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Additional Information

Effects of virtual try-on technology as an innovative e-commerce tool on consumers' online purchase intentions

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Abstract

Purpose: The purpose of this study is to investigate the role of using augmented reality (AR) in the form of virtual try-on technology in consumers' purchase decision-making process.

Design/methodology/ approach: The study, executed in a beauty industry context, uses the Value-based Adoption Model (VAM). Data were collected using a survey carried out on 238 Tunisian women. Subjects performed an experimental task using the virtual try-on (VTO) application on the L'Oréal website. Web-administered questionnaires were used to collect the data, which was processed using an exploratory factor analysis and Partial least squares structural equation modeling.

Findings: The findings show that perceived value is positively related to purchase intentions and it was affected by both perceived benefits and perceived costs. In particular, perceived benefit (perceived usefulness) was found to have a strong positive effect on perceived value. Moreover, it turns out that perceived enjoyment does not have a significant effect on the perceived value. In terms of perceived costs, perceived intrusiveness was found to limit perceived value. The results also show a significant relationship between AR characteristics and perceived benefits. For personal traits, personal innovativeness is found positively influences perceived usefulness, but it shows no significant effect on perceived enjoyment.

Practical implications – Companies should highlight the benefits for consumers (interactivity, informativeness and usefulness) and attempt to reduce the costs (intrusiveness) related to the use of VTO AR technology, which can play a substantial role in determining the perceived value and purchase intentions.

Originality/value—The existent literature, that examines AR in e-tailing, shows weak acknowledgment of theories related to consumer barriers to AR adoption in e-tailing, they overlook the role of consumer psychology and individual differences in AR acceptance. Thus, this study contributes to the literature by enhancing the understanding of the roles that AR -- based VTO technology plays in determining consumers' online purchase intentions by extending the application of perceived value theory and taking into account its characteristics and personal traits that play a role in weakening or strengthening the customer's benefits and cost perceptions.

Key words: Augmented reality, virtual try-on, online shopping, purchase intention, value-based adoption model (VAM).

Introduction

Consume behavior is changing as a result of immersive technologies such as augmented reality (AR), especially after COVID-19, we have seen fascinating use cases. E-commerce is an example of businesses embracing this technology. E-tailers, however, are dealing with challenges, such as high return rates, online shopping cart abandonment, and web rooming, i.e., browsing products online, and then buying them offline (Dacko, 2016; Hilken et al., 2018). These issues may be related in part to the absence of direct product experiences while shopping online, as online product presentations do not provide the same sensory information as those found in physical stores (Hilken et al., 2017; Smink et al., 2019). As a solution to this problem, the gaps between offline and online shopping can be reduced with the aid of AR technologies (Baek et al, 2018). The combination of interactions between the real world and the virtual world utilized by AR[1] makes users feel the information displayed in real-time seems interactive and real and integrates adaptive content (Vieira et al., 2022). Virtual try-on experiences are a great application of AR in retail because they allow customers to virtually try products on their faces or environment in real-time (e.g., make-up, furniture, sunglasses). Numerous large brands and corporations are utilizing AR's various capabilities to provide an enhanced and immersive consumer experience (Scholz & Smith, 2016). Beauty brands and clothing brands are among the most frequent users of this technology in retail (Zhang et al., 2019). For example, L'Oréal, a global leader in beauty (Statista, 2021), acquired Modiface in 2018 to incorporate virtual try-on into its marketing strategy. The group's e-commerce sales increased by 52%. On the other hand, it has partnered with Facebook for a social virtual try-on in 2021 (L'Oréal, 2021). Indeed, the question of the impact of virtual try-on in a marketing context arises. Through this study, we answered the following research question: How do AR features and personal characteristics

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[1] Augmented reality

shape consumer perceptions towards AR virtual try-on technology, which in turn affect purchase intentions in an online shopping context?

Thus, the main purpose of this study is to gain a better understanding of the role of the virtual try-on technology on consumer's decision-making process toward online purchase intention using the Value-based adoption model (VAM) in beauty industry context. In the following: the first section expands on related literature and hypotheses development. In the second section, the methodology is detailed. Then, the paper concludes with a discussion of findings, managerial implications, limitations and future research opportunities**.**

1. Literature review and hypotheses development

1.1 The augmented reality virtual try-on technology

The literature claims that VTO[2] technology has utilitarian and hedonic values. Utilitarian value involves helping consumers address the suit, fit and match dilemma. For example, McLean & Wilson (2019) and Qin et al., (2021) find that AR applications allow consumers to manipulate the technology to their needs by visualizing products, thus increasing its usefulness. Thus, it provides rich product information by letting consumers try virtual products in the real world, thus improving cognitive and affective responses to products in the real world, (Kowalczuk et al., 2021). Those arguments were also supported by early studies (Rese et al., 2014; Rese et al., 2017). Even though it's a virtual trial, the customer can see how the product would seem, making it easier for them to picture the outcome of the purchase they are considering (Choi & Choi, 2020). As a result, augmented reality content assists consumers in their decision-making process (Whang, 2021) while also reducing the time spent searching for suitable products (Bonetti et al., 2018) and thus, improving their shopping experience : prompting positive brand attitudes and consequently stimulating purchase intentions (Wedel et al., 2020). Previous research

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[2] Virtual try-on

has shown how AR favors this outcome through the perceived value in the context of AR smart glasses (Erdmann et al., 2023).

Additionally, Zhang et al. 2019 found that customers' attitude toward VTO technology can affect their intention to purchase a garment online, which is affected by perceived usefulness, perceived enjoyment and perceived privacy risk. This technology not only assists consumers throughout the entire purchasing process, but it also provides "entertaining and experiential value" (Bonetti et al., 2018). It can offer a temporary escape from reality creating a fun atmosphere during online shopping, thereby improving the elaboration and quality of mental imagery and generating positive attitudes (Wang & Wang, 2022).

According to Nikhashemi et al. (2021), this application of AR in e-commerce can create an even better experience and add value to users, which are influenced by several AR characteristics that influence user behavior in using e-commerce (Butt et al., 2021; Nikhashemi et al., 2021; Hsu et al., 2021). Augmented reality can provide users with more information (Kim & Choo, 2021). It engages consumers in an interactive presentation of a product and it has a positive impact on purchasing behavior and positively impacts consumer satisfaction (Bonetti et al., 2018; Porter & Heppelmann, 2017) and increases the level of sales (Flavian et al., 2019 ; Tan et al., 2022).

Despite its utilitarian and hedonic values, using VTO technology is not cost-free. AR try-on elicits high intrusiveness by demanding personal information, adversely impacting app and brand-related consumer responses (Feng & Xie, 2019; Smink et al., 2019; Smink et al., 2020). AR-based e-tailing platforms that limit consumers' control over their personal information diminish satisfaction with and discourage further use of AR (Poushneh, 2018). High privacy concerns decrease the favorable effects of AR, leading to negative app attitudes (Hilken et al., 2017; Feng & Xie, 2019; Zhang et al., 2019).

Although scholarly publications on AR implementation in online and offline retailing have grown over time (Wedel et al., 2020), the literature remains scattered and indecisive regarding the role of AR in e-tailing. Additionally, Jayaswal & Parida (2023), identify a strong need to explore other theoretical models outside the current scope of TAM[3] to study AR adoption behavior and to understand the perceived values they desire from AR-enabled e-tailing platforms to predict consumers' adoption of this technology.

1.2 The VAM model

As mentioned above, the investigation of augmented reality in online retail has primarily used the technology acceptance model (TAM) which focuses mainly on cognitive beliefs (PU and PEOU) (McLean and Wilson, 2019; Plotkina and Saurel, 2019; Rese et al., 2017; Rauschnabel, 2018; Qin et al., 2021) which examined technology acceptance motivations through the lens of users' perceived benefits from technology acceptance (Davis et al, 1989, Shuhaiber and Mashal, 2019). However, obtaining the benefits of technology adoption requires some sacrifice, and the user evaluates these two conflicting aspects while making an adoption decision. The existing literature shows weak acknowledgment of theories related to consumer resistance and barriers to AR adoption in e-tailing (Jayaswal & Parida, 2023). Thus, it would appear rational for users to evaluate technology adoption in terms of both benefits and costs, which is critical for managerial decision making. Businesses may gain a better understanding of how consumers perceive and respond to AR applications by examining its costs and benefits. This information can be utilized to enhance AR experiences and boost customer satisfaction by identifying potential barriers to AR adoption and develop strategies to overcome them (Hoffman & Mai, 2022 ; Erdmann et al, 2023).

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[3] Technology acceptance model

Earlier studies have evaluated perceived value in a balanced way; Kim et al. (2007) proposed a Value-based Adoption Model (VAM) which distinguishes costs and benefits as predictors of the perceived value of new technology (Shah et al.,2021). It is considering a wider range compared to TAM which focuses mainly on factors (emotional, social, functional, and costs). This model has been successfully used and extended to examine individual behavior in a variety of contexts, including the usability of augmented reality technology-based mobile applications (Yoon & Oh, 2022), Erdmann et al (2023) extended it to explore online purchase intention through AR smart glasses, Lau, Chui, and Au (2019) used it to assess the adoption of augmented reality (AR) technology in the hotel and tourism industries. Likewise, the VAM has been utilized to examine human behavior in the context of wearable devices (Yang et al., 2016), the adoption of virtual reality (Vishwakarma et al., 2020) as well as smart homes (Lucia-Palacios and Pérez-Lopéz, 2023), and social commerce (Chen et al., 2018).

According to Kim et al. (2007), perceived usefulness and perceived enjoyment are benefiting factors of perceived value, while technicality and perceived cost are cost factors. Perceived usefulness was defined as the extent to which one believes that the use of technology will help in enhancing one's task performance (Davis, 1989). Furthermore, perceived enjoyment was defined in this study as the level of enjoyment experienced while using technology (Yoon and Oh, 2022). Third, technicality was defined as the level of physical and mental effort needed to use technology, which is analogous to the concept of technological complexity. Fourth, perceived cost describes the monetary costs associated with using technology. Perceived value was defined as a consumer's overall evaluation of the utility of a service or product based on their perception of what they receive "get factors" and what they give "input factors" (Zeithaml, 1988).

In line with previous researchers, we propose perceived usefulness and perceived enjoyment as benefits and perceived intrusiveness as costs. Additionally, we extended the model by adding

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AR characteristics and personal traits variables to investigate their effect on the perceived benefits, the perceived costs, on perceived value, and purchase intention.

1.3 Hypotheses development

1.3.1 Perceived value and purchase intention

Bagozzi and Burnkrant (1979) defined the concept of purchase intention as a personal behavioral predisposition to purchase a product and is closely related to the individual's future purchasing behavior. Perceived value is defined as the overall evaluation of a product's utility based on perceptions of what is received and given (Zeithaml, 1988). According to Erdmann et al. (2023), the perceived value of AR smart glasses for online purchases has a considerable, favorable impact on online purchase intention. Numerous studies have revealed that purchase intention is based on the symbolic and functional aspects of the product, while the utilitarian value resides in the practicality, convenience, and cost-saving experiences by customers during the purchasing process (Batra & Ahtola, 1990; Chen et al, 2015) . The perceived function value and perceived hedonic value of the consumption process influence the frequency of online repurchase behavior (Lorenzo-Romero et al, 2016). In the process of online buying, consumers must discover a feeling that makes all types of services and assistance valuable to them, such as cost and experience, which will lead to purchase intention and behavior. According to empirical studies, perceived value serves as an efficient mediator between AI technology experience and consumers' purchase intention on an online shopping platform (Yin & Qiu, 2021). Furthermore, the perceived value of the online store image in an online shopping environment might lead to intentional and impulsive buying behavior (Jiang & Zhao, 2013). Therefore, consumers who perceive the high value of augmented reality technology, are expected to use it for shopping. Based on the above discussions and literature reviewed, we propose the following hypothesis:

H1. Perceived value of the innovative technology VTO has a positive effect on purchase intention.

1.3.2 Perceived benefits and perceived value

When using products and services, consumers consider not only practical benefits but also hedonic benefits. Many previous studies that used a value-based adoption model confirmed the effect of perceived usefulness and perceived enjoyment on perceived value in many settings, such as augmented reality-based mobile applications (Yoon & Oh, 2022), the adoption of augmented reality in tourism (Lau et al., 2019), the adoption of virtual reality (Vishwakarma et al., 2020) and wearable devices (Yang et al., 2016). Based on this, we propose:

H2. Perceived usefulness has a positive effect on perceived value of the innovative technology VTO.

H3. Perceived enjoyment has a positive effect on perceived value of the innovative technology VTO.

1.3.3 Perceived cost and perceived value

Considered as a cost, it has been stated that intrusiveness is disturbing, annoying, and insensitive (Mani and chouk, 2017). It may arouse unpleasant feelings like annoyance and irritation, which may negatively affect how customers react to it (Li et al., 2002). This is what might happen when AR apps ask for camera access. Perceived intrusiveness influences attitudes toward the brand and app as well as willingness to share personal information (Smink et al. 2019; Smink et al. 2020). Additionally, it has a negative impact on consumer experience value when interacting with smart products (Lucia-Palacios and Pérez-Lopéz, 2023). Therefore, we suggest that consumers are more likely to lower the evaluation of perceived value if they perceive using the virtual try-on technology to be intrusive. Based on the above debate, we suggest:

H4. Perceived intrusiveness has a negative effect on perceived value of the innovative technology VTO.

1.3.4 Augmented reality characteristics and perceived benefits

Product informativeness is defined by Rese et al. (2014) as the extent to which an innovative system provides useful product information for purchase decisions. Some of the results suggest that increased levels of informativeness and high-quality information in AR can decrease uncertainty about items, boost perceptions of usefulness, and favorably influence choice confidence (Adam and Pecorelli, 2018). Furthermore, prior AR studies demonstrate that perceived usefulness is increased by perceived informativeness (Rese et al., 2014; Rese et al., 2017, Kwalczuk et al., (2020), and the information presented playfully has a higher hedonic value (Pantano and Di Pietro, 2012). Consequently, we propose the following:

H5a. Product informativeness in the innovative technology VTO has a positive effect on perceived usefulness.

H5b. Product informativeness in the innovative technology VTO has a positive effect on perceived enjoyment.

Additionally, AR was investigated in terms of interactivity in several studies (in 28.9% of the cases). It is defined as the extent to which users can alter virtual objects in the mediated environment in real time (Steuer, 1992) by looking at all of its features and imagining it from different angles, which helps them make good decisions (Jiang and Benbasat, 2004). Therefore, interactivity significantly enhances perceived usefulness and perceived enjoyment (McLean & Wilson , 2019; Yim et al., 2017). Thus, we propose the following hypotheses:

H6a. Interactivity with the innovative technology VTO is positively associated with perceived usefulness.

H6b. Interactivity with the innovative technology VTO is positively associated with perceived enjoyment.

1.3.5 Personal factors, Perceived Benefits and perceived Costs

While existing literature investigates the impact of AR characteristics on experiential value, the impact of consumer personal factors/personality traits is understudied (Watson et al., 2020). This study seeks to fill this gap by examining two key consumer characteristics: personal innovativeness and privacy concerns.

Personal innovativeness is an external variable; it refers to a person's willingness to experiment with innovation (Agarwal & Prasad, 1998). Highly innovative people are more likely to accept new technology (Godoe & Johansen, 2012). Perceived usefulness and ease of use are found significantly influenced favorably by personal innovativeness (Kuo & Yen, 2009, Yi et al., 2006). Additionally, if a new system is more innovative and novel, (Venkatesh et al., 2012), also perceive additional hedonic benefits by doing so by raising the level of innovativeness. In line with previous research, we expect that:

H7a. Personal innovativeness has a positive effect on perceived usefulness.

H7b. Personal innovativeness has a positive effect on perceived enjoyment.

Privacy concerns reflect fears when information is collected and used by entities for purposes and in ways that the individual did not intend (Bandara et al., 2019). Because of the vast amount and variety of data collection methods, consumers' privacy concerns have grown. According to Hilken et al., (2017), Customers' decision comfort is significantly influenced by privacy concerns. We can make the case that customers won't find a technology that is likely to invade their privacy useful. Additionally, in a virtual try-on app (self-viewing) experiment, it was

discovered that people with greater privacy concerns have negative brand attitudes and high perceived intrusiveness (Feng and Xie, 2019). Consequently, we expect that:

H8a. Privacy Concerns has a negative effect on Perceived usefulness.

H8b. Privacy Concerns has a positive effect on Perceived intrusiveness.

The research model is presented in **Fig. 1**
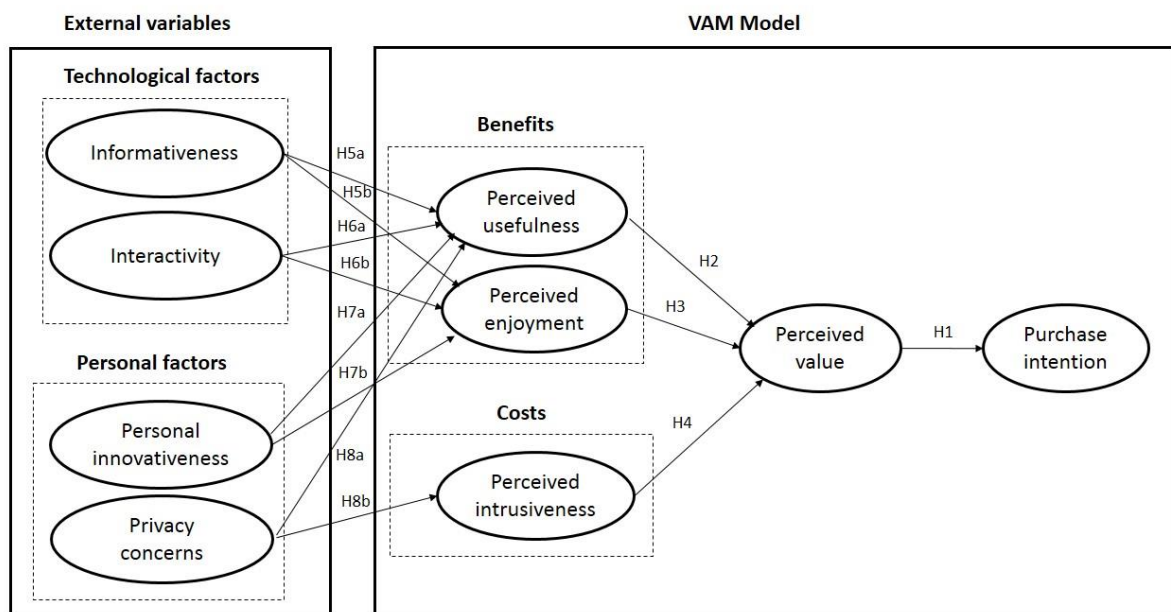
2. Research Methodology

2.1 Data collection

This research's chosen method of gathering respondents is convenience sampling. We tested the research hypotheses using an online survey. The link to the questionnaire was distributed via Facebook, Instagram, and WhatsApp applications. Respondents were asked to complete the survey questions after completing an online virtual try-on simulation using the L'Oréal website link provided in the questionnaire (Excellence Crème 7 Natural Dark Blonde Permanent Hair Dye | Hair Colour | L'Oréal Paris (loreal-paris.co.uk)). They can virtually try on different shades of hair color to choose the one they would hypothetically purchase, in an attempt to see how

AR enhances their experience. This is accomplished by selecting the virtual try-on option button for the desired product. Following that, the user's camera is accessed, and video footage of the user's face appears, followed by a swipe through the shades to find the product that best suits her.

2.2 Demographic results

According to Sigma Conseil, 75% used the internet in 2023, up 1.3% from 2021. Women are more active on social networks, with 90.2% participating. Additionally, 32.9% use online shopping services. Women continue to dominate with 38.8%, compared to 27.3% of men (Sigma Conseil, 2023)

Because the online application involved a beauty product (hair color), only women were enabled to participate. The study sample consisted of 238 participants. The majority of the respondents' ages fall between 26 and 35 (41.2%), followed by 32.8% of those between 18 and 25 years old, 24.4% between 36 and 50 years old, and the rest of the sample 1.7% over 50 years old. For the professional category, the obtained results reveal that 40.8% are "Students", 29.4% are "Employees", 15.5% are "Executive", 8.5% have a liberal profession and the rest 5.5% have other professions. The majority of the respondents (89.5%) has a university degree and the rest (10.5%) have a secondary school degree.

All measurement scales were adapted from the previous literature. Items measuring online consumers' purchase intention were developed by (Wang et al., 2007). The scale created by (Joseph et al. 2000) was used to assess perceived value. To measure the perceived usefulness, perceived enjoyment, and informativeness constructs, we used scales from Rese et al. (2014). Items developed by (Li, Edwards et al., 2002) were used to measure consumers' perceived intrusiveness. To measure the interactivity variable, we used a scale adapted from Tsikriktsis (2002) and van der Hejiden (2003). To measure the personal innovativeness and the privacy

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concerns constructs, we used scales adapted from Compeau & Higgins (1995) and Gu et al. (2017) respectively. All constructs were unidimensional and measured on a five-point Likert scale (1 = completely disagree, 5= completely agree).

2.3 Common method bias

To overcome this problem, both a priori and post hoc remedies were employed. Priori remedies included a questionnaire pre-testing to ensure the clarity of terms used and to improve the questionnaire design, additionally, each respondent's anonymity was ensured, to encourage honest responses to the questions. As post hoc remedies, Harman single factor analysis and multicollinearity test were used (Podsakoff et al, 2003). Harman's single-component analysis revealed that the first factor accounted for just 40.328% of the total variance, less than 50% (Akter et al., 2017). The multicollinearity test was also used to validate the Harman single-factor analysis findings. The VIF values of all constructs were between 1.000 and 2.681, which are lower than the threshold limit of 5 (Mason and Perreault, 1991; Becker et al., 2015). This means that common method bias is not an issue in our research.

4. Data analysis and results

4.1 Measurement results

SPSS 26.0 was used to carry out the exploratory factor analysis to determine the dimensionality of our constructs and SMARTPLS4 was used to conduct the confirmatory factor analysis. The results showed that the loadings of all items on their corresponding variables are greater than 0.70 at the 0.001 significance level. All retained measurement scales were reliable with satisfying Cronbach's coefficients ranging between .85 and .95. Furthermore, all of the AVEs in table 1 exceeds the recommended 0.50 level (Hair et al., 2017) which indicates the presence of discriminant validity. **Table 1** indicates that the CR for all the constructs exceeding the recommended threshold of 0.70 (Gefen et al., 2011), demonstrates high construct reliability. As

a result, the measurement model has satisfactory convergent validity. **Table 2** shows that the HTMT value for each pair of reflective constructs is less than 0.90, indicating that satisfactory discriminant validity has been proven. The variance inflation factor coefficient values are lower than 5 which means that multicollinearity is not an issue in our study.

4.2 Structural results

We employed the Q2 value recommended by Stone (1974) and Geisser (1974) to test the predictive relevance. Our models indicate that the primary dependent variable has a positive Q2 value, as presented in **Table 3**. The results suggest that, except for the paths from perceived enjoyment to perceived value, from personal innovativeness to perceived enjoyment, and from privacy concerns to perceived usefulness, all paths are significant, as shown in **Table 4**. The path analysis of perceived value yields a value of 0.757 for purchase intention. The perceived usefulness and perceived intrusiveness path coefficients towards perceived value are 0.485 and -0.295, respectively. The path analysis values for informativeness are 0.334 towards perceived usefulness and 0.414 towards perceived enjoyment. The path analysis values for interactivity are 0.395 towards perceived usefulness and 0.171 towards perceived enjoyment. The path analysis of personal innovativeness yields a value of 0.095 towards perceived usefulness, and finally, the path analysis of privacy concerns yields a value of 0.283 towards perceived intrusiveness. All hypotheses, except H3, H7b, and H8a, are supported by the data.

5. Discussion

This study proposes that AR characteristics, consumers' traits, and their usage experiences with VTO technology play an important role in their online purchase intention based on an extended value-based adoption model (VAM) created by Kim et al., (2007). The results of examining the proposed model show that customers' perceived value of the VTO technology can affect their purchase intention. That is consistent with previous studies (Yin & Qiu, 2021; Erdmann et al., 2023; Jiang & Zhao, 2013). Perceived value is found to be affected by perceived usefulness and perceived

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intrusiveness. Similar results by Yoon and Oh (2022), Vishwakarma et al. (2020), and Chen et al. (2018) that put highlight the existence of a significant positive relationship between the perceived usefulness and perceived value and Lucia-Placios & Pérez-Lopéz (2023) study's which revealed that perceived intrusiveness had negative effects on the perceived value. However, and unexpectedly, perceived enjoyment doesn't have a significant effect on the perceived value. We can explain this result by the fact that women perceived the value of the technology by its utilitarian benefits in the context of the virtual try-on of the hair coloration product more than its hedonic benefits. Shafir et al. (1993) suggested that it is easier to construct reasons for utilitarian consumption than for hedonic consumption. Hedonic goods deliver benefits primarily in the form of experiential enjoyment, which may be more difficult to evaluate and quantify than the practical, functional benefits that utilitarian goods deliver. Additionally, Wang (2010) identifies in his research, whether perceived utilitarian and hedonic value dimensions affecting consumer response to information search and shopping intention are similar or different. This work also investigates the effect of gender differences. At this point, findings further show the most notable differences in hedonic value effects; males' primary consumption goal for information search is both utilitarian and hedonic, and females depend more on utilitarian than on hedonic value. On the other hand, perceived intrusiveness seems to have a significant negative effect on perceived value. Therefore, perceived benefits appear to have a greater influence than the degree of perceived costs on perceived value and perceived usefulness, the utilitarian benefit, emerged as the most important factor influencing purchase intention through perceived value. Concerning the effect of AR characteristics on the perceived benefits, informativeness, and interactivity, have both a positive significant effect on the perceived benefits; perceived usefulness, and perceived enjoyment, which is consistent with the findings of Adam and Pecorelli (2018), Pantano and Di Pietro (2012), McLean & Wilson (2019) and Yim et al. (2017). For personal traits, personal innovativeness positively influences

perceived usefulness, consistent with previous studies (Kuo & Yen, 2009, Yi et al., 2006, Alam et al., 2021), but unexpectedly, it shows no significant effect on perceived enjoyment. An explanation for this may be that for more innovative users, fun is not important in forming their attitudes due to the utilitarian component of the virtual try-on technology. Since highly innovative women will be more experienced in using VTO technology, they will not be so affected by perceived enjoyment in situations where they seek to accomplish goals (Matute-Vallejo and Malero-Polo, 2019) that improve their decision-making and online shopping performance. That is implies, by raising the level of innovativeness, women not only are more encouraged to adopt this technology but also perceive additional utilitarian benefits more than the hedonic benefits. In the other hand, privacy concerns seemed to significantly and positively impact perceived intrusiveness, consistent with previous studies (Feng & Xie, 2019). However, it showed no significance on perceived usefulness. It can be explained by the privacy paradox, that a person's privacy concerns may not deter use if the app provides hedonic, functional, and social benefits (e.g., Church et al., 2017).

5.1 Theoretical and practical implications

This study contributed to literature in the following ways: its ability to extend the application of perceived value theory to an understanding of the role of virtual try AR technology by taking into account its characteristics and personal traits that play a role in weakening or strengthening the customer's benefits and cost perceptions. It demonstrates, additionally, how augmented reality technology can have unfavorable persuasive effects by creating a more intrusive experience. But it shows that the benefits of using the technology seemed to outweigh the possible costs. Thus, these negative effects via intrusiveness can be diluted with perceived usefulness, the utilitarian benefit, which seems to have the greatest impact on perceived value. This could imply that VTO in the beauty context serves more as a utilitarian tool.

Our findings have important implications for managers: First, this technology can be a powerful tool for increasing purchase intentions because it provides a 'try before you buy' experience that can bridge the gap between online and offline shopping. Second, this study found that it primarily had positive effects on brand responses by increasing perceived usefulness and consequently perceived value thanks to its features; informativeness and interactivity. Simultaneously, negative effects were discovered due to perceived intrusiveness. As a result, retailers and marketers should be careful when it comes to products that concern the self, as greater intrusiveness may negate the positive persuasive outcomes. It is preferable to provide consumers with the option of selecting the AR function themselves, as well as an alternative, non-AR mode. Furthermore, the utilitarian nature of this technology was evident in beauty retail because the utilitarian benefit appeared to be a better predictor of perceived value as well as purchase intention. While developing a solution, marketers should keep the primary utilitarian aspect of the technology in mind. For example, they could highlight utilitarian features that it is a purchasing tool, such as the high level of interactivity and the quality of the provided information. Third, marketers should consider the targeted population's personal characteristics, as personal innovativeness strengthens the effect of perceived usefulness on perceived value; this implies that marketing campaigns should target the segment of more innovative users. In terms of privacy, practitioners may develop simple privacy policies, such as simplified consumer choice and transparency (FTC, 2012) and they may also inform customers about how their personal data will be used and with whom the information will be shared. Privacy-related barriers are found to be crucial for products using self-augmentation (e.g., eyewear and makeup); therefore, managers should communicate data security practices with consumers to build the latter's confidence in AR.

5.2 Limitations and suggestions for further research

No research is without limitation. First, data was collected based on 238 responses which were included in the analysis and the sampling method used was convenience sampling. Thus, future research is required to collect and analyze data using a larger sample size. Second, all the participants were from Tunisia and this could affect the results as it is the same culture and might be too homogeneous. Therefore, in the future, we recommend expanding the research to other countries and expanding the overall amount of data collected. Third, we also acknowledge the potential limitation of the self-completed survey—the online survey was not conducted in a controlled lab environment. This may affect the results. While this online simulation provided a more natural setting that enabled participants to try the application in their own time and their environment, this also enabled participants to choose a different online product virtual try-on than they were assigned to. Future studies could account for this by choosing a more controlled setting. Further, the author did not have any communication with the participants. They did not have the opportunity to ask follow-up questions about the survey question to make sure everything was understood correctly. Consequently, there could be some bias with the responses here, with possible confusion or misunderstandings. Thus, we recommend future studies to conduct a face-to-face survey. In addition, this study focuses on customers using the VTO technology of one pioneering brand in the beauty industry; future studies could investigate different online retailers, and industries and put the model to test other products categories. Fourth, since the results highlight the non-significance of the relationship between the hedonic factor and perceived value in contradiction with previous studies, further research is needed to examine this effect in this context. Additionally, other variables could also be assessed for future research to explore this matter like "playfulness". Other additional cost constructs can be considered such as "irritation" or "technicality" to understand to which extent the variable influences perceived value. Finally, qualitative research is well-suited to shed light on the

mental events and private processes associated with the consumption and usage of AR technologies in retailing.

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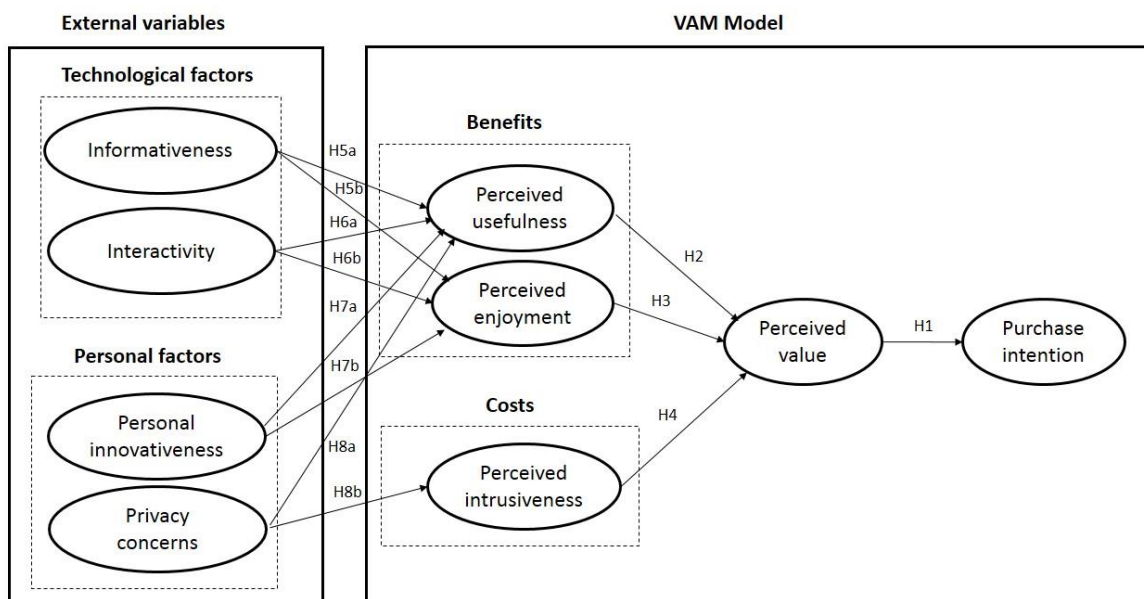
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Appendixes

Appendix 1

Figure1. Conceptual model

External variables — Technological factors: Informativeness, Interactivity. Personal factors: Personal innovativeness, Privacy concerns.

VAM Model — Benefits: Perceived usefulness, Perceived enjoyment. Costs: Perceived intrusiveness. Perceived value → Purchase intention.

H1, H2, H3, H4, H5a, H5b, H6a, H6b, H7a, H7b, H8a, H8b

Appendix 2

Figure2. Measurement model

Note: *<0,05 ***<0,001
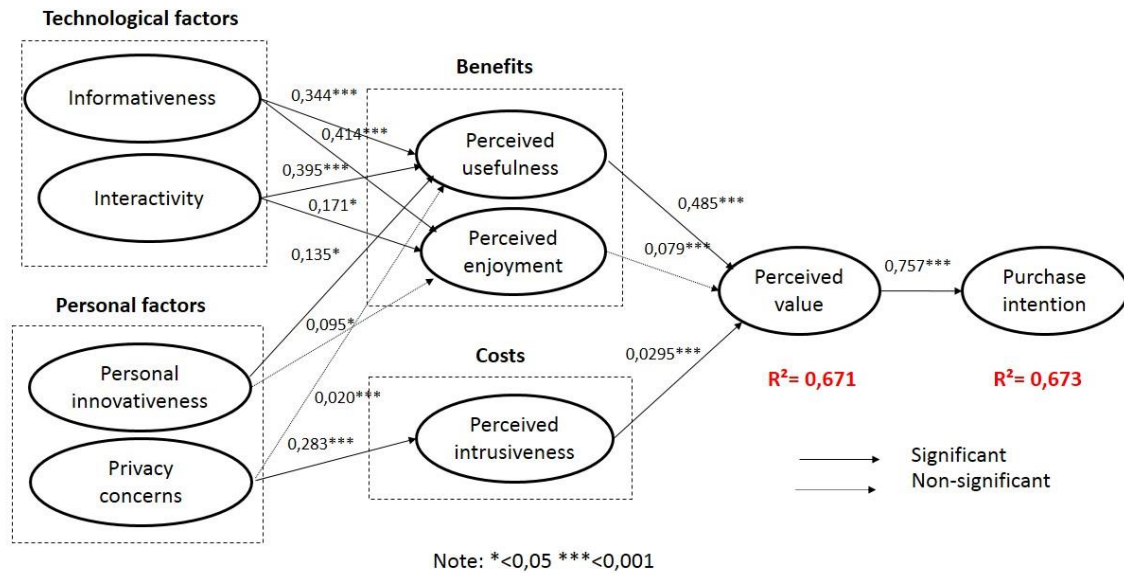
Appendix 3

Table1. Measurement Model: Internal Reliability and Convergent Validity

Constructs and items	Std. loadings	Cronbach's α	C.R	AVE
Purchase intention		0.950	0.968	0.909
If it were possible, I could imagine buying beauty products from this Web site.	0.947			
The next time I buy beauty products, I will take this Web site into consideration if it is possible to buy products on it.	0.957			
I would be very interested in buying beauty products on this Web site.	0.956			
Perceived value		0.926	0.947	0.818
Overall, I believe that the value of using the virtual try-on was good.	0.854			

Overall, I believe that I received more than what I gave up when using the virtual try-on.	0.870			
Overall, I believe that the virtual try-on satisfied my expectations.	0.904			

Perceived usefulness

For me the virtual try-on has great value.		0.879	0.911	0.673
The virtual try-on provides beautiful ideas for the products.	0.898 0.825			
The virtual try-on is very inspiring in terms of beauty products.	0.906			
The virtual try-on is a perfect aid to come to a decision in the selection of beauty product.	0.888			

Perceived enjoyment

Using the virtual try-on is really funny.		0.903	0.932	0.774
The virtual try-on is good practice.	0.898			
It is fun to discover the virtual try-on.	0.877			
The virtual try-on invites you to discover L'Oreal online shop.	0.903 0.874			

Perceived intrusiveness

Trying the product in the virtual try-on was disturbing.	0.859	0.849	0.908	0.768
Trying the product in the virtual try-on was difficult.	0.818			
Trying the product in the virtual try-on was intrusive.	0.823			
Trying the product in the virtual try-on was unpleasant.	0.835			
Trying the product in the virtual try-on was invasive.	0.764			

Interactivity

Through the interaction with the virtual		0.895	0.935	0.827
product presentation in the AR virtual				
try-on, I can get a profound picture of	0.853			
the product.				
I am able to interact with the virtual				
product presentation in the AR virtual				
try-on in order to get information	0.898			
tailored to my specific needs.				
The degree of interaction with the virtual				
product presentation in the AR virtual				
try-on on the website is outstanding.	0.896			

Informativeness

The AR virtual try-on shows the		0.938	0.953	0.801
information I expected.				
The AR virtual try-on provides detailed	0.870			
information about the products.				
The AR virtual try-on provides complete	0.896			
information about the products.				
The AR virtual try-on provides	0.901			
information that helps me in my				
decision.	0.915			
The AR virtual try-on provides				
information to compare products.	0.893			

Personal innavtiveness

If I heard about a new information		0.858	0.913	0.778
technology, I would look for ways to	0.939			
experiment with it.				
Among my peers, I am usually the first				
to try out new information	0.886			
technologies.				

In general, I like to experiment with new

  information technologies.

Privacy concerns   0.903

I think virtual try-on will over-collect   0.910   0.937   0.788

  my personal information.

 I will worry that virtual try-on leaks my   0.938

  personal information to irrelevant third

  parties.   0.880

I am concerned about threats to my

  privacy.

I would be concerned that virtual try-on   0.885

  would misuse my personal

  information.   0.913

Appendix 4

Table 2. Heterotrait-monotrait ratios

	INF	IN	PIIT	PC	PU	PE	PIV	PV	PI
INF									
PIIT	0.610								
IN	0.860	0.629							
PE	0.648	0.467	0.613						
PIV	0.681	0.556	0.705	0.552					
PU	0.761	0.588	0.813	0.698	0.647				
PVAL	0.750	0.602	0.869	0.604	0.711	0.794			
PC	0.219	0.260	0.220	0.139	0.308	0.167	0.245		
PI	0.803	0.631	0.775	0.640	0.721	0.822	0.838	0.219	

Notes: INF: informativeness, **PIIT**: personal innovativeness, **IN**: interactivity, **PE**: perceived enjoyment, **PIV**: perceived intrusiveness, **PU**: perceived usefulness, **PVAL**: perceived value, **PC**: privacy concerns, **PI**: purchase intention

Appendix 5

Table3. Out-of-sample predictive performance of constructs

	Q² Predict
PE	0.361

PIV	0.071
PU	0.580
PVAL	0.472
PI	0.409

Notes: PE: perceived enjoyment, **PIV**: perceived intrusiveness, **PU**: perceived usefulness, **PVAL**: perceived value, **PI**: purchase intention

Appendix 6

Table4. Results of hypotheses testing

Relationships	Original sample (O)	Sample mean (M)	Standard deviation (STDE)	T statistics (O/STDEV)	P values
P VAL → PI	0.757	0.755	0.037	20.361	0.000
PU → PVAL	0.485	0.478	0.072	6.768	0.000
PE → PVAL	0.079	0.079	0.055	1.432	0.152
P IV → PVAL	-0.295	-0.299	0.073	4.024	0.000
INF → PU	0.334	0.330	0.069	4.821	0.000
INF → PE	0.414	0.412	0.082	5.054	0.000
IN → PU	0.395	0.395	0.062	6.385	0.000
IN → PE	0.171	0.169	0.086	1.979	0.048
PIIT → PU	0.135	0.137	0.052	2.622	0.009
PIIT → PE	0.095	0.100	0.066	1.452	0.147
PC → PU	0.020	0.017	0.049	0.412	0.680
PC → PIV	0.283	0.287	0.053	5.326	0.000

Notes: INF: informativeness, **PIIT**: personal innovativeness, **IN**: interactivity, **PE**: perceived enjoyment, purchase intention