



Virginie Lavoye

# AUGMENTED REALITY IN CONSUMER RETAIL: A PRESENCE THEORY APPROACH



Virginie Lavoye

## **AUGMENTED REALITY IN CONSUMER RETAIL: A PRESENCE THEORY APPROACH**

Dissertation for the degree of Doctor of Science (Economics and Business Administration) to be presented with due permission for public examination and criticism in the auditorium 1314 at Lappeenranta-Lahti University of Technology LUT, Lappeenranta, Finland on the 20<sup>th</sup> of October 2023, at noon.

Acta Universitatis  
Lappeenrantaensis 1090

Supervisors Professor Anssi Tarkiainen  
LUT Business School  
Lappeenranta-Lahti University of Technology LUT  
Finland

Academy of Finland post-doctoral researcher Jenni Sipilä  
LUT Business School  
Lappeenranta-Lahti University of Technology LUT  
Finland

Associate Professor Joel Mero  
School of Business and Economics  
University of Jyväskylä  
Finland

Reviewers Professor Nina Michaelidou  
Department of Marketing and Retailing  
Loughborough University  
England

Professor Jari Salo  
Department of Economics and Management  
University of Helsinki  
Finland

Opponent Associate Professor Carlos Velasco  
Department of Marketing  
BI Norwegian Business School  
Norway

ISBN 978-952-335-972-7  
ISBN 978-952-335-973-4 (PDF)  
ISSN 1456-4491 (Print)  
ISSN 2814-5518 (Online)

Lappeenranta-Lahti University of Technology LUT  
LUT University Press 2023

# Abstract

**Virginie Lavoye**

**Augmented reality in consumer retail: A presence theory approach**

Lappeenranta 2023

97 pages

Acta Universitatis Lappeenrantaensis 1090

Diss. Lappeenranta-Lahti University of Technology LUT

ISBN 978-952-335-972-7, ISBN 978-952-335-973-4 (PDF)

ISSN 1456-4491 (Print), ISSN 2814-5518 (Online)

This doctoral dissertation investigates the role of virtual try-ons (VTOs) enabled by augmented reality (AR) to foster positive consumer responses using a presence theory approach. Presence refers to the sense that a virtual object is real, and due to its importance in decision making, current research focuses on spatial presence as the key feature of a realistic product experience. However, this notion is used solely to refer to the feeling that the virtual product is real; thus, research overlooks the fact that when consumers are looking to make a purchase, they use other dimensions of the tangible experience in their decision making. In addition, it is not understood how the AR experience enables the exploration of styles and subsequent consumer responses.

This research fills these gaps with four articles that investigate AR in several ways. The first study starts by showing key antecedents of AR optimal experience and provides practical grounds to investigate the importance of the three presence dimensions. I find that the optimal AR experience delivers a realistic experience of the product, the virtual self, and the social context. Thereafter, this dissertation emphasizes the key role of presence theory in explaining consumer responses and empirically tests the theory of presence with a multi-dimensional perspective comprised of spatial, social, and self-presence as well as a multi-contextual perspective that investigates consumer responses at the decision-making stage and earlier in the customer journey. At the decision-making stage, the results show that AR influences attitude certainty via spatial and social but not self-presence. However, self-presence positively influences consumers' responses toward brands when they are exploring styles in the early stage of the decision journey.

The main contribution lies in redefining the presence experience in AR and in uncovering its effects on the consumer experience in different contexts. The results confirm the importance of a multi-dimensional view of presence, and the multi-contextual approach shows that the role of presence is more complex than the existing research suggests. In addition, this dissertation proposes guidelines for retailers, AR developers, and marketers to better deliver value to consumers in different contexts. Lastly, this dissertation ends with a call for future research on presence to further provide a detailed understanding of optimal realistic experience and its outcomes.

**Keywords:** e-commerce, consumer behavior, augmented reality, spatial presence, self-presence, social presence



## Acknowledgements

First and foremost, I want to thank my supervisors, Anssi Tarkiainen, Joel Mero, and Jenni Sipilä. Thank you for giving me the opportunity to work with you and the support you showed me throughout these years. I must express my gratitude to LUT Business School for providing me with the opportunity to complete my doctoral degree.

My special gratitude also goes to my friends and colleagues at LUT Business School for their enjoyable company and for their support: Svetlana Obukhovich, Chukwuka Igboanua, Malahat Ghoreishi, Titta Pitman and Natalia Lyly.

Thank you, Olivia Petit, for welcoming me as a visiting scholar at KEDGE Business School. I cannot express in a single paragraph how enriching and wonderful that experience was for me. I will be forever thankful for this opportunity to you and to everyone at KEDGE Business School. A special thanks to Hiba, Alice, Paola, Maria Teresa, and Giulia who made my stay even more enjoyable.

*There are certain people who make the world a better place just by being in it. You, you all, are those people to me: Mickaël & Adel, and little Eléna, Julie, Marie P., Emeline, Viki, Leti, Noopy, Marie B., Diellza, Mariana, Mehmet, Ville, Jaakko and, Jaana & Pekka. To my family and friends, thank you for helping me grow you have a very special place in my heart.*

Thank you to my reviewers Nina Michaelidou and Jari Salo, during my examination you brilliantly encouraged me to grow as a researcher. Also, thank you Carlos Velasco for agreeing to be my opponent in this public examination. I have no doubt that we will make this day memorable.

Virginie Lavoye  
October 2023  
Lappeenranta, Finland



“Becoming isn’t about arriving somewhere or achieving a certain aim. I see it instead as forward motion, a means of evolving, a way to reach continuously toward a better self. The journey doesn’t end.”

— Michelle Obama





# Contents

**Abstract**

**Acknowledgements**

**Contents**

<b>List of publications</b>	<b>11</b>
<b>Nomenclature</b>	<b>13</b>
<b>1 Introduction</b>	<b>15</b>
1.1 Background and motivation for the dissertation project .....	16
1.2 Research objectives .....	19
1.2.1 Research gaps addressed by the dissertation.....	19
1.2.2 Research questions and objectives .....	23
1.3 Structure of the thesis .....	24
<b>2 Literature review</b>	<b>27</b>
2.1 Alternative immersive experiences .....	27
2.2 Presence theory.....	29
2.2.1 Cognitive processing of presence .....	31
2.2.2 Spatial presence theory .....	32
2.2.3 Self-presence theory .....	33
2.2.4 Social presence theory .....	34
2.2.5 Extended self in augmented reality .....	35
2.3 Persuasive effects of presence .....	36
2.3.1 Self-explorative engagement.....	36
2.3.2 Attitudes .....	37
2.3.3 Cognitive processing .....	37
2.3.4 Contextual differences of presence outcomes.....	38
<b>3 Research designs and methods</b>	<b>41</b>
3.1 Systematic literature review .....	41
3.2 Conceptual research .....	42
3.3 Sampling and data collection .....	43
3.4 Structural equation modeling with confirmatory factor analysis .....	43
3.5 Validity and reliability of the study.....	44
3.5.1 Publications 1 and 2 .....	44
3.5.2 Publication 3 .....	45
3.5.3 Publication 4 .....	45
<b>4 Results</b>	<b>47</b>
4.1 Summary of the publications and review of the findings.....	47
4.2 Publication 1.....	49

4.2.1	Objectives.....	49
4.2.2	Main contributions .....	49
4.3	Publication 2.....	52
4.3.1	Objectives.....	52
4.3.2	Main contributions .....	52
4.4	Publication 3.....	54
4.4.1	Objectives.....	54
4.4.2	Main contributions .....	55
4.5	Publication 4.....	56
4.5.1	Objectives.....	56
4.5.2	Main contributions .....	56
<b>5</b>	<b>Discussion and conclusion</b>	<b>59</b>
5.1	Answering the research questions .....	59
5.1.1	Research question 1 .....	59
5.1.2	Research question 2 .....	59
5.1.3	Research question 3 .....	60
5.1.4	Research question 4 .....	61
5.2	Theoretical contributions.....	61
5.2.1	Contribution to presence theory literature .....	61
5.2.2	Contribution to the theory of extended self .....	63
5.3	Managerial implications.....	64
5.3.1	Implications for retailers .....	64
5.3.2	Implication for branded app design .....	66
5.3.3	Implications for marketers .....	67
5.4	Limitations and suggestions for future research topics .....	67
	<b>References</b>	<b>71</b>
	<b>Appendix A: Additional table</b>	<b>97</b>
	<b>Publications</b>	

## List of publications

This dissertation is based on the following papers. The rights have been granted by the publishers to include the papers in this dissertation.

- I. Lavoye, V., Mero, J., & Tarkiainen, A. (2021). Consumer behavior with augmented reality in retail: a review and research agenda. *International Review of Retail, Distribution and Consumer Research*, 31(3), 299–329.  
<https://doi.org/10.1080/09593969.2021.1901765>
- II. Lavoye, V. (2023). Augmented reality: Toward a research agenda for studying the impact of its presence dimensions on consumer behavior. In J.L. Reis, M.K. Peter, J.A.V. Gonzáles & Z. Bogdanović (Eds.), *Marketing and Smart Technologies. Smart Innovation, Systems and Technologies*, 337 (pp 641–648). Springer Nature. [https://doi.org/10.1007/978-981-19-9099-1\\_44](https://doi.org/10.1007/978-981-19-9099-1_44)
- III. Lavoye, V., & Tarkiainen, A. (2021). Toward an improved understanding of AR-based presence dimensions and their impact on attitude certainty. [Conference paper]. *Proceedings of the European Marketing Academy*, 94505. <http://proceedings.emac-online.org/pdfs/A2021-94505.pdf>
- IV. Lavoye, V., Sipilä, J., Mero, J., & Tarkiainen, A. (2023). The emperor's new clothes: Self-exploration in virtual try-on service experiences positively impacts brand responses. *Journal of Services Marketing*, 37(10), 1–21.  
<https://doi.org/10.1108/JSM-04-2022-0137>

## Author's contribution

Virginie Lavoye is the principal author and investigator in all papers.

**Publication 1:** The author was responsible for the development of the research plan, collecting and analyzing the data and writing the manuscript.

**Publication 2:** The author was the sole author and responsible for the development of the research plan, collecting and analyzing the data, and writing the manuscript.

**Publication 3:** The author was responsible for the development of the research plan, collecting and analyzing the data and writing the manuscript.

**Publication 4:** The author was responsible for the development of the research plan, collecting and analyzing the data and writing the manuscript.



## Nomenclature

AR	augmented reality
CASA paradigm	“computers are social actors” paradigm
CFA	confirmatory factor analysis
HCI	human–computer interaction
SEM	structural equation modeling
VR	virtual reality
VTO	virtual try-on



## 1 Introduction

Because consumers have high expectations, little patience, and numerous options, customer acquisition and loyalty are complicated objectives for firms (Wilson, 2023). A recent study showed that 61% of consumers are excited about realistic, convenient, and seamless experiences (Wilson, 2023). Thus, immersive shopping technologies, such as augmented reality (AR) and virtual reality (VR), are gaining momentum (Tom Dieck & Han, 2022). The development of virtual try-on (VTO) technology enables consumers to virtually try on fashion, footwear, and accessories by overlaying digital content to alter their views of a physical service environment (Heller et al., 2021). Sephora is among the retail success stories and has gained a competitive advantage in the cosmetics industry by using AR service augmentation as part of the retail experience both offline and online to showcase the multitude of styles available so consumers can try before they buy (Qian, 2021). Specifically, the process of trying on makeup to see how the makeup looks using the Sephora AR-VTO (their smartphone's display) app is similar to the way consumers try on makeup in real life (Qian, 2021). Thus, AR enables consumers to evaluate products in an authentic manner as they would if they were in a physical retail store (Hilken et al., 2017). Encouraging AR usage is profitable for brands because it is associated with increased sales from online channel adoption and category expansion (Tan et al., 2022). Online channel adoption occurs when new online users adopt AR for shopping, while category expansion refers to introducing new customers to the product category (Tan et al., 2022). The resulting increase in sales is particularly important for high product-related uncertainty thus, AR helps to evaluate product fit and increases consumers' purchase confidence (Tan et al., 2022).

Moreover, AR provides novel opportunities to engage consumers and transform brand experiences (Tan et al., 2022). Consumers value enjoyable and memorable experiences provided by companies that deliver personalized content (Gilmore & Pine, 1998). In addition, consumers require engaging interactions that enable deeper personalization (Wilson, 2023). In response, consumers increasingly use AR in their decision journey. For instance, by 2025, the rate of AR usage when buying products online is expected to reach 18% in Europe and 28% in the United States and Canada (Statista, 2022). However, determining whether to use AR and how to implement AR to serve firms' strategic goals remains a difficult decision for any business (Chandukala et al., 2022). In addition, researchers called for an increased understanding of the role of AR at different stages of the decision-making journey to enhance firms' competitive advantage (Kannan & Li, 2017).

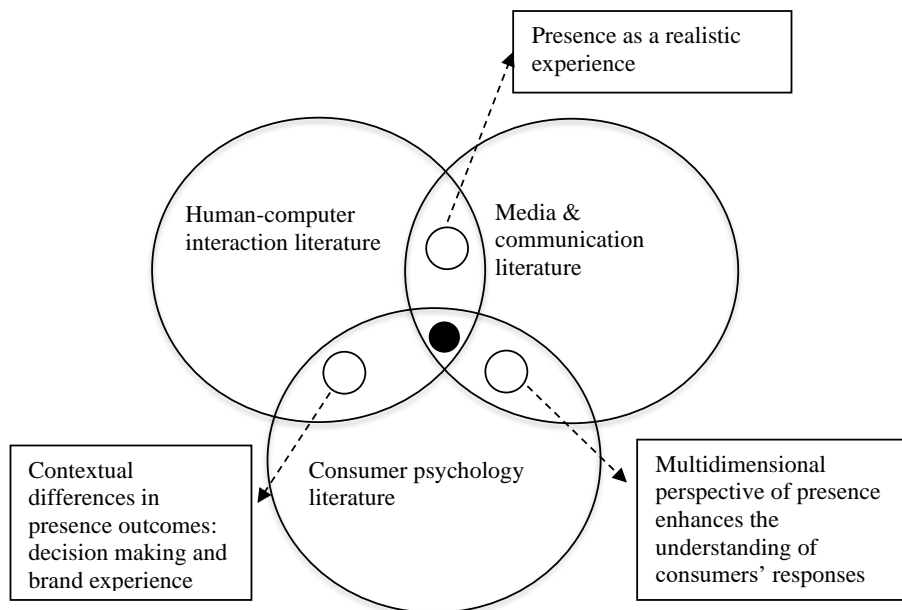
Given the technological differences between AR's many existing formats, current frameworks may neglect the role of influential AR features (Rauschnabel et al., 2019). AR-powered VTOs enable a tangible service encounter that integrates several presence dimensions. Presence is a psychological state that occurs when people believe that a virtual object is real (Lee, 2004). According to experts in the field, AR assists users in the completion of a task via a presence experience that occurs when AR realistically and seamlessly merges real and virtual content (Rauschnabel, Felix, et al., 2022). This



dissertation defines and investigates a three-dimensional AR presence experience comprised of spatial, social, and self-presence as the key determinants of a successful realistic shopping experience. Lastly, this dissertation integrates several dimensions of the presence experience to propose a framework for AR implementation of presence dimensions depending on firms' strategic goals such as facilitating decision-making and creating optimal brand experiences.

### 1.1 Background and motivation for the dissertation project

The study of AR and its unique ability to embed a virtual object into the user's environment and enhance spatial presence is gaining interest in various fields, such as marketing and services research (Heller et al., 2021; Smink et al., 2020), health care (Kaczmarek et al., 2017), psychology (Botella et al., 2010; Juan et al., 2006), engineering (Schein & Rauschnabel, 2021), education (Cai et al., 2014; Cheng & Tsai, 2013), and tourism (Fan et al., 2022; Orús et al., 2021). This dissertation relates to the impact of AR-based presence on product and brand evaluation and draws from three literature streams: human-computer interaction (HCI), media and communication, and consumer psychology.



**Figure 1.** Positioning of the dissertation

● Focus area of the research: The multi-dimensional presence experience in AR influences consumer responses

First, this dissertation draws from the literature on AR in the field of HCI. Research on AR in HCI encompasses three key fields: (1) education, learning, and training research; (2) marketing, consumer behavior, and business research; and (3) digital tourism and cultural heritage research. AR users are influenced by a realistic virtual experience, which is similar to actually experiencing the event (Hilken et al., 2017). Research within this stream of literature suggests that contemporary technologies should be considered as a manifestation of an underlying phenomenon rather than as particular objects (Flanagin, 2020). Virtual technologies such as AR, VR, and mixed reality create a realistic perception of the virtual content in a phenomenon known as presence or telepresence (Lombard & Ditton, 1997). Presence is a complex mechanism that needs to be precisely conceptualized (Lombard & Jones, 2015). Thus, the concept of presence serves as a taxonomy to define and differentiate virtual technologies (Milgram & Kishino, 1994). To differentiate virtual technologies, HCI research places AR experiences on a virtuality continuum (Milgram & Kishino, 1994) that goes from a computer-mediated display of the real environment (e.g., a video feed of Saimaa Seals) to a fully virtual environment (e.g., a video game). Virtual elements refer to computer-generated items, while real elements are tangible elements that exist in the real world and can be perceived via senses such as sight and touch (Milgram & Kishino, 1994).

Mixed realities encompass technologies that create an environment that includes both real and virtual objects (Milgram & Kishino, 1994). AR overlays virtual elements onto the real environment in real time, while VR embeds elements of the real user's experience into a virtual environment in real time (Milgram & Kishino, 1994). VR and AR refer to a set of technologies that create a mix of real and computer-generated virtual elements with the aim of creating the impression that the experience is not actually artificial but real (Milgram & Kishino, 1994). Therefore, AR and VR are similar experiences because the elements that constitute the experience are a mix of real and virtual objects placed at different levels of the reality–virtuality continuum. Thus, virtual technologies such as AR, VR, and mixed reality create a sense of presence (Lombard & Ditton, 1997).

Second, the media and communication literature discusses the outcomes of presence and the process that leads to attitudes and intentions being changed. The media and communication literature is interested in the process that leads people to perceive that information transmitted by a medium feels real (Schubert, 2009) as well as the role of presence as a predictor of attitudinal and behavioral changes when people use media technology (Bandura, 2001). For instance, VR is often described as an empathy machine. When watching VR films from the New York Times on refugee children in South Sudan, Ukraine, and Lebanon, presence increased viewers' empathy (Shin, 2018). In addition, spatial presence increased empathy and the intention to share the news story (Sundar et al., 2017). However, presence failed to explain differences in the level of empathy after storytelling; instead, the emotional intensity of the story was more influential (Sundar et al., 2017). These inconsistent findings have prompted researchers to extend the dimensions of presence beyond the unidimensional concept of spatial presence. In the absence of differences in spatial presence, higher social presence of a 360° video about the refugee crisis increased empathy and prosocial behaviors (Pimentel et al., 2021).

Beyond spatial presence, identification with the avatar (i.e., a component of self-presence) enhanced empathy and prosocial behaviors in a virtual world setting (Gillath et al., 2008). Some studies have used the multidimensional conceptualization of presence to show that each dimension of presence has a unique impact on people's attitudes and behaviors (Behm-Morawitz, 2013; Ma, 2020). Thus, the multidimensional concept of presence in this field informs the multidimensional perspective adopted in this dissertation. Regarding the impact of AR on media users, research remains scarce, and the few studies have focused on the unidimensional sense of spatial presence (Aitamurto et al., 2022). Specifically, the study found that the AR condition (compared with an interactive and static condition) led to a higher sense of spatial presence. Nevertheless, no clear benefit of AR on consumer responses emerged (Aitamurto et al., 2022). Therefore, this field is in its infancy, and the dimensions of presence in AR need to be investigated further. This dissertation relies on the intersection of HCI with the media and communication literature to describe how the multi-dimensional sense of presence that is specific to the current AR experience influences attitudes and changes intentions.

Third, consumer psychology research is interested in decision making (Bettman et al., 1991), motivation (Rucker & Petty, 2004; Wan et al., 2010), and persuasion (Cialdini et al., 2006). Consumer psychology is being increasingly applied in retail contexts to investigate the similarities and differences of using technologies in online setting or in-store (e.g., Daugherty et al., 2005; Vinitzky & Mazursky, 2011). In the store context, when consumers evaluate a product in a direct experience, it increases sales (Zhang et al., 2022). Offline purchases result in higher consumer value because consumers are more engaged in the store than on an e-commerce website (Zhang et al., 2022), and they can better learn about products from a direct experience (Hoch & Deighton, 1989; Zhang et al., 2022). Products that need to be tried on (i.e., experiential products) are best sold offline because consumers require a direct, tangible, and multisensory experience (Zhang et al., 2022). Research in the context of e-commerce websites recognizes the importance of several dimensions of presence (typically spatial and social presence) on consumers' attitudes and behaviors. Presence online provides a realistic experience that resembles the in-store experience in many aspects. For instance, three-dimensional images enhance the sense that the product is real compared to two-dimensional images (i.e., spatial presence), increase product knowledge, and improve brand attitudes and purchase intentions (Li et al., 2002). In addition, websites that integrate social cues have a competitive advantage due to increased human connections and social bonds (Wang et al., 2007). Social cues on websites can give consumers a sense that the seller is real, increase trust in the e-seller (Sohn et al., 2020), or make it easier to shop online together with a friend in different locations by giving a sense that the shopping partner is there in the virtual world (i.e., social presence; Zhu et al., 2010). Furthermore, social cues increase hedonic and utilitarian value, enhance patronage intentions (Wang et al., 2007), and consequently increase sales (Gefen & Straub, 2003). Overall, this dissertation relies on the intersection of the fields of HCI and consumer psychology because it demonstrates that the virtual environment provides a realistic experience and increases positive consumer responses in several contexts such as decision making and brand experiences.

AR technology can enhance the e-commerce shopping experience using VTO technologies. A VTO is a technology that enables consumers to use a three-dimensional virtual model that serves as a realistic virtual self to try on apparel (Merle et al., 2012). When consumers feel they can interact with an object, AR creates a sensory experience that users perceive as authentic (Hilken et al., 2017). Thus, AR enhances spatial presence compared to an e-commerce website (Verhagen et al., 2014); this direct and tangible AR experience enhances sales compared to other e-commerce websites (Tan et al., 2022). Consumers' faces and bodies are augmented with virtual products, such as apparel and accessories (Verhagen et al., 2014). Furthermore, VTO technology powered by VR enables a realistic experience of one's own face and body to increase identification with the avatar (i.e., self-presence) and thus improve the perceived diagnosticity of the apparel (Suh et al., 2011). Thus, VTO technologies require the incorporation of self-presence as part of the multidimensional concept of presence. AR-based VTOs incorporate the product, the self, and the branded AR app (Lavoye, 2023). Therefore, the multidimensional concept of presence requires further research to clarify the impact of this specific dimension on consumer response. This dissertation relies on the field of media and communication research at the intersection of consumer psychology literature because it shows that the three-dimensional approach to presence predicts consumer responses in various ways.

## **1.2 Research objectives**

### **1.2.1 Research gaps addressed by the dissertation**

This section outlines the four research gaps addressed in this dissertation. These gaps are related to the optimal experience of AR in retail and adopt a presence theory perspective. These gaps serve as the basis for the objectives and research questions of the dissertation, which are subsequently presented and discussed.

**Gap 1:** Lack of clarity about the influence of AR on consumer responses in retail.

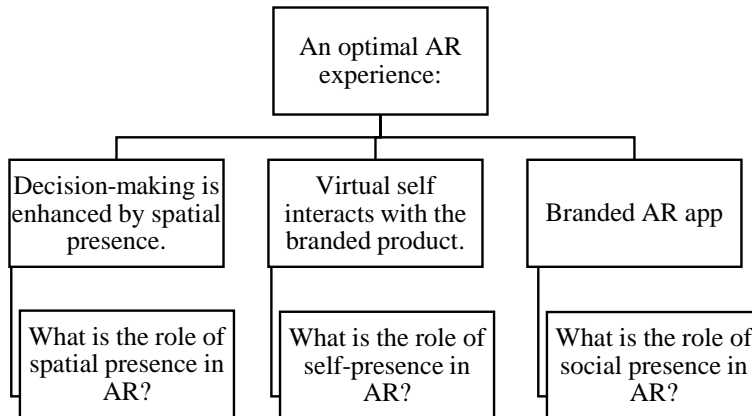
Previous literature reviews on AR have identified the gaps in AR research. Specifically, there are two popular literature reviews identified in AR research: Bonetti et al. (2018) and Javornik (2016a). First, Bonetti et al.'s (2018) review distinguished between retailers' perspectives on AR and consumers' perspectives on, acceptance of, and adoption of AR technologies. Unfortunately, this review focused merely on consumer responses to technology acceptance and thus overlooked decision making and experiential AR. Second, Javornik's (2016a) review focused on the core AR features linked to consumer responses (e.g., vividness, interactivity, and augmentation). However, Javornik's (2016a) review did not provide an analysis of actual consumer responses to AR usage. In light of the rapid growth in AR research, a holistic view of the research aiming to uncover the key AR features that lead to positive consumer outcomes is still lacking. Meanwhile, Chylinski et al. (2020) called for a better understanding of AR to provide better quality recommendations to marketers and lawmakers. Lastly, research in AR remains thematically scattered due to multidisciplinary streams; an organizing framework is thus necessary to increase knowledge (Lavoye et al., 2021).

To fill this gap, the first publication seeks to complement the reviews of Javornik (2016a) and Bonetti et al. (2018) and organizes the literature using different consumer behavior phenomena and theoretical lenses. This dissertation finds that the research on AR has investigated four main themes: (1) decision making, (2) utilitarian and hedonic value, (3) virtual self and brand interaction, and (4) avoiding negative effects (Lavoye et al., 2021). Publication 1 indicates that theoretical lenses, such as mental imagery theory, flow theory, and presence theory, are often used (Lavoye et al., 2021). Importantly, presence theory proposes that an authentic experience relies on the sense that several virtual elements may be perceived as actual (Lee, 2004). Current research focuses solely on realistic product experiences; however, Publication 1 indicates that several aspects of AR enhance consumer responses, suggesting that the optimal realistic experience is multidimensional. Similarly, presence is a multidimensional concept that may shed light on the important features of a realistic AR experience. The doubt surrounding the optimal realistic experience is the basis for the second gap.

**Gap 2:** Need to define several dimensions of the AR presence experience.

Publication 1 highlights that several aspects of the AR experience—(1) decision making, (2) utilitarian and hedonic value, (3) virtual self and brand interaction, and (4) avoiding negative effects (Lavoye et al., 2021)—influence consumers’ responses. Publication 2 grounds the investigation of AR on presence theory to better understand the complex AR experience and organizes the optimal realistic experience into three dimensions of presence (Lavoye, 2023) that parallel two themes of AR performance highlighted in Publication 1 (Lavoye et al., 2021). In addition, I investigate a branded AR app as a social actor.

**Figure 2** shows the main themes of AR research and proposes research on related dimensions of presence. First, this dissertation reviews the literature on AR and shows that AR decision making is enhanced by spatial presence (Hilken et al., 2017; Verhagen et al., 2014). As this dissertation aims to focus on the realistic AR experience, the consumer value theme is not explored further. The second theme identifies the connection between the virtual self and the brand in self-viewing AR, and this theme suggests that elements of authentic experience of the virtual self (i.e., self-presence) may be important to understanding the AR experience. Third, some authors have considered AR as an interface and have explored different values derived from it (e.g., Hilken et al., 2017; Huang & Liao, 2015). However, the role of a branded AR app that facilitates the experience has yet to be studied. Thus, I inquire into the role of an app as a social actor. Specifically, this dissertation proposes that an AR app can give a sense of closeness by providing interactive personalized content, and thus consumers feel that the AR app is an actual seller in a store (Lavoye, 2023). Hence, this dissertation studies three dimensions of presence as the foundation for optimal realistic experiences in AR-based VTOs.



**Figure 2.** Optimal AR realistic experience.

**Gap 3:** Ambiguity on the role of multiple dimensions of AR presence in decision making.

AR has been investigated from different perspectives in the extant literature. Some authors considered AR to be a set of characteristics, such as interactivity, vividness, and novelty, and investigated their impact on customer response (e.g., McLean & Wilson, 2019; Watson et al., 2018). Others compared customers' responses to AR and websites (e.g., Kowalczyk et al., 2020; Yim et al., 2017) or compared AR and VR (e.g., Kim et al., 2023; Mishra et al., 2021). While these investigations helped describe and compare AR to unravel its positive effects, they did not focus on consumers' psychological sense that they were receiving a realistic shopping experience. Presence theory is a cornerstone of research in virtual environments, such as VR and virtual worlds (Lee, 2004; Martínez-Navarro et al., 2019; Skalski & Tamborini, 2007). However, presence theory in AR has yet to receive an in-depth evaluation. Waterworth et al. (2015) noted that "terminological and other confusions about what comprises presence, and what does not, have impeded progress in the field" (p. 36). Consequently, it is imperative to provide clear definitions of the dimensions of presence being investigated (Lombard & Jones, 2015). Thus far, research on AR has provided a unidimensional view of presence that limits it to individuals' feelings that the virtual object is present in the real world (Heller et al., 2019a; Javornik, 2016b; Smink et al., 2020). Research on spatial presence in AR has described its influence on decision making (see Hilken et al., 2017; Smink et al., 2020; Verhagen et al., 2014; Vonkeman et al., 2017). Chylinski et al. (2020) and Vieira et al. (2022) recommended investigating a multi-dimensional perspective of AR because it may better predict consumers' experiences. While presence is a multi-dimensional construct (Lee, 2004), social and self-presence have escaped investigation in the AR context thus far. This gap is particularly troublesome because social and self-presence were the main predictors of consumer experience and decision making in earlier shopping technologies (Cyr et al., 2007; Suh et al., 2011). Thus, by unpacking the three dimensions of presence, researchers can better attribute the realistic experience to its respective elements, thus providing a more detailed understanding of the optimal AR experience (Lavoye, 2023). In addition, precise understanding enables researchers to make recommendations to marketers and app developers about whether and to what extent presence dimensions influence concepts related to consumer decision making, such as attitude certainty.

**Gap 4:** Ambiguity on the role of self-presence during experiential AR.

Few studies have addressed AR usage during the early stages of the purchase journey, instead focusing on the later stages, when consumers make purchase decisions (Jessen et al., 2020). Experiential AR refers to AR usage for its own sake and without a purchase goal (Lavoye et al., 2023). A product experience occurs when the stimulus is a product, and a brand experience entails that the stimulus is a brand (Chang & Chieng, 2006). Experiences occur as a response to stimuli resulting from direct participation in or observation of real or virtual events (Schmitt, 1999). AR-enhanced experiences display consumers' virtual selves with brand information superimposed, thus facilitating self-referencing, enhancing the self-brand connection (Baek et al., 2018), and increasing consumers' positive attitudes toward the brand (Phua & Kim, 2018). Self-referencing is a mental simulation of imagining oneself using a product (Huang, 2019), in which consumers relate brand information to their self-concept (Burnkrant & Unnava, 1995). However, empirical evidence of the role of self-presence as an antecedent of the exploration of styles (i.e., self-explorative engagement) in AR is lacking, and this gap is particularly important to address consumer demand for personally relevant experiences to form positive relationships with brands (Ambika et al., 2022; Phua & Kim, 2018; Xu et al., 2019). In addition, AR usage increases consumers' motivation to explore their styles by decorating their virtual selves (Huang & Liao, 2017), which helps them discover their possible selves and impacts their self-concept (El-Shamandi Ahmed et al., 2023; Javornik et al., 2021). Nevertheless, previous studies examining the mechanisms through which AR fosters positive consumer-brand outcomes are scarce (Plotkina et al., 2021). Lastly, investigating experiential AR in this dissertation sheds light on the differences in presence dimensions that predict positive consumer responses.

**1.2.2 Research questions and objectives**

The current dissertation is motivated by the need to define the optimal realistic experience in AR and adopts a presence theory perspective. Additionally, this dissertation aims to explain the contextual role of AR usage motives, that is, decision making and experiential AR usage. Thus, the main objective of this research is:

*To define the three presence dimensions in AR and investigate their effects on consumer responses.*

This objective is met by addressing the following four research questions:

- 1) How does AR influence consumer responses in retail?
- 2) What are the key dimensions of presence in AR?
- 3) What are the effects of presence on consumers' responses to AR?
- 4) How does self-presence enable experiential AR?



To achieve the main objective presented above, this dissertation presents four studies. In addition to the main objective, Table 1 provides an overview of the publications included in the dissertation, with the key questions and sub-objectives they aim to address as well as the research method used for each publication.

**Table 1.** Research questions, objectives, and publications

Research Questions	Gap	Objectives	Pub.	Method
How does AR influence consumer responses in retail?	1	Shed light on the key features of AR and their impact on consumer behavior in retail	1	Literature review
What are the key dimensions of presence in AR?	2	Identify the features of AR-based presence dimensions as antecedents of consumer outcomes	2	Conceptual paper
What are the effects of presence on consumers' responses to AR?	3	Identify the role of presence dimensions to enhance consumer responses	3	SEM with LISREL software; survey of 70 respondents
How does self-presence enable experiential AR?	4	Identify the role of self-presence when consumers explore styles	4	SEM with LISREL software; two surveys with 500 respondents in two contexts

**Note:** Gap 1: Lack of clarity about the influence of AR on consumer responses in retail.

Gap 2: Need to define several dimensions of the AR presence experience.

Gap 3: Ambiguity on the role of multiple dimensions of AR presence in decision making.

Gap 4: Ambiguity on the role of self-presence during experiential AR.

### 1.3 Structure of the thesis

Against the background discussed thus far, the remainder of the dissertation is organized as follows. First, Chapter 2 begins by describing immersive experiences in AR and their similarities. This is followed by a review of the current knowledge on spatial, social, and self-presence. Chapter 3 discusses the research methods used to empirically study the outcomes of AR usage, namely, a systematic literature review of AR in retail, a conceptual paper on presence theory, and two surveys analyzed with confirmatory factor analysis structural equation modeling (CFA-SEM), including the assessment of the validity and reliability of the results. Chapter 4 presents the specific

objectives and main contributions of each publication included in the dissertation. Chapter 5 highlights the theoretical and empirical contributions, limitations, and future research directions of this dissertation.



## 2 Literature review

In this section, the key concepts used in this dissertation are defined. First, alternative immersive experiences and the motivation to use presence theory are discussed. Second, the concept of presence is defined, followed by an up-to-date definition of the three dimensions of presence: spatial, self, and social. The next section defines the outcomes of presence investigated in this dissertation: self-explorative engagement, attitudes, and cognitive processing.

### 2.1 Alternative immersive experiences

In Publication 1, flow, mental imagery and spatial presence are immersive experiences and enablers of consumer decision making in AR (Lavoye et al., 2021). These three types of immersive experiences are related but distinct concepts. While the positive effects of mental imagery and flow on consumer responses are well-known (Heller et al., 2019a; Huang & Liao, 2017; Javornik, 2016b; Park & Yoo, 2020), little is known about the realistic presence experience in AR.

Flow refers to the optimal hedonic experience (Csikszentmihalyi & LeFevre, 1989) and is comprised of immersion, curiosity, fun, and control (Javornik, 2016b; van Noort et al., 2012). An optimal experience is achieved when the person faces a stimulating level of challenge matched by an appropriate skill level (Csikszentmihalyi & LeFevre, 1989). AR heightens flow compared to a normal shopping experience (Brannon Barhorst et al., 2021). AR's interactivity, vividness, and novelty increase flow, information utility, learning, enjoyment, and satisfaction with the experience (Brannon Barhorst et al., 2021). Telepresence is a key antecedent of flow experience in the virtual environment (Cheng et al., 2014). Similarly, presence and other elements of a realistic experience predict flow experience in AR (Chen & Lin, 2022; Javornik, 2016b). Other antecedents of flow in AR are multisensory (i.e., self-location and haptic imagery) and engagement (i.e., sense of body ownership, ownership control, and self-explorative engagement) features (Huang & Liao, 2017). Flow in AR-VTOs enhances the awe experience, particularly when consumers have a positive perception of artificial intelligence-enabled service quality (Kautish & Khare, 2022). Flow has been used to predict usage of the Pokémon Go AR game and in-app purchases (Rauschnabel et al., 2017). The flow experience enhances consumer engagement and attitude via trust, leading to positive brand outcomes (Arghashi & Yuksel, 2022). However, privacy concerns when using AR filters can dampen flow and reduce use intentions and word of mouth (Cowan et al., 2021).

Mental imagery refers to the ability to form mental images in the working memory (MacInnis & Price, 1987). Consumers' ability to form mental images of products and experiences enhances their attitudes and intentions (Escalas, 2004b). Imagery generation refers to the internal generation of representations of objects, events, or scenes and their interrelationships (MacInnis & Price, 1987). Imagery transformation occurs when a

mental image is transformed for further processing (Pearson et al., 2015). In the context of AR, mental imagery generation and transformation are facilitated because AR allows the consumer to imagine a three-dimensional visual and lasting product representation in the real world (Heller et al., 2019a). In addition, mental imagery is enhanced by sensory modalities, such as touch (Heller et al., 2019b). AR reduces the mental effort associated with product-related mental imagery and facilitates choice (Heller et al., 2019a). AR reduces product uncertainty and increases positive brand attitude via presence and mental imagery (Sun et al., 2022). AR-enhanced mental imagery improves consumer attitudes and behavioral intentions toward products (Heller et al., 2019a; Park & Yoo, 2020).

Furthermore, the impact of mental imagery depends on the technology used and the type of product displayed. In a study by Petit et al. (2021), AR improved the visualization of eating processes for served food and enhanced purchase intentions compared to three-dimensional pictures. In addition, viewing served (vs. packaged) food in AR with low (vs. high) instrumental properties was shown to enhance purchase intentions. For three-dimensional visualization, viewing packaged (vs. served) food increased purchase intentions (Petit et al., 2021). Hilken, Chylinski, et al. (2022) found that AR enhanced purchase intentions via enhanced product-focused imagery, while VR enhanced brand attitudes via context-focused imagery. When AR and VR were used sequentially, the experience improved both brand attitude and purchase intentions (Hilken, Chylinski, et al., 2022). In addition, the impact of AR-enhanced mental imagery depends on the type of product displayed (Hilken, Chylinski, et al., 2022). As such, the positive effect of AR-enhanced mental imagery on purchase intentions was shown to be higher when the cognitive load of the mental imagery increased, for instance, when consumers evaluated bundles compared to individual objects (Hilken, Heller, et al., 2022).

Mental imagery is related to presence because presence can occur from external stimuli, such as the immersion level of immersive technologies (AR apps; Daassi & Debbabi, 2021), or internal processes, such as mental imagery (which predicts telepresence; Bogicevic et al., 2019; Rodríguez-Ardura & Martínez-López, 2014). Telepresence refers to the sense of being physically located in a computer-mediated environment (Steuer, 1992). Telepresence in VR is concerned with the perception that the virtual environment is real and that the VR user is actually there in the virtual environment (Coyle & Thorson, 2001). In fact, telepresence is more popular than spatial presence in the field of consumer research (Coyle & Thorson, 2001; Mollen & Wilson, 2010; Novak et al., 2000) and is applied to current shopping technologies, including e-commerce, AR, and VR (Lim & Ayyagari, 2018; Xi et al., 2022). In addition, telepresence is also used for object presence and is defined as the perception of direct product experience via a medium (Coyle & Thorson, 2001; Lim & Ayyagari, 2018). In the past, spatial presence was used for the virtual environment and telepresence in telecommunications (Lee, 2004); nowadays, telepresence and spatial presence are similar terms, and their use seems to follow research traditions rather than clear-cut conceptual differences. The current literature often uses both terms interchangeably because spatial presence and telepresence aim to capture the same phenomenon with different approaches. Specifically, both telepresence and spatial presence occur when people form spatial mental representations that enable them to feel

like they are in a realistic experience when encountering virtual objects. Spatial mental representation refers to the mental model position of objects in space and the possibility for action (Schubert et al., 2001). To sum up, there is a lack of common terminology on presence dimensions; telepresence, virtual presence, and mediated presence are based on the devices used to access the virtual environment. Steuer (1992) defined presence as the natural perception of an environment and telepresence as a mediated perception of the environment. In addition, telepresence, spatial presence, self-presence, social presence, and co-presence (defined in Appendix A) are specific constructs in the broader class of presence phenomena (Lombard & Ditton, 1997).

Little is known about which aspects of a realistic AR experience affect consumer attitudes and intentions (Lavoye, 2023). The VTO context entails the representation of the embodied virtual self, yet only spatial presence has been studied in this context (see Hilken et al., 2017; Verhagen et al., 2014). Research in the video game context showed that the effects of using a virtual self translated into the real world, influencing consumer attitudes and behavioral intentions (Behm-Morawitz, 2013). Self-presence in the health-related context was the sole predictor of health and appearance behavior changes, while spatial and social presence were non-significant (Behm-Morawitz, 2013). Therefore, different dimensions of presence influence behavior change differently. In the case of a health-related game, enhanced control over and interaction with the virtual self enhanced self-presence and fostered positive health behavior change (Behm-Morawitz, 2013). Thus, a multi-dimensional approach to presence permits a finer-grain investigation of the elements of a realistic AR experience and the role of each dimension in improving consumers' attitudes and intentions. As a result, this dissertation adopts a presence theory perspective and unpacks the dimensions of presence that are important in AR-enabled VTO. In the plethora of presence dimensions, the current practical features of AR-enhanced technology guided the selection process.

## 2.2 Presence theory

Presence is different from related terms, such as immersion, involvement, and realism. Cognitive processes mediate presence from the perceptual stimuli of immersion (Schubert et al., 2001). Immersion is a quantifiable experience that refers to the extent to which a computer delivers a realistic experience of an object, person, or event (Schubert et al., 2001). Involvement and spatial presence measure closely related constructs but are different concepts (Hartmann et al., 2016). Involvement is a psychological state that occurs when individuals focus their attention on a focal activity or event (Schubert et al., 2001). Realism entails how well the content is displayed and simulates a real object (psychological realism); when the content represents a real person, object, or event, this is known as factual realism (Orús et al., 2021).

I propose that the optimal AR experience should deliver a realistic experience of the product, the virtual self, and the social context (Lavoye, 2023). Building upon the work

of Lee (2004), this dissertation adopts a multi-dimensional view of presence in AR studies. The multidimensional approach broadens the scope of research, which has typically focused on spatial presence (see Hilken et al., 2017; Verhagen et al., 2014). Beyond the existing definition of spatial presence in the AR context (Hilken et al., 2017), I define social and self-presence in the AR-enhanced VTO context (Lavoye, 2023).

**Table 2** summarizes the terminology used in the publications included in this dissertation and serves as a glossary for the reader.

**Table 2.** Definitions and conceptualizations of AR presence dimensions

Concept	Definitions and Conceptualizations
Presence	When users experience virtual objects as real objects; has three dimensions: spatial, social, and self-presence (Lee, 2004)
Spatial presence	When users feel that the virtual object is in the real environment and can be interacted with, giving the sense that the virtual product is an actual product (Hilken et al., 2017)
Self-presence	When users feel that the virtual self is physically similar and identify with the virtual self, thus resulting in the perception that the virtual self is the actual self (Seo et al., 2017)
Social presence	When users feel a sense of human warmth and personalness within a virtual environment (here, a branded AR app) and perceive the virtual actor as an actual social actor (Gefen & Straub, 2003)

A virtual experience refers to the multisensory experience of para-authentic or artificial objects and may entail several types of virtual objects, such as the environment or products (for a review, see Lombard & Ditton, 1997). Social presence refers to the psychological perception that virtual social actors are experienced as actual social actors (Oh et al., 2018). Understanding presence as part of the computers are social actors (CASA) paradigm entails differentiating between para-authentic and artificial social actors. A para-authentic object refers to a virtual version of an actual object (e.g., the product or self), while an artificial object is a virtual version of an imaginary object (e.g., a branded app as a social actor). Specifically, this dissertation focuses on a branded app (i.e., an artificial social actor) perceived as an actual social actor (Lavoye, 2023). Self-presence refers to a sense that the virtual self is physically similar to oneself and the individual identifies with the virtual self (Seo et al., 2017).

### 2.2.1 Cognitive processing of presence

Presence infers a natural perception, while telepresence infers that presence is mediated by technology (Steuer, 1992). However, the distinction between sensation and perception suggests that perception is always mediated because sensation refers to sensory stimuli and perception to the interpretation of those stimuli affected by both sensation and other subjective factors, such as previous experience, expectations, emotion, and cognitive processing (Lee, 2004). Therefore, following Lee (2004), this dissertation rejects the distinction between presence and telepresence and uses presence to refer to the perception of one's surroundings as if they were the real environment via the perception of the surroundings as mediated by both automatic and controlled mental processes (Gibson, 2014). Virtual technologies provide sensorimotor feedback that enhances presence because the technologies support users' actions in the world and their perceptions of virtual objects through the senses of sight and touch (Biocca, 1997).

Schubert (2009) defines presence as a cognitive feeling that is felt from unconscious cognitive processes of spatial perception that locates the body into the environment and possible interactions with the environment. Therefore, spatial presence is a conscious state that results from spatial cognitive cues (Schubert, 2009). Feelings of spatial presence require perception of the object in the environment and possible action over the object (Schubert, 2009). Presence is enabled by the representation of interactions with the environment and its objects in all types of environments (real environments, virtual environments, pictures, movies, books, and even imagination; Schubert, 2009). In all cases, the interaction must be mentally represented as an action of one's own body in the virtual environment (Schubert, 2009). Presence enables the user to distinguish a sensory stimulus (e.g., thinking or dreaming about holding a cup) from the actual perception of the event (e.g., perception of holding an actual object) to reach the appropriate response (e.g., grasping the handle and holding a cup). In turn, the reality-testing system becomes confused when technology provides a sensory stimulus, and users may believe in the reality of the experiences displayed by the technology (Lombard & Ditton, 1997). For instance, people integrate information from television into their judgments because technology causes difficulty for the reality-monitoring system, and information learned from television is retrieved as if it was learned from real experiences (Shapiro & Lang, 1991).

According to the embodied theory of cognition, the perception of objects (i.e., physical objects, the self, and other social actors) activates motor responses from affordances (Barsalou, 2008). Affordances inform individuals on possible actions and may trigger action and/or serve as symbolic representations (Sundar et al., 2013). Spatial presence is formed by motor responses to the perception of objects (e.g., physical objects such as a cup or a screwdriver). Thereafter, when individuals perceive common objects, they automatically create motor programs for how to handle them from their own experience (Schubert, 2009). A motor program refers to appropriate action corresponding the perceived object. Therefore, spatial presence can come from the perception of an object's physical attributes (Schubert, 2009). For instance, presence in VR is more influential



when consumers perceive a screwdriver than a T-shirt (Alzayat & Lee, 2021). Although Schubert (2009) only discussed spatial presence, the same logic can be applied to self and social actors in the experience.

### **2.2.2 Spatial presence theory**

Experience becomes virtual when experienced objects are artificially created or simulated by technology (Lee, 2004). Virtual experiences refer to the experience of para-authentic or artificial objects. Sensory and non-sensory spatial presence are defined as the experience of being located in the midst of mediated virtual objects (Wirth et al., 2007). As such, the concept of spatial presence is grounded in embodied cognition and proposes that the mental representation of a virtual environment requires the ability to imagine action in the environment (Wirth et al., 2007). Thus, spatial presence gives a sense that users are concentrating on the virtual environment and ignoring the real environment (Schubert et al., 2001). Spatial presence requires that the object of the virtual experience be proximal to the users' body (Schubert, 2009), both in AR and VR contexts. The concept of spatial presence is most common in HCI research, for instance, as an outcome of VR usage (Villani et al., 2012) and related to improved performance, such as student learning (Huang et al., 2019) and self-efficacy (Shu et al., 2019). In media research, spatial presence is an antecedent of behavioral change (Ahn et al., 2016). Lastly, spatial presence in consumer research is mainly used in the context of AR (Smink et al., 2020).

AR superimposes virtual objects on the user's real world (Hilken et al., 2017). For instance, consumers can place a sofa in their living room or wear sunglasses on their face. Thus, spatial presence in AR refers to the presence of the product and occurs when users get the sense that the virtual product is in the real environment (Hilken et al., 2017). This dissertation focuses on spatial presence in the AR context. In the context of AR-VTOs, spatial presence represents an object that is close to the consumer and appears to exist in the real environment (Verhagen et al., 2014; Vonkeman et al., 2017). Spatial presence is the key element of a positive AR experience (Rauschnabel, Felix, et al., 2022). Hilken et al. (2017) built upon the definition of AR to suggest that spatial presence in AR enables users to control the elements of the experience interactively in the real environment and in real time (Azuma, 1997). Spatial presence in VR occurs when users get a sense that they are present in a virtual environment and have the ability to interact with the environment (Sanchez-Vives & Slater, 2005; Schubert, 2009). Thus, Hilken et al. (2017) proposed that AR spatial presence occurs when consumers experience the virtual object as an actual physical object that they can interact with in their real environment (Hilken et al., 2017). Therefore, Hilken et al. (2017) highlighted that the experience is embedded in the real environment (i.e., the placement of the product upon the real environment is realistic) and embodied in the virtual self (i.e., it enables a realistic interaction with the product with realistic body movements).

Rauschnabel, Felix, et al. (2022) proposed a novel conceptual framework of spatial presence in AR applicable to the whole range of virtual experiences. They highlighted two factors of spatial presence: integrated and persistent virtual content in the real

environment. These dovetail well with embedded and embodied spatial presence. Spatial presence experiences are conceptualized on a continuum from low integration and low persistency to high integration and high persistency (Rauschnabel, Felix, et al., 2022). For the first dimension, integration dovetails with embeddedness and highlights the need to fit the virtual content realistically and seamlessly within the real environment (Rauschnabel, Felix, et al., 2022). For instance, low integration in makeup try-ons is exemplified by unrealistic outcomes of interaction with the makeup; for example, passing the hand in front of one's face superimposes the makeup on one's hand (MAC, n.d.). In contrast, high integration in the LEGO app brings a virtual racing experience to the user's physical racing car; the experience is built so that AR users place a physical car on the virtual road, and the car's speed is adapted to the in-game controls (LEGO, n.d.). The second dimension, persistency, relates to embodied interactions with virtual objects. Nowadays, technologies such as IKEA's AR app enable users to place furniture in their living room; however, the app delivers low persistency because the furniture moves when the user moves the screen (IKEA, n.d.). High persistency, for instance, in AR metaverses, enables users to move the screen or their head if wearing AR glasses. Users can look away, and when they look back at the same spot, they will see that the object remained in place. Another example is geofencing games such as Pokémon GO, which places virtual arenas and Pokéstops on the map (Pokémon, n.d.). At the high spatial presence end of the continuum, AR entails a highly sophisticated merging of virtual and real objects (Rauschnabel, Felix, et al., 2022). Thus, geo-localization may be used to embed information in the real environment in the absence of a visual live feed of the environment. For instance, the geofencing game Pokémon GO can be played without activating the smartphone's camera. Additionally, the five senses may increase spatial presence embodiment by providing higher sensorimotor responses to interactions with virtual objects. For instance, pressing a key on a virtual piano would make a corresponding musical note.

### 2.2.3 Self-presence theory

The self is comprised of a social self and a physical self (Riva et al., 2019). The virtual self is defined as the para-authentic or alternative self simulated by technology (Lee, 2004). The virtual self can be physically manifested or psychologically assumed (Lee, 2004). When self-presence is psychologically assumed, people do not see a representation of themselves but react as if they were in the virtual environment (Lee, 2004). For instance, people may have a first-person view of the environment, or other players may greet them by their real name (Lee, 2004). Although interacting with the product entails the body, which enables action, spatial presence is different from self-presence because it focuses on the vividness of the experience with the product in the consumers' direct environment, while self-presence refers to how connected one feels to their virtual body or identity (Oh et al., 2018; Ratan & Hasler, 2009). When technology enables an embodied interaction with the virtual world, the virtual self constrains its presence to the physical representation so that self-presence and spatial presence are intertwined (Schultze & Leahy, 2009). Furthermore, social presence and self-presence are intertwined and capture the interaction between the virtual self and others, reinforcing both

dimensions (Schultze & Leahy, 2009). For instance, game players have reported heightened para-social interactions when they experience self-presence (Jin & Park, 2009).

Early work on embodiment focused on the physical self and whether users believe in the realistic virtual self as a self-representation (Kruzan & Won, 2019). In addition, self-presence has a social component because the self is socially constructed (Biocca, 1997; Lee, 2004). Thus, when technologies allow consumers to personalize their avatar, the conceptual self becomes personally relevant. To sum up, people may experience body-level and identity-level self-presence (Ratan & Hasler, 2010). When people believe that the virtual self is an actual representation of themselves, they experience self-presence (Lee, 2004).

Perceived similarity and identification with the virtual self reflects the sense that the virtual self is the actual self (i.e., self-presence; Suh et al., 2011). Perceived similarity reflects the feeling of being similar to one's virtual self (Allen & Anderson, 2021). Identification with a virtual self reflects the temporary merging of characteristics of the virtual self with concepts of the self (Allen & Anderson, 2021). Public and private self-information constitute one's self-concept and are considered when people focus on themselves (Haji et al., 2021). Public self-information refers to observable characteristics (e.g., behavior and physical appearance), while private self-information is composed of unobservable characteristics (e.g., emotions, physiological sensations, values, and goals; Haji et al., 2021). Thus, perceived similarity may be conceptualized with public or private self-information. For instance, studies measure private self-information, such as feelings during play, absorption during play, positive attitude toward the avatar, and importance to identity (Li et al., 2013; McLeod et al., 2014; Teng, 2017). This dissertation defines self-presence as the sense that the virtual self is an actual self and includes two dimensions: physical similarity (i.e., public self-information) and identification with the virtual self (i.e., private self-information; Lavoye, 2023; Suh et al., 2011). If an individual perceives that their virtual self is physically similar (i.e., public self-information), it may sufficiently reflect the user's self-concept (Suh et al., 2011).

#### **2.2.4 Social presence theory**

Previous studies have pointed out that social presence may be experienced in AR-based VTOs. Specifically, one of the main antecedents to social presence in the CASA context is anthropomorphism (Lombard & Xu, 2021; Xu et al., 2022). Studies in AR have already discussed anthropomorphism as an important antecedent to the success of the AR experience in store (e.g., van Esch et al., 2019) and in a VTO format used to enhance destination brand love (e.g., Huang & Liu, 2021).

Social experience becomes virtual when people experience social actors simulated by virtual technology (Lee, 2004). People pay particular attention to other people over objects; similarly, in the virtual environment, people pay special attention to technology-mediated stimuli of the physical and psychological cues of humanness (Lee, 2004). This

dissertation adopts the definition of presence from the CASA paradigm to describe the types of social cues in AR-enhanced VTOs. Social presence theory refers to the depth and breadth of verbal and nonverbal social cues in a communication medium (Short et al., 1976). Individuals tend to apply human–human communication rules when interacting with technologies; thus, technology can be viewed as another type of social actor that can be persuasive (Reeves & Nass, 1996). People project human attributes onto technology and communicate with computers in reciprocal ways, such as self-disclosing when computers self-disclose (Hooi & Cho, 2014; van Esch et al., 2019).

In the CASA literature, presence involves social responses to cues provided by the medium itself (Nass et al., 1994). Thus, social presence is concerned with the ability of technology to convey a sense of warmth, personalness and closeness (Hassanein & Head, 2005). E-commerce websites enable social presence that is conceptualized as a sense of human contact (Cyr et al., 2007; Gefen & Straub, 2003; Hassanein & Head, 2005, 2007). While websites do not always facilitate direct interaction with another human, prior e-commerce research discusses the inherent “subjective quality” of websites. Social presence of the web refers to the capability of a website to convey a sense of human warmth and sociability (Cyr et al., 2007; Gefen & Straub, 2003). Sometimes, other features are embedded into a website in order to enhance social presence, for instance, physically embodied agents (Lee et al., 2006), three-dimensional avatars or videos, text-to-speech (Qiu & Benbasat, 2008), and recommendations and consumer reviews (Kumar & Benbasat, 2006). Socially rich images and texts on e-commerce websites are cues of social presence (Hassanein & Head, 2007; Qiu & Benbasat, 2005).

At the customer–employee interface, artificial automated social actors—for instance, an anthropomorphized robot or conversational agent (Lee, 2004) or AR-based VTOs—can give a sense of social interaction. Social presence as part of the CASA paradigm is finding a new interest in artificial intelligence chatbots and voice-based assistants. Social presence enhance trust (McLean et al., 2020) and may increase consumers’ purchase intentions compared to human sellers when the service involve an embarrassing situation (Holthöwer & van Doorn, 2022). New technologies can be infused with social presence because they provide tailored responses to consumer needs (Bulu, 2012). For instance, tailored responses and the response variety of conversational agents enhance social presence and delivers a more engaging experience (Schuetzler et al., 2020). Thus, personalized service encounters may enhance social presence at the customer–employee interface (Hennig-Thurau et al., 2022). In the same vein, a VTO provides similar social cues to a real try-on experience because it displays products directly on individuals, similar to how a salesperson would let the client try on a product (Lavoye, 2023).

### **2.2.5 Extended self in augmented reality**

Physical stores provide a hedonic service experience when they offer a personal beauty makeover (Mathwick et al., 2001). Similarly, people use AR to discover products without defined purchase goals (Jessen et al., 2020). People use and decorate their virtual selves to express their values (Kang & Yang, 2006; O’Brien & Murnane, 2009). Thus,

consumers can use AR-VTO to discover styles without a purchase goal (Huang & Liao, 2017; Scholz & Duffy, 2018). The symbolic meaning of a branded product refers to the sense of being that is presumably provided by the brand (Belk, 1988). Consumers use the symbolic meaning of clothes, makeup, automobiles, and so forth in their extended self (Jensen et al., 2003). According to Belk's (1988, 2013) theory of self-extension, people extend their self-concept with their possessions when they integrate the symbolic meaning of the brand into their self-concept. For instance, people who consider Harley-Davidson to be rugged and want to integrate that desirable trait (i.e., ruggedness) into their self-concept will do so by driving a Harley-Davidson motorcycle. Physical proximity and the ability to manipulate the product are determinants of a product's inclusion into consumers' sense of self (Belk, 1988). In addition, Belk (2014) emphasized that when consumers can personalize their bodies or styles, they can explore multiple possible selves. Possible selves refer to different forms of self-expression (i.e., how people assert their identity or self; Oyserman, 2009). For instance, people can choose to express their actual, ideal, or ought-to self (Markus & Nurius, 1986).

AR technology facilitates the process of imagining how branded products would look directly on oneself (Heller et al., 2019a). When people use VTO, they can integrate the brand into their self-concept (Phua & Kim, 2018). People can use their virtual self to integrate symbols from brands into their extended self (Belk, 2014), giving them a sense that the virtual self is themselves (Belk, 2014). When people explore their possible selves and interact with brands, they use prior experiences, desires, and tastes to simulate the experience (Belk, 2014). Self-explorative engagement allows users to explore possible selves and provides a sense of self-presence (Lavoye et al., 2023). Moreover, self-extension leads to them caring about and liking the brand more (Belk, 1988). Thus, self-extension in AR occurs when people try on styles in AR, are motivated to learn about the brand, and thus have a more positive brand attitude (Lavoye et al., 2023).

## **2.3 Persuasive effects of presence**

### **2.3.1 Self-explorative engagement**

People explore their style when they try new or different apparel, shoes, and hairstyles to see how they look on their body (Gurel & Gurel, 1979). In addition, they may experiment with their appearance out of curiosity about how clothing items might fit and suit them because they enjoy a novel experience without a defined goal (Gurel & Gurel, 1979). Therefore, self-exploration enables consumers to challenge their current appearance and decide whether their current style still represents them or if they need to discover and create their new best-fitting style.

In a similar fashion, consumers use VTOs for self-explorative engagement in AR (Huang & Liao, 2017; Lavoye et al., 2023). Specifically, AR-based VTOs simplify the process of imagining how consumers would look wearing products because they display a virtual

product directly on consumers' faces or bodies (Heller et al., 2019a; Hilken et al., 2017). When events are simulated, consumers can think about their own actual or potential behavior in a situation (Escalas, 2004b). As such, the VTO service experience allows consumers to inspect styles via virtual products by using poses and expressions learned from past try-on experiences (Huang & Liao, 2017). When using VTOs, consumers are motivated to try on different styles because the changes are not permanent or very risky (Behm-Morawitz, 2013). In addition, the consequences of the changes can be observed and mimicked in real life.

### **2.3.2 Attitudes**

Product or brand attitude refers to consumers' global evaluations of products or brands (Rucker et al., 2014). Attitudes have a valence that can be positive or negative (Ajzen, 1991) and a strength that goes from strong to weak (Howe & Krosnick, 2017). Brand attitudes and product attitudes are key predictors of behavioral intentions (Ajzen, 1991; Ajzen & Cote, 2008; Zhu & Chang, 2014). In the AR context, a positive attitude toward a brand (Phua & Kim, 2018; Smink et al., 2019) or a product (Verhagen et al., 2014) predicts purchase intentions. When consumers are foregrounded into the VTO experience and explore their style, they form intimate relationships with brands (Scholz & Duffy, 2018).

Attitude certainty refers to the subjective appraisal of confidence that ones' attitude is correct (Rucker et al., 2014). Thus, when interacting with products during a VTO, consumers form a judgement and evaluation of a product, and certainty is a secondary assessment of the evaluation of the product (Rucker et al., 2014). In Publication 3, the assessment relates to confidence in one's attitude toward a product (Lavoye & Tarkiainen, 2021; Tormala & Rucker, 2018). Notably, high attitude certainty (vs. low certainty) lasts longer and better predicts consumers' subsequent behavior (Rucker et al., 2014). Telepresence increases attitude certainty (Klein, 2003). However, little is known about the impact of AR usage on consumer certainty. Therefore, this dissertation focuses on brand attitude and product-related attitude certainty.

### **2.3.3 Cognitive processing**

Processing of information is crucial to research on mediated technologies because experiencing a sophisticated virtual environment may be highly demanding and cognitively overload users (Keogh & Pearson, 2014). A long research tradition suggests that consumers can learn about products and brands from direct experience (Hoch & Deighton, 1989). Virtual experiences simulate direct experiences, thus enhancing brand cognitive processing (Brodie et al., 2013). Brand cognitive processing refers to a consumer's level of processing and elaboration when experiencing a particular brand (Hollebeek et al., 2014). Technological features such as perceived ease of use, perceived usefulness, enjoyment, novelty, and subjective norms were shown to enhance brand cognitive processing for two AR apps, ASOS and IKEA (McLean & Wilson, 2019). Spatial presence components increase cognitive fluency and decrease cognitive load, leading to improved product attitudes when using AR (Fan et al., 2020). Higher levels of

spatial presence in AR enhance consumer learning and persuasion compared to lower levels of spatial presence by increasing decision comfort (Hilken et al., 2017) and decreasing product uncertainty (Sun et al., 2022). However, overly high levels of presence lead to extraneous cognitive load, which decreases persuasion (Ahn et al., 2022).

#### **2.3.4 Contextual differences of presence outcomes**

To the light of differences in antecedents to the presence experiences, this dissertation tests two contextual factors: the consistency between VTO-enhanced AR apps (e.g., fashion and beauty) and the differences between stages of the decision-making process. Specifically, presence can occur from internal processes, (e.g., mental imagery Bogicevic et al., 2019) or external stimuli from the technology (e.g., AR apps; Daassi & Debbabi, 2021). Thus, a medium may influence the presence experience; for instance, Verhagen et al. (2014) found that AR enhanced spatial presence and purchase intentions better than images and 360-spin. However, presence is a psychological state, and thus, it is not solely linked to the features of the medium (Lee, 2004).

This dissertation defines AR presence based on the types of experiences that current AR-based VTOs and different technological features may provide. For instance, other immersive technologies may share features with AR. For instance, both VR and AR can enable consumers to see a photorealistic view of themselves by pointing a camera at themselves. Thus, both might enable the same level of physical similarity and self-presence. However, more simple form of AR may not display the body of the user and result in low self-presence. In addition, AR does not permit the kind of social presence enabled by social media because AR does not integrate communication with other people except as an additional feature outside the AR display (e.g., to send a selfie to a friend or post it on social media; Javornik, 2016a). Therefore, it is important to provide better generalizability on the presence dimensions and their outcomes in AR-enhanced VTOs. Therefore, the results of Publication 4 were tested with AR apps for fashion and beauty products. The results were consistent in the experiential usage of AR and enhanced brand responses at similar levels (Lavoye et al., 2023).

In addition, consumers' motivations and benefits may vary during the decision-making process. Therefore, consumers' responses to AR evolve along the different stages of the decision-making process (Wedel et al., 2020). Kannan and Li (2017) called for a better understanding of the role of AR during different stages of the decision-making process as competitive assets for firms. Decision making takes place in several stages: need recognition, beginning of information search, selection of alternatives, and purchase (Greenleaf & Lehmann, 1995). At the decision-making step, product-related attitudes and intentions are the key performance indicators during the pre-purchase stage, while knowledge, attitudes, and satisfaction with the experience are key performance indicators in the earlier stage of the decision-making process (Wedel et al., 2020). This dissertation aims to show that different dimensions of AR influence consumers differently depending on the stage of the decision-making process. The role of presence may vary depending on the context of AR usage; thus, this dissertation investigates decision-making and brand-

related outcomes. Providing an immersive experience benefits brands by increasing engagement and conversion rates (Monsanto & Buob, 2021). An immersive experience during decision making serves a transactional objective, and its performance is measured with indicators such as decision comfort or purchase intention (Hilken et al., 2017; Verhagen et al., 2014). Jessen et al. (2020) observed that the majority of AR researchers have focused on later stages of the purchase journey, closer to when the decision is made. These highly transactional advantages only arise later in the customer journey when consumers are looking to purchase a product. In the earlier stages, one of the uses of AR is to entertain consumers, which AR does by creating novel and engaging experiences and building brand interest (Tan et al., 2022). In addition, consumers enjoy being creative in their AR experience and thus engage in the AR experience for its own sake (Jessen et al., 2020). Fashion and beauty AR apps are the most popular types of VTOs in consumer retail and have strong experiential benefits (Watson et al., 2018). Experiential AR involves the enjoyment of the whole shopping experience rather than just the product (Holbrook & Hirschman, 1982; Watson et al., 2018). For instance, Gucci's AR service allows consumers to wear their virtual sneakers and share their experience on social media. Overall, this type of virtual experience builds consumer-brand relationships that go beyond advertising a certain product (Chen et al., 2022).





### 3 Research designs and methods

This dissertation adopts the ontological (i.e., how researchers make assumptions about the world) and epistemological (i.e., how researchers can know the world) perspectives of critical realism. The realist view proposes that in the long term, the success of a theory indicates that something similar to the structure postulated by the theory actually exists (Hunt, 1990). In addition, critical realism proposes that no theory provides absolute certainty of truth (Hunt, 1990), and therefore, it cannot provide definitive answers (Easton, 2002).

Multiple methods for evaluating presence exist, including physiological and questionnaire measures (for a review, see Grassini & Laumann, 2020). Research on presence typically uses self-reported measures comprised of latent variables (see Behm-Morawitz, 2013; Cyr et al., 2007; Hilken et al., 2017). Thus, this dissertation also uses self-reported questionnaire items to measure presence dimensions. The realist view supports the use of latent variables in SEM for theory testing (Borsboom et al., 2003). SEM allows for the investigation of the mediation between latent constructs (Jöreskog & Sörbom, 1993). This dissertation follows the hypothetico-deductive scientific inquiry and therefore starts with a systematic literature review that focuses on describing the state of AR research in retail (Publication 1), presents a conceptual model that extends knowledge on presence theory in the AR context based on a review of users' responses to immersive shopping technologies (Publication 2), and tests the theory using SEM in two different contexts (Publications 3 and 4).

#### 3.1 Systematic literature review

A review of relevant literature creates a foundation to advance knowledge and is a key part of any academic project (Webster & Watson, 2002). Literature reviews are at the foundation of academic research because they provide an overview, synthesis, and assessment of previous studies (Xiao & Watson, 2019). Importantly, literature reviews should be rigorous, unbiased, reliable, and repeatable (Boell & Cecez-Kecmanovic, 2015). To ensure this, many researchers have suggested steps to follow. For instance, Webster and Watson (2002) proposed a topic-centric approach to present, synthesize, and assess previous studies. The literature review in Publication 1 aims to identify articles that address the topic of consumer behavior with AR in retail. It is a comprehensive review of the literature that involved searching, selecting, and reading the literature to classify and critically assess prior studies (Boell & Cecez-Kecmanovic, 2015). Literature search processes are central to an objective and replicable systematic literature review (Boell & Cecez-Kecmanovic, 2015). A literature search serves to answer one or several research questions (Xiao & Watson, 2019). The literature search in Publication 1 aims to answer the research questions and follows the two-stage approach suggested by Webster and Watson (2002) and Boell and Cecez-Kecmanovic (2015). The first stage consisted of

searching the online databases Scopus and Web of Science. The use of databases generally provides good coverage of relevant publications (Boell & Cecez-Kecmanovic, 2015). The searches were combinations of terms, for instance, “augmented reality” and “shopping.” Thereafter, the selection of keywords evolved during the literature search process as new terms were added (e.g., “local presence” and “virtual try-on”).

In the second stage, a stricter selection of articles was implemented by creating inclusion and exclusion criteria to keep only articles that focused on AR in the context of retailing, that were listed in the Social Sciences Citation Index or the Science Citation Index Expanded, that contained empirical studies, or that included studies in which participants had actually used AR before. After checking for duplicates and ensuring that the articles fit the selection criteria, 45 peer-reviewed articles published from 2014 to December 2019 were identified. The time frame is explained by the inclusion and exclusion criteria alone and the latest date corresponds to the latest date of literature search.

### **3.2 Conceptual research**

In two steps, this study delineates the concept of AR presence and differentiates AR presence dimensions from presence in prior shopping technologies. It uncovers the outcomes of presence and proposes that future research should investigate the contrasts between other shopping technologies and AR presence outcomes. Conceptual research enables several conceptual contributions, including delineating and differentiating knowledge (MacInnis, 2011). Delineating entails describing a construct in detail (MacInnis, 2011). By mapping out the components of the AR presence experience, this study provides better grounding for future quantitative research. Differentiation occurs when researchers show differences by comparing constructs between studies (MacInnis, 2011). To begin, Publication 2 delineates the presence experience in AR by defining AR spatial presence and proposing definitions for AR social and self-presence by drawing parallels between AR apps’ features and prior technologies’ features (Lavoye, 2023). Thus, I identify relevant presence dimensions to investigate in the context of AR-powered VTOs.

Thereafter, Publication 2 reviews the outcomes of relevant presence dimensions from prior shopping technologies on product-relevant affect, cognition, and behavioral intentions. To do so, Publication 2 relies on a review of literature and follows previous approach of research based on technologies’ effects on users (Javornik, 2016a; Varadarajan et al., 2010; Voorveld et al., 2009). Based on the conceptualizations of AR presence dimensions presented above, I selected studies on immersive shopping technologies that discussed the impact of similar presence features (e.g., object presence is similar to AR spatial presence, while game character identification is similar to AR self-presence) on product-relevant affect, cognition, and behavioral intentions. Thereafter, the study proposes a research agenda to uncover the similarities and differences in the presence outcomes in the AR context.

### 3.3 Sampling and data collection

This dissertation involves two sets of collected data. Publication 3 used a student population, and Publication 4 used a U.S. sample recruited on Qualtrics. In Publication 3, the aim was to test the three-dimensional conceptualizations of AR presence (i.e., spatial presence, self-presence, and social presence) and their role in influencing attitude certainty. The link to the survey was shared with two business school classrooms via Moodle, resulting in 70 participants. The average participant age was 26 years old, and 60% of the participants were women. Before starting the survey, participants used a VTO for sunglasses and were asked to try on several sunglasses. In Publication 4, a wider sample ( $N = 500$ ) representative of U.S. consumers was selected, and the study consisted of a between-subjects study design with two conditions: one VTO for fashion accessories and one for beauty products.

Several steps, such as an attention check, excluding respondents whose answering time was clearly too short to complete the survey carefully (below 2 minutes), and excluding straight-liners, were implemented to ensure data quality. As a result, 58 participants were eliminated from the initial group of 500. Afterwards, I conducted another round of data collection with 66 participants, from which eight more were excluded based on the criteria mentioned before. Only women were assigned to the beauty group, while anyone could be placed in the fashion group. The final sample consisted of 500 people, with a median age of 35-44 years, and 254 participants tried on sunglasses (104 women, 144 men, and six others) while 246 women tried on lipstick. Participants in the sunglasses group were instructed to look through a selection of sunglasses, while those in the makeup group were told to try on different lipsticks.

### 3.4 Structural equation modeling with confirmatory factor analysis

This dissertation uses CFA-SEM with maximum likelihood with LISREL 8.80 statistical software because CFA-SEM is a confirmatory technique that allows theories to be tested (Jöreskog & Sörbom, 1993). When a construct has items adapted from other research, a pretest needs to be run using respondents similar to the study's target population to screen for item appropriateness (Hair et al., 2010). Small sample sizes ( $n < 50$  people) are sufficient to adequately estimate SEM models containing up to five constructs, each with more than three items (observed variables) and with high item communalities (.6 or higher). Sample size is important because there needs to be more observations than the number of latent constructs for the model to run (Hair et al., 2010). A general rule of thumb is that there need to be at least 10 observations per parameter (Hair et al., 2010). A larger sample size produces more stable solutions and enhances the generalizability of the findings (Hair et al., 2010). The scale for the presence dimension was adapted from different contexts therefore, Publication 3 consisted of a pre-test with 70 participants to test the measures. In addition, item parceling for SEM was used to mitigate the risk linked

to a small sample size (Hair et al., 2010). Lastly, Publication 4 collected answers from 500 participants in two different contexts (fashion and beauty VTOs).

### **3.5 Validity and reliability of the study**

#### **3.5.1 Publications 1 and 2**

Conducting a systematic literature review improves the quality, replicability, reliability, and validity of the research (Xiao & Watson, 2019). A comprehensive literature review uses organized, transparent, and replicable procedures (Palmatier et al., 2018). There is no one-size-fits-all rule for literature selection in a systematic literature review because the goal is to use appropriate relevant literature to answer one or several specific research questions (Xiao & Watson, 2019). To improve the trustworthiness of the systematic literature review, authors are encouraged to describe and explain their inclusion and exclusion criteria and to include articles that make a significant contribution to the field (Palmatier et al., 2018). In addition, relevant literature should be synthesized and used to answer the research questions rigorously in an organized manner and with a critical evaluation (Palmatier et al., 2018). Replicability of the research is ensured when authors describe the inclusion criteria to such an extent that another research could replicate the study (Palmatier et al., 2018). In addition, the procedure used to analyze and extract the findings should be described with similar rigor (Palmatier et al., 2018). The results of a good review lay foundational knowledge that needs to be presented in a usable manner (Palmatier et al., 2018). For instance, conceptual models are often used to organize works because they present information in a usable manner (Palmatier et al., 2018). Publications 1 and 2 follow Xiao and Watson's (2019) recommended steps for literature reviews. However, the specific inclusion criteria varied depending on the questions each publication aimed to answer. Publication 1 was a systematic literature review of consumer responses to AR in the retail context. Publication 2 was a literature review of presence outcomes in the context of immersive shopping technologies with the goal of extending the knowledge on presence theory with a conceptual model of AR presence.

### 3.5.2 Publication 3

This study confirms the measurement of presence adapted from previously validated scales and proposed in Publication 2. Thereafter, I used SEM-CFA with maximum likelihood in the LISREL 8.80 statistical software. This approach involves specifying the measurement and structural models and assessing their validity (Hair et al., 2010). The measurement model confirmed that the model fit was acceptable ( $\chi^2 = 73.859$ ,  $df = 71$ ,  $\chi^2/df = 1.00$ ). The composite reliability loaded above the threshold value (.6) for all items, and the average variance extracted (AVE) values for each construct exceeded the threshold value (.5), as recommended by Fornell and Larcker (1981). In addition, discriminant validity was confirmed in two ways. First, pairwise nested models were tested with fixed-parameter correlation and then with free parameters, followed by a chi-difference test to confirm the factors' discriminant validity. Second, the Fornell–Larcker criterion (1981) was obtained by comparing squared correlations with AVEs for corresponding constructs.

For hypothesis testing, this study used item parceling for the exogenous latent variables (i.e., spatial, social, and self-presence) and items for the endogenous latent variable (i.e., attitude certainty). Parceling involves averaging item scores from items with a focal latent variable and using these average scores in an SEM analysis (Bandalos, 2002). The use of item parceling results in the estimation of fewer parameters in the model, a more optimal sample size for the parameter estimates ratio, and more stable parameter estimates for small samples (Bagozzi & Edwards, 1998). Although Publication 3 used a small dataset ( $N = 70$ ), after item parceling, close to five cases for each parameter estimate remained, which was acceptable (Hair et al., 2010). In addition, the hypothesized structural model indicated acceptable fit measures.

### 3.5.3 Publication 4

All scales used in this study were used in prior research and displayed good consistency and validity (Gefen & Straub, 2003; Hilken et al., 2017; Seo et al., 2017). The results of the measurement model revealed a satisfactory fit to the data (Lavoye et al., 2023). In this study, two surveys with 500 participants in two different contexts were collected. Comparing the two contexts (or groups) necessitated a test of metric invariance. Measurement invariance verifies that the same construct is measured across groups (Hair et al., 2010). Similar to McLean and Wilson (2019), I used multi-group SEM and tested measurement invariance to ensure that the results obtained from the two VTO conditions (sunglasses and makeup) were comparable. This was achieved in two steps by testing the configural and metric invariance of path parameters of both conditions simultaneously (Jöreskog & Sörbom, 1993). The first step, configural invariance, tests if an equivalent factor structure exists in both groups (Hair et al., 2010). The second step, metric invariance, represents the equivalence of factor loading. Metric invariance tests equivalence in the relationships between the measured variables and the construct (Hair et al., 2010). Metric invariance is necessary to compare relationships between groups of participants (Hair et al., 2010).

The validity and reliability of the measurement model were confirmed; the composite reliability and discriminant validity loaded well above their respective threshold values (Bagozzi & Yi, 1988; Fornell & Larcker, 1981; Hair et al., 2010). Furthermore, multicollinearity is not a cause for concern because all variance inflation factor values were well below the threshold (Field, 2009), and condition index values were all well below the threshold (Field, 2009). Additionally, the preventative steps to reduce common method variance recommended by Mackenzie and Podsakoff (2012) were implemented in a post-hoc test. Harman's single-factor test with CFA confirmed that common method variance was not a serious threat to the quality of the data (Korsgaard & Roberson, 1995; Mossholder et al., 1998). Pearson's chi-squared test and t-test confirmed that non-response bias was not an issue in this study (Armstrong & Overton, 1977). In addition, the normality of the data was checked with a visual inspection of P-P plots and skewness and kurtosis tests (Fabrigar et al., 1999). Lastly, the Hartley  $F_{\max}$  variance ratio confirms the homogeneity of the variance between both groups for each variable (Field, 2009).

## 4 Results

### 4.1 Summary of the publications and review of the findings

As outlined thus far, an improved conceptualization of presence in AR is the central theme of this dissertation. The first study begins by showing key antecedents to an optimal AR experience and provides practical groundwork for investigating the importance of the three presence dimensions. Thereafter, the definitions of the AR presence dimensions are developed in Publication 2 and further applied and evaluated through subsequent empirical publications (Publications 3 and 4).

Publication 1 investigates the key features of AR that deliver an optimal consumer experience. Four key themes suggest that the experience of AR delivers competitive advantages when it enhances both (1) perceived value and (2) decision making and when it facilitates the ability to use (3) the virtual self to interact with brands; lastly, researchers warn about (4) the negative effects of using AR (Lavoye et al., 2021). The decision-making theme finds that several researchers use presence theory to understand realistic AR experiences (Lavoye et al., 2021). Other theories are discussed in the decision-making section; however, presence stands out as the key psychological state that enables consumers to gain a sense that the experience of AR is realistic. Therefore, this dissertation selects this theoretical approach to improve the understanding of the AR experience.

Based on prior literature on presence in technologies, Publication 2 shows the importance of the spatial presence, self-presence, and social presence of the medium. This study contributes to AR presence research by defining social and self-presence and proposing the outcomes of presence from research on prior shopping technologies. Thereafter, this study provides a future research agenda to explore the impact of the dimensions of presence in the AR context.

Publication 3 aims to empirically test the three-dimensional conceptualization of presence developed in Publication 2. The questionnaire items were tested for their convergent validity. This publication shows that all three dimensions of presence are experienced in AR-VTO. However, this study found that only two dimensions, spatial and social presence, predicted attitude certainty in the context of a VTO app for sunglasses.

Lastly, Publication 4 improves the understanding of the role of self-presence in creating positive brand outcomes. Self-presence enhances cognitive brand processing and brand attitudes. Additionally, self-presence is a key antecedent of self-extension in AR because when consumers can see themselves in the avatar, they may associate themselves with the branded product. This research reveals that to delight consumers, service marketers should enable the discovery of styles in AR (herein called self-exploratory engagement). When consumers explore their possible styles, they also explore their possible selves. Exploring possible selves encourages them to learn about brands (i.e., brand cognitive



processing) and to integrate aspects of the brand into oneself (i.e., self-extension). By building connections with brands, consumers enhance their attitudes toward the brands (Escalas, 2004a). Thus, the self-extension mechanism in AR entails consumers' exploration of their possible selves and leads to positive brand attitudes via brand cognitive processing. In addition, Publication 4 confirms the findings in two contexts—fashion and beauty—and provides evidence for the generalizability of the findings.

The key findings of the studies are presented in **Figure 3**.

Conceptualization of three AR presence dimensions (Publication 2)	Mechanisms	Outcomes
Spatial presence (Publications 1–4)	Evaluation of the product (Publication 3)	Attitude certainty (Publication 3)
Social presence (Publications 2 & 3)	Branded AR app as a social actor (Publication 3)	
Self-presence (Publications 2–4)	Implication of the product for the self (Publication 3)	
	Self-explorative engagement (Publication 4)	Brand cognitive processing (Publication 4)
		Brand attitude (Publication 4)
<u>Contexts:</u> <ul style="list-style-type: none"> <li>• Consumer experience with sunglasses VTO app (Publications 3 &amp; 4)</li> <li>• Consumer experience with makeup VTO app (Publication 4)</li> </ul>		

**Figure 3.** Overview of the studies' findings

Overall, this dissertation provides a detailed definition and fine-grained description of the presence dimensions that better predict consumer responses depending on the context of usage during the customer journey. AR is a novel technology, and its specific features make it crucial to understand how AR differs from prior interactive technologies. In addition, the depth of the analysis helps provide recommendations for retailers, app designers, and marketers.

## 4.2 Publication 1

*Consumer behavior with augmented reality in retail: A review and research agenda*

### 4.2.1 Objectives

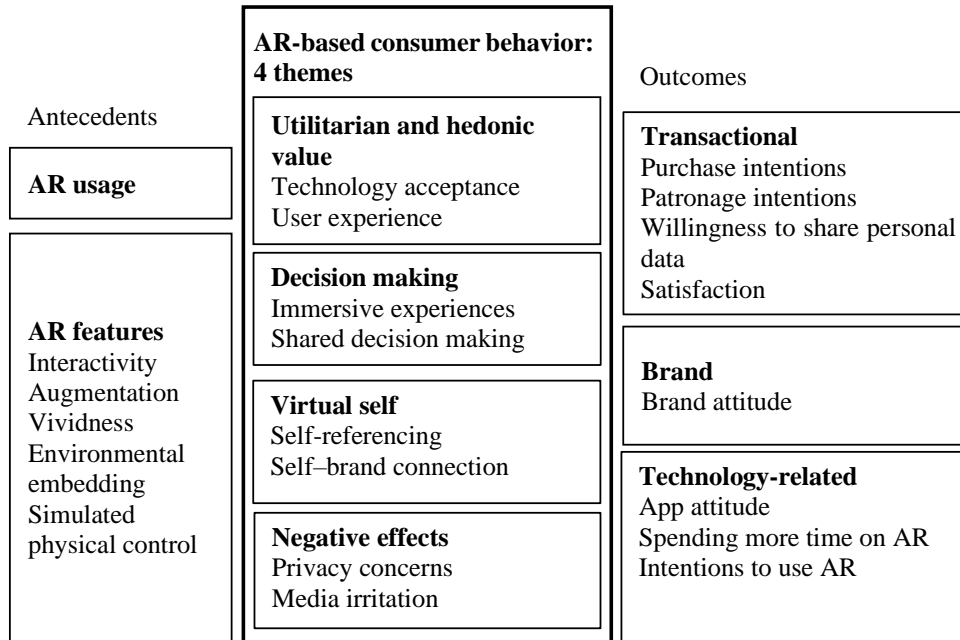
This publication begins by investigating the optimal features of an AR experience with the goal of providing a better understanding of the antecedents, mechanisms, and outcomes of an AR experience (Lavoye et al., 2021). This is particularly important because of the growing interest in AR in retail (Kumar, 2022). In addition, the literature remains scattered between a large range of themes that need to be organized to present the current knowledge clearly and to provide a strong background for future inquiries in the field (Lavoye et al., 2021). Thus, this study provides a theoretical framework of the process from AR usage to positive transactional and relational brand outcomes (Lavoye et al., 2021). Additionally, I build on current knowledge to propose a future research agenda on AR in the retail context; notably, I encourage future studies to focus on the conditions and outcomes of realistic AR experiences (Lavoye et al., 2021). In addition, I warn about the negative effects of AR usage (Lavoye et al., 2021).

This study aims to answer the following research question:

- What are the characteristics of an optimal AR experience?

### 4.2.2 Main contributions

By conducting a literature review, this study reveals that the optimal AR experience is multidimensional. The review finds that the current literature focuses on (1) the object of the decision making, (2) virtual self-interaction with the brand, (3) the app that delivers value to consumers, and (4) how to mitigate the negative effects of AR (Lavoye et al., 2021). I contribute to AR research with a framework, which is presented in **Figure 4**.



**Figure 4.** Framework of consumer behavior with AR

First, the key property of AR is that it facilitates a realistic experience of how offerings would look in a real environment or on oneself and enables the user to interact with the offering in an embodied manner in real time, similar to mental imagery (Heller et al., 2019a), spatial presence (Hilken et al., 2017), and augmentation (Javornik, 2016b). Thus, consumers believe they are actually trying on the offering (Hilken et al., 2017) in their real environment (Vonkeman et al., 2017). In turn, spatial presence increases the enjoyment of the product and makes the product information feel more direct and less risky (Verhagen et al., 2014; Vonkeman et al., 2017). Such an immersive experience enhances decision comfort and purchase intentions (Hilken et al., 2017).

Second, the virtual self can serve as the background for the product's presentation. Superimposing the branded product on consumers' bodies helps consumers relate to the brand (Phua & Kim, 2018). Moreover, viewing a photorealistic representation of oneself is highly involving, and viewing a brand or product directly on oneself enhances the consumer-brand relationship (Huang, 2019).

Third, AR apps deliver utilitarian (e.g., ease of use, usefulness, and informativeness) and hedonic (e.g., enjoyment) value to consumers and motivate AR usage (Rese et al., 2014, 2017; Yim & Park, 2019). Earlier studies found that this perceived value explains consumers' intentions to continue using AR via the technology acceptance model (e.g., Huang & Liao, 2015; Pantano et al., 2017; Rese et al., 2014, 2017; Yim & Park, 2019).

Utilitarian and hedonic value also enhance brand attitudes and purchase intentions (Rauschnabel et al., 2019).

Fourth, the last theme encompasses the negative effects of AR and emphasizes that privacy concerns might negatively affect consumers' perceptions of apps or the brands offering the apps (van Esch et al., 2019). Privacy concerns are another risk that companies need to manage, particularly for apps that augment consumers' bodies or faces (Poushneh, 2018; Smink et al., 2019).

Lastly, the review suggests a future research agenda based on the current knowledge and proposes six research questions that aim to improve the understanding of how AR can improve psychological processes and related consumer decision making. In addition, we recognize the potential of AR to improve consumer-brand relationships; thus, this study calls for further research to improve the understanding of the processes that lead to positive brand outcomes. Lastly, this study highlights that the dark sides of AR, such as privacy concerns and motion sickness or fatigue, need to be investigated.

### 4.3 Publication 2

*Augmented reality: Toward a research agenda for studying the impact of its presence dimensions on consumer behavior*

#### 4.3.1 Objectives

The concept of presence is prominent in several literature streams, including HCI and media and communications, because it can be applied to experiences regardless of the devices used to access the virtual environment (Lombard et al., 2015). However, this increases the risk that the lack of clarity regarding the definition of presence will impede research on the desirable realistic experience (Lombard et al., 2015). Research on AR in retail falls into this pitfall because until now, only spatial presence has been conceptualized in AR research, and thus, presence remains limited to the experience of the realistic product (Lavoye, 2023). This publication provides a better understanding of the optimal realistic AR experience and adopts a presence theory perspective (Lavoye, 2023). Thus, I show that presence theory improves the understanding of the optimal realistic experience in AR, and I suggest that three dimensions of presence can be distinguished by drawing parallels between current AR-based VTOs and the type of realistic experiences enabled by prior immersive shopping technologies (Lavoye, 2023). In addition, Publication 2 shows that presence is a highly relevant construct that provides a fine-grained perspective on the aspects of a desirable realistic experience to optimize consumer responses (Lavoye, 2023). Based on how presence has enhanced prior immersive shopping technologies, Publication 2 also aims to provide recommendations for future research in AR that highlights the similarities and differences in consumer responses (Lavoye, 2023).

The main objective is to answer the following research questions:

- What are the key dimensions of presence in AR?
- What are the effects of presence on consumers' responses to AR?

#### 4.3.2 Main contributions

The presence experience focuses on realistic elements. Spatial presence refers to the physical product, while self-presence refers to the perception of oneself in the experience. Finally, social presence refers to the believable experience of a branded app as a social actor (Lavoye, 2023). After defining the AR presence experience, Publication 2 reviews the literature on relevant presence dimensions in prior immersive technologies and highlights positive consumer responses.

This definition of presence is well-fitted for AR-based VTOs. Spatial presence occurs when consumers get a sense that the object is tangible and can be moved around in the real world (Hilken et al., 2017). Spatial presence delivers highly contextual information about the product and thus enhances decision comfort (Hilken et al., 2017). Publication 2

proposes definitions of social and self-presence in the AR-based VTO context based on video games and e-commerce website contexts, respectively. AR self-presence refers to the sense that one's virtual representation is oneself in the real world (Seo et al., 2017) and is conceptualized as physical similarity and identification with the virtual self (Seo et al., 2017). Self-presence increases the sense that the situation is self-involving, and it enhances self-efficacy and loyalty (Hooi & Cho, 2017). In addition, self-presence increases product diagnosticity when the product directly involves one's body or identity (Suh et al., 2011). AR social presence refers to the sense that the AR app is a social actor (Gefen & Straub, 2003) and is conceptualized as a sense of human contact in the online environment (Gefen & Straub, 2003). Social presence increases consumers' sense of closeness with the seller; the AR app provides a virtual approximation of a social actor, such as a seller in a store (Suh et al., 2011). Social presence enhances trust (Gefen & Straub, 2003) and results in a positive product attitude (Hassanein & Head, 2005).

Finally, this publication aims to inspire future studies of AR presence in marketing by investigating the role of the multidimensional perspective of presence (three presence dimensions in AR: spatial, social, and self) on consumers' responses. In addition, future research should clarify the role of contextual factors, such as the marketing channel (e.g., in store or online) and the types of products displayed in AR (e.g., makeup, sunglasses, or tattoos), to explain differences in the outcomes of presence (Lavoye, 2023).

## 4.4 Publication 3

*Toward an improved understanding of AR-based presence dimensions and their impact on attitude certainty*

### 4.4.1 Objectives

This publication defines the multi-dimensional perspective of presence in AR and proposes subsequent consumer responses (Lavoye, 2023). The existing research on the outcomes of presence merely addressed a single presence dimension—spatial presence (see Breves, 2021; Daassi & Debbabi, 2021; Hilken et al., 2017; Smink et al., 2020). Specifically, the research on VTOs has focused on spatial presence and its impact on product-related outcomes, such as purchase intentions (Hilken et al., 2017; Vonkeman et al., 2017), while the roles of self-presence and social presence have remained largely overlooked. This gap appears consistently when researchers investigate specific technologies and select one dimension of presence, thus overlooking the multidimensional conceptualization. For instance, spatial presence facilitates learning about products in AR shopping (Hilken et al., 2017; Smink et al., 2020; Verhagen et al., 2014), self-presence provides a self-relevant experience with products in a video game context (Behm-Morawitz, 2013; Li & Lwin, 2016; Teng, 2017), and social presence enhances trust toward companies and products in the context of a three-dimensional virtual model (Algharabat & Shatnawi, 2014) and e-commerce (Dash & Saji, 2008). The objectives of this publication are twofold. First, Publication 3 aims to empirically test the validity and reliability of the scales for the three-dimensional perspective of presence. Second, this publication aims to verify whether and to what extent the three dimensions of presence in AR are important to consumer decision making. Thus, we tested the conceptualization of AR presence in the context of a VTO for sunglasses. To do so, this study used a survey method to investigate the role of three key dimensions of AR presence in consumer decision making.

#### **4.4.2 Main contributions**

To the author's knowledge, this is the first study to show that consumers experience spatial, social, and self-presence dimensions in the AR-VTO context. Thus, this study provides theoretical and empirical groundwork for investigating the three dimensions of presence. The presence experience is an important predictor of consumer decision certainty. The results confirm the importance of a multidimensional approach because different dimensions of presence influence attitude certainty differently. Specifically, AR users get a sense of a realistic experience via three presence dimensions: spatial, social, and self. Spatial and social presence positively influence attitude certainty, while self-presence does not (Lavoye & Tarkiainen, 2021). Publication 3 suggests that consumers' attitude certainty is predicted by spatial presence; thus, when consumers can move the product around realistically in the real world, they feel more confident about their attitudes toward the product. In addition, a sense of closeness with the firm via social presence is an indication that the branded AR can be trusted. Therefore, tangible product and social interaction with the firm enhance attitude certainty in the online context. However, attitude certainty does not depend on how the self is represented. Overall, these results confirm the importance of a multi-dimensional definition of presence to provide a fine-grained understanding of how AR enhances decision making.



## 4.5 Publication 4

*The emperor's new clothes: Self-explorative engagement in virtual try-on service experiences positively impacts brand outcomes*

### 4.5.1 Objectives

Clothing and fashion products have symbolic meanings that are integrated into consumers' concept of self (Piacentini & Mailer, 2004). The self encompasses how people think and feel about themselves (Sirgy, 1982). People typically try on clothes before purchasing them (Alexander et al., 2005; Holmlund et al., 2011). In the context of offline retail, consumers modify their appearance out of curiosity, for instance, about how clothing items fit; often, this is done without a defined goal (Gurel & Gurel, 1979). Similarly, in AR-enhanced VTO, people may wish to explore their style and be motivated to try on branded products from brands that propose such services. The extant literature discusses the role of self-referencing, personalization, and inspiration as elements of consumer-brand interactions enhanced by AR (e.g., Hinsch et al., 2020; Rauschnabel et al., 2019). In addition, consumers' motivations to personalize their experiences in AR enhance their intentions to purchase (Smink et al., 2020). Because there were only few previous attempts to conceptualize self-explorative engagement (cf. Huang & Liao, 2017; Scholz & Duffy, 2018), its drivers and consequences for brands remain mostly unknown. Self-explorative engagement refers to the exploration of styles in AR and constitutes the core usage of AR-based VTOs (Huang & Liao, 2017). The theory of self-extension demonstrates that virtual environments can enable people to explore their possible selves (Belk, 2013). Therefore, the aim of this publication is to improve the understanding of AR-based VTO experiences with a self-extension perspective and to focus on AR usage when consumers enjoy the experience for its own sake and without a purchase goal. This study addresses the core objective of this dissertation because it demonstrates the context in which self-presence predicts positive consumer outcomes.

Thus, this publication aims to answer:

- What are the effects of presence on consumers' responses to AR?
- How does self-presence enable experiential AR?

### 4.5.2 Main contributions

First, self-presence enhances self-explorative engagement, brand cognitive processing, and brand attitudes when people use AR with experiential motives (Lavoye et al., 2023). As such, this study extends research on presence because experiential AR is a contextual factor that explains the influence of self-presence (Lavoye et al., 2023).

Second, Publication 4 contributes to the research on the motivation to use branded AR apps by showing that self-presence and self-explorative engagement enable the exploration of possible selves. This finding provides novel insight that answers the call

to improve the understanding of consumers' motivation to use online services (Furrer et al., 2020). Self-expression refers to the different ways individuals may choose to present themselves to others (Oyserman, 2009). Possible selves include the expression of people's actual, ideal, or ought-to self (Markus & Nurius, 1986). Virtual self-representation permits individuals to modify their physical and symbolic attributes and explore their possible selves (Jin, 2012). The exploration of possible selves include a variety of behaviors that can go from imagining wearing certain clothes to imagining being a good student (Belk, 2003; Erikson, 2007). The digital environments enable consumers to explore a variety of possible selves (Belk, 2013). For instance, when AR for makeup enables consumers to try on Rihanna's makeup style, they explore possible selves (El-Shamandi Ahmed et al., 2023). In the early stages of the decision-making process, AR usage can be a self-care activity dedicated to exploring one's possible self (Scholz & Duffy, 2018).

Third, self-explorative engagement enhances brand cognitive processing and brand attitudes (Lavoye et al., 2023). Self-extension theory suggests that the exploration of possible selves encourages consumers to think about the brands' attributes and traits associated with the brands because consumers may wish to identify personally with those brands (Belk, 2003). The theory of the extended self explains that consumers can try out new aspects of their identities by exploring new styles, in turn they may integrate the branded product into their sense of self (Belk, 1988, 2013). In turn, self-extension enhances attention to and enjoyment of the brand (Belk, 1988, 2013). Therefore, when individuals explore their style via a process of self-extension, the AR experience increases brand cognitive processing and brand attitudes (Lavoye et al., 2023). This publication suggests that trying on clothes and makeup in an AR-based VTO enables self-extension (Lavoye et al., 2023).

Lastly, the generalizability and robustness of the study's findings were confirmed. As such, the study's findings align for two popular fashion and beauty brands. In addition, the research model was first investigated without covariates and then with the covariates of age, education, and interest in fashion shopping to provide additional support for the findings.



## 5 Discussion and conclusion

### 5.1 Answering the research questions

#### 5.1.1 Research question 1

*How does AR influence consumer responses in retail?*

First, this dissertation reveals that there are three main phenomena that explain the positive effects of AR-VTO on consumer responses (Lavoye et al., 2021). Specifically, an AR app increases perceived value and enhances consumers' responses. A recent meta-analysis confirmed the effects of AR on consumer attitudes, satisfaction, and behavioral intentions via utilitarian and hedonic value (Vieira et al., 2022). Second, the impact of AR spatial presence on decision making is explained by AR users' ability to imagine that the product is located in the real environment and can be moved in the real world (Lavoye et al., 2021). Third, the relationship between the virtual self and the brand enhances consumers' responses (Lavoye et al., 2021). This dissertation suggests that the influential effects of the presence dimensions are conditional depending on the stage of the decision-making process, so self-presence is not important at the decision-making stage (Lavoye, 2023; Lavoye & Tarkiainen, 2021). This finding is further confirmed in Publication 4, which shows that self-presence drives self-extension in the VTO environment and enables self-explorative engagement and subsequent positive brand outcomes (Lavoye et al., 2023).

Overall, the components of an optimal AR experience detailed in this dissertation provide an important cornerstone for studying the three-dimensional perspective of presence. Lastly, the negative aspects of AR represent risks that must be mitigated to ensure AR usage. Specifically, the two pitfalls that should be avoided for the long-term success of AR are privacy concerns and shiny object syndrome. Privacy concerns are particularly important in the VTO context because a live-feed camera is pointed at consumers. Several studies have investigated privacy concerns as a focal construct (e.g., Cowan et al., 2021; Feng & Xie, 2018). Privacy concerns with AR are mainly based on the sensitivity of the content that the app requires permission to access and users' number of prior app downloads (Harborth & Pape, 2021). To conclude, the usefulness of and risks associated with AR are still mostly unknown to consumers and marketers.

#### 5.1.2 Research question 2

*What are the key dimensions of presence in augmented reality?*

The realistic AR experience is composed of three dimensions of AR presence: spatial, social and self-presence. Spatial presence occurs when users feel that the virtual object is in the real environment and can be interacted with; thus, they feel that the virtual product is an actual product (Hilken et al., 2017). Self-presence refers to users' feeling that the virtual self is physically similar to themselves and that they identify with the virtual self;

thus, they feel that the virtual self is their actual self (Seo et al., 2017). Lastly, social presence refers to users' sense of human warmth and personalness within the branded AR app; thus, they feel that the virtual actor is an actual social actor (Gefen & Straub, 2003).

This dissertation suggests that the influential role of presence at the consumer–employee frontline can be explained in several ways. First, spatial presence via the experience of embeddedness and embodiment makes highly contextual information about the product available and enhances decision comfort (Hilken et al., 2017). Second, self-presence increases product diagnosticity when the product directly involves one's body or identity (Suh et al., 2011). Third, social presence increases virtual proximity to the social actor as if it was a seller in a store (Suh et al., 2011). Thus, social presence enhances trust (Gefen & Straub, 2003) and results in positive consumer attitudes toward a product (Hassanein & Head, 2005). To sum up, this dissertation shows that immersive shopping technologies can decrease the physical, personal, and social intangibility inherent in buyer–seller relationships. The next question elucidates the presence outcomes in the AR-based VTO context in two different stages of the customer journey: decision making and experiential usage of AR.

### **5.1.3 Research question 3**

*What are the effects of presence on consumers' responses to augmented reality?*

Spatial and social presence positively influence attitude certainty, while self-presence does not (Lavoye & Tarkiainen, 2021). Spatial presence occurs when consumers get the sense that the product is located in their environment and can be interacted with (Hilken et al., 2017). AR improves cognitive fluency and reduces the cognitive load associated with product evaluation (Fan et al., 2020). Meanwhile, spatial presence improves product tangibility and enhances purchase intentions (Verhagen et al., 2014). Thus, these results indicate that the AR-induced reduction to cognitive load and increased tangibility strengthen consumers' certainty in their attitude formation. Social presence occurs when users get a sense of human connection with a company or product (Gefen & Straub, 2003). Social presence enhances trust and reduces the perception that the seller might hide information or behave in an untrustworthy manner (Gefen & Straub, 2003). Therefore, social presence improves certainty in attitude formation (Lavoye & Tarkiainen, 2021). However, self-presence did not predict attitude certainty in the AR-based VTO for sunglasses (Lavoye & Tarkiainen, 2021). Self-presence refers to the sense that the virtual self is oneself in two aspects: physical similarity and identification (Seo et al., 2017). At the decision-making stage, the sense that the virtual self is oneself is less important because consumers have already formed their attitudes toward the product and are instead focused on product and seller-related information (Lavoye & Tarkiainen, 2021).

This dissertation details that self-presence has a physical and a conceptual facet, and thus, it is better suited to influencing consumers' responses toward brands during self-extension. Specifically, self-presence enhances self-explorative engagement, brand cognitive processing, and attitudes (Lavoye et al., 2023). According to the theory of self-

extension, when consumers explore styles, they may relate aspects of the brand with aspects of the self (Belk, 1988). Consumers using VTOs are motivated to explore their style (Huang & Liao, 2017), while self-presence gives access to private aspects of the self (Hooi & Cho, 2014). Thus, self-presence enables self-explorative engagement (Lavoye et al., 2023). In addition, information that is highly self-relevant is easier and faster to process and easier to recall (Rogers et al., 1977). Self-presence enables a highly self-relevant experience and may enhance elaboration about the brand; thus, self-presence enhances brand cognitive processing (Lavoye et al., 2023). In addition, the positive effects of self-presence on consumers' responses were consistent between the two AR-VTO contexts, which increases the generalizability of the findings (Lavoye et al., 2023).

To conclude, the effects of presence on consumer response depend on the context of AR usage during the customer journey but do not depend on the type of product displayed in AR. Overall, this dissertation finds that spatial and social presence are more important during decision making, and self-presence is more important when exploring styles and to improve brand response in an experiential context.

#### **5.1.4 Research question 4**

*How does self-presence enable experiential augmented reality?*

Self-presence serves as the foundation for self-extension in AR, which results in positive brand attitudes. People need to recognize themselves in the experience to be motivated to explore their styles in AR and to create personalized brand information (Lavoye et al., 2023). In turn, self-explorative engagement enhances brand attitude via brand cognitive processing (Lavoye et al., 2023). Therefore, Publication 4 shows a mediated effect of self-explorative engagement on brand attitudes via brand cognitive processing (Lavoye et al., 2023). This process can be explained by the fact that consumers experience self-extension in the VTO environment (Lavoye et al., 2023). Specifically, self-extension occurs when consumers extend themselves via branded information; in turn, self-extension increases consumers' positive attitudes toward brands (Belk, 1988). AR facilitates the processing of brand information because AR unloads the cognitive processing of the exploration of styles onto the device (Lavoye et al., 2023). In addition, self-explorative engagement results in the creation of personalized brand information, increases the processing of such brand information, and positively impacts brand attitudes (Lavoye et al., 2023).

## **5.2 Theoretical contributions**

### **5.2.1 Contribution to presence theory literature**

My contribution to presence theory is threefold: defining presence in the context of AR, highlighting the importance of the three dimensions, and indicating the context-dependent outcomes of presence. Spatial presence occurs when users feel that the virtual object is in the real environment and can be interacted with; thus, they feel that the virtual product is

an actual product (Hilken et al., 2017). Self-presence occurs when users feel that the virtual self is physically similar to their real self and identify with the virtual self; thus, they feel that the virtual self is themselves (Seo et al., 2017). Social presence occurs when users feel a sense of human warmth and personalness within a virtual environment (here a branded AR app); thus, they feel that the virtual actor is an actual social actor (Gefen & Straub, 2003).

AR research has, thus far, solely focused on spatial presence in the decision-making context, indicating that the study of the holistic presence experience in the AR context is missing (Lavoye et al., 2021). In contrast, this dissertation defines the three presence dimensions and investigates their impact on consumers (Lavoye et al., 2021, 2023; Lavoye & Tarkiainen, 2021). In parallel to the importance of spatial presence theory, this dissertation emphasizes the role of social presence theory to provide an in-depth understanding of decision making in AR. Therefore, this dissertation suggests that when consumers use AR to purchase products, they are influenced by the product in the environment and the action possibility as well as the social cues of the technology. This finding provides additional evidence for Sadamali et al. (2023) who propose that social presence in the product viewing experience, defined as a combination of spatial and social presence cues, is a key predictor of consumer attitude change. In addition, when the technology displays the virtual self then the importance of self-presence depends on whether the information is linked to the body in a meaningful way (van Brakel et al., 2023).

Afterwards, this dissertation demonstrates the importance of a fine-grained understanding of presence to better predict positive consumer responses. First, a sense of spatial presence when using shopping technologies enhances learning about a product with highly contextual information and facilitates decision making (Hilken et al., 2017). Second, self-presence gives a sense that the information is self-relevant (Hooi & Cho, 2017) and enhances attention and behavior change intentions (Behm-Morawitz, 2013). In addition, self-presence increases product diagnosticity when the product directly involves one's body or identity (Suh et al., 2011). Third, social presence facilitates a sense of closeness with the seller (Suh et al., 2011) and enhances trust (Gefen & Straub, 2003; Hassanein & Head, 2005). Therefore, immersive shopping technologies decrease the physical, personal, and social intangibility inherent to the buyer–seller relationship (Lavoye, 2023). As such, the optimal realistic shopping experience in AR is comprised of spatial, self, and social presence, which corresponds to the sense of an actual product, sense of self, and sense of the branded app as an actual social actor, respectively (Lavoye, 2023). To sum up, this dissertation provides important background for the specific role of each AR presence dimension in enhancing consumer responses. This finding confirms recent study on social VR platforms that show that social and self-presence enhance a sense of social support and heightened users' well-being, while spatial presence did not have an effect (van Brakel et al., 2023).

Additionally, this dissertation discusses one contextual factor—the optimal AR presence dimensions for different decision-making stages. Spatial and social presence influence

attitude certainty in the context of a branded AR app for makeup products (Lavoye & Tarkiainen, 2021). While, self-presence influences self-explorative engagement, brand cognitive processing, and brand attitude for two branded AR apps for fashion and beauty products (Lavoye et al., 2023). Taken together, Publications 3 and 4 confirm the role of presence dimensions in influencing consumer responses and the contextual differences in presence outcomes depending on the motives for AR usage (Lavoye et al., 2023; Lavoye & Tarkiainen, 2021). Meanwhile, the product displayed in the AR-enhanced VTO did not have a contextual impact during experiential AR usage because both the sunglasses and makeup app consistently predicted self-presence, self-explorative engagement, and brand responses (Lavoye et al., 2023).

### **5.2.2 Contribution to the theory of extended self**

According to the theory of self-extension, when consumers relate to the brand, they care about and like the brand more (Belk, 1988, 2013). This dissertation contributes to research on the exploration of possible selves in the virtual context (Ambika et al., 2022; El-Shamandi Ahmed et al., 2023) and discusses several outcomes of virtual self-extension in the VTO context. Specifically, when people experience a realistic try-on experience, the realistic self enables them to explore their possible selves and facilitates learning about the brand (Lavoye et al., 2023). During this process, consumers may integrate symbolic meaning from the brand into their self-concept and improve their attitudes toward the focal brand (Lavoye et al., 2023). Previous studies that investigated AR try-ons for multiple brands or unbranded styles found that consumers did not feel that AR was realistic and would not use it to explore themselves (El-Shamandi Ahmed et al., 2023; Javornik et al., 2022). Our study shows that branded AR apps allow consumers to learn about the focal app and lead to positive brand attitudes. Therefore, the symbolic meaning of a focal brand gives reassurance and permits self-extension in the virtual environment.

This dissertation further establishes that self-presence is an influential antecedent of self-explorative engagement in the context of VTOs. Therefore, this dissertation contributes to consumer research on explorative consumers (see Chernev et al., 2011). I find that the exploration of style is a novel motivation to use online services thus, this research answer calls for novel insights into the use of online services (Furrer et al., 2020). Consumers naturally explore their style in AR-based service contexts (Scholz & Duffy, 2018) when they get a sense that the virtual self is themselves. Thus, using a VTO is not merely an enjoyable experience; it also supports consumers in their desire for self-exploration and learning about brands, consequently increasing brand attitudes (Lavoye et al., 2023). In addition, self-presence enhance consumer-brand affective and cognitive responses (Lavoye et al., 2023). Thus, this dissertation extends prior research that showing the role of self-presence in VR to improve the image of the travel destinations (Adachi et al., 2020). Thus, this dissertation highlights the role of self-presence in improving consumers' attitudes and cognitive processing in the context of AR-based VTOs. Lastly, these findings extend the work of Scholz and Duffy (2018) by showing that self-presence is necessary for consumers' self-exploration.

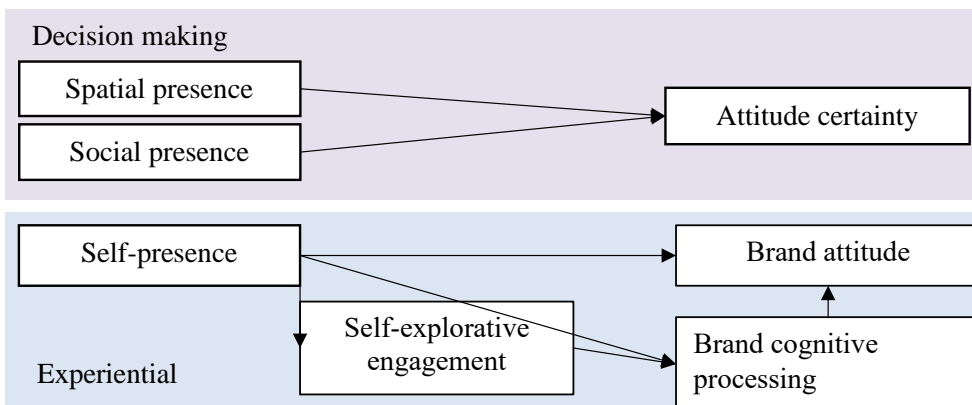


## 5.3 Managerial implications

### 5.3.1 Implications for retailers

New retail technologies enable frictionless, highly personalized interactions with brands that help firms build much deeper ties with customers and improve the customer experience (Siggelkow & Terwiesch, 2019). Brands use AR-based VTO to sell directly to consumers whenever and wherever they are. For instance, L'Oréal developed recommendation agents to provide a realistic and highly personalized service. Similarly, Sephora used AR as an omnichannel strategy to serve consumers' needs as they arose. AR can be part of the omnichannel strategy (Hilken et al., 2018), as research has shown that multichannel customers, particularly new AR users, are more profitable (Tan et al., 2022; Zhang et al., 2022).

The three dimensions of presence predicted consumer responses, such as attitude certainty at the decision-making stage and brand responses in experiential AR. The contextual differences in the outcomes regarding presence are an interesting finding because they show that presence dimensions can serve as a foundation for recommending AR features that improve consumer responses depending on retailers' strategic goals. Figure 5 shows the role of presence dimensions in influencing consumer responses.



**Figure 5.** Dimensions of presence influencing consumer responses

The differences in the outcomes regarding presence provide the groundwork for studying the dimensions separately and enable the provision of detailed recommendations to retail brands. Taken together, Publications 3 and 4 suggest that the outcomes of presence dimensions depend on motives for AR usage, such as decision making and experiential usage earlier in the decision-making process.

Publication 3 finds that spatial and social presence are highly influential in enhancing consumers' attitude certainty at the decision-making stage (Lavoye & Tarkiainen, 2021). Spatial presence is the most investigated presence dimension because it helps evaluate experiential products, such as a car or sofa (Smink et al., 2020). When consumers shop for products, such as apparel and accessories, these products are more free-floating in nature; therefore, spatial presence is likely to influence decision making (Lavoye & Tarkiainen, 2021). Social presence enhances attitude certainty; thus, companies should invest in social cues to enhance social presence in the VTO environment (Lavoye & Tarkiainen, 2021). The positive impacts of spatial and social presence can be explained by consumers' greater focus on the evaluation of the product and whether they trust the branded AR apps to provide believable product information (Lavoye & Tarkiainen, 2021). In contrast, self-presence does not help consumers feel more confident in their attitudes toward the product. I suggest that when consumers are close to the decision stage, self-presence becomes extraneous information.

In addition, this dissertation emphasizes that consumers value self-presence more when they use AR for experiential motives (Lavoye et al., 2023). When using AR for the experience itself, self-presence provides self-relevant information about the product experience; therefore, it enhances brand cognitive processing and brand attitudes (Lavoye et al., 2023). When consumers explore their styles, they need to feel self-presence so that their experiences are personally relevant (Lavoye et al., 2023). Therefore, improving self-presence and self-explorative engagement helps enhance consumer responses toward brands in the context of branded fashion and makeup apps (Lavoye et al., 2023). Additionally, exploration of a possible self constitutes a novel motivation for technology use in retail and may help retailers find their audience in the online context (Lavoye et al., 2023). This novel way of interacting with firms at the organizational frontline has the potential to deepen consumer-brand relationships (Marinova et al., 2017). The two contexts provide evidence regarding the generalizability of the outcomes of self-presence in experiential contexts.

Apps in the fashion industry (e.g., for clothes, accessories, and shoes) should rely on self-presence to encourage consumers to learn about brands and improve brand attitudes by enabling self-explorative engagement (Lavoye et al., 2023). Higher cognitive and affective attitudes toward brands are dimensions of consumer brand engagement and may lead to consumer loyalty (Hollebeek & Macky, 2019). In addition, self-explorative engagement is a novel form of interaction with a company's frontline in the virtual environment, and I propose that the hedonic experience will create a lock-in effect. Lock-in effects refer to a situation where customers remain loyal to a brand because the benefits of switching are outweighed by the costs involved (Murray & Häubl, 2007). As such, this loyalty of consumers is achieved because people have invested time and effort learning how to use the product or brand (Shih, 2012). In contrast, this loyalty may be created from positive experiences with products and brands (Shih, 2012). Therefore, this dissertation suggests that the use of AR-VTO in branded apps such as Sephora or Nike can encourage consumers to explore styles, foster positive attitudes, increase learning about the brand,

heighten loyalty and boost sales. This approach can help brands capture more value for themselves without paying commissions to a platform.

### **5.3.2 Implication for branded app design**

Presence can result from internal processes, such as mental imagery, or external stimuli, such as the immersion level of a technology. Thus, a medium may influence the presence experience. For instance, AR has been shown to be superior to images and 360-spin for enhancing spatial presence and encouraging purchase intentions (Verhagen et al., 2014). Therefore, app designers play a key role in providing high-quality immersive experiences through a sense of presence. This dissertation claims that the optimal AR experience encompasses three dimensions of presence; however, their levels and importance are highly context dependent. Social presence theory argues that the optimal level of presence is not always required to achieve the best results. For instance, self-presence in the sunglasses VTO did not improve decision certainty (Lavoye & Tarkiainen, 2021).

Spatial presence can be encouraged by increasing the realistic embedding of products in AR. The app should be able to register other objects in the space and place the product in a realistic manner. For instance, if AR users try on a T-shirt while they are wearing a jacket, the T-shirt should be under the jacket instead of superimposed (Rauschnabel, Felix, et al., 2022). In addition, a higher spatial presence is needed so that the AR content is persistent. For example, if AR users place a painting on their wall, it should be pinned into place and not move as the screen moves around (Rauschnabel, Felix, et al., 2022).

Self-presence can be encouraged by apps that enable camera live feed of the users' body or face (Seo et al., 2017). In addition, fashion increasingly aims to be inclusive, and consumers desire products that fit their actual skin color, facial features, and textures (El-Shamandi Ahmed et al., 2023). Therefore, app designers can benefit from different groups of consumers co-creating the experience (Lavoye et al., 2023). Lastly, the superimposed information should not be too eccentric so that consumers do not identify with wearing such clothes or makeup (El-Shamandi Ahmed et al., 2023).

Social presence can be enhanced through social cues, for instance, by providing product recommendations (Qiu & Benbasat, 2008). In the AR context, recommender systems have been shown to enhance consumer responses (Adam & Pecorelli, 2018). Thus, recommender systems in the VTO context may be influential sources of social presence that enhance consumer responses. In addition to presence dimensions, this dissertation also finds that self-explorative engagement is a novel way for consumers to interact with the company's frontline in a virtual environment (Marinova et al., 2017). Exploration of self via AR is part of the self-presentation motive and explains the use of AR face filters (Javornik et al., 2022). Thus, self-explorative engagement is an important part of a realistic experience with AR-based VTOs and can enhance cognitive processing and brand attitudes.

### 5.3.3 Implications for marketers

Extant marketing practices differ from AR marketing because AR content is embedded in the real environment, embodied, and highly self-relevant, and it enables realistic interactions with the brand. First, traditional online marketing may display branded content on Instagram. Instead of being fully on-screen content, branded AR content enables users to see marketing campaigns in their real environment in real size. For instance, the A/R Jordan social commerce experience partnered with Snapchat to enable consumers to relive the famous '88 Slam Dunk Contest shot. Snapchat users could go to a geofenced basketball court in downtown Los Angeles (Dickey, 2018) and see Jordan's famous pose as well as purchase the updated edition of Jordan's sneakers within the app (Dickey, 2018). The virtual campaign resulted in the shoes being sold out in 23 minutes. These types of campaigns deliver the kind of experience consumers crave and cannot get anywhere else. Therefore, the firm gave consumers the perfect reason to buy directly from Nike. Moreover, when users have access to embodied devices, such as AR glasses, the AR marketing campaign may outperform existing real-life advertising options. For instance, instead of a Coca-Cola sponsorship of a concert, customers could launch a virtual concert of hit singer Ava Max in the users' physical space by scanning the Coca-Cola Starlight can or bottle (Hein, 2022). Therefore, the firm was able to reach Coca-Cola customers wherever they were, and the AR glasses delivered a highly interactive and inspiring campaign in a naturalistic way. In addition, traditional marketing typically is not user or context specific (Rauschnabel, Babin, et al., 2022). However, AR marketing can target consumers based on estimated consumers' needs that vary across situations (Rauschnabel, Babin, et al., 2022). For instance, the Nike Swoosh High campaign used AR-VTO in stores to provide a novel shopping experience in which customers could try on apparel and shoes and unlock access to discounts (Snapchat, n.d.). Depending on the consumer purchase journey, apps may enhance decision making or increase consumer engagement by allowing consumers to playfully experience a brand. Lastly, the amount of data that firms may gather on users' preferences is greater in AR (Rauschnabel, Babin, et al., 2022). For instance, captors in AR may detect users' physical and social environment and recognize the location, objects in the room, interactions with other people, etc. Combined with other technologies that enable access to the metaverse, AR may provide access to consumer behavior data that firms can arrange as heatmaps showing consumers' interactions with firms' frontlines (Dwivedi et al., 2022).

## 5.4 Limitations and suggestions for future research topics

Publication 1 is limited by the fact that it is a systematic literature review. The literature search was solely based on our inclusion and exclusion criteria, which were aimed at providing an overview of consumer behavior in the retail context. Second, research on AR remains fragmented due to its multidisciplinary streams. However, interest in AR in the field of HCI is growing, and future research should aim to provide theoretical frameworks on the impact of AR on consumer responses.

A limitation of the study in Publication 2 is that presence scales rely on people's reported perceptions. The literature is too scarce to propose links between technological features and AR-relevant presence dimensions. However, the field would benefit from a literature review on the technological features of current virtual technologies and their impact on presence dimensions and marketing-relevant outcomes. For instance, preliminary efforts to link technology features to social presence and its outcomes exist (Oh et al., 2018).

Publication 3 was a pre-test of a multidimensional perspective on AR presence, and thus, the sample was small ( $N = 70$ ). This limitation was partially mitigated by using item parceling for the exogenous variables, which resulted in about five cases for each parameter, which is acceptable, as Hair et al. (2010) indicated that there should be between five and 10 cases per parameter. However, this study needs to be expanded both in terms of the sample size and the context studied. In addition, the results revealed different effects of presence dimensions on consumers' decision making. Thus, future research should systematically investigate the three dimensions of presence to provide a better understanding of presence outcomes. In addition, prior literature suggests contextual differences that prompt future exploration of the role of product type. Specifically, while consumers experienced spatial presence in makeup AR apps (Daassi & Debbabi, 2021), spatial presence did not improve purchase intentions (Smink et al., 2020). VTOs allow consumers to try on an appearance in a manner that is not permanent or very risky (Behm-Morawitz, 2013). Self-presence influences people to change their appearance and adopt healthy behaviors offline (Behm-Morawitz, 2013). Thus, self-presence may be more important and better explain consumer decision making in the context of makeup VTOs.

Publication 4 collected cross-sectional surveys. Due to this method, common method bias may have been a limitation of this study (Baumgartner et al., 2021). However, this risk was partially mitigated by following the preventative steps recommended by MacKenzie and Podsakoff (2012). Furthermore, a post-hoc test for common method bias following Harman's criterion indicated that common method bias was not a risk in this study (Field, 2009). To our knowledge, Publication 4 is the first to show the role of self-presence in AR in enhancing brands' cognitive and affective outcomes. The study discussed the exploration of styles in AR but did not investigate the deeper meaning for consumers' self-concept. In addition, self-explorative engagement was measured with self-reported questionnaire items, so further research should verify our findings by measuring self-explorative engagement as performance. For instance, such a study may measure the time spent on the app, how many looks were tried on, or how different the look tried on was from the typical style. Another limitation of Publication 4 is that branded apps that solely sold their own brands were used. Self-extension typically increases loyalty to one focal brand; however, virtual products may reduce loyalty (Belk, 2013). Therefore, future research should investigate whether self-explorative engagement can decrease loyalty, for instance, in the context of retailers' apps. For instance, Amazon provides a VTO that lets consumers explore thousands of styles from various brands, such as New Balance, Adidas, Reebok, and Lacoste (Perez, 2022). Publication 4 examines the impact of two product categories, lipstick and sunglasses, but it is possible that other product categories

may reveal new boundary conditions. Further research is necessary to address some conflicting findings and explore consumers' satisfaction with their appearance. Satisfaction with one's appearance can enhance self-presence, product diagnosticity, and loyalty to the try-on technology (Suh et al., 2011). Conversely, consumers' dissatisfaction with their body image can increase the popularity of VTOs (Yim & Park, 2019). This indicates that a lower self-presence resulting from dissatisfaction with one's appearance can protect against negative emotions and shift consumers' focus towards the products and the experience. Therefore, future studies should investigate how varying levels of self-presence affect different types of consumers in this context and provide service designers with guidelines.

Overall, future research on the metaverse may use this dissertation as a background to study the realistic AR experience. Concerning spatial presence, for instance, the distinction between spatial presence in AR and VR may be reconciled in the future by giving the sense that the body is proximal to the virtual object. This could be done by either providing the sense that the individual is in the virtual environment or that the product is in the real world. I argue that the more virtual technologies improve, the less the difference between "being there" and "being here with the virtual object" will matter. Notably, in the metaverse, the virtual and real worlds will be blended, and consumers will pass seamlessly from one environment to the other several times a day (Golf-Papez et al., 2022). Spatial presence that is located in the users' real environment and enables actions in the real world is known as local presence (Rauschnabel, Felix, et al., 2022). A high level of spatial presence in the AR context would register the virtual object in the real world so that products could be realistically integrated into the environment and be persistent over time (Rauschnabel, Felix, et al., 2022). Thus, a virtual object that augments or diminishes the environment should blend in with the world (Rauschnabel, Felix, et al., 2022). Social presence in the metaverse will be accessed via reality-enhancing technologies. Thus, as technology evolves, interactions will evolve from exchanging text and audio to multidimensional visual and haptic sensations (Hennig-Thurau et al., 2022). This is an important opportunity for firms, as brands, branded products, and branded environments will continue to play a key role in the metaverse. Thus, social presence at the customer–employee interface will continue to enrich sales interactions. Unfortunately, this remains under-researched (Hennig-Thurau et al., 2022). Overall, research on social presence is the most dynamic dimension of presence in consumer research. In addition, the research agenda on social presence in the metaverse points to the importance of social presence in reality-enhancing technologies (Hennig-Thurau et al., 2022). Research on social presence theory has been driven by the success of social media, social commerce, and social virtual worlds. However, those technologies entail different types of social presence: the social presence of a computer agent, the feeling of the presence of another actual person, and the feeling of interaction with another person (Hew et al., 2018; Leong et al., 2020). Social presence and the related notion of co-presence are popular in the virtual shopping world and in social commerce contexts. Social presence in the social media context is conceptualized as the sense of presence of other para-authentic humans (Hajli et al., 2017; Lu et al., 2016) and co-presence as being together with other para-authentic humans (Schultze, 2010). Both social presence and co-

presence in the social media context refer to disembodied social actors; however, the VR metaverse enables the sense of social presence and the co-presence of para-authentic embodied social actors.

## References

- Adachi, R., Cramer, E. M., & Song, H. (2020). Using virtual reality for tourism marketing: A mediating role of self-presence. *The Social Science Journal*, 1–14. <https://doi.org/10.1080/03623319.2020.1727245>
- Adam, M., & Pecorelli, M. (2018). Recommendations in augmented reality applications – The effect of customer reviews and seller recommendations on purchase intention and product selection. *Proceedings of the 26th European Conference on Information Systems (ECIS)*.
- Ahn, S. J. G., Bostick, J., Ogle, E., Nowak, K. L., McGillicuddy, K. T., & Bailenson, J. N. (2016). Experiencing Nature: Embodying Animals in Immersive Virtual Environments Increases Inclusion of Nature in Self and Involvement With Nature. *Journal of Computer-Mediated Communication*, 21(6), 399–419. <https://doi.org/10.1111/jcc4.12173>
- Ahn, S. J. (Grace), Nowak, K. L., & Bailenson, J. N. (2022). Unintended consequences of spatial presence on learning in virtual reality. *Computers and Education*, 186, 104532. <https://doi.org/10.1016/j.compedu.2022.104532>
- Aitamurto, T., Aymerich-Franch, L., Saldivar, J., Kircos, C., Sadeghi, Y., & Sakshuwong, S. (2022). Examining augmented reality in journalism: Presence, knowledge gain, and perceived visual authenticity. *New Media and Society*, 24(6), 1281–1302. <https://doi.org/10.1177/1461444820951925>
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen, I., & Cote, N. G. (2008). Attitudes and the prediction of behavior. In W. D. Crano & R. Prislin (Eds.), *Attitudes and attitude change* (pp. 289–311).
- Alexander, M., Jo Connell, L., & Beth Presley, A. (2005). Clothing fit preferences of young female adult consumers. *International Journal of Clothing Science and Technology*, 17(1), 52–64. <https://doi.org/10.1108/09556220510577961>
- Algharabat, R. S., & Shatnawi, T. (2014). The effect of 3D product quality (3D-Q) on perceived risk and purchase intentions: The case of apparel online retailers. *International Journal of Electronic Business*, 11(3), 256–273. <https://doi.org/10.1504/IJEB.2014.063031>
- Allen, J. J., & Anderson, C. A. (2021). Does avatar identification make unjustified video game violence more morally consequential? *Media Psychology*, 24(2), 236–258. <https://doi.org/10.1080/15213269.2019.1683030>



- Alzayat, A., & Lee, S. H. M. (2021). Virtual products as an extension of my body: Exploring hedonic and utilitarian shopping value in a virtual reality retail environment. *Journal of Business Research, 130*, 348–363. <https://doi.org/10.1016/j.jbusres.2021.03.017>
- Ambika, A., Jain, V., & Belk, R. (2022). Self-Augmentation and Consumer Experiences: An Exploratory Study: An Abstract. In J. Allen, B. Jochims, & S. Wu (Eds.), *Celebrating the Past and Future of Marketing and Discovery with Social Impact* (pp. 45–46). Springer International Publishing.
- Arghashi, V., & Yuksel, C. A. (2022). Interactivity, Inspiration, and Perceived Usefulness! How retailers' AR-apps improve consumer engagement through flow. *Journal of Retailing and Consumer Services, 64*, 102756. <https://doi.org/10.1016/j.jretconser.2021.102756>
- Armstrong, J. S., & Overton, T. S. (1977). Estimating Nonresponse Bias in Mail Surveys. *Journal of Marketing Research, 14*(3), 396–402. <https://doi.org/10.1177/002224377701400320>
- Azuma, R. (1997). A survey of augmented reality. *Presence: Teleoperators and Virtual Environments, 6*(4), 355–385. <https://doi.org/10.1162/pres.1997.6.4.355>
- Baek, T. H., Yoo, C. Y., & Yoon, S. (2018). Augment yourself through virtual mirror: the impact of self-viewing and narcissism on consumer responses. *International Journal of Advertising, 37*(3), 421–439. <https://doi.org/10.1080/02650487.2016.1244887>
- Bagozzi, R. P., & Edwards, J. R. (1998). A general approach for representing constructs in organizational research. *Organizational Research Methods, 1*(1), 45–87. <https://doi.org/10.1177/109442819800100104>
- Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*(1), 74–94. <https://doi.org/10.1007/BF02723327>
- Bandalos, D. L. (2002). The effects of item parceling on goodness-of-fit and parameter estimate bias in structural equation modeling. *Structural Equation Modeling, 9*(1), 78–102. [https://doi.org/10.1207/S15328007SEM0901\\_5](https://doi.org/10.1207/S15328007SEM0901_5)
- Bandura, A. (2001). Social cognitive theory of mass communication. *Media Psychology, 3*(3), 265–299. [https://doi.org/10.1207/S1532785XMEP0303\\_03](https://doi.org/10.1207/S1532785XMEP0303_03)
- Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology, 59*(1), 617–645. <https://doi.org/10.1146/annurev.psych.59.103006.093639>

- Baumgartner, H., Weijters, B., & Pieters, R. (2021). The biasing effect of common method variance: some clarifications. *Journal of the Academy of Marketing Science*, 49(2), 221–235. <https://doi.org/10.1007/s11747-020-00766-8>
- Behm-Morawitz, E. (2013). Mirrored selves: The influence of self-presence in a virtual world on health, appearance, and well-being. *Computers in Human Behavior*, 29(1), 119–128. <https://doi.org/10.1016/j.chb.2012.07.023>
- Belk, R. (1988). Possessions and the extended self. *Journal of Consumer Research*, 15(2), 139–168. <https://doi.org/10.1086/209154>
- Belk, R. (2014). Digital consumption and the extended self. *Journal of Marketing Management*, 30(11–12), 1101–1118. <https://doi.org/10.1080/0267257X.2014.939217>
- Belk, R. W. (2003). Shoes and self. *ACR North American Advances*.
- Belk, R. W. (2013). Extended self in a digital world. *Journal of Consumer Research*, 40(3), 477–500. <https://doi.org/10.1086/671052>
- Bettman, J. R., Johnson, E. J., & Payne, J. W. (1991). Consumer decision making. In G. Keren and G. Wu (Eds.), *Handbook of consumer behaviour* (pp. 875–899). John Wiley & Sons. <https://doi.org/10.1002/9781118468333.ch31>
- Biocca, F. (1997). The cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, 3(2). <https://doi.org/10.1111/j.1083-6101.1997.tb00070.x>
- Boell, S. K., & Cecez-Kecmanovic, D. (2015). On being 'systematic' in literature reviews in IS. *Journal of Information Technology*, 30(2), 161–173. <https://doi.org/10.1057/jit.2014.26>
- Bogicevic, V., Seo, S., Kandampully, J. A., Liu, S. Q., & Rudd, N. A. (2019). Virtual reality presence as a preamble of tourism experience: The role of mental imagery. *Tourism Management*, 74, 55–64. <https://doi.org/10.1016/j.tourman.2019.02.009>
- Bonetti, F., Warnaby, G., & Quinn, L. (2018). Augmented reality and virtual reality in physical and online retailing: A review, synthesis and research agenda. In T., Jung, M. tom Dieck (Eds.), *Augmented Reality and Virtual Reality. Progress in IS. Springer, Cham* (pp. 119–132). [https://doi.org/10.1007/978-3-319-64027-3\\_9](https://doi.org/10.1007/978-3-319-64027-3_9)
- Borsboom, D., Mellenbergh, G. J., & van Heerden, J. (2003). The theoretical status of latent variables. *Psychological Review*, 110(2), 203–219. <https://doi.org/10.1037/0033-295X.110.2.203>

- Botella, C., Bretón-López, J., Quero, S., Baños, R., & García-Palacios, A. (2010). Treating cockroach phobia with augmented reality. *Behavior Therapy, 41*(3), 401–413. <https://doi.org/https://doi.org/10.1016/j.beth.2009.07.002>
- Brannon Barhorst, J., McLean, G., Shah, E., & Mack, R. (2021). Blending the real world and the virtual world: Exploring the role of flow in augmented reality experiences. *Journal of Business Research, 122*, 423–436. <https://doi.org/10.1016/j.jbusres.2020.08.041>
- Breves, P. (2021). Biased by being there: The persuasive impact of spatial presence on cognitive processing. *Computers in Human Behavior, 119*, 106723. <https://doi.org/10.1016/j.chb.2021.106723>
- Brodie, R. J., Ilic, A., Juric, B., & Hollebeek, L. D. (2013). Consumer engagement in a virtual brand community: An exploratory analysis. *Journal of Business Research, 66*(1), 105–114. <https://doi.org/10.1016/j.jbusres.2011.07.029>
- Bulu, S. T. (2012). Place presence, social presence, co-presence, and satisfaction in virtual worlds. *Computers and Education, 58*(1), 154–161. <https://doi.org/10.1016/j.compedu.2011.08.024>
- Burnkrant, R. E., & Unnava, H. R. (1995). Effects of self-referencing on persuasion. *Journal of Consumer Research, 22*(1), 17–26. <https://doi.org/10.1086/209432>
- Cai, S., Wang, X., & Chiang, F. K. (2014). A case study of Augmented Reality simulation system application in a chemistry course. *Computers in Human Behavior, 37*, 31–40. <https://doi.org/10.1016/j.chb.2014.04.018>
- Chandukala, S. R., Reddy, S. K., & Tan, Y.-C. (2022). *How augmented reality can — and can't — help your brand*. Harvard business review. <https://hbr.org/2022/03/how-augmented-reality-can-and-cant-help-your-brand>
- Chang, P.-L., & Chieng, M.-H. (2006). Building consumer–brand relationship: A cross-cultural experiential view. *Psychology and Marketing, 23*(11), 927–959. <https://doi.org/10.1002/mar.20140>
- Chen, R., Perry, P., Boardman, R., & McCormick, H. (2022). Augmented reality in retail: a systematic review of research foci and future research agenda. *International Journal of Retail & Distribution Management, 50*(4), 498–518. <https://doi.org/10.1108/IJRDM-11-2020-0472>
- Chen, Y., & Lin, C. A. (2022). Consumer behavior in an augmented reality environment: Exploring the effects of flow via augmented realism and technology fluidity. *Telematics and Informatics, 71*(May), 101833. <https://doi.org/10.1016/j.tele.2022.101833>

- Cheng, K.-H., & Tsai, C.-C. (2013). Affordances of augmented reality in science learning: Suggestions for future research. *Journal of Science Education and Technology*, 22(4), 449–462. <https://doi.org/10.1007/s10956-012-9405-9>
- Cheng, L.-K., Chieng, M.-H., & Chieng, W.-H. (2014). Measuring virtual experience in a three-dimensional virtual reality interactive simulator environment: A structural equation modeling approach. *Virtual Reality*, 18(3), 173–188. <https://doi.org/10.1007/s10055-014-0244-2>
- Chernev, A., Hamilton, R., & Gal, D. (2011). Competing for consumer identity: limits to self-expression and the perils of lifestyle branding. *Journal of Marketing*, 75(3), 66–82. <https://doi.org/10.1509/jmkg.75.3.66>
- Chylinski, M., Heller, J., Hilken, T., Keeling, D. I., Mahr, D., & de Ruyter, K. (2020). Augmented reality marketing: A technology-enabled approach to situated customer experience. *Australasian Marketing Journal*, 28(4), 374–384. <https://doi.org/10.1016/j.ausmj.2020.04.004>
- Cialdini, R. B., Demaine, L. J., Sagarin, B. J., Barrett, D. W., Rhoads, K., & Winter, P. L. (2006). Managing social norms for persuasive impact. *Social Influence*, 1(1), 3–15. <https://doi.org/10.1080/15534510500181459>
- Cowan, K., Javornik, A., & Jiang, P. (2021). Privacy concerns when using augmented reality face filters? Explaining why and when use avoidance occurs. *Psychology and Marketing*, 38(10), 1799–1813. <https://doi.org/10.1002/mar.21576>
- Coyle, J. R., & Thorson, E. (2001). The effects of progressive levels of interactivity and vividness in web marketing sites. *Journal of Advertising*, 30(3), 65–77. <https://doi.org/10.1080/00913367.2001.10673646>
- Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal Experience in Work and Leisure. *Journal of Personality and Social Psychology*, 56(5), 815–822. <https://doi.org/10.1037/0022-3514.56.5.815>
- Cyr, D., Hassanein, K., Head, M., & Ivanov, A. (2007). The role of social presence in establishing loyalty in e-Service environments. *Interacting with Computers*, 19(1), 43–56. <https://doi.org/10.1016/j.intcom.2006.07.010>
- Daassi, M., & Debbabi, S. (2021). Intention to reuse AR-based apps: The combined role of the sense of immersion, product presence and perceived realism. *Information and Management*, 58(4). <https://doi.org/10.1016/j.im.2021.103453>
- Dash, S., & Saji, K. B. (2008). The role of consumer self-efficacy and website social presence in customers' adoption of b2c online shopping. *Journal of International Consumer Marketing*, 20(2), 33–48. [https://doi.org/10.1300/J046v20n02\\_04](https://doi.org/10.1300/J046v20n02_04)

- Daugherty, T., Li, H., & Biocca, F. (2005). Experiential ecommerce: A summary of research investigating the impact of virtual experience on consumer learning. In C. P. Haugtvedt, K. A. Machleit, & R. Yalch (Eds.), *Online Consumer Psychology: Understanding and Influencing Consumer Behavior in the Virtual World* (pp. 428–459). Psychology Press. <https://doi.org/10.4324/9781410612694>
- Dickey, M. R. (2018). *Nike teamed up with Snap and Darkstore to pre-release Air Jordan III 'Tinker' shoes on Snapchat*. Accessed: 15.9.2023. Available at : <https://techcrunch.com/2018/02/19/nike-teamed-up-with-snap-and-darkstore-to-pre-release-air-jordan-iii-tinker-shoes-on-snapchat/>
- Dwivedi, Y. K., Hughes, L., Wang, Y., Alalwan, A. A., Ahn, S. J., Balakrishnan, J., Barta, S., Belk, R., Buhalis, D., Dutot, V., Felix, R., Filieri, R., Flavián, C., Gustafsson, A., Hinsch, C., Hollensen, S., Jain, V., Kim, J., Krishen, A. S., ... Wirtz, J. (2022). Metaverse marketing: How the metaverse will shape the future of consumer research and practice. *Psychology and Marketing*, 40(4), 750–776. <https://doi.org/10.1002/mar.21767>
- Easton, G. (2002). Marketing: a critical realist approach. *Journal of Business Research*, 55(2), 103–109. [https://doi.org/10.1016/S0148-2963\(00\)00145-4](https://doi.org/10.1016/S0148-2963(00)00145-4)
- El-Shamandi Ahmed, K., Ambika, A., & Belk, R. (2023). Augmented reality magic mirror in the service sector: experiential consumption and the self. *Journal of Service Management*, 34(1), 56–77. <https://doi.org/10.1108/JOSM-12-2021-0484>
- Erikson, M. G. (2007). The Meaning of the Future: Toward a More Specific Definition of Possible Selves. *Review of General Psychology*, 11(4), 348–358. <https://doi.org/10.1037/1089-2680.11.4.348>
- Escalas, J. E. (2004a). Imagine yourself in the product : Mental Simulation, Narrative Transportation, and Persuasion. *Journal of Advertising*, 33(2), 37–48. <https://doi.org/10.1080/00913367.2004.10639163>
- Escalas, J. E. (2004b). Narrative Processing: Building Consumer Connections to Brands. *Journal of Consumer Psychology*, 14(1–2), 168–180. [https://doi.org/10.1207/s15327663jcp1401&2\\_19](https://doi.org/10.1207/s15327663jcp1401&2_19)
- Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4(3), 272–299. <https://doi.org/10.1037/1082-989X.4.3.272>
- Fan, X., Chai, Z., Deng, N., & Dong, X. (2020). Adoption of augmented reality in online retailing and consumers' product attitude: A cognitive perspective. *Journal of Retailing and Consumer Services*, 53, 101986. <https://doi.org/10.1016/j.jretconser.2019.101986>

- Fan, X., Jiang, X., & Deng, N. (2022). Immersive technology: A meta-analysis of augmented/virtual reality applications and their impact on tourism experience. *Tourism Management, 91*(18), 104534. <https://doi.org/10.1016/j.tourman.2022.104534>
- Feng, Y., & Xie, Q. (2018). Measuring the content characteristics of videos featuring augmented reality advertising campaigns. *Journal of Research in Interactive Marketing, 12*(4), 489–508. <https://doi.org/10.1108/JRIM-01-2018-0027>
- Field, A. (2009). *Discovering statistics using SPSS*. SAGE.
- Flanagin, A. J. (2020). The conduct and consequence of research on digital communication. *Journal of Computer-Mediated Communication, 25*(1), 23–31. <https://doi.org/10.1093/jcmc/zmz019>
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. <https://doi.org/10.2307/3151312>
- Furrer, O., Yu Kerguignas, J., Delcourt, C., & Gremler, D. D. (2020). Twenty-seven years of service research: a literature review and research agenda. *Journal of Services Marketing, 34*(3), 299–316. <https://doi.org/10.1108/JSM-02-2019-0078>
- Gefen, & Straub. (2003). Managing user trust in B2C e-services. *E-Service Journal, 2*(2), 7. <https://doi.org/10.2979/esj.2003.2.2.7>
- Gibson, J. J. (2014). *The Ecological Approach to Visual Perception* (Classic Ed). Psychology Press. <https://doi.org/10.4324/9781315740218>
- Gillath, O., Mccall, C., Shaver, P. R., & Blascovich, J. (2008). What can virtual reality teach us about prosocial tendencies in real and virtual environments? *Media Psychology, 11*(2), 259–282. <https://doi.org/10.1080/15213260801906489>
- Gilmore, J. H., & Pine, B. J. (1998). Welcome to the experience economy. *Harvard Business Review, 97*–105.
- Golf-Papez, M., Heller, J., Hilken, T., Chylinski, M., de Ruyter, K., Keeling, D. I., & Mahr, D. (2022). Embracing falsity through the metaverse: The case of synthetic customer experiences. *Business Horizons, 65*(6), 739–749. <https://doi.org/10.1016/j.bushor.2022.07.007>
- Grassini, S., & Laumann, K. (2020). Questionnaire measures and physiological correlates of presence: A systematic review. *Frontiers in Psychology, 11*. <https://doi.org/10.3389/fpsyg.2020.00349>

- Greenleaf, E. A., & Lehmann, D. R. (1995). Reasons for Substantial Delay in Consumer Decision Making. *Journal of Consumer Research*, 22(2), 186–199. <https://doi.org/10.1086/209444>
- Gurel, L. M., & Gurel, L. (1979). Clothing Interest: Conceptualization and Measurement. *Home Economics Research Journal*, 7(5), 274–282. <https://doi.org/10.1177/1077727X7900700501>
- Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). *Multivariate data analysis: A Global Perspective* (7th ed.). Pearson Education.
- Haji, I. H. A., Peluso, A. M., & Jong, A. de. (2021). Online private self-disclosure's potential for experiential value co-creation. *European Journal of Marketing*, 55(12), 3059–3098. <https://doi.org/10.1108/EJM-04-2019-0302>
- Hajli, N., Sims, J., Zadeh, A. H., & Richard, M. O. (2017). A social commerce investigation of the role of trust in a social networking site on purchase intentions. *Journal of Business Research*, 71, 133–141. <https://doi.org/10.1016/j.jbusres.2016.10.004>
- Harborth, D., & Pape, S. (2021). Investigating privacy concerns related to mobile augmented reality Apps – A vignette based online experiment. *Computers in Human Behavior*, 122, 106833. <https://doi.org/10.1016/j.chb.2021.106833>
- Hartmann, T., Wirth, W., Schramm, H., Klimmt, C., Vorderer, P., Gysbers, A., Böcking, S., Ravaja, N., Laarni, J., Saari, T., Gouveia, F., & Sacau, A. M. (2016). The spatial presence experience scale (SPES): A short self-report measure for diverse media settings. *Journal of Media Psychology*, 28(1), 1–15. <https://doi.org/10.1027/1864-1105/a000137>
- Hassanein, K., & Head, M. (2005). The impact of infusing social presence in the web interface: An investigation across product types. *International Journal of Electronic Commerce*, 10(2), 31–55. <https://doi.org/10.2753/JEC1086-4415100202>
- Hassanein, K., & Head, M. (2007). Manipulating perceived social presence through the web interface and its impact on attitude towards online shopping. *International Journal of Human Computer Studies*, 65(8), 689–708. <https://doi.org/10.1016/j.ijhcs.2006.11.018>
- Hein, K. (2022). *Coke innovation platform takes flight with Ava Max & space-inspired Coca-Cola Starlight*. Accessed: 15.09.2023. Available at: <https://www.thedrum.com/news/2022/02/17/coke-innovation-platform-takes-flight-with-ava-max-space-inspired-coca-cola>
- Heller, J., Chylinski, M., de Ruyter, K., Keeling, D. I., Hilken, T., & Mahr, D. (2021). Tangible service automation: Decomposing the technology-enabled engagement process

- (TEEP) for Augmented Reality. *Journal of Service Research*, 24(1), 84–103.  
<https://doi.org/10.1177/1094670520933692>
- Heller, J., Chylinski, M., de Ruyter, K., Mahr, D., & Keeling, D. I. (2019a). Let me imagine that for you: Transforming the retail frontline through augmenting customer mental imagery ability. *Journal of Retailing*, 95(2), 94–114.  
<https://doi.org/10.1016/j.jretai.2019.03.005>
- Heller, J., Chylinski, M., de Ruyter, K., Mahr, D., & Keeling, D. I. (2019b). Touching the untouchable: exploring multi-sensory augmented reality in the context of online retailing. *Journal of Retailing*, 95(4), 219–234.  
<https://doi.org/10.1016/j.jretai.2019.10.008>
- Hennig-Thurau, T., Aliman, D. N., Herting, A. M., Cziehso, G. P., Linder, M., & Kübler, R. V. (2022). Social interactions in the metaverse: Framework, initial evidence, and research roadmap. *Journal of the Academy of Marketing Science*, 51, 889–913.  
<https://doi.org/10.1007/s11747-022-00908-0>
- Hew, J.-J., Leong, L.-Y., Tan, G. W.-H., Lee, V.-H., & Ooi, K.-B. (2018). Mobile social tourism shopping: A dual-stage analysis of a multi-mediation model. *Tourism Management*, 66, 121–139. <https://doi.org/10.1016/j.tourman.2017.10.005>
- Hilken, T., Chylinski, M., Keeling, D. I., Heller, J., de Ruyter, K., & Mahr, D. (2022). How to strategically choose or combine augmented and virtual reality for improved online experiential retailing. *Psychology and Marketing*, 39(3), 495–507.  
<https://doi.org/10.1002/mar.21600>
- Hilken, T., de Ruyter, K., Chylinski, M., Mahr, D., & Keeling, D. I. (2017). Augmenting the eye of the beholder: Exploring the strategic potential of augmented reality to enhance online service experiences. *Journal of the Academy of Marketing Science*, 45(6), 884–905. <https://doi.org/10.1007/s11747-017-0541-x>
- Hilken, T., Heller, J., Chylinski, M., Keeling, D. I., Mahr, D., & de Ruyter, K. (2018). Making omnichannel an augmented reality: the current and future state of the art. *Journal of Research in Interactive Marketing*, 12(4), 509–523.  
<https://doi.org/10.1108/JRIM-01-2018-0023>
- Hilken, T., Heller, J., Keeling, D. I., Chylinski, M., Mahr, D., & de Ruyter, K. (2022). Bridging imagination gaps on the path to purchase with augmented reality: Field and experimental evidence. *Journal of Interactive Marketing*, 57(2), 356–375.  
<https://doi.org/10.1177/10949968221083555>
- Hinsch, C., Felix, R., & Rauschnabel, P. A. (2020). Nostalgia beats the wow-effect: Inspiration, awe and meaningful associations in augmented reality marketing. *Journal of Retailing and Consumer Services*, 53, 101987.  
<https://doi.org/10.1016/j.jretconser.2019.101987>



- Hoch, S. J., & Deighton, J. (1989). Managing what consumers learn from experience. *Journal of Marketing*, 53(2), 1. <https://doi.org/10.2307/1251410>
- Holbrook, M. B., & Hirschman, E. C. (1982). The Experiential Aspects of Consumption: Consumer Fantasies, Feelings, and Fun. *Journal of Consumer Research*, 9(2), 132–140. <https://doi.org/10.1086/208906>
- Hollebeek, L. D., Glynn, M. S., & Brodie, R. J. (2014). Consumer brand engagement in social media: Conceptualization, scale development and validation. *Journal of Interactive Marketing*, 28(2), 149–165. <https://doi.org/10.1016/j.intmar.2013.12.002>
- Hollebeek, L. D., & Macky, K. (2019). Digital Content Marketing's Role in Fostering Consumer Engagement, Trust, and Value: Framework, Fundamental Propositions, and Implications. *Journal of Interactive Marketing*, 45, 27–41. <https://doi.org/10.1016/j.intmar.2018.07.003>
- Holmlund, M., Hagman, A., & Polska, P. (2011). An exploration of how mature women buy clothing: empirical insights and a model. *Journal of Fashion Marketing and Management: An International Journal*, 15(1), 108–122. <https://doi.org/10.1108/13612021111112377>
- Holthöwer, J., & van Doorn, J. (2022). Robots do not judge: service robots can alleviate embarrassment in service encounters. *Journal of the Academy of Marketing Science*, 51, 767–784. <https://doi.org/10.1007/s11747-022-00862-x>
- Hooi, R., & Cho, H. (2014). Avatar-driven self-disclosure: The virtual me is the actual me. *Computers in Human Behavior*, 39, 20–28. <https://doi.org/10.1016/j.chb.2014.06.019>
- Hooi, R., & Cho, H. (2017). Virtual world continuance intention. *Telematics and Informatics*, 34(8), 1454–1464. <https://doi.org/10.1016/j.tele.2017.06.009>
- Howe, L. C., & Krosnick, J. A. (2017). Attitude Strength. *Annual Review of Psychology*, 68, 327–351. <https://doi.org/10.1146/annurev-psych-122414-033600>
- Huang, K. T., Ball, C., Francis, J., Ratan, R., Boumis, J., & Fordham, J. (2019). Augmented versus virtual reality in education: An exploratory study examining science knowledge retention when using augmented reality/virtual reality mobile applications. *Cyberpsychology, Behavior, and Social Networking*, 22(2), 105–110. <https://doi.org/10.1089/cyber.2018.0150>
- Huang, T.-L. (2019). Psychological mechanisms of brand love and information technology identity in virtual retail environments. *Journal of Retailing and Consumer Services*, 47, 251–264. <https://doi.org/10.1016/j.jretconser.2018.11.016>

- Huang, T.-L., & Liao, S. (2015). A model of acceptance of augmented-reality interactive technology: the moderating role of cognitive innovativeness. *Electronic Commerce Research*, 15(2), 269–295. <https://doi.org/10.1007/s10660-014-9163-2>
- Huang, T.-L., & Liao, S.-L. (2017). Creating e-shopping multisensory flow experience through augmented-reality interactive technology. *Internet Research*, 27(2), 449–475. <https://doi.org/10.1108/IntR-11-2015-0321>
- Huang, T.-L., & Liu, B. S. C. (2021). Augmented reality is human-like: How the humanizing experience inspires destination brand love. *Technological Forecasting and Social Change*, 170, 120853. <https://doi.org/10.1016/j.techfore.2021.120853>
- Hunt, S. D. (1990). Truth in Marketing Theory and Research. *Journal of Marketing*, 54(3), 1–15. <https://doi.org/10.1177/002224299005400301>
- IKEA. (n.d.). *Say hej to IKEA Place*. Accessed: 15.9.2023. Available at: <https://www.ikea.com/au/en/customer-service/mobile-apps/say-hej-to-ikea-place-pub1f8af050>
- Javornik, A. (2016a). Augmented reality: Research agenda for studying the impact of its media characteristics on consumer behaviour. *Journal of Retailing and Consumer Services*, 30, 252–261. <https://doi.org/10.1016/j.jretconser.2016.02.004>
- Javornik, A. (2016b). ‘It’s an illusion, but it looks real!’ Consumer affective, cognitive and behavioural responses to augmented reality applications. *Journal of Marketing Management*, 32(9–10), 987–1011. <https://doi.org/10.1080/0267257X.2016.1174726>
- Javornik, A., Marder, B., Barhorst, J. B., McLean, G., Rogers, Y., Marshall, P., & Warlop, L. (2022). ‘What lies behind the filter?’ Uncovering the motivations for using augmented reality (AR) face filters on social media and their effect on well-being. *Computers in Human Behavior*, 128, 107126. <https://doi.org/10.1016/j.chb.2021.107126>
- Javornik, A., Marder, B., Pizzetti, M., & Warlop, L. (2021). Augmented self - The effects of virtual face augmentation on consumers’ self-concept. *Journal of Business Research*, 130, 170–187. <https://doi.org/10.1016/j.jbusres.2021.03.026>
- Jensen Schau, H., & Gilly, M. C. (2003). We are what we post? Self-presentation in personal web space. *Journal of Consumer Research*, 30(3), 385–404. <https://doi.org/10.1086/378616>
- Jessen, A., Hilken, T., Chylinski, M., Mahr, D., Heller, J., Keeling, D. I., & de Ruyter, K. (2020). The playground effect: How augmented reality drives creative customer engagement. *Journal of Business Research*, 116, 85–98. <https://doi.org/10.1016/j.jbusres.2020.05.002>

- Jin, S. A. A. (2012). The virtual malleable self and the virtual identity discrepancy model: Investigative frameworks for virtual possible selves and others in avatar-based identity construction and social interaction. *Computers in Human Behavior*, 28(6), 2160–2168. <https://doi.org/10.1016/j.chb.2012.06.022>
- Jin, S.-A. A., & Park, N. (2009). Parasocial Interaction with My Avatar: Effects of Interdependent Self-Construal and the Mediating Role of Self-Presence in an Avatar-Based Console Game, Wii. *CyberPsychology & Behavior*, 12(6), 723–727. <https://doi.org/10.1089/cpb.2008.0289>
- Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Scientific Software International.
- Juan, M. C., Baños, R., Botella, C., Pérez, D., Alcaniiz, M., & Monserrat, C. (2006). An augmented reality system for the treatment of acrophobia: The sense of presence using immersive photography. *Presence: Teleoperators and Virtual Environments*, 15(4), 393–402. <https://doi.org/10.1162/pres.15.4.393>
- Kaczmarek, L. D., Misiak, M., Behnke, M., Dziekan, M., & Guzik, P. (2017). The Pikachu effect: Social and health gaming motivations lead to greater benefits of Pokémon GO use. *Computers in Human Behavior*, 75, 356–363. <https://doi.org/10.1016/j.chb.2017.05.031>
- Kang, H.-S., & Yang, H.-D. (2006). The visual characteristics of avatars in computer-mediated communication: Comparison of internet relay chat and instant messenger as of 2003. *International Journal of Human-Computer Studies*, 64(12), 1173–1183. <https://doi.org/10.1016/j.ijhcs.2006.07.003>
- Kannan, P. K., & Li, H. “Alice.” (2017). Digital marketing: A framework, review and research agenda. *International Journal of Research in Marketing*, 34(1), 22–45. <https://doi.org/10.1016/j.ijresmar.2016.11.006>
- Kautish, P., & Khare, A. (2022). Investigating the moderating role of AI-enabled services on flow and awe experience. *International Journal of Information Management*, 66, 102519. <https://doi.org/10.1016/j.ijinfomgt.2022.102519>
- Keogh, R., & Pearson, J. (2014). The sensory strength of voluntary visual imagery predicts visual working memory capacity. *Journal of Vision*, 14(12), 7.
- Kim, J.-H., Kim, M., Park, M., & Yoo, J. (2023). Immersive interactive technologies and virtual shopping experiences: Differences in consumer perceptions between augmented reality (AR) and virtual reality (VR). *Telematics and Informatics*, 77. <https://doi.org/10.1016/j.tele.2022.101936>
- Klein, L. R. (2003). Creating virtual product experiences: The role of telepresence. *Journal of Interactive Marketing*, 17(1), 41–55. <https://doi.org/10.1002/dir.10046>

- Korsgaard, M. A., & Roberson, L. (1995). Procedural justice in performance evaluation: The role of instrumental and non-instrumental voice in performance appraisal discussions. *Journal of Management*, 21(4), 657–669.
- Kowalczyk, P., Siepmann (née Scheiben), C., & Adler, J. (2020). Cognitive, affective, and behavioral consumer responses to augmented reality in e-commerce: A comparative study. *Journal of Business Research*, 124, 357–373. <https://doi.org/10.1016/j.jbusres.2020.10.050>
- Kruzan, K. P., & Won, A. S. (2019). Embodied well-being through two media technologies: Virtual reality and social media. *New Media and Society*, 21(8), 1734–1749. <https://doi.org/10.1177/1461444819829873>
- Kumar, H. (2022). Augmented reality in online retailing: a systematic review and research agenda. *International Journal of Retail and Distribution Management*, 50(4), 537–559. <https://doi.org/10.1108/IJRDM-06-2021-0287>
- Kumar, N., & Benbasat, I. (2006). The influence of recommendations and consumer reviews on evaluations of websites. *Information Systems Research*, 17(4), 425–439. <https://doi.org/10.1287/isre.1060.0107>
- Lavoye, V. (2023). Augmented reality: Toward a research agenda for studying the impact of its presence dimensions on consumer behavior. In J.L. Reis, M.K. Peter, J.A.V. Gonzáles & Z. Bogdanović (Eds.), *Marketing and Smart Technologies. Smart Innovation, Systems and Technologies*, 337 (pp 641–648). Springer Nature. [https://doi.org/10.1007/978-981-19-9099-1\\_44](https://doi.org/10.1007/978-981-19-9099-1_44)
- Lavoye, V., Mero, J., & Tarkiainen, A. (2021). Consumer behavior with augmented reality in retail: a review and research agenda. *International Review of Retail, Distribution and Consumer Research*, 31(3), 299–329. <https://doi.org/10.1080/09593969.2021.1901765>
- Lavoye, V., Sipilä, J., Mero, J., & Tarkiainen, A. (2023). The emperor’s new clothes: Self-exploration in virtual try-on service experiences positively impacts brand responses. *Journal of Services Marketing*, 37(10), 1–21. <https://doi.org/10.1108/JSM-04-2022-0137>
- Lavoye, V., & Tarkiainen, A. (2021). Toward an improved understanding of AR-based presence dimensions and their impact on attitude certainty. [Conference paper]. *Proceedings of the European Marketing Academy*, 94505. <http://proceedings.emac-online.org/pdfs/A2021-94505.pdf>
- Lee, K. M. (2004). Presence, Explicated. *Communication Theory*, 14(1), 27–50. <https://doi.org/10.1111/j.1468-2885.2004.tb00302.x>

- LEGO. (n.d.). *LEGO® Technic™ AR App*. Accessed: 15.9.2023. Available at: <https://www.lego.com/en-us/themes/technic/ar-app>
- Leong, L.-Y., Hew, T.-S., Ooi, K.-B., & Chong, A. Y.-L. (2020). Predicting the antecedents of trust in social commerce – A hybrid structural equation modeling with neural network approach. *Journal of Business Research*, *110*, 24–40. <https://doi.org/10.1016/j.jbusres.2019.11.056>
- Li, B. J., & Lwin, M. O. (2016). Player see, player do: Testing an exergame motivation model based on the influence of the self avatar. *Computers in Human Behavior*, *59*, 350–357. <https://doi.org/10.1016/j.chb.2016.02.034>
- Li, D. D., Liao, A. K., & Khoo, A. (2013). Player-Avatar Identification in video gaming: Concept and measurement. *Computers in Human Behavior*, *29*(1), 257–263. <https://doi.org/10.1016/j.chb.2012.09.002>
- Li, H., Daugherty, T., & Biocca, F. (2002). Impact of 3-D advertising on product knowledge, brand attitude, and purchase intention: the mediating role of presence. *Journal of Advertising*, *31*(3), 43–57. <https://doi.org/10.1080/00913367.2002.10673675>
- Lim, J., & Ayyagari, R. (2018). Investigating the determinants of telepresence in the e-commerce setting. *Computers in Human Behavior*, *85*, 360–371. <https://doi.org/10.1016/j.chb.2018.04.024>
- Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication*, *3*(2), 0–0. <https://doi.org/10.1111/j.1083-6101.1997.tb00072.x>
- Lombard, M., & Jones, M. T. (2015). Defining presence. In *Immersed in Media* (pp. 13–34). Springer.
- Lombard, M., & Xu, K. (2021). Social Responses to Media Technologies in the 21st Century: The Media are Social Actors Paradigm. *Human-Machine Communication*, *2*, 29–55. <https://doi.org/10.30658/hmc.2.2>
- Lu, B., Fan, W., & Zhou, M. (2016). Social presence, trust, and social commerce purchase intention: An empirical research. *Computers in Human Behavior*, *56*, 225–237. <https://doi.org/10.1016/j.chb.2015.11.057>
- Ma, Z. (2020). Effects of immersive stories on prosocial attitudes and willingness to help: Testing psychological mechanisms. *Media Psychology*, *23*(6), 865–890. <https://doi.org/10.1080/15213269.2019.1651655>
- MAC. (n.d.). *MAC Cosmetics*. Accessed: 15.9.2023. Available at: [https://www.maccosmetics.co.uk/product/13854/99908/products/makeup/lips/lipstick/powder-kiss-velvet-blur-slim-stick?shade=ruby\\_new](https://www.maccosmetics.co.uk/product/13854/99908/products/makeup/lips/lipstick/powder-kiss-velvet-blur-slim-stick?shade=ruby_new)

- MacInnis, D. J. (2011). A framework for conceptual contributions in marketing. *Journal of Marketing*, 75(4), 136–154. <https://doi.org/10.1509/jmkg.75.4.136>
- MacInnis, D. J., & Price, L. L. (1987). The role of imagery in information processing: Review and extensions. *Journal of Consumer Research*, 13(4), 473–491. <https://doi.org/10.1086/209082>
- MacKenzie, S. B., & Podsakoff, P. M. (2012). Common method bias in marketing: Causes, mechanisms, and procedural remedies. *Journal of Retailing*, 88(4), 542–555. <https://doi.org/10.1016/j.jretai.2012.08.001>
- Marinova, D., de Ruyter, K., Huang, M.-H., Meuter, M. L., & Challagalla, G. (2017). Getting smart. *Journal of Service Research*, 20(1), 29–42. <https://doi.org/10.1177/1094670516679273>
- Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist*, 41(9), 954–969. <https://doi.org/10.1037/0003-066X.41.9.954>
- Martínez-Navarro, J., Bigné, E., Guixeres, J., Alcañiz, M., & Torrecilla, C. (2019). The influence of virtual reality in e-commerce. *Journal of Business Research*, 100, 475–482. <https://doi.org/10.1016/j.jbusres.2018.10.054>
- Mathwick, C., Malhotra, N., & Rigdon, E. (2001). Experiential value: conceptualization, measurement and application in the catalog and Internet shopping environment. *Journal of Retailing*, 77(1), 39–56. [https://doi.org/10.1016/S0022-4359\(00\)00045-2](https://doi.org/10.1016/S0022-4359(00)00045-2)
- McLean, G., Osei-Frimpong, K., Wilson, A., & Pitardi, V. (2020). How live chat assistants drive travel consumers' attitudes, trust and purchase intentions: The role of human touch. *International Journal of Contemporary Hospitality Management*, 32(5), 1795–1812. <https://doi.org/10.1108/IJCHM-07-2019-0605>
- McLean, G., & Wilson, A. (2019). Shopping in the digital world: Examining customer engagement through augmented reality mobile applications. *Computers in Human Behavior*, 101, 210–224. <https://doi.org/10.1016/j.chb.2019.07.002>
- McLeod, P. L., Liu, Y. C., & Axline, J. E. (2014). When your Second Life comes knocking: Effects of personality on changes to real life from virtual world experiences. *Computers in Human Behavior*, 39, 59–70. <https://doi.org/10.1016/j.chb.2014.06.025>
- Merle, A., Senecal, S., & St-Onge, A. (2012). Whether and how virtual try-on influences consumer responses to an apparel web site. *International Journal of Electronic Commerce*, 16(3), 41–64. <https://doi.org/10.2753/jec1086-4415160302>
- Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. *IEICE Transactions on Information Systems*, 77(12), 1321–1329.

- Mishra, A., Shukla, A., Rana, N. P., & Dwivedi, Y. K. (2021). From “touch” to a “multisensory” experience: The impact of technology interface and product type on consumer responses. *Psychology & Marketing*, *38*(3), 385–396. <https://doi.org/10.1002/mar.21436>
- Mollen, A., & Wilson, H. (2010). Engagement, telepresence and interactivity in online consumer experience: Reconciling scholastic and managerial perspectives. *Journal of Business Research*, *63*(9–10), 919–925. <https://doi.org/10.1016/j.jbusres.2009.05.014>
- Monsanto, C., & Buob, M. (2021). *Immersive experiences are driving customer loyalty*. Accessed: 15.9.2023. Available at: <https://venturebeat.com/commerce/how-immersive-experiences-are-driving-customer-loyalty/>
- Mossholder, K. W., Bennett, N., Kemery, E. R., & Wesolowski, M. A. (1998). Relationships between bases of power and work reactions: The mediational role of procedural justice. *Journal of Management*, *24*(4), 533–552. <https://doi.org/10.1177/014920639802400404>
- Murray, K. B., & Häubl, G. (2007). Explaining cognitive lock-in: The role of skill-based habits of use in consumer choice. *Journal of Consumer Research*, *34*(1), 77–88. <https://doi.org/10.1086/513048>
- Nass, C., Steuer, J., & Tauber, E. R. (1994). Computers are social actors. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems Celebrating Interdependence - CHI '94*, 72–78. <https://doi.org/10.1145/191666.191703>
- Novak, T. P., Hoffman, D. L., & Yung, Y.-F. (2000). Measuring the customer experience in online environments: A structural modeling approach. *Marketing Science*, *19*(1), 22–42. <https://doi.org/10.1287/mksc.19.1.22.15184>
- O’Brien, L., & Murnane, J. (2009). An investigation into how avatar appearance can affect interactions in a virtual world. *International Journal of Social and Humanistic Computing*, *1*(2), 192–202. <https://doi.org/10.1504/ijshc.2009.031007>
- Oh, C. S., Bailenson, J. N., & Welch, G. F. (2018). A systematic review of social presence: Definition, antecedents, and implications. *Frontiers Robotics AI*, *5*(OCT), 1–35. <https://doi.org/10.3389/frobt.2018.00114>
- Orús, C., Ibáñez-Sánchez, S., & Flavián, C. (2021). Enhancing the customer experience with virtual and augmented reality: The impact of content and device type. *International Journal of Hospitality Management*, *98*. <https://doi.org/10.1016/j.ijhm.2021.103019>
- Oyserman, D. (2009). Identity-based motivation: Implications for action-readiness, procedural-readiness, and consumer behavior. *Journal of Consumer Psychology*, *19*(3), 250–260. <https://doi.org/10.1016/j.jcps.2009.05.008>

- Palmatier, R. W., Houston, M. B., & Hulland, J. (2018). Review articles: purpose, process, and structure. *Journal of the Academy of Marketing Science*, 46(1), 1–5. <https://doi.org/10.1007/s11747-017-0563-4>
- Pantano, E., Rese, A., & Baier, D. (2017). Enhancing the online decision-making process by using augmented reality: A two country comparison of youth markets. *Journal of Retailing and Consumer Services*, 38, 81–95. <https://doi.org/10.1016/j.jretconser.2017.05.011>
- Park, M., & Yoo, J. (2020). Effects of perceived interactivity of augmented reality on consumer responses: A mental imagery perspective. *Journal of Retailing and Consumer Services*, 52, 101912. <https://doi.org/10.1016/j.jretconser.2019.101912>
- Pearson, J., Naselaris, T., Holmes, E. A., & Kosslyn, S. M. (2015). Mental Imagery: Functional Mechanisms and Clinical Applications. *Trends in Cognitive Sciences*, 19(10), 590–602. <https://doi.org/10.1016/j.tics.2015.08.003>
- Perez, S. (2022). *Amazon gets into AR shopping with launch of 'Virtual Try-On for Shoes.'* Accessed: 15.9.2023. Available at: <https://techcrunch.com/2022/06/09/amazon-gets-into-ar-shopping-with-launch-of-virtual-try-on-for-shoes/>
- Petit, O., Javornik, A., & Velasco, C. (2021). We eat first with our (digital) eyes: Enhancing mental simulation of eating experiences via visual-enabling technologies. *Journal of Retailing*, 98(2), 277–293. <https://doi.org/10.1016/j.jretai.2021.04.003>
- Phua, J., & Kim, J. (Jay). (2018). Starring in your own Snapchat advertisement: Influence of self-brand congruity, self-referencing and perceived humor on brand attitude and purchase intention of advertised brands. *Telematics and Informatics*, 35(5), 1524–1533. <https://doi.org/10.1016/j.tele.2018.03.020>
- Piacentini, M., & Mailer, G. (2004). Symbolic consumption in teenagers' clothing choices. *Journal of Consumer Behaviour*, 3(3), 251–262. <https://doi.org/10.1002/cb.138>
- Pimentel, D., Kalyanaraman, S., Lee, Y. H., & Halan, S. (2021). Voices of the unsung: The role of social presence and interactivity in building empathy in 360 video. *New Media and Society*, 23(8), 2230–2254. <https://doi.org/10.1177/1461444821993124>
- Plotkina, D., Dinsmore, J., & Racat, M. (2021). Improving service brand personality with augmented reality marketing. *Journal of Services Marketing*. <https://doi.org/10.1108/JSM-12-2020-0519>
- Pokemon. (n.d.). *Pokemon Go*. Accessed: 15.9.2023. Available at: <https://www.pokemon.com/us/app/pokemon-go/>



- Poushneh, A. (2018). Augmented reality in retail: A trade-off between user's control of access to personal information and augmentation quality. *Journal of Retailing and Consumer Services*, 41, 169–176. <https://doi.org/10.1016/j.jretconser.2017.12.010>
- Qian, J. (2021). *Sephora: The omnichannel strategy which redefined CX in cosmetics*. Accessed: 15.9.2023. Available at: <https://blog.contactpigeon.com/sephora-omnichannel-strategy/>
- Qiu, L., & Benbasat, I. (2005). An investigation into the effects of text-to-speech voice and 3D avatars on the perception of presence and flow of live help in electronic commerce. *ACM Transactions on Computer-Human Interaction*, 12(4), 329–355. <https://doi.org/10.1145/1121112.1121113>
- Qiu, L., & Benbasat, I. (2008). Evaluating anthropomorphic product recommendation agents: A social relationship perspective to designing information systems. *Journal of Management Information Systems*, 25(4), 145–182. <https://doi.org/10.2753/MIS0742-1222250405>
- Ratan, R., & Hasler, B. (2009). Self-presence standardized: Introducing the self-presence questionnaire (SPQ). In *Proceedings of the 12th annual international workshop on presence (Vol. 81)*.
- Ratan, R., & Hasler, B. S. (2010). Exploring self-presence in collaborative virtual teams. *PsychNology Journal*, 8(1), 11–31.
- Rauschnabel, P. A., Babin, B. J., tom Dieck, M. C., Krey, N., & Jung, T. (2022). What is augmented reality marketing? Its definition, complexity, and future. *Journal of Business Research*, 142, 1140–1150. <https://doi.org/10.1016/j.jbusres.2021.12.084>
- Rauschnabel, P. A., Felix, R., & Hinsch, C. (2019). Augmented reality marketing: How mobile AR-apps can improve brands through inspiration. *Journal of Retailing and Consumer Services*, 49, 43–53. <https://doi.org/10.1016/j.jretconser.2019.03.004>
- Rauschnabel, P. A., Felix, R., Hinsch, C., Shahab, H., & Alt, F. (2022). What is XR? Towards a framework for augmented and virtual reality. *Computers in Human Behavior*, 133, 107289. <https://doi.org/10.1016/j.chb.2022.107289>
- Rauschnabel, P. A., Rossmann, A., & tom Dieck, M. C. (2017). An adoption framework for mobile augmented reality games: The case of Pokémon Go. *Computers in Human Behavior*, 76, 276–286. <https://doi.org/10.1016/j.chb.2017.07.030>
- Reeves, B., & Nass, C. I. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. Cambridge University Press.
- Rese, A., Baier, D., Geyer-Schulz, A., & Schreiber, S. (2017). How augmented reality apps are accepted by consumers: A comparative analysis using scales and opinions.

- Technological Forecasting and Social Change*, 124, 306–319.  
<https://doi.org/10.1016/j.techfore.2016.10.010>
- Rese, A., Schreiber, S., & Baier, D. (2014). Technology acceptance modeling of augmented reality at the point of sale: Can surveys be replaced by an analysis of online reviews? *Journal of Retailing and Consumer Services*, 21(5), 869–876.  
<https://doi.org/10.1016/j.jretconser.2014.02.011>
- Riva, G., Wiederhold, B. K., & Mantovani, F. (2019). Neuroscience of Virtual Reality: From Virtual Exposure to Embodied Medicine. *Cyberpsychology, Behavior, and Social Networking*, 22(1), 82–96. <https://doi.org/10.1089/cyber.2017.29099.gri>
- Rodríguez-Ardura, I., & Martínez-López, F. J. (2014). Another look at ‘being there’ experiences in digital media: Exploring connections of telepresence with mental imagery. *Computers in Human Behavior*, 30, 508–518.  
<https://doi.org/10.1016/j.chb.2013.06.016>
- Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology*, 35(9), 677.
- Rucker, D. D., & Petty, R. E. (2004). Emotion specificity and consumer behavior: Anger, sadness, and preference for activity. *Motivation and Emotion*, 28(1), 3–21.  
<https://doi.org/10.1023/B:MOEM.0000027275.95071.82>
- Rucker, D. D., Tormala, Z. L., Petty, R. E., & Briñol, P. (2014). Consumer conviction and commitment: An appraisal-based framework for attitude certainty. *Journal of Consumer Psychology*, 24(1), 119–136. <https://doi.org/10.1016/j.jcps.2013.07.001>
- Sadamali Jayawardena, N., Thaichon, P., Quach, S., Razzaq, A., & Behl, A. (2023). ‘The persuasion effects of virtual reality (VR) and augmented reality (AR) video advertisements: A conceptual review.’ *Journal of Business Research*, 160, 113739.  
<https://doi.org/10.1016/j.jbusres.2023.113739>
- Sanchez-Vives, M. V., & Slater, M. (2005). From Presence Towards Consciousness. *Nature Reviews Neuroscience*, 6(10), 332.
- Schein, K. E., & Rauschnabel, P. A. (2021). Augmented reality in manufacturing: Exploring workers’ perceptions of barriers. *IEEE Transactions on Engineering Management*.
- Schmitt, B. (1999). Experiential marketing. *Journal of Marketing Management*, 15(1–3), 53–67.
- Scholz, J., & Duffy, K. (2018). We ARE at home: How augmented reality reshapes mobile marketing and consumer-brand relationships. *Journal of Retailing and Consumer Services*, 44, 11–23. <https://doi.org/10.1016/j.jretconser.2018.05.004>

- Schubert, T. (2009). A new conception of spatial presence: Once again, with feeling. *Communication Theory, 19*(2), 161–187. <https://doi.org/10.1111/j.1468-2885.2009.01340.x>
- Schubert, T., Friedmann, F., & Regenbrecht, H. (2001). The experience of presence: Factor analytic insights. *Presence: Teleoperators and Virtual Environments, 10*(3), 266–281. <https://doi.org/10.1162/105474601300343603>
- Schuemie, M. J., Van der Straaten, P., Krijn, M., & Van der Mast, C. A. P. G. (2001). Research on presence in virtual reality: A survey. *Cyberpsychology and Behavior, 4*(2), 183–201. <https://doi.org/10.1089/109493101300117884>
- Schuetzler, R. M., Grimes, G. M., & Scott Giboney, J. (2020). The impact of chatbot conversational skill on engagement and perceived humanness. *Journal of Management Information Systems, 37*(3), 875–900. <https://doi.org/10.1080/07421222.2020.1790204>
- Schultze, U. (2010). Embodiment and presence in virtual worlds: A review. *Journal of Information Technology, 25*(4), 434–449. <https://doi.org/10.1057/jit.2010.25>
- Schultze, U., & Leahy, M. M. (2009). The avatar-self relationship: Enacting presence in second life. *Icis 2009*.
- Seo, Y., Kim, M., Jung, Y., & Lee, D. (2017). Avatar face recognition and self-presence. *Computers in Human Behavior, 69*, 120–127. <https://doi.org/10.1016/j.chb.2016.12.020>
- Shapiro, M., & Lang, A. (1991). Making Television Reality. *Communication Research, 18*(5), 685–705. <https://doi.org/10.1177/009365091018005007>
- Shih, H.-P. (2012). Cognitive Lock-In Effects on Consumer Purchase Intentions in the Context of B2C Web Sites. *Psychology & Marketing, 29*(10), 738–751. <https://doi.org/10.1002/mar.20560>
- Shin, D. (2018). Empathy and embodied experience in virtual environment: To what extent can virtual reality stimulate empathy and embodied experience? *Computers in Human Behavior, 78*, 64–73. <https://doi.org/10.1016/j.chb.2017.09.012>
- Short, J., Williams, E., & Christie, B. (1976). *The Social Psychology of Telecommunications*. Wiley.
- Shu, Y., Huang, Y.-Z., Chang, S.-H., & Chen, M.-Y. (2019). Do virtual reality head-mounted displays make a difference? A comparison of presence and self-efficacy between head-mounted displays and desktop computer-facilitated virtual environments. *Virtual Reality, 23*, 437–446.

- Siggelkow, N., & Terwiesch, C. (2019). The age of continuous connection new technologies have made 24/7 customer relationships possible. It's time to change your business model accordingly. *Harvard Business Review*, 97(3), 63–73.
- Sirgy, J. (1982). Self-Concept in Consumer Behavior : A Critical Review. *Journal of Consumer Research*, 9(3), 287–300.
- Skalski, P., & Tamborini, R. (2007). The role of social presence in interactive agent-based persuasion. *Media Psychology*, 10(3), 385–413.  
<https://doi.org/10.1080/15213260701533102>
- Smink, A. R., Frowijn, S., van Reijmersdal, E. A., van Noort, G., & Neijens, P. C. (2019). Try online before you buy: How does shopping with augmented reality affect brand responses and personal data disclosure. *Electronic Commerce Research and Applications*, 35, 100854. <https://doi.org/10.1016/j.elerap.2019.100854>
- Smink, A. R., van Reijmersdal, E. A., van Noort, G., & Neijens, P. C. (2020). Shopping in augmented reality: The effects of spatial presence, personalization and intrusiveness on app and brand responses. *Journal of Business Research*, 118, 474–485.  
<https://doi.org/10.1016/j.jbusres.2020.07.018>
- Snapchat. (n.d.). *There's more in store with AR*. Accessed: 15.9.2023. Available at: <https://forbusiness.snapchat.com/inspiration/nike-new-york-augmented-reality>
- Sohn, S., Seegebarth, B., Kissling, M., & Sippel, T. (2020). Social cues and the online purchase intentions of organic wine. *Foods*, 9(5), 1–15.  
<https://doi.org/10.3390/foods9050643>
- Statista. (2022). *Forecast share of consumers who will have used AR when buying products online worldwide by 2025, by country*. Accessed: 15.9.2023. Available at: <https://www.statista.com/statistics/1270070/ar-use-forecast-in-buying-online/>
- Steuer, J. (1992). Defining Virtual Reality: Dimensions Determining Telepresence. *Journal of Communication*, 42(4), 73–93. <https://doi.org/10.1111/j.1460-2466.1992.tb00812.x>
- Suh, K.-S., Kim, H., & Suh, E. K. (2011). What if your avatar looks like you? Dual-congruity perspectives for avatar use. *MIS Quarterly*, 35(3), 711–729.  
<https://doi.org/10.2307/23042805>
- Sun, C., Fang, Y., Kong, M., Chen, X., & Liu, Y. (2022). Influence of augmented reality product display on consumers' product attitudes: A product uncertainty reduction perspective. *Journal of Retailing and Consumer Services*, 64, 102828.  
<https://doi.org/10.1016/j.jretconser.2021.102828>

- Sundar, S. S., Kang, J., & Oprean, D. (2017). Being there in the midst of the story: How immersive journalism affects our perceptions and cognitions. *Cyberpsychology, Behavior, and Social Networking*, 20(11), 672–682. <https://doi.org/10.1089/cyber.2017.0271>
- Sundar, S. S., Oh, J., Kang, H., & Sreenivasan, A. (2013). How does technology persuade? Theoretical mechanisms for persuasive technologies. In J. P., Dillard, & L., Shen (Eds.), *The SAGE handbook of persuasion* (pp. 388–400). Sage.
- Tan, Y.-C., Chandukala, S. R., & Reddy, S. K. (2022). Augmented reality in retail and its impact on sales. *Journal of Marketing*, 86(1), 48–66. <https://doi.org/10.1177/0022242921995449>
- Teng, C. I. (2017). Impact of avatar identification on online gamer loyalty: Perspectives of social identity and social capital theories. *International Journal of Information Management*, 37(6), 601–610. <https://doi.org/10.1016/j.ijinfomgt.2017.06.006>
- Tom Dieck, M. C., & Han, D. D. (2022). The role of immersive technology in customer experience management. *Journal of Marketing Theory and Practice*, 30(1), 108–119. <https://doi.org/10.1080/10696679.2021.1891939>
- Tormala, Z. L., & Rucker, D. D. (2018). Attitude certainty: Antecedents, consequences, and new directions. *Consumer Psychology Review*, 1(1), 72–89. <https://doi.org/10.1002/arc.1004>
- van Brakel, V., Barreda-Ángeles, M., & Hartmann, T. (2023). Feelings of presence and perceived social support in social virtual reality platforms. *Computers in Human Behavior*, 139. <https://doi.org/10.1016/j.chb.2022.107523>
- van Esch, P., Arli, D., Gheshlaghi, M. H., Andonopoulos, V., von der Heide, T., & Northey, G. (2019). Anthropomorphism and augmented reality in the retail environment. *Journal of Retailing and Consumer Services*, 49, 35–42. <https://doi.org/10.1016/j.jretconser.2019.03.002>
- van Noort, G., Voorveld, H. A. M., & van Reijmersdal, E. A. (2012). Interactivity in brand web sites: Cognitive, affective, and behavioral responses explained by consumers' online flow experience. *Journal of Interactive Marketing*, 26(4), 223–234. <https://doi.org/10.1016/j.intmar.2011.11.002>
- Varadarajan, R., Srinivasan, R., Vadakkepatt, G. G., Yadav, M. S., Pavlou, P. A., Krishnamurthy, S., & Krause, T. (2010). Interactive technologies and retailing strategy: A review, conceptual framework and future research directions. *Journal of Interactive Marketing*, 24(2), 96–110. <https://doi.org/10.1016/j.intmar.2010.02.004>

- Verhagen, T., Vonkeman, C., Feldberg, F., & Verhagen, P. (2014). Present it like it is here: Creating local presence to improve online product experiences. *Computers in Human Behavior*, *39*, 270–280. <https://doi.org/10.1016/j.chb.2014.07.036>
- Vieira, V. A., Rafael, D. N., & Agnihotri, R. (2022). Augmented reality generalizations: A meta-analytical review on consumer-related outcomes and the mediating role of hedonic and utilitarian values. *Journal of Business Research*, *151*, 170–184. <https://doi.org/10.1016/j.jbusres.2022.06.030>
- Villani, D., Repetto, C., Cipresso, P., & Riva, G. (2012). May I experience more presence in doing the same thing in virtual reality than in reality? An answer from a simulated job interview. *Interacting with Computers*, *24*(4), 265–272. <https://doi.org/10.1016/j.intcom.2012.04.008>
- Vinitzky, G., & Mazursky, D. (2011). The effects of cognitive thinking style and ambient scent on online consumer approach behavior, experience approach behavior, and search motivation. *Psychology and Marketing*, *28*(5), 496–519. <https://doi.org/10.1002/mar.20398>
- Vonkeman, C., Verhagen, T., & van Dolen, W. (2017). Role of local presence in online impulse buying. *Information and Management*, *54*(8), 1038–1048. <https://doi.org/10.1016/j.im.2017.02.008>
- Voorveld, H. A. M., Neijens, P. C., & Smit, E. G. (2009). Consumers' responses to brand websites: an interdisciplinary review. *Internet Research*, *19*(5), 535–565. <https://doi.org/10.1108/10662240920998887>
- Wan, E. W., Rucker, D. D., Tormala, Z. L., & Clarkson, J. J. (2010). The effect of regulatory depletion on attitude certainty. *Journal of Marketing Research*, *47*(3), 531–541. <https://doi.org/10.1509/jmkr.47.3.531>
- Wang, L. C., Baker, J., Wagner, J. A., Wakefield, K., Lamb, C., Grewal, D., Babin, B., & Mosley-Matchett, J. D. (2007). Can a retail web site be social? *Journal of Marketing*, *71*, 143–157. <https://doi.org/10.1509/jmkg.71.3.143>
- Waterworth, J. A., Waterworth, E. L., Riva, G., & Mantovani, F. (2015). Presence: Form, Content and Consciousness. In M. Lombard, F. Biocca, J. Freeman, W. IJsselsteijn, & R. J. Schaevitz (Eds.), *Immersed in Media: Telepresence Theory, Measurement & Technology* (pp. 35–58). Springer International Publishing. [https://doi.org/10.1007/978-3-319-10190-3\\_3](https://doi.org/10.1007/978-3-319-10190-3_3)
- Watson, A., Alexander, B., & Salavati, L. (2018). The impact of experiential augmented reality applications on fashion purchase intention. *International Journal of Retail & Distribution Management*. <https://doi.org/10.1108/IJRDM-06-2017-0117>

- Whang, J. Bin, Song, J. H., Choi, B., & Lee, J. H. (2021). The effect of Augmented Reality on purchase intention of beauty products: The roles of consumers' control. *Journal of Business Research*, 133, 275–284. <https://doi.org/10.1016/j.jbusres.2021.04.057>
- Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26(2), xiii–xxiii. <https://doi.org/10.1.1.104.6570>
- Wedel, M., Bigné, E., & Zhang, J. (2020). Virtual and augmented reality: Advancing research in consumer marketing. *International Journal of Research in Marketing*, 37(3), 443–465. <https://doi.org/10.1016/j.ijresmar.2020.04.004>
- Wilson, D. (2023). *Immersive CX is the New Way to Win and Keep Customers*. Accessed: 15.09.2023. Available at: <https://www.businesswire.com/news/home/20230118005151/en/Immersive-CX-is-the-New-Way-to-Win-and-Keep-Customers>
- Wirth, W., Hartmann, T., Böcking, S., Vorderer, P., Klimmt, C., Schramm, H., Saari, T., Laarni, J., Ravaja, N., Gouveia, F. R., Biocca, F., Sacau, A., Jäncke, L., Baumgartner, T., & Jäncke, P. (2007). A Process Model of the Formation of Spatial Presence Experiences. *Media Psychology*, 9(3), 493–525. <https://doi.org/10.1080/15213260701283079>
- Xi, N., Chen, J., Gama, F., Riar, M., & Hamari, J. (2022). The challenges of entering the metaverse: An experiment on the effect of extended reality on workload. *Information Systems Frontiers*. <https://doi.org/10.1007/s10796-022-10244-x>
- Xiao, Y., & Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, 39(1), 93–112. <https://doi.org/10.1177/0739456X17723971>
- Xu, K., Chen, X., & Huang, L. (2022). Deep mind in social responses to technologies: A new approach to explaining the Computers are Social Actors phenomena. *Computers in Human Behavior*, 134, 107321. <https://doi.org/10.1016/j.chb.2022.107321>
- Xu, L., Zhang, L., Cui, N., & Yang, Z. (2019). How and when AR technology affects product attitude. *Asia Pacific Journal of Marketing and Logistics*, 32(6), 1226–1241. <https://doi.org/10.1108/APJML-03-2019-0221>
- Yim, M. Y.-C., Chu, S.-C., & Sauer, P. L. (2017). Is augmented reality technology an effective tool for e-commerce? An interactivity and vividness perspective. *Journal of Interactive Marketing*, 39, 89–103. <https://doi.org/10.1016/j.intmar.2017.04.001>
- Yim, M. Y.-C., & Park, S.-Y. (2019). “I am not satisfied with my body, so I like augmented reality (AR)” Consumer responses to AR-based product presentations.

*Journal of Business Research*, 100, 581–589.  
<https://doi.org/10.1016/j.jbusres.2018.10.041>

Zhang, J. Z., Chang, C.-W., & Neslin, S. A. (2022). How physical stores enhance customer value: the importance of product inspection depth. *Journal of Marketing*, 86(2), 166–185. <https://doi.org/10.1177/00222429211012106>

Zhu, D. H., & Chang, Y. P. (2014). Investigating consumer attitude and intention toward free trials of technology-based services. *Computers in Human Behavior*, 30, 328–334. <https://doi.org/10.1016/j.chb.2013.09.008>

Zhu, L., Benbasat, I., & Jiang, Z. (2010). Let's shop online together: An empirical investigation of collaborative online shopping support. *Information Systems Research*, 21(4), 872–891. <https://doi.org/10.1287/isre.1080.0218>





## Appendix A: Additional table

**Table A1.** Alternative definitions of dimensions of presence

Concept of presence	Definition
telepresence	Telepresence refers to the sense of being engaged in a mediated environment (Whang et al., 2021).
presence	Illusion that the observer is present within that world caused as a response to the technological stimuli (Milgram & Kishino, 1994).
spatial presence	In the VR context, spatial presence refers to the sense of being there in the virtual environment (Schubert et al., 2001).
social presence	Social presence occurs when users get a sense that another being also exist within the virtual environment (Schuemie et al., 2001).
co-presence	Co-presence refers to the sense to be together with another person (Bulu, 2012).



## **Publication I**

Lavoie, V., Mero J., and Tarkiainen A.

**Consumer behavior with augmented reality in retail: A review and research agenda**

Reprinted with permission from  
*International Review of Retail, Distribution and Consumer Research*  
31(3), pp. 299-329  
© 2021, Routledge





## Consumer behavior with augmented reality in retail: a review and research agenda

Virginie Lavoye<sup>a</sup>, Joel Mero<sup>b</sup> and Anssi Tarkiainen<sup>c</sup>

<sup>a</sup>LUT University, School of Business and Management, Lappeenranta, Finland; <sup>b</sup>University of Jyväskylä, School of Business and Economics, Jyväskylä, Finland; <sup>c</sup>LUT University, School of Business and Management, Lappeenranta, Finland

### ABSTRACT

Driven by the rapid technological development and adoption of augmented reality (AR) in retail, academic research has grown rapidly. Our purpose is to understand the reasons why consumers use augmented reality in retail and what outcomes retailers can expect. This study presents a systematic literature review and summarizes the current empirical knowledge on consumer behavior with AR in retail. This topic remains scattered between various literature streams showing that the potential of AR to create value for consumers lays in its ability to generate utilitarian and hedonic value, to improve decision-making, and to enhance personalization of the virtual self. Then, this study warns about negative effects of AR usage. The contribution is a systematic literature review and a conceptual framework covering the most important consumer behaviors with AR and their brand-related, transactional, and technology-related outcomes. In addition, this paper adopts a holistic view to propose future research directions and emphasize the need for more research on social augmented reality.

### ARTICLE HISTORY

Received 28 April 2020  
Accepted 8 March 2021

### KEYWORDS

Augmented reality; retail; experience; self; decision-making

## Introduction

Augmented reality (AR) refers to a set of technologies that superimposes digital information and images on the physical reality of the user, thus creating a new interface between the digital and physical worlds (Javornik 2016b; Porter and Heppelmann 2017; Yim, Chu, and Sauer 2017). The AR market in retailing is expected to reach USD 11.4 billion by 2025 with an annual growth rate of 39% (Markets and Markets 2019), which underlines the potential that retailers perceive in AR technologies (Piroth, Rüger-Muck, and Bruwer 2020). In particular, by enhancing consumers' shopping experience and reducing decision-making uncertainty, AR may relieve online retailers' mounting problems with low conversion rates, high shopping cart abandonment and high product return rates, all of which have a significant impact on financial performance (Janakiraman, Syrdal, and Freling 2016).

Augmented reality-branded apps may be used in a multi-channel strategy, in order to provide value to consumers that goes beyond information search and responds to consumers' experiential needs (Yrjölä, Spence, and Saarijärvi 2018). In addition to the

enhanced convenience in terms of savings in transportation and shopping time, AR helps consumers in their arduous task of mentally translating 2-D information into the 3-D world, by providing an interface that aligns with consumers' natural information processing (Hilken et al. 2017; Porter and Heppelmann 2017). Many retailers have incorporated AR as part of their service experience to focus on the interaction between consumers and retail frontline (Hilken et al. 2017). Harnessing the power of information in context, AR is changing how consumers shop (Cook et al. 2020). AR displays information in context that is aware of the consumer, its physical environment (Hilken et al. 2017), and enhances the felt presence of others (Grewal et al. 2020).

Three different modes of AR shopping coexist: augmentation of the self (e.g., YouCam Makeup; Park and Yoo 2020), augmentation of one's direct environment (e.g., IKEA Place; Rauschnabel, Felix, and Hinsch 2019), and augmentation of an object (e.g., Dessert menu; Heller et al. 2019a). The common uses of AR shopping are for glasses, makeup, and furniture (Cook et al. 2020), and these uses have also received the most research interest. AR technology helps consumers imagine how the cosmetics products or glasses look on themselves and to explore a new look or new color (Heller et al. 2019a), thus enabling them to browse through a large range of products more easily. Brands such as L'Oréal and Wayfair deliver 'try-before-you-buy' experiences that enable consumers to point their live cameras on themselves or into their homes and overlay 3-D virtual products (Power 2019). In addition to its look, how the furniture fits in the room is displayed through a true-to-scale visual representation of the room (Power 2019). Augmentation of an object has been implemented by Dulux, a company that allows users to pick a paint color for their wall and explore different options for the wall digitally; their app also enables sharing of the visualization as a video or picture. As consumers can see the information in context, it brings confidence into their purchase decisions (Power 2019). L'Oréal emphasizes that the AR experience is about personalized advice and sharing with the brands' experts. Therefore, L'Oréal provides tutorials to teach consumers how to apply makeup, and they have created a skin analyzer to improve consumers' skincare choices. In a promising development in social AR shopping, Dior uses Snapchat to implement augmented shopping, thereby enabling their wide audience to share their try-before-you-buy experiences and to receive suggestions from other consumers (Cohen 2020). Therefore, AR delivers a high-convenience, high-social-presence experience, which is crucial for the future of in-store technology (Grewal et al. 2020). Consequently, AR has the potential to improve consumers' ability to absorb product information more efficiently, to make better purchasing decisions, and to obtain enjoyment from enhanced shopping experiences (Dacko 2017; Huang and Liao 2015).

In response to the growing interest in the industry, scholarly attention to AR in retailing has increased in recent years. The empirical research has contributed to our knowledge of AR retailing applications from various aspects, such as technology acceptance (e.g., Huang and Liao 2015), consumer decision-making (e.g., Hilken et al. 2019), and user experience (Poushneh and Vasquez-Parraga 2017). However, the fragmentation of AR research into numerous literature streams and theoretical approaches makes it difficult to obtain a holistic picture of the current evidence, and there is an urgent need to provide an overview of AR research that would help scholars position their scholarly efforts within a broader realm of AR phenomena in retailing.

Against this backdrop, this study presents a literature review on empirical research conducted in the context of AR in retailing that aims to answer the following research questions. 1) What is the current state of research in the field of AR in retail? 2) What are the key consumer behavior phenomena related to AR in retailing? 3) What are the consequences of AR usage on consumer attitudes and behavior? 4) Which research gaps remain to be addressed? This research contributes to the existing literature by generating a systematic account of the literature and combining various literature streams into one framework that demonstrates the key consumer behavior phenomena related to AR in retailing. Based on in-depth investigation of current research, the study proposes a number of important future research avenues.

This article starts by explaining the background for the literature review and positioning it against previous AR-related literature reviews. Then, the methodological choices in the identification and selection of suitable studies for the review are explained. Next, this paper describes the theoretical approaches, contexts, and methods that have been used in AR research. Subsequently, a framework is presented that provides a comprehensive view of AR consumer behavior phenomena and analyzes in detail the studies that relate to these phenomena. Finally, the future research agenda, conclusion, and limitations are discussed.

## Background

AR and its applications in retail have developed rapidly due to rapid technological development, and the topic has naturally drawn attention in academic research as well. Unfortunately, the academic research is fragmented, probably due to the interdisciplinary origin of the topic (Bonetti, Warnaby, and Quinn 2018). As the body of academic research on AR in retail and e-commerce grows, there is a need for literature reviews to take stock of past research on the topic and to suggest an agenda for future research. Previous literature reviews on AR have focused on the differences between augmented reality, mixed reality and virtual reality (Flavián, Ibáñez-sánchez, and Carlos 2018), active and passive ingredients of AR marketing programs (Scholz and Smith 2016), mobile AR research at different levels of analysis (users, devices, and industry) (Liao 2019), and the role of AR in omnichannel experiences across the customer journey (Hilken et al. 2018). In light of our focus on consumer behavior with AR in retailing, we identify three reviews that are particularly relevant to our work. First, Javornik (2016a) reviews how media characteristics of AR are related to consumer responses. Second, Bonetti, Warnaby, and Quinn (2018) review AR research and organize it into three key debates in the field. Third, Caboni and Hagberg (2019) review literature on AR in retailing and identify three types of AR applications in retailing, as well as their benefits to consumers and retailers. In the remainder of this section, the foundational work presented in these reviews is summarized to explain how our review complements the lessons learned from them.

Javornik (2016a) grounds her work in communication literature and assembles a framework that depicts the media characteristics<sup>1</sup> of interactive media. In her review of studies, she organizes AR studies with these media characteristics and links the media characteristics to different consumer responses. As a conclusion in her review, Javornik (2016a) observes that AR differs from other interactive technologies in that augmentation (i.e., the 'ability to overlay physical environments with virtual elements', p. 259) is its



defining characteristic. Since Javornik's (2016a) review, augmentation and its qualities have been regarded as among the key features of AR (Rauschnabel, Felix, and Hinsch 2019; Poushneh 2018; Javornik 2016b). Javornik (2016a) concludes that other symptomatic aspects of AR are location-specificity, mobility, and machine- or space-related interactivity. The media characteristics or features such as environmental embedding and simulated physical control (Hilken et al. 2017), AR generation and AR transformation (Heller et al. 2019a), and vividness (Yim, Chu, and Sauer 2017) capture these aspects.

Bonetti, Warnaby, and Quinn (2018) chronologically review AR-related research in retail and provide a synthesis of key debates in the field. They structure the key debates into three categories: adoption, applications, and acceptance. The adoption-related debate revolves around retailers' adoption of AR technologies and the actual purposes and benefits of adopting the technologies. For example, does the use of technology merely capture consumers' attention, or is it truly a viable solution (Bonetti, Warnaby, and Quinn 2018)? Under applications, Bonetti, Warnaby, and Quinn (2018) recognize that AR applications in retail are mainly virtual fitting room applications, and they include the e-commerce context as well as in-store use of AR. The acceptance debate in Bonetti, Warnaby, and Quinn (2018) review mainly discusses the drivers of consumers' acceptance of AR technologies, in which the technology acceptance model (TAM, Davis 1989) plays the main role.

Caboni and Hagberg (2019) review literature on AR in retailing. They identify that the three major applications of AR in the retailing context are online web-based, in-store, and mobile applications. Furthermore, they synthesize the current knowledge of the potential value of AR for consumers and retailers. Caboni and Hagberg (2019) conclude that the benefits of AR for consumers include enhanced interaction with products and brands, augmentation of the shopping experience, and involvement in product personalization.

All of these reviews (Bonetti, Warnaby, and Quinn 2018; Caboni and Hagberg 2019; Javornik 2016a) are helpful in organizing the research literature on AR in retail. It seems that the emphasis is gradually changing from defining AR technology to a more nuanced understanding of its impact on consumer behavior in retail. Javornik's (2016a) work clearly distinguishes AR technology from other interactive technologies and recognizes the core features of AR that are linked to consumer responses. However, since the research literature is organized by the media characteristics of AR, Javornik's (2016a) review does not offer a clear synthesis of the actual consumer responses that can be achieved with AR. Bonetti, Warnaby, and Quinn (2018) review organizes literature on the research themes, which helps to distinguish between retailers' perspectives on AR and consumers' perspectives on accepting and adopting AR technologies. While these authors recognize that retailers might search for different consumer responses (e.g., mere attention vs. long-term benefits), they limit their analysis of consumer responses to technology acceptance. Caboni and Hagberg (2019) defined the three major types of AR applications and identified different types of value for consumers and retailers. Their review opens consumers' perspectives by increasing our understanding of the AR's value drivers for consumers in comparison to retailers. While Caboni and Hagberg's (2019) review does provide important insights on consumer behavior, it looks at consumer behavior from the retailer's point of view. Consequently, the focus is on retailers' desired outcomes, such as satisfaction and shopping experience.

Our literature review seeks to complement the reviews of Javornik (2016a), Bonetti, Warnaby, and Quinn (2018), and Caboni and Hagberg (2019) by examining AR in retail as a context and by organizing the literature according to different consumer behavior phenomena. Therefore, this review includes the consumer's role as a change agent (in comparison to retailers' desired outcomes) and identifies the research stream that focuses on the consumer's virtual self.

## Methodology

We identified articles that addressed the issue of consumer behavior with AR in retail by following the two-stage approach suggested by Webster and Watson (2002) and by Boell and Cecez-Kecmanovic (2015). In the first stage, relevant articles are identified by a keyword search, followed by more rigorous inclusion and exclusion processes in the selection of the articles in the second stage. In the first stage, we limited the search to journal articles because those findings are considered to be validated and are more likely to influence the academic and business fields (Podsakoff et al. 2005). We searched articles that were written in the English language in the online databases Scopus and Web of Science. The keyword searches were limited to the title and abstract of the articles. We adopted a broad range of terms coherent with our topic, both to limit irrelevant papers and to increase efficiency in identifying relevant papers. The searches were combinations of terms and are summarized in Table 1. In line with Boell and Cecez-Kecmanovic (2015), the selection of keywords evolved during the literature search process as we learned new terms that are commonly used in AR research (e.g., local presence, virtual try-on, and virtual fitting room).

In the second stage, we delimited the selection of articles in accordance with the following inclusion and exclusion criteria. First, we included only those articles that focused on AR in the context of retailing. Second, to ensure study quality, we included only articles listed in the Social Sciences Citation Index (SSCI) or the Science Citation Index Expanded (SCIE). Third, we excluded conceptual approaches because our review focuses on empirical studies. Fourth, we excluded studies in which it was unclear whether the respondents had ever actually used AR because AR shopping is still difficult to understand or is unknown for most consumers (Dacko 2017). This process resulted in the identification of 45 peer-reviewed articles (marked with an asterisk in the references) from 2014 to December 2019 (see Appendix A). The starting time frame was not fixed by default; the earliest empirical study that focuses on consumer behavior with AR in our search results is from 2014.

**Table 1.** Keyword association for identification of relevant literature.

First term	Second term
'augmented reality'	'marketing', 'shopping', 'retail*', 'e-commerce', 'consumer behavior', 'consumer engagement', 'experiential value', 'customer experience', 'point of sale'
'augmented reality'	'virtual shopping', 'virtual try-on', 'virtual fitting room', 'virtual mirror', 'experiential marketing', 'virtual product interaction', 'immersive store'
'marketing'	'virtual shopping', 'virtual try-on', 'virtual fitting room'
'experiential value'	'virtual shopping', 'virtual try-on', 'virtual fitting room'
'virtual mirror'	'consumers'
'local* presence'	'product'

**Note:** All entries are to be read as the association of the first term AND the second term (e.g., augmented reality AND 'marketing').

## Overview of reviewed articles

The reviewed articles adopt a wide range of theories to investigate AR in retailing. The most commonly used theoretical approaches are based on the TAM, socially situated cognition theory, and mental imagery theory. In Appendix B (Table B1), we present a list of theories along with their descriptions. Methodologically, the studies were survey-based (e.g., Huang and Liu 2014; Rese, Schreiber, and Baier 2014; Dacko 2017), or experimental (Beck and Crié 2018; Hilken et al. 2017; Javornik 2016b), or adopted multi-method approaches (Scholz and Duffy 2018). Notably, 23 studies used student samples (51%), and an additional seven studies used young adult samples (16%), which is typical of studies focusing on new technologies (Darley, Blankson, and Luethge 2010) because students and young adults are known to be more open to innovative technologies (Yim, Chu, and Sauer 2017). However, the disproportionate use of student and young adult samples (67% of studies) limits the generalizability of the findings to the broader population of online consumers (Verhagen et al. 2014). Existing studies also focus predominantly on hedonic and low-involvement product categories (e.g., fashion and entertainment) and interactions between the consumer and medium or brand, while consumer-consumer interaction facilitated by an AR app is seldom studied.

One notable issue is that AR is treated differently between studies. First, some studies treat AR as a set of features (e.g., interactivity and vividness) and investigate the impact of these features on dependent variables (Javornik 2016b). Second, some studies treat AR as a context to test the relationships of other variables and demonstrate the mechanisms that underlie the potential value of AR interfaces (Hilken et al. 2017; Heller et al. 2019a). Third, other studies compare the AR interface with standard web interfaces and investigate their differing impacts on dependent variables (e.g., Baek, Yoo, and Yoon 2018).

## Research streams of AR-enhanced consumer behavior in retailing

The literature analysis resulted in the identification of several subthemes related to consumer behavior with AR in retailing. These subthemes were subsequently categorized into four broader research streams. The first research stream addresses the utilitarian and hedonic value that AR creates, which explains the motivation to engage in and commit to AR shopping experiences (see Table A1). The second stream concerns decision-making and involves research on AR as an immersive experience, and related subthemes of local presence, flow, and mental imagery that facilitate decision-making and AR-enhanced shared decision-making (see Table A2). The third stream is labeled the virtual self and refers to the potential of the AR experience to trigger self-referencing and self-brand connection aspects, such as self-brand connection and self-brand congruity (see Table A3). The fourth stream addresses the negative effects of AR that entail concepts closely related to privacy concerns, such as perceived intrusiveness, discomfort, and users' control of access to personal information, as well as media irritation including issues about app quality. To conclude, we created a framework that highlights these four research streams as well as their antecedents and consequences that are commonly studied across the streams (Figure 1). Although the streams are not meant to be exclusive, the framework provides a meaningful synthesis of major research avenues.

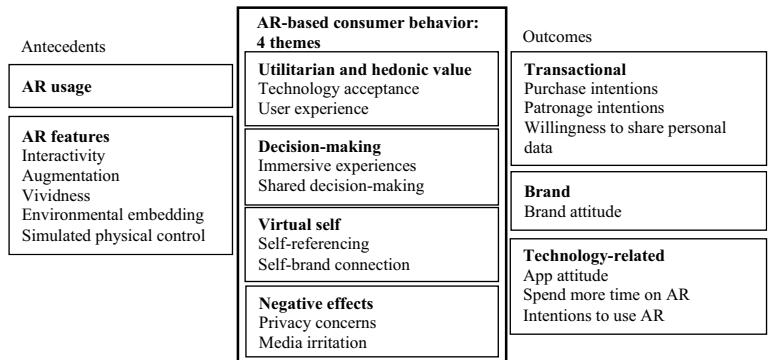


Figure 1. Framework of consumer behavior with AR.

**Utilitarian and hedonic value**

An AR-enhanced user experience can create hedonic and utilitarian value; the former refers to enjoyment, while the latter refers to the effectiveness of the experience (Rauschnabel, Felix, and Hinsch 2019; Poushneh 2018; Hilken et al. 2017). The role of AR in creating utilitarian and hedonic value is often studied via the TAM. The TAM has been extended to include utilitarian (e.g., ease of use, usefulness, and informativeness) and hedonic value (e.g., enjoyment) to predict intention to use AR (e.g., Pantano, Rese, and Baier 2017). Studies include more specific dimensions that rely on the user experience concept, such as quality of information, aesthetic quality, response time, and interactivity (Pantano, Rese, and Baier 2017). Overall, both utilitarian and hedonic value predict the intention to continue using AR (Rese, Schreiber, and Baier 2014; Rese et al. 2017; Yim and Park 2019; Pantano, Rese, and Baier 2017; Huang and Liao 2015). Furthermore, utilitarian and hedonic value positively impact brand-related and app-related attitudes (Rauschnabel, Felix, and Hinsch 2019). Consumers with high cognitive innovativeness are more likely to consistently use AR (Huang and Liao 2015). Yim and Park (2019) demonstrate that the possibility of using AR try-on apps in private space is highly valued by participants with an unfavorable body image. This study also suggests that participants with an unfavorable body image are less susceptible to lower interactivity and irritation in forming their intention to adopt AR and record greater media usefulness and enjoyment.

As a natural continuum for AR acceptance and adoption, this stream focuses on examining whether the use of AR and resulting utilitarian and hedonic experiences (or motives) increase consumers’ positive responses, such as satisfaction, purchase intentions, and patronage intentions (Dacko 2017; Poncin and Ben Mimoun 2014; Poushneh and Vasquez-Parraga 2017). AR enhances the holistic in-store experience, consumers’ positive emotions, and perceived value and leads to improved satisfaction and patronage intention (Poncin and Ben Mimoun 2014). AR increases curiosity about the product, which enhances exploratory behavior and drives patronage intentions and willingness to buy in an omnichannel context (Beck and Crié 2018). Watson, Alexander, and Salavati (2018) suggest that augmentation triggers affective responses, which then improve purchase intentions. Hedonic motivation moderates this effect.

### **Decision-making**

AR affects decision-making via immersive experiences and shared decision-making. Immersive experiences are facilitated by technology that offers more or better-quality sensory information and dissolves the boundary between the real and virtual worlds (Suh and Prophet 2018). As an immersive technology, AR provides believable product examination and enriches the decision-making process with additional visual and sensory information about products (Yim, Chu, and Sauer 2017). We find that AR enhances three distinct immersive experiences, namely, flow, local presence, and imagery.

Flow is a psychological state in which consumers feel focused immersion, enjoyment, control, curiosity, and temporal dissociation (Javornik 2016b; Huang and Liao 2017). Augmentation enhances flow and app-centric responses, such as app attitudes and recommendation intentions, but decreases cognitive responses (Javornik 2016b). Higher levels of flow increase the cognitive load of the immersive experience and make it difficult for consumers to process brand-related information (Javornik 2016b). Virtual liminoid theory suggests that the use of AR multisensory experience motivates consumers to decorate themselves (Huang and Liao 2017). Drawing on virtual liminoid theory, AR immerses users into flow and results in satisfaction and willingness to spend more time on AR (Huang and Liao 2017).

Presence has shifted from a sense of being present in a remote (virtual) location (see Huang and Liu 2014; Huang and Liao 2015) to sensing a virtual object close to consumers' real environment (see Hilken et al. 2017; Vonkeman, Verhagen, and Van Dolen 2017). For simplicity, we will call the AR type of object presence local presence. Local presence provides an authentic situated experience in which consumers believe they are actually trying on the offering (Hilken et al. 2017) in their real environment (Vonkeman, Verhagen, and Van Dolen 2017). AR visualization triggers local presence, increases experiential value, improves decision comfort and leads to purchase intentions (Hilken et al. 2017). Vonkeman, Verhagen, and Van Dolen (2017) show that by increasing product affect, local presence enhances impulse buying. By providing the feeling of being close to an offering, local presence responds to the main pitfalls of online shopping with regard to the mediated nature of the experience and, in turn, influences consumers' appreciation for the product because product information feels more direct and less risky (Verhagen et al. 2014; Vonkeman, Verhagen, and Van Dolen 2017) and is linked with increased purchase intentions and recommendation intentions (Hilken et al. 2017; Verhagen et al. 2014).

AR permits imagining using 'a visual, lasting 3-dimensional (3D) product representation against the backdrop of the natural world' (Heller et al. 2019a, 98), and the imagery persists after AR usage (Javornik 2016b, 996). Mental imagery is central to consumer decision-making, and preconsumption evaluation would not be possible without imagination (Heller et al. 2019a). Without touching and experiencing the product directly, generating mental images of the usability of a product is challenging (Heller et al. 2019a). Heller et al. (2019a) show that AR offloads two distinct stages of mental imagery (i.e., imagery generation and transformation), enhances imagery processing fluency, and leads to choice. Park and Yoo (2020) show that interactivity enhances mental imagery elaboration and quality and results in positive attitudes and intentions toward products and apps. In addition, sensory modalities such as touch enhance mental imagery (Heller

et al. 2019b). The effect of improved cognitive processing on decision comfort is stronger for contextual products (Heller et al. 2019a). Regarding consumers' characteristics, visualizers benefit less from local presence in terms of utilitarian value perceptions (Hilken et al. 2017), and spatial visualizers benefit less than object visualizers in terms of processing fluency, decision comfort, and WOM intentions (Heller et al. 2019a).

The extant literature discusses the influence of social conversation on retail shopping (X. Zhang, Li and Burke 2018). However, there is scarce research addressing AR optimal configuration for shared decision-making and its impact on consumer behavior (Hilken et al. 2019). Drawing on situated cognition theory (Semin and Smith 2013), researchers show that AR reduces cognitive load and enhances fluency and comfort, resulting in enhanced patronage and purchase intentions (Hilken et al. 2019, 2017; Fan et al. 2020). Hilken et al. (2019) find that the optimal configuration of social AR creates a sense of social empowerment for the recommender and enhances the recommendation comfort. Their findings show that the decision comfort retrieved from social empowerment decreases if the recommender is worried that he or she might make a negative impression on the decision maker. Furthermore, they find evidence that AR creates personal choice engagement for recommenders. They also find that, for decision makers, social empowerment enhances choice, and makes them more likely to follow the recommender's opinion. This effect decreases if the recommender exhibits a strong persuasion goal.

### **Virtual self**

AR enables consumers to access their sense of self because consumers can explore different personality possibilities and are motivated to decorate their virtual self (Huang and Liao 2017) and to develop their ideal self (Huang 2018). Self-referencing is a mental simulation of imagining oneself using a product (Huang 2019), in which consumers process information by relating it to their self-structure or aspects of it (Burnkrant and Unnava 1995). Concretely, when using AR makeover apps, consumers see their real body and virtual product information over it, which triggers self-focused thoughts and connects consumers' self with brands (Baek, Yoo, and Yoon 2018; Smink et al. 2019; Huang 2019; Phua and Kim 2018). Self-referencing is one of the main mechanisms for shaping the relationship between consumers and brands (Huang 2019).

The self-focused perspective on humanizing brands is composed of two related dimensions: 'consumers may perceive a brand as being "like me" (having brand-self congruity) or as being "close to me" as a person (having brand-self connections)' (MacInnis and Folkes 2017, 363). With AR, self-brand congruity enhances brand attitudes and purchase intentions (Phua and Kim 2018). MacInnis and Folkes (2017) propose that, as self-brand congruity increases, the brand becomes part of the self (drawing on the extended self; Belk 1988); thus, self-brand connection refers to the extent to which individuals use brands to reinforce and express their self-identity. Baek, Yoo, and Yoon (2018) demonstrate that AR-based self-referencing enhances self-brand connection and purchase intentions. Furthermore, their research suggests that more narcissistic consumers report stronger self-brand connections because narcissists who view themselves in AR are more likely to rely on self-referent cues.

### **Negative effects**

The main perils of AR to be addressed are privacy concerns and media irritation. According to Poushneh (2018), AR enhances consumer satisfaction (vs. product pictures on websites) because consumers positively judge the trade-off between the level of augmentation quality and the value they attribute to the control of their personal information (Poushneh 2018). The study follows equity theory to explain that, on the one hand, compared to non-AR product presentation with a picture of the consumer's own face or a model, the AR virtual dressing room is more informative and fun. On the other hand, compared with different AR apps, a self-viewing app that augments the faces of consumers raises the highest privacy concerns. Thus, Poushneh (2018) confirms a burden of AR when it needs to film the user's own body or direct environment. The positive effect of decision comfort is attenuated by customers' privacy concerns (Hilken et al. 2017). In stores, consumers' discomfort caused by a lack of privacy in AR negatively impacts brand attitudes (Van Esch et al. 2019). According to Poushneh (2018), AR and non-AR pictures of consumers' own faces are perceived as more intrusive than model pictures. Although both own-face conditions (AR and picture) are deemed more intrusive, this does not lead to reactance; surprisingly, it leads to greater willingness to disclose personal information (Smink et al. 2019). Therefore, the positive effects of AR seem to outweigh the potential negative effects.

Compared to traditional ecommerce websites, AR is considered more novel and interactive but creates more media irritation (Yim and Park 2019). To be used in the long term, the technology speed and maturity level of AR need improvements (Rese et al. 2017), and AR content needs to be more realistic and accurately represent sizes (Yim and Park 2019). AR is significantly better at creating immersion, for consumers with low media experience (Yim, Chu, and Sauer 2017), and perceptual-specific curiosity is dependent on the perception of a novel and complex system (Beck and Crié 2018).

### **Future research agenda**

Below, we propose avenues for future research to clarify the effects of AR into four research streams, including a new focus on customer-to-customer communication in a social AR setting.

The first stream differentiates between utilitarian and hedonic experiences or motivations for adopting and using AR technology. This stream contributes to knowledge of AR in retail by showing that the pursuit of both utilitarian and hedonic experiences and value drives the acceptance and adoption of AR technology (Rese, Schreiber, and Baier 2014; Pantano, Rese, and Baier 2017). Furthermore, the findings within this research stream provide empirical evidence that the use of AR technology and the consequent utilitarian and hedonic experiences are related to positive outcomes, such as brand attitudes and purchase intentions (McLean and Wilson 2019; Plotkina and Saurel 2019). Within this research stream, the natural continuum is to examine the boundary conditions under which AR adoption and its positive consequences are more likely to occur. Some recent studies provide initial insights into this issue by examining consumer characteristics, such as cognitive innovativeness (Huang and Liao 2015) or body image (Yim and Park 2019). Of course, more research on the moderating effects of consumer characteristics, such as



personality and demographics, is needed. Additionally, other contextual moderators should be examined. Thus far, AR sensory marketing is mostly visual, although other senses (e.g., sound, touch, smell) may influence the acquisition of cognitive information about online and offline offerings and influence consumer behavior (Marketing Science Institute 2018). AR applications are typically brand-based content; thus, the search is limited within brands, which can reduce the number of products with similar attributes. Future research should determine whether AR applications should be delivered by retailers (e.g., Amazon, Marks and Spencer) or by manufacturers (e.g., L'Oréal, Unilever) and what product presentation would be an optimal choice set (e.g., comparable vs. non-comparable products, small vs. large choice set). Therefore, we propose that one key research question for future research on AR in retail is the following:

*RQ1: What are the boundary conditions under which AR technology a) is adopted by consumers and b) leads to positive brand outcomes?*

Another question that arises from the knowledge provided by the first research stream is how AR technology enables these positive outcomes. Research streams two (i.e., decision-making) and three (i.e., virtual self) in our review already pave the way to answering these questions. The research stream that examines decision-making appears to take a more transactional approach with a focus on purchase decisions, whereas the research stream that focuses on the 'virtual self' examines mechanisms by which the use of AR technology shapes consumers' brand relationships. Both streams suggest that AR technology use enhances processes of imagination (i.e., imagery, Park and Yoo 2020; local presence, Verhagen et al. 2014; self-referencing, Huang 2019). Past studies confirm that enhanced imagination influences both decision-making at the transaction level (e.g., Hilken et al. 2017; Heller et al. 2019a) and the formation of brand relationships in the long term (e.g., Huang 2019). However, research on the decision-making stream also recognizes that AR may immerse users in a psychological state of flow (Huang and Liao 2017), which may hinder the processing of brand-related information (Javornik 2016b). Clearly, more research is needed to understand the interplay of enhanced imagination and flow in shaping consumers' decisions and brand relationships.

*RQ2: How, when, and why does AR technology use lead to a) enhanced imagination and b) flow?*

*RQ3: How, when and why are imagination processes and the state of flow related to both a) transactional decision-making and b) consumer-brand relationships?*

Because AR enhances self-referencing, the tendency to humanize brands may be stronger. Previous research in AR has examined the self-focused perspective on humanizing brands. The same drivers of humanizing brands (sociality, effectance, and the elicitation of agent knowledge) in the self-focused perspective can enhance the relationship-focused perspective; furthermore, the self-focused perspective influences the relationship-focused perspective (MacInnis and Folkes 2017). AR influences the view that brands are like humans (anthropomorphism; Van Esch et al. 2019) or are like oneself (self-brand connection; Baek, Yoo, and Yoon 2018) and that brands are in a relationship with oneself (brand love, Huang 2019). Another relationship of interest is brand attachment. Following MacInnis and Folkes (2017), as consumers experience a strong self-brand connection, they are likely to become attached to a brand as a relationship partner. Studying the extent to which AR creates brand



attachment entails complementing current knowledge on self-brand connection with prominence (C. W. Park et al. 2010). Prominence refers to the salience in consumers' memory of the cognitive and emotional bond between consumers and brands (MacInnis and Folkes 2017). Strong brand attachment may motivate consumers to invest (time, money, reputation) in the brand. Brand attachment is linked to transactional outcomes, such as brand loyalty behaviors, and to relationship outcomes, such as brand advocacy (C. W. Park et al. 2010).

*RQ4: How, when, and why do the processes of humanizing brands lead to a) transactional outcomes and b) consumer-brand relationships?*

An interesting emerging theme in both decision-making and virtual self-research streams is the social use of AR. Shoppers often wish to conduct their shopping with others and may use AR to share their perspective and enrich the decision-making process. For example, shopping with others occurs when decision makers ask for opinions on the best paint color from a recommender through AR layers (Hilken et al. 2019), and when groups interact with a product to make the best car design (Carrozzi et al. 2019). Research on shared decision-making shows that consumers can obtain recommendations and feedback from their peers by sharing their AR images. Decision makers feel more empowered when they receive image-enhanced recommendations (Hilken et al. 2019). Furthermore, researchers find that shared decision-making in AR creates social empowerment and results in positive transactional outcomes, namely, choice for the decision maker and enhanced desire for the product for recommenders.

We believe that the social use of AR is also relevant as a channel for expressing the self. Belk's (2013) extended self in a digital world comprises sharing and co-construction of the self. Sharing AR holograms may contribute to consumers' personality exploration, whether in a private mode (only with friends and family) to enhance decision-making, or in a public mode (accessible to anonymous viewers) to enhance the self and other-oriented perceived value (ethics and connectedness, Salo et al. 2013). When an AR hologram is shared, consumers using AR simultaneously maintain social differentiation and assimilate with peers (Carrozzi et al. 2019). The results demonstrate that the connectivity of AR customization enables users to compromise on some design aspects (color, location) while also expressing their personal preferences. In addition, whether consumers use personal or shared devices influences whether consumers look for differentiation or assimilation. At the same time, consumers with AR can receive advice from 'purchase pals' online or offline. 'The girls in the dressing room act as extended self "purchase pals" in the traditional sense of the term' (Belk 2013, 487). 'Purchase pals' serve a similar role of reassurance when using AR. Social AR entails opportunities for future research on the co-construction of the self with other entities such as brands and possessions. Disinhibition online makes it easier for friends and anonymous viewers to provide feedback for the co-construction of the self. Building an aggregate extended self may take a new form as holograms can be a collaborative project among friends, families or anonymous viewers. Thus, the boundaries between the self and other entities are less clear; for example, consumers report a dissolution of self-brand boundaries (Scholz and Duffy 2018). Further research should examine consumer-consumer interaction and how

the aggregate self, of two 'purchase pals' or a larger social group, may incorporate the brand into consumers' self-representations.

*RQ5: How, when and why do consumers share their AR images, and how does this change consumer behavior?*

Most studies in the first three research streams focus on examining the positive effects of AR technology. The fourth research stream, the negative effects, raises issues such as privacy concerns in AR usage. It is crucial to investigate how the social acceptance of AR will constrain the use of AR holograms if consumers think their information is continuously being collected. Privacy concerns with AR are particularly obvious because the camera needs to be pointed at the content it augments, such as consumers' bodies or homes, and may retrieve more contextual information (notably, face recognition) than desired and used for information filtering. In the context of diminished trust among e-commerce consumers (Reibstein, Day, and Wind 2009), it is crucial to study how AR can improve online trust-building and diminish privacy concerns. Research is especially needed to clarify findings concerning the novelty effect of AR, because some studies have found an impact (Scholz and Duffy 2018) while others have rejected its confounding effect (Heller et al. 2019a; Carrozzi et al. 2019).

It seems that most studies that examine negative effects related to AR actually examine factors that might hinder the usage of AR. The use of AR technology, especially its social use, may raise new problematic issues. For example, Vonkeman, Verhagen, and Van Dolen (2017) find that AR technology enhances impulse buying, which might lead to negative emotions such as guilt and shame (Yi and Baumgartner 2011). Sharing holograms in the virtual world may create a sense of shared digital possessions or a shared sense of space and may be similar to online brand communities (Carrozzi et al. 2019). Jussila et al. (2015) note that such a sense of possession (i.e., psychological ownership) may lead to property rights violations. Potentially, social AR might give rise to bullying behaviors, which are harmful for both consumers and brands (Breitsohl, Roschk, and Feyertag 2018). We encourage more research on potentially problematic outcomes of AR technology usage.

*RQ6: When, how, and why does AR technology use lead to negative consequences?*

## Conclusions

The focus of this study was to answer the following questions. 1) What is the current state of research in the field of AR in retail? 2) What are the key consumer behavior phenomena related to AR in retailing? 3) What are the consequences of AR usage on consumer attitudes and behavior? 4) Which research gaps remain to be addressed? To do so, we conducted a systematic literature review and organized the results in a conceptual framework. Four themes emerge from our analysis that show the potential of AR to create hedonic and utilitarian value, improve decision-making, and to enhance personalization of the virtual self.

Then, this study warns about negative effects of AR usage. Research is needed in each theme, notably, the increasingly social aspect of AR should be researched further.

Our systematic review, like any review, has several limitations (Boell and Cecez-Kecmanovic 2015). First, the literature examined was chosen purely through the inclusion and exclusion criteria. The implication of this choice is that we might have missed some of

the uses of AR because of this selection. Second, the literature streams are fragmented and interdisciplinary, and we focus on consumer research. The last difficulty is the lack of clarity in naming the technology used; a virtual try-on can be fully virtual, based on virtual reality, or based on AR.

## Note

1. The media characteristics in Javornik's (2016a) study are interactivity, hypertextuality, modality, connectivity, location-specificity, mobility, and virtuality.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Notes on contributors

**Virginie Lavoye** (Master's degree) is a junior researcher and a PhD candidate at LUT University, School of Business and Management. Her research focuses on digital marketing and consumer behavior and specializes in interactions between augmented reality and consumers.

**Joel Mero** is an Assistant Professor of Marketing at University of Jyväskylä (School of Business and Economics). His research interests focus on the use of data and new technologies in marketing management. His previous research has been published in *Industrial Marketing Management*, *Electronic Markets*, and *Marketing Management Journal*, among others. His teaching focuses on digital marketing strategies and tactics.

**Anssi Tarkiainen** is an Associate Professor (tenure track) in Digital Marketing in LUT School of Business and Management. Overarching theme in his research is human behavior and decision-making of individuals and groups, which he has studied in the contexts of consumer behavior, sales & marketing management, and strategy. He teaches marketing analytics and digital marketing.

## ORCID

Virginie Lavoye  <http://orcid.org/0000-0002-6586-8324>

## References

- Belk, R. W. 1988. "Possessions and the Extended Self." *Journal of Consumer Research* 15 (2): 139–168. doi:10.1086/209154.
- Belk, R. W. 2013. "Extended Self in a Digital World." *Journal of Consumer Research* 40 (3): 477–500. doi:10.1086/671052.
- Boell, S. K., and D. Cecez-Kecmanovic. 2015. "On Being 'Systematic' in Literature Reviews in IS." *Journal of Information Technology* 30 (2): 161–173. doi:10.1057/jit.2014.26.
- \*Brito, P. Q., J. Stoyanova, and A. Coelho. 2018. "Augmented Reality versus Conventional Interface: Is There Any Difference in Effectiveness?" *Multimedia Tools and Applications* 77 (6): 7487–7516. doi:10.1007/s11042-017-4658-1.
- \*Brenngman, M., K. Willems, and H. Van Kerrebroeck. 2018. "Can't Touch This: The Impact of Augmented Reality versus Touch and Non-Touch Interfaces on Perceived Ownership." *Virtual Reality* 23: 269–280. doi:10.1007/s10055-018-0335-6

- \*Bonnin, G. 2020. "The Roles of Perceived Risk, Attractiveness of the Online Store and Familiarity with AR in the Influence of AR on Patronage Intention." *Journal of Retailing and Consumer Services* 52: 101938. 2019.101938. doi:10.1016/j.jretconser.2019.101938.
- Bonetti, F., G. Warnaby, and L. Quinn. 2018. "Augmented Reality and Virtual Reality in Physical and Online Retailing: A Review, Synthesis and Research Agenda." In: Jung T., tom Dieck M. (eds) *Augmented Reality and Virtual Reality*. Progress in IS. Springer, Cham. 119–132. doi:10.1007/978-3-319-64027-3\_9
- Breitsohl, J., H. Roschk, and C. Feyertag. 2018. "Consumer Brand Bullying Behaviour in Online Communities of Service Firms." In: Bruhn M., Hadwich K. (eds) *Service Business Development*. Springer Gabler, Wiesbaden. 289–312. doi:10.1007/978-3-658-22424-0\_13
- Burnkrant, R. E., and H. R. Unnava. 1995. "Effects of Self-Referencing on Persuasion." *Journal of Consumer Research* 22 (1): 17–26. doi:10.1086/209432
- Caboni, F., and J. Hagberg. 2019. "Augmented Reality in Retailing: A Review of Features, Applications and Value." *International Journal of Retail and Distribution Management* 47 (11): 1125–1140. doi:10.1108/IJRDM-12-2018-0263.
- \*Dacko, S. G. 2017. "Enabling Smart Retail Settings via Mobile Augmented Reality Shopping Apps." *Technological Forecasting and Social Change* 124: 243–256. doi:10.1016/j.techfore.2016.09.032.
- \*Carrozzi, A., M. Chylinski, J. Heller, T. Hilken, D. I. Keeling, and K. De Ruyter. 2019. "What's Mine Is a Hologram? How Shared Augmented Reality Augments Psychological Ownership." *Journal of Interactive Marketing* 48: 71–88. Elsevier Inc. doi:10.1016/j.intmar.2019.05.004
- Cohen, D. 2020. „Dior Lets Snapchatters Virtually Try On Its New B27 Sneaker,, AdWeek. Accessed 08/02/2021. <https://www.adweek.com/media/dior-lets-snapchatters-virtually-try-on-its-new-b27-sneaker/>
- \*Baek, T. H., C. Y. Yoo, and S. Yoon. 2018. "Augment Yourself through Virtual Mirror: The Impact of Self-Viewing and Narcissism on Consumer Responses." *International Journal of Advertising* 37 (3): 421–439. doi:10.1080/02650487.2016.1244887
- \*Beck, M., and D. Crié. 2018. "I Virtually Try It . . . I Want It! Virtual Fitting Room: A Tool to Increase on-Line and off-Line Exploratory Behavior, Patronage and Purchase Intentions." *Journal of Retailing and Consumer Services* 40: 279–286. doi:10.1016/j.jretconser.2016.08.006
- Cook A.V., L. Ohri, L. Kusumoto, C. Reynolds, and E. Schwertzel. 2020. „Augmented shopping: The quiet revolution,,. Deloitte Insight. Accessed 08/02/2021. <https://www2.deloitte.com/us/en/insights/topics/emerging-technologies/augmented-shopping-3d-technology-retail.html>.
- Darley, W. K., C. Blankson, and D. J. Luethge. 2010. "Toward an Integrated Framework for Online Consumer Behavior and Decision Making Process: A Review." *Psychology and Marketing* 27 (2): 94–116. doi:10.1002/mar.20322.
- Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." *MIS Quarterly* 13 (3): 319–340. doi:10.2307/249008.
- \*Fan, X., Z. Chai, N. Deng, and X. Dong. 2020. "Adoption of Augmented Reality in Online Retailing and Consumers' Product Attitude: A Cognitive Perspective." *Journal of Retailing and Consumer Services* 53: 101986. Elsevier Ltd. doi:10.1016/j.jretconser.2019.101986.
- Flavián, C., S. Ibáñez-Sánchez, and C. Orús. 2018. "The Impact of Virtual, Augmented and Mixed Reality Technologies on the Customer Experience." *Journal of Business Research* 100: 1–14. doi:10.1016/j.jbusres.2018.10.050.
- Grewal, D., S. M. Noble, A. L. Roggeveen, and J. Nordfalt. 2020. "The Future of In-store Technology." *Journal of the Academy of Marketing Science* 48 (1): 96–113. doi:10.1007/s11747-019-00697-z.
- \*Hilken, T., K. De Ruyter, M. Chylinski, D. Mahr, and D. I. Keeling. 2017. "Augmenting the Eye of the Beholder: Exploring the Strategic Potential of Augmented Reality to Enhance Online Service Experiences." *Journal of the Academy of Marketing Science* 45 (6): 884–905. doi:10.1007/s11747-017-0541-x.
- \*Huang, T.-L. 2018. "Creating a Commercially Compelling Smart Service Encounter." *Service Business* 12 (2): 357–377. doi:10.1007/s11628-017-0351-8.
- Hilken, T., J. Heller, M. Chylinski, D. I. Keeling, D. Mahr, and K. De Ruyter. 2018. "Making Omnichannel an Augmented Reality: The Current and Future State of the Art." *Journal of Research in Interactive Marketing* 12 (4): 509–523. doi:10.1108/JRIM-01-2018-0023.

- \*Huang, T.-L. 2019. "Psychological Mechanisms of Brand Love and Information Technology Identity in Virtual Retail Environments." *Journal of Retailing and Consumer Services* 47: 251–264. (July 2018). Elsevier Ltd. doi:10.1016/j.jretconser.2018.11.016 .2018.11.016. . doi:
- \*Hilken, T., D. I. Keeling, K. De Ruyter, D. Mahr, and M. Chylinski. 2019. "Seeing Eye to Eye: Social Augmented Reality and Shared Decision Making in the Marketplace." *Journal of the Academy of Marketing Science* 48 (2): 143–164. doi:10.1007/s11747-019-00688-0.
- \*Heller, J., M. Chylinski, K. De Ruyter, D. Mahr, and D. I. Keeling. 2019a. "Let Me Imagine that for You: Transforming the Retail Frontline through Augmenting Customer Mental Imagery Ability." *Journal of Retailing* 95 (2): 94–114. New York University. doi:10.1016/j.jretai.2019.03.005
- \*Heller, J., M. Chylinski, K. De Ruyter, D. Mahr, and D. I. Keeling. 2019b. "Touching the Untouchable: Exploring Multi-Sensory Augmented Reality in the Context of Online Retailing." *Journal of Retailing* 95 (4): 219–234. New York University. doi:10.1016/j.jretai.2019.10.008.
- \*Hinsch, C., R. Felix, and P. A. Rauschnabel. 2020. "Nostalgia Beats the Wow-Effect: Inspiration, Awe and Meaningful Associations in Augmented Reality Marketing." *Journal of Retailing and Consumer Services* 53: 101987. Elsevier Ltd. doi:10.1016/j.jretconser.2019.101987.
- \*Huang, T.-L., and S. Liao. 2015. "A Model of Acceptance of Augmented-Reality Interactive Technology: The Moderating Role of Cognitive Innovativeness." *Electronic Commerce Research* 15 (2): 269–295. doi:10.1007/s10660-014-9163-2.
- \*Huang, T.-L., and F. H. Liu. 2014. "Formation of Augmented-Reality Interactive Technology's Persuasive Effects from the Perspective of Experiential Value." *Internet Research* 24 (1): 82–109. doi:10.1108/IntR-07-2012-0133.
- \*Huang, T.-L., S. Mathews, and C. Y. Chou. 2019. "Enhancing Online Rapport Experience via Augmented Reality." *Journal of Services Marketing* 33 (7): 851–865. doi:10.1108/JSM-12-2018-0366.
- \*Huang, T.-L., and S.-L. Liao. 2017. "Creating E-Shopping Multisensory Flow Experience through Augmented-Reality Interactive Technology." *Internet Research* 27 (2): 449–475. doi:10.1108/IntR-11-2015-0321.
- Janakiraman, N., H. A. Syrdal, and R. Freling. 2016. "The Effect of Return Policy Leniency on Consumer Purchase and Return Decisions: A Meta-Analytic Review." *Journal of Retailing* 92 (2): 226–235. doi:10.1016/j.jretai.2015.11.002
- Javornik, A. 2016a. "Augmented Reality: Research Agenda for Studying the Impact of Its Media Characteristics on Consumer Behaviour." *Journal of Retailing and Consumer Services* 30: 252–261. Elsevier. doi:10.1016/j.jretconser.2016.02.004.
- \*Javornik, A. 2016b. "It's an Illusion, but It Looks Real! Consumer Affective, Cognitive and Behavioural Responses to Augmented Reality Applications." *Journal of Marketing Management* 32 (9–10): 987–1011. doi:10.1080/0267257X.2016.1174726.
- Jussila, I., A. Tarkiainen, M. Sarstedt, and J. F. Hair. 2015. "Individual Psychological Ownership: Concepts, Evidence, and Implications for Research in Marketing." *Journal of Marketing Theory and Practice* 23 (2): 121–139. doi:10.1080/10696679.2015.1002330.
- Liao, T. 2019. "Future Directions for Mobile Augmented Reality Research: Understanding Relationships between Augmented Reality Users, Nonusers, Content, Devices, and Industry." *Mobile Media & Communication* 7 (1): 131–149. doi:10.1177/2050157918792438.
- MacInnis, D. J., and V. S. Folkes. 2017. "Humanizing Brands: When Brands Seem to Be like Me, Part of Me, and in a Relationship with Me." *Journal of Consumer Psychology* 27 (3): 355–374. Society for Consumer Psychology. doi:10.1016/j.jcps.2016.12.003.
- MarketsandMarkets. 2019. "Augmented Reality in Retail Market Worth \$11.4 Billion by 2025." Accessed 19.2.2020. <https://www.marketsandmarkets.com/PressReleases/augmented-reality-retail.asp>
- Marketing Science Institute, 2018. "Research Priorities 2018-2020." <https://www.msi.org/articles/marketers-top-challenges-2018-2020-research-priorities/>.
- \*McLean, G., and A. Wilson. 2019. "Shopping in the Digital World: Examining Customer Engagement through Augmented Reality Mobile Applications." *Computers in Human Behavior* 101: 210–224. (July). Elsevier. doi:10.1016/j.chb.2019.07.002.
- Park, C. W., D. J. Macinnis, J. Priester, A. B. Eisingerich, and D. Iacobucci. 2010. "Brand Attachment and Brand Attitude Strength: Conceptual and Empirical Differentiation of Two Critical Brand Equity Drivers." *Journal of Marketing* 74 (6): 1–17. doi:10.1509/jmkg.74.6.1.

- \*Pantano, E., A. Rese, and D. Baier. 2017. "Enhancing the Online Decision-Making Process by Using Augmented Reality: A Two Country Comparison of Youth Markets." *Journal of Retailing and Consumer Services* 38: 81–95. doi:10.1016/j.jretconser.2017.05.011.
- \*Park, M., and J. Yoo. 2020. "Effects of Perceived Interactivity of Augmented Reality on Consumer Responses: A Mental Imagery Perspective." *Journal of Retailing and Consumer Services* 52: 101912. doi:10.1016/j.jretconser.2019.101912.
- \*Phua, J., and J. (Jay) Kim. 2018. "Starring in Your Own Snapchat Advertisement: Influence of Self-Brand Congruity, Self-Referencing and Perceived Humor on Brand Attitude and Purchase Intention of Advertised Brands." *Telematics and Informatics* 35 (5): 1524–1533. doi:10.1016/j.tele.2018.03.020.
- Piroth, P., E. Rüger-Muck, and J. Bruwer. 2020. "Digitalisation in Grocery Retailing in Germany: An Exploratory Study." *The International Review of Retail, Distribution and Consumer Research* 1–19. doi:10.1080/09593969.2020.1738260.
- \*Plotkina, D., and H. Saurel. 2019. "Me or Just like Me? the Role of Virtual Try-on and Physical Appearance in Apparel M-Retailing." *Journal of Retailing and Consumer Services* 51: 362–377. doi:10.1016/j.jretconser.2019.07.002.
- Podsakoff, P. M., S. B. Mackenzie, D. G. Bachrach, and N. P. Podsakoff. 2005. "The Influence of Management Journals in the 1980s and 1990s." *Strategic Management Journal* 26 (5): 473–488. doi:10.1002/smj.454.
- \*Poncin, I., and M. S. Ben Mimoun. 2014. "The Impact of "E-atmospherics" on Physical Stores." *Journal of Retailing and Consumer Services* 21 (5): 851–859. doi:10.1016/j.jretconser.2014.02.013.
- Porter, M. E., and J. E. Heppelmann. 2017. "Why Every Organization Needs an Augmented Reality Strategy." *Harvard Business Review* 95 (6): 46–57.
- \*Poushneh, A., and A. Z. Vasquez-Parraga. 2017. "Discernible Impact of Augmented Reality on Retail customer's Experience, Satisfaction and Willingness to Buy." *Journal of Retailing and Consumer Services* 34: 229–234. doi:10.1016/j.jretconser.2016.10.005.
- \*Poushneh, A. 2018. "Augmented Reality in Retail: A Trade-off between user's Control of Access to Personal Information and Augmentation Quality." *Journal of Retailing and Consumer Services* 41: 169–176. doi:10.1016/j.jretconser.2017.12.010.
- Power, D. 2019. "Augmented Reality: A Realistic 'Try-Before-You-Buy' Visual Experience Drives the Evolution of Brands Like Wayfair,," US chamber of commerce. Accessed 08/02/2021. <https://www.uschamber.com/co/good-company/launch-pad/augmented-reality-transforming-wayfair?cid=search>
- \*Rauschnabel, P. A., R. Felix, and C. Hinsch. 2019. "Augmented Reality Marketing: How Mobile AR-Apps Can Improve Brands through Inspiration." *Journal of Retailing and Consumer Services* 49: 43–53. July 2019. doi:10.1016/j.jretconser.2019.03.004.
- Reibstein, D. J., G. Day, and J. Wind. 2009. "Guest Editorial: Is Marketing Academia Losing Its Way?" *Journal of Marketing* 73 (4): 1–3. doi:10.1509/jmkg.73.4.001.
- \*Rese, A., S. Schreiber, and D. Baier. 2014. "Technology Acceptance Modeling of Augmented Reality at the Point of Sale: Can Surveys Be Replaced by an Analysis of Online Reviews?" *Journal of Retailing and Consumer Services* 21 (5): 869–876. doi:10.1016/j.jretconser.2014.02.011.
- \*Rese, A., D. Baier, A. Geyer-Schulz, and S. Schreiber. 2017. "How Augmented Reality Apps are Accepted by Consumers: A Comparative Analysis Using Scales and Opinions." *Technological Forecasting and Social Change* 124: 306–319. doi:10.1016/j.techfore.2016.10.010.
- Salo, M., T. Olsson, M. Makkonen, A. Hautamäki, and L. Frank. 2013. "Consumer Value of Camera-Based Mobile Interaction with the Real World." *Pervasive and Mobile Computing* 9 (2): 258–268. doi:10.1016/j.pmcj.2012.06.001.
- \*Scholz, J., and K. Duffy. 2018. "We are at Home: How Augmented Reality Reshapes Mobile Marketing and Consumer-Brand Relationships." *Journal of Retailing and Consumer Services* 44: 11–23. doi:10.1016/j.jretconser.2018.05.004.
- Scholz, J., and A. N. Smith. 2016. "Augmented Reality: Designing Immersive Experiences That Maximize Consumer Engagement." *Business Horizons* 59 (2): 149–161. doi:10.1016/j.bushor.2015.10.003.
- Semin, G. R., and E. R. Smith. 2013. "Socially Situated Cognition in Perspective." *Social Cognition* 31 (2): 125–146. doi:10.1521/soco.2013.31.2.125.



- \*Smink, A. R., S. Sanne Frowijn, E. A. Van, G. Van Noort, and P. C. Neijens. 2019. "Try Online before You Buy: How Does Shopping with Augmented Reality Affect Brand Responses and Personal Data Disclosure." *Electronic Commerce Research and Applications* 35: 100854. doi:10.1016/j.elerap.2019.100854.
- \*Song, H. K., E. Baek, and H. J. Choo. 2019. "Try-on Experience with Augmented Reality Comforts Your Decision: Focusing on the Roles of Immersion and Psychological Ownership." *Information Technology and People* 33 (4): 1214–1234. doi:10.1108/ITP-02-2019-0092
- Suh, A., and J. Prophet. 2018. "The State of Immersive Technology Research: A Literature Analysis." *Computers in Human Behavior* 86: 77–90. doi:10.1016/j.chb.2018.04.019.
- \*Verhagen, T., C. Vonkeman, F. Feldberg, and P. Verhagen. 2014. "Present It like It Is Here: Creating Local Presence to Improve Online Product Experiences." *Computers in Human Behavior* 39: 270–280. doi:10.1016/j.chb.2014.07.036.
- \*Verhagen, T., C. Vonkeman, and W. Van Dolen. 2016. "Making Online Products More Tangible: The Effect of Product Presentation Formats on Product Evaluations." *Cyberpsychology, Behavior, and Social Networking* 19 (7): 460–464. doi:10.1089/cyber.2015.0520.
- \*Vonkeman, C., T. Verhagen, and W. Van Dolen. 2017. "Role of Local Presence in Online Impulse Buying." *Information and Management* 54 (8): 1038–1048. doi:10.1016/j.im.2017.02.008.
- \*Watson, A., B. Alexander, and L. Salavati. 2018. "The Impact of Experiential Augmented Reality Applications on Fashion Purchase Intention." *International Journal of Retail & Distribution Management* 48 (5): 433–451. doi:10.1108/IJRDM-06-2017-0117
- \*Van Esch, P., D. Arli, M. H. Gheshlaghi, V. Andonopoulos, T. Von Der Heide, and G. Northey. 2019. "Anthropomorphism and Augmented Reality in the Retail Environment." *Journal of Retailing and Consumer Services* 49: 35–42. doi:10.1016/j.jretconser.2019.03.002.
- Webster, J., and R. T. Watson. 2002. "Analyzing the past to Prepare for the Future: Writing a Literature Review." *MIS Quarterly* 26 (2): 13–23. doi:10.2307/4132319.
- \*Xu, L., L. Zhang, N. Cui, and Z. Yang. 2019. "How and When AR Technology Affects Product Attitude." *Asia Pacific Journal of Marketing and Logistics* 32 (6): 1226–1241. doi:10.1108/APJML-03-2019-0221
- \*Yang, S., J. R. Carlson, and S. Chen. 2020. "How Augmented Reality Affects Advertising Effectiveness: The Mediating Effects of Curiosity and Attention toward the Ad." *Journal of Retailing and Consumer Services* 54: 102020. doi:10.1016/j.jretconser.2019.102020
- Yi, S., and H. Baumgartner. 2011. "Coping with Guilt and Shame in the Impulse Buying Context." *Journal of Economic Psychology* 32 (3): 458–467. doi:10.1016/j.joep.2011.03.011.
- \*Yim, M.Y.-C., S.-C. Chu, and P. L. Sauer. 2017. "Is Augmented Reality Technology an Effective Tool for E-Commerce? an Interactivity and Vividness Perspective." *Journal of Interactive Marketing* 39: 89–103. doi:10.1016/j.intmar.2017.04.001
- \*Yim, M.Y.-C., and S.Y. Park. 2019. "I Am Not Satisfied with My Body, so I like Augmented Reality (AR)." *Journal of Business Research* 100: 581–589. doi:10.1016/j.jbusres.2018.10.041
- Yrjölä, M., M. T. Spence, and H. Saarijärvi. 2018. "Omni-Channel Retailing: Propositions, Examples and Solutions." *The International Review of Retail, Distribution and Consumer Research* 28 (3): 259–276. doi:10.1080/09593969.2018.1445657.
- \*Zhao, X., C. Shi, X. You, and C. Zong. 2017. "Analysis of Mental Workload in Online Shopping." *Are Augmented and Virtual Reality Consistent?* *Frontiers in Psychology* 8: 1–8. doi:10.3389/fpsyg.2017.00071.
- \*Zhang, T., W. Y. C. Wang, L. Cao, and Y. Wang. 2019. "The Role of Virtual Try-on Technology in Online Purchase Decision from Consumers' Aspect." *Internet Research* 29 (3): 529–551. doi:10.1108/IntR-12-2017-0540.
- Zhang, X., S. Li, and R.R. Burke. 2018. "Modeling the Effects of Dynamic Group Influence on Shopper Zone Choice, Purchase Conversion, and Spending." *Journal of the Academy of Marketing Science* 46 (6): 1089–1107. doi:10.1007/s11747-018-0590-9

## Appendices

**Appendix A In Appendix A, the first three themes are presented in independent Tables, while negative effects are presented throughout the Tables**

**Table A1. Utilitarian and hedonic value.**

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Poncin and Ben Mimoun 2014)	Field study	140 consumers in toy store	-	-	Perceived store atmosphere, Utilitarian and hedonic value, Emotion	-	Satisfaction, Patronage intention	Enhanced holistic in-store experience, perceived value and positive emotion are shown to improve satisfaction and patronage intention.
(Rese, Schreiber, and Baier 2014)	Mixed methods AR attitude, Intention to use AR	275, mostly students TAM predicts customer acceptance of augmented reality at the point of sale. Online reviews can replace experimental settings to study the TAM model. However, text samples are not suitable.	Technology acceptance model	-	Perceived	-	-	Perceived informativeness, Perceived enjoyment, Perceived ease of use, Perceived usefulness
(Dacko 2017)	Survey	779 young consumers	-	-	Aesthetics, Playfulness, Consumer ROI, Service excellence	-	"Unique" perceived value,	Preference, Patronage intention

AR is expected to provide more efficient and entertaining shopping experiences, more complete information, and more decision certainty resulting in positive behavioral intentions. Privacy concerns are considered a drawback of AR use.

(Continued)





Table A1. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Pantano, Reese, and Baier 2017)	Experiment	318 students	Technology acceptance model	Aesthetics quality,	Interactivity, Response time, Quality of information	Perceived ease of use,		Enjoyment, Perceived usefulness
-	Attitude toward using, Behavioral intention	AR enhances consumer intention to shop online. Few differences between German and Italian samples related to consumers' motivations to use AR.						
(Poushneh and Vasquez-Parraga 2017)	Experiment	99 mostly young consumers	Equity theory	Interactivity	User experience	Trade-off between price and value, Users'		information privacy control
User willingness to buy, User satisfaction	AR significantly contributes to a positive user experience and in turn influences user satisfaction and willingness to buy.							
(Reese et al. 2017)	Experiment	978 students	Technology acceptance model	-	Perceived			informativeness, Perceived enjoyment, Perceived ease of use, Perceived usefulness
-	App attitude, Intention to use AR	Both markerless AR apps outperform marker-based AR apps in the TAM model constructs, providing enhanced recommendation and usage intentions. Both virtual mirrors are described by their utilitarian aspects.						
(Beck and Crié 2018)	Experiment	469 students	-	-	Perceptual specific curiosity	-	Patronage intention, Purchase intention online and offline	AR-based fitting room influences perceptual specific curiosity, patronage intention and purchase intention online and offline.

(Continued)

Table A1. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Poushneh 2018)	Experiment	80 young and 329 consumers	Equity theory	Augmentation quality	Users' control of access to personal information	-	User	satisfaction
Both augmentation quality and users' control of access to personal information enhance user satisfaction. (Watson, Alexander, and Salavati 2018)	Experiment	162 mostly young consumers	Stimulus-organism-response model	Augmentation	Positive affective response	Hedonic motivation	Purchase intentions	Augmentation creates a more positive emotional response (vs. no augmentation) and enhances purchase intentions. Consumers who are more concerned with hedonic fulfillment derive greater pleasure from the augmented experience. surveillance, Fashion consciousness
(Huang, Mathews, and Chou 2019)	Survey	207 students	Self-determination theory, Self-evaluation theory	Modality,	Synchronous sense of ownership control, Re-processability	-	Body	
Rapport experience	AR try-on features positively affect consumers' rapport experience. Both body surveillance and fashion consciousness moderate the effects of AR try-on service system characteristics on consumer rapport experience.							
(McLean and Wilson 2019)	Survey	441 consumers	Technology acceptance model	Interactivity Vividness Novelty	Perceived ease of use, Enjoyment, Perceived usefulness, Subjective norms	Utilitarian and hedonic motivation	Brand	engagement, Satisfaction with app experience, Brand usage intention

(Continued)



Table A1. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
AR attributes and technology acceptance attributes have a positive impact on brand engagement, increased satisfaction with app experience and brand usage intentions. These relations are sometimes moderated by utilitarian and hedonic motivation. (Plotkina and Saurel 2019)	Experiment and qualitative study	415 consumers and 49 consumers	Technology acceptance model	-	Convenience, Ease of use, Usefulness, Enjoyment	-	Attitude toward app, Purchase intention	Deals with the extent to which apparel M-commerce should display visuals close to consumers' body fit and ethnicity. Enjoyment (vs. utilitarian technology features) better explains attitude toward the AR. Both utilitarian and hedonic benefits contribute to attitudes toward the app.
(Rauschnabel, Felix, and Hinsch 2019)	Survey	201 students	Information integration theory	Augmentation quality	Utilitarian benefits, Hedonic benefits, Inspiration	-	Attitude toward AR, Brand attitude	Participants with a favorable body image recorded greater media usefulness and enjoyment, more favorable attitudes, and greater adoption intentions toward AR. Individuals with an unfavorable body image are less susceptible to interactivity and irritation in forming their intention to adopt AR.
(Yim and Park 2019)	Survey	406 students	-	Interactivity, Media irritation	Media usefulness, Media enjoyment	Body image	Attitude toward AR, Intention to adopt AR	Perceived usefulness, perceived enjoyment and perceived privacy risk enhance attitudes toward the app, which positively impacts purchase intentions.
(T. Zhang et al. 2019)	Survey	208 consumers	-	-	Usefulness, Ease of use, Enjoyment, Socialization, Product risk, Privacy risk	-	Attitude towards app, Purchase intention	Perceived usefulness, perceived enjoyment and perceived privacy risk enhance attitudes toward the app, which positively impacts purchase intentions.

(Continued)



Table A1. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Bonnin 2020)	Experiment	289 young consumers	-	-	Utilitarian and hedonic value, Perceived product risk, Store attractiveness	Familiarity with AR	Patronage intention	Shows that AR decreases the perceived risk of buying a product online and increases patronage intention. The more familiar consumers are with AR, the more perceived product risk decreases and patronage intention increases. Augmentation quality
(Hinsch, Felix, and Rauschnabel 2020) Inspiration, Nostalgia	Survey	145 young consumers	-	Hedonic benefits,				
	-	Behavioral inspiration	AR enhances inspiration as a process from inspired-by into inspired-to through nostalgia. The wow effect is not a significant mediator of inspiration.					
(Yang, Carlson, and Chen 2020)	Experiment	432 consumers and 156 students	-	-	Curiosity, Attention	Novelty	Attitude toward ad	AR increases curiosity and attention and results in positive attitudes toward the ad. However, AR effectiveness in advertising suffers from a novelty effect.

**Table A2.** Decision-making.

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Huang and Liu 2014)	Survey	344 students	Narrative theory	-	Presence, Perception narrative, Media richness	-	Aesthetics, Playfulness, Consumer ROI, Service excellence	Although presence has a significant effect on aesthetics and service excellence, narrative experience provides the highest experiential value. AR is more efficient at delivering local presence than other product visualization formats. Local presence improves online purchase intentions through product tangibility and product likability.
(Verhagen et al. 2014)	Experiment	366 students	-	-	Local presence, Product tangibility, Product likability	-	Online purchase intentions	AR is more efficient at delivering local presence than other product visualization formats. Local presence improves online purchase intentions through product tangibility and product likability.
(Huang and Liao 2015)	Survey	220 students	Technology acceptance model, Experiential value	-	Presence, Perceived ease of use, Perceived usefulness, Aesthetics, Service excellence, Playfulness	Cognitive Innovativeness	Sustainable relationship behavior toward AR	Usefulness, ease of use, service excellence, aesthetics, and playfulness are the five key factors that foster consumers' sustainable relationship behavior toward using AR. Consumers with high cognitive innovativeness are more likely to use AR.
(Javornik 2016b)	Experiment	60 students	Flow theory, Theory of interactive media effects	Augmentation	Flow	-	App attitude, Revisit intentions, Recommendation intentions, Cognitive responses	Perceived augmentation enhances flow as well as affective and behavioral intentions toward the app. The results of cognitive responses indicate negative correlations, where more immersed consumers reported fewer thoughts.
(Verhagen, Vonkeman, and Van Dolen 2016)	Experiment	366 students	-	-	Mental tangibility, Physical tangibility, Perceived diagnosticity	-	Online purchase intentions	Perceived diagnosticity positively mediates the path from mental and physical tangibility to purchase intentions.

(Continued)



Table A2. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Hilken et al. 2017)	Experiment	832 students	Situated cognition theory	Environmental embedding, Simulated physical control	Spatial presence, Utilitarian and hedonic value, Decision comfort	Style of information processing, Awareness of privacy practices	Patronage intentions, Purchase intentions	AR simulates physical control and environmental embedding and enhances consumers' value perception and spatial presence, decision comfort and behavioral intentions. The effect of spatial presence on utilitarian value perceptions is greater for customers with a semantic information processing style.
(Huang and Liao 2017)	Survey	336 students	Flow theory, Virtual liminoid theory	Self-location, Haptic imagery	Sense of body ownership, Ownership control, Self-exploratory engagement, Flow	-	Spend more time on AR, Satisfaction	AR can motivate consumers to decorate their virtual self. When using AR, the rich multisensory experience immerses users into flow through the decorating psychological states.
(Vonkeman, Verhagen, and Van Dolen 2017)	Experiment	212 students	Construal level theory	Interactivity, Vividness	Local presence, Product risk, Product affect	-	Urge to buy impulsively	Interactivity and vividness of AR-based product presentation improves local presence and enhances impulse buying.
(Yim, Chu, and Sauer 2017)	Experiment	258 and 801 students	-	Interactivity, Vividness	Immersion, Media usefulness, Enjoyment	Previous media experience, Media novelty	Attitude toward the medium, Purchase intention	AR-based product presentations are superior to traditional web-based product presentations in the effect on media novelty, immersion, enjoyment, usefulness, enhanced attitude toward medium, and purchase intention.
(Zhao et al. 2017)	Mixed method	36 young consumers	-	-	Shopping method, Product value, Sensory channel	-	Mental workload	Males' mental workloads are significantly higher than females' loads. For males, the mental workload of high-value products is significantly higher than that of low-value products.

(Continued)



Table A2. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Brito, Stoyanova, and Coelho 2018)	Experiment	150 consumers	Theory of transfer	-	Brand awareness, Category familiarity, Product website interaction, Emotional intensity, Innovativeness, Perceived risk	Opinion Leadership	Emotional response, Brand attitude, Interactive response, Future relationship with the brand	Participants show higher emotional response, interactive response and brand evaluation in marker-based AR and markerless AR than in conventional interactive technology.
(Huang 2018)	Survey	232 students	-	Audiovisual, Haptic, Rehearsability, Symbol sets,	Reprocessability	Hedonic value, Functional value, Social value, Epistemic value	-	Price premium
All paths are significant and positive except epistemic value on the price premium. (Carrozzini et al. 2019)	Experiment	210 students	Socially situated cognition theory	Customization	Social assimilation and differentiation	-	Psychological ownership	Customization of AR holograms generates psychological ownership toward the digital product through social assimilation and differentiation depending on the device.
(Heller et al. 2019a)	Experiment	914 consumers	Mental imagery theory	Generation,	Transformation	Processing fluency, Decision comfort	Consumer processing type, Product contextuality	Choice, WOM
The interaction of imagery generation and imagery transformation enhances processing fluency, decision comfort and WOM intentions.								
(Heller et al. 2019b)	Experiment	489 students	Active inference theory	Sensory control modalities	Mental intangibility, Decision comfort	Multi-sensory feedback assessment	Willingness to pay	AR-based touch reduces mental intangibility and increases decision comfort, thereby enhancing consumers' willingness to pay. The reduction of mental intangibility is particularly strong for consumers high in assessment orientation.

(Continued)



Table A2. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Hilken et al. 2019)	Experiment	458 students, 295 consumers	Socially situated cognition theory	POV sharing format, Communicate acts format	Recommendation comfort, Social empowerment	Recommenders' impression management concerns, Recommenders' persuasion goal	Choice, Desire for product, Usage intentions, WOM	Social AR enables decision-makers to share their point of view and to receive recommendation in formats that make it more likely to impact choice. In addition, social AR increases social empowerment and enhances the recommender's comfort, desire for the product and positive intentions.
(Song, Baek, and Choo 2019)	Survey	99 students	Socially situated cognition theory	Environmental embedding, Simulated physical control	Immersion, Psychological ownership	Prior experience	Decision comfort	AR characteristics enhance immersion and ownership and result in decision comfort. Prior experience with AR decreases immersion.
(Fan et al. 2020)	Experiment	493 students	Situated cognition theory	Environmental embedding, Simulated physical control	Cognitive load, Cognitive fluency	Product type	Attitude toward product	AR-based environmental embedding and simulated physical control reduce cognitive load, enhance cognitive fluency and lead to improved product attitudes. Product type moderates the impact of AR on cognitive fluency but not on cognitive load.
(Park and Yoo 2020)	Survey	302 consumers	Mental imagery theory	Interactivity	Mental imagery	Involvement	Attitude toward product, Behavioral intentions toward product and app	Controllability and playfulness of AR influence mental imagery elaboration and quality, which enhance attitude toward a product and behavioral intentions toward the product and the app. The level of involvement moderates the effect of interactivity on mental imagery.





Table A3. Virtual self

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Baek, Yoo, and Yoon 2018)	Experiment	174 students	Self-attention theory	-	Self-viewing, Self-brand connection	Narcissism	Purchase intention	Self-viewing enhances both self-brand connection (SBC) and purchase intention. Narcissistic individuals show heightened SBCs and purchase intentions when they view themselves (vs. others) in the AR virtual mirror.
(Brenngman, Willems, and Van Kerrebroeck 2018)	Experiment	277 students	-	-	Perceived ownership	-	Product attitudes, Purchase intentions	The results demonstrate that (vs. laptop vs. mobile phone) mobile augmented reality increases feelings of perceived ownership, which positively affects product attitudes and purchase intentions.
(Phua and Kim 2018)	Survey	311 consumers	-	-	Self-referencing, Self-brand congruity, Perceived humor	-	Brand attitude, Purchase intention	AR induces self-brand congruity, self-referencing and perceived humor, enhancing brand attitude and purchase intention. Self-brand congruity better explains purchase intention. Perceived humor is more important than self-referencing for brand attitude.
(Scholz and Duffy 2018)	Ethnographic study	31 young women	-	-	Branded app as personal space, Dissolving of boundaries and foregrounding the consumer, Protecting and dissolving the consumer/brand fusion	-	Consumer brand relationship	AR can result in more intimate consumer-brand relationships if marketers are able to keep the brand and transactional aspects of the app in the background. Quality problems of AR content are forgiven if consumers are foregrounded in the consumer-brand relationship.

(Continued)



Table A3. (Continued).

Study	Methods	Sample	Theory base	AR variable(s)	Process variables	Boundary condition(s)	Outcome variable(s)	Key findings
(Huang 2019)	Experiment	232 consumers	-	-	Sense of ownership control, Rehearsability, Self-referencing, IT identity	-	Brand love	AR is higher in interactive effect and higher in audiovisual effect. Brand love is positively influenced by self-referencing and by IT identity.
(Smink et al. 2019)	Experiment	319 consumers	Equity theory, Reactance theory	-	Self-referencing, Perceived informativeness, Perceived enjoyment, Perceived intrusiveness	-	Brand attitude, Purchase intention, Willingness to share personal data	AR mainly has positive effects on brand responses and willingness to share data.
(Van Esch et al. 2019)	Field-study	319 consumers	-	-	Anthropomorphism, Confidence, Convenience of the transaction, Discomfort, AR innovativeness, Barriers to use, Side effects of the technology	-	Brand attitude	Anthropomorphism positively mediates most process variables (but not discomfort) which in turn positively influence attitude toward the brand (not innovativeness of AR).
(Xu et al. 2019)	Experiment	150 young consumers	-	-	Self-referencing	Quality beliefs, Taste beliefs, Luxury brand	Attitude toward product	Self-referencing mediates the effect of AR technology on consumers' product attitude, and the effect is attenuated when consumers hold quality beliefs rather than taste beliefs or when the product is a luxury brand.

## Appendix B

**Table B1. Main theoretical definitions**

Theoretical foundation	Description in context	Reference
Active inference theory	This theory suggests that to express a judgment or make a choice for a product or service, consumers rely on sensory control and feedback inferred from their behavior when interacting with an object.	(Heller et al. 2019b)
Construal level theory	This theory suggests that psychological proximity induces low-level construal of the object. When low-level construals are triggered, it makes the 'here and now' more salient, which leads to decreased self-control and an increase in impulsive behavior.	(Vonkeman, Verhagen, and Van Dolen 2017)
Equity theory	This theory suggests that, when AR users make a decision, they balance the benefits against the costs to ensure that they receive more than what they sacrifice.	(Poushneh 2018)
Flow theory	Flow is defined as an optimal tradeoff between challenges faced in an environment and a person's skills, so the person feels immersed in a challenging activity.	(Javornik 2016b)
Information integration theory	The theory suggests that existing associations can be altered once new related information is processed and integrated into existing knowledge. In the context of brands, brand attitudes are influenced when consumers receive, process, and integrate new information (e.g., from an app) related to their existing brand associations.	(Rauschnabel, Felix, and Hinsch 2019)
Mental imagery theory	Most researchers agree on visual imagery as an important factor of mental imagery. Customers imagine a visual representation of the use of offerings to predict outcome of use and notably reduce uncertainty about the relation of product attributes to satisfaction. Mental imagery through AR simulates direct experience in an online environment.	(Heller et al. 2019a)
Reactance theory	This theory suggests that consumers who perceive their control or freedom to be threatened try to resist persuasion and respond negatively. This negative effect can spill over to brand attitude and purchase intention.	(Smink et al. 2019)
Self-attention theory	This theory suggests that when AR users encounter information, self-focused attention facilitates the accuracy of elaboration of self-referent information.	(Baek, Yoo, and Yoon 2018)
Socially situated cognition theory	This theory suggests that people rely on each other's support to complete a task. A situated cognition perspective implies that information processing occurs within (i.e., is embedded in) and actively exploits (i.e., embodies) a person's environment rather than occurring as an abstract activity in the mind.	(Hilken et al. 2019)
Stimulus-organism-response model	This model suggests that, when individuals encounter a stimulus, it triggers an internal state called an organism, which in turn delivers responses.	(Watson, Alexander, and Salavati 2018)

(Continued)

Theoretical foundation	Description in context	Reference
Technology acceptance model	In the basic TAM model, two specific beliefs with regard to technological innovation – perceived ease of use (PEOU) and perceived usefulness (PU) – are linked to attitudes and behavioral intentions toward using the innovation. The intention to use an innovation or an available system is used as a proxy for user acceptance.	(Pantano, Rese, and Baier 2017; Rese, Schreiber, and Baier 2014; Rese et al. 2017)
Theory of interactive media effect	This theory suggests that the medium of communication can trigger affordances. Affordances are action possibilities that can trigger action on the part of the user and/or serve as symbolic representational cues on the interface and can affect users' psychology.	(Javornik 2016b)
Virtual liminoid theory	This theory suggests that when AR users go from a physical self to a virtual self (also called liminality), they trigger a decorating psychological state that motivates decoration of the stature of their virtual self.	(Huang and Liao 2017)



## **Publication II**

Lavoye, V.

**Augmented reality: Toward a research agenda for studying the impact of its presence dimensions on consumer behavior**

Reprinted with permission from  
*Marketing and Smart Technologies. Smart innovations, Systems and Technologies* 337, pp. 641-648  
© 2023, Springer Nature.



# Chapter 44

## Augmented Reality: Toward a Research Agenda for Studying the Impact of Its Presence Dimensions on Consumer Behavior



Virginie Lavoye 

**Abstract** Augmented reality (AR) virtual try-ons (VTO) have emerged as an important decision-making tool because of the highly realistic experience. For instance, AR enables users to virtually try-on sunglasses by placing the virtual product on their face. Research increasingly emphasizes the importance of spatial presence in the realistic AR experience. However, prior research on AR presence remains scant and overlooks social and self-presence. To fill this gap, we review literature on presence in the context of prior immersive technologies and propose a future research agenda on the impact of AR presence dimensions on product-relevant outcomes. This article starts by presenting AR spatial presence definition and proposing definitions for AR social and self-presence by drawing parallels between AR apps features and the presence dimensions of prior immersive shopping technologies. Thereafter, our review uncovers how each presence dimension leads to positive consumer outcomes. Then, we propose a research agenda for future studies of AR presence in marketing that outlines the need for a multidimensional perspective of presence to help uncover their unique impact on consumer responses. In addition, future research should investigate which contextual factors (marketing channels, for instance, in store and online as well as the types of products displayed in AR for instance makeup and sunglasses) might explain differences in the outcomes of presence. Our study has several limitations as it only considers the type of presence dimensions relevant to current AR-VTO experiences.

### 44.1 Introduction and Research Aim

The key advantage of augmented reality (AR) service is the highly contextual and realistic information [11, 13]. For instance, Sephora AR mirror is an augmented service that enables consumers to try-on the company's entire online assortment without needing to go to the physical stores [6]. Moreover, Sephora's color match

---

V. Lavoye (✉)  
LUT Business School, Lappeenranta, Finland  
e-mail: [virginie.lavoye@lut.fi](mailto:virginie.lavoye@lut.fi)

© The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2023  
J. L. Reis et al. (eds.), *Marketing and Smart Technologies*, Smart Innovation, Systems and Technologies 337, [https://doi.org/10.1007/978-981-19-9099-1\\_44](https://doi.org/10.1007/978-981-19-9099-1_44)



helps customers find the right color shade for their skin tone [6]. Overall, such service augmentation strategy focuses on services that are typically available in stores [13]. The digitalization of physical aspects of services poses novel challenges to firms and marketers, for instance, whether the experience is realistic, and the products are tangible enough to attract consumer engagement [10]. AR-based virtual try-ons (VTOs) provide a tangible service experience by replacing tangible service elements with superimposed digital content on the real environment [10]. Tangible virtual experiences rely on presence, the psychological state in which consumers perceive a virtual object to be real [18].

For consumers, the potential benefits of VTO include being able to try the products wherever and whenever they want, and without size restrictions [6]. While for firms, AR service augmentation can free employee input and replace the need for employees to bring boxes and advice consumers on best fitting products for instance. Overall, AR service augmentation has the potential to save time and money for consumers and service providers [10]. However, determining whether to use AR is a difficult decision for any business, and 52% of retailers are not ready to use AR as part of their service experience [4]. Notably, one key issue is that AR remains expensive to develop and the possible marketing-relevant outcomes remain unclear. Thus, providing clearer description of the mechanisms that enable AR to enhance consumer outcomes is highly important and timely.

The optimal AR experience should deliver a realistic experience of the product, the virtual self, and the social context [5]. Despite preliminary studies on spatial presence in AR [13, 22, 26], little is known about the holistic presence dimensions (spatial, social, and self-presence) in AR and their specific impact on consumer outcomes. Therefore, we aim to focus on presence dimensions because research in prior immersive shopping technology asserts their role in enhancing marketing-relevant outcomes. In addition, focusing on presence would enable to propose guidelines to marketers and developers to improve consumer experience.

This article starts by presenting AR spatial presence definition and proposing definitions for AR social and self-presence by drawing parallels between AR apps and the presence dimensions of prior immersive shopping technologies. By studying the impact of these presence dimensions on product-relevant outcomes, we uncover the psychological mechanisms that enable the persuasive impact of presence dimensions.

We address two research questions in line with this aim:

**RQ1:** What is the definition of our three AR presence dimensions?

**RQ2:** How does each presence dimension influence consumers' responses?

Then, we are able to propose a research agenda for future studies of AR in marketing that outlines the need for a (1) multidimensional perspective of presence to unravel their unique impact on consumer outcomes, as well as boundary conditions such as (2) the type of consumer experience they deliver in different marketing channels including in retail and online and that (3) different product types may require different combination of presence.

## 44.2 Background

Presence refers to the psychological state in which consumers perceive a virtual object to be real [18]. Presence dimensions can be facilitated by a range of immersive technologies including AR, virtual reality (VR), e-commerce website, or virtual worlds [18, 23]. Presence dimensions vary in intensity and types between technologies, however, we emphasize similarities between prior presence dimensions and AR presence dimensions and propose to study whether and to what extent the outcomes of AR presence will be similar to prior presence outcomes. In addition, there are studies on AR spatial presence that we also include into the analysis. This study starts by defining AR spatial presence and proposes definition for AR self-presence and social presence by drawing parallels between presence experience in AR-VTO apps with the presence experience in prior immersive shopping technologies.

Based on spatial presence in virtual reality context, Hilken et al. [13] developed AR spatial presence. AR superimposes virtual object on the real world in real time [2] thus, studying spatial presence in AR entails that the object “is here” rather than the user being transported as in virtual reality research [13]. Specifically, when using IKEA or makeup AR apps, AR spatial presence involves that the location of the product appears to be in one’s living room or on their body [13]. In addition, spatial presence also entails that the product can be moved around in the real world [13]. To sum up, spatial presence is defined as the sense that the object is embedded in the real environment and embodied on consumers [13].

Self-presence in video game occurs when players get a sense of physical resemblance and identification with their virtual self [25]. When users feel they are physically similar, they often relate with the virtual self personally [24] and experience self-presence [3]. AR superimposes virtual object on one’s virtual body or self. For instance, L’Oréal Makeup Genius displays a virtual lipstick on a live feed of a consumer’s face. Thus, AR users may experience self-presence because the virtual self can be considered highly physically similar (not perfectly similar because a virtual lipstick is superimposed) and enables users to identify with the virtual self. Therefore, we propose that AR self-presence refers to the sense that one’s virtual representation is oneself in the real world [21] and is conceptualized as physical similarity and identification with the virtual self [21].

Based on social presence on e-commerce website, social presence occurs when consumers get a sense of human contact when they interact with technology at the company’s frontline [8]. AR apps convey highly contextual information that help match the characteristic of a try-on technology with the actual try-on experience and address needs for consumers as if it was a salesperson in a store [13]. Thus, we propose that AR social presence refers to the sense that the AR app is a social actor [8] and is conceptualized as a sense of human contact in the online environment [8].

Overall, we define AR presence experience as follows: AR gives a sense that the offering is located in the physical environment and can be interacted with (i.e., spatial presence), involves a sense of self in the experience (i.e., self-presence), and the AR

app gives a sense of human warmth similar to a salesperson in a store (i.e., social presence).

### 44.3 Methodology

We follow the recommended steps for literature review from Xiao and Watson [27]. Based on our definitions and conceptualizations of AR presence dimensions presented above, we keep only the studies on immersive shopping technologies that discuss the impact of similar presence features (e.g., object presence is similar to AR spatial presence, while game character identification is similar to AR self-presence) on product-relevant affect, cognition, and behavioral intentions. This approach to literature review based on technologies' effects on users has been used in previous reviews [16]. We repeat the selection process three times, once for each presence dimensions.

First, we searched in title and abstract for terms such spatial presence, physical presence and augmented reality or online shopping on Web of Science. We identified 14 relevant studies that we checked for eligibility and included in the review. Second, we searched in title and abstract for self-presence combined with game character on Web of Science. We identified 7 relevant studies that we checked for eligibility and included in the review. Third, social presence was combined with purchase, retail, shopping, or consumer on Web of Science. We find 14 relevant studies that we checked for eligibility and included in the review.

### 44.4 Results

This section is a short presentation of the effects of presence dimensions on consumers' responses. First, spatial presence delivers highly contextual information about the product, and thus, it enhances decision comfort [13]. Second, self-presence increases the sense that the situation is self-involving, and it enhances self-efficacy and loyalty [15]. In addition, self-presence increases product diagnosticity when the product directly involves one's body or identity [24]. Third, social presence increases consumers' sense of closeness with the seller, the AR app gives virtual proximity to the social actor as a seller in a store [24]. Social presence enhances trust [8] and results in positive product attitude [9]. To sum up, we show that immersive shopping technologies can decrease the physical, personal, and social intangibility inherent to buyer–seller relationships.

## 44.5 Future Research Directions

From prior literature, we find that each presence dimensions has a unique role in influencing positive consumer outcomes. In addition, literature on AR suggests that AR delivers an optimal realistic product experience [10, 13], thus we ask:

**FRQ1:** Whether and to what extent can the unique role of each AR presence dimensions enhance consumer outcomes?

Moreover, when people experience high self-presence online, they are more comfortable to disclose personal information, as long as they are not identifiable [14]. Thus, self-presence in store might have a negative effect with people feeling too self-cautious to look at themselves, in a virtual mirror, around strangers. We propose that different uses of AR will explain contextual differences in presence outcomes impact consumers thus, we ask:

**FRQ2:** What are the optimal AR presence dimensions for different shopping experiences such as in retail and online?

Spatial presence was found to have a positive effect on purchase intentions in sunglasses AR apps [26] but not in the makeup app [22]. When consumers play an exergame, self-presence influences behavioral intentions, while spatial and social presence do not [3]. Such contradictory findings reveal the need for additional research thus, we ask:

**FRQ3:** Whether and to what extent would the impact of AR presence dimension on consumer outcomes be influenced by product types?

## 44.6 Implications for Theory and Practice

First, our multidimensional approach of presence confirms the importance of presence dimensions and their potential to benefit both consumers and firms [13]. We suggest that holistic view of presence dimensions enables to distinguish their effects on consumer outcomes. For instance, spatial and social presence increase attitude certainty for sunglasses AR-VTO, while self-presence does not [17]. Therefore, the authors suggest that a firm that aims to enhance decision-making should focus on spatial and social presence in the fashion accessories context. Enhancing spatial presence can include making the virtual product more realistic and improve the interaction with the product [13]. While social presence can be enhanced by implementing an AR recommendation system enabled by artificial intelligence technology (e.g., Ray-Ban matches glasses shape to user's face shape) or as an add-on outside of the app (e.g., Nordstrom proposes to book a virtual call with a stylist).

Second, our study proposes that boundary conditions (e.g., different touchpoints such as offline and online or differences in the type of products that AR displays) should be researched to provide guidelines to firms and marketers on the contextual elements that explains that each AR presence dimension does not always lead to

increased marketing-relevant outcomes. For instance, high self-presence in public might not be beneficial. People dislike seeing personalized advertisement in public [12]. In addition, people prefer to explore styles by watching influencers they can identify with rather than with AR technology [7]. Therefore, identification is appreciated as long as people are not identifiable thus, physical similarity creates privacy issues in this context. This exemplifies that the highest presence dimension is not always beneficial and depends on the context.

Third, we find that presence dimensions (spatial, self, and social) are highly inter-related [20] thus, studying one presence dimension at the time would still capture other dimensions. For instance, a highly realistic embodied experience with a product enhances spatial presence in AR [13], however, a highly embodied experience is often part of the conceptualization of self-presence [1]. Studying three dimensions help attribute the outcomes of presence to its specific enabler and provide more consistent ground for recommendations to marketers. We also encourage authors to be more consistent in the conceptualization of presence dimensions.

## 44.7 Conclusion

This study is a short version of our review on presence dimensions and a call to research presence in AR in a holistic manner that considers the impacts of spatial presence, self-presence, and social presence. Moreover, we show that presence dimensions trigger different mechanisms that lead to positive consumer behavior. Therefore, understanding the effect of each presence dimension can inform marketers and app developers on the elements of the experience to implement in priority to reach the firm's strategic goals. Finally, contextual differences, such as whether the technology is used in store or online and what type of products is displayed in the AR-VTO, may explain differences in the outcomes of presence and should be investigated further.

This study has several limitations that are avenue for future research. First, presence is a psychological state thus, it depends more on users' perception rather than on specific technological features. For instance, immersion is a strong predictor of social presence, however, increasing immersion does not always lead to higher social presence [20]. Therefore, technological features do not linearly translate into presence and in turn, our recommendations are not based on specific technological features. Second, based on our definition of AR social presence, we study strictly the computer as social actor (CASA) definition in which consumers perceive a sense of human touch in the virtual experience [8]. We do not discuss social presence defined as the presence of another embodied or disembodied real (vs. imagined) social actor and co-presence as the sense of "being together" in the virtual environment [19]. However, we can foresee that development in AR and VR technology, as well as the multi-verse will make this dimension of presence highly relevant and timely. Thus, future research should improve our multidimensional perspective with new dimensions.

## References

1. Allen, J.J., Anderson, C.A.: Does avatar identification make unjustified video game violence more morally consequential? *Media Psychol.* **24**(2), 236–258 (2021)
2. Azuma, R.: A survey of augmented reality. *Presence Teleoperators Virtual Environ.* **6**(4), 355–385 (1997)
3. Behm-Morawitz, E.: Mirrored selves: the influence of self-presence in a virtual world on health, appearance, and well-being. *Comput. Human Beh.* Elsevier Ltd **29**(1), 119–128 (2013)
4. Chandukala, S.R., Reddy, S.K., Tan, Y.-C.: How augmented reality can—and can't—help your brand. *Harvard Bus. Rev.* (2022). Available at: <https://hbr.org/2022/03/how-augmented-reality-can-and-cant-help-your-brand>
5. Chylinski, M., Heller, J., Hilken, T., Keeling, D.I., Mahr, D., de Ruyter, K.: Augmented reality marketing: a technology-enabled approach to situated customer experience. *Australas. Mark. J.* **28**(4), 374–384 (2020)
6. DeNisco Rayome, A.: How Sephora is leveraging AR and AI to transform retail and help customers buy cosmetics. TechRepublic, available at: <https://www.techrepublic.com/article/how-sephora-is-leveraging-ar-and-ai-to-transform-retail-and-help-customers-buy-cosmetics/>
7. El-Shamandi Ahmed, K., Ambika, A., Belk, R.: Augmented reality magic mirror in the service sector: experiential consumption and the self. *J. Service Manage.* (2022). Available at: <https://doi.org/10.1108/JOSM-12-2021-0484>
8. Gefen, Straub: Managing user trust in B2C e-services. *E-Serv. J.* **2**(2), 7
9. Hassanein, K., Head, M.: The impact of infusing social presence in the web interface: an investigation across product types. *Int. J. Electron. Commer.* **10**(2), 31–55 (2005)
10. Heller, J., Chylinski, M., de Ruyter, K., Keeling, D.I., Hilken, T., Mahr, D.: Tangible service automation: decomposing the technology-enabled engagement process (TEEP) for augmented reality. *J. Serv. Res.* **24**(1), 84–103 (2021)
11. Heller, J., Chylinski, M., de Ruyter, K., Mahr, D., Keeling, D.I.: Let me imagine that for you: transforming the retail frontline through augmenting customer mental imagery ability. *J. Retail.* **95**(2), 94–114 (2019)
12. Hess, N.J., Kelley, C.M., Scott, M.L., Mende, M., Schumann, J.H.: Getting personal in public!? How consumers respond to public personalized advertising in retail stores. *J. Retail. New York Univ.* **96**(3), 344–361 (2020)
13. Hilken, T., de Ruyter, K., Chylinski, M., Mahr, D., Keeling, D.I.: Augmenting the eye of the beholder: exploring the strategic potential of augmented reality to enhance online service experiences. *J. Acad. Mark. Sci.* **45**(6), 884–905 (2017)
14. Hooi, R., Cho, H.: Avatar-driven self-disclosure: the virtual me is the actual me. *Comput. Hum. Behav.* **39**, 20–28 (2014)
15. Hooi, R., Cho, H.: Virtual world continuance intention. *Telematics Inform. Elsevier Ltd.* **34**(8), 1454–1464 (2017)
16. Javornik, A.: Augmented reality: research agenda for studying the impact of its media characteristics on consumer behaviour. *J. Retail. Consumer Services Elsevier* **30**, 252–261 (2016)
17. Lavoye, V., Tarkiainen, A.: Toward an improved understanding of AR-based presence dimensions and their impact on attitude certainty. *Eur. Market. Acad. (EMAC) 50th*, p. 94505 (2021)
18. Lee, K.M.: Presence, explicated. *Commun. Theory* **14**(1), 27–50 (2004)
19. Mennecke, B.E., Triplett, J.L., Hassall, L.M., Conde, Z.J., Heer, R.: An examination of a theory of embodied social presence in virtual worlds. *Decis. Sci.* **42**(2), 413–450 (2011)
20. Oh, C.S., Bailenson, J.N., Welch, G.F.: A systematic review of social presence: definition, antecedents, and implications. *Frontiers Robot. AI* **5**(OCT), 1–35 (2018)
21. Seo, Y., Kim, M., Jung, Y., Lee, D.: Avatar face recognition and self-presence. *Comput. Human Beh.* Elsevier Ltd. **69**, 120–127 (2017)

22. Smink, A.R., van Reijmersdal, E.A., van Noort, G., Neijens, P.C.: Shopping in augmented reality: the effects of spatial presence, personalization and intrusiveness on app and brand responses. *J. Bus. Res. Elsevier* **118**, 474–485 (2020)
23. Steuer, J.: Defining virtual reality: dimensions determining telepresence. *J. Commun.* **42**(4), 73–93 (1992)
24. Suh, K.-S., Kim, H., Suh, E.K.: What if your avatar looks like you? Dual-congruity perspectives for avatar use. *MIS Q.* **35**(3), 711–729 (2011)
25. Teng, C.I. (2021). How can avatar's item customizability impact gamer loyalty? *Telematics and Inform. Elsevier Ltd.* **62**(July 2020), 101626
26. Verhagen, T., Vonkeman, C., Feldberg, F., Verhagen, P.: Present it like it is here: creating local presence to improve online product experiences. *Comput. Human Beh. Elsevier Ltd* **39**, 270–280 (2014)
27. Xiao, Y., Watson, M.: Guidance on conducting a systematic literature review. *J. Plan. Educ. Res.* **39**(1), 93–112 (2019)

## **Publication III**

Lavoye, V., and Tarkiainen, A.

**Toward an improved understanding of AR-based presence dimensions and their impact on attitude certainty**

Reprinted with permission from  
*The proceedings of the European Marketing Academy,*

94505

© 2021





## **Toward an improved understanding of AR-based presence dimensions and their impact on attitude certainty**

### **Abstract:**

Augmented reality (AR) applications for product visualization are increasingly popular. Prior research has shown that AR apps for virtual try-on help consumers evaluate the products by enabling the felt presence of the product. However, prior research has mainly focused on a one-dimensional conceptualization of presence. Research on immersive technologies recognizes that presence consists of three dimensions: spatial presence, self-presence, and social presence. The herein study extends the prior research on virtual try-on by assessing the impact of these three dimensions of felt presence on consumers' attitude certainty. Attitudes held with high certainty (vs. low certainty) persist longer and have a greater impact on behavior. The results of this empirical pretest of a survey (N = 70) show that social presence and spatial presence influence attitude certainty, while self-presence is not significantly linked to attitude certainty.

*Presence; certainty; decision making.*

*Track: Retailing & Omni-Channel Management*

## **1. Introduction**

The multimedia messaging app, Snapchat collaborates with such brands as Garnier, Lancôme, L'Oréal Paris, and Maybelline to make branded augmented reality (AR) features widely available (Cohen, 2020). With the growing ubiquity of AR usage, further research is needed to explain how consumer decision making can benefit from virtual try-on technology. Researchers agree that AR enables a more direct product experience through an enhanced feeling of presence (Hilken, de Ruyter, Chylinski, Mahr, and Keeling, 2017; Huang & Liao, 2017; Verhagen, Vonkeman, Feldberg, and Verhagen, 2014). Presence is defined as “a psychological state in which the virtuality of experience is unnoticed” (Lee, 2004, p. 32). As the degree of presence augments, consumers will perceive a product experience as being more unmediated.

Presence in AR is different from that in other virtual environments, because the user is not transported to another place; rather, virtual elements are transported to the real-world context, interactively and in real time (Azuma et al., 2001). While the literature on presence defines it as multidimensional spatial, social, and self-presence, the research on AR is dominated by a focus on a one-dimensional conceptualization of spatial presence. Little is known about the effects of spatial presence compared to self-presence and social presence (Behm-Morawitz, 2013). Therefore, this study adopts a multi-dimensional approach to presence and examines its impact on attitude certainty.

## **2. Attitude certainty**

Attitude certainty is the subjective sense of conviction about an attitude (Tormala & Rucker, 2018). When interacting with products during a virtual try-on, consumers form a judgement and evaluation of a product, and certainty is a secondary assessment of the evaluation of the product (Rucker, Tormala, Petty, and Briñol, 2014). Klein (2003) found a significant impact of telepresence on attitude strength, of which attitude certainty is among the most impactful dimensions because attitudes held with high certainty (vs. low certainty) persist longer and have a greater impact on behavior (Tormala & Rucker, 2018).

### 3. Presence

In this paper, we show that presence is a multi-faceted phenomenon conceptualized in three dimensions: spatial, social, and self-presence. Spatial presence refers to the interactive virtual object and the interactive product in a real environment, while self-presence refers to the feeling that the avatar, as an extension of the self, is present in the real world. Finally, social presence refers to the feeling that the branded AR technology as a social actor is present in the real world. For example, in the case of the virtual try-on of Ray-Ban sunglasses, consumers experience the spatial presence of the virtual object (sunglasses), the self-presence of the photorealistic avatar (video feed of the real body), and the social presence of the brand and technology (AR feature on the Ray-Ban website). In the next sections, we provide detailed definitions of the dimensions of presence and hypothesize their relationship with the attitude certainty.

#### 3.1 Spatial presence

Spatial presence is defined as “a binary experience, during which perceived self-location and, in most cases, perceived action possibilities are connected to a mediated spatial environment, and mental capacities are bound by the mediated environment instead of reality” (Wirth et al., 2007, p. 497). Hilken and colleagues’ (2017) definition of spatial presence follows a situated view of presence and includes both ‘object-location’ and ‘possible action.’ In this respect, AR spatial presence is consistent with conceptualizations of object presence or ‘it is here’ presence (Hilken et al., 2017, p. 890).

AR enhances product attitude by increasing cognitive fluency and lowering the cognitive load (Fan, Chai, Deng and Dong, 2020). Meanwhile, spatial presence improves purchase intentions through product likeability and product tangibility (Verhagen et al., 2014). Thus, we assert that the AR-induced reduction of the cognitive load and increased tangibility also strengthen consumers’ certainty in their attitude formation, as follows:

**H1.** Spatial presence leads to attitude certainty.

### ***3.2 Self-presence***

Self-presence is defined as “a psychological state in which virtual self/selves are experienced as the actual self” (Lee, 2004, p. 46). In addition, Biocca (1997) defines self-presence as the effects of the virtual environment on users’ body schema (perception of their body) and other mental models of the self.

Self-presence is typically studied in the context of video games, as players report feeling as if they are actually taking part in the virtual world through the avatar (Behm-Morawitz, 2013), and their online persona influences their self-representation online and offline (Fox, Bailenson, and Tricase, 2013). In the marketing context, the study of self-representation shows that one’s own face representation in a picture enhances self-presence (Seo, Kim, Jung, and Lee, 2017). Control of the re-embodied self constitutes the most compelling form of the virtual representation of the body and the self-identity (Belk, 2014). Hence, we assert that similarly to an avatar in a video game, AR displays an extended version of users’ actual selves and enhance self-presence.

Biocca (1997) shows that the virtual self influences the offline self when users experience self-presence and when the avatar’s product experiences are used to evaluate the offline self. Behm-Morawitz (2013) argues that the greater the level of self-presence, the more likely one is to use the avatar as a source for making judgments about the self and as a factor when making decisions. Self-endorsed AR enhances self-brand congruity and positively influences brand attitudes (Baek, Yoo, and Yoon, 2018; Phua & Kim, 2018), self-brand connection and purchase intentions (Baek et al., 2018). We assert that AR-induced self-presence makes it easier for consumers to evaluate an object during a virtual try-on, and this consequently leads to greater certainty in attitude formation, as follows:

**H2.** Self-presence leads to attitude certainty.

### ***3.3 Social presence***

Social presence is defined as “a psychological state in which virtual (para-authentic or artificial) social actors are experienced as actual social actors in either sensory or

nonsensory ways” (Lee, 2004, p. 45). A successful simulation of other intelligences occurs when technology users do not notice either the artificiality or the para-authenticity of experienced social actors (both humans and nonhuman intelligences) (Lee, 2004).

Lee (2004) suggests that during an encounter with an anthropomorphic robot, people may feel strongly that they are interacting with an actual human. In addition, consumers tend to humanize brands (MacInnis & Folkes, 2017). Van Esch et al. (2019) show that the anthropomorphism of AR can influence consumers, and it can lead to positive attitudes toward the brand. In a retail context, van Esch et al. (2019) show that an AR app (CluckAR app) was perceived as anthropomorphic, and they discuss that anthropomorphism in AR comes from the brand and the technology, suggesting that an app is perceived as anthropomorphic when it provides relevant information to consumers and replaces the need to conduct their own internet-based research. Hence, we hypothesize that a try-on that fits the product on consumers’ bodies so they do not need to imagine how it would fit will enhance social presence.

Social presence enhances the perceived usefulness, trust, and enjoyment of the shopping experience and leads to positive attitudes (Hassanein & Head, 2007), and in AR, perceived personalization enhances purchase intentions (Smink, van Reijmersdal, van Noort, and Neijens, 2020). When an AR app is tailored to a specific consumer, and when it enables the user to customize their experience, persuasion is enhanced (Smink et al., 2020). Given that felt social presence enhances felt trust during the shopping experience, we assert that the AR-induced feeling of social presence leads to improved certainty in attitude formation, as follows:

**H3.** Social presence leads to attitude certainty.

## 4. Methodology

### 4.1 Research model and procedure

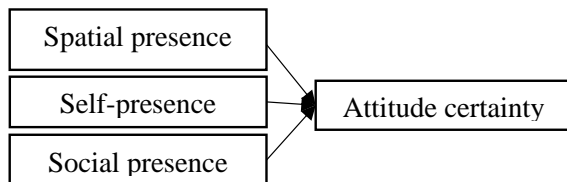


Figure 1. Research framework

In total, 70 respondents accomplished the task of trying on a few pairs of sunglasses in an AR virtual try-on before taking the survey. All participants are potential consumers who are university students from two business school courses. Respondents include 42 females, 26 males, and 2 individuals who preferred not to say. Of these, 64 respondents are between 18 and 24 years old, 5 are between 25 and 34 years, and 2 are between 35 and 44 years. We used survey items validated in published studies, and we asked doctoral students to read the questionnaire to verify that it was easy to understand to increase validity. Items were ranked on a seven-point Likert scale from ‘Strongly disagree’ to ‘Strongly agree’.

### 4.2 Results

To test the measurement model, we used structural equation modelling (SEM)-confirmatory factor analysis (CFA) with maximum likelihood on all four latent factors pairwise. SEM-CFA was used for this study because CFA is a confirmatory technique that is theory driven (Schreiber, Stage, King, Nora, and Barlow, 2006), and it was tested using the LISREL statistical software. The results of the CFA are presented in Table 1. Model fit indicates acceptable indices ( $\chi^2 = 73.859$ , d.f. = 71; and  $\chi^2/\text{d.f.} = 1.040$ ) (Hair, Anderson, Tatham and Black, 1998). The composite reliability (CR) loaded above the threshold value for all items, and the average variance extracted (AVE) values for each construct exceeded the threshold value, as recommended by Fornell and Larcker (1981). We tested for discriminant validity with nested models pairwise, first with fixed

parameters correlation and then with free parameters, and we confirmed that the factors discriminate. In addition, the discriminant validity was confirmed by comparing squared correlations with AVEs for corresponding constructs.

Construct	Indicator	Lambda	SMC	B	SE	t-value	p	CR	AVE
Self-presence	SEP3	0.791	0.626					0.914	0.727
Self-presence	SEP4	0.843	0.711	0.996	0.125	7.990	***		
Self-presence	SEP5	0.957	0.915	1.257	0.136	9.219	***		
Self-presence	SEP6	0.810	0.656	0.988	0.131	7.565	***		
Social presence	SOP1	0.826	0.682					0.891	0.672
Social presence	SOP2	0.743	0.552	0.802	0.117	6.832	***		
Social presence	SOP3	0.881	0.776	0.980	0.115	8.557	***		
Social presence	SOP5	0.824	0.680	1.063	0.135	7.868	***		
Spatial presence	SPP3	0.658	0.434					0.779	0.544
Spatial presence	SPP4	0.868	0.753	1.277	0.249	5.124	***		
Spatial presence	SPP6	0.663	0.440	1.063	0.231	4.591	***		
Attitude certainty	AC1	0.717	0.514					0.831	0.625
Attitude certainty	AC2	0.913	0.834	1.475	0.228	6.475	***		
Attitude certainty	AC3	0.726	0.526	1.234	0.218	5.652	***		

(Note: Lambda: Standardized path coefficients, B: Unstandardized path coefficients, SE: Standard error, SMC: Squared multiple correlations, Critical t-value (one-tailed) = 1.645, \*\*\*: p<0.001).

Table 1. Results of the CFA within the four latent factors



To test the proposed hypotheses (see Table 2), we used item parceling for the exogenous latent variables and used the items for the endogenous latent variable. The hypothesized structural model indicated acceptable fit measures (d.f. = 6,  $\chi^2 = 3.60$  and  $\chi^2/d.f. = 0.6$ ). Although the sample size is small, we have close to five cases for each parameter estimate. We found that H1 and H3 are supported; hence, spatial presence and social presence positively influence attitude certainty, while self-presence does not predict certainty (H2). The model explains 50% of the variance in attitude certainty.

Hypothesized relationships	Lambda	B	SE	t-value	p	Result
H1: Spatial presence → Attitude certainty	0.312	0.206	0.089	2.328	**	Supported
H2: Self-presence → Attitude certainty	0.111	0.070	0.069	1.002	N.S.	Rejected
H3: Social presence → Attitude certainty	0.454	0.283	0.086	3.301	**	Supported

(Note: Lambda: Standardized path coefficients, B: Unstandardized path coefficients, SE: Standard error, SMC: Squared multiple correlations, Critical t-value (one-tailed) = 1.645, \*\* <0.05, N.S.: Non-significant).

Table 2. Structural model

## 5. Implications and conclusion

This pre-study aims to answer the call to study empirically how new virtual technologies affect the sense of presence and facilitate consumers' decision making (Wedel et al., 2020). Confidence with which an attitude is held is influenced by presence dimensions. Coherent with Fazio & Zanna (1978) the more direct experience enhances the level of confidence with which consumers hold their attitude. Our findings imply that marketers should focus on increasing spatial and social cues in the virtual try-on environment to facilitate consumers' decision making. Spatial presence and social presence improve consumers' certainty by reducing the distance that the online environment creates between consumers and the product. We suggest that these dimensions are key, because consumers' attitude certainty requires them to think about their attitude toward the product, and social cues are an indication that the branded AR can be trusted. Trust is conceptualized as "existing when one party has confidence in an exchange partner's reliability and integrity" (Morgan & Hunt, 1994, p. 23). In turn, the

legitimacy of AR information influence attitude certainty (Tormala & Rucker, 2018). Behm-Morawitz (2013) discusses that the greater the level of self-presence, the more likely one is to use the avatar as a source for making judgments about the self and as a factor when making decisions. In contrast, we propose that the impact of self-presence does not extend to the metacognitive assessment of consumer attitudes.

To conclude, this study is relevant in three manners. First, this pre-test provides valuable insight for survey measurement. Indeed, it was necessary to re-specify the measurement model to achieve a good model fit with the data. Moreover, we plan to collect a larger data set and develop this model further to determine what technological elements have a direct effect on presence and an indirect effect on relevant consumer outcomes. Second, this study contributes to the presence research by showing that AR virtual try-on environments can deliver three types of presence, and these presence dimensions contribute differently to consumer attitude certainty. Third, we provide grounds for additional consumer behavior research to investigate how presence dimensions can influence relevant marketing outcomes, such as attitudes toward products and purchase intentions.

## 6. References

- Azuma, R., Baillot, Y., Behringer, R., Feiner, S., Julier, S., & MacIntyre, B. (2001). Recent advances in augmented reality. *IEEE Computer Graphics and Applications*, 21(6), 34–47. <https://doi.org/10.1109/38.963459>
- Baek, T. H., Yoo, C. Y., & Yoon, S. (2018). Augment yourself through virtual mirror: the impact of self-viewing and narcissism on consumer responses. *International Journal of Advertising*, 37(3), 421–439. <https://doi.org/10.1080/02650487.2016.1244887>
- Behm-Morawitz, E. (2013). Mirrored selves: The influence of self-presence in a virtual world on health, appearance, and well-being. *Computers in Human Behavior*, 29(1), 119–128. <https://doi.org/10.1016/j.chb.2012.07.023>
- Belk, R. (2014). Digital consumption and the extended self. *Journal of Marketing Management*, 30(11–12), 1101–1118. <https://doi.org/10.1080/0267257X.2014.939217>
- Biocca, F. (1997). The Cyborg's dilemma: Embodiment in virtual environments. *Proceedings of the International Conference on Cognitive Technology*, 12–26.
- Cohen, D. (April 29, 2020). AdWeek David-L'Oréal USA Creates 8 Custom-Branded AR Lenses for Snap Camera Desktop App. Retrieved from

- <https://www.adweek.com/digital/loreal-usa-creates-8-custom-branded-ar-lenses-for-snap-camera-desktop-app/> (Last accessed October, 28, 2020).
- Fan, X., Chai, Z., Deng, N., & Dong, X. (2020). Adoption of augmented reality in online retailing and consumers' product attitude: A cognitive perspective. *Journal of Retailing and Consumer Services*, 53, 101986. <https://doi.org/10.1016/j.jretconser.2019.101986>
- Fazio, R. H., & Zanna, M. P. (1978). On the predictive validity of attitudes: The roles of direct experience and confidence. *Journal of Personality*, 46(2), 228–243. <https://doi.org/10.1111/j.1467-6494.1978.tb00177.x>
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39. <https://doi.org/10.2307/3151312>
- Fox, J., Bailenson, J. N., & Tricase, L. (2013). The embodiment of sexualized virtual selves: The Proteus effect and experiences of self-objectification via avatars. *Computers in Human Behavior*, 29(3), 930–938. <https://doi.org/10.1016/j.chb.2012.12.027>
- Hair, J.E., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998), *Multivariate Data Analysis*, 5th ed., Prentice Hall, Upper Saddle River, NJ.
- Hassanein, K., & Head, M. (2007). Manipulating perceived social presence through the web interface and its impact on attitude towards online shopping. *International Journal of Human Computer Studies*, 65(8), 689–708. <https://doi.org/10.1016/j.ijhcs.2006.11.018>
- Hilken, T., de Ruyter, K., Chylinski, M., Mahr, D., & Keeling, D. I. (2017). Augmenting the eye of the beholder: exploring the strategic potential of augmented reality to enhance online service experiences. *Journal of the Academy of Marketing Science*, 45(6), 884–905. <https://doi.org/10.1007/s11747-017-0541-x>
- Huang, T.-L., & Liao, S.-L. (2017). Creating e-shopping multisensory flow experience through augmented-reality interactive technology. *Internet Research*, 27(2), 449–475. <https://doi.org/10.1108/IntR-11-2015-0321>
- Klein, L. R. (2003). Creating virtual product experiences: The role of telepresence. *Journal of Interactive Marketing*, 17(1), 41–55. <https://doi.org/10.1002/dir.10046>
- Lee, K. M. (2004). Presence, Explicated. *Communication Theory*, 14(1), 27–50. <https://doi.org/10.1111/j.1468-2885.2004.tb00302.x>
- MacInnis, D. J., & Folkes, V. S. (2017). Humanizing brands: When brands seem to be like me, part of me, and in a relationship with me. *Journal of Consumer Psychology*, 27(3), 355–374. <https://doi.org/10.1016/j.jcps.2016.12.003>
- Morgan, R. M., & Hunt, S. D. (1994). The Commitment-Trust Theory of Relationship Marketing. *Journal of Marketing*, 58(3), 20. <https://doi.org/10.2307/1252308>
- Phua, J., & Kim, J. (Jay). (2018). Starring in your own Snapchat advertisement: Influence of self-brand congruity, self-referencing and perceived humor on brand attitude and purchase intention of advertised brands. *Telematics and Informatics*, 35(5), 1524–1533. <https://doi.org/10.1016/j.tele.2018.03.020>
- Rucker, D. D., Tormala, Z. L., Petty, R. E., & Briñol, P. (2014). Consumer conviction and commitment: An appraisal-based framework for attitude certainty. *Journal of*

- Consumer Psychology, 24(1), 119–136.  
<https://doi.org/10.1016/j.jcps.2013.07.001>
- Schreiber, J. B., Stage, F. K., King, J., Nora, A., & Barlow, E. A. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *Journal of Educational Research*, 99(6), 323–338.  
<https://doi.org/10.3200/JOER.99.6.323-338>
- Seo, Y., Kim, M., Jung, Y., & Lee, D. (2017). Avatar face recognition and self-presence. *Computers in Human Behavior*, 69, 120–127.  
<https://doi.org/10.1016/j.chb.2016.12.020>
- Smink, A. R., van Reijmersdal, E. A., van Noort, G., & Neijens, P. C. (2020). Shopping in augmented reality: The effects of spatial presence, personalization and intrusiveness on app and brand responses. *Journal of Business Research*, 118(July), 474–485. <https://doi.org/10.1016/j.jbusres.2020.07.018>
- Tormala, Z. L., & Rucker, D. D. (2018). Attitude certainty: Antecedents, consequences, and new directions. *Consumer Psychology Review*, 1(1), 72–89.  
<https://doi.org/10.1002/arc.1004>
- van Esch, P., Arli, D., Gheshlaghi, M. H., Andonopoulos, V., von der Heide, T., & Northey, G. (2019). Anthropomorphism and augmented reality in the retail environment. *Journal of Retailing and Consumer Services*, 49, 35–42.  
<https://doi.org/10.1016/j.jretconser.2019.03.002>
- Verhagen, T., Vonkeman, C., Feldberg, F., & Verhagen, P. (2014). Present it like it is here: Creating local presence to improve online product experiences. *Computers in Human Behavior*, 39, 270–280. <https://doi.org/10.1016/j.chb.2014.07.036>
- Wedel, M., Bigné, E., & Zhang, J. (2020). Virtual and augmented reality: Advancing research in consumer marketing. *International Journal of Research in Marketing*, 37(3), 443–465. <https://doi.org/10.1016/j.ijresmar.2020.04.004>
- Wirth, W., Hartmann, T., Böcking, S., Vorderer, P., Klimmt, C., Schramm, H., ... Jäncke, P. (2007). A Process Model of the Formation of Spatial Presence Experiences. *Media Psychology*, 9(3), 493–525. <https://doi.org/10.1080/15213260701283079>



## **Publication IV**

Lavoye, V., Sipilä, J., Mero, J., and Tarkiainen, A.

**The emperor's new clothes: Self-explorative engagement in virtual try-on service experiences positively impacts brand outcomes**

Reprinted with permission from

*Journal of Services Marketing*

37(10), pp. 1-21

© 2023, Emerald



# The emperor's new clothes: self-explorative engagement in virtual try-on service experiences positively impacts brand outcomes

Virginie Lavoye and Jenni Sipilä

LUT Business School, LUT University, Lappeenranta, Finland

Joel Mero

School of Business and Economics, Jyväskylä University, Jyväskylä, Finland, and

Anssi Tarkiainen

LUT Business School, LUT University, Lappeenranta, Finland

## Abstract

**Purpose** – Virtual try-on (VTO) technology offers an opportunity for fashion and beauty brands to provide enriched self-explorative experiences. The increased popularity of VTOs makes it urgent to understand the drivers and consequences of the exploration of styles in VTO contexts (herein called self-explorative engagement). Notably, little is known about the antecedent and outcomes of the personalized self-explorative experience central to VTOs. This paper aims to fill this knowledge gap.

**Design/methodology/approach** – An online quasi-experiment ( $N = 500$ ) was conducted in the context of fashion and beauty VTOs. Participants were asked to virtually try on sunglasses or lipsticks and subsequently answer a questionnaire measuring the key constructs: self-presence (i.e. physical similarity and identification), self-explorative engagement (i.e. exploration of styles in VTO context), brand cognitive processing and brand attitude. The authors analyze the data with structural equation modeling via maximum likelihood estimation in LISREL.

**Findings** – The experience of self-presence during consumers' use of VTOs in augmented reality environments has a positive effect on self-explorative engagement. Furthermore, a mediation analysis reveals that self-explorative engagement improves brand attitude via brand cognitive processing. The results are confirmed for two popular fashion and beauty brands.

**Originality/value** – Grounded in extended self theory, to the best of the authors' knowledge, this is the first study to show that a realistic VTO experience encourages self-extension via a process starting from the exploration of styles and results in increased brand cognitive processing and more positive brand attitudes. The exploration of styles is enabled by self-presence.

**Keywords** Augmented reality, E-commerce, Self-explorative engagement, Self-presence, Brand

**Paper type** Research paper

## 1. Introduction

The act of purchasing clothes is often preceded by fitting the clothes on oneself (Alexander *et al.*, 2005; Holmlund *et al.*, 2011). In traditional offline retail, consumers experiment with their appearance by curiosity about how clothing items fit and suit them because they enjoy the novel experience without a defined goal (Gurel and Gurel, 1979). Moreover, clothing and fashion products have symbolic meanings and are related to consumers' self-concept (Piacentini and Mailer, 2004). The self-concept or self refers to the entirety of people's thoughts and feelings toward themselves (Sirgy, 1982). The theory of extended self asserts that consumers can try out new identities by buying clothes and changing styles and when consumers integrate aspects of the branded product into their self-concept,

it increases attention and liking for the brand (Belk, 1988, 2013).

However, physical intangibility in e-commerce websites makes it impossible to physically fit clothing and fashion items on oneself. Therefore, many firms (e.g. L'Oréal, Levi's, Mac Cosmetics, Ray-Ban) have adopted a strategy of service augmentation focusing not only on the core product but also on the process-related aspects of consumer-brand interaction (Grönroos, 2020). Specifically, try-on services that used to be limited to in-store shopping (Childers *et al.*, 2001) are increasingly available in the online environment via virtual

---

© Virginie Lavoye, Jenni Sipilä, Joel Mero and Anssi Tarkiainen. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licenses/by/4.0/> legalcode

---

The current issue and full text archive of this journal is available on Emerald Insight at: <https://www.emerald.com/insight/0887-6045.htm>



Journal of Services Marketing  
37/10 (2023) 1–21  
Emerald Publishing Limited [ISSN 0887-6045]  
[DOI 10.1108/JSM-04-2022-0137]

Received 21 April 2022  
Revised 17 September 2022  
26 January 2023  
Accepted 9 March 2023



try-on technology (hereafter VTO). Augmented reality (AR) registers augmented virtual products onto consumers' bodies or into their surroundings (Rauschnabel *et al.*, 2022). A VTO is a subcategory of AR applications that displays virtual products directly on consumers' body and facilitates the fitting of products (Hilken *et al.*, 2017). Thus, AR facilitates a self-relevant experience that leads to positive brand outcomes (Ambika *et al.*, 2022; Phua and Kim, 2018; Xu *et al.*, 2019). However, previous studies examining the mechanisms through which AR fosters positive consumer-brand outcomes are scarce (Plotkina *et al.*, 2021). Studies suggest that AR-VTOs motivate consumers to decorate their virtual selves (Huang and Liao, 2017), help discover possible selves and impact consumers' self-concept (Javornik *et al.*, 2021). Furthermore, the existing studies discuss the possibilities and impossibilities of exploring possible selves virtually and their interconnection to self-concept (El-Shamandi Ahmed *et al.*, 2023). However, little is known about the antecedents of the exploration of possible selves and how it leads to positive brand responses.

Against this backdrop, this research has two objectives. In Section 2.2.1, we show that self-presence provides a realistic experience and is, therefore, a key antecedent to self-exploratory engagement (i.e. exploration of styles in VTO contexts). Thereafter in Section 2.2.2, grounded in extended self theory, we propose that self-exploratory engagement increases brand cognitive processing and, subsequently, improves attitude toward the brand. In Section 3, we empirically test our theoretical framework and conduct a quasi-experimental study to compare fashion and beauty branded VTOs because these products represent symbolic consumption (Schouten, 1991) and the comparison adds to the generalizability of this study. For instance, Ray-Ban has launched a VTO that offers shoppers hundreds of sunglasses to see on their faces in real time, with the use of their Webcam (see [ray-ban.com](http://ray-ban.com)). In parallel, body beautification services, such as L'Oréal's Makeup Genius are becoming the "dressing room" before cosmetic purchases enabling consumers to envision different versions of themselves (Javornik *et al.*, 2021).

This research outlines three main contributions. First, we contribute to research on presence in the context of AR by revealing that self-presence has a pivotal role for self-exploratory engagement and enhances brand responses. Second, we contribute to research on motivation to use branded AR apps by showing that self-presence and self-exploratory engagement enable the exploration of possible selves. Third, we contribute to the literature on extended self theory (Belk, 1988, 2013) by showing that self-exploratory engagement enhances brand cognitive processing during the process of self-extension, and consequently improves brand attitudes. Managerially, the findings imply that investments in developing AR-based VTOs have positive effects on brand-related outcomes if they facilitate a realistic try-on service experience and allow consumers to conveniently explore different styles.

## 2. Literature review and theoretical background

### 2.1 Literature review

The existing research on consumer-brand interactions in the AR context has studied the role of self-referencing, personalization, inspiration and the resulting consumer-brand relationships. AR

usage inspires consumers to be more creative (Hinsch *et al.*, 2020; Rauschnabel *et al.*, 2019) and motivates them to spend more time exploring products online (Beck and Crié, 2018). From this body of the research, we can conclude that consumers are motivated to use AR when they can personalize the self-relevant try-on experience (Smink *et al.*, 2020). However, the existing research does not provide an understanding of the predictors of consumers' exploration of styles.

Scholz and Duffy (2018) have investigated the symbolic meaning associated with building relationships with brands through long-term usage of branded AR apps. They find that AR app usage is a form of self-care activity that enables consumers to explore their possible selves. Furthermore, as consumers are foregrounded into the experience, they form intimate relationships with brands. Thus, as presented in Table 1, prior literature shows that when consumers can relate aspects of themselves with the brand in the virtual environment, it improves their relationship with a focal brand (Huang, 2019; Phua and Kim, 2018). However, little is known about the exploration of possible selves in AR and how it leads to positive brand responses. Therefore, this study aims to unpack this phenomenon for popular fashion and beauty branded products (i.e. Ray-Ban and MAC Cosmetics).

### 2.2 Theoretical background and hypothesis development

#### 2.2.1 Self-presence and self-exploratory engagement

Self-presence refers to the perception that the virtual self is oneself (Lee, 2004; Vorderer, 2006) on two aspects: physical similarity and identification (Seo *et al.*, 2017). Therefore, self-presence occurs when consumers feel that the VTO permits to view their own physical (virtual) representation and identify with the virtual self. In a similar vein, Ratan and Hasler (2010) conceptualize self-presence to include both body-level presence and identity-level presence. Body-level presence (i.e. physical similarity) refers to the extent to which a virtual self is integrated into the perception of one's body (Ratan and Hasler, 2010). This is exemplified when a consumer tries lipstick on their virtual self and integrates it into their mental representation of their physical offline body. Identity-level self-presence (i.e. identification), in turn, refers to the extent to which some aspects of a virtual self are related to some aspects of personal identity (Ratan and Hasler, 2010). Personal identities (e.g. being fashionable, being a rugged individual) focus on personal traits, characteristics and goals (Oyserman, 2009). When consumers can relate aspects of the virtual self to aspects of their identity, they experience identity-level self-presence (Ratan and Hasler, 2010).

When people want to explore different styles, they are motivated to use mass-customization options (Fiore *et al.*, 2004) and use prior experiences, desires and tastes to simulate the experience (Belk, 2014). Similarly, self-exploratory engagement permits consumers to explore styles in a realistic manner and to use prior experience to evaluate options (Huang and Liao, 2017). Thus, virtual self can be used to modify one's physical and symbolic attributes and to explore possible selves (Jin, 2012), which refer to different forms of self-expression (i.e. how people assert their identity or self; Oyserman, 2009). For instance, people can choose to express their actual, ideal or ought to self (Markus and Nurius, 1986). Exploring one's

Table 1 Summary of the literature on consumer-brand themes in augmented reality

References	Method	Process variables/ moderators	Dependent variables	Key findings
(Baek <i>et al.</i> , 2018)	Experiment	Self-viewing, self-brand connection/narcissism	Purchase intention	Self-viewing enhances both self-brand connection and purchase intention
(Phua and Kim, 2018)	Survey	Self-referencing, self-brand congruity, perceived humor	Brand attitude, purchase intention	AR enhances attitudes toward brands through self-brand congruity, self-referencing and perceived humor. Perceived humor is more important than self-referencing for brand attitudes
(Scholz and Duffy, 2018)	Ethnographic study	Branded app as personal space, dissolving of boundaries and foregrounding the consumer, protecting and dissolving the consumer/brand fusion	Consumer–brand relationship	AR enables consumers' self-exploration and self-expression. AR drives more intimate consumer–brand relationships when marketers keep both the brand and transactional aspects of the app in the background
(Huang <i>et al.</i> , 2019)	Experiment	Sense of ownership control, rehearsability, self-referencing, IT identity	Brand love	AR is higher in interactive effect and higher in audiovisual effect. Brand love is positively influenced by self-referencing and by IT identity
(Rauschnabel <i>et al.</i> , 2019)	Survey	Augmentation quality, hedonic and utilitarian quality, inspiration	Brand attitudes	AR apps inspire consumers and improve their attitudes toward brands
(Smink <i>et al.</i> , 2019)	Experiment	Self-referencing, perceived informativeness, perceived enjoyment, perceived intrusiveness	Brand attitude, purchase intention, willingness to share personal data	AR enhance self-referencing, in turn, it increases positive brand responses, such as brand attitudes and purchase intentions
(Xu <i>et al.</i> , 2019)	Experiment	Self-referencing	Attitude toward product	Self-referencing enhances attitudes toward product
(Smink <i>et al.</i> , 2020)	Experiment	Spatial presence, personalization, perceived intrusiveness	Attitude and behavior toward the app, brand attitude, purchase intention	Personalization led to purchase intentions (but not enhanced brand attitudes), while perceived intrusiveness had negative consequences
This study	Survey	Self-presence, self-explorative engagement	Brand cognitive processing, brand attitude	Consumers' sense of an authentic virtual self leads to self-explorative engagement. When consumers explore their styles, it enhances consumers' learning about brands and, thus, heightens brand attitude

Note: AR = augmented reality

Source: Authors' own work

possible selves ranges from imagining wearing a pair of shoes to imagining being a good student (Belk, 2003; Erikson, 2007), and in many cases, digital environments enable consumers to explore their possible selves (Belk, 2013). For instance, AR for makeup enables consumers to explore possible selves via a lived fantasy experience, such as trying on Rihanna's makeup style (El-Shamandi Ahmed *et al.*, 2023).

Studies that have examined the antecedents of self-explorative engagement in the VTO context already hint toward the possibility that self-presence is one of the key drivers. Specifically, Huang and Liao (2017) proposed two key technological features as antecedents for self-explorative engagement in the context of fitting clothes: self-location,

which refers to the sense of being in the body of a virtual representation and haptic imagery, which refers to the sense of touching the clothes. However, these antecedents dovetail body-level presence only, whereas we go further and argue that the antecedents to self-explorative engagement entails both body-level and identity-level presence.

Based on these considerations, we argue that when a consumer experiences self-presence, they are not role-playing or projecting a self, but instead, they are the virtual self. If a consumer tries a red lipstick on her virtual self because she has always wondered what it would look like on herself; this exemplifies self-explorative engagement in the VTO context. Furthermore, the theory of extended self suggests that when

people explore styles, they think about the traits associated with the brands and whether they wish to identify personally with those brands (Belk, 2003). Self-presence gives consumers access to private aspects of the self in the virtual environment (Hooi and Cho, 2014) that are used to explore possible selves. Based on these notions, we predict that:

*H1.* Self-presence enhances self-explorative engagement during the virtual try-on service experience.

### 2.2.2 Cognitive and affective outcomes of self-presence and self-explorative engagement

Consumers include the symbolic meaning of clothes, makeup, automobiles and so forth into their extended self (Jensen Schau and Gilly, 2003). In addition, brands are meaningful in constructing possible selves (Escalas and Bettman, 2005). According to the extended self theory (Belk, 1988, 2013), when consumers try on symbolic products, they may integrate the brand offering into their self-concept. The symbolic meaning of a branded product refers to the sense of being that is presumably provided by a branded product (Belk, 1988) or traits, such as glamour or ruggedness, that people wish to associate with (Belk, 2003). People consider their augmented images as part of their extended self (Scholz and Duffy, 2018). Consumers may extend their self-concept with the branded beauty product experienced in AR-VTO if this possible self is accepted by others (El-Shamandi Ahmed *et al.*, 2023). Thus, consumers give attention to brands that have become related to aspects of themselves (Escalas and Bettman, 2005).

Furthermore, information that is highly relevant to one's self-concept increases elaboration of message information (Burnkrant and Unnava, 1995). When people feel that the virtual self is physically similar to them, it increases trust in the product information (Shim and Lee, 2011) and consumer intentions to use the VTO (Suh *et al.*, 2011). Therefore, a message tailored to be self-relevant to virtual world users increases its persuasive outcomes (Fox *et al.*, 2009). The self is deeply involved in information processing, interpretation and memory of personal information (Rogers *et al.*, 1977). New information encoded as self-relevant lead to easier and faster processing and easier recall (Rogers *et al.*, 1977). Thus, we suggest that self-presence as a cue for highly self-relevant information enhances elaboration about the brand during the VTO experience. Therefore, we predict that:

*H2.* Self-presence enhances brand cognitive processing during the virtual try-on service experience.

Products and brands presented in self-relevant advertisements are perceived as more like oneself (Burnkrant and Unnava, 1995). When the message is highly self-relevant, for instance, by using a cue that represents the self in the virtual space, such as a name, the pronoun "you," profile picture of the self or an avatar, it influences consumers to like the brand more (Ahn and Bailenson, 2011; Escalas, 2007). The VTO experience allows consumers to view brands directly on themselves, which facilitates the formation of a relationship between brands and consumers and increases positive attitudes toward brands (Huang, 2019; Xu *et al.*, 2019). When AR enables consumers to view themselves during the brand experience, consumers'

brand attitude and purchase intentions improve (Ahn and Bailenson, 2011). Thus, we hypothesize:

*H3.* Self-presence enhances brand attitude during the virtual try-on service experience.

Self-explorative engagement might prompt cognitive processing of information, which could, on the one hand, overload the working memory, make the information less valuable for decision-making and distract attention from other mental tasks (Keogh and Pearson, 2014). For example, picturing oneself trying on a shirt and keeping the image in working memory can be a highly demanding task and reduce consumers' consideration of other information, such as learning information about a brand. On the other hand, however, AR allows consumers to digitally generate a vivid, lasting three-dimensional representation of the try-on experience on a live-stream of consumers' faces (Heller *et al.*, 2019). Therefore, AR offloads the cognitive processing of imagining how the product would look like in a realistic manner (Heller *et al.*, 2019). Notably, such offloading of otherwise internalized cognitive processing facilitates the processing of complex visual information (Heller *et al.*, 2019). Based on these considerations, we argue that when consumers engage in self-brand-related activities, such as trying on products of a specific brand, self-relevant information enhances consumers' information processing (Escalas, 2007). Thus, when consumers are mentally simulating trying on products, more cognitive resources can be allocated to processing brand-related information. Based on these notions and extended self theory, we suggest that trying on styles and using past experiences to evaluate products is highly self-involving and encourages consumers to learn about the brands. We, therefore, argue that:

*H4.* Self-explorative engagement increases brand cognitive processing during the virtual try-on service experience.

According to the theory of extended self, the more an object is tied to one's extended self, the more attention and care it receives (Belk, 1988). When consumers explore possible selves virtually, they are motivated to gather new information from brands and to integrate aspects of the brand into their self-concept. For instance, an AR experience (compared to a non-AR experience) is more likely to create positive brand outcomes because it motivates consumers to create, reinforce and express their sense of self (Huang, 2019). Consumers appreciate brands that allow them to creatively explore themselves (Chernev *et al.*, 2011). "Elaboration leads to attitude change via logical consideration and evaluation of arguments" (Green and Brock, 2000, p. 702), and when information is highly self-relevant, people are more willing to process it and thus will have more favorable brand attitudes (Schlosser, 2003). Thus, we propose that self-exploration enables the creation of personalized information about a branded product, results in more cognitive processing about the brand and positively impacts brand attitude. Based on these notions, we infer that:

*H5.* Self-explorative engagement positively impacts brand attitude through increased brand cognitive processing during the virtual try-on service experience.

### 3. Methodology

#### 3.1 Study design

Many studies recommend service managers to invest in AR apps to improve consumer experience (Dacko, 2017). Thus, given that AR apps are applied in various industries, it is important to understand whether different types of apps elicit different outcomes (van Noort and van Reijmersdal, 2019). Plotkina *et al.* (2021) compared six types of AR apps and, among them, two apparel VTOs. This constitutes an important ground work for comparing AR apps as they show that VTO apps are the most popular AR apps, and consequently resulted in more favorable brand outcomes (Plotkina *et al.*, 2021). Fashion and beauty industries participate to body beautification, and therefore, we infer that both product categories encourage consumers to explore what fits and suits them. We used popular branded AR apps in both contexts for this study.

Thus, this study is an online quasi-experiment with a between-subjects study design with two conditions: one VTO for fashion accessories and one for beauty products. Only female participants were assigned to the beauty condition, while all genders could be assigned to the fashion condition. The online survey was administered to a US national panel from Qualtrics. Participants were asked their age because we aimed to collect a representative sample. Participants in the sunglasses condition were instructed to browse through two or three pairs of sunglasses, while participants in the makeup condition were instructed to try two or three lipsticks on. Thereafter, participants were directed to the VTO application on a brand's website, where they saw the virtual products on themselves by using their own mobile devices. Concretely, the participants saw themselves on the screens of their own devices, filmed via the Web cameras of their devices. Participants could spend as much time as they wished inspecting products and, subsequently, responding to the questionnaire that includes the self-presence, self-explorative engagement, brand cognitive processing and brand attitude items. Participants spent 5 min on average on the overall survey for both conditions. We implemented an attention check ("Does this statement correspond to the task you completed? I fitted products on fashion models," for which the correct answer was "No") at the beginning of the questionnaire to ensure that participants used the AR apps. Therefore, if the participants failed the attention check, they did not access the questionnaire. Therefore, of the original 500 participants, 58 were rejected. We then conducted an additional round of data collection ( $n = 58$ ).

In the final sample ( $n = 500$ ; median age group is 35–44), 254 participants tried on the sunglasses (i.e. fashion condition) – 104 females, 144 males and 6 others – and 246 female participants tried on the lipsticks (i.e. beauty condition). Additional demographics are presented in Table 2.

All scales used in this study are previously validated (see Table A1 in Appendix for measurement items). The descriptive statistics of both conditions are reported in Table 3 (see Table A2 in Appendix for goodness of fit statistics).

Table 2 Participants' demographics

Characteristics	No.	%
Overall, US sample	500	100
<b>Age (years)</b>		
18–24	68	13.6
25–34	108	21.6
35–44	113	22.6
45–54	122	24.4
55–64	89	17.8
<b>Previous experience with VTO</b>		
Yes	83	16.6
No	383	76.6
Not sure	34	6.8
<b>Education</b>		
High school	251	50.2
Bachelor's degree	143	28.6
Master's degree	57	11.4
PhD	13	2.6
No degree	36	7.2
Fashion buyers*	376	64.2

Note: \* Respondents who bought fashion items in the past two years  
Source: Authors' own work

#### 3.2 Results of the measurement model

The results of the measurement model revealed a satisfactory fit to the data. The measures were validated by confirmatory factor analysis (CFA) and tested using LISREL 8.80 statistical software. Similar to McLean and Wilson (2019), we use multigroup structural equation modeling and test measurement invariance to ensure that the results obtained from the two VTO conditions (sunglasses and makeup) were comparable. This was achieved in two-steps by testing configural and metric invariance of path parameters of both conditions simultaneously. Measurement invariance verifies that the same construct is measured across groups (Hair *et al.*, 2010). To do so, at each step, we compared an unconstrained measurement model to a constrained one and used changes in the chi-square ( $\chi^2$ ) and degrees of freedom (d.f.) as measures of whether invariance exists between measurement models. The  $\chi^2$  values and differences in  $\chi^2$  values between the base model and constrained model indicate insignificant degradation of the model fit compared with the base model; therefore, we confirm equivalence between both conditions (Table 4).

The validity and reliability of the measurement model were confirmed, as the composite reliability (CR) loaded above the threshold value of 0.6 for all items (Bagozzi and Yi, 1988) and the average variance extracted (AVE) values for each construct exceeded the threshold value of 0.5 (Hair *et al.*, 2010). Discriminant validity was assessed by the Fornell–Larcker criterion (Fornell and Larcker, 1981) by comparing correlations with the square root of AVEs for the corresponding constructs. All square root AVEs are greater than the corresponding correlations; thus, the results confirm discriminant validity (see Table 5). Furthermore, the highest variance inflation factor (VIF) is 2.27; thus, we confirm that all VIF values are well below the threshold of 10

Table 3 Descriptive statistics

Construct	Items	Mean	SD	Item loading	Cronbach's alpha
Fashion condition Self-presence	Total	3.95	1.41		0.90
	SEP1			0.82	
	SEP2			0.90	
	SEP3			0.88	
Self-explorative engagement	Total	4.32	1.43		0.88
	SE1			0.83	
	SE2			0.83	
	SE3			0.86	
Brand cognitive processing	Total	4.37	1.40		0.85
	BCP1			0.76	
	BCP2			0.83	
	BCP3			0.84	
Brand attitude	Total	4.75	1.45		0.90
	BA1			0.84	
	BA2			0.91	
	BA3			0.87	
Beauty condition Self-presence	Total	3.87	1.42		0.92
	SEP1			0.87	
	SEP2			0.92	
	SEP3			0.88	
Self-explorative engagement	Total	4.38	1.38		0.88
	SE1			0.81	
	SE2			0.84	
	SE3			0.85	
Brand cognitive processing	Total	4.37	1.35		0.86
	BCP1			0.77	
	BCP2			0.86	
	BCP3			0.86	
Brand attitude	Total	4.50	1.68		0.95
	BA1			0.91	
	BA2			0.98	
	BA3			0.91	

Source: Authors' own work

(Field, 2009). In addition, the highest condition index is 12.36, which is well below the threshold of 30 (Field, 2009). Therefore, multicollinearity is not a cause for concern (see Table A3 in Appendix 1).

Following recommendations by Armstrong and Overton (1977), we performed nonresponse bias analyses (see Table A4 in Appendix 1). The results of Pearson's chi-squared tests indicate that the early respondents do not significantly differ from the late respondents in terms of gender ( $\chi^2 = 0.52$ ,

$p > 0.05$ ) or level of education ( $\chi^2 = 4.44$ ,  $p > 0.05$ ) while there is a significant difference in age groups ( $\chi^2 = 60.24$ ,  $p < 0.05$ ). However, as reported later (Section 4.4), including age as a control variable does not impact our model. The  $t$ -tests indicate nonsignificant differences in self-presence  $t(248) = 1.15$ ,  $p > 0.05$ , self-explorative engagement  $t(248) = 0.45$ ,  $p > 0.05$ , brand cognitive processing  $t(248) = 0.03$ ,  $p > 0.05$  and brand attitude  $t(248) = 0.28$ ,  $p > 0.05$  between the early and late respondents.

Table 4 Multigroup CFA for invariance testing

Model	$\chi^2$ (d.f.)	Delta: $\chi^2$ (d.f.)	RMSEA	NNFI	CFI
Configural invariance	252.64 (99)		0.07	0.97	0.98
Metric invariance	261.60 (107)	7.76 (8)	0.07	0.98	0.98

Notes:  $\chi^2$  = chi-square; d.f. = degrees of freedom; RMSEA = root mean square error of approximation; NNFI = non-normed fit index; CFI = comparative fit index

Source: Authors' own work

Table 5 Measure properties

	1	2	3	4	Square root AVE
<b>Fashion condition</b>					
1. Self-presence	1.00				0.87
2. Self-explorative engagement	0.68	1.00			0.84
3. Brand attitude	0.53	0.49	1.00		0.84
4. Brand cognitive processing	0.69	0.79	0.55	1.00	0.82
CR	0.90	0.88	0.90	0.86	
AVE	0.76	0.72	0.76	0.67	
<b>Beauty condition</b>					
1. Self-presence	1.00				0.89
2. Self-explorative engagement	0.69	1.00			0.83
3. Brand attitude	0.57	0.59	1.00		0.94
4. Brand cognitive processing	0.70	0.78	0.63	1.00	0.83
CR	0.90	0.88	0.90	0.86	
AVE	0.76	0.72	0.76	0.67	

Note: AVE = average variance extracted

Source: Authors' own work

To ensure that common method bias is not an issue, we implemented the preventative steps recommended by Mackenzie and Podsakoff (2012). We minimized the difficulty of responding with the help of several doctoral students from various fields that confirmed the questionnaire is easy to understand and unambiguous. Furthermore, we ensured that the participants were motivated to respond accurately by offering monetary compensation if their questionnaire answers were not rejected due to quality issues. To reduce satisficing, participants were informed that the researchers do not have access to their private information, and therefore, their answers to the questionnaire are anonymous. Furthermore, our variables make it unlikely that the participants' answers were driven by social desirability. Nevertheless, we additionally calculated common method variance. After data collection, we used Harman's single-factor test with CFA to test the hypothesis that a single factor can account for all of the variance in the data (Korsgaard and Roberson, 1995; Mossholder *et al.*, 1998). Thereby, we conducted two CFAs, one with a single-factor solution whereby all items loaded on one factor ( $\chi^2 = 1,849.36$ , d.f. = 54) and another one with a two-factor solution ( $\chi^2 = 1,626.80$ , d.f. = 53) and compared the chi-square and d.f. for both models. A significant chi-squared test indicates a significant improvement in the model fit and is supported by a change in chi-square above the threshold of 3.84 for d.f. = 1 (Field, 2009). We find that the CFA with a two-factor solution had a significantly better fit than the CFA with a one-factor solution ( $\Delta$  chi-square = 222.56,  $\Delta$  d.f. = 1) (see Table A5 in Appendix 1). Thus, we conclude that common method bias is not a serious threat to the robustness of the results.

### 3.3 Results of hypothesis testing

The structural equation model was estimated based on the hypothesized model in Figure 1. The structural model presented an acceptable fit (Jöreskog and Sörbom, 1993) (root mean square error of approximation [RMSEA] = 0.07;  $\chi^2 = 261.60$ , d.f. = 107,  $p < 0.005$ , SRMR = 0.04, RMR = 0.09, comparative fit index [CFI] = 0.98, NFI = 0.97, GFI = 0.92).

The model supports all the hypothesized relationships for both conditions (see Table 6).

H1 proposed that self-presence influences self-explorative engagement: this hypothesis is confirmed ( $H1_{\text{Fashion}}$ :  $\beta = 0.69$ ,  $p < 0.001$ ,  $H1_{\text{Beauty}}$ :  $\beta = 0.69$ ,  $p < 0.001$ ). H2 confirms that self-presence enhances brand cognitive processing ( $H2_{\text{Fashion}}$ :  $\beta = 0.28$ ,  $p < 0.001$ ,  $H2_{\text{Beauty}}$ :  $\beta = 0.30$ ,  $p < 0.001$ ). H3 states that self-presence enhances brand attitude and is confirmed ( $H3_{\text{Fashion}}$ :  $\beta = 0.29$ ,  $p < 0.001$ ,  $H3_{\text{Beauty}}$ :  $\beta = 0.20$ ,  $p < 0.01$ ). Self-explorative engagement improves brand cognitive processing ( $H4_{\text{Fashion}}$ :  $\beta = 0.59$ ,  $p < 0.001$ ,  $H4_{\text{Beauty}}$ :  $\beta = 0.59$ ,  $p < 0.001$ ), therefore, H4 is confirmed. As predicted by H5, self-explorative engagement positively influences brand attitude through brand cognitive processing. Notably, we use LISREL and find that the indirect effects ( $H5_{\text{Fashion}}$ :  $\beta = 0.19$ ,  $p < 0.01$ ,  $H5_{\text{Beauty}}$ :  $\beta = 0.20$ ,  $p < 0.01$ ) and the total effects ( $\text{Fashion}$ :  $\beta = 0.23$ ,  $p < 0.01$ ,  $\text{Beauty}$ :  $\beta = 0.38$ ,  $p < 0.01$ ) are significant while the direct effects ( $\text{Fashion}$ :  $\beta = 0.19$ , n.s.,  $\text{Beauty}$ :  $\beta = 0.20$ , n.s.) are not significant. Hayes (2018) notes that the "condition for mediation" by Baron and Kenny (1986) have been criticized and are not anymore the standard in statistical research. Instead, Hayes (2018) recommends to confirm the mediation hypotheses by estimating and interpreting the direct, indirect and total effects. Moreover, the strength of the mediation should be measured by the size of the indirect effect (Zhao *et al.*, 2010). In the fashion condition, our model explains 48% of self-explorative engagement, 30% of brand attitude and 66% of brand cognitive processing. In the beauty condition, our model explains 48% of self-explorative engagement, 45% of brand attitude and 69% of brand cognitive processing.

### 3.4 Robustness checks

Thereafter, we estimate the model again including three control variables (age, education and interest in fashion shopping) on the dependent variables. The results confirm the previous significant relationships (see Table A6 in Appendix 1); thus, we gain additional support for our model. In addition,



Figure 1 Conceptual framework

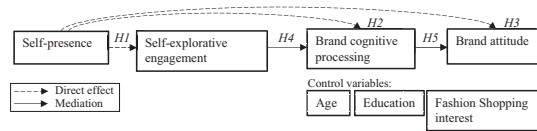


Table 6 Results of structural equation modeling

Hypothesized relationships	Effects <sup>a</sup>	Stderr	t-value	Result
<b>Fashion condition</b>				
Self-presence → SE	0.69***	0.06	11.22	H1: confirmed
SEP → BCP	0.28***	0.07	3.72	H2: confirmed
SEP → BA	0.29***	0.09	3.13	H3: confirmed
Indirect effect: SEP → SE → BCP	0.41***	0.06	6.44	
Indirect effect: SEP → SE → BA	0.25***	0.07	3.62	
Total effect: SEP → BCP	0.68***	0.06	10.68	
Total effect: SEP → BA	0.54***	0.06	8.56	
SE → BCP	0.59***	0.07	7.38	H4: confirmed
Indirect effect: SE → BCP → BA	0.19**	0.07	2.60	H5: confirmed
Total effect: SE → BA	0.23**	0.07	2.54	
Direct effect: SE → BA	0.04 <sup>n.s.</sup>	0.11	0.30	
BCP → brand attitude	0.33**	0.13	2.78	
<b>Beauty condition</b>				
Self-presence → SE	0.69***	0.06	11.22	H1: confirmed
SEP → BCP	0.30***	0.07	4.13	H2: confirmed
SEP → BA	0.20**	0.10	2.44	H3: confirmed
Indirect effect: SEP → SE → BCP	0.41***	0.06	6.45	
Indirect effect: SEP → SE → BA	0.25***	0.07	6.00	
Total effect: SEP → BCP	0.68***	0.06	10.78	
Total effect: SEP → BA	0.54***	0.07	9.84	
SE → BCP	0.59***	0.07	7.47	H4: confirmed
Indirect effect: SE → BCP → BA	0.20**	0.09	2.60	H5: confirmed
Total effect: SE → BA	0.38***	0.13	5.13	
Direct effect: SE → BA	0.19 <sup>n.s.</sup>	0.13	1.60	
BCP → BA	0.35***	0.15	3.13	

Notes: SE = self-explorative engagement; SEP = self-presence; BA = brand attitude, BCP; brand cognitive processing; <sup>a</sup>standardized effect; Stderr = standard error; critical t-value (one-tailed) = 1.645. \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; <sup>n.s.</sup> $p > 0.05$

Source: Authors' own work

most of the effects of the control variables on the focal variables are insignificant. However, we find that interest for fashion shopping improves brand attitude in both the fashion and beauty conditions, while age negatively influences self-explorative engagement in the beauty condition. In addition, we investigate the mediation with a more stringent test that consists in model comparison and  $\chi^2$  significance test between the freely estimated effect of self-explorative engagement on brand attitude and by constraining the relationship to zero. Model fit is good (RMSEA = 0.07), but this stronger statistical test does not provide enough proof to confirm full mediation because the constrained model (full mediation) results in a significant degradation of fit ( $\Delta$  d.f. = 2,  $\Delta$  chi-square = 7.92; see Table A7 in Appendix 1). Thus, the more stringent test indicates a partial mediation of self-explorative engagement on brand attitude.

Finally, we provide support for the normality and homogeneity of the data. Field (2009) advises to inspect the shape of the distribution visually and to inspect the value of the skewness and kurtosis statistics. The visual inspection of the p-p plots (see Figure B1 in Appendix 2) indicates that there is no concern about normality of the data. The normality assumption for maximum likelihood estimation was tested, and we reported (see Table B1 in Appendix 2) that all variables are well below the threshold of two for skewness and seven for kurtosis (Fabrigar et al., 1999). Regarding testing homogeneity of variance between two groups, Levene's test and Hartley's variance Fmax ratio can be used. The variances were equal between the fashion and beauty conditions for self-presence  $F(1,498) = 0.07$ , n.s., for self-explorative engagement  $F(1,498) = 0.40$ , n.s. and for the brand cognitive processing  $F(1,498) = 0.62$ , n.s., but not for brand attitude  $F(1,498) = 4.12$ ,  $p < 0.05$ . In large

samples, Levene's test can be significant even when the variance between groups is not very different; thus, it should be interpreted in conjunction with the variance ratio (Field, 2009). We find that Hartley Fmax variance ratio is close to one, and thus, we confirm homogeneity of variance between both groups for each variable (Field, 2009) (see Table B2 in Appendix 2).

## 4. Discussion

### 4.1 Theoretical contributions

VTO revolutionizes the shopping experience because it allows consumers to decorate themselves virtually, which mimics their window-shopping in-store experience without having to travel to the store. Such services are crucial to help brands be more competitive (Berry, 2016). The findings of the present study make three main contributions.

First, we participate in the discussion on the role of presence experiences in AR. We show that consumers are motivated to explore their styles in AR-based service contexts (Scholz and Duffy, 2018), provided that they consider the virtual self to be themselves (i.e. self-presence). In addition, to the best of the authors' knowledge, this study is the first to show that self-presence also has a direct positive impact on cognitive and affective brand-related outcomes in AR-enabled service contexts. These findings extend the work of Scholz and Duffy (2018), who find that AR makeup apps enable consumers to try-on a product on their own face and in their personal space, therefore, foregrounding consumers' self-exploration and leading to intimate consumer-brand relationships. Furthermore, we extend the work of Adachi *et al.* (2020), who show that self-presence in VR leads to positive attitudes that transfer to the image of travel destinations by demonstrating that self-presence has the potential to improve consumers' attitudes also in the context of AR-based VTOs.

Second, this study contributes to research on the exploration of possible selves in virtual contexts (Ambika *et al.*, 2022; El-Shamandi Ahmed *et al.*, 2023) by showing that self-presence and self-explorative engagement enable consumers to explore their possible selves. This finding extends prior research, which shows that consumers use AR to explore their ideal and true self-presentation (Javornik *et al.*, 2022). Our results provide nuance to many studies that point out that consumers do not believe that AR is realistic and would not use it to explore themselves (El-Shamandi Ahmed *et al.*, 2023; Javornik *et al.*, 2022). Importantly, such studies considered AR try-ons that display multiple brands or unbranded styles while we confirm our findings in two branded AR contexts. We further establish that self-presence is an important and novel prerequisite for self-explorative engagement in the context of VTO and, therefore, contribute to the existing research on consumers' self-explorative engagement (Chernev *et al.*, 2011). This finding answers the call for novel insights about consumers' key motivations to use online services (Furrer *et al.*, 2020).

Third, this study contributes to research on the extended self (Belk, 1988, 2013) by denoting the existence of an extended self in AR-VTOs that results in positive brand attitudes when consumers use branded fashion and beauty apps. Belk (2013) concluded that virtual self may influence offline selves and help create multiplicity of selves. Our study contributes to this literature on how AR helps consumers present themselves and

shows that in the context of AR branded apps, the symbolic meaning from a focal brand gives reassurance and permits self-extension. Specifically, during self-extension, consumers explore their styles and increase their processing of brand information. In turn, self-extension benefits brands that offer such services.

### 4.2 Practical implications

The findings of this study are verified across two online service experiences and have several implications for service managers and developers of AR-based shopping apps. First, developing apps that enhance consumers' self-explorative engagement requires that app developers provide a realistic experience of the virtual self (i.e. self-presence). Prior research shows that consumers report a lack of authenticity in the VTO service experience and desire a believable representation of shades and sizes on people's own physical characteristics, for instance, different skin colors or facial features (El-Shamandi Ahmed *et al.*, 2023). Thus, designers should involve consumers in the cocreation of the service experience from the beginning to make AR more inclusive, for instance, making it more accurate for Asian women (El-Shamandi Ahmed *et al.*, 2023). In addition, brands should be the background of the service experience while consumers are foregrounded (Scholz and Duffy, 2018).

Second, self-explorative engagement provides a novel type of experience that service managers can propose for finding their target audience willing to embrace AR. Most AR research focuses on increasing purchases and views AR as a mere decision-making tool (Hilken *et al.*, 2017; Whang *et al.*, 2021), while we suggest that VTOs might have an additional role in the customer journey. Specifically, this study finds that the VTO is a tool for self-exploratory behavior (Javornik *et al.*, 2022) that enhances affective and cognitive brand outcomes, and previous research suggests that self-explorative engagement can help companies form close relationships with consumers (Scholz and Duffy, 2018). Therefore, service managers and brands should not focus only on supporting the utilitarian purposes of using VTO apps but also enable more hedonic self-explorative engagement. This is a novel way to enable interaction between consumers and the organizational frontline with the potential to expand services by deepening consumer relationships (Marinova *et al.*, 2017). Therefore, we recommend especially smaller and less-known brands to consider using VTO services to increase positive attitudes toward brands. This is consistent with a recent study showing that AR apps are particularly useful for less known brands, brands with smaller target audiences and luxury products (Tan *et al.*, 2022).

Third, brands investing in AR technology might create a lock-in effect with the branded app. Lock-in effects are a type of loyalty that occurs when the costs of switching is higher than the benefits (Murray and Häubl, 2007). When people are loyal to an online vendor, it is often because they have spent time and energy learning how to use it and learning about the brand (Shih, 2012). Technological lock-ins stem from a positive affective and cognitive experience with products and brands (Shih, 2012). An AR-VTO as a feature of a branded app (e.g. Sephora and Nike AR apps) encourages consumer exploration of styles and facilitates affective and cognitive responses toward the focal brand and can, therefore, help create lock-in effects. We suggest that through this mechanism, AR can help brands



capture more value for themselves instead of joining a marketplace and pay commission to the platform.

## 5. Limitations and future research

The present study is a cross sectional one, thus involving the risk of common method bias (Podsakoff *et al.*, 2003), which we considered before and after data collection. Prior to the data collection, we implemented the preventative steps recommended by MacKenzie and Podsakoff (2012) to ensure that common method bias is not a serious issue in our study. We also checked for common method bias afterwards with Harman's criterion. However, in light of current controversy on Harman's criterion (Baumgartner *et al.*, 2021), we recognize that common method bias might be a limitation to our data.

Furthermore, this study has several limitations that offer fruitful avenues for future research. First, to the best of authors' knowledge, this is the first study to show the importance of self-presence in AR, and we hope it will inspire further research on presence theory. Research discusses presence as multidimensional concept that encompasses spatial presence, self-presence and social presence (Lavoye and Tarkiainen, 2021; Lee, 2004). Whereas spatial presence has been the most commonly studied presence dimension in AR research thus far (Hilken *et al.*, 2017; Smink *et al.*, 2020), the present research provides important background for a multidimensional investigation of presence.

Second, we only discuss the exploration of styles via VTO but do not investigate the deeper meaning of such exploration for consumers' self-concept. The research literature recognizes the importance of many self-related constructs (self-expression, Belk, 1988; self-congruity, Sirgy, 1982) as antecedents to positive brand outcomes in the context of VTOs. These self-related constructs assume that consumers already have formed a self-image they wish to express, and they will assess the brands' congruence with this self-image. However, research also shows that low self-esteem consumers are the most keen to use AR (Yim and Park, 2019), and they wish to explore their self-concept with AR (Javornik *et al.*, 2021). Therefore, helping this segment to explore their self-concept is an important avenue for future research. Future research can dive into the self-explorative experience and collect additional data to verify our findings with self-explorative engagement as performance, which can entail observing how many products participant try-on, how long they use the app and how creative their experience is.

Third, extended self theory recognizes that the incorporation of branded products into the self happens through a process of increasing knowledge of the object, which becomes desirable thereafter (Belk, 1988). However, our results did not provide support for a full mediation between self-explorative engagement and brand attitude via brand cognitive processing; thus, we encourage future research to provide additional clarity on these relationships. Beyond cognitive and affective brand outcomes, future studies should investigate whether self-explorative engagement might, under some conditions, decrease loyalty to brands and businesses. Self-extension typically increases loyalty to a focal brand; however, digital products might play different roles and reduce brand loyalty (Belk, 2013). This might be the case because some VTOs

enable consumers to explore brands, and consumers might, therefore, move from one brand to another easily. Consequently, their loyalty to any individual brand could be decreased. Retailers are increasingly investing in VTOs, for instance, Amazon is adding AR-VTO for shoes, and therefore, lets consumers explore thousands of styles from footwear brands including New Balance, Adidas, Reebok and Lacoste (Perez, 2022). Many big Tech rivals, for instance, Snapchat, Pinterest and Google, also leverage AR-VTO to display clothes, makeup and accessories (Perez, 2022). This is an important topic because of the popularity of those platforms that make VTO technologies instantly available to millions of users.

Fourth, our stimuli compare two different product categories (i.e. lipstick and sunglasses), and more product categories should be considered as they might reveal new boundary conditions to our findings. Other possible boundary conditions are consumers' characteristics, such as their satisfaction with their appearance. Specifically, consumers' satisfaction with their appearance improves self-presence, product diagnosticity and loyalty toward the try-on experience (Suh *et al.*, 2011), while consumers' dissatisfaction (vs satisfaction) with their body image enhances the popularity of VTOs (Yim and Park, 2019). We suggest that dissatisfaction with one's appearance reduces self-presence and, in turn, a lower self-presence protects against the negative emotions linked with one's low self-image and enables consumers to focus on the products and the experience. Therefore, future studies should investigate the extent to which different levels of self-presence will benefit different consumers in this context and provide guidelines to service designers.

Fifth, and finally, the lipstick condition was only tested by women, as it is the typical target segment for makeup; however, gender might be an interesting boundary condition to investigate further. In addition, this survey had an experimental task, and 77% of the participants had never used AR before. Future research on this topic would benefit from insights of more experienced users of the apps to better understand their needs and motivations when using such technologies.

## References

- Adachi, R., Cramer, E.M. and Song, H. (2020), "Using virtual reality for tourism marketing: a mediating role of self-presence", *The Social Science Journal*, pp. 1-14.
- Ahn, S.J. and Bailenson, J.N. (2011), "Self-endorsing versus other-endorsing in virtual environments", *Journal of Advertising*, Vol. 40 No. 2, pp. 93-106.
- Alexander, M., Jo Connell, L. and Beth Presley, A. (2005), "Clothing fit preferences of young female adult consumers", *International Journal of Clothing Science and Technology*, Vol. 17 No. 1, pp. 52-64.
- Ambika, A., Jain, V. and Belk, R. (2022), "Self-augmentation and consumer experiences: an exploratory study: an abstract", in Allen, J., Jochims, B. and Wu, S. (Eds), *Celebrating the Past and Future of Marketing and Discovery with Social Impact*, pp. 45-46.
- Armstrong, J.S. and Overton, T.S. (1977), "Estimating nonresponse bias in mail surveys", *Journal of Marketing Research*, Vol. 14 No. 3, pp. 396-402.

- Baek, T.H., Yoo, C.Y. and Yoon, S. (2018), "Augment yourself through virtual mirror: the impact of self-viewing and narcissism on consumer responses", *International Journal of Advertising*, Vol. 37 No. 3, pp. 421-439.
- Bagozzi, R.P. and Yi, Y. (1988), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16 No. 1, pp. 74-94.
- Baron, R.M. and Kenny, D.A. (1986), "The moderator-mediator variable distinction in social psychological research. Conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psychology*, Vol. 51 No. 6, pp. 1173-1182.
- Baumgartner, H., Weijters, B. and Pieters, R. (2021), "The biasing effect of common method variance: some clarifications", *Journal of the Academy of Marketing Science*, Vol. 49 No. 2, pp. 221-235.
- Beck, M. and Crié, D. (2018), "I virtually try it I want it! Virtual fitting room: a tool to increase on-line and off-line exploratory behavior, patronage and purchase intentions", *Journal of Retailing and Consumer Services*, Vol. 40, pp. 279-286.
- Belk, R. (1988), "Possessions and the extended self", *Journal of Consumer Research*, Vol. 15 No. 2, pp. 139-168.
- Belk, R. (2014), "Digital consumption and the extended self", *Journal of Marketing Management*, Vol. 30 Nos 11/12, pp. 1101-1118.
- Belk, R.W. (2003), *Shoes and Self*, ACR North American Advances.
- Belk, R.W. (2013), "Extended self in a digital world", *Journal of Consumer Research*, Vol. 40 No. 3, pp. 477-500.
- Berry, L.L. (2016), "Revisiting 'big ideas in services marketing' 30 years later", *Journal of Services Marketing*, Vol. 30 No. 1, pp. 3-6.
- Burnkrant, R.E. and Unnava, H.R. (1995), "Effects of self-referencing on persuasion", *Journal of Consumer Research*, Vol. 22 No. 1, p. 17.
- Chernev, A., Hamilton, R. and Gal, D. (2011), "Competing for consumer identity: limits to self-expression and the perils of lifestyle branding", *Journal of Marketing*, Vol. 75 No. 3, pp. 66-82.
- Childers, T.L., Carr, C.L., Peck, J. and Carson, S. (2001), "Hedonic and utilitarian motivations for online retail shopping behavior", *Journal of Retailing*, Vol. 77 No. 4, pp. 511-535.
- Dacko, S.G. (2017), "Enabling smart retail settings via mobile augmented reality shopping apps", *Technological Forecasting and Social Change*, Vol. 124, pp. 243-256.
- El-Shamandi Ahmed, K., Ambika, A. and Belk, R. (2023), "Augmented reality magic mirror in the service sector: experiential consumption and the self", *Journal of Service Management*, Vol. 34 No. 1, pp. 56-77.
- Erikson, M.G. (2007), "The meaning of the future: toward a more specific definition of possible selves", *Review of General Psychology*, Vol. 11 No. 4, pp. 348-358.
- Escalas, J.E. (2007), "Self-referencing and persuasion: narrative transportation versus analytical elaboration", *Journal of Consumer Research*, Vol. 33 No. 4, pp. 421-429.
- Escalas, J.E. and Bettman, J.R. (2005), "Self-construal, reference groups, and brand meaning", *Journal of Consumer Research*, Vol. 32 No. 3, pp. 378-389.
- Fabrigar, L.R., Wegener, D.T., MacCallum, R.C. and Strahan, E.J. (1999), "Evaluating the use of exploratory factor analysis in psychological research", *Psychological Methods*, Vol. 4 No. 3, pp. 272-299.
- Field, A. (2009), *Discovering Statistics Using SPSS*, SAGE Publications.
- Fiore, A.M., Lee, S. and Kunz, G. (2004), "Individual differences, motivations, and willingness to use a mass customization option for fashion products", *European Journal of Marketing*, Vol. 38 No. 7, pp. 835-849.
- Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
- Fox, J., Bailenson, J. and Binney, J. (2009), "Virtual experiences, physical behaviors: the effect of presence on imitation of an eating avatar", *Presence: Teleoperators and Virtual Environments*, Vol. 18 No. 4, pp. 294-303.
- Furrer, O., Yu Kerguignas, J., Delcourt, C. and Gremler, D.D. (2020), "Twenty-seven years of service research: a literature review and research agenda", *Journal of Services Marketing*, Vol. 34 No. 3, pp. 299-316.
- Green, M.C. and Brock, T.C. (2000), "The role of transportation in the persuasiveness of public narratives", *Journal of Personality and Social Psychology*, Vol. 79 No. 5, pp. 701-721.
- Grönroos, C. (2020), "Viewpoint: service marketing research priorities", *Journal of Services Marketing*, Vol. 34 No. 3, pp. 291-298.
- Gurel, L.M. and Gurel, L. (1979), "Clothing interest: conceptualization and measurement", *Home Economics Research Journal*, Vol. 7 No. 5, pp. 274-282.
- Hair, J.F., Anderson, R.E., Babin, B.J. and Black, W.C. (2010), *Multivariate Data Analysis: A Global Perspective*, 7th ed., Pearson Education, Upper Saddle River, NJ.
- Hayes, A.F. (2018), *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*, Guilford press, New York, NY.
- Heller, J., Chylinski, M., de Ruyter, K., Mahr, D. and Keeling, D.I. (2019), "Let me imagine that for you: transforming the retail frontline through augmenting customer mental imagery ability", *Journal of Retailing*, Vol. 95 No. 2, pp. 94-114.
- Hilken, T., de Ruyter, K., Chylinski, M., Mahr, D. and Keeling, D.I. (2017), "Augmenting the eye of the beholder: exploring the strategic potential of augmented reality to enhance online service experiences", *Journal of the Academy of Marketing Science*, Vol. 45 No. 6, pp. 884-905.
- Hinsch, C., Felix, R. and Rauschnabel, P.A. (2020), "Nostalgia beats the wow-effect: inspiration, awe and meaningful associations in augmented reality marketing", *Journal of Retailing and Consumer Services*, Vol. 53, p. 101987.
- Hollebeck, L.D., Glynn, M.S. and Brodie, R.J. (2014), "Consumer brand engagement in social media: conceptualization, scale development and validation", *Journal of Interactive Marketing*, Vol. 28 No. 2, pp. 149-165.
- Holmlund, M., Hagman, A. and Polska, P. (2011), "An exploration of how mature women buy clothing: empirical insights and a model", *Journal of Fashion Marketing and Management: An International Journal*, Vol. 15 No. 1, pp. 108-122.

- Hooi, R. and Cho, H. (2014), "Avatar-driven self-disclosure: the virtual me is the actual me", *Computers in Human Behavior*, Vol. 39, pp. 20-28.
- Huang, T.-L. (2019), "Psychological mechanisms of brand love and information technology identity in virtual retail environments", *Journal of Retailing and Consumer Services*, Vol. 47, pp. 251-264.
- Huang, T.-L. and Liao, S.-L. (2017), "Creating e-shopping multisensory flow experience through augmented-reality interactive technology", *Internet Research*, Vol. 27 No. 2, pp. 449-475.
- Huang, T.-L., Mathews, S. and Chou, C.Y. (2019), "Enhancing online rapport experience via augmented reality", *Journal of Services Marketing*, Vol. 33 No. 7, pp. 851-865.
- Javornik, A., Marder, B., Barhorst, J.B., McLean, G., Rogers, Y., Marshall, P. and Warlop, L. (2022), "What lies behind the filter? Uncovering the motivations for using augmented reality (AR) face filters on social media and their effect on well-being", *Computers in Human Behavior*, Vol. 128, p. 107126.
- Javornik, A., Marder, B., Pizzetti, M. and Warlop, L. (2021), "Augmented self - the effects of virtual face augmentation on consumers' self-concept", *Journal of Business Research*, Vol. 130, pp. 170-187.
- Jensen Schau, H. and Gilly, M.C. (2003), "We are what we post? Self-presentation in personal web space", *Journal of Consumer Research*, Vol. 30 No. 3, pp. 385-404.
- Jin, S.A.A. (2012), "The virtual malleable self and the virtual identity discrepancy model: investigative frameworks for virtual possible selves and others in avatar-based identity construction and social interaction", *Computers in Human Behavior*, Vol. 28 No. 6, pp. 2160-2168.
- Jöreskog, K.G. and Sörbom, D. (1993), *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*, Scientific Software International, Chicago, IL, US.
- Keogh, R. and Pearson, J. (2014), "The sensory strength of voluntary visual imagery predicts visual working memory capacity", *Journal of Vision, the Association for Research in Vision and Ophthalmology*, Vol. 14 No. 12, p. 7.
- Korsgaard, M.A. and Roberson, L. (1995), "Procedural justice in performance evaluation: the role of instrumental and non-instrumental voice in performance appraisal discussions", *Journal of Management*, Vol. 21 No. 4, pp. 657-669.
- Lavoye, V. and Tarkiainen, A. (2021), "Toward an improved understanding of AR-based presence dimensions and their impact on attitude certainty", *European Marketing Academy (EMAC) 50th*, p. 94505.
- Lee, K.M. (2004), "Presence, explicated", *Communication Theory*, Vol. 14 No. 1, pp. 27-50.
- Li, H., Daugherty, T. and Biocca, F. (2002), "Impact of 3-D advertising on product knowledge, brand attitude, and purchase intention: the mediating role of presence", *Journal of Advertising*, Vol. 31 No. 3, pp. 43-57.
- MacKenzie, S.B. and Podsakoff, P.M. (2012), "Common method bias in marketing: causes, mechanisms, and procedural remedies", *Journal of Retailing*, Vol. 88 No. 4, pp. 542-555.
- McLean, G. and Wilson, A. (2019), "Shopping in the digital world: examining customer engagement through augmented reality mobile applications", *Computers in Human Behavior*, Vol. 101, pp. 210-224.
- Marinova, D., de Ruyter, K., Huang, M.-H., Meuter, M.L. and Challagalla, G. (2017), "Getting smart", *Journal of Service Research*, Vol. 20 No. 1, pp. 29-42.
- Markus, H. and Nurius, P. (1986), "Possible selves", *American Psychologist*, Vol. 41 No. 9, pp. 954-969.
- Mossholder, K.W., Bennett, N., Kemery, E.R. and Wesolowski, M.A. (1998), "Relationships between bases of power and work reactions: the mediational role of procedural justice", *Journal of Management*, Vol. 24 No. 4, pp. 533-552.
- Murray, K.B. and Häubl, G. (2007), "Explaining cognitive lock-in: the role of skill-based habits of use in consumer choice", *Journal of Consumer Research*, Vol. 34 No. 1, pp. 77-88.
- Oyserman, D. (2009), "Identity-based motivation: implications for action-readiness, procedural-readiness, and consumer behavior", *Journal of Consumer Psychology*, Vol. 19 No. 3, pp. 250-260.
- Perez, S. (2022), "Amazon gets into AR shopping with launch of 'virtual Try-On for shoes'", TechCrunch, available at: <https://techcrunch.com/2022/06/09/amazon-gets-into-ar-shopping-with-launch-of-virtual-try-on-for-shoes/>
- Phua, J. and Kim, J. (2018), "Starring in your own Snapchat advertisement: influence of self-brand congruity, self-referencing and perceived humor on brand attitude and purchase intention of advertised brands", *Telematics and Informatics*, Vol. 35 No. 5, pp. 1524-1533.
- Piacentini, M. and Mailer, G. (2004), "Symbolic consumption in teenagers' clothing choices", *Journal of Consumer Behaviour*, Vol. 3 No. 3, pp. 251-262.
- Plotkina, D., Dinsmore, J. and Racat, M. (2021), "Improving service brand personality with augmented reality marketing", *Journal of Services Marketing*, Vol. 39 No. 12, pp. 945-959, doi: 10.1108/JSM-12-2020-0519.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *The Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.
- Ratan, R. and Hasler, B.S. (2010), "Exploring self-presence in collaborative virtual teams", *Psychology Journal*, Vol. 8 No. 1, pp. 11-31.
- Rauschnabel, P.A., Felix, R. and Hinsch, C. (2019), "Augmented reality marketing: how mobile AR-apps can improve brands through inspiration", *Journal of Retailing and Consumer Services*, Vol. 49, pp. 43-53.
- Rauschnabel, P.A., Felix, R., Hinsch, C., Shahab, H. and Alt, F. (2022), "What is XR? Towards a framework for augmented and virtual reality", *Computers in Human Behavior*, Vol. 133, p. 107289.
- Rogers, T.B., Kuiper, N.A. and Kirker, W.S. (1977), "Self-reference and the encoding of personal information", *Journal of Personality and Social Psychology*, Vol. 35 No. 9, p. 677.
- Schlosser, A.E. (2003), "Experiencing products in the virtual world: the role of goal and imagery in influencing attitudes versus purchase intentions", *Journal of Consumer Research*, Vol. 30 No. 2, pp. 184-198.
- Scholz, J. and Duffy, K. (2018), "We ARE at home: how augmented reality reshapes mobile marketing and consumer-brand relationships", *Journal of Retailing and Consumer Services*, Vol. 44, pp. 11-23.

- Schouten, J.W. (1991), "Selves in transition: symbolic consumption in personal rites of passage and identity reconstruction", *Journal of Consumer Research*, Vol. 17 No. 4, p. 412.
- Seo, Y., Kim, M., Jung, Y. and Lee, D. (2017), "Avatar face recognition and self-presence", *Computers in Human Behavior*, Vol. 69, pp. 120-127.
- Shih, H.-P. (2012), "Cognitive lock-in effects on consumer purchase intentions in the context of B2C web sites", *Psychology & Marketing*, Vol. 29 No. 10, pp. 738-751.
- Shim, S.I. and Lee, Y. (2011), "Consumer's perceived risk reduction by 3D virtual model", *International Journal of Retail and Distribution Management*, Vol. 39 No. 12, pp. 945-959.
- Sirgy, J. (1982), "Self-Concept in consumer behavior: a critical review", *Journal of Consumer Research*, Vol. 9 No. 3, pp. 287-300.
- Smink, A.R., Frowijn, S., van Reijmersdal, E.A., van Noort, G. and Neijens, P.C. (2019), "Try online before you buy: how does shopping with augmented reality affect brand responses and personal data disclosure", *Electronic Commerce Research and Applications*, Vol. 35, p. 100854.
- Smink, A.R., van Reijmersdal, E.A., van Noort, G. and Neijens, P.C. (2020), "Shopping in augmented reality: the effects of spatial presence, personalization and intrusiveness on app and brand responses", *Journal of Business Research*, Vol. 118, pp. 474-485.
- Suh, K.-S., Kim, H. and Suh, E.K. (2011), "What if your avatar looks like you? Dual-congruity perspectives for avatar use", *MIS Quarterly*, Vol. 35 No. 3, pp. 711-729.
- Tan, Y.-C., Chandukala, S.R. and Reddy, S.K. (2022), "Augmented reality in retail and its impact on sales", *Journal of Marketing*, Vol. 86 No. 1, pp. 48-66.
- van Noort, G. and van Reijmersdal, E.A. (2019), "Branded apps: explaining effects of brands' mobile phone applications on brand responses", *Journal of Interactive Marketing*, Vol. 45, pp. 16-26.
- Vorderer, P. (2006), "The role of presence in the experience of electronic games", in Vorderer, P. and Bryant, J. (Eds),

- Playing Video Games: Motives, Responses, and Consequences*, Routledge, New York, NY, pp. 225-240.
- Whang, J.B., Song, J.H., Choi, B. and Lee, J.H. (2021), "The effect of augmented reality on purchase intention of beauty products: the roles of consumers' control", *Journal of Business Research*, Vol. 133, pp. 275-284.
- Xu, L., Zhang, L., Cui, N. and Yang, Z. (2019), "How and when AR technology affects product attitude", *Asia Pacific Journal of Marketing and Logistics*, Vol. 32 No. 6, pp. 1226-1241.
- Yim, M.Y.-C. and Park, S.-Y. (2019), "I am not satisfied with my body, so I like augmented reality (AR)' consumer responses to AR-based product presentations", *Journal of Business Research*, Vol. 100, pp. 581-589.
- Zhao, X., Lynch, J.G. and Chen, Q. (2010), "Reconsidering Baron and Kenny: myths and truths about mediation analysis", *Journal of Consumer Research*, Vol. 37 No. 2, pp. 197-206.

### Further reading

- Hilken, T., Chylinski, M., Keeling, D.I., Heller, J., de Ruyter, K. and Mahr, D. (2022), "How to strategically choose or combine augmented and virtual reality for improved online experiential retailing", *Psychology and Marketing*, Vol. 39 No. 3, pp. 495-507.
- Jessen, A., Hilken, T., Chylinski, M., Mahr, D., Heller, J., Keeling, D.I. and de Ruyter, K. (2020), "The playground effect: how augmented reality drives creative customer engagement", *Journal of Business Research*, Vol. 116, pp. 85-98.
- Vieira, V.A., Rafael, D.N. and Agnihotri, R. (2022), "Augmented reality generalizations: a meta-analytical review on consumer-related outcomes and the mediating role of hedonic and utilitarian values", *Journal of Business Research*, Vol. 151, pp. 170-184.

## Appendix 1

Table A1 Measurement items

Construct	Source	Item wording
<i>Seven-point Likert scale: 1 = "strongly disagree," 7 = "strongly agree"</i>		
Self-presence	Adapted from Seo et al. (2017)	SEP1: I felt like this character resembled me SEP2: I felt like I identified with this character SEP3: I felt like this character represented something in me
Self-explorative engagement	Adapted from Huang and Liao (2017)	SE1: I was able to try-on various expressions and poses SE2: I was able to apply my previous try-on experiences to the experience with the virtual product SE3: I was able to move the way I would in real life to inspect the product's fit
Brand cognitive processing	Adapted from Hollebeek et al. (2014) and McLean and Wilson (2019)	BCP1: I was able to learn about the brand BCP2: I thought a lot about the brand BCP3: I was motivated to learn more about the brand
<i>Seven-point semantic differential scale</i>		
Brand attitude	Adapted from Li et al. (2002)	BA1: Bad/good BA2: Unappealing/appealing BA3: I do not like the brand/ I like the brand

Source: Authors' own work

Table A2 Goodness of fit indexes per condition

Condition	$\chi^2$ (d.f.)	RMSEA	NNFI	CFI
Fashion condition	127.86 (48)	0.08	0.97	0.98
Beauty condition	122.31 (48)	0.07	0.98	0.98

Notes:  $\chi^2$  = chi-square; d.f. = degrees of freedom; RMSEA = root mean square error of approximation; NNFI = non-normed fit index; CFI = comparative fit index

Source: Authors' own work

Table A3 Collinearity statistics

Independent variables	Dependent variables	VIF	Condition index
<i>Fashion condition</i>			
Self-presence	Brand attitude	1.80	9.42
Self-explorative engagement		2.25	7.96
Brand cognitive processing		2.23	11.81
<i>Beauty condition</i>			
Self-presence	Brand attitude	1.89	7.90
Self-explorative engagement		2.27	9.88
Brand cognitive processing		2.33	12.36

Note: VIF = variance inflation factor

Source: Authors' own work

Table A4 Nonresponse bias

Demographic	Pearson's $\chi^2$ results	Significance
Age	$\chi^2 = 60.24, p < 0.05$	Significant
Gender	$\chi^2 = 4.44, p > 0.05$	Not significant
Education	$\chi^2 = 0.52, p > 0.05$	Not significant
Dependent variables	<i>t</i> -test results	Significance
Self-presence	$t(248) = 1.15, p > 0.05$	Not significant
Self-explorative engagement	$t(248) = 0.45, p > 0.05$	Not significant
Brand cognitive processing	$t(248) = 0.03, p > 0.05$	Not significant
Brand attitude	$t(248) = 0.28, p > 0.05$	Not significant

Source: Authors' own work

Table A5 Common method variance test

Model	$\chi^2$ (d.f.)	Delta: $\chi^2$ (d.f.)	RMSEA	NNFI	CFI
One-factor model	1,849.36 (54)		0.25	0.80	0.83
Two-factor model	1,626.80 (53)	222.56 (1)	0.24	0.84	0.87

Notes:  $\chi^2$  = chi-square; d.f. = degrees of freedom; RMSEA = root mean square error of approximation; NNFI = non-normed fit index; CFI = comparative fit index

Source: Authors' own work

Table A6 Results of structural equation modeling with covariates in the analysis

Hypothesized relationships	Effects <sup>a</sup>	Stderr	t-value	Result
<i>Fashion condition</i>				
Self-presence → SE	0.68***	0.07	10.75	H1: confirmed
SEP → brand cognitive processing	0.27***	0.07	3.54	H2: confirmed
SEP → brand attitude	0.25**	0.09	2.76	H3: confirmed
Indirect effect: SEP→SE→BCP	0.40***	0.06	6.44	
Indirect effect: SEP→SE→BA	0.24***	0.07	3.62	
Total effect: SEP→BCP	0.67***	0.06	10.27	
Total effect: SEP→BA	0.49***	0.07	7.69	
SE → BCP	0.60***	0.07	7.44	H4: confirmed
Indirect effect: SE → BCP→BA	0.20**	0.07	2.69	H5: confirmed
Total effect: SE → BA	0.22**	0.08	2.41	
Direct effect: SE → BA	0.01 <sup>n.s.</sup>	0.11	0.10	
BCP → BA	0.34**	0.13	2.88	
<i>Beauty condition</i>				
SEP → SE	0.68***	0.06	10.96	H1: confirmed
SEP → BCP	0.30***	0.06	4.13	H2: confirmed
SEP → BA	0.21**	0.10	2.49	H3: confirmed
Indirect effect: SEP→SE→BCP	0.39***	0.06	6.20	
Indirect effect: SEP→SE→BA	0.35***	0.07	5.85	
Total effect: SEP→BCP	0.68***	0.06	10.21	
Total effect: SEP→BA	0.55***	0.06	9.35	
SE → BCP	0.57***	0.07	7.37	H4: confirmed
Indirect effect: SE → BCP→BA	0.18***	0.07	2.98	H5: confirmed
Total effect: SE → BA	0.37***	0.09	5.14	
Direct effect: SE → BA	0.19 <sup>n.s.</sup>	0.13	1.60	
BCP → BA	0.32**	0.15	2.79	
<i>Covariates</i>				
<i>Fashion condition</i>				
Age → SE	0.01 <sup>n.s.</sup>	0.06	0.18	
Edu → SE	-0.05 <sup>n.s.</sup>	0.08	-1.24	
Int → SE	0.06 <sup>n.s.</sup>	0.14	1.10	
Age → BCP	0.03 <sup>n.s.</sup>	0.04	0.55	
Edu → BCP	0.06 <sup>n.s.</sup>	0.06	1.10	
Int → BCP	0.01 <sup>n.s.</sup>	0.11	1.10	
Age → BA	-0.08 <sup>n.s.</sup>	0.06	-1.39	
Edu → BA	-0.04 <sup>n.s.</sup>	0.08	-0.50	
Int → BA	0.12**	0.15	2.18	
<i>Beauty condition</i>				
Age → SE	-0.10*	0.05	-1.81	
Edu → SE	0.01 <sup>n.s.</sup>	0.06	0.25	
Int → SE	0.04 <sup>n.s.</sup>	0.14	0.71	
Age → BCP	-0.04 <sup>n.s.</sup>	0.05	-0.96	
Edu → BCP	-0.04 <sup>n.s.</sup>	0.07	1.10	
Int → BCP	0.10 <sup>n.s.</sup>	0.11	0.15	
Age → BA	0.04 <sup>n.s.</sup>	0.06	-1.39	
Edu → BA	-0.02 <sup>n.s.</sup>	0.08	-0.50	
Int → BA	0.13**	0.15	2.18	

Notes: SE = self-explorative engagement; SEP = self-presence; BA = brand attitude; BCP = brand cognitive processing. <sup>a</sup>standardized effect; Stderr = standard error; critical t-value (one-tailed) = 1.645. \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; <sup>n.s.</sup> $p > 0.05$

Source: Authors' own work



Table A7 Full mediation robustness check

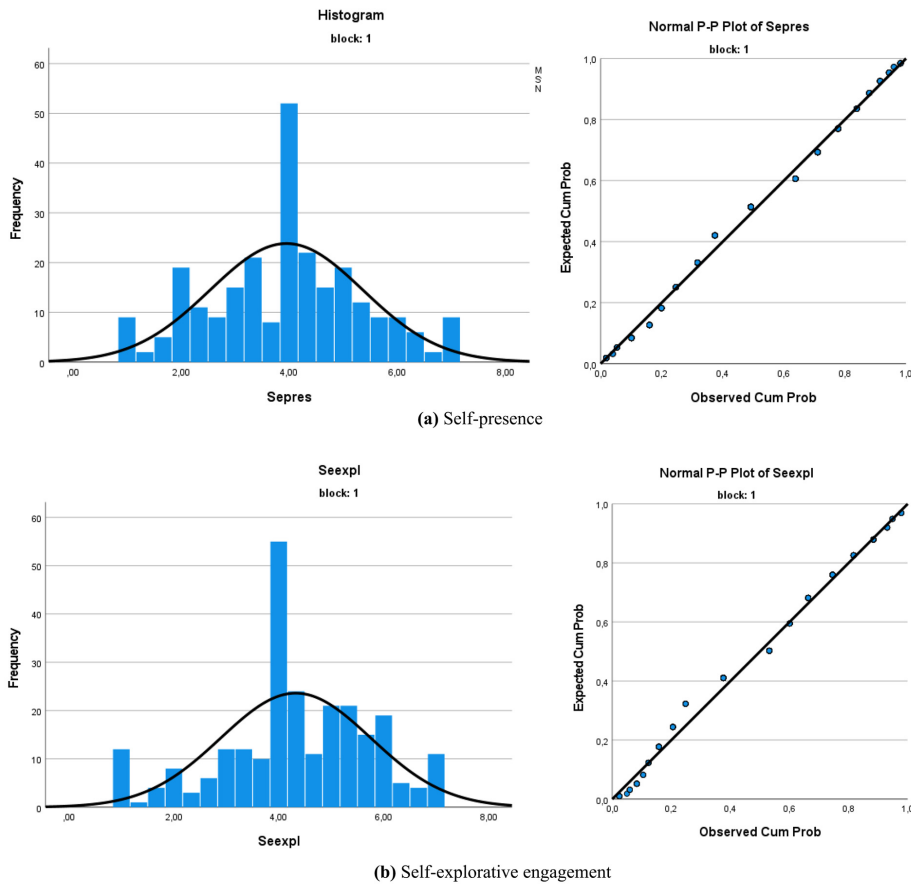
Model	$\chi^2$ (d.f.)	Delta: $\chi^2$ (d.f.)
Unconstrained (partial mediation)	261.60 (107)	
Constrained (full mediation)	269.52 (109)	7.92 (2)

Source: Authors' own work

## Appendix 2. Assumptions

Figure A1 Normality analysis with histogram (on the left) and p-p plot (on the right)

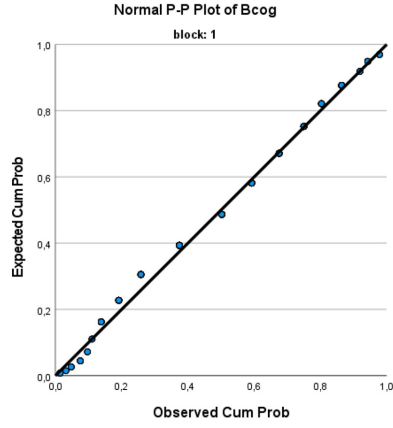
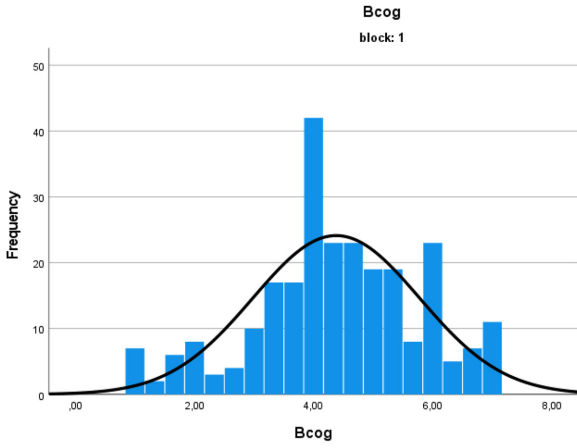
### Fashion condition



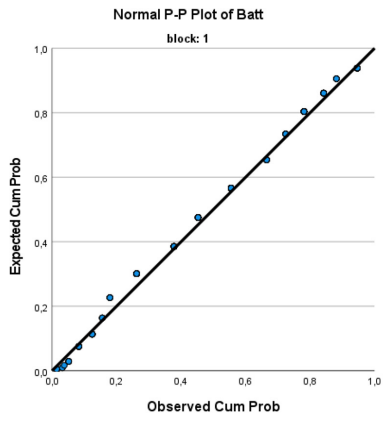
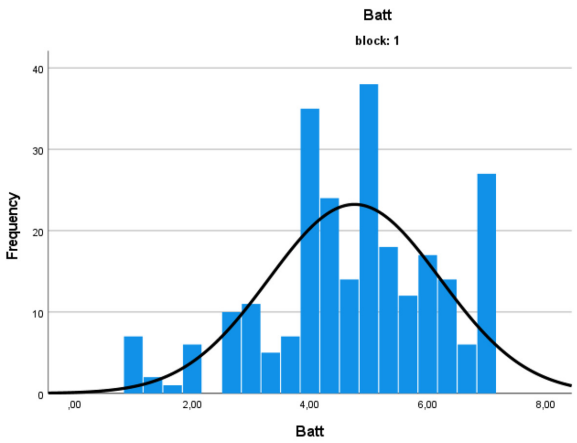
(continued)



Figure A1



(c) Brand cognitive processing

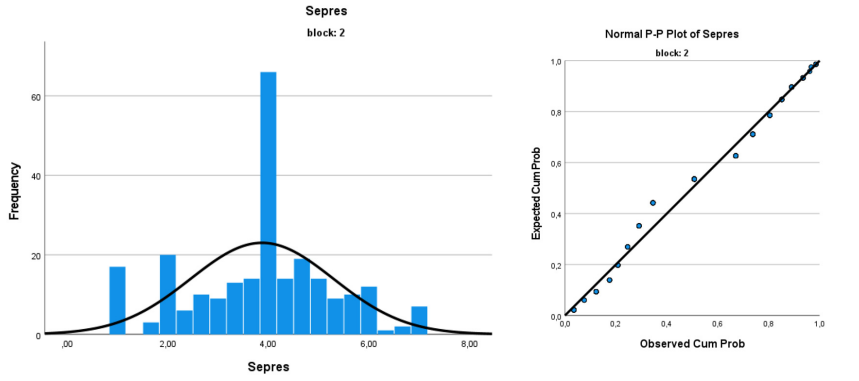


(d) Brand attitude

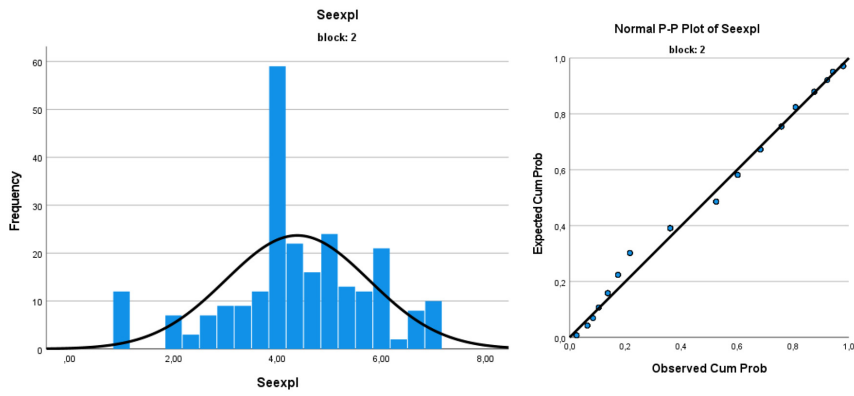
(continued)

Figure A1

Beauty condition



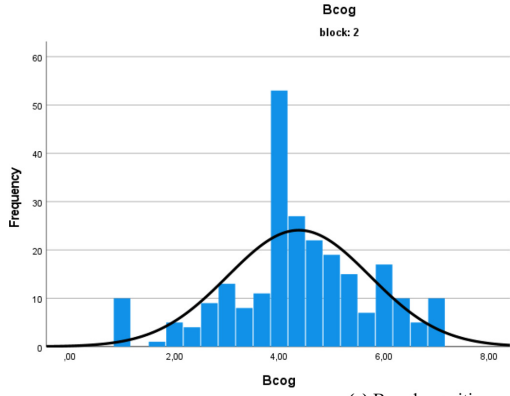
(a) Self-presence



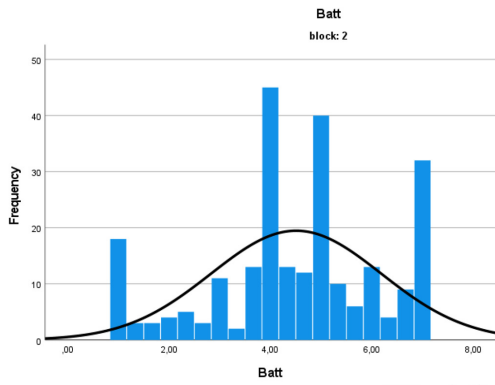
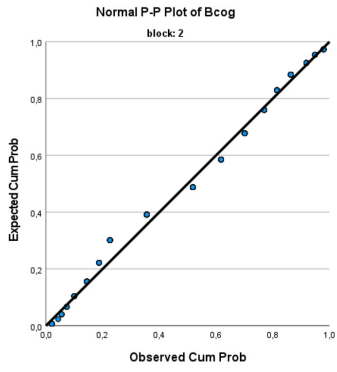
(b) Self-explorative engagement

(continued)

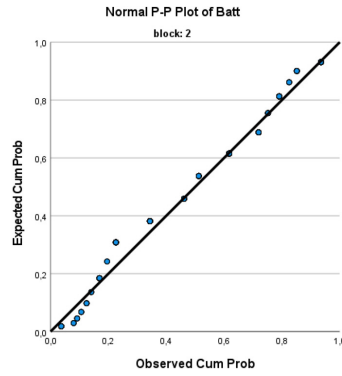
Figure A1



(c) Brand cognitive processing



(d) Brand attitude



Source: Authors' own work

Table A8 Skewness and kurtosis

Variables	Skewness	Std. error of skewness	Kurtosis	Std. error of kurtosis
<i>Fashion condition</i>				
Self-presence	−0.38	0.15	−0.03	0.30
Self-explorative engagement	−0.38	0.15	−0.30	0.30
Brand cognitive engagement	−0.29	0.15	−0.09	0.30
Brand attitude	−0.45	0.15	−0.01	0.30
<i>Beauty condition</i>				
Self-presence	−0.16	0.15	−0.18	0.31
Self-explorative engagement	−0.38	0.15	0.26	0.31
Brand cognitive engagement	−0.29	0.15	0.20	0.31
Brand attitude	−0.40	0.15	−0.33	0.31

Source: Authors' own work

Table A9 Tests for homogeneity of variance

Variables	Variance in fashion condition	Variance in beauty condition	Hartley FMax
Self-presence	2.00	2.02	0.99
Self-explorative engagement	2.05	1.9	1.07
Brand cognitive engagement	1.96	1.84	1.06
Brand attitude	2.11	2.82	0.75

Source: Authors' own work

**Corresponding author**Virginie Lavoye can be contacted at: [virginie.lavoye@lut.fi](mailto:virginie.lavoye@lut.fi)

For instructions on how to order reprints of this article, please visit our website:

[www.emeraldgroupublishing.com/licensing/reprints.htm](http://www.emeraldgroupublishing.com/licensing/reprints.htm)Or contact us for further details: [permissions@emeraldinsight.com](mailto:permissions@emeraldinsight.com)



## ACTA UNIVERSITATIS LAPPEENRANTAENSIS

1052. TSERING, TENZIN. Research advancements and future needs of microplastic analytics: microplastics in the shore sediment of the freshwater sources of the Indian Himalaya. 2022. Diss.
1053. HOSEINPUR, FARHOOD. Towards security and resource efficiency in fog computing networks. 2022. Diss.
1054. MAKSIMOV, PAVEL. Methanol synthesis via CO<sub>2</sub> hydrogenation in a periodically operated multifunctional reactor. 2022. Diss.
1055. LIPIÄINEN, KALLE. Fatigue performance and the effect of manufacturing quality on uncoated and hot-dip galvanized ultra-high-strength steel laser cut edges. 2022. Diss.
1056. MONTONEN, JAN-HENRI. Modeling and system analysis of electrically driven mechatronic systems. 2022. Diss.
1057. HAVUKAINEN, MINNA. Global climate as a commons — from decision making to climate actions in least developed countries. 2022. Diss.
1058. KHAN, MUSHAROF. Environmental impacts of the utilisation of challenging plastic-containing waste. 2022. Diss.
1059. RINTALA, VILLE. Coupling Monte Carlo neutronics with thermal hydraulics and fuel thermo-mechanics. 2022. Diss.
1060. LÄHDEAHO, OSKARI. Competitiveness through sustainability: Drivers for logistics industry transformation. 2022. Diss.
1061. ESKOLA, ROOPE. Value creation in manufacturing industry based on the simulation. 2022. Diss.
1062. MAKARAVA, IRYNA. Electrochemical recovery of rare-earth elements from NdFeB magnets. 2022. Diss.
1063. LUHAS, JUKKA. The interconnections of lock-in mechanisms in the forest-based bioeconomy transition towards sustainability. 2022. Diss.
1064. QIN, GUODONG. Research on key technologies of snake arm maintainers in extreme environments. 2022. Diss.
1065. TAMMINEN, JUSSI. Fast contact copper extraction. 2022. Diss.
1066. JANTUNEN, NIKLAS. Development of liquid–liquid extraction processes for concentrated hydrometallurgical solutions. 2023. Diss.
1067. GULAGI, ASHISH. South Asia's Energy [R]evolution – Transition towards defossilised power systems by 2050 with special focus on India. 2023. Diss.
1068. OBREZKOV LEONID. Development of continuum beam elements for the Achilles tendon modeling. 2023. Diss.
1069. KASEVA, JANNE. Assessing the climate resilience of plant-soil systems through response diversity. 2023. Diss.
1070. HYNNINEN, TIMO. Development directions in software testing and quality assurance. 2023. Diss.

1071. AGHAHOSSEINI, ARMAN. Analyses and comparison of energy systems and scenarios for carbon neutrality - Focus on the Americas, the MENA region, and the role of geo-technologies. 2023. Diss.
1072. LAKANEN, LAURA. Developing handprints to enhance the environmental performance of other actors. 2023. Diss.
1073. ABRAMENKO, VALERII. Synchronous reluctance motor with an axially laminated anisotropic rotor in high-speed applications. 2023. Diss.
1074. GUTIERREZ ROJAS, DANIEL. Anomaly detection in cyber-physical applications. 2023. Diss.
1075. ESANOV, BAKHTIYOR. Adaptive user-controlled personalization for virtual journey applications. 2023. Diss.
1076. SILTANEN, JUKKA. Laser and hybrid welding of high-strength structural steels. 2023. Diss.
1077. NOUSIAINEN, JALO. Model-based reinforcement learning and inverse problems in extreme adaptive optics control. 2023. Diss.
1078. USTINOV, STANISLAV. Fast and accurate simulation of fluid power circuits in the presence of small volumes using advanced methods and models for numerical stiffness elimination. 2023. Diss.
1079. HUSSAIN, HAFIZ MAJID. Heuristic-based packetized energy management for residential electricity demand. 2023. Diss.
1080. HÄMÄLÄINEN, MINNA. Principals managing entrepreneurship education in schools. 2023. Diss.
1081. WANG, ZHAO. Photocatalytic degradation of pharmaceutical and person care products (PPCPs) by commercial and synthesized catalysts under UV irradiation. 2023. Diss.
1082. LOHRMANN, ALENA. The water footprint of the global power sector: Status quo, challenges, and opportunities for tackling the global water crisis. 2023. Diss.
1083. PONOMAREV, NIKOLAI. A salt and alkali synergy for synthesising active carbons from lignin: porosity development and techno-economic assessment. 2023. Diss.
1084. AFANASYEVA, SVETLANA. Wind farm layout optimization: project economics and risk. 2023. Diss.
1085. VOSTROV, KONSTANTIN. Reduction of non-circulating bearing currents by electrical machine design. 2023. Diss.
1086. CARILLO MELGAREJO, DICK. Improving the design of cellular networks beyond 5G for smart grids. 2023. Diss.
1087. MALACINA, IRYNA. Zooming in and out: The strategic management of innovation across multiple levels of complex supply networks. 2023. Diss.
1088. SORE, SARISEELIA. Impact of information system capabilities on business value creation: Aspects of IT-producing and IT-consuming companies. 2023. Diss.
1089. IMMONEN, EERO. Advances in optimal design of shapes and processes by computational fluid dynamics. 2023. Diss.







ISBN 978-952-335-972-7  
ISBN 978-952-335-973-4 (PDF)  
ISSN 1456-4491 (Print)  
ISSN 2814-5518 (Online)  
Lappeenranta 2023