Online Shopping in Augmented Reality: Systematic Literature Review of Consumer Behavior

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Abstract

The application of Augmented Reality (AR) technology in online shopping is becoming increasingly widespread, drawing significant attention from the academic community. This study aims to systematically review the literature on AR in online shopping based on the PRISMA framework, with a total of 83 articles included in the review process. The study confirms that AR technology primarily enhances the user experience by improving product visualization, hedonic value, and decision confidence. The research also found that AR characteristics, functional factors, and hedonic factors are the main driving forces, while purchase intention and continuance usage intention are identified as key behavioral outcomes. The Technology Acceptance Model (TAM), Stimulus-Organism-Response (S-O-R) theory, and Flow theory were identified as the most commonly used theoretical frameworks. In conclusion, AR technology not only creates a pleasurable shopping experience for consumers but also brings unique business value to retailers. Therefore, future research is recommended to focus more on the long-term effects of AR usage, cross-cultural differences, and a more comprehensive explanation of AR consumer behavior by integrating multiple theoretical perspectives.

Keywords: Augmented reality, Online shopping, Consumer behavior, Customer experience, Systematic literature review.

1. Introduction

Over the past decade, with the rapid development of smartphones and other technologies, the technology-driven online marketing environment has undergone fundamental changes [1], [2], which have also significantly impacted the retail landscape[3]. Recent studies suggest that augmented reality (AR) will become an indispensable part of consumers' lives in the future[2]. Therefore, it is imperative for marketers to quickly determine how AR technology can be leveraged to attract customers, enhance user experience, and integrate it into their marketing strategies. These technologies can help increase sales, boost the certainty of users' purchasing decisions, and foster brand loyalty[4], [5], [6], [7]. Particularly in the online environment, this represents new opportunities and challenges for companies.

Faced with these opportunities and challenges, augmented reality (AR) as one of the most promising technological fields, fundamentally integrates virtual objects (computer-generated images, text, sound, etc.) seamlessly into users' real environments[2], [5], [8]. This interactive technology is applied to various devices, such as wearable devices (Microsoft HoloLens), mobile devices (IKEA Place App), and stationary devices (FXMirror AR avatar). With the surge in global smartphone users, mobile augmented reality (MAR) has become one of the most ideal carriers[9], [10]. It aims to transform the traditional "try before you buy" consumption model by visualizing products and reshaping consumer behavior[9], [11]. According to Reportlinker (2021), the AR market was valued at $14.7 billion in 2020 and is expected to reach $88.4 billion by 2026. Currently, many global retail companies (Sephora, Gucci, POIZON, Gap, L'Oréal, etc.) have launched their own MAR applications [12], [13], [14], AR's impact on the online retail industry cannot be ignored[3].

Augmented Reality (AR) is interdisciplinary by nature, and current literature on AR has explored it from different perspectives, showing a relatively dispersed distribution [3].

For instance, some scholars have compared AR and non-AR

online shopping environments, examining their effects on consumers' emotional responses[15], [16]. Other scholars have studied the impact of AR attributes on user behavior[17], [18]. Some have explored AR from a system perspective, viewing it as a complex technological ecosystem that creates unique business value[4], [19], [20]. Given the widespread distribution of literature across various dimensions, a systematic review undoubtedly becomes a comprehensive method for literature retrieval and synthesis [3]. It not only supports evidence-based decision-making for scholars but also helps identify gaps in future research and provides a comprehensive summary of evidence [8], [21].

Although the understanding of augmented reality (AR) in this field has gradually increased and has become a popular topic among scholars, research on how AR affects consumer behavior and user experience in online retail remains limited, leading to an incomplete understanding. Furthermore, many scholars primarily focus on empirical studies, with a significant lack of systematic reviews. Therefore, this study will use a systematic literature review to investigate the following questions:

RQ1: What is the key role of AR in enhancing user experience in online shopping?

RQ2: What are the driving factors and outcomes of AR in online shopping?

RQ3: What are the main theoretical frameworks for using AR in online retail?

Currently, augmented reality (AR) is still in its early stages of development, and managers lack understanding of AR. This research aims to broaden retailers' understanding of AR and consumer behavior. Additionally, it seeks to identify the current research gaps to advance the construction of the existing knowledge system.

2. THEORETICAL BACKGROUND

The concept of augmented reality (AR) technology can be traced back to the 1960s, but its development has long been hindered by limitations in available devices[22]. AR is defined as the seamless integration of computer-generated virtual images into the physical real world, creating a unique hybrid experience [5]. Unlike fully virtual reality (VR), AR is not meant to replace reality but to enrich users' real-world experiences through digital enhancements. This technology allows consumers to virtually try on clothing and shoes via AR shopping applications on mobile devices or virtually place furniture in their homes, fundamentally changing traditional shopping modes and providing unique value to the field of consumer behavior research[6], [10], [23].

The core advantage of augmented reality (AR) technology lies in its ability to seamlessly combine virtual and real elements, providing consumers with a highly personalized and interactive product experience[22], [24]. AR comprises several interconnected features that collectively form the core attributes of AR technology. Scholars widely emphasize interactivity, vividness, and novelty as the key characteristics of AR[17], [19], [22], [23], [25]. Reference [25] empirically validated the impact of these AR application attributes on customer behavioral responses.

Augmented reality (AR) technology has been applied in various fields, including marketing, entertainment, tourism, and education, demonstrating tremendous potential[6], [26], [27]. In the field of retail marketing, AR is particularly regarded as a powerful tool for achieving the "BICK four elements": Branding, Inspiring, Convincing, and Keeping [19]. AR applications change how businesses, brands, and customers communicate and enhance product displays by placing virtual objects in the real world, improving information processing, and providing a more satisfying experience[28], [29]. This all-encompassing influence highlights the critical role of AR in shaping consumer behavior, from brand perception to post-purchase behavior, where AR may have a significant impact.

3. RESEARCH METHODOLOGY

A literature review forms the foundation for developing new conceptual models or theories and contributes to a deeper understanding of knowledge in a specific field[3]. This method is considered a scientific and informative approach [30], primarily used to systematically collect, review, and analyze literature, including domain-based, theory-based, and method-based reviews [31]. This approach minimizes bias and provides reliable results for decision-making while identifying what is known and unknown within the field [32].

To address the research questions posed in this study, the authors adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, which involves four steps: identification, screening, eligibility, and inclusion[33]. The PRISMA method is widely used in academia for reviewing research. A total of 83 articles were ultimately selected for review. Each stage of the process is detailed below:

In the identification stage, this study selected the SCOPUS and WEB OF SCIENCE (WoS) databases to search for literature. Scopus and WoS were chosen because they are multidisciplinary databases, covering a wide range of academic fields and being widely recognized globally for their high-quality inclusion. By conducting a preliminary review of papers related to the field, the keywords for this study were finalized. These keywords included: "augmented reality," "AR," "mixed reality," "virtual try-on," "virtual fitting room," "retail," "e-commerce," "online shopping," "digital shopping," "smart retail," "consumer," "customer," "user," "behavior," "experience," "engagement," "adoption," "acceptance," "intention," and "satisfaction." These keywords cover multiple aspects such as augmented reality technology, the retail environment, user subjects, and user behavior and experience. We used Boolean operators AND and OR to combine these keywords, constructing a comprehensive and precise search strategy. The SCOPUS database yielded 734 results, while the WoS database yielded 508 results. After the initial search, we applied screening criteria, only including English peer-reviewed journal articles from fields such as business, management, and accounting, social sciences, psychology, and information systems. As of September 12, 2024, this process resulted in the inclusion of 228 and 294 articles, respectively, with no fixed start date for the time range.

To further enhance the quality of the review, the quality of the articles was screened. We excluded journal papers not listed in the ABDC (Australian Business Deans Council) categories. Journals were filtered based on ABDC rankings, which are classified into four levels: A*, A, B, and C, with A* being the highest and C the lowest. We retained journals ranked at A*, A, and B levels, excluding 20 articles from C-level and unranked journals. No C-level journals were found in the WoS results. Additionally, we removed 150 duplicate entries.

After the screening process, researchers conducted full-text readings of the articles. Eligibility criteria were developed based on the type and relevance of the articles. Only conceptual and empirical papers were included. During this process, 19 systematic literature reviews were excluded. To maintain relevance, only papers directly related to AR and the general retail environment were included, specifically those discussing AR features, AR applications in online retail, AR drivers and outcomes, and AR's impact on consumer behavior. During this stage, 194 papers were excluded due to irrelevance to the research objectives or not being published within the last five years. Additionally, 56 qualitative studies were excluded. Ultimately, a total of 83 articles were included in the review process.

In the final inclusion stage, any omissions of relevant articles were reviewed. First, the 19 previously excluded systematic reviews were referenced to determine the inclusiveness of the study. Second, the reference lists of selected articles were reviewed to search for any other relevant studies in the field until saturation was reached. In the next stage, an Excel sheet was maintained to summarize the articles, containing 11 parameters, including author, publisher, methodology, independent variables, dependent variables, mediating and moderating variables, theory used, research objectives, country, findings, and limitations (see Figures 1 and 2).

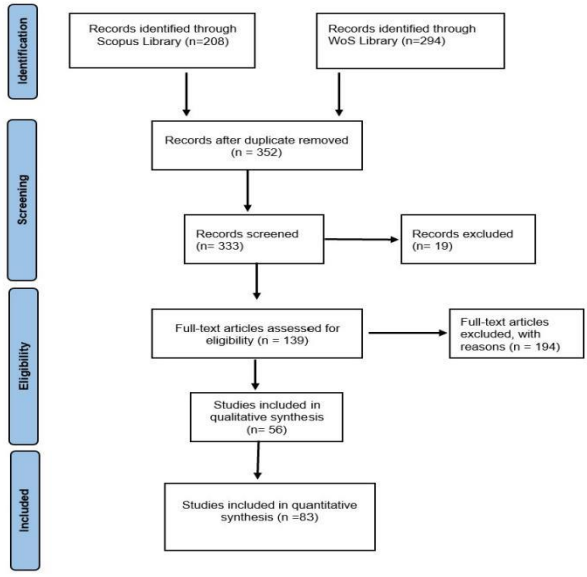

Figure 1: Schematic diagram PRISMA Literature Review

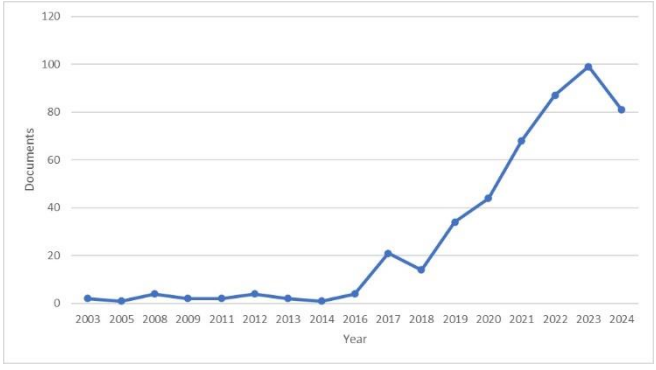

Figure 2: Year-wise distribution of articles from Scopus and Web of Science (WoS) databases

4. RESEARCH FINDINGS

The Key Role of AR in User Experience in Online Shopping (RQ1)

Multiple studies have confirmed that augmented reality (AR) plays a critical role in guiding consumer purchase decisions by bridging the gap between the virtual and real world [6], [14], [34], [35]. This finding is closely related to the key technological features of AR, such as

interactivity, novelty, and vividness. For example, the novelty of AR allows users to directly place virtual products on themselves or in their environment, creating new and personalized experiences[17]. These experiences include virtually "trying on" products or previewing items in their home setting. Such experiences enable customers to visualize how the displayed items would look in their actual context, providing unique, tailored information based on their interests and preferences [35]. As a result, this visualization function reduces uncertainty, increases user engagement, and enhances the overall shopping experience. Studies have shown that the immersive experience of AR significantly increases user satisfaction and boosts confidence in their purchasing decisions [14], [36], [37]. Thus, AR is not just a tool for helping users select products, but also a medium for strengthening emotional connections between users and brands.

Currently, a major issue faced by the online shopping industry is the lack of entertaining interactivity between platforms and users[38]. This interaction is not merely driven by engagement, but more so by the need to imbue platforms with entertainment value [19]. The studies by [6] and [39] confirmed that perceived enjoyment is an important predictor of users' continuance intention. Reference [13] suggested that service providers should focus on personalized communication with customers and offer enjoyable experiences to increase user retention. Furthermore, reference [36] applied flow theory and confirmed that augmented reality (AR) can enhance consumers' purchase intentions by inducing a sense of immersion and flow experience. The results showed that enjoyment and exploratory behavior, both elements of flow experience, significantly positively impact purchase intention. Reference[15] compared AR and non-AR websites, finding that consumer characteristics (hedonic motivation) play a crucial role in the effectiveness of AR, providing empirical evidence for the experiential value of online retail and its promotion of purchase intention.

Although the benefits of augmented reality (AR) for user experience have been widely documented, the general applicability of these benefits requires further exploration. Many studies focus on specific industries like fashion, where AR's visual and interactive features are particularly relevant. However, other industries may not find AR to have the same level of importance for user experience. For instance, product categories such as groceries or electronics, which rely less on visual presentation, may not gain the same advantages. Therefore, future research should critically assess the boundary conditions of AR’s role in improving user experience, particularly across different retail categories.

The Drivers and Behavioral Outcomes of AR in Online Shopping (RQ2)

The literature confirms that the adoption of augmented reality (AR) in the online retail environment is influenced by a combination of technological, psychological, and social factors. These drivers lead to specific behavioral outcomes, such as increased purchase intention and brand loyalty. However, these outcomes depend on how seamlessly AR technology integrates into the consumer’s shopping process.

The literature identifies several motivational factors that drive customers’ behavior towards augmented reality (AR), including AR technological characteristics [23], [35] functional factors[12], [40], hedonic factors, social factors [41], perceived value [2], [42], personal traits[43], and psychological/contextual factors [5], [10], [43]. Among these, AR technological

characteristics, functional factors, and hedonic motivations are particularly prominent. For example,[24] empirically confirmed that, compared to traditional shopping experiences, AR features (vividness, interactivity, and novelty) can induce a higher state of flow. Reference [28] corroborated this finding, explaining that AR functions in shopping experiences provide unique or personalized content services, enabling users to experience a flow state and higher satisfaction. Reference [36] further elaborated on how AR features influence decision-making comfort and purchase intentions through a sense of spatial presence.

Moreover, many studies confirm the importance of ease of use, practicality, and informativeness in augmented reality (AR) adoption[22], [44], [45]. Consumers tend to adopt AR technologies that offer tangible benefits, and the simpler the technology is to operate, the higher the likelihood of adoption [22]. Additionally, ease of use is particularly important for first-time users. The ability to quickly understand and operate AR functions determines whether users perceive it as a useful tool [4].

The literature suggests that hedonic value (flow experience, perceived enjoyment, and pleasure) and psychological factors (satisfaction, attitude) can foster sustainable customer relationships, purchase intention, and revisit intention [14], [36], [46]. As new technologies bring convenience to life, some privacy concerns gradually emerge. This is an aspect that researchers tend to overlook. For example, [46] mentioned in their study that privacy threats may become inhibitors, hindering users' continuance intention and leading to negative attitudes toward the brand[47].

Decision-making, behavioral intentions, and attitudes constitute the behavioral outcomes of augmented reality (AR) technology adoption [22], [48], [49], [50]. Decision-making mainly manifests when users, immersed in an experience created by AR, can reduce cognitive load through psychological intentions, making the decision-making process smoother and easier [36]. Reference [50] confirmed this in their study, where AR enhanced consumer decision confidence and reduced post-purchase cognitive dissonance. Reference [51] also demonstrated that AR impacts consumers' online shopping experience and decision-making process by facilitating information gathering and interaction with accessible information. This may trigger a chain reaction influencing loyalty and word-of-mouth[7], [52], [53]

Current literature consistently reports the relationship between augmented reality (AR), purchase intention, attitude, and adoption. Some scholars argue that AR has a positive impact on purchase intention[36], [40]. Additionally, AR can positively influence brand attitude through the emotional process of transferring positive emotions to the brand [2], [47]. It also affects engagement [22] and adoption intention [16], [54].

It is worth noting that the link between augmented reality (AR) adoption and brand loyalty is complex. Some studies suggest that while AR enhances the shopping experience, its novelty may wear off, diminishing its long-term impact on consumer behavior[2]. Therefore, retailers need to continuously innovate and integrate AR with other personalized features to maintain its effectiveness.

While TAM and hedonic motivation explain much of augmented reality (AR) adoption, they may overlook other important factors, such as trust in the technology or social influence. The success of AR may not only depend on users' perceptions of its usefulness and ease of use but

also on trust in the retailer and how society perceives AR usage. Future research should explore these aspects, especially in different cultural contexts, to better understand the broader drivers and outcomes of AR usage in online retail.

Prevailing Theoretical Frameworks in AR Online Shopping (RQ3)

Based on a review of existing literature in the context of online shopping, we have identified several theoretical frameworks currently employed by scholars to explain consumer behavior. The Technology Acceptance Model (TAM) is the most widely used theoretical framework in augmented reality (AR) shopping research. The core predictors in TAM are perceived ease of use and perceived usefulness[22]. It is considered a key framework for understanding user adoption of AR shopping technologies [40]. For instance, studies by [12] and [45] both confirm the significant influence of these two factors on the intention to use AR shopping applications. However, TAM has been criticized in academia for being overly simplistic [55](Sagnier et al., 2020). While TAM is widely used for researching pre-adoption behaviors, it lacks sufficient explanatory power for post-adoption behaviors [19], [56].

Additionally, the Stimulus-Organism-Response (S-O-R) theory has been validated in several studies within the augmented reality (AR) shopping domain. It reveals how external stimuli can influence users' cognition and emotions, which in turn affect user behavior [57]. For example, in their study,[5] found that four AR attributes significantly impacted emotional and cognitive responses, which indirectly influenced the intention to reuse AR apps. Reference [17] discovered that AR's interactivity and novelty significantly affect users' hedonic value, which in turn influences satisfaction. However, although the S-O-R theory has been used, there is considerable disagreement on the selection, definition, and measurement of core constructs such as stimuli, emotional and cognitive responses, and behaviors. The AR shopping field lacks a unified theoretical framework and measurement standards. Future research needs to clarify construct definitions, standardize measurement tools, and expand theoretical frameworks based on a review of the literature.

It is also worth noting that Flow Theory has been extensively used to explain positive user behavioral responses in this field[37], [39], [58]. For example, [39] proposed using flow theory to reveal that the three components of flow (perceived enjoyment, perceived control, and concentration) all significantly influence the continuance intention to use augmented reality (AR), with perceived enjoyment having the strongest effect. The results suggest that flow is a key factor in retaining users. In contrast, studies by [54] and [59] found that only the perceived enjoyment dimension of flow had a significant impact on the intention to adopt AR, while perceived control and concentration did not. Therefore, there is reason to question the applicability of flow in this context. The authors suggest that future research should conduct a more comprehensive operationalization of flow to fully understand its role in sustaining behavior in AR shopping.

In current augmented reality (AR) shopping research, there are also some less commonly used theories. For instance, the Experiential Hierarchy Model (EHM)[14], Uses and Gratifications Theory (UGT)[12], [23], [60], Information Systems Success Model (ISS)[7], [20], [46], Cognition-Affect-Conation (C-A-C)[34], [61], Unified Theory of Acceptance and Use of

Technology (UTAUT)[62], [63], [64], TIME[65], and Innovation Diffusion Theory (IDT)[49] are some of the theoretical frameworks utilized. Among these, the C-A-C model has a lower explanatory variance for user behavior, indicating that it may lack important connections or determinants, thus presenting limitations.

In current augmented reality (AR) online shopping research, besides mainstream theories, there are several less frequently used yet insightful theoretical frameworks. These can generally be divided into three categories: consumer behavior theories, technology acceptance theories, and media use theories.

In the realm of consumer behavior theories, the Experiential Hierarchy Model (EHM)[14] and the Cognition-Affect-Conation Model (C-A-C)[34], [61] provide frameworks for understanding the formation process of the AR shopping experience. However, the C-A-C model exhibits lower variance in explaining user behavior, possibly due to the more complex consumer decision-making process in AR environments, where traditional linear models may struggle to fully capture the intricacies.

In terms of technology acceptance theories, the Unified Theory of Acceptance and Use of Technology (UTAUT)[62], [63], [64] and Innovation Diffusion Theory (IDT)[49] complement the Technology Acceptance Model (TAM) by providing broader perspectives for understanding augmented reality (AR) technology adoption. These theories particularly emphasize the role of social influence and innovation characteristics in technology adoption, which is especially crucial in the study of emerging technologies like AR.

Media use theories, such as Uses and Gratifications Theory (UGT)[12], [23], [60] and the Technology-Person-Media-Engagement (TIME) theory[65], focus on the motivations and engagement processes of users in actively adopting augmented reality (AR). These theories help explain why consumers choose to use AR and how they interact with AR technology. Additionally, the Information Systems Success (ISS) model assesses the success of AR applications from the perspectives of system quality, information quality, and service quality, providing practical guidance for improving AR shopping applications.

These theoretical frameworks have been applied using a variety of methods, including experimental studies, surveys, and longitudinal research. Future studies could consider integrating these theories to explore how AR shopping experiences meet users' multi-level needs.

5. CONCLUSION

This study provides a comprehensive insight into the augmented reality (AR) online shopping environment. Through a systematic literature review, the authors used the PRISMA methodology to include and exclude relevant literature, ultimately addressing three research questions. First, AR significantly enhances the user shopping experience by improving product visualization and decision confidence. Second, AR technology characteristics, functional factors, and hedonic factors emerged as key drivers of AR technology adoption, with purchase intention and continuance usage intention as critical behavioral outcomes. Additionally, we presented the theoretical frameworks commonly employed in current AR shopping research, with the

Technology Acceptance Model (TAM), Stimulus-Organism-Response (S-O-R) theory, and Flow theory being the most frequently used. At the same time, some emerging theories, such as the Experiential Hierarchy Model (EHM) and Uses and Gratifications Theory (UGT), also offer unique insights.

In conclusion, the role of augmented reality (AR) technology goes beyond what has been explored so far, requiring further in-depth investigation. Therefore, future research should focus more on the long-term effects of AR, cross-cultural differences, and integrating diverse theoretical perspectives to provide a more comprehensive explanation of AR shopping behavior. These findings not only enrich theoretical knowledge but also offer practical guidance for retailers in formulating AR strategies, potentially driving innovation in the online retail experience.

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