; Mansoor et al., 2024). These can create environments that go beyond the capabilities of traditional physical and digital channels. By leveraging iVR's unique affordances—such as sensory richness, interactivity, and spatial immersion—retailers can engage customers in ways that foster deeper emotional connections to influence their purchasing decisions (Hollebeek et al., 2020; Koronaki et al., 2023). For instance, iVR allows customers to personalize experiences in real time as they navigate virtual environments that mimic real-world settings. Product usage simulations can enhance customer engagement and provide an innovative shopping channel that eliminates geographical limitations, reduces reliance on physical inventory, and lead to data-driven personalization strategies. These advancements can strengthen the integration of digital and physical retail environments to create a seamless and enriched CX.

The customer journey framework provides a robust lens for examining how customers navigate interactions with brands over time. Traditionally divided into three stages—pre-purchase, purchase, and post-purchase—this framework underscores the significance of touchpoints in shaping customer perceptions, decisions, and satisfaction (Lemon & Verhoef, 2016). In virtual reality (VR) contexts, the immersive qualities of the medium add another dimension to these touchpoints. For example, during the pre-purchase stage, iVR can evoke curiosity and trust through vivid product demonstrations, while the purchase stage might involve interactive decision-making facilitated by real-time feedback. In the post-purchase stage, iVR offers opportunities for building lasting relationships through personalized follow-up experiences and virtual after-sales support (Hollebeek et al., 2020; Reitsamer & Becker, 2024). However, little is known about how these touchpoints interact with customer emotions and behaviors across the customer journey in immersive retail settings.

Existing research on iVR show CX through a representation of theoretical literature that often neglects the granular examination of stage-specific touchpoints and any dynamic

interdependencies that may occur (Hollebeek et al., 2020; Koronaki et al., 2023). The transition between journey stages is a critical determinant of the overall CX; however, the role of emotions and behaviors in shaping these transitions in iVR environments remains underexplored (Reitsamer & Becker, 2024). This study bridges these gaps by examining the customer journey in iVR retail, with a specific focus on mapping touchpoints, emotions, and behaviors across the pre-purchase, purchase, and post-purchase stages. Herewith we have conducted an iVR shopping experiment (involving 30 participants) that emulates a realistic retail scenario. Participants engaged in a shopping task within an iVR convenience store, after which they categorized 27 predefined touchpoints into journey stages using card sorting. Further, semi-structured interviews were conducted to explore participants' emotional and behavioral responses to these touchpoints. Accordingly, the following research questions have been posed:

RQ1: What are the key touchpoints experienced by users during the pre-purchase, purchase, and post-purchase stages in iVR retail environments?

RQ2: What emotions and behaviors are exhibited by users across different stages of the iVR customer journey?

In answering the above questions, our mixed method approach has offered a stage-specific analysis of touchpoints and transitions, and contributed towards understanding how iVR environments shape customer journeys and influence CX. Unlike previous research that primarily explore technical capabilities or experiential benefits, this study adds to emerging literature on iVR-enabled CX, thereby advancing theoretical frameworks and in providing actionable guidance for practitioners. Our findings highlight the strategic potential of iVR to create value-driven customer journeys, to position iVR as a cornerstone of next-generation retail strategies.

7.2 Background

Recent research has demonstrated that a meaningful CX can significantly improve performance outcomes such as customer loyalty (Pekovic & Rolland, 2020; Stein & Ramaseshan, 2020) and customer satisfaction (Domina et al., 2012; Pei et al., 2020). As a result, CX has become increasingly crucial for the success of organizations. This growing importance has led to heightened scholarly interest, resulting in a surge of academic papers and special issues devoted to CX across a wide range of disciplines, yielding substantial advancements in understanding. However, this proliferation of research has also led to fragmentation and

theoretical confusion, with no unified view on CX literature (Becker & Jaakkola, 2020); this calls for understanding the key constructs being discussed in retail shopping contexts.

Examining the literature has revealed certain constructs frequently discussed as being central to CX; these comprise purchase phases, touchpoints, emotional responses, and customer journey mapping (Homburg et al., 2017; Lemon & Verhoef, 2016; Pekovic & Rolland, 2020; Schmitt, 1999; Verhoef et al., 2009; Voorhees et al., 2017). iVR therefore presents a transformative shift in how customers experience their journey with a brand and introduces new dimensions to traditionally understood phases and touchpoints. The integration of sensory-rich, immersive interactions in iVR environments necessitates a deeper understanding of the key constructs of CX. This section explores these constructs, to focus on touchpoints, purchase phases, and the role of emotions in shaping customer interactions within iVR retail.

7.2.1 Customer Journey and Touchpoints

The customer journey encompasses the entirety of a CX with a brand, traditionally segmented into pre-purchase, purchase, and post-purchase stages. These stages are defined and influenced by touchpoints or moments of interaction that shape perceptions, decisions, and loyalty (Lemon & Verhoef, 2016). In iVR retail, touchpoints take on new dimensions of importance due to the immersive, interactive, and sensory-rich nature of the medium (Koronaki et al., 2023; Mansoor et al., 2024).

Koronaki et al. (2023) emphasize the fusion of digital and physical touchpoints in iVR environments, showing how this integration creates seamless and engaging CX. Yet, their findings reveal a critical gap in understanding the behavioral dynamics of these interactions across different journey stages. Similarly, Mansoor et al. (2024) highlight trialability as a key iVR touchpoint, that is, allowing customers to virtually "try" products before purchase, to significantly enhance their engagement and purchase intention. This touchpoint is particularly valuable for iVR retail, as it mimics physical shopping environments while offering unique advantages like personalization and scalability.

Reitsamer and Becker (2024) propose the concept of "customer journey partitioning," which challenges the traditional linear perception of the customer journey. Instead, CX their journey as a series of distinct yet interconnected events, shaped by touchpoints that create lasting impressions. While this perspective enriches our understanding of CX, the role of iVR touchpoints in creating these meaningful and memorable moments remains underexplored.

Addressing this gap is vital for developing practical strategies that align with business goals like customer retention, brand differentiation, and operational efficiency.

7.2.2 Purchase Phases

The purchase journey is segmented into three phases—pre-purchase, purchase, and post-purchase—that together inform touchpoint categories at individual and aggregate levels (Lemon & Verhoef, 2016). With iVR technologies, new layers of complexity and opportunity are introduced to these phases to reshape how customers interact with products, brands, and services.

The pre-purchase phase encompasses activities such as need recognition, information search, and product evaluation. According to Hollebeek et al. (2020), iVR enhances this phase by providing immersive simulations that allow customers to visualize and interact with products in virtual spaces. For example, features like virtual try-ons and 3D visualizations reduce uncertainty and foster trust by enabling customers to assess product fit and quality. Koronaki et al. (2023) further emphasize the role of interactivity during this phase; they note that active engagement with virtual products promotes cognitive involvement and emotional investment, which are crucial in shaping purchase decisions.

The purchase phase focuses on decision-making and transaction execution. iVR environments replicate the tactile and visual experiences of physical stores, while also offering real-time feedback and personalized recommendations, creating an enriched decision-making environment (Peukert et al., 2019). Mansoor et al. (2024) highlight the sensory engagement facilitated by iVR during this phase, demonstrating how virtual handling of products can significantly influence purchase intentions. However, the design of intuitive iVR interfaces is essential, as poorly designed systems can lead to cognitive overload and diminish the overall CX (Koronaki et al., 2023).

In the post-purchase phase, customers engage in activities such as product use, feedback, and customer support. Reitsamer and Becker (2024) argue that iVR offers unique opportunities to enhance this phase, such as providing virtual after-sales support or immersive tutorials, which can strengthen customer loyalty and satisfaction. Nevertheless, Koronaki et al. (2023) caution that the novelty of iVR may lead to heightened customer expectations, making it essential for businesses to deliver consistent and meaningful experiences to sustain long-term retention.

An alternative framework tailored to iVR environments has been proposed by Hollebeek et al. (2020), which divides the journey into pre-VR, intra-VR, and post-VR phases. This model

accounts for the unique affordances of iVR, such as spatial immersion and sensory engagement. However, its practical application in business strategies remains underexplored, particularly in understanding how transitions between these phases impact customer satisfaction and loyalty. As iVR continues to evolve, further research is needed to address these gaps and optimize the purchase journey in immersive environments.

7.2.3 Emotions During the Customer Journey

Emotions are fundamental to the customer journey, shaping perceptions, behaviors, and long-term loyalty (Lemon & Verhoef, 2016). In VR retail, the medium's immersive qualities heighten emotional engagement, creating powerful experiences that drive customer satisfaction and retention (Holdack & Lurie-Stoyanov, 2021; Kim et al., 2021).

Mansoor et al. (2024) highlight the role of social presence in iVR environments, where elements like avatars or virtual assistants evoke feelings of connection and authenticity. Such features can amplify emotional appeal, particularly during the purchase phase, by fostering trust and engagement. However, poorly designed VR interfaces can trigger frustration or confusion, negatively affecting customer perceptions (Koronaki et al., 2023).

The "peak-end rule" proposed by Reitsamer and Becker (2024) is particularly relevant in iVR contexts, where customers are likely to remember peak emotional moments and the final stages of their journey more vividly than other interactions. This again highlights the importance of designing iVR touchpoints that create positive emotional peaks, especially during the purchase and post-purchase phases. Holdack and Lurie-Stoyanov (2021) further emphasize the role of enjoyment in fostering loyalty, showing that pleasurable iVR experiences significantly increase the likelihood of return visits and recommendations.

Despite these findings, the interplay between touchpoints and emotional responses across different journey stages in iVR environments remains underexplored. Understanding these dynamics is essential for designing emotionally resonant iVR experiences that align with customer expectations and business objectives.

7.3 Methodology

This study utilized a mixed methods approach to investigate CX in iVR retail environments. By combining quantitative and qualitative methods, the research has provided a comprehensive analysis of participants' behaviors, emotions, and interactions across different stages of the customer journey. The core of the study was an iVR shopping experiment designed to emulate a realistic retail scenario, supported by data collection through card sorting and semi-structured interviews. This methodological design ensured a balanced approach to capturing both measurable data and rich qualitative insights into participants' subjective experiences. It addresses the study's objective of comprehending potential leverage points across iVR-enabled customer journeys to develop and organize a CX framework for advancing theory and practice knowledge in iVR retail.

We opted to design an experiment due to the critical role experimental studies play in establishing causal relationships (Papagiannidis et al., 2017). This approach enabled us to directly observe iVR elements' impact on consumer behavior, facilitating a deeper understanding of how these components shape retail experiences. Moreover, the structured design of experiments enhanced the reproducibility of findings, a cornerstone of building a credible and enduring scientific foundation (Van Kerrebroeck et al., 2017).

7.3.1 Procedure

The experiment was conducted in three distinct phases: Pre-Experiment, Experiment, and Post-Experiment, as illustrated in Figure 7.1. The flowchart below provides an overview of the procedural steps across the three experimental phases.

Figure 7 1 An overview of the procedural steps across the three experimental phases.

7.3.1.1 Pre-experiment

The pre-experiment phase involved preparatory activities to ensure that participants were informed and adequately prepared. Participants were briefed on the objectives of the study, after which they signed a consent form to confirm their willingness to partake in the study. Participants then completed a pre-questionnaire to provide demographic information, enabling the study to account for diverse backgrounds.

To familiarize participants with the iVR environment, they were guided through a training session where they could practice navigation and interaction with the VR equipment. This step was critical in minimizing technical difficulties and reducing the initial excitement associated with VR exposure, as suggested by Desmet et al. (2013). Standardizing this training ensured that all participants began the study with a similar level of familiarity and competence with the immersive virtual shopping environment.

7.3.1.2 Experiment

In the experiment phase, participants engaged in a realistic shopping task within a iVR convenience store. The scenario involved a hypothetical Friday evening gathering, where participants were instructed to shop for specific items—crackers, soft drinks, and ice cream—sufficient for four people, along with any additional snacks they deemed suitable. This scenario was designed to mimic real-world decision-making while minimizing the influence of participants' individual demographics on their choices.

Participants were free to explore the virtual store, which featured 15 product categories such as chips, chocolate, ice cream, and beverages, with familiar and fictional brands strategically placed to resemble a typical New Zealand convenience store (Schnack et al., 2021). The convenience store context was chosen for the iVR shopping experiment because it represents a highly familiar task that reduces cognitive load and allows participants to focus on their behaviors and emotions. Additionally, convenience stores offer enough product variety for a realistic experience without the complexity of a full supermarket, making them ideal for simulating a complete shopping journey within a 10-minute timeframe. Environmental realism was further enhanced through sensory details such as ambient sounds, in-store advertisements, and interaction feedback, creating an engaging and immersive experience. To encourage natural behavior, participants were asked to imagine they were spending real money and shopping in a physical store.

The iVR system utilized stereoscopic head-mounted displays (HTC Vive) with handheld motion-tracked controllers. These controllers enabled participants to pick up products, interact with

virtual shelves, and place items in their shopping basket, mimicking the tactile engagement of a real-world shopping trip.

7.3.1.3 Post-experiment

The post-experiment phase focused on gathering insights into participants' experiences and decision-making processes. Participants first completed a card sorting exercise, where they categorized 27 predefined touchpoints into pre-purchase, purchase, or post-purchase stages based on their perceived influence. This technique provided structured data on how participants experienced different aspects of the shopping journey.

Following the card sorting, semi-structured interviews were conducted to explore participants' emotional and behavioral responses in greater depth. These interviews delved into the reasons behind their touchpoint categorizations and captured nuanced feedback about their overall experience. To conclude, participants were thanked for their participation and provided with a $20 (NZD) voucher as a gesture of appreciation.

7.3.2 Participants

The study involved 30 participants ranging in age from 20 to over 59 years, with the majority (83%) falling within the 20–39 age bracket. The average age of participants was approximately 33 years. This sample size aligns with established research on the optimal number of participants for card sorting tasks. According to Lantz et al. (2019), a group of 10–15 participants is generally sufficient to approximate the similarity matrix of pairwise data collection, with diminishing returns observed beyond this range. Similarly, Tullis and Wood (2004) suggest that gathering data from more than 20–30 participants in a card sorting study may not be cost-effective, making our sample size both practical and methodologically sound.

In this study, we ensured that data saturation was achieved, as recommended by Hennink and Kaiser (2022), to validate the richness and reliability of the data collected. All participants resided in Auckland, New Zealand, and were recruited through a combination of convenience sampling, social media advertisements, street intercepts, and snowball sampling. This multi-faceted recruitment approach not only addressed time and budget constraints but also facilitated a diverse participant pool. Comprehensive demographic details of the participants are presented in Table C.1 in Appendix C.

To ensure meaningful engagement, specific inclusion criteria were applied. Participants were required to be at least 18 years old to ensure independent decision-making capabilities. English proficiency was necessary to enable participants to comprehend instructions, complete

questionnaires, and participate effectively in interviews. The study also prioritized demographic diversity by recruiting individuals with varied educational backgrounds, occupations, and income levels.

The resulting sample reflected these criteria, featuring a balanced gender distribution and a range of educational qualifications, from diplomas to postgraduate degrees. Participants represented diverse occupations, including engineers, researchers, healthcare professionals, students, and supply chain managers. In terms of income, the sample spanned all brackets, from less than $10,000 to over $140,000 annually, with 33% reporting earnings above $100,000. This demographic diversity allowed the study to capture a wide array of consumer behaviors and perspectives, enriching the findings and ensuring broader applicability.

7.3.3 Data Collection

A combination of questionnaires, observational methods, card sorting, and semi-structured interviews were used to capture CX in the experimental setting. The combination of quantitative and qualitative data ensured both objective and subjective aspects of customer behavior and emotions could be explored. Such multiple data collection methods align with best practices outlined in mixed-methods research to exploit the strengths of quantitative and qualitative approaches (Harrison & Reilly, 2011; Purohit & Radia, 2022).

Card sorting provided a structured technique for categorizing 27 predefined touchpoints into customer journey stages—pre-purchase, purchase, and post-purchase. Here participants organized individually labeled cards into groups based on criteria that they find most logical or meaningful (Arslan et al., 2023). This method is widely recognized for its ability to reveal participants' mental models and perceptions, and in providing measurable data that can be systematically analyzed. Optimal Workshop, a user-friendly digital platform, facilitated this process and ensured consistency and reliability in data collection (Palomino et al., 2023). The process began with a demographic questionnaire administered via Optimal Workshop to collect baseline information, ensuring a diverse and representative participant sample. This laid the contextual foundation for interpreting the results.

During the shopping task in the iVR convenience store, observational data were gathered unobtrusively to record participants' behaviors, such as product selection, and interactions with the touchpoints. This allowed for real-time insights into how participants interacted with the immersive environment and provided nuanced understanding of perceptions towards touchpoints and its relevance across the customer journey. A think-aloud protocol was

considered but excluded to avoid disrupting natural behavior in the immersive setting. Instead, spontaneous interactions were observed, and immediate post-session interviews were conducted to minimize recall decay. Observational data were further complemented with semi-structured interviews to gauge participants' emotional responses and reasoning behind their touchpoint categorizations. Appendix F3 shows the basic questions for the interviews. Audio recordings of the interviews were made with consent and later transcribed for analysis, enriching the qualitative dataset. Data triangulation from questionnaires, observations, card sorting, and interviews, helped ensure a richer understanding of CX in iVR retail (Arias Valencia, 2022).

7.3.4 Data Analysis

Both quantitative and qualitative data underwent rigorous data analysis to gain a holistic understanding of CX in the iVR retail environment. Advanced analytical techniques such as thematic analysis for qualitative data and structured tools like the standardization grid and similarity matrix for card sorting results were employed; these helped in achieving a robust triangulation of insights.

This methodological rigor allowed for the identification of patterns, themes, and relationships that aligned with the study's objective and explore the interplay between customer behaviors, emotions, and touchpoints across the customer journey.

7.3.4.1 Qualitative Data Analysis

Thematic analysis was employed to analyze the interview transcripts; it provided a systematic approach to identify, organize, and interpret recurring themes related to participants' emotional and behavioral responses to the iVR shopping experience. This method is especially suitable for exploratory research, as it enables the researcher to uncover nuanced insights from participants' subjective experiences (Braun & Clarke, 2006). The analysis followed a six-phase process: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report.

Transcriptions of the audio-recorded interviews were carefully reviewed, with key phrases and patterns coded based on their relevance to the study's research questions. For example, participants' reflections on their decision-making processes and their emotional reactions to specific touchpoints were coded and categorized into themes such as "ease of navigation," "emotional engagement," and "frustration due to cognitive overload". Inter-coder reliability (ICR) was meticulously managed to maintain the rigor and validity of the qualitative analysis.

Following best practices outlined by Patton (2002), we selected an ICR method tailored specifically to the study's requirements. To enhance reliability, intercoder agreement was ensured by involving multiple researchers in the coding process, thereby mitigating potential bias and ensuring consistency of thematic interpretations (Guest et al., 2012; Ritter et al., 2023).

7.3.4.2 Quantitative Data Analysis

Card sorting results were analyzed using two established techniques: the standardization grid and the similarity matrix. These tools provided a structured approach to uncover patterns on how participants categorized touchpoints across the pre-purchase, purchase, and post-purchase stages of the customer journey. The standardization grid consolidated participants' categorizations by mapping touchpoints into standardized categories based on shared themes or functions. This process ensured uniformity in interpreting results, aligning individual responses with broader, consistent patterns. For instance, touchpoints such as "product details" and "familiar brands" were consistently categorized under the purchase stage, emphasizing their perceived importance in influencing decision-making. To further identify the significant touchpoints for each stage of the customer journey, we employed a structured grouping approach. Using equal interval binning, a widely recognized quantitative method (Putri et al., 2023), touchpoints were classified into categories based on their importance in specific shopping stages. Equal interval binning divides a range of data into equal intervals, ensuring a systematic grouping of data points and facilitating clearer analysis. This method allowed us to focus on touchpoints that the majority of participants consistently categorized within a particular stage, highlighting only the most prominent features for deeper examination. By adopting this approach, the analysis provided a robust and reliable identification of key touchpoints, reinforcing the validity of the findings and their relevance to understanding CX in iVR retail environments. To visualize this, touchpoints were grouped into five equal-width frequency bins ranging from Very Low (0–4 participants) to Very High (20–24 participants) based on how many participants selected them. This approach enabled consistent intervals and clearer visual distinction in the results, as shown in Figure 7.2.

The similarity matrix further enriched the analysis by calculating the proportion of participants who grouped specific pairs of touchpoints into the same category. Each intersecting cell in the matrix represented the percentage of participants who linked two touchpoints, allowing for the identification of strong associations and shared perceptions among the sample. This technique is particularly effective in card sorting studies for visualizing consensus and divergence in participant responses (Spencer, 2009). For example, a high degree of similarity between "store

navigation" and "store atmosphere" underscored their shared relevance in shaping pre-purchase behaviors. These quantitative insights complemented the thematic analysis by providing measurable evidence of participants' perceptions.

7.3.4.3 Data Integration

Integration of qualitative and quantitative findings was a critical step in the data analysis process; it ensured a holistic understanding of how participants experience and interpret the iVR shopping environment. Thematic insights from interviews were cross-referenced with the standardized card sorting results to validate and enrich the findings. For example, interview responses highlighting participants' emotional engagement with immersive touchpoints were corroborated by the frequent categorization of these touchpoints in the purchase stage during the card sorting exercise. This triangulation of data sources enhanced the validity and reliability of the study's conclusions, aligning with best practices in mixed-methods research (Creswell & Poth, 2016).

To ensure the robustness of the analysis, several measures were implemented. First, the use of established analytical frameworks and tools, such as thematic analysis and the similarity matrix, provided a structured and replicable approach to data interpretation. Second, the involvement of multiple researchers in the coding process and the use of software tools like Optimal Workshop enhanced the accuracy and reliability of the results. Finally, the integration of quantitative and qualitative data allowed for a multidimensional perspective, addressing potential limitations inherent in single-method studies.

7.4 Findings

This section presents the core findings of the study. The research questions have been answered by exploring participants customer journey experiences in the experimental setting of the iVR retail environment. The findings focus on three key dimensions that emerged as central to understanding iVR CX, namely, touchpoints, emotions, and observed behaviors.

The findings are structured to first identify the significant touchpoints in the customer journey across different stages. These touchpoints highlight the critical moments that shaped participants' perceptions and decisions during their shopping experience. Next, the emotional responses elicited during the VR shopping journey are examined to understand what participants felt in specific stages of the customer journey. Finally, the observed behaviors of participants during the shopping task are analyzed to provide insights into their shopping processes and interactions with the touchpoints.

7.4.1 Touchpoints

This study identified critical touchpoints in an iVR shopping experience and categorized them by the stages of the customer journey: pre-purchase, purchase, and post-purchase.

7.4.1.1 Standardization Grid: Categorization of Touchpoints across Customer Journey Stages

The standardization grid revealed clear distinctions among touchpoints categorized by participants across the pre-purchase, purchase, and post-purchase stages in the iVR shopping journey. Table 7.1 shows this. Darker cells in the grid indicate that a larger number of participants consistently categorized certain touchpoints into specific categories. For example, “Checkout System” is illustrated by a darker shade in the post-purchase column, indicating that many participants viewed it as integral to the post-purchase phase.

Table 7. 1 Standardization grid of touchpoints.

Name	It didn't affect my decision in any stage	Pre-purchase	Purchase	Post-purchase
Advertisements	16	11	3	0
Aisle signs	8	12	9	1
Background Music	14	12	4	0
Brand Logo	6	9	15	0
Characters' expressions	15	5	4	6
Checkout System	6	0	0	24
Colors	7	14	9	0
Controller Feedback/Vibration	3	11	13	3
Familiar Brands	1	5	24	0
Movement Control	3	17	9	1
Other Characters	15	9	3	3
Product Details	4	7	18	1
Product Display	2	13	15	0
Product Location	5	12	12	1
Product Packaging	2	10	18	0
Product Pricing	5	7	15	3
Sensations	7	5	18	0
Shelf locations	6	16	8	0
Shopping Basket	9	12	8	1
Store Atmosphere	6	19	3	2
Store Lighting	10	17	2	1
Store Navigation	2	21	6	1
Talking to Others	15	2	2	11
Virtual Assistant	9	4	4	13
Visual Quality	1	15	14	0
Window View	14	14	1	1
Your Digital Self/Avatar	21	4	5	0

Table 7.1 presents the number of participants who selected each touchpoint as important. Unlike earlier tables that focused on frequency alone making cross-touchpoint comparisons more intuitive and to highlight which touchpoints stood out as most significant. This format approach improves interpretability and sets the foundation for the visual summary shown in Figure 7.2.

To further analyze the critical touchpoints within each stage of the customer journey, this study employed equal interval binning as outlined in the methodology. This analytical approach facilitated the grouping of touchpoints into five importance ranges, based on the frequency of their categorization across the pre-purchase, purchase, and post-purchase stages. The method provided a systematic and transparent framework for classifying touchpoints, ensuring clarity and consistency in identifying their significance to participants' shopping experiences. By creating these structured ranges, the study was able to uncover meaningful distinctions in how participants perceived the impact of various touchpoints throughout their interactions in the iVR shopping environment.

The decision to adopt five importance ranges was guided by the need to balance granularity with interpretability. Five intervals offered a manageable framework that allowed for meaningful differentiation between touchpoints of varying influence, while avoiding overly complex categorizations that might obscure actionable insights. This approach ensured a nuanced understanding of how touchpoints shape customer perceptions and behaviors at different stages of their journey. For example, the analysis has revealed that touchpoints categorized within the "Very High Importance" range were critical in influencing decisions, whereas those in the "Low" or "Very Low Importance" ranges had minimal impact. Figure 7.2 illustrates touchpoint categorization, with darker shading representing higher levels of importance based on participant responses. This structured representation reinforces the findings by providing a clear and comprehensive overview of the significance of touchpoints. The figure highlights the critical moments that influenced customer interactions, offering actionable insights for designing impactful CX in iVR retail environments.

Touchpoints in the "Very High Importance" range, categorized by 20 to 24 participants, emerged as essential in shaping customer decisions and experiences. Examples include "Familiar Brands," which played a pivotal role during the purchase stage, and "Checkout System," which dominated the post-purchase stage. Similarly, touchpoints in the "High Importance" range (categorized by 15 to 19 participants), such as "Store Navigation" in the pre-purchase stage and

"Product Details" during the purchase stage, were found to exert a significant influence on customer engagement and decision-making.

Touchpoints in the "Medium Importance" range, categorized by 10 to 14 participants, demonstrated a moderate influence on the shopping experience. These included elements such as "Product Display" and "Product Packaging," which contributed to participants' decision-making processes during the purchase stage. Meanwhile, touchpoints in the "Low Importance" range (categorized by 5 to 9 participants), such as "Background Music" and "Colors" during the pre-purchase stage, were occasionally noted but did not strongly influence decisions. Finally, touchpoints in the "Very Low Importance" range, categorized by fewer than five participants, such as "Other Characters" and "Talking to Others," were perceived as having little to no impact on the shopping journey.

The analysis of these importance ranges revealed several key patterns. In the pre-purchase stage, touchpoints like "Store Atmosphere" and "Store Navigation" emerged as highly impactful, shaping participants' initial impressions and engagement with the iVR environment. During the purchase stage, elements such as "Product Details" and "Familiar Brands" dominated, reflecting their direct influence on decision-making processes. In the post-purchase stage, the "Checkout System" stood out as the most critical touchpoint, highlighting the importance of a seamless and efficient checkout experience.

By employing equal interval binning to categorize touchpoints, the study not only identified the most influential elements of the iVR shopping experience, but has also provided a replicable framework for future research. This method allowed for a systematic understanding of the interplay between touchpoints and customer journey stages, ultimately offering both theoretical advancements and practical guidance for optimizing iVR-enabled CX.

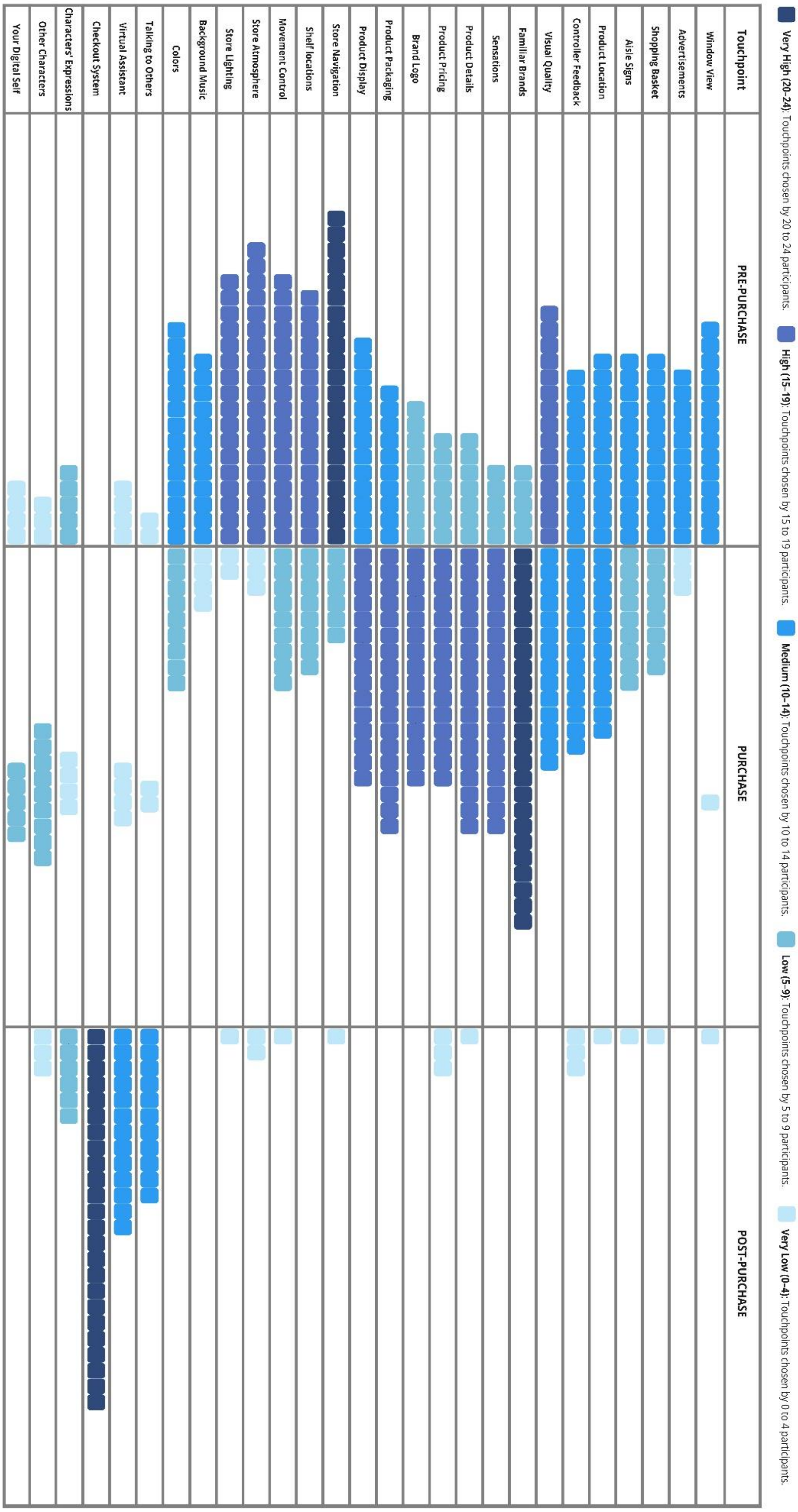

Figure 7. 2 Illustration of the categorization of touchpoints.

7.4.1.2 Similarity Matrix: Insights into Perceived Touchpoint Relationships

The similarity matrix analysis added a valuable layer of depth to the findings derived from the standardization grid (Figure 7.2). While the grid identified the importance of individual touchpoints across different stages of the customer journey, the similarity matrix revealed how participants perceived relationships between touchpoints, offering insights into their interconnectivity and combined influence on the CX. Figure 7.3 illustrates these relationships, with darker cells indicating a higher percentage of participants who grouped specific touchpoints together within the same stage.

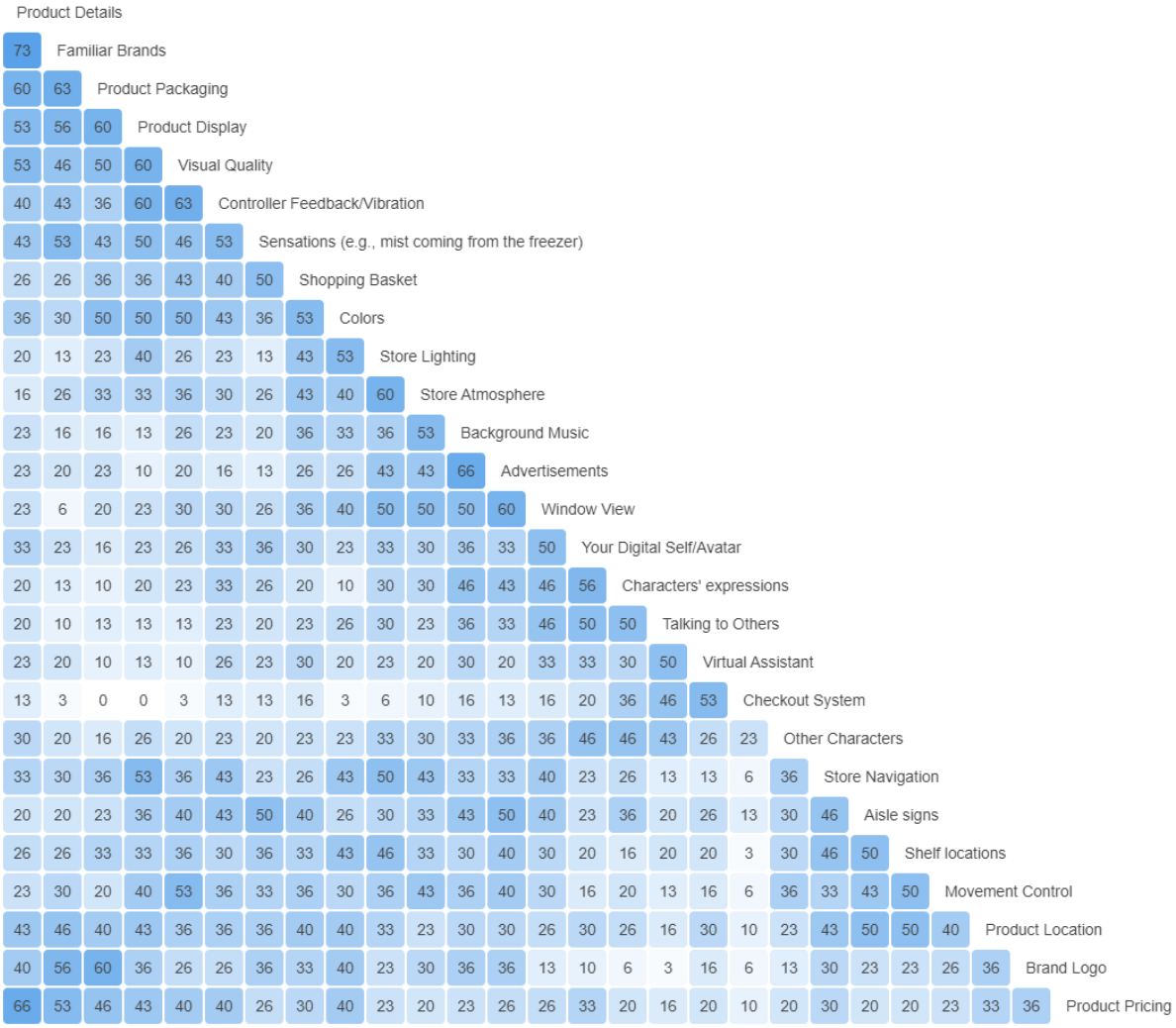

Figure 7. 3 Similarity matrix of touchpoints.

This matrix highlighted functional and perceptual connections among touchpoints, reinforcing the findings of the standardization grid. For example, a strong association between "Product Display" and "Product Packaging" during the purchase stage revealed their collective influence on shaping participants' purchase decisions. Similarly, "Store Navigation" and "Aisle Signs" in the pre-purchase stage were often grouped together, emphasizing the role of wayfinding aids in

facilitating spatial awareness and engagement. These connections again underscore the importance of designing touchpoints that work synergistically to enhance the overall CX.

The similarity matrix also uncovered nuances in participants' perceptions of touchpoints that were not immediately apparent in the grid. For instance, touchpoints like "Sensations" and "Controller Feedback," which were individually categorized as important in the purchase stage, were frequently linked by participants, suggesting that sensory and haptic elements jointly contributed to creating a more immersive and engaging shopping experience. By identifying such patterns, the similarity matrix provided actionable insights into how touchpoints can be strategically combined to optimize their impact within iVR environments.

In summary, the similarity matrix validated and enriched the findings from the standardization grid by revealing interdependencies among touchpoints. This integration of quantitative insights highlights the complex interplay between functional and experiential elements in iVR shopping environments, providing a robust foundation for the thematic analysis that follows.

7.4.1.3 Themes of Touchpoints Across the Customer Journey

Thematic analysis of touchpoints categorized by participants has offered a structured understanding of how these elements influenced the customer journey in iVR shopping environments. Building on the findings from the standardization grid and similarity matrix, we identified key themes for each stage of the customer journey—pre-purchase, purchase, and post-purchase—from a functional and experiential stance of customer interactions. Table 7.2 provides a summary of these themes, categorizing the touchpoints and their corresponding stages within the customer journey. The table also includes supporting quotes that exemplify participants' perceptions and interactions with these touchpoints, offering qualitative evidence to complement the quantitative findings.

Table 7. 2 Summary of the themes of touchpoints.

Stage	Theme	Touchpoints	Supporting Quote
Pre-purchase	Wayfinding and Spatial Awareness	Store Navigation (21), Movement Control (17), Shelf locations (16), Aisle Signs (12), Product Location (12), Controller Feedback (11)	"The movement controls were smooth—they made it fun to explore the space, which encouraged me to look around more than just at the areas I needed." - P5 "I could find my favorite brands very easily. Especially when talking about sensations, the ice cream fridge was really nice." - P1
	Ambiance and Environmental Cues	Store Atmosphere (19), Store Lighting (17), Visual Quality (15), Colors (14), Window View (14), Background Music (12)	"The lighting was nice, though it might have been a bit too white for me. If it had been warm lighting, I think it would have felt even better." - P1 "The colors and window view were inviting. It felt like being in a magical but familiar place." - P5
	Shopping Triggers	Product Display (13), Shopping Basket (12), Advertisements (11), Product Packaging (10)	"I noticed some familiar advertisements and packaging that helped me decide quickly." - P13 "Product display made the products I like stand out, and I just went for those immediately." - P2
Purchase	Product Appeal and Value Communication	Familiar Brands (24), Product Details (18), Product Packaging (18), Product Pricing (15), Brand Logo (15), Product Display (15), Product Location (12)	"Product details and brand logos helped me compare quickly." - P12
	Immersive Sensory Experience	Sensations (18), Visual Quality (14), Controller Feedback (13)	"I really liked the mist from the freezer; it made the experience feel more real." - P6
Post-purchase	Checkout Experience	Checkout System (24), Virtual Assistant (13), Talking to Others (11)	"The checkout system was very easy. I didn't have to spend too much time or effort on it." - P1 "I liked interacting with the virtual assistant—it felt familiar and natural." - P13

7.4.1.3.1 Pre-purchase Stage for Toucpoints

In the pre-purchase stage, three interrelated themes emerged: Wayfinding and Spatial Awareness, Ambiance and Environmental Cues, and Shopping Triggers and Visual Cues. Together, these themes illustrate how participants navigated, perceived, and engaged with the iVR shopping environment during this initial stage of the customer journey.

Wayfinding and Spatial Awareness was a dominant theme, driven by touchpoints such as "Store Navigation," "Aisle Signs," "Shelf Locations," and "Movement Control." These touchpoints were considered essential for enabling participants to be able to explore and orient themselves effectively within the virtual store, and to ensure a seamless and intuitive navigation experience. The similarity matrix revealed strong associations among these touchpoints, underscoring their interconnected role in fostering spatial understanding and efficient movement within the environment. Participants consistently emphasized how these elements made the store easy to explore, reducing cognitive effort and enhancing overall satisfaction.

The second theme, Ambiance and Environmental Cues, captured the sensory and atmospheric qualities of the iVR store, including touchpoints like "Store Atmosphere," "Lighting," "Visual Quality," and "Background Music." These environmental factors set the tone for participants' engagement by creating an inviting and immersive environment that evoked feelings of comfort, curiosity, and familiarity. Thematic analysis revealed that participants often described these sensory cues as integral to their initial impressions, highlighting how these elements encouraged exploration and fostered a positive emotional connection with the store.

The third theme, Shopping Triggers, reflected touchpoints that directly influenced participants' readiness to shop and their engagement with products. Key touchpoints in this theme included "Product Display," "Advertisements," "Shopping Basket," and "Product Packaging." These visual and functional elements captured participants' attention and acted as decision-making triggers, guiding their interactions with specific products. Participants frequently noted how visually appealing displays and recognizable advertisements facilitated quick and confident product selections. These touchpoints underscored the importance of strategically designed visual elements in enhancing the pre-purchase experience.

7.4.1.3.2 Purchase Stage for Toucpoints

The purchase stage was characterized by two overarching themes: Product Appeal and Value Communication, and Immersive Sensory Experience. These themes emphasize the role of product-focused and sensory-rich touchpoints in shaping participants' decision-making processes during this critical phase of the journey.

Product Appeal and Value Communication emerged as a key theme, encompassing touchpoints such as "Familiar Brands," "Product Details," "Product Packaging," and "Product Pricing." These touchpoints facilitated product comparisons, built trust, and reinforced participants' confidence in their purchasing decisions. The standardization grid consistently categorized these touchpoints as highly significant, and the similarity matrix further underscored their interconnected influence on purchase behavior. Participants frequently highlighted how detailed product information and recognizable brands expedited decision-making, providing a sense of assurance in their choices.

The second theme, Immersive Sensory Experience, centered on touchpoints like "Mist from the Freezer" and "Controller Feedback," which added a sensory dimension to the iVR shopping experience. These elements heightened the realism of the environment, making the purchase process more engaging and memorable. Thematic analysis revealed that participants valued these sensory-rich touchpoints for their ability to mimic physical shopping experiences while

leveraging the unique affordances of iVR. These findings underscore the importance of incorporating sensory elements into iVR retail design to enhance customer immersion and satisfaction.

7.4.1.3.3 Post-purchase Stage for Toucpoints

The post-purchase stage was defined by the theme of Seamless Checkout and Support, which emphasized the critical role of efficient and personalized touchpoints in concluding the customer journey.

The "Checkout System" emerged as the most influential touchpoint during this stage, consistently highlighted as critical in both the standardization grid and the similarity matrix. Participants emphasized its efficiency and ease of use, describing it as pivotal in ensuring a smooth and satisfactory conclusion to their shopping experience. Thematic analysis also revealed that participants valued the system's ability to minimize effort and frustration, reinforcing the importance of designing intuitive and user-friendly checkout processes in iVR retail.

Additionally, the similarity matrix revealed strong associations between the "Checkout System" and the "Virtual Assistant," underscoring the role of personalized support in enhancing the post-purchase experience. Participants frequently described the virtual assistant as familiar and helpful, highlighting its contribution to creating a supportive and positive interaction during checkout. These findings suggest that integrating efficient systems with personalized support can significantly enhance the post-purchase phase, leaving a lasting positive impression on customers.

7.4.2 Emotions

Participants' emotional responses played a pivotal role in shaping their experiences within the iVR shopping environment. Through thematic analysis of the interview data, we identified distinct emotional themes associated with each stage of the customer journey: pre-purchase, purchase, and post-purchase. These emotions influenced not only how participants interacted with the iVR environment but also their overall satisfaction and perceptions of the shopping experience. Table 7.3 summarizes the key emotional themes, the specific emotions expressed by participants, and representative supporting quotes for each stage. Refer to Table D.1 in Appendix D for a comprehensive table detailing the emotions and underlying reasons for each stage.

Table 7. 3 Summary of the themes of emotions.

Stage	Theme	Emotions	Supporting Quote
Pre-Purchase	Curiosity and Excitement about VR Shopping	Curious (15), Excited (6), Amazed (2), Engaged (2), Surprised (2), Eager (1), Positive (1), Interested (1)	"I was curious to see how VR shopping would work—it's something different." - P1 "I was excited to try something new, especially since it was VR shopping." - P3
	Comfort in Familiarity and Realism	Neutral (3), Calm (2), Relaxed (2), Focused (2), Secure (1), Comfortable (1), Content (1), Orderly (1)	"Seeing brands I know made me feel comfortable in the VR store." - P12 "The secure feeling of seeing familiar products helped me relax." - P8
	Initial Nervousness and Skepticism	Nervous (5), Skeptical (3), Anxious (3), Cautious (2), Concerned (1), Stressed (1)	"I was nervous about using the controls in VR." - P6 "I wasn't sure if it would actually feel like real shopping." - P14
Purchase	Increased Immersion through Sensory Details and Realism	Realistic (5), Immersed (1)	"It even had mist effects from the freezer, which made it feel very real." - P10 "The way you could pick up items and look at them closely felt similar to real-life shopping." - P17
	Reinforcement of Familiarity	Nostalgic (1), Familiar (5), Comfortable (3), Satisfied (1), Confident (1)	"I recognized brands I liked, which gave me a nostalgic feeling." - P7 "Seeing brands I know helped me focus on finding exactly what I wanted." - P15
	Positive Engagement and Exploration	Engaged (10), Joyful (4), Exploratory (4), Fun (2), Curious (2), Surprised (1), Enjoyable (1), Interested (1)	"It was fun to try something different; it made the shopping experience feel joyful and engaging." -P12 "I felt relieved when I could find things easily—it felt like real shopping but more enjoyable." - P25
	Frustration with Technical Aspects	Annoyed (6), Frustrated (4)	"It was overall a good experience, but the basket could be easier to use." - P21 "Sometimes the other characters got in my way a bit." - P24
	Task Orientation and Problem Solving	Relaxed (9), Focused (8), Task-oriented (6), Orderly (2), Relieved (1)	"I focused on completing the task within the budget, which made it feel like a game almost." - P9 "I tried to stay organized and stick to what I needed, like a real shopping list." - P20
Post-Purchase	Sense of Accomplishment and Satisfaction	Joyful (2), Satisfied (12), Accomplished (9), Relieved (2), Happy (1), Relaxed (1), Fun (1)	"After finishing, I felt accomplished and relieved to have completed it successfully." - P18 "It was satisfying to finish, like accomplishing a task." - P22
	Reflection on VR's Potential and Limitations	Reflective (12), Optimistic (1), Motivated (2), Hopeful (2), Curious (2), Exploratory (1)	"This felt like a new option that could work for some things, so it made me curious about it." - P13 "It was good, but there's still room for making it even better in future VR versions." - P19

Interestingly, participants' categorization of touchpoints largely mirrored real-world shopping behavior. Navigation aids appeared in the pre-purchase phase, product selection in purchase, and checkout elements in post-purchase—reflecting familiar retail patterns and suggesting that users bring existing mental models into iVR, enabling intuitive interactions. However, there were

notable differences as well: some participants hesitated when interpreting virtual signage, and sensory elements like lighting or sound often triggered stronger emotional reactions. These differences indicate that while iVR can replicate core shopping behaviors, its immersive nature still influences how users perceive and interact within the environment.

7.4.2.1 Pre-purchase Stage for Emotions

In the pre-purchase stage, participants experienced a diverse array of emotions that laid the groundwork for their engagement with the iVR shopping environment. One of the most prominent emotional responses was a sense of curiosity and excitement about the novelty of iVR shopping. Many participants were intrigued by the opportunity to try something innovative and different, expressing eagerness and anticipation as they explored the virtual store. This excitement not only created a positive initial impression but also motivated participants to actively engage with the environment, heightening their overall interest in the shopping experience.

At the same time, participants reported feelings of comfort and relaxation stemming from familiar and realistic elements within the iVR store. Recognizable brands and the authentic replication of a physical shopping atmosphere contributed to a sense of security and ease, making the transition to the virtual environment less intimidating. For some, this familiarity bridged the gap between virtual and real-world shopping, providing a sense of order and focus that enhanced their confidence and overall comfort within the experience.

However, not all participants approached the pre-purchase stage with the same level of enthusiasm. For some, initial nervousness and skepticism shaped their emotions. Participants expressed concerns about the usability of VR controls and questioned whether the virtual environment could realistically replicate a traditional shopping experience. This sense of apprehension was accompanied by feelings of stress and cautiousness, highlighting the importance of intuitive design and effective onboarding processes to help users acclimate to the technology. Addressing these initial hesitations is essential for ensuring that the pre-purchase stage fosters positive emotions, setting a strong foundation for subsequent engagement with the iVR environment.

7.4.2.2 Purchase Stage for Emotions

During the purchase stage, participants' emotions became more dynamic and multifaceted as they immersed themselves in the shopping task. A notable emotional response was the sense of heightened immersion and realism brought about by sensory details embedded in the iVR environment. Elements such as the mist effects from freezers and tactile feedback when

handling products created a vivid, lifelike experience. These sensory enhancements strengthened participants' emotional connection to the environment, making the shopping process more engaging and evocative of real-life experiences.

At the same time, the continued presence of familiar brands and products reinforced feelings of comfort, satisfaction, and confidence. Participants reported that recognizing known brands helped them focus on their shopping objectives and facilitated quicker decision-making. This sense of familiarity not only provided emotional reassurance but also contributed to a seamless and satisfying shopping experience, underscoring the value of incorporating recognizable elements into iVR retail environments to evoke positive emotions.

Many participants expressed enjoyment, happiness, and curiosity as they explored the iVR store. The interactive and exploratory nature of the environment encouraged active engagement, with participants describing the experience as enjoyable and novel. The ability to freely interact with products and navigate the store at their own pace contributed to emotions such as joy and interest, highlighting the appeal of the immersive and playful aspects of iVR shopping.

However, not all emotions during the purchase stage were positive. Some participants experienced frustration and annoyance with technical aspects of the iVR system. Issues such as difficulties using the shopping basket and disruptions caused by interactions with other virtual characters were cited as sources of irritation. These moments of frustration illustrate the importance of refining technical features to maintain a consistently positive user experience and prevent negative emotions from detracting from the overall engagement.

In addition, certain participants adopted a task-oriented approach to their shopping experience, focusing on completing the task efficiently within constraints like budget or time. Emotions such as focus, orderliness, and relief were associated with this pragmatic engagement. This reflects how VR shopping can evoke similar emotions to real-life shopping, where the satisfaction of accomplishing specific objectives plays a central role. Together, these varied emotional responses during the purchase stage highlight the need for a balance between sensory richness, technical reliability, and goal-oriented usability to optimize the CX in iVR retail settings.

7.4.2.3 Post-Purchase Stage for Emotions

In the post-purchase stage, participants shifted from active engagement to reflective evaluation of their overall experience. This stage was marked by two key emotional themes: a sense of

accomplishment and satisfaction and reflection on iVR's potential and limitations. Together, these themes encapsulate participants' emotional responses as they concluded their shopping journey and considered the implications of iVR shopping technology.

A strong sense of accomplishment and satisfaction emerged as a predominant emotional response. Participants frequently expressed feelings of joy, relief, and fulfillment after completing the shopping task. Successfully navigating the virtual environment and achieving their shopping objectives gave rise to a sense of achievement, reinforcing the engaging and rewarding nature of the iVR shopping experience. This emotional outcome indicates that the iVR environment effectively facilitated task completion while providing participants with a gratifying conclusion. The emotional satisfaction derived from this accomplishment underscores the potential of iVR shopping to foster positive end-of-journey experiences, which can contribute to greater overall customer satisfaction.

Beyond these immediate feelings of satisfaction, participants also engaged in reflective thinking about the iVR shopping experience. Optimism and curiosity were prominent emotions as participants contemplated the future applications and possibilities of iVR technology in retail. Many recognized its potential to revolutionize traditional shopping paradigms, expressing hopefulness about how iVR might enhance convenience, personalization, and interactivity in future iterations.

However, participants' reflections were not without critique. Alongside their optimism, they also identified limitations and areas where the technology could improve, such as usability, interface design, and integration of more realistic elements. This thoughtful appraisal reflects a balanced emotional response, where participants recognized both the strengths and current challenges of iVR shopping. Their desire for improvement suggests that while the experience was engaging and innovative, there is room for refinement to meet higher user expectations.

Overall, the post-purchase stage was characterized by a mix of satisfaction and reflective thoughtfulness, encapsulating the dual outcomes of accomplishment and critical evaluation. These emotional responses not only validate the effectiveness of the iVR shopping experience in providing a rewarding conclusion but also highlight its potential to generate lasting impressions and stimulate considerations of its future impact.

7.4.3 Observed Behaviors

The observed behaviors during the iVR shopping experience provided a detailed view of how participants interacted with the virtual environment and approached the shopping task. These

behaviors reveal important insights about task orientation, environmental engagement, and social-cognitive interactions, offering a foundation for designing iVR retail environments that align with users' expectations and needs. The following analysis examines key patterns in participant behaviors, drawing connections to usability challenges and opportunities for design refinement. Table 7.4 summarizes the key observed behaviors, their frequency, and participant distribution.

Table 7. 4 Summary of the observed behaviors.

Observation	Participants	%	Quote
Closing the Freezer Doors	P1, P2, P3, P4, P6, P8, P9, P11, P12, P13, P15, P16, P17, P18, P19, P20, P21, P23, P24, P25, P26, P27, P29, P30	80.00	"When I walked away from the freezer and saw the mist still coming out, I realized I should probably close the door. So I went back and closed it." - P15 "The freezer was left open, and it just didn't feel right. I closed it because it felt like something I'd do in a real store." - P21
Bending to Look at Bottom Shelves	P1, P2, P4, P6, P7, P8, P10, P11, P13, P16, P18, P19, P25, P29, P30	50.00	"The low shelves were harder to interact with because I had to bend down. But I still made an effort since I didn't want to miss anything." - P25
Checking the product information	P1, P2, P6, P9, P11, P12, P16, P19, P22, P26, P27, P29	40.00	"I placed product details and product pricing in the pre-purchase category because they affected my decisions. I had a budget of $100, so I needed to be mindful of prices." - P12 "I kept checking the product descriptions to make sure they matched what I wanted. It felt very realistic, like I was really shopping." - P27
Attempting to Interact with NPCs	P2, P5, P6, P10, P13, P21, P25, P27, P28, P29, P30	36.67	I also tried interacting with some people, but they didn't respond, except for the cashier who took my money." - P10 "I tried talking to the virtual assistant, but it wasn't responding the way I thought it would. It's something they could improve for future versions." - P28
Reaching for Top Shelves	P1, P5, P8, P10, P12, P18, P19, P24, P28, P30	33.33	"I didn't pick items I couldn't read clearly in VR, like those on the top shelf." - P12 "The top shelf items were difficult to reach. I feel like a virtual environment should make this easier, but it mimicked reality a bit too well." - P24
Buying unfamiliar brands	P2, P5, P6, P13, P16, P23, P27, P29	26.67	"The last item I chose before the chocolates was an olive-flavored cracker. I didn't know the brand, but it felt Mediterranean, which appealed to me." - P6 "I picked a brand I didn't know because it looked interesting and the packaging stood out. I wanted to try something different." - P23
Bumping into Objects or NPCs	P9, P10, P14, P18, P20, P22, P25, P29	26.67	"One of the NPCs, a guy with a hat, was blocking a shelf, which made it harder to see items there." - P14 "I accidentally walked into one of the characters. It was a bit awkward because I didn't expect them to block my path like that." - P29

Proceeding to Checkout Due to Full Basket (Despite Wanting to Continue Shopping)	P5, P10, P11, P13, P19, P25, P30	23.33	"The shopping basket was cool. I played around with it a bit, and I liked that it fit everything realistically. However, when it was full, I couldn't add more items, which was a bit limiting." - P13 "When my basket was full, I just headed to the checkout. It felt like a natural flow, and the process was straightforward." - P30
Returning Products to Initial Positions	P4, P6, P8, P16, P26	16.67	"I actually thought about it when I put the crackers back on the shelf after checking the ingredients. Maybe I should've just thrown it aside, but I chose to be 'righteous." - P6 "I picked up a product, realized I didn't want it, and put it back." -P26
Exploring Outside the Supermarket	P1, P2, P6, P10	13.33	"The outside view was really nice. I think I should have spent more time outside once I finished purchasing." - P1
Verbally Calculating the Total Amount	P3, P7, P8, P25	13.33	"I expected it to be more convenient. Also, you mentioned that I needed to use $100, but during the shopping, I had no way to keep track of my spending." - P8
Placing the Basket on the Floor and Retrieving It Later	P5, P18, P28	10.00	"The only thing was that I had to hold the button the whole time to carry the basket. If you could pick it up and release the button, then press again to put it down, it would feel more natural" -P18
Tried to use not purchasable objects (eg, Microwave)	P10, P16	6.67	"I liked poking around and exploring for products, and it started to feel like a real shopping experience. I even tried interacting with some objects and people, but they didn't respond, except for the cashier who took my money." - P10
Dropping the shopping basket	P1, P20, P28, P30	13.33	"I accidentally dropped the basket while looking at something. Picking it up again was simple, though, so it didn't bother me." - P28 "Holding the basket was a bit hard because I had to grip it constantly, and my fingers got tired. There was also a glitch where a chocolate bar stayed on top of my basket rather than going inside, which was annoying." -P30
Attempting to Obtain a Second Shopping Basket	P10	3.33	"Later, I found it hard to add more items once the basket was full—I wasn't sure where to put everything" - P10

7.4.3.1 Interaction with the Virtual Environment: Aligning with Real-World Practices

Participants exhibited a strong inclination to replicate real-world shopping behaviors within the virtual environment, underscoring the immersive quality of the iVR setting. The most frequently observed behavior, closing freezer doors (80%), illustrates participants' responsiveness to environmental cues. This behavior, as noted by Participant 21, was driven by a sense of realism: "The freezer was left open, and it just didn't feel right. I closed it because it felt like something I'd do in a real store." Such immersive interactions highlight the potential of designing VR environments with realistic environmental elements to evoke natural behaviors and reinforce user engagement.

Other behaviors, such as bending to look at bottom shelves (50%) and reaching for top shelves (33.33%), demonstrate participants' active spatial engagement with the virtual store layout. While these behaviors align closely with real-world shopping habits, some participants found them challenging. For instance, Participant 25 stated, "The low shelves were harder to interact with because I had to bend down. But I still made an effort since I didn't want to miss anything." These findings highlight the need for ergonomic design considerations, such as adjustable shelf heights or alternative navigation tools, to accommodate diverse user needs and enhance accessibility.

Checking product information (40%) was another prominent behavior, emphasizing participants' reliance on visible and accessible product details. As Participant 27 remarked, "I kept checking the product descriptions to make sure they matched what I wanted. It felt very realistic, like I was really shopping." This behavior underscores the importance of incorporating detailed and easy-to-read product labels to support informed decision-making.

7.4.3.2 Social and Cognitive Engagement: Navigating Expectations and Challenges

The iVR environment also elicited behaviors reflecting participants' social and cognitive expectations. Attempting to interact with non-playable characters (NPCs) (36.67%) was a notable pattern, as users often perceived NPCs as potential sources of assistance. Participant 10 shared, "I tried interacting with some people, but they didn't respond, except for the cashier who took my money." This behavior highlights a gap between users' expectations of social interaction and the system's current capabilities, suggesting opportunities to enhance the functionality of NPCs to align with real-world customer service dynamics.

However, challenges with spatial awareness occasionally led to frustration. Bumping into objects or NPCs (23.33%) was a frequent occurrence, as noted by Participant 29: "I accidentally walked into one of the characters. It was a bit awkward because I didn't expect them to block my path like that." These issues underscore the need for clearer spatial boundaries, collision feedback, and navigation aids to improve the user experience and reduce disruptions.

Cognitively, participants demonstrated active engagement with the task, as evidenced by behaviors such as verbally calculating the total amount (13.33%). Participant 8 commented, "I expected it to be more convenient... I had no way to keep track of my spending." This suggests that integrating budget tracking tools or real-time expense displays could enhance the shopping experience by reducing cognitive load and fostering financial awareness.

7.4.3.3 Task-Oriented Behaviors and Decision-Making

Task-oriented behaviors reflected participants' focus on completing their shopping tasks efficiently. For example, buying unfamiliar brands (26.67%) demonstrated participants' openness to experimentation, often driven by visual appeal. As Participant 23 noted, "I picked a brand I didn't know because it looked interesting, and the packaging stood out. I wanted to try something different." This finding underscores the importance of product visibility and design in influencing consumer exploration and purchase decisions.

Returning products to initial positions (16.67%) highlighted participants' reflective decision-making processes. Participant 26 explained, "I picked up a product, realized I didn't want it, and put it back." This behavior suggests the value of interfaces that support iterative decision-making, allowing users to revise or undo selections seamlessly.

Interestingly, only 23.33% of participants proceeded to checkout with a full basket. Participant 30 remarked, "When my basket was full, I just headed to the checkout. It felt like a natural flow, and the process was straightforward." This relatively low percentage may indicate a lack of motivation to finalize purchases, highlighting an opportunity to integrate gamified elements or incentives to encourage task completion.

7.4.3.4 Peripheral and Exploratory Behaviors: Design Refinement Opportunities

Peripheral behaviors, while less common, reveal areas for refinement in the iVR environment. Exploring outside the supermarket (13.33%) reflects participants' curiosity and desire for engagement beyond the shopping task. Participant 1 shared, "The outside view was really nice. I think I should have spent more time outside once I finished purchasing." Subtle cues, such as visual prompts or auditory guidance, could redirect users' attention back to the task while still accommodating exploratory tendencies.

Unintended interactions, such as dropping the shopping basket (13.33%) or attempting to use non-purchasable objects like microwaves (6.67%), highlight usability gaps. Participant 30 noted, "Holding the basket was a bit hard because I had to grip it constantly, and my fingers got tired." These findings suggest the need for more intuitive interaction designs, such as improved basket mechanics or clearer visual indicators for interactive elements, to enhance task flow and reduce frustration.

Lastly, attempting to obtain a second shopping basket (3.33%) reflects an unmet need for additional capacity. Participant 10 explained, "Later, I found it hard to add more items once the basket was full—I wasn't sure where to put everything." This behavior indicates the potential

value of interface features that allow for basket upgrades or cart usage, aligning with real-world shopping practices.

The observed behaviors provide actionable insights into the design and refinement of iVR retail environments. High-frequency behaviors, such as closing freezer doors and checking product information, highlight the immersive potential of the environment and the importance of realistic design elements. Conversely, challenges related to navigation, NPC functionality, and task clarity underscore areas requiring improvement. These findings will be further analyzed and discussed in the following section, where their implications for iVR retail design and user experience will be explored in greater detail.

7.5 Discussion

This study explores the critical touchpoints, emotional responses, and actionable opportunities within the iVR customer journey, offering a structured framework to enhance CX in iVR retail environments. By examining the pre-purchase, purchase, and post-purchase stages, this research identifies key elements shaping consumer interactions and highlights their impact on customer emotions and behaviors. These findings culminate in the development of a comprehensive CX framework for iVR retail, integrating actions, touchpoints, emotions, and opportunities to guide both academic inquiry and practical application.

Addressing RQ1: Identification of Key Touchpoints

Through a detailed analysis, this study identifies stage-specific touchpoints essential for creating engaging and effective iVR shopping experiences. During the pre-purchase stage, wayfinding and spatial awareness (e.g., store navigation, movement control), ambiance and environmental cues (e.g., lighting, music, visual quality), and shopping triggers (e.g., product displays, shelf advertisements) emerged as pivotal in attracting customers, building trust, and encouraging exploration. These touchpoints effectively transitioned users from initial skepticism to curiosity and engagement as they navigated the virtual environment.

In the purchase stage, product appeal and value communication (e.g., detailed product information, familiar branding), and immersive sensory experiences (e.g., tactile feedback, visual quality) fostered emotional connections and supported interactive decision-making. However, technical challenges, such as usability issues with shopping baskets, occasionally detracted from the overall experience, underscoring the importance of intuitive design.

Finally, the post-purchase stage highlighted the significance of checkout experience (e.g., efficient systems, virtual assistants, and summary features) in creating a positive conclusion to the shopping journey. These touchpoints elicited satisfaction and accomplishment, reinforcing customer loyalty and retention.

These findings align with Lemon and Verhoef (2016) emphasis on touchpoints shaping customer perceptions and extend this understanding into the virtual realm by focusing on the sensory and interactive elements unique to iVR contexts. By mapping these touchpoints across the customer journey, this study contributes a granular, stage-specific perspective that addresses a critical gap in the literature on immersive retail environments.

Addressing RQ2: Emotional and Behavioral Responses

The research also sheds light on the emotions and behaviors elicited by these touchpoints at different stages. During the pre-purchase stage, initial emotions of nervousness and skepticism were gradually replaced by comfort in familiarity and realism and a sense of curiosity and excitement about shopping, as users acclimated to the virtual environment through sensory and navigational elements. Observed behaviors included exploratory navigation, where users engaged with spatial cues and visual triggers to orient themselves and discover the shopping environment.

In the purchase stage, emotions ranged from reinforcement of familiarity and positive engagement and exploration to occasional frustration with technical aspects and increased immersion, especially regarding shopping basket usability and budget tracking. These emotions were closely tied to product appeal and value communication (e.g., familiar branding, product details) and immersive sensory experiences (e.g., tactile feedback, visual quality), which encouraged sustained engagement. Behavioral insights included task orientation and problem-solving behaviors, where users actively sought solutions for navigating challenges and completing their shopping goals. Additionally, technical frustrations, such as managing NPC movements and the usability of teleportation mechanics, occasionally interrupted the immersive experience, highlighting areas for refinement. Participants also expressed a strong preference for features like product comparison and enhanced real-time purchase tracking, reflecting their desire for efficient yet immersive decision-making.

Post-purchase emotions, such as a sense of accomplishment and satisfaction, were closely tied to effective checkout systems and the perceived seamlessness of the shopping process. Additionally, participants expressed reflective emotions regarding the potential and limitations

of iVR, pointing to a critical need for continuous improvement. Behavioral observations included users' appreciation for simplified processes and celebratory features that acknowledged task completion.

These findings underscore the interplay between touchpoints and emotional dynamics in shaping the iVR shopping journey. Consistent with Hollebeek et al. (2020), the results highlight the importance of designing virtual environments that cater to users' emotional and cognitive needs. By linking emotional engagement to specific touchpoints, this study provides a deeper understanding of how VR experiences influence consumer behavior, offering actionable insights for improving customer satisfaction and loyalty.

7.5.1 CX Framework for iVR Retail

These insights have culminated in the development of an CX framework for iVR retail, which consolidates actions, touchpoints, emotions, and opportunities into a unified structure. By addressing the functional and emotional needs of users, the framework provides a roadmap for designing optimized iVR retail experiences, positioning this study as a significant contribution to the theoretical and practical understanding of iVR retail CX. This study presents a comprehensive CX framework (Figure 7.4) for iVR retail, structured around the pre-purchase, purchase, and post-purchase stages. By integrating touchpoints, emotions, and customer behaviors, the roadmap outlines actionable insights and opportunities for businesses to optimize their design strategies. Each stage of the journey is defined by distinct business actions, which are supported by findings from this study and further justified using academic theories. These insights highlight how carefully designed touchpoints can create emotionally resonant and behaviorally effective CX, positioning iVR retail as a transformative shopping platform.

The proposed framework encapsulates the complexity of iVR retail by emphasizing the interplay between functional touchpoints and the emotional responses they evoke at different stages of the customer journey. Drawing on theories such as the Technology Acceptance Model (Davis et al., 1989) and the cognitive load theory (Sweller, 1988), this framework acknowledges that effective iVR design must balance usability with immersive engagement. The integration of these theoretical foundations with empirical data positions this framework as a distinctive contribution to the literature. Unlike traditional retail frameworks, our model highlights the importance of personalized sensory settings, intuitive navigation tools, and real-time interactivity to meet customer needs in a virtual context.

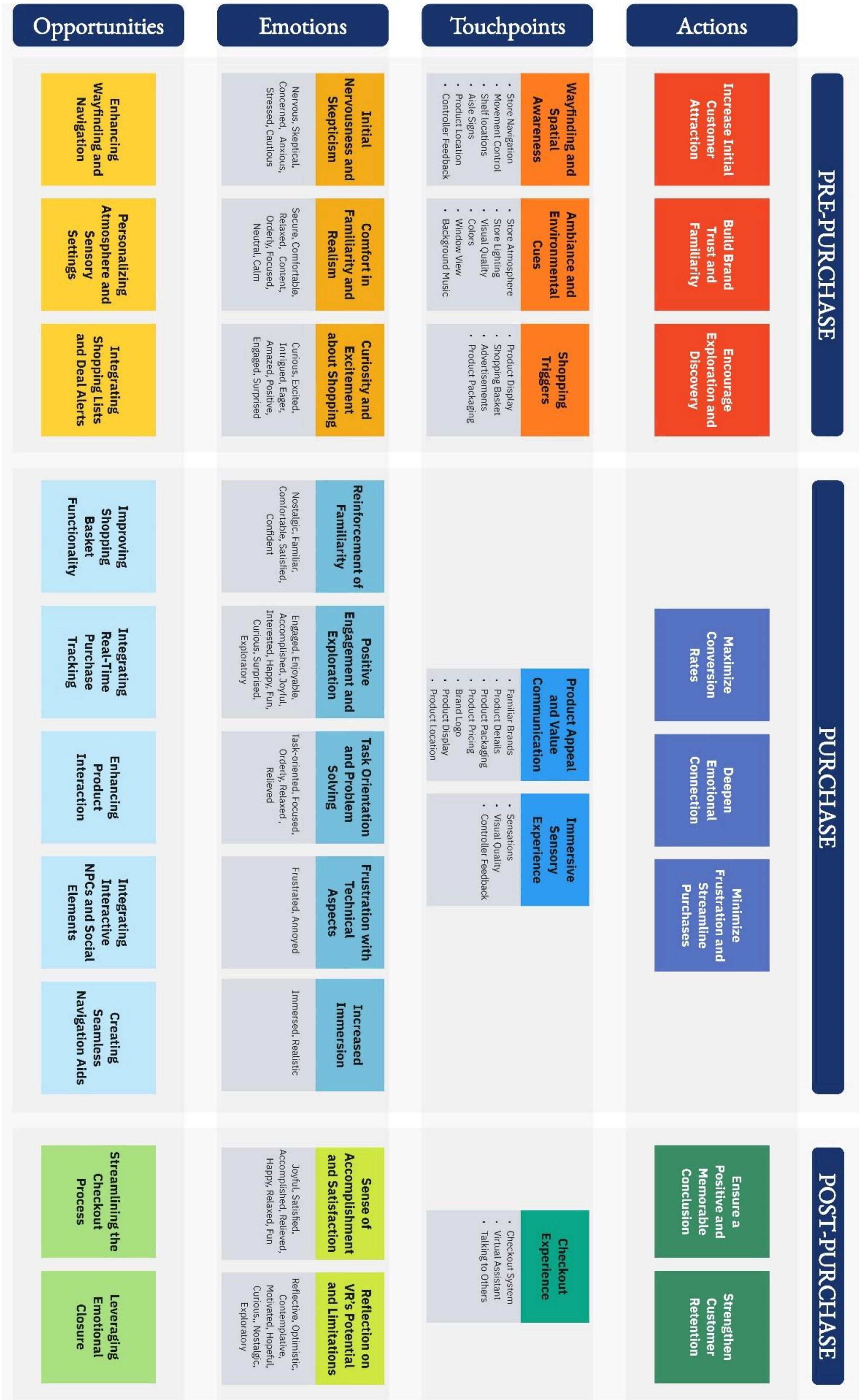

Figure 7. 4 CX framework for iVR retail.

7.5.2.1 Pre-Purchase Stage: Establishing Trust and Stimulating Exploration

The pre-purchase stage is foundational in creating a meaningful and engaging iVR shopping experience, as it sets the tone for subsequent interactions and encourages exploration. The selected actions—increasing customer attraction, building trust and familiarity, and fostering exploration and discovery—are firmly rooted in literature emphasizing the importance of initial touchpoints in shaping perceptions and decisions. Lemon and Verhoef (2016) highlight the significance of the pre-purchase phase in laying the groundwork for trust and inviting exploration, while Koronaki et al. (2023) underscore the role of interactive and immersive features in fostering cognitive and emotional engagement at this stage.

Participants in the study identified intuitive wayfinding tools and sensory personalization as critical touchpoints for overcoming initial apprehensions. Features such as teleportation and shelf indicators were particularly effective in facilitating spatial orientation. However, some participants encountered challenges with teleportation, including occasional collisions with objects or NPCs. To address these issues, integrating automatic post-teleportation adjustments and mini-maps could improve spatial awareness, enhance ease of movement, and reduce cognitive load, consistent with the need for seamless navigation outlined by Koronaki et al. (2023). These interventions align with the broader goal of reducing friction and ensuring that users feel confident in their ability to explore the virtual environment.

Customization emerged as another critical element in the pre-purchase stage. Participants expressed a strong preference for adjusting lighting, music, and other environmental factors to suit their individual needs, echoing Schmitt (1999) emphasis on sensory engagement as a core component of CX. For example, while some users favored warm lighting to reduce sensory strain, others preferred brighter illumination for improved product visibility. Allowing users to personalize these settings not only enhances emotional comfort but also fosters a sense of control, making the shopping environment feel familiar and inviting. The potential to integrate personal playlists or podcasts into the virtual environment further extends this personalization, creating a relaxing atmosphere that supports exploration.

Another notable finding was participants' enthusiasm for shopping list integration, allowing users to sync lists from their phones and check off items during their shopping journey. This functionality taps into task-oriented behaviors, fostering a sense of achievement and productivity. Highlighting deals and promotions near relevant products further encouraged exploratory behavior, aligning with Koronaki et al. (2023). emphasis on the situational relevance of touchpoints in driving consumer engagement. These enhancements collectively create an

environment that supports both functional efficiency and emotional engagement, laying a strong foundation for deeper involvement in subsequent stages.

7.5.2.2 Purchase Stage: Driving Engagement and Enhancing Emotional Connection

The purchase stage is the core of the iVR shopping journey, where users move from exploration to decision-making. Actions such as maximizing conversion rates, deepening emotional connections, and minimizing frustration are central to this phase, as they address the dual need for cognitive efficiency and emotional satisfaction. Verhoef et al. (2009) emphasize the importance of sensory-rich experiences in influencing purchasing behavior, while Mansoor et al. (2024) highlight the role of VR touchpoints in replicating tactile and visual aspects of physical shopping.

Participants highlighted sensory engagement, including haptic feedback, product details, and brand familiarity, as pivotal in sustaining emotional connections. Haptic feedback, in particular, gave participants a sense of achievement and the feeling of “getting it right.” They noted how clear it felt to pick up items from the virtual shelves, and many expressed enjoyment in the tactile realism of these interactions. This feature should be strategically utilized in iVR stores to reinforce positive engagement and enhance the shopping experience. These touchpoints evoked feelings of accomplishment and satisfaction, fostering positive engagement. Kim and Ha (2019) found similar results in their study on fashion product shopping in iVR environments, and this insight holds true for convenience stores as well. However, technical challenges, particularly with shopping baskets and budget tracking, occasionally disrupted this engagement. Participants suggested features such as an auto-follow basket or a "grab-and-release" mechanism to reduce physical strain and improve usability. Redesigning the basket to adjust dynamically without appearing overcrowded could further alleviate stress and encourage continued shopping. These recommendations align with the importance of intuitive interfaces highlighted by Koronaki et al. (2023).

Another area of concern was the physical interaction required for certain tasks. Some participants found bending and reaching for items unpleasant, noting that these actions could pose significant challenges for individuals with disabilities. Purwantono et al. (2021) also recommend that disabled shoppers should be able to request a variety of assistance from virtual assistants, which should immediately respond in VR shopping environments to provide more effective support. This limitation underscores a unique opportunity for iVR to reimagine store layouts beyond traditional designs. For instance, virtual stores could position all items at eye level, eliminating the need for uncomfortable movements and improving accessibility.

Additionally, the incorporation of voice-activated browsing systems could further address accessibility challenges, allowing users to locate products and navigate the store seamlessly through voice commands.

The usability of product comparisons. Participants expressed frustration with the inability to view multiple product details simultaneously, emphasizing the need for side-by-side comparison tools and scalable pop-up windows. These features would support informed decision-making, consistent with the findings of Mansoor et al. (2024), who advocate for interactive and accessible design elements in VR shopping environments.

Additionally, participants highlighted that they were checking product labels and details primarily for three reasons: health concerns, curiosity, and specific dietary requirements, such as ensuring products were halal. These motivations underscore the importance of providing clear and easily accessible product information to accommodate diverse consumer needs. However, participants often struggled with small product labels, further emphasizing the necessity for enhanced visual clarity and accessibility. Addressing these issues would not only improve usability but also ensure the shopping experience meets the expectations of a wide range of users with varying priorities and concerns.

Social interactions emerged as a polarizing touchpoint. While some participants appreciated the presence of NPCs as virtual assistants, others found them obstructive. Offering customizable settings to enable or disable NPC interactions or allowing users to shop with friends and family provides a balanced solution, fostering engagement and inclusivity. Incorporating voice commands for locating products or seeking assistance further supports accessibility, enhancing the overall shopping experience.

By addressing these challenges and opportunities, the purchase stage can be transformed into a seamless and engaging phase that balances functional usability with emotional satisfaction. Such enhancements ensure that users feel empowered to make decisions confidently, driving conversion rates and fostering long-term loyalty.

7.5.2.3 Post-Purchase Stage: Ensuring Satisfaction and Driving Retention

The post-purchase stage is pivotal in shaping lasting impressions and reinforcing customer loyalty. Actions such as ensuring a positive and memorable conclusion and strengthening retention are critical in creating a satisfying end to the shopping journey. Reitsamer and Becker (2024) highlight the "peak-end rule," which suggests that final touchpoints disproportionately

influence overall satisfaction. Therefore, enhancing these moments is essential for fostering positive associations and long-term engagement.

Participants valued efficient checkout systems but noted that the lack of celebratory elements diminished the emotional impact of completing their shopping journey. Enhancing checkout touchpoints with features such as purchase summaries and voice-activated commands addresses participants' desire for clarity and reduces cognitive strain, aligning with best practices from existing e-commerce platforms (Peukert et al., 2019). Including personalized thank-you messages or gamified elements, such as earning virtual badges, can further elevate the experience, tapping into intrinsic motivations identified by Domina et al. (2012).

Finally, after-sales engagement opportunities, such as virtual product tutorials or follow-up interactions, to extend the customer journey beyond the immediate purchase. These touchpoints not only enhance satisfaction but also foster long-term relationships, consistent with the relationship marketing principles outlined by Stein and Ramaseshan (2020). By addressing these insights, the post-purchase stage can leave a lasting positive impression, ensuring that customers return to the platform and advocate for the brand.

7.5.2 Theoretical Implications

This study advances the theoretical understanding of CX in iVR retail by bridging existing gaps and extending traditional frameworks into the realm of virtual environments. By structuring the customer journey across pre-purchase, purchase, and post-purchase stages, the research provides a nuanced exploration of how sensory engagement, emotional responses, and observed behaviors manifest within iVR settings. This detailed mapping contributes to addressing the fragmentation in CX literature noted by Becker and Jaakkola (2020), offering a cohesive framework that captures the unique dynamics of immersive retail.

The research sheds light on the evolving role of touchpoints within iVR contexts, expanding on prior studies that emphasize their importance in traditional settings (Lemon & Verhoef, 2016). By identifying stage-specific touchpoints and categorizing them into actionable themes, the study demonstrates how these interactions gain new dimensions through the medium's interactive and sensory capabilities (Koronaki et al., 2023; Mansoor et al., 2024). This deeper understanding not only underscores the transformative potential of iVR technologies but also provides a foundation for examining how touchpoints function as pivotal moments of influence throughout the customer journey.

In addition to touchpoints, this study underscores the importance of emotions in shaping customer experiences, aligning with Hollebeek et al.'s (2020) emphasis on emotional engagement as a key driver of satisfaction. The findings illustrate how immersive environments amplify emotional responses at each stage of the journey, linking specific touchpoints to feelings such as curiosity, excitement, frustration, and accomplishment. This integration of emotional dynamics into CX models enriches the understanding of customer behavior in virtual settings and highlights the critical role of designing experiences that resonate emotionally with users.

Furthermore, the behavioral analysis provides insights into how customers interact with iVR environments, revealing patterns that mirror real-world practices while also highlighting areas of divergence. These observations contribute to updating theoretical models of customer behavior to reflect the influence of advanced technologies in retail. The study emphasizes the interplay between user actions and technological affordances, addressing the need for frameworks that account for the unique features of immersive environments.

The development of an CX framework for iVR retail represents a key theoretical contribution of this study. By integrating actions, touchpoints, emotions, and opportunities into a unified structure, the framework offers a comprehensive model that enhances the understanding of customer experiences in iVR retail. It not only bridges theoretical gaps but also sets the stage for future research to explore the dynamic relationship between technology, customer engagement, and behavioral outcomes in virtual environments.

7.5.3 Practical Implications

The findings of this study provide actionable insights for retailers, VR designers, and marketers aiming to optimize CX in iVR retail environments. The detailed mapping of the customer journey offers a roadmap for practitioners to design environments that align with customer needs and expectations at each stage of the shopping experience. For instance, enhancing wayfinding tools and enabling personalized sensory settings during the pre-purchase stage can create an environment that fosters trust and encourages exploration, reflecting customers' preference for intuitive and customizable experiences.

Addressing usability challenges is another critical takeaway from the study. Technical issues, such as difficulties with shopping baskets, reading product information, and managing interactions with NPCs, highlight areas that require refinement. Implementing features like auto-follow shopping baskets, scalable pop-up product details, and customizable NPC settings

can significantly improve user engagement by minimizing friction and frustration. These improvements are essential for creating seamless and satisfying experiences that encourage customers to return to the platform.

Emotional engagement emerged as a key element in enhancing the overall CX. By incorporating features such as real-time budget tracking, gamified rewards, and personalized thank-you messages, retailers can tap into customers' emotional connections, fostering satisfaction and loyalty. These elements add depth to the shopping experience, transforming it into a memorable and emotionally resonant journey that drives repeat patronage and positive word-of-mouth.

The study also highlights the importance of balancing realism with the unique affordances of virtual environments. While replicating real-world shopping behaviors enhances immersion, leveraging the flexibility of iVR technology to offer additional features—such as environmental customization or interactive virtual assistants—can differentiate the iVR shopping experience from traditional retail. Practitioners can create added value by designing environments that blend familiarity with the innovative possibilities of virtual technologies.

Finally, the findings reveal opportunities for innovation in marketing and customer engagement strategies. Participants expressed a desire for more social shopping experiences and ongoing post-purchase support, suggesting that features like shared shopping with friends or family and virtual product tutorials could enhance customer satisfaction. These strategies not only address customer needs but also position iVR retail as a platform capable of fostering long-term relationships and loyalty.

By applying these insights, practitioners can design iVR retail environments that go beyond functionality to deliver engaging and emotionally meaningful CX. This approach not only enhances customer satisfaction but also offers a competitive advantage in the rapidly evolving landscape of virtual retail.

7.5.4 Limitations

While this study offers valuable insights into customer journeys in iVR retail environments, a few limitations must be noted to contextualize the findings and provide avenues for future research. First, the focus of this research was on the pre-purchase and purchase stages of the customer journey, with less emphasis placed on post-purchase touchpoints such as after-sales support, feedback mechanisms, and long-term engagement. This focus allowed for an in-depth exploration of the earlier stages but leaves opportunities for future work to address the complete customer journey. Expanding research to include post-purchase interactions would

enhance the understanding of long-term customer satisfaction and loyalty within iVR settings and provide a more holistic framework.

The study's participant sample comprised primarily able-bodied individuals, offering consistency in evaluating user experiences. However, this limits the inclusivity of the findings by not fully addressing the experiences of individuals with disabilities or specific accessibility needs. Future research could benefit from including a more diverse range of participants, thereby capturing the perspectives of users with varying physical, sensory, or cognitive requirements. This would not only strengthen the generalizability of findings but also contribute to the design of more universally accessible iVR environments.

While the study identified key touchpoints shaping the iVR shopping experience, it is recognized that the dynamic nature of virtual environments may involve additional touchpoints that were not captured within this scope. This study provides a robust foundation, but future research could explore a broader range of interactions by employing alternative methodologies such as ethnographic observations or larger-scale studies. Such approaches would ensure that the evolving nature of iVR retail environments is more comprehensively mapped, enhancing the adaptability of proposed frameworks.

Lastly, the iVR environment used in this study prioritized realism by replicating a traditional retail setting, which was well-received by participants. However, this design focus limits insights into how alternative, imaginative, or unconventional virtual environments might influence CX. While the findings are particularly applicable to realistic iVR retail settings, future studies could explore the impact of diverse environmental designs on customer emotions and behaviors, broadening the potential applications of the proposed framework.

Overall, while these considerations suggest areas for future exploration, they do not detract from the contributions of this study. Rather, they highlight opportunities to build upon the findings, ensuring that the understanding of CX in iVR retail continues to evolve and adapt to emerging technologies and diverse user needs.

7.5.5 Future Research

This study provides a foundational understanding of CX in iVR retail environments, offering insights into touchpoints, emotional responses, and behaviors. However, the dynamic nature of iVR and the rapid evolution of technology present numerous opportunities for further exploration. Table 7.5 summarizes key research areas, objectives, and potential studies that can address current gaps and expand the scope of iVR retail research.

Table 7. 5 Summary of future research areas.

Area	Objective	Potential Studies
Post-Purchase Touchpoints	Map post-purchase interactions in iVR environments.	Longitudinal studies tracking loyalty, virtual customer service impact analysis.
Inclusive Design	Enhance accessibility for users with disabilities.	Usability testing with assistive tech, emotional/behavioral comparisons across diverse user groups.
Environment Design	Explore realistic vs. fantastical environments.	Experimental studies on design impacts, personalization effects on satisfaction.
Social Shopping	Investigate collaborative shopping experiences.	Experiments on multi-user scenarios, analysis of social media integration effects.
Emotional Impacts	Assess psychological responses to iVR shopping.	Studies on immersion effects, ethical guidelines to prevent overstimulation.
Advanced Technologies	Integrate AI for personalization and analytics.	Evaluations of AI assistants, predictive analytics for store layout optimization.
Cross-Cultural Insights	Understand cultural differences in iVR retail.	Comparative studies across regions, localized content analysis.
Gamification and Loyalty Programs	Evaluate gamification's role in post-purchase engagement.	Behavioral comparisons of gamified vs. traditional experiences, virtual loyalty program impact analysis.
Comparative Analysis	Compare touchpoints and their effects in iVR with traditional online and physical retail.	Surveys on perceived convenience, analysis of hybrid models integrating iVR with physical stores.

Table 7.5 outlines key areas where further investigation can deepen our understanding of iVR retail. For instance, post-purchase touchpoints remain underexplored, and future studies could employ longitudinal designs to track loyalty or evaluate the effectiveness of virtual customer service. This would contribute to a comprehensive understanding of the entire customer journey.

Inclusive design is another critical area that deserves attention. Ensuring accessibility for users with disabilities through usability testing and assistive technologies can promote inclusivity and broaden the reach of iVR retail. Exploring how emotional and behavioral responses vary across diverse user groups can further enhance design strategies.

The environment design of iVR spaces also offers opportunities for innovation. Experimenting with both realistic and fantastical settings can uncover insights into how these designs affect customer engagement, while allowing personalization of virtual environments may improve satisfaction and purchasing behaviors.

Additionally, the potential of social shopping within iVR environments is significant. Multi-user experiences and social media integration could redefine collaborative shopping, emphasizing shared interactions and community engagement. Similarly, understanding the emotional

impacts of iVR shopping, including the role of immersion and ethical considerations, can guide the creation of responsible and engaging experiences.

Advancements in artificial intelligence (AI) and analytics represent a major frontier. Personalization through AI assistants and predictive analytics can optimize virtual store layouts and elevate CX. Moreover, exploring cross-cultural insights and comparing iVR shopping with traditional retail channels can reveal global trends and highlight unique advantages of iVR.

Finally, incorporating gamification and loyalty programs into iVR retail could enhance customer engagement and retention, while comparative analyses of touchpoints across retail channels can identify best practices for hybrid models integrating iVR with physical stores.

7.6 Conclusion

This study identified key touchpoints across the iVR retail customer journey, revealing their influence on customer emotions and behaviors. In addressing RQ1, we mapped critical touchpoints specific to the pre-purchase, purchase, and post-purchase stages; And, for RQ2, we uncovered emotional responses ranging from initial curiosity and excitement to post-purchase feelings of accomplishment and reflection. Our research advances theoretical understanding by extending traditional CX frameworks into the iVR domain and developing an CX framework for iVR retail that addresses the fragmentation in existing literature. Practically, the findings offer actionable insights for designing customer-centric iVR retail experiences, such as enhancing navigation tools and personalizing sensory settings. Limitations include the focus on pre-purchase and purchase stages, lack of participants with accessibility needs, and use of a realistic environment without exploring fantastical settings. Future research should explore post-purchase interactions, include diverse participant groups, and investigate different virtual environment designs. In conclusion, this study underscores the transformative potential of iVR in retail, highlighting the importance of designing immersive experiences that cater to customers' functional and emotional needs.

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Appendix C

Table C 1 Demographics of participants.

ID	Age	Gender	Education	Occupation	Yearly Income
P1	30-39	Female	Bachelor's Degree	Procurement Manager	>140000
P2	30-39	Male	Postgraduate or Higher Education	Lawyer	>140000
P3	30-39	Male	Postgraduate or Higher Education	Project Manager	>140000
P4	30-39	Female	Bachelor's Degree	Business Analyst	120001-140000
P5	30-39	Female	Certificate or Diploma	Retail assistant	20001-40000
P6	30-39	Male	Bachelor's Degree	Manufacturing Engineer - Composites	100001-120000
P7	30-39	Male	Postgraduate or Higher Education	VET	100001-120000
P8	20-29	Female	Postgraduate or Higher Education	PhD student	20001-40000
P9	20-29	Female	Postgraduate or Higher Education	Postdoc research fellow	80001-100000
P10	30-39	Male	Postgraduate or Higher Education	PhD student	<10000
P11	30-39	Male	Postgraduate or Higher Education	AI engineer	80001-100000
P12	30-39	Female	Bachelor's Degree	Recruitment Experience Contracts & Compliance Specialist	60001-80000
P13	30-39	Male	Postgraduate or Higher Education	Supply Chain Professional	100001-120000
P14	30-39	Male	Bachelor's Degree	Civil Engineer	60001-80000
P15	30-39	Female	Postgraduate or Higher Education	Researcher	<10000
P16	20-29	Male	Bachelor's Degree	Student	20001-40000
P17	30-39	Female	Postgraduate or Higher Education	Nurse	60001-80000
P18	30-39	Male	Postgraduate or Higher Education	Research Fellow	80001-100000
P19	20-29	Male	Postgraduate or Higher Education	Student	20001-40000
P20	20-29	Male	Postgraduate or Higher Education	student	<10000
P21	30-39	Male	Postgraduate or Higher Education	PhD student	20001-40000
P22	40-49	Female	Postgraduate or Higher Education	Researcher	<10000
P23	20-29	Male	Bachelor's Degree	Student	<10000
P24	20-29	Female	Postgraduate or Higher Education	Student	20001-40000
P25	>59	Male	Postgraduate or Higher Education	University Professor	>140000
P26	30-39	Male	Postgraduate or Higher Education	Supply Chain	20001-40000
P27	20-29	Female	Postgraduate or Higher Education	PhD	<10000
P28	30-39	Male	Postgraduate or Higher Education	PhD Candidate	20001-40000
P29	20-29	Male	Bachelor's Degree	student	<10000
P30	30-39	Female	Bachelor's Degree	Service Designer	120001-140000

Appendix D

Table D 1 The emotions of participants and underlying reasons for each stage.

ID	Pre-Purchase Emotions	Reason Why (Pre-Purchase)	Purchase Emotions	Reason Why (Purchase)	Post-Purchase Emotions	Reason Why (Post-Purchase)
P1	Curious, Excited	Eager to explore the VR environment	Joyful, Familiar, Annoyed	Recognized familiar niche products, which sparked joy, annoyed by NPC movements	Joyful, Satisfied, Accomplished	Enjoyed the experience and was reluctant for it to end
P2	Content, Curious	Interested in exploring a new method of shopping	Realistic, Curious	Examined product packaging closely, appreciating the realism	Satisfied, Reflective	Felt the experience was effective and reflected on how it could apply in real life
P3	Skeptical, Surprised, Excited	Unsure if the VR shopping would feel real and excited to discover it	Realistic, Surprised, Comfortable, Annoyed	Found VR surprisingly realistic, adapted quickly, felt comfortable, annoyed by NPC movements	Reflective, Optimistic	Impressed by VR experience, hopeful for future improvements
P4	Nervous, Curious	Unfamiliar with VR shopping, curious about the process	Relaxed, Confident, Exploratory, Comfortable, Frustrated	Became comfortable with VR controls, allowing relaxed exploration, frustrated by NPCs blocking the way	Accomplished, Relieved, Successful	Felt successful after completing the shopping task
P5	Nervous, Anxious, Eager	Anxious about controls, but eager to engage with VR	Fun, Engaged, Exploratory	Smooth navigation and visual quality encouraged exploration	Motivated, Excited	Motivated by VR experience, excited about additional virtual features
P6	Skeptical, Nervous, Orderly	Unsure of VR functionality but eager to organize items	Curious, Orderly	Interested in familiar brands and kept a sense of order	Satisfied, Hopeful	Satisfied and hopeful for VR improvements in future iterations
P7	Relaxed, Secure	Felt secure in VR environment due to familiar brands	Familiar, Relaxed, Focused	Familiarity with brands helped focus on finding desired items easily	Content, Reflective	Content with the experience, reflected on VR shopping advantages over physical shopping
P8	Nervous, Stressed, Relaxed	Nervous about new controls and VR technology but relaxed after get used to it.	Nervous, Relaxed, Frustrated	Initial difficulty with controls transitioned into relaxation as they adapted, frustrated by shopping basket control	Accomplished, Relieved	Relieved to have completed the task after initial nervousness

P9	Focused, Anxious	Focused on task but anxious about managing budget	Focused, Relieved	Focused on task completion, felt relief upon finding necessary items	Reflective, Unsure	Reflective but unsure about item suitability for a gathering
P10	Excited, Nervous	Excited about VR shopping but slightly nervous about navigation	Enjoyable, Exploratory, Realistic	Enjoyed discovering familiar products and realistic feedback from virtual objects	Happy, Reflective	Content with realistic elements, optimistic for VR shopping improvements
P11	Excited, Amazed	Amazed by the VR environment's detail	Focused, Relaxed	VR allowed close inspection of items, aiding focus and relaxation	Joyful, Curious	Wanted to stay longer in VR, enjoying the shopping experience
P12	Positive, Curious, Comfortable	Curious about the VR experience and feels comfortable in VR store	Task-oriented, Engaged, Joyful	Treated VR shopping as a task, focused on completing within budget but enjoyed by completing it	Relaxed, Accomplished, Satisfied	Felt a sense of achievement and satisfaction after finishing
P13	Curious, Concerned	Curious about VR but concerned about potential motion sickness	Immersed, Nostalgic	VR environment’s realistic design brought nostalgia, increased immersion	Satisfied, Curious	Experience brought a sense of satisfaction and curious for the future of VR shopping
P14	Neutral, Engaged, Skeptical	Approached VR shopping pragmatically without strong expectations but with a little skeptisism	Focused, Task-oriented	Aimed to accomplish shopping efficiently, enjoyed the process but focused on task	Reflective	Reflected on how VR could improve shopping experience
P15	Excited, Engaged	Excited by the novelty of VR shopping experience	Joyful, Interested, Familiar	Found virtual items interesting and familiar, enjoyed examining them	Motivated	Wished to extend the shopping experience because it felt fun and immersive
P16	Neutral, Cautious	Approach VR shopping cautiously, without particular expectations	Relaxed, Familiar, Frustrated	Focused on familiar brands and felt at ease with recognizable products, slightly frustrated by the basket handling	Satisfied	Satisfied overall
P17	Excited, Curious	Excited to try VR shopping, curious about the setup	Engaged, Exploratory, Realistic	Found VR engaging and realistic, enjoyed exploring new features	Fun, Exploratory	Fun and intrigued by VR's potential for social interaction

P18	Curious, Pleasantly surprised	Curious about VR features, pleasantly surprised by store's realism	Task-oriented, Engaged, Annoyed	Engaged in shopping task, enjoying realistic sensations like mist effect from freezer, annoyed by NPC movements	Satisfied, Hopeful, Accomplished	Satisfied with experience, felt accomplished, hopeful for more features in VR shopping
P19	Curious, Interested	Curious about VR technology and its potential for shopping	Relaxed, Task-oriented	Relaxed as the VR environment felt intuitive, allowing focus on items	Content, Reflective	Content with VR experience, reflected on possible improvements
P20	Curious, Excited	Eager to explore VR shopping as a new experience	Annoyed, Focused, Orderly, Comfortable	Comfortable in the VR setting, focused on finding and choosing items, found NPCs occasionally disruptive	Content	Content overall
P21	Familiar, Neutral	Relied on familiar items, felt neutral about exploring	Focused, Realistic, Annoyed	Focused on choosing familiar items as in real-life shopping, annoyed by the basket handling	Reflective, Neutral	Reflected on VR's similarities to online and in-store shopping, felt neutral
P22	Culturally aware, Cautious	Cautious about product details due to cultural and religious requirements	Engaged, Task-oriented	Engaged with familiar brands and prioritized items that met personal requirements	Satisfied, Accomplished	Felt satisfied and accomplished after successfully selecting items for task
P23	Curious, Confused	Curious about VR but initially confused about navigation	Fun, Engaged	Found VR engaging after learning navigation, enjoyed the shopping experience	Satisfied, Reflective	Satisfied with the experience, reflected on future possibilities in VR shopping
P24	Introverted, Task-oriented	Preferred minimal interaction and goal-oriented navigation in store	Engaged, Relaxed	Engaged with familiar brands and enjoyed the quiet, task-focused shopping	Satisfied, Neutral	Content with experience, had neutral feelings toward the conclusion
P25	Curious, Frustrated	Curious but struggled with initial controls and navigation	Engaged, Familiar, Joyful, Annoyed	Familiarity with VR grew during experience, making it more enjoyable, annoyed by NPCs blocking the way	Satisfied, Reflective	Satisfied but reflected on navigation improvements that could enhance VR
P26	Curious, Amazed	Intrigued by VR atmosphere and vibrant visuals	Task-oriented, Engaged	Engaged by realistic sensations like freezer mist, made shopping feel authentic	Familiar, Accomplished	Felt like they completed a satisfying task, similar to real-life shopping

P27	Calm, Curious	Calm and curious about the intuitive navigation and organization of store	Focused, Quality-conscious	Focused on high-quality items, appreciated familiar brands and visual details	Reflective, Satisfied	Satisfied with the VR shopping experience, found it intuitive and immersive
P28	Calm, Focused	Calm and focused on finding specified items, found lighting helpful for navigation	Relaxed, Satisfied, Frustrated	Felt relaxed with easy navigation and engagement with familiar brands, frustrated by shopping basket control	Content, Accomplished	Content with experience, felt a sense of accomplishment completing the shopping task
P29	Curious, Confused	Curious but initially confused about controls	Engaged, Relaxed	Engaged with familiar products, navigated store more easily after learning controls	Content, Neutral	Felt neutral after task, content with VR shopping experience
P30	Anxious, Curious	Curious about VR but anxious due to unfamiliarity with controls	Focused, Frustrated	Focused on healthy products, but frustrated by awkward basket handling	Accomplished, Reflective	Felt accomplished with VR task completion, reflected on possible shopping list integration

CHAPTER 8

Conclusion

This research has investigated how iVR technologies shape CX in retail environments bridging theoretical inquiry and practical application. It contributes towards new understanding of a customer's shopping journey which is shaped by their behaviors, emotions, and interactions across the three phases of pre-purchase, purchase, and post-purchase. Through a HCD approach, the research has reported on different key touchpoints, emotional responses, and behaviors in iVR retail, to frame actionable frameworks that cater to customers' functional and emotional needs. The findings reveal that iVR environments evoke heightened sensory engagement, spatial interaction, and embodiment not typically present in other digital shopping experiences, such as mobile apps or web-based platforms. These qualities result in immersive, affect-driven decision-making processes and require new design considerations such as intuitive spatial navigation, realistic product handling, and ambient cues that are exclusive to VR contexts. The study has further proposed design guidelines to equip businesses to develop a cohesive CX strategy for their VR retail projects. This chapter outlines the theoretical and practical contributions of the study, discusses broader implications, acknowledges its limitations, and suggests directions for future research.

8.1 Theoretical Contributions

This study makes significant theoretical advancements in the field of iVR retail by enhancing existing models and frameworks:

Extension of the S-O-R Model: The study extends the Stimulus-Organism-Response (S-O-R) model to capture the sensory and emotional dimensions of iVR environments. This extension provides a deeper understanding of how immersive stimuli influence customer emotions and decision-making processes.

Refinement of the Double Diamond Framework: The iterative nature of iVR design challenges traditional linear approaches. This study refines the Double Diamond framework, adapting it to the dynamic and iterative demands of designing for iVR retail, offering a structured yet flexible approach to the design process.

Comprehensive Customer Experience Framework: A detailed iVR customer journey framework was developed, mapping touchpoints, emotions, and behaviors across the pre-purchase, purchase, and post-purchase stages. This framework serves as a foundation for understanding customer engagement and satisfaction in immersive retail contexts.

8.2 Practical Contributions

The study offers actionable design principles and recommendations for optimizing iVR retail environments, addressing real-world challenges faced by practitioners:

Design Guidelines: Practical recommendations include features such as voice-activated navigation, dynamic product comparison tools, enhanced visual clarity, and redesigned layouts to improve accessibility and inclusivity.

Enhancing Usability and Engagement: By identifying key pain points, such as physical strain and small product labels, the study suggests solutions that foster intuitive and emotionally engaging shopping experiences.

Supporting Retail Strategy: The findings provide businesses with a roadmap for leveraging iVR to improve customer engagement, drive purchasing behavior, and build loyalty.

8.3 Implications

This research has broader implications across academia, industry, and society:

Academic Implications: The extended models and frameworks have contributed towards a deeper interpretation of how immersive technologies can be applied to enhance customer experiences, thereby opening new avenues for research in human-computer interaction (HCI), retail, and psychology.

Industrial Implications: The study's practical recommendations can guide businesses in implementing iVR solutions that can enhance customer satisfaction and operational efficiency, to position iVR as a transformative tool in their retail strategy.

Social Implications: The emphasis on accessibility and inclusivity further ensures that iVR environments should cater to diverse populations, including individuals with disabilities, thereby promoting equitable access to improve immersive shopping experiences.

8.4 Limitations and Future Directions

While this research has provided valuable contributions to understanding customer experiences in iVR retail environments, it is important to acknowledge its limitations and outline opportunities for future research.

One limitation lies in the study's focus on a HCD approach, which prioritized understanding the perspectives of users, academic researchers, and VR designers. While these perspectives offer critical insights, the study could be expanded to include additional stakeholders, such as business owners, marketing professionals, and retail strategists. Engaging these groups could provide a more comprehensive understanding of the operational and strategic dimensions of iVR retail adoption, complementing the existing findings.

Additionally, this study has focused on a specific demographic, limiting the generalizability of the findings. Future research should seek to include diverse user groups across different age ranges, cultural backgrounds, and technological proficiencies. Broadening the participant pool could reveal new dimensions of iVR customer behavior and increase the strenth of the findings. Longitudinal studies would also be beneficial to assess the long-term effects of iVR retail experiences on customer satisfaction, loyalty, and purchasing behaviors, providing insights into the sustainability of iVR as a retail tool.

One consideration that emerged across the reviewed studies is the potential novelty effect of iVR technology, particularly for users with limited prior exposure to immersive environments. Some studies explicitly acknowledged that the novelty of VR interfaces may have temporarily elevated engagement, emotional response, or enjoyment. Others attempted to mitigate this by using repeated exposure sessions or including a pre-task familiarization phase. However, novelty remains a confounding variable, and future research should explore how consumer responses evolve with continued or habitual use of iVR systems.

Although this study has developed awareness into key touchpoints and the emotional and behavioral responses across different stages of the customer journey, future research studies could expand these constructs. One promising direction involves more directly reconciling the perspectives of consumers and VR design experts. While this research examined these groups separately, a comparative or integrative analysis could uncover alignment and dissonance in priorities, expectations, and interpretations of customer experience. Such an approach could yield richer insights into how design decisions are perceived by end users and where critical gaps may exist between design intent and user reality.

Also, we encourage new studies to validate and refine the proposed framework, as immersive technologies are quickly gaining more momentum. The iVR retail shopping framework would therefore involve more corroboration from newer studies to ensure its reliability and robustness across the emergent iVR retail contexts. For instance, this research predominantly examined current-generation iVR technologies and their capabilities. As iVR technology continues to evolve, future studies should explore the implications of advancements such as haptic suits, AI-driven personalization, and enhanced graphical fidelity. These innovations may introduce new customer touchpoints and reshape existing behaviors and emotions in iVR environments.

Lastly, the study's methodology also presents certain constraints. While the combination of qualitative, quantitative, and experimental methods ensured a holistic analysis, triangulation with large-scale quantitative surveys could provide a broader validation of the findings. Future research could integrate such approaches to ensure that the insights gained are applicable across a wide range of retail contexts.

In summary, future research can build on this study by expanding the stakeholder base, validating findings into a unified framework, diversifying participant demographics, incorporating longitudinal approaches, and exploring emerging technologies and collaborative shopping experiences. Addressing these directions will further enrich the theoretical and practical understanding of iVR retail, ensuring its relevance in an evolving technological landscape.

8.6 Concluding Remarks

In making our final remarks, this study has provided a comprehensive exploration of customer experiences in iVR retail environments. It has highlighted current theoretical boundaries and practical limitations to propose novel frameworks that incorporate practitioner insights to extend existing research. Both empirical and theoretical evidence has contributed towards these frameworks that reflect customer-centric insights and further offer actionable design guidelines. The study adopted a robust methodological approach, combining systematic literature reviews, VR experts insights and experiments conducted with end-users, to inform the research findings and contribute towards showcasing iVR as a transformative element of the retail landscape. It has equipped designers, researchers, and businesses with the tools and knowledge to create impactful, inclusive, and emotionally engaging virtual shopping experiences. We believe, this work lays a strong foundation for future studies in fostering innovation and ensuring that customer experiences align with the evolution of immersive technologies in retail.

Appendix E

E 1 Ethic approval notification letter for iVR experiment.

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

19/08/2024

Dear: Aysu Erensoy

Re: Low Risk Notification - 4000029517 - Using Virtual Store to Investigate In-store Shopper Preferences

Thank you for submitting a low risk notification for your research/teaching/evaluation.

This email is to acknowledge receipt of the low risk notification and to inform you that the details of your project have been recorded in our database for inclusion in the annual reports to the Health Research Council Ethics Committee (HRCEC) and the Massey University Research Committee (URC).

You may proceed with your research, though it is advisable to provide a couple of weeks before commencing, as all low risk notifications are checked for completeness and clarity by a Research Ethics Advisor. You may be contacted if your application is incomplete and/or further clarification is required.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis.

If a sponsoring organisation, funding authority (e.g., the Health Research Council) or a journal require evidence of ethical approval from a Human Ethics Committee (with an approval number), you need to complete a full Massey University Human Ethics application to be reviewed and approved by one of our Human Ethics Committees. Applications must be submitted and approved prior to the commencement of the research.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact the Research Ethics Office, email humanethics@massey.ac.nz. "

Please include the following statement on all public documents (e.g., information sheet, consent form) related to your project:

> ***This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.***
>
> ***If you have any concerns about the ethical conduct of this research that you want to raise with someone other than the researcher(s), please contact Massey University Human Ethics by email: humanethics@massey.ac.nz.***

I wish you all the best in your research, teaching or evaluation activities and appreciate your thoughtful consideration of ethics principles and practices.

Ngā mihi nui,

Professor Tracy Riley
Acting Chair, Research Ethics Chair's Committee

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 951 6840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

E 2 Ethic approval notification letter for VR expert interviews.

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

7/03/2023

Dear: Aysu Erensoy

Re: Low Risk Notification - 4000027141 - Development of a Customer Experience Framework for Virtual Reality Retail: Interviews with Specialists

Thank you for submitting a low risk notification for your research/teaching/evaluation.

This email is to acknowledge receipt of the low risk notification and to inform you that the details of your project have been recorded in our database for inclusion in the annual reports to the Health Research Council Ethics Committee (HRCEC) and the Massey University Research Committee (URC).

You may proceed with your research, though it is advisable to provide a couple of weeks before commencing, as all low risk notifications are checked for completeness and clarity by a Research Ethics Advisor. You may be contacted if your application is incomplete and/or further clarification is required.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis.

If a sponsoring organisation, funding authority (e.g., the Health Research Council) or a journal require evidence of ethical approval from a Human Ethics Committee (with an approval number), you need to complete a full Massey University Human Ethics application to be reviewed and approved by one of our Human Ethics Committees. Applications must be submitted and approved prior to the commencement of the research.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact the Research Ethics Office, email humanethics@massey.ac.nz. "

Please include the following statement on all public documents (e.g., information sheet, consent form) related to your project:

> ***This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.***
>
> ***If you have any concerns about the ethical conduct of this research that you want to raise with someone other than the researcher(s), please contact Massey University Human Ethics by email: humanethics@massey.ac.nz.***

I wish you all the best in your research, teaching or evaluation activities and appreciate your thoughtful consideration of ethics principles and practices.

Ngā mihi nui,

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 951 6840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

Appendix F

F 3 Semi-structured interview questions of Chapter 5.

The semi-structured interviews with VR design experts in Chapter 5 were guided by the following base questions:

1. Can you describe the general design process you follow when creating iVR retail environments?
2. Which stages or phases do you consider essential in an iVR design project?
3. How do you approach planning, ideation, prototyping, and testing in VR projects?
4. Who is typically involved at each stage of the process?
5. Can you provide examples of how different roles (e.g., developers, UX designers, marketers) contribute during the project?
6. How do you coordinate across teams or stakeholders throughout the process?
7. Are there specific methods or frameworks you use to structure your VR retail design work?
8. How do you see iVR evolving in the retail industry in the next 5–10 years?
9. Are there any specific technologies or trends you think will become critical to future iVR shopping experiences?

F 2 Semi-structured interview questions of Chapter 6.

The semi-structured interviews with VR experts in Chapter 6 focused on CX design and were guided by the following base questions:

1. What are the most important factors that influence customer behavior in a VR shopping environment?
2. Which types of user emotions or reactions do you aim to evoke or avoid in your projects?
3. How do you define and measure a successful VR customer experience?
4. What kind of stimuli (visual, auditory, spatial) do you design intentionally to shape user responses?
5. How do you consider individual differences, such as prior VR experience or shopping preferences?
6. What are the most important design principles you apply to improve engagement or satisfaction in iVR?
7. Have you observed any consistent customer behaviors in immersive retail environments?

F 3 Semi-structured interview questions of Chapter 7.

The post-experiment interviews with participants in Chapter 7 were guided by the following base questions:

1. Can you describe what it felt like to shop in the VR environment?
2. How did you decide which products to choose?
3. Were there any moments that felt confusing, frustrating, or particularly enjoyable?
4. Did you feel like the store layout or signage helped you navigate?
5. Was there anything missing from the experience that you would expect in a real store?
6. What stood out to you most during the experience?

7. How would you compare this VR shopping experience to shopping in a physical store or online?
8. Would you use this kind of VR store in your real life if it were available?
9. Were there any specific aspects of the VR store that made you feel more immersed or disconnected?
10. What emotions did you associate with different parts of the experience?
11. What were your expectations before entering the VR store, and how did the experience compare?
12. What motivated your product choices?
13. Were there any points where you hesitated, got confused, or felt unsure about what to do next? Why?
14. How did you perceive the realism of the environment, and did it affect your behavior or trust in the products?