Revue Internationale des Sciences de Gestion
ISSN: 2665-7473
Volume 8 : Numéro 1

The Impact of Augmented Reality Characteristics on Cyberconsumer Responses : Affective, Cognitive, and Behavioral

L'impact des caractéristiques de la réalité augmentée sur les réponses des cyberconsommateurs : affectives, cognitives et comportementales

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Date submitted : 10/01/2025

Date of acceptance: 17/02/2025

To cite this article :

MZID N. & al. (2025) «The Impact of Augmented Reality Characteristics on Cyberconsumer Responses : Affective, Cognitive, and Behavioral», Revue Internationale des Sciences de Gestion « Volume 8 : Numéro 1 » pp : 1081 - 1106

Abstract :

This research aims to study how the characteristics offered by augmented reality (AR) such as interactivity, system quality, product information can influence the affective (immersion, pleasure and appreciation of the product), cognitive (usefulness of the media) and behavioral (intention to reuse) responses of the Tunisian cyberconsumer. To achieve this, we will conduct a quantitative study using a questionnaire administered to a sample of 350 consumers. The results via SPSS 18 and AMOS 21 software reveal that interactivity has a positive impact on immersion and pleasure (affective responses), that the quality of the system and product information have a positive impact on the usefulness of the media (cognitive response), and that the pleasure and usefulness of the media have a positive impact on the intention to reuse (behavioral response). This research provides valuable insights for marketing and e-commerce professionals in developing effective strategies focused on consumer experiences with augmented reality.

Keywords : Augmented Reality ; System Quality ; Product Information ; Immersion ; Intention to Reuse.

Résumé :

Cette recherche vise à étudier comment les caractéristiques offertes par la réalité augmentée (RA) telles que l'interactivité, la qualité du système et les informations sur le produit peuvent influencer les réponses affectives (immersion, plaisir et appréciation du produit), cognitives (utilité des médias) et comportementales (intention de réutilisation) du cyberconsommateur tunisien. Une étude quantitative sera menée à l'aide d'un questionnaire sur un échantillon de 350 cyberconsommateurs. Les résultats obtenus via SPSS 18 et AMOS 21 révèlent que l'interactivité a un impact positif sur l'immersion et le plaisir (réponses affectives), que la qualité du système et les informations sur le produit ont un impact positif sur l'utilité des médias (réponse cognitive), et que le plaisir et l'utilité des médias ont un impact positif sur l'intention de réutilisation (réponse comportementale). Cette recherche fournit des perspectives précieuses pour les professionnels du marketing et du commerce électronique dans le développement de stratégies efficaces centrées sur les expériences virtuelles des cyberconsommateurs basées sur la réalité augmentée.

Mots-clés : Réalité Augmentée ; Qualité du Système ; Informations sur le Produit ; Immersion ; Intention de Réutilisation.

Introduction

In recent years, the rapid advancement of science and technology, particularly in the fields of marketing and sales, has led to intense competition among companies, with each striving to attract customers using various strategies and techniques. Marketing research suggests that product trials significantly influence consumers, as they enable a better evaluation of product quality (Branca, et al., 2023). However, in the online environment, the inability to physically try products is considered a major barrier to purchase (Ebrahimabad, et al., 2024). To overcome this challenge, companies have increasingly turned to technological solutions that bring virtual experiences as close to reality as possible (ECHEFAJ, 2023).

One such solution is augmented reality (AR), a ground-breaking technology that enables consumers to virtually test products on themselves. According to Fan et al. (2020), AR is an emerging technology in marketing that enhances users' visual, auditory, tactile, and olfactory perception by overlaying digital content, such as text, geolocation data, graphics, audio, and video, onto live views of physical objects and environments. This interaction blurs the line between users' physical spaces and virtual objects, making the experience more immersive, interactive, and realistic (Cipresso, et al., 2018).

Given its transformative potential, augmented reality is becoming increasingly significant in commercial contexts and academic discussions (Branca, et al., 2023). AR is often viewed as a "technological megatrend," advancing the digitalization of human life and revolutionizing online shopping experiences by offering new methods of interaction with cyberconsumers. With the growing popularity of mobile devices and high-speed wireless networks, the use of AR in web-based and mobile applications is gaining momentum, creating innovative, engaging, and valuable user experiences (Tan, et al., 2022). Thus, AR is on track to become a disruptive technology that will reshape marketing in the years to come.

Today, AR applications are widespread across numerous industries and are having a profound impact on how people perceive the world. Its influence is growing in sectors such as audio-visual media, design, and, most notably, e-commerce and promotion.

According to a report by PwC (2019), augmented reality generated an economic impact of $33 billion in 2019, and this is projected to grow to $338.1 billion by 2025, potentially adding $1.1 trillion to the global economy by 2030. In Tunisia, AR's potential is gaining recognition, with the official launch of the Tunisian Augmented Reality and Virtual Reality Community in 2017. We also observe that one of the few focused studies, Kowalczuk et al. (2021) examined the cognitive, affective, and behavioral consumer responses to augmented reality in e-commerce.

While Kowalczuk et al. (2021) explored the relationship between immersion and pleasure in the context of augmented reality, our study extends this framework by reversing the causal direction to examine how pleasure influences immersion. This alternative perspective provides new insights into the affective dynamics of AR experiences, suggesting that positive emotional responses can deepen users' sense of immersion. Furthermore, our research introduces a novel hypothesis that was not considered by Kowalczuk et al. (2021) : the direct relationship between immersion and reuse intention. By integrating this link, we emphasize the critical role of immersion not only as a mediator of engagement but also as a direct driver of continued AR adoption. Additionally, while Kowalczuk et al. (2021) conducted their study in a foreign market, our research is among the first to explore these relationships in the Tunisian context, using a sample of 350 cyberconsumers. This regional focus allows us to provide valuable insights into AR adoption in emerging markets, where digital transformation is rapidly evolving but remains underexplored in academic research. This addition refines the understanding of AR's experiential impact and opens new avenues for future research on sustained user engagement in immersive digital environments.

As AR becomes more widespread, research on its applications in marketing and consumer experience has intensified (Rauschnabel, et al., 2024). One prominent AR application in e-commerce is virtual try-on (VTO), which blends the real and virtual worlds, providing promising opportunities for fully online shopping experiences. Despite its potential, the concept of virtual try-on remains relatively under-explored, especially regarding its role in consumer decision-making (Bretos, et al., 2024 ; Herliana, et al., 2024 ; Al Morabet, et al., 2021).

Moreover, limited research has delved into how AR features such as interactivity, system quality, and product information integrated into virtual try-ons, affect consumers' affective, cognitive, and behavioral responses. These gaps in the literature leave many questions unanswered regarding how AR influences cyberconsumers' reactions and their intentions to reuse AR technologies (Soon, et al., 2023 ; Gong, et al., 2023).

In response to this gap, our research aims to answer the following central question : What is the impact of augmented reality characteristics on the affective, cognitive, and behavioral responses of cyberconsumers ?

The primary objective of this study is to examine how the characteristics of augmented reality specifically interactivity, system quality, and product information affect the affective (immersion, pleasure, and appreciation of the product), cognitive (perceived usefulness), and behavioral (intention to reuse) responses of cyberconsumers.

To achieve this objective, we adopted a quantitative approach by administering a questionnaire to a sample of 350 Tunisian consumers. Data analysis was conducted using SPSS 18 and AMOS 21 software, allowing us to examine the effects of augmented reality features on the affective, cognitive, and behavioral responses of cyberconsumers.

The structure of this paper is as follows : First, we outline the theoretical foundations of our research model and review the existing literature. We then present our hypotheses, followed by the methods used to collect data for the study. The results of the research are presented next, and the final section discusses these findings, highlighting their theoretical and managerial implications, along with limitations and future research avenues.

1. Theoretical background and hypotheses development

1.1. Theoretical framework

In this research, we present the two most widely used theories in the context of augmented reality : the Flow Theory (Chen, et al., 2024) and the Holbrook & Hirschman Experiential Hierarchy Model (EHM) (Kowalczuk, et al., 2021). We then outline the rationale for adopting these two theories in our study.

• *Flow Theory*

Flow Theory represents a mental state in which a person is completely persuaded by the experience of augmented reality. In this state, people feel lost, focused, and waste a lot of time in this captivating experience. Similarly, in augmented reality, Flow occurs when system features such as interactivity, graphics, and quality allow cyberconsumers to immerse themselves in AR experiences, often losing track of time. The research of Chen et al. (2024) focuses on the conditions that lead to this Flow experience in AR experiences. These authors show that factors such as ease of use, sense of immersion, and expectation satisfaction play a crucial role in bringing online consumers into this Flow state, also improving their overall experiences. Ghazali et al. (2019) suggest that when consumers perceive an experience as enjoyable and adventurous, they are more likely to develop a positive behavioral intention to continue with that experience. Flow Theory states that an individual can enter a flow state by stepping away from their everyday reality to focus on a specific activity. This state is characterized by total immersion in the present moment, excluding the ordinary thoughts that typically occupy the human mind. The particularities of augmented reality (AR) contribute to creating this immersive state of flow. Recent studies, such as those conducted by Soon et al.

(2023) highlight the importance of emotional responses in the context of AR, distinguishing them from traditional textual content.

• *Holbrook & Hirschman's Experiential Hierarchy Model (EHM) (Kowalczuk, et al., 2021).*

The Holbrook & Hirschman Experiential Model (EHM) examines the role of subjective, emotional, and sensory consumer experiences in the purchasing process. In e-commerce, augmented reality serves as a communication tool that enhances the consumer journey. This study leverages the EHM model (Holbrook & Hirschman, 1982) to analyze cyberconsumer reactions to mobile and web-based augmented reality product presentations.

EHM categorizes consumer experiences into three key dimensions sensation, emotion, and thought structured across three phases : before, during, and after purchase (Kowalczuk, et al., 2021). Kowalczuk et al. (2021) revisited this model to apply it to virtual experiences, highlighting the role of immersion in human-machine interaction and its psychological effects on cyberconsumers. However, their framework has limitations : it overlooks the reciprocal influence between pleasure and immersion and does not account for the direct relationship between immersion and reuse intention. Our research extends this model by incorporating these factors to offer a more comprehensive understanding of how immersive technologies impact cyberconsumer engagement.

1.2. Hypotheses Development

This study aims to enrich the body of research by simultaneously introducing the characteristics of augmented reality (interactivity, system quality, and product information) and the responses of the cyberconsumer (affective responses, cognitive responses, and behavioral responses). Tunisia, as a developing Arab country, currently lacks studies on augmented reality. The conceptual model (Figure 1) will be provided in the following sections.

1.2.1. Impact of Interactivity on Product Enjoyment, Immersion, and Appreciation

The hypothesis that interactivity enhances immersion, pleasure, and product appreciation can be made clearer by explaining how Flow Theory applies. Flow Theory suggests that individuals enter a state of optimal experience when they are fully engaged in an activity. Interactivity in augmented reality can provide the conditions for this state by offering challenges and rewards in the form of sensory information and immersive experiences, leading to increased enjoyment and immersion.

Augmented Reality (AR) is a technological innovation that enhances the real-life visual experience of cyberconsumers by integrating digital elements in 2D or 3D formats into the real world in real time (Herliana, et al., 2024).

Immersion refers to the degree to which augmented reality creates the sensation of being temporarily immersed in a virtual presentation, thanks to the sensory information flows of virtual products (Gouton, 2022).

As for pleasure, it is defined as the extent to which the use of augmented reality itself is perceived as pleasant and satisfying, regardless of the consequences (Leveau & Camus, 2023). According to Leveau and Camus (2023), AR is a fun experience for the consumer that influences their attitude by creating new preferences regarding the product viewed virtually. These two elements are fundamental to elicit the flow state of the virtual reality (AR) experience and relive it, where the consumer is fully absorbed in their interaction with the media, excluding superfluous thoughts and delving better into this virtual experience (Duquet, 2022). Salame (2020) and Gouton (2022) confirm the impact of interactivity on immersion in the context of augmented reality.

Following the integration of technical systems of interactivity such as predictability or speed of response in the augmented reality experience, consumers feel significantly higher flows of positive emotions aroused by this interactivity such as the feeling of entertainment and the feeling of pleasure (Barhorst, et al., 2021). In this sense, Haile et al. (2020) state that interactivity, which is more immersive than all traditional and virtual reality applications, has increased consumers' emotional connection with the brand. Yoo (2023) states that in an interactive context, this immersion allows the user to explore the product's features and practicality in a more realistic and concrete way, thereby increasing its practical value. Ribeiro et al. (2024) state that immersive environments with different levels of contextual cues were applied to assess how these differences could impact not only a hedonic evaluation but also levels of engagement and presence. Pfaff & Spann's (2023) study examines the impact of immersive and interactive features of augmented reality on cyberconsumers' product perception. Barhorst et al. (2021) suggest that augmented reality is a useful way to educate consumers about the brand or product. Subsequent learning experienced through augmented reality in turn influences consumer satisfaction with their experience. Following these statements, we can conclude that consumer interactivity increases immersion, pleasure, and overall product appreciation.

We can thus state the first three hypotheses :

H1: Interactivity has a positive impact on immersion.

H2: Interactivity has a positive impact on pleasure.

H3: Interactivity has a positive impact on product appreciation.

1.2.2. The impact of immersion on pleasure

Flow Theory suggests that the deeper an individual's immersion in an activity, the more likely they are to experience heightened pleasure and enjoyment.

Most research demonstrates a consensus that highlights the ability of augmented reality to create immersive experiences that can affect the pleasure of the cyberconsumer, such as the study by Marto et al. (2022) which aims to explore the impact of different sensory conditions by combining visual, audio and olfactory stimuli on measures of presence, pleasure, knowledge and value of the user experience. Barhorst et al. (2021) state that a state of flow is characterized by feelings of serenity, loss of daily life worries, immersion, pleasure, and focused attention. Zanger et al. (2022) examined the ability of augmented reality to stimulate affective responses, which include inspiration and pleasure. Similarly, Duquet (2022) and Barhorst et al. (2021) highlighted the positive impact of immersion on pleasure.

As a result, the experience offered by augmented reality is more pleasant and immersive, creating rich positive sensory emotions for consumers. When immersed in the situation, consumers perceive the possibility of interacting with a virtual product, which evokes feelings of pleasure or fun and leads to a high level of satisfaction with the virtual experience.

Therefore, we can formulate the following hypothesis:

H4: Immersion has a positive impact on pleasure.

1.2.3. The Impact of System Quality on Media Usefulness

According to Flow Theory, optimal user experiences are closely tied to the seamless interaction between the individual and the system.

At this level of the study, we question the interaction between system quality and system usefulness. These questions go hand in hand with the study by Baabdullah et al. (2022), which highlights that high system quality in augmented reality-based learning applications- exemplified by ease of use, seamless functionality, and interactive design- significantly improves students' perception of media usefulness. In this sense, Jang et al. (2021) confirm a positive relationship between system quality and media usefulness in the field of augmented reality (AR) and virtual reality (VR) learning. According to these authors, the incorporation of augmented reality and virtual reality technologies improves the user experience, perceived

usefulness (PU) and perceived ease of use (PEU) of the media, which play a key role in learning. According to the results of Papakostas et al. (2021), a higher quality system leads to greater perceived use of the augmented reality training tool. The latter confirms the positive and significant relationship between these two variables. In accordance with the above-mentioned works, the quality of the system is positively correlated with the usefulness of the media. We then cite the following research hypothesis H5:

H5: The quality of the system has a positive impact on the usefulness of the media.

1.2.4. The impact of product information on media usefulness

EHM Model (Holbrook & Hirschman, 1982) emphasizes the role of product information in influencing consumers' attitudes through two routes : central and peripheral. When product information is presented clearly and effectively in the AR context, consumers are more likely to engage in central processing, focusing on the product's features and benefits. This leads to a higher evaluation of the media's usefulness.

In the research conducted on the relationship between product information and media usefulness, we note that authors such as Qin et al. (2021) suggest that advanced technologies, such as augmented reality mobile applications, add value in three key aspects: faster information retrieval, improved service at the point of sale, and a positive shopping experience. They add that virtual presence reflects the ability of media to present physical and virtual components of products through immersion in the environment generated by augmented reality. Similarly, Chakrabarty (2024) states that augmented reality is making its way into the media and has the potential to shift customer opinions. For example, information search, evaluation and testing of products can influence the decision-making of cyberconsumers. The author adds that with the rapid advancement of augmented reality, people are integrating it into various aspects of their daily lives. These results are in line with the work of Barhorst et al. (2021); Duquet (2022); Balińska & Jaska (2022); and Rauschnabel et al. (2019). These different statements prove the existence of a positive and significant relationship between product information and media usefulness. Thus, we can pose the following hypothesis H6:

H6: Product information has a positive impact on media usefulness.

1.2.5. The impact of enjoyment on intention to reuse

Previous studies identified enjoyment as a key factor in online shopping. For instance, we can cite Saprikis et al. (2020) who showed that the feeling of enjoyment has a positive impact on the behavioral intention to adopt and continue using augmented reality applications in shopping

malls. This suggests that the more pleasant the experience, the higher the likelihood of reuse. Yu et al. (2024) claim that perceived enjoyment was one of the constructs that positively affect satisfaction and reuse intention of augmented reality and virtual reality. We also mention the studies of Meng and al. (2021); Leveau & Camus (2023); and Duquet (2022) who show that perceived enjoyment in virtual environments promotes the intention to reuse these immersive technologies.

H7: Enjoyment has a positive impact on intention to reuse.

1.2.6. The Impact of Product Appreciation on Intention to Reuse

Given the large number of products available on the Internet, purchasing decisions are becoming increasingly complex. A study by Jiang et al. (2022) indicates that consumers' attitudes towards a virtual shoe try-on feature in augmented reality positively and significantly affect their willingness to continue using this technology. Kang et al. (2020) find that the combination of the informative and playful aspect of 3D virtual environments promotes user appreciation and constant engagement. Similarly, Kowalczuk et al. (2021) confirm the positive and significant effect between these two concepts. This this consensus among researchers leads us to propose the following hypothesis :

H8: Product appreciation has a positive impact on intention to reuse.

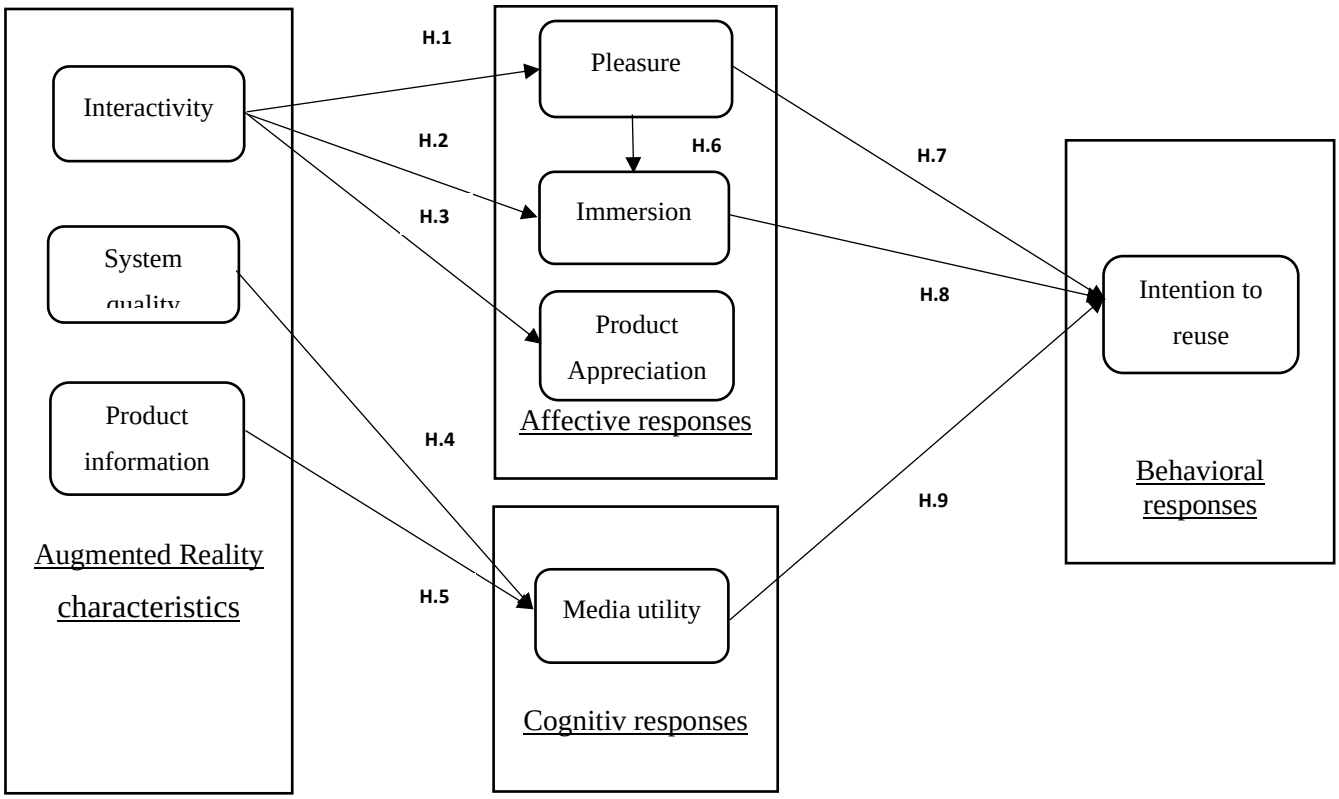
1.2.7. The Impact of Media Usefulness on Intention to Reuse

Brands seek to engage consumers cognitively and emotionally through compelling content. According to Schultz et al. (2023), media relevance positively affects intention to reuse in different technological contexts, including search engine advertising. The latter shows the satisfaction felt, the relevance of the content and the usefulness of the technology used, strengthening the intention of cyberconsumers to continue their use of a digital platform. Iranmanesh et al. (2024) confirm that the perception of the usefulness of augmented reality (AR) media has a positive impact on the intention to reuse the application. Others highlight the presence of significance between media usefulness and intention to reuse (Cheng, et al., 2024 ; Iranmanesh, et al., 2024 ; Daassi & Debbabi, 2021). Based on these statements, we derive the following hypothesis :

H9 : Media usefulness has a positive impact on intention to reuse.

Based on the above description and analysis of various models, Figure 1 shows the research model.

Figure N°1: The research model



Source: Author, 2025

2. Research methodology

2.1. Data collection

In line with Carricano & Poujol (2010), who emphasize that "the population must be defined with the greatest care," we adopted a rigorous approach in selecting our sample. Our study focuses on individuals who actively use social networks, as they are the primary users of augmented reality (AR) applications in digital marketing.

We selected Tunisia as our case study due to its rapidly growing digital landscape and increasing adoption of mobile technologies, particularly among younger consumers. Tunisia has one of the highest internet penetration rates in North Africa, with a strong presence of social media users engaging with digital marketing content. This context makes it a relevant setting for examining AR-driven consumer behavior.

A total of 350 Tunisian participants were selected using a probabilistic random sampling approach. This method ensures sample representativeness and allows for reliable statistical inferences (Akrout, 2018). Following Roussel (1998), who recommends that the sample size

should be 5 to 10 times the number of items analyzed, we determined that 350 respondents were appropriate for conducting both exploratory and confirmatory factor analyses.

Participants were invited to test the Auglio virtual fitting platform (https://auglio.com/en/demo-store/), an AR-based tool that enables users to virtually try on products like eyewear and accessories using their device's camera. This immersive shopping experience makes the platform highly relevant for studying cyberconsumer responses.

The online survey method was chosen over face-to-face data collection due to its ability to reach geographically dispersed participants and facilitate automated data collection. The questionnaire, which took approximately 15 minutes to complete, was distributed over a one-month period. Our sample includes diverse socio-professional categories (students, senior executives, middle executives, professionals, workers, retirees, and non-active individuals), ensuring a broad range of perspectives. Notably, students represented 42.8% of respondents, and 57.2% of the sample were women. These characteristics, detailed in Table 1, are critical in assessing the generalizability of our findings.

To analyze our data, we used AMOS, a structural equation modeling (SEM) software. AMOS was chosen because it allows for robust confirmatory factor analysis (CFA) and structural path modeling, providing a detailed assessment of measurement validity and the relationships between variables (Hair, et al., 2010). This makes it particularly suitable for our study, as it allows us to validate the theoretical constructs and test the proposed causal relationships in our research model.

Table N°1 : Descriptive characteristics of the sample

Designation		Collection number (n = 350)
Total questionnaires distributed		500
Total questionnaires selected for analysis		350
Response rate		70%
Characteristics of the sample		N=350
Gender	Man	150
	Woman	200
Age	Under 18 years old	45
	Between 18 and 24 years old	180
	Between 25 and 35 years	100
	Between 36 and 46 years	20

	Over 47 years old	5
SPC	Students	42,8%
	Executives	9,8%
	Middle managers	2,7%
	Professionals	3,9%
	Workers	22,8%
	Retirees	5,3%
	Non-active	5,6%
	Other	7,1%
Marital status (SM)	Married	120
	Single	200
	Divorced	20
	Widow	10

Source: Authors, 2025

2.2. Content of the questionnaire

In this research, we chose the quantitative survey research technique. We will use a self-administered questionnaire which is considered a tool for measuring reality (Mbengue &Vandangeon-Derumez, 1999). The questions included in the questionnaire will allow us to obtain answers to our research problem and verify our hypotheses (Hair, et al, 2007).

According to Igalens & Roussel (1998), the construction and implementation phases of a survey are of paramount importance. It is essential to find a fair balance between the simplicity and clarity of the questions, while preserving the content and meaning of the original items of the measurement scales. To do this, a double bidirectional translation of the original items was carried out to avoid any loss of information due to translation and to minimize potential biases. Given that the Tunisian population is predominantly French-speaking, it was necessary to adapt the measurement scales accordingly. To collect the data, a survey was conducted using a questionnaire that included 32 items addressing various attributes of augmented reality, such as product information, interactivity, and system quality, as well as consumer responses at the affective, cognitive, and behavioral levels.

To ensure that respondents understood the survey questions and provided adequate answers, as well as to eliminate potential errors, we pre-tested the questionnaire with a small sample.

The questionnaire consisted of three parts. The first part focuses on consumers' general knowledge of augmented reality usage and the presentation of the virtual try-on experience on the Auglio website. On this website, participants can test four different product categories within the same interface: glasses, cosmetics, jewelry, and accessories. This diversity provides a rich experience for participants.

The second part asks specific questions about the variables of the research model, their determinants and their results. All the questions in this part were adapted to the objective of the study based on the existing literature. The variables were all measured using 5-point Likert scales, ranging from "Strongly disagree" to "Strongly agree".

Finally, the last part of the questionnaire focuses on participants' profiles by asking questions about gender, age and socio-professional category.

2.3. Measurement instruments

In our research, we focus on three fundamental criteria for the choice of the measurement scales, namely: reliability, recency, and adequacy with the research framework. These measurement scales were carefully selected according to the specific objectives of the study and adapted from the relevant literature. To assess the different variables, 5-point Likert scales were used. Eight variables were measured in this research, namely: interactivity, system quality, product information, immersion, enjoyment, product appreciation, media usefulness, intention to reuse.

4 items to measure interactivity inspired by the original version of Pantano et al. (2017).

4 items to measure system quality inspired by the original version of Kowalczuk (2018).

5 items to measure product information based on the version of Rese et al. (2014).

3 items to measure immersion adopted from the Yim et al. (2017) measurement scale.

4 items to measure enjoyment based on the Kim & Forsythe (2008) version.

4 items to measure product appreciation adopted from the Cox & Cox (1988) measurement scale.

5 items to measure media usefulness adapted from the Kim & Forsythe (2008) scale.

3 items to measure intention to reuse inspired by the Kim & Hyun (2016) version.

3. Results

3.1. Analysis of the measurement model

In this part, exploratory factor analysis (EFA) is used to assess the validity of the constructs. Its objective is to summarize a set of observed variables into a smaller number of factors. This technique seeks to explore the underlying dimensions of the observed variables. Subsequently, we use a confirmatory factor analysis (CFA) to confirm the different measurement models resulting from the EFA (Roussel, et al., 2002). We evaluated the model fit using the maximum likelihood (ML) estimation method.

First, we analyzed the critical ratio (CR) for each hypothesized relationship, which must be greater than 1.96, using a significance level ($p < 0.05$) to determine the existence of an effect

between the variables we tested. Then, the standardized regression coefficient for each variable should be greater than 0.7. Based on our analysis, we confirmed that all variables have standardized regression coefficients greater than 0.7 and are statistically significant (Table 2).
Subsequently, we checked the reliability based on the calculation of Cronbach's alpha. It is accepted that a scale has satisfactory internal consistency when the Rho value is greater than 0.7 (Fornell & Larcker, 1981) (Table 2).

After conducting the reliability analysis, we checked the convergent validity detrmine if the items intended to measure the same phenomenon are strongly correlated (Frikha, 2019). This index is calculated according to the average variance extracted (AVE) of Fornell & Larker (1981). To check the convergent validity, two criteria seem necessary: all the standardized regression coefficients are greater than the norm, and all T-values associated with the factorial contributions are significantly greater than 1.96. We also verified that the AVE was greater than the significant threshold of 0.5. These results confirm the consistency and validity of all the constructs.

Discriminant validity is determined by demonstrating that a measure is not highly correlated with variables from which it should differ (Peter, 1981). It is established when the average correlations of the latent variable with its indicators are greater than the variance it shares with the other constructs, as shown in the table. The values of the square root of the AVE are all greater than the correlations between the constructs, as shown in Table 3. Based on our analyses, we concluded that our measurement scales have discriminant relevance. All the results of the discriminant validity are presented in Table 3.

The measurement of the convergent validity is based on two criteria: the result of the t-test (CR = critical ratio) which must be significant and greater than 1.96, as well as the average variance extracted (VCM) which must be greater than 0.5. Similarly, our measurement model demonstrates a convergent validity by calculating the average variance extracted (AVE) of Fornell and Larker (1981). We also verified that the value of the AVE is greater than the significant threshold of 0.5. These results allow us to verify the internal consistency and validity of all the constructs.

Table N°2: Results of the measurement model

Construct	Items	Contributions Factorial	SMC	Cronbach's α	AVE	Error variance
Interactivity	INT1	0,749	0,560	0,766	0,832	0,053
	INT2	0,799	0,638			0,056
	INT3	0,777	0,603			0,066
	INT4	0,744	0,533			0,052
System quality	QS1	0,740	0,642			0,051
	QS2	0,781	0,609	0,762	0,822	0,044
	QS3	0,799	0,639			0,047
	QS4	0,742	0,550			0,042
Product information	INF1	0,777	0,604	0,801	0,809	0,055
	INF2	0,803	0,645			0,050
	INF3	0,731	0,591			0,049
	INF4	0,685	0,566			0,052
	INF5	0,739	0,546			0,054
Immersion	IMM1	0,803	0,645	0,705	0,899	0,040
	IMM2	0,812	0,659			0,039
	IMM3	0,765	0,585			0,042
Pleasure	PL1	0,752	0,566	0,729	0,889	0,044
	PL2	0,806	0,650			0,042
	PL3	0,696	0,584			0,054
	PL4	0,771	0,594			0,058
Product appreciation	PD1	0,789	0,622	0,762	0,878	0,046
	PD2	0,690	0,655			0,052
	PD3	0,692	0,578			0,058
	PD4	0,745	0,570			0,060
The usefulness of the media	UTILI1	0,629	0,595	0,706	0,889	0,047
	UTILI2	0,736	0,541			0,048
	UTILI3	0,756	0,571			0,046
	UTILI4	0,730	0,532			0,056
	UTILI5	0,658	0,501			0,053
The intention to reuse	REA1	0,912	0,832	0,866	0,901	0,054
	REA2	0,855	0,732			0,058
	REA3	0,879	0,773			0,061

Source: Authors, 2025

Table N°3: Correlations and the square root of the AVE

	INT	QS	INF	IMM	PL	PD	USE	REA
INT	0.840							
QS	**0,455**	0.882						
INF	0,589	**0,289**	0,922					
IMM	0.605	0.466	**0,482**	0.929				
PL	0,686	0,675	0,678	**0,620**	0,888			

PD	0,832	0,687	0,718	0,693	**0,688**	0,902		
USE	0,680	0,586	0,673	0,606	0,645	**0,558**	0,884	
REA	0,757	0,845	0,813	0,715	0,662	0,498	**0,573**	0,819

Source: Authors, 2025

3.2. Structural model analysis

Confirmatory factor analysis of the factors revealed that the measurement model shows a satisfactory fit between the structural model and the data. This analysis revealed that all the adjustment indices are consistent with the conventional thresholds.

The GFI (Goodness of Fit) and AGFI (Adjusted Goodness of Fit) values are between 0 and 1. The closer it is to 1, the better the model fit (Akrout,2018).

The RMR (Root Mean Square Residual) value must be less than or equal to 0.05. If the model adequately represents the data, these residuals have very low values, less than 0.05. An RMSEA ≤0.05 indicates a very good model fit. An RMSEA between 0.05 and 0.08 indicates a good fit of the model. The value of NFI, TLI and CFI should ideally be greater than 0.90 (Akrout,2018). The value of Chi-square (χ2 /ddl1) should be less than 5.

Furthermore, we found that our results are in line with these recommendations (Table 4). The values of the model fit indices are presented in Table 4.

Table N° 4: structural model fit indices

	GFI	AGFI	CMA	RMSEA	NFI	TLI	CFI	Chi Two
Thresholds of acceptability	>0.9	>0.9	≥ 0.05	≤ 0.08	> 0.9	> 0.9	> 0.9	<5
Value Indices	0,745	0,705	0,055	0,088	0,633	0,711	0,735	2,553

Source: Authors, 2025

3.3. Hypothesis testing

This study is grounded in Flow Theory, which suggests that immersion and enjoyment are key factors in fostering engagement in augmented reality experiences. Additionally, it builds on the Experiential Hierarchy Model (EHM) (Holbrook & Hirschman, 1982), which highlights the role of sensory, emotional, and cognitive experiences in shaping consumer behavior.

All research hypotheses (H1–H9) were supported. The results of the confirmatory factor analysis (CFA) indicate that interactivity has a statistically significant positive effect on immersion (H1) ($\beta = 0.45$, $p < 0.005$), pleasure (H2) ($\beta = 0.39$, $p < 0.005$), and product appreciation (H3) ($\beta = 0.25$, $p < 0.005$). These findings align with Flow Theory, as they demonstrate that system interactivity enhances user immersion, leading to an increased sense of enjoyment and engagement. The positive regression coefficients confirm the strength of these relationships (Table 2).

Furthermore, the results support H4, which examines whether immersion significantly affects pleasure ($\beta = 0.35$, $p < 0.005$). This finding reinforces the idea that a deep sense of immersion enhances consumer enjoyment, a core principle of Flow Theory.

The structural model also reveals a positive relationship between system quality and media usefulness (H5) ($\beta = 0.23$, $p < 0.005$) and confirms that product information significantly influences media usefulness (H6) ($\beta = 0.34$, $p < 0.005$). Finally, hypotheses H7, H8, and H9 demonstrate that product appreciation ($\beta = 0.62$, $p < 0.005$), enjoyment ($\beta = 0.52$, $p < 0.005$), and media usefulness ($\beta = 0.32$, $p < 0.005$) positively affect the intention to reuse.

These findings support the Experiential Hierarchy Model (EHM), which emphasizes that sensorial and emotional engagement play a critical role in shaping consumer decision-making. The study confirms that immersive experiences in augmented reality contribute to a positive psychological state, reinforcing consumer intention to re-engage with the digital environment. Table 5 summarizes the confirmed hypotheses in the estimated structural model.

Table N°5: Results of the structural model

Hypotheses	Structural equations			Coefficients (β)	P	Results
H1	Interactivity	→	Immersion	0.45	***	Confirmed
H2	Interactivity	→	Pleasure	0.39	***	Confirmed
H3	Interactivity	→	Product appreciation	0.25	***	Confirmed
H4	Immersion	→	Pleasure	0.35	***	Confirmed
H5	System quality	→	The usefulness of the media	0.23	***	Confirmed
H6	Product Information	→	The usefulness of the media	0.34	***	Confirmed
H7	Product appreciation	→	The intention to reuse	0.62	***	Confirmed
H8	Pleasure	→	The intention to reuse	0.52	***	Confirmed
H9	The usefulness of the media	→	The intention to reuse	0.32	***	Confirmed

Source: Authors, 2025

4. Discussion of results

In this section, we review the key results of the quantitative analysis of our study, to extract confirmed hypothetical relationships. While this field of research is broad and has been widely studied, we note a particular lack of research within the Tunisian context, which underscores the relevance of our study. As part of our research, we undertook to study the impact of

augmented reality characteristics- such as interactivity, system quality, and product information- on the affective (immersion, pleasure and appreciation of the product), cognitive (media usefulness) and behavioral (intention to reuse) responses of the cyberconsumer.

From our analyses, we can see that augmented reality characteristics are key pillars to support cyberconsumers' responses. The first hypothesis shows the impact of interactivity on immersion, at a rate of (β =0.45). We found that this result makes sense, as a smooth and natural interaction with the environment allows users to feel more immersed. Likewise, the more realistic the interaction, the deeper the immersion. In this sense, Gong et al. (2024) state that augmented reality produces an interactive environment that significantly improves immersion and makes the experience more engaging and memorable. This result corroborates the results of Kowalczuk et al. (2021), who demonstrated that direct interactivity with virtual products represents an essential characteristic of immersive experiences. Similarly, Haile et al. (2020) highlighted the significant relationship between interactivity and immersion.

The second hypothesis confirmed a positive and significant impact of interactivity on enjoyment, at a rate of (β=0.39). Hsu et al. (2024) highlight that interactivity, authenticity, and vividness, combined with psychological and affective responses, create an immersive shopping experience. They add that interactivity provides a significant instant gratification stimulus that is a key component of enjoyment. This result shows how the higher quality of product presentation via augmented reality creates a sense of pleasure and enjoyment among cyberconsumers. This result is supported by Yu et al. (2024); Soon et al. (2024); Widyastuti (2024) and Saprikis et al. (2021), who showed that augmented reality can enhance cyberconsumers' enjoyment and subsequently increase their intention to reuse.

According to the results of the significance test regarding interactivity and product appreciation, we accept hypothesis H3. This result seems logical to us because with augmented reality, cyberconsumers can better understand the product, its features, its advantages, and its value, which strengthens their perception and therefore their appreciation. This result corroborates the results of Yoo (2023), who showed that telepresence positively influences the product's utilitarian and hedonic value. Yoo further states that the use of augmented reality improves the perception of the product's practical or functional aspects. This result aligns with those of Pfaff and Spann (2023); Ribeiro et al. (2024); and Chodak (2024). Our results for hypothesis H.4 show the significant link between immersion and pleasure, at a rate of (β=0.35). This result makes sense as users who are absorbed in an experience to the point of forgetting their real environment often feel immediate pleasure. Barhorst et al. (2021) point out that individuals who

experience flow typically report feelings of immersed pleasure, absorbed interest, focused attention, and perceived acceleration of time. This result is consistent with those of Cho et al. (2021) and Marto et al. (2022), who confirmed the significant effect of immersion on pleasure. The results for hypothesis H5 showed the significant and positive effect of system quality on media usefulness. This result shows that ease of use and system quality- characterized by fast loading speed and an ergonomic interface- improve the user experience and operation of the media. In this case, users can benefit from this fast functionality without encountering technical difficulties. This result coincides with recent studies by Kowalczuk et al. (2021), who assert that a system's technical quality- particularly in terms of its performance, fluidity and ergonomics- directly affects users' perception of the usefulness of these media. Previous research recognized that ease of use could be related to the usefulness of media in general. We cite for example Jang et al. (2021) and Papakostas et al. (2021), who confirmed the positive and significant effect between these two variables.

Hypothesis 6 is confirmed, indicating the positive and significant relationship between product information and media usefulness. This relationship makes sense, as clear, complete, and precise information about a product enhances the perceived usefulness of the media. This relationship is confirmed by Qin et al. (2021) who state that virtual presence reflects the ability of media to present physical and virtual components through immersion in the environment generated by augmented reality. Thus, Barhorst et al. (2021); Duquet (2022); Balińska and Jaska (2022); and Rauschnabel et al. (2019) confirmed the hypothesis that media are essential in presenting product information effectively, clearly and relevantly in the context of augmented reality.

The results for the seventh hypothesis indicate a significant and positive link between pleasure and intention to reuse. This result suggests that when cyberconsumers have a positive, pleasant and engaging experience, their willingness to repeat and reuse the product increases. This result is supported by Saprikis et al. (2020) who confirm a positive correlation between pleasure and intention to reuse in the context of mobile augmented reality applications. This result corroborates the results of Yu et al. (2024), who demonstrated that the pleasure felt improves the intention to reuse these immersive technologies. This result is in line with those of Meng et al. (2021); Leveau and Camus (2023); and Buhalis et al. (2019), who confirm that the perceived pleasure in virtual environments fosters the intention to reuse these immersive technologies.

Hypothesis 8 is also confirmed. This hypothesis indicates that the appreciation of the product through an augmented reality application motivates cyberconsumers to reuse this experience.

This hypothesis "has challenged that any positive experience with a product motivates the intention to reuse". This result is supported by the works of Kowalczuk et al. (2021), Jiang et al. (2022) and Kang et al. (2020) who addressed this hypothetical relationship by confirming a significant and positive correla1tion between these two concepts.

For the last hypothesis, the significance test confirms the relationship between media usefulness and reuse intention, leading us to accept hypothesis H9. This result shows that when cyberconsumers perceive an augmented reality application as effective, their motivation to reuse it is reinforced. This result corroborates the results of Cheng et al. (2024); Iranmanesh et al. (2024); Schultz et al. (2023); Daassi and Debbabi (2021) and McLean and Wilson (2019), who highlighted a significant relationship between these two concepts.

5.Conclusion

Overall, our findings contribute to the literature on augmented reality by demonstrating how specific AR characteristics, such as interactivity, system quality, and product information, influence cyberconsumers' affective, cognitive, and behavioral responses. This study addresses a gap in the Tunisian context and offers valuable insights for improving AR applications in the marketplace. By providing a clearer understanding of how AR enhances consumer engagement, enjoyment, and reuse intentions, our research offers practical implications for businesses looking to leverage AR technology to enhance customer experience and loyalty.

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