



Psychological mechanisms of brand love and information technology identity in virtual retail environments

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ABSTRACT

The extant literature on augmented-reality interactive technology (ARIT) has not addressed the capability of this new technology on enhancing brand love, an important driver for consumers' long-term dedication to an e-retailer or online brand. In particular, no studies have directly compared ARIT and non-ARIT (such as traditional webpage browsing) e-shopping environments in terms of their effects on brand love formation. The present study conducts an experiment to provide the evidences of the difference in brand love fostering effects between the two shopping environments. Moreover, this study elucidates the psychological mechanism of brand love formation, indicating that the characteristics of ARIT—ownership control and rehearsability—may engender self-referencing, which further fosters information technological identity, then results in brand love. The research results may help e-retailers and online brand managers to select proper ARIT technology to shape brand love and create an effective online simulation experience.

1. Introduction

Unlike short-term purchase intention or any single consumption behavior, brand love effectively stimulates consumers' willingness to purchase products in the long run while also reducing the likelihood of switching to other brands (Magids et al., 2015). An empirical study (Magids et al., 2015) indicated that the consumers it examined who had high levels of brand love purchased clothes twice as frequently as those who were merely satisfied. On average, consumers with high levels of brand love spent \$468 on purchasing clothes annually, nearly twice as much as consumers who are satisfied, who spent only \$235. Further consumers with high levels of brand love recommended the given clothing store to their friends and relatives 1.4 times as often as consumers who were satisfied. According to Magids et al. (2015), to create long-term consumption in large amounts and ensure a low turnover rate, e-retailers and online brands should focus on shaping online consumers' brand love instead of stimulating single-purchase intentions. Nevertheless, brand love literature is generally restricted to scenarios in physical stores (e.g., Batra et al., 2012; Carroll and Ahuvia, 2006; Rauschnabel and Ahuvia, 2014; Rauschnabel et al., 2016). This leaves e-retailers and online brands without guidance in how to use digital simulation technology (such as augmented-reality interactive technology, ARIT) to shape brand love.

More importantly, many e-retailers and online brands already use ARIT to empower online consumers to actively and spontaneously

create their own consumption experiences (Rafaeli et al., 2017). Unfortunately, recent studies of ARIT have largely been limited to explorations of the effects of ARIT on strengthening purchase intention (Beck and Crié, 2018; Hilken et al., 2017; Mulcahy and Riedel, in press; Poushneh and Vasquez-Parraga, 2017), ignoring the aforementioned benefits of brand love. Thus, it is worth exploring whether the empowerment of participation in digital simulation scenarios through ARIT can successfully create brand love, what features of ARIT are responsible for this, and what psychological mechanisms are involved. This study explores and demonstrates the entire process and psychological mechanisms by which ARIT simulation experience shapes brand love, offering future e-retailers and online brands the opportunity to use ARIT to shape marketing guidelines to achieve the benefits associated with such emotion.

In the simulation of product utilization, self-referencing is the main method and psychological mechanism that enables consumers to concretely simulate and imagine the effects of using a given product (Yoon and Park, 2012). Self-referencing can, on one hand, accelerate the process of pairing consumers and brand commodities; on the other hand, it also forges an effective consumer–brand connection (Escalas, 2004a, 2004b), offering a significant psychological path to e-retailers and online brands that shapes brand love. Previous studies of self-referencing only incorporate advertisement scenarios (e.g., Burnkrant and Unnava, 1995; Debevec and Romeo, 1992; Escalas, 2004a, 2004b, 2007); in this context, the means of triggering self-reference is limited

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to static pictures in experiments (e.g., viewing consumers' own photos) and abstract text (e.g., "you may remember feeling..."). Unlike static advertisement pictures, ARIT simulation allows rehearsability (e.g., empowering online consumers to edit interactive content), and it also brings a strong sense of ownership control (simulating product utilization with a somatosensorily manipulable avatar) (Hilken et al., 2017). Therefore, the results of research that uses static advertisement pictures to stimulate self-referencing do not apply to an understanding of the experience of ARIT simulation, which includes the empowering effects of rehearsability and a high-level somatosensory sense of ownership control. Recently, numerous e-retailers and online brands have introduced ARIT into their online retail experience (Scholz and Duffy, 2018), indicating an urgent need to research the factors that can stimulate self-referencing and how to shape brand love with self-referencing within a dynamic ARIT simulation.

Unlike static advertisement pictures and traditional webpage browsing, ARIT includes an avatar, allowing consumers to express themselves in real time and freely through a simulation. Carter and Grover (2015) claimed that allowing consumers to express themselves freely via avatar is the effect of information-technology (IT) identity. Interestingly, recent studies of virtual interaction have found that the more exact the mirroring of a consumer's self onto an avatar or IT identity is, the more likely he or she is to feel positively toward the online brand or e-retailer (Ahn and Bailenson, 2011). In other words, IT identity in the ARIT simulation experience may be the result of another important psychological mechanism that can enable brand love. If existing e-retailers and online brands expect to be able to use ARIT to harness the benefits of brand love, IT identity cannot be ignored. However, the current literature on ARIT is confined to the exploration of sensory factors (e.g., Hilken et al., 2017; Yim et al., 2017), and it ignores the benefits of IT identity in ARIT as shaped by avatar, restricting exploration and any discovery of causal relationships through which IT identity can influence brand love. Theories to fill this gap would support e-retailers that are working within the present environment of digital technology that is rapidly developing as they work to create a consumer base that possesses a greater brand love. Research filling this gap would have real, practical importance.

Recent interactive marketing studies have found that the main characteristic of ARIT that shapes the experience of online simulation is the distinction in quality it has from non-ARIT e-shopping environments (e.g., traditional webpage browsing) (Yim et al., 2017). For example, in sharp distinction from a non-ARIT e-shopping environment, ARIT can shape a more intense sense of ownership control (e.g., an e-shopper can freely and fully control his or her virtual stature or avatar, allowing him or her to virtually try on clothes and pose in them) (Dacko, 2017; Roy et al., 2017), and an ARIT environment can also fully display rehearsability, providing the ability to adjust and edit online interactive content at a high level, in a somatosensory way (e.g., adjusting the size, color, orientation, background, and music of an online clothes-shopping environment using somatosensory gestures, with immediate response, and reviewing any previous try-on experience at any time) (Huang, 2018). Empirical studies are needed to compare the differences in features and effects within the online simulation experience between ARIT and non-ARIT retailers (especially insofar as it shapes brand love). ARIT can benefit e-retailers and online brands for the following three reasons: first, when promoting self-guided shopping platforms, e-retailers and online brands can focus on the point that using their ARIT platform allows online products to display in a way that is more suitable and can fit every e-shopper's preferences when they try on and view products, attracting more e-shoppers to use it and stick with a given platform. Second, where ARIT and non-ARIT platforms are compared, e-retailers and online brands can understand more exactly how ARIT platforms and online consumers mesh well with each other (Scholz and Duffy, 2018), thereby either offering e-retailers and online brands the ability to view and examine shortcomings in the creation of close emotional connections and attachment relationships

between themselves and their consumers online if they remain within the current paradigm of traditional webpage browsing (non-ARIT), providing them with a selection of digital marketing tools as a foundation to establish intimate relationships with consumers and creating an online simulation experience. Last but not least, e-retailers and online brands can emphasize that ARIT offers an effective, easier, and more intuitive interface for fulfilling the demand for timely edited interactive content and to successfully promote ARIT services.

Studies comparing ARIT and non-ARIT retail will surpass the limits of existing research, confined to the exploration of ARIT and development of the intention to adopt it (e.g., Pantano et al., 2017; Rauschnabel, 2018; Roy et al., 2018). However, to date, ARIT research has been limited to single research scenarios (e.g., Hilken et al., 2017; Mulcahy and Riedel, in press; Rauschnabel, 2018), merely demonstrating differences in main characteristics and effects between ARIT and non-ARIT and comparing their effects on the final online experience (Yim et al., 2017). In particular, no direct comparison between ARIT e-shopping and traditional non-ARIT e-shopping in terms of their effects on brand love has yet been conducted. To this end, this study reviews self-referencing theory to build a theoretical framework; the adoption of such a theory is relevant because self-referencing is an important psychological mechanism and construct associated with the digital simulation of product usage (Ahn and Bailenson, 2011; Chang, 2005b). Moreover, it is a valid predictor of the creation of close self-brand connections in this context (Escalas, 2004b), which indicates that this theory would be appropriate for the present study. The theory proposes that first-person effects (such as the online sense of ownership control) and self-generated experiences (e.g., rehearsability in online product-usage simulations) contribute to self-referencing (Ahn and Bailenson, 2011; Escalas, 2004a, 2004b) and thus should be included in the research framework. The extensive mirroring of consumers' self onto an avatar (IT identity) may develop an attraction toward an online brand or e-retailer (Ahn and Bailenson, 2011). Thus, the present study also accounts for IT identity as a predictor variable for brand love to enhance the validity of the findings. Self-referencing theory also argues that in highly direct sensory experience and in personalized interactions, the effects of self-referencing are more obvious (Burnkrant and Unnava, 1995; Chang, 2005b; Tam and Ho, 2006). Unlike in a non-ARIT e-retailing environment (such as traditional webpage browsing), ARIT e-retailing incorporates highly direct sensory experiences and personalized interactions (Rafaeli et al., 2017; Roy et al., 2017). This study explores the moderating effects of ARIT adoption on four major relationships, namely, between rehearsability and self-referencing, sense of ownership control and self-referencing, self-referencing and online brand love, and self-referencing and IT identity. Fig. 1 presents the research framework of this study.

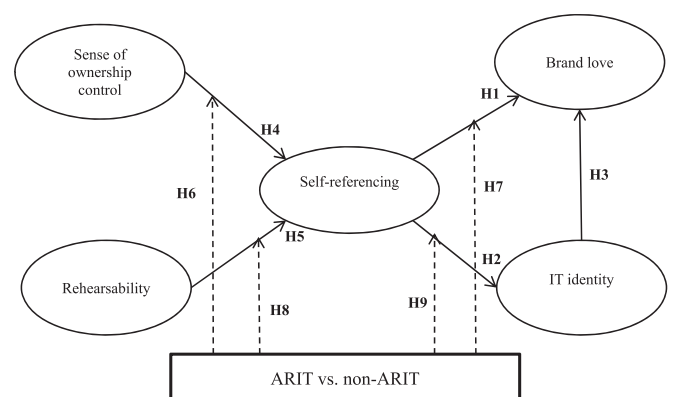


Fig. 1. Research framework for this study.

2. Theoretical background and research hypotheses

2.1. An activation context of brand love

Brand love is defined as the degree of emotional attachment a satisfied consumer has for a particular brand, which can be formed when the consumer is capable of (a) actively creating a self-concept and/or reinforcing and expressing a self-identity, (b) activating his/her memory, and (c) inspiring his/her pleasure and excitement emotion (Albert et al., 2009; Batra et al., 2012). For example, in the product usage simulation, the synchronous self-presentation feature of ARIT allows e-shoppers to manipulate their self-representation and decorate the stature of their avatar or virtual self to their heart's content (Hanus and Fox, 2015; Huang and Liao, 2015). Therefore, an ARIT e-retailing environment is more capable to create a shopping context that is closer to the personal self-concept and self-identity of the consumer in comparison with traditional Web page browsing. A study on consumer psychology noted that individuals who are able to fully demonstrate a personal self-image will be more suitable to develop, shape and create close brand relationships such as brand love (Chang, 2012).

The second capability, memories activation, refers to the new brand stimulating consumers to recall past positive memories of themselves and connect the new brand information with the consumers past memories and experiences to induce sentiments of nostalgia (Albert et al., 2008, 2009). The multiple augmented sensory inputs of ARIT offers, realism, and a dynamic experience to e-shoppers in such a way that an ARIT e-retailing environment could induce a stronger first-person effect in simulating products when compared to traditional Web page browsing (Roy et al., 2017). Escalas (2004a) experimental results showed that first-person product usage simulations are most effective in triggering previous a consumer's memory and integrating this memory with new brand information to develop a close mutual relationship between the consumer and the brand. Compared with non-ARIT e-shopping environment, ARIT e-retailing environment is more suitable for an activation context of brand love.

Triggering consumer pleasure and excitement are found to be the vital emotional factors to foster the feeling of affectionate love (Albert et al., 2008, 2009). In online product usage simulations, synchronous self-presentation and multiple augmented inputs from ARIT allows e-shoppers to realistically and naturally see themselves, to fit and try on various apparels and accessories (such as bags and necklaces) to decorate their avatar and appearance, while non-ARIT environment fail to do so (Pachoulakis and Kapetanakis, 2012). Cho and Schwarz's (2012) experimental results showed situations such as the one described above, presenting full view of self-image naturally and the fitting effects with brand products are most likely to trigger pleasure and excitement in e-shoppers. Based on this, it can be reiterated that an ARIT e-retailing environment is more effective in creating brand love through the active engagement with an augmented reality, when compared with non-ARIT e-retailing environment.

2.2. The psychological mechanism of triggering brand love

Drawing on self-referencing theory (Burnkrant and Unnava, 1995; Debevec and Romeo, 1992; Escalas, 2004a, 2004b, 2007), the main psychological mechanism shaping a tight relationship between consumer and brand (such as brand love) are described by two approaches: self-referencing in the product usage simulation and the assimilation of a consumer's self into the IT identity through self-referencing.

2.2.1. Self-referencing

Self-referencing is a mental simulation wherein consumers imagine themselves using products; specifically, self-referencing is the imitative mental representation of some event or series of events, including imagining oneself in the product, expressing current and desired self-identity in the product usage simulation experience, and developing

vivid imaginative pictures of the self-representation during the simulation process (Escalas, 2004a, 2004b). Studies on consumer behavior have assessed mental imagery, which is the level of clarity and vividness of consumers' imagining a scenario and image, to capture self-referencing (e.g., Burnkrant and Unnava, 1995; Chang, 2005a, 2005b; Song et al., 2007). For example, Debevec and Romeo (1992) measured self-referencing through the vividness and clarity of consumers' imaginative stimulation of using a product. Yoon and Park (2012) claimed that self-referencing can become more detailed and strengthened when the clarity and vividness of mental imagery (i.e., imagined displaying of self while trying various outfits under simulation) increases.

Therefore, self-referencing can integrate consumers' self-identity and brand or advertisement messages by stimulating consumers to imagine the use of the product, thereby shaping self-brand integration (Chang, 2005a, 2005b). Escalas (2004b) also asserted that consumers tend to use self-referencing to relate the brand experiences and advertisement messages to their past personal experiences, memories, and sense of self, creating a self-brand connection. In particular, self-referencing triggered by mental simulation of product usage effectively integrates brand interactive experiences with both consumers' self-image and past experiences and memories and generates the effect of image enhancement by reinforcing and expressing current and desired self-identity (Chang, 2005a, 2005b, 2012; Escalas, 2004b). For example, Ahn and Bailenson (2011) reported that in a virtual interaction context, when consumers imagine themselves using the products in a simulated experience, even if the experience is fictional, it can optimally express or demonstrate self-identity and lead to brand-self-congruency effects, subsequently increasing the likelihood of liking the brand and product procurement.

2.2.2. IT identity

In experiencing product usage simulation, a consumer mirrors him/her-self onto a character that is the evidence of self-referencing effect which may indirectly develop a close relationship between the consumer and brand (Escalas, 2004a). The character in online interaction or communication process can construct one's self-identity in the virtual world (Carter et al., 2012). Thereby, being able to mirror the self fully onto the character in the virtual interactive simulation context refers to a consumer achieving the benefits of self-extension by expressing or displaying their self completely through the avatar/IT (Li et al., 2013). For example, Ahn and Bailenson (2011) empirically determined that the more self-referencing in an online product usage simulation displays and demonstrates consumers' own features, the more the consumers are able to view the product usage simulation through avatar/IT as a self-manipulated experience. Li et al. (2013) indicated that in a simulated interactive experience, the more IT is able to effectively demonstrate the online consumers' immediate emotion and cognitive characteristics, the more the consumers view the avatar/IT as part of their extended self and form a self-avatar identity.

Carter and Grover (2015) described the above scenario of consumer mirroring the self onto avatar/IT as IT identity. IT identity refers to consumers' autonomy and empowerment to use interactive technology to optimally express or display their self (Carter and Grover, 2015). Forming IT identity mainly depends on consumers' use of various IT functions to complete a task or fulfill the desire of self-identity expression.

More importantly, consumer psychology studies have indicated that the mirroring effect of a consumer's self onto the character, triggered by a self-referencing experience in the product usage simulation, results in less critical analysis of advertisement arguments, fewer negative thoughts, and strong affective responses, which subsequently increases the likelihood of a brand acceptance (Chang, 2005a, 2005b; Escalas, 2004a; Green and Brock, 2000). Ahn and Bailenson (2011) also demonstrated that an extensive mirroring of a consumer's self onto avatar/IT (IT identity), the more likely he/she is to develop a liking toward the online brand or e-retailer. IT identity is achieved as product

usage stimulation creates assimilation and extension of self onto avatar/IT. Moreover, self-referencing is able to indirectly and positively affect the shaping of brand love through IT identity.

H1. Self-referencing will positively affect brand love.

H2. Self-referencing will positively affect IT identity.

H3. IT identity will positively affect brand love.

2.3. Major factors stimulating self-reference in product usage simulations

Self-reference theory (Escalas, 2004a, 2004b, 2007) highlighted that producing the first-person perspective (e.g., browsing or viewing personal photos) and self-generated experience based on consumer individual preferences (such as consumer self-imagined product usage stimulation) are two critical methods of triggering self-referencing. However, early advertisement research (e.g., Burnkrant and Unnava, 1995; Debevec and Romeo, 1992; Escalas, 2004a, 2004b, 2007) has mainly utilized the static pictures (e.g., viewing consumers' own photos) and abstract text (e.g., "you may remember feeling...") to determine the first-person effect and self-generated experience.

In contrast to the advertisement research context, in an online product usage simulation, online consumers not only desire to view themselves but also hope to own, control and display their physique (Nantel, 2004). Interactive marketing studies have revealed that e-shoppers often represent their actual selves by decorating and controlling their avatars in the virtual world, particularly in an online try-on experience (Huang and Liu, 2014; Merle et al., 2012). Ahn and Bailenson (2011) asserted that compared with viewing their own photographs to trigger self-referencing, allowing online consumers to control their virtual stature or avatars is a major factor in developing high self-referencing in product usage simulations. In their empirical research results, compared to merely seeing their own photo, the method of allowing online consumers to actively control their virtual stature or avatars is indeed more likely to drive higher self-referencing effect. An online sense of ownership control refers to consumers having complete control over their virtual stature or avatars and encompasses subjective elements such as action, control, intention, action choice, and freedom of thought (Blanke and Metzinger, 2009; Kalckert and Ehrsson, 2012). Based on pertinent literature (Nantel, 2004; Blanke and Metzinger, 2009; Merle et al., 2012; Huang and Liu, 2014) and by Ahn and Bailenson (2011), the online sense of ownership control in online product usage simulations conforms with the principle of triggering self-referencing through first-person effect.

H4. Sense of ownership control will positively affect self-referencing.

In addition to enabling consumers to gain control over virtual stature or avatars to develop self-referencing, online retailers or websites provide them with control based on personal preferences and instant correction in online product simulations to facilitate self-referencing (Ahn and Bailenson, 2011). For example, Tam and Ho (2006) created a high self-referencing website by allowing consumers to apply their personal interaction preferences and purposes to immediately adjust or edit the interaction presentation (which included providing immediate product recommendation or instant product search function based on consumer needs). Furthermore, Hanus and Fox (2015) provided consumers complete control over virtual stature or avatars and particularly allowed the online consumers to immediately adjust or edit avatars' clothes, face, hair style, and hair color. The above results also show that providing high modification autonomy in consumers' interactive experiences ensures that consumers' imagination simulations are clear and vivid, in addition to prompting consumers to believe that all interactions are self-derived, thereby creating a highly immersive experience in the product usage simulation. Evidence (Burnkrant and Unnava, 1995; Chang, 2005a, 2005b; Debevec and Romeo, 1992; Yoon and Park, 2012) suggests that this high autonomous product usage

simulation is a type of high self-referencing effect. Escalas (2004a) highlighted that producing self-generated stories or experiences based on consumer individual preferences (such as providing consumers with high autonomy to adjust or edit interaction experiences) is a critical method of triggering self-referencing. Digital media rehearsability refers to a process in which the sender can autonomously edit and meticulously adjust a message before sending it (Tang et al., 2013). Therefore, rehearsability in online product usage simulations conforms with the principle of triggering self-referencing through self-generated experience.

H5. Rehearsability will positively affect self-referencing.

Based on the empirical results of interactive marketing research (Hanus and Fox, 2015; Huang and Liao, 2015; Roy et al., 2017), ARIT e-retailing environment is more suitable for an activation context of brand love than traditional Web page browsing methods (non-ARIT). Thus, the following paragraphs justify and argue the moderating effect of ARIT.

2.4. Moderating effect of ARIT adoption

A higher feeling of ownership control can shape consumer first-person perspective when experiencing a product usage simulation (Blanke and Metzinger, 2009). Meanwhile, the first-person perspective is a major factor in resulting self-referencing effect in product usage simulations (Ahn and Bailenson, 2011; Meyers-Levy and Peracchio, 1996). Along this line, a sense of ownership control can positively shape high self-referencing in product usage simulations.

Compared with non-ARIT e-shopping environment (such as traditional Web page browsing), synchronous self-presentation of ARIT allows consumers to manipulate their avatar in terms of s height, weight and/or hair color using selected occasions in a virtual environment (Dacko, 2017; David, Newen, and Vogeley, 2008). Thus, AIRT e-shopping environment is more suitable to create the first-person product usage simulations. On the other hand, the sensory capability of ARIT allows consumers to augment their senses, for example lively and vividly presenting the e-shoppers' immediate fitting effects in a virtual shopping environment (Roy et al., 2017). As a result, synchronous self-presentation and various multiple augmented senses of ARIT strengthen the impact of the sense of ownership control on self-referencing through the first-person perspective characteristics. Therefore,

H6. The relationship between the sense of ownership control and self-referencing is stronger in an online ARIT environment than in an online non-ARIT environment.

Pertinent literature demonstrated that the integration of an online brand with consumer's self-concept, past experiences and memories drives self-referencing effect that may directly and positively form consumers' brand love (e.g., Ahn and Bailenson, 2011; Chang, 2005a, 2005b, 2012; Escalas, 2004b). Compared with non-ARIT e-shopping environment (such as traditional Web page browsing), ARIT e-retailing environment allows consumers to synchronously and unrestrictedly manipulate their self-representation (Hanus and Fox, 2015; Huang and Liao, 2015). Thus, ARIT creates the benefits that allow e-shoppers to freely and synchronously demonstrate and decorate stature of their avatar or virtual self based on self-concept, previous fitting experiences and memory. With this experience, e-shoppers simultaneously observe try-on effects on their avatars.

On the other hand, consumers in ARIT e-retailing environment can rewind, replay and reexamine details of a particular brand (Dacko, 2017); therefore they can replace and select preferable brand apparel that is closer to the self-concept in a selected shopping context. As such, compared with non-ARIT e-shopping environment, ARIT strengthens self-referencing effect by integrating online brand with consumers' self-concepts to positively and directly form brand love. Therefore,

H7. The relationship between self-referencing and brand love is stronger in an online ARIT environment than in an online non-ARIT environment.

Escalas (2004a) highlighted that producing self-generated consumption experiences based on consumer personal preferences (such as providing consumers with high autonomy to adjust or edit interaction experiences) is a critical method in forming better self-referencing effects. Evidence suggests that a higher autonomous product usage simulation results in a better self-referencing effect (Burnkrant and Unnava, 1995; Chang, 2005a, 2005b; Debevec and Romeo, 1992; Yoon and Park, 2012). High rehearsability of e-retailing environment allows consumers to unrestrictedly adjust and/or edit the interactive content (Tang et al., 2013). Thus, high rehearsability of e-tailing environment provides high modification autonomy in consumers' interactive experiences to ensure the clearness and vividness of consumer imagination. Thereby, it creates a high self-referencing experience in the product usage simulation.

Compared with non-ARIT e-shopping environment, synchronous self-presentation and real-time rewinding previous consumption episodes of ARIT are better in providing consumer a feeling of autonomy to adjust and/or edit the interactive content. For example, using augmented reality for clothes fittings, online shoppers experience various expressions or poses in accordance with their preferences. Moreover, e-shoppers adjust sizes and colors of a clothing item based on their personal assessment (Huang and Liao, 2015). Consequently, compared with non-ARIT e-shopping environment, ARIT e-shopping environment has better rehearsability in terms of better autonomous and self-generated consumption experiences that forms self-referencing effects. Therefore,

H8. The relationship between rehearsability and self-referencing is stronger in an online ARIT environment than in an online non-ARIT environment.

As consumer's self-referencing simulation is more dynamic and realistic, the process of consumers assimilating into the protagonist of the product usage simulation is more evident (Burnkrant and Unnava, 1995; Chang, 2005a, 2005b; Escalas, 2004a, 2004b). Especially in the virtual simulation experience, as the level of self-referencing with the manipulation of one's self-representation in the product usage simulation is higher, e-shoppers are more able to extend and/or assimilate their self into avatar/IT (so-called IT identity) (Ahn and Bailenson, 2011). In other words, the characteristic of dynamic and realistic simulation in self-referencing is a key that facilitate e-shoppers to form IT identity.

Contrary to traditional shopping websites, various multiple augment senses of ARIT not only shapes more diverse sensory experiences that is closed to consumer's self, but facilitates a smart and interactive retailing environment (Huang, 2018; Scholz and Duffy, 2018). For example, synchronously using image capturing techniques, ARIT can be used to track online consumer behaviors that then immediately present the actual image to the consumer. Thus he/she not only receives various brand product information (semantic information), but grasp personal physical movements (non-semantic consumer behavior) (Dacko, 2017). Recent research on human computer interaction (Huang and Liu, 2014) points out that synchronous self-presentation of ARIT can help e-shoppers fully demonstrate themselves and shape first-person product usage simulations. For example, augmented reality allows consumers to freely adjust the size of the apparel in the interactive screen, instantly seeing preferable apparent styles and colors (Roy et al., 2017). At the same time, e-shoppers can realistically and immediately see fitting effects of their own face, physique, and skin tone with various apparels, replacing traditional Internet or physical store where browsing models is the method to appraise products (Huang and Liao, 2015). Compared with non-ARIT e-shopping environment, synchronous self-presentation and various multiple augment senses of ARIT

strengthens self-referencing through dynamic and realistic characteristics to positively and directly form IT identity. Therefore,

H9. The relationship between self-referencing and IT identity is stronger in an online ARIT environment than that in an online non-ARIT environment.

3. Methodology

3.1. Laboratory design

To test the aforementioned hypotheses, a task-oriented laboratory method was applied. According to an eMarketer survey, the volume of online apparel and accessories sales has rapidly increased; among e-commerce transactions, apparel and accessories are the best-selling products (eMarketer, 2012). Thus, the online clothes-fitting and shopping context was employed in this study. Meanwhile, in order to test whether ARIT could strengthen the positive impact of self-referencing on online brand love and IT identity, the study follows previous self-brand connection studies (e.g., Ahn and Bailenson, 2011; Escalas, 2004a, 2004b; Hanus and Fox, 2015) using between-subjects designs to compare and analyze the different effects of path parameter estimates and variables (such as brand love) in the study model between ARIT fitting room (the experimental group; Fig. 2) and non-ARIT fitting room (control group). Meanwhile, the study presents the same factual new brand name in two try-on environment types (ARIT/non-ARIT fitting room), and informs subjects this factual new brand recently provide online fitting shopping experience.

3.2. Stimulus: online ARIT versus non-ARIT environments

According to the preceding literature review (Poushneh and Vasquez-Parraga, 2017), this study aims to create an online ARIT experience by applying interactive and audiovisual sensations. For interactive sensations, the proposed ARIT incorporates Microsoft Kinect, a type of somatosensory technology, for tracking the user's palm position to extend the range of virtual control (i.e., the physical interaction zone) through the user performing hand gestures (as shown in Fig. 2, which shows a hand gesture being performed to move an item into the basket). When the user's palm position matches the cursor area on the computer screen, the system recognizes the action (e.g., pushing and grabbing) as a hand gesture. Therefore, ARIT users do not require a mouse; they can operate the interface through control buttons and by pressing on the apparel merchandise by performing gestures.

The audiovisual component mainly uses Kinect and depth sensors to distinguish between the user's body and the background environment. The user interface superimposes the selected apparel onto the image of the user, who can reposition his or her hand to adjust the angle and size. Thus, the proposed ARIT can directly integrate the virtual apparel onto the virtual image of the user's body and accurately depict the apparel fit effect (Fig. 2), which includes displaying the back of the apparel on the screen when the user turns around.

In this study, in the online ARIT try-on environment (Fig. 2), facial expression, appearance, skin color, and body shape were directly, synchronously, and realistically applied to a body on the screen. Users could touch all the virtual clothing in the ARIT environment and change the size, position, and movement of their avatars. They could also change the appearance of the simulated fitting room (e.g., a male or female fitting room). In addition, the users could take photographs in the ARIT environment, which is a useful means of saving preferred clothes for later review. In summary, the ARIT enabled the users to enjoy online try-on experiences freely and quickly without time or space limitations. Furthermore, the users could control the try-on process. For example, they could freely browse their try-on images according to their preferred types and sequences. They could, at any time, try on clothes, end the try-on service, take pictures, and interact with



Fig. 2. Augmented-reality interactive technology; ARIT.
Source: this research.

the system. From the first-person perspective available in the ARIT, each online user could enjoy a personal and unique try-on experience.

Regarding the design of an online non-ARIT try-on environment, this study provides photos of models trying on various apparels for the subject to view. Therefore the subject is limited to using only the mouse to browse, unable to change or control actions such as interactive enlargement, reduction, movement, rotation, or photographic functions of the model in the fitting context. Furthermore, the online non-ARIT environment does not display users' facial expressions, appearances, skin colors, or body shapes. Therefore, when this research studies sense of ownership control, in a non-ARIT environment, the subjects were mainly asked whether they can control the character, rather than asked whether they can control the avatar. In brief, although the online non-ARIT and ARIT environments included the same types and numbers of clothes, the ARIT environment provided dynamic images of the user while trying on the clothes, whereas the non-ARIT did not.

3.3. Participants

The participants were recruited through an online shopping forum in Taiwan between June 2017 and January 2018. This forum was developed to support networking and discussions of fashionable clothes. Many consumers use this forum to discuss information on fashion and to share their shopping experiences. The users of this forum come from different age groups, work in different occupations, have different browsing frequencies, and spend different amounts of money. This presented a sufficient variety of subjects for this research. To recruit participants, a recruitment advertisement was posted on the forum. Each consumer who agreed to participate in the experiment was invited to the shopping experience laboratory, located at a university in northern Taiwan.

There were 232 subjects who took part in this study (116 in the ARIT environment and 116 in the non-ARIT environment). A total of 232 valid questionnaires were analyzed. Table 1 contains the respondents' demographic data. Overall, 44.6% of the participants were between 20 and 24 years old, whereas 46.5% of the participants were older than 24 years old. Moreover, 20% of the participants worked at the management level in their industries, 20% were public servants, and 60% were students. Of all participants, 8.8% browsed online shopping forums multiple times per day, 5% browsed once per day, 9.9% did so once every 3 days, 12.6% did it once per week, 9.7% browsed once every 2 weeks, 14.6% looked at online shopping forums once per month, and 16% did so once every 2 months.

3.4. Procedure

Each of the participants was randomly distributed to either ARIT fitting room or non-ARIT fitting room. Then, the researcher explained the research procedure and the purpose of the clothes-fitting software, and then instructed the participants to imagine that they intended to shop online from home. The researcher then left the room. The participants were allowed to simulate trying on apparel without interruptions. The women's apparel included 17 types of clothing (e.g., dresses). The men's apparel included four types of clothing (e.g., shirts, sweaters, and T-shirts). Thirteen colors were available. The participants were able to try on the clothes for as long as they wished and were free to stop at any time. Each participant completed an anonymous questionnaire after testing the online try-on environment. After completing the questionnaire, each participant received a gift for participating in the study.

3.5. Manipulation checks

To check the manipulation effects of ARIT, interactive items (By pressing the button on the screen, I am able to freely adjust the size and style of clothing on the screen) and audiovisual items (such as this website offers augmented reality fitting imagery) respectively asserts the perceived interactive and audiovisual degree of ARIT participants and non-ARIT participants. T-test showed that an online try-on environment type (ARIT/non-ARIT fitting room) significantly affected the interactive experience of participants. ($t = 5.95, p < 0.01$). The participants in ARIT fitting room ($M = 3.62, SD = 0.75$) rated themselves higher on interactive effect than those in non-ARIT fitting room ($M = 3.0, SD = 0.78$). Meanwhile, online try-on environment type also significantly affected the audiovisual experience of participants ($t = 8.23, p < 0.01$). The participants in ARIT fitting room ($M = 4.02, SD = 0.66$) rated themselves higher on audiovisual effect than those in non-ARIT fitting room ($M = 3.29, SD = 0.69$).

3.6. Measures

The questionnaire was adapted from previous studies to fit the research context of this study. The Appendix contains items of each variable and provides references for each variable. The responses to each question were provided on a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). In addition, the wording of each question was validated by conducting a pilot study of 30 online

Table 1
Results of measurement properties.

Construct	Items	Factor loading ^a	Cronbach's alpha	Composite reliability (ρ_c)	AVE				
Sense of ownership control (SC)	S1	.90	.940	.957	.848				
	S2	.92							
	S3	.93							
	S4	.93							
Rehearsability (RH)	R1	.88	.741	.885	.794				
	R2	.90							
Self-referencing (SR)	SR1	.85	.858	.904	.702				
	SR2	.83							
	SR3	.83							
	SR4	.84							
Brand love	Uniqueness (UN)	U1	.96	.923	.963	.929			
		U2	.97						
	Pleasure (PL)	P1	.89				.935	.953	.837
		P2	.90						
		P3	.94						
		P4	.93						
	Intimacy (IN)	I1	.91				.841	.905	.762
		I2	.92						
		I3	.78						
	Idealization (ID)	ID1	.88				.794	.880	.710
		ID2	.88						
		ID3	.76						
	Duration (DU)	D1	.86				.760	.863	.679
		D2	.89						
		D3	.72						
	Memories (ME)	M1	.88				.876	.924	.801
		M2	.92						
		M3	.89						
	Dream (DR)	DR1	.76				.837	.891	.673
		DR2	.83						
DR3		.84							
DR4		.85							
Information Technology Identity	Emotional Energy (EE)	E1	.89	.908	.943	.846			
		E2	.94						
		E3	.93						
	Relatedness (RE)	R1	.84				.900	.931	.770
		R2	.89						
		R3	.88						
		R4	.91						
	Dependence (DE)	De1	.83				.897	.928	.765
		De2	.92						
		De3	.90						
		De4	.84						

Note 1. A total of 232 valid questionnaires were collected (116 for online ARIT and 116 for online non-ARIT environments);

Note 2. 116 valid questionnaires were collected from the ARIT environment. 40% of the respondents were male and 60% were female. Respondents browsed multiple times per day (8.9%), once per day (6.5%), once every 3 days (7.7%), once per week (13%), once every 2 weeks (6.5%), once per month (19.6%), or once every 2 months (17.3%). Furthermore, 87.5%, 10.5%, and 2% of the respondents spent 2 h or less, 2–5 h, and 6 h or more at a time, respectively. Among the respondents, 44.6%, 29.8%, and 25.6% spent US\$17 or less, US\$18–34, and US\$35 or more on online apparel products at a time, respectively. In addition, 36.3% had a monthly disposable income of less than US\$166, 11.9% earned US\$167 to US\$333 per month, and 51.8% had a monthly disposable income of more than US\$334; 8.9% were younger than 20 years old, 44.6% were 20 to 24 years old, and 46.5% were more than 25 years old; 87% had bachelor's degrees, and 13% had high school degrees or less.

Note 3. 116 valid questionnaires were collected from the non-ARIT environment. 43% of the respondents were male and 57% were female. In addition, the frequency with which respondents browsed online apparel products differed: respondents browsed multiple times per day (8.6%), once per day (3.4%), once every 3 days (12.1%), once per week (12.1%), once every 2 weeks (12.9%), once per month (9.5%), once every 2 months (14.7%). Furthermore, 85%, and 15% of the respondents spent 2 h or less and 2–5 h respectively.

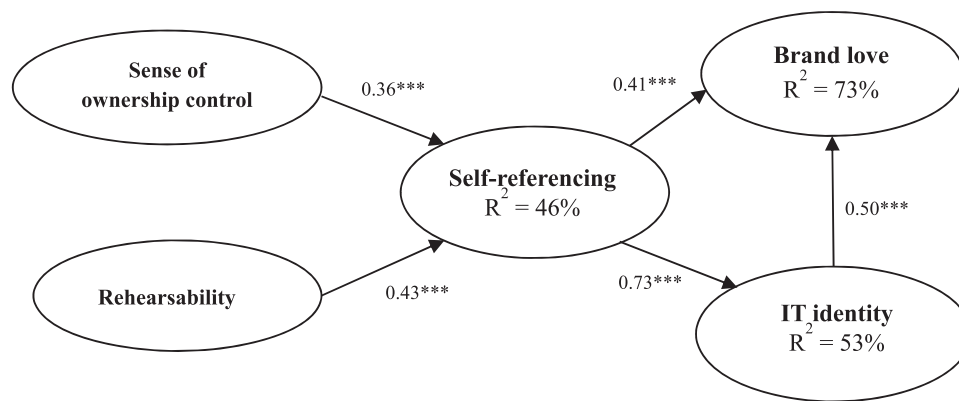
^a All item loadings were significant at $p < .01$.

shoppers. Structural equation modeling was used to evaluate the quality of a measurement model and the interrelationships among structural model constructs.

3.7. ARIT and non-ARIT two-group analysis

This study employs partial least squares-based structural equation modeling (PLS-SEM) instead of any other structure analysis method (e.g. LISREL) to analyze the differences between the effects of ARIT and non-ARIT platforms as follows. First, PLS-SEM does not require distributional assumptions. Second, it can be used for a relatively small sample (Fornell and Bookstein, 1982). Hair et al. (2014) indicated that researchers should substitute the minimum R^2 method for the 10-times

rule when calculating ideal sample size. In the model used in this study (Fig. 3), the maximum number of arrows indicating a latent variable is 2, and the minimum R^2 is .46. By contrast with Kock and Hadaya (2018) who use the minimum R^2 method to estimate the minimum sample size, the closest cell in our minimum sample size estimation table showed a minimum sample size of 52, which we used as our estimate. ARIT and non-ARIT groups in this study are respectively 116 valid participants, which satisfies the requirement for the minimum sample size; therefore, it is suitable to use PLS-SEM to conduct two-group analysis. Third, PLS-SEM can be used to explore underlying theoretical structures in high-complexity models (Jöreskog and Wold, 1982). This study uses three first-order factors (sense of ownership control, rehearsability, and self-reference), two second-order factors



Notes: ** $p < 0.05$; *** $p < 0.01$; dashed lines: not significant; solid lines: significant

Fig. 3. Results for the structural model.

(brand love and IT identity), and the moderating effects of ARIT adoption. Thus, the theoretical structure of the study featured a high-complexity model. Fourth, PLS-SEM is frequently used to test and validate hypothesized relationships of exploratory models at a theoretical level (Julien and Ramangalahy, 2003; Mahmood et al., 2004) and in online purchases (Ha et al., 2010; Rose et al., 2012). This study explores the moderating effects of ARIT adoption on four major relationships, namely, between rehearsability and self-referencing, sense of ownership control and self-referencing, self-referencing and online brand love, and self-referencing and IT identity. These relationships have been ignored in previous research, and this constitutes an exploratory model at the theoretical level. PLS-SEM is more suitable for conducting ARIT and non-ARIT two-group analysis. Hair et al. (2018) suggested that the parametric test in PLS-SEM is the best method of statistical analysis for examining different effects of path parameter estimates between two groups. This study uses PLS-SEM to compare the effects of parameter estimates between ARIT and non-ARIT groups.

4. Results

4.1. Measurement reliability and validity

The reliability and validity of each variable was verified. Table 1 also lists the loadings of the research model measures. All the items showed significant path loadings at the .01 level and exceeded .70. As indicated in Table 1, the Cronbach's alpha values ranged from .7 to .87 for the seven first-order constructs. All the values exceeded .70, indicating high internal consistency in the reliability of the measures (Nunnally, 1978). Composite reliability was determined by examining ρ_c for constructs and exceeded the suggested threshold of .70 in all constructs, indicating satisfactory reliability. In this study, convergent validity was assessed using the average variance extracted (AVE) and ratio of construct variance to total variance of the indicators. Table 1 shows the values of AVE for the seven constructs, all of which exceeded .50 (Barclay et al., 1995), confirming that all of the measures exhibited satisfactory convergent validity. Subsequently, we examined discriminant validity by using a correlation matrix. As listed in Table 2, all of the values of the square root of AVE for the measures on the diagonal exceeded the correlations among the measures of the diagonal (Fornell and Larcker, 1981). The discriminant validity was thus satisfactory.

4.2. Mediating effect of self-referencing

The path coefficients for all relationships among sense of ownership control, rehearsability, self-referencing, brand love, and IT identity were significant ($p < .05$), as per data shown in Fig. 3, which supports H1, H2, H3, H4, and H5. The fact that H1, H2, and H3 were supported

implies that methods to shape online consumers' brand love can be divided into two paths. Influencing the self-reference of online consumers is the primary means of shaping the level of brand love. If concrete, vivid simulations of product utilization are successfully triggered in them, online consumers can closely relate themselves (including personal experiences, memories, self-image, and sense of self) to the e-retailer, creating brand love for the e-retailer. Second, the IT identity triggered by self-referencing constitutes another important means of successfully stimulating brand love. For example, with a somatosensorily manipulable avatar in an ARIT to express themselves, online consumers can both easily project themselves into their avatar and connect the sense of identity they have with their avatar to the e-retailer, generating brand love effects for e-retailers.

This study has demonstrated that sense of ownership control is positively related to self-referencing (H4). This finding suggests that environments that employ digital simulation of product usage, which give online consumers the freedom to control their virtual stature, effectively trigger online consumers' active willingness to imagine and enhance their mental simulation of product use, making it more vivid and realistic. Škola and Liarokapis (2016) highlighted ownership control, which can be shaped by ARIT and can arouse online consumers' brain functions, including concentration, imagination, and meditation. Meanwhile, this study also found a significant effect of rehearsability on self-referencing (H5). This finding suggests that augmentation of visual representations of e-shoppers' own bodies and manipulation of their self-representation, including changes to their avatar's clothes, face, hairstyle, and hair color, drive the imaginative stimulation of e-shoppers, encouraging them to use a product in the ARIT e-retailing environment.

To investigate the indirect effect of the dependent variables through the mediator, bias-corrected bootstrapping and percentile bootstrapping were performed using 2000 bootstrap samples to calculate 95% confidence intervals. Following the suggestion of Preacher and Hayes (2008), the confidence intervals of the lower and upper bounds were calculated to test whether the indirect effects were significant. As shown in Tables 3 and 4, the bootstrap test results confirmed the existence of a positive and significant partial mediating effect for self-referencing between sense of ownership control and brand love, and a significant full mediating effect for self-referencing between rehearsability and brand love. According to the results of Tables 5 and 6, self-referencing also significantly fully mediates the positive relationship between sense of ownership control and IT identity and between rehearsability and IT identity. All in all, consumers' sense of ownership control and rehearsability in virtual environments are foundational for their brand love and IT identity, which is mediated by self-referencing effects. Apparently, sensory stimulation is insufficient: only with self-referencing simulation can online consumers truly build a close

Table 2
Means, Standard Deviations, Correlations, and the square root of the Average Variance Extracted.

Construct Name	Mean	SD	SR	SC	RH	DE	DR	EE	PL	UN	ID	DU	IN	ME	RE
SR	3.17	.78	.84												
SC	3.24	1.01	.58	.92											
RH	3.34	.81	.61	.50	.89										
DE	2.45	.77	.45	.35	.38	.87									
DR	2.88	.82	.60	.50	.44	.59	.82								
EE	3.03	.84	.68	.47	.40	.43	.52	.92							
PL	3.23	.86	.75	.58	.57	.49	.66	.70	.91						
UN	3.68	.89	.47	.48	.37	.23	.48	.31	.56	.96					
ID	3.10	.77	.61	.51	.45	.52	.60	.62	.72	.51	.84				
DU	2.86	.79	.60	.49	.48	.64	.72	.55	.67	.48	.72	.82			
IN	3.12	.79	.76	.56	.54	.50	.65	.69	.84	.50	.74	.67	.87		
ME	3.07	.86	.53	.42	.44	.46	.61	.47	.55	.45	.61	.56	.57	.90	
RE	3.01	.83	.67	.47	.51	.49	.58	.72	.68	.28	.65	.57	.70	.51	.88

Note: A total of 232 valid questionnaires were collected (116 for online ARIT and 116 for online non-ARIT environments). Values in the shaded diagonal are the square root of the average variance extracted (AVE).

emotional connection with and attachment to an e-retailer, subsequently forming brand love.

4.3. Ascertaining the moderating effects of ARIT try-on environment

4.3.1. Testing measurement invariance

Before comparing the coefficient variances in the cause-and effect model within ARIT and non/ARIT try-on environments, all measurements used to evaluate independent and dependent variables in both try-on environments should meet the measurement invariance criteria (Parameswaran et al., 2015). Specifically, Parameswaran et al. (2015) confirm the measurement invariance analysis sequence after reviewing measurement invariance researches in various research fields including the interactive technology research (Lai and Li, 2005), consumer behavior study (Steenkamp and Baumgartner, 1998), marketing research (Cheung, 2008), and organization research (Delgado-Ballester, 2004; Vandenberg and Lance, 2000) Thus, this study adopted Parameswaran and his colleagues' steps of analysis to examine the measurement invariance for examining all variables.

The results in Table 7 show that configural invariance was supported for the baseline measurement model (Model 1). A full metric invariance model (Model 2) was established by constraining all factor loadings. The full metric invariance model fits the data well. The χ^2 difference between this model and the configural model was not significant ($\Delta\chi^2 = 4.11, \Delta df = 15, p > 0.05$). This full metric invariance model was then used as a baseline model for comparing the other invariance models. Next, the uniqueness invariance model (Model 3) was established. This model was nested with Model 2. Because the χ^2 of the uniqueness invariance model was not significantly larger ($\Delta\chi^2 = 28.37, \Delta df = 19, p > 0.05$) than that of the partial metric invariance model. Therefore, the uniqueness invariance was accepted.

Table 3
Mediation of the effect of self-referencing on the relationship between sense of ownership control and brand love.

Variables	Point Estimate	Product of Coefficients		Bootstrapping			
				Bias-Corrected 95% CI		Percentile 95% CI	
		SE	Z	Lower	Upper	Lower	Upper
Total Effects							
Sense of ownership control → brand love	.362	.06	6.03***	.236	.482	.236	.482
Indirect Effects							
Sense of ownership control → brand love	.28	.053	5.28***	.187	.397	.185	.389
Direct Effects							
Sense of ownership control → brand love	.082	.037	2.22*	.016	.157	.011	.154

Note 1. 2000 bootstrap samples. *: $p < .05$, **: $p < .01$, ***: $p < .001$; $\chi^2/df = 1.83$, non-normed fit index (NNFI) = 0.91, comparative fit index (CFI) = 0.91, RMSEA = 0.043.

Next, the invariance in the construct variance model (Model 4) was established. This model was nested with Model 2 as well. The fit of this model was acceptable, and the model did not differ significantly from Model 2. Next, the invariance in the construct covariance model (Model 5) was established. This model was again nested with Model 2. The fit of this model was acceptable, and the model did not differ significantly from Model 2. The results showed that both ARIT and non/ARIT try-on environments meet the measurement invariance in between all variables as seen in Parameswaran et al. (2015) as well. Therefore, a further comparison analysis of the variances between coefficients in the cause-and-effect structural model can be established.

4.3.2. Comparing the coefficient variances in the cause-and effect model in ARIT and non/ARIT

In addition to supporting H1–H5, the invariance results of the hypothesized model among the groups revealed statistically significant differences in the path parameter estimates between the online ARIT and non-ARIT try-on environments (Table 8). Such results indicated that ARIT scenarios significantly moderated the effect of self-referencing on brand love and IT identity and the effect of rehearsability on self-referencing except for the effect of sense of ownership control on self-referencing, supporting H7, H8, and H9; H6 was not supported.

According to the above findings, significant differences existed between coefficient values in the structural model in both ARIT and non/ARIT try on environments. Hence, this study ascertains ARIT has significant moderate effects on brand love and IT identity. Different degrees of augmented reality show moderating effects on three major relationships, namely, between self-referencing and online brand love (H7), rehearsability and self-referencing (H8), and self-referencing and IT identity (H9), except for the effect of sense of ownership control on self-referencing (H6). It has been noted in this report that ARIT

Table 4
Mediation of the effect of self-referencing on the relationship between rehearsability and brand love.

Variables	Point Estimate	Product of Coefficients		Bootstrapping			
				Bias-Corrected 95% CI		Percentile 95% CI	
		SE	Z	Lower	Upper	Lower	Upper
Total Effects							
Rehearsability → brand love	.550	.099	5.56***	.374	.758	.369	.757
Indirect Effects							
Rehearsability → brand love	.490	.112	4.38***	.313	.756	.295	.727
Direct Effects							
Rehearsability → brand love	.059	.088	.67	-.123	.238	-.118	.238

Note 1. 2000 bootstrap samples. *: $p < .05$, **: $p < .01$, ***: $p < .001$; $\chi^2/df = 1.91$, non-normed fit index (NNFI) = 0.90, comparative fit index (CFI) = 0.90, RMSEA = 0.045.

environments empower e-shoppers to use interactive technology to optimally express their selves and consumption emotions, to a greater degree than non-ARIT environments. Thus, ARIT e-shoppers can use their avatar to simulate use of products and brands as well as to express their emotions and desires for consumption in real time, ultimately creating a close emotional connection and attachment in various relationships, such as those between themselves and the e-retailer and between themselves and the branded interactive platform (including the avatar in an ARIT experience). Obviously, to strengthen brand love, the retail service industry should empower consumers to express consumption emotions as part of their basic design.

5. Conclusion

This study drew on self-referencing theory to investigate the formation of brand love and IT identity in virtual environments. Three main research findings were obtained. First, two aspects to creating brand love were found. These were that simulating self-reference in online consumers produces concrete and vivid product utilization and that online consumers place themselves within the sense of identity that is shaped by their avatar in the simulation experience, transferring it to the e-retailer and generating brand love. Second, it was demonstrated that rehearsability and high-level somatosensory ownership control are two determinants that shape self-referencing in dynamic simulations. These two are influencing factors that previous self-referencing research (such as the study of static advertisements) has ignored and that has proven difficult to investigate. In particular, brand love can only be created from these two factors by concrete and vivid self-referencing. This cause–effect relation and psychological mechanism cannot be ignored and are worth emphasizing to future researchers in this field. Finally, three major relationships (between rehearsability and self-referencing, self-referencing and online brand love, and self-referencing and IT identity) were found to be strengthened in ARIT environments, whereas the effect of the sense of ownership control on self-referencing

was not. This may be because the somatosensory empowerment effect and the features of the integration of virtual and physical reality in the embedding of e-shoppers’ physical body images in a virtual environment are more significant in ARIT than non-ARIT environments (such as in advertisements or traditional webpage browsing). This study contributes both theoretically and practically. These contributions are enumerated in further detail below.

5.1. Theoretical implications

The results of the empirical study found that ARIT e-retailing environment is more suitable for an activation context of brand love than non-ARIT e-retailing environment. The three major relationships between rehearsability and self-referencing, self-referencing and online brand love, and self-referencing and IT identity were better reinforced in the ARIT environment. An online ARIT environment with multi-sensory technology that displays product details substantially increases rehearsability among online consumers while increasing the possibility of online consumers using self-referencing to produce, shape, and compile digital content, which enhances the benefits of online brand love and IT identity in a cocreation and interactive process. The results are consistent with their study as highly interactive digital content can create high brand value (Baron et al., 2014).

The present study also examined the link between digital simulation experience and brand love from a self-referencing perspective. When self-identity is incorporated into the digital simulation of product usage, brand love is created that encompasses a link between brand simulation experience and brand emotion. Previous studies on feeling of love toward brand have been based on lovemarks theory (Cho, 2011; Roberts, 2004) in which the researchers claimed that the feeling of love towards a brand is created when consumers perceive the brand story, high sensory experiences, and intimacy. This study drew on self-referencing theory to verify the antecedent variables of brand love, that is, a sense of ownership control and rehearsability in the digital simulation of

Table 5
Mediation of the effect of self-referencing on the relationship between sense of ownership control and IT identity.

Variables	Point Estimate	Product of Coefficients		Bootstrapping			
				Bias-Corrected 95% CI		Percentile 95% CI	
		SE	Z	Lower	Upper	Lower	Upper
Total Effects							
Sense of ownership control → IT identity	.382	.062	6.16***	.262	.507	.260	.504
Indirect Effects							
Sense of ownership control → IT identity	.360	.072	5.00***	.233	.531	.230	.522
Direct Effects							
Sense of ownership control → IT identity	.022	.050	.44	-.082	.115	-.084	.114

Note 1. 2000 bootstrap samples. *: $p < .05$, **: $p < .01$, ***: $p < .001$; $\chi^2/df = 1.98$, non-normed fit index (NNFI) = 0.94, comparative fit index (CFI) = 0.94, RMSEA = 0.046.

Table 6
Mediation of the effect of self-referencing on the relationship between rehearsability and IT identity.

Variables	Point Estimate	Product of Coefficients		Bootstrapping			
		SE	Z	Bias-Corrected 95% CI		Percentile 95% CI	
				Lower	Upper	Lower	Upper
Total Effects							
Rehearsability → IT identity	.596	.107	5.57***	.423	.849	.414	.834
Indirect Effects							
Rehearsability → IT identity	.640	.168	3.81***	.370	1.027	.370	1.028
Direct Effects							
Rehearsability → IT identity	-.044	.129	-.34	-.350	.171	-.348	.175

Note 1. 2000 bootstrap samples. *: $p < .05$, **: $p < .01$, ***: $p < .001$; $\chi^2/df = 2.35$, non-normed fit index (NNFI) = 0.92, comparative fit index (CFI) = 0.92, RMSEA = 0.05.

product usage. Meanwhile, this study examined the mediating effect of self-referencing on the aforementioned relationships.

Although considerable research has discussed the role of physical brand identity in consumer behavior (e.g., Vallaster and von Wallpach, 2013; Kastanakis and Balabanis, 2012) and the effect of corporate identity on individual behavior (Burghausen and Balmer, 2015), little has discussed IT identity within ARIT e-retailing domain. This study argued that in a digital simulation of product usage, consumers not only form connections with online e-retailing brand but also interact with ARIT environment through their avatar creating a digital simulation experience. For example, in a try-on simulation environment, e-shoppers often use try-on technology to mirror and represent their sense of self (Merle et al., 2012). They then form a connection and emotional attachment with the try-on technology (such as a desire to continuously use the technology) (Nantel, 2004), which then creates an IT identity effect (Carter and Grover, 2015). The results of this study enhances the identity literature by verifying the role of IT identity and linking the formation of IT identity with self-referencing in the simulation of product usage. Notably, the formation of IT identity through self-referencing in the simulation of product usage also enhances the development acceleration of first-time e-shoppers' brand love for a specific e-retailing brand.

The current results also suggest that a sense of ownership control and rehearsability can positively affect the cocreation of brand love and IT identity. Specifically, providing consumers with an online experience in which they can demonstrate themselves freely according to their personal inclinations (i.e., an online experience created from a first-person perspective) and providing them with more tools and power for self-compilation and content creation are major techniques of triggering the most attractive brand love and IT identity based on digital simulation experiences. The current research suggests that consumers in a virtual digital environment develop an emotional attachment to online brands through mutual participation and by proactively producing diverse digital content and experiences. This emotional link is not limited to online brands; it follows the more frequent use of technology to provide consumer digital simulation experiences, thereby enabling consumers to foster a close relationship with IT. The current findings fill the gap in research on brand love and IT identity conducted from the perspective of self-referencing theory.

Table 7
Tests for the equivalence of the measurement models across ARIT and non-ARIT try-on environments.

Model	Test of equivalence	Unconstrained vs. constrained models	df	χ^2	χ^2/df	RMSEA	IFI	CFI	Δdf	$\Delta\chi^2$	p-value
1	Configural invariance		318	607.90	1.91	0.06	0.91	0.91			
2	Full metric invariance	1 vs. 2	333	612.01	1.84	0.06	0.91	0.91	15	4.11	0.99
3	Uniqueness invariance	2 vs. 3	352	640.38	1.82	0.06	0.91	0.91	19	28.37	0.08
4	Invariance in construct variance	2 vs. 4	357	645.73	1.81	0.06	0.91	0.91	24	33.72	0.09
5	Invariance in construct covariance	2 vs. 5	367	657.03	1.79	0.06	0.91	0.91	34	45.02	0.10

** : $p < 0.05$; ***: $p < 0.01$.

The evaluation results reveal that self-referencing mediates various relationships such as those between sense of ownership control and online brand love, sense of ownership control and IT identity, rehearsability and online brand love, and rehearsability and IT identity. Self-referencing is a critical psychological mechanism in simulating interaction experiences and digital consumption creation to successfully shape online brand love and IT identity. As Franceschi et al. (2009) suggested, if self-referencing detracts from the online digital media experience, the consumer is unable to interpret any significance of sensorimotor information. Most studies on self-referencing have examined how the concrete text of a static environment (including website pictures and text) influences self-referencing (e.g., Tam and Ho, 2006). Advertising research confirmed that visual and verbal advertising messages evoke self-referencing, which further influences cognitive, affective, and conative responses (Debevec and Romeo, 1992). A tourism study revealed that the self-referencing evoked by concrete pictures in a travel advertisement enhances behavioral intentions (Miller and Stoica, 2003). In contrast to the findings of previous advertising research (e.g., Burnkrant and Unnava, 1995; Debevec and Romeo, 1992; Escalas, 2004a, 2004b, 2007), the current study determined that self-referencing directly shapes online brand love and IT identity based on digital simulations of product usage (e.g., sense of ownership control and rehearsability). Such findings fill the research gap regarding the role of self-referencing in the digital simulation of product usage environments (Ahn and Bailenson, 2011; Rodríguez-Ardura and Martínez-López, 2014) and verifies the perspective and ideas of self-referencing theory, thereby broadening the perspective of self-referencing in research on digital simulation environments.

5.2. Practical implications

For online retailers, precise feedback is the main criterion for developing a high sense of ownership control (David et al., 2008). For example, users typically compare the movement of the simulated body in a virtual digital environment with their actions in the real world, which shapes their perception of ownership control. Thus, online brands should ensure that after every action, online users receive accurate feedback and have their simulated bodies respond appropriately. For the synchronization of visual and control sensations, ensuring that

Table 8
The comparisons of various try-on environments.

Path parameter estimates	ARIT	Non-ARIT	Difference of T-value
Sense of ownership control → Self-referencing	$\gamma = .22^{**}$	$\gamma = .39^{***}$	1.35
Rehearsability → Self-referencing	$\gamma = .54^{***}$	$\gamma = .31^{***}$	2.27**
Self-referencing → Brand love	$\beta = .78^{***}$	$\beta = .66^{***}$	2.10**
Self-referencing → IT identity	$\beta = .77^{***}$	$\beta = .60^{***}$	2.55**

Note: ARIT: online ARIT environment (n = 116); Non-ARIT: online non-ARIT environment (n = 116).

** : p < .05.

*** : p < .01.

the movement of users is accurately reflected by their simulated bodies (Blanke and Metzinger, 2009) enables the users to enjoy the online try-on experience.

Regarding rehearsability, online brands should ensure that consumers can create digital content by editing, producing, shaping, and rehearsing before sending a message. Enabling online consumers to meticulously edit a message before sending it ensures that the expressed meaning is correct, thus enabling the recipient to decode and process the information easily. This constitutes a cocreation experience involving coordination and integration, in addition to creating a closer and more intimate link and brand experience for the sender and recipient.

Regarding the relationship between the user and technology, the degree of emotional investment in technology and the user's reliance on the technology directly influence IT identity (Carter and Grover, 2015). The major prerequisite to developing long-term IT use involves effectively demonstrating or expressing the user's first-person perspective through IT to accurately achieve the user's desire (Hackbarth et al., 2003). In addition, when users use IT to complete missions or search and demonstrate self, their reliance on technology naturally surfaces (Lamb and Davidson, 2005; Lamb and Kling, 2003). According to the preceding discussion, the current study suggests that IT designers enable users to create a sense of ownership control and rehearsability through qualified IT. By adopting these suggestions, a firm can shape its IT identity.

Online brands can make more use of interactive ARIT-based service experience that employ multisensory and simultaneous display results, thereby satisfying the entertainment needs of online consumers regarding the editing and creation of personal digital content. While shaping production, online consumers are likely to use self-referencing to link personal experiences and self-concepts with online brands, thereby enhancing online brand love and IT identity.

5.3. limitations, and future research

Some limitations and suggestions for future research are as follows.

Appendix

Construct	Items
Sense of ownership control (Kalckert and Ehrsson, 2012)	S1 I feel that I can control the “avatar’s” (“character’s” was used in non-ARIT questionnaire) body.
	S2 The avatar’s body, like my own body, can be easily controlled.
	S3 The avatar’s hands appear to move according to my intention and desire.
	S4 Controlling the avatar’s hands appears to be similar to controlling my own hands.
Rehearsability (Tang et al., 2013)	R1 This online system can provide me with sufficient time to think about my expectations before starting to try on the clothes online.
	R2 This online system can help me craft the try-on results before starting to actually try on the clothes online.
Self-referencing (Song et al., 2007)	SR1 When using this interactive system, the happy imaginal picture of actually using the product in the future appeared in my mind.
	SR2 This interactive system enables me to picture myself dressed in the image I clearly desire in my mind.
	SR3 This interactive system creates a vivid image of actual try-on simulation in my mind.
	SR4 Using this online system enables me to clearly picture myself actually wearing the clothes.

First, Due to the first-person effect, we expect that the relationship between the sense of ownership control and self-referencing is stronger in an online ARIT environment than in an online non-ARIT environment. However, this effect was no evident in the findings. Early advertisement research empirically found using text description and a photograph browsing method produces first-person effects that triggers self-referencing (e.g., Burnkrant and Unnava, 1995; Debevec and Romeo, 1992; Escalas, 2004a, 2004b, 2007). For this reason, the relationship between the sense of ownership control and self-referencing induced by the first-person perspective may show insignificant differences between ARIT and non-ARIT e-shopping environment. Future research may investigate the cause of this apparent indifference.

Second, this study examined clothes fitting in an online shopping context because this is the most rapidly growing area in e-commerce and yields the highest sales revenues. Future research should focus on related products (e.g., electronic products, which consumers also physically examine before purchase) to validate the sensory experiences discussed in this study. In addition, this study adopted a task-based laboratory method focusing on the model developed in this study. Each participant was required to imagine shopping online at home. We recommend that future studies use more ecologically valid settings (e.g., an actual purchase setting) and explore brand love and IT identity more directly among participants with different use patterns. Finally, consumer characteristics, such as consumer innovativeness and the need for touch, may be crucial moderating variables influencing user response to online try-on services. Therefore, future research could elucidate the role of consumer characteristics in order to provide a comprehensive understanding of online shopping behavior.

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Brand love (Albert et al., 2009)	Uniqueness	U1	This e-retailer is special.
		U2	This e-retailer is unique.
	Pleasure	P1	I enjoy trying products provided by this e-retailer.
		P2	Discovering new products from this e-retailer is purely pleasurable.
		P3	I really enjoy interacting with this e-retailer.
		P4	I am always happy to interact with this e-retailer.
	Intimacy	I1	I have a warm and comfortable relationship with this e-retailer.
		I2	I feel emotionally close to this e-retailer.
		I3	I value this e-retailer greatly in my life.
	Idealization	ID1	There is something almost “magical” about my relationship with this e-retailer.
		ID2	There is nothing more important to me than my relationship with this e-retailer.
		ID3	I idealize this e-retailer.
	Duration	D1	I would continue to interact with this e-retailer.
		D2	I would be interacting with this e-retailer for a long time.
		D3	Apart from this e-retailer, I will not interact with any other e-retailer.
	Memories	M1	This e-retailer reminds me of some important try-on experiences.
M2		This e-retailer reminds me of memories, moments of my past (childhood, adolescence, a meeting, etc.).	
M3		I associate this e-retailer with some important events of my try-on experience.	
Dream	DR1	This e-retailer is an ideal e-retailer for me.	
	DR2	I have dreamed of interacting with this e-retailer for long.	
	DR3	This e-retailer is a shopper's dream.	
	DR4	I dream (or have dreamed) to develop a relationship or connection with this e-retailer.	
Information Technology Identity (Carter and Grover, 2015)	Emotional Energy	E1	Thinking of myself in relation to this information technology, I feel confident.
		E2	Thinking of myself in relation to this information technology, I feel enthusiastic.
		E3	Thinking of myself in relation to this information technology, I feel energized.
	Relatedness	R1	Thinking of myself in relation to this information technology, I feel a connection with this information technology.
		R2	Thinking of myself in relation to this information technology, I feel that I am in coordination with this information technology.
		R3	Thinking of myself in relation to this information technology, I feel that I am close with this information technology.
		R4	Thinking of myself in relation to this information technology, I feel that I am linked with this information technology.
	Dependence	De1	Thinking of myself in relation to this information technology, I feel that I need this information technology.
		De2	Thinking of myself in relation to this information technology, I feel that I can trust this information technology.
De3		Thinking of myself in relation to this information technology, I feel that I rely on this information technology.	
De4		Thinking of myself in relation to this information technology, I feel that I depend on this information technology.	

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