

AUGMENTED REALITY TO IMPROVE THE SHOPPING EXPERIENCE OF CUSTOMERS – A REVIEW

NICOLAS PINTADO¹,
SUSSY BAYONA-ORÉ^{2,*}, CHRISTIAN CERVANTES¹

¹Universidad Autónoma del Perú, Panamericana Sur Km. 16.3, Villa El Salvador, Lima, Perú

²Vicerrectorado de Investigación, Universidad Autónoma del Perú, Panamericana Sur Km.
16.3, Villa EL Salvador, Lima, Perú

*Corresponding Author: sbayonao@hotmail.com

Abstract

Augmented reality (AR) is a technology with significant prominence in various companies and sectors because it enables new virtual product buying experiences. Mastering AR technology is a challenge for many companies. This article presents a literature review using the PRISMA methodology, analysing articles published in major databases such as Scopus, SpringerLink, Wiley, Taylor & Francis, ScienceDirect, and IEEE Xplore. A total of 65 articles were studied with the aim of identifying the sectors in which AR is most frequently used, as well as evaluating visualisation techniques and their impact on customer experience. The results of this review highlight the furniture sector as one in which AR is widely applicable. Additionally, this review emphasises the high usage of hand displays. These findings contribute to recognising the characteristics, sectors and techniques that impact the effect of AR on the customer experience.

Keywords: Augmented reality, PRISMA, Purchasing decision, Shopping experience, Visualisation techniques.

1. Introduction

Augmented reality (AR) is conceptualised as a three-dimensional artificial environment [1]. It is also a mainstream and widely marketed technology that is readily available on smartphones [2], allowing customers to experience coexisting virtual and real objects [3]. Many definitions of AR have been proposed; however, they all agree on its interactive, simultaneous, experiential and technical characteristics [4]. AR enhances the customer experience by encompassing the cognitive, affective, psychological and/or physical feelings that customers generate when interacting with a product [5]. Additionally, it includes a set of behavioural elements associated with a purchase [6], leading to interactive, novel, and time-saving characteristics [7].

Consequently, consumers can experience or perform tests to validate whether products meet their requirements through actual experiences [8]. AR allows customers to experience products in a realistic manner, thereby benefiting their purchase decisions [9]. AR technology has sparked consumer interest in immersive experiences [10]. AR has been combined with other technologies and applied in different sectors. For example, in a store, AR can play an important role in the use of virtual glasses and taking pictures of users on social media [11]. AR enables virtual try-ons, improving the availability of information and the ability of a customer to visualise an article from different perspectives [12]. During the COVID-19 pandemic, customers faced challenges in decision-making while purchasing furniture online due to being unable to physically appreciate it [13]. To address this issue, online retailers are increasingly turning to smartphone-based AR applications [14].

This study aims to analyse AR applications and their influence on the customer's shopping experience, the sectors in which AR has been applied, AR visualisation techniques and terms related to AR. The rest of this article is organised as follows. Section 2 explores previous work related to the customer shopping experience using AR. Section 3 describes the research methodology used in this study. Section 4 presents the results of the literature review, and a discussion of the results obtained. Finally, the conclusions are presented in Section 5.

2. Review of Related Works

2.1. Augmented reality (AR)

AR utilises superimposed 3D virtual objects to interactively modify a physical environment for the user [15]. By presenting objects or products, AR provides interactive information [16]. It combines real and artificial elements to enhance human performance [17]. Utilising digital content for an improved perception of the world, making it a powerful and customisable visual technology [18]. Through signal communication, this technology delivers stimuli to wearers, creating an immersive experience [16]. Additionally, AR generally reduces mental workload by efficiently providing a large amount of information and offering augmented vision benefits [19]. Realism is crucial for achieving this, as it allows users to experience virtual objects as if they were actual elements in the physical environment [20].

A clear example in marketing is the combination of media with AR experiences, which helps provide detailed strategic product information and creates value for the brand [21]. In e-commerce, AR enables high purchase intentions by representing virtual products and offering a better online understanding without the need for

face-to-face interactions [16]. AR can provide online consumers with kinesthetic experiences and somatosensory activities [22]. Moreover, IKEA allows customers to experiment with 3D virtual furniture through its mobile applications [23]. Another example is Microsoft's Microsoft HoloLens, which features a large screen with position sensors and was used for assembly tasks. HoloLens is not only used in assembly tasks but also finds applications in the aerospace, medical, and entertainment industries [18]. The growth of AR is projected to improve by 48.6% during the period from 2019 to 2026 [24]. This success can be attributed to AR's ability to interact with various human senses, including sight, hearing, and touch [25]. By doing so, AR offers benefits that enhance both utilitarian and hedonic aspects for users [21]. The primary aim is to eliminate uncertainty from the product or scenario and empower users to access information with full control [15].

2.2. Customer experience

Customer experience is defined as a person's reaction to certain stimuli, which triggers cognitive and emotional responses that can influence the consumer's long-term memory [26]. It can also be described as the interaction with a product or service that evokes an internal response [27]. It is considered a multidimensional construct that involves affective responses from the customer towards the retailer [28]. This experience plays a role in the consumer journey, as it fosters emotional bonding and customer loyalty [29]. One crucial aspect of a good customer experience is decision satisfaction, as it enables better decision-making when purchasing a product [30]. Some customers receive brand experience stimuli related to packaging or brand design, which contributes to positive brand loyalty and encourages repeat purchases [31]. The goal of organisations is related to create a positive memory for customers by delivering value, ultimately aiming to establish a lasting memory value [32]. Another crucial aspect contributing to a positive customer experience is the quality of the order fulfilment process. Ensuring that customers can easily claim their orders and receive them in good condition is essential to avoid leaving them dissatisfied [33].

2.3. Augmented reality in customer experience

Roggeveen and Sethuraman [34], stated that retail sales are undergoing rapid changes, primarily due to new retail technologies that interact with customers and influence their buying process. These technologies are categorised into three stages: (1) pre-purchase, (2) purchase, and (3) post-purchase. Similarly, Riar et al. [35] analysed retail technologies, including AR, which overlays information in a real environment. Their conclusion highlighted how AR can offer new utilitarian and hedonic shopping experiences in retail environments. In a different study [36], researchers analysed the main factors influencing the consumer experience when purchasing wooden furniture. Their findings led to practical implications for enhancing the consumer experience during furniture purchases.

Kim et al. [37] focused on various emerging AR technologies, AR applications, and AR hardware and software, asserting that AR can create modern immersive interactions and dynamic consumer experiences. There is a vision of new innovative technologies in consumer experience, such as AR and virtual reality[38]. Additionally, Nizam et al. [39] proposed a tangible and spatial

awareness interaction technique to introduce new AR interaction techniques for consumers. Similarly, Riar et al. [40] provided synthesised and structured overviews of AR shopping. Moreover, Kuan and Shiratuddin [41] demonstrated how AR improves engagement in the customer experience during online purchases. Linked to this, Kazmi et al. [42] analysed how AR can help overcome online shopping phobias experienced by customers.

3. Methodology

PRISMA [43] was used to conduct the systematic literature review process. While this methodology is originally oriented towards the health environment, it can be applied for various other purposes as well. Utilising this methodology enables the synthesis of statistical information from both quantitative and qualitative data. The following research questions (RQ) were proposed as part of this work.

- RQ1: What characteristics influence the augmented reality customer shopping experience?
- RQ2: Where is augmented reality most frequently used in the customer shopping experience?
- RQ3: Which augmented reality visualisation techniques are most widely used in the customer shopping experience?
- RQ4: How are related keywords used in studies on the customer shopping experience and AR?

The inclusion and exclusion criteria used in research to limit the selection of articles were defined. The following three inclusion criteria were identified: 1) studies related to AR in the customer shopping experience; 2) studies related to AR visualisation techniques; and 3) studies published during the period 2017–2024. The following two exclusion criteria were also identified: 1) articles written in the Spanish language; and 2) systematic review articles. These criteria were applied to select articles from scientific databases in order to perform the systematic literature review. Six scientific databases were used as sources of information in this research: 1) Scopus, 2) IEEE Xplore, 3) ScienceDirect, 4) SpringerLink, 5) Wiley and 6) Taylor & Francis. The search strategy covered multidisciplinary topics, including AR and the shopping experience. During the analysis, it was found that some articles from SpringerLink were also available in ScienceDirect. The search string used for finding the articles was "Augmented reality" AND "Customer experience" OR "furniture purchases".

A total of 1602 articles were returned in a search of the electronic databases listed above. Figure 1 shows the PRISMA flow diagram of the study selection process. To avoid redundancy in the analysis of the studies, 58 articles with duplicate titles were removed. After reviewing the titles and abstracts, a total of 1314 studies were removed. Therefore, 230 articles were evaluated, from which, after an exhaustive analysis of eligibility, 86 further articles were removed because they did not present characteristics of AR. Of the remaining 144 articles, 79 articles were removed because they did not include the criteria for analysing the purchasing experience. Thus, the final synthesis included 65 articles emphasising the AR and customer shopping experience.

Figure 1 provides a detailed overview of each screening step. Additionally, the articles were added to Mendeley, a reference management tool, to maintain better

control over citations, titles and article information. Relevant data from the selected articles were extracted and organised in a spreadsheet. The extracted data were then uploaded to Google Drive, a cloud-based file hosting tool, for easy access and collaboration. The list of relevant data extracted from the selected articles includes the following categories: 1) Title, 2) Authors, 3) Year of publication, 4) Database, 5) Country, 6) Definition of AR, 7) Characteristics of AR, 8) Customer experience in furniture shopping, 9) Statistical technique, 10) Instrument, 11) Conclusion, 12) Visualisation techniques, 13) AR sector, 14) Application of AR and 15) AR analysis within sectors.

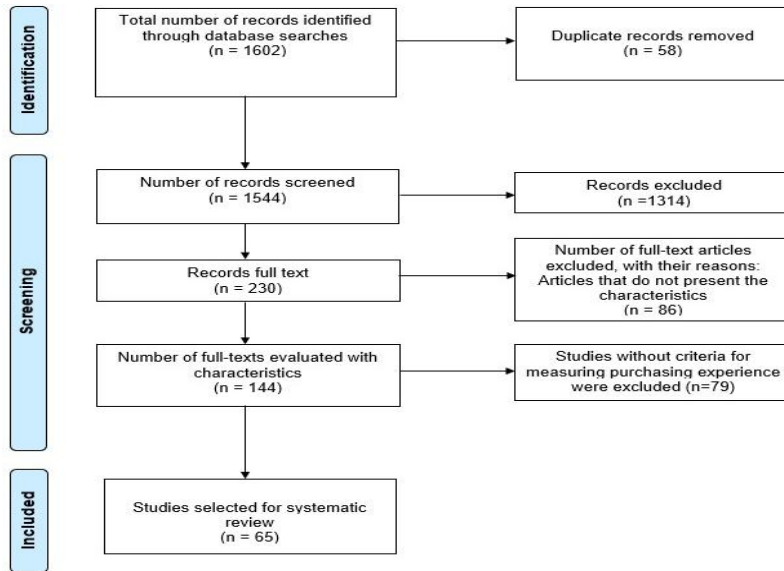


Fig. 1. Flow chart showing the process of selection of primary articles.

4. Results

The results of the literature review concerning the characteristics influencing AR customer shopping experience are presented in this section.

4.1. RQ1: What characteristics influence the augmented reality customer shopping experience?

The review of the primary articles allowed us to extract and analyse the most influential characteristics of AR. The majority of these characteristics were found to provide hedonic benefits rather than utilitarian benefits. This finding is consistent with evidence showing that AR can increase customer satisfaction by offering elements of entertainment and enjoyment [5]. There is a relation between customer satisfaction and customer continuance intention [44]. Additionally, the ability to personalize the AR experience, such as through visual or audio content, enhances these hedonic and utilitarian benefits, resulting in greater overall satisfaction [7].

As a utilitarian benefit, the interactivity of AR also contributes to user engagement, allowing for greater control over, and participation in, the personal shopping experience [15]. This engagement can be measured by frequency of use and user retention rate, which reflect how hedonic benefits influence ongoing interaction with the app. On the other hand, the hedonic benefits of AR enrich the user experience, thereby improving purchase intent and attitude towards products [20]. Although most of the AR features analysed primarily offer hedonic benefits, the integration of these elements can have a positive impact on business outcomes, demonstrating their value not only in terms of satisfaction, but also in customer engagement and attitude towards purchase. Table 1 presents the list of AR applications and AR features.

Table 1. Experience influential features of AR.

Ref. No.	Description and influential features of AR
[6, 45-59]	IKEA AR Mobile Application: this app integrates various elements, including interactivity, immersion and personalisation, allowing users to visualise 3D furniture within their real environment. By enhancing the perceived value and utility through virtuality and presence, it influences consumer experience and purchase intention, providing both hedonic and utilitarian benefits. Influential features of AR: Utilitarian benefits, Augmentation quality, Inspiration, Attitude, Information, Intention to use, Ease of use, Enjoyment, Perceived value, Utility, Risk value, Personalization, Trust, Co-creation intention, Interactivity, Virtuality, Irritation, Entertainment, Purchase intention, Affection, Cognition, Consumer experience, Presence, Authenticity, Satisfaction, Purchase benefits, Creativity, Orientation, Engagement, Usability, Portability, Liveliness, Novelty, Immersion, Telepresence, Intrusion.
[5, 56, 60-71]	AR Mobile Application: this tool elevates the user experience by seamlessly integrating interactive features with a focus on sustainability and affordability, ultimately increasing purchase intention and brand recognition. Influential features of AR: Cognitive fluency, Attitude, Continuity of use, Behavioural intention, Nostalgia, Utilitarian benefits, Information, Novelty, Entertainment, Complexity, Restorative experience, Decision making, Consumer experience, Purchase intention, Utility, Engagement, Ease of use, Reuse intention, Recognition and learning, Interactivity, Telepresence, Liveliness, Spatial, Appeal.
[58, 72-74]	Sephora Virtual Artist: this tool enhances the consumer experience by offering a lively and interactive platform that introduces novel features, leading to increased customer satisfaction and positive attitudes while delivering both utilitarian and hedonic benefits. Influential features of AR: Utilitarian benefits, Hedonic benefits, Satisfaction, Interactivity, Liveliness, Novelty, Consumer experience, Attitude.
[75-77]	Wanna Kicks: This app drives purchase intention by offering an interactive and authentic experience, enhancing user trust and attitude through lively and engaging features that deliver strong hedonic value. Influential features of AR: Attitude, Trust, Hedonic value, Purchase intention, Interactivity, Authenticity, Liveliness.
[56, 78, 79]	L'Oréal: this app leverages interactivity and telepresence to create a novel and lively experience, engaging users with its innovative features. Influential features of AR: Decision making, Immersion, Perceived value, Hedonic benefits, Innovation, Interactivity, Telepresence, Novelty, Liveliness.
[80, 81]	Ray-Ban Virtual Try-on: this tool enhances purchase intention by combining ease of use and interactivity with both hedonic value and utilitarian benefits, providing a satisfying virtual experience that boosts user attitude and delivers tangible purchase benefits. Influential features of AR: Satisfaction, Purchase intention.
[56, 82]	Nike AR: this app boosts purchase intention by creating an immersive and novel experience that engages users through interactivity and mental imagery, thereby enhancing their sense of telepresence and liveliness. Influential features of AR: Immersion, Mental imagery, Purchase intention, Interactivity, Telepresence, Novelty, Liveliness.
[83, 84]	YouCam Makeup: this app informs and inspires users through a social and experiential platform, enhancing the perceived customer service and driving intention to use, ultimately leading to greater satisfaction. Influential features of AR: Information, Consumer experience, Inspiration, Intention to use, Perception.
[85, 86]	Kinect 3D: provides voice recognition capabilities, full-body 3D motion capture, and facial recognition without requiring additional devices. Influential features of AR: Innovation, Familiarity, Consumer experience.
[87]	360° 3D Website: this website features rotating 3D images to enhance the shopping experience for shoes, bags and accessories. Influential features of AR: Perceived value.
[88]	Yenprima Mebel AR Application: this application is designed to assist users in finding products that require more knowledge and significantly reduce the purchase process time. Influential features of AR: Decision making, Satisfaction.

Ref. No.	Description and influential features of AR
[89]	WallaME: this app enhances consumer experience and intention to use by fostering interactivity and identity, appealing particularly to users with extraverted personalities. Influential features of AR: Consumer experience, intention to use, interactivity, identity, extraversion.
[90]	GlassOn App: this app stands out for its perceived value and novelty, improving attitudes towards use and intention to use. It provides an enjoyable and easy-to-use experience, enhancing overall satisfaction. Influential features of AR: Perceived value, novelty, attitude, intention to use, enjoyment, ease of use.
[91]	Aug-traveller: this tool emphasises authenticity, quality and innovation, offering a unique and high-quality travel experience. Influential features of AR: Authenticity, quality, innovation.
[92]	Gucci AR: This app enhances the brand experience by integrating interactivity and virtuality, improving user attitude and delivering both hedonic value and utility. It offers a novel and lively experience with strong telepresence. Influential features of AR: Interactivity, virtuality, brand, attitude, hedonic benefits, utilitarian benefits.
[44]	Starbucks AR: this app focuses on delivering high levels of satisfaction through its augmented reality features, enhancing the overall customer experience. Influential features of AR: Satisfaction.
[93]	Hoolens RA Application: these virtual glasses allow the user to visualise elements in 3D. Influential features of AR: Decision comfort, sensory.
[94]	Wayfair's View-in-Room 3D: this AR tool excels in visual precision, allowing users to accurately see how furniture and décor fit into their space. Influential features of AR: Presence.
[81]	Hyundai AR: this app uses augmented reality to help vehicle owners learn about spare parts and features by pointing their device at the car, making it easier to understand and use. Influential features of AR: Satisfaction.
[95]	EyeNavi X1 Extreme AR: this application takes charge of 3D driving a car. Influential features of AR: Satisfaction, presence, spatial ability, purchase intention.
[13]	Amazon RA: this app focuses on delivering high levels of satisfaction through its augmented reality features, thereby enhancing the overall shopping experience. Influential features of AR: Satisfaction.
[46]	Auto BILD AR: this app uses augmented reality to bring the magazine to life with videos, engine sounds, 3D models and interactive features when scanned with a smartphone or tablet. Influential features of AR: Information, ease of use, intention to use, enjoyment, attitude, utility.
[96]	Kik AR: this app allows interaction with the makeup product catalogue. Influential features of AR: Satisfaction, purchase intention, revisit intention.
[97]	Snapchat AR: this app influences user perception and attitude through its engaging AR features, enhancing the overall experience. Influential features of AR: Perception.
[98]	Akzo Noel AR: this app strengthens the benefits of online shopping for customers, allowing them to try products without leaving their homes. Influential features of AR: Decision making, behavioural intention.
[58]	AR Try On: this tool enhances consumer experience through high interactivity and novelty, creating a lively environment that fosters a smooth flow experience. Influential features of AR: Interactivity, liveliness, novelty, consumer experience.
[99]	Mobile Application Using AR Libraries: this application aims to help users find products they require with greater knowledge. Influential features of AR: Enhanced experience
[100]	DEWU: this app drives purchase intention by enhancing engagement and utility through interactive and lively features. Influential features of AR: Engagement, purchase intention, utility, interactivity, liveliness.
[78]	Mister Spex AR: this app provides a virtual mirror to vary simulated control and environmental embedding. Influential features of AR: Decision making.
[101]	Wearables AR: these wearables project images for each eye in a partial mirror, providing links to virtual elements in the user's physical field, and responding to voice commands and gestures. Influential features of AR: Information, intention to use.
[102]	Magic Mirror with AR: this tool enhances purchase intention by showcasing the benefits of AR features, thereby improving the overall shopping experience. Influential features of AR: Purchase intention.
[103]	Old Compton: this app enhances perceived value and ease of use through its interactive features, providing a user-friendly and engaging experience. Influential features of AR: Interactivity, perceived value, ease of use.
[104]	Virtual Tour in the Parmigiano Reggiano Dairy: this virtual tour allows consumers to explore the food production site and influences their intention to physically visit and purchase food. Influential features of AR: Purchase intention, intention to visit.

RQ1 drove the search to identify features that influence the customer's shopping experience using AR. Our review of articles allowed us to extract and analyse their most influential features. It also allowed us to show that most of the identified characteristics provided hedonic benefit rather than utilitarian benefit. Among the most relevant characteristics were the interactivity and attitude of the consumer, since the comfort of the customer is used to make a decision [48-51, 55, 59, 69, 73-

-75, 77, 88, 95, 96, 98, 103]. Figure 2 presents a summary of the most relevant characteristics of AR showing that AR has been applied in various sectors and demonstrating that the most influential characteristics in the customer's shopping experience with AR are decision-making, satisfaction and attitude.

The results shown in Fig. 2 indicate that the most influential features in the customer's shopping experience with AR are interactivity (8.1%), attitude (6.6%), satisfaction (6.1%), purchase intention (6.1%) and consumer experience (5.1%). The interactivity feature of AR makes it possible for customers to visualize a product in real-time and facilitates purchase intent [96]. It also increases both the hedonic value (fun) as well as the utilitarian value (functionality), which improves customer satisfaction and allows for more informed decision-making [83]. In addition, it is very important for creating immersive experiences and generating positive affective responses. Greater interactivity leads to a more engaging and immersive shopping experience [96]. A customer's positive attitude towards AR allows them to interact with it more proactively, which in turn influences their purchasing decisions [74] and increases their satisfaction [96]. Satisfaction increases when the platform is interactive, and the customer's perception [100] and purchase intention are improved. Purchase intent improves when AR offers comprehensive and personalised information [77]. Additionally, AR improves the customer experience [5, 74, 83], especially when it is interactive, making the customer experience more engaging [100].

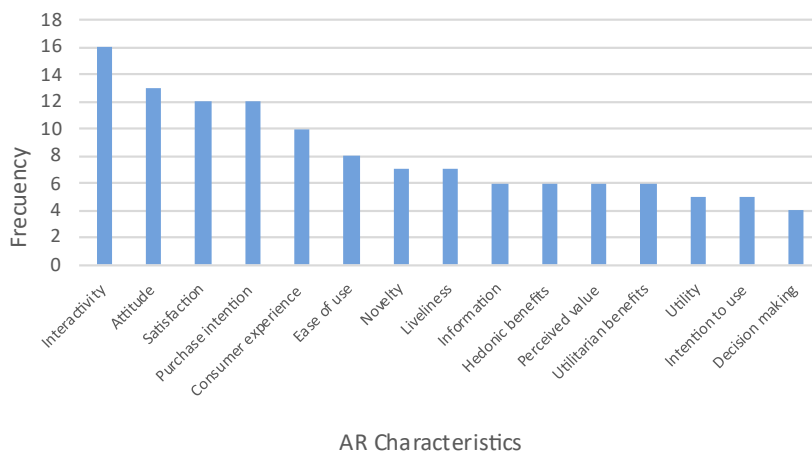


Fig. 2. Features that influence the customer's shopping experience with AR.

Empirical studies based on Structural Equation Modelling (SEM) have shown that factors influencing user satisfaction have a significant impact on purchase intention. The T value is a statistical measure used in SEM to assess the significance of relationships between variables. A T value greater than 1.96 indicates that the relationship between variables is statistically significant. Several studies have shown that customer satisfaction when using AR directly influences purchase intention, with high T values such as $T = 2.98$ [52], $T = 6.134$ [49] or $T = 17.411$ [95]. In addition, media enjoyment also influences purchase intention, with a value of $T = 3.736$ [100].

Customer satisfaction plays a key role in purchase intention. Attitude and hedonic benefits directly impact user satisfaction ($T = 3.565$) [49]. Higher satisfaction with the augmented reality experience significantly influences customer attitude ($T = 11.951$) [64]. This satisfaction, in turn, drives purchase intention ($T = 17.411$) [95]. These findings highlight the importance of generating satisfying experiences in augmented reality environments to strengthen relationships with customers. Furthermore, brand engagement in AR environments influences purchase intention ($T = 5.691$) [75], and this is influenced by psychological inspiration ($T = 6.134$). In the advertising domain, engagement influences purchase intention ($T = 7.067$), while attitude towards advertising influences purchase intention ($T = 2.571$) [97]. Finally, usefulness and enjoyment of media influence brand engagement ($T = 6.838$ and $T = 7.758$ respectively), which increases purchase intention ($T = 6.732$) [100].

4.2. RQ2: Where is augmented reality most frequently used in the customer shopping experience?

This study also explored the usage of AR in the customer shopping experience as part of RQ2. The results show that the AR technologies studied were employed for the following uses: (1) furniture [6, 13, 45-59, 68, 70, 81, 88, 93, 94, 101], (2) beauty [5, 56, 58, 65, 66, 72-74, 78, 79, 83, 84, 96], (3) glasses [46, 58, 78, 80, 81, 90], (4) footwear [75-77, 85, 87, 100], (5) fashion [87, 92, 97], (6) clothing [56, 86, 102], (7) food [44, 103, 104], (8) tourism [63, 64, 91], (9) electronic products [5, 61, 71], (10) shopping [67, 82], (11) driving and navigation [95], (12) barber shops [69], (13) paint [98], (14) supermarkets [99], (15) social media [89], (16) marketing [62], (17) liquors [4] and entertainment [60] (Table 2).

Table 2. Sectors of the applicability of augmented reality.

Ref. No.	Sector	%
[6, 13, 45-59, 68, 70, 81, 88, 93, 94, 101]	Furniture: AR applications substantially improve the furniture shopping experience by allowing customers to visualise and interact with virtual furniture in their homes, leading to faster and more satisfying purchase decisions. In comparison to traditional methods, AR offers enhanced realism and customization, as evidenced by IKEA's "Place" app. AR technology facilitates precise adjustments and direct product comparisons, highlighting unique features and enhancing decision-making in the furniture sector.	32.0%
[5, 56, 58, 65, 66, 72-74, 78, 79, 83, 84, 96]	Beauty: The enjoyment of AR applications drives continued use, particularly for online makeup, providing entertainment and convenience. Discrepancies between expected and experienced benefits highlight the need for accurate marketing communication. AR enhances e-commerce by boosting purchase intentions and the willingness to pay more, with MARA rated as efficient and user-friendly in selecting makeup products.	17.3%
[46, 58, 78, 80, 81, 90]	Glasses: Retailers should tailor AR apps to consumers' cultural contexts, enhancing real-time virtual product experiences. AR apps facilitate direct interactions by allowing users to try on glasses at home using their device's webcam. The app overlays glasses onto the user's live image, providing a strong visual experience that improves product visualization and consumer engagement.	8.0%
[75-77, 85, 87, 100]	Footwear: AR technology, exemplified by the "Wanna Kicks" app, allows consumers to virtually try on shoes from numerous brands, including Nike, Adidas, and Fila, providing a more detailed view than traditional 2D images. This enhances the online shopping experience, making it more akin to trying on shoes in-store. The study supports the potential of AR to replace or complement physical stores by offering similar product experiences while improving product evaluation.	8.0%

Ref. No.	Sector	%
[87, 92, 97]	Fashion: AR enhances consumer experiences in fashion by allowing detailed exploration of luxury handbags, clothing, and dresses, thereby boosting perceived quality and brand connection. Although AR can optimise experiences in various fashion segments, focusing on personalization is crucial.	5.3%
[56, 86, 102]	Clothing: In the clothing sector, our study found that consumers with high body surveillance levels achieve a sense of body ownership through AR try-on systems, improving the online fitting process relative to purely visual methods. A major challenge for AR technologies, such as magic mirrors, involves how consumers perceive recommendations, i.e., as valuable or intrusive. Retailers can mitigate negative perceptions by allowing customers to use AR apps at their convenience, aiming to foster transparency and trust.	4.0%
[44, 103, 104]	Food: In the food sector, AR enhances consumer experiences by superimposing food items onto their real-time environment, making them seem more personally relevant. This visual integration increases mental simulation, leading to improved evaluations of food. Retailers using AR to provide additional product insights or education find that users perceive significant value, leading to increased engagement and satisfaction. Enhanced user satisfaction also positively influences user intention to continue using AR.	4.0%
[63, 64, 91]	Tourism: In the tourism sector, AR applications offer information in a novel and highly contextual manner by blending real and virtual concepts. The results reveal that AR enhances economic benefits, including financial gains, new business opportunities, and improved efficiency for small cultural heritage tourism organizations, while uncovering new strategic advantages.	4.0%
[5, 61, 71]	Electronic Products: Our findings highlight the importance of integrating AR into product development and point-of-sale presentations for electronic devices. Physical prototypes are essential for assessing features related to physical pleasure that are challenging to evaluate using virtual prototypes alone. Adding an AR layer to electronic products can enhance authenticity by revealing internal mechanisms or adding dynamic features. Companies such as Lego and some newspapers use AR to provide interactive elements, while AR is also utilised in the manufacture of interactive content and manuals.	4.0%
[67, 82]	Shopping: AR enhances consumer decision-making by creating a "wow" feeling and improving purchase intentions. For instance, Nike's AR app, Nike Fit, partners with Invertex to offer custom-fit shoes through scanning technology, which has positively impacted consumer purchase intentions. Additionally, our findings highlight the importance of AR app-based brand experiences in influencing consumer responses. A high-quality AR app experience improves attitudes toward the app, fostering a positive opinion of the brand, co-creation, and online review intentions. Marketers should leverage AR apps as key tools to achieve these positive brand outcomes.	2.7%
[95]	Driving and Navigation: This study confirms that conceptual understanding, a key user perception of AR technology, strongly influences experiential economy factors related to absorption, such as educational and entertainment experiences, in the context of AR navigation systems.	1.3%
[69]	Barber shop: Smartification services enhance customer interactions by offering sensory experiences that meet diverse needs. AR technology allows consumers to proactively test hair-colouring effects, reducing the risk associated with uncertain outcomes.	1.3%
[98]	Paint: In the paint sector, the innovative Akzo Nobel Visualizer app empirically tests optimal configurations for sharing viewpoints and improving communication acts. The app enhances the comfort of those giving purchase advice by allowing them to project specific wall colours onto shared photos and videos, advancing beyond verbal description. This approach influences decision-making by providing a more vivid and accurate representation of the recommended colour.	1.3%
[99]	Supermarket: In the supermarket sector, AR can guide customers to the location of desired products and allow them to visualise items and models within the store. In addition to viewing a product, customers can access useful information such as specifications, available models, and sizes, enhancing both their shopping experience and the decision-making process.	1.3%

Ref. No.	Sector	%
[89]	Social media: Social AR apps can foster customer-to-customer relationships through shared social experiences giving a sense of place, interaction, and identity.	1.3%
[62]	Marketing: In marketing, AR content must deliver useful information and be both novel and entertaining to enhance campaign credibility and viewer attitudes. Novelty and entertainment positively influence attitudes, providing more engaging and innovative AR content crucial for successful advertising.	1.3%
[4]	Liquors: In the liquor sector, a key limitation is our focus on a commercially available AR experience specific to the wine industry. This choice was made to enhance realism due to the nature of wine purchasing. Although this was effective for the study considered in this review, future research should explore other AR applications and industries to see if similar results are achieved.	1.3%
[60]	Entertainment: In the entertainment sector, the study found that peer influence does not significantly impact subjective norms, contrary to previous research. This may be because AR entertainment apps are often solo experiences, where users can escape the real world and avoid excessive peer interaction, unlike team-based games.	1.3%

32.0% of the studies reviewed were in the furniture sector, 17.3% in the beauty sector and 8.0% in the glasses and footwear sector. Table 3 presents a comparative analysis of the efficiency of AR in the sectors that present the highest frequency such as furniture, beauty, glasses and footwear. Applications based on AR allow marketing costs, operational costs and the costs of returning products to be reduced. In various sectors, AR is perceived in a positive way when it provides useful information, responds to positive emotions and provides interactive and immersive presentation while remaining closely related to emotions. In most AR studies, satisfaction is high when the customer experience improves, and control of personal information is maintained. Furthermore, the quality of the applications is very important; this depends on the technologies used. When realism is combined with physical presence, they are combined. In the sectors studied AR improves the shopping experience. However, it is important to consider potential limitations when implementing AR applications such as data privacy, technological infrastructure, emotional integration and response time, among others.

Table 3. Comparison of sectors.

Criteria	Furniture	Beauty	Glasses	Footwear
Saving	AR reduces uncertainty, saves time and reduces product returns [5, 10, 12, 15].	AR reduces marketing costs [74, 83], operational costs [65] and/or product returns costs [66].	AR reduces costs [78] and simplifies the purchasing process, allowing savings in customer service costs [77].	Potential savings in product returns [75].
Perception	AR generates value and control for users [5, 8, 10, 14]. It fosters positive attitudes and more informed decisions by displaying products with higher visual quality [15, 17]. Their use increases creativity and promotes purchase intent through virtual interaction [42, 56].	AR is useful and interactive [74], providing immersive and entertaining interaction [83], personalised interactions with products [65, 74] and enhances positive emotions [83].	Positive perception when presenting useful information [46], responds to emotional expectations [58] and allows control over personal information [81].	Positive perception of interactive visualisation [87, 100], AR products that generate instant satisfaction or when AR presentations are rich in sensory and visual information [76, 85].

Criteria	Furniture	Beauty	Glasses	Footwear
Satisfaction	AR reduces cognitive effort [8, 12, 14], generates customer satisfaction and improves brand engagement through interactive and enjoyable experiences [65, 75]. Positive sensory experiences increase satisfaction [56, 59, 60].	High because it improves the customer experience [74, 83], virtual product try-on experience before purchasing [66], as well as facilitating more informed purchasing decisions [67].	High when apps offer pleasant experiences [46, 90], when quality is high [81] and when control over personal information is maintained [81].	Greater satisfaction with 360° visualisations [87], the information provided includes both hedonic and utilitarian attributes [76], and when an immersive and personalised experience is provided [77, 86].
Quality	AR allows users to visualise details of materials and sizes [1, 8], increases the quality of virtual objects [15] and presents realistic 3D models [19, 21]. These experiences offer competitive advantages [38, 58].	The quality of AR applications improves customer satisfaction [74, 85], improves the shopping experience [84,83], increases purchase intent [66] and improves customer purchasing decision-making [5, 74].	Quality depends on the technologies that are used in AR [45], how AR can simulate emotions [58], the ability to deliver immersive experiences [90], to deliver greater customer satisfaction [78, 81, 80], and the user's willingness to purchase [80].	When the quality of 3D visualisations is high, AR improves the perception of product value [87], and the quality of AR with greater realism improves the purchase decision [85]. When AR creates a sense of product presence [77] the physical presence and realism of products are combined [76].
Justification	AR accelerates the purchase decision [1], they inspire users by showing them diverse possibilities [5]. By connecting the real and virtual world, they provide a superior experience [17] and help consumers make informed decisions [42].	AR increases satisfaction during the buying process [75], improves the customer's shopping experience [65, 83, 84] and purchase decision [75], and decreases negative emotions [66].	AR improve the shopping experience [80], maintaining the balance of information control and the quality of AR [81], or when it responds to emotional needs and creates immersive experiences [59].	AR improves value perception [76], purchase perception and decision compared to other technologies [85] and improves consumer engagement and purchase decision [100].

AR has become a key tool in retailing, especially when shopping for furniture where it reduces mental intangibility and enhances digital immersion without altering the consumer's real environment [11]. Its ability to project 3D models facilitates product personalisation and understanding, providing greater confidence in the purchase and expanding its application to different retail scenarios [3, 14]. While in make-up and glasses, AR emphasises personalisation and visual design to enhance the user experience [4, 5, 11], in shoe fitting interactivity plays a key role. Users can change the colour and model of the shoes, virtually walk with them and share their experience, generating sensory feedback that enhances their interaction with the product [6].

4.3. RQ3: Which augmented reality visualisation techniques are most widely used in the customer shopping experience?

Three main AR display techniques were identified: 1) head-mounted display (HMD) (3.1%), 2) handled display (92.3%) and 3) spatial display (4.6%). It was found that the handled display dispositive was the most commonly used. Furthermore, the handled display had an impact on consumer hedonic values, whereas the HMD was more impactful for utilitarian values (see Fig. 3).

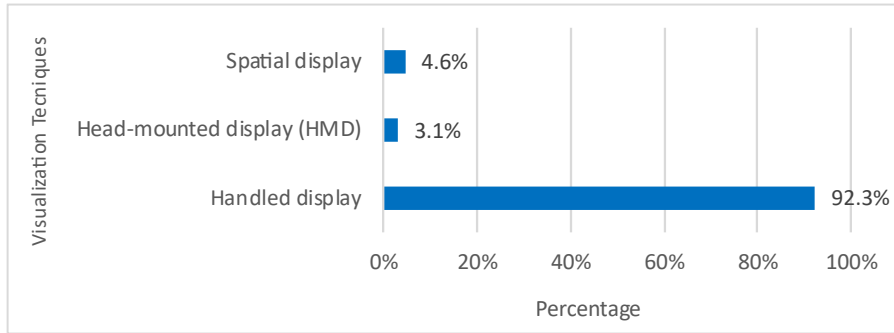


Fig. 3. AR visualisation techniques.

Handheld display-based AR is the most accessible and dominant option for furniture shopping due to the ubiquity of smartphones and tablets [3]. Also, it enables a personalized experience anywhere, anytime, supporting mass adoption in furniture retail [3, 14, 75]. In contrast, head-mounted displays (HMDs) require specialised hardware and a learning curve.

4.4. RQ4: How are related keywords used in studies on customer shopping experience and AR?

The VOSviewer tool was used to evaluate how the AR-related keywords are used in studies of customer shopping experience [105]. Figure 4 shows the co-occurrence network map of the main keywords used in the selected studies. The analysis of titles and abstracts was performed using a binary counting method of 30 keywords. It was examined with a minimum threshold of two occurrences, resulting in 29 terms. Figure 4 shows that all seven clusters are interconnected. The relationships between the terms demonstrate the importance of using AR in the customer experience when making purchases using e-commerce. Aspects such as interactivity, user satisfaction, engagement, and customer experience are highlighted in the co-occurrence map. Table 4 presents descriptions of each of the clusters formed.

Table 4. Description of each cluster used in augmented reality.

Cluster	Description
Cluster 1 (red): augmented reality (AR), customer engagement, customer experience, e-commerce, retail, service quality, user satisfaction.	Cluster 1 (red) focuses on the role of AR in enhancing customer engagement and experience within e-commerce and retail. It includes concepts such as AR, service quality and user satisfaction, highlighting the mechanisms by which AR improves both online and in-store shopping experiences, leading to improved customer interaction.
Cluster 2 (green): AR, augmented reality marketing, flow, inspiration, mixed reality.	Cluster 2 (green) centres on the use of AR and mixed reality in marketing. It includes concepts such as flow and inspiration, emphasising how these technologies create immersive experiences that captivate users, enhancing engagement, and driving innovative marketing strategies.
Cluster 3 (blue): consumer behaviour, metaverse, retailing, spatial computing.	Cluster 3 (blue) focuses on the intersection of consumer behaviour and emerging technologies – including the metaverse and spatial computing – in retail. It explores how these innovations redefine shopping experiences and influence consumer behaviour, driving new trends in the retail sector.

Cluster	Description
Cluster 4 (yellow) 4: co-creation, interactivity, mobile augmented reality, perceived value.	Cluster 4 (yellow) highlights the role of mobile AR in fostering interactivity and co-creation. It includes concepts such as perceived value, emphasising how mobile AR enhances customer engagement by allowing users to actively participate in shaping their experiences, thereby increasing the perceived value of products or services.
Cluster 5 (purple): engagement, online shopping, social augmented reality, technology acceptance model.	Cluster 5 (purple) focuses on engagement in online shopping through the use of social AR. It incorporates the Technology Acceptance Model, highlighting how the integration of AR into social platforms enhances user interactions, making online shopping more engaging and influencing consumers' acceptance and use of this technology.
Cluster 6 (light blue): augmented reality, psychological ownership, user experience.	Cluster 6 (light blue) explores the impact of AR on user experience and psychological ownership. It emphasises how AR creates immersive interactions that foster a sense of ownership over products or services, enhancing the overall user experience and deepening emotional connections with brands.
Cluster 7 (orange) marketing, virtual reality.	Cluster 7 (orange) focuses on the application of virtual reality (VR) in marketing. It highlights how VR technologies can create compelling and immersive marketing experiences, offering new ways to engage customers and enhance brand interactions through virtual environments.

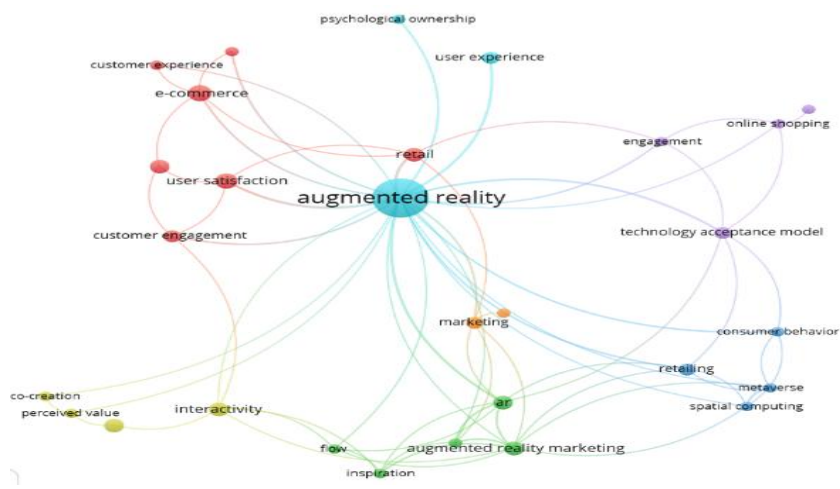


Fig. 4. Co-occurrence network map of the main keywords.

5. Conclusions

This article presents the results of a literature review of AR and the customer shopping experience. A total of 65 articles published during the period 2017–2024 were selected. The customer shopping experience is complex due to its abstract nature. However, evaluating this experience is a key aspect for organisations to understand the importance of implementing AR correctly. The results of our systematic literature review show that the most influential characteristics in the customer’s shopping experience with AR are interactivity (8.1%), attitude (6.6%), satisfaction (6.1%), purchase intention (6.1%) and consumer experience (5.1%). AR has been applied in various sectors, such as the purchase of furniture, glasses, beauty products and footwear, among others. The most commonly used technique in AR implementation was the handheld display technique, which positively influences both hedonic and utilitarian indicators. Additionally, a co-occurrence analysis of the terms used in the reviewed studies shows that aspects of interactivity, customer experience and consumer satisfaction are related to purchases

made using AR. It is hoped that the results of this research will establish a new starting point for accurately measuring the customer's shopping experience with AR.

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