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RESEARCH ARTICLE

Can augmented reality satisfy consumers' need for touch?

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Abstract

Consumers with a high autotelic need for touch tend to experience deprivation because they cannot touch products while shopping online. Augmented reality (AR) in retail allows consumers to explore products virtually as if they were present in the physical environment, except the fact that they are not touchable. This study investigates whether AR can compensate for this lack of touch or whether, on the contrary, these consumers are skeptical because they crave even more real haptic input. The results of four studies consistently show that consumers' autotelic need for touch is associated with benefits that positively impact various managerially relevant outcomes such as store and product attitudes or purchase intentions. However, the results also point to differences between expected and experienced hedonic and utilitarian benefits along the customer journey. Hedonic benefits prevail when consumers with a high need for touch actually experience AR, while they instead expect utilitarian benefits. The findings contribute to the AR marketing and online retailing literature by demonstrating that AR features can mimic touchable features of products. They also highlight the practical benefits of AR as a powerful tool in digital marketing.

KEYWORDS

augmented reality, autotelic need for touch, hedonic benefits, expected gratifications, marketing, retail, obtained gratifications, technology acceptance, utilitarian benefits

1 | INTRODUCTION

An increasing number of consumers are shopping online for a variety of goods, including clothing, music, books, technology, and so forth (eMarketer, 2021). Although online preferences vary across consumers and product categories, higher levels of convenience, additional information from online reviews, and lower prices are among the most frequently mentioned benefits (e.g., Park & Lee, 2017). However, there are also multiple aspects that individuals dislike about online shopping (TimeTrade, 2017). These include such factors as habit, risk perceptions, a lack of personal interaction with salespeople, and the lack of an opportunity to touch a product. In particular, touching a product is

highly relevant to many consumers in the process of its evaluation (Grohmann et al., 2007; Marlow & Jansson-Boyd, 2011). Therefore, it is not surprising that consumers with a general preference for touching products, that is, with a high need for touch, are still less willing to shop online (McCabe & Nowlis, 2003; Rathee & Rajain, 2019). According to a survey conducted in 2017, this concerns many consumers; about 70% of US consumers prefer physical stores because they enable touching products before purchasing (TimeTrade, 2017). In this regard, two specific motivations for touch have been described, namely autotelic (touching products for the haptic experience itself) and instrumental (touching products to obtain more information about them) need for touch (Peck & Childers, 2003a).

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Retailers show a keen interest in expanding their online channels (Caboni, 2020) yet still seek strategies to overcome the disadvantages of digital environments. Augmented reality (AR) is a promising approach to target consumers digitally (Caboni & Hagberg, 2019; Heller et al., 2019a; Hilken et al., 2017; Rauschnabel et al., 2019; Scholz & Duffy, 2018) and has been mentioned as a digital sensory-enabling technology that might be able to satisfy consumer's wish for more sensory input in online shopping (Velasco et al., 2019). Especially in recent years, the effects of AR in a retailing context have increasingly come into focus (e.g., Fan et al., 2020; Heller et al., 2019a, 2019b; McLean & Wilson, 2019; Perannagari & Chakrabarti, 2020; Smink et al., 2020).

Although AR has been shown to have the potential to address many issues of established online channels (Caboni & Hagberg, 2019), a particular issue remains: AR content is still purely digital and therefore not touchable (Rauschnabel, 2021). Accordingly, one of the main reasons why people tend to shop in offline stores remains. Perhaps even more importantly, AR could backfire, as Peck and Childers (2003a) show that barriers to touching a product can lead to frustration among touch-motivated consumers. This would be especially detrimental for consumers high in need for touch. Therefore, one could conceivably assume that AR is promising for consumers low in need for touch—but not for those high in need for touch.

This study, however, provides a counterintuitive view and proposes that AR can be an effective tool for addressing consumers with a high need for touch and thus provides a useful tool to complement traditional online channels. Therefore, a core assumption is that interacting with virtual content embedded in the real world can partly substitute for product interactions, provide benefits, and cause positive managerial outcomes. In addition, besides considering actual benefits experienced by consumers, this study includes consumer expectations of the benefits obtained by AR use. It is important to study these concepts in a differentiated manner. First, expectations play an important role in early stages of the customer journey when consumers decide to actually use or purchase a good or service (e.g., Lemon & Verhoef, 2016). Put differently, expectations determine whether actual gratifications will be obtained at all. A second aspect is that potential discrepancies between expectations and actual experiences must be considered and tackled from the beginning to avoid dissatisfied customers (e.g., Churchill & Surprenant, 1982).

More formally, this study aims to address the following research question: Can AR satisfy consumers' need for touch? A series of four studies in which consumers high and low in need for touch evaluate different AR apps and potential behavioral consequences provide answers to this question. The findings across the studies are consistent and show that a higher need for touch relates to greater benefit from AR, which consequently leads to better marketing outcomes. This study also identifies several differences between obtained (after using an app) and expected (before using an app) gratifications. In two studies implementing the actual use of an AR tool, the results show that respondents higher in need for touch derive more hedonic benefits and form a more positive brand attitude

after the use of the feature (Studies 1 and 2). In two further studies, the results show that in the absence of an actual AR experience, consumers higher in need for touch only anticipate its utilitarian but not its hedonic benefits. However, this still results in more positive shop and product evaluations and a higher purchase likelihood (Studies 3 and 4).

These findings address an existing research gap that has already been articulated by Hilken et al. (2017) by answering the question of how consumers that differ regarding their individual need for touch are influenced by AR. Until now, there has been only one study that illustrated that vivid memories elicited by AR had a higher impact on a perceived shopping experience for consumers high in autotelic need for touch (Huang & Tseng, 2015). However, this study did neither investigate AR as an independent variable, nor did it explain how shop and product evaluations or purchase intentions are affected.

On a more general level, this study helps to fill an even broader gap in the literature by contributing to a better understanding of consumer heterogeneity in relation to AR (see Table 1 for an overview). Until now, the individual difference variables that have been considered are limited. One frequently investigated trait is consumer innovativeness (e.g., Brito & Stoyanova, 2018; Huang & Liao, 2015), in addition to consumers' familiarity with AR (Bonnin, 2020). Other cognitive aspects are the consumers' processing style (Heller et al., 2019b; Hilken et al., 2017) and their awareness of privacy practices (Hilken et al., 2017). In addition, body-related aspects, such as body image (e.g., Yim & Park, 2019) and appearance self-esteem (Javornik et al., 2021), as well as more complex psychological constructs, such as narcissism (Baek et al., 2018), mental imagery (Hilken et al., 2021), and locus of control (Lixändroui et al., 2021), have been studied. Surprisingly, the fundamental trait of the need for touch, which is highly relevant for shopping behavior, has been neglected.

With regard to its theoretical contribution, this article provides input to the discussion of the intangibility of content in online shopping (e.g., Rathee & Rajain, 2019), as well as to the association between AR and sensory input (e.g., Heller et al., 2019a). The characteristics of AR make it appear likely that immersive reality formats might lead to the stimulation "of one or more of the user's five senses" (Guttentag, 2010, p. 638) and that, in particular, tactile perceptions will be elicited. However, while interactivity and vividness have been discussed thoroughly (Yim et al., 2017) and are associated with perceptions of touch, only a few articles have investigated the role of tactile input with respect to AR and the need for this more directly. This study adds to prior research on sensory-enabling technologies (Kim & Forsythe, 2008a) that shows that "touching" and interacting with products in new realities might lead to a decrease in mental intangibility (Heller et al., 2019a). This study also extends prior research by showing that consumers' desire to touch physical products can partly be satisfied by providing them with realistic content. More importantly, it shows that people with such a need react even more positively than those who do not have such a need. Thus, this study suggests that consumers tend to perceive AR as not "just another" online channel with its associated intangibility disadvantage but as a potential substitute for physical stores. This study further

TABLE 1 Overview of studies investigating the effects of consumer characteristics when using AR in a retail context

Authors	Individual difference variable studied	Context and type of AR employed	Methodology	DVs
Baek et al. (2018)	Narcissism	AR try-on of clothes (on computer)	Online experiment (n = 209)	Self-brand connection, purchase intention
Bonnin (2020)	Familiarity with AR	Shopping (sun glasses and shoes)	Two online experiments (n = 98 and n = 191)	Store attractiveness, patronage intention
Brito and Stoyanova (2018)	Chronic emotional intensity, innovativeness	Online shopping of shoes, AR try-on	Lab experiment (markerless AR vs. marker-based AR vs. conventional interface; n = 150)	Usability, arousal, interactive experience, intention to recommend the brand
Brito, Stoyanova, and Coelho (2018)	Innovativeness, perceived risk, opinion leadership, chronic emotional intensity	Online shopping of shoes, AR try-on	Lab experiment (markerless AR vs. marker-based AR vs. conventional interface; n = 150)	Emotional and interactive response, attitude, future relationship toward the brand
Hilken et al. (2017)	Style of processing (verbalizers vs. visualizers ^a), awareness of privacy practices ^b , involvement as control variable	Virtual mirrors of an online eyewear retailer (Studies 1,3,4) and virtual makeup mirror (Makeup Genius; Study 2)	Three lab experiments (n = 156, n = 173, and n = 321) and a survey (n = 400)	Spatial presence (mediator), utilitarian and hedonic value, decision comfort, behavioral intentions
Heller et al. (2019a)	Assessment orientation	Online retailing	Four experimental lab studies (n = 139, n = 108, n = 106, and n = 136)	Willingness to pay
Heller et al. (2019b)	Processing type	(Online) shopping, dining	Five experimental studies: one lab study (n = 304), three online experiments (n = 259, n = 214 and n = 107) and an online field experiment (n = 158)	Decision comfort, WOM, choice of higher value products
Huang and Liao (2015)	Cognitive innovativeness ^c	AR try-on of clothes on a retailer website	Online experiment (n = 220)	Perceived usefulness, perceived esthetics, service excellence, ease of use, behavioral intentions
Huang et al. (2019)	Body surveillance, fashion consciousness	Advanced AR try-on system for clothes, including Kinect lens and Motion-Sensing technologies	Survey (n = 207)	Rapport experience (enjoyable interaction, personal connection)
Huang and Tseng (2015)	Autotelic need for touch	AR try-on of clothes on a retailer website (no variation)	Lab survey (n = 336)	Concentration, exploratory behavior, playfulness, and time distortion (as four dimensions of exploratory shopping experience)
Javornik et al. (2021)	Appearance self-esteem	Virtual AR make-up mirror	Three lab experiments with young females (n = 111, n = 76, and n = 123), vs. one survey study (n = 184 females)	Ideal-actual attractiveness gap, variety seeking
Lixăndroiou et al. (2021)	Locus of control (internal vs. external), big five personality traits	AR dressing room (based on the Zugara application)	Quasi-experimental design (AR app versus regular online shop; n = 121)	User experience, attitude, buying impulsiveness, system usability, buying intention

TABLE 1 (Continued)

Authors	Individual difference variable studied	Context and type of AR employed	Methodology	DVs
Saprikis et al. (2021)	Innovativeness	Mobile AR apps in shopping malls	Online survey of regular mall shoppers ($n = 381$)	Behavioral intention, enjoyment
Yim and Park (2019)	Body image (i.e., satisfaction with one's own body)	AR-based virtual try-on product presentations of sunglasses	Experimental online study (AR app vs. conventional website; $n = 406$)	Media usefulness, media enjoyment, attitude toward technology, adoption intention

Note: The study selection represents an overview of studies investigating individual differences variables (IDVs) in the context of augmented reality (AR) use in retailing (excluding AR hardware research and studies that used IDVs as covariates or control variables without discussing results).

^aVisualizers prefer to process information through the construction of visual images, whereas verbalizers prefer semantic processing without forming images.

^bDegree to which a customer is concerned about his/her awareness of information privacy practices.

^cConsumers who have a different involvement concerning technology acceptance.

contributes by showing that consumers still have difficulties in evaluating the gratification they can achieve from AR use in advance. This reduces adoption intentions and thus the likelihood that those who would benefit most from such an app will actually be able to do so.

2 | THEORETICAL FRAMEWORK

2.1 | Augmented reality

Although not uniformly defined, AR allows users to experience the real world alongside virtual content through digital technologies (Peddie, 2017). IKEA, for example, offers an app that allows a consumer to look “through” their smartphone and place virtual three-dimensional (3D) models of furniture in their living room. Similarly, Sephora's app allows users to see themselves on a mobile device (using the front-facing camera) as if they were in a mirror and virtually experience makeup products on their own face. After reviewing multiple definitions and use cases of AR in retailing, Caboni and Hagberg (2019) conclude that AR has the potential to provide numerous advantages to retailers and consumers. However, unlike virtual reality (VR), AR users are not isolated from the real world; they still see their physical surroundings, but the technology augments it with virtual information (Dwivedi et al., 2020).

There is a keen interest among managers in integrating AR into their marketing activities (Caboni & Hagberg, 2019; Chylinski et al., 2020; Sheehan, 2018). One of the most popular and prominent approaches are AR try-out apps, and a growing body of research has looked at the benefits such apps can provide (Chylinski et al., 2020). For instance, Rauschnabel et al. (2019) show that AR apps can increase brand attitude, and other studies indicate positive impacts on purchase behaviors (Dacko, 2017), decision-making comfort (Carrozzi et al., 2019), and customer satisfaction (Do et al., 2020). This body of research also provides insights into the mechanisms that drive these outputs. Although they might differ between different focal variables, they include hedonic and utilitarian benefits (Do et al., 2020; Hilken et al., 2018; Hinsch et al., 2020; Rauschnabel, 2018), flow experiences (Javornik, 2016), and interactivity (Do et al., 2020), among others. In the next section, we introduce uses and gratification theory as a theoretical lens to theorize the role of the need for touch in shaping these benefits.

2.2 | AR experiences and gratifications

According to the uses and gratification theory (UGT), people tend to use technologies and media in a goal-oriented way. That is, consumers are assumed to be aware of their needs and proactively search for ways to satisfy them (Katz et al., 1973). These needs can vary across different consumers and media, and scholars have used various levels of detail to study them. However, most UGT studies conclude that utilitarian and hedonic gratifications are particularly

important in many contexts, and research in marketing and retailing (e.g., Babin et al., 1994; Bridges & Florsheim, 2008) echoes this. Utilitarian benefits are functional and goal oriented. They aim at improving a consumers' effectivity or efficiency (Venkatesh et al., 2012) and thus contribute to a more efficient life (Rauschnabel, 2018). In a shopping context, this might include making better or faster decisions with less effort. In contrast, hedonic motivations are "more subjective" (Babin et al., 1994, p. 646) and address consumers' tension-related needs (McGuire, 1974). A high hedonic benefit is typically characterized by fun, entertainment, arousal, fantasy fulfillment, escapism, enjoyment, and/or positive mood, and thus represents a core motivation to engage in shopping activities (e.g., Arnold & Reynolds, 2003; Babin et al., 1994). Various AR scholars, such as Hilken et al. (2017) and Yim et al. (2017), have shown that consumers evaluate AR experiences not just based on utilitarian benefits but also on hedonic ones. For instance, they showed that hedonic and utilitarian evaluations serve as mediators between AR characteristics (e.g., spatial presence) and their impact on consumer behavior. Likewise, Rauschnabel et al. (2019), as well as Yim et al. (2017), reveal that utilitarian and hedonic benefits lead to more favorable evaluations of AR marketing apps.

AR shopping apps allow consumers to visualize and try out products in the real world. Following prior research (e.g., Hilken et al., 2017), these AR functions can potentially provide utilitarian benefits because they can reduce the risk of making "wrong" purchases, and they might lower cognitive effort in imagining what a product could look like in reality. Likewise, AR can offer hedonic benefits because experiencing products with AR is typically perceived as "vivid" (Yim et al., 2017), and the apps often have a playful character (Huang & Liao, 2015; Jessen et al., 2020). While these effects have been detected in prior research, the consumers' need for touch might play a moderating role on these effects, as discussed later.

In addition, it is important to note that UGT distinguished between gratifications sought and those obtained (Katz et al., 1973; Rayburn & Palmgreen, 1984; Rubin, 2002). Gratifications sought represent consumers' needs and expectations. In contrast, the gratifications that were obtained reflect consumers' evaluations of an actual experience. Against the background of the well-established expectancy disconfirmation theory (Oliver, 1980), from which we know that initial expectations are an important determinant of how customers evaluate an offer and the brand itself, this distinct consideration seems helpful from a retailer perspective with regard to our research questions. A negative disconfirmation, that is, a situation in which consumers' expectations are not met, can have detrimental consequences on customer satisfaction, attitude toward the retailer and consumers' loyalty intentions (e.g., Churchill & Surprenant, 1982; Szymanski & Henard, 2001). Even the future usage of the technology may be discouraged in general. Following UGT, consumers will judge an AR app based on cues (e.g., a description of the app) and their overall evaluation of an app, the displayed products, the corresponding shop, or their anticipated purchases.

2.3 | Need for touch

Need for touch describes a predisposition of people to touch objects. For people high in need for touch, haptic information is generally more accessible (Peck & Childers, 2003b). Need for touch can be differentiated into autotelic and instrumental need for touch. Autotelic need for touch describes people who experience pleasure if they can touch products, and it is hedonically driven. Touching products in this mode is an "end in and of itself" (p. 431). Instrumental need for touch refers to the functional value of touch. People high in instrumental need for touch typically touch objects in a goal-directed and utility-orientated way, with the intention to evaluate the product's attributes, usefulness, and quality. If people high in need for touch cannot touch products, they experience frustration (Peck & Wiggins, 2006) and quality-related concerns (Kühn et al., 2020) – making need for touch a relevant construct in the context of online marketing (e.g., Flavián et al., 2016).

Autotelic and instrumental need for touch are no independent personality characteristics, yet scholars occasionally treat need for touch as a unidimensional construct (Yazdanparast & Spears, 2013). Although both dimensions are correlated, they have been found to be influential in different contexts (e.g., Ranaweera et al., 2021). Peck and Childers (2003b) find that autotelic need for touch is more strongly than instrumental need for touch associated with higher chronic accessibility and consequently with spontaneous haptic processing. They argue that autotelic need for touch is more implicit and associated with automatic processing. Contrarily, instrumental need for touch is more cognitively driven and has utility-oriented purposes. By using AR, a sensory experience is created automatically, but consumers gain no real information on the product's haptic features. With regard to a reaction toward AR features, autotelic need for touch is consequently assumed to be more influential than instrumental need for touch. In particular, people higher in instrumental need for touch will rather maintain the impression that only real touch can help them to validly evaluate product attributes. Besides, their automatic response should be weaker. Therefore, the focus of this paper will be on autotelic need for touch. For the sake of completeness, instrumental need for touch will though be discussed on the sidelines and will also be considered in the empirical analyses but rather serves as a comparison. The following section discusses which gratifications will likely be obtained by consumers higher in autotelic need for touch and which gratifications they might expect.

2.4 | Gratifications obtained from AR and the moderating role of autotelic need for touch

If people use an AR feature, they interact with the provided content and may even mentally imagine touching it. According to Barsalou (2008), imagined experiences are perceived to be very similar to real ones. According to the theory, all cognitive processes are mirrored in the brain's respective sensory modality-specific processing systems and, thus, bodily states. In addition, similar experiences are often

recalled simultaneously. For both reasons, the triggered images are consequently substantiated with actual sensory experiences and are therefore quasi-perceptual (Rodríguez-Ardura & Martínez-López, 2014). Accordingly, Peck et al. (2013) found that imagining haptic experiences can elicit similar effects as real haptic experiences. In particular, vivid object presentations (Petrova & Cialdini, 2005) or external stimuli that are similar to real perceptions or memories can activate such imagery, which makes this very likely to be realized in AR (Yim et al., 2017).

Since people high in need for touch engage in more haptic imagery, these haptic experiences might enrich the sensory intensity of imagery: Peck and Childers (2003b) found that people high in both instrumental and autotelic need for touch are more able to retrieve haptic information from their memory and do this faster than others. Furthermore, they show in a lexical decision task measuring the reaction time to haptically and not haptically related words that especially those higher in autotelic need for touch react faster to haptically related words, while this was not found for those higher in instrumental need for touch. Hence, consumers higher in need for touch are automatically predisposed to engage in haptic imagery when using an AR feature, and might therefore be more immersed in an AR experience than people lower in need for touch. Not only because people high in autotelic need for touch are often also higher in instrumental need for touch, but also because both tend to process information more haptically, this is likely to be the case for people with a high degree of either touch need. However, these processes proceed automatically, though the spontaneous haptic processing that is elicited should be relevant here and this is stronger for those higher in autotelic need for touch. Based on these considerations, people higher in autotelic need for touch might obtain greater benefits from an AR experience. More specifically, sensory input and imagery are generally described as eliciting hedonic value (Hirschman & Holbrook, 1982). In support of this, Yim et al. (2017) describe that the vividness and perceived intensity of the interactions determine the hedonic benefits derived from 3D or VR media, and as outlined, they are expected to be higher for those high in autotelic need for touch. This also fits with Metcalfe and Mischel's (1999) distinction between a hot and a cold regulatory system, as Kross et al. (2004) found that a higher immersion increases the activation of the "hot" system associated with emotion compared to the "cold" regulatory system associated with a reflective and more cognitive response. Thus, we hypothesized the following:

Hypothesis 1: *Using an AR feature increases perceived hedonic benefits for people higher (compared to lower) in autotelic need for touch.*

Although hedonic benefits may be predominant when using AR, as the literature provides stronger support for this relationship, there is also some indication of a positive effect of AR on utilitarian benefits (Yim et al., 2017). These authors argue that immersion caused by AR experiences mediates its positive effects on both hedonic and utilitarian benefits.

In addition, utilitarian benefits from AR might relate to whether it enhances the chance that the right decision is made. Additional

information for consumers associated with touch could be whether a product is comfortable or stable. In the case of the actual usage of AR, it might be easily noticed that AR cannot communicate these aspects reliably. For this reason, people higher in instrumental need for touch are not proposed to experience AR as providing more utilitarian benefits. However, those higher in autotelic need for touch might also experience a higher utilitarian value because the imagined interaction might, at least in part, substitute for the real haptic input which is a fundamental need of them (Peck & Childers, 2003a, 2003b). Thus, we hypothesized the following:

Hypothesis 2: *Using an AR feature increases perceived utilitarian benefits for people higher in autotelic need for touch compared to people lower in autotelic need for touch.*

As described, the interactivity and vividness of the experience account for the positive effects of AR and especially its hedonic benefits (Yim et al., 2017). People high in autotelic need for touch are predisposed to engage in haptic imagery. Consequently, for them, the imagined interaction will be richer overall, and the hedonic value of the experience will be more strongly associated with the feeling of a real haptic experience. High autotelic need for touch individuals will accordingly describe the experience of touch as more realistic and the product as more tangible. Thus, we hypothesized the following:

Hypothesis 3: *The increased hedonic benefits gained from AR use will lead to a higher imagined tangibility.*

It is likely that the perceived enhancement of benefits will cause a spillover effect and positively affect app liking, brand and product attitude, and purchase intention. In line with this, higher utilitarian and hedonic benefits elicited by AR were previously found to cause positive evaluations, such as with app evaluations (e.g., Yim et al., 2017). In addition, mental imagery induced by AR has previously been found to affect evaluations (e.g., Park & Yoo, 2020). When people cannot evaluate brands based on a real experience, they will use imagery to form an evaluation (Li et al., 2003). The valence of the elicited imaginations and their sensory richness consequently shape the resulting evaluation. As described before, those higher in instrumental need for touch are as well as those higher in autotelic need for touch predisposed to engage in more haptic processing and consequently will likely experience value. This effect should though be weaker and less relevant, because that is not what people high in instrumental need for touch search for when using AR. However, and as explained above, we expect this value-generating effect for both types of benefits, utilitarian and hedonic. Thus, we hypothesized the following:

Hypothesis 4: *Utilitarian benefits mediate AR's positive effect on (a) app evaluation, (b) brand attitude, (c) product attitude, and (d) purchase intention for people high in autotelic need for touch.*

Hypothesis 5: *Hedonic benefits mediate AR's positive effect on (a) app evaluation, (b) brand attitude, (c) product attitude, and (d) purchase intention for people high in autotelic need for touch.*

2.5 | Gratifications expected from AR and the moderating role of autotelic need for touch

After having discussed the benefits of actual AR usage, the question arises whether consumers expect the discussed benefits before or in the absence of an AR product experience. Consumers higher in autotelic need for touch might anticipate more utilitarian but not hedonic benefits from AR experiences than their lower autotelic need for touch counterparts because AR does not provide a real haptic experience but a feeling “as if,” which is just what people high in autotelic need for touch crave (Peck & Childers, 2003a, 2003b). This, however, might not be sufficient to elicit the anticipation of hedonic benefits because utilitarian benefits are more salient than hedonic ones, which are hard to anticipate (Dhar & Wertenbroch, 2000). In line with this, Pino et al. (2020) recently showed that imagined product touch increases the expected ease of use for functional products. However, hedonic benefits are more salient if actually experienced. In the context of AR, which is new to many consumers, hedonic experiences might be even harder to anticipate. In his cognitive-experiential self-theory, Epstein (1998) differentiates two different systems relevant for affective forecasting and real affective responses. While affective forecasts rely on logic, real evoked emotions stem from the experiential system. Accordingly, imagined experiences are generally less affect-rich than real experiences (Buechel et al., 2017). This is again in line with Metcalfe and Mischel's (1999) differentiation between the hot and cold regulatory systems. As a consequence, the hedonic benefits of touch can be expected to be more difficult to imagine and thus, to substitute, even for people high in need for touch. In principle, however, an AR feature satisfies a strong implicit need consumers high in autotelic need for touch have, and therefore provides utilitarian benefits. These consumers will therefore value the benefits of an AR feature more, relatively speaking, than individuals low in need for touch or only high in instrumental need for touch. Consequently, depending on the attractiveness of a non-AR comparison standard, they will expect more benefits from an AR feature. Hence, for the situation of an expected AR use, we hypothesized the following interaction effect between the type of feature (AR vs. non-AR) and the consumers' autotelic need for touch:

Hypothesis 6: *Consumers higher in autotelic need for touch will expect more utilitarian benefits from the AR features than consumers lower in autotelic need for touch.*

The next hypothesis looks at downstream consequences of the expectation that the AR feature will provide more utilitarian benefits. Following the premises of technology and media adoption research, higher anticipated levels of utilitarian benefits will lead to a higher intended use of a technology (Rauschnabel, 2018; Venkatesh

et al., 2012). Also, on a more general level, consumers' expectations of a new product's performance will likely affect their preferences for it, because higher expectations lead to higher preferences (Moreau et al., 2001). In line with these findings, Lin and Lin (2008) documented a higher adoption of a new technology as a consequence of higher expected benefits. The effect that positive expectations about a product can positively bias the evaluation process and, as a consequence, improve one's attitude toward the product was also found in an advertising context (Daume & Hüttl-Maack, 2020). Based on H6, hypothesizing higher (utilitarian) benefits for high autotelic need for touch individuals will translate into various attitudinal and behavioral consequences. Thus, we hypothesized the following for an expected AR use:

Hypothesis 7: *Higher expected utilitarian benefits will lead to higher expectations that the feature increases (a) shop attitude, (b) product attitude, and (c) purchase intention for people higher in autotelic need for touch compared to consumers lower in autotelic need for touch.*

3 | METHODS

3.1 | Study overview

To provide a sufficient level of generalizability, this research applies a series of four studies using different product categories (e.g., Peck & Childers, 2003a). Study 1 used an AR app by the cosmetic brand Sephora, which had been used in several previous AR studies (e.g., Scholz & Duffy, 2018; Smink et al., 2019). The study included two measurement time points (i.e., before and after app use), which allowed changes in attitude to be captured. The results show that consumers higher (vs. lower) in autotelic need for touch draw more hedonic and utilitarian benefits from actual AR app use and evaluate the app and the respective brand more positively.

Study 2 compared the effects of using the AR feature of the regular Amazon retail app with using the same app without the AR feature. It finds that consumers higher in autotelic need for touch draw more hedonic benefits from the AR experience, resulting in positive evaluations.

Two additional experimental studies assessed the gratifications expected in advance of AR use. For this purpose, descriptions of AR features were compared to alternative features. To increase the generalizability of the results, these features varied as in the real world, where AR features used for retailing compete with a variety of alternative digital features, such as images, customer reviews, and verbal descriptions. In both experiments, fictional online shops were used, and participants were told that they should imagine that they had considered purchasing there but were yet unsure. It was found that those higher in autotelic need for touch expect more utilitarian benefits. Table 2 provides an overview of the four studies.

TABLE 2 Study overview

Study	Methodology	Product category	Features	Actual versus expected usage	Tested hypotheses	Main findings
1	Before-after design (survey)	Make-up	Augmented reality (AR)	Actual	H1*, H2*, H3*, H4a*, H4b*, H5a*, H5b	Autotelic need for touch positively affects utilitarian and hedonic benefits; both positively affect app attitude; only utilitarian benefits positively affect brand attitude.
2	Experiment (2 × 2)	Floor lamp	AR vs. standard Amazon product descriptions	Actual	H1*, H2, H3*, H4b, H4c, H4d, H5b, H5c*, H5d*	Autotelic need for touch positively affects hedonic benefits, product and brand attitude, and purchase intention.
3	Experiment (2 × 2)	Carpets	AR vs. feature offering many product pictures, function to zoom in, function to combine products with colored backgrounds	Expected	H6*, H7a*, H7b*, H7c*	Autotelic need for touch positively affects utilitarian benefits, product and shop attitude, and purchase intention.
4	Experiment (2 × 2)	Furniture and deco cushion	AR vs. feature offering function to combine products with decoration ideas or backgrounds	Expected	H6*, H7a*, H7b*, H7c*	Autotelic need for touch positively affects utilitarian benefits, product and shop attitude, and purchase intention.

Notes: Detailed descriptions of the stimuli are available upon request from the corresponding author. * Indicates that the hypothesis was supported.

3.2 | Study 1: How need for touch influences a real AR experience with a make-up app

3.2.1 | Procedure

Study 1 used the AR feature of the Sephora beauty app and collected data at two measurement points: several days before and immediately after the use of the AR feature. A total of 173 females participated at both measurement points ($M_{\text{age}} = 23.98$, $SD = 2.77$, range: 19–35 years). The participants were students at a German university and were contacted via messages on a university webpage, in courses, by flyers, and word-of-mouth. At the first measurement point, participants registered online and answered questions regarding demographics, brand attitude, and need for touch. Three items each were used to assess autotelic need for touch (e.g., "Touching products can be fun"; $\alpha = 0.786$) and instrumental need for touch (e.g., "The only way to make sure a product is worth buying is to touch it"; $\alpha = 0.797$; Nuszbaum et al., 2010), with a correlation between the scales of $r = 0.661$. Brand attitude was measured using two items (e.g., "My attitude toward this brand is very positive"; Batra et al., 2012; $r = 0.789$). On an average of 18 days later, they were invited to the university to participate in the main part of the study. After a short introduction, the respondents were given an iPad on which they used the AR app and a laptop computer on which they completed the questionnaire. They could interact with the app as long as they wished (on average 16 looks were investigated), and, subsequently, they completed the survey. Respondents were incentivized with refreshments and a raffle for a gift certificate (100€ for a Sephora shop or a beauty coaching). Brand attitude was measured using the same items as with the first measurement point ($r = 0.812$), and difference scores between the post- and pre-brand attitudes were calculated (Rauschnabel et al., 2019). Utilitarian benefits were assessed using two items ("I find this feature useful" and "This feature helps in making a decision"; $r = 0.836$; adapted from Rauschnabel et al., 2019). Hedonic benefits of the feature were assessed using three items ("I assume using this feature is enjoyable [entertaining] [fun]"; $\alpha = 0.901$; adapted from Venkatesh et al., 2012). In addition, app attitude was measured by two items ("good" and "positive"; $r = 0.919$). All items were measured on 7-point Likert scales (1 = *totally disagree*, 7 = *totally agree*).

3.2.2 | Results

Bootstrapping analyses using PROCESS (Model 4; Hayes, 2018) including both mediators simultaneously revealed a positive relationship between autotelic need for touch and the extent to which the app was perceived to provide hedonic benefits (0.219 , $p = 0.006$; $R^2 = 0.044$), supporting H1, and the extent to which it was perceived to provide utilitarian benefits (0.182 , $p = 0.024$; $R^2 = 0.030$), supporting H2. Hedonic benefits (0.049 , $SE = 0.025$, confidence interval $[CI_{95\%}]$: [0.009, 0.105]) and utilitarian benefits (0.121 , $SE = 0.055$, $CI_{95\%}$: [0.021, 0.238]) both mediated the positive effect of autotelic need for touch on app evaluation ($R^2 = 0.668$), which is in line with H4a and H5a. In addition, there is support for H4b because utilitarian benefits (0.052 , $SE = 0.027$, $CI_{95\%}$: [0.008, 0.116])

mediated the positive relationship between autotelic need for touch and attitude toward the brand ($R^2 = 0.105$). However, the effect of hedonic benefits on attitude toward the brand (-0.023 , $SE = 0.026$, $CI_{95\%}: [-0.087, 0.017]$) did not reach significance, leading to a rejection of H5b. The conclusions remained stable when the number of days between both measurement points and the number of looks that were examined were controlled for. Figure 1 summarizes the results and provides an overview of the study procedure and regarded variables. Instrumental need for touch also enhanced hedonic value, which influenced app attitude but not brand attitude. Here, the results are in accordance with the results for autotelic need for touch. However, those higher in instrumental need for touch did not experience a higher utilitarian value. This supports our notion that the effects for instrumental need for touch are similar to those of autotelic need for touch, but less influential and less stable. Table S1 in the web appendix depicts the results for both autotelic and instrumental need for touch for the calculated models and for all four studies.

The highlights of this study are the before-after design that applied two measurement sequences and the realistic setting in which the respondents used the app. The next study compared an AR app with a non-AR app in a between-subjects design and investigated whether the effects hold for a product category for which haptic input might be somewhat less important.

3.3 | Study 2: How need for touch influences a real AR experience with the Amazon app

3.3.1 | Design, sample, and procedure

A sample of 212 young adults aged from 18 to 35 ($M_{\text{age}} = 27.36$, $SD = 5.16$, 63% female) recruited from an ISO-certified online-access

panel service provider participated for financial compensation. To participate in the study, panel members had to own a smartphone no more than three years old and be willing to use the Amazon app on it. To create conditions as similar as possible for the participants, they were instructed to participate in the survey while they were at home. They were randomly assigned to one of two conditions (AR vs. control). Study 2 complements the first study by incorporating both males and females using floor lamps as a product category (which was considered less gender specific than using make-up in Study 1) to increase the generalizability of the findings. For the same reason, we decided on a product for which tactile input was less crucial for decision-making than for textiles, as an example (McCabe & Nowlis, 2003; Peck & Childers, 2003a). The participants were asked to install the Amazon app on their smartphones and were then invited to look at a specific lamp. They were prompted to either only read the description and look at the three provided pictures (control condition) or to also project the product in their home using the AR function (AR condition). To make sure that the participants followed the instructions, they were also asked to upload a screenshot documenting their app use to the survey tool (they were informed about and agreed to this procedure before being able to start the actual survey). Autotelic ($\alpha = 0.917$) and instrumental need for touch ($\alpha = 0.894$) of the participants were measured with the full scale (six items each) translated and validated by Nuszbaum et al. (2010). These subscales correlated highly ($r = 0.730$). Utilitarian ($\alpha = 0.825$) and hedonic ($\alpha = 0.877$) benefits were assessed using the same items as in Study 1, except one additional item for utilitarian value was added (Rauschnabel et al., 2019). To dig deeper into the role of touch, the imagined tangibility was assessed using three items adapted from Laroche et al. (2005) (e.g., "It seemed like I could touch the lamp"; $\alpha = 0.976$). Purchase intention (e.g., "I would likely buy this product"; $r = 0.820$), attitude toward the products ("very positive" and "very good"; $r = 0.786$), and attitude toward the brand

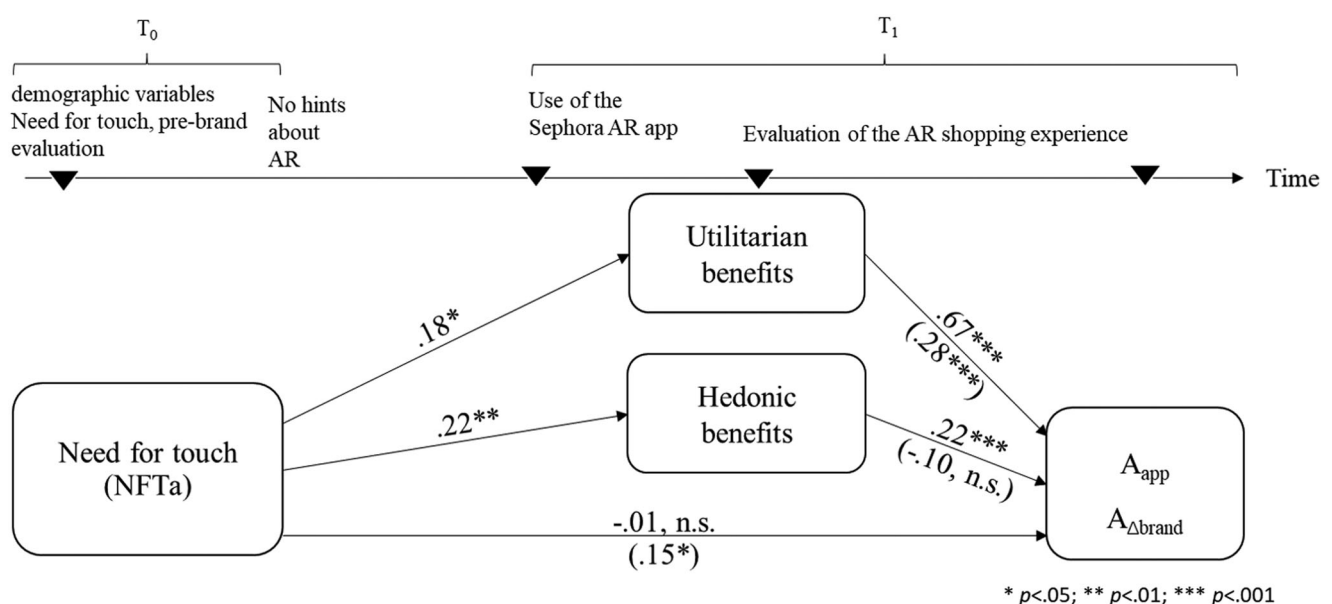


FIGURE 1 Results of the mediation analysis and procedure of Study 1. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Results without parentheses = model on attitude toward the app, parentheses = attitude toward the brand. AR, augmented reality. The timeline on top represents the measurement points of the survey

("very positive" and "very good"; $r = 0.776$) were measured using two items each (1 = *totally disagree*, 7 = *totally agree*).

3.3.2 | Results

Initial checks revealed no differences in need for touch between the conditions (autotelic need for touch: $M_{\text{control}} = 4.25$ versus $M_{\text{AR}} = 4.09$, $F(1, 211) = 0.62$, $p = 0.431$; instrumental need for touch: $M_{\text{control}} = 4.47$ versus $M_{\text{AR}} = 4.53$, $F(1, 211) = 0.13$, $p = 0.724$). The hypothesized model was tested using the PROCESS bootstrapping macro with autotelic need for touch as a moderating variable and hedonic value and imagined tangibility as stepwise mediators affecting product, brand attitude, and purchase intention (Model 83; Hayes, 2018). Gender was included as control but did not affect the results. There were no main effects of app type, autotelic need for touch, or gender on hedonic benefits, but there was a significant interaction between app type and autotelic need for touch ($b = 0.315$, $p = 0.016$, $R^2_{\text{change}} = 0.026$). An inspection of the interaction examining the directions of the indirect effects shows that, in line with H1, people higher in autotelic need for touch tend to evaluate the AR app as providing more hedonic benefits (need for touch_{high}: 1.163, $SE = 0.263$, $CI_{95\%}$: [0.643, 1.682]; need for touch_{low}: 0.245, $SE = 0.267$, $CI_{95\%}$: [-0.281, 0.771]). The perceived utilitarian value did not differ between the app types ($b = -0.317$, $p = 0.486$), autotelic need for touch ($b = -0.040$, $p = 0.611$), or due to the interaction between the two ($b = 0.102$, $p = 0.324$), which contradicts H2 and consequently, the respective mediation hypothesis H4. The index of the moderated mediation from the app type via hedonic benefits and imagined tangibility was significant for product attitude (0.033, $SE = 0.018$, $CI_{95\%}$: [0.004, 0.073]), brand attitude (0.028, $SE = 0.015$, $CI_{95\%}$: [0.004, 0.061]), and purchase intention (0.047, $SE = 0.026$, $CI_{95\%}$: [0.005, 0.104]), which supports H3, H5b, H5c, and H5d. Figure 2 shows the stepwise moderated mediation model.

As in Study 1, instrumental need for touch enhanced perceived hedonic benefits, which mediated positive effects on the outcome measures. Utilitarian benefits were not affected. As outlined above, it was important to assess in the next step to what extent consumers are aware of the benefits of AR features before actual use, which will determine their behavioral intentions. For this purpose, the subsequent two studies investigated expected gratifications and how they are influenced by consumer's need for touch.

3.4 | Study 3: How autotelic need for touch influences perceived app utility, attitude toward the product and shop and purchase intent

3.4.1 | Design, sample, and procedure

Study 3 used a sample of 92 females ($M_{\text{age}} = 33.64$, $SD = 11.15$) recruited via Clickworker, a German crowdworking platform. A fictitious online

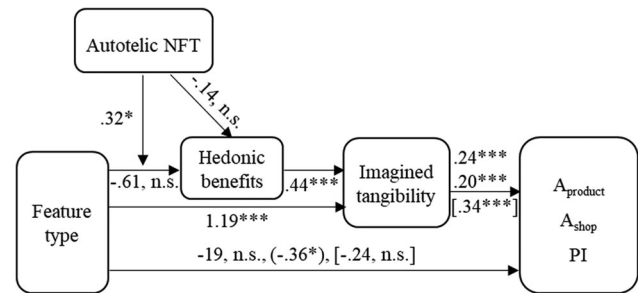


FIGURE 2 Results of Study 2. Stepwise moderated mediation analyses. Feature type was dummy coded with 0 = neutral feature, and 1 = AR feature. * $p < 0.05$, *** $p < 0.001$. Results without parentheses = model on attitude toward the product, parentheses = attitude toward the shop, square brackets = purchase intention. AR, augmented reality

shop selling carpets was described in the study. The neutral feature was described as offering many pictures, allowing the ability to zoom in and combine products with colored backgrounds to determine how products looked with colored walls or furniture, such as the user's own couch. For the AR feature, it was described as being able to be used to project the products within the user's own home (e.g., just in front of the person). The autotelic need for touch of the participants was measured using two of the items from Study 1 ($r = 0.561$). Perceived utilitarian benefits were measured using the first item reported for Study 1. Purchase intention was assessed by two items (e.g., "I would likely buy in this shop"; $r = 0.896$). Attitude toward the products ($r = 0.855$) and attitude toward the shop ($r = 0.875$) were measured using the same items as in Study 2. To account for differences in the consumers' general perception of new technologies (Kim & Forsythe, 2008b), technology innovativeness served as a control variable in the model (two items, e.g., "I enjoy using new digital services before others even know they exist"; $r = 0.862$).

3.4.2 | Results

A comparison between the two conditions reveals no significant difference in need for touch (autotelic: $M_{\text{control}} = 4.60$ versus $M_{\text{AR}} = 4.90$, $F(1, 90) = 1.10$, $p = 0.297$; instrumental: $M_{\text{control}} = 4.96$ versus $M_{\text{AR}} = 5.09$, $F(1, 90) = 0.28$, $p = 0.600$). The moderating role of need for touch with hedonic and utilitarian benefits simultaneously integrated as mediators was again assessed using the PROCESS macro (Model 7). Technological innovativeness was included as a control variable. The results indicate lower utilitarian benefits when an AR feature is offered ($b = -2.865$, $p = 0.002$) and a negative effect of autotelic need for touch ($b = -0.301$, $p = 0.034$), while innovativeness ($b = 0.353$, $p < 0.001$) and the interaction between the conditions and autotelic need for touch are also significant ($b = 0.459$, $p = 0.012$, $R^2_{\text{change}} = 0.056$). The significant interaction as well as a further analysis of the direction of the effects using PROCESS support H6 and show that individuals low in autotelic need for touch expect higher utilitarian benefits of the non-AR feature (-1.325 ,

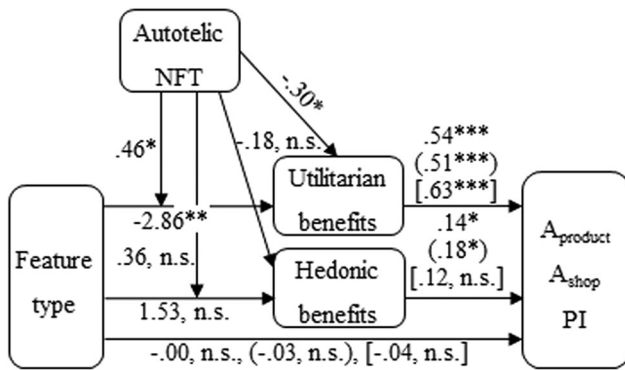


FIGURE 3 Results of Study 3. Moderated mediation analyses. Feature type was dummy coded with 0 = neutral feature, and 1 = AR feature. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Results without parentheses = model on attitude toward the product, parentheses = attitude toward the shop, square brackets = purchase intention. AR, augmented reality

$SE = 0.344$, $CI_{95\%} [-2.008, -0.642]$), while those higher in autotelic need for touch evaluate both as similarly useful (-0.049 , $SE = 0.352$, $CI_{95\%} [-0.748, 0.650]$). Hedonic benefits neither depend on the feature type ($b = 1.535$, $p = 0.153$) nor the autotelic need for touch ($b = -0.177$, $p = 0.299$), and there is no interaction between these factors ($b = 0.364$, $p = 0.097$).

Conditional effects further show that individuals low in autotelic need for touch are less likely to purchase (-0.794 , $SE = 0.252$, $CI_{95\%} [-1.306, -0.333]$) and evaluate the shop (-0.640 , $SE = 0.231$, $CI_{95\%} [-1.118, -0.231]$) and the product (-0.720 , $SE = 0.234$, $CI_{95\%} [-1.199, -0.286]$) less positively when the AR feature is described. For those higher in need for touch, purchase intention (-0.054 , $SE = 0.231$, $CI_{95\%} [-0.497, 0.437]$), shop (-0.044 , $SE = 0.191$, $CI_{95\%} [-0.437, 0.337]$) and product attitude (-0.026 , $SE = 0.212$, $CI_{95\%} [-0.444, 0.403]$) do not differ between the conditions. These patterns support H7a, H7b, and H7c, predicting more positive outcomes due to an AR feature for those higher in autotelic need for touch compared to those lower in autotelic need for touch (see Figure 3 for the coefficients of the models). All the indices of moderated mediation are significant (purchase intent: 0.289 , $SE = 0.143$, $CI_{95\%} [0.022, 0.579]$; product attitude: 0.233 , $SE = 0.121$, $CI_{95\%} [0.014, 0.487]$; shop attitude: 0.249 , $SE = 0.122$, $CI_{95\%} [0.020, 0.505]$). Only autotelic need for touch significantly influenced utilitarian benefits and the outcome measures, whereas this effect was not found for instrumental need for touch.

Study 3 found higher expectations of utilitarian benefits as well as higher purchase intention and more positive attitudes for the AR feature by consumers higher in need for touch. However, the presented non-AR feature was designed such that it was perceived as very attractive and seemed to provide features that the respondents knew well and valued highly. Hence, the overall reaction was more positive toward the non-AR compared with the AR feature. For this reason, Study 4 uses an adjusted description of the non-AR feature to be perceived as somewhat less attractive to test whether the effect of the need for touch is replicated.

3.5 | Study 4: Replication study on how autotelic need for touch influences perceived app utility, attitude toward the product and shop, and purchase intent

3.5.1 | Design, sample, and procedure

A total of 113 females ($M_{age} = 38.24$, $SD = 12.35$) from the Clickworker crowdworking platform participated for a small compensation and were randomly assigned to either the AR or the non-AR condition. An unknown online shop for furniture and décor, offering cushions, vases, and similar products, was introduced. A picture of the main page of the shop was provided to enhance realism. Participants were told that the shop offered a feature they could use to inform themselves about products. The non-AR feature was described as providing the possibility to combine products with decoration ideas, such as plantings, or to position products against different backgrounds, such as wallpapers. The description of the AR feature was adopted from the previous study. The need for touch of the participants was measured using the same three items as in Study 1 (autotelic: $\alpha = 0.851$, instrumental: $\alpha = 0.866$; $r = 0.762$). Utilitarian ($\alpha = 0.943$) and hedonic benefits ($\alpha = 0.931$) were assessed using the same items as in Studies 1 and 2. Purchase intention ($r = 0.900$), attitude toward the products ($r = 0.897$), and attitude toward the shop ($r = 0.876$) were measured by the same items as in Studies 2 and 3.

3.5.2 | Results

Individuals in both conditions did not differ in need for touch (autotelic: $M_{control} = 4.80$ versus $M_{AR} = 4.88$, $F(1, 112) = 0.10$, $p = 0.755$; instrumental: $M_{control} = 4.80$ versus $M_{AR} = 4.78$, $F(1, 112) = 0.01$, $p = 0.936$).

Again, the effect of autotelic need for touch on the utilitarian and hedonic benefits of the AR feature and, consequently, on purchase intention, attitude toward the shop, and attitude toward the products were analyzed with the PROCESS macro. The expected benefits were influenced significantly by autotelic need for touch. The results indicate a nonsignificant effect of the feature type ($b = -1.544$, $p = 0.102$) and a negative effect of autotelic need for touch ($b = -0.292$, $p = 0.016$), while the interaction between the conditions and autotelic need for touch is also significant ($b = 0.413$, $p = 0.029$, $R^2_{change} = 0.041$). The significant interaction and the direction of the effects are in line with H6, as those low in autotelic need for touch expected higher utilitarian benefits from the non-AR feature (-0.099 , $SE = 0.351$, $CI_{95\%} [-0.794, 0.597]$), while those higher in autotelic need for touch expected more utilitarian benefits from the AR feature (1.010 , $SE = 0.349$, $CI_{95\%} [0.317, 1.701]$). Hedonic benefits neither depend on the feature type ($b = -0.002$, $p = 0.999$) nor the autotelic need for touch ($b = 0.045$, $p = 0.713$), and there is no interaction between these factors ($b = 0.141$, $p = 0.463$). For individuals higher in autotelic need for touch, the expected utilitarian benefits

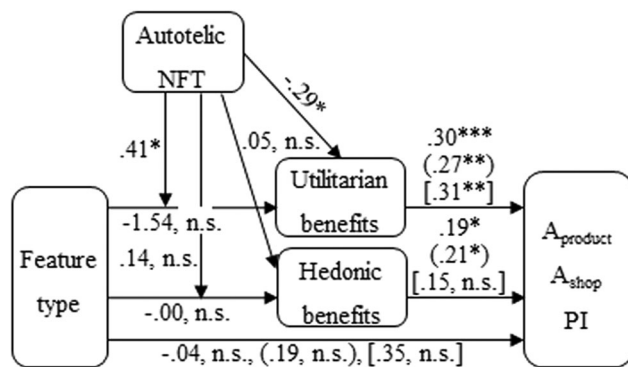


FIGURE 4 Results of Study 4. B: Moderated mediation analyses. $N = 113$. Feature type was dummy coded with 0 = neutral feature, and 1 = AR feature. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Results without parentheses = model on attitude toward the product, normal parentheses = attitude toward the shop, square brackets = purchase intention. AR, augmented reality

result in a higher purchase intention (0.312, $SE = 0.186$, $CI_{95\%}$: [0.004, 0.703]) and a more positive attitude toward the products (0.300, $SE = 0.152$, $CI_{95\%}$: [0.042, 0.625]) and the shop (0.272, $SE = 0.150$, $CI_{95\%}$: [0.025, 0.598], see Figure 4 for the detailed results of the model). For individuals low in autotelic need for touch, purchase intention (-0.031 , $SE = 0.111$, $CI_{95\%}$: $[-0.299, 0.157]$), product (-0.029 , $SE = 0.102$, $CI_{95\%}$: $[-0.274, 0.144]$), and shop attitude (-0.027 , $SE = 0.093$, $CI_{95\%}$: $[-0.243, 0.137]$) do not differ depending on which feature was described. This supports H7a, H7b, and H7c, stating that those higher in need for touch would react more positively toward an AR feature than those low in need for touch. Hence, Study 4 replicates the effects shown in Study 3.

The indices of moderated mediation are significant for product attitude (0.123, $SE = 0.073$, $CI_{95\%}$: [0.008, 0.291]) and shop attitude (0.111, $SE = 0.070$, $CI_{95\%}$: [0.004, 0.272]) but not for purchase intention (0.128, $SE = 0.088$, $CI_{95\%}$: $[-0.003, 0.327]$). Instrumental need for touch neither influenced utilitarian nor hedonic benefits and accordingly, did not affect the outcome measures.

4 | GENERAL DISCUSSION

Only a few studies, so far, have specifically tackled the role of consumer characteristics in the context of AR. Against this background, the current research assessed consumers' motivation to touch products—their level of need for touch.

4.1 | Results summary

Counterintuitively and replicated in a series of experimental studies, it turned out that consumers with a high need for touch tend to rate AR content even better than those with a low need for touch. By doing so, this study shows that AR content can have the potential to

substitute for physical in-store experiences. More concretely, the results show consistently that in the case of a real interaction with the AR content, consumers higher in autotelic need for touch experience higher hedonic benefits than consumers lower in autotelic need for touch. These hedonic benefits also lead to more positive marketing outcomes, such as a more positive brand, product and app attitude, and purchase intention. Only the effects on the attitude toward the brand could not be replicated. We assume that this is because brand attitude is more stable and less context-dependent than other outcomes, such as product attitude. Partly, but less stable, utilitarian benefits are also experienced when an AR feature is actually used. In cases when usage is only anticipated, consumers higher in autotelic need for touch constantly expect higher utilitarian benefits than consumers lower in autotelic need for touch, which also affects attitudinal outcomes positively. Hedonic benefits, however, are not anticipated. If the instrumental need for touch is instead considered, the effects are partly similar, but less consistent.

These findings have multiple theoretical contributions, as discussed below.

4.2 | Theoretical contribution

The theoretical contributions of this study are fivefold.

First, this study contributes to consumer research on AR marketing (Chylinski et al., 2020; Scholz & Duffy, 2018) and retailing (Caboni & Hagberg, 2019; Hilken et al., 2017, 2018). As discussed, most studies in this stream have made significant contributions to understanding how consumers process AR content in a marketing context (Jessen et al., 2020; Rauschnabel, 2021; Yim & Park, 2019) and how AR can impact various managerially relevant outcomes, such as consumer-brand relationships (Scholz & Duffy, 2018). In short, these studies suggest that AR can outperform various other forms of media, such as 2D presentations of products (e.g., Jessen et al., 2020). While these studies have enhanced the understanding of AR's specific characteristics, only a few consumer characteristics have been investigated, often only as control variables (see Table 1). These exceptions included variables such as innovativeness (Saprikis et al., 2021), demographics (Hinsch et al., 2020), processing styles (Hilken et al., 2017), and self-esteem (Javornik et al., 2021). Research that studies how consumers who would like to touch products in the real world (i.e., those with a high need for touch) react to realistically looking, yet untouchable, products is scarce (Huang & Tseng, 2015).

This study contributes to the AR marketing literature by showing that AR's effectiveness differs between consumers with different levels of need for touch. Intuitively, one might expect that consumers with a general preference to touch products before purchasing them do not prefer shopping environments in which products are only visually displayed, such as online shops (McCabe & Nowlis, 2003; Rathee & Rajain, 2019) or AR apps. However, across four studies, the current research reveals that AR can provide a particular benefit to consumers with a high need for touch, most likely because consumers with a high need for touch tend to have stronger imagery

(Huang & Tseng, 2015). Moreover, AR's strengths include the realistic visualization of products as if they were physically present in one's space (Scholz & Duffy, 2018). On a broader level, this study highlights the role of consumer characteristics as potential moderators in the advancement of AR theory.

Second, the current research provides a methodological contribution to AR research. Most of the reviewed studies on AR have investigated consumer reactions after respondents had actually used an AR feature (as in Studies 1 and 2 in this research). Studies 3 and 4 assessed how consumers react to the idea of using such a feature (which reflects a pre-usage scenario), while providing a description of an AR feature to respondents without actual use. This approach reflects a real-life situation where consumers learn about the availability of an AR feature and decide whether to use it or not. Our findings show that in the pre-usage stage, consumers expect more utilitarian benefits (i.e., they expect it to be a problem solver), whereas, after use, they experience more hedonic benefits (Studies 1 and 2). Thus, using a fictitious description of an AR experience as a proxy for a real AR experience (or vice versa) might lead to false conclusions. For instance, when finding that users value a specific AR app for its entertainment value, it might be imprudent to focus too much on the entertaining value when marketing to potential users.

Third, extant research has investigated strategies of how retailers can reach new target groups through new channels. Traditional online shopping provides numerous advantages to consumers, such as high levels of convenience, as well as disadvantages in that consumers must rely on some form of digital content (typically text and photos on a website). This study shows that one of the less promising target groups for e-commerce, those consumers with a high need for touch (McCabe & Nowlis, 2003; Rathee & Rajain, 2019), can be targeted through AR. Marketers are typically not aware of each consumer's level of need for touch. However, especially with the advancement in platform AR (e.g., AR features in the Amazon app) and webAR (i.e., AR via browsers), marketers can relatively easily integrate these features into their websites and communicate this to consumers. While this study replicates the potential benefits of AR in general (e.g., Hilken et al., 2017), it also suggests that these benefits might be particularly higher for consumers high in need for touch. In sum, this study contributes to the literature on the digitalization of retailing (e.g., Hagberg et al., 2016) by suggesting AR as an additional touchpoint in the distribution mix.

Fourth, there is a discussion as to how specific media can substitute for physical experiences. McCabe and Nowlis (2003) found that pictures can only substitute haptic information for people lower in need for touch, while verbal descriptions can substitute them only for people higher in need for touch. Kühn et al. (2020) found that videos showing product touch lead to more positive evaluations in online shopping for consumers higher in need for touch and for grocery products for which touch is diagnostic. Apparently, the extent to which media appeal to people with a rather high need for touch is quite variable. This study contributes to this discussion by showing that AR is appealing to those higher in need for touch, and the results support the assumption that tactile imagery is one driver of the effect. Verbal descriptions of tactile input and videos showing touch facilitate imaginations of touch, because

the experience is quite well described and the consumer only has to passively follow the imagination process. In contrast, in the case of AR, more of the imaginary generation process is left to consumers. The results support the assumption that those higher in need for touch actively engage in such imagery when they are confronted with AR.

Finally, there is a growing body of research that tackles the role of sensory experiences in marketing (e.g., Marlow & Jansson-Boyd, 2011). AR has been suggested as a technology useful in this regard (Velasco et al., 2019). This study contributes to this domain by showing AR's potential to imitate and substitute tangibility.

4.3 | Managerial implications

This study provides important insights that can inspire current marketing practices. As discussed, online retailers have difficulties in targeting consumers with a specific preference to touch products. These consumers thus tend to be more loyal to traditional stores. Although AR does not provide actual opportunities to touch products, this study shows that AR can provide a new opportunity to reach consumers with a high need for touch. Therefore, online stores likely benefit from AR elements at their virtual point of purchase. Amazon is currently rolling out this opportunity in some product categories (e.g., lamps). Consumers can view a product in the traditional Amazon.com app and also view the product "through" their devices in an AR mode. This strategy might be a promising starting point. The challenge, however, is that retailers need to include AR technology in their online shops and require 3D models for all of their products.

However, physical stores can also benefit from the findings of this study, because their consumers likely have higher levels of need for touch than their solely online competitors. Because many retailers are still relying on print advertising materials, for instance, in newspapers, they could add AR features to them. Some brands have already started to add AR layers to print magazines, and research indicates that this approach can be beneficial (e.g., Yaoyuneyong et al., 2016). That is, consumers can look "through" their phone on a newspaper and see the ad augmented with virtual, potentially interactive AR content. Marketers could allow consumers to scan products from an advertisement in a newspaper or TV with their mobile devices and experience the products in 3D at home. Such solutions already exist for TV content, and industry reports indicate their effectiveness (e.g., Eyecandylab, 2019); according to the findings of this study, this is particularly promising for targeting consumers with a high need for touch (for whom ads without AR might be less effective).

Finally, the finding that the benefits consumers expected and experienced from AR use differ provides important implications. Consumers high in need for touch primarily expect utilitarian benefits, but actually, experience greater hedonic benefits. To avoid disconfirmation of expectations and thus, the risk of having dissatisfied customers, marketers should counteract by providing the right information upfront. They could support the introduction of AR features by describing benefits to be expected or by using imagery techniques. In addition, the experiences or comments of other users

could be highlighted, for example in the way it is done in customer reviews. After being enticed to use an AR feature with more specific information preparing consumers regarding what to expect, they will benefit more from the overall experience.

4.4 | Limitations and future research directions

As with any research, this study has some limitations. Most importantly, the current research used only self-reported measures for selected product categories. In addition, for some constructs, scales consisting of only one or two items were used. Compared to field experiments with actual behavior (Tan et al., 2021), the strength of lab experiments include high internal validity and the ability to detect mediating constructs, yet external validity might have suffered. Three of the four studies used female participants, which is in line with extant studies (e.g., Javornik et al., 2021) but could still limit the applicability to others. However, Study 2 used both genders, indicating that this limitation was not too severe. Future research should address these limitations. Finally, echoing recent research (e.g., Chung et al., 2018), one might argue that merely touching a device could explain the positive effects of the need for touch; however, Study 2's findings, where respondents in both conditions touched the device, indicate that this alternative explanation seems not to be dominant.

Future research might also investigate the role of instrumental need for touch because Studies 1 and 2 found a positive effect on hedonic value in the case of an actual usage of the AR feature. A potential explanation for this is that both need for touch constructs are not distinct but have a common core. However, it appears that those higher in instrumental need for touch are overall less engaged by AR, resulting in weaker hedonic effects in the case of actual usage and no effects in the case of anticipated usage. Future research might investigate this and could, in these terms, investigate the role of different product categories, as previous research has (e.g., Kühn et al., 2020).

Additional avenues for future research will emerge as the technology evolves. For instance, some recent patents and hardware concepts show that specific gloves can imitate haptic experiences (Perret & Vander Poorten, 2018). In a consumption context, a consumer could then actually touch and feel virtual products. Understanding how consumers with different levels of need for touch interact with virtual versus "virtually-touchable" products provides another fruitful avenue for further research. Moreover, this study has made the first attempt to investigate senses other than vision in AR. Inspired by the groundwork research on multi-sense in virtual reality (e.g., Flavián et al., 2021), future research could assess this in AR.

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DATA AVAILABILITY STATEMENT

Research data are not shared.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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