Shopping in the digital world: Examining customer brand engagement through augmented reality mobile applications

ABSTRACT

This paper furthers our understanding of customer brand engagement through augmented reality (AR) features on retailers' mobile applications. Due to the ubiquitous smartphone device, augmented reality has emerged as a new technology available to retailers to engage with customers. While AR in consumer markets is in its infancy, some innovative retailers have implemented AR technology within their mobile application. Through a web-based survey of 441 consumers, the research establishes the variables influencing brand engagement through retailers' mobile apps and the consequent outcomes of AR related brand engagement. The research introduces a new set of augmented reality attributes, namely, AR novelty, AR interactivity and AR vividness and establishes their influence on technology acceptance attributes of perceived ease of use, usefulness, enjoyment and subjective norms. Positive perceptions of the AR attributes and technology acceptance attributes positively influence brand engagement through the retailer's AR mobile application. The findings also indicate that AR enabled brand engagement results in increased satisfaction with the app experience and future brand usage intent. The research provides retailers important practical implications on the use of AR technology.

INTRODUCTION

Technology is continuing to advance at an unprecedented rate. Augmented reality (AR) has emerged as a new technology available to retailers to engage with customers in a unique and vivid way (Javornick, 2016; Yim et al, 2017). While AR is in its infancy in terms of its application in consumer markets, spending on the technology is expected to reach $60 billion by 2020 (Porter and Heppelmann, 2017). Augmented reality aims to link the real world with the virtual world (Rauschnabel et al, 2015). Azuma (1997) asserts that augmented reality integrates computer generated objects with the real world and provides individuals with real-time interactions. Faust et al (2012) define AR as 'the superposition of virtual objects (computer generated images, texts, sounds etc.) on the real environment of the user'. For a long time, AR has been hindered by large and cumbersome devices (Rese et al, 2017). However, with the adoption of the ubiquitous smartphone, developers, retailers and consumers' interest in augmented reality has significantly grown, as such many retailers are

now implementing augmented reality features into their mobile applications (Dacko, 2017). Firms such as Sephora, L'Oreal, Nike, Adidas and Mini have implemented augmented reality in an attempt to enhance the realistic experience of their products (Archer, 2015) and aid consumers during decision making (Heller et al, 2019). Pantano (2014) and Javornik (2016) conceptualise the potential of augmented reality in engaging customers and influencing their purchase intentions, whilst Rauchnabel et al (2018) suggest that AR features can provide both utilitarian and hedonic benefits to consumers. AR's ability to overlay the physical environment with virtual elements including information and images, which can interact with the physical environment during real-time, offers firms new possibilities in delivering content to consumers. In turn, the functions available through augmented reality has the potential to change a number of consumer activities including product trials, virtual try on and information search and acquisition (Javornik, 2016). More recently, brands have introduced augmented reality features to aid in customer information search within mobile applications. Online retailers ASOS and Amazon have introduced a search by image feature within their mobile applications, enabling consumers to take a photo of a product on their smartphone and use the photo to search for a specific product within the mobile application. Additionally, IKEA's mobile application enables consumers to place furniture items from the virtual world into their real world view. Thus, as consumers' use of augmented reality increases there is a growing need to understand its influence on customer behaviour, its purpose of use and the experience it delivers (Javornik, 2016).

Drawing upon Javornik's (2016) augmented reality research agenda, as well as Rese et al (2017), Rauschnabel et al (2018), Kim and Hyun (2016) and Yim et al (2017) research on the adoption of AR technology, the aim of this research is threefold. Firstly, to explore the variables that influence customer brand engagement through augmented reality features on mobile applications. Secondly, to assess the influence of such brand engagement through augmented reality on satisfaction with the customer experience and brand usage intent. Thirdly, to understand consumer's purpose of using Augmented Reality and the subsequent moderating role of goal directed (utilitarian) and pleasure seeking (hedonic) use.

CONCEPTUAL DEVELOPMENT

Customer Brand Engagement

Customer brand engagement (CBE) has received increased attention in both industry and academia in recent years (Harmeling et al, 2017). Technological advancements have allowed organisations to offer customers tools to engage with their brand such as websites, social media platforms and mobile applications (Osei-Frimpong and McLean, 2017; Dolan et al, 2016; Hollebeek et al, 2014; McLean, 2018). Prior research alluded to customer engagement as a consumer's focused attention (Chapman et al, 1999), their curiosity (Jacques et al, 1995) along with their appeal (Jennings, 2000) towards a specific artefact. While the extant literature does not provide an agreed definition of customer engagement or even a set of attributes leading to engagement (Beckers et al, 2018), commonly, engagement is considered a multidimensional construct that incorporates cognitive, affective and behavioural (conative) elements of a consumer's experience (Hollebeek et al, 2016; Hollebeek et al, 2014; Pansari and Kumar, 2017). Hollebeek et al (2014, p.154) conceptualise consumer brand engagement as 'a consumer's positive valence cognitive, emotional and behavioural brand-related activity during, or related to, specific consumer/brand interactions'. As a result, customer engagement includes the concept of dedication and commitment on the part of the consumer (Osei-Frimpong and McLean, 2017). Thus, drawing on this discussion, it is somewhat evident that customer brand engagement involves 'behavioural manifestations that incorporate a brand focus, deriving from motivational drivers' (Van Doorn et al, 2010, p.254). Thus, such manifestations can result in positive or negative valance towards the brand (for a detailed overview on customer brand engagement see: Hollebeek et al (2014); Alexander et al (2017) Pansari and Kumar (2017); Brodie et al (2011); Van Doorn et al (2010); Jaakkola and Alexander (2014))

The extant literature affirms a number of variables influencing customer engagement online (Hammedi et al, 2015; Osei-Frimpong and McLean, 2017; Dolan et al, 2016) with particular focus on brand engagement in social media branded communities. However, customer brand engagement is particular to context (Beckers et al, 2018; Brodie et al, 2013; Dolan et al, 2016). Therefore, in order to further our understanding of brand engagement through retailers' AR mobile apps, steps need to be taken to examine the variables influencing AR enabled brand engagement. The following sections illustrate the variables conceptually proposed and empirically examined in the adoption of new technology with the extended

technology acceptance model and the unified theory of acceptance and use of technology providing our theoretical foundation.

Technology Acceptance Attributes

Consumer acceptance is critical for the market success of new technology (Rese et al, 2017). The technology acceptance model (TAM) developed by Davis (1989) is one of the most prominent models in examining consumer acceptance of technologies. This prominence is noted in the hundreds of academic articles in which the TAM model has been applied. Based on a simple stimulus-organism-response model and the theory of reasoned action (TRA), the first technology acceptance model proposed by Davis (1989) suggested that the motivation to use a technological system was explained from customers' attitudes towards the technology, along with its perceived ease of use and perceived usefulness. Perceived ease of use is defined as the extent to which an individual views the use of a technological system as being free from effort (Davis, 1989). Thus, a technological system that is considered easy to use, is one that allows individuals to complete tasks, increase their productivity, while also enhancing their performance and efficiency (McLean, 2018). Perceived ease of use has been outlined as influencing consumers' use of websites (Rose et al, 2012) and more recently their use of mobile applications (Munoz-Leiva et al, 2017). The perceived usefulness of a technological system is often referred to as an important construct in swaying the adoption of new technologies (Kim et al, 2017). Previous research affirms that the usefulness of technology refers to individuals' confidence that utilising a particular technological system will enhance their performance (Davis, 1989).

However, meta analyses have outlined that such variables (perceived ease of use and perceived usefulness) explain around 40% of the variance in the behavioural intention to use a technological system (Legris et al, 2003). Thus, TAM as a theoretical framework has been subject to criticism due to its oversimplified view of technology adoption. As a result, TAM2 (Venkatesh and Davis, 2000) and TAM3 (Venkatesh and Bala, 2008) and subsequently UTAUT and UTAUT2 (Venkatesh et al, 2012) were introduced to include variables on human behaviour and experience. Perceived Enjoyment and Subjective Norm have been examined as important attributes of technology theories (Venkatesh et al, 2012; Venkatesh and Bala, 2008). Venkatesh et al (2012) define perceived enjoyment as 'the activity of using a specific system that is enjoyable in its own right, aside from any performance consequences resulting from system use'. The extant literature outlines that enjoyment can influence the use

of a computer (Davis et al, 1992) the use of the Internet (Venkatesh et al, 2012) the use of SST (Hilton et al, 2013) and the use of mobile applications (Hsiao et al, 2016). Olsson et al (2013) suggests that AR apps are expected to offer a playful and entertaining experience. Thus, perceived enjoyment has become an important variable in understanding the adoption and use of new technology.

Subjective Norm has been a consistent factor in understanding consumer behaviour and the adoption of technology. Ajzen (1991) introduced subjective norm in the theory of reasoned action (TRA) and was subsequently incorporated into the technology acceptance model (TAM2) and UTAUT/UTAUT2. Subjective norm is defined as 'the perceived social pressure to perform or not to perform a behaviour' (Ajzen, 1991). Thus, in the context of this study, subjective norm refers to an individual's perception of the expectations of important others regarding the use of augmented reality through mobile applications. Venkatesh et al (2012) outlined that subjective norms can influence individuals' use of particular websites. In addition, Yang's (2013) research found that important others (i.e. Peers, parents, idols) influence an individual's behaviour towards adopting mobile applications. Thus, subjective norm can be considered an important variable in technology adoption and use.

However, Kwon and Zmud (1987) outline the importance of recognising the context of the technology under investigation. Legris et al (2003) outline the importance of expanding the technology theories with variables based on the context of the research, to recognise the developments in technology and to provide specifically relevant findings. In a similar vain, Chong et al (2012) assert the importance of extending the technology acceptance theories when applied to mobile services. Therefore, building on earlier research in general, rather than applying a single prior model, we outline an exploratory model that entials pertinent techology factors as well as context specific factors related to augmented reality. This is also in line with the common practice of technology acceptance research where researchers apply the basic TAM and extend it with important, context-specific findings from other theories (e.g., Lin, 2003). McLean (2018) utilises such technology acceptance theories to understand brand engagement through mobile applications. Further, Rauschnabel and Ro (2016, p.128) suggest that it seems reasonable to use a basic, clear and structured technology related model and extend it with context specific AR factors that influence the use of the technology. Accordingly, the subsequent section discusses such context specific augmented reality attributes.

Augmented Reality Attributes

As previously outlined, augmented reality technology has existed for a long time but has been hindered by the lack of devices that can utilise AR technology, until the recent developments of the smartphone (Kim and Hyun, 2016). During decision making consumers often rely on mental imagery to generate mental images that somewhat reflect products and experiences (Pearson et al, 2015). A key benefit of AR is its ability to generate a clear representation of a product combining the real world and the virtual world (Heller et al, 2019). Thus, AR can provide consumers with a visual represntation of a product or expeirence enabling them to offload the mental imagery during the decision making process. However, while research has explored the adoption of AR smart-glasses through applying a uses and gratification approach (Rauschnabel et al, 2018), recent research within the extant literature provides little detail on the unique attributes of augmented reality. Azuma (1997) highlights that AR has three key characteristics, firstly, AR combines the real world and virtual world, thus continually providing users a unique *novel* experience specific to their actions. Secondly, AR is interactive in real time, therefore providing an *interactive* experience. Thirdly, AR is registered in 3D (Azuma, 1997), thus offering a *vivid* visual experience. Accordingly, we propose that the unique atributes of augmented reality can be considered threefold. We dintinguish and label each of these attributes as (1) *AR Interactivity* – the ability to control what the user sees combining the real world with the virtual world. (2) *AR Vividness* – the clear, detailed representation of an image (often overlaid in 3-D) in combination of the real world and virtual world. (3) *AR Novelty* – the unique and user specifc information combining the real world and the virtual world each time an individual uses the AR feature. The following secitions will discuss these attributes in more detail.

Interactivity

Almost all human interactions involve some element of interactivity (Heeter, 2000) and thus, the definition of interactivity diverges. Yim et al (2017) outline two complementary viewpoints on interactivity which helps to provide a holistic definition that provides understanding on the role of interactivity in augmented reality, namely, as a technological outcome and as a user perception.

Steuer (1992) highlights the significance of technology features in defining interactivity deriving from the technology used. Therefore, interactivity comes from the technological system's capacity to allow individuals to more easily interact with and be involved with

content (Hoffman and Novak, 2009). Consumers' perceptions may be influenced by sub-components of the technology involving the *speed*, such as how quickly users can manipulate content; *mapping*, the similarity of the control in the virtual world to the real world; and *range*, the extent to which the content can be manipulated by the user (Steuer, 1992). From a user perception perspective, interactivity involves an individual's subjective perceptions of interactivity (Downes and McMillan, 2000). Newhagen et al (1995) assert that an individual's perception of interactivity cannot be experienced without an individual's motivation to participate with the interactive technology. Thus, interactivity is only generated if consumers are willing to participate with the technology. Inherent to augmented reality is user participation in manipulating what the user sees combining the real world with the virtual world. The combiniation of manipulating the real world and the virtual world is a unique attribute of augmented reality (Azuma, 1997).

Vividness

Steuer (1992) defines vividness as 'the ability of a technology to produce a sensorially rich mediated environment'. It combines the sensory experience of actual objects with the non-sensory experience of imaginary objects to create a clear image in an individual's mind (Lee, 2004). Flavian et al (2017) suggest vivid information can be any type of information (e.g., pictures, audio-visual content, and colourful exemplars), that evokes the physical and experiential aspects of a purchase. Within the online environment, vividness is often associated with the aesthetic appeal and the quality of the display of products (Flavian et al 2017; Griffith and Gray, 2002). A vivid display of products is therefore likely to influence consumers' cognitive processing (Keller and Block, 1997; Nisbett and Ross, 1980), as it is more interesting and prompts a more thorough evaluation of the product related information than what pallid information would provide (Jiang and Benbasat, 2007). From a technological point of view, vividness can be heightened through enriching the quality of the information provided while increasing the number of sensory dimensions (Li et al, 2002). According to Orus et al (2016), vividness can influence the process of cognitive elaboration of information and enhance the recall of previously stored information, which may positively or negatively influence product preferences depending on the valence of the information recalled. Like interactivity, vividness helps consumers to mentally picture forthcoming experiences with products in the future (Phillips et al, 1995). Therefore, this indicates that enhancing the

vividness of product depictions can result in greater product-relevant thoughts and recall of the product information (Petrova and Ciadini, 2005). Augmented reality enables individuals to create a unique clear and detailed view of a combined virtual and real world experience.

Interactivity and Vividness of AR

Interactivity refers to how *quickly* consumers can manipulate the technology, the level of *control* over the manipulation and the *extent* to which consumers can manipulate the technology (Steuer, 1992). From a technology perspective, as previously outlined, perceived ease of use is considered the extent to which individuals' view the use of technology as being effortless resulting in enhanced productivity, performance, efficiency and control (Davis, 1989). Previous research (Martin et al, 2015; Rose et al, 2012; Chau and Lai, 2003) assert that control over technology (e.g. website) and the ability to complete tasks at an efficient speed are essential elements in a consumer's perception of ease of use. In addition, the vividness of the technology is associated with the quality of the presentation of products and thus considered clear, detailed, sharp and well defined (Yim et al, 2017; Flavian et al 2017; Griffith and Gray, 2002). Such clarity, detail and well defined presentation that results in a vivid display of the real world and the virtual world is likely to influence customer perceptions of the ease of use of the technology. Thus we hypothesise the following:

H1a: The interactivity provided by the augmented reality technology through the retailer's mobile application will positively influence the perceived ease of use of AR

H1b: The vividness of the augmented reality technology through the retailer's mobile application will positively influence the perceived ease of use of AR

Furthermore, previous research alludes that enhanced interactivity and vividness on a website allows consumers to gather more effective information due to the ability to manipulate products for visual examination and being able to see a clear and well defined presentation of the product (Argyriou, 2012; Petrova and Cialdini, 2008; Ariely, 2000). The interactivity and vividness of the product presentation can stimulate cognitive elaboration of information and therefore enhance the availability of the previously stored information in the mind of the consumer (Petrova and Cialdini, 2008). Thus, the product is mentally consumed and can be recalled for future anticipatory consumption contexts (Phillips et al, 1995). As a result, the vividness and interactivity of technology systems often encourage more proactive participation during product search with more detailed and efficient information processing, resulting in a potentially enhanced perceived usefulness of the technology (Van Noort et al,

2012). Augmented Reality technology has been conceptualised as assisting customers in increasing their knowledge in work, training, and consumption contexts due to the added information such as 3-D visualisation, providing a richer product experience (Yim et al, 2017). Thus, we hypothesise:

H2a: The interactivity provided by the augmented reality technology through the retailer's mobile application will positively influence the perceived usefulness of AR

H2b: The vividness of the augmented reality technology through the retailer's mobile application will positively influence the perceived usefulness of AR

Furthermore, Yim et al (2017) suggest that enjoyment obtained from technology is related to two functional elements, interactivity and vividness. As previously outlined enjoyment with technology refers to the use of technology being enjoyable in its own right (Venkatesh et al, 2012). The extant literature outlines that enjoyment can influence the use of a computer, Internet, websites and mobile applications. Nicholas et al (2000) asserts that individuals who experience more interactive features while playing computer games will experience a higher level of enjoyment. Similarly, Yim et al (2012) found that those experiencing 3D images have a greater level of enjoyment than those experiencing traditional 2D images within the online environment. Within the e-commerce environment, previous research finds that consumers who are presented with more vivid product visualisations (such as product inspection tools) show a more positive customer experience (Pantano et al, 2017). Accordingly, enjoyment may be elicited due to the innovative visualisation experience provided by augmented reality as consumers are able to manipulate products and have the potential to create themselves a customisable experience. Kim et al (2007) affirms that 3-D virtual models within the online environment to try on products can stimulate enjoyment during a customer's experience. As a result, a variety of media features that provide interactivity and vividness to consumers through augmented reality may be capable of enriching a consumer's imaginative construction process during their experience, integrating their actual environment with the virtual environment to develop an enjoyable experience through the visualisation of new products. Drawing upon the previous discussion and Olsson et al (2013) conceptualisation that AR apps are expected to offer a playful and entertaining experience, we hypothesise that:

H3a: The interactivity provided by the augmented reality technology through the retailer's mobile application will positively influence consumers' enjoyment of the AR experience

H3b: The vividness of the augmented reality technology through the retailer's mobile application will positively influence consumers' enjoyment of the AR experience

Moreover, given the high level of interactivity and vividness inherent within augmented reality it is expected that AR interactivity and AR vividness would be appealing to individuals due to the control and clear representation of content provided through the technology. Interactivity is regarded as one of the core concepts of digital technology and thus appealing to individuals (Javornik, 2016). As previously discussed, in the context of AR, the technology provides individuals with high levels of control to manipulate objects on their screen in front of them while often overlaid on the real world environment. Accordingly, the vividness of the AR combines the sensory experience of actual objects with the non-sensory experience of imaginary objects to create a clear image in an individual's mind (Lee, 2004). Like interactivity, vividness helps consumers to mentally picture forthcoming experiences with products in the future (Phillips et al, 1995). Augmented reality enables individuals to create a unique, clear and detailed view of a combined virtual and real world experience. Such an experience is likely to resonate amongst peer groups, encouraging the use of such technology. As noted, technology acceptance research has continually acknowledged and outlined the importance of subjective norms in influencing individuals to use technology. Accordingly, the unique attributes of augmented reality (AR interactivity and AR vividness) technology may stimulate perceptions amongst peer groups and other reference groups that like-minded individuals should utilise the technology. Thus we hypothesise:

H4a: The interactivity provided by the augmented reality technology through the retailer's mobile application will positively influence subjective norms.

H4b: The vividness of the augmented reality technology through the retailer's mobile application will positively influence subjective norms.

Novelty

AR combines the real and virtual world, providing consumers with a continually unique experience. Each time an individual uses an augmented reality feature, the user is likely presented with new stimuli given the range and scope of manipulation between the real world and the virtual world. Thus, novelty does not refer to the 'newness' of AR in this context,

rather novelty refers to the new, unique, personalised, novel content (stimuli) experienced each time through the AR display. Massetti (1996) defines novelty as a situation when an individual regards something as 'new, unique and different', while Berlyne et al (1963) suggest novelty is the combination of new and unusal stimuli. AR content can be presented in the form of text, images, videos and other virtual items (Javornik, 2016). AR apps enable users to place virtual objects such as furniture in a physical room. The unique presentation of this content allows indivdiuals to see what a furniture item would look like in their own home providing highly personalised, novel content (Javornik, 2016; Preece et al, 2015). Thus, AR enables individuals to personalise content to their own perferences and interests. Additionally, AR apps can provide further product information such as supplimentary video and text content including catwalk demonstrations, material information and product reviews as seen on American Appael's AR offering. The utility that derives from this unique content is likely to increase an individual's shopping performance resulting in completing tasks more efficently, increasing shopping efficency and making it easier to shop and visulise products. The ability to scan products and be presented with a visually enhanced representation of a product or shown additional information about a product or shown reviews directly related to the product or be able to change the colours of the item is likely to influence the perceived ease of use and usefulness of the technology. Thus, we hypothesise:

H5: The novelty of the content from the augmented reality technology through the retailer's mobile application will positively influence a) the perceived ease of use of AR b) the usefulness of use of AR

Moreover, one of the most distinugishing features of novelty is found during an individuals information processing where it can draw the attention of a consumer(s) leading to curiosity and becoming engrossed (Kover and James, 1993). Hoffman and Novak (2009) outline such pyschological states as leading to enjoyment and immersion. The human pyschological response to novel stimuli/situations seems to be inborn and evident from an early age, where individuals like to interact with novel stimuli. The unusual element of novel stimuli encourages cognitive processing and individuals sharing and discussing such novel products or situations. In contrast, familiar stimuli do not provide the same functional cues required to effect cognitive processing therefore resulting in less arousal and engagement (Yim et al, 2017). Cue Utilisation Theory (Easterbrook, 1959) suggests that unusual stimuli engages inivdiuals' cognitive flow which can lead to higher levels of arousal. Thus, the curiosity of the novel stimuli may result in consumers sharing such information with peers, in turn

influencing peers' perceptions and use of the technology. Given the novel stimuli presented through augmented reality and the liklihood of sharing and discussing the novel content, individuals may perceive social pressures from important others regarding the use of augmented reality features. The arousal from the novel stimuli may influence the expectation of like-minded individuals to use the technology. Thus, from this section we hypothesise:

H5: The novelty of the content from the augmented reality technology through the retailer's mobile application will positively influence c) a consumer's enjoyment d) subjective norms

TAM attributes on Engagement

While research on the acceptance attributes of technology has been well documented, initial acceptance of a brand's technology does not determine brand engagement via the technology (Hsieh et al, 2008). Following the introduction of the extended technology acceptance models (i.e. TAM2, TAM3 and subsequently UTAUT and UTAUT2), technology acceptance attributes have been outlined as influencing attitudes and behavioural intentions in relation to using a brand's technology (e.g. Mobile Apps, see Mclean, 2018). As previously outlined, Hollebeek et al (2014, p.154) affirm consumer brand engagement as a mix of consumers' attitudes and behaviours, specifically they define consumer brand engagement as 'a consumer's cognitive, emotional and behavioural brand-related activity during, or related to, focal consumer/brand interactions'. Accordingly, customer brand engagement involves behavioural actions that incorporate a brand focus, deriving from motivational drivers (Van Doorn et al, 2010, p.254). Thus, given the aforementioned technology attributes capability to influence attitudes and intentions, this research assesses the influence of perceived ease of use (the perception that using a technological function/system is effortless), perceived usefulness (the perception that using a technological function/system will enhance performance), enjoyment (the activity of using a specific system that is enjoyable in its own right, aside from any performance consequences resulting from system use) and subjective norms (the perceived social pressure to perform or not to perform a behaviour) on the behavioural and attitudinal construct of consumer brand engagement through retailers' augmented reality mobile applications. Therefore, we hypothesise:

H6: The perceived ease of use of the augmented reality technology will positively influence brand engagement through a retailer's AR mobile application

H7: The perceived usefulness of augmented reality technology will positively influence brand engagement through a retailer's AR mobile application

H8: The enjoyment derived from the augmented reality technology will positively influence brand engagement through a retailer's AR mobile application

H9: Subjective Norms will positively influence brand engagement through a retailer's AR mobile application

As earlier noted, brand engagement involves the dedication and commitment of the consumer, along with their compelling experiences with the brand (Osei-Frimpong and McLean, 2017; Hsieh and Cheng, 2016; Mollen and Wilson, 2010). Additionally, past research alludes to positive outcomes following brand engagement (Hollebeek et al, 2014). Consumers' engagement has been outlined in helping to strengthen consumer-brand relationships (Brodie et al, 2011). Thus, consumer engagement through augmented reality on retailers' mobile applications may serve to strengthen such relationships, which in turn is likely to influence their brand usage intention. Prior research alludes to consumer brand engagement within social networking channels influencing satisfaction with the brand, brand usage intention and purchase intention (Hsieg and Cheng, 2016; Hollebeek et al, 2014; Algesheimer et al, 2010). In this vein, interactions with the vivid, novel and interactive content through augmented reality on retailers' mobile applications could serve as a means of influencing customers' satisfaction with their experience and brand usage intention. Therefore, we hypothesise:

H10: Brand engagement through a retailer's AR mobile application will positively influence satisfaction with the experience.

H11: Brand engagement through a retailer's AR mobile application will positively influence brand usage intent.

Furthermore, previous research outlines that differences can exist in influencing individuals to interact with technology depending on the purpose of use (Chattaraman et al, 2012; Chattaraman et al, 2019; McLean, 2018). Ashraf et al (2018) illustrate that differences exist between the variables influencing the utilitarian and hedonic engagement with social media. Additionally, Park et al (2012) illustrate that e-commerce shopping behaviour is influenced by the purpose of shopping, affirming differences in hedonic shopping contexts compared to utilitairn shopping contexts. In a related study, Rauschnabel et al (2018) outline that

differences can exist between a utilitarian or hedonic purpose of use in the context of AR smart-glasses, while Javornik (2016) acknowledge potential differences in relation to augmented reality. A utilitarian purpose of use is most often goal directed, whereas a hedonic purpose of use is mostly for intrinsic enjoyment. Thus defining the purpose of use as (1) hedonic and (2) utilitarian, we hypothesise:

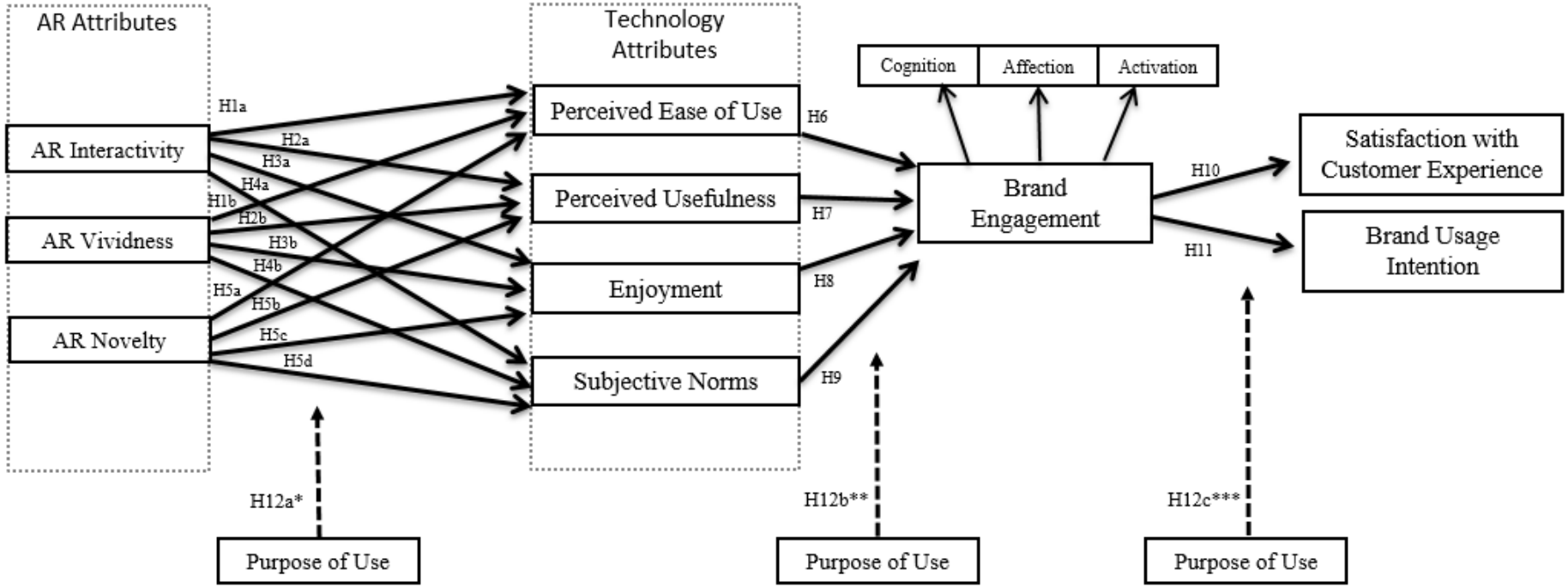
H12: (a) The influence of AR attributes on technology attributes will be moderated by the purpose of use.

(b) The influence of the technology attributes on brand engagement will be moderated by the purpose of use.

(c) The influence of brand engagement through a retailer's AR mobile application on satisfaction with the customer experience and brand usage intention will be moderated by the purpose of use.

Following the above discussions, a visual representation of our hypothesised model is shown in figure 1.

Figure 1 Hypothesised Model



H12a,b,c are drawn for ease of illustration
* H12a moderates H1a,b; H2a,b; H3a,b; H4a,b; H5a,b,c,d
** H12b moderates H6, H7, H8, H9
*** H12c moderates H10, H11

METHODOLOGY

An online questionnaire was administered with participants in the form of a panel-based quota sample in the UK, where a minimum number of users of three AR apps were sought in order to gather the data required for the study. A small financial incentive was given to respondents. Data were gathered from consumers who had used the augmented reality features from either of the following selected branded retail apps, Amazon, ASOS or IKEA, which are downloadable from the Play Store on the android platform and the App Store on the iOS platform (see appendix 1 for a visual representation and description of each app). Respondents had downloaded and retained the app for at least one month and used the augmented reality feature more than once. Such information on the sample was captured through screening questions; (1) How long ago did you download the (brand name inserted) app? (2) How often have you used the Augmented Reality feature on the (brand name inserted) app? To confirm respondents had used the actual AR feature within their chosen app, a video was shown detailing an individual using the AR feature. Respondents were then asked to confirm if they had used this feature on the app. Respondents that had not retained the app for one month or had not used the AR feature at least once were not invited to complete the rest of the online questionnaire. In total, data were gathered from 474 consumers. Following data cleansing and removing those questionnaires that were not fully completed or obtained missing values, the sample consisted of 441 valid responses. Table 1 presents in-depth characteristics of the respondents in the study.

Table 1 Characteristics of Respondents

Characteristics	Number (n)	Percentage
Gender		
Male	190	43
Female	251	57
Age Groups		
18 – 24	132	30
25 – 34	159	36
35 – 44	102	23
45 – 54	44	10
55 – 64	4	1
Education		
High-School Graduate	180	41
College Degree	119	27
University Degree	124	28
No Formal Qualification	18	4
General App Use Frequency		
Multiple times daily	9	2
Once daily	27	6
Multiple times weekly	176	40
Once weekly	216	49
At least once a month	13	3
Confidence in Mobile App Use		
Extremely confident	150	34
Confident	225	51
Somewhat confident	57	13
Not confident	9	2
Extremely not confident	0	0
Motivation for using the App		
Browsing	176	40
Information Search	66	32
Order Management	22	5
Purchasing products	97	22
Purpose of using AR feature		
Goal Directed (Utilitarian Purpose)	243	55
Fun/Entertainment (Hedonic Purpose)	198	45
Respondents per App		
IKEA	151	34
ASOS	122	28
Amazon	168	38

Prior to the main study, a pilot test was conducted with 30 respondents. A preliminary analysis of the pilot study illustrated both content validity and reliability of the data. The scales used in the questionnaire were drawn from previously used scales in the extant literature to measure interactivity, vividness, novelty, perceived ease of use, perceived usefulness, subjective norms, enjoyment, AR brand engagement, satisfaction with the experience and brand usage intention. Therefore, 46 items were measured on a 7-point Likert scale with a range from Strongly Disagree → Strongly Agree. Table 2 illustrates the scales and items used in the questionnaire.

Table 2 Questionnaire Scales

Variable	Reference	Scale Items	Cronbach's Alpha
Interactivity	Adapted from: Yim et al (2017)	• I was in control of my navigation through the augmented reality technology • I had some control of the augmented reality technology that I wanted to see • The augmented reality technology had the ability to respond to my specific needs quickly and efficiently	.841
Vividness	Adapted from: Yim et al (2017)	• The visual display through the AR technology was clear • The visual display through the AR technology was detailed • The visual display through the AR technology was vague (R) • The visual display through the AR technology was vivid • The visual display through the AR technology was sharp • The visual display through the AR technology was well-defined	.826
Novelty	Adapted from Yim et al (2017)	• Using the augmented reality feature offers something new each time • Using the augmented reality feature offers unique information • Using the augmented reality feature is something different each time • Using the augmented reality feature offers specific content	.837
Perceived Ease of Use	Adapted from: Davis (1989)	• Learning to use the AR feature on the app is easy for me • I find it easy to get the AR feature on the app to do what I want it to do • My interaction with the AR feature on the app is clear and understandable • I find the AR feature on the app to be flexible to interact with • It is easy for me to become skilful at using the AR feature on the app • I find the AR feature on the app easy to use	.842
Perceived Usefulness	Adapted from: Davis (1989)	• Using the AR feature on the app enables me to accomplish shopping tasks more quickly. • Using AR feature on the app enhances my shopping performance. • Using the AR feature on the app increases my shopping productivity. • Using the AR feature on the app enhances my shopping effectiveness. • Using the AR feature on the app would make it easier to shop.	.801

		• I find the AR feature on the app to be useful.	
Enjoyment	Adapted from: Davis et al (1992)	• I find using the AR feature on the app to be enjoyable • The actual process of using the AR feature on the app is pleasant • I have fun using the AR feature on the app	.869
Subjective Norm	Adapted from: Zeithaml and Berry (1996)	• People important to me think I should use the augmented reality feature on the app • It is expected that people like me use the augmented reality feature on the app • People I look up to expect me to use the augmented reality feature on the app	.779
Brand Engagement	Adapted from: Hollebeek et al. (2014)		.802
Cognition		• Using the brand's AR feature on the app gets me thinking about the brand • I think about the brand a lot when using the brand's AR feature on the app • Using the brand's AR feature on the brand's app stimulates my interest in the brand	.811
Affection		• I feel positive when I use the brand's AR feature on the app • I feel good when I use the AR feature on the brand's app • Using the brand's AR feature on the app makes me happy	.801
Activation		• I spend a lot of time using the AR feature on the brand's app compared to other brands. • Whenever I am using the App, I often interact with the brand's AR feature	.791
Satisfaction with the experience	Adapted from: Mclean and Osei-Frimpong (2017)	• I am satisfied with my experience • The experience is exactly what I needed • The experience has worked out as well as I thought it would	.842
Brand Usage Intent	Hollebeek et al (2014)	• It makes sense to use brand X following my engagement with the brand • Even if another brand has the same features as brand X, I would prefer to use brand X • If there is another brand as good as brand X, I prefer to use brand X because of my experience with the brand • If another brand is not different from brand X in any way, it seems smarter to use brand X because of my knowledge on the brand	.781

Preliminary Analysis

Numerous preliminary analyses were conducted prior to structural equation modelling to test the hypothesised model in figure 1. In the assessment of scale reliability, Cronbach's alpha coefficient was calculated for each scale used in the study as shown in table 2 and exceeding the critical value of .7 (Pallant, 2013), as a result the scales used are reliable indicators of their corresponding constructs. As the brand engagement construct is considered multidimensional, a subsequent exploratory factor analysis (EFA) was performed on the scale measuring Brand Engagement (Pallant, 2013). The exploratory factor analysis indicated a KMO sampling adequacy of 0.781, satisfying the critical value of .6 and a corresponding ρ-value < .0001 for Bartlett's Test of Sphericity (Kaiser, 1970). Additionally, items loaded on corresponding variables, averaging above .7 with no evidence of cross loading. Following the EFA, a Confirmatory Factor Analysis (CFA) was calculated which outlined *goodness of fit* (RMSEA = .049; RMR = .016; SRMR = .037; CFI = .956; GFI = .951; NFI = .960). Thus, Brand Engagement was measured as a reflective second order latent variable (reflective regression weights and statistical significance in our structural model can be seen in table 3).

Subsequently, Structural Equation Modelling (SEM) with the use of AMOS Graphics 24 was used to test the hypothesised relationships outlined in figure 1. Confirmatory SEM is a two-step approach, first a confirmatory factor analysis (CFA) is performed followed by the estimation and assessment of the structural model. The confirmatory factor analysis is conducted to illustrate the causal relationships. The results of the confirmatory factor analysis show *goodness of fit*: $x^2_{(736)} = 2046$, $\rho = .001$, $x^2/df = 2.78$; RMSEA = .053, RMR = .017, SRMR = .039, CFI = .969, NFI = .968, GFI = .959. Additionally, each of the regression values were acceptable and statistically significant ($p < .05$).

Following the CFA, further analysis satisfied discriminant and convergent validity as the results shown in table 3 indicate convergent validity was satisfied following the average variance extracted (AVE) values above .50 and construct reliabilities above .70. Additionally, the AVE values were greater than the square of their correlations, supporting discriminant validity.

Furthermore, in order to avoid misleading conclusions, tests for common method bias (CMB) were conducted (Podsakoff et al, 2003). The scale items of corresponding constructs were mixed throughout the questionnaire as a technique to reduce the likelihood of CMB (Karikari et al, 2017; Ranaweera and Jayawardhena, 2014). Additionally, a common latent factor was

presented with all indicators of the constructs included in the model. The common latent factor produced a value of .489. To calculate the common method variance .489 was squared, which equals .239 (23.9%). Values which fall below 50% (Ranaweera and Jayawardhena, 2014) are considered to satisfy the unlikelihood of CMB.

Lastly, in order to assess multicollinearity each of the variables were assessed using the variance inflation factor (VIF) analysis. Given that the results outlined no variable above the critical value of 3.0 (Hair et al, 2013) it can be concluded that multi-collinearity was not violated.

Table 3 Convergent and Discriminant Validity

	CR	AVE	MSV	INT	VIV	NOV	PEOU	PU	ENJ	SN	ENG	EXP	BUI
Interactivity (INT)	0.841	0.711	0.499	**0.843**									
Vividness (VIV)	0.826	0.674	0.513	0.444	**0.820**								
Novelty (NOV)	0.837	0.702	0.472	0.236	0.259	**0.838**							
Perceived Ease of Use (PEU)	0.842	0.621	0.486	0.217	0.182	0.261	**0.788**						
Perceived Usefulness (PU)	0.801	0.733	0.541	0.303	0.301	0.178	0.401	**0.856**					
Enjoyment (ENJ)	0.869	0.606	0.559	0.279	0.222	0.368	0.308	0.274	**0.778**				
Subjective Norm (SN)	0.779	0.635	0.583	0.217	0.162	0.174	0.271	0.220	0.209	**0.796**			
AR Brand Engagement (ENG)	0.796	0.714	0.397	0.366	0.219	0.237	0.325	0.167	0.191	0.226	**0.845**		
Satisfaction with Experience (EXP)	0.842	0.613	0.402	0.234	0.277	0.211	0.228	0.246	0.307	0.261	0.368	**0.783**	
Brand Usage Intention (BUI)	0.781	0.702	0.569	0.179	0.254	0.204	0.233	0.170	0.165	0.234	0.401	0.413	**0.838**

CR - Construct Reliability; AVE – Average Variance Extracted; MSV - Maximum Shared Variance

Following the confirmatory factor analysis, the data from each augmented realty app (ASOS, IKEA and Amazon) were pooled and tested for Configural invariance (see: Byrne, 2016) procedure. Configural invariance is important to establish in order for pooled data analysis to provide meaningful insights (Vandanberg and Lance, 2000). The Configural invariance test is used to evaluate the assumption that the regression loadings are similar across groups (apps). Thus, a confirmatory factor analysis was calculated for each mobile application used in the study (ASOS app, IKEA app and the Amazon app). From each CFA, the *goodness of fit* values were examined to assess *goodness of fit* in each model for each app. The findings indicated that each model presented *goodness of fit* (ASOS: $x^2 = 1.966$; RMSEA =.061; CFI = .969; IKEA: $x^2 = 2.145$; RMSEA =.066; CFI = .970; Amazon: $x^2 = 1.816$; RMSEA = .056; CFI =.977), which highlights the factor structure of the apps are similar (Byrne, 2016) along with similar regression loadings. Therefore, it can be concluded that there is *goodness of fit* across each group (app). Further, the invariance tests provided an assessment on the equivalence across each app at both the measurement and structural level. Constraints were assigned to three groups, through computing the difference in the CFI value from both the Configural and constrained models, the findings indicated a *CFI difference* of < .01 and non-significant *p-values >.05*, such findings affirm equivalence across all three apps used in the study (see: Cheung and Rensvold, 2008).

Structural Equation Modelling (SEM)

Following the *goodness of fit* of the CFA and satisfying the subsequent tests, the structural equation model was then estimated based on the hypothesised model in figure 1. The structural model presented *goodness of fit* ($x^2_{(28)} = 47.054$, $p < .05$, $x^2/df = 1.681$, RMSEA = .039, SRMR = .020, RMR = .017, CFI = .960, NFI = .959, GFI = .977) and support many of the hypothesised relationships as shown in table 4.

Table 4 SEM Regression Estimates

Hypotheses				Standardised Estimate β	t-value	R^2
H1a	Interactivity	→	Perceived Ease of Use	.661 **	2.10	.58
H1b	Vividness	→	Perceived Ease of Use	.504 **	2.25	.58
H2a	Interactivity	→	Perceived Usefulness	.689 ***	5.21	.62
H2b	Vividness	→	Perceived Usefulness	.640 ***	4.16	.62
H3a	Interactivity	→	Enjoyment	.566 ***	2.32	.40
H3b	Vividness	→	Enjoyment	.531**	2.18	.40
H4a	Interactivity	→	Subjective Norms	.177**	2.11	.10
H4b	Vividness	→	Subjective Norms	.201**	2.17	.10
H5a	Novelty	→	Perceived Ease of Use	.377***	4.21	.58
H5b	Novelty	→	Perceived Usefulness	.402***	4.89	.62
H5c	Novelty	→	Enjoyment	.501 **	6.11	.40
H5d	Novelty	→	Subjective Norms	.121 ns	1.76	.10
H6	Perceived Ease of Use	→	AR brand Engagement	.608 **	2.41	.69
H7	Perceived Usefulness	→	AR brand Engagement	.702 ***	5.14	.69
H8	Enjoyment	→	AR brand Engagement	.601 **	4.33	.69
H9	Subjective Norms	→	AR brand Engagement	.486 **	2.03	.69
H10	AR brand Engagement	→	Satisfaction with the Experience	.409 **	2.16	.41
H11	AR brand Engagement	→	Brand Usage Intention	.696 ***	6.08	.56
	Cognition	←	AR brand Engagement	.781***	7.13	.69
	Affection	←	AR brand Engagement	.717***	6.92	.69
	Activation	←	AR brand Engagement	.814***	7.64	.69

$\rho < 0.001$, **$\rho < 0.05$, ns = not significant

The results shown in table 4 highlight many strong regression β and significant relationships ($p < .05$). With exception to *H5d* (Novelty → Subjective Norm), each of the hypotheses have been supported. The results illustrate that the interactivity and vividness provided by the

augmented reality technology as well as the novelty of the content has a positive influence on the perceived ease of use, perceived usefulness and enjoyment with the technology, supporting H1a, b, H2a, b, H3a, b, H5a, b, c. Table 4 outlines a strong regression coefficient and statistical significance ($p < .001$) of the vividness, interactivity of the technology and novelty of the content on the perceived usefulness of the augmented reality feature. Additionally, all three AR attributes have a significant influence on a customer's enjoyment with the AR feature. Thus, the AR features of vividness and interactivity providing consumers' the ability to manipulate the technology to their own needs through 3D visualisation of products for example are important in influencing the usefulness and the enjoyment of the technology. The results indicate that the novelty of the augmented reality content influences a consumer's enjoyment with the technology, however as previously alluded to, the novelty of the AR feature has no significant influence on subjective norms. Thus, the novelty of the AR stimuli on retailers' mobile applications has no influence on the perception that expected others (peers, family, idols) should use the technology. However, despite this, the interactivity and vividness of the AR technology has a positive influence on the perception that like-minded individuals should use the technology, supporting H4a, b. Thus, the interactivity and vividness of the technology help to explain why individuals expect their peers to use the technology.

Moreover, the results revel that the Technology Acceptance attributes of perceived ease of use, perceived usefulness, enjoyment and subjective norms influences AR brand engagement through retailers' mobile apps, supporting *H6, H7, H8, H9.* Previous research highlighted that such variables influence adoption of a brand's technology, however such adoption does not ascertain brand engagement. Thus, this research finds that the aforementioned TAM attributes influence AR brand engagement. The perceived usefulness of the AR feature is outlined as the most significant variable influencing engagement, however all four variables show high levels of significance and account for 69% of variance in influencing brand engagement with a retailer's AR feature through their mobile application.

Finally, supporting H10 and H11, the results affirm a relationship between AR brand engagement and satisfaction with the app experience. Thus, following engagement with augmented reality features on retailers' mobile applications, customers' express a positive customer experience. Additionally, in line with Hollebeek et al (2014), the results indicate that brand engagement with the AR feature on a retailer's mobile application positively influences future brand usage intent.

Before discussing the theoretical and practical implications of this research, further multi-group analysis was conducted between the purpose (Hedonic vs Utilitarian) of using the AR technology.

Multi-group Analysis – AR Purpose of Use

Moreover, we conducted multi-group analysis in the assessment of hypotheses *H12a, b and c* regarding the purpose of using the AR mobile application. Table 1 illustrated that 243 respondents used the AR feature for a goal directed purpose (Utilitarian), while 198 respondents used the AR feature for fun/entertainment purpose (Hedonic). Respondents were asked: Did you use the AR function to complete a specific task or did you use the AR feature for fun? With a dichotomous option of, (1) for a specific task (2) for fun. Multi-group analysis was completed in AMOS Graphics 24 in order to conduct analysis on the purpose of using the Augmented Reality feature on the retailer's mobile application. The multi-group analysis enabled comparison between paths assessing the goal directed use (Utilitarian use) and fun/entertainment use (Hedonic use). A chi square difference test provides a useful insight into the difference between the complete model between each group (Utilitarian vs. Hedonic). The test found that there was a significant difference between each structural model, however the test does not provide details on the differences between paths for each group (Hair et al, 2010). Thus, in order to assess individual paths between each purpose, groups were created in AMOS graphics for each use of the AR technology (1: Utilitarian Use n = 243; 2: Hedonic Use n = 198), each path was assigned a name for analysis. Bootstrapping was selected in the analysis which provides the confidence interval between each group. As outlined in table 5, significant differences were found for each purpose of use (Utilitarian vs Hedonic).

Table 5 Multi-group Test – purpose of using AR (Utilitarian vs Hedonic)

Relationship (Hypotheses)	**Utilitarian Use of AR (UTI) Path Coefficient (β, p, R^2)**	**Hedonic Use of AR (HED) Path Coefficient (β, p, R^2)**	**UTI - HED Significant Difference 'P value'**
(H1a) INT→PEOU	β =.721, p ***, R^2 =.59	β =.503, p **, R^2 =.61	p = .041
(H1b) VIV→PEOU	β =.606, p **, R^2 =.59	β =.421, p **, R^2 =.61	p = .121
(H2a) INT→PU	β =.734, p ***, R^2 = .62	β =.559, p**, R^2 =.60	p = .038
(H2b) VIV→PU	β =.691, p ***, R^2 =.62	β =.549, p**, R^2 =.60	p = .061

(H3a) INT→ENJ	β =.471, p **, R^2 =.31	β =.719, p ***, R^2 =.57	p = .031
(H3b) VIV→ENJ	β =.460, p **, R^2 =.31	β =.681, p ***, R^2 =.57	p = .037
(H4a) INT→SN	β =.174, p **, R^2 =.09	β =.182, p **, R^2 =.10	p = .622
(H4b) VIV→SN	β =.194, p **, R^2 =.09	β =.211, p **, R^2 =.10	p = .404
(H5a) NOV→PEOU	β =.370, p **, R^2 =.59	β =..411, p ***, R^2 =.61	p = .033
(H5b) NOV→PU	β =.388, p **, R^2 =.62	β =.420, p ***, R^2 =.60	p = .041
(H5c) NOV→ENJ	β =.277, p**, R^2 =.31	β =.616, p***, R^2 =.57	p = .028
(H5d) NOV→SN	β =.111, p ns, R^2 =.07	β =.151, p ns, R^2 =.08	p = .378
(H6) PEOU→ENG	β =.711, p ***, R^2 =.69	β =.501, p **, R^2 =.70	p = .0.40
(H7) PU→ENG	β =.741, p ***, R^2 =.69	β =.577, p **, R^2 =.70	p = .039
(H8) ENJ→ENG	β =.331, p **, R^2 =.69	β =.703, p ***, R^2 =.70	p = .029
(H9) SN→ENG	β =.521, p **, R^2 =.69	β =.446, p**, R^2 =.70	p = .412
(H10) ENG→EXP	β =.398, p **, R^2 =.34	β =.681, p***, R^2 =.51	p = .038
(H11) ENG→BUI	β =.701, p ***, R^2 =.58	β =.521, p **, R^2 =.48	p = .040

(INT = Interactivity; VIV = Vividness; PEOU = Perceived Ease of Use; PU = Perceived Usefulness; ENJ = Enjoyment; NOV = Novelty; SN = Subjective Norms; ENG = AR Brand Engagement; EXP = Satisfaction with Experience; BUI = Brand Usage Intent)

The results in table 5 outline a number of significant differences in relation to the purpose of using the augmented reality features on a retailer's mobile application; for either utilitarian purpose or hedonic purpose, affirming support for hypotheses H12a, b, c with exception of the relationship between Novelty and Subjective Norms; Interactivity and Subjective Norms; Vividness and Subjective Norms and lastly Vividness and Perceived Ease of Use.

Each of the paths show a level of significance, with exception of novelty → subjective norms. The level of *importance* attributed to each of the other paths vary depending on the purpose of using the augmented reality through the retailer's mobile application. The multi-group analysis highlights that the vividness of the augmented reality and the interactivity available has a more significant influence on the perceived ease of use and perceived usefulness of the AR feature during use for goal directed (utilitarian) purposes. In turn, the perceived ease of use and perceived usefulness of the AR feature is more influential on brand engagement during utilitarian use in comparison to using the features for a hedonic purpose. In contrast, the three attributes of augmented reality, interactivity, vividness and novelty are more important in influencing a customer's level of enjoyment with augmented reality features when used for hedonic purposes, while novelty is also more important in influencing the

perceived ease of use and perceived usefulness of the technology in comparison to goal directed use. This finding may be due to the appreciation of the varied content presented through AR during a hedonic activity, in comparison to more controllable and vivid content sought in a goal directed context. Additionally, unsurprisingly, the results affirm that enjoyment is more important in influencing brand engagement during hedonic use.

Lastly, the multi-group analysis finds that brand engagement through augmented reality is more influential on satisfaction with the experience when used for a hedonic purpose rather than a utilitarian purpose. However, brand engagement through AR is more influential on future brand usage intent when used in a utilitarian purpose compared to use in a hedonic purpose. Such findings are discussed in more detail in the subsequent section.

DISCUSSION

Theoretical implications

The application of augmented reality to consumer markets is in its infancy. This research advances our theoretical understanding of the antecedents and behavioural outcomes of brand engagement through retailers' AR mobile applications in consumer markets. The research identifies the role of augmented reality attributes and defines such attributes, namely AR Interactivity, AR Vividness and AR Novelty. Specifically, the research identifies the AR attributes and Technology attributes driving brand engagement through AR apps and the positive influence of such AR enabled brand engagement on satisfaction with the experience and brand usage intent, while establishing the moderating effect of hedonic or utilitarian use. Further, the research illustrates the role of AR in aiding consumers during decision making, removing the need to use mental imagery to imagine how products may look.

The theoretical foundation of this research is rooted in Technology Acceptance theories (e.g. TAM and its subsequent extensions TAM2 and TAM3 and the following development of the Unified Theory of Acceptance and Use of Technology, UTAUT and UTAUT2) (Davis, 1989; Venkatesh and Davis, 2000; Venkatesh and Bala, 2008; Venkatesh et al, 2012). Due to the infancy of research on augmented reality, such technology acceptance theories provide a useful theoretical foundation. Therefore, building on earlier research in general (rather than applying a single prior model), we outline an exploratory model that covers both pertinent technology factors as well as context specific factors of augmented reality. Accordingly, this

research introduces and defines three attributes of AR technology, namely *AR Interactivity, AR Vividness* and *AR Novelty. AR Interactivity* refers to the ability to control what the user sees combining the real world with the virtual world. *AR Vividness* refers to the clear, detailed representation of an image (often overlaid in 3-D) in combination of the real world and virtual world. *AR Novelty* refers to the unique and user specifc information combining the real world and the virtual world each time an individual uses the AR feature. AR Interactivity, AR Vividness and AR Novelty were assessed in terms of their influence on technology related attributes of perceived ease of use, perceived usefulness, enjoyment and subjective norms. As previously alluded to, while augmented reality has been in existence for some time, its application to consumer markets has been hindered by the lack of devices that can utilise AR technology, until the recent advent of the smartphone device (Kim and Hyun, 2016).

The results indicate that the interactivity and vividness of the augmented reality facility within the retailer's mobile app and the novelty of the content displayed through AR influences the perceived ease of use of the augmented reality technology. In line with Hoffman and Novak (2009), we suggest that Interactivity refers to the technology's ability to enable users to more easily interact, manipulate and become involved with content. Arguably, augmented reality provides customers with the most interactive type of technology available, where individuals have control over their manipulation in combining both the real world and virtual world environment. However, such advanced interactivity runs the risk of providing an over-complicated set of interactions for the consumer, despite this risk, this research illustrates that the interactivity within augmented reality positively enhances customers' perceptions of ease of use. The vividness of the AR experience combines the sensory experience of actual objects with the non-sensory experience of imaginary objects to create a clear image in the mind of the consumer. Thus, the AR experience is able to generate mental images that reflect products and experiences, which is an important skill during consumer decision making. Consumers have long tried to visualise the use of products to understand their applicability before purchase. Instead, with AR, consumers no longer have to create a mental image in their own mind. Providing an AR experience may reduce the cognitive processing required by consumers while shopping as they do not need to imagine what the product looks like, instead they are presented with a detailed and clear representation of the image with minimal effort or difficulty, thus resulting in consumers perceiving the technology as easy to use. Moreover, the uniqueness of the content presented to consumers

through the AR technology influences the perceived ease of use of the technology. AR provides individuals with content that is specific, personalised and unique to their own situation. For example, an individual may place an item of furniture in their own home or try on a pair of Nike shoes with their current outfit. This unique application of content is unrivalled with any other technology; accordingly, the results find that such novelty of content influences the perceived ease of use of the technology.

Further drawing on the discussion in relation to the perceived ease of use of the technology, the results also affirm the positive influence of the vividness and interactivity of the AR technology as well as the novelty of the AR content in enhancing the perceived usefulness of the technology. Thus, the vivid information provided by augmented reality in the form of pictures, audio-visual content and colourful depictions of future reality influence the perceived usefulness of the technology, aiding consumers in their decision making. The vivid experience provided by augmented reality is fundamental to distinguishing the technology from any other available. As discussed by Nisbett and Ross (1980), the vivid display of products is likely to influence a consumer's cognitive processing as it provides more interesting stimuli and prompts more thorough evaluation of the product related information than what pallid information would provide the consumer. Therefore, due to the clear and detailed nature of augmented reality and the ability to interact with the technology by manipulating the position of products on the screen while overlaid in the real life environment, consumers often experience an enriched information quality influencing customers' perceptions of the usefulness of the technology. Additionally, the personalised, novel stimuli presented to consumers through the augmented reality features, such as a piece of furniture placed in the consumer's own home adds to the utility derived from the technology, enhancing shopping productivity, enabling consumers to shop more efficiently contributing to the usefulness and ease of shopping.

Moreover, the results also assert the influence of AR vividness, AR interactivity on an individual's enjoyment with the technology. Such a finding is in line with Yim et al (2017) who outline vividness and interactivity as two key characteristics that influence individual's enjoyment with technology. Olsson et al (2013) conceptualise that augmented reality within mobile applications is expected to provide a playful and entertaining experience for customers, however they did not allude to the characteristics of augmented reality that provided such an experience.

The mental imagery that consumers often use to fill missing information (i.e. mentally picture a product) influences an individual's level of enjoyment during a shopping experience (Schwartz and Black, 1999). The interactivity and vividness of the AR experience, blending the real world with the virtual world to provide a clear, vivid and often 3D representation of an imaginary product positively influences a consumer's level of enjoyment during the shopping experience. Accordingly, not only do we find that AR vividness and AR interactivity influence an individual's enjoyment with retailers' mobile applications but also the novelty of the content in that AR can provide a uniquely tailored experience. In contrast to the traditional web environment, where each consumer is presented with the same image of a product, users of augmented reality are able to see or use a product in an environment that is unique to them. Therefore, in contrast to familiar stimuli such as that found on websites, the novel stimuli generated by agumented reality leads to consumer curiosity, in which Hoffman and Novak (2009) outline as an element of enjoyment. Thus, the three attributes of augmneted reality (AR Vividness, AR Interactivity and AR Novelty) outlined in this study have a significant influnece on enjoyment with the technology.

However, despite the unique nature of augmented reality influencing customer enjoyment, the results indicate that the novelty of the stimuli displayed through the technology does not influence subjective norms. Previous research suggests that the unusal element of novel stimuli encourages cognitive processing and individuals discussing such novel products or situations and incrasing the expectation that important others should use such technology in contrast to familiar stimuli which does not provide the same functional cues required to effect cognitive processing therefore resulting in less arousal. However, in the context of this study, the results do not find any influence of the novelty of augmented reality stimuli on subjective norms. This may be due to the fact that all consumers are able to experience novel content unique to their preferences anytime they use the AR feature and thus becomes less relevant to share and discuss with important others. However, in contrast the interactivity and vividness of the AR technology positively influences subjective norms. Thus, while the uniquness of the content may not influence the expectation that individuals should use the technology, the higher levels of control and the clear and vidvid representation of products plays an important role in why individuals would expect their peers to use the technology. Given that interactivity and vividness are important characteristics of technology, this may explain why such variables influence the expectation that others should use the technology. Additionally, the interactivity and vividness of the technology reduces the need to develop a mental image

of a product, as the AR technology provides a clear and detailed represntation of the image which can often be manipulated in 3D. Thus, such an aid during consumer decision making may explain the positive influence of interactivity and vividness on subjective norms.

Moreover, the technology acceptance attributes (Davis, 1989; Venkatesh and Davis, 2000; Venkatesh and Bala, 2008) have been outlined in many studies as influencing the adoption of new technologies. However, the adoption of new technology does not determine engagement with a retailer's technology. With use of the technology acceptance theories as a theoretical framework, we have established that the augmented reality attributes of AR vividness, AR interactivity and AR novelty influence the technology acceptance attributes of perecieved usefulness, perceived ease of use, and enjoyment. In furthering our theortical understanding of brand engagment through retailers' AR mobile applications, the results affirm the influnece of the percieved ease of use of the AR feature in influencing brand engagment, driven by the control, clear an detailed image and the uniquely tailored stimuli. Thus, the ability to use the technology effortlessly has a significant influence on brand engagement through retailers' AR features in their mobile applications. In addition, the usefulness of the technology, influenced by the novelty of the content, interactivity and vividness provided by the AR features subsequently influneces consumer brand engagement. Therefore, an individual's belief that using the AR features enhances their performance has a significant influence on brand engagement trough the retailer's AR mobile application.

Moreover, as part of the extended TAM and the UTAUT model, Venkatesh and Bala (2008) and Venkatesh et al (2012) illustrate the importance of enjoyment in the adoption of new technology. This research highlights that enjoyment, influenced by the novelty, interactivity and vividness of the AR technology has an influnece on brand engagement through a retailer's AR mobile application. Lastly, as outlined by Venkatesh and Davis (2000) and Venkatesh et al (2012), subjective norms have an influnece on the adoption of technology. This research finds that the percieved social pressure of others to use AR technology influenced by the interactivity and vividness of the AR has a positive influence on brand engagement. Thus, the perception that important others (peers, family members, idols) expect an inividual to use the technology has an influnce on consumers' brand engagement through AR features within a retailer's mobile app.

Furthermore, customer brand engagement has been outlined as having important implications for retailers, such as increased brand usage intention, satisfaction, word of mouth and loyalty

towards a brand (Brodie et al, 2011). Customer brand engagement is considered a multidemnsional construct that involves behavioural, cognitive and affective elements of a customer's experience (Hollebeek et al, 2014). Thus, previous research conceptulise that engagement with a brand involves commitment on the part of the consumer to interact with a brand. Brodie et al (2011) outlined that customer engagement through a brand's technology can help to strengthen customer relationships. Drawing upon this assertion, the findings indicate that customer brand engagement through augmented reality features on retailers' mobile applications has a positive influnece on a consumer's brand usage intention. Previous research found that customer engagement with brands within social networking websites influences future brand usage intention, this research builds upon this within a different technological domain and finds that customer brand engagement through AR mobile app features that inhernetly provide a vivid, interactive and novel experience has a significant influnece on brand usage intent.

Additionally, the results affirm that brand engagment through AR features within the retailer's mobile application positively influences satisfaction with the customer's app experience. Satisfaction with the experience has been heralded as one of the most important outcomes in regard to consumer interactions with a brand and in particular the brand's technology. Therefore, this research points out that brand engagement through a retailer's augmented reality offering, influenced by positively percieved AR attributes and technology attributes, positively influences future brand uasge intentions and satisafaction with the brand experience.

In further developing our theoretical understanding of consumers' use of augmented reality, the results affirm that differences exist in the relationships between AR attributes and technology attributes depending on the nature of use, namely for hedonic use or utilitarian use. The results outline that AR interactivity and AR vividness are most important in influnecing the percieved usefulness and percieved ease of use of the AR technology during a goal directed utilitarian use of the technology, while the percieved ease of use and usefulness become most important in influencing brand engagement during goal directed use. In turn, the AR interactivity, AR vividness and AR novelty become more important in influencing an individual's level of enjoyment during hedonic use, while the level of enjoyment is most important in influencing brand engagement. Additionally, the results assert that the novelty of the content displayed through AR is also more important in influencing the perceived ease of use and perceived usefulness of the technology during hedonic use. While, this may seem

somewhat surprising, the ability to see products through the combined personalised sensory experience of actual objects with the non-sensory experience of imaginary objects to create a clear image in the mind of the consumer may enhance the perceived ease of use and usefulness while providing a pleasurable experience.

Importantly, the results assert that brand engagement through augmented reality is more influential on satisfaction with the experience when used for a hedonic purpose rather than a utilitarian purpose, this finding may be due to the customer having no real goal to achieve during the hedonic service encounter in comparison to the utilitarian, goal directed, encounter. However, brand engagement through AR is more influential on future brand usage intent when used in a utilitarian purpose compared to use in a hedonic purpose, this finding may be due to customers appreciating and acknowledging the advanced technology provided by the retailer, thus making them more likely to use the brand again in the future.

Practical Implications

This research provides retailers with practical implications for the implementation of augmented reality and brand engagement through augmented reality features within mobile applications. The research highlights to managers that augmented reality can influence customer satisfaction and brand usage intention. It is important for managers to note that customers' who perceive the AR technology as easy to use, useful and enjoyable positively influences brand engagement which subsequently influences satisfaction with the experience and brand usage intention. To date, a number of researchers have conceptualised the possible benefits of augmented reality, this research highlights to managers that AR is not a fad and investment in augmented reality results in favourable outcomes.

Additionally, it is important that app developers and managers acknowledge the overall importance of AR attributes, firstly, AR interactivity, enabling the customer to control and manipulate a product in 3D and become actively involved in the experience. Secondly, AR vividness, providing customers with a clear, vibrant and detailed representation of the virtual world combined with the real world, offering interesting stimuli that influences the customer's cognitive processing. Thirdly, AR novelty, illustrating the novel personalised stimuli customers are displayed based on their preferences and actions through augmented reality, which uniquely combines the real world and the virtual world to provide an enriched digital media experience unique to the individual's environment. Managers should ensure that

app developers utilise these three key attributes of augmented reality when developing apps for their customers. Through providing customers with AR experiences that enable them to see products through a combination of the real world and the virtual world rather than leaving customers to rely on mental imagery to generate mental images that reflect products and experiences results in satisfaction with the experience and future brand usage intent.

Accordingly, managers ought to clearly communicate these unique experiences that the app's augmented reality features offer, outlining the value proposition to customers in the level of control they are provided through the augmented reality features in being able to actively interact and manipulate the technology to their own individual needs. During decision making, consumers visually simulate or imagine the use of products. Instead AR offers managers the possibility to aid consumers during their decision making process, removing the need to imagine how products look. For example, the IKEA app enables users to place furniture items in a room to gain a visual, vivid, unique, interactive and real/virtual world representation of how the items would look. In turn, customers' engaging with such augmented reality mobile apps that provide a vivid, novel and interactive experience result in expressing positive perceptions regarding the technology, engagement with the brand, satisfaction and brand usage intent. Augmented reality provides managers with the ability to more accurately provide consumers with an understanding of how products look than consumers relying on developing an imaginary mental image.

Moreover, previous research alludes to the importance of active participation in co-creating experiences. The level of interactivity is often outlined as an important factor in contributing to customer participation. This research further outlines that interactivity is inherent in augmented reality technology, and such interactivity has a positive influence on the perceptions of the technology as well as subsequent favourable outcomes of enhanced brand engagement, satisfaction and brand usage intent. Thus, managers should acknowledge the important role augmented reality plays in enhancing customer interactivity as part of their app experience.

In addition, the research also finds the significance of important others (e.g. peers, family, idols) in influencing consumer engagement through augmented reality. Considering the favourable results deriving from AR enabled brand engagement, managers should firstly utilise the role of important others in influencing consumer adoption and brand engagement through augmented reality features. Through utilising idols and peers in app demonstrations

and advertisements, retailers can illustrate the novelty, interactivity and vividness of the AR features as a key value proposition within their mobile applications. Secondly, managers should ensure that users are able to easily share their experiences with peers. For example, enabling customers to share an image of their placed IKEA furniture or their virtual try-on of shoes or clothing to seek their peers' feedback. Accordingly, the results assert such social sharing can result in positively influencing brand engagement.

Lastly, this research finds that the purpose of using the AR technology through a retailer's mobile application can moderate the influence of AR attributes and technology attributes on brand engagement. Accordingly, app developers and managers should establish the purpose in which customers' use their app and consider the variables identified in this study influencing customer brand engagement during usability testing. In turn, this will help retailers to provide a successful mobile app that offers augmented reality features that meet customer needs, resulting in enhanced brand engagement, satisfaction and brand usage intent.

LIMITATIONS AND FUTURE RESEARCH

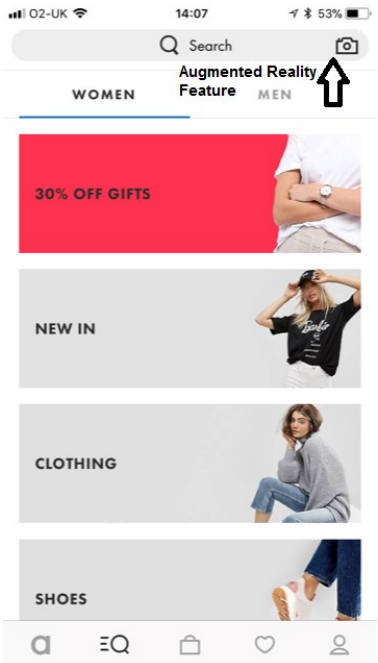
This study investigated the variables influencing customer brand engagement through augmented reality features in retailers' mobile apps and the following outcomes of such engagement. Due to the infancy of augmented reality in consumer markets, there are a limited number of apps utilising augmented reality to its fullest potential. As such, as augmented reality becomes more mainstream it would be beneficial to investigate different types of augmented reality features and the varying levels of AR such as low level augmented reality features vs medium vs high level AR features.

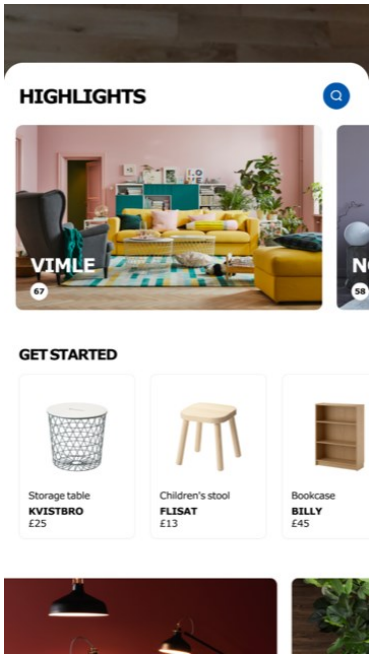
While this research has taken the initial steps in exploring customer brand engagement with reatilers augmented reality apps, future research should examine customer perceptions of those apps that contain augmented reality features against those that do not provide such features, this line of resarch would advance our understanding of the value of augmented reality in retailers' mobile applications.

Additionally, given the non-significant effect of the novelty of the AR content on Subjective Norms, future research may explore this further and assess if Subjective Norms positively or negatively influence the percieved novelty of the AR content.

Lastly, an experiment based research design may allow researchers to gain a further insight into the unique AR attributes influencing brand engagement. Future research could manipulate the different types of information that can be presented to users through the AR facility to inform further theoretical and practical insights for both academics and managers.

APPENDIX 1:

Retailer's Application	AR feature Description	Image
ASOS	ASOS AR search product feature. Users can take an image of an item with their smartphone's camera and search for the item (or similar item) on the ASOS app. This blends the real world with the virtual world enabling users to search for a product with an image in front of them from their real world environment.	
Amazon	Amazon's AR search product feature enables users to take an image with their smartphone's camera of an 'actual' product or scan the product's barcode to find the item (or similar item) on Amazon. This experience blends the real world with the virtual world.	

IKEA	The IKEA AR product selection enables users to select a product from the IKEA app catalogue to place in their own home. Through the camera view on the individual's smartphone the app enables the user to integrate computer generated objects with the real world and provide individuals with real-time interactions. This enables the user to manipulate the product in the virtual environment while overlaid on the real world environment. An example of the IKEA AR product overlay feature: This user has placed a floor-standing lamp in their living room. The view in the image is the view the user sees through their in-phone camera on the IKEA Place app.	 

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