Effect of Augmented Reality (AR) experiential value and flow experience on psychological ownership of product and technology

Idaf Iqbal

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Goodman School of Business, Brock University

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Abstract

The emergence of Augmented Reality (AR) technologies has made it possible for marketers to engage and interact with consumers in new ways and thus influence positive behavioral outcome. The interactive nature of the AR technologies provides consumers scope to form attachment with the product and technology in forms of psychological ownership. Although the formation of psychological ownership of both product and technology has been studied, they have been studied separately. As AR being highly interactive provides scope for forming attachment with the product and technology, this study addresses the literature gap by providing a mechanism to understand the formation of both psychological ownership of product and technology and their relationship with AR's functional and emotional value. By analyzing responses from 480 online survey respondents, we provide empirical evidence that the functional and emotional value has opposite effect on the psychological ownership of consumers. Specifically, our results show that the functional value negatively affects while as emotional value positively affects psychological ownership of product and technology, and flow experience mediates these relationships. Consumers' perceived control also plays a role in the formation of psychological ownership of product and technology as well as their flow experience. We find empirical evidence that for high (low) perceived control, the positive effect of emotional value of consumers on the psychological ownership of product and technology is strengthened (weakened); while as for high (low) perceived control, the negative effect of functional value on the consumers psychological of product and technology is weakened (strengthened). Although our results show that perceived control does not moderate the relationship of functional values with that of flow experience, it moderates the relationship of emotional values with flow experience such that for high (low) perceived control, the positive effect of emotional value on flow experience is strengthened

(weakened). These findings can help marketers in AR app design by helping them understand how different functional and emotional aspects of the AR experience affect consumers' psychological ownership of product and technology.

Keywords: Augmented Reality (AR); functional values; emotional values; flow experience; psychological ownership

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Introduction

Augmented Reality (AR) is one of the trending phenomena of today's world owing to its capability to enhance physical worlds with digital information. Early success of apps like Pokémon Go and Snapchat, made AR enhanced apps more familiar to regular consumers and different industries around the globe took notice of AR's mostly untapped potential. World leading corporations like Apple, Facebook, Alphabet, Disney, Nike and Wayfair have invested millions of USD in developing AR solutions, which is being hailed as the next generation display technology following cellphones (Xiong, Hsiang, He, Zhan & Wu, 2021). Today, AR is on its way to become a technology that can be easily accessed by consumers (Park & Yoo, 2020), thus changing ways in which consumer interact, view and purchase products (Verhoef, 2021). AR market size is expected to grow from approximately 3.4 billion USD to a staggering 198 billion USD in 2025 (Alsop, 2022). It is also predicted that the total number of worldwide mobile AR users will reach 1.73 billion. Recent survey by Deloitte reveals that 88% of mid-market American companies (firms that stacks annual revenues between 100 million USD and 1 billion USD) have started integrating augmented and virtual reality as a part of their business model (Deloitte, 2019). These findings indicated that AR is going to be an integral part for most businesses soon. Rauschnabel, Felix and Hinsch (2019), suggests that soon AR, which is often defined as technology integrating computer generated information (e.g., images and sounds) with real world environments of users (Baek, Yoo & Yoon, 2018), will be indispensable to marketing as well. AR as a system consists of two key characteristics: "1. combine both real and virtual; 2. are interactive in real time; and are registered in 3-D" (Mekni & Lemieux, 2014). Unlike virtual reality (VR), AR enhances consumers' perception of reality instead of suppressing it by combining computer generated contents with real world objects in ways that users can interact with virtual elements in real life

(Shabani, Munir & Hassan, 2018). AR's ability to combine real world environment and virtual objects enriches users' sensory perception which is why it has become an important part of studying e-marketing (Shabani et al., 2019). The multisensory perception that AR generates prompts users to visit online stores (Park & Yoo, 2020) and interact with the digital objects online (Javornik, 2016). With the help of AR, retailers can bridge the gap between offline and online experience enabling consumers to maintain realistic expectation of the products (Fan, Chai, Deng & Dong, 2020). In doing so, AR can improve customer experiences, while also saving them time and reducing their purchase uncertainty (Dacko, 2017). Marketing literature has long suggested the importance to understand and manage consumer experience (for e.g., Lemon & Verhoef, 2016) and one of the unique aspects of consumers' AR experience is the perception of touch (Gatter, Hüttl-Maack & Rauschnabel, 2022). Consumers use touch for various reasons including but not limited to, attaining product information (McCabe & Nowlis 2003; Peck & Childers, 2003). Although through AR, consumers merely 'observe' touching a product, this visual representation of haptic engagement is enough to make them feel as if the object at the center of such haptic engagement is "owned by him or her" (Lamberton & Goldsmith, 2020; Maille, Morrin, & Reynolds-McIlnay, 2020; Morewedge, Monga, Palmatier, Shu, & Small, 2021; Pierce, Kostova, & Dirks, 2001). This feeling of ownership is termed as psychological ownership and it is distinct from legal ownership in a sense that it is possible to psychologically own a target of ownership even without being a legal owner of that object (Luangrath, Peck, Hedgcock & Xu, 2022). Merely touching a product enhances one's feelings of psychological ownership, while imagined touch can also be as effective as actual touch in eliciting ownership feelings (Peck & Shu, 2009; Peck, Barger & Webb, 2013). Due to AR's affordance of providing visual representation of digital objects touching consumers' body or overlapping with their actual physical world or territory, the

construct of psychological ownership becomes particularly relevant and important in our endeavor to understand consumer and consumption experiences in a relatively novel technology like AR.

Psychological ownership is defined as the state of mind where the target feels to be owned by an individual (Pierce, Kostova, & Dirks 2001). The psychological ownership can arise from the experience of fulfillment of ownership motives and is mediated through the routes (namely, controlling target of ownership, coming to know the target intimately, and investing the self into the target) to ownership (Pierce et al., 2003). Developing feelings of ownership occurs through experiencing a product or technology. Based on the theory of psychological ownership by Jussila, Tarkiainen, Sarstedt & Hair (2015), there have been four significant motives for psychological ownership: 1. Efficacy and Effectance (control, exclusivity etc.); 2. Self-Identity (creation, transformation, or communication of identity etc.); 3. Having a place or relatedness (familiarity of object/place, sense of belonging etc.); 4. Need for stimulation (enjoyment, playfulness etc.). These motives are suggested to be the roots of psychological ownership (Pierce et al., 2003). These motives can lead to activation of a few routes through which the psychological ownership emerges (Pierce et al., 2003). The individual's ability to claim ownership of an object is dependent on these routes namely: control, intimate knowledge, and investment. In other words, feelings of ownership require affordance from the target object. By affordance, it is meant as the interaction and use of an object as per the object properties and user capabilities (Norman, 2013). Through the access of these affordances, the three routes to ownership can be activated. Psychological or perceived ownership has garnered significant recent interest in the marketing literature due to its ability to predict positive consumer outcomes for marketers, such as willingness to pay more for products (Peck & Shu, 2009; Fuchs, Prandelli, & Schreier, 2010), warranties (Lessard-Bonaventure &

Chebat, 2015), word of mouth (Kirk, McSherry & Swain, 2015) and purchase intention (Spears & Yazdanparast, 2014).

The literature investigating the relationship between AR and psychological ownership has been scant so far. Although advances in AR marketing literature have adopted technology acceptance model for gauging the outcome variables including but not limited to purchase intention, word-of-mouth, intention to use etc. (Huang & Liao, 2015; Pantano, Rese & Baier, 2017), psychological ownership has received relatively lesser attention. Previous research mainly investigated virtual objects and space as target of ownership. Object ownership targets have been suggested to emerge from creation, manipulation or change of the objects (Barki, Paré, & Sicotte, 2008; Buchem, 2012; Lee & Chen, 2011; Sotamaa, 2010). Lee and Chen (2011) suggested usability and design affect the sense of ownership of virtual environments and objects. The other stem of research investigates place as target of ownership. Ducheneaut, Moore and Nickell (2007) investigated the discomfort in virtual space that relates to violation of personal space. Psychological ownership over place and object has been shown to result in emotional investment and active engagement (Lee & Chen, 2011). Although psychological ownership of AR technology has not been distinctly studied, several studies identified technology ownership in general. Kirk, Swain and Gaskin (2015) for example, linked technology appropriation to psychological ownership of technology through mediation of user pride. Gaskin and Lyytinen (2012) proposed different antecedents of technology appropriation and argued appropriation is theoretically equivalent to psychological ownership. Zhao, Chen and Wang (2016) also studied psychological ownership of social media among the users. Examining the antecedents and consequences of psychological ownership they proposed social influence as an important driver. New and emerging technologies offers scope for enhanced interaction and results in innovative consumption. These

interactions are often with the technology itself offering a scope of developing technology ownership. Morewedge et al. (2021) also recognized the fact that technology-driven evolution of consumption offers new prospects of development of psychological ownership. Specifically new interactive technologies offer to either threaten, transfer or present new opportunities to preserve psychological ownership, and a key element for these effects is that several technologies replace material goods with experiential substitutes (Morewedge et al., 2021). AR being a highly interactive technology should also exert some effect on development of psychological ownership as AR is an interactive experience in itself and there is enough evidence in the literature that supports the notion of an experiential view of AR.

Huang and Liu (2014) indicated that the interactive AR experience goes beyond the traditional retail boundaries and online shopping (e.g., product picture reviews, etc.). In line with Fogg (2003), they assert that AR should be viewed as an experiential technology, as it offers and delivers experiential value. Their idea is consistent with the notion that AR is a technology that offers an immersive experience rather than merely being a tool for product purchase. Now most scholars consider *functional and emotional values* as the main components of experiential value (Sweeney & Soutar, 2001; Mathwick, Malhotra & Rigdon, 2001). Functional value refers to how well specific features satisfy customers' utilitarian needs whereas emotional value refers to the feelings (enjoyment, playfulness etc.) customers experience from the experience. When we view AR as an experience as opposed to tool for shopping, we must also consider that the difference of value perception among the components of experiential value. The difference of perceived value should have an effect on how consumers appropriate the AR affordances that can be utilized to achieve maximum utility or satisfaction. As the economic theory of utility suggests that the consumers intend to maximize their utility or satisfaction, Thaler (1985) replaced the utility

function with value function (as it is psychologically based) in developing his model of consumer choice. In line with this theory, the functional or emotional value perception should drive consumers to appropriate the AR affordances in a way that maximizes the values. The functional values are derived from minimization of effort in AR, and the emotional values are derived mostly through enjoyment and play that foster increase in effort and time. Thus, it is possible that the effects of perceived functional and emotional values on the psychological ownership of the consumers can be different.

Moreover, functional values are realized when consumer perceive that the AR technology provides them with the functionalities to use their skill to match the challenge of using the AR system to pursue an end goal. Emotional values on the other hand relate to consumers enjoying their time in exploring the AR in such a way that they are concentrated and absorbed in having fun. Csikszentmihalyi (1975) and Koufaris (2002) suggests that active pursuit of clear goal, perception of challenge-skill match, enjoyment and absorption in activity are all conducive of having flow experience. As functional values are related to clear end goals (Babin et al., 1994) and emotional values are related to enjoyment, active concentration and absorbed engagement (Ha & Jang, 2010) it is possible that the consumers flow experience stems from perceived functional and emotional values. Flow is also known to evoke feeling of owning a target of ownership (Yuan, Wang, Yu, Kim & Moon, 2021). Thus, it is possible that perceived functional and emotional value generates flow which in turn generates feeling of psychological ownership of the consumers. Which is why, we have integrated flow in our study showing that there is an indirect effect of perceived functional and emotional values on psychological ownership of product and psychological ownership of technology through flow experience.

Another important construct that is related to both flow experience and psychological ownership of consumers is "perceived control". Perceived control has been described as ability to control a specific situation according to one's will (Ajzen, 1991). Perceived control has been shown to be positively associated with psychological ownership (Liu, Wang, Hui & Lee, 2012). Perceived control has also been showed to positively influence flow experience (Jiang & Benbasat, 2004). Ward and Barnes (2001) portray that flow perceived control increases the consumers level of involvement. Although perceived functional values relate to lesser self-investment and emotional value relates to more self-investment, having high degree of perceived control will likely mean that, the consumers will be more involved and invested in the product and technology exploration which will attenuate the negative effect of perceived functional value and strengthen the positive effect of perceived emotional value on consumers psychological ownership of product and technology.

The effect of perceived functional value and perceived emotional value on flow are also possibly moderated by degree of perceived control. A balance between challenge and skill is a necessary condition for experiencing flow, and conscious awareness of this balance is associated with feelings of competence which is facilitated by the degree to which the user have control (Mitchell, 1988). Similarly perceived emotional values are related user enjoyment and Park, Baek, Ohm and Chang (2014) show that high degree of control increases the level of enjoyment and satisfaction which is again related to flow experience (Csikszentmihalyi, 1975). Thus, it is possible that consumers perceiving high degree of control will feel competent about their skill to match the challenge of using the AR system which will possibly strengthen the relationship of perceived functional value on flow experience. Similarly, the increase enjoyment and satisfaction of having high degree of control will possibly strengthen the relationship of perceived emotional value with

flow experience. To the best of our knowledge no studies have previously studied these possible relationships as discussed above. Neither the mechanism of possible varying effect of perceived functional and emotional value (because of the varying degree of self-investment associated with the two values) on consumers psychological ownership of product and technology has not been studied nor the role of flow and perceived control in such has been examined. Therefore, this research aims to answer two questions:

RQ1: Do perceived functional and emotional values affect psychological ownership (product and technology) differently? Does perceived control of product and technology moderate the relationships?

RQ2: What role do perceived values play in developing flow experience? How does flow experience connects the perceived values and psychological ownership of products and technology?

Based on the theory of psychological ownership (Jussila et al., 2015), this research proposes and investigates the antecedents and routes of formation of psychological ownership as well as the mechanism of formation of psychological ownership of product and AR technology for consumers exploring products in the AR system. Specifically, it proposes that functional value negatively impacts the psychological ownership of product and technology while as emotional value has a positive impact on the psychological ownership of product and technology. The research also suggests that functional and emotional values are positively linked with flow experience and flow experience then leads to psychological ownership of both product and technology. Interestingly we suggest that although functional value has a direct negative relationship with psychological ownership of product and psychological ownership of technology, it is positively related to flow which then is positively related to psychological ownership of

product and technology. Moreover, we also suggest that consumers perceived control moderates the relationships of perceived values (functional and emotional) with that of flow experience and psychological ownership (product and technology). To test our hypotheses, we conducted an online survey via Prolific. 480 respondents were recruited to use two applications namely, Wayfair (a home furnishing and décor item purchase app) and Warby-Parker (an eye-glass brand app), via their cellphones and report their experience through online questionnaire. The responses were then analyzed through covariance based structural equation model in AMOS. The study makes contribution to the literature and managerial practices in several ways.

Firstly, in contrast to existing literature this research distinguishes differences between ownership of product and ownership of AR technology. The literature is circled around formation of psychological ownership of either one of object (Poretski, Arazy, Lanir and Nov, 2021; Song, Baek & Choo, 2019; Yuan et al., 2021) or technology (Kirk, Swain & Gaskin, 2015; Morewedge et al., 2021). We add to the AR literature by proposing a model that integrates formation of psychological ownership of both the product and the technology. This is necessary because an immersive and interactive technology like AR offers serious avenue for psychologically owning both the product and the technology. Having a model that can explain both psychological ownership of product and psychological ownership of technology helps to understand the relevant factors that can affect both types of psychological ownership. Secondly, this research suggests that the perceived values of AR can affect the perceived ownership of both product and AR technology. Existing research in AR concentrates on simulated control (Hilken, de Ruyter, Chylinski, Mahr & Keeling, 2017), informativeness, aesthetics and novelty (Yuan et al., 2021), affective and cognitive appraisals (Lee & Chen, 2011) towards forming psychological ownership of objects and authentic pride towards formation of psychological ownership of technology (Kirk, Swain & Gaskin, 2015).

This research adds perceived functional and emotional values of the AR technology as predictors of psychological ownership of both product and technology. Thirdly, this research contributes to the flow experience literature. Adding to the existing literature that only demonstrates flow experience's connection with psychological ownership of object (Yuan et al., 2021) this research shows that the flow experience can serve as an important construct to understand the psychological ownership of both the product and the AR technology. Our findings show that flow experience mediates the indirect positive effect of perceived functional and emotional value on psychological ownership of product and technology.

This research provides important insights for AR system designers in terms of being cautious regarding designing functional and emotional elements of the system as they exhibit different nature of relationship with consumers psychological ownership of both product and technology. As outcome variables such as intention to purchase, pay higher price etc. (Peck & Shu, 2009; Spears & Yazdanparast, 2014), and psychological ownership of technology can be linked to revisit intention, WOM and valuation (Klesel, Ndicu, & Niehaves, 2016; Kirk, Swain & Gaskin, 2015), functional and emotional value design can possibly bear important implication for designers. At the same time the importance of flow in terms of understanding consumers' psychological ownership of products and technology can be of importance for managers as flow is also suggested to improve the consumer knowledge of the products (Petty & Cacioppo, 1986) and subsequent attachment with both product and technology.

Literature Review and Hypothesis development

Psychological Ownership

Psychological ownership has been referred to as a state in which consumers sense attachment of themselves to a target and perceive it as theirs (Peck & Shu, 2009; Pierce et al., 2003). Feelings of ownership can be exhibited for various types of targets, ranging from tangible objects such as mugs (Shu & Peck, 2011) or T-shirts (Fuchs et al. 2010) to other people (Rudmin & Berry, 1987), ideas (Baer & Brown, 2012), physical spaces (Rudmin & Berry, 1987) and digital technologies (Kirk & Swain, 2018).

Psychological ownership theory suggests that people develop feelings of ownership by any of three routes: exerting control over a target, investing themselves in a target, and coming to know a target intimately (Pierce et al., 2003). In consumer psychology, simple imagination of touching an object has been reported to enhance the perception of control and feeling of ownership (Peck, Barger & Webb, 2013). Investment of self refers to an investment of time, energy, or labor in a target, and we are likely to feel a sense of ownership for that which we "shape, create, or produce" (Norton, Mochon, & Ariely 2012; Pierce et al., 2003). Belk (1988) suggested that as the consumers invest effort and energy in products, they regard them as part of their self as the products are thought to be emerged from the self as individuals own their effort or energy. Consumers invest themselves by customizing (Franke, Schreier & Kaiser, 2010; Moreau, Bonney & Herd, 2011) or even imagining interacting with (Spears & Yazdanparast, 2014) a product and thus as an interactive technology there is much scope of relevance of psychological ownership in the AR technology use. Consumers also develop feelings of ownership as they perceive themselves to be knowledgeable about their target of ownership. They develop a "living relationship" with a product

or brand by using it (Pierce et al., 2003) or associating themselves with it (Beggan & Brown, 1994; Rudmin & Berry, 1987), thus coming to know it intimately.

Shaw and colleagues (2012) have demonstrated that consumers' perceived psychological ownership towards ideas and goods which they had no legal claim over and, similar findings has been replicated in group settings by Verkuyten and Martinovic (2017). There are several domains of consumer behavior where psychological ownership has been identified as an important driver. Such domains include digital technology (Atasoy & Morewedge, 2018; Kirk & Swain, 2013), economic and financial decisions (Dickert, Ashby & Dickert, 2018; Shu & Payne, 2013), categorization (Weiss & Johar, 2013), personal data (Acquisiti, John & Loewenstein, 2013; Kamleitner & Mitchell, 2018), shared experiences (Kovacheva & Lamberton 2018), sustainability (Sussenbach & Kamleitner, 2018; Shu & Peck, 2018), and consumption of nondurable goods (Sheehan & Dommer, 2019). Studies show that mere touching or thinking carefully about a target object can elicit psychological ownership (Fuchs et al., 2010; Peck & Shu, 2009; Shu & Peck, 2011). Brasel and Gips (2014) suggested that haptic interfaces can enhance the psychological ownership of products as well. Luangrath and colleagues (2022) has suggested that the observation of a physical hand to be in touch with an object in virtual world can elicit feeling of psychological ownership towards that object.

Recent advances in the domain of psychological ownership have also established that it is possible for consumers to perceive psychological ownership of digital products and technologies (Atasoy & Morewedge 2018; Kirk & Swain 2013). The properties of digital technologies that makes it possible for consumers to interact with an object result in users being engaged in some actions and perform tasks based on users' capabilities" (Baxter, Aurisicchio & Childs, 2015: p. 141; Norman, 2013). Users choose different properties of digital technologies making

idiosyncratic use of the digital technology as a mean of self-design (Moreau, Bonney & Herd, 2011). In doing so, users develop sense of ownership towards the digital technology as suggested by recent conceptual model by Kirk, Swain & Gaskin (2015).

Perceived Value

Perceived value is an evaluation of the desirability of a product (or service) based on the perceived worthiness of the trade-off between the product's costs and benefits. While such trade-offs are most represented by a ratio or comparison between quality and price (Cravens, Holland, Lamb & Moncrief, 1988; Monroe, 1990), it has been argued that many other factors also help to determine how value is perceived (e.g., Bolton & Drew, 1991; Porter, 1990; Sweeney & Soutar, 2001). One of the most influential models in this regard was proposed by Sheth, Newman and Gross (1991), who argued that consumers' choices are a function of five values: functional value, epistemic value, conditional value, social value, and emotional value. Social values are associated with social groups, epistemic values are related to curiosity and conditional values are associated with choice in specific set of situations (Sheth et al., 1991). On the other hand, functional values relate to utilitarian performance to deliver desired function and emotional values are values that gives rise to affective states. In the context of our study to understand psychological ownership of consumers in AR, functional and emotional values are the most relevant because they provide direct utilitarian and hedonic benefits to consumers (Vieira, Rafael & Agnihotri, 2022) which in turn relates to minimization or maximization of effort and time thereby possibly affecting the psychological ownership of consumers.

AR research has considered technological aspects of AR but ignored the experience of end users so far. As online retailers use AR for improvement of the online shopping experience, the

technology acceptance model does not recognize consumers' experience variation and subsequent attitude formation. Some scholars have studied AR from the perspective of perceived risks in online shopping environments (Kim & Forsythe, 2008). The value of AR is providing online shoppers with a meaningful experience using sufficient product information to enable them to evaluate the target product and make a more accurate decision (Oh, Yoon & Shyu, 2008). Another stream of research has studied the impact of AR adoption on consumer behaviour from a user experience perspective, including functional (e.g., availability) and emotional dimensions (e.g., hedonic value) (Poushneh & Vasquez-Parraga, 2017). They showed that user experience is significantly molded by AR by affecting various characteristics of product quality, and that user experience subsequently influences user satisfaction and user's willingness to buy.

The features of a product including but not limited to usability, functions, size, weight, and symbols are displayed through AR applications (apps). AR apps can provide more information on these aspects, reduce users' anxiety (Huang & Liu, 2014; Poretski et al., 2021), and facilitate decision-making (Kim & Forsythe, 2008a, Kim & Forsythe, 2008b) and these features of AR fosters the formation of functional value perception of the AR apps. Consequently, AR may influence user experience through developing affecting hedonic quality and thus facilitating several emotional benefits that are derived from AR interactions. AR facilitates user involvement and thereby enhances the hedonic value of experience (Kim and Forsythe, 2008b), which provides users the ability to share personalized experiences on social networks, thus enhancing playfulness (Huang & Hsu-Liu, 2014). These AR app features thus help formation of the emotional value perception of the AR app that is concerned with the enjoyment, playfulness etc. Thus, we see that AR apps offer consumers with both function and emotional benefits fostering the perception of functional and emotional values.

Flow Experience

In computer-mediated contexts, as the users interact with the technology that creates an immersive experience (Van Noort, Voorveld & Van Reijmersdal, 2012). Consumers' flow experience in the online environment is a cognitive state and has been recognized as an "optimal experience" because of its characteristics, including seamless response and interactivity with the application, consumers' inner pleasure and enjoyment, and loss of one's senses of time and space (Lin, Lin, Turel & Xu, 2020). Liu, Chu, Huang and Chen (2016) defines flow as a temporarily unaware experience in which viewers engage in AR marketing activities with total control, enjoyment, and concentration.

In the marketing literature, AR is likely to enhance the flow experience, facilitating positive attitudes and consequently companies' revenues (Huang & Liao 2015; Javornik, 2016; Poushneh & Vasquez-Parraga, 2017). Yim, Chu, and Sauer (2017), suggested that the AR technology offers a distraction free platform where the consumers can be engaged with the products and engrossed in the experience. Earlier studies in marketing literature have investigated the flow experience that occurs when using technology to complete work-related tasks (Ghani & Deshpande, 1994; Webster, Trevino & Ryan, 1993) and navigate websites (Hoffman & Novak, 1996). However, recent studies have used interactive technologies in virtual spaces to demonstrate the real self in various virtual avatar decorations such as clothing or accessories (Jung & Pawlowski, 2014). Chou and Ting (2003) re-explored and examined the concept of the flow experience in virtual avatar decoration contexts such as cyber games. Given the characteristics of flow experience, it is possible that consumers in flow experience are more engaged and invested in the product and technology and thus sense enhanced psychological ownership of product and technology. To our knowledge, only Yuan et al., (2021) have studied flow in the context of psychological ownership of only the object attachment in the AR environment and not the technological ownership. No previous studies

have focused on the possibility of emotional value being an antecedent of flow experience in AR and thereby facilitating psychological attachment to both product and the technology. This research focuses on these aspects and tries to device a model to explain both psychological ownership of product and technology in terms of consequences of flow and perceived values.

Perceived Control

Image interactive technologies like AR has enabled consumers to play with and manipulate digital products and product information so that it simulates product operation in a way that is perceived as natural. This is known to affect the consumers' perception of control and it is seen as one of the key features of interactive technologies like AR (Liu & Shrum, 2002; Steuer, 1992). Perceived control is defined as the belief of people about their extent of control over a target object or environment (Skinner, 1996). People who perceive a higher sense of control believe that they have more ability to change or impact in modification of their environment or target objects. In consumer behavior setting, perceived control has been defined as the degree of control a consumer perceives to have during interaction with a product (Huang, 2021) and technology (Hui & Bateson, 1991; Zhu, Nakata, Sivakumar & Grewal, 2007). When consumers are using interactive technologies like AR, they can use body and hand gestures or touch to move, rotate and manipulate their environment (Huang, 2021). For the purpose of this study, we define perceived control as the degree of control a user experiences while interacting with virtual objects and the AR technology while using the AR app.

Interactive technologies like AR also provides a sense of control suggested by Zhu et al., (2007). The term "perceived control" is described a subjective assessment of control over a task in a technological environment (Langeard, Bateson, Lovelock & Eiglier, 1981). Hui and Bateson (1991) suggested that perceived control is an important concept for understanding several

emotional and behavioral responses such as perceived pleasantness and approach or avoidance (desire to enter and stay in a service situation). Zeithaml, Parasuraman and Malhotra (2002) determined that perceived control while navigating a website affects customer appraisal, intention and use of technology. Whang, Song, Choi and Lee (2021) suggested perceived control while using AR positively affects consumers' purchase intention in the context of AR apps. Park and Yoo (2020) suggested that the perceived control also positively affects users' attitude and behaviors.

AR

Due to the fast development of AR and its application it has received wide academic attention (Bonetti, Warnaby & Quinn, 2018). Caboni and Hagberg (2019) review literature on the use of AR in retailing. They identified that AR technology in retail is used mainly in online web-based, in-store and mobile apps. Rauschnabel, Felix & Hinsch (2019) investigated the utilitarian and hedonic values of AR and showed that utilitarian and hedonic values positively impact brand-related and app-related attitudes. They suggested that these attitudes are driven by inspiring the users (Rauschnabel et al., 2019). In terms of behaviors related to product, AR has shown to drive patronage intention (Beck & Crié, 2018). Watson, Alexander and Salavati (2018) suggested a link between AR affective response and purchase intention and that hedonic motivation moderated this relationship (Watson et al., 2018). Other researchers have investigated the immersion experienced in AR and suggested that it dissolves boundaries of virtual world and real world (Suh & Prophet, 2018) and enriches decision making with additional visual and sensory information (Yim, Chu & Sauer, 2017). Hilken (2017) showed that the AR triggered presence that led to increased experiential value, decision comfort and ultimately purchase intention.

Research of psychological ownership in the AR context has focused on the formation of psychological ownership of products in different contexts. The literature has looked into several aspects of psychological ownership in AR such as: shared AR experience and ambiguity over object ownership (Poretski, Arazy, Lanir & Nov, 2021); flow experience as mediator of consumer perception and psychological ownership of objects (Yuan et al., 2021); impact of stimulated physical control on psychological ownership of products (Song et al., 2019). Apart from these a few other studies have also considered the psychological ownership formation in AR. We summarize these research findings in table 1. As shown in Table 1, most research has concentrated on ownership of object, and perceived values has only been linked to the outcome attitude (e.g., ease of use and usefulness) while no distinction has been made as to how psychological ownership will be manifested for both the product and the AR technology in relation to perceived values.

Table 1. Related Literatures of Psychological Ownership in AR

Sl.	Reference	Context	Theory Base	Independent Variables	Mediating Variables	Dependent Variables	Analysis Method and Sample size	Key Findings	FV	EV	FLO	PC	POP	POT
1	Cranmer, Dieck and Fountoulaki (2020)	AR in tourism	Service-Dominant Logic	Perceived values		Adoption of AR	Thematic analysis. n = 15	The study proposes five tourism specific values and provides insights into the supplier's perspective of adoption of new technologies like AR.	✓	✓	x	x	x	x
2	Alimamy, and Al-Imamy (2022)	AR retail apps experience	Service-Dominant Logic	Quality of AR experience	Attitude towards AR	Perceived values	SEM. n = 300	Consumers experience quality positively impacts consumer attitudes and consumer attitude AR technology has positive effect on the perceived value and mediates the relationship between	✓	✓	x	x	x	x

								experience quality and perceived value.						
3	Alimamy and Nadeem, (2021).	AR value co-creation.	Service-Dominant Logic	Perceived authentic experience	Customer engagement	Value co-creation	CFA. n = 266	Authenticity perception leads to engagement which positively relates to intention to create value.	✓	✓	x	x	x	x
4	Huang and Liu (2014)	ARIT media properties	Narrative theory, Media richness theory	Media richness, Presence, Narrative experience		Consumer ROI (efficiency, economic value), Service excellence	CFA. n = 344	Narrative experience results in higher experiential value than simulative experience.	✓	✓	x	x	x	x
5	Nikhashemi, Knight, Nusair and Liat (2021)	AR app usage	Stimulus-organism-response model (SOR)	AR vividness, novelty, interactivity, and customization	Hedonic benefit, utilitarian benefit	Willingness to pay-price premium, intention to use app	PLS-SEM. n = 301	The study examines the effect of AR attributes on of continuous intention to use a shopping AR app and to pay a price premium; customer's benefits perception, psychological inspiration and engagement mediates the relationship of attributes with continuance intention and	✓	✓	x	x	x	x

								willingness to pay premium.						
6	Kang (2014)	E-apparel shopping	Prospect Theory and the Value-Attitude-Behavior hierarchy consumer decision model	Perceived values	Performance expectancy	Usage intention	CFA. n = 806	Monetary, convenience, emotional, and social values had an indirect influence on usage intention, mediated by utilitarian performance expectancy. Ego involvement and cognitive effort moderated the link between utilitarian performance expectancy and usage intention.	✓	✓	x	x	x	x
7	Qin, Osatuyi, and Xu (2021).	Mobile-AR experience	Cognitive-affective-conative framework	Presence, experiential value, shopping benefits, perceived value	Attitude, satisfaction	Usage intention, purchase intention	PLS-SEM. n = 316	The results of the study show that the consumers cognitive evaluation of Mobile AR stimulates affective reaction which further results in conative behaviors. The study suggests positive relationship	✓	✓	x	x	x	x

								between perceived values with that of usage intention and purchase intention mediated by user satisfaction.							
8	Erdmann, Mas and Arilla (2021).	AR smart glass	Value-based adoption model	Immersion, tech-complexity, subjective norm	Benefits, cost difficulty, perceived value	Purchase intention	PLS-SEM. n = 172	The results of the study show a significant positive effect of the perceived value of the AR Smart Glass on the intention to use this technology for purchase online.	✓	✓	x	x	x	x
9	Rauschnabe, Felix and Hinsch (2019).	AR apps	AR marketing theory	Utilitarian and hedonic benefits, and augmentati-on quality	Attitude and inspiration	Changes in brand attitude	CFA. n = 201	The results shous that AR app hedonic benefits results in change of brand attitude.	✓	✓	x	x	x	x
10	Bonnin (2020)	AR app	AR marketing theory	Absence or presence of AR	Utilitarian evaluation, hedonic evaluation, perceived risk, attractive-ness	AR patronage intention	PROCESS V 3.3 macro (Hayes, 2018; model 80). n = 98	AR positively impacts patronage and purchase intention mediated via hedonic and utilitarian evaluations.	✓	✓	x	x	x	x
11	Papagiannidis, Pantano, See-To, Dennis	Immersive 3D retail environ-ment	Cognitive-affective-conative framework	Hedonic value, simulated experience,	Engagement, enjoyment, satisfaction	Purchase intention	PLS. n = 150	Results demonstrate the major role of telepresence	✓	✓	x	x	x	x

	and Bourlakis, (2017)			utilitarian value.				components in simulated experience and the critical role of that experience, along with hedonic and utilitarian values, in engagement. Engagement then in turn affects satisfaction and purchase intention.						
12	McLean and Wilson (2019).	Mobile AR	Consumer brand engagement theory, Technology acceptance model.	AR attributes	Perceived values, Brand engagement	Satisfaction, usage intention	CFA-SEM. n = 441	Positive perceptions of the AR attributes and technology acceptance attributes has a positive effect on brand engagement through the retailer's AR mobile application. AR enabled brand engagement positively associates with increased satisfaction with the app experience and future brand usage intent.	✓	✓	x	x	x	x

13	Lee, Choi and Kim (2021)	Service-industry	Psychological ownership theory, risk-benefit analysis theory	Hedonic benefits, utilitarian benefits, perceived risk	Customer satisfaction, trust	Psychological ownership of service vendor	CFA-SEM. n = 205	Utilitarian and hedonic benefits lead towards consumers psychological ownership of the vendor and this relationship is mediated by customers satisfaction and trust.	✓	✓	x	x	x	✓
14	Huang and Liao (2017)	AR interactive technology	Virtual Liminoid theory, Flow theory	Self-location, haptic imagery	Body-ownership, ownership control, self-explorative engagement, flow	Satisfaction, time spent of AR	PLS-SEM. n = 336	The study conceptualizes three decorating psychological states (sense of body ownership, sense of ownership control, and self-explorative engagement) that directly induced a multisensory flow experience. Furthermore, the study also shows, two multisensory factors (sense of self-location and haptic imagery) mediated the multisensory	x	x	x	✓	x	x

								flow experience through these three decorating psychological states.							
15	Whang, Song, Choi and Lee (2021)	AR apps	Telepresence theory	Vividness, Interactivity	Behavioral control, Cognitive control	Purchase intention	MAN-COVA. n = 106, 120	AR experience results in cognitive and behavioral control. Cognitive control subsequently leads to consumers purchase intention.	x	x	x	✓	x	x	
16	Fan et al., (2020)	AR apps	Cognitive theory of multimedia learning, Situated Cognition theory, Cognitive fluency theory	Environmental embedding, Simulated physical control.	Cognitive fluency, cognitive load,	Product attitude, purchase intention	ANOVA. n = 493	Environmental embedding and simulated physical control can reduce cognitive load and increase processing fluency thereby enhancing product attitude of consumers.	x	x	x	✓	x	x	
17	Zhu, Nakata, Sivakumar and Grewal (2007)	Self-service technology (SST)	Resource matching theory	Comparative information, interactivity		Perceived control, interface evaluation	ANOVA n = 141, 127	Comparative information and interactivity individually exert positive influence on users' effectiveness but	x	x	x	✓	x	x	

								when they are combined, they put make cognitive processing cumbersome and thus results in diminished control and evaluation.							
18	Park and Yoo (2020)	AR app	Mental Imagery theory	Perceived control, responsiveness, playfulness	Elaboration, quality	Attitudes, behaviors	AMOS-SEM. n = 302	Consumers controllability of AR and perceived playfulness positively influences mental imagery. Mental imagery (elaboration and quality) then in turn positively affects consumers attitudes and behavioral intentions.	x	x	x	✓	x	x
19	Hu and Wise (2020)	Image interactivity in online product display.	Theory of virtual product experience, Image interactivity theory.	Interactive vs static image.	Perceived control of product.	Attitude towards retail store.	ANOVA n = 125, 80.	The interactive image has more positive influence towards consumer attitude, informativeness and WTP than static image. The relationship is	x	x	x	✓	x	x

								mediated by perceived product control.						
20	Kirk, Peck and Swain (2018)	Territoriality research	Theory of psychological ownership, theory of territoriality	Consumer's psychological ownership, Ownership signal (Knowledge, control, self-investment)	Infringement perception	Territorial response	ANOVA, Binary logistic regressi-on.	Consumers infer the psychological ownership of others from signals of the antecedents of psychological ownership: control, investment of self, and intimate knowledge.	x	x	x	x	✓	x
21	Poretski et al., (2021).	Shared AR	Socially situated cognition theory, psychological ownership theory, active inference theory, organizationa l theory	AR interaction, Space proprietorship		Psychological ownership	Three-way mixed ANOVA. n = 28	Shared AR fosters ambiguities over ownership as per interactions with the virtual objects. Space proprietors and object creators feel ownership of the virtual objects at the same time, and this states that the attachment of virtual artifacts with personal belongings disturbs the ownership over them.	x	x	x	x	✓	x

22	Hilken et al., (2017)	AR online service experience	Situated cognition theory	Simulated physical control, environmental embedding	Spatial presence	Utilitarian value, hedonic value	PROCESS macro. Study 1: n=156,; Study 2: n = 173, Study 3: n = 321; Study 4: n= 100	Simulated physical control and environmental embedding has an interaction effect leading to presence. They show in an alternate mediation test that when participants have simulated physical control, adding environmental embedding creates a sense of psychological ownership, which elicits hedonic value. They suggested that more research is needed to identify when the enjoyment benefits of AR-based service augmentation stem from an enhanced service experience (in our case from AR application experience) and when they are due to customer	✓	✓	x	✓	✓	x

								attachment to a specific offering.								
23	Yuan et al., (2021)	AR app experience	Flow theory, psychological ownership theory	Perceived informativeness, perceived aesthetics, perceived novelty, para-social relationship	Flow experience	Psychological ownership of product	SEM. n = 527	Perceived informativeness, perceived aesthetics, perceived novelty, and para-social relationship has a positive effect on consumers' flow experience, which, in turn, positively influences psychological ownership. They suggested that flow experience partially mediates the relationships that exists between consumer perceptions and psychological ownership.	x	x	✓	x	✓	x
24	Song et al., (2019)		Virtual liminoid theory, Situated cognition theory, Habituation tedium theory,	Simulated physical control, environmental embedding	Immersion	Psychological ownership of product, decision comfort	PLS-SEM. n = 99	The results demonstrated that environmental embedding and simulated physical control evoke immersion and the feeling	x	x	x	✓	✓	x

			psychological ownership theory					of ownership of a virtual product, which increased decision comfort. Further, immersion mediated the effect of EE but SPC on the feeling of ownership, which corroborated the direct effect of SPC on the feeling of ownership.							
25	Poretski, Lanir and Arazy. (2018).	Shared AR	Collaborative and social competing theory	Social identity, self-identity		Psychological ownership	Interview, thematic analysis n = 28	The research concerns preserving of social and self-identity and how it relates to space and sense of ownership.	x	x	x	x	✓	x
26	Lee and Chen (2011)	VR	Design theory, psychological ownership theory, theory of planned behavior	Usability and design features	Cognitive appraisal, perceived control, affective appraisal, self-investment	Psychological ownership of virtual world	SEM. n = 239.	Investigated the effective and cognitive appraisal effect towards psychological ownership	x	x	x	x	✓	x
27	Kirk, Swain and Gaskin (2015)	Technology usage of consumers	Acceptance strength theory, social comparison theory,	Consumer technology appropriation	Authentic pride	Psychological ownership of technology, valuation, WOM	Conceptual paper	Technology appropriation affects psychological ownership	x	x	x	x	x	✓

								through authentic pride.						
28	Barki, Paré and Sicotte (2008).	IT implementation and acceptance	Psychological ownership theory, theory of reasoned action, theory of planned behavior	User participation	Psychological ownership of IT, perceived usefulness, ease of use	System use	PLS-SEM. n = 91	Psychological ownership of technology mediated relationship of user participation with users' acceptance of technology.	x	x	x	x	x	✓
29	Zhao, Chen and Wang (2016)	Social media	Psychological ownership theory,	Perceived control, perceived familiarity, self-investment, social influence, perceived usefulness, perceived ease of use	Psychological ownership, satisfaction	Continuance usage, willingness to pay more	SEM. n = 791	Psychological ownership of social media mediates the relationship of control, familiarity, usefulness, ease of use, social influence and self-investment with continuance intention, willingness to pay more.	x	x	x	✓	x	✓

**** FV- Functional Value, EV- Emotional Value, FLO- Flow Experience, PC- Perceived Control, POP- Psychological Ownership of Product, POT- Psychological Ownership of Technology.**

The literature summary as outlined by Table 1 gives us an insight into the relevant works in the field of AR, psychological ownership, perceived values, and perceived control. The literature of AR has dealt with the construct of perceived values in several fashions. Cranmer, Dieck and Fountoulaki (2020) and Kang (2014) suggested perceived values of AR leads to adoption of AR technologies as well as usage intention. Qin et al., (2021) suggests similar findings as their study determines that the positive relationship of perceived values and purchase intention is mediated by user satisfaction with AR. Huang and Liu (2014) indicated perceived values culminated in consumer ROI and perception of service excellence. Bonnin (2020) suggested that perceived values in AR is also linked with patronage intention. Perceived values have also been linked with change in brand attitude (Rauschnabel et al., 2019) and psychological ownership of service vendor (Lee et al., 2021). The research of perceived control has mainly focused in simulated physical control (SPC). The SPC or perceived control of the virtual object (product) has shown to be related to product attitude and purchase intention (Fan et al., 2020), attitude towards retail store (Hu & Wise, 2020), utilitarian and hedonic value (Hilken et al., 2017). Song, Baek and Cho (2019) also tested the effect of perceived control on psychological ownership of product and suggested that psychological ownership of product was enhanced due to increased perceived control. Zhu, Nakata, Sivakumar and Grewal (2007) suggested that perceived control resulted from comparative information and interactivity in self-service technologies. Zhao, Chen and Wang (2016) studied perceived control in the context of social media. Their findings suggest that perceived control leads to psychological ownership of that platform (Zhu et al., 2007). In the AR context, Park and Yoo (2020) studied perceived control and found that it enhanced mental imagery which, in turn, affected consumer behavior and attitude. Additionally, because AR is a relatively novel technology, literature on AR and psychological ownership is relatively scarce. Kirk, Peck and

Swain (2018) studied consumers' territorial response and inferred that the psychological ownership of others is inferred in terms of the three antecedents of ownership namely, control, investment, and knowledge. Poretski et al., (2021) reflected that AR interaction and space proprietorship has an effect on psychological ownership of product in shared AR experiences. Hilken (2017) showed environmental embedding interacting with simulated physical control creates sense of psychological ownership of the product. Yuan (2021) suggested that perceived informativeness, aesthetics, novelty influence psychological ownership of products and the relationship is mediated by flow experience. Poretski et al., (2018) showed social and self-identity is related to psychological ownership of products in shared AR experience. On the other hand, the psychological ownership of technology has been shown to stem from consumer technology appropriation (Kirk et al., 2015), user participation (Barki et al., 2008), and perceived control (Zhao et al., 2016). Kirk et al., (2015) has shown that consumer technology appropriation positively affects their sense of psychological ownership of the technology and this relationship is mediated by authentic pride. Barki et al., (2015) showed that user participation in use of technology lead to psychological ownership of the technology that consequently led to user's acceptance of and intention to use the technology. Zhao et al., (2016) demonstrated that control, ease of use, usefulness, social influence influenced continuance intention of social media through psychological ownership of the technology. None of these studies regarding psychological ownership of technology has been in the context of AR.

AR as an experiential technology drive perceived functional and emotional values, provides optimal shopping experience (flow), generates sensation of touch by visual representation of haptic feedback and sensation of control with its highly interactive interface. The functional and emotional values differ in terms of their ability to foster or deter investment of time and effort and

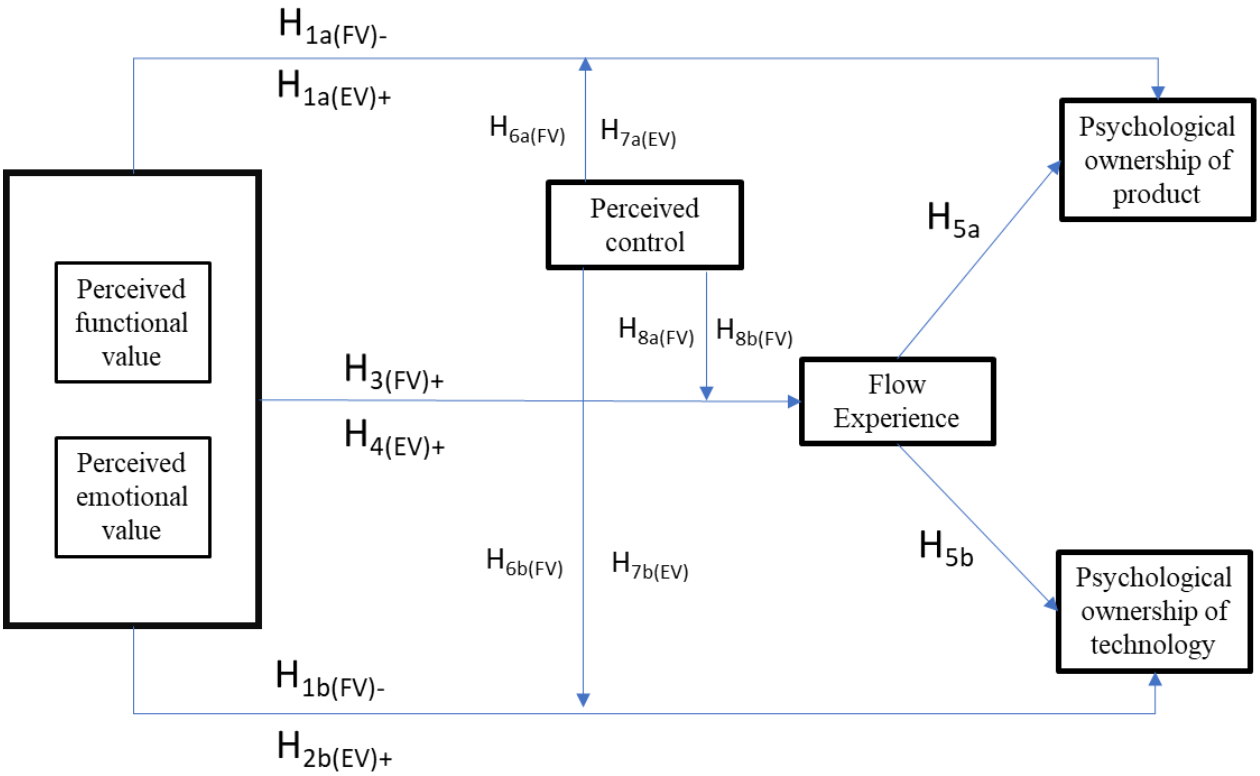
as the theory of psychological ownership suggests, investment of self is an important aspect in the formation of psychological ownership (Jussila et al., 2015). The functional values can help user to easily pursuit their goal (Babin et al., 1994) while as emotional values can help them enjoy and be concentrated with the playful features of AR (Lee and Wu, 2017), both of which can result in flow experience (Csikszentmihalyi, 1975; Csikszentmihalyi, 1997). Yuan et al., (2021) while shows that flow experience can be related to consumer psychological ownership, there are evidence in the literature that shows that flow and psychological ownership are both impacted by perceived control (Jussila et al., 2019; Jiang & Benbasat, 2004). For these reasons it becomes imperative to study the constructs of perceived functional and emotional value, perceived control, flow experience and psychological ownership (product and technology) in the context of AR, which has clearly never been done before as is apparent upon review of the table 1. The literature is yet to establish a connection between the perceived functional and emotional values of AR with psychological ownership of product and technology. There also exists no clear model that can explain the psychological ownership formation of both product and technology.

Thus, this research intends to address these gaps by distinguishing the variation in formation of ownership of technology and the product and suggesting a scenario when psychological ownership of product and technology can be negatively affected. We do so by examining the link between perceived values (functional and emotional), flow experience, psychological ownership and perceived control.

Conceptual Framework

Psychological ownership is relevant for both product and AR technology and this research proposes that emotional and functional values affect psychological ownership of product and technology differently. As shown in the conceptual framework in figure 1 this research suggests

that the perceived emotional value has a positive effect on psychological ownership of product and technology, consumers perceived functional value has a negative effect on the psychological ownership of product and technology. This relationship is moderated by the perceived control. The figure also shows that the functional and emotional values are positively connected to flow and flow experience leads to psychological ownership of product and technology. The relationships between functional and emotional values are also moderated by the perceived control . The rationales for the mentioned relationships are discussed following the conceptual model of Figure 1.



*FV- functional values, EV-emotional values

Figure 1. Conceptual Model

Due to the functional and emotional nature of experiential technology like AR (Huang & Liu, 2014), it is important to consider its possible association with the AR's affordance to illicit psychological ownership of product (through manifestation of haptic images) and psychological ownership of technology. The interactive nature of AR provides sensation of control while the vivid images offer scope for knowing more about the product with minimum effort. The interactive nature of AR also is fun to use, thus possibly creating optimal experience for users, possibly generating flow. We suggest the perceived values will be linked with psychological ownership (of product and technology) and flow experience. We also suggest that perceived control will act as moderator for the relationships of perceived values (functional and emotional) with that of flow experience and psychological ownership of product and psychological ownership of technology. We discuss the rational for such propositions in the section below.

Perceived Functional Value, Psychological Ownership of Products and Psychological Ownership of Technology

Following Sheth et al., (1991) we define functional values as the perceived utility that the consumers acquire which using AR's capacity for functional or utilitarian performance. Perceived functional value is related to perceived performance or utility of the product or service that is being offered in terms of the offering's intrinsic ability to perform its function effectively and efficiently. Consumers processes information based on mental events that involves visualizations of a concept (Lutz & Lutz, 1978); for example, when ordering a new lamp customer actively employ mental imagery to generate a representation in their mind's eye and visualize the object (in various forms) in their personal space (Phillips, Olson & Baumgartner, 1995). The AR technology helps to superimpose the product on their body or ambience facilitating a scenario where the consumers can quickly perceive the colour, size, and fit of the products on their device screen all through a

few touches and hand gestures, without even having to be in a physical store (Kang, 2014). Also, experiential use of specific and quality visual imagery, even in the absence of physical interaction with a product reduces the cognitive effort to generate mental imagery as AR eases information processing (mental transformation of objects) by offloading mental imagery processes (Heller et al., 2019). In a nutshell, as one of its key functionalities, AR allows customers to transform (e.g., rotate) digital content, sufficing consumers need for additional visual information which in turn assists visual imagery processes during decision making. These functional values of AR relate to rational and practical evaluations (Chaudhuri & Holbrook, 2001; Voss et al., 2003) of products and AR technology, and these values also relate to the shopping efficiency (Jin & Kim, 2001). Consumers want ease, convenience, and speed in obtaining the desired products for efficient use of the AR technology and this efficiency creates the perception of the functional value as the experience leads to investment minimization in terms of time and effort (Childers et al., 2001). The minimization of time and effort thus mean lesser involvement for the customers. Cheng, Chang, and Lee (2020) suggest a similar notion as they show that functional values negatively relate to customer involvement. These arguments indicate that the perceived functional values are associated with customer behaviour that relates to reduced time and effort investment in the process of exploring products through the AR. Thus, we assume that the functional values can negatively affect psychological ownership. Drawing from the literature on psychological ownership we know that physical, cognitive, and emotional investments made by individuals into objects connect these objects to the self (Csikszentmihalyi & Rothberg-Halton, 1981) and generate feelings of ownership toward the work output (Belk, 1988). According to Locke (1690), because we own our labour and ourselves, we feel that we own what we invest ourselves into. The time and energy—and even identity invested into the work product— “allow an individual to see their

reflection in the target and feel their own effort in its existence" (Pierce et al., 2001, p. 17). Perceived functional values relate to reduced effort and time invested in exploration of products and the AR system (Yaoyuneyong, Foster, Johnson & Johnson, 2016). The psychological ownership theory suggests that self-investment and involvement are crucial antecedents for the formation of psychological ownership (Baxter, Aurisicchio & Childs, 2015).Thus, it is reasonable to suggest that perceived functional values should have a negative impact on the consumers' psychological ownership of the product and the psychological ownership of the AR technology. So, we propose,

H_{1a}: Perceived functional value has a negative effect on the psychological ownership of the product.

H_{1b}: Perceived functional value has a negative effect on the psychological ownership of the AR technology.

Perceived Emotional Value, Psychological Ownership of Products and Psychological Ownership of Technology

Following Sheth et al., (1991) we define perceived emotional values as the AR's ability to arouse feelings or affective states among the users. According to Sheth and colleagues (1991) a product or service acquires emotional value when it is associated with feelings. Emotional value is personal and is more subjective perception than functional value. Perceived emotional value results from fun or playful experience. Babin and colleagues (1994) suggest that emotional value results from potential entertainment and emotional worth during a shopping experience.

AR perceived emotional value is a more personal and subjective perception than functional value. It is contended that AR technology provides more hedonic than utilitarian experience adding

to its emotional value (Javornik, 2016b). Emotional value reflects potential entertainment and emotional worth during the shopping journey (Babin et al., 1994). AR technology provides enjoyment and playfulness to the shopping experience (Huang & Liu, 2014; Huang & Liao, 2017; Javornik, 2016a) and the fun gained by using a service is related to emotional value (Holbrook, 1994). Moreover, manipulation of digital contents (Scholz & Smith, 2016), playful presentation of information (Pantano & Pietro, 2012), personalization features (Hsu et al., 2021), and interactivity (Huang and Liao, 2015) also adds to perceived emotional value (Hsu et al., 2021). Now these entertaining features of AR are known to improve users' effort and involvement in the shopping experience. For example, interactivity has been found to increase the time spent by the users (Fiore & Jin, 2003), playful 3-D presentation of product and information has been suggested to make consumers more involved and willing to spend time, effort, and money (Park, Lenon & Stoel, 2005). Higgins and Scholer (2009) suggested that the emotional experience that associated with the target, i.e., the subjective pleasure/pain properties, is a major contributor to consumer engagement as well. Similar findings are also reported by Lee and Chen (2011) who suggest that emotional value of technologies strongly links to self-investment of the users. Belk (2014) also suggests that as consumer spend more time with virtual objects, they become attached to it. According to the literature of psychological ownership, the investment of an individual's self into objects causes the self to become one with the object and to develop feelings of ownership towards that object (Rochberg-Halton, 1980). Perceived emotional value of AR technologies tends to provide such sensory rich entertainment or fun experience that users will be more engaged and invest in the product and the AR technology. Emotional value can possibly lead consumers to spend more time and resources on the product as they explore the product, views it in their personal space in real time, thereby forming a sense of personal attachment towards the object through

increased self-investment. Consumers will also interact and invest themselves in the AR technology as they enjoy, explore, play, and have fun with the AR technology while they explore the product by using the AR technology. Thus, perceived emotional value can positively affect the psychological ownership of product and psychological ownership of the technology. So, we posit that,

H_{2a}: Perceived emotional value has a positive effect on the psychological ownership of the product.

H_{2b}: Perceived emotional value has a positive effect on the psychological ownership of the AR technology.

Perceived Values and Flow Experience

Following Lin et al., (2020) we define flow experience as a cognitive state that is considered an "optimal experience" and characterized by seamless response and interactivity, inner pleasure, and enjoyment. AR technology helps consumers to have more realistic experience of products even vicariously (i.e., without the need of experiencing the physical products) (Yim et al., 2017), and consumers who are in this process are shown to demonstrate sense of deep focus, and are free from distraction (Yim et al., 2017), resulting in flow experience (Yuan et al., 2021). Shin (2019) also suggests that flow is highly relevant for AR users.

AR allows consumers to view products from different perspectives, angles and distances, as well as explore the different functions and feature of available products (Jiang & Benbasat, 2004), it reduces the perceptual distance between the real and the virtual scenarios, developing an efficient match between physical and the digital store shopping experience (Pantano & Laria, 2012), by enhancing the sense of being in the environment while interacting with it (Parke, 2005). As consumers seeking functional values want a quick and efficient shopping trip, AR apps can support these consumers in understanding specific characteristics of a product and making their

product decisions by displaying product information about virtual contents. Relevant and useful information helps consumers to increase their clarity regarding the product (Hsu et al., 2021). Functional values of AR are realized when consumer perceive that the challenge of using the technology matches their skill and they can effectively and efficiently use the AR to reach their end goal. The match of skills of an individual and the difficulty of the work are among the factors affecting the flow experience (Koufaris, 2002). Functional value is primarily instrumental and cognitive; and it represents customer value as the means to an end (Chandon, Wansink & Laurent, 2000). Also, Babin et al. (1994) extend the work of Faber and O'Guinn, by observing that consumption activities describe functional value (p.645) as "resulting from some type of conscious pursuit of an intended consequence" meaning that functional values are related to clear and conscious goals. Csikszentmihalyi (1975), explains that in order for flow to occur, it is required that goal clarity should exist along with challenge and skill. As functional values are related to goals to reach desired end state, perceived functional value of AR should be positively related to flow experience. In line with these arguments, we propose that,

H_3: Perceived functional value has a positive effect on flow experience.

Liu et al. (2016) and Yuan et al. (2021) both suggest that the flow experience in AR is a temporarily unaware experience where users experience control, enjoyment, and concentration, and thus it is possible that there is a viable link between the perceived emotional values and flow experience. Ha and Jang (2010) suggest that emotional states are gained from experience's emotional value. Perceived emotional value also leads to enjoyment, enhances concentration, and helps users to get immersed in the experience (Lee & Wu, 2017). Specifically, a consumer who perceives emotional value from the AR technology exhibit enjoyment and emotional release that also helps engendering positive attitudes (Ducoffe, 1996). Papagiannidis et al., (2017) suggested

that perceived emotional values result in enhanced engagement in the digital environment. A feeling of time distortion is also frequent when people are having fun (Agarwal & Karahanna, 2000). Huang and Liao (2015) found that both the entertainment and enjoyment promote smooth accomplishment of customers' shopping activity, which is instrumental for consumers to get the optimal shopping experience.

Individuals who are enjoying the AR experience, as they are interacting with the technology will be more prone to achieve an optimal experience as they are more concentrated, have lost perception of time and are absorbed in the experience of having fun and enjoyment (Ha, Yoon, & Choi, 2007). According to flow theory, absorbed engagement, enjoyment, concentration, and pleasure (Csikszentmihalyi, 1997) are antecedents of flow, and these affective states are gained due to the experience of emotional value (Ha & Jang, 2010). Thus, it is likely that perceived emotional value of the AR users will engender emotional states of enhanced concentration, enjoyment, engrossment and create an optimal shopping experience thereby facilitating flow experience. Based on the following arguments we suggest that,

H_4: Perceived emotional value has a positive effect on the flow experience of consumers using the AR technology.

Flow Experience and Psychological Ownership

Csikszentmihalyi (1975) first noted the flow experience through the examination of play activities and determined flow as a psychological state of optimal experience where an individual is completely immersed and absorbed in the activity. As enjoyment in an activity leads to concentration and the compound effect of both creates a time distortion perception facilitating flow (Ghani & Deshpande, 1994). Such traits of flow and its subsequent consequences are highlighted in computer-human interaction studies as well. Hoffman and Novak (1996) studied consumer

experience in hypermedia environments and suggested an integrated model for explaining flow experience in website navigation context. Hoffman and Novak (1996) suggested that consumers who experience flow experience shows desire for exploratory behaviors, and as they experience time distortion due to flow experience, the passage of time is perceived to be fast resulting in the desire to spend more time and invest more time in experiencing the events. In the AR context this possibly means that the customers who are in flow state will be spending more time and effort in terms of using the AR technology and exploring the products. AR technology provides more enjoyment and richer experiences to customers (Huang & Liao 2015), which can also be understood as a user's subjective enjoyment of the interaction and communication with the technology (Siekpe, 2005). Hence, experiencing flow in AR is so enjoyable that people will re-experience it, even at great cost i.e., they will invest time and resources to relive the experience (Lin et al. 2020; Shin 2019). This AR experience involves providing consumers with haptic interactive images and allows consumers to virtually touch commodities and overlay the virtual image to the real context, thus enhancing the sense of product tangibility (Vonkeman, Verhagen, & Van Dolen, 2017) and product tangibility results in attachment (Griffiths, 2005). See-To et al. (2012) also note that flow experience results in increased engagement with the digital technology as well. Jung, Perez-Mira & Wiley-Patton (2009) suggests that the users experiencing the flow becomes actively engaged with the digital technology as they interact with it. Shen, Tsai & Tseng (2022) showed that flow experience has a significant and positive impact on consumers attachment with board games.

As the customer in flow state spends more time and effort in the interaction with these haptic product images and AR technology it is possible that they form a sense of attachment to the product and technology. According to Pierce et al. (2001), psychological ownership is a state in

which “individuals consider as if the target of ownership is theirs” (i.e., “this item is mine”) and this sense of ownership arises from attachment, and self-investment in terms of time and effort (Lee & Chen, 2011). The flow experience in AR prompts consumers to spend more time and effort (Lin et al., 2020; Shin, 2019), and to be engaged with the product and technology (Jung et al., 2009), so it is likely that the flow experience positively affects the psychological ownership of product and psychological ownership of technology. Therefore, we formulate the hypotheses:

H_{5a}: Flow experience has a positive effect on the psychological ownership of the product.

H_{5b}: Flow experience has a positive effect on the psychological ownership of the AR technology.

Perceived Control

For the purpose of this study, following Ajzen (1991) we define perceived control as the degree of control a user experiences while interacting with virtual objects and the AR technology while using AR application. Research has shown that the mere act of touching (Shu & Peck, 2011) or even mental imagery of touching the product resulted in increased sense of ownership (Peck et al., 2013) because users experience control through the act of touching. AR technology offers users control to manipulate virtual objects embedded in real world over their device screen. The interactivity, navigability, well connected design components are some of the components of AR that can promote the user’s perceived control (Lee & Chen, 2012). AR is also able to simulate control over an offering as embodiment (Hilken et al., 2017). Consumers’ interaction with products is well known to evoke certain affects, such as pleasure and enhances customers’ ability to evaluate the offering (Grohmann, Spangenberg & Sprott, 2007) and is critical to the shopping experience (e.g., Peck & Shu, 2009). The mere touching activity or even an imagery of touching is known to increase product valuation via an increased feeling of ownership (Peck & Shu, 2009).

AR try-on experiences can provide consumers with some control over virtual products engaging the same physical movements using the AR interface (Rosa & Malter, 2003). This brings some of the sensory elements of actual product use to the online shopping experience to help people experience the product as "real" (Hilken et al., 2017) and to have a control over them. Pierce et al., (2001) suggested that control is an important structural component contributing to the development of psychological ownership. Carrozzi and colleagues (2019) as well as Hilken and colleagues (2017) suggested that the perceived control while using the AR technology enhances the psychological ownership of the products as the ability to control an object is considered important for achieving a sense of ownership (Pierce et al., 2003). Similarly, Liu et al., (2012) have also reported that the sense of control enhances the sense of ownership towards the technology. As consumers perceive high degree of control the consumers become more invested as they want to explore the environment, manipulate it and use it in their own way (Ward & Barnes 2001). In doing so the consumers possibly dedicate time and resources in the AR system (Van Rompay, Tanja-Dijkstra, Verhoeven & van Es, 2012). Perceived control has also been known to ease information processing and hence, consumers can obtain detailed information instantly (Rosa & Malter, 2003). Thus, perceived control not only make consumers invested, but it also increases relevant knowledge about the product and technology (Rosa & Malter, 2003). When high degree of control is present the negative effect of perceived functional value should be lessened. Although perceived functional values relate to lesser self-investment, having high degree of control should make the AR users want to dedicate more time and resources (Lala & Chakraborty, 2015). People tend to psychologically own the things, they put their labor towards and have knowledge of (Pierce et al., 2003). Thus, the negative effect of functional value on psychological ownership of product and technology should be attenuated (strengthened) when high degree of control is present (vs

absent). Meanwhile increased control is known to increase enjoyment as it satisfies consumers need for autonomy and competence (Rogers, Carpentier & Barnard, 2016). Enhanced enjoyment will also lead towards more time spent in exploring the products and the AR system (Forsythe & Bailey, 1996). Thus, for consumers perceiving high degree of control the effect of perceiving emotional value on psychological ownership of product and technology will strengthen due to increased enjoyment and self-investment in exploring the product and technology. In line with these arguments, it is likely that perceived control can moderate the effect of perceived values on psychological ownership of product and technology. Thus, we posit that,

H6a: For high (low) perceived control, the negative effect of perceived functional value on psychological ownership of product is weaker (stronger).

H6b: For high (low) perceived control, the negative effect of perceived functional value on psychological ownership of technology is weaker (stronger).

H7a: For high (low) perceived control, the positive effect of perceived emotional value on psychological ownership of product is stronger (weaker).

H7b: For high (low) perceived technology control, the positive effect of perceived emotional value on psychological ownership of technology is stronger (weaker).

In the specific context of online buying, atmospheric cues enhancing perception of control are a major principle underlying consumers' response to the environment. For example, a navigational design of a web site enhancing user's control can lead to the flow experience, that is the state in which people are so intensely involved in an activity that "nothing else seems to matter" (Csikszentmihalyi, 1990, p. 4). Thus, control appears as a major concept for consumers to enjoy their flow experience. Jiang and Benbasat (2004) stated that perceived control positively associated

with the flow experience. Perceived control makes consumer focused and encourages exploratory behavior (Jiang & Benbasat, 2004). Focused attention and enjoyment (which can stem from perception of control) make consumer absorbed and immersed in the experience resulting in flow experience which is why perceived control is considered an important antecedent of flow.

In the AR context the strength of the relationship of perceived values with flow experience possibly depends on perceived control. For functional value, increased control leads to increase in perception of challenge and skill match as control leads to the feeling of competence to use the AR to reach the intended end goal (Mitchell, 1988). Match of challenge and skill as well as efficiency to reach intended goal enhances flow experience (Csikszentmihalyi, 1975). Thus, high degree of control will strengthen the positive effect of perceived functional value on flow experience because it will make consumers reach their end goal efficiently and make them feel competent to match the challenge of exploring the AR system. The emotional values on the other hand relates to pleasure, enjoyment and satisfaction which are known antecedents of flow (Csikszentmihalyi, 1975). Consumers inner pleasure and satisfaction are increased due to when they perceive high level of control as control leads to better task performance (Bitner, 1992; Hui & Bateson, 1991). Lee, Jeong and Jeon (2016) states that enjoyment, attention, pleasure and satisfaction are conducive to consumers flow experience while appropriating technologies. Thus, for consumers with high degree of perceived control, perceived emotional values of AR will lead to higher degree of flow experience as enjoyment, pleasure, satisfaction and focused attention resulting from high level of control enhances the emotional experience and results in increased flow. In line with these arguments, we posit that the positive effect of perceived functional value and perceived emotional value on flow experience will be strengthened when the degree of perceived control is high. High level of perception of control will help the consumers get a

seamless optimal experience which is conducive to flow. Hence, perceived control should strengthen the effect of perceived functional and emotional value on consumers flow experience. Hence, we suggest,

H8a: For high (low) perceived control the positive effect of perceived functional values on flow experience is stronger (weaker).

H8b: For high (low) perceived control the positive effect of perceived emotional values on flow experience is stronger (weaker).

Methodology

To test the hypotheses, the research conducted a survey study. Data collected from the survey will be analyzed through Confirmatory factor analysis and Structural Equation Modeling with SPSS AMOS. Wayfair (home décor and improvement shop) and Warby Parker AR mobile apps were used for this study. Wayfair app is a mobile app for the e-commerce giant Wayfair that users can buy various household items and furnitures and Warby-Parker app is a mobile app for the eyeglasses brand Warby-Parker that users can buy eyeglasses and lenses. The AR features in the Wayfair app allow users to virtually decorate/choose different furniture products on their physical environments. Using this app, a user can drag and drop a selected product onto a space where their camera is looking at. The Warby Parker AR app embeds virtual eyeglasses on the user's face. Four hundred and eighty respondents recruited from Prolific, an online panel similar to Amazon Mechnical Turk, participated in an online survey. Out of these 480 responses, 27 respondents failed the attention check measures and our final sample included 453 respondents.

Respondents were randomly assigned to either Wayfair or Warby Parker AR conditions. Wayfair app respondents were asked to explore table and floor lamps using the Wayfiar AR app features and Warby Parker app respondents were asked to explore different sunglasses using the

Warby Parker app AR features. The respondents were instructed to explore the products for 5-10 minutes and then complete the survey. Attention check questions regarding products and apps were in place to ensure that the respondents met the requirements of the survey instruction. Respondent instructions can be found in the appendix A.

Measures

Perceived functional value was measured with four items adapted from Kumar and Noble (2016), and Shukla and Purani (2012). Perceived emotional Value was measured with seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7) consisting of four items adapted from Kim, Galliers, Shin, Ryoo and Kim (2012), and Sweeney and Soutar (2001). Flow experience was measured with seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7) consisting of three items adapted from- Triantafillidou & Siomkos (2018). Psychological ownership of product was measured with seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7) consisting of four items adapted from Song, Baek and Choo (2019). Psychological ownership of technology was measured with seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7) consisting of four items adapted from Barki, Paré and Sicotte (2008). Perceived Control was measured with seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7) consisting of six items adapted from Shin (2009), Guo and Poole (2009), Van Dolen, Dabholkar and De Ruyter (2007) and Song, Baek and Choo (2019). We also collected demographics information, including age, gender, income as well as Internet literacy and AR use experience. The measurement items used in the survey are provided in appendix B.

Analysis

We used structural equation modeling and confirmatory factor analysis to analyze the data using AMOS. Confirmation factor analysis was executed to assess the reliabilities and validities of the research constructs. We also assessed multi-collinearity of the constructs. A reliability

analysis was performed. Cronbach's alpha was used to assess the internal consistency. An estimated structural model has been presented with model fit indices. We have presented the results with regression weights; path estimates and the p-values of the constructs and conclude on the results on all hypotheses.

Data Analysis

We tested the hypothesized model by using Structural Equation Modeling (SEM). As Schumacker and Marcoulides (1998) suggested, maximum likelihood was estimated using the Analysis of Moment Structures (AMOS) program, version 26. We measured the moderating influence of perceived product control and perceived technology control by creating interaction terms with perceived functional and emotional values. As we were required to estimate of a large number of parameters in our structural model, we employed Path Analysis (i.e., a subset of SEM) to examine the hypothesized relationships (Kline, 1998).

Measurement Model

Significance tests for path coefficients were analyzed using AMOS 26.0. We evaluated model fit, reliability, convergent validity, and discriminant validity to determine the adequacy of the measurement model. To make sure that we have a good model fit, the chi-square normalized by the degrees of freedom (χ^2/df), non-normed fit index (NNFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR) were assessed. According to Hu and Bentler (1999), χ^2/df value of less than 3, CFI exceeding 0.95, SRMR lesser than 0.08 and RMSEA lesser than 0.06 indicate an excellent model fit. Our measurement model satisfies the recommended thresholds as the observed values of CMIN/DF= 2.270, CFI= 0.969, SRMR= 0.047 and RMSEA= 0.053. According to Table 2, all model fit indices exceeded their respective common acceptance levels suggested by previous research of Hu and Bentler (1999).

Table 2. Measurement Model Fit Indices

Measure	Estimate	Threshold	Interpretation
CMIN	572.054	--	--
DF	252.000	--	--
CMIN/DF	2.270	Between 1 and 3	Excellent
CFI	0.969	>0.95	Excellent
SRMR	0.047	<0.08	Excellent
RMSEA	0.053	<0.06	Excellent
PClose	0.190	>0.05	Excellent

Thus, we infer that the proposed model correlates well with the observed data and the model demonstrates a good fit with the collected data. We also assessed internal consistency, convergent validity, and discriminant validity of the instrument items for evaluating the measurement model. We used the measure of Cronbach's α as indicator of internal consistency. According to Hair and colleagues (1992), item loadings exceeding 0.50 on their associated factors provide indication of convergent validity. Fornell and Larcker (1981) also suggest that the constructs having average variance extracted (AVE) of at least 0.50 means having adequate convergent validity. Table 3 provides a summary of the internal reliability and convergent validity for constructs.

Table 3. Item Factor Loadings, AVE, Alpha

Variable	Items	Factor Loadings	Cronbach's α	CR	AVE
Functional value	FV1	0.824	0.905	0.903	0.700
	FV2	0.815			
	FV3	0.871			
	FV4	0.833			
Emotional value	EV1	0.885		0.926	0.757
	EV2	0.837			

	EV3	0.925	0.926		
	EV4	0.831			
Flow experience	FLO1	0.910	0.846	0.859	0.675
	FLO2	0.899			
	FLO3	0.624			
Psychological ownership of product	POP1	0.931	0.922	0.929	0.771
	POP2	0.954			
	POP3	0.956			
	POP4	0.626			
Psychological ownership of technology	POT1	0.859	0.921	0.928	0.765
	POT2	0.936			
	POT3	0.949			
	POT4	0.739			
Perceived control	PC1	0.802	0.916	0.917	0.647
	PC2	0.841			
	PC3	0.805			
	PC4	0.866			
	PC5	0.758			
	PC6	0.748			

The item loadings of the constructs range from 0.62 to 0.95 which are well above the cut-off value of 0.5 (Hair et al., 1992). Additionally, all the AVE values of the constructs, exceeded the recommended threshold of 0.50 (Barclay, Higgins & Thompson, 1995). This demonstrates convergent validity of each construct. Cronbach's α of all the constructs exceeded the threshold value of 0.70 as suggested by Nunnally (1978). So, we can infer that the Cronbach's α demonstrates high internal consistency.

Table 4. Measures for Internal Consistency

	1	2	3	4	5	6
Functional value (1)	**0.836**					
Emotional value (2)	0.673**	**0.870**				
Flow experience (3)	0.594**	0.679**	**0.822**			
Perceived control (4)	0.513**	0.608**	0.525**	**0.804**		
Psychological ownership of product (5)	0.319**	0.481**	0.468**	0.579**	**0.878**	
Psychological ownership of technology (6)	0.335**	0.570**	0.559**	0.510**	0.613**	**0.875**

According to Table 4, Square roots of the AVE (reported on the diagonal) exceeded the construct correlations (Fornell & Larcker, 1981) confirming the discriminant validity of the constructs. Thus, based on the following tests we conferred that the proposed measurement model had no internal consistency or convergent and divergent validity concern.

Following Podsakoff, MacKenzie & Podsakoff (2003) recommendations, we took several steps to test and control the common method bias at the design and analysis stage of our studies. We carefully constructed our survey at the design stage. We used pre-established, validated scales that were simple, concise, and unambiguous (Podsakoff et al., 2003). Moreover, while collecting data, we assured respondents that there are no right or wrong answers. The respondents were asked to answer as honestly as possible. At the analysis stage, we first performed Harman's one-factor test to examine if our study had common method bias. We found that neither (1) a single factor emerged from the factor analysis, nor (2) one "general" factor accounted for most of the

covariance—less than 50% of the variance—in the independent criterion variables. The results of the test for common method bias can be found in the Appendix.

Structural Model

Results of the second step of our data analysis involved evaluation of the proposed structural model. The Table 5 indicates the model fit indices. We had a χ^2/df value of 2.126, CFI value equal to 0.963 which is greater than 0.95, SRMR value of 0.045 and RMSEA value equal 0.050.

Table 5. Structural Model fit indices

Measure	Estimate	Threshold	Interpretation
CMIN	831.502	--	--
DF	368.00	--	--
CMIN/DF	2.126	Between 1 and 3	Excellent
CFI	0.963	>0.95	Excellent
SRMR	0.044	<0.08	Excellent
RMSEA	0.052	<0.06	Excellent
PClose	0.505	>0.05	Excellent

According to Hu and Bentlar (1999), these values indicate an excellent model fit and adequacy of the proposed model for being statistically evaluated for the causal links suggested by our study.

Path analysis

We conducted a path analysis to determine the causal links between our observed variables. The direct and indirect effects presented in the model were studied. The results show that the squared multiple correlation (R^2) value of psychological ownership of product and psychological ownership of technology were 0.440 and 0.395 respectively. Thus, it means that 44% variance in psychological ownership of product and 39% variance in psychological

ownership of technology are accounted for perceived functional value, perceived emotional value, flow experience, and perceived control. The Table 6 represents the direct effects between psychological ownership (product and technology) and perceived values (functional and emotional) and flow experience.

The study assesses the impact of perceived functional and emotional s on psychological ownership of product and technology. Our analysis demonstrates that perceived functional value has significant direct relationships with flow experience, psychological ownership of product and technology. Perceived emotional value also exhibits significant direct relationships with flow experience, psychological ownership of product and technology.

Table 6. Direct Effect Analysis

Direct Paths		**β**	**S.E.**	**C.R.**	**p-value**	**Comment**
Functional value → psychological ownership of product	H_{1a}	-.261*	.185	-2.505	*<0.05*	Supported
Functional value → psychological ownership of technology	H_{1b}	-.316**	.175	-3.093	*<0.05*	Supported
Emotional value → psychological ownership of product	H_{2a}	0.441***	.134	4.885	*<0.05*	Supported
Emotional value → psychological ownership of technology	H_{2b}	0.509***	.127	5.749	*<0.05*	Supported
Functional value → flow experience	H_3	0.216*	.119	2.390	*<0.05*	Supported
Emotional value → flow experience	H_4	0.552***	.079	7.721	*<0.05*	Supported
Flow experience → psychological ownership of product	H_{5a}	0.290***	.096	4.084	*<0.05*	Supported
Flow experience → psychological ownership of technology	H_{5b}	0.309***	.090	4.437	*<0.05*	Supported
Control Variables		**β**	**S.E.**	**C.R.**	**p-value**	
Previous AR use → psychological ownership of product		-0.045	.136	-1.162	.245	

Previous AR use → psychological ownership of technology	-0.025	.127	-.663	.508
Age → psychological ownership of product	0.021	.026	.543	.587
Age → psychological ownership of technology	0.071	.025	1.852	.064
Gender → psychological ownership of product	-0.350	.120	-2.915	.004
Gender → psychological ownership of technology	-0.455	.113	-4.027	***

According to Table 6, the impact of perceived functional value on psychological ownership of product was negative and significant (β= -0.261, t = -2.505, significant at $p < .05$); thus, H_1 was supported. Perceived functional value was had a significant negative relationship (β= -0.316, t= -3.093, significant at $p<0.01$) with psychological ownership of technology, supporting H_2. On the contrary, perceived emotional value had significant positive impact on both psychological ownership of product (β= 0.441, t= 4.885, significant at $p < .001$) and psychological ownership of technology (β= 0.509, t= 5.749, significant at $p < .001$). This supports our hypothesis H_{3a} and H_{3b}. Perceived functional value and perceived emotional value also had a direct relationship with flow experience. Perceived functional value had a significant positive impact (β= 0.216, t= 2.390, significant at p<0.05) on flow experience whereas the perceived emotional value's impact on flow experience was also positive but much greater (β= 0.552, t= 7.721, significant at $p < .001$). Thus, H_3 and H_4 were supported.

Flow experience had direct relationship with psychological ownership of product and psychological ownership of technology. The impact of flow experience on psychological ownership of product was significant and positive (β= 0.290, t= 4.084, significant at $p < .001$).

Flow experience also had a slightly greater and significant positive effect on psychological ownership of technology (β= 0.309, t= 4.437, significant at $p < .001$). This supports our hypothesis H_{5a} and $H_{5b.}$ We also analyzed the indirect effects of perceived functional and emotional values on psychological ownership of product and psychological ownership of technology. Table 7 demonstrates the nature of the indirect effects of the observed variables.

Table 7. Indirect effects analysis

Indirect Effects	**Estimate**	**Lower**	**Upper**	**p**
perceived functional value → flow experience → psychological ownership of product	.111*	.032	.264	*<0.05*
perceived functional value → flow experience → psychological ownership of technology	.114*	.032	.254	*<0.05*
perceived emotional value → flow experience → psychological ownership of product	.239**	.137	.371	*<0.05*
perceived emotional value → flow experience → psychological ownership of technology	.245**	.151	.376	*<0.05*

The indirect effect of perceived functional value on psychological ownership of product (b= 0.111, 95% CI [0.032, 0.264], $p < .05$) and on psychological ownership of technology (b= 0.114, 95% CI [0.032, 0.254], $p < .05$) in the presence of flow experience was also significant. But a significant negative direct effect of perceived functional value on psychological ownership of product (β= -0.261) and psychological ownership of technology (β= -0.316) also exists. The analysis of indirect effect shows that indirect effect of perceived emotional value on psychological ownership of product (b= 0.239, 95% CI [0.137, 0.371], $p < .01$) and on psychological ownership of technology (b= 0.245, 95% CI [0.151, 0.376], $p < .01$) in the presence of flow experience was significant. As there exists a significant direct effect of perceived emotional value on

psychological ownership of product (β= 0.441) and psychological ownership of technology (β= 0.509), we can say that flow experience partially mediates the effect of perceived emotional value on psychological ownership of product and technology.

In accordance with our proposed model, we tested the moderation effect of perceived control. We suggested that the perceived control moderates the effect of perceived functional value and perceived emotional value on psychological ownership of product and psychological ownership of technology. We also suggested that the perceived control moderates the relationship of perceived values (functional and emotional) on the flow experience. Table 8 demonstrates standardized estimates of the observed relationships relevant to our proposed moderation effects.

Table 8. Moderation effect analysis

Moderation Relationships	**Hypothesis**	**Estimate**	**S.E.**	**C.R.**	**P**	**Comment**
perceived functional value x perceived control → psychological ownership of product	H_{6a}	-.226**	.093	-3.131	*<0.05*	*Supported*
perceived functional value x perceived control → psy**chological** ownership of technology	H_{6b}	-.182*	.088	-2.581	*<0.05*	*Supported*
perceived emotional value x perceived control → psy**chological** ownership of product	H_{7a}	.350***	.082	5.175	*<0.05*	*Supported*
perceived emotional value x perceived control → psy**chological** ownership of technology	H_{7b}	.311***	.077	4.715	*<0.05*	*Supported*
perceived functional value x perceived control → flow experience	H_{8a}	-.017	.061	-.262	.793	*Not Supported*
perceived emotional value x perceived control → flow experience	H_{8b}	.131*	.053	2.218	*<0.05*	*Supported*

The interaction effect of perceived functional value with perceived control on the psychological ownership of product was negative and significant (β= -0.226, t= -3.131, $p < .01$). The interaction effect of perceived functional value with perceived control on the psychological ownership of technology was negative and significant as well (β= -0.182, t= -2.581, $p < .05$). The results also show that the interaction of emotional value and perceived control on psychological ownership of product was significant (β= 0.350, t= 5.175, $p < 0.001$). The interaction of emotional value and perceived control on psychological ownership of technology was also significant (β= 0.311, t= 4.715, $p < 0.001$). Thus, H_{7a} and H_{7b} were supported. The interaction effect of perceived functional value with perceived control was not significant on flow experience (β= -0.017, t= -.262, p= .793). But the interaction of emotional value and perceived control on psychological ownership of flow experience was significant (β= 0.131, t= 2.218, $p < .05$). Thus, H8a was not supported and H8b was supported.

The results suggests that perceived control strengthens the effect of only perceived emotional value on the flow experience of consumers. On the other hand, the results suggests that perceived control weakens the negative effect of perceived functional value on the psychological ownership of product and technology. Additionally, in line with previous research, we also included three control variables in our hypothesized model: gender (Gefen & Straub, 1997; Venkatesh & Morris, 2000), age (Venkatesh & Zhang, 2010), and AR use experience (Davis, 1989; Venkatesh & Zhang, 2010). The control variables had no significant effect on the hypothesized relationships.

Post Ad-Hoc test:

We also conducted a post ad-hoc test to see if the psychological ownership of product and technology relates to consumer outcome behaviors such as purchase intention and technology re-

use intention respectively. Our new measurement model had a χ^2/df value of 1.996, CFI of 0.972, SRMR of 0.042 and RMSEA of 0.047. While as our new structural model that added paths from psychological ownership of product-to-product purchase intention and from psychological ownership of technology to AR re-use intention, had a χ2/df value of 2.196, CFI of 0.956, and RMSEA of 0.051. Thus, we see that both our measurement model and structural model for our ad-hoc test had good model fit. The ad-hoc analysis confirms our proposed relationships and are consistent with our original findings. In addition, we find support that psychological ownership of product has a significant positive impact (β= 0.445, t= 11.393, $p < .001$) on product purchase intention of consumers while psychological ownership of the technology has a significant positive impact (β= 0.411, t= 9.906, $p < .001$) on the AR-reuse intention.

Discussion

AR offers a new way for the consumers to interact with the products or experiences. The AR technologies can generate digital products which can generate the perception of touch and trying on much like products in actual physical world thus making it crucial for managers to delve deeper and find consumers behavioral reaction or outcome in presence of such digital technologies and products (Sinclair & Tinson, 2017). Psychological ownership is deemed as one of those behavioral outcomes of consumers due to their interaction with digital technologies like AR (Brengman, Willems & Van Kerrebroeck, 2019). Our study investigates the role of the perceived values of the AR technology in their potential to evoke psychological ownership of the product and the AR technology.

Our results indicate a few key relationships in the mechanism of formation of psychological ownership of product and psychological ownership of technology. Firstly, the

results show that the direct impact of different types of value, namely functional value, and emotional value, is different on consumers psychological ownership (for both product and technology). While the perceived emotional value has direct positive impact on the psychological ownership of product and psychological ownership of the technology, the perceived functional value has indeed a direct negative effect on the psychological ownership of product and psychological ownership of technology. These findings add to previous works by Song et al., (2019) and Kirk et al., (2015), who focused on different factors (e.g., shared user experience, immersion, environmental embedding) by adding consumers two distinct experiential value (functional and emotional) as predictors of psychological ownership of product and technology while using the AR. Our results indicate that both perceived functional value and perceived emotional value have positive effect on consumers flow experience while using AR technology. The study results also suggest that flow experience has positive effect on the psychological ownership of product and psychological ownership of the technology. These findings extend previous works from Yuan et al., (2021) who studied the influence of perceived novelty, aesthetics and informativeness of AR users on their psychological ownership of products, our analysis confirms that the flow experience acts as a mediator for the indirect effect of perceived functional value and perceived emotional value on the psychological ownership of product and psychological ownership of technology. We find that perceived functional value has a negative direct effect and positive indirect effect on the psychological ownership of product and psychological ownership of technology of consumers. This is possibly because functional values are linked with end goals (Chen, Lee & Yap, 2017) of consumers. They possibly focused on the online activity of reaching that end goal and not on the virtual product or technology. Functional values align with clear goals and the perception of ability to meet the challenge of using AR

effectively which in turn is possibly perceived as challenge skill match. Goal clarity and challenge skill match are positively related to flow experience; while as the lower time spent and effort related to functional values dictates a negative relationship with the psychological ownership of product and psychological ownership of technology (Yaoyuneyong et al., 2016).

We also find validation of moderating effect by perceived control of users of AR on their flow experience and their psychological ownership of product and technology. The results indicate that perceived control moderates the effect of perceived functional and emotional value on the psychological ownership of product and psychological ownership of technology. When perceived control increases, the negative effect of functional values on the psychological ownership of product and psychological ownership of technology was attenuated. The results indicate that the interaction of perceived control with perceived emotional value had a significant positive effect on the psychological ownership of product and psychological ownership of technology. Perceived control also positively moderated the relationship between emotional values and flow experience. However, the perceived control did not have any moderating effect on the relationship between perceived functional value and flow experience. This might be owning to the fact that consumers perceived functional value closely relates to shopping efficiency. Chen, Lee and Yap (2017) suggested that the utilitarian motivated consumers are more focused on obtaining end state and exhibit lesser intent to have control as their sought end-supposedly satisfies their need for control. This can be one of the reasons why perceived control does not have a significant moderation effect on the relationship bewteen perceived functional value and flow experience.

Theoretical Contributions

Our research makes several key contributions towards the marketing literature centered on digital technologies. Firstly, we add to AR literature by proposing a model that can explain both the formation of psychological ownership of product and psychological ownership of technology of the consumers while using AR and thus portraying a few important variables that affects both psychological ownership of product and technology because previous literature does not contain common antecedents for the two types of psychological ownership. Previous literature to this date has mostly focused on formation of psychological ownership of objects in AR as well as on aspects like shared psychological ownership in virtual space. Previous researchers have studied the formation of object attachment in the presence of AR (Yuan et al., 2019; Brengman et al., 2019; Javornik & Pizzetti, 2017). On the other hand, some studies have studied the formation of psychological ownership of technology (Kirk et al., 2015; Morewedge et al., 2021) but not in the AR context. But what is noteworthy is that the above-mentioned studies did not consider the effect of the studied variables on psychological ownership of both the product and technology. This researc fills this gap in the literature by presenting a model that illustrates the formation of psychological ownership of product and technology in the AR context. Thus, our study adds key common mechanism of formation of psychological ownership of both product and technology and enriches the existing literature on object and technology attachment in AR (e.g., Poretski et al., 2021; Song et al., 2019; Yuan et al., 2021; Kirk et al., 2015; Morewedge et al., 2021). Secondly, we contribute to the psychological ownership literature by adding perceived values as antecedents of psychological ownership. Previous studies have considered variables like simulated control, informativeness, aesthetics and novelty, affective and cognitive appraisals, and authentic pride, customization etc. all of which positively affects the sense of psychological ownership (Hilken et al., 2017; Yuan et al., 2021; Lee & Chen, 2011; Kirk, Swain & Gaskin,

2015; Carrozzi et al., 2019). Our findings support our suggestion that emotional value has a positive effect on psychological ownership of product and technology. Unlike simulated control (Hilken et al., 2017), informativeness, aesthetics and novelty (Yuan et al., 2021), affective and cognitive appraisals (Lee & Chen, 2011), and authentic pride (Kirk et al., 2015), all of which positively affects the sense of psychological ownership, functional value has a negative effect on the psychological ownership of product and technology. Thirdly our study makes important contribution to the consumer flow experience literature by introducing flow experience as common construct that is relevant in the formation of psychological ownership of both product and technology. To the best of our knowledge, little research has investigated the relationship between flow experience psychological ownership of products. Yuan and colleagues (2021) illustrated flow experience as a crucial part in the process of formation of psychological ownership of products only. We add to this body of literature by suggesting that psychological ownership of technology is also influenced by flow experience. Our findings demonstrate the mediating role of flow experience in the effects of perceived functional and emotional values on psychological ownership of product and technology.

Managerial Implications

Our research gives several key managerial insights in terms of use of AR technology. The potential of AR in making comprehensive and better shopping experience is indicated by the existing literature (Yaoyuneyong, Foster, Johnson, & Johnson, 2016). AR can play a crucial role in building relationships with consumers. Our study establishes the importance of AR's functional and emotional value in creating psychological ownership which itself is a key predictor of several important consumer outcome behavior such as willingness to pay more for products (Peck & Shu, 2009; Shu & Peck, 2011), warranties (Lessard-Bonaventure & Chebat, 2015), word of mouth (Kirk, McSherry, & Swain, 2015) and purchase intention (Spears & Yazdanparast, 2014).

Our study has illustrated that perceived functional and emotional values have opposite effects on psychological ownership of product and technology. The findings can be very crucial for the marketers in terms of AR experience design. As our study shows that functional value indeed negatively affects the psychological ownership of product and technology while emotional value positively affects the psychological ownership of product and technology, AR app designers and marketers need to carefully evaluate the choice of application design elements that can result in functional and emotional value perceptions. To circumvent the negative effect of functional values, AR app designers can have more emotional value laden applications. The AR platform designed in ways where the emotional values are more apparent and using the app is more "fun" than being simply "easy" can possibly negate the effect of functional value on psychological ownership by making emotional value more apparent and dominant over functional value. AR apps should be so designed that they are heavily inclined in the emotional aspects as well apart from providing key functionality as the emotional value according to our study is very crucial to positive behavioral outcome such as psychological ownership and flow experience. For example, apart from just enabling shoppers to view furniture in their personal space through AR, Wayfair can encourage virtual space decoration and sharing décor ideas with peers resulting in a playful interaction of customers with their products. In our study we also highlight the importance of flow experience in determining the psychological ownership of product and technology. AR app designers and managers can draw on our findings that emotional values are stronger predictor of flow experience that is very crucial to attract consumers attention. This also reveals AR's potential as a marketing medium. The developers can present visual information in a way that is fun and play evoking, which can be helpful to make customers feel attached and from the theory of endowment we know that attachment leads to willingness to purchase or pay more (Chatterjee,

Irmak & Rose, 2013). For example, Warby-Parker can provide consumers Snap-chat like AR-filters along with trying out glasses to invoke play and facilitate flow experience. Thus, managers can use the design aspects of AR to generate positive behavioral outcome from target consumers by providing entertaining visual information and environment through AR advertising. Apps like Wayfair or Warby Parker can provide animated transitions and visually appealing hypertexts over the AR holograms of their products for example to make the augmented interaction more fun and playful and thus encourage positive behavioral outcome such as psychological ownership.

The perceived control is also crucial factor for the managers and the app designers as our study shows that the perceived control strengthens the relationship of emotional value with psychological ownership (of product and technology) and weakens the negative effect of functional value on the psychological ownership (of product and technology). Perceived control also strengthens the relationship between emotional value and flow experience. Thus, the AR should be so designed that the perception of control is adequate for the consumers to be in flow while using the AR app. This can be done by enabling seamless transition of animation of augmented objects and through creating a smooth and interactive interface that is easy to understand and use.

Limitations and Future Research

Our study is not without a few limitations. Firstly, due to the limited scope of the study we could not determine particularly which functional aspects are related to negative effects that the study showed perceived functional value has on the psychological ownership of product and technology. The result of our analysis shows albeit small, an indirect positive effect of functional value on psychological ownership mediated by flow experience. Thus, we see that there are two opposite relationships of functional value with that of psychological ownership of product and

technology. Future research can further investigate this interesting aspect of functional value and determine the key functionalities of AR that negatively affects psychological ownership. Secondly, we could not exactly determine why perception of control only strengthens the relationship of emotional value with that of flow and does not moderate the relationship of functional value with that of flow experience.

Although the theory of flow experience states that flow is strengthened when there is an increased perception of control, prior research by Chen et al., (2017) suggests that utilitarian motivated consumers are more focused on obtaining end state and exhibit lesser intent to have control as their sought end-supposedly satisfies their need for control. Our study design did not specifically allow us to confirm such contrary findings. Future studies can further investigate these findings and determine the nature of interaction between functional value and perceived control. Thirdly, future studies can investigate psychological ownership while using such apps wherein the experienced products or experiences cannot be legally owned but rather accessed. Our study was only tested with AR apps that are physical product laden. There are a multitude of AR apps that offers immersive experiences into arts and culture. Such AR apps let consumers explore museums and art galleries for example and do not allow purchase of physical tangible products. Morewedge and colleagues (2021) contemplated such innovations in the process of consumption and stated that such evolutions in consumptions either provides scope to preserve, threaten or transfer psychological ownership along the plane of material to experiential consumption. It will be interesting to see if the results of this study can also be replicated for AR apps that provides access-based consumption. If the results are not consistent under such context, then it will be interesting to find how and under what conditions transfer of or threat to psychological ownership of users occur.

Conclusion

The technological advancements of the last few decades, exemplified by proliferation of cellular device technologies, generate new and promising avenues for different businesses to generate new sources of value and enhance capabilities of marketing (Cui et al., 2012). The widespread use of mobile devices offers today's businesses a chance to spread their consumer reach and maintain a persuasive presence via electronic media and other internet technologies and interfaces (Varnali & Toker, 2010). AR is one of the relatively new technologies that has a strong and well-developed foundation.

The first paper of AR's use in marketing dates to 2008. Early publications in AR marketing is focused on studying the effects of AR technologies on consumer experience, its ability to support marketing activities and strengthen the brand-customer relationship, all while offering new prospects of enabling competitiveness. AR as a technological tool is extremely promising in expanding and creating immersive consumer experiences which replicates in store experiences. As a technology that provides visualization of haptic engagement AR can foster attachment and psychological ownership of consumers. But the literature on psychological ownership in the context of AR is scant as AR is a relatively novel technology. The studies in the AR context have studied psychological ownership of products (Poretski et al., 2021; Song, Baek & Choo, 2019; Yuan et al., 2021) and psychological ownership of technologies (Kirk et al., 2015; Morewedge et al., 2021) as distinct mechanisms. Our study bridges that gap by providing a common framework that explains both the psychological ownership of product and psychological ownership of technology. We determined perceived functional values and perceived emotional values as critical determinants with opposite effects on psychological ownership of consumers. By extend ending Yuan and colleagues (2021) we also suggested that flow experience is related

to the consumers perceived values and it helps in creating indirect effect on the psychological ownership of consumers. AR app designers and marketers can draw on these critical findings and determine the extent to which they want their apps to be affect laden or convenience laden (functional) as they have opposite influence on the consumers psychological ownership.

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Appendix A

Instructions

Scenario 1: It's just past noon on a Saturday, and none of your friends are around. You recently discovered that Warby Parker provides a virtual try-on of sunglasses through an AR-enhanced application. You want to spend some time in Warby Parker's virtual store and try on sunglasses.

• Please spend 5–10 minutes on the app to try on different sunglasses with AR and go through the relevant information.

After you are done exploring a few products in your personal space through AR, you will be required to respond to a 10-15-minute survey. Please note that, you will also be asked some questions later in the survey to confirm that you have spent enough time on the App as per the requirement of the study.

If you want to continue the study, please download the Warby Parker app on your device.

The app is available at: https://apps.apple.com/ca/app/warby-parker/id1107693363

Scenario 2: It's just past noon on a Saturday, and none of your friends are around. You decide to visit Wayfair's AR-enhanced online store because its mobile app lets you view products in your own space. You want to explore the "Table & Floor Lamps" under the category "Lighting", as offered in the Wayfair app.

- Please spend 5–10 minutes to explore different lamps in AR as offered in the app and go through relevant information.

(Please note that every product under the category "Table & Floor Lamps" can't be viewed in the AR system. Products that can be viewed with AR are market with an  icon beside the product name. Once you swipe through the product pictures you will be able to see the option "View in Your Room".)

After you are done exploring a few products in your personal space through AR, you will be required to respond to a 10-15-minute survey. Please note that, you will also be asked some questions later in the survey to confirm that you have spent enough time on the App as per the requirement of the study.

If you want to continue the study, please download the Wayfair app on your device.

For IOS, the app is available at:
- https://apps.apple.com/us/app/wayfair-shop-all-things-home/id836767708

For Android, the app is available at:
- https://play.google.com/store/apps/details?id=com.wayfair.wayfair&hl=en_CA&gl=US

Appendix B

Measures

Perceived Values

Functional Values:

Seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7)

Please indicate to what extent do you agree with the following statements.

1. The AR system I used is helpful in viewing/examining the product.
2. The AR system I used has high functional utility.
3. The AR system I used is useful for browsing/purchasing products.
4. The use of the AR system is practical.

Emotional Values:

Items adopted from Kim, Galliers, Shin, Ryoo and Kim (2012), and Sweeney and Soutar (2001).

Seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7)

Please indicate to what extent do you agree with the following statements.

1. It is fun to use the AR system.
2. I got excited while using this AR system.
3. It is enjoyable to use the AR system
4. Using the AR system gives me pleasure.

Flow Experience

Items adopted from- Triantafillidou & Siomkos (2018)

Seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7)

Please indicate to what extent do you agree with the following statements.

1. I was totally immersed in the experience, while using the AR system.
2. I was totally absorbed in the experience, while using the AR system.
3. My total focus and attention were on the experience, while using the AR system.

Psychological Ownership

Seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7)

Product Ownership: Items adopted from Song, Baek and Choo (2019).

Please indicate to what extent do you agree with the following statements**.**

1. When I was exploring the products in the AR system, it felt as if those products were mine.
2. When I was exploring the products in the AR system, I felt a very high degree of personal ownership of the products.
3. When I was exploring the products in the AR system, I felt like I owned those products.
4. When I was exploring the products in the AR system, it was not hard for me to think about those products as mine.

Technology Ownership

Items adopted from Barki, Paré and Sicotte (2008)

Seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7)

Please indicate to what extent do you agree with the following statements.

1. When I think about it, I see the AR system as a part of myself.
2. When I use the AR system, I feel as if it belongs to me.
3. When I use the AR system, I feel a high level of ownership towards it.
4. I became inseparable from the AR system when I use it.

Perceived Control:

Items adopted from Shin (2009), Guo and Poole (2009), and Song, Baek and Choo (2019).

Seven-point Likert Scale ("strongly disagree" = 1 to "strongly agree" = 7)

Please indicate to what extent do you agree with the following statements.

1. While using the AR system I was able to move the product(s) around however I wanted
2. While using the AR system, I felt I had physical control over the product(s).
3. Through this AR system I have a direct control on getting the information I need.
4. While using the AR system I felt in control of the experience I gained from the system.
5. While using the AR system I felt I was in control of my actions.
6. I was able to control the AR System in my own way.

Demographics

1. Please specify the primary device you use to access the application:
    - Smartphone
    - Tablet
2. Please specify if you have used augmented reality-based applications before.
    - Yes
    - No
3. What was your personal income last year?
    - Less than $10,000
    - $10,000 to 24,999
    - $25,000 to $49,999
    - $50,000 to $74,999
    - $75,000 to $99,999
    - $100,000 to $149,999
    - $150,000 and greater
4. Which is the primary language you use on the application?
    - Chinese
    - Danish
    - Dutch
    - English
    - French
    - German
    - Greek
    - Hebrew
    - Italian
    - Japanese

- Korean
- Norwegian
- Portuguese
- Russian
- Spanish
- Swedish
- Other language

5. Please indicate your gender:

- Male
- Female
- Transgender
- Non-binary
- Intersex
- Prefer not to answer

6. Please indicate your age:

- Under 19 years old
- 19 – 25 years old
- 26 – 30 years old
- 31 – 35 years old
- 36 – 40 years old
- 41– 45 years old
- 46– 50 years old
- 51 – 55 years old
- 56 – 60 years old
- 61 years and above

7. Please indicate your education Level:

- High School/College Degree
- Undergraduate—Bachelor's Degree
- Graduate—Master's Degree
- PhD or Terminal Degrees

Appendix C

Common Method Bias Output

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% Of Variance	Cumulative %	Total	% Of Variance	Cumulative %
1	11.456	45.826	45.826	11.456	45.826	45.826
2	3.405	13.620	59.446	3.405	13.620	59.446
3	1.944	7.775	67.221	1.944	7.775	67.221
4	1.083	4.331	71.552	1.083	4.331	71.552
5	.861	3.444	74.996			
6	.739	2.957	77.953			
7	.690	2.760	80.713			
8	.510	2.041	82.753			
9	.470	1.880	84.634			
10	.437	1.747	86.381			
11	.379	1.516	87.897			
12	.364	1.456	89.353			
13	.350	1.401	90.754			
14	.300	1.199	91.953			
15	.291	1.163	93.116			
16	.282	1.129	94.245			
17	.260	1.041	95.286			
18	.209	.836	96.122			
19	.202	.806	96.928			
20	.177	.709	97.637			
21	.162	.647	98.284			
22	.135	.540	98.824			
23	.117	.467	99.291			
24	.108	.432	99.722			
25	.069	.278	100.000			

Extraction Method: Principal Component Analysis.