CUSTOMER DISSATISFACTION AND SATISFACTION WITH AUGMENTED REALITY IN SHOPPING AND ENTERTAINMENT

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ABSTRACT

Over the past decade or so, technology and marketing have become increasingly integrated, and consumers are reaping an increasing number of benefits as a result. One of these technologies, augmented reality (AR), is designed to enhance consumers' experiences when shopping and seeking entertainment. If this technology is to produce the desired effect on consumers, the enhancement it creates needs to be top quality. Should this enhancement be poor or non-existent, however, the low quality may not be due to faulty augmented reality (AR); rather, it may be due to AR's failure to provide the attributes necessary to satisfy consumers. This study, based on seven AR groups in the contexts of shopping and entertainment service with adult consumers, applied statistical and qualitative analyses to investigate the major causes of consumer satisfaction and dissatisfaction with AR across the seven groups. Statistical analysis was employed to examine the relationship between consumer experience and satisfaction or dissatisfaction resulting from this experience, and this analysis guided the research that uncovered which of the AR groups demonstrated higher levels of consumer satisfaction. The higher the discrepancy between consumers' actual experience and expected experience, the lower the level of satisfaction and the higher the level of dissatisfaction. Content analysis was also utilized to locate the gaps between consumers' actual and expected experience and thereby identify the specific AR attributes that created consumer satisfaction or dissatisfaction. The main AR attributes that produce satisfaction are rich quality of augmentation (realistic view and telepresence), elevated level of informativeness and interactivity, the availability of crucial utilities (search features, narration, quick response, and need for touch), connectivity (social features), and entertaining attributes. The more consumers interact with these AR attributes, the more satisfied they are; conversely, the less consumers are able to interact with these features, the more dissatisfied they are. Important implications for researchers and managers are drawn from the discrepancy and its consequences for consumer satisfaction.

Keywords: *Augmented reality, actual consumer experience with AR, expected consumer experience with AR, augmentation, interactivity, informativeness*.

INTRODUCTION

Let us start with this observation. Imagine consumers who want to know about stars and planets and be entertained while learning, but they lack a celestial telescope. An advanced interactive technology called Augmented Reality (AR) can help them educate themselves and have fun at the same time. Augmented reality superimposes computer generated images and virtual information onto the real world and enhances consumers' perceptions with this integration of real and digital information. In other words, AR is a

type of informative media that enhances reality by presenting such virtual information (Lu and Smith, 2007) as three-dimensional product images in different shapes, colors, and styles (Kim and Forsythe, 2008a,2008b).

Many companies—e.g., Application, Zugara, Oculus, Vuzix, Google, and Blippar, to name a few—have started developing and implementing AR technology as mobile applications and smart glasses (Vuzix Smart glass). The life of specific AR technology has ups and downs. Pokémon Go, for instance, was launched in 2016, and it attracted the attention of so many game players around the world so rapidly that in the first month of its release, Pokémon Go earned about $200 million. This game application can be installed on consumers' smart devices so that they can walk around, find, and catch the hidden Pokémon character in the real environment. Nonetheless, since August 2016, Pokémon Go has lost one third of its daily players, and its daily revenue dropped from $16 million daily to $ 2 million (Humphery-Jenner, 2016). The reason for such dramatic losses? Pokémon Go's application was unable to authenticate players and login failures occurred. This is an example of how AR technology can draw people's attention and then platau or die.

More importantly, there is a lack of research helping marketers understand what consumers expect using AR and what causes them to be satisfied or dissatisfied with it. Marketers seem to have little understanding of the AR attributes that may provide satisfactory consumer feedback as a result of consumer positive experience with AR. The literature emphasizes the technological aspects of AR, but it neglects the role of AR in meeting consumers' needs and solving their problems (Swan and Gabbard, 2005). On the one side, AR is increasingly employed in the design and delivery of products (Kozick and Gettliffe, 2010). On the other side, products are often not developed with customers in mind (Swan and Gabbard, 2005).

Thus, this study set out to learn:

R1: What do consumers experience when interacting with AR in shopping and entertainment contexts?

R2: What do consumers expect to be offered when interacting with AR in shopping and entertainment contexts?

R3: What are the gaps between consumers' actual experiences with AR and the benefits they expect to accrue by using it?

R4: Which AR attributes are the major causes of consumer satisfaction and which are the major culprits for consumer dissatisfaction in shopping and entertainment contexts?

The remainder of this paper is organized as follows: First, the relevant literature on augmented reality, consumer experience, and consumer satisfaction is briefly reviewed. Next, the research methodology, analysis, and results are presented. Finally, the study's conclusions, managerial implications (how AR designers should develop AR applications that can enhance consumer satisfaction), limitations of the study, and suggestions for future research are discussed.

LITERATURE REVIEW

Augmented Reality (AR)

Augmented reality integrates digital information into consumers' real-world information in ways that help them perform tasks. The physical reality becomes enriched with virtual information, thus consumers perceive a mediated reality created by the interaction between physical and virtual information. As a consequence of this interaction, consumers perceive experiential consumption. In a retail context, for instance, some customers do not purchase online

because they lack product information, which in their mind makes purchase decisions risky (Kim and Forsythe, 2008a). Here is where AR can help. By providing additional product information (Lu and Smith, 2007), AR can create meaningful experiences for online shoppers (MacIntyre et al., 2001). The additional information enables customers to evaluate products more fully (Kim and Forsythe, 2008a) so they can make decisions with more certainty (Oh, Yoon, and Shyu, 2008).

Augmented reality has been introduced into a variety of industries such as medical services, repair and maintenance, retailing, and entertainment because it can be applied to both shopping and service use. In addition to helping shoppers make purchase decisions, it also provides them with enjoyable experiences (Li, Daugherty, and Biocca, 2001) as they interact with three-dimensional pictures of products (Fiore, Kim, and Lee, 2005).

User Experience (UX)

User experience (UX) is defined as, "All the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they are using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it" (Alben, 1996, p. 5). The concept of user experience is holistic, subjective (McCarthy and Wright, 2004), and varies across time (Law et al., 2009).

Because the concept of user experience may be too broad, ambiguous, and abstract for a precise definition (Park et al., 2013), it is difficult to determine how it should be evaluated. Traditional methods have evaluated UX in terms of usability (Butler, 1996; ISO 9241, 1998), instrumental, and pragmatic quality (Hassenzahl et al., 2003). Usability involves efficiency, effectiveness, and satisfaction (Hoehle and Venkatesh, 2015; Butler, 1996), and, additionally, time of execution, performance, and learning abilities (Abran, Khelifi, Suryn, and Seffah, 2003). Instrumental quality is related to the achievement of behavioral goals. Non-instrumental quality dispenses with human needs and incorporates aesthetic, symbolic, and motivational characteristics of human behavior (Mahlke, 2008).

According to some authors, user experience is not just pragmatic or instrumental; it also carries affective and socio-cognitive qualities (Hassenzahl and Tractinsky, 2006) and intermixes various aspects of interaction between product and consumer (Alben, 1996; Arhippainen and Tahti, 2003; Forlizzi and Ford, 2000). Previous studies have emphasized both instrumental or pragmatic qualities, and such non-instrumental qualities such as hedonism and emotions (Hassenzahl et al., 2003), pleasure (Jordan, 1998), fun (Draper, 1999), and aesthetic expressions (Tractinsky et al., 2000). Thus the concept of user experience is multidimensional and must reflect pragmatic, hedonic, and aesthetic qualities (e.g., Hassenzahl et al., 2003; Laugwitz et al., 2008).

Consumer Satisfaction and Dissatisfaction with Augmented Reality

Satisfaction refers to the difference between consumer's prediction of what should occur and what actually occurs (Parasuraman et al., 1988). The smaller the difference, the more satisfied a consumer is. Satisfaction is both cognitive and affective (Mano and Oliver, 1993; Westbrook and Oliver, 1991). Satisfaction is, "not [only] the pleasurableness of the [consumption] experience, it is the evaluation rendered that the experience was at least as good as it was supposed to be" (Hunt, 1977, p. 459).

This study pays particular attention to consumer satisfaction because it is the main driver of behavioral intention (e.g., Oliver,

1999). Consumer satisfaction influences customer loyalty (Oliver, 1999; Anderson and Sullivan, 1993; Bearden and Teel, 1983; Boulding et al., 1993; Fornell, 1992; Oliver and Swan, 1989), consumers willingness to buy (e.g., Bearden and Teel, 1983), and consumers' after-purchase attitudes (Howard, 1974).

Augmented reality can foster positive customer-brand relationships (Owyang, 2010) and thus produce consumer satisfaction through the creation of perceived experiential value (Chou, 2009; Yuan and Wu, 2008). This technology can even create consumer satisfaction before the purchase **(**Bulearca and Tamarjan, 2010), at the time customers evaluate a product (Woodsa, 2009), and just before customers make their purchase decisions (Fill, 2009). Because AR can enhance the whole consumer experience and not just the product or service (Yuan and Wu, 2008; Schmitt, 1999), this study evaluates the linkage between actual consumer experience with AR (or expected consumer experience with AR) and consumer satisfaction or dissatisfaction with AR.

METHODOLOGY

Quasi-experimental Design to Examine User Experience with Augmented Reality

The study used five conditions from star mobile applications related to entertainment services and two conditions from Ray Ban's website related to shopping experiences. The participants were randomly assigned to one of the seven conditions, regardless of their previous experience with AR devices.

A sample of seventy young adults was selected in a Southwestern metropolitan area of the U.S., and it was comprised of a balanced demographic profile: 28 males and 42 females, with ages ranging from 19 to 43 years: 25 females and 13 males (19 to 24 years); 11 females and 8 males (25 to 30 years); two females and five males (31 to 36 years); and four females and two males (37 to 43 years). All participants were asked prescreening questions to assess their familiarity with Internet usage and knowledge of the products used in the applications (mobile star applications and the Ray Ban website). Six items per product were included, as shown in Table 1.

Participants were asked to use their own smart phones, and then they were randomly assigned to one of the seven groups. Each group was exposed to one AR treatment. The first group was exposed to Night Sky Lite; the second group was exposed to Sky View Free; the third group was exposed to Star Tracker; the fourth group was exposed to Star Chart; the fifth group was exposed to Space Journey; the sixth group was exposed to the AR feature of the Ray Ban website; and the last group was exposed to a version of the Ray Ban website called Virtual Model, which lacked AR features. After five minutes of exposure to one AR treatment, all participants answered survey questions and two-open questions, and narrated their actual and expected experience with AR.

Measurement of Consumer Satisfaction with Experience of Augmented Reality

To measure consumer satisfaction, three items were borrowed from Taylor and Baker (1994). Both prescreening answers and consumer satisfaction were measured using a 7-point Likert scale anchored at 1 = strongly disagree and 7 = strongly agree. The resulting means varied from 5.12 to 6.70 for the group exposed to the mobile star applications and from 5.42 to 6.71 for the group exposed to the Ray Ban website, thus ensuring the inclusion of participants familiar with the Internet who also had knowledge of the target product.

TABLE 1: PRESCREENING AND CONSUMER SATISFACTION QUESTIONS

Prescreening Questions for Mobile Star Applications	**Mean***
I frequently use the Internet to search.	6.23
I think that technology is necessary for my daily works.	5.79
I visit the Internet websites to collect information.	6.70
I visit the Internet to collect more information about stars and planets.	5.12
I would like to know more about celestial bodies in the sky.	5.55
I like to watch stars and other celestial bodies in the sky.	6.21
Prescreening Questions for Ray Ban Websites	**Mean***
I am familiar with using the Internet.	6.32
I frequently use the Internet to shop online.	6.60
I think that technology is necessary for my daily works.	5.67
I visit the Internet retail websites to collect product information.	5.42
I visit the Internet retail websites for purchasing products	5.91
I am a user of eyeglasses or sunglasses.	6.71
I would like to wear eyeglasses or sunglasses.	6.40
Consumer Satisfaction Measurement	
Overall, I am satisfied with this application.	5.74
Being a user of this application has been a satisfying experience.	5.76
Having experienced this application was pleasurable.	6.01

* Of a Likert Scale from 1 = Strongly Disagree to 7 = Strongly Agree.

SPSS software was applied to obtain descriptive statistics and perform reliability analyses. Cronbach's Alpha of consumer satisfaction was .951, thus demonstrating construct internal consistency (Nunnally and Bernstein, 1994). Exploratory factor analysis (EFA) was performed using Principal Component Method and Varimax rotation to check for the uni-dimensionality of the construct (KMO = .774, χ^2 = 247.736 df = 3, sig = .000). The results showed that consumer satisfaction was uni-dimensional with all factor loadings ranging from .950 to .959, which is higher than the required minimum score of .6 (Hair et al., 2006).

The following two-open questions were asked to obtain feedback on consumer experience: 1) What did you experience? 2) What did you expect to experience that you have not experienced by interacting with this mobile application? (in context 1) or What did you expect to experience that you have not experienced by interacting with the Ray Ban website? (in context 2).

What follows summarizes key details in the procedures utilized for each of the seven groups in both contexts.

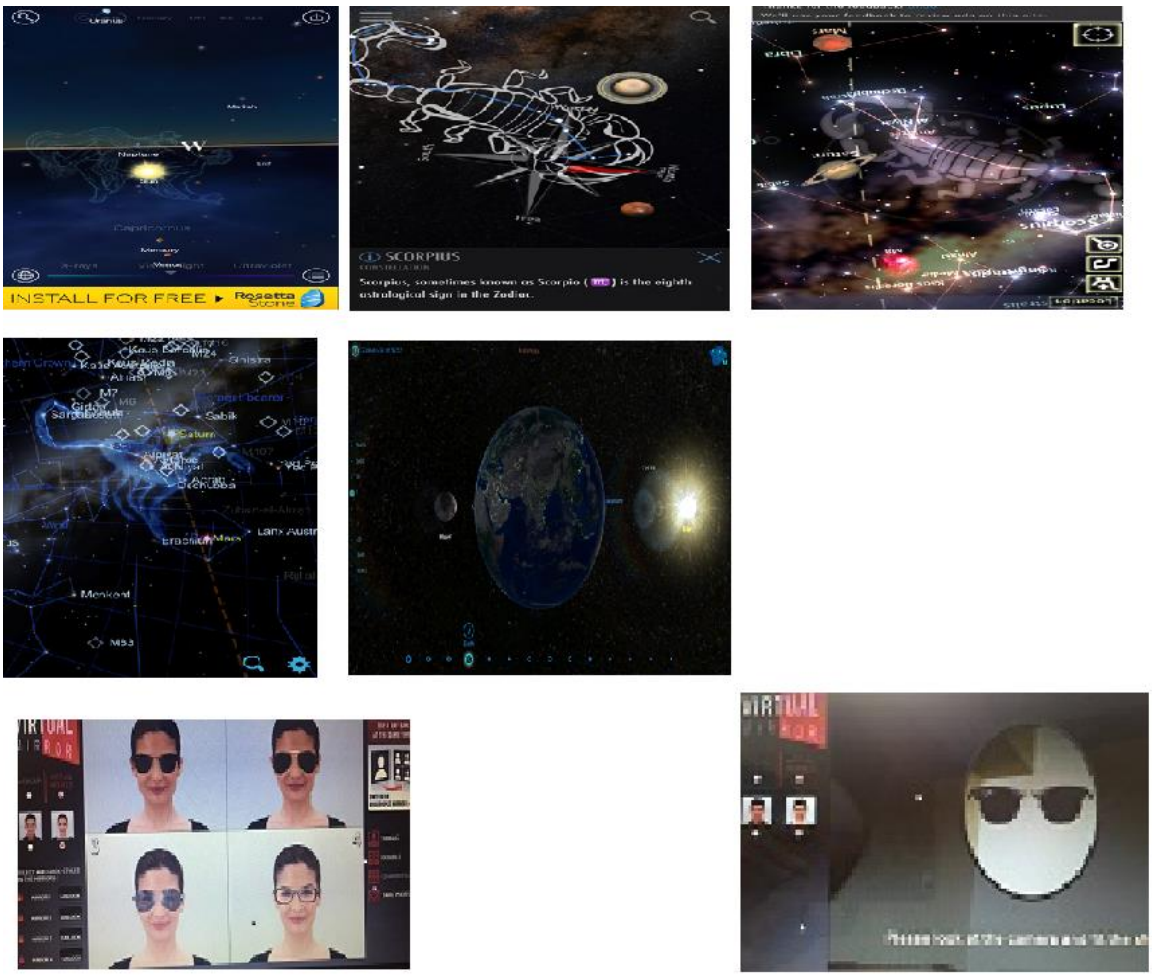
Context 1: Consumer Experience with AR Applied to Entertainment Services

Participants in each group were asked to download the relevant star mobile application on their smart phones. They interacted with the mobile application for five minutes, and then they were asked to close the application and answer the questions.

Each mobile application utilized for each of the five groups follows. Figure 1 shows screen shots of the five AR star mobile applications.

Figure 1

Screen Shots Of AR Star Mobile Applications (Night Sky, Sky View Free, Star Tracker, Star Chart, And Space Journey) And Webcam (AR) Ray Ban Website (Webcam And Virtual Model)



First Group: Consumer Experience with AR Applied to Night Sky

The application used was fully interactive and allowed participants to interact with virtual objects (e.g., stars and planets), listen to background music, and modify the content of the augmented reality shown on the screen. Participants could activate commands to produce sound effects, notifications, news, sky information, and/or satellites. They could also change the color of the screen, zoom in on or out of an image, and they could request more information about the virtual objects they were seeing. Moreover, the application

enabled participants to stay connected with others by allowing them to take photos of the virtual objects and share them on social networks. Although Night Sky provided many novel features, the application also displayed many advertisments at the bottom of the screen (e.g., Google application), which annoyed some participants.

Second Group: Consumer Experience with AR Applied to Sky View

This application was somewhat interactive and informative, and it also provided novel features such as background music, sound effects, social features, and an augmented reality camera. Participants could modify the content of the augmentation shown on the screen, and they were able to take a picture or video of a virtual object and post it on social networks. But the application had a few drawbacks: it did not provide an elevated level of interactivity, and participants were unable to zoom in on or out from the virtual objects, thus reducing the fun of using it.

Third Group: Consumer Experience with AR Applied to Star Tracker

This application was fully interactive and provided such personalized maneuvering as calibrating a location. Participants could zoom in on and out from virtual objects shown on the screen, and they could also stay connected with others. This application also had some drawbacks: it was not informative enough, it did not provide much information about the virtual objects, and it did not allow participants to take pictures of virtual objects.

Fourth Group: Consumer Experience with AR Applied to Star Chart

This application also provided personalized maneuvering such as calibrating a location, and it enabled participants to zoom in on and out from virtual objects. The application has social features that enable participants to take pictures of virtual objects and post them on social networks. But the application was not easy to use, as some participants experienced difficulties in learning how to use it. Moreover, it was only slightly interactive; it did not provide background music; it loaded too much information onto the virtual objects as shown in lines, images, and text. Some participants felt overloaded with information and had an unpleasant experience as a result.

Fifth Group: Consumer Experience with AR Applied to Space Journey

This application was only slightly interactive and informative. It did enable participants to zoom in on and out from the virtual objects shown on the screen, but it provided little information about them.

Context 2: Consumer Experience with Shopping in AR

The second context involved two groups using a website to shop. The study asked each participant to log in to a Ray Ban website, which has two versions, one with AR features and one without. The sixth group was exposed to the web cam feature of the Ray Ban website, the one that provided AR features

TABLE 2
Actual Consumer Experience Versus Expected Consumer Experience Of Augmented Reality (AR) By Treatment Group

AR Treatments	Actual User Experience of AR	Expected Consumer Experience of AR
First Group:	High quality of augmentation	No advertisement
Night Sky	Highly interactive	Voice narration
	Highly informative	Search feature
	Connectivity	
Second Group:	High quality of augmentation	Highly interactive
SkyView	Middle level of interactivity	Highly informative
	Middle level of informativeness	More fun
	Novel features (music)	
	Search feature	
	Little fun and pleasure	
Third Group:	High quality of augmentation	Highly informative
Star Tracker	Highly interactive	Novel features (e.g., taking pictures of stars)
	Slightly informative	Search feature
	Connectivity	No advertisement
	No novel features except background music	
	Advertisement	
	Nice aesthetic user interface	
Fourth Group:	High quality of augmentation	Highly interactive
Star Chart	Slightly interactive	Sufficient information
	Overloaded information	Easy to use
	Social feature	Easy to learn
	Search features	Pleasant experience
	Background music	Voice narration)
	Unpleasant experience	
Fifth Group:	Slightly interactive	Highly interactivite
Space Journey	Slightly informative	Highly informative
	No social feature	Social features
	No background music	Novel features
Sixth Group:	Highly interactive	High quality of augmentation or realistic view
Augmented	Personalized experience	Highly informative (e.g., inventory, customer
Reality	Middle level of informativeness	reviews, popular products, and so on)
Ray Ban	Social features	Quick response
	Moderate quality of augmentation or realistic view	Touch
		Virtual salesperson like stores
Seventh Group:	Slightly interactive	Personalized experience
Virtual Model	Slightly informative	More models
Ray Ban	Not personalized experience	Highly interactive
	Social features	Highly informative

http://www.rayban.com/international/virtual-mirror. The seventh group was exposed to the Virtual Model version, which lacked AR features. After participants interacted with the websites for five minutes, they were asked to close the application and answer the questions.

Sixth Group: Consumer Experience with AR Applied to Web Cam Ray Ban (Augmented-Self)

The AR version of the website was fully informative and interactive, and it provided a personalized experience. Participants could select favorite sunglasses or eyeglasses from the Ray Ban catalogue and see how the virtual glasses looked on their facial image. This feature enabled participants to modify their images, zoom in on and out from the virtual glasses, take pictures of themselves wearing the virtual glasses and email them to friends or post them on social networks.

Seventh Group: Consumer Experience with AR Applied to Virtual Model Ray Ban

This version of the website was slightly interactive and did not provide a personalized experience, but it did offer two models, one for men and one for women. Like the application used by the sixth group, participants could select favorite sunglasses or eyeglasses from the Ray Ban catalogue and see how the virtual glasses looked on their faceial images. Even though it did not enable participants to have personalized experiences, it did allow users to compare up to four pairs of glasses.

Figure 1 shows screen shots of the features offered by both versions of the Ray Ban website, Web Cam and Virtual Model. Table 2 shows a detailed summary of comparisons between actual consumer experiences and their expected experiences for the seven participating groups.

RESULTS AND DISCUSSION

Qualitative and quantitative methods were used to ascertain and compare the level of consumer satisfaction reached by each group. Content analysis revealed gaps between consumers' actual experience and their expected experience with AR, and this analysis of the gaps helped determine which AR attributes created satisfaction and which ones led to dissatisfaction. Statistical analysis accounted for the level of consumer satisfaction reached by each group and compared the means obtained.

Consumers' Actual Experience and Consumers' Expected Experience with AR

Table 3 uses the responses to the two-open questions to compare the actual consumer experience with the expected experience for all groups exposed to AR mobile star applications (context 1) and the AR Ray Ban website (context 2). The results showed a significant discrepancy between what consumers expected to be offered when using augmented reality in shopping or entertainment contexts and what they actually experienced. Participants expected high quality augmentation (realistic view and telepresence), elevated level of informativeness, high level of interactivity, and the availability of crucial utilities (search features, narration, quick response, and need for touch). They experienced fun, pleasure, control, and connectivity, but they also experienced low levels of interactivity, of received information, and a quality of augmentation that was low or mediocre.

Level of Consumer Satisfaction with Augmented Reality Across the Seven Groups

Table 4 displays the number of participants, the results of t-tests, p-values, and the means of consumer satisfaction for each group. The level of satisfaction is reported from the highest level to the lowest level, from Night Sky, Sky View Free, and Web Cam Ray Ban

TABLE 3:
Summary Of Findings: Comparison Of Actual Consumer Experience And Expected Consumer Experience For All Groups Exposed To AR Mobile Star Applications And Ray Ban Websites

A)Actual consumer experience of AR star mobile applications	**A)Expected consumer experience of AR star mobile applications**
Low quality augmentation: The participants reported that some applications offered low quality AR.	High quality augmentation: The participants reported that some AR applications did not offer high quality AR.
Low level of interactivity: Participants experienced a low level of interactivity with the virtual objects. At best, they could zoom in on or out from the augmented objects.	High level of interactivity: The participants expected to have extensive interaction with the virtual objects.
Control: The participants had control over the application. They could choose background music, colors, location, and so on.	Utilities (Search, narrative, and quick response): The applications lacked search and narration. Some participants expected the AR applications to educate them on use using the applications. *She expected to hear Morgan Freeman's voice (Female, 21).*
Connectivity: Participants could take a picture of the virtual objects and post it on social networks.	Realistic view of augmented objects: Applications did not provide vivid images of virtual objects. *The application was so artificial (Male, 24)*
Low level of informativeness: The AR applications provided little information about the virtual objects.	High level of informativenss: Applications did not provide enough information on the virtual objects. Sometimes, it provided either too much or insufficient information.
Fun and pleasure experience: Participants had a fun and pleasurable experience using the applications.	Ease of learn (Learnability): Participants expected that applications would educate the users on using the AR applications.

TABLE 3 Continued

A)Actual consumer experience of AR Ray Ban Websites	**A)Expected consumer experience of AR Ray Ban Websites**
Low quality augmentation: Participants could see the virtual products on the model or their face. The quality of augmentation was rather poor.	High quality augmentation: Website did not provide high quality augmentation. *It was not me, the website did not augment well (Female, 23).* *I do not like avatar-ish or animated view of the self (Female, 22).*
Easy to navigate and easy to use	Utilities (Quick response): participants expected quick output by the AR website.
Low level of informativeness: Participants received little information about the products.	High level of informativeness: participants expected the website to show the inventory level of local stores. *I expected to see the level of inventory (Male, 35).* *I wanted to see more information about bestselling products, new arrivals, most popular and most tried-on products (Female, 25).* *It was expected to see more variety of products (Female, 20).*
Control: Participants could easily select their favorite products.	
Connectivity: Website allowed them to stay connected with others.	

at the top to Star Tracker, Star Chart, Space Journey, and Virtual Model at the lower levels.

To ascertain which groups experienced the highest levels of satisfaction, a post-hoc test with Bonforroni in ANOVA was applied. The results showed that in Context 1, the level of consumer satisfaction was significantly different across the Space Journey and Sky View Free applications ($p = .06$), and the level of satisfaction experienced from interacting with Space Journey was significantly different from that of Night Sky ($p = .05$). In Context 2, the level of satisfaction was significantly different between the two groups ($p = .03$).

TABLE 4
Statistical Analysis By Group: Number Of Participants, T-Test, P-Value, And Means Of Consumer Satisfaction

Groups	Number of Participants	T-test	p-value	Means of Consumer Satisfaction
Night Sky	9	46.60	.000	6.74
Sky View	10	30.76	.000	6.61
Star Tracker	16	12.13	.000	6.16
Star Chart	10	16.56	.000	5.18
Space Journey	10	6.97	.000	4.86
Web Cam Ray Ban	9	26.31	.000	6.59
Virtual Model	8	6.61	.000	4.54

Overall, the higher the discrepancy between actual consumer experience and expected experience, the lower the level of satisfaction and the higher the level of dissatisfaction.

AR Attributes Linked to Consumer Satisfaction

To identify the AR attributes linked to consumer satisfaction, a narrative analysis was used. The results showed that a significant difference in consumer satisfaction existed between consumers' expectations and the actual experiences in most of the AR groups. In general, high quality of augmentation, highly informative, and novel, interactive AR applications that have high connectivity are linked to higher levels of satisfaction. Lower levels of satisfaction are linked to lower levels of augmentation quality, informativeness, and interactivity, as well as the lack of utilities and fun features.

Specifically, in Context 1, Night Sky offered the highest level of satisfaction because of its high interactivity, informativeness, and connectivity. Sky View provided the second highest level of satisfaction. Though it featured novelty and utilities, it had a middle level of interactivity and informativeness. Star Chart ranked third in the level of satisfaction, as it was only slightly interactive, though it did offer social and utility features. It also overloaded participants with information, which made it unpleasant for some. Star Tracker ranked fourth. It produced some satisfaction because it was highly interactive, but it was only slightly informative and lacked novelty features. Space Journey earned the lowest level of satisfaction not only because it was only slightly interactive and informative, it also lacked social and novel features.

In Context 2, the quality of augmentation, level of informativeness, interactivity and utilities were essential to user satisfaction. Web Cam Ray Ban earned the higher level of satisfaction because of its high interactivity, connectivity, and personalized shopping experience, though it had only a moderate quality of augmentation

and a middle level of informativeness. Virtual Model received the lowest rating of satisfaction because it was only slightly interactive and informative, it lacked entertaining features, and it did not offer a personalized experience.

Table 5 summarizes the main AR attributes that contribute to consumer satisfaction and the absence or poor attributes that create dissatisfaction. Highly interactive and informative AR applications that generate high quality augmentation are linked to consumer satisfaction. Night Sky, for example, achieved the highest level of satisfaction because it possessed these attributes, whereas Space Journey earned the lowest level of satisfaction because of its low levels of augmentation quality, informativeness, interactivity, connectivity, and utilities. Overall, the main attributes that contribute to consumer satisfaction are: 1) quality of augmentation, 2) level of informativeness, 3) level of interactivity, 4) utilities, 5) connectivity, 6) fun and entertaining features.

Table 6 condenses the AR attributes expected by consumers and corresponding descriptions based on results from the studies of the two contexts. This wish list emphasizes the main AR attributes consumers expect: high quality augmentation, an elevated level of informativeness, a high level of interactivity, utilities, and learning ease. Such desires coincide with the AR attributes that contribute to consumer satisfaction, and they are listed in Table 5. Additional descriptions and illustrations of these and other AR attributes are presented in Appendix A.

TABLE 5
Summary Of Augmented Reality Attributes That Contribute To Consumer Satisfaction Or Dissatisfaction

Contribute to Consumer satisfaction	Contribute to Consumer dissatisfaction
Fun and enjoyment	Lack of fun and enjoyment
High quality of augmentation	Poor quality of augmentation
High level of interactivity	Low level of interactivity
High level of informativeness	Low level of informativeness
Connectivity or social features	Lack of connectivity or social features
Utilities	Lack of utilities

TABLE 6
Summary Of AR Expected Consumer AR Attributes In Entertainment And Shopping Contetxs

Expected consumer AR attributes	**Description**
Quality of augmentation: Realistic view of virtual objects	Feeling of receiving realistic view of the augmented objects (size and dimensions) so that the virtual objects are inserted into the place where they belong.
High level of informativeness	Receiving sufficient amount of information regarding the virtual objects.
High level of interactivity	Being able to interact with virtual objects provided by AR (e.g., zoom in and out, change the content of augmentation).
Utilities: Search features	Being able to search for information about the objects within AR application
Ease of learning	Requirement of the AR application to educate consumers on using the AR application
Narrative	Receiving audio instruction (narrator) on using the AR application.
Quick response	Receiving output (virtual objects) in a quickly manner.
Need for touch	Being able to virtually touch the virtual objects.
Control	Feeling of having control over the virtual objects
Connectivity	Felling of being connected with other consumers
Fun and pleasure	Feeling of having fun and being entertained while using AR
Telepresence	Feeling of being immersed in the environment

MANAGERIAL IMPLICATIONS

Consumers expect to interact with AR applications possessing high quality augmentation (realistic view and telepresence), an elevated level of informativeness and interactivity, and crucial utilities (search features, narration, quick response, and need for touch). While some AR applications offer fun, pleasure, and social features that keep consumers entertained and connected, many applications fail to provide a high level of interactivity and informativeness. This failure can easily frustrate consumers and create dissatisfaction.

These results have important implications for companies designing AR applications. Augmented reality should be developed as usable, practical, fun, and pleasant media that effectively enhances consumers' ability to perform tasks and their awareness of reality. Although some AR applications have been designed to entertain consumers, consumers' expectations go beyond entertainment benefits. They expect AR applications to offer a rich quality of augmentation and elevated levels of informativeness and interactivity, thus if applications are to satisfy consumers, designers must incorporate these qualities. They should also focus on designing applications that are highly interactive and informative in addition to being fun and pleasurable.

Some AR applications and websites currently available do not meet consumer expectations in terms of interactivity, informativeness, quality of augmentation, and utilities. Make-Up Genius, for example, is an AR application that applies virtual make up to a customer's facial image. Although the application provides superior quality augmentation, it does not allow customers to modify or interact with the augmented-self-image, nor is it interactive enough to allow customers to zoom in on or out from the augmented-self-image.

The results of this study emphasize the role of quality augmentation, informativeness, interactivity, utilities, telepresence, and control as major contributors to consumer satisfaction with AR. Developers should pay attention to the quality of augmentation by considering size and dimensions. For instance, Cimagine is an AR application that enables-customers to see how virtual furniture looks in their homes. Yet the application does not take into account the size and dimensions of the space allotted for the furniture, thus denying customers the ability to virtually see how well the furniture will fit where they want it. Interactive AR with high quality augmentation needs to realistically overaly virtual objects onto the real world. Practical and entertaining AR relies on highly interactive attributes that enable consumers to feel in control when interacting with virtual objects.

Augmented reality applications supplement reality by mapping virtual information onto real world experience. This mapping is likely to be important to consumers when purchasing clothing, glasses, furniture, so it must be considered seriously. The lack of mapping or its poor use may well contribute to consumer dissatisfaction. Because mapping virtual content onto the real world can be complicated, it is essential that developers consider the proper attributes that make AR satisfactory for consumers and thus an effective selling tool. A well-designed AR supplement should be able to generate rich quality of augmentation with high levels of informativeness and interactivity plus utilities that enable consumers to have personalized and realistic experiences.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This study has some limitations. First, the sample was limited, so a larger sample may be required to reach definitive conclusions that enable us to fully understand both what consumers actually experience when interacting with AR in shopping or entertainment and what they expect to be offered. It is particularly important to identify specifically the AR attributes that enhance customer satisfaction.

Future research might apply AR applications in other contexts such as health care service or the automobile industry. It may also employ further quantitative methods to evaluate the impact of AR on consumer experience and other consumer outcomes. Another interesting avenue for future research might be measuring consumers' personality traits and their role in consumers' willingness to purchase.

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APPENDIX A
AR Attributes and Expected Consumer Experiences of Augmented Reality

Quality of augmentation (Realistic view of augmentation): Quality of augmentation (output quality) refers to the quality of output overlayed by AR. Augmented reality is designed to insert the virtual objects into the reality in which they belong. This is one of the most desirable experiences AR offers.

Less than desirable AR applications and websites do not deliver good quality augmentation. Some applications, for instance, do not deliver precise three-dimensional images of products, which may disappoint consumers. Poor AR usage occurs when virtual information is not inserted in the appropriate places or when a balance between the size and placement of the digital information and the real information is lacking. Some Virtual Try-on applications deliver poor quality and unrealistic output by placing the virtual sunglasses in the wrong place on the consumers' facial images.

Quality of augmentation and output quality are crucial to AR usage because they influence consumer's behavioral intention to use it (Olsson et al., 2012). Consumers want a rich quality of augmentation regardless of the context in which AR is being used (Olsson et al., 2012; 2013). Consumers may be easy to satisfy when they receive high quality augmentation (Wang and Chen, 2011; Chen, 2013) and be willing to recommend the AR application to others (Jung et al. 2015), unlike consumers who fail to receive high quality augmentation. These consumers may become dissatisfied and unwilling to recommend AR as a result.

Informativeness: Informativeness refers to the extent to which AR offers relevant and useful information about virtual objects. The level of information about the virtual objects, however, needs to be an appropriate amount, i.e., neither too much nor too little. Star Chart, for example, overlays so much information about constellations that consumers find it unpleasant. The Ray Ban Website was slightly informative, but it lacked information about new arrivals and the most popular products. Informativness and interactivity are linked. Poor levels of interactivity may also add less useful virtual information about a real product. Augmented reality technology with poor levels of interactivity are not intuitive enough to estimate how much virtual information consumers expect. Thus the level of informativeness is crucial in producing satisfaction or dissatisfaction. A low level of informativeness leads to dissatisfaction and affects future consumer expectations.

Interactivity: Perceived interactivity is the second desirable feature of AR requested by participants. Perceived interactivity refers to the "extent to which users can participate in modifying the form and content of a mediated environment in real time" (Steuer, 1992, p. 84), and it has been found to be a multi-dimensional construct, one that includes playfulness, choice, connectivity, information collection, and reciprocal communication (Ha and James, 1998). The participants' expectations coincided with Lee's (2005) four components of website consumer interactivity: control, responsibility, personalization, and perceived connectedness. Consumer control refers to the ability of a consumer to control the application's information. Responsiveness refers to the ability of the website to respond to the consumer. Personalization enables consumers to customize products. Perceived connectness focuses on consumers' desire to share with others their experiences with products.

Moreover, interactivity enables consumers to customize and personalize information in three-dimensional images (Fiore et al., 2005). These images can significantly help consumers who request information. Some AR applications such as Virtual Try-on offer some degree of image interactivity. The interactivity featured by apparel retailers such as Virtual Model, for instance, enables consumers to visualize customized product images (Fiore et al., 2005) and provides a considerable amount of information (Fiore and Jin, 2003). Thsese features of interactivity may influence online

shoppers' attitudes by presenting product information in three-dimensional images (Fiore et al., 2005) that reflect real products in the store. A high level of interactivity between consumer and AR has the potential to provide telepresence and informativeness.

Interactivity can also entertain shoppers and thereby enhance their satisfaction with online shopping (e.g., Koufaris et al., 2001). For example, participants considered Night Sky Lite entertaining because they could interact with virtual objects. They could zoom in on or out from them and receive more information about the objects. Space Journey and Star Tracker were only slightly entertaining because they offered a low degree of interactivity.

The role of interactivity cannot be overemphasized. Previous studies have shown that interactivity provides both utilitarian and hedonic value to shoppers (Klein, 1998; Fiore et al., 2005), can save them time and effort, reduce their risk (Klein, 1998), and offer personalized output, all of which can lead to shoppers' willingness to purchase online (Fiore et al., 2005).

Utilities (search features, narration, learning ease, and quick response): Utilities refer to functional qualities of AR such as search capability, ease of learning (learnability), quick response, and need for touch. Search features refer to functions that enable users to search effectively and efficiently for proucts and information. Narration refers to the integration of narrative components that educate consumers about using AR. Ease of learning refers to consumers' conviction that using AR technology will be easy to learn. Quick response refers to the speed of overlaying virtual information on reality. Need for touch refers to the extent to which AR allows consumers to virtually touch virtual objects on the screen in order to learn about texture, material and/or the temperature of such virtual objects as clothing. As consumers access more functionalities of technology, such features as search, quick response, learnability and narration become available to AR consumers.

Participants in the study expected AR to allow them to seek information effectively and efficiently and to receive instructions that clearly explained the steps required to best use AR. One of the participants said that she expected the application to "have commentators like Morgan Freeman narrating." Even though some AR applications and websites are novel, advanced, and free of bugs (e.g., Star Chart), users can lose interest when the application lacks clearn instructions that explain explaining how to use them, or the application is slow in generating output.

Connectivity or Social Features: Connectivity refers to the consumers' desire to stay connected with other people. Augmented reality applications and websites often enable consumers to connect and stay connected with others. Night Sky, for example, allows consumers to take photos of virtual objects and post them on social networks or email them to others. Connectivity features produce satisfaction, and the lack of these features leads to unsatisfactory consumer experiences.

Control: Consumer control refers to the ability of consumers to control information such as product selection and choice of available products and features within the application. Having control over information is one of the major factors affecting consumers' willingness to use technology (Polatoglu and Ekin, 2001). Consumers expect to control virtual objects, personal information, and the content of AR. Therefore, a high level of control contributes

to consumer satisfaction, and the lack of it produces dissatisfaction.

Telepresence: Telepresence refers to consumers' presence in an environment by means of a communication medium rather than being present in the immediate physical environment (Steuer, 1993). This study's results showed that consumers want to have their experience mediated by AR just as if they were in a physical store. Consumers expect to experience a more realistic view of a retail outlet, i.e, they would like to see store racks, virtual salespersons, or virtual employees walking through the store and showing customers the products or even allowing them to physically touch the products. Telepresence creates satisfactory experiences because consumers feel they have realistic experiences and that they can trust the technology. Therefore, telepresence increases satisfaction and the lack of telepresence produces dissatisfaction with AR.

Fun and Pleasure: AR can generate fun and enjoyable experiences for shoppers by providing simulated experiences with three-dimensional images (Tang et al., 2004). Shoppers interacting with virtual objects enjoy the products (Li et al., 2001) and have positive attitudes when shopping online (Kim and Forsythe, 2008a). Shiseido, for instance, contributes to women's fun and pleasure by providing an AR technology called "Cosmetic Mirror," which facilitates women's decision-making when purchasing cosmetics by enabling them to add virtual makeup to their facial images. Fun and pleasant interaction with AR creates pleasurable experiences and leads to satisfaction with the technology, whereas the lack of fun and pleasurable interactions with AR diminishes the satisfaction of the experience.