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Augment yourself through virtual mirror: the impact of self-viewing and narcissism on consumer responses

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ABSTRACT

Virtual mirror, an increasingly popular application of augmented reality, allows consumers to view their visages overlaid with product images on digital displays. The authors of this study examine how augmented reality technology affects consumers' brand perceptions and purchase intentions. Study 1, using a real brand, demonstrates that consumers tend to form higher self-brand connections and purchase intention when viewing themselves trying a product via a virtual mirror, rather than when viewing professional models wearing the product. Study 2, using a fictitious brand, reveals that narcissistic participants show pronounced positive self-viewing effects, but non-narcissistic participants show attenuated effects. Implications for digital marketers are discussed.

Introduction

The Ray-Ban website, like many other online shopping sites, allows consumers to browse, choose, and purchase sunglasses from a variety of styles and designs. However, the website has a unique feature that sets it apart from other shopping sites: online shoppers can use a computer camera to try on sunglasses, virtually, as if in the fitting room at a brick-and-mortar store. This novel technology, called augmented reality (AR, hereafter), creates a virtual mirror on a computer screen and overlays or surrounds a shopper's image with computer-generated product images. The traditional alternative option is still available: shoppers can see images of professional models wearing the product.

Marketing practitioners and scholars have shown growing interest in this type of AR applications because of evident, personalized, and novel advantages. However, the lack of empirical research has limited our knowledge of how AR applications affect consumer behavior and digital marketing effectiveness. Furthermore, the unique and distinctive experience that distinguishes an AR application from indirect experience (e.g., traditional advertising) has rarely been examined. Especially in an AR mirror, consumers are able to see themselves trying the product. Then, do those consumers show varying purchase intentions in comparison to other consumers with indirect experiences such as seeing professional models wearing the product? Do consumers who experience the product

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through a virtual mirror feel more connected to the brand? Practically, is the AR technology an effective marketing communication tool? If so, what personality traits would moderate consumers' reactions to an AR mirror? This research aims to answer these questions.

Gazing into a mirror provides a self-viewing experience (Pines 1984), thus self-perception theories (Bem 1967) would be essential for testing marketing efforts via an AR virtual mirror. Drawing on self-referencing effects (Rogers, Kuiper, and Kirker 1977) and self-attention theory (Carver 1979; Mullen 1987), we propose that AR-enhanced self-viewing (e.g., viewing oneself wearing sunglasses on a computer screen) is more effective than other-viewing (e.g., viewing professional models wearing sunglasses on a computer screen) in increasing brand purchase intentions. Furthermore, we expect that the influence of self-viewing versus other-viewing would vary with the level of narcissism – defined as 'a personality trait reflecting a grandiose and inflated self-concept' (Buffardi and Campbell 2008, 1304). Although 'narcissism' has rarely been examined in the advertising and marketing literature, many social psychology studies based on self-attention and self-perception theories have focused on it as a personality trait that affects individual behaviors (e.g., Campbell, Rudich, and Sedikides 2002; John and Robins 1994; Jones and Brunell 2014; Robins and John 1997). Like the pool that so deeply entranced Narcissus, self-viewing through an AR virtual mirror might cause narcissistic consumers to undergo a heightened sense of self-enhancement and self-admiration, in comparison with non-narcissistic consumers. Recently, a steadily growing number of consumers have shown narcissistic traits (Twenge and Foster 2010); thus, studying the effects of narcissism as a consumer trait variable in the context of an AR virtual mirror could have important theoretical and practical implications.

Therefore, the purpose of this study is threefold. First, in the context of AR virtual mirrors, we empirically test the influence of self-viewing compared to other-viewing (i.e., consumers' viewpoints) on perceptions of consumer-brand connections and purchase intentions. Second, we identify an individual boundary condition – narcissism – as the moderator affecting the AR self-viewing effects. Finally, we examine the underlying psychological mechanism to explain the mediating role of perceived self-brand connection (SBC) in the AR self-viewing and other-viewing effects.

Literature review

Augmented reality (AR)

AR refers to a digital technology that imposes computer-generated information such as images and sounds on a user's real-world view. AR is distinguished from virtual reality (VR) where users are completely immersed within a virtually simulated environment (Haller, Billinghurst, and Thomas 2006). In short, computer-generated information partially enhances AR users' physical environment, whereas a computer-generated environment replaces VR users' physical environment (Huang and Liao 2015).

The AR prototype was first introduced in the 1960s (Sutherland 1965), but marketers adopted the technology as a marketing communications tool only recently (Yim and Chu 2013). For instance, General Electric incorporated an AR application into their 'Plug into the Smart Grid' campaign in 2011. In this application, consumers held a piece of paper as a marker in front of their computer webcam. The computer screen then showed their

image, but the marker became a three-dimensional (3D) animated model of a Smart Grid, so interactive that when they blew into the computer microphone, the wind turbines in the Smart Grid began spinning. This type of AR application, called 'AR with a marker,' is somewhat unwieldy, however, because consumers must print out and hold the symbol in front of a computer camera (Pereira, Silva, and Alves 2011). Alternatively, some online retailers incorporated AR technologies and created the so-called 'virtual mirror' or 'virtual fitting room' featuring interactive 3D images offering consumers an opportunity to see how they would look wearing a product such as jewelry, clothing, shoes, and eyeglasses. This 'AR with silhouettes' application requires users to be positioned correctly within the angle of a computer camera and then allows them to manipulate the application through varying gestures; in essence, they can try on different items.

Marketers are not alone in using AR technologies. Traditional brick-and-mortar retail settings have also adopted kiosk-style AR offerings that provide interactive 3D digital experiences. For instance, Lego provides screens and webcams in stores so that consumers can use its 'Digital Box' application: they expose a Lego box to the screen and then view the assembled product (Jepson 2010). Branded mobile applications have also incorporated AR technologies. For example, Walgreen provides a 3D map of their retail locations from the users' orientation and shows them where products are located in the store (Kaye 2014).

Despite AR's potential as a digital marketing tool for enriching consumers' online shopping experience, empirical research exploring the effectiveness of AR technology on brand evaluations is limited. Only a handful of studies to date have identified potential factors that might influence the consumer decision-making process in an AR environment (Huang and Liao 2015; Verhagen et al. 2014; Yim and Chu 2013). For example, Huang and Liao (2015) adopted the technology acceptance model and showed that presence – defined as a sense of 'being there' (Yim, Cicchirillo, and Drumwright 2012) – positively predicted usefulness, ease of use, service excellence, aesthetics, and playfulness, thereby leading to stronger intentions toward using AR technology. Verhagen et al. (2014) found that local presence was more prevalent among consumers using virtual mirrors than those using other product visualization formats (i.e., pictures and 360-spin rotation), resulting in increased product tangibility and likability. In a similar vein, Yim and Chu (2013), examining the effectiveness of AR technology in online product presentations, revealed that interactivity was the most important characteristic of AR technology adoption intention. Based on these studies, the interactive nature of product visualization is what stimulates a consumer's sense of presence when experiencing a sensory-rich AR environment. This distinctive and salient experience might prime consumers while using an AR application, potentially raising attention, enhancing evaluations, and ultimately affecting buying behavior. Thus, we expect that consumers are more likely to perceive an AR experience to be richer and more personal than the indirect experience of traditional advertising in which they see professional models using the products; the former is likely to be a more direct experience because of a sense of presence, relevance, and interactivity stimulated by an AR application.

In sum, AR offers consumers a new way to experience products and brands in a realistic environment. Consequently, marketing practitioners are increasingly adopting AR to bridge virtual and physical marketplaces. Although AR is being increasingly adopted as a marketing tool, scholars have yet to understand when and how AR effectively contributes

to building positive consumer-brand relationships. To fill the gap between practice and research, in the next section, we review the self-referencing effects and self-attention theory as an integrated theoretical framework to explain the AR self-viewing effect, and suggest study hypotheses.

The self-referencing effects

Advertisers often encourage consumers to imagine how they would relate with advertised products. The cognitive process of personally relating with information, known as self-referencing, has been shown to generally heighten memories of ad information (Burnkrant and Unnava 1989; Nelson, Yaros, and Keum 2006) and to enhance product and brand evaluations (Debevec and Romeo 1992). Persuasive strategies that utilize reference groups (Escalas and Bettman 2003; Wei and Yu 2012), celebrity endorsement (Escalas and Bettman 2009), ad model ethnicity (Lee, Fernandez, and Martin 2002), and narrative advertising (Escalas 2004) are proven to trigger self-referencing.

Then, how does self-referencing increase advertising effectiveness? Consumers tend to process self-related information more easily and deeply than other types of information (Chang and Lee 2011). This high fluency and elaboration increases the amount and strength of associative pathways linked to the information (Symons and Johnson 1997; Yoon, Choi, and Song 2011). Following that thought, Meyers-Levy and Peracchio (1996) experimented by altering the ad copy and visuals to vary self-reference levels, and found that moderate (extreme) self-referencing enhanced (undermined) persuasion. Interestingly, the effect emerged only when participants were highly motivated to attend the ad. Similarly, Sujan, Bettman, and Baumgartner (1993) reported that ads encouraging the retrieval of autobiographical memories emotionally engage viewers with the product, using appeals such as, 'Think back to the last time you and a close friend spent a special evening together.' This affective engagement in turn transfers to the ad and generates positive ad evaluations through 'affect transfer.' Ahn and Bailenson (2011) extended self-referencing to a digital context and found that participants preferred the brand worn by their virtual self over the same brand worn by others in the role of product endorsers.

Taken together, the literature indicates that self-referencing could profoundly impact brand-related responses. AR brings an interesting viewpoint perspective on self-referencing in that all AR-mediated experiences are partially real and partially virtual, and psychological processes involved in those experiences may occur both explicitly and implicitly. Consumers looking at their own reflections in virtual mirrors might readily access self-focused thoughts and connect themselves to the brand.

Self-attention theory

Self-attention theory (Carver 1979; Mullen 1987) also provides useful insights into understanding the role of self-viewing in an AR environment. A basic premise of this theory is that self-focused attention determines the extent to which reality is perceived and construed (Filipp, Aymanns, and Braukmann 1986). According to Gibbons (1983), self-focused attention intensifies the accuracy of individuals' self-perceptions. Self-focused attention has been conceptualized as 'an awareness of self-referent, internally generated information' (Ingram 1990, 156). Previous research has shown that individuals high in self-focused

attention are more likely to facilitate the elaboration of self-referent information than those low in self-focused attention (Duval and Wicklund 1972). Remarkably, self-focused attention can be situationally created by being reflected in a mirror (Gibbons 1983; Mullen 1987). Thus, we infer that self-viewing through an AR virtual mirror could generate self-referent information (i.e., reflecting a virtual representation of the self-using a product or brand) by initiating self-focused attention during the encoding process.

Self-brand connections (SBCs)

Consumers use brands, publicly and privately, to create and express their desired self-images (Choi, Yoon, and Lacey 2013; Dommer, Swaminathan, and Ahluwalia 2013; Escalas and Bettman 2003). SBCs refer to how extensively consumers incorporate brands into their self-concepts. In essence, SBCs capture the strength of the link between perceived brand meanings and consumers' self-concepts (Escalas 2004). When consumers find brands useful to build and communicate their self-concepts to others, they feel deeper SBCs (Escalas and Bettman 2003). From the marketer's perspective, establishing strong SBCs with core consumers is essential: brands with strong SBCs gain enduring competitive advantages that competitors cannot easily duplicate. Furthermore, strong SBCs are likely to yield positive brand evaluations because consumers with strong SBCs tend to exhibit higher levels of brand attitude strength (Moore and Homer 2008) and relationship quality (Dwivedi, Johnson, and McDonald 2016). Accordingly, extensive literature has documented the positive effect of SBCs on purchase intention (Escala 2004; Paharia et al. 2011).

As suggested by a 'meaning transfer' model (McCracken 1989), consumers develop brand meanings over time from indirect (e.g., traditional advertising) as well as direct experience with the brand, and utilize those brand meanings to actively construct their self-identities (Escalas 2004). They also engage in matching processes to identify brands that are congruent with their self-image (Do, Ko, and Woodside 2015; Hosany and Martin 2012); they self-categorize brands as 'for-me' or 'not-for-me.' Salient cues in marketing communications often trigger the matching process (Forehand and Deshpandé 2001) through which consumers elaborately encode brand benefits and characteristics in relation to themselves.

Extending to the AR context, the unique and salient experience in virtual mirrors – viewing oneself trying the product – creates a great level of self-focused attention, which triggers self-referencing processes (Cheng, White, and Chaplin 2012). Thus, if consumers attend to brand information that matches their self-focused thoughts, they are likely to experience more associations between the self and the brand in memory. Furthermore, self-focused thoughts incorporated into the creation of brand meanings have been shown to enhance SBCs (Escalas and Bettamn 2005; Monga and Lau-Gesk 2007).

As such, self-viewing, which is directly associated with oneself, should produce more extensive associative pathways. In contrast, other-viewing provides vicarious experiences not deeply rooted in the self, and is less likely to generate self-focused attention in brand evaluation. In this regard, Perkins and Forehand (2012) conducted a study in which participants learned fictitious brand names paired with either self (I, self, me, and mine) or others (they, other, them, their, and theirs) referents, and found that non-volitional pairings of brands with self-referents enhance brand evaluations. Accordingly, we posit that consumer viewpoints regarding an AR environment, whether self-viewing or other-viewing,

will cause them to experience distinct self-referencing effects. Specifically, we expect that self-viewing (vs. other-viewing) via an AR application will trigger higher SBCs and then lead to greater purchase intentions. Therefore, we propose:

H1: Self-viewing will elicit (a) higher SBCs and (b) greater purchase intentions than will other-viewing (the AR effect).

H2: SBCs will mediate the AR effect on purchase intentions.

Study 1

In Study 1, we tested these ideas using a real AR website with a real brand, Ray-Ban. We predicted that participants in the self-viewing condition would exhibit greater SBCs and purchase intentions than would participants in the other-viewing condition (H1), and that SBCs would mediate the process (H2).

Method

Design, participants, and procedure

Study 1 used a one-factor between-subjects design (the AR viewpoint: self-viewing vs. other-viewing). One hundred and seventy-four undergraduates (47.1% men and 52.9% women, average age: 21.1) from a Northeastern University in the United States received extra credit for participating in the online experiment. Participants were provided with a URL link to the experimental website. Specifically, participants were led the Ray-Ban website (namely, *Ray-Ban Virtual Mirror*) where they could try on several models of sunglasses in either the self-viewing or other-viewing condition. In the self-viewing condition, using a computer camera, participants could overlay computer-generated images of sunglasses on their own reflection. In the other-viewing condition, participants could overlay a pair of sunglasses on a professional model (see Appendix 1 for screenshots of the two experiment conditions).

All other interactive features (e.g., overlaying functions and available sunglasses' shapes, styles, and colors) remained constant across the two conditions to minimize the confounding effect of interactivity. Participants were instructed to inspect five pairs of sunglasses suited for them. The average amount of time participants spent using the AR virtual mirror was 5 minutes 12 seconds. Afterward, participants completed a questionnaire that included dependent measures, covariates, and demographics. On completion, they were debriefed, thanked, and dismissed.

Measures

SBCs were measured by seven items (Escalas and Bettman 2003). Participants indicated their agreement with each of the following statements (1 = *not at all,* 5 = *extremely well*): 'This brand reflects who I am,' 'I can identify with this brand,' 'I feel a personal connection to this brand,' 'I use this brand to communicate who I am to other people,' 'I think this brand helps me become the type of person I want to be,' 'I consider this brand to be me (it reflects who I consider myself to be or the way that I want to present myself to others),' and 'This brand suits me well.' The seven items were averaged to form an index for SBCs (Cronbach's alpha = .96). Purchase intentions were measured by three items (Dodds,

Monroe, and Grewal 1991; 1 = *very low* and 5 = *very high*): 'My willingness to buy this brand,' 'The likelihood of purchasing this brand,' and 'The probability that I would consider buying this brand.' The three items were averaged to form an index for purchase intentions (Cronbach's alpha = .95). Finally, participants answered demographic questions (e.g., age, gender, and ethnicity) and then completed an open-ended question to assess demand characteristics: 'What do you think was the purpose of this experiment?' No participants correctly guessed the hypotheses. To assess potential covariates, we also measured brand familiarity and prior purchase experience. None did not significantly impact any dependent variables ($F < 1$). Thus, brand familiarity and prior purchase experience are not examined further.

Results

Self-brand connections and purchase intentions

To test whether the self-viewing leads to stronger SBCs than the other-viewing does, we conducted an independent *t*-test. A significant main effect for the AR viewpoint on SBCs ($t = 2.27$, $p < .05$) revealed that participants in the self-viewing condition ($M = 3.62$, SD = 1.61) reported greater SBCs than those in the other-viewing condition ($M = 3.08$, SD = 1.47), supporting H1(a). And, a significant main effect for the AR viewpoint on purchase intentions ($t = 2.11$, $p < .05$) showed that participants in the self-viewing condition ($M = 4.86$, SD = 1.46) reported greater purchase intentions than those in the other-viewing condition ($M = 4.33$, SD = 1.80), supporting H1(b).

Mediation analysis

We conducted a mediation analysis to test whether SBCs mediated the relationship between the AR viewpoint (0 = other-viewing, 1 = self-viewing) and purchase intentions. Following Zhao, Lynch, and Chen (2010), we treated the AR viewpoint as the independent variable, SBCs as the mediator, and purchase intentions as the dependent variable. We used 5000 bootstrapped samples (Baek and King 2015; Preacher and Hayes 2008). As Figure 1 shows, bootstrapping analysis revealed that the indirect effect was significant because the bias-corrected 95% confidence interval (CI) did not contain zero (95% CI = .061 to .705). However, the direct effect of the AR viewpoint on purchase intentions after
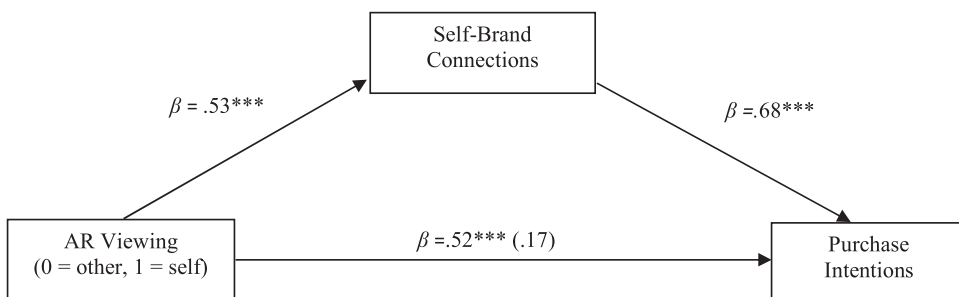
Figure 1. Mediation model.
Note: Bootstrapped 95% confidence interval [CI] for indirect effect = [.061 to .705]; the β coefficient for the direct effect of AR viewing on purchase intentions after accounting for the mediator is shown in parentheses.***$p < .001$. Source: Author

accounting for the mediator was not statistically significant ($\beta = .17$, $t = .84$, $p = .40$). These results suggested that SBCs fully mediated the effect of the AR viewpoint on purchase intentions. Therefore, H2 was supported.

Discussion

The results show that self-viewing through an AR virtual mirror positively affects SBCs and purchase intentions. Participants viewing themselves virtually trying the product on a computer screen feel more connected to and more likely to purchase the brand, compared with those viewing models wearing the same product. Furthermore, we identify SBCs as the underlying mechanism for the observed AR effect: SBCs mediate the effect of the AR viewpoint on purchase intentions. Nonetheless, we question whether consumers' personality characteristics may play a role in moderating the AR effect. Study 2 investigates that possibility.

Study 2

In Study 2, we explore narcissism as a personality trait that may cause AR virtual mirror users to experience higher, more intense levels of SBCs, thereby increasing their purchase intentions. According to the agency model of narcissism (Campbell, Brunell, and Finkel 2006), narcissists tend to have agentic (self-focused) rather than communal (other-focused) characteristics. Prior work has documented that narcissism is closely associated with positive and grandiose self-views (Brown and Zeigler-Hill 2004; Campbell, Rudich, and Sedikides 2002; Gabriel, Critelli, and Ee 1994), and thus, narcissists are more concerned about physical appearances than are non-narcissists (Vazire et al. 2008). Perhaps that is why narcissistic consumers tend to seek situational circumstances in which they can boost their self-enhancement or self-confidence by seeing themselves from external, third-person perspectives (Robins and John 1997). In contrast, non-narcissists disdain self-focused attention and self-enhancement (Campbell, Foster, and Finkel 2002).

Emerging evidence suggests that narcissism evokes high levels of self-reference effect (e.g., positive evaluation and superior memory for self-relevant information). For example, Jones and Brunell (2014) reported that narcissistic individuals were more likely to select positive trait words as self-descriptive and were better at recalling those words under the self- (versus other-) referent condition. The results suggest that narcissists' self-enhancement motives to maximize positive self-views result in great reliance on self-referent cues. Extending to the AR virtual mirror, we expect that when making brand-related evaluations, narcissists are more likely to rely on self-referent inputs rather than other-referent inputs. This is because narcissists strive to behave in line with self-focused attention (Campbell, Foster, and Finkel 2002; Robins and John 1997) and they are inclined toward self-referent cues that enable them to maximize their self-views (Jones and Brunell 2014).

In sum, we expect narcissistic consumers to feel more connected to the brand and show greater purchase intentions under the self-viewing condition than under the other-viewing condition. Narcissistic consumers are more likely to enjoy seeing themselves in a virtual mirror, which should activate their aggrandized self-views in connection with the brand. However, we expect the AR self-viewing effects – the increased SBCs and purchase

intentions from the self-viewing versus other-viewing condition – to become weaker among less-narcissistic consumers. Hence we propose:

H3: Narcissism will moderate the AR self-viewing and other-viewing effects on SBCs and purchase intentions. Specifically, for more (less) *narcissistic* participants, the effect of self-viewing on (a) SBCs and (b) purchase intentions will be stronger (weaker) than the effect of other-viewing.

Method

The purpose of Study 2 was to conceptually replicate the main findings from Study 1 (i.e., the AR self-viewing effects on SBCs and purchase intentions) in a different AR setting and to examine narcissism as a moderator of the AR effect. In Study 2, we used a fictitious apparel brand, *Modley*, to experimentally control for potential confounding variables such as participants' prior brand knowledge and pre-existing SBCs associated with a real brand.

Design, participants, and procedure

We used a 2 (the AR viewpoint: self-viewing vs. other-viewing) × 2 (narcissism: high vs. low) between-subjects design. Two hundred and nine undergraduates from a Northeastern University participated in the study in exchange for course credit. We provided participants a URL link for completing the online experiment. We embedded the stimulus AR into the website so that participants could try on various apparel products in a virtual mirror (Appendix 2). In the self-viewing condition, participants could overlay computer-generated images of clothes on their reflection; in the other-viewing condition, they overlaid the same clothes on a professional model. Participants were instructed to inspect three clothing items suited for them. The average duration of AR virtual mirror use was 5 minutes 38 seconds. When they completed the experimental task, they answered a questionnaire including dependent measures and demographics. Then they were debriefed, thanked, and dismissed.

Measures

Narcissism was measured by the Narcissistic Personality Inventory-16 (NPI-16; Ames, Rose, and Anderson 2006). Participants indicated the extent to which they agreed with the 16 statements (e.g., 'I really like to be the center of attention,' 'I think I am a special person,' 'I like having authority over people,' and 'I am more capable than other people') on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). The 16 items were averaged to form an index for narcissism (Cronbach's alpha = .92). We then asked participants to respond to a series of questions assessing their SBCs (Cronbach's alpha = .96; Escalas and Bettman 2003) and purchase intentions (Cronbach's alpha = .93; Dodds, Monroe, and Grewal 1991). In the end, participants were probed to assess their suspicions regarding possible demand characteristics. No participants were aware of the hypotheses.

Results

Prior to data analysis, we mean-centered the continuously measured narcissism for regression analyses (Aiken and West 1991). We found no statistically significant differences in

the distributions of demographic factors (e.g., age, gender, and ethnicity) for any dependent variables.

Self-brand connections

We ran a regression analysis with SBCs as the dependent variable and the dummy-coded AR viewpoint (0 = other-viewing, 1 = self-viewing), mean-centered narcissism score, and their interaction term as the independent variables. Results showed that the full model was statistically significant ($F = 8.84$, $p < .01$). The AR viewpoint ($\beta = .24$, $t = 2.60$, $p < .05$) and narcissism ($\beta = .31$, $t = 3.44$, $p < .01$) significantly predicted SBCs.

The two-way interaction between AR viewing and narcissism was significant ($\beta = .18$, $t = 2.03$, $p < .05$). We examined the simple slopes at values one standard deviation above (high) and below (low) the mean of narcissism (Aiken and West 1991). As Figure 2 shows, when narcissism was relatively high (i.e., +1 SD), the SBCs of the participants in the self-viewing condition ($M = 3.46$) was higher than that of the participants in the other-viewing condition ($M = 2.62$; $\beta = .42$, $t = 3.26$, $p < .01$). On the other hand, when narcissism was relatively low (i.e., −1 SD), we found no significant difference in SBCs between the self-viewing condition ($M = 2.47$) and the other-viewing condition ($M = 2.37$) ($\beta = .05$, $t = .39$, $p = .70$). Therefore, H3(a) for SBCs was supported.
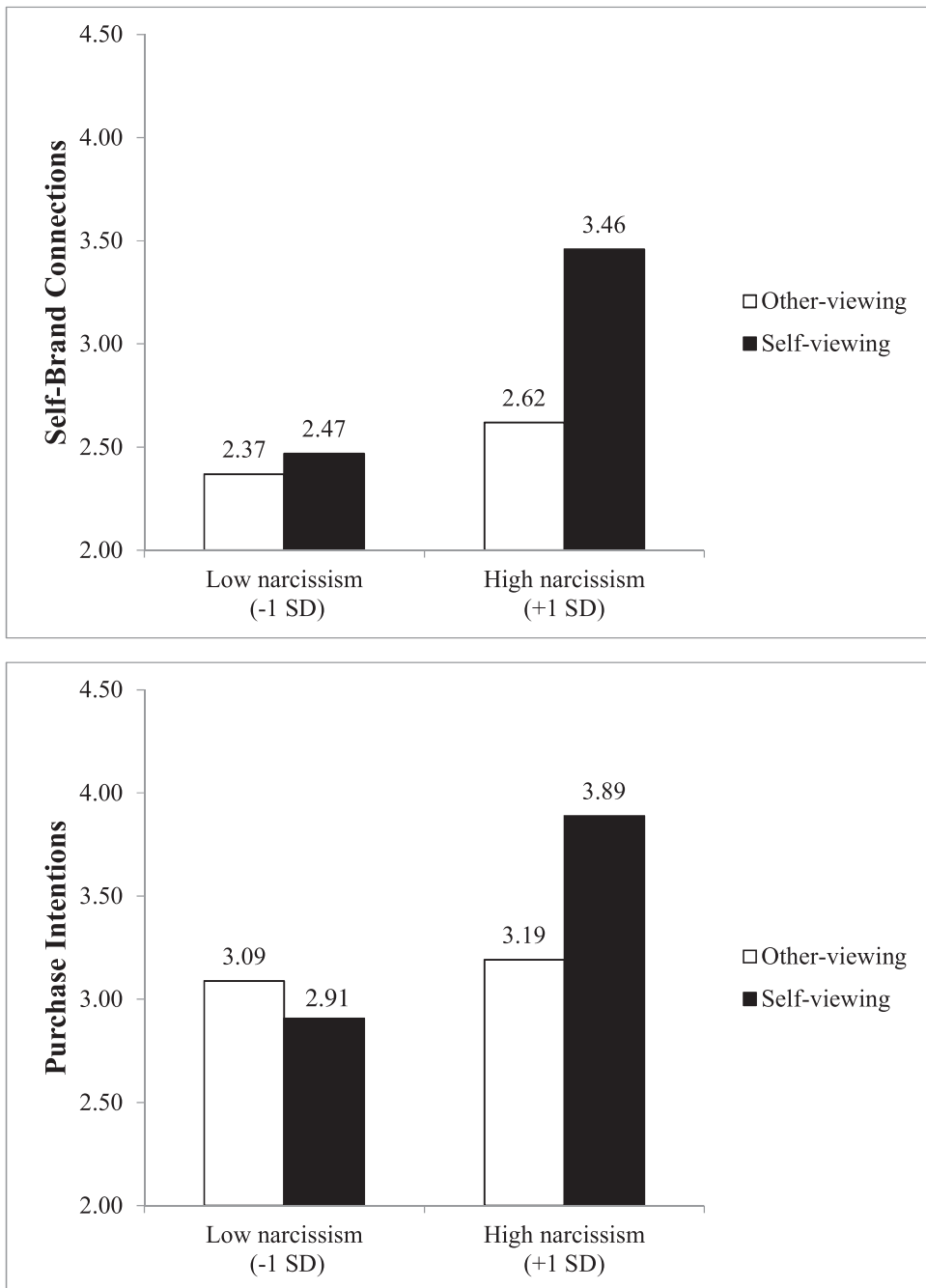
Purchase intentions

In the regression analysis, the full model was statistically significant ($F = 4.92$, $p < .01$). This analysis produced a significant main effect of narcissism ($\beta = .27$, $t = 2.65$, $p < .01$) but no main effect of the AR viewpoint ($\beta = .13$, $t = 1.24$, $p = .21$) on purchase intentions.

The two-way interaction between the AR viewpoint and narcissism was significant ($\beta = .22$, $t = 2.12$, $p < .05$). Thus, we further examined the simple slopes at values one standard deviation above (high) and below (low) the mean of narcissism (Aiken and West 1991). As Figure 2 shows, when narcissism was relatively high (i.e., +1 SD), participants in the self-viewing condition ($M = 3.89$) had higher purchase intentions than did participants in the other-viewing condition ($M = 3.19$; $\beta = .35$, $t = 2.37$, $p < .05$). On the other hand, when narcissism was relatively low (i.e., −1 SD), we found no significant difference in purchase intentions between the self-viewing condition ($M = 2.91$) and the other-viewing condition ($M = 3.09$) ($\beta = −.09$, $t = −.63$, $p = .53$). Hence, H3(b) for purchase intentions was supported.
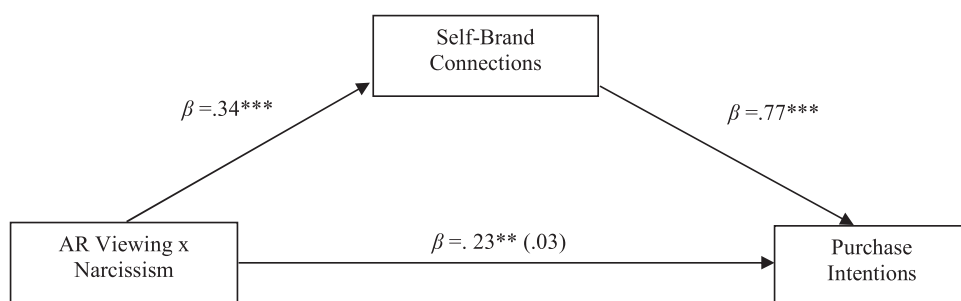
Mediated moderation

Mediated moderation analysis was used to validate the role of SBCs in the interaction effect of the AR viewpoint and narcissism on purchase intentions. We employed a bootstrapping method that generated a re-sample size of 5000 (Baek and King 2015; Preacher and Hayes 2008). We included the interaction term (the AR viewpoint × narcissism) as the key predictor, SBCs as the mediator, and purchase intentions as the dependent variable. Our results showed that the interaction of the AR viewpoint and narcissism predicted SBCs in the mediator model ($\beta = .34$, $t = 5.11$, $p < .001$). In the dependent variable model, SBCs predicted purchase intentions ($\beta = .77$, $t = 17.41$, $p < .001$), whereas the direct effect of the AR viewpoint × narcissism interaction was no longer significant ($\beta = .03$, $t = .65$, $p = .52$) when including SBCs as a predictor of purchase intentions. The indirect effect of the AR viewpoint × narcissism interaction on purchase intentions through SBCs was

Figure 2. Simple slopes of AR viewing by Narcissism on self-brand connections and purchase intentions.
Note: Low is one SD below and high is one SD above the mean of narcissism. Source: Author

significant ($\beta = .23$, $t = 3.42$, $p < .01$). As shown in Figure 3, a 95% bias-corrected bootstrap confidence interval of .528–1.199 (excluding zero) revealed that SBCs *fully* mediated the interaction effect of the AR viewpoint and narcissism on purchase intentions.

Figure 3. Mediated moderation model.
Note: Bootstrapped 95% confidence interval (CI) for indirect effect = [.528 to 1.199]; the β coefficient for the direct effect of AR viewing on purchase intentions after accounting for the mediator is shown in parentheses.**$p < .01$; ***$p < .001$. Source: Author

Discussion

The results of Study 2 show that narcissism plays a key moderating role in the relationship between the self-viewing versus other-viewing AR effects on SBCs and purchase intentions. Narcissistic individuals show heightened SBCs and purchase intentions when they view themselves (vs. others) in the AR virtual mirror. However, such difference fails to emerge among those who score low in narcissism: less-narcissistic individuals show equal SBCs and purchase intentions regardless of whether they view themselves or others in the AR virtual mirror. In addition, the mediated-moderation analysis suggests that SBCs mediate the interaction effect of the AR viewpoint and narcissism on purchase intentions.

General discussion

Our two studies support the proposition that self-viewing in the AR virtual mirror improves SBCs and purchase intentions. The findings are robust across two experimental settings – one with a real brand (Study 1), and one with a fictitious brand (Study 2). In Study 1, using the Ray-Ban's virtual mirror, we demonstrate that when participants see themselves wearing the product (i.e., self-viewing) they will have greater SBCs and purchase intentions than when they view a professional model wearing the product (i.e., other-viewing). Furthermore, we find that SBCs – the extent to which consumers tie the brand with their self-concept – mediates the AR effect on purchase intentions. Study 2 replicates this AR effect with a fictitious apparel brand, and further shows that the AR effect varies in magnitude depending on participants' levels of narcissism: that is, highly narcissistic participants show pronounced superiority of self-viewing to other-viewing on SBCs and purchase intention, but the effect is alleviated among less-narcissistic participants.

Our findings provide several theoretical implications. First, we add to the growing body of literature explaining how consumers react to different viewpoints in the AR environment. Notably, Cho and Schwarz (2010) found the product evaluation advantage when the product was shown on a familiar other's regular image over mirror image. However, no such advantage was found for an unfamiliar other image. Thus, the current research extends the prior findings and offers a novel perspective on self-viewing by empirically

demonstrating that the effects of virtual mirror hold true when consumers view themselves virtually trying on a product, compared to the product is paired with an unfamiliar other image. Our work also sheds light on the nature of AR self-viewing effects by specifying when consumers are more likely to prefer to view themselves trying on a product via a virtual mirror. Unlike the prior research focusing on visual elements such as facial expression, visual enhancement, and image format (Cho and Schwarz 2012), our results show that consumers' personality trait such as narcissism also intensify (or attenuate) the AR effects on SBC and brand purchase intentions. Furthermore, we provide evidence of the self-referencing effect caused by narcissism (Jones and Brunell 2014) in the AR environment.

Furthermore, this research extends the prior work documenting that self-endorsing strengthens brand attitudes and purchase intentions in the VR setting (Ahn and Bailenson 2011). In their experiments, participants self-endorsed a brand. However, we deem such randomized self-endorsing in a study design unrealistic, because only self-selected, avid brand advocates would voluntarily endorse the brand in the real marketplace. By including realistic aspects of the online shopping environment such as marketers' strategic decision on self- versus other-referent AR, we extend the prior research and give straightforward insight to marketers who pursue significant control over self-referencing effects.

Finally, our mediated moderation analysis reveals that SBCs mediate the interaction effect of the AR viewpoint and narcissism on brand purchase intentions. We go beyond past research (Huang and Liao 2015; Verhagen et al. 2014; Yim and Chu 2013) focusing on the roles of media and user characteristics (e.g., presence and interactivity), and provide an understanding of the psychological process underlying the AR effect involving the self and brand-related constructs. Consistent with McCracken's (1989) model of meaning transfer, our findings suggest that a brand-related AR application enables consumers to facilitate the transfer of self-referent meaning to the brand, thereby being more prominent to the formation of SBCs.

Our results have important practical implications for digital marketers. AR technologies allow remote consumers to pseudo-directly experience products. Thus, marketers no longer have to rely solely on conventional solicitation techniques such as asking consumers to recall past experiences or imagine using a product to prompt self-related thoughts (e.g., 'New doors opened. Imagine yourself in a Mercury now'). This increased flexibility enables consumers to experience products from a first-person perspective. Accordingly, marketers can simply offer an AR feature and let consumers self-select to experience it, as a Swedish clothing company, H&M, recently introduced in its mobile AR application in which consumers can virtually try on outfits while physically shopping at a retail store.

Importantly, marketers should factor in how narcissistic their customers are when executing AR campaigns. A simple survey on narcissism may help mass marketers to decide whether a marketing communication tactic should include AR features such as a virtual mirror. Meanwhile, more sophisticated methods such as mining consumers' social media profiles may be useful for direct marketers to reveal core target consumers' narcissistic tendency, because narcissistic consumers are shown to frequently post status updates and change profile pictures (Carpenter 2012). Given that consumers in individualistic cultures have higher levels of narcissism than those in collectivistic cultures (Foster, Campbell, and Twenge 2003), global marketers should consider narcissistic tendencies as a characteristic of their target audiences in different cultures when crafting AR campaigns. For example,

American consumers have shown steadily increasing narcissistic traits over the past decades (Twenge and Foster 2010), and narcissism is more prevalent in the United States than in other cultures (Campbell, Miller, and Buffardi 2010). Thus, it would be useful to examine whether cultural differences in narcissism may alter the impact of the AR campaign.

Limitations and future research

Our investigation has some limitations that warrant future research. First, our examination is confined to web-based AR virtual mirrors. Thus, future research may expand our findings to different AR environments, such as branded mobile applications or kiosks in retail stores. Second, although college students are one of the largest segments purchasing sunglasses and apparel products used in our studies (Mediamark 2014), college student samples limit the generalizability of the findings. Additional research is warranted to use nonstudent samples with a broader demographic spectrum. Furthermore, it would be interesting to replicate the findings with other product categories, such as home furniture (e.g., IKEA AR catalog) or cosmetics (e.g., Shisedio AR makeup mirror). Finally, we encourage future investigations to validate our findings in a field experiment setting. Studies using consumer panels might provide valuable insights. In terms of methodology, future research should consider using well-specified single-item measures of purchase intention rather than multiple-item measures of the same construct used in our study (Rossiter 2011). Although the methodological debate over using multiple scale items has been discussed in the literature (Churchill 1979; Rossiter 2011), the use of single-item scales might help future researchers increase response rates, avoid demand effects and hypothesis guessing drawn from larger numbers of similar items, and reduce mindless response behavior and fatigue that could lower data quality (Franke, Rapp, and Andzulis 2013).

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix 1

Study 1: Self-viewing condition

Study 1: Other-viewing condition

Appendix 2
Study 2: Self-viewing condition

Study 2: Other-viewing condition