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The Effect of Augmented Reality Shopping on E-Consumer Satisfaction

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Abstract:

The development of technology and the internet has brought great changes to the way consumers shop. The traditional way of visiting a store is considered no longer relevant, replaced with online shopping through social media, websites, and e-commerce. But the problem encountered is consumers cannot observe from various sides and details, touch and try the product. One of the solutions currently provided is through application of augmented reality. However, the application of this technology to online shopping media is still limited, therefore this research analyzes the effect of augmented reality shopping on e-satisfaction from 89 consumers in South Jakarta, Indonesia. Data were analyzed using SEM-PLS and smartPLS software package. The analysis results indicated that perceived augmentation and playfulness directly affect augmented quality (coeff = 0.396 and 0.286, respectively) while convenience and playfulness directly affect e-satisfaction (coeff = 0.478 and 0.221, respectively). Convenience gives a greater total effect on e-satisfaction than playfulness while perceived augmentation gives a greater total effect on augmented quality than playfulness. Finally, the presence augmented quality significantly increases the influence of convenience and playfulness on e-satisfaction.

Keywords: augmented reality; augmented quality; e-commerce; e-satisfaction; SEM-PLS

JEL classification: O32

1. Introduction

Within the past decade, e-commerce has become a necessity for citizens of the world, this is evident in the 53% of global internet users who made online purchases in 2016 (US Census Bureau 2017). The growth of technologies and the internet has allowed people to shift the way they do things, including the way we shop. The future of shopping will no longer require consumers to leave their houses and visit stores; consumers will be free from the hassle of crowded stores, low in-store stocks causing unavailability of products, and carrying big amounts of cash. Rapid e-commerce-related developments make it possible for retailers to provide 24/7 online-based stores where consumers can browse and purchase items whenever and wherever they are, and choose when the purchased products to arrive at their doorstep. Eventually, people will look to even more advanced platforms that grant them an easier and more convenient way to shop and handle their transactions.

As convenient as e-commerce is, some consumers may experience a bit of a drawback in purchasing items online, that is they cannot see, feel, and touch the desired items as they can at physical stores; they don't have the means to project how an item looks like in real life and if the item is up to their expectations. This is where augmented reality shopping can fill the loophole by enabling consumers to experience a more interesting,

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interactive, convenient, and satisfactory means of shopping, mimicking that of a traditional brick-and-mortar store experience even when they are at home.

The wonders of technology have brought us augmented reality, where individuals can use their gadgets to interact with both virtual and reality at the same time. In Indonesia, however, the use of augmented reality for commerce is not yet common, though there are several businesses that have started using these platforms such as *IKEA*, *Dulux*, and *Alfamind*. Therefore, the objective of this research is to discuss the effect of augmented reality shopping on e-satisfaction. This study contributes to the literature by providing empirical evidence of the relationship between augmented reality, augmented quality and e-satisfaction on online shopping sites and applications, especially in Indonesia.

2. Literature review

2.1. Augmented reality (AR)

Augmented Reality or AR is defined as an environment that includes both virtual reality and real-world factors, for instance, a user can use translucent goggles which lead them to see the real world as well as computer-generated images projected on top of that world (Azuma *et al.* 2001). Caudell and Mizell (1992) first created this term, which is applied to describe a head-mounted digital display that guided workers in assembling large bundles of electrical wires for aircrafts. Augmented Reality allows consumers to see how products will look in their homes, how products will look on them when tried on, how to use and access further information about the products (Baird 2017). Agrawal (2017) stated that researchers are pulling graphics out of the computer screen and integrating them into the real world by pushing the barriers of photorealism in augmented reality.

Augmented Reality is not to be confused with Virtual Reality (VR), which removes the real elements and instead immerse the user in a totally virtual environment with virtual objects (Behzadan and Kamat 2005). Agrawal (2017) stated that there are certain key differences between the two which can be very well explained as follows:

- 75% virtual + 25% real = virtual reality;
- 75% real + 25% virtual = augmented reality.

In this digital era of heightened consumer expectations, AR is becoming an essential tool for e-commerce (Javornik, Rogers, Moutinho, and Freeman 2016).

Although the term of AR is considered new in online shopping, but previous studies that discussed this has been done a lot from analyzing the development of AR technology (Feiner, MacIntyre, Höllerer, and Webster 1997, Kukulakos and Vallino 1998, Pryor, Furness, and Viirree 1998, Höllerer, Feiner, Terauchi, Rashid, and Hallaway 1999, Azuma *et al.* 2001, Ohta, Sugaya, Igarashi, Ohtsuki, and Taguchi 2002) as well as problems encountered from every technological development generated (Fuhrmann, Hesina, Faure, and Gervautz 1999, Julier *et al.* 2000, Lepetit and Berger 2000, MacIntyre and Machado Coelho 2000). Research on the application of AR has been done in various fields including health (Fuchs *et al.* 1998), manufactures (Navab, Bascle, Appel, and Cubillo 1999), games (Jebara, Eyster, Weaver, Starner, and Pentland 1997, Ohshima, Satoh, Yamamoto, and Tamura 1998) entertainments (Cavallaro 1997) educations (Specht, Ternier, and Greller 2011, FitzGerald *et al.* 2013), tourisms (Kourouthanassis, Boletsis, Bardaki, and Chasanidou 2015), transportations (De Crescenzio *et al.* 2011), fashions (Tabuscha 2014), retails (Poushneh 2018) and online shoppings (Javornik, Rogers, Moutinho, and Freeman 2016). In the 1990s until the 2000s, AR studies focused on the technologies and applications used and the problems faced in their application in various fields. But since 2010, recent studies have focused on the user experiences, their expectations and the effects on various decisions and user satisfaction (Olsson, Lagerstam, Kärkkäinen, and Väänänen-Vainio-Mattila 2013, Chang *et al.* 2014, Huang and Liu 2014, Kourouthanassis, Boletsis, Bardaki, and Chasanidou 2015, Wang, Chiang, and Wang 2015, Javornik, Rogers, Moutinho, and Freeman 2016, Poushneh 2018).

The AR application on online shopping is a supporting factor in online marketing today. Wang, Chiang, and Wang (2015) proved that AR can increase the preference and efficiency when shopping online. In addition, the use of AR reduces the rate of return of products purchased online (Tabuscha 2014, Baier, Rese, and Schreiber 2015), and increase product values (Tabuscha 2014, Dacko 2017). Furthermore, AR significantly affects consumer satisfaction (Poushneh 2018) and behavioral intention such as word of mouth (WOM), repurchase intentions, and loyalty (Brakus, Schmitt, and Zarantonello 2009, Eyüboğlu 2011). Javornik, Rogers, Moutinho, and Freeman (2016) has defined three AR experience indicators: perceived augmentation (Javornik 2015), convenience (Forsythe, Liu, Shannon, and Gardner 2006) and playfulness (Moon and Kim 2001). Perceived augmentation is the user's perception of AR application (Song and Zinkhan 2008). Perceived augmentation has been indicated to have a positive effect on satisfaction and behavioral intentions (WOM and repurchase intentions) (Javornik 2015).

Convenience is a functional benefit that users receive from the AR use (Forsythe, Liu, Shannon, and Gardner 2006). Conversely, playfulness is a non functional benefit due to the use of AR (Forsythe, Liu, Shannon, and Gardner 2006; Moon and Kim 2001). Both of these benefits have positive effects on satisfaction and behavioral intentions on online shopping (Childers, Carr, Peck, and Carson 2001). Based on the above explanation, the hypotheses tested in this study are:

Hypothesis 1. Perceived augmentation has a positive effect on augmented quality;

Hypothesis 2. Convenience has a positive effect on augmented quality;

Hypothesis 3. Playfulness has a positive effect on augmented quality;

Hypothesis 4. Perceived augmentation has a positive effect on e-satisfaction;

Hypothesis 5. Convenience has a positive effect on e-satisfaction;

Hypothesis 6. Playfulness has a positive effect on e-satisfaction.

2.2. Augmented quality (AQ)

Augmented quality is the output obtained from user interaction with AR (Javornik, Rogers, Moutinho, and Freeman 2016, Poushneh 2018). The quality of information, mapping and awareness received by users when using AR has a positive effect on their behavior towards online shopping (Pantano and Servidio 2012). When all three aspects of augmented quality exceed user expectations, then AR will lead to e-satisfaction and loyalty. Based on the above explanation, the hypothesis tested in this study is:

Hypothesis 7. Augmented quality has a positive effect on e-satisfaction

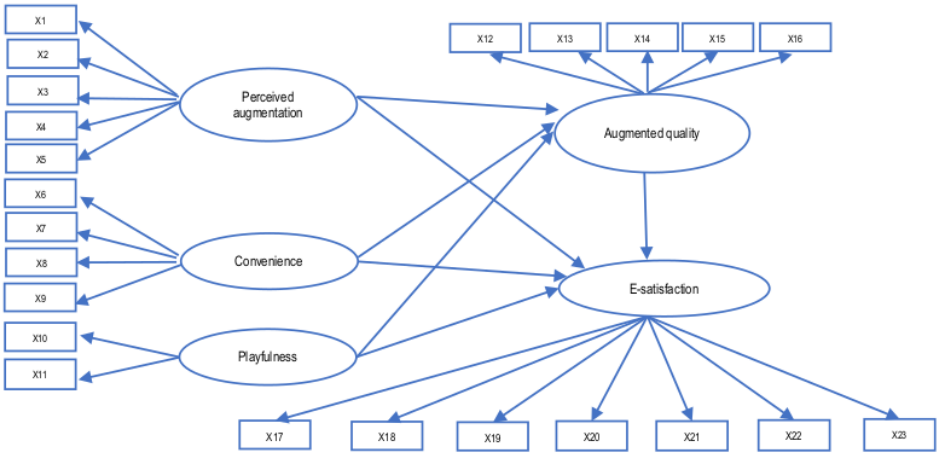
2.3. E-satisfaction

Oliver (2014) stated that satisfaction is a consumer psychological condition resulting from a series of experiences and interactions with products or services. Along with the current trends in online shopping, consumer satisfaction begins to shift from the satisfaction of the product or service traditionally to e-satisfaction. The online customer experience has become increasingly important due to the progress of technological developments and the increasing importance of the online aspects (Elliot and Fowell 2000). Customers benefit from online platforms by saving time and the offer of high flexibility, especially due to the round-the-clock accessibility (Agatz, Fleischmann, and Van Nunen 2008). Azam, Qiang, and Abdullah (2012) defined e-satisfaction as customer satisfaction resulting from previous purchasing experience with online shopping. E-satisfaction can be conceptualized as the consumer's judgment of their Internet retail stores (Szymanski and Hise 2000). Further research by Szymanski and Hise (2000) suggested that e-satisfaction is the result of the perceived convenience of consumers when shopping online, product characteristics, sites, and security of payment transactions. From attitudinal and behavioral perspective, e-satisfaction can be defined as a behavioral attitude (Cenfetelli, Benbasat, and Al-Natour 2005).

The online medium could improve the shopping process by enabling customers to sort and group information, by increasing the number of options available, and by enabling customers to access peer opinions and ratings (Meuter, Ostrom, Roundtree, and Bitner 2000). Potentially, there is more information available online which the customers will likely to devote more cognitive effort to their decision process because they can see the potential additional benefits through the additional effort (Johnson and Payne 1985). Additional information will improve the quality of the choices that customers make, which in turn, is likely to result in a service experience that delivers higher satisfaction when the choices are made online than offline (Shankar, Smith, and Rangaswamy 2003). Higher e-service quality, including AR technology will improve e-satisfaction (Bressolles, Durrieu, and Senecal 2014) and reduce the problem of uncertainty and distrust of consumers to the system. Consumer trust will bring satisfaction and loyalty (Leonnard 2018, Leonnard and Susanti 2019).

The constellation of causality between variables and hypotheses to be tested is constructed in Figure 1 below. The latent and manifest variables used in the analysis are denoted in Table A.1 (Appendix A.1).

Figure 1. The proposed model of augmented reality on e-satisfaction



3. Methodology

3.1. Samples

The respondents of this study are e-commerce buyers and sellers berjumlah 89 orang within the age range of 15 to 35 who live in South Jakarta, Indonesia. The survey was done through questionnaires via online Google Forms. Respondents consisted of 2.2% of high school students, 79.8% of university students, 12.4% of employees, 3.4% of entrepreneurs, 1.1% of housewives, and 1.1% others. Moreover, as many as 47.2% of respondents aged 15 to 20 years, 38.2% of respondents aged 34 years, 11.2% of respondents aged 27 to 31 years, and as many as 3.4% of respondents aged 32 to 35 years. Most respondents are university students with an age of 15 to 20 years, which supports the assumption that teenagers and young adults, mainly high school or university students, are more likely to try new technologies, specifically augmented-reality based shopping.

3.2. Measurements

Augmented experiences in this study were measured through three latent variables: perceived augmentation, convenience, and playfulness followed Javornik *et al.* (2016). Perceived augmentation consists of 5 attributes, convenience consists of 4 attributes, and playfulness consists of 2 attributes (Appendix A.1). Then the augmented quality followed Poushneh (2018) consisting of 5 attributes and e-satisfaction followed Bressolles, Durrieu, and Senecal (2014) which consists of 7 attributes. The measurements are obtained using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

3.3. Data analysis

Data analysis is done through several stages. In the first stage exploratory factor analysis (EFA) is executed to adjust the attributes of each latent variable in accordance with the theory of data set conditions. The determination of attributes is determined by using Principal Component Analysis (PCA) and PROMAX rotation method. The choice of rotation method is based on the opinion of Fabrigar, Wegener, MacCallum, and Strahan (1999) and an application by Howat and Assaker (2013) which states that this method maximizes the variance and loadings of each attribute. Partial Least Square Structural Equation Model (PLS-SEM) was used to test the model using the SmartPLS 3.0 software.

The selection of this model is due to the number of samples that do not satisfy the assumptions to perform SEM covariance based analysis. Small sample size will result in poor parameter estimates, convergent assumptions are not met, and it causes Heywood cases. Therefore, PLS-SEM is a good alternative method for structural equation modeling. This model does not assume data normality and is based on variance (Yamin and Kurniawan 2011). The PLS-SEM stages include generating latent variable scores based on weight estimate, estimating path coefficients and estimating parameters (Lohmöller 1989). The evaluation of the goodness of the PLS-SEM model is executed through evaluation of the measurement model (convergent validity and discriminant validity) and structural model evaluation (Yamin and Kurniawan 2011).

4. Findings

4.1. Results of exploratory factor analysis (EFA)

The EFA results indicated the total variance is divided into 3 factors (initial eigenvalues > 1). This result is in accordance with the theory that there are three main variables used in this study; augmented reality experiences, augmented quality and e-satisfaction. Augmented reality experiences able to explain the variance of 54.354%, augmented quality of 7452% and e-satisfaction of 5.803%. The total variance explained by these three factors is 67.608% (Table 1).

Table 1. Exploratory factor analysis results using principal component analysis (PCA)

Component	Latent variables	Initial eigenvalues		
		Total	% of Variance	Cumulative %
1	Augmented reality experiences	12.501	54.354	54.354
2	Augmented quality	1.714	7.452	61.806
3	E-satisfaction	1.335	5.803	67.608

Furthermore, the determination of the attributes of each variable is based on the largest correlation with each factor. Augmented reality experiences consist of 11 attributes, while augmented quality consists of 5 attributes and e-satisfaction consists of 7 attributes (Table 2). Kaiser Meyer Oliver Measure of Sampling (KMO) value of EFA is 0.902 and Barlett Test of Spehricity sig. of 0.000.

Table 2. Rotated component matrix

Attributes	Augmented reality experiences	Augmented quality	E-satisfaction
X1	0.924		
X2	0.966		
X3	0.885		
X4	0.724		
X5	0.953		
X6	0.716		
X7	0.654		
X8	0.478		
X9	0.611		
X10	0.593		
X11	0.700		
X12		0.571	
X13		0.811	
X14		0.701	
X15		0.465	
X16		0.403	
X17			0.853
X18			0.574
X19			0.885
X20			0.816
X21			0.789
X22			0.547
X23			0.553

After performing EFA on the overall data set, further EFA analysis is performed on the attributes of augmented reality experiences which is divided into 3 factors consisting of perceived augmentation, playfulness, and convenience. This division is adapted to the theory used. Perceived augmentation able to explain the variance of 68.754%, playfulness of 6.733% and convenience of 4.407%. The total variance explained by these three factors is 79.895% (Table 3).

Furthermore, the determination of the attributes of each variable is based on the largest correlation with each factor. Perceived augmentation consists of 5 attributes, while convenience consists of 4 attributes and playfulness consists of 2 attributes (Table 4). The value of Kaiser Meyer Olkin Measure of Sampling (KMO) of EFA is 0.927 and Barlett Test of Spehricity sig. of 0.000.

Table 3. Exploratory factor analysis results using principal component analysis (PCA)

Component	Latent variables	Initial eigenvalues		
		Total	% of Variance	Cumulative %
1	Perceived augmentation	7.563	68.754	68.754
2	Convenience	0.485	4.407	79.895
3	Playfulness	0.741	6.733	75.487

Table 4. Rotated component matrix

Attributes	Perceived augmentation	Convenience	Playfulness
X4	0.769		
X5	0.829		
X6	0.547		
X9	1.054		
X10	0.468		
X11		0.612	
X22		1.025	
X23		0.696	
X24		0.501	
X8			0.650
X19			1.001

4.2. Partial Least Square Structural Equation Model (PLS-SEM) analysis

The evaluation of PLS-SEM model consists of evaluation of measurement model and evaluation of structural model. Evaluation of measurement model is executed by evaluating convergent validity through the indicator of validity, constraint reliability, and Average Variance Extracted (AVE). Evaluation of the validity indicator is executed by looking at the values of standardized loadings > 0.5 and t-statistics > 2.0. The results in table 5 indicated significant indicators of validity. The value of composite reliability and Cronbach's Alpha are all reliable with values > 0.7. Finally, the AVE value of all latent variables > 0.5 indicates latent variables have good convergent validity.

Table 5. Result of measurement model

Latent variables	Manifest variables	Std. Loadings	t-Statistics	Average Variance Extracted (AVE)	Composite reliability	Cronbach's Alpha	Rho A
Perceived augmentation	X1	0.895	30.483	0.773	0.945	0.926	0.926
	X2	0.881	22.741				
	X3	0.896	37.546				
	X4	0.902	26.360				
	X5	0.822	17.127				
Convenience	X6	0.924	48.752	0.772	0.931	0.901	0.906
	X7	0.844	17.717				
	X8	0.879	30.873				
	X9	0.865	24.188				
Playfulness	X10	0.915	42.383	0.849	0.918	0.822	0.826
	X11	0.927	53.470				
Augmented quality	X12	0.793	11.647	0.539	0.853	0.788	0.818
	X13	0.650	8.679				
	X14	0.620	6.429				
	X15	0.805	16.395				
	X16	0.784	17.156				
E-Satisfaction	X17	0.846	19.722	0.659	0.931	0.913	0.916
	X18	0.719	11.942				
	X19	0.840	21.344				
	X20	0.845	26.511				
	X21	0.820	17.697				
	X22	0.791	15.751				
	X23	0.815	18.340				

Evaluation of discriminant validity is executed by comparing the correlation of each attribute with latent variable in the cross loading table. The results indicated the highest correlation of each attribute with its latent variables compared with other variables. Therefore, discriminant validity has been reached (Table 6).

Table 6. Cross loadings

Labels	Augmented reality experiences			Augmented quality	E-satisfaction
	Perceived augmentation	Convenience	Playfulness		
X1	0.891	0.757	0.715	0.552	0.619
X2	0.888	0.698	0.662	0.654	0.546
X3	0.892	0.780	0.714	0.582	0.642
X4	0.905	0.662	0.661	0.601	0.549
X5	0.820	0.691	0.659	0.596	0.616
X6	0.755	0.926	0.736	0.616	0.728
X7	0.687	0.839	0.639	0.473	0.631
X8	0.676	0.880	0.729	0.548	0.664
X9	0.744	0.867	0.677	0.554	0.669
X10	0.744	0.747	0.917	0.571	0.638
X11	0.684	0.716	0.925	0.616	0.707
X12	0.532	0.526	0.546	0.793	0.524
X13	0.266	0.178	0.340	0.650	0.407
X14	0.344	0.250	0.302	0.620	0.392
X15	0.633	0.569	0.545	0.805	0.619
X16	0.603	0.613	0.576	0.784	0.625
X17	0.535	0.662	0.562	0.567	0.841
X18	0.431	0.482	0.446	0.655	0.741
X19	0.525	0.580	0.564	0.532	0.837
X20	0.587	0.656	0.578	0.513	0.836
X21	0.509	0.722	0.656	0.587	0.821
X22	0.572	0.554	0.642	0.606	0.796
X23	0.677	0.711	0.699	0.580	0.804

Further evaluation of the structural model is performed by looking at the path coefficients, direct, indirect, and total effects resulting from the relationship between each latent variable. Perceived augmentation and playfulness significantly affect augmented quality (coeff = 0.396 and 0.286, respectively). These results support hypotheses 1 and 3. Convenience and playfulness also significantly affect e-satisfaction (coeff = 0.478 and 0.221, respectively). These results support hypotheses 5 and 6. Finally, augmented quality significantly affects e-satisfaction (coeff = 0.345). This result supports hypothesis 7. Convenience gives the highest total effect on e-satisfaction (coeff = 0.505) then followed by playfulness (coeff = 0.320) while perceived augmentation does not significantly affect e-satisfaction. Perceived augmentation gives the highest total effect on augmented quality (coeff = 0.396) then followed by playfulness (coeff = 0.286) while convenience does not significantly affect augmented quality (Table 7).

Table 7. Direct, indirect, and total effects of PLS-SEM

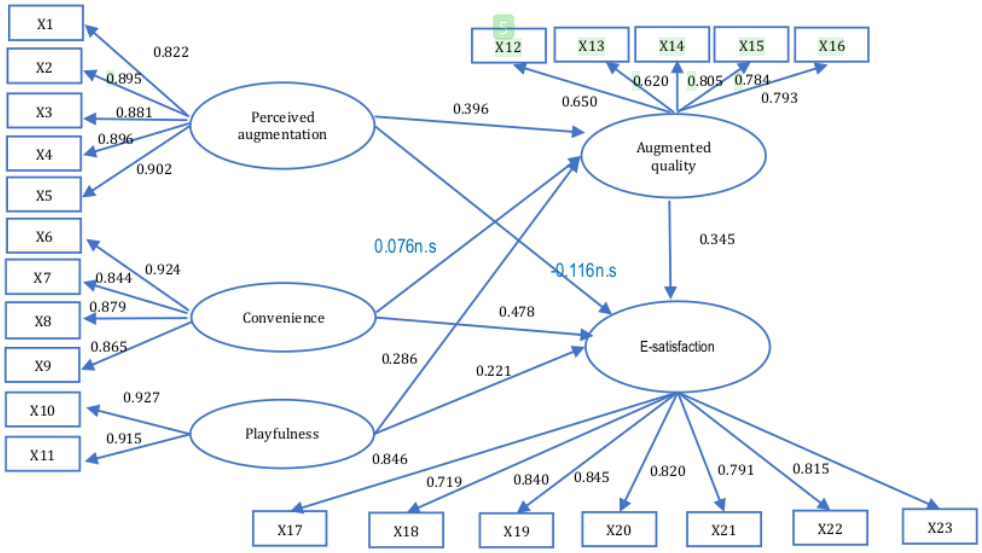
	Direct effect	Indirect effect	Total effect
Perceived augmentation -> Augmented quality	0.396	-	0.396
Perceived augmentation -> E- satisfaction	-0.116n.s	0.136	0.020n.s
Convenience -> Augmented quality	0.076n.s	-	0.076n.s
Convenience -> E- satisfaction	0.478	0.026n.s	0.505
Playfulness -> Augmented quality	0.286	-	0.286
Playfulness -> E- satisfaction	0.221	0.099n.s	0.320
Augmented quality -> E-satisfaction	0.345	-	0.345

Note: n.s = non-significant at alpha 0.05

The outer Variance Inflation Factor (VIF) score < 5 and the inner Variance Inflation Factor (VIF) < 4 in each variable indicated the absence of multicollinearity among variables. The value of R^2, *s* which can be explained by augmented quality is 50.3% and e-satisfaction is 69.9%.

The relationship between each of the latent variables is indicated in Figure 2 below.

Figure 2. Structural result model of PLS-SEM



Note: n.s = non-significant at alpha 0.05

5. Discussions

The results indicated that 5 of the 7 hypotheses proved. The dimensions of augmented reality experiences that significantly affect augmented quality are perceived augmentation and playfulness. Playfulness is a non functional benefit that consumers perceive by using AR when shopping online. These benefits are related to the emotional and social level of the consumers (Menon and Kahn 2002). While convenience is a functional benefit that consumers receive from the use of AR when shopping online (Forsythe, Liu, Shannon, and Gardner 2006). These benefits are related to convenience, product type, quality, and price (Bhatnagar and Ghose 2004).

The use of AR in the online shopping process significantly provides both these benefits. The presence of online shopping has provided many benefits and convenience for consumers compared to traditional shopping. However, on the other hand, online shopping also carries risks. One of the risks is products that are not in accordance with consumer expectations. This happens because consumers are not able to touch, see from various dimensions, and try directly the products before deciding to make a purchase. Consumers rely heavily on images displayed on e-commerce. This risk affects the consumer's desires to make a purchase. According to Bhatnagar and Ghose (2004), although the benefits offered by online shopping are numerous, consumers are more concerned about the risks they face than the benefits they may have.

The presence of AR has enabled consumers to experience trying, interacting and evaluating products as if they were in the actual store (Wojciechowski and Cellary 2013). The presence of AR produces output in the form of augmented quality higher than without AR. Augmented quality will ultimately affect their behavioral intentions for shopping. This result is in accordance with Poushneh (2018). Poushneh (2018) analyzed the effect of augmentation quality on customer satisfaction. The results obtained proved significant and positive, although it employed different dimensions; image recognition, correspondence quality, information quality, and access to user's personal information. In this study augmentation quality is measured through 5 attributes; AR in the online shopping app has many features, AR is very interesting and produces high output quality, AR is very easy to use, AR does not require any enhancements other than smartphones, tablets or laptops, AR capability to adjust with users is very high, AR can be used anytime and anywhere. These five attributes have covered both attributes proposed by Poushneh (2018); correspondence quality and information quality. Furthermore, convenience and playfulness significantly affect e-satisfaction. These results are consistent with Childers, Carr, Peck, and Carson (2001), Moon and Kim (2001) and Forsythe, Liu, Shannon, and Gardner (2006). This is indicated by the absence of augmented quality, the existence of convenience and playfulness when using AR has been able to bring to the user satisfaction. While perceived augmentation proved not significantly affect user satisfaction. Perceived augmentation is the user's perception of AR application (Song and Zinkhan 2008).

These variables include applications, features, and technologies that users perceive when using AR. The results of this study prove that the physical and technical aspects of AR do not affect the satisfaction of users directly. However, feelings, emotions and comfort felt when using AR are two very important variables for the user. In this study, playfulness measured through AR gives me a new experience, AR simplifies online shopping while convenience measured through AR in online shopping provides more attractive feature choices, AR in online shopping improves the quality of information delivery, online shopping using AR provides a variety of product options, online shopping using AR provides more options to view or try products in the real world. These attributes generally correspond to Moon and Kim (2001) and Forsythe, Liu, Shannon, and Gardner (2006).

The total effects of convenience (coeff. = 0.478) and playfulness (coeff. = 0.221) to e-satisfaction are higher than direct effect of each variable (coeff. = 0.505 and coeff. = 0.320, respectively). This result indicated the great effect of augmented quality as moderating variable to e-satisfaction. Augmented quality also significantly affects e-satisfaction (coeff. = 0.345). This result is in accordance with Szymanski and Hise (2000), Shankar, Smith, and Rangaswamy (2003), Bressolles, Durrieu, and Senecal (2014). An AR application which capable of delivering high AR output quality will lead to e-satisfaction. Thus, managers should not only focus on AR applications, features and technologies, but also on how they produce image quality, correspondence quality, and high quality information. In Indonesia, the application of augmented reality is still considered new. There has not many companies used this application yet. The results of this study indicated that significant AR applications will increase consumer satisfaction when shopping online. Although the effect of e-satisfaction on consumer behavioral intentions, such as re-purchase is not analyzed in this study, but from prior studies it has also proven to have a positive effect. Consumers who satisfy with AR have a greater chance to shop online. This is because the risks they face against product disguise are reduced. This application enables companies to reach a segment of consumers who did not believe in shopping online.

Conclusions and limitations

In this study, the relationship between augmented reality experiences with augmented quality and e-satisfaction is confirmed. Perceived augmentation and playfulness directly affect augmented quality (coeff. = 0.396 and 0.286, respectively) while convenience and playfulness directly affect e-satisfaction (coeff. = 0.478 and 0.221, respectively). Convenience gives a greater total effect on e-satisfaction than playfulness. Perceived augmentation gives a greater total effect on augmented quality than playfulness. The presence of augmented quality significantly increases the influence of convenience and playfulness on e-satisfaction. However, this study has some limitations. The first is the small number of samples and this study assume the use of AR applications on all sites and online shopping apps, but not specifically divide or use AR applications on specific brands or products. Further research that discusses the relationship between latent variables in a particular brand or product is strongly recommended.

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Appendix A

Table A.1. Variables and attributes used in the study

Latent variables	Labels	Attributes
Perceived augmentation	X4	AR helps me to visualize virtual objects become visible
	X5	AR provides information about virtual objects
	X6	AR is an excellent medium for delivering messages with texts, sounds, images, videos, animations
	X9	AR makes the app more interactive
	X10	Online shopping apps that use AR are more memorable and special
Convenience	X11	Shopping online using AR provides more choices of interesting features
	X22	I feel AR in online shopping improves the quality of information delivery
	X23	Online shopping using AR provides a variety of product options
	X24	Online shopping using AR gives you more options to view or try products in the real world
Playfulness	X8	Using an app with AR feature gives me a new experience
	X19	The use of AR in the app simplifies the online shopping process
Augmented quality	X7	AR on online shopping app has many features, is very interesting and produces high quality output
	X12	AR is very easy to use
	X14	AR does not require any enhancements other than smartphones, tablets, or laptops
	X15	The ability of AR to adjust with users is very high
	X16	AR can be used anytime and anywhere
E-Satisfaction	X17	Online shopping with AR makes it easy to access reviews and ratings from other customers
	X18	AR can be accessed easily
	X20	Shopping online using the AR feature is more efficient and effective
	X21	I feel AR in online shopping provides more information
	X25	Information accessed through AR provides satisfaction in online shopping
	X26	I would be more interested in choosing an online shopping app that uses AR
	X27	Online shopping with AR features is more satisfying as I can visualize products in the real world

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