

Investigating the effect of augmented reality on customer brand engagement: The mediating role of technology attributes

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Keywords

Augmented reality, Customer brand engagement, Interactivity, Novelty Technology acceptance model, Vividness.

Abstract

Increasing customer participation and engagement with the brand has become prominent to increase customer brand experience along the customer journey. Technological advancement and the growth in Augmented reality (AR) provide marketers with promising opportunities to engage customers. This study investigated the effect of augmented reality on customer brand engagement (CBE); the technology attributes based on the Technology acceptance model (TAM); perceived usefulness, perceived ease of use, and enjoyment were used as a mediator. An experiment was conducted on females in Egypt on a cosmetic AR Mobile application. Structural equation modelling (SEM) was employed to identify the relationships of AR attributes, technology attributes, and customer brand engagement. All the hypotheses were statistically supported. The findings confirmed that augmented reality attributes positively affect customer brand engagement. Additionally, perceived usefulness, perceived ease of use, and enjoyment mediated the indirect and positive effects on CBE. The research provides marketers with practical implications for using AR technology.

1. Introduction

Advances in new technologies are dislocating marketing and the marketplace. New innovations in particularly augmented reality, virtual reality, internet of things and artificial intelligence have many implications in marketing practices. Along with this growth in virtual technology, Augmented reality (AR) is a major growing area of interest within the field of marketing.

Augmented reality (AR) is one of the contemporary concepts that are concerned with the wide usage of technology in digital marketing. It has emerged as a technology capable of superimposing video, images, text, and audio components onto existing images or space (Yusoff, et al., 2018). It enables the real-time combination of digital and physical information via various technological designs such as smartphones, tablets, and computers to create this new reality, which has had an impact on the number of AR applications (Almenara, et al., 2019).

The increasing prevalence of smartphones has significantly increased the interest of developers, retailers, and consumers in augmented reality. A few years ago, mobile augmented reality emerged as a new breed of AR. Users of mobile Augmented Reality applications can view a heads-up display-style AR image of data relevant to their immediate surroundings by holding up their phone (Arol, 2014; Baratali, et al., 2016). and many retailers are now incorporating augmented reality features into their mobile applications (Dacko, 2017; Wilson & McLean, 2019). Numerous brands use AR to give their customers a different perspective and to impact consumers' buying decisions (Pantano, 2014; Javornik, 2016; Heller, et al., 2019), and to improve the realistic experience of their products such as Ray-Ban, Sephora, American Apparel, Burberry and Top shop (Wilson & McLean, 2019). Mobile Augmented Reality Apps are designed to provide rich services, applications, and functionality to mobile phone users on top of physical reality. Such applications incorporate real images, video, or scenarios into them by utilizing the phone's camera, touch screen element, GPS, and other sensory and motion detectors (Baratali, et al., 2016).

AR is a marketing goldmine that every company should be utilizing to capture the attention of consumers. The technology provides an interactive experience, increases brand loyalty, and is enjoyable to

use .AR can be inserted into magazines, newspapers, books, billboards, and even stores as a point of promotion to increase sales (Baratali, et al., 2016).

Javornik (2016) conceptualize augmented reality's potential for engaging customers and influencing their purchase intentions. AR's unique capabilities provide marketers with new ways of engaging customers and transform the brand experience. Scholars identified four broad uses of the technology in retail settings: to educate customers, to entertain, to assist them in evaluating product fit, and to improve the post purchase consumption experience (Tan, et al., 2022).

Moreover, AR provides companies with creative ways to interact with customers and to promote their products and can be integrated with multiple marketing channels. It is highly interactive for consumers; It shifts how consumers shop online as it enables the consumer to view the product, try it and engage with the brands close and personal before buying it. This shows that AR can increase sales, customer loyalty as a result of improving customer experience which in turn increase profitability.

Increasing customer participation and engagement with brands has become prominent (Hollebeek, 2011). Marketers seek customer engagement (CE) because it results in appealing outcomes such as increased brand awareness (Erkan, 2015) trust, loyalty, self-brand connections, and emotional brand attachment (Brodie, et al., 2013; Brodie, et al., 2011). To engage users, social media sites employ various indicators of customer engagement behavior, such as "likes" on Facebook and "hearts" on Instagram (Wang & Lee, 2020).

According to (Graffigna & Gambetti, 2015) customer brand engagement (CBE) is a new topic as a part of CE that plays a major role in marketing and that more research is needed due to its importance in strategic brand decisions. Prior research (Wang, et al., 2018; Shiau & Yang, 2017; Shareef & Dwivedi, 2018; Halaszovich & Nel, 2017), assert that CBE are still needed further analysis. (Brodie, et al., 2011; Hollebeek, 2011; Hollebeek et al. 2011) were the first to examine CBE's core tenets (Algahrabat, et al., 2020). Hollebeek, et al.,(2014) defined customer brand engagement (CBE) as the ability to induce a specific emotional response from consumers in response to the featured brand. The authors contend that CBE improves communication between the social media platform and its customers, leading to more opportunities for customers to collaborate on content creation (Algahrabat, et al., 2020).

The present study will make a significant contribution by investigating the effect of augmented reality (AR) on customer brand engagement (CBE). The technology acceptance model (TAM) with three dimensions: perceived usefulness, perceived ease of use, and enjoyment was used as a mediator. Hence, within the context of mobile augmented reality, the current study will investigate the effect of interactivity, vividness, and novelty as augmented reality attributes. The research paper has three objectives:

Develop an understanding of the use of augmented reality in marketing and how can marketers make sense of AR as a marketing tool?

Investigate the effects of augmented reality (AR) on customer brand engagement.

Examine the relationship between AR attributes, technology attributes and customer Brand engagement.

2. Theoretical background and research hypotheses

2.1 Augmented reality

Faust et al. (2012) defined augmented reality (AR) as "The superposition of virtual objects (computer generated images, texts, sounds, etc.) on the real world of the user's environment" (Faust, et al., 2012, p. 1164).

Augmented reality is defined by (Olsson, et al., 2013), as a technique that combines real and computer-generated digital information into the user's view of the physical world so that they appear as a single environment. AR combines the virtual and real worlds (Huang & Liao, 2015) via a virtual layer that can add images, text, videos, and other virtual elements to the user's real-time view of the physical environment (Carmingniani, et al., 2011). Augmented reality is quite similar to other forms of digital technology in the sense that it is mostly accessed through mobile devices such as smartphones and offers a high level of interactivity for end users. However, augmented reality is quite distinct from conventional marketing methods. The development of real-life simulations is made easier with the help of virtual

reality technology, which also produces an immersive experience for users, giving them the impression that they are truly interacting with the digital environment they are in (Yim, et al., 2017).

AR-related research has grown in the last few years, with some scholars focusing on users' AR usage behaviors (Scholz & Smith, 2016; Poushneh & Parraga, 2017; Alexander Jessen, et al., 2020) and others investigating the potential of AR in the marketing field and user needs (Rauschnabel, et al., 2019; Kazmi, et al., 2021). It has been found that AR technology strongly influences user experience via numerous aspects that affect product quality, and satisfaction and purchase intention are also influenced by this (Poushneh & Parraga, 2017). To sum up, (Smink, et al., 2019) argue that, in a marketing context, the advantages of consumer use of AR outweigh the risks and also positively influence brand response. What makes augmented reality stand out from other technologies is the exciting new ways it allows brands and stores to interact with customers (Javornik, 2016; Yim, et al., 2017; Chen, et al., 2022).

2.2 Augmented reality attributes

According to Azuma (1997) AR has three distinct media features: It "combines

real and virtual", is "interactive in real time", and is "registered in 3-D" (Azuma, 1997, p. 2) Accordingly (Wilson & McLean, 2019) introduced a set of Augmented reality attributes: AR Interactivity, AR vividness and AR Novelty.

2.2.1 Interactivity

Interactivity can be found in all human behaviors (Heeter, 2000). Interaction with people, the environment, advertising, the Internet, and a vast array of other items is the essence of interactivity, which is why it is utilized in virtually every field. Interactivity is often used in academic research, but the operational definitions are sometimes too broad and inconsistent (kioussis, 2002). The most important aspect of AR is the integration of the user's physical and virtual worlds. The user will notice the integration of virtual and real images, with this special presentation technology being one of AR's distinguishing features (Azuma, 1997; Chen, et al., 2022).

Interactivity can be defined in numerous ways; however, (Yim et al., 2017) present a comprehensive definition of interactivity that enables understanding of its function in the operationalization of AR effectiveness: (1) as a technology output; and (2) as a user perception. Interactivity is defined by scholars who emphasize the significance of technological characteristics as a result of the properties of the technology (Downes & McMillan, 2000; Steuer 1992), as the technology's ability to enable users to interact with and engage with content more easily (Hoffman & Novak, 1996). Prior study has also uncovered a new facet of interactivity that has been dubbed "communication." This facet is defined as the means via which users feel a website is capable of two-way communication (Song & Zinkhan, 2008).

Scholars have recently classified interactivity as an AR characteristic, arguing that the ability to interact with virtual objects or the environment while using AR stimulates users' cognitive awareness of information, thereby increasing satisfaction or engagement (McLean and Wilson, 2019; Yim et al., 2017). When referring to augmented reality (AR) content, the term "interactivity" refers to the ability of users to control what they see in a hybrid of the real and virtual worlds (Wilson & McLean, 2019). Interactivity can be created when consumers are willing to associate themselves with augmented reality technology. The use of AR makes shopping more fun and engaging for customers, which in turn increases their level of participation (Sheehan, 2018). AR interactivity grants users the ability to manipulate the forms and contents of the mediated environment in real time, in addition to providing them the opportunity to interact with content (Hoffman and Novak, 2009; Arghashi & Yuksel, 2022).

Generally, when a customer discovers an application that is not only user-friendly but also engaging, this can improve the customer's engagement with the brand regardless of the smart device or application being used. It is necessary to have some level of literacy in order to use these devices and applications.

2.2.2 Vividness

Vividness refers to "a technology's ability to produce a sensory-rich mediated environment" (Steuer, 1992, p. 80). It combines "sensory experience with actual objects" and "hallucination," or "nonsensory experience with imaginary objects" (Lee, 2004, p. 38). "Realness," "realism," and "richness" are some of the

terms that have been used by other academics to describe this idea (Sadowski and Stanney 2002; Witmer and Singer 1998).

In the context of e-commerce, vividness has frequently been perceived as the quality of product presentations (Jiang & Benbasat, 2007; Yim, et al., 2017).

Past research on consumer imagery has shown that consumers pay more attention to visually stimulating content about products than they do to textual or visually inert content about those products (Jiang & Benbasat, 2007). This means that consumers are better able to understand the product and that the likelihood of the product failing to meet expectations and the consumer being dissatisfied after purchase is decreased when more detailed and vivid information is provided (Jiang and Benbasat, 2007; Li and Meshkova, 2013).

In the research on augmented reality, some scholars have identified vividness as a characteristic of augmented reality, believing that the experience of virtual environments or objects in augmented reality can stimulate users' fun, imagination, and enjoyment, thereby influencing their purchase intent or increase their involvement (McLean and Wilson, 2019; Yim et al., 2017). In summary, vividness is frequently used to quantify the degree of vividness experienced by individuals. Consequently, this study considers vividness as an AR characteristic that is expected to impact customer engagement.

2.2.3 Novelty

Scholars define novelty as the quality of being novel, distinct, and original (Masseti, 1996). AR combines the real and virtual worlds to provide users with a continuous and unique experience, with the possibility of experiencing new fun and excitement each time the AR feature is used. Text, images, videos, and other virtual objects can be used to present AR content (Javornik, 2016; Chen, et al., 2022). Given the scope and depth of interaction between the real and virtual worlds, the user is likely to be exposed to new stimuli each time they use an augmented reality feature. Thus, novelty does not refer to the 'newness' of augmented reality; rather, novelty refers to the new, unique, customized, innovative material (stimuli) encountered each time through the augmented reality display (Wilson & McLean, 2019).

Additionally, the screen provides detailed product information for the convenience of consumers. The unique novelty of the augmented reality application may improve the user's performance, generate interest in browsing the products, and stimulate shopping. As a result, it enables consumers to tailor content to their preferences and increase engagement (Chen, et al., 2022).

In summary, novelty is adequate for measuring the degree of uniqueness experienced by users after an experience; as the most significant point in which novelty influences information processing is through the attention it generates in its audience (Kover and James 1993; Lang 2000; Thorson and Lang 1992).

The most significant point in which novelty influences information processing is through the attention it generates in its audience (Kover and James 1993; Thorson and Lang 1992). Therefore, this study considers novelty as a state of experience that is also significantly related to the customer engagement

Based on the relevant literature discussed above, the study expects that AR attributes provided by AR Mobile apps will affect Customer brand engagement. Therefore, the following research hypotheses are proposed:

H1: AR attributes positively affect Customer Brand engagement

H_{1a}: AR interactivity positively affects customer brand engagement.

H_{1b}: AR vividness positively affects customer brand engagement.

H_{1c}: AR novelty positively affects customer brand engagement.

2.3 Model of Technology Acceptance (TAM)

Consumer acceptance of a new technology is crucial to its market success (Rese, et al., 2017). Several studies have been conducted over the last five years by researchers all over the world to investigate the acceptance of AR in retail using various types of AR applications. Theories such as Technology Acceptance Model (TAM) (Wilson & McLean, 2019), flow theory (Huang & Liao, 2015) equity theory (Poushneh and Parraga, 2017; Poushneh, 2018), virtual liminoid theory (Huang and Liao, 2017), self-referencing theory (Huang and Tseng, 2015 ;Huang & Liao, 2015; Huang, 2019), theory of interactive media effects (Javornik, 2016) excitation-transfer theory (Poncin, et al., 2017)prospect theory (Perannagari

& Chakrabarti, 2019) among others, were the base for constructs used in these studies (Perannagari & Chakrabarti, 2019).

Davis (1989) developed the "Technology Acceptance Model," or TAM, in 1986. It was based on the psychological theory of "Reasoned Action" by Ajzen and Fishbein (1980), which aimed to predict an individual's behaviour as a function of their intentions and attitudes. It suggested that two variables determined one's attitude or predisposition toward the intention to use a technology: perceived usefulness and perceived ease of use as cited in (Almenara, et al., 2019). The majority of studies revealed that TAM relationships are valid for AR apps (Spreer & Kallweit., 2014; Huang and Liao, 2015; Pantano et al., 2017 (Wilson & McLean, 2019). Despite the fact that research has identified many factors that contribute to technology acceptance, but it is not necessarily the acceptance of brand's technology (Wilson & McLean, 2019). Prior research studied the applicability of TAM in the context of retailing and AR (Olsson, et al., 2013; Rese et al., 2017; Wilson & McLean, 2019) consequently, the TAM Model is eligible for the research.

2.3.1 Perceived Ease of Use

"Perceived ease of use"(PEOU) refers to a consumer's belief that AR applications are simple to use and thus require little training (Davis, 1989). As a result, PEOU has a direct impact on hedonic and utilitarian values. (Chun, et al., 2012;Yang, 2013) demonstrated this phenomenon by demonstrating that PEOU had a causal effect on consumers' assessments of the utilitarian value of online apps. (Phuthong, 2022). As a result, the following hypotheses were proposed:

H2a: *Perceived Ease of use will positively mediate the effect of interactivity of AR apps. on customer brand engagement.*

H2b: *Perceived ease of use will positively mediate the effect of AR vividness on customer brand engagement.*

H2c: *Perceived ease of use will positively mediate the effect of AR novelty on customer brand engagement.*

2.3.2. Perceived Usefulness

According to Davis (1989), perceived usefulness of technology is defined as "The users' belief that a specific technology will improve their current performance". It is frequently acknowledged as a fundamental construct in user adaptation to new technology (Arghashi & Yuksel, 2022) When people recognize that a specific technology (for example, AR apps) is useful, they have a positive attitude toward it. Therefore, perceived usefulness has a substantial effect on consumer attitude toward AR technology (Chung, et al., 2015). Yim et al. (2017) demonstrated that augmented reality apps are regarded to be more useful than regular apps. According to Rese et al. (2017), perceived usefulness influences customer attitudes and intent to utilize augmented reality. According to Pantano et al. (2017), consumer attitudes toward augmented reality (AR) are positively correlated with the perceived usefulness of augmented reality (AR) apps in online retail contexts. When consumers view AR apps as a useful purchasing tool, they will view AR technology as more suitable and, as a result, have a more favourable attitude toward it (Holdack, et al., 2020).

Previous research has found that people become interested in AR technology because it is useful. According to McLean and Wilson (2019), AR features directly affect perceived usefulness of AR technology, which in turn increases consumer engagement via AR. apps. This study discovered that the perceived usefulness of augmented reality (AR) influences brand engagement via a retailer's AR app. According to Davis (1989), perceived usefulness is a precursor factor for consumer adaptation to technology (Davis, 1989). According to Moriuchi (2019), perceived usefulness improves consumer engagement with technology by encouraging consumers to use more of a specific technology. As a result, it is plausible to assert that perceived usefulness is positively related to attitude toward technology and trust in it, which can account for more variation in consumer engagement with technology. As a result, hypotheses are proposed as follows:

H3a: *Perceived usefulness will positively mediate the effect of AR interactivity on customer brand engagement.*

H3b: *Perceived usefulness will positively mediate the effect of AR vividness on customer brand engagement.*

H3c: *Perceived usefulness will positively mediate the effect of AR novelty on customer brand engagement.*

2.3.3 Enjoyment

Perceived enjoyment (PE) refers to the hedonic value of new technology and explains how joyful its use is for participants. It seeks to explicate a user's fundamental motivation, so as to promote future technological adoption (Pantano, 2014). In the context of this study, enjoyment refers to the activity of utilizing a particular system that is fun and interesting in and of itself, apart from the performance consequences of doing so Pantano, (2014.) As AR enables Users to interact with the product and try it; envision the look of a product on themselves, as a result, AR usage may have a substantial effect on customer brand engagement. Accordingly, the following hypotheses were derived as follows:

H4a: *Enjoyment will positively mediate the effect of AR interactivity on customer brand engagement.*

H4b: *Enjoyment will positively mediate the effect of AR vividness on customer brand engagement.*

H4c: *Enjoyment will positively mediate the effect of AR novelty on customer brand engagement.*

2.4 Customer Brand Engagement

The rise of social media contributed to a change in the balance of power and the production of value away from businesses and toward consumers (Berthon, et al., 2012). It has been noticed that people's search for information and socializing habits, as well as their consumption patterns, have undergone significant shifts (Wang & Lee, 2020). As a result, communication technology has a significant impact on customer-firm relationships. Rather than merely being consumers of goods and services, customers have the potential to contribute to the creation of new ones. Consumers' interactions with brands in the social media context require businesses to study how they consume, contribute to, and generate content. Therefore, figuring out how to create and manage engagement between customers and brands via social marketing should be an issue of vital concern (Wang & Lee, 2020).

According to research carried out (Brodie , et al., 2011), customer engagement (CE) functions as a strategic factor and makes a significant contribution to the achievement of superior performance outcomes (Hollebeek, et al., 2014). In order to maintain a competitive edge, it has become necessary to involve customers in specific interactions and interactive experiences in order to establish and enhance customer relationships (Brodie, et al., 2013).

According to Brodie, et al.,(2013) Customer engagement with a business is defined as a dynamic, iterative psychological state. It can be seen in the creation of communities of users that work together to develop content and value that better serves their needs (Sashi, 2012; Pansari and Kumar, 2017; Gligor & Russo, 2019).

Customer brand engagement (CBE) has gained increased attention from both industry and academia in recent years. Technological advances have enabled businesses to provide customers with tools to interact with their brand, such as websites, social media platforms, and mobile applications (Osei-Frimpong & McLean, 2018; Wilson & McLean, 2019).

The number of empirical studies in the CBE area is limited (e.g., Brodie et al., 2013; Hollebeek et al., 2014; Leckie et al., 2016; Martnez-López et al., 2017; Schultz, 2017) and they lack an overall definition of and conceptualization of customer brand engagement (Dessart, et al., 2016). Brand engagement is described by Mollen and Wilson (2010) as "the affective and cognitive commitment of an active relation with an individual brand via a website or computer-mediated devices meant to communicate the value of the individual brand." (Algahrabat, et al., 2020). A collaborative association with a specific brand, as well as the view of experiential motivation notwithstanding the instrumental incentives to be received from communications with the brand (Abrar, 2019).

Hollebeek et al. (2014) have researched brand engagement from the customer's perspective and provided a clear definition of CBE that explains how customers could cognitively valence and emotionally and behaviorally react to all brand activities conducted on social media platforms (Algahrabat, et al., 2020). As a result, customers who shop online are more invested in the success or failure of a particular company (Kim & Forsythe., 2008). Consumers' engagement with a brand not only boosts their overall brand engagement, but it may also help increase the sales of an organization. In addition, it has its roots in relationship marketing that promotes customer interaction and experiences (Vivek, et al., 2012; Abrar, 2019).

Customers can become more engaged and creative when identifying new and valuable consumption options utilizing augmented reality (Wang & Lee, 2020). Existing augmented reality (AR) applications often aim to facilitate engagement (Scholz & Smith, 2016), such as through playful, immersive, and enjoyable experiences in which users try out various purchase alternatives in a range of situations (Scholz & Duffy, 2018). In addition, empirical research has revealed the favorable benefits of augmented reality on customer engagement (Wang & Lee, 2020).

Furthermore, enhancing the client experience and enhancing brand effects are both made possible by augmented reality (Rauschnabel et al., 2019; Smink et al., 2019). It has been shown that augmented reality features and technological acceptance attributes such as perceived usefulness have a substantial effect on brand engagement with augmented reality apps. Consumer happiness and brand usage intent were found to be boosted by AR. AR's perceived usefulness has been argued to have a positive effect on consumers' attitudes and intentions to use it. According to McLean(2018), the perceived usefulness of mobile branded apps is a major determinant of user engagement. In this regard, the current research will examine the direct effect of AR Attributes on customer brand engagement on AR mobile apps and the indirect effect mediated by the technology attributes. The following hypotheses are proposed as follows:

H5: Perceived ease of use will positively affect Customer brand engagement

H6: Perceived usefulness will positively affect Customer brand engagement

H7: Enjoyment will positively affect Customer brand engagement

2.5 Research Model

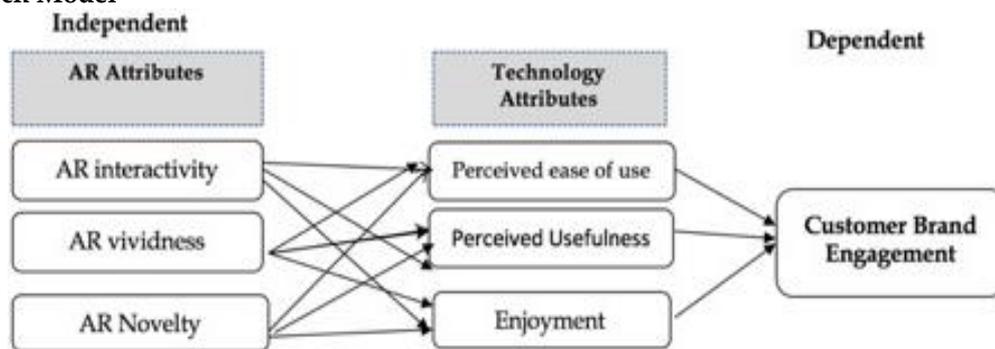


Fig.1 Conceptual Model

3. Research methodology

The researcher used Structural Equation model (SEM) with the use of AMOS 26.0 in testing the direct and indirect path analysis for the effect of AR attributes on customer brand engagement in the presence of technology attributes as a mediator variable. The researcher measures AR attributes through three main attributes which are: interactivity, vividness and novelty, also the technology attributes consist of three main attributes which are: perceived ease of use, perceived usefulness, and enjoyment.

3.1 Research Design

An experiment was conducted. Data were collected from alumni who attended an event at the university's theatre. Females were invited to take part in the experiment. The experiment was conducted on two phases. In phase 1, the researcher began by greeting participants and informing them about the study. By scanning the QR code, they were given detailed instructions. Then they were instructed to download the Oriflamme Mobile app "Makeup Wizard" where the theatre's WIFI was enabled. In Phase 2, participants use the app to browse makeup products and try them on. After 10 minutes, participants were asked to take an online questionnaire via a link in order to ensure that they had the opportunity to try at least 5 different products.

3.2 Sample

Convenience sampling was selected, and the researcher has succeeded to collect 111 valid responses to be an appropriate sample size in order to be analyzed. The participants of the study were recruited

during an alumni event at the university. Participants were invited to join the experiment. Followed by the questionnaire.

3.3 Measures

The researcher employed a 36-item questionnaire designed on a 5-point Likert scale (Strongly agree, agree, neutral, disagree and strongly disagree). The questionnaire was administrated online via a link after the participants were exposed to the stimulus (AR App.) Which is the "Makeup Wizard". To comply with common method bias, most of the statements were positively stated to reduce respondents' apprehension. Few statements were reversed scored to ensure the accuracy and validity of the responses. Moreover, the participants were informed that their identity will remain confidential and that the collected data will only be used for the purpose of research. The following Table (1) shows the scales used for the purpose of the research.

Construct	Number of items	Sources	Sample items
Interactivity	3	Yim et al. (2017)	The augmented reality technology had the ability to respond to my specific needs quickly and efficiently
Vividness	6	Yim et al. (2017)	The visual display through the AR technology was vague (R)
Novelty	4	Yim et al. (2017)	Using the augmented reality feature offers something new each time
Perceived ease of use	6	Davis (1989)	Learning to use the AR feature on the app is easy for me
Perceived Usefulness	6	Davis (1989)	Using the AR feature on the app would make it easier to shop.
Enjoyment	3	Davis et al. (1992)	I have fun using the AR feature on the app
Customer Brand Engagement	8	Hollebeek et al.(2014)	I spend a lot of time using the AR feature on the Oriflamme's app compared to other

Table (1) Scale Items

4. Results and Data Analysis

4.1 Demographic Analysis

Demographic		Frequency	%
Age groups	18-24	29	26%
	25-34	55	49.5%
	35-44	25	22.5%
	45-54	1	0.9%
Education	University graduate	79	71.1
	Undergraduate	28	25.2
	Postgraduate	4	3.6

Table (2) Demographic characteristics of the respondents (N=111)

Table (2) shows that about half of the sample 55 person their age ranged between 25 and 34 years old, 29 person their age ranges from 18 to 24 years old, 25 person their age ranged from 35 to 44 years old and finally there are two persons one of them his or her age lies between 45 to 54 years old and the other one has 55 years old. The majority of sample 79 persons are university graduate, 28 persons are undergraduate and there are only 4 persons have a postgraduate degree.

Variable	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation
Interactivity	1.33	5.00	3.9399	1.06856	0.271212
Vividness	1.17	5.00	3.8468	1.07006	0.278164
Novelty	1.25	5.00	3.8694	1.01346	0.261918
Perceived ease of use	1.17	5.00	3.8724	1.08571	0.280373
Perceived Usefulness	1.17	5.00	3.9264	1.08355	0.275964
Enjoyment	1.33	5.00	3.9489	1.06477	0.269634
Customer Brand Engagement	1.25	5.00	3.8773	1.07621	0.277571

Table (3): Variables descriptive analysis

4.2 Reliability and validity tests

Cronbach's Alpha coefficient was used to measure the consistency of a measure and the degree of study variable's reliability. As shown in Table (4) that there is a high level of reliability for the responses for each variable as the Cronbach's Alpha coefficient for each variable are all greater than 0.7 (Hair, et al., 1998). The composite reliability (CR) was calculated to achieve more accurate reliability for the structural equation model (SEM), the results showed that for each set of indicators all the constructs are greater than the 0.7. The convergent validity was tested using the average variance extracted and all the AVE values were greater than 0.5 thus establishing convergent validity (Fornell & Larcker, 1981).

Variable	Number of statements	Cronbach's Alpha	Average Variance extracted (AVE)	Composite Reliability
Interactivity	3	0.989	0.9639	0.929
Vividness	6	0.989	0.9732	0.947
Novelty	4	0.989	0.9682	0.937
Perceived ease of use	6	0.988	0.9818	0.964
Perceived Usefulness	6	0.989	0.9713	0.943
Enjoyment	3	0.990	0.9601	0.922
Customer Brand Engagement	8	0.987	0.9863	0.973

Table (4): Reliability and Validity of measures

As shown in table 4, it is concluded that there is a high level of reliability and validity for the responses for each variable as the Cronbach's Alpha test show high level of reliability as its values for each variable is 0.98 which is greater than 0.7, the Average Variance extracted (AVE) for the 7 variables has a value of 0.9721 which is greater than 0.5 and the average Composite Reliability is 0.9918 which is greater than 0.7.

4.3 Test of normality

The researcher applied Shapiro-Wilk test to determine whether the main variables of study follow the normal distribution or not.

Variable	Statistic	DF	P-value
Interactivity	0.773	111	0.000
Vividness	0.776	111	0.000
Novelty	0.793	111	0.000
Perceived ease of use	0.777	111	0.000
Perceived Usefulness	0.768	111	0.000
Enjoyment	0.768	111	0.000
Customer Brand Engagement	0.767	111	0.000

Table (5): Shapiro-Wilk test of normality

From table (5) it is concluded that all the independent, dependent and the mediator variables are not normally distributed as their p-value of Chi-square statistic is less than 0.05, so the alternative hypothesis will be accepted that the variables are not follow the normal distribution.

4.4 Heteroscedasticity Test variables Homogeneity

Overall test of Heteroscedasticity	Chi-square	P - value
	3.983088	0.031254

Table (6): Heteroscedasticity test for Homogeneity

The above table shows that the chi-squared test of value 57.485436 has a p-value of 0.031254 which means accepting the null hypothesis which means that the study model does not suffer from the problem of random error instability and the study variables are endogenous to each other's.

4.5 Variance Inflation Factor (VIF) test

In order to assess the multicollinearity of each variable, the Variance Inflation Factor (VIF) analysis was assessed. The test has a minimum possible value equals to 1.0 and the values greater than 10.0 indicate a collinearity problem. As shown in Table (7) it is concluded that there is no variable suffers from multi-collinearity as the VIF values don't exceed 10.

Variable	VIF
Interactivity	1.721
Vividness	5.192
Novelty	3.158
Perceived ease of use	8.798
Perceived Usefulness	3.371
Enjoyment	8.553

Table (7): VIF of the independent and control variable

4.6 Correlation Matrix

Following the test of normality for the main dimensions of the independent, mediator and the dependent variables of study, it was found that the study variables don't follow the normal distribution, therefore Spearman correlation coefficient will be the most appropriate coefficient for determining the relation strength and direction between each two variables, then the correlation coefficient is tested by a t-test which its null hypothesis states that correlation does not exist if the test p-value is greater than 0.05.

Variable	Interactivity	Vividness	Novelty	Perceived ease of use	Perceived Usefulness	Enjoyment	Customer Brand Engagement
Interactivity	1						
<i>P-value</i>	-						
Vividness	0.677**	1					
<i>P-value</i>	0.000	-					
Novelty	0.722**	0.825**	1				
<i>P-value</i>	0.000	0.000	-				
Perceived ease of use	0.768**	0.726**	0.756**	1			
<i>P-value</i>	0.000	0.000	0.000	-			
Perceived Usefulness	0.706**	0.712**	0.780**	0.763**	1		
<i>P-value</i>	0.000	0.000	0.000	0.000	-		
Enjoyment	0.806**	0.755**	0.765**	0.781**	0.738**	1	
<i>P-value</i>	0.000	0.000	0.000	0.000	0.000	-	
Customer Brand Engagement	0.745**	0.726**	0.842**	0.793**	0.795**	0.763**	1
<i>P-value</i>	0.000	0.000	0.000	0.000	0.000	0.000	-

Table (8) : Spearman correlation coefficient matrix

Table (8) shows that:

There is a significant, positive, and strong relation between interactivity and customer brand engagement of correlation value 0.745 and *P-value* 0.000.

There is a significant, positive, and strong relation between vividness and customer brand engagement of correlation value 0.726 and *P-value* 0.000.

There is a significant, positive, and strong relation between novelty and customer brand engagement of correlation value 0.842 and *P-value* 0.000.

There is a significant, positive, and strong relation between perceived ease of use and customer brand engagement of correlation value 0.793 and *P-value* 0.000.

There is a significant, positive, and strong relation between perceived usefulness and customer brand engagement of correlation value 0.795 and *P-value* 0.000.

There is a significant, positive, and strong relation between enjoyment and customer brand engagement of correlation value 0.763 and *P-value* 0.000.

4.7 Structural Equation Modelling (SEM) Analysis:

4.7.1 The direct path analysis:

The researcher used the SEM path analysis in order to determine AR attributes (Interactivity, Vividness and Novelty) are either positively affected customer brand engagement, The following Table (9) shows the model paths, the Unstandardized Coefficients, the Standardized Coefficients, the Standard Error (S.E.), their p-value, and the adjusted coefficient of determination R^2 from the simple linear regression model between each component of the AR attributes and customer brand engagement.

Path		Estimate	S.E.	t-test	P-value	R ²
Interactivity	→ Customer Brand Engagement	0.533	0.022	6.124	<0.001	82.8%
Vividness	→ Customer Brand Engagement	0.440	0.014	2.909	0.004	79.5%
Novelty	→ Customer Brand Engagement	0.171	0.015	4.776	<0.001	78%

Table (9) Direct Path analysis model between AR attributes and CBE

The results shown in table (9) indicate significant relationships and H1 has been supported. Interactivity has a direct and significant effect on customer brand engagement with an estimate coefficient of 0.533 and *p-value* <0.001 and an adjusted coefficient of determination of 82.8% which means that the 82.8% from the total variation in customer brand engagement is due to the variation of the independent variable interactivity by one unit.

Vividness has a direct and significant effect on customer brand engagement with an estimate coefficient of 0.440 and *p-value* 0.004 and an adjusted coefficient of determination of 79.5% which means that the 79.5% from the total variation in customer brand engagement is due to the variation of the independent variable vividness by one unit.

Novelty has a direct and significant effect on customer brand engagement with an estimate coefficient of 0.171 and *p-value* <0.001 and an adjusted coefficient of determination of 78% which means that the 78% from the total variation in customer brand engagement is due to the variation of the independent variable Novelty by one unit.

The results indicates that augmented reality attributes significantly affect customer brand engagement supporting H1a, H1b, and H1c. The interactivity of the AR app is identified as the most important variable impacting brand engagement which account for 82.8%.

4.7.2. The indirect path analysis

The researcher created a SEM path analysis in order to determine the mediating role of technology attributes (perceived ease of use, perceived usefulness, and enjoyment) of the effect of AR attributes (Interactivity, Vividness and Novelty) on customer brand engagement. The following figure (2) shows the indirect path analysis model between the three AR attributes and customer brand engagement in the presence of technology attributes as mediators.

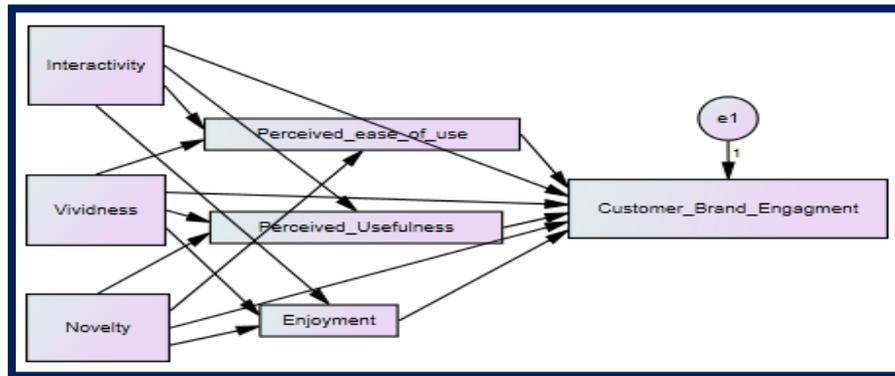
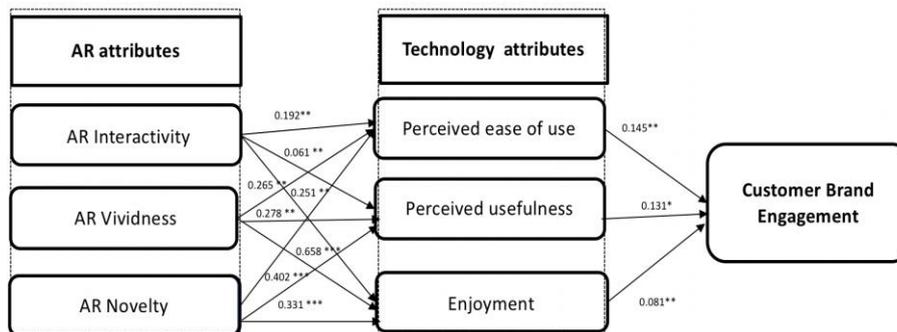


Fig. 2. Path analysis for the indirect SEM



Note: * p < 0.01, ** p < 0.05, *** p < 0.001

Fig. 3. Results of the proposed model

The following Table (10) shows the model paths, the Unstandardized Coefficients, the Standardized Coefficients, the Standard Error (S.E.), the t-test (C.R.), and their p-value.

	Path	Estimate	S.E.	t-test	P-value
Interactivity	→ Customer Brand Engagement	0.533	0.022	8.852	<0.001
Interactivity	→ Perceived ease of use	0.192	0.147	4.900	0.030
Interactivity	→ Perceived usefulness	0.061	0.138	2.936	0.047
Interactivity	→ Enjoyment	0.251	0.137	3.262	0.042
Vividness	→ Customer Brand Engagement	0.440	0.014	3.500	0.004
Vividness	→ Perceived ease of use	0.265	0.176	5.677	0.031
Vividness	→ Perceived usefulness	0.658	.1880	15.113	<0.001
Vividness	→ Enjoyment	0.278	0.186	5.314	0.035
Novelty	→ Customer Brand Engagement	0.171	0.015	9.522	<0.001
Novelty	→ Perceived ease of use	0.402	0.126	126.000	0.001
Novelty	→ Perceived usefulness	0.331	0.147	5.880	0.025
Novelty	→ Enjoyment	0.202	0.146	3.106	0.047
Perceived ease of use	→ Customer Brand Engagement	0.145	0.232	7.250	0.032
Perceived usefulness	→ Customer Brand Engagement	0.131	0.317	3.963	0.080
Enjoyment	→ Customer Brand Engagement	0.081	0.340	28.333	0.012

Table (10) Indirect Path analysis model between AR attributes and CBE

The full model was examined by SPSS .22 and AMOS. 26 Software to evaluate the structured model to the data and test the proposed hypotheses. The results indicate the statistical significance of all the hypotheses. It was found that all hypotheses are supported, and the technology attributes mediated the effect of Augmented reality on customer brand engagement and all results are summarized in table (10) and (11). Table (10) shows that:

Interactivity has a positive and significant effect on customer brand engagement with an estimate coefficient of 0.533 and *p-value* <0.01.

Interactivity has a positive and significant effect on Perceived ease of use with an estimate coefficient of 0.192 and *p-value* 0.030.

Interactivity has a positive and significant effect on Perceived usefulness with an estimate coefficient of 0.061 and *p-value* 0.047.

Interactivity has a positive and significant effect on Enjoyment with an estimate coefficient of 0.251 and *p-value* 0.042.

Vividness has a positive and significant effect on customer brand engagement with an estimate coefficient of 0.440 and *p-value* 0.004.

Vividness has a positive and significant effect on Perceived ease of use with an estimate coefficient of 0.265 and *p-value* 0.031.

Vividness has a positive and significant effect on Perceived usefulness with an estimate coefficient of 0.658 and *p-value* <0.001.

Vividness has a positive and significant effect on Enjoyment with an estimate coefficient of 0.278 and *p-value* 0.035.

Novelty has a positive and significant effect on customer brand engagement with an estimate coefficient of 0.071 and *p-value* <0.001.

Novelty has a positive and significant effect on Perceived ease of use with an estimate coefficient of 0.402 and *p-value* 0.001.

Novelty has a positive and significant effect on Perceived usefulness with an estimate coefficient of 0.331 and *p-value* 0.025.

Novelty has a positive and significant effect on Enjoyment with an estimate coefficient of 0.202 and *p-value* 0.047.

Perceived ease of use has a positive and significant effect on customer brand engagement with an estimate coefficient of 0.145 and *p-value* 0.0032.

Perceived usefulness has a positive and significant effect on customer brand engagement with an estimate coefficient of 0.131 and *p-value* 0.080.

Enjoyment has a positive and significant effect on customer brand engagement with an estimate coefficient of 0.081 and *p-value* 0.012.

The following Table (11) shows the multiple linear regression models for determining the effect of each AR attribute component with each technology attribute component on customer brand engagement.

Model	Multiple OLS	Dependent variable	Customer brand engagement	R ²
Variables	Coefficient	p-value	Significance	
Constant	0.826667	<0.0001	Significant	
Interactivity	0.835197	<0.0001	Significant	83.9%
Perceived ease of use	0.514356	0.0043	Significant	
Constant	0.836841	<0.0001	Significant	
Interactivity	0.712993	<0.0001	Significant	85.5%
Perceived Usefulness	0.655810	<0.0001	Significant	
Constant	0.849678	<0.0001	Significant	
Interactivity	0.729995	<0.0001	Significant	86.5%
Enjoyment	0.667616	<0.0001	Significant	
Constant	0.0694578	0.4083	Insignificant	
Vividness	0.368174	<0.0001	Significant	95.3%
Perceived ease of use	0.617577	<0.0001	Significant	
Constant	0.827430	<0.0001	Significant	
Vividness	0.537234	0.0003	Significant	84.3%
Perceived Usefulness	0.820945	<0.0001	Significant	
Constant	0.833000	<0.0001	Significant	
Vividness	0.544770	0.0004	Significant	83.9%
Enjoyment	0.823026	<0.0001	Significant	
Constant	0.825886	<0.0001	Significant	
Novelty	0.526802	0.0032	Significant	82.2%
Perceived ease of use	0.835716	<0.0001	Significant	
Constant	0.832468	<0.0001	Significant	
Novelty	0.441856	0.0090	Significant	83.3%
Perceived Usefulness	0.924686	<0.0001	Significant	
Constant	0.845588	<0.0001	Significant	
Novelty	0.516108	0.0007	Significant	83.7%
Enjoyment	0.879882	<0.0001	Significant	

Table (11) Multiple Linear regression Model and Summary of results

Interactivity and perceived ease of use have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 83.9% which means that the customer brand engagement changes by 83.9% due to the change of the interactivity and perceived ease of use by one unit.

Interactivity and perceived usefulness have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 85.5% which means that the customer brand engagement changes by 85.5% due to the change of the interactivity and perceived usefulness by one unit.

Interactivity and enjoyment have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 86.5% which means that the customer brand engagement changes by 86.5% due to the change of the interactivity and enjoyment by one unit.

Vividness and perceived ease of use have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 95.3% which means that the customer brand engagement changes by 95.3% due to the change of the vividness and perceived ease of use by one unit.

vividness and perceived usefulness have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 84.3% which means that the customer brand engagement changes by 84.3% due to the change of the vividness and perceived usefulness by one unit.

Vividness and enjoyment have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 83.9% which means that the customer brand engagement changes by 83.9% due to the change of the vividness and enjoyment by one unit.

Novelty and perceived ease of use have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 82.2% which means that the customer brand engagement changes by 82.2% due to the change of the novelty and perceived ease of use by one unit.

Novelty and perceived usefulness have a significant and positive effect on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of multiple determination of 83.3% which means that the customer brand engagement changes by 83.3% due to the change of the interactivity and perceived usefulness by one unit.

Novelty and enjoyment have a significant and positive on customer brand engagement as their coefficients of estimate have p-value less than 0.05 and the overall regression model has a coefficient of

multiple determination of 83.7% which means that the customer brand engagement changes by 83.7% due to the change of the interactivity and enjoyment by one unit.

Discussion

Over the course of the last few years, augmented reality has been gradually garnering more and more attention in the realm of marketing. The current research investigates the effect of augmented reality and technology attributes on customer brand engagement through the augmented reality mobile application in Egypt, where the exposure to AR still in its early phase. The theoretical foundation of this study is rooted in the technology acceptance model and building on the research of (Wilson & McLean, 2019), the researcher used the AR attributes namely interactivity, vividness and novelty and identifies the role of technology attributes in mediating the relationship between augmented reality and customer brand engagement.

First, regarding the direct effect of AR attributes on customer engagement, the results revealed that augmented reality attributes significantly affect customer brand engagement supporting H1a, H1b, and H1c. The interactivity of the app is identified as the most significant variable impacting brand engagement.

Second, the results illustrated that AR attributes indirectly affect customer brand engagement via the mediation of technology attributes. The interactivity, vividness and novelty of the content displayed within the make-up wizards 's mobile app influences the perceived ease of use of the AR technology and indirectly affect the customer brand engagement. The findings are in line with previous studies (Wilson & McLean ,2019; Arghasi & Yusksel ,2022) The interactivity allow users to more easily interact, manipulate, and become involved with content. Customers may benefit from augmented reality by utilizing the most cutting-edge, user-friendly technology currently available, and have full control over how they combine both the physical and digital worlds are involved.

Moreover, the AR vividness mixes the sensory experience of real objects with that of imagined objects to produce a distinct mental image in the consumer's mind. Prior to purchase, buyers have endeavoured to imagine the use of a product in order to comprehend its utility. Rather, AR eliminates the necessity for consumers to build their own mental images. As consumers are shown with a detailed and clear representation of the product with minimal effort or difficulty, they may see the technology as easy to use.

Furthermore, the results also confirm the effect of novelty on the perceived ease of use as the newness of the content offered to consumers via augmented reality technology, allowing them to try on makeup in a personalized manner. and visualize products on their own face that is specific to themselves. Not only make-up but also such products as sunglasses, clothing, and furniture.

Additionally, the uniqueness of the content presented to consumers via AR technology influences their perception of the technology's usefulness. AR provides individuals with content that is situation-specific, personalized, and unique.

Further, the perceived Usefulness mediated the effect of AR attributes in customer brand engagement. it can be explained by the fact that the vividness and interactivity along with the novelty of the AR content enriching the perceived usefulness of the technology. As the AR provide such vivid data in the form of pictures, audio visual and colorful representation of future reality, making it easier for consumers to make their own decisions. As Customers' perceptions of the usefulness of augmented reality are influenced by its clarity and realism, as well as their ability to interact with it by repositioning objects on the screen as they are superimposed in the actual environment.

The results also affirm that interactivity, vividness, and novelty affect the consumers' enjoyment with technology. The finding supported previous studies by (Yim et.al ,2017; Mclean and Wislon ,2019; Olsen ,2013) who found that Mobile augmented reality is expecting to provide a playful and entertaining experience for customers. additionally, the mental imagery that consumer often use affect its level of enjoyment during a shopping experience as well as the novelty of the content that are personalized to specific situation provide them with a unique tailored experience which in turn affect customer brand engagement.

A number of theoretical contributions have been captured in the current study. Initial prior literature described the notion of customer brand engagement as an underexplored one, (France, et al., 2016; Graffigna & Gambetti. , 2015; IIslam & Rahman, 2016) hence in response to the call of previous

research to conduct more empirical research in different cultures and contexts. The current study was conducted within the Egyptian context and aimed to investigate the effects of augmented reality on customer brand engagement using the technology attributes as mediators.

Up to the best knowledge of the researcher, there is no study that investigated the effect of AR attributes on customer brand engagement in Egypt and this was considered the main contribution of this research.

Managerial implications

In the past, almost everything was deemed impossible, but technological advancements have made nearly everything possible. Technology has gained immense significance and occupies a significant place in the lives of individuals. Particularly for literate customers, augmented reality plays a significant role in their purchasing intent.

Consumers are increasingly using AR-enabled apps on their smartphones, owing in part to rapid advances in smartphone hardware performance and in part to the fact that AR hardware is currently prohibitively expensive for consumers, in comparison to smartphones, which have the highest penetration rates and the lowest barriers to entry (Chen, et al., 2022).

The findings of the study provide practical implications for marketers. First, Marketing managers and retailers should consider adding AR features on Mobile applications as it adds new dimensions to the shopping experience by adding more personalized experience.

Second, AR app can be a powerful marketing tool to enhance customer brand engagement which in turn increase customer purchase intention and brand usage as well as word of mouth. As the customer will not only make the purchase but will recommend friends and peers for the consumption of that specific product. Third, marketing managers and app. developers should recognize the power of technology attributes and its mediating role between AR and CBE that can collaborate and develop effective marketing strategies that enhance customer brand engagement. Fourth, marketing managers should consider the AR attributes and ensure that the app. developers should utilize the three AR attributes, namely the interactivity in designing their app enabling the customers to manipulate and control the products. The vividness of the products by providing detailed depiction of the products in the real world combined with the virtual world in a vibrant and clear way. In addition to the novelty of the content on the AR app that provide a personalized, unique, and specific experience to meet customer needs and preferences.

Limitations and future research

The study has some limitations, which may provide starting point for further research. First The research data was collected from female who participated in the experiment as it involved a make-up app. Therefore, future studies should consider other types of products such as apparel, furniture, sunglasses that involve both gender and may demonstrate different effects on CBE. Second, the study was conducted in Egypt as developing country in the field of augmented reality. Where some participants were first users for AR app. Which may limit the generalization of results; thereby, future studies should consider conduct the proposed model in different contexts. Due to the limited number of AR apps in retail marketing in Egypt the study has chosen a specific single brand to examine the research model. Since the augmented reality in marketing are relatively new; future research can examine the effect of AR app on customer retention; how the AR can be used more effectively at different stages of the customer journey to increase brand engagement. Additionally, how influencers can affect customer brand engagement in AR mobile app.

Conclusion

Technological advancements and the growth in augmented reality provide marketers with promising opportunities to engage customers. This research study aimed at investigating the effect of augmented reality on customer brand engagement; the technology attributes based on the technology acceptance model (TAM); Perceived usefulness, perceived ease of use, and enjoyment were used as a mediator. An experiment was conducted on females in Egypt on a cosmetic AR mobile app. Structural equation modeling (SEM) was employed to identify the relationships of AR attributes, technology attributes, and customer brand engagement. The results indicate that augmented reality attributes

positively affect customer brand engagement. Additionally, Perceived usefulness, perceived ease of use, and enjoyment mediated the indirect and positive effects on CBE. Findings reveal that AR interactivity has a more influential impact. Accordingly, these findings are significant for marketers and mobile app developers to adopt AR technology and to design marketing strategies considering the AR attributes to enhance customer brand engagement

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