Examining The Influence of Social Augmented Reality Apps on Customer Relationships: The Mediating Role of Shared Social Experience

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Abstract

The development of augmented reality (AR) has provided firms with increasing opportunities to improve customer experiences, especially in a shared context where customers are encouraged to communicate with others. This study investigates the effectiveness of social AR in building relationships among customers through a shared social experience, one which includes shared sense of place, social interaction, and social identity. Data was collected from 378 active users of a social AR application and was analyzed using the partial least squares structural equation modelling (PLS-SEM) and Hayes' PROCESS Macro. Results from this study show that shared sense of place, social interaction, and social identity mediate the influence of social AR past usage on customer-to-customer relationships, which consequently enhance customers' continuance intention to use the social AR application. Additionally, the results of the moderated mediation analysis reveal that the indirect effect of social AR past usage on continuance intention is positively moderated by extraversion, such that at higher level of extraversion the mediated relationship becomes stronger. These findings offer important contributions to the AR marketing literature and add valuable insights for practitioners to advance the use of AR technology.

Keywords: social augmented reality, customer-to-customer relationships, shared social experience, continuance intention

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1. Introduction

In recent years, augmented reality (AR) has changed from nice-to-have to a prominent technology for firms who want to distinguish themselves from competitors by offering their customers not just an add-on activity while shopping, but also a unique and engaging experience. Ranging from previewing and fitting a couch in your own living room with IKEA's IKEA Place to trying on cosmetics without actually applying make-up products on your face with Sephora's Virtual Artist (Mishra et al., 2020), AR applications provide an immersive experience to customers where they can modify and visualize on their mobile devices how the changes they have made in the digital world blend with the physical surroundings in real time (Carmigniani & Furht, 2011). The unique way that AR supplements customers' cognitive process (Heller et al., 2019) has made AR a breakthrough means of communication that encourages interaction and engagement not only between firms and customers, but also facilitates socialization among customers (Porter and Heppelmann, 2017), the result of which is the emergence of social AR (Hilken et al., 2020).

While a precise definition of social AR has not yet been established, generally practitioners refer to social AR as a social media platform that is equipped with built-in AR features (Groove Jones, 2020). Recently, retail brands, such as ASOS or Kohl's, have started integrating communication features into their apps along with AR technology to allow customers to share their AR-enabled wardrobe ideas with friends by posting on social media platforms. Firms are also striving for seamless AR experiences where customers can avoid the nuisance of changing from an AR application to a social application. For instance, Snap introduced their City Painter tool, which allows application users to become visual artists just by pointing their phone cameras at the streets to virtually decorate them as they wish. As a shared AR experience, City Painter users can also see how their fellow users have digitally changed the streets (Gilliland, 2021).

Despite the increased development and usage of shared AR experience in practice, research has not yet paid adequate attention to social AR and its impact on customer behaviors. The extant AR marketing research mainly focuses on the individual context while somewhat neglecting the shared context of AR usage, as presented in Table 1. For example, AR proves itself as an efficient tool for e-commerce marketers by delivering interactivity and vividness to customers, resulting in positive attitudes and purchase intention (Yim et al., 2017). Customers have also been found to change their brand attitude after doing their shopping using AR-enabled mobile applications due to the high level of inspiration they derive from using the AR applications (Rauschnabel et al., 2019). While scholars have identified the importance of shared experiences (Chylinski et al., 2020) and sociability (Moorhouse et al., 2017) in AR settings, only a recent study by Hilken et al. (2020) has investigated how customers communicate and change a common digital view together through social AR apps. Accordingly, social AR apps act as an effective tool for customers to make and receive recommendations seamlessly, thus supporting their shopping journeys.

*** insert Table 1.1.***

As social AR is an environment that is distinctly different from merely online or merely brick-and-mortar settings (Dwivedi et al., 2021), it provides users with a unique platform to socially engage with other users. Despite its potential, so far most of the studies in this area (except for Hilken et al.'s (2020) study) are within the context of business-to-customer relationships. Thus, there is a strong need for a study focused on customer-to-customer relationship in the social AR context. Past research has shown that the communication among consumers through information and experience sharing positively influences subsequent sales and helps retain both experienced and novice consumers (Adjei et al., 2010). Therefore, we aim to contribute to the sparse extant research in social AR and provide a specific guide for firms to increase customers' continuous intention of social AR apps by directly investigating

its impact on customer-to-customer relationships and how it does so. Specifically, we focus on answering the research questions:

(1) What is the mechanism underlying the social AR's impact on customer-to-customer relationships?

(2) How do firms encourage strong and meaningful customer relationships via social AR?

To explore how social AR influences customer-to-customer relationships, we utilize social network theory (Kadushin, 2004), which suggests that the likelihood of relationship establishment among members of a network is facilitated by a flow of information exchange and shared social attributes. On this basis, we propose that the exclusive implication of social AR is its ability to provide its users shared social experience. This experience is comprised of shared sense of place, social interaction, and social identity. By identifying the unique features of social AR, we offer a comprehensive outlook on the process of how social AR promotes customer-to-customer relationships, which can lead to positive outcomes for firms. As a consequence, we offer three contributions to the social AR literature.

First, adapting reasonings from social network theory (Kadushin, 2004), we propose that a distinct feature of social AR that is, its shared social experience, is that it establishes customer-to-customer relationships. Furthermore, we conceptualize shared social AR experience as a multidimensional construct comprising of shared sense of place, social interaction, and social identity. Considering shared social AR experience as a multidimensional construct helps us gain a better understanding of social AR, which directly answers the call for more research on this particular topic (Hilken et al., 2018). Second, by investigating how social AR customers share a sense of place with others (even when they are physically apart), increasing the likelihood of creating stronger customer-to-customer relationships, we explain how location-specific social AR apps influence customers. Third, as

extraverted customers have been found to be related to higher social media use (Correa et al., 2010) and engagement in brand communities (Marbach et al., 2018), we seek to understand how extraversion moderates the impact of social AR apps on customer-to-customer relationships.

Managerially, we propose two implications for firms and managers. First, as we investigate how social AR can strengthen customer-to-customer relationships to effectively enhance customers' continuance intention to use social AR applications, managers should consider implementing social features into their AR applications and by doing so, firms can retain their customers even longer on their apps. Second, since our study provides insights on the importance of sociability in AR settings, marketers can utilize this perspective when conducting campaigns to attract more first-time as well as returning customers. As such, social AR apps can be a place for customers to effectively communicate and build stronger relationships.

We present a conceptual framework that studies the use of social AR as an independent variable, customer-to-customer relationships and continuance intention to use social AR applications as dependent variables, shared sense of place, social interaction, and social identity as three mediators, and extraversion as moderator. A survey study was conducted by recruiting active users of a social AR application (i.e., WallaMe). We employed partial least square structural equation modeling (PLS-SEM) and Hayes' PROCESS Macro to test the influence of social AR on customer-to-customer relationships, as well as the mediating effects of shared social experience (i.e., shared sense of place, social interaction, and social identity).

2. Literature Review

2.1. Social AR Research in Marketing

In their 2001 study, Azuma et al. defined AR as a system where computer-generated objects seem to coexist in the real world. Combining physical and virtual objects in the same environment, AR provides its users a digitally enhanced view of a physical environment in real-time (Carmigniani & Furht, 2011). Due to significant developments and improvements of digital technologies, especially AR systems, as well as abundant innovations of hand-held devices and mobile-enabled platforms, customer behaviors and shopping patterns have greatly evolved (Dwivedi et al., 2021; Rauschnabel et al., 2019). For instance, the Swedish furniture and appliances retailer IKEA launched the mobile application IKEA Place in 2017 that customers can download to their smartphones. The application provides users the ability to virtually design their home by simple actions such as to drag and drop furniture items to a specific place while using a smartphone to point at the surrounding space. Delivering "highly vivid, customized, and connected digital content," AR is capable of providing customers with a highly personalized context which allows them to evaluate products and services (Hilken et al., 2018, p. 512).

While early research focused on AR media characteristics, such as vividness (Huang & Tseng, 2015), interactivity (Yim et al., 2017), hedonic and utilitarian values (Dacko, 2017) to study its effects on user adoption (Rese et al., 2017) or brand attitude (Javornik, 2016b), recent research has examined AR as an enabler for improved and shared customer experiences. For instance, tom Dieck et al. (2018) reveal that AR usage in science festivals influences participants' experience satisfaction, thus enhancing their engagement intentions. Similarly, Heller et al. (2019) explain that by supporting customers through their decision-making process, AR apps in retail settings promote communication among customers, who are more likely to share their positive AR experiences with others. Likewise, Sung (2021) shows that after experiencing an authentic AR advertisement that has produced satisfaction, customers are more likely to share their experiences with social groups on online networks.

In the same vein, the recent study of Hilken et al. (2020) identifies an up-to-date classification of AR by referring to social AR as "a technology that enables two or more users to communicate by sharing and virtually enhancing a common view of the physical environment" (p. 144). An example of social AR app is Akzo Nobel's Visualizer. The app allows customers to virtually customize their wall color and share the results with their friends via AR-enhanced videos and photos. Since the app encourages users to alter the shared videos and photos and suggest recommendations to revise the color choices, users can co-create a shared AR model through their interactions. As such, AR users gain the extended customer experience through communication with others (Hilken et al., 2018). Accordingly, a crucial influence of social AR is that it emphasizes the value of co-creation among members of a network through social interactions (de Ruyter et al., 2018). Furthermore, by allowing for social interactions in a shared experience rather than a personal AR setting, social AR enhances customers' needs for social assimilation, which then influences their perceived ownership of the AR-enabled holograms (Carrozzi et al., 2019). In addition, the use of AR in social media is suggested to provide unique and improved customer interactions than merely brick-and-mortar stores or web-based environments such as social media (Dwivedi et al., 2020). Besides the characteristics of AR, such as the interactive and real-time integration of virtual setting with physical environment, social AR provides customers a unique experience where they have a chance to communicate and interact with others through visually enhanced media, in the form of videos and photos.

2.2. Shared Social Experience through Social AR

Adapting from the research that recognizes the importance of social interactions among AR users (de Ruyter et al., 2018; Sung, 2021; Dwivedi et al., 2021) and the principle of extended customer experience (Hilken et al., 2018), we propose that social AR provides its users a distinct feature that is, a shared social experience. Social AR provides users the ability

to share their experience of augmenting the physical world with digital objects, thus encouraging a shared social experience.

Kadushin (2004) presented two crucial components of a social network: propinquity and homophily. The former refers to the likelihood that members in a network will establish relationships when there is a flow or an exchange of place among them. The latter component indicates the likelihood of relationships among a network's members when they share common social attributes. Studying social attributes that constitute customer experience, Keiningham et al. (2017) identify social experience as how someone shares or relates to others as a result of their interactions with others. During their social experience with like-minded individuals, members of a community also view and share their social identities. These studies have encouraged us to identify three elements of shared social experience: shared sense of place, social interaction, and social identity.

First, we propose that social AR provides its users a shared sense of place, allowing for the integration of virtual objects into physical environments. Unlike VR, which drives customers into a virtual world, social AR leaves customers with a presence of real world and at the same time, view computer-generated objects in their physical environment (Azuma et al., 2001). Customers can communicate with others by sharing vivid, interactive, and real-time digital content (Hilken et al., 2020). Another important feature of social AR is the ability of customization. Unlike other means of content sharing that is passive information sharing, since recipients obtain the information already presented on videos and photos, social AR allows both ends of information and content sharing process to customize virtual objects on real and shared physical environment (Jung & tom Dieck, 2017). Accordingly, social AR uniquely enables the ability of customers to obtain a strong shared sense of place due to the visually enhanced videos and photos. Therefore, we propose sense of place as an important feature of social AR. Through social AR, customers can share highly vivid, interactive, real-

time, and customized content via visually enhanced videos and photos. This ability enables a shared sense of place, thus strengthening their relationships and as a consequence, encouraging a stronger social network (Kadushin, 2004).

Secondly, social AR allows customers to create and share digital content that is embedded in the physical environment. As customers seek recommendations and support from others through peer reviews and ratings, which leads to AR perceived usefulness and ease of use (tom Dieck & Jung, 2015), social AR offers an exclusive and valuable experience for customers. Social AR allows them to express and exchange their preferences on products or services by sharing AR-enhanced videos and photos as well as typical message sharing (Hilken et al., 2020). For instance, the Akzo Nobel's Visualizer allows its users to change the wall color and recommend their preferences to their friends. Hence, social AR emphasizes the social interactions that are derived from the content sharing process. As social AR customers use visually enhanced videos and photos to interact with others, they produce social interactions that support information and content exchange, thus creating a relationship among individuals and pursuing the connection among people under a common interest (Cakir, 2015).

Lastly, social identity is an important driver of consumers' satisfaction and behaviors, especially on online environments (Dutot, 2020). For instance, perceiving themselves as part of a university's social identity, students are more likely to share positive reviews about their school (Lee et al., 2020). Similarly, as customers increasingly participate in online brand communities, the perceived social identity of such community, which is built by customers' content sharing and interaction, can even affect a brand image (Gensler et al., 2013). Even more vivid and interactive than social media platforms, social AR enables customers to share visually customized products that they prefer through videos and photos, which fulfills their identity signaling needs (Grewal et al., 2019). Altogether, social AR uniquely encourages

social interactions and social identity as customers share visually enhanced content. Therefore, we propose social interaction and social identity as important elements of social AR that empower customers' relationships and strengthen their social network.

2.3. Customer-to-Customer Relationships in Social AR

Martin and Clark (1996) define customer-to-customer relationships as ''individual and group interactions and impressions between customers encountered in the acquisition and consumption of goods and services.'' Thus, customer-to-customer interaction is a central part of customer-to-customer relationships (Georgi & Mink, 2013). In their comprehensive research on customer-to-customer interactions, Libai et al. (2010) identify different dimensions of interactions in online vs. offline environments. While online interactions take place on websites, social networking sites, forums, or online communities, offline interactions refer to face-to-face communications among customers while they are in-store, at home, or even while they are on the road. Given that, compared to online settings, research on offline customer-to-customer interaction has been quite neglected. For example, a study by Gruen et al. (2006) investigates the influence of customer-to-customer know-how exchange in the form of electronic word-of-mouth communication (e-WOM). Specifically, customer exchange of their know-how in e-WOM influences product perception and promotes them to recommend products to others. The study by Mathwick et al. (2008) also concentrates on the online dimension of customer-to-customer relationships. The authors explore the importance of social capital formation in customer interactions within a branded after-sale service community, where customers seek help from other fellows. On the other hand, Martin (2016) emphasizes how encounters among customers in a service setting influence their trust and involvement in brand communities, especially on social media where customers have a greater chance to connect with others that use the same service. When considering the offline dimension of customer-to-customer interactions, Harris and Baron

(2004) empirically study customer conversations in travel settings. The findings suggest that among train passengers, the more conversations they have with others, the more improved experience they derive. Notably, a study by Toubia et al. (2011) indicates that most social interactions among customers occur offline, despite customers being exposed to a significant amount of online marketing programs. Libai et al. (2010) also recommend that channels for customer interactions that involve sensory modes, for instance a text-based conversation, a voice conversation, or a photo or video with added visual information, can influence customer-to-customer interactions. Nonetheless, social AR emerges as a blend of online and offline environment where customers are not restricted to a specific experience setting (Dwivedi et al., 2021), thus an analysis on how customer-to-customer interactions can take place in the context of social AR is essential. Adapting from the conceptualization of relationship quality in the study by Adjei et al. (2010), we operationalize customer-to-customer relationship based on the quality of the relationship.

2.4. Continuance Intention to Use Social AR

As the development of AR technology is moving from store-based experience to personal hand-held devices and mobile applications due to the mobility of AR technology (Reitmayr & Drummond, 2006), social AR is mostly seen in the form of a company's/retailer's AR application. Intuitively, a branded application can impact its customers' attitudes and behaviors, as well as customers' loyalty to the brand only if customers continue to use the application (Fang, 2017). While successfully persuading customers to download and use its application is an important step for any brand, the long-term consequences and eventual success "depend on its *continued* rather than *first-time* use" (Bhattaacherjee, 2001, p. 352). However, to date, we still have limited understanding regarding the effect of social AR past usage on customers' continuance intention to use social AR applications.

Adapting from Bhattaacherjee's study (2001), continuance intention to use social AR application refers to customers' intention to continue using and experiencing a company's social AR application. Studying customers' continuance intention for AR applications, Kim et al. (2016) empirically suggest that perceived usefulness is a strong and direct indicator for continuance intention. However, Fang (2017) discovers that beyond usefulness, it is the engaging and rewarding customer relationship a person derives from using a branded application that promotes positive attitudes, which results in continuance intention toward the application. Similarly, Hsu and Chiu (2004) also discover that the interpersonal influences a person receives from their surrounding individuals is strongly related to the continuance intention toward an online service. In addition, Hsiao et al. (2016) confirm the relationship between social factors, particularly social ties among users, and continuance usage of social applications. Social applications encourage interactive conversations among the networks of users and provide opportunities for frequent communications, consequently influence users' continuance intention to use the applications. Altogether, these studies indicate a noteworthy linkage between application users' interpersonal relationships with other users and their intention to continue using an application.

Social AR provides users the capability to communicate by sharing their virtually enhanced view of physical surroundings (Hilken et al., 2020). As previously mentioned, social AR applications can strengthen customer-to-customer relationships through shared social experience. We further argue that social AR application users are encouraged to actively create conversations with others in the application and interact with others through the act of sharing AR-enabled videos and photos. Thus, they are more likely to remain engaged in the social AR application as a means for communication. Therefore, we expect a positive relationship between customer-to-customer relationships and customers' continuance intention to use social AR.

2.5. Extraversion in Social AR

The concept of extraversion as an influential personality trait on consumer attitude and behavior has been widely studied in the field of consumer behaviour. Summarizing studies by trait psychologists, Watson and Clark (1997) emphasize the interpersonal aspect of the construct of extraversion. Extraverts are viewed as individuals who are sociable, friendly, talkative, and love being with other people. They are also described as enthusiastic, cheerful, and optimistic. Extraverted individuals are more willing to participate in highly energized and affective activities, such as seeking excitement and stimulation through socialization. Testing a diverse set of participants from 39 nations, Lucas et al. (2000) indicate that extraverted people have the fascination with both expanding and deepening their interpersonal relationships by actively sharing their personal information and ideas with others.

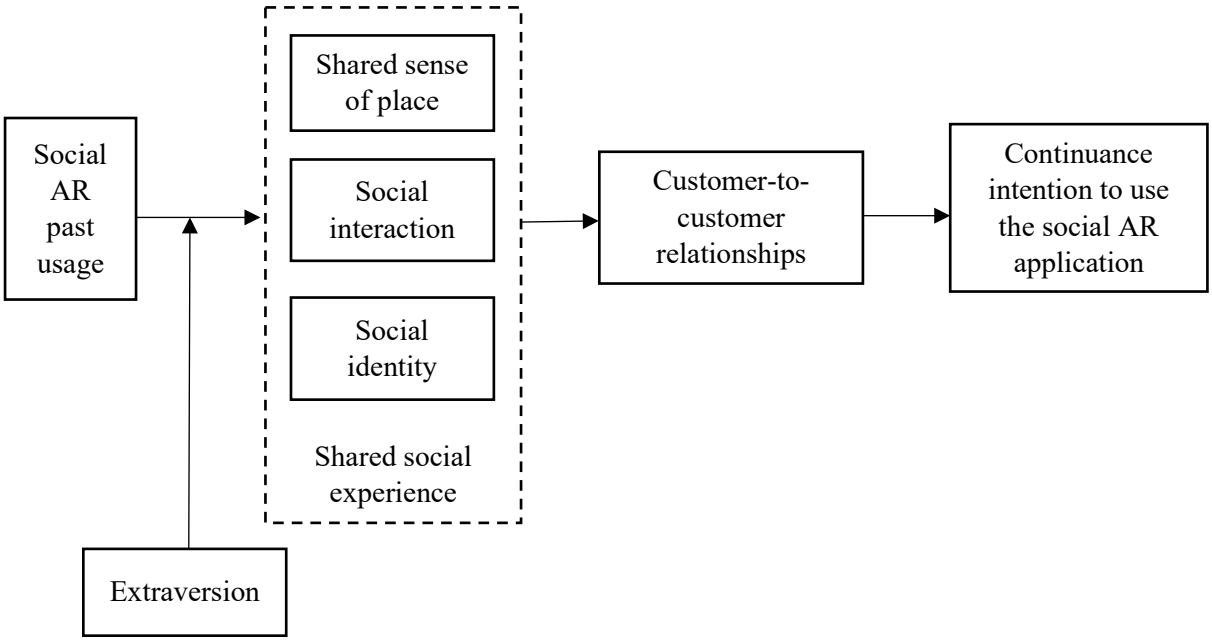
In the context of online settings, extraversion is suggested as a stimulus for online community members to actively engage in content generation. Pagani et al. (2013) find that extraverted people have a higher proclivity toward actively participating in a user-generated community platform due to their self-expression needs and outgoing characteristics. These findings are in line with the study by Lucas et al. (2000), which posits that the social manner of extraverts can be explained through their reward sensitivity such that the more they socialize, the more they feel comfortable. The study by Azucar et al. (2018) also indicates that extraversion has a strong predictive power when it comes to their digital engagement and footprint. Thus, it is crucial to consider extraversion as a moderator in our research as social AR poses a question on the sociability of its users.

3. Hypothesis Development

This section presents the conceptual framework and hypothesizes how customers who experience social AR develop strong relationships, which consequently influences their intention to continue using social AR apps. The mediators are conceptualized as shared social

experience, with three elements: shared sense of place, social interaction, and social identity. The framework also considers extraversion as a moderator that can strengthen and weaken the influence of social AR on its users' shared social experience.

Figure 1.1. Conceptual Framework



3.1. Shared Sense of Place

In their research, Chang et al. (2015) identify three dimensions of sense of place, as place attachment, place dependence, and place identity. Firstly, place attachment refers to the affective content of a place that can be seen as the emotional bonding between individuals and places (Altman & Low, 1992). As such, individuals "associate personal characteristics and experiences" (Chang et al., 2015, p. 169) with a place. Consequently, they establish emotional connections with it. Secondly, place dependence demonstrates how individuals correlate a place with specific behaviors. In addition, place dependence encourages people to create meaningful experiences related to that place (Chang et al., 2015). Lastly, place identity is the cognitive dimension of sense of place. To be specific, it indicates the resonance between a person's perception of self and a place. Through their experiments, Chang et al.

(2015) confirm the ability of AR in contributing to a sense of place in individuals on three dimensions.

Considering the social AR context, when social AR customers share a video or photo with others, they are exchanging a visually enhanced content of their surrounding environment (Hilken et al., 2020). For example, walking by a plain fence, users of WallaMe, a social application, can put their own graffiti on that fence without actually damaging the property and can then share that image with other people directly in the application. Through the photos that they share, social AR allows them and their friends to see the exact same view of a place. Adopting explanations of sense of place by Chang et al. (2015), we suggest that social AR customers experience shared sense of place through three paths according to three components, place attachment, place dependence, and place identity. Firstly, social AR users may relate the characteristics and experiences of a place to others who may have had same experiences as them, thus developing their emotional connections. Secondly, social AR users may refer specific behaviours to specific places they have seen on the social AR application. For example, after digitally drawing a picture or leaving a message at a street corner with WallaMe, a user who comes to that location may recognize it as a place for a unique AR experience. Lastly, because of the experience gained from being exposed to the photos that are shared on the social AR platform, users may connect a place to a specific identity. Accordingly, we propose that social AR customers maintain a shared sense of place. When social AR application users share photos of different places with other users and visit the places shared by others, they are sharing a sense of place related to specific locations they have in common. Social AR applications make use of the collective locations that users share with each other, thus promoting a shared sense of place. According to social network theory (Kadusin, 2004), individuals are more likely to connect with people when they are in close distance to each other. Such shared sense of place encourages social AR application users to

build relationships as they actively share different places with fellow users. Therefore, we argue that customers experiencing social AR are more likely to develop stronger relationships with other users because they share a sense of place.

H1: The positive relationship between social AR past usage and customer-to-customer relationships is mediated by shared sense of place.

3.2. Social Interaction

In general, social interaction can be defined as the social exchange between two or more people. Goffman (1963) suggests two distinctions of social interactions: (1) unfocused social interaction that refers to the interactions that individuals exchange in greetings, such as smiling or nodding, and (2) focused social interaction that occurs when two or more people have an interest in common and make conversation about their interest (Hall, 2016). Social interaction in online environment involves the interaction among users of social networks and allow networks' members to exchange information, create relationships among individuals and pursue the connection among people with common and overlapping interests (Cakir, 2015). A study by Toubia et al. (2011) indicates that most social interactions among customers occur offline, although customers are exposed to marketing programs with significant online activities. Considering that social AR creates an "highly vivid, customized, connected digital content" (Hilken et al. 2018, p. 512) exchange process for users, social interactions among social AR customers occur in a real-time and visually enhanced way. Compared with the conventional way of online interaction, social AR creates a more specific and interactive way for interaction. Studying AR shoppers, Smink et al. (2019) found that the informativeness of AR-enabled shopping environments motivates customers to share personal data. As such, social AR users can share and receive unique photos and videos with other people, thus encouraging them to share more about themselves. Therefore, we propose that by experiencing social AR via sharing AR-enabled videos and photos of physical

surroundings, customers are virtually having social interactions, and consequently, developing relationships.

H2: The positive relationship between social AR past usage and customer-to-customer relationships is mediated by social interaction.

3.3. Social Identity

Social identity theory suggests that individuals have the intuition to identify themselves within a social group based on similarities (Tajfel and Turner, 1986). When people perceive themselves as part of a group, their actions and behaviors are consistent with the norms of the group. Recent research has investigated social identity as an important antecedent that leads to customer engagement in online settings (Chahal et al., 2019; Chi et al., 2021). For example, Reyes-Menendez et al. (2020) found that when users on social platforms interact with other people of similar interests, through the hashtag #MeToo, their perception of social identity is strongly correlated with others.

In the context of social AR, customers can virtually observe, interact, and communicate their customization of a similar and specific physical environment with others (Hilken et al., 2020). As such, when social AR users share their photos and communicate with others on the application, they are exchanging a common virtual view of the physical world. Thus, they may perceive themselves to be in the same group with other application users, considering their common interest in, for example, drawing, visiting places, or technology. As a result, social AR customers will establish stronger relationships among themselves.

H3: The positive relationship between social AR past usage and customer-to-customer relationships is mediated by social identity.

3.4. Continuance Intention to Use the Social AR Application

Continuance intention refers to customers' intentions to keep using an application after they have gone through the first step of application acceptance (Bhattaacherjee, 2001).

Research in online social networks has provided insights into the interpersonal relationships that play an important role in indicating customers' continuance intention (He et al., 2009). In online social network context, a person builds stronger relationships through frequent and close interactions with other members. This type of relationship promotes the interpersonal influence that customers experience, thus impacting their intention to continue using the social network site (He et al., 2009). Similarly, research in branded applications has presented evidence of the influence of social factors on application continuance usage. As social applications act as a channel for frequent conversations among people, its users are less likely to switch to different apps due to possible loss of connections, thus increasing their continuance intention to use social applications (Hsiao et al., 2016). Similarly, Fang (2017) found that the relationships that customers build with other users in a branded application positively influence their attitudes towards the application and, consequently, they continue to continue using the application. Considering that social AR provides its users the capability to better communicate by sharing their virtually enhanced view of physical surroundings (Hilken et al., 2020), we argue that the relationships that users of social AR applications have developed from using the application encourage them to frequently create conversations and interact with others by sharing AR-enabled videos and photos, which results in their continuance intention to retain such relationships. Thus, it is expected that in social AR application, customers are more likely to continue using the application when they have built intimate and connected relationships with other users. Therefore, we propose that:

H4: Customer-to-customer relationships positively influence customers' continuance intention to use the social AR application.

3.5. Moderating Effect of Extraversion

Even though extraverted people, with their social, active, talkative nature, prefer face-to-face communication over virtual communication (McElroy et al., 2007), results from Wang's

(2013) study reveal that location sharing behaviors among extraverts on social networking platforms act as a means to share not only their places, but also their current feelings or events they are participating in. This, in turn, allow extraverts to be more engaging in the virtual environment. Extant research has supported the proposition that location sharing is correlated with establishing online social connections (Lindqvist et al., 2011). Since social app users share their locations via Facebook check-ins as a means to promote themselves with other users about their choices (Kim, 2016), the more they share about different places, the more they get involved with and build connections with other people on the app (Hsieh & Lee, 2020). Likewise, Wang and Stefanone (2013) showed that extraversion is associated with Facebook check-ins due to self-disclosure. To elaborate, since extraverts seek self-presentation (Seidman, 2013), online location-sharing helps them to express themselves to other people in the app community, which results in forming social relationships (Lindqvist et al., 2011). Altogether, we argue that social AR provides extraverts with a greater shared sense of place. In particular, when using social AR, users can share their immediate physical surroundings with others. Thus, an extravert who is more eager to share in sharing places can better utilize social AR as their way to transpose physical environments with others and replicate face-to-face communication.

H5a: Extraversion strengthens the positive indirect effect between social AR past usage and customer-to-customer relationships through shared sense of place.

From their comprehensive study on social network site users, particularly Facebook users, Correa et al. (2010) demonstrated that extraversion is positively related to social media use. Extraverts are found to make more friends as well as post more photos on Facebook. They are reported to share more about their personal lives with others online. Similarly, Tsai et al. (2012) discovered that extraversion positively influences brand community members to interact more with others and become involved in more activities in the community.

These studies suggest that self-disclosure effects occur with extraverts when they participate in activities on social networking sites (Wang, 2013). Particularly, the desire for self-disclosure – the act of sharing personal information – motivates extraverts to share their thoughts and activities with other people (Tamir & Mitchell, 2012). Compared with online social network sites, social AR applications grant its users more advantages to communicate and share personal information. For example, Savela et al. (2020) find that AR app users tend to leave more comments for fellow users on the app compared to non-AR app users. Research on AR games also shows favorable supports for AR technology as it encourages users to connect with others by sharing their experiences with the app, which leads to social interactions among app users (Vella et al., 2019). Such advantages when using social AR should intensify self-disclosure in extraverts, resulting in their extended social interaction with other people. Therefore, we expect extraversion to strengthen the positive relationship between social AR and social interaction.

H5b: Extraversion strengthens the positive, indirect effect between social AR past usage and customer-to-customer relationships through social interaction.

Given that social AR provides customers with the ability to modify their view of physical world with their own digital preferences and share their view with others (Hilken et al., 2018), identity similarity (Hall-Philips et al., 2016) can be more salient in extraverted social AR application users. In particular, since social AR apps focus on the interaction of like-minded individuals who are also creating virtually enhanced content, extraverts may perceive more identity similarities between themselves and other application users in the community through social network features such as liking or commenting on other people photos, which consequently influences their sense of social identity. Therefore, extraversion is expected to positively moderate the influence of social AR on social identity, such that the more extraverted a person is, the more social identity they perceive from using social AR.

H5c: Extraversion strengthens the positive indirect effect between social AR past usage and customer-to-customer relationships through social identity.

4. Methodology

4.1. Data Collection

As this study aims to investigate the influence of social AR apps, we specifically recruited participants who have used a social AR application called WallaMe. It is a free AR application that allows users to take a photo of their surroundings, e.g., a wall, fence, sidewalk, or just a surface, and leave their own digital message on the picture by writing, drawing, or adding sticker to it. App users can choose to publicly share their "wall", the photo with a unique message they have created to anyone in the application or make it visible only to selected friends. WallaMe also includes communication features, through which users can interact with others by liking, commenting on, or sharing others' photos. The WallaMe application was chosen for three reasons. First, WallaMe provides its users the ability to integrate digital content into their physical places as well as the tools to communicate with other application users in the application. Thus, it is an appropriate social AR application as its technology allows users to communicate through virtually-enhanced and shared physical surroundings (Hilken et al., 2020). Second, as WallaMe is a location-based AR application where users are encouraged to go to various places to view hidden messages, it is a relevant application to this study since we investigate shared sense of place as an important construct in the proposed model. Lastly, WallaMe was first introduced in 2015 and has accumulated millions of downloads worldwide and frequent users. Thus, we chose WallaMe users as the targeted participants for this research.

We recruited participants through a market research company that offered access to an extensive online panel with experience in using WallaMe. An email invitation was sent to people who have knowledge and experience in using AR apps. Next, individuals who

confirmed that they have used the WallaMe application were invited to participate in the study. We acquired 400 responses and then eliminated 22 unengaged responses that failed the attention check questions. Therefore, 378 complete and valid responses were used for the analysis. Participants answered questions about their social AR past usage, shared sense of place, social interaction, social identity, customer-to-customer relationship, continuance intention to use social AR, and extraversion. Participants' demographic information was also collected. After that, participants were thanked and debriefed on the study.

4.2. Measurements and Statistical Analysis

The questionnaire adapted measurement items (see Table 2) from established literature using 7-point Likert-type scale with higher points representing higher agreement or evaluation. In particular, the social AR past usage measure was adapted from Rosen et al. (2013) and Marty-Dugas et al. (2018). For mediating variables, we adapted measures for shared sense of place from Jorgensen & Stedman (2006) and Brocato et al. (2014), social interaction from Chiu et al. (2006), and social identity from Dholakia et al. (2004) and Mousavi et al. (2017). Measures for customer-to-customer relationships and social AR application continuance intention were adapted from Adjei et al. (2010) and from Bhattacherjee (2001) and Ku et al. (2013), respectively. We adapted the measure for the moderator extraversion from Viswanathan et al. (2018). Regarding control variables, we adapted two variables, including age and gender from Hughes et al. (2019). We also included device (smartphone versus tablet) and language (English versus non-English) as control variables given that extant research has shown the effect of smartphone usage on customers' self-disclosure tendency (Melumad & Meyer, 2020) and the effect of language on customers' reactions and behaviors (Noriega & Blair, 2008).

Partial least squares structural equation modeling (PLS-SEM) was employed for data analysis using the SmartPLS software version 3.0 (Ringle, Wende, & Becker, 2015).

According to Hair et al. (2014), compared to covariance-based SEM (CB-SEM), PLS-SEM is a more appropriate method for predictive analysis rather than confirming an existing modeling. As this study adapts theories from various disciplines in the social AR context and focuses on predicting how social AR past usage influences customer-to-customer relationships through shared social experience, which, by their nature, are complex constructs, PLS-SEM is the appropriate method for our research (Davcik, 2014; Bolander et al., 2015). In addition, PLS-SEM is ideal when the research involves estimation of complex models (Hair et al., 2014), which in our case is the mediating effects of shared sense of place, social interaction, and social identity, as well as the moderating effects of extraversion.

Before testing the proposed model, we assessed the validity of the measurement items by reviewing construct reliability and validity, as well as discriminant validity. We include factor loadings, Cronbach's alpha (α), composite reliability (CR), and average variance extracted (AVE) of the measurement items in Table 2, which show that measurement items load on their respective constructs with all factor loadings were greater than the threshold value of 0.6, as recommended by Hair et al. (2014). As the table shows, composite reliability (CR) and AVE values for all constructs was greater than the recommended threshold of 0.7 and 0.5, respectively (Hair et al., 2014), which indicated the construct reliability and convergent validity.

insert Table 4.1.

To assess the discriminant validity of the constructs, we followed Fornell and Larcker (1981) by comparing whether the square root of AVE for each construct is greater than the shared variance among constructs to evaluate discriminant validity. We also checked for discriminant validity using the Hetorotrait-Monotrait ratio (HTMT) criteria. For all correlations among variables, there is no HTMT value exceeding the threshold value of 0.90 (Hensenler et al., 2015). As shown in Table 3, discriminant validity of the constructs was

confirmed. After validating measurement items, we test the proposed model by conducting a bootstrap of 5000 iterations in SmartPLS.

*** insert Table 4.2. ***

5. Results

5.1. Structural Model

In the structural model evaluation process, we tested the mediating roles of shared sense of place, social interaction, and social identity and the moderating effects of extraversion by running the bootstrapping procedure with 5000 iterations. Table 4 presents estimated indirect effects according to the proposed hypotheses. As predicted in hypotheses H1, H2, and H3, social AR past usage is positively associated with customer-to-customer relationship (β = 0.440, $p < .001$) and this relationship is mediated by shared sense of place (β = 0.113, t-value = 5.161), social interaction (β = 0.154, t-value = 5.049), and social identity (β = 0.155, t-value = 6.400), with all p-values < 0.001. Hence, hypotheses H1, H2, and H3 are supported.

*** insert Table 5.1. ***

Furthermore, customer-to-customer relationships has a positive influence on users' continuance intention to use social AR (β = 0.742, t-value = 20.896), supporting hypothesis H4. In addition, interaction effects of extraversion and social AR past usage on shared sense of place (β = 0.107, t-value = 2.636), social interaction (β = 0.90, t-value = 1.752), and social identity (β = 0.145, t-value = 2.951) are all statistically significant. Therefore, hypotheses H5a, H5b, and H5c are supported. Control variables, including age (β = -0.017, p-value = 0.566), device (β = -0.010, p-value = 0.749), gender (β = -0.026, p-value = 0.399), and language (β = -0.031, p-value = 0.478), did not show significant effects on continuance intention to use social AR application.

*** insert Table 5.2. ***

5.2. Robustness Checks

The PROCESS macro (Model 7; Hayes, 2013) was used to assess the effects of the moderated mediation model, with continuance intention to use social AR application as an independent variable, customer-to-customer relationships as the dependent variable, shared sense of place, social interaction, and social identity as three mediators, and extraversion as the moderator. The bootstrap procedure was conducted with 5000 resamples at 90% and 95% percentile-based confidence intervals. In line with results from the PLS-SEM analysis in preceding section, results summarized in Table 6 reveals that extraversion moderated the mediation effects of three mediators, including shared sense of place (β = .1128, SE = .0699, CI = 90%, LL = .0052, UL =.2326), social interaction (β = .1679, SE = .0982, CI = 95%, LL = .0012, UL =.3887), and social identity (β = .1464, SE = .0739, CI = 95%, LL = .0264, UL =.3148). We also tested the effects of control variables on the moderated mediation model, which were insignificant. Thus, the results from analyzing data using PROCESS macro also confirmed the results from the SEM-PLS analysis.

*** insert Table 5.3. ***

Additionally, the effect of social AR past usage on customer-to-customer relationships through three mediators were assessed at three levels of extraversion: the mean value, one standard deviation above, and one below the mean. As shown in Table 7, the moderated-mediation effect is significant for all levels of extraversion. The mediating effects of shared sense of place, social interaction, and social identity were especially more salient when the level of extraversion increases. As such, the more a customer is extraverted, the higher the effect of social AR past usage on customer-to-customer relationships. It also indicates that even individuals who are less extraverted than other people may build relationships with their fellow application users through shared sense of place, social interaction, and social identity.

*** insert Table 5.4. ***

Findings from this study indicate that shared social experience, which includes shared sense of place, social interaction, and social identity, plays a key role in mediating the influence of social AR past usage on customer-to-customer relationship, which, in turn, positively impacts social AR application continued usage intention. In addition, extraversion strengthens the relationships between (1) social AR past usage and shared sense of place, (2) social AR past usage and social interaction, and (3) social AR past usage and social identity.

6. Discussion

In this research, we explore how shared social experience (i.e., shared sense of place, social interaction, and social identity) acts as the underlying mechanism that can explain the influence of social AR past usage on customer-to-customer relationships, which then leads to customers' continuance intention to use social AR applications. Results from this research also show that extraversion can intensify the relationship between social AR past usage and customer-to-customer relationships. From the study findings, we can draw several important theoretical and managerial implications for researchers and practitioners in the field of AR marketing.

6.1. Theoretical Implications

First, this study contributes to the emerging research on AR marketing by demonstrating a structured model of mediators that explain how customers create and maintain their relationships with fellow users when experiencing social AR. While the extant literature has shown the positive influence of AR characteristics, namely interactivity, vividness, and novelty, on customers' individual experience with AR (Barhorst et al., 2021; McLean & Wilson, 2019; Yim et al., 2017), our research is among the first to explore how social AR provides customers with a shared social experience through the increased shared sense of place, social interaction, and social identity. Thus, our study extends previous literature that emphasizes the importance of sociability in AR experiences (Hilken et al., 2020; Sung, 2021)

by demonstrating that social AR applications can act as more than just a tool to augment the real world. In fact, social AR applications can be considered an effective technology to build customer-to-customer relationships as users are encouraged to share and communicate with each other, through their increased shared sense of place, social interaction, and social identity.

Second, by considering shared sense of place as an imperative mediator, we provide insights on how AR's location-specificity influences customers' behaviors. In line with previous research (Javornik, 2016; Scavarelli et al., 2021), AR experience occurs in immediate and personal places, such as private rooms versus classrooms, can impact the social and interactive engagement between AR users. Our findings reveal that as social AR applications allow users to capture and virtually modify their surroundings while simultaneously sharing their specific view of a place to other people (Vella et al., 2019) despite not being in a place together, users still develop shared sense of place, which encourages them to build their relationships.

Third, our study extends previous research on AR marketing and psychology by demonstrating that extraversion strengthens the relationship between social AR past usage on shared sense of place, social interaction, and social identity. The findings are in line with recent studies which demonstrate how extraverted customers are positively engaging in and contributing to brand communities (e.g., Itani et al., 2020; Marbach et al., 2019). In fact, social AR applications can serve as an effective tool for extraverts to express themselves more vividly and communicate with other people more frequently. Our findings reveal that even customers with lower levels of extraversion take advantage of social AR applications as a means to build relationships with other application users through shared social experience. While recent research suggests that extraversion does not significantly influence customer interaction and knowledge sharing (Ranjan and Read, 2019), our study presents that

extraversion does have a role in facilitating the use of social AR applications and has an effect on developing customer-to-customer relationships.

6.2. Managerial Implications

Firms are struggling to retain their hard-earned application users. According to a recent report (Statista, 2019), the application abandonment rate after three-month usage is 71%, which means only a third of application users continue using an application. Our study addresses this concern by demonstrating that with social features that encourage communication among customers, AR applications can act as a practical tool for relationship building among like-minded users. As customers can experience an immersive experience with AR and easily share it with other people (Sung, 2021), social AR can increase the continuance intention to use the application among customers. From this perspective, social AR can be utilized for long-term marketing strategies. According to a recent report (Statista, 2020), nearly 38% of worldwide applications generate revenues by integrating different advertisements within the application while the in-application advertising market is also expected to reach USD 472 billion in 2027 (Absolute Marketing Insights, 2019). Thus, convincing users to continue to use an application can be an appropriate way for firms to generate revenue through the in-application advertising approach. Thus, in order to retain application users, managers can offer specific social AR applications for their customers where they can communicate and build relationships with each other, thus resulting in continuous use of the application.

In addition, our findings reveal how sharing and communicating among social AR application users can build customer-to-customer relationships and that encourages them to continue using the AR application. Firms should, therefore, focus on the sociability aspect when promoting their AR applications to new customers whether they are more or less extraverted, as they both can benefit from a shared social experience. For instance, firms can

advertise their AR application as a tool for customers to easily visualize or try on a product (Heller et al., 2019) but in fact, they can consider going beyond promoting their customers to interact and communicate with their friends and family when using the social AR application. As social commerce market size is growing to an expected USD 2 trillion during 2020-2024 (Business Wire, 2020), firms can recruit users by advertising the social value of their AR applications by presenting the fact that AR can also be a tool for sharing and connecting with other people.

6.3. Limitations and Future Research

This research includes some limitations that can offer future research possibilities. While we focus on the impact of social AR past usage, future research can study whether shared social experience exists in AR applications without built-in social media features and compare how different users from a social AR application and a non-social AR application build their relationships with other application users. Furthermore, as social AR applications encourage more interactions among application users, it is fruitful for future research to study more about co-creation, which is an exciting dimension of customer experience from using AR applications (Dwivedi et al., 2021).

7. Conclusion

Our research shows social AR influences people to create customer-to-customer relationships and consequently, encourages them to continue using these applications. In particular, we hypothesize that the effects of social AR past usage on customer-to-customer relationships are mediated by shared social experience, which includes shared sense of place, social interaction, and social identity. As social AR apps promote the communication of people in an augmented reality environment where they can simultaneously see other people's digital views of different physical places, consumers develop a shared sense of place which helps connect them and thus create customer-to-customer relationships. Similarly,

when using social AR apps, consumers are given more chances to increase their social interaction and social identity with other application users. Therefore, they are more likely to build relationships with people from the application. Shared sense of place, social interaction, and social identity are the mediators that strengthen the positive impact of social AR past usage on customer-to-customer relationships, which then influences users' continuance intention toward the social AR apps.

We also outline how extraversion acts as a moderator in the conceptual model. As extraverts are more willing to share their own perspectives and more frequently communicate with other people, extraversion intensifies the positive relationship between social AR past usage and shared sense of place, social interaction, and social identity, respectively. The implication is that compared to less extraverted individuals using social AR apps, extraverts are more likely to experience shared sense of place, obtain greater social interaction and social identity.

Overall, as we proposed and tested how customer-to-customer relationships are driven by shared social experience, which is derived from customers' past usage of social AR, this study offers impactful contributions to the augmented reality and marketing literature, which still lacks adequate attention and research from scholars.

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Table 1.1. Selected research on AR application usage

Study	Theoretical context	Independent variable(s)	Mediator(s)	Moderator(s)	Condition(s)	Outcome variable(s)	Main findings
AR application usage in individual context							
Yim, Chu, and Sauer (2017)	Investigating the effectiveness of two AR's media characteristics (interactivity and vividness) in product presentations.	Interactivity and vividness	Immersion	Media novelty, previous AR experience	--	Perceived media usefulness and enjoyment, attitude toward AR, and purchase intention	When AR is used for product presentations, immersion mediates the influence of AR's interactivity and vividness on customers' perceived media usefulness and enjoyment, which consequently influence their attitude toward AR and purchase intention.
McLean and Wilson (2019)	Investigating how three AR characteristics (interactivity, vividness, and novelty) influence brand engagement through four technology acceptance attributes.	Interactivity, vividness, and novelty	Perceived ease of use, usefulness, enjoyment, and subjective norms.	Purpose of AR usage (hedonic or utilitarian)		Brand engagement, satisfaction with the AR experience, and brand usage intention	During utilitarian AR usage, the interactivity and vividness of AR drive customers' perceived ease of use and perceived usefulness, which influence brand engagement, subsequently brand usage intention. During hedonic AR usage, three AR attributes affect customers' enjoyment, which leads to brand engagement and customers' satisfaction with the AR experience.
Heller et al. (2019)	Employing mental imagery theory to investigate how AR supports customer's cognitive processes in retail environment.	Imagery generation and transformation processes via AR	Processing fluency and decision comfort	--	Customers' visual processing styles and product contextuality	Customer choice and WOM	The combination of mental imagery generation and transformation via AR drives retail customers' WOM intentions and choices due to the improved processing fluency and decision comfort.
Rauschnabel, Felix, and Hinsch (2019)	Employing AR marketing literature to investigate how utilitarian and hedonic benefits and perceived augmentation quality influences changes in brand attitude through inspiration.	Perceived augmentation quality, utilitarian benefits, and hedonic benefits	Inspiration	--	--	Changes in brand attitude	Changes in brand attitude are driven by high levels of inspiration. Inspiration is also driven by the hedonic benefits that the user derives from using the AR app, but not by utilitarian benefits.
Jessen et al. (2020)	Investigating how AR influences customer behavior in their early shopping journey through	AR usage	Customer engagement, customer creativity	Assessment orientation		Anticipated satisfaction	The exploratory and playful nature of AR shopping experiences motivate customer engagement and consequently customer creativity, which then enhances customers'

	creative customer engagement.						anticipated satisfaction with the AR experience. This effect is strengthened for customers that demonstrate high assessment orientation.
Smink et al. (2020)	Investigating both positive and negative effects of AR apps on app- and brand-related responses.	AR app	Spatial presence, perceived personalization, perceived intrusiveness			Attitude towards the app, behavioral intention, brand attitude, purchase intention	AR apps positively influence customers' attitude and behavioral intention towards the app through spatial presence and perceived personalization. Perceived intrusiveness is the underlying process that explains negative effects of AR apps on customer responses, especially when the AR experience is by self-view.
Barhorst et al. (2021)	Employing flow theory to investigate how AR characteristics (interactivity, vividness, and novelty) influence customers' satisfaction during the AR experience.	Interactivity, vividness, and novelty	Flow, information utility, learning, and enjoyment	--	--	Satisfaction with the AR experience	AR technology, with the unique characteristics of interactivity, vividness, and novelty, can generate a state of flow in customers, which then leads to their satisfaction with the AR experience.
AR app usage in the shared context							
Carrozzi et al. (2019)	Employing socially situated cognition theory to investigate how customisation of AR holograms influences customer's psychological ownership through social identity needs.	Customisation	Social assimilation and dissimilation	--	Personal vs. shared AR device	Psychological ownership	When using a personal device, customisation of an AR hologram influences customers' psychological ownership of that hologram through social dissimilation. When using a shared device, social assimilation mediates the relationship between customisation of an AR hologram and psychological ownership.
Hilken et al. (2020)	Employing socially situated cognition theory to investigate how social AR supports both recommender and decision maker during shared decision-making process.	POV sharing formats and communicative acts	Social empowerment	Recommenders' communicative motives	--	Decision makers' product choice Recommenders' recommendation comfort and spillover effects	For recommenders, the optimal configuration of static POV sharing and image-enhanced acts enables greater recommendation comfort due to the feeling of social empowerment. For decision makers, image-enhanced communicative acts influence their product choice also due to social empowerment.

Sung (2021)	Employing experience economy theory to investigate how customers' experiences with immersive AR advertising leads to purchase intentions and shared social experience.	Esthetics, entertainment, education, escapism, authenticity	AR advertising satisfaction, new brand experience			Purchase intentions, shared social experience	AR experience motivations, drawn from experience economy theory, have a positive impact on customers' shared social experience and purchase intentions through their satisfaction with AR advertising and new brand experience.
Current research	Investigating how social AR past usage promotes consumer-to-consumer relationships, consequently app continuance intention	Social AR past usage	Shared sense of place Social interaction Social identity	Extraversion	--	Consumer-to-consumer relationships, Continuance intention to use social AR	Social AR influences the extent to which customers form relationship among others, consequently, affects customers' continuance intention toward the social AR app. Shared social experience mediates the positive relationship between social AR and customer relationships.

Table 4.1. Measurement Model with Factor Loadings

Construct and Indicator	Factor loadings
Social AR past usage (AVE = 0.783; α = 0.859; CR = 0.915)	
On a typical day, I use WallaMe to…	
… click "like" to photos that are shared on WallaMe	0.807
… take photos and write, draw, or add stickers on them?	0.910
… share photos that you take?	0.932
Customer-to-customer relationships (AVE = 0.784; α = 0.931; CR = 0.948)	
The time and effort I spent in the relationship with friends on the application has been worthwhile.	0.903
My relationships with my WallaMe friends have been satisfactory.	0.882
As a user, I have high-quality relationships with my WallaMe friends.	0.896
The relationships I have with my WallaMe friends are something I intend to maintain.	0.887
The relationships I have with my WallaMe friends are something I really care about.	0.858
Continuance intention to use the social AR application (AVE = 0.900; α = 0.944; CR = 0.964)	
I intend to use this application again.	0.932
I plan to keep using this application in the future.	0.953
I expect that I will continue using this application in the future.	0.960
Shared sense of place	
Virtual Place Attachment (AVE = 0.857; α = 0.833; CR = 0.923)	
Some of the places that my WallaMe friends share with me are my favorite places to visit virtually.	0.932
I feel happy virtually visiting some places that my WallaMe friends share with me.	0.919
Physical Place Attachment (AVE = 0.842; α = 0.812; CR = 0.914)	
Some of the places that my WallaMe friends share with me are my favorite places to visit physically.	0.914
I feel happy physically visiting some places that my WallaMe friends share with me.	0.921
Virtual Place Dependence (AVE = 0.836; α = 0.807; CR = 0.911)	

I would get greater satisfaction by virtually visiting some of the places that my WallaMe friends share with me.	0.894
It is important to me to virtually visit some of the places that my WallaMe friends share with me.	0.935
Physical Place Dependence (AVE = 0.810; α = 0.773; CR = 0.895)	
I would get greater satisfaction by physically visiting to some of the places that my WallaMe friends share with me.	0.876
It is important to me to physically visit some of the places that my WallaMe friends share with me.	0.926
Place Identity (AVE = 0.825; α = 0.788; CR = 0.904)	
I identify strongly with some of the places that I share with my WallaMe friends.	0.915
Some of the places that I share with my WallaMe friends are representative of who I am.	0.902
Social interaction (AVE = 0.775; α = 0.903; CR = 0.932)	
I maintain close social relationships with some of my WallaMe friends.	0.886
I spend a lot of time interacting with some of my WallaMe friends.	0.882
I know some of my WallaMe friends on a personal level.	0.855
I have frequent communication with some of my WallaMe friends.	0.897
Social identity (AVE = 0.663; α = 0.832; CR = 0.886)	
If WallaMe were criticized, it would influence how I thought about myself.	0.717
Please indicate to what degree your self-image overlaps with the identity of WallaMe users as you perceive it.	0.717
How attached are you to the group of WallaMe friends?	0.897
How strong of a connection do you feel to the group of WallaMe friends?	0.906
Extraversion (AVE = 0.598; α = 0.669; CR = 0.816)	
I am rather communicative.	0.797
I am enthusiastic.	0.844
I am gregarious.	0.669
Second-Order Latent Construct	
Shared sense of place (AVE = 0.659; α = 0.870; CR = 0.906)	
Virtual Place Attachment	0.858
Physical Place Attachment	0.834

Virtual Place Dependence	0.840
Physical Place Dependence	0.672
Place Identity	0.842

Note: α = Cronbach's Alpha, CR = composite reliability.

Table 4.2. Discriminant validity

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) C2C Relationships	**0.885**										
(2) Continuance Intention	0.818	**0.949**									
(3) Extraversion	0.532	0.482	**0.774**								
(4) Physical Place Attachment	0.608	0.544	0.415	**0.918**							
(5) Physical Place Dependence	0.438	0.363	0.396	0.572	**0.902**						
(6) Place Identity	0.673	0.607	0.452	0.595	0.502	**0.908**					
(7) Social Identity	0.776	0.667	0.411	0.496	0.326	0.583	**0.814**				
(8) Social Interaction	0.797	0.657	0.419	0.597	0.380	0.636	0.709	**0.880**			
(9) Social AR Past Usage	0.538	0.528	0.213	0.369	0.191	0.348	0.515	0.490	**0.885**		
(10) Virtual Place Attachment	0.683	0.657	0.456	0.634	0.417	0.654	0.557	0.599	0.433	**0.926**	
(11) Virtual Place Dependence	0.682	0.622	0.424	0.602	0.406	0.633	0.616	0.641	0.383	0.699	**0.915**

Notes: The diagonal values (bold) represent the square root of AVE values. The off-diagonal values represent the correlations among variables.
C2C Relationship: Customer-to-customer Relationship

Table 5.1. Indirect effect

	Estimated indirect effect	t-Value	Bias-corrected 95% confidence interval	Support for hypotheses
Social AR past usage → Shared sense of place → C2C relationships				
	0.113***	5.161	[0.082; 0.153]	H1 Supported
Social AR past usage → Social interaction → C2C relationships				
	0.142***	5.049	[0.098; 0.153]	H2 Supported
Social AR past usage → Social identity → C2C relationships				
	0.155***	6.400	[0.115; 0.196]	H3 Supported

Notes: *p < .1, **p < .01 ***p .001.
C2C Relationships: Customer-to-customer Relationships

Table 5.2. Structural Model Estimate

Relationships	**Path coefficient**	**t-Value**	**Bias-corrected 95% confidence interval**	**Support for hypotheses**
Social AR past usage → C2C relationships				
	0.096**	2.744	[0.038; 0.152]	--
C2C relationships → Continuance intention				
	0.742***	20.896	[0.680; 0.798]	H4 Supported

Extraversion × Shared sense of place	0.107**	2.636	[0.038; 0.798]	H5a Supported
Extraversion × Social interaction	0.090*	1.752	[0.008; 0.174]	H5b Supported
Extraversion × Social identity	0.145**	2.951	[0.052; 0.216]	H5c Supported

Notes: *p < .1, **p < .01 ***p .001.
C2C Relationship: Customer-to-customer Relationship

Table 5.3.
Index of moderated mediation in the relationship between social AR past usage and C2C relationships

Social AR past usage → Shared sense of place → C2C relationships				
	Index	SE	90% LL CI	90% UL CI
Moderator: Extraversion	.1128	.0715	.0064	.2374
Social AR past usage → Social interaction → C2C relationships				
	Index	SE	95% LL CI	95% UL CI
Moderator: Extraversion	.1679	.0988	.0026	.3947
Social AR past usage → Social identity → C2C relationships				
	Index	SE	95% LL CI	95% UL CI
Moderator: Extraversion	.1464	.0736	.0230	.3145

Note: SE: Bootstrapped standard error. LL: Lower limit. UL: Upper Limit. CI: Percentile-based confidence intervals (5000 resamples). C2C Relationships: Customer-to-customer Relationships

Table 5.4. Conditional indirect effect of social AR past usage on C2C relationships at different levels of extraversion

Social AR past usage → Shared sense of place → C2C relationships				
Level of extraversion	Indirect effect	SE	90% LL CI	90% UL CI
-1 SD	.3326	.0767	.2167	.4665
Mean	.4416	.0906	.3074	.6022
+1 SD	.5507	.1417	.3439	.8042
Social AR past usage → Social interaction → C2C relationships				
Level of extraversion	Indirect effect	SE	95% LL CI	95% UL CI
-1 SD	.4784	.1062	.2860	.6982
Mean	.6409	.1264	.4204	.9140
+1 SD	.8033	.1974	.4685	1.2517
Social AR past usage → Social identity → C2C relationships				
Level of extraversion	Indirect effect	SE	95% LL CI	95% UL CI
-1 SD	.3312	.0764	.1873	.4890
Mean	.4728	.0877	.3132	.6620
+1 SD	.6145	.1403	.3805	.9200

Note: SD: Standard deviation. SE: Bootstrapped standard error. LL: Lower limit. UL: Upper Limit. CI: Percentile-based confidence intervals (5000 resamples). C2C Relationships: Customer-to-customer Relationships