Electron Commer Res (2015) 15:269–295
DOI 10.1007/s10660-014-9163-2

A model of acceptance of augmented-reality interactive technology: the moderating role of cognitive innovativeness

Tseng-Lung Huang · Shuling Liao

Published online: 12 November 2014

Abstract This research integrates the technology acceptance model and concepts of experiential value to investigate factors that affect sustainable relationship behavior toward using augmented-reality interactive technology (ARIT). In line with consumers' innovativeness, this research discovers that consumers' level of cognitive innovativeness affects their sustainable relationship behaviors toward using ARIT. Online consumers with high cognitive innovativeness put more emphasis on usefulness, aesthetics, and service excellence presented by ARIT; in contrast, those with low cognitive innovativeness focus on playfulness and ease of use presented by ARIT.

Keywords Augmented-reality interactive technology · Technology acceptance model · Experiential value · Cognitive innovativeness

1 Introduction

In today's global economy, innovation plays an important role in the development of technology. To respond to advances in online interactive media technology, retailers must break from existing service models [5,35,77]. For example, many clothing retailers use augmented-reality interactive technology (ARIT) to enable consumers to try on clothes online [9,37]. ARIT not only recreates the physical experience of trying on clothes but, more important, displays the face shape, hair color, skin color, and body shape of each customer on the screen. This enables consumers to move beyond static images of the clothes to immediately see the effect of trying on the clothes, saving time and energy [25,73]. Therefore, exploringwhich factors affect consumers' continued

T.-L. Huang (✉) · S. Liao
College of Management, Yuan Ze University, Chung-Li, Tao-Yuan 32003, Taiwan
e-mail: blessing@saturn.yzu.edu.tw; long728@mail2000.com.tw

S. Liao
e-mail: ibslliao@saturn.yzu.edu.tw; ibslliao@gmail.com

use of ARIT is an important line of research [37,38,77]. To encourage consumers to continue using interactive technology, retailers should provide important inducements [26,63] and ensure that the technology offers unique benefits and values [14].

Relationship marketing research focuses on how firms can build productive, interactive, sustainable relationships with customers. Studies emphasize not only consumers' intentions to use interactive technology in the future but the means by which firms can encourage consumers to keep using this technology [6,14,77]. The three elements of sustainable relationship behavior—relational behavior, relationship investment, and repatronage intentions—can be used to predict consumers' intentions to continue using information technology [7,56,69]. Despite its importance, there are few studies on sustainable relationship behavior and the use of ARIT, and most studies have examined only intentions to use ARIT [37,38,77].

The technology acceptance model (TAM) is widely used to explain how firms and individuals adopt new technology [11]. To extend the model, the present study uses the TAM to predict which factors may affect consumers' sustainable relationship behavior toward using ARIT. The experience of using augmented reality offers consumers a great variety of values and benefits [37,38,47] such as entertainment value, ease of use, and speeding up process of purchase decision-making. Companies should view ARIT as a type of persuasive technology that forms and delivers experiential value rather than only a functional technology [23]. If companies intend to turn first-time visitors into repeat online buyers, the online retail experience has to deliver unique value [70]. Thus, the present study integrates the TAM and concepts of experiential value to develop a research model that predicts which factors will affect consumers' sustainable relationship behavior toward using ARIT.

Researchers have investigated consumers' willingness to continue using interactive technology [77]. They have found that future using intentions and the characteristics of consumers have a significant positive effect on consumers' continued use of interactive technology [37,38,68]. Existing studies on interactive technology also suggest that a consumer's level of innovativeness affects his or her acceptance of innovative interactive technology and ARIT in particular [37,38]. For example, early adopters of innovative technology have a significantly different level of acceptance of innovative interactive technology than others such as late adopters [74]. Nevertheless, it remains unknown by the current study results whether or not consumers who have different innovative involvement would be concerned about different factors of technology acceptance [77]. To fill such void, the present study not only includes consumers' level of involvement with innovation in the research framework but also investigate which factors may elicit positive sustainable relationship behavior among consumers with different levels of cognitive innovativeness.

2 Theoretical background

2.1 Augmented-reality interactive technology

Compared to virtual reality technology, ARIT is a more advanced image interactivity technology which consists of web site features that enable creation and manipula-

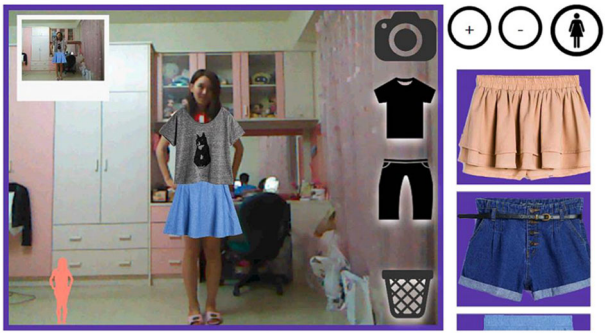


Fig. 1 Augmented-reality interactive technology (ARIT)

tion of product or environment images to simulate users' actual experience with the product or environment [75]. For example, virtual reality technologies fully immerse online consumers inside a synthetic environment, yet consumers can't see the physical reality around them [22]. Contrarily, ARIT in Fig. 1 allows online consumers to zoom in on product features, rotate and view the product from different angles, and view the product in various colors on a virtual model created to imitate consumers' appearance. ARIT can deliver product information that closely resembles the information acquired from examining the product directly, thereby reducing product risk. In short, ARIT allows online consumers to see dimensional virtual objects superimposed upon the real world [27]. Previous studies have indicated that ARIT fulfill the following characteristics: (1) combining both real and virtual contents and aligning real and virtual objects with each other, (2) interactive and performing in real time, and (3) virtual contents registered with the real world [3,75].

According to the above characteristics of ARIT and through ARIT's webcam function, it is able to instantly reflect online consumers' facial expressions, figures, and environments on the computer screen, and also able to integrate virtual objects directly on the figure of the online consumer, achieving the same effects as if they were trying it on in reality [37,38]. On the other hand, the control of the order of presentation in ARIT is decided by online consumers. It is able to simultaneously reflect the body movements of the consumer on the screen without any lag. Online consumers can therefore freely view product content in accordance with their own needs and in any order, such as clothing styles, size, or color category without being subjected to any restrictions. In sum, ARIT takes a first person perspective to shape an online shopping experience, such as online fitting the clothes.

2.2 Experiential value & consumers' sustainable relationship behavior

Perceived value has been characterized as the essential outcome of marketing activity and a primary motivation for customers to enter into marketing relationships [4,30]. Mathwick et al. [46] suggested that experiential value helps retailers create and manage relationships between consumers and service providers. For instance, the value consumers receive as a result of an experience with a service provider motivates them

to create a sustainable relationship with that provider [55]. If a company intends to transform first-time buyers into loyal consumers, it needs to consistently deliver unique value in every purchasing experience [70]. This is exemplified by the fact that some clothing retailers have positioned themselves as providers of an experience rather than providers of only a service or product [57].

Therefore, an interactive technology can become a persuasive technology that convinces consumers [23]; it is not only a technology tool to provide usage functions, but also important to provide users vicarious and interactive simulation experience. Such interactive experience could help people rehearse a behavior and at the same time enhance using motivation and persuasion effects [23], due to its richness in utilitarian and hedonic values and grappling with consumers' demands [22,46].

Taken together, ARIT that creates interactive simulation experience can not only deliver product information that closely resembles the information acquired from examining the product directly to reduce product risk, but also provide multisensory simulation experience such as visual and haptic to enrich playful shopping experience. It should be viewed as a form of persuasive technology that can create and deliver experiential value rather than just a functional technology [23,47]. The creation of experiential value not only mitigates the high risk that leads to low intentions to purchase but increases consumers' confidence in online shopping [46]. To e-tailers, shopping experiences simulated by using ARIT not only increase consumers' perceptions of the value of prior purchases but create value in the form of visual satisfaction, enjoyment, playfulness, and efficiency and all of such increase consumers' willingness to make online purchases in a simulated shopping experience [37,38]. This coincides with the perspective of relationship marketing paradigm that perceived benefits or values are the most critical factors in customers maintaining and investing in a relationship with interactive technology.

Leuthesser and Kohli [40] indicated that sustainable relationship behavior mainly consists of several types based on the extent to which information is disclosed and mutually shared; the degree to which both parties continue to invest time and energy in interaction behavior; and the richness of interactive communication content and etc. According to the above definitions, there are three aspects of consumers' sustainable relationship behavior: (1) relationship willingness: the willingness of consumers to maintain a new interactive relationship by providing or renewing personal information [56]; (2) relationship investment: the time and effort consumers spend to maintain an interactive relationship with a service provider [69]; and (3) repatronage intention: the willingness of consumers to use a service again [7]. In our study, measuring sustainable relationship behavior can reveal the extent of consumers' sustainable relationship with a given retailer who applies ARIT. The experiential value will be the most critical factor that encourages consumers' sustainable relationship behavior toward using ARIT.

Fiore et al. [22] asserted that image interactivity technology, such as ARIT, offers consumers both utilitarian and hedonic values and these values positively trigger the willingness of consumers to reuse image interactivity technology. As suggested by Mathwick et al. [46], there are four types of experiential value, including consumer return on investment, aesthetics, service excellence, and playfulness. The following introduces the relationships between four types of experiential value and consumers' sustainable relationship behavior.

2.2.1 *Consumer return on investment, TAM & consumers' sustainable relationship behavior*

Consumer return on investment includes returns on finance, time, behavior, and mental investment in acquiring rewards and benefits [46]. Parallel to the concept of consumer return on investment, perceived usefulness in the TAM reflects relative advantage of innovation adoption [63], which is the extent to which a new technology is perceived as better than its precursor; meanwhile, perceived ease of use reflects complexity, which is the degree to which an innovative technology is perceived as difficult to understand and use [10,50,84]. Both perceived usefulness and perceived ease of use are rewards and benefits of using technology [14,17,18]. Accordingly, the present study measures perceived usefulness and perceived ease of use instead of consumer return on investment.

The TAM is widely used to predict how and in what situations corporations or individuals adopt a new technology [17,18,41], for example, iPod [74]. The model is also used to predict and explain motivation and willingness of consumers to adopt a blog [31]. In fact, more than 424 journal articles in this field have applied the TAM to predict acceptance and future use of new information technologies [78]. Likewise, the TAM is suitable for predicting benefits that are the most critical in inspiring consumers to maintain a loyal relationship with an interactive technology [14], including ARIT.

The TAM suggests that consumers' intentions to use interactive technology are strongly affected by the perceived usefulness and ease of use of the information system [17]. Perceived ease of use implicates that the user does not need to exhaust too many cognitive resources for using a technology [17,18]. In this case, perceived ease of use does not affect behavior directly but influences it indirectly through perceived usefulness [18]. It is evidenced by recent studies that ease of use has an indirect effect on intentions to use a given technology [10]. On the other hand, perceived usefulness can be characterized as how an individual thinks about the probability of improving performance on tasks through use of a given technology. In the present study, perceived usefulness refers to the ability of the ARIT system to help consumers try on, match with, and purchase costumes and outfits. Specifically, we measure how people will be willing to continue using an ARIT technology for completing a clothing fitting task based on if the ARIT provides correct and useful product information (such as size, color, and collection) and improves consumers' ability to make decisions when purchasing clothes. For such a purpose, perceived usefulness is central to the ARIT online shopping task. Compared to perceived usefulness, perceived ease of use is indirect in influencing intentions to use a given technology [10].

As both perceived usefulness and perceived ease of use assess benefits of using an interactive technology, to receive such benefits, consumers will maintain a loyal relationship and engage in sustainable relationship behavior with an interactive technology as suggested by the relationship marketing paradigm [14]. Therefore, perceived usefulness and perceived ease of use can be seen as the most critical factors that encourage consumers' sustainable relationship behavior with regard to using an interactive technology such as ARIT. In particular, perceived usefulness influences sustainable relationship behavior for using technology directly, whereas perceived ease of use has an indirect effect on this behavior. Premkumar and Bhattacherjee [60] have also

proposed that perceived usefulness has a significant effect on continual usage of information technology when perceived ease of use falls short of significant and direct effects.

2.2.2 Aesthetics & consumers' sustainable relationship behavior

The aesthetics of online retailing encompasses visual appeal and entertainment value [46]. Visual appeal is formed by the stimulation of picture and body's appeal and internal gracefulness [29]; thus, aesthetics can be controlled through design, color, virtual reality, and vividness [46]. Entertainment value comes from consumers' enjoyment of the online shopping experience [4]. Hence, the aesthetic value fits the construct of sensory experiential value proposed by Holbrook [30]. Both visual appeal and entertainment of the aesthetical experience delivered by ARIT offer an immediate online retailing environment that facilitates smooth accomplishment of consumers' specific shopping tasks. For apparel buying, visual attractiveness by fitting clothing to a consumer's body figure [21,24] and by clothing worn together [48] is central to both rational purchase decisions and utilitarian experience for consumers. In this case, aesthetics is not only the critical factor that affects how one can use ARIT to successfully accomplish a shopping task but also the most important factor for the consumer to maintain and invest in a relationship with the retailer that employs ARIT.

2.2.3 Service excellence & consumers' sustainable relationship behavior

Being the core of the service operation paradigm, service excellence correlated with service quality is manifested in the performance result [53]. Service excellence, through professional evaluations and performance outcomes, also indicates consumers' appreciation of a service provider's delivery on its promise [85]. This kind of value can be acquired through the consumer's appraisal and evaluation of services or products [46]. To achieve better customer evaluation, online retailers would expect ARIT to deliver a shopping service that is similar to that experienced in a physical shop [37,38]. van Krevelen and Poelman [75] suggested that ARIT is a more advanced image interactivity technology than virtual reality technology, owing to its website features that create and manipulate product or environment-related images for simulation purposes. The 3D visuotactile can be synchronously paired with haptic imagery that simulates real touch in creating an effect of having control of the real object, to successfully shape ARIT's sense of body ownership and ownership control [34,54,64,67]. When service quality of an online shopping experience through ARIT is perceived as good as that in a physical store (e.g., customers can try on clothes or choose from all kinds of clothes and other effects), online consumers will directly evaluate quality of services or products through haptic simulation presented by ARIT. Like aesthetics, service excellence is central to the ARIT shopping experience and directly affects consumers' completion of a specific shopping task. Therefore, service excellence is another primary feature that will boost consumers' sustainable relationship behavior toward using ARIT.

2.2.4 Playfulness & consumers' sustainable relationship behavior

Playfulness in the online retail environment can take the form of fun or escapism, allowing consumers to temporarily escape from reality and feel enjoyment while shopping [46]. ARIT lends playfulness to the online shopping experience in addition to facilitating product evaluation [37,38]. For example, in a simulated experience created by ARIT, an interesting atmosphere is used to generate enjoyment [73]. Moreover, the playfulness provided by interaction with ARIT while shopping online is likely to create more positive attitudes [37,38]. Customer value paradigms indicate that playfulness is a hedonic value rather than a functional value [30]. In other words, playfulness only indirectly affects consumers' completion of a specific shopping task by creating a fun atmosphere and has no direct relation with the delivery of visual image of costume match, unlike aesthetics and service excellence. Therefore, playfulness can be viewed as a secondary rather than primary feature of the online shopping experience created by ARIT.

3 Hypotheses development

3.1 Effects of presence on experiential value

DeLone and McLean [19] suggested that measures of interactive technology quality, including information quality and system quality, are important to the success of an information system. Tang et al. [73] employed the concept of presence to express both the information quality and system quality of ARIT for the following reasons. First, it is evident with empirical support that presence is important for measuring the success of ARIT [73]. Second, the degree of presence in ARIT is greater than that in other types of information technology (such as virtual reality) and users of ARIT are generally more confident making bodily motions than users of 2D information technology [37,38,49]. Third, despite its usefulness, many people resist using ARIT because of the adverse physiological reactions, such as nausea, headache, and eyestrain, caused by poor visual design [73]. In correspondence to these reasons, Tang et al. [73] proposed presence in ARIT to be composed of four elements: sense of physical space, engagement, ecological validity, and negative effects. *Sense of physical space* refers to the consumer's perception of space, *engagement* represents the strong visual attraction for consumers, *ecological validity* is the degree to which the consumer perceives reality in the simulated environment, and *negative effects* refers to the unease resulting from the visual stimulation [39].

As both information quality and system quality affect the benefits users perceive from using the information technology (e.g., usefulness, ease of use) [42], we hence postulate that the quality of ARIT as measured by presence will affect users' perceived benefits.

H1 Presence has positive effects on consumers' (a) perceived usefulness, (b) perceived ease of use, (c) perceived aesthetics, (d) perceived service excellence, and (e) perceived playfulness of ARIT.

3.2 The moderating role of cognitive innovativeness

Different characteristics of consumers with respect to innovation will greatly influence consumers' acceptance of innovative interactive technology [74]. Liu et al. [43] added personal innovativeness [1] to their model, with the construct being defined as an individual's disposition toward trying any new information technology. Individuals with higher levels of innovativeness are more likely than those with lower levels to develop positive beliefs about innovations. Dabholkar and Bagozzi [16] examined the moderating effects of novelty seeking on the relationship between beliefs (ease of use, performance, and fun) and attitude toward using a technology-based self-service. Kim and Forsythe [37,38] suggested that two consumer traits, technology anxiety and innovativeness, may directly affect a consumer's intended use of new interactive technology regardless of his or her attitude toward using new interactive technology. In particular, consumers with high cognitive innovativeness are more likely to adopt an innovation (e.g., innovative technology) [82]. Early adopters with high cognitive innovativeness for new technology products look out innovation and technology to achieve performance and thus pay attention to key features of the new technology that can help them accomplish a task directly [82]. In contrast, consumers with low cognitive innovativeness lack ability, knowledge, and involvement with regard to new technology; they are insensitive to the effect of the new technology in accomplishing a task. Since the factors that affect how each group adopts new technology are different [28], consumers' cognitive innovativeness would moderate the impact of usefulness, service excellence, aesthetics, ease of use, and playfulness on consumers' sustainable relationship behavior toward using ARIT. Yet, the role of cognitive innovativeness on the use of innovative technology, particularly sustainable relationship behavior toward using ARIT, has been little examined.

Venkatesh et al. [79] advocated that when people focus on goal achievement and pursuit of performance, they would not hesitate to spend time and cost in solving problems by the moment, neither would they care the amount of time and effort consumed in the process of goal attainment. Therefore, individuals who pursue goals will focus on task performance and accentuate on perceived usefulness rather than emphasizing on how effortless to reach the goal, that is, perceived ease of use [78]. High cognitive innovative consumers not only enjoy thinking for its own sake, but also have a propensity to devote a great deal of mental energy to solve problems they encounter [82]. Comparatively, perceived usefulness is more important than perceived ease of use for high cognitive innovative consumers. As Venkatraman [80] found that complexity or perceived ease of using products will create no impact given cognitive innovators enjoy thinking and mental exertions, we thus hypothesize the following:
H2 A higher level of cognitive innovativeness in terms of perceived usefulness will positively affect consumers' sustainable relationship behavior toward using ARIT.

Because ARIT can create vivid and lifelike image interactivity, it provides consumers with rich sensory of product trial experience, such as drape and fit of clothes on body [22]. Past studies also indicated that the effects between consumers and merchandise, apparel merchandise visual effects, and consumers' figurative images of the body have become very important for rational purchase decision-making and

utilitarian experience for consumers' apparel buying [21,24,48]. Aesthetics and easy accomplishment of consumers' apparel shopping task thus are inextricably linked [72]. Therefore, aesthetics will be the most important for high cognitive innovativeness consumers. We thus hypothesize the following:

H3 A higher level of cognitive innovativeness in terms of perceived aesthetics will positively affect consumers' sustainable relationship behavior toward using ARIT.

As ARIT uses 3D visuotactile to create visual and haptic synchronously integrated imagery, it allows consumers to simulate the touch feelings [34,54,64,67,75] and be able to successfully evaluate the merits of the quality of goods and services. The service excellence delivered by ARIT will be the critical factor that enables consumers to smoothly accomplish their apparel shopping tasks. This tendency will be particularly true to consumers who are high cognitive innovative since their emphasis is more on the outcome of a shopping task rather than the process. Accordingly, we propose Hypotheses 4:

H4 A higher level of cognitive innovativeness in terms of perceived service excellence will positively affect consumers' sustainable relationship behavior toward using ARIT.

Compared to consumers with high cognitive innovativeness, low cognitive innovative consumers are less likely to willingly make efforts to overcome constraints that hurdle their goal achievement, since they care more on the magnitude of the effort involved rather the outcome of a task [82]. Perceived ease of use implicates that the user care more about if cognitive resources demanded in using a new technology are as low as possible [17,18]. Accordingly, the perceived ease or difficulty of using a technology is expected to be critical for low cognitive innovative consumers to decide if they would adopt (or reject) a new technology for their online apparel shopping. We thus hypothesize the following:

H5 A lower level of cognitive innovativeness in terms of perceived ease of use will positively affect perceived usefulness.

Since cognitive innovators seek novelty, they will consider newness of a product a pivotal determinant in their decisions to adopt. They are also likely to evaluate an innovation's relative advantage and consider this important in the purchase decision [80]. New products' functional, practical attributes are especially crucial to cognitive innovative consumers [81]. Venkatraman and Price [82] found that cognitive innovators act less impulsive and they agree with statements such as "I generally rely on careful thinking to make up my mind" and "I am not an impulse buyer." Conversely, consumers with low cognitive innovativeness tend to be impulsive and have a strong preference for emotive elements, compared to high cognitive innovative consumers. Therefore, consumers with low cognitive innovativeness are attracted by hedonic products and services that are enjoyable and with fun and playfulness. We thus postulate that compared to those with higher levels of cognitive innovativeness, online shoppers with lower levels of cognitive innovativeness will develop stronger beliefs about the ARIT system's playfulness and ease of use than about its usefulness, service excellence, and aesthetics effects. Hypotheses 6 and 7 are as follows:

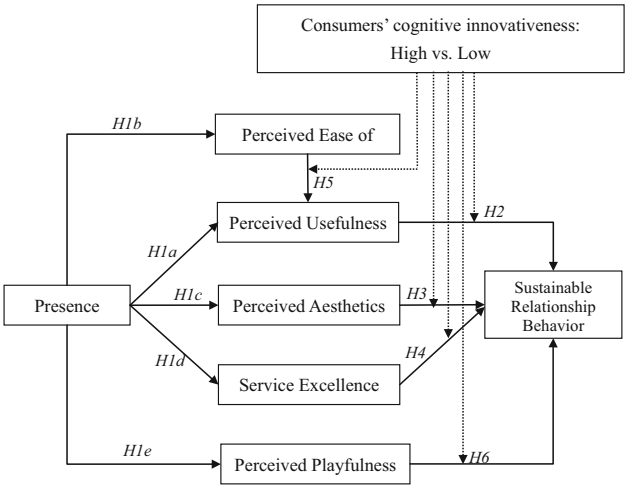


Fig. 2 Research model

H6 A lower level of cognitive innovativeness in terms of perceived playfulness will positively affect consumers' sustainable relationship behavior toward using ARIT.

H7 Consumers' cognitive innovativeness will moderate the influence of usefulness, service excellence, aesthetics, ease of use, and playfulness on sustainable relationship behavior toward using ARIT.

Based on the preceding literature review and hypotheses development, the research framework of the present study is shown in Fig. 2.

4 Methodology

4.1 Sample and data collection procedures

The study population consisted of young undergraduate and graduate students at a private university in Taipei, Taiwan. The students were first sent a link to the website of an online clothing retailer and then experienced an online fitting through ARIT. Next, the participants were led to another web page, where they completed a questionnaire about their ARIT usage experience. All questionnaires were self-administered. The testing process was completed when the participants submitted their responses. A total of 220 valid questionnaires were collected. Of the participants, 47 % were male and 53 % female; 29 % were younger than 20 years old, 54 % were 20 to 24, and 17 % were older than 25; 54 % had a bachelor's degree and 46 % had a graduate degree; and 46 % had a monthly disposable income of less than 5,000 TWD, 20 % had an income of 5,001 TWD to 10,000 TWD, 14 % had an income of 10,001 TWD to 20,000 TWD, and 20 % had an income of more than 20,000 TWD.

4.2 Questionnaire design and measures

The questionnaire was adapted from previous studies (see Appendix 1). The questions on the perception of presence (a second-order factor), with regard to the four dimensions of sense of physical space, engagement, ecological validity, and negative effects, were mainly adopted from Tang et al. [73]. The questions on perceived usefulness (a first-order factor) and perceived ease of use (a first-order factor) were based on Kim and Forsythe [38]. The questions on perceived aesthetics, perceived service excellence, and perceived playfulness (all first-order factors) were based on Mathwick et al. [46] and Keng and Ting [36]. The questions on sustainable relationship behavior (a second-order factor), with regard to the three dimensions of relational behavior, relationship investment, and repatronage intentions, were mainly modified from Blodgett et al. [7], Phelps et al. [56], and Smith and Barclay [69,83]. Finally, the questions on consumers' cognitive innovativeness (a first-order factor) were adopted from Venkatraman and Price [82]. We conducted a pilot study with 30 online shoppers before finalizing the questionnaires to optimize language in each question and flow between questions. Responses to all questions were measured using a 5-point Likert scale, ranging from "strongly disagree (1)" to "strongly agree (5)."

5 Data analysis and results

According to the suggestions of previous empirical studies, we calculated participants' level of cognitive innovativeness by determining the average mean score on the cognitive innovativeness scale and then using mean splits to recode participants as scoring high or low on cognitive innovativeness [32]. A total of 119 participants scored high on cognitive innovativeness and 101 scored low. The resulting standardized item alpha for the cognitive innovativeness scale was .81.

Because all of the data were collected from a single source, the potential for common method variance existed. This study conducted Harman's single-factor test [58] with confirmatory factor analysis (CFA) to determine whether all of the manifested items were modeled as indicators of a single factor [45]. Given that CFA represents a more sophisticated approach [59], a substantial amount of common method variance is present if the single-factor model fits the data [51]. The results revealed that the one-factor model fit the data poorly: $\chi^2/df = 4.59$, comparative fit index (CFI) = 0.93, nonnormed fit index (NNFI) = 0.93, and root mean square error of approximation (RMSEA) = 0.14. However, the fit of the seven-factor model was satisfactory ($p < 0.001$) : $\chi^2/\text{df} = 2.07$, CFI = 0.98, NNFI = 0.98, and RMSEA =0.07. Thus, the potential problem of common method bias was excluded in our study.

5.1 Equivalence of measurement models across the two cognitive innovativeness groups

We used CFA to test the adequacy of the measurement models in both the high and low cognitive innovativeness groups. First, the validity of the measurement model

in the high cognitive innovativeness group was evaluated. High levels of variance in the measures were captured by the latent constructs, as all loadings were highly significant or almost highly significant and almost all standardized loadings were above 0.5, indicating acceptable convergent validity (see Table 1). Examination of the measurement model in the low cognitive innovativeness showed that the latent constructs captured high levels of variance in the measures, as all loadings were highly significant and almost all standardized loadings were above 0.5, indicating acceptable convergent validity (see Table 1). According to Table 1, Cronbach's alpha values for the constructs ranging from 0.76 to 0.91 all exceed .70, indicating high internal consistency of the measure reliability [52]. For discriminant validity, as shown in the correlation matrix in Table 2, the values of the square root of AVE for the measures on the diagonal all exceeded the correlations among the measures off the diagonal, indicating satisfactory discriminant validity.

To assess the equivalence of the measurements across the two cognitive innovativeness groups, we conducted the hierarchical tests outlined by Bollen [8]. Table 3 summarizes these assessments. The model without constraints provided a baseline chi-square for further comparisons. The results revealed a good measurement model fit: $\chi^2_{(418)} = 734.66$, NNFI $= 0.97$, CFI $= 0.98$, and RMSEA = 0.078. The factor loading invariance was then constrained. The non-significant chi-square difference between this model (Model 2 in Table 3) and the baseline model showed that the factor loadings of the two measurement models were invariant, $\Delta\,\chi^2_{(16)} = 9.21$, not significant at $p < 0.05$. Then the equality of the latent variables' error variances was tested across the two groups. The results indicated that these constraints decreased the chi-square significantly, $\Delta\,\chi^2_{(23)} = 35.7$, significant at $p < 0.05$. Steenkamp and Baumgartner [71] recommended that researchers should free the error which is the largest modification index in order to resolve this kind of problem. The results revealed that the nonsignificant difference in the chi-square between this model (Model 3) and Model 2 indicated that the error variances were invariant, $\Delta\,\chi^2_{(22)} = 32.7$, not significant at $p < 0.05$. The equality of variances and covariance of the latent variables across the two groups was then evaluated. The results revealed that the insignificant difference in the chi-square between these constraints (Model 4) and Model 3 indicated that the variances and covariance of the latent variables of the two measurement models were invariant, $\Delta\,\chi^2_{(28)} = 29.49$, not significant at $p < 0.05$. These analyses demonstrated that the measurement models were invariant across the two cognitive innovativeness groups at the pattern, loading (lambda), error, and covariance levels.

Next, we examined equivalence using the recommended steps outlined in previous studies [2,13,33]. Model 2 in Table 3 provides the factor loadings and item intercepts of all items for equivalence testing, and the results showed that such standards were in compliance with equivalence [13]; in other words, all factor loadings and item intercepts were equivalent between the two cognitive innovativeness groups. As the two groups met full configural, partial metric, partial scalar invariance of the standards, it allowed a follow-up invariance comparison between two structural models.

We then evaluated the validity of the final model (see Table 4). The latent constructs captured high levels of variance in the measures, as all loadings were highly significant and all standardized loadings were above 0.5 except for Presence 4, indicating accept-

Table 1 Measurement models in high and low cognitive innovativeness groups

Measurement models in high and low cognitive innovativeness	Common metric completely standardized solution (t value) in high cognitive innovativeness	Common metric completely standardized solution (t value) in low cognitive innovativeness	Cronbach alpha in high cognitive innovativeness	Cronbach alpha in high cognitive innovativeness
Presence 1	0.87	0.88	0.82	0.83
Presence 2	0.87 (11.85)	0.87 (11.80)		
Presence 3	0.76 (9.78)	0.81 (10.39)		
Presence 4	−0.42 (−4.63)	−0.44 (−4.53)		
Ease 1	0.80	0.80	0.82	0.91
Ease 2	0.71 (7.81)	0.85 (9.52)		
Ease 3	0.77 (8.63)	0.79 (8.65)		
Ease 4	0.68 (7.41)	0.83 (9.22)		
Usefulness 1	0.88	0.88	0.88	0.89
Usefulness 2	0.86 (12.23)	0.88 (12.00)		
Usefulness 3	0.79 (10.66)	0.77 (9.55)		
Usefulness 4	0.70 (8.80)	0.89 (12.58)		
Service excellence 1	0.84	0.81	0.76	0.77
Service excellence 2	0.73 (8.60)	0.77 (7.85)		
Aesthetics 1	0.75	0.81	0.85	0.84
Aesthetics 2	0.83 (9.04)	0.79 (9.09)		
Aesthetics 3	0.86 (9.39)	0.78 (8.91)		
Playfulness 1	0.90	0.78	0.85	0.80
Playfulness 2	0.86 (10.86)	0.79 (7.26)		
Playfulness 3	0.69 (8.31)	0.69 (6.51)		
Behavior 1	0.91	0.90	0.90	0.91
Behavior 2	0.86 (13.40)	0.83 (11.38)		
Behavior 3	0.85 (13.06)	0.89 (13.16)		
χ^2/df	1.80	1.71		
NNFI	0.97	0.97		
CFI	0.97	0.98		
RMSEA	0.076	0.080		

All measurement coefficients are significant at $p < .05$

able convergent validity. This measurement model with loading and error invariance was used for the subsequent structural model analyses.

5.2 Hypotheses tests

Figure 3 shows the results for the high cognitive innovativeness group. The overall fit of the structural model was $\chi^2/df = 1.91$, NNFI = 0.96, CFI = 0.97, and RMSEA

Table 2 Correlations and square root of the average variance extracted

Construct name	AE	PEU	PL	PR	SRB	SE	PU
AE	**0.88**						
PEU	0.67	**0.84**					
PL	0.54	0.33	**0.86**				
PR	0.75	0.63	0.45	**0.82**			
SRB	0.74	0.66	0.54	0.67	**0.92**		
SE	0.73	0.61	0.49	0.67	0.69	**0.91**	
PU	0.69	0.66	0.46	0.63	0.75	0.67	**0.88**

Note: n = 220. Values in the bold diagonal are the square root of the average variance extracted (AVE). *AE* aesthetics, *PEU* perceived ease of use, *PL* playfulness, *PR* presence, *SRB* sustainable relationship behavior, *SE* service excellence, *PU* perceived usefulness

Table 3 Tests for the equivalence of the measurement models across high and low cognitive innovativeness groups

Measurement model	Goodness of fit	Equivalence tests of the measurement models
Model 1: Baseline model (no constraints)	$\chi^2_{(418)} = 734.66$, non-normed fit index (NNFI) = 0.97 comparative fit index (CFI) = 0.98, RMSEA = 0.078	
Model 2: Factor loadings specified invariant	$\chi^2_{(434)} = 743.87$, non-normed fit index (NNFI) = 0.97 comparative fit index (CFI) = 0.98, RMSEA = 0.076	Model 2 – Model 1: $\Delta\chi^2_{(16)} = 9.21$, ns at $p < .05$
Model 3: Factor loadings, error variances, and specified invariant	$\chi^2_{(456)} = 776.58$, non-normed fit index (NNFI) = 0.97 comparative fit index (CFI) = 0.98, RMSEA = 0.078	Model 3 – Model 2: $\Delta\chi^2_{(22)} = 32.7$, ns at $p < .05$
Model 4: Factor loadings, error variances, and correlations invariant	$\chi^2_{(484)} = 806.07$, non-normed fit index (NNFI) = 0.97 comparative fit index (CFI) = 0.98, RMSEA = 0.075	Model 4 – Model 3: $\Delta\chi^2_{(28)} = 29.49$, ns at $p < .05$

ns not significant

= 0.08. Thus, this model index exceeded the accepted thresholds. In support of H2, perceived usefulness had a positive and significant effect on sustainable relationship behavior toward using ARIT ($\beta = 0.24, t = 2.61$, significant at $p < 0.01$). The effect of perceived aesthetics on sustainable relationship behavior was positive and significant ($\beta = 0.42, t = 2.35$, significant at $p < 0.05$), supporting H3. Consistent with H4, perceived service excellence positively affected consumers' sustainable relationship behavior ($\beta = 0.46, t = 2.55$, significant at $p < 0.05$). As expected, for high cognitive innovative consumers, not only did perceived ease of use value have no impact on perceived usefulness ($\beta = 0.21, t = 1.4$, not significant, $p > 0.05$) but playfulness value had no impact on sustainable relationship behavior toward using ARIT ($\beta = -0.02, t = -0.3$, not significant, $p > 0.05$).

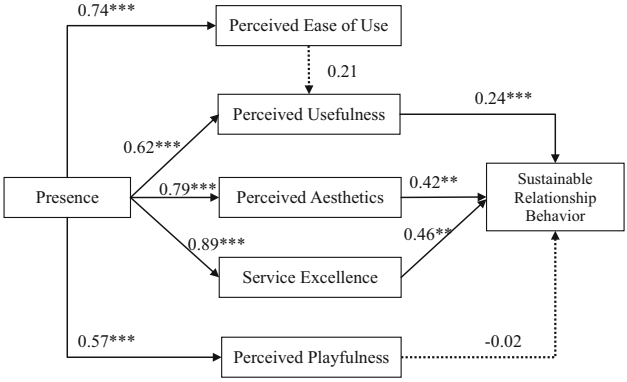
Table 4 Final measurement model

Measurement model (constrained as equal across high and low cognitive innovativeness groups)	Unstandardized solution (t value)	Common metric completely standardized solution
Presence 1	1.00	0.87
Presence 2	1.00 (16.64)	0.87
Presence 3	0.90 (14.14)	0.78
Presence 4	−0.50 (−6.45)	−0.43
Ease 1	1.00	0.80
Ease 2	0.97 (12.22)	0.78
Ease 3	1.00 (12.46)	0.80
Ease 4	0.94 (11.61)	0.75
Usefulness 1	1.00	0.88
Usefulness 2	0.98 (16.95)	0.87
Usefulness 3	0.88 (14.15)	0.78
Usefulness 4	0.90 (14.70)	0.80
Service excellence 1	1.00	0.83
Service excellence 2	0.91 (11.65)	0.75
Aesthetics 1	1.00	0.78
Aesthetics 2	1.03 (12.70)	0.80
Aesthetics 3	1.05 (13.04)	0.82
Playfulness 1	1.00	0.85
Playfulness 2	0.97 (12.39)	0.83
Playfulness 3	0.81 (10.39)	0.69
Behavior 1	1.00	0.91
Behavior 2	0.93 (17.66)	0.85
Behavior 3	0.95 (18.46)	0.87

All measurement coefficients are significant at $p < .05$; $\chi^2/df = 1.67$; NNFI = 0.97; CFI = 0.98; RMSEA = 0.076

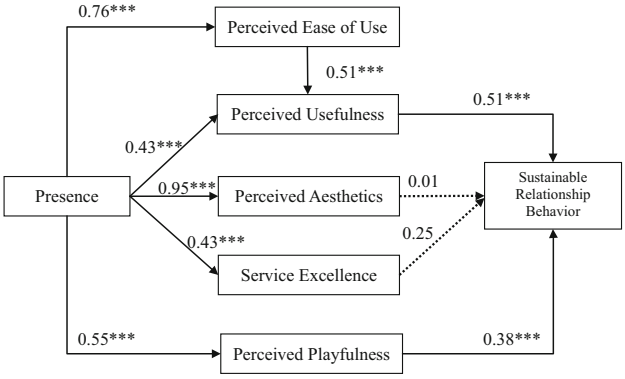
Figure 4 shows the results for the low cognitive innovativeness group. The overall fit of the structural model was $\chi^2/df = 1.73$, NNFI = 0.97, CFI = 0.98, and RMSEA = 0.083. Thus, this model index also exceeded the accepted thresholds. In support of H5, perceived ease of use positively affected perceived usefulness ($\beta = 0.51$, $t = 3.27$, significant at $p < 0.01$). The effect of perceived playfulness on sustainable relationship behavior was positive and significant ($\beta = 0.38$, $t = 3.82$, significant at $p < 0.01$), supporting H6. Unlike usefulness ($\beta = 0.51$, $t = 4.69$, significant at $p < 0.01$), perceived service excellence ($\beta = 0.01$, $t = 0.05$, not significant, $p > 0.05$) and perceived aesthetics ($\beta = 0.25$, $t = 1.11$, not significant, $p > 0.05$) had no impact on this group of consumers.

Along with H1 through H6 being substantiated, the results for the invariance of the hypothesized model across the groups also revealed that there were statistically significant differences in path parameter estimates between online consumers with



** = sig. at $p < 0.05$; *** = sig. at $p < 0.01$.

Fig. 3 High cognitive innovative consumers' ARIT acceptance model

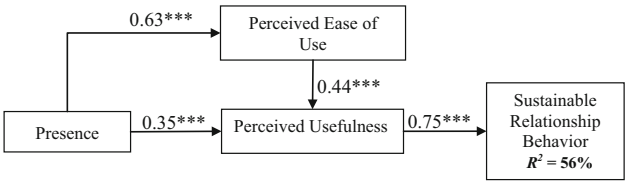


** = sig. at $p < 0.05$; *** = sig. at $p < 0.01$.

Fig. 4 Low cognitive innovative consumers' ARIT acceptance model

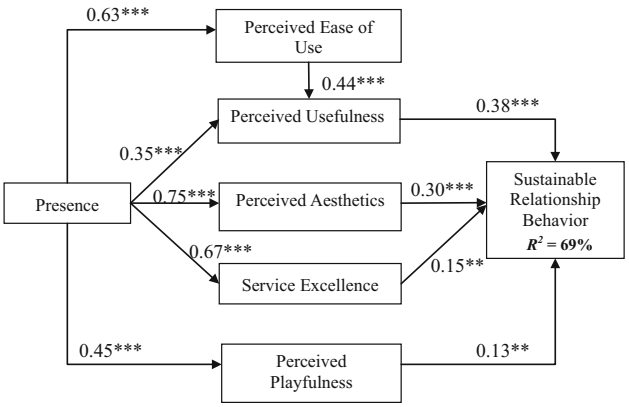
high or low cognitive innovativeness ($\Delta\,\chi^2 = 19.72$, $\Delta df = 10$, significant at $p < 0.05$). Such results indicated that consumers' cognitive innovativeness moderated the impact of usefulness, service excellence, aesthetics, ease of use, and playfulness on sustainable relationship behavior toward using ARIT. Based on the above results, H7 was sustained.

As shown in Figs. 3 and 4, the effect of presence on perceived usefulness was positive and significant regardless of consumers' level of cognitive innovativeness (high cognitive awareness group: $\gamma = 0.62$, t = 4.14, significant at $p < 0.01$; low cognitive awareness group: $\gamma = 0.43$, t = 3.00, significant at $p < 0.01$), supporting H1a. As expected, presence also positively affected ease of use (high: $\gamma = 0.74$, t = 7.39, significant at $p < 0.01$; low: $\gamma = 0.76$, t = 7.45, significant at $p < 0.01$), aesthetics (high: $\gamma = 0.79$, t = 8.02, significant at $p < 0.01$; low: $\gamma = 0.95$, t = 9.42, significant at $p < 0.01$), service excellence (high: $\gamma = 0.89$, t = 9.10, significant at $p < 0.01$; low: $\gamma = 0.43$, t = 3.00, significant at $p < 0.01$), and playfulness (high:



** = sig. at $p < 0.05$; *** = sig. at $p < 0.01$.

Fig. 5 PLS analysis of traditional TAM



** = sig. at $p < 0.05$; *** = sig. at $p < 0.01$.

Fig. 6 PLS analysis of integrated ARIT acceptance model

$\gamma = 0.57$, t = 5.30, significant at $p < 0.01$; low: $\gamma = 0.55$, t = 5.08, significant at $p < 0.01$) regardless of levels of consumers' cognitive innovativeness. Thus, H1b, H1c, H1d, and H1e were all supported by the data.

To determine if our integrated ARIT acceptance model is better than the traditional TAM, we compared the explanatory power of two competing theoretical models by employing the techniques of partial least squares (PLS) evaluated R^2 and Chow test (F-tests) suggested by Premkumar and Bhattacherjee [60]. Through PLS estimation for effect sizes tests (f^2), it can also be further confirmed that adding variables (i.e., perceived aesthetics, service excellence, and perceived playfulness) to the original TAM model is able to significantly improve the R^2 increment [15]. Accordingly, this study used the Chow test (F-tests) with effect sizes (f^2) estimation to determine whether the R^2 or explanatory ability of our integrated ARIT acceptance model would outperform the original TAM. SmartPLS [61] was used to perform structural equation modeling and assess the interrelationships among the structural model constructs.

As shown in Fig. 6, PLS analysis of the integrated ARIT acceptance model explains 69 % of the variance in sustainable relationship behavior toward using ARIT, which exceeds the substantial value of 67 % for R^2 proposed by previous studies [12,76]. In contrast, PLS analysis of the traditional TAM (Fig. 5) explains 56 % of the variance in sustainable relationship behavior toward using ARIT, which exceeds the average value of 33 % for R^2. Then the study conducted Chow test (F-tests) comparing the

R^2 values of the integrated ARIT acceptance model with the traditional TAM. The result found that the R^2 improvement in the integrated ARIT acceptance model (0.69) was significantly greater at $p < 0.001$ than the traditional TAM (0.56) ($F = 38.11$). According to the results of PLS estimation shown in Fig. 6, sustainable relationship behavior toward using ARIT was successfully predicted by aesthetics ($\beta = 0.30$, t = 4.03, significant at $p < 0.01$), service excellence ($\beta = 0.15$, t = 2.34, significant at $p < 0.05$), and playfulness ($\beta = 0.13$, t = 2.40, significant at $p < 0.05$), with total effect size (f^2) of 0.40, which exceeds the cut-off value of 35 % for large effect on endogenous latent variables proposed by previous studies [12,76]. These findings attested to the improved explanatory ability of integrated ARIT acceptance model over and above the traditional TAM. In addition, the results of empirical study also found that the overall model fit of our integrated ARIT acceptance model ($\chi^2/df = 2.28$, CFI = 0.924, and RMSEA = 0.077) waZs better than that of the traditional TAM ($\chi^2/df = 3.31$, CFI = 0.918, and RMSEA = 0.103).

6 Conclusions and implications

6.1 Integrated use of the TAM and experiential values to investigate antecedents of sustainable relationship behavior

Prior studies using the TAM have examined only the usefulness and ease of use of ARIT [37,38]. Such existing empirical results overlook the fact that today's interactive technology has become a critical means of enhancing consumers' online shopping experience by making it more attractive and compelling. To address this gap in the research area, the present study integrated Holbrook's [30] four dimensions of experiential values and the TAM to develop an integrated ARIT acceptance model for predicting consumers' sustainable relationship behavior toward using ARIT. Holbrook [30] proposed that a good consumer experience should include these four dimensions [4,57]. Accordingly, we examined user's experience with and perceived benefits of ARIT to further clarify which factors affect the continual use of such interactive technologies. The integrated ARIT acceptance model provides some intersecting results. For example, the results of PLS analysis for the integrated ARIT acceptance model, combining traditional TAM and experiential value constructs, presented greater explanatory power than the traditional TAM, as indicated by the significant increase in R^2 in sustainable relationship behavior toward using ARIT. Meanwhile, the results of empirical study found that the integrated ARIT acceptance model demonstrated a better overall model fit than the traditional TAM. Consequently, this integrated perspective leads to better associations among research on the TAM, experiential marketing, and relationship marketing.

The results of this study indicate that usefulness, ease of use, service excellence, aesthetics, and playfulness are the five key factors that foster consumers' sustainable relationship behavior toward using ARIT. ARIT thus serves not only a functional role but also a hedonic role in online shopping. Cases of industrial practices support the effect of both the functional and hedonic roles played by ARIT on online purchasing behavior. For instance, IKEA offers an interactive online catalog that frees shoppers

from merely imagining the arrangement of furniture in their space. Users of smartphones or tablets can speed up their decision-making processes by easily dragging any item from the catalog and putting it anywhere in the simulated space on the screen and then immediately taking screenshots of it. In this manner, catalogs become more interactive, and by increasing playfulness and convenience they stimulate consumers' intentions to buy and their impressions of the brand. Therefore, retailers should view ARIT as a form of persuasive technology that creates and delivers experiential values rather than as only a functional technology [23,47]. If academic research fails to address ARIT's capability to enhance experiential value to achieve a better persuasive effect, the research ideas may become irrelevant to practical application.

Online retailers need to fully understand which factors affect consumers' adoption of ARIT, especially in the fashion industry [37,38]. Our findings illustrate that usefulness, ease of use, service excellence, aesthetics, and playfulness not only affect the adoption of ARIT but also act as perceived benefits to customers' maintenance of relationships with ARIT. Understanding the benefits ARIT delivers will assist online retailers in designing and implementing appropriate technologies to decrease consumers' cognitive risk and, more important, engage consumers in the online shopping process. One industry report has indicated that effective use of interactive 3D technologies leads to greater intentions to buy and increased sales of online apparel [44]. Our findings thus have implications for online retailers that wish to increase revenues and maximize profits over the long term.

6.2 The moderating role of cognitive innovativeness

The present study found that usefulness, service excellence, and aesthetics facilitate high cognitive innovative consumers to form a sustainable relationship with retailers applying ARIT. In contrast, usefulness, ease of use, and playfulness nurture such a relationship between low cognitive innovative consumers and the retailers who practice ARIT. At the same time, the results reveal statistically significant differences in path parameter estimates between these two groups of consumers. Based on the findings of this study, we suggest that consumers with a high level of cognitive innovativeness are more likely to use ARIT because their emphasis will be more on the factors that affect outcome of their apparel shopping tasks (e.g., usefulness, service excellence, and aesthetics) than the factors that affect the magnitude of the effort involved (e.g., ease of use); whereas consumers with a low level of cognitive innovativeness are more likely to use ARIT because they have a stronger preference for ease of using technology and emotive elements than the factors on outcome of an apparel shopping task.

ARIT can help online consumers with different levels of cognitive innovativeness simulate the functionality and/or appearance of product, creating a more compelling online shopping experience. This argument is consistent with the views of previous researchers, who have reported that designing interactive technologies with consumers' needs and personal characteristics in mind results in effective use of these technologies and excellent adoption experiences [29,65].

In the technology context, several studies have found that the adoption of interactive technologies is a function of consumers' needs, experiences, and characteristics [62, 66]. The present study not only underscores the fact that personal characteristics

affect consumers' frequent use of new interactive technologies but also fills a gap in the existing research by revealing that consumers who have the different innovative involvement concerning about different factors of accepting technology.

In sum, consumers' level of cognitive innovativeness plays an important moderating role between factors that affect frequent use of interactive technologies and sustainable relationship behavior toward using ARIT. Therefore, ARIT should be designed according to consumers' level of cognitive innovativeness.

6.3 Presence as an antecedent of the creation of perceived benefits by ARIT

Measures of quality, such as information quality and system quality, are important constructs for foreseeing the success of an information technology [22]. Our findings demonstrate that presence not only is related to the success of an ARIT but also, more importantly, affects factors that impact the frequent use of ARIT. These empirical results show that presence has positive effects on usefulness, ease of use, aesthetics, service excellence, and playfulness. There is evidence to infer that when online retailers enhance the amount of presence in augmented-reality environments, online shoppers will perceive various benefits and regard ARIT as valuable regardless of their level of cognitive innovativeness.

Presence in augmented-reality environments is composed of four elements: sense of physical space, engagement, ecological validity, and negative effects [73]. Online retailers should design ARIT with these four aspects in mind, especially as one industry report has stressed the potential impact of visualization features on online sales [20]. Sense of physical space and engagement emphasize the real, specific embodiment of visual sensation; these two features enable consumers to immerse themselves in the situation [39]. Thus, sense of physical space and engagement are two essential components of ARIT [73]. Ecological validity is the degree to which the consumer believes in the simulated environment. Designers of simulated environments should pay attention to authenticity and naturalness. Lastly, negative effects refer to the unease feelings arising from visual stimulation. When a technology's window visual effect is undesirable and poorly displayed, users will likely experience anxiety and adverse physical reactions. Thus, when online retailers purchase 3D and present visual effects, they should ensure and avoid beforehand if the interactive technology would cause users' uncomfortable sensations such as nausea, headache, and eyestrain.

7 Limitations and future research

Although this study makes several prominent contributions, it is limited in certain respects because of time and budget. We suggest the following avenues for further investigation. First, for replication, future studies can use the research model in this study to test consumers' experiences with other interactive technology, for example, location-based services. Second, researchers could investigate what roles consumers' cognitive innovativeness might play in experiences with other interactive technology. Finally, future studies might build on the current findings by using a larger sample or

including other antecedents of the creation of perceived benefits derived from studies of different information technologies.

Acknowledgments The authors would like to thank the Ministry of Science and Technology of the Republic of China, Taiwan, for financially supporting this research under Contract No. MOST 103-2410-H-155-022-, MOST 102-2410-H-155-046-, and NSC 101-2410-H-155-056.

Appendix I

See Appendix Table 5.

Table 5 Measurement scales

Construct		Item	
Presence	Sense of physical space (presence 1)	P1-1	I had a sense of being in the scenes displayed
		P1-2	I felt I was visiting the places in the displayed environment
		P1-3	I felt that the characters and/or objects could almost be touched
	Engagement (Presence 2)	P2-1	I felt involved (in the displayed environment)
		P2-2	I enjoyed myself
		P2-3	My experience was strong
	Ecological Validity (Presence 3)	P3-1	The content seemed believable to me
		P3-2	The displayed environment seemed natural
		P3-3	I had a strong sense that the characters and objects were physical
	Negative Effect (Presence 4)	P4-1	I felt dizzy
		P4-2	I felt nauseous
		P4-3	I felt I had a headache
		P4-4	I had eyestrain
Perceived Ease of Use	Ease 1		Using this augmented-reality interactive technology (ARIT) is clear and understandable

Table 5 continued

Construct		Item	
	Ease 2		Using this ARIT does not require a lot of mental effort
	Ease 3		This ARIT is easy to use
	Ease 4		I would find it easy to get this ARIT to do what I want it to do
Perceived Usefulness	Usefulness 1		This ARIT improves my online shopping productivity
	Usefulness 2		This ARIT enhances my effectiveness when shopping online
	Usefulness 3		This ARIT is helpful in buying what I want online
	Usefulness 4		This ARIT improves my online shopping ability
Service excellence	Service excellence 1		When I think of this ARIT, I think of excellence
	Service excellence 2		I think of this ARIT as an expert in the merchandise it offers
Aesthetics	Aesthetics 1		The way this ARIT displays its products is attractive
	Aesthetics 2		I like the way ARIT's visual image looks
	Aesthetics 3		I think this ARIT is very entertaining
Playfulness	Playfulness 1		Shopping by using this ARIT makes me feel like I am in another world
	Playfulness 2		I get so involved when I shop by using this ARIT that I forget everything else
	Playfulness 3		I enjoy shopping by using this ARIT for the sake of it, not just for the items I may have purchased
Sustainable relationship behavior	Relational behavior (Behavior 1)	B1-1	I will continue to update my personal information on the database of this ARIT's Web site
		B1-2	I will inform this ARIT's Web site of changes in my personal information
		B1-3	I am willing to volunteer additional information to this ARIT utilization

Table 5 continued

Construct		Item	
	Relationship investment (Behavior 2)	B2-1	I will devote time and energy to making my relationship with this ARIT work
		B2-2	I will make the effort to show my interest in my relationship with this ARIT
		B2-3	I will provide this ARIT information I may not share with other ARIT
	Repatronage intentions (Behavior 3)	B3-1	I would experience this ARIT again
		B3-2	What is the likelihood that you would use this ARIT in future?
		B3-3	In future, I would return to use this ARIT

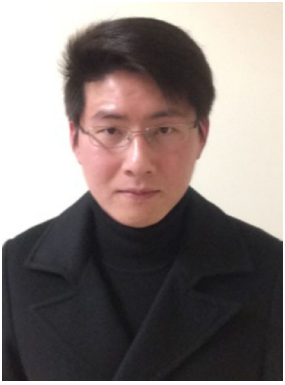
References

1. Agarwal, R., & Prasad, J. (1998). The antecedents and consequents of user perceptions in information technology adoption. *Decision Support Systems*, *22*(1), 15–29.
2. Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423.
3. Azuma, R. T. (1997). A survey of augmented reality. *Presence: Teleoperators and Virtual Environments*, *6*(4), 355–385.
4. Babin, B., Darden, W., & Griffin, M. (1994). Work and/or fun: Measuring hedonic and utilitarian shopping value. *Journal of Consumer Research*, *20*, 644–656.
5. Blasco-Arcas, L., Hernandez-Ortega, B., & Jimenez-Martinez, J. (2013). Adopting television as a new channel for e-commerce. The influence of interactive technologies on consumer behavior. *Electronic Commerce Research* doi:10.1007/s10660-013-9132-1.
6. Blattberg, R. C., Getz, G., & Thomas, J. S. (2001). *Customer equity: Building and managing relationships as valuable assets*. Boston, Mass: Harvard Business School Press.
7. Blodgett, J. G., Hill, D. J., & Tax, S. S. (1997). The effects of distributive, procedural, and interactional justice on postcomplaint behavior. *Journal of Retailing*, *73*(2), 185–210.
8. Bollen, K. A. (1989). *Structural equations with latent variables*. New York: John Wiley.
9. Bourlakis, M., Papagiannidis, S., & Li, F. (2009). Retail spatial evolution: Paving the way from traditional to metaverse retailing. *Electronic Commerce Research*, *9*(1–2), 135–148.
10. Carvalho, M. L. d., Guimarães, H., Ferreira, J. B. & Freitas, A. (2012). Intention to use M-learning: An extension of the technology acceptance model. In *19th International Conference on Recent Advances in Retailing and Consumer Services Science*, July 9–12. Vienna, Austria.
11. Chen, Q., Chen, H. M., & Kazman, R. (2007). Investigating antecedents of technology acceptance of initial eCRM users beyond generation X and the role of self-construal. *Electronic Commerce Research*, *7*(3–4), 315–339.
12. Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 1295–1336). Mahwah, NJ: Lawrence Erlbaum Associates.
13. Chiou, J. S., Droge, C., & Hanvanich, S. (2002). Does customer knowledge affect how loyalty is formed? *Journal of Service Research*, *5*(2), 113–124.

14. Chiou, J. S., & Shen, C. C. (2012). The Antecedents of online financial service adoption: The impact of physical banking services on internet banking acceptance. *Behaviour & Information Technology*, *31*(9), 859–871.
15. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
16. Dabholkar, P. A., & Bagozzi, R. P. (2002). An attitudinal model of technology-based self-service: Moderating effects of consumer traits and situational factors. *Journal of the Academy of Marketing Science*, *30*, 318–341.
17. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.
18. Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, *22*(14), 1111–1132.
19. DeLone, W. H., & McLean, E. R. (1992). Information system success: The quest for the dependent variable. *Information Systems Research*, *3*(1), 60–95.
20. Demery, P. (2003). The latest flash. Internet Retailer. Retrieved May 15, 2009, http://www.internetretailer.com/article.asp?id=10323.
21. Eckman, M., Damhorst, M. L., & Kadolph, S. J. (1990). Toward a model of the in-store purchase decision process: Consumer use of criteria for evaluating women's apparel. *Clothing and Textiles Research Journal*, *8*(2), 13–22.
22. Fiore, Ann Marie, Kim, J., & Lee, H.-H. (2005). Effects of image interactivity on approach responses towards an online retailer. *Journal of Interactive Marketing*, *19*(3), 38–53.
23. Fogg, B. J. (2003). *Persuasive technology: Using computers to change what we think and do*. San Francisco, CA: Kaufmann Publishers.
24. Geissler, G. L., & Zinkhan, G. M. (1998). Consumer perceptions of the world wide web: An exploratory study using focus group interviews. *Advances in Consumer Research*, *25*, 386–392.
25. Goel, L., & Prokopec, S. (2009). If you build it will they come?: An empirical investigation of consumer perceptions and strategy in virtual worlds. *Electronic Commerce Research*, *9*(1–2), 115–134.
26. Guo, Y., & Barnes, S. (2009). Virtual item purchase behavior in virtual worlds: An exploratory investigation. *Electronic Commerce Research*, *9*(1–2), 77–96.
27. Haller, M., Billinghurst, M., & Thomas, B. (2007). *Emerging technologies of augmented reality: Interfaces and design*. Hershey: Idea Group Pub.
28. Hirschman, E. C. (1984). Experience seeking: A subjectivist perspective of consumption. *Journal of Business Research*, *2*(1), 115–136.
29. Hoffman, D. L., & Thomas, P. N. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing*, *60*(July), 50–69.
30. Holbrook, M. B. (1994). The nature of customer value: An axiology of services in the consumption experience. In R. T. Rust & R. L. Oliver (Eds.), *Service quality: New directions in theory and practice, Newbury Park* (pp. 21–71). CA: Sage.
31. Hsu, C. L., & Lin, J. C. C. (2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & Management*, *45*(1), 65–74.
32. Irani, T., & O'Malley, M. (1998). Cognitive innovativeness as a predictor of student attitudes and intent: an application of the theory of planned behavior to online learning environments. Poster presented at the Association for Education *in Journalism and Mass Communication National Conference*, Baltimore, MD.
33. Jöreskog, K. G., & Sörbom, D. (1989). *LISREL 7: A guide to the program and applications*. Chicago: SPSS. Inc.
34. Kalckert, A., & Ehrsson, H. H. (2012). Moving a rubber hand that feels like your own: A dissociation of ownership and agency. *Frontiers in Human Neuroscience*, *6*(40), 1–14.
35. Keng, C. J., Liao, T. H., & Yang, Y. I. (2012). The effects of sequential combinations of virtual experience, direct experience, and indirect experience: The moderating roles of need for touch and product involvement. *Electronic Commerce Research*, *12*(2), 177–199.
36. Keng, C. J., & Ting, H. Y. (2009). The acceptance of blogs: Using a customer experiential value perspective. *Internet Research*, *19*(5), 479–495.
37. Kim, J., & Forsythe, S. (2008a). Adoption of virtual try-on technology for online apparel shopping. *Journal of Interactive Marketing*, *22*(2), 45–59.
38. Kim, J., & Forsythe, S. (2008b). Sensory enabling technology acceptance model (SE-TAM): Multiple-group structural model comparison. *Psychology and Marketing*, *25*(9), 901–922.

39. Lessiter, J., Freeman, J., Keogh, E., & Davidoff, J. (2001). A cross-media presence questionnaire: The ITC-sense of presence inventory. *Presence*, *10*(3), 282–297.
40. Leuthesser, L., & Kohli, A. K. (1995). Relational behavior in business markets: Implications for relationship management. *Journal of Business Research*, *34*, 221–233.
41. Lin, C., Shih, H., & Sher, P. J. (2007). Integrating technology readiness into technology acceptance: The TRAM model. *Psychology & Marketing*, *24*(7), 641–657.
42. Lin, J. C. C., & Lu, H. (2000). Towards an understanding of the behavioural intention to use a web site. *International Journal of Information Management*, *20*(3), 197–208.
43. Liu, Y., Li, H., & Carlsson, C. (2010). Factors driving the adoption of m-learning: An empirical study. *Computers & Education*, *55*(3), 1211–1219.
44. Mahoney, M. (2001). *E-tailers dangle 3D imaging to covert surfers to buyers. Ecommerce Times*. Available: http://www.ecommercetimes.com/perl/story/13521.html.
45. Malhotra, N. K., Kim, S. S., & Patil, A. (2006). Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research. *Management Science*, *52*(12), 1865–1883.
46. Mathwick, C., Malhotra, N., & Rigdon, E. (2001). Experiential value: Conceptualization, measurement and application in the catalog and internet shopping environment. *Journal of Retailing*, *77*(1), 51–60.
47. McCarthy, J., & Wright, P. (2004). *Technology as experience*. Cambridge, MA: The MIT Press.
48. McKinney, M. (2000). *Study: Bean, lands' end in online service* (p. 16). Harrisonburg: Daily News Record.
49. Milgram, P., Takemura, H., Utsumi, A., & Kishino, F. (1994). Augmented reality: A class of displays on the reality-virtuality continuum. *Telemanipulator and Telepresence Technologies*. Proc. SPIE, Vol. 2351, 282–291.
50. Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, *2*(3), 173–191.
51. Mossholder, K. W., Bennett, N., Kemery, E. R., & Wesolowski, M. A. (1998). Relationships between bases of power and work reactions: The mediational role of procedural justice. *Journal of Management*, *24*(4), 533–552.
52. Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw Hill.
53. Oliver, R. (1999). Value as excellence in the consumption experience. In M. Holbrook (Ed.), *Customer value, a framework for analysis and research* (pp. 43–62). London and New York: Routledge.
54. Peck, J., Barger, V., & Webb, A. (2013). In search of a surrogate for touch: The effect of haptic imagery on perceived ownership. *Journal of Consumer Psychology*, *23*(2), 189–196. doi:10.1016/j.jcps.2012.09.001.
55. Peterson, R. A. (1995). Relationship marketing and the consumer. *Journal of the Academy of Marketing Science*, *23*(4), 278–281.
56. Phelps, Joseph E., Nowak, Glen J., & Ferrell, Elizabeth. (2000). Privacy concerns and consumer willingness to provide personal information. *Journal of Public Policy & Marketing*, *19*(1), 27–41.
57. Pine, B. J., & Gilmore, J. H. (1999). *The experience economy: Work is theater & every business a stage*. Boston, MA: Harvard Business Press.
58. Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903.
59. Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management*, *12*(4), 531–544.
60. Premkumar, G., & Bhattacherjee, A. (2008). Explaining information technology usage: A test of competing models. *Omega*, *36*(1), 64–75.
61. Ringle, C. M., Wende, S., & Will, A. (2007). *SmartPLS 2.0 M3*. University of Hamburg, Hamburg, Germany. Retrieved from http://www.smartpls.de.
62. Robinson, L, Jr, Marshall, G. W., & Miriam, B. S. (2005). Sales force use of technology: Antecedents to technology acceptance. *Journal of Business Research*, *58*(12), 1623–1631.
63. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.
64. Rosa, J. A., Qualls, W. J., & Ruth, J. A. (2013). Consumer creativity: Effects of gender and variation in the richness of vision and touch inputs. *Journal of Business Research*, *67*, 386–393. doi:10.1016/j.jbusres.2012.12.023.
65. Sharps, H., Rogers, Y., & Preece, J. (2007). *Interaction design: Beyond Human-Computer interaction* (2nd ed.). Chichester, England: John Wiley.

66. Shim, S., & Mary, F. D. (1990). Consumer intention to utilize electronic shopping. *Journal of Direct Marketing*, *4*(3), 22–33.
67. Shimada, S., Fukuda, K., & Hiraki, K. (2009). Rubber hand illusion under delayed visual feedback. *PLoS ONE*, *4*(7), e6185. doi:10.1371/journal.pone.0006185.
68. Simon, F., & Usunier, J. C. (2007). Cognitive, demographic, and situational determinants of service customer preference for personnel-in-contact over self-service technology. *International Journal of Research in Marketing*, *24*(2), 163–173.
69. Smith, J. B., & Barclay, D. W. (1997). The effects of organizational differences and trust on the effectiveness of selling partner relationships. *Journal of Marketing*, *61*(1), 3–21.
70. Spiegelman, P. (2000). Live customer interaction and the internet join in 'Internation'. *Direct Marketing*, August, 38–41.
71. Steenkamp, J. B., & Baumgartner, H. (1998). Assessing measurement invariance in cross-national research. *Journal of Consumer Research*, *25*(June), 78–90.
72. Suki, N. M. (2013). Consumer shopping behaviour on the Internet: Insights from Malaysia. *Electronic Commerce Research*,. doi:10.1007/s10660-013-9131-2.
73. Tang, A., Biocca, F., & Lim, L. (2004). Comparing differences in presence during social interaction in augmented reality versus virtual reality environments: an exploratory study. *Proceedings of PRESENCE 2004, Seventh Annual International Workshop on Presence, 2004* (pp. 204–207). Valencia, Spain.
74. Tzou, R. C., & Lu, H. P. (2009). Exploring the emotional, aesthetic, and ergonomic facets of innovative product on fashion technology acceptance model. *Behaviour & Information Technology*, *28*(4), 311–322.
75. van Krevelen, D. W. F., & Poelman, R. (2010). A survey of augmented reality technologies, applications and limitations. *The International Journal of Virtual Reality*, *9*(2), 1–20.
76. Urbach, Nils, & Ahlemann, Frederik. (2010). Structural equation modeling in information systems research using partial least squares. *Journal of Information Technology Theory and Application*, *11*(2), 5–40.
77. Varadarajan, R., Srinivasan, R., Vadakkepatt, G. G., Yadav, M. S., Pavlou, P. A., Krishnamurthy, S., et al. (2010). Interactive technologies and retailing strategy: a review, conceptual framework and future research directions. *Journal of Interactive Marketing*, *24*(2), 96–110.
78. Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, *24*(1), 115–139.
79. Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A longitudinal field investigation of gender differences in individual technology adoption decision? Making processes. *Organizational Behavior and Human Decision Processes*, *83*(1), 33–60.
80. Venkatraman, Meera P. (1991). The impact of innovativeness and innovation type on adoption. *Journal of Retailing*, *67*(1), 51–67.
81. Venkatraman, M. P., & MacInnis, D. (1985). An investigation of the epistemic and sensory exploratory behaviors of hedonic and cognitive Consumers. In E. C. Hirschman & M. L. Holbrook (Eds.), *Advances in consumer research*. Provo, Utah: Association for Consumer Research.
82. Venkatraman, M. P., & Price, L. L. (1990). Differentiating between cognitive and sensory innovativeness: Concept, measurement, and implications. *Journal of Business Research*, *20*(4), 293–315.
83. Wirtz, J., & Lwin, M. (2009). Regulatory focus theory, trust, and privacy concern. *Journal of Service Research*, *12*(2), 190.
84. Wu, J. H., & Wang, S. C. (2005). What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. *Information Management*, *42*, 719–729.
85. Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *Journal of Marketing*, *52*, 2–22.



Tseng-Lung Huang is the corresponding author and an assistant professor of Marketing in College of Management at Yuan Ze University in Taiwan. He earned his Ph.D. degree in Department of Business Administration (Marketing Group) from National Chengchi University, Taiwan and his MBA from Graduate Institute of Commerce Automation and Management, National Taipei University of Technology, Taiwan. His research interests include electronic commerce, interactive marketing, and consumer behavior. His publications have appeared in *Internet Research, International Journal of Mobile Communications, International Journal of Service Industries Management, Young Consumers,* and *Journal of E-Business*.

Shuling Liao is a Professor of Marketing in College of Management at Yuan Ze University in Taiwan. She earned her PhD from Purdue University and a MA in Advertising from the University of Texas at Austin. Her research interests are human-computer interaction, cyber-psychology, virtual communities and social networks, electronic word-of-mouth, and electronic commerce. Her publications have appeared in *Journal of Business Research, European Journal of Marketing, Academy of Marketing Science Review, Online Information Review, Service Industries Journal, International Journal of Business and Information, Journal of Internet Commerce* and other renowned international journals.