Make it real, Make it useful! The impact of AR social experience on brand positivity and information sharing.

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Abstract

Purpose: This study investigated the impact of the perceived Augmented Reality (AR) social experience of restaurant menus on two types of prosocial behaviors: brand positivity and brand information sharing.

Design/methodology/approach: This study adopts the expectancy-value model as a framework, drawing on the cognitive load, self-determination, and media richness theories. Using a sample of 879 participants from the United States, the research model was tested using structural equation modeling (PLS-SEM).

Findings: The findings indicate that the social experience derived from using AR menus significantly predicts brand positivity and brand information sharing. The perceived usefulness of AR mediates this relationship. Moreover, AR reality congruence acts as a significant mediator between perceived AR social experience and brand positivity but not brand information sharing. The positive relationship between AR social experience, brand positivity, and brand information sharing is sequentially mediated by AR reality congruence and AR usefulness.

Originality/Value: This groundbreaking research pioneers a fresh perspective, delving into the impact of AR social experiences on consumers' prosocial behaviors, specifically brand positivity and information sharing. Unravels intricate mechanisms, shedding light on how and under what circumstances AR social experiences foster positive behaviors within the dynamic realm of food services and restaurant settings. This study provides valuable insights for restaurant managers and marketers to leverage AR technology to create engaging and immersive customer-dining experiences, a concept that has not been thoroughly explored in previous studies.

Keywords: Augmented Reality, Social Experience, Reality Congruence, Reality Usefulness, Brand Positivity, Brand Information Sharing, Restaurant Industry.

1. Introduction

The food industry is currently undergoing a rapid transformation driven by dynamic customer interactions, engagement, and the massive potential integration of cutting-edge technology (Chai *et al.*, 2022). In this evolving context, restaurants have encountered the challenge of attracting customers by offering exceptional experiences. Digital technologies play a crucial role in meeting diverse customer needs, and desires by providing restaurants with opportunities to create unique and personalized experiences (Batat, 2021). Augmented reality (AR) is a recent interactive technology that enables the overlay of digital data onto a real-life environment captured through a camera or other image-capturing devices, allowing users to explore the surrounding environment using mobile technologies (Flavián *et al.,* 2019; Georgiou and Kyza, 2017). AR technology adoption is surging with anticipated market value to hit $198 billion in 2025 (Anthony, 2023). AR technology offers various new activities, including product trials, virtual try-on experiences, information searches, exploration, acquisition, and navigation (Olya *et al.*, 2020). Moreover, it is expected to play a significant

role in various industries, including hospitality (Dieck *et al.,* 2018; Jung, Lee, Chung, & tom Dieck, 2018; Ali, 2022).

In light of today's rapidly changing consumer behavior and attitudes, restaurant businesses are in demand to provide experiences that are greatly different from what is already offered. Consequently, restaurants are increasingly evolving to be more responsive, personalized, and interconnected, catering directly to the customer experience (Balasubramanian and Konar, 2022). This evolution has allowed restaurants to offer more memorable and socially engaging experiences within their service environments (Batat, 2021). Social experience refers to interactions and activities that involve individuals or groups within a social context. It encompasses shared activities, communication, cultural exchanges, and emotional connections that contribute to a sense of belonging, understanding, and mutual engagement among people (Miller *et al.*, 2019). In this vein, Hirskyj-Douglas et al., (2020) defined AR social experience as the perceived encounter that customers have when using augmented reality technology to initiate, support, encourage, or mediate in-person interactions involving two or more people.

AR technology has attracted significant industry investment, particularly in the food and beverage sector, to enhance customer experience, however, academic research into its impact on consumer judgments and behaviors in this context is still in its infancy (Fritz *et al.*, 2023). Consequently, various efforts have been made to better understand the role of AR technology in the food and beverage industry, with a focus on several research streams. Çöl *et al.* (2023) conducted a comprehensive review of AR technology in the food industry. Fritz, Hadi, and Stephen, (2023) found that AR enhances consumers' mental simulation of food consumption, thereby, enhancing their desire and likelihood to purchase. Balasubramanian and Konar (2022) investigate the prospects of an AR-integrated menu in producing a healthy dining experience with nutritional information as well as a realistic/immersive dining pace. Bhavadharini *et al.* (2023) explored how augmented, and mixed reality affects consumer food choices, leading to new product development, real-time shopping insights, and an understanding of emotional influences on product selection. Styliaras, (2021) study explores the current utilization of augmented reality applications in the food analysis and promotion sectors through products and orders.

While these investigations have yielded valuable insights into our understanding of AR technology, a fundamental question remains unanswered: How does the social experience gained from using AR technology affect consumer prosocial behavior? This study aims to fill this gap in the literature. To the best of the author's knowledge, only two attempts have been made to investigate the consequences of customer experiences with AR on consumers within the food and beverage context. Ali (2022) developed a measurement scale to evaluate consumer experiences with AR technology, encompassing utilitarian, hedonic, and social aspects in the restaurant industry. The study subsequently tested the scale's efficacy in predicting consumer behavior within the same context. Batat (2021) investigated AR applications in the restaurant sector, highlighting their sensory, affective, behavioral, and social impacts that positively or negatively influence restaurant experiences. Ali (2022) and Batat (2021) emphasized AR's positive impact on behavioral intentions and customer experiences across various dimensions in the restaurant industry, calling for further investigation to better understand the

consequences of AR technology on consumer behavior. Moreover, the current literature is inadequate for determining the impact of AR social experiences on customer behavior (Ali, 2022; Loureiro *et al.*, 2020; Sung, 2021; Yawised *et al.,* 2023). Paul *et al.* (2024) claimed that limited research has been conducted on the social interaction impacts and consequences of AR technology on consumers. This study responds to the increasing call for further exploration of the consequences of AR technology. It complements previous research within this domain by examining the effects of AR social experiences on customer pro-social behavior, an area that has not yet been investigated.

Customer prosocial behavior refers to discretionary social actions (behaviors) of customers that are not directly or explicitly expected or rewarded and are aimed at benefiting others, including society, individuals, or brands. These actions reflect customers reciprocating those who benefit from them (Kordshouli *et al.*, 2016; Pfattheicher *et al.*, 2022). Previous studies (e.g., Ali, 2022; Van Tonder *et al.,* 2020) have acknowledged that when customers achieve desired outcomes through their interactions with a brand, they are likely to share positive emotions, behaviors, and thoughts with others, which can manifest as actions such as sharing brand information and having a positive attitude toward the brand (Abdelrazek and El-Bassiouny, 2023; Kim *et al.*, 2023). Therefore, in this study, brand positivity and brand information sharing were chosen as two forms of customer pro-social behavior. Brand positivity refers to favorable expressions about a brand, whereas brand information sharing involves communicating detailed explanations or promotions about the brand (Wong and Hung, 2023).

Moreover, as a step forward, this study aimed to investigate the mechanism underlying the expected relationship between perceived AR social experience and pro-social behavior. The media richness theory explains why various forms of media yield varying levels of productivity (Daft & Lengel, 1986; Shahbaznezhad *et al*., 2021). In the context of the highly experiential fast-food service sector, reality congruence evaluates how closely the displayed product resembles the real product (Kowalczuk *et al*., 2021; Ali, 2022), potentially influencing the experience of restaurant-goers. Kowalczuk *et al.* (2021) proposed that AR reality congruence significantly influences AR media usefulness, consequently motivating positive customer behavioral responses. They also indicated that the perceived fit between virtual and real products is relevant for other mixed-reality technologies, suggesting the necessity for further research to apply the proposed model variables to various product categories and choice situations. Usefulness is a key component of the Technology acceptance model, defined as the degree to which customers believe that a particular platform can help them achieve their desired goals (Davis, 1989; Harrigan *et al.*, 2021). Thus, usefulness and reality congruence were considered two potential factors that could mediate the relationship between perceived AR social experience and prosocial behavior.

Overall, the research problem of this study centers on the underexplored zone of AR experiences within the food service and restaurant contexts. The two research questions guiding this study are: (1) To what extent does AR-enhanced social experience influence brand information-sharing and brand positivity? (2) Do reality congruence and usefulness mediate the relationship between AR-enhanced social experience and brand information sharing and brand positivity? By answering these two questions, we aimed to accomplish the following objectives: First, we investigated the impact of perceived AR social experience on brand information sharing and brand positivity. Second, we examined the potential mediating roles

of reality congruence and usefulness in the relationship between perceived AR social experience, brand information sharing, and brand positivity. Third, we explored the sequential mediation effect of reality congruence and usefulness in the relationship between AR customers' social experience, brand information sharing, and brand positivity. This study is rooted in the framework of the expectancy-value model (Eccles *et al.*,1983), which suggests that people's decisions rely on their expectations (beliefs) of the outcomes and the value they assign to these outcomes. We utilized the expectancy-value model as a theoretical framework and cognitive load theory (Sweller, 1988), media richness theory (Daft and Lengel, 1986), and self-determination theory (Deci and Ryan, 1985) to explain the relationship between the constructs of the study.

This study contributes to the literature in several ways. Firstly, this study responds to Ali's (2022) call to validate the perceived AR social experience scale developed in restaurant configurations different from its original development. To accomplish this, the current study employed the perceived AR social experience scale within the fast-food context for the first time. Second, this study extends the predictive validity of the perceived AR social experience scale to brand-related outcomes (brand information sharing and brand positivity), which previous studies have overlooked by focusing solely on consumer purchase intention. Third, it highlights the impact of AR social experiences in restaurants on brand-information sharing and brand positivity, a neglected relationship. Fourth, it explores the role of AR reality congruence and usefulness in connecting AR social experiences with brand information sharing and brand positivity. Additionally, it investigated the sequential mediation effect of AR reality congruence and usefulness on the relationship between AR social experiences, brand information sharing, and brand positivity. Hence, by examining these relationships, this study contributes to a deeper understanding of how AR technology influences consumer behavior in food and restaurant settings. This adds insights into technology-consumer-psychology interactions in food services and marketing. Furthermore, the study offers managerial insights, emphasizing the importance of AR in food services, restaurants, and hospitality settings, the need for interactive applications, and the significance of effective marketing strategies employing the latest technologies, such as AR.

2. Literature Review

2.1 Expectancy-Value Model as a Conceptual Framework

This study utilizes the expectancy-value model (Eccles *et al.*, 1983) as a conceptual framework within the context of the study. Scholars have extensively used the expectancy-value model to investigate the consequences of using new media and information technology (Kang *et al.*, 2023). The expectancy-value model posits that individuals make decisions and form attitudes based on their expectations (beliefs) regarding the consequences of their actions and the assessment (value) of these outcomes (J. S. Eccles et al., 1983; Littlejohn and Foss, 2010). In this study, perceived AR social experience serves as an action that represents individuals' engagement with AR technology in social settings. This engagement is shaped by expectations or beliefs about the outcomes of the AR social experience, such as enhanced interaction with brands and positive brand perceptions. Palmgreen and Rayburn (1982) claimed that attitudes toward objects are formed based on individuals' beliefs about the object and the evaluative responses associated with these beliefs. Hence, the value component of the expectancy-value model comes into play as individuals assess the outcomes associated with their AR social

experience based on perceived benefits and behave accordingly. In this study, the two benefits that could be perceived were the usefulness of the AR technology and its congruence with reality. Positive evaluations of these outcomes are expected to lead to more positive attitudes toward the brands involved (Arghashi and Yuksel, 2022; Kowalczuk *et al.*, 2021; Lim *et al.*, 2024). Therefore, by examining the relationships between perceived AR social experience, perceived AR usefulness, AR reality congruence, and brand-related outcomes such as information sharing and brand positivity, this study aims to understand the underlying mechanisms through which AR experiences influence brand-related outcomes (brand positivity and brand information sharing) within the theoretical framework of the expectancy-value model. Additionally, to further support the study's hypotheses, three psychological theories were applied: cognitive load theory (Sweller, 2020) to explain the direct impact of perceived AR social experience on brand-related outcomes, and self-determination theory (Deci and Ryan, 1985) alongside media richness theory (Daft and Lengel, 1986) for the mediation effect of both the perceived usefulness of the AR menu and reality congruence. Figure 1 presents the conceptual framework of this study.

[Figure 1 here]

2.2 AR in the Restaurant Industry

The convergence of global exogenous shocks significantly affects businesses, resulting in environmental uncertainty. Consequently, industries have increasingly adopted cutting-edge technologies such as AR (Ameen, Viglia, and Altinay, 2023). Food services and restaurants thrive through innovative menus, service technologies, and unique experiences to meet evolving customer expectations (Gómez-Rico *et al.,* 2022). The restaurant industry has witnessed numerous applications in AR technology. One notable example is the innovative "Le Petit Chef" concept, which utilizes a 3D video mapping technique (Batat, 2021). An example of AR technology in restaurants is an AR menu. The AR restaurant menu is a digital menu system that incorporates AR technology to enhance the dining experience of customers. It combines virtual elements with physical menus, allowing customers to interact with menu items in a highly immersive and engaging manner. When visiting a restaurant that utilizes this technology, placing a smartphone in front of the QR code opens the menu and provides access to detailed information about the 3D modules of the dishes (Çöl *et al.,* 2023). Batat (2021) conducted an exploratory analysis using a qualitative multi-method approach and found that AR can affect consumers' perceptions of restaurant experiences across sensory, affective, behavioral, social, and intellectual dimensions, ultimately influencing their attitudes toward AR in the restaurant industry. In addition, Ali (2022) a study using restaurant-goers in the United States found that implementing AR technology in restaurants significantly contributes to positive behavioral intentions. Moreover, the review by Çöl *et al.* (2023) provides an overview of the AR technology and its applications in the food industry.

Researchers have approached AR technology in various ways. For example, Javornik, (2016) and Qin *et al.* (2021) highlighted interactivity and virtuality as the significant characteristics of AR applications. Kowalczuk *et al.*, (2021) operationalized AR in terms of interactivity, system quality, product informativeness, and reality congruence. Yim *et al.* (2017) focus on the interactivity and vividness of AR applications. Ali (2022) developed a measurement scale to evaluate the restaurant industry's consumer experience with AR technology. The scale

consisted of 19 items across three dimensions: utilitarian, hedonic, and social. Ali also included a five-item component within the social dimension that assesses the collective, interactive, engaging, co-creative, and connected aspects of AR technology. This study adopts the social dimension of the AR app proposed by Ali (2022). Building on prior studies on AR (Ali, 2022; Batat, 2021), this study defines perceived AR social experience as the socially driven encounters that customers have while using AR menus in restaurants, involving enhanced interactivity, customer collaboration during navigation, engagement efforts, a sense of connection, and shared interaction and information among customers.

2.3 Effect of AR Social Experience on Brand Information Sharing and Brand Positivity

Cognitive load theory, which is widely recognized in psychology, focuses on mental effort during tasks (Sweller, 2020). this warns that too much information can overwhelm consumer, leading to negative attitudes toward products and less willingness to engage (Ayres, 2020; Semin & Smith, 2013). This theory impacts education (Sweller, 2020), health science (Ghanbari *et al*., 2020), and marketing (Kao and Wu, 2019),, emphasizing the need to present information to optimize learning, user experience, and consumer behavior. AR technology can reduce cognitive load by offering virtual representations of products that closely align with consumers' bodies and environments, reducing their reliance on imagination and enhancing their mental imaging capacity (Buchner *et al*., 2022). This process can augment consumers' mental imaging capacity and simplify the processing of information related to brands and products. Based on the cognitive load theory, we expect that the use of restaurant AR menus will play a vital role in enhancing consumers' overall perception of the brand, thus increasing their willingness to engage in behaviors such as sharing information about the brand and maintaining positive images toward the brand. Therefore, we hypothesize as follows:

H1. Perceived AR Social Experience has a Positive Impact on (a) Brand Information Sharing and (b) Brand Positivity.

2.4 Perceived Usefulness as a Mediator

The self-determination theory proposed by Deci and Ryan (1985) offers a framework for comprehending human behavior and motivation, positing that individuals inherently seek autonomy, competence, and relatedness (Deci *et al*., 1991). Autonomy involves decision ownership, competence relates to achievement, and relatedness pertains to a sense of belonging (Ryan and Deci, 2020). Self-determined individuals engage in activities outside of personal volition driven by genuine interest and intrinsic satisfaction (Song *et al*., 2021). Thus, enhancing customer participation and engagement is critical. Therefore, recognizing the utility of AR technology significantly influences consumer attitudes (Chung *et al.*, 2015), and such applications are regarded as more useful than regular apps (Yim *et al.*, 2017). In addition, an investigation of the impact of AR on customer brand engagement revealed that perceived usefulness has a significant mediation effect on this relationship (Diaa, 2022). In the context of AR social experiences, we expected perceived usefulness to act as a mediator that influences the relationship between AR experience and brand-related outcomes.

Perceived usefulness is widely acknowledged as a critical factor in the technology acceptance model (TAM), reflecting users' belief that technology enhances their performance (Davis 1989). In the specific context of a restaurant's AR menu, we define AR-perceived usefulness as the users' perception of the menu that assists in attaining activity objectives. We

hypothesized that using an AR menu would enhance perceived usefulness. This increase can be attributed to users having control over their interactions and engagement with the menu (Bansal *et al.*, 2022; McLean & Wilson, 2019; tom Dieck *et al.*, 2018), thus promoting a sense of autonomy. In addition, users may perceive competence by acquiring new knowledge and skills (Nhan *et al*., 2022) through the AR menu, which fosters a sense of relatedness. Moreover, the AR menu enables users to connect and engage with others in a social context (Batat, 2021), thereby enhancing the feeling of relatedness. Empirical findings support this notion. McLean and Wilson (2019) found that AR features directly affect the perceived usefulness of AR technology. Thus, we hypothesize as follows:

H2. Perceived AR social experience has a positive impact on the perceived usefulness of the AR menu.

By contrast, when individuals recognize the utility of a specific technology, such as a restaurant AR menu, they develop positive brand-related behaviors (Arghashi and Yuksel, 2022), such as brand information sharing and brand positivity. A recent study conducted by Khalil *et al.* (2023) revealed that the perceived usefulness of AR technology plays a critical role in enhancing consumers' positive attitudes. Van Tonder & Petzer, (2018) found that perceived usefulness of technology is a significant predictor of customer help and advocacy behaviors. Based on this information, we propose the following hypotheses:

H3. The perceived usefulness of an AR menu has a positive impact on (a) brand information sharing and (b) brand positivity.

Considering that perceived AR social experience may have a predictive effect on perceived usefulness (H2), subsequently fostering prosocial customer behaviors, such as brand information sharing and brand positivity (H3), perceived AR usefulness can be considered a mediator, reinforcing the connection between AR social-enhanced experience and the outcomes of brand information sharing and brand positivity.

H4. The relationship between the perceived AR social experience and (a) brand information sharing and (b) brand positivity is mediated by perceived AR usefulness.

2.5 AR Reality Congruence as a Mediator

Media richness theory can be applied to argue that a perceived AR social experience using an AR menu positively affects AR reality congruence. According to Daft and Lengel (1986), communication effectiveness is influenced by the richness of the communication medium employed. (Suh, 1999) further argued that communication media varies in the richness of information processing based on several factors, such as feedback capability, communication channels, language, and personal focus. The more a medium incorporates these characteristics, the richer it becomes. Consistent with this notion, Fritz *et al*., (2023) and Sung (2021) confirm that 3D advertising surpasses 2D advertising in terms of richness, presence boosting, product knowledge, brand attitude, and purchase intention.

In this study, The AR menu elevated the dining experience by enabling immersive engagement with virtual food through virtualization and interactive features. This aligns with Suh's concept of richness, which enhances information density, provides sensory cues, and facilitates interactive exploration (Batat, 2021). This interactive and visually stimulating experience may bridge the gap between the physical and virtual realms, increasing the sense of congruence between the user's perception of reality and the presented AR. Based on this rationale, we propose the following hypothesis:

H5. Perceived AR Social Experience has a Positive Impact on AR Reality Congruence.

AR congruence reflects enhanced media richness in which menu items are presented realistically, providing an immersive and effective user experience (Kowalczuk *et al.,* 2021). The study conducted by De Amorim *et al.* (2022) supported the argument that media richness (i.e., AR reality congruence in this study) is a significant predictor of customers' cognitive responses. These cognitive responses, in turn, affect consumer behavior. For instance, a study conducted by Kowalczuk *et al.* (2021) demonstrated the positive impact of AR reality congruence on customer behavior and intention and provided empirical evidence linking AR reality congruence to favorable customer responses and behavioral outcomes. Therefore, we hypothesize as follows:

H6. AR reality congruence has a positive impact on (a) brand information sharing and (b) brand positivity.

Researchers have suggested that the attractiveness and informativeness of virtual product displays are important in evoking cognitive reactions such as perceived usefulness (Flavián and Casaló, 2022). The expectancy-value model proposes an intercorrelation between perceived relevance (i.e., AR reality congruence) and the perceived likelihood of success (i.e., AR usefulness) (Jacquelynne *et al*., 2002; Leaper, 2011). Empirical findings support this notion. For instance, Kowalczuk *et al.* (2021) found that AR congruence significantly predicts AR usefulness. Therefore, we hypothesize as follows:

H7. Reality congruence of the AR menu positively affects the usefulness of the AR menu.

Considering the influence of perceived AR social experience on AR reality congruence (H5), which subsequently affects brand information sharing and brand positivity (H6), the positive relationship between perceived AR social experience and brand information sharing, as well as brand positivity, may be mediated by AR reality congruence. Based on this rationale, we propose the following hypotheses:

H8. The relationship between the perceived AR social experience and (a) brand information sharing and (b) brand positivity is mediated by AR reality congruence.

Similarly, given that perceived AR social experience has the potential to predict AR reality congruence (H5), which can then predict AR usefulness (H7) and subsequently influence brand information sharing and brand positivity (H3), the positive association between AR social experience, brand information sharing, and brand positivity is sequentially influenced by AR reality congruence and perceived usefulness. Hence, we propose the following hypotheses:

H9. The relationship between the perceived AR social enhanced experience and (a) brand information sharing and (b) brand positivity is sequentially mediated by AR reality congruence and perceived AR usefulness.

3. Methodology

3.1. Sample and Data Collection

This study focuses on frequent restaurant-goers in the US, using convenience sampling via MTurk and Qualtrics tools for data collection, a commonly used method in the food industry (Lefebvre and Orlowski, 2020; Mainolfi *et al.*, 2022). As no data collection approach is free of failure (Chinchanachokchai and de Gregorio, 2020), several procedures were followed to mitigate the potential limitations associated with the use of MTurk. An attention check

question was used to filter out respondents who might not be fully engaged or provide accurate responses, as recommended by (Aguinis *et al.*, 2021). One captcha verification question is to avoid obtaining responses from non-human workers (Chmielewski and Kucker, 2020). Participants who completed the survey within five minutes or less were excluded (Peer *et al*., 2014). Only respondents with previous experience in AR restaurant menus were included in this study. Therefore, the screening question, 'Have you ever used an AR restaurant menu?' was included at the beginning of the survey. Considering that MTurk participants are more attentive to instructions than other data collection tools (e.g., students) (Graça and Kharé, 2023), clear instructions were added at the beginning of the survey. Consequently, the study participants were required to respond to an informed consent question.

The survey method was selected as the most commonly used approach in AR studies (Dey *et al.*, 2018). We included a video in the survey to assist eligible participants in recalling previous memories and experiences in the restaurant's AR menu (Kang *et al.*, 2023). The video shows extensive utilization of an AR menu in a restaurant, encompassing activities such as browsing, visualizing, selecting food items, and placing orders. Participants were asked to imagine a scenario (Huang, 2021) in which they visited the Infinity Restaurant, a new establishment in their area, for lunch. Upon being seated, they were presented with an AR-enabled menu. After eligible participants watched the video, they completed an online self-administered survey. The data collection process took place between April 15, 2023, and April 29, 2023. A total of 879 responses from an online survey were analyzed (Mainolfi *et al.*, 2022). The participants included 47.7% females and 52.3% males. Generation Z (23.8%), Generation Y (46.6%), Generation X (19.8%), and Baby Boomers (10%). Additionally, all respondents dined out weekly; about 60.5% frequented restaurants to 2-3 times a week. In terms of education, 66.8% held bachelor's degrees, 23.4% held master's degrees, and 7.2% held diplomas or lower.

3.2. Measurement

This study utilized a well-designed questionnaire derived from prior research, with four sections: 1) objectives, 2) YouTube videos showcasing the AR menu, 3) research model measurements, and 4) demographics. Perceived AR social experience was assessed using five items adapted from Ali (2022), originally developed for restaurant use, with items in a summarized form. A literature review clarified these terms and converted them into a seven-point Likert scale. A pilot test verified their accuracy in capturing the intended meaning based on Ali's (2022) study. The pilot group comprised marketing professors, AR researchers, and doctoral marketing students. No significant changes were suggested after the pretests, confirming the items' meticulous crafting, ease of understanding, appropriate length, and clear wording. Perceived AR reality congruence employed six items from Kowalczuk *et al.* (2021), whereas AR menu usefulness was measured using four items from Flavián and Casaló (2022). Brand information sharing and brand positivity were measured using five and four items respectively, adapted from Wilk *et al*. (2020). Table 1 lists all the items of each construct. Attention check questions were inserted to ensure response engagement (Peer *et al.*, 2014), For example, "To what extent do you agree that an apple's fruit color is black? Items were rated on a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree).

[Table 1 here]

3.3. Assessing the Measurement Model

Smart-PLS 4 was utilized for the analysis to evaluate the validity and reliability of all constructs to ensure the quality of the outer model. The Cronbach's alpha values of the variables ranged from 0.83 to 0.89, indicating reliable internal consistency. The composite reliability of the five variables exceeded 0.7. Item loadings (0.71 to 0.88) confirmed indicator reliability. Adequate convergent validity was confirmed by item average variance extracted (AVE) values exceeding 0.5 (Hair *et al.*, 2021), as shown in Table 1. Discriminant validity was confirmed as shown in Table 2, where the square root of AVE for each factor pair exceeded the correlation between factors (Fornell and Larcker, 1981), the Heterotrait Monotrait (HTMT) ratios were all below 0.90, confirming validity across constructs (Henseler *et al.,* 2015). The collinearity tests, displayed in Table 1, revealed variance inflation factor (VIF) values below 3.3 for all indicators, indicating no collinearity (Hair *et al.*, 2021). Moreover, as shown in Table 3, full collinearity test results of VIF values below 3.3, suggest no common method bias (Kock, 2015). This thorough measurement model evaluation establishes a robust foundation for the subsequent analysis phases.

[Table 2 here]

[Table 3 here]

4. RESULTS

4.1 Hypothesis Testing

To test the model's hypotheses, a bootstrapping method using Smart-PLS with 5.000 subsamples was used, generating a 95% confidence interval (Hair *et al.*, 2018); the results are presented in Table 3. The overall model quality assessment included variance explained by endogenous construct determination coefficients, the effective size of (f^2), Q-square(Q^2), (β) coefficient, and t-values statistics were obtained. The (R^2) values of variables exceeded the recommended threshold of 0.10 (Falk and Miller, 1992). The model explained the variances of 52.0% in AR reality congruence, 66.1% in AR usefulness, 67.7% in brand positivity, and 53.1% in brand information-sharing. Assessment of the model's effect size (f^2), as suggested by Cohen (1988), where (>=0.02 small; >= 0.15 medium;>= 0.35 large), this quantifies the contribution of each exogenous construct to the outcome variable's R^2. The (f^2) values for perceived AR social experience on other model constructs exceeded thresholds of 0.15 or 0.35, highlighting the intrinsic influence of perceived AR social experience on the study constructs, the (f^2) of AR reality congruence on AR usefulness is moderate, and weak on both brand information sharing and brand positivity. Moreover, the effect size of AR usefulness is moderate for brand positivity but weak for brand information sharing. The Q-square assesses the predictive relevance of endogenous constructs. Following Shmueli *et al.* (2019), Q^2 values (0.493-0.594) indicate strong model relevance.

This study demonstrates that all direct effects are significant except between AR reality congruence and brand information sharing. Perceived AR social experience predicted brand information-sharing ($\beta = 0.51$, $p < 0.05$) and brand positivity ($\beta = 0.392$, $p < 0.05$), thus supporting H1a and H1b. Moreover, the direct relationship between perceived AR social experience and AR usefulness is significant ($\beta = 0.506$, $p < 0.05$), supporting H2. In addition,

a significant relationship was found between AR usefulness and brand information-sharing (β = 0.317, p < 0.05) and brand positivity (β = 0.385, p < 0.05). Thus, H3a and H3b were supported. A significant direct link was found between perceived AR social experience and AR reality congruence (β = 0.721, p < 0.05), and between AR reality congruence and brand positivity (β = 0.114, p < 0.05), affirming H5 and H6b. Similarly, the direct relationship between AR reality congruence and AR usefulness (β = 0.369, p < 0.05) affirms H7. The direct relationship between AR reality congruence and brand information sharing is not significant (β = -0.07, p > 0.05). Thus, H6a was not supported.

The indirect effects showed that AR reality congruence significantly affected the relationship between perceived AR social experience and brand positivity (β = 0.082, $p < 0.05$), supporting H8b. The indirect effect of perceived AR social experience on brand information sharing through AR reality congruence was not significant (β = -0.051, $p > 0.05$). Thus, H8a was not supported. Furthermore, AR usefulness was a significant mediator in the relationship between perceived AR social experience and both brand information sharing (β = 0.160, $p < 0.05$) and brand positivity (β = 0.195, $p < 0.05$). Therefore, H4a and H4b were supported. Moreover, the results confirmed the sequential mediation effect of AR reality congruence and AR usefulness on the relationship between perceived AR social experience and brand information sharing (β = 0.084, $p < 0.05$) and brand positivity (β = 0.102, $p < 0.05$), thus supporting H9a and H9b respectively.

5. Discussion

5.1 Theoretical Implications

The current top technologies are virtual reality and AR, which allow businesses to improve customer prosocial behavior (Jacobsen *et al.*, 2021). Business AR technologies are considered valuable long-term strategic assets that are distinct from other digital marketing tools because they enhance enjoyment and minimize customer uncertainty (Rauschnabel *et al*., 2019; Hoyer *et al*., 2020). This study makes several important theoretical contributions to the existing literature. First, the influence of AR menus on brand positivity and brand information-sharing remains poorly understood. This investigation of AR technology rejuvenates the literature on the role of AR social experience in influencing brand-related behavior within the restaurant context. To the best of our knowledge, very limited attention has been paid to exploring the impact of AR experience on consumer behavior within this context. Hence, this study extends Ali's (2022) and Batat's (2021) works by first emphasizing the social aspect and uncovering the novel outcomes of AR social experiences within the restaurant setting. Second, consistent with the expectancy-value model, the findings of this study revealed that customer social experience driven by the usage of AR menus in restaurants could serve as a predictor of customer responses. This is in line with previous studies that argued that AR technology has a positive effect on consumer behavior. However, this study is the first to investigate brand information sharing and brand positivity as key outcomes of perceived AR social experience within the food context. Hence, this study contributes to the literature by extending our understanding of the impact of AR technology within the food context, shedding light on the previously unexplored dimensions of brand information-sharing and brand positivity resulting from perceived AR social experience. Furthermore, the findings of this study support the power of cognitive load theory and its applicability in explaining the consequences of AR technology on consumers in the food industry.

Third, this study is the first to adopt Ali's (2022) newly developed scale and implement it in different contexts, according to his recommendations, to assess its validity. The findings of this research unveil the scale's effectiveness in capturing social experiences evoked by the utilization of AR menus. Fourth, this study contributes to the AR literature by, for the first time, incorporating AR reality congruence as a factor in examining the impact of AR on consumer behavior. The results of our study indicate that utilization of a restaurant AR menu enhances AR reality congruence, subsequently leading to increased brand positivity. This shows that when AR elements align with users' expectations of reality, their overall experience and positive attitudes toward the brand are enhanced. This finding is in line with previous studies that emphasize the crucial role of consumers' perception of the presentation of a product as closely matching the actual item in eliciting positive consumer responses (e.g., Kowalczuk *et al.*, 2021). Interestingly, this case is not similar to brand information sharing. Fifth, this study's findings revealed that the level of alignment between the AR experience and the user's perception of reality does not play a significant role in influencing the user's likelihood of sharing brand information. This means that sharing brand information may involve more than just congruence between the AR experience and user's perception of reality. Considering that perceived AR-enhanced social experience directly affects brand information sharing, as per the findings of this study, other factors are involved in influencing this behavior, such as users' motivation to share information and the perceived value and usefulness of using the AR menu. One such factor is the perceived usefulness of an AR menu, which serves as a significant mediator in this relationship, according to the findings of this study. Finally, this study contributes to the AR and restaurant literature by empirically demonstrating a noteworthy discovery: the link between perceived AR social experience and brand information sharing, mediated by reality congruence, becomes significant when customers perceive the usefulness of AR menus. Additionally, the results indicate that the sequential mediation of AR reality congruence and AR usefulness plays a role in the indirect relationship between AR social experience and brand positivity. These findings highlight the importance of perceived AR usefulness in examining the indirect relationship between perceived AR social experiences and prosocial customer behaviors, such as brand positivity and sharing information, through AR reality congruence.

5.2 Managerial Implications

This study has valuable implications for managers, marketers, and technology developers in the context of food industry services. This study revealed that food companies, especially restaurants, should consider substituting traditional paper menus with AR-powered menus. First, AR technology can enhance positive brand-related outcomes by reducing the cognitive load of customers, which in turn fosters a more positive attitude towards the brand. Hence, understanding and taking action to invest in AR technology by allocating resources and collaborating with technology providers to develop tailored AR solutions that foster social interactions and positive customer experiences are essential. Second, managers and decision-makers should design engaging AR experiences that promote social interaction and collaboration among customers, incorporating gamification elements, interactive features, and social sharing functionalities to make the AR experience enjoyable and memorable. Third, managers should implement AR services that stimulate user-generated content by encouraging customers to share their AR experiences on social media platforms and review sites, using branded hashtags and incentives. This approach amplifies positive word-of-mouth marketing and enhances brand visibility. Fourth, Managers should use AR services to incorporate feedback mechanisms to gather customer input on their AR experience, which can be used to identify areas for improvement and optimization, allowing for iterative enhancements of AR features, menu offerings, and service delivery. This iterative process ensures that AR

experiences align closely with customers' needs and expectations. Fifth, AR reality congruence is crucial, and managers should ensure seamless integration with the physical menu and environment to create a cohesive and immersive experience by aligning AR content visually and contextually with physical menus to enhance realism and authenticity, thereby positively influencing customer perceptions. Sixth, based on the study, managers and decision-makers should simultaneously optimize both AR reality congruence and perceived usefulness, since it enhances the relationship between AR-enhanced social experiences and brand-related outcomes. Finally, AR menus can be integrated with loyalty programs and customer feedback mechanisms to gather valuable information about customer preferences, behaviors, and satisfaction levels; businesses can better understand their customers' needs and preferences, allowing strategic marketing managers to tailor their offerings and strategies. This can empower food service and restaurant industry managers to understand their customers better, enhance brand engagement, and drive long-term business success.

6. Limitations and Future Studies

Although this study offers valuable findings and managerial implications, it also has a few limitations. This study was conducted in a restaurant context; therefore, the findings may not be generalizable to other contexts, because of the distinct characteristics of each sector. Future research should replicate this conceptual model in different contexts to identify potential differences. The reliance on perceived social experiences of AR may introduce a potential gap between participants' subjective perceptions and the objective reality of their experiences. Although perceived experiences offer valuable insights into participants' attitudes, they may not fully capture consumers' actual behavior by interacting with AR technology. This variation can limit the generalizability of the study's findings as they may not accurately reflect how consumers would behave in real-world scenarios. The survey items used to measure AR social experience perceived usefulness, and AR reality congruency were likely to be more understandable if participants were provided with an actual menu containing AR components before answering the survey questions. Although various methods were employed to simulate the experience of using a real AR menu in this study (e.g., using a video demonstration, recalling previous experiences with AR menus, and encouraging participants to imagine previous experiences), the results may be more accurate if a real AR menu is utilized. Hence, future research should incorporate experimental designs in real-world restaurant settings with real AR menus to bridge the gap between perceived and actual AR social experiences and enhance the study's ecological validity and generalizability.

Given that the adoption of technology rates may vary across generations (Calvo-Porral and Pesqueira-Sanchez, 2019; Ameen *et al.*, 2021), understanding how generational differences influence the impact of AR menus on prosocial consumer behavior could provide valuable insights for both academia and industry. When examining the relationship between the constructs under study, this study did not consider AR intensity, which refers to the frequency of AR technology use among participants. However, this consideration could represent a valuable avenue for future investigation in this domain. Regarding technology readiness, recent studies on AR have confirmed the influence of customer technology readiness on consumer perceptions regarding the use of new technologies, such as Rather *et al*., (2023), which has not been considered in this study. The mechanism by which AR technology readiness affects the relationship between the constructs in this study should be investigated. Relying on participants to recall past experiences with AR menus and imagine hypothetical scenarios may have introduced memory biases and limitations to participant responses. While the inclusion of a video demonstration aimed to aid participants in recalling their experiences, actual interactions

with AR menus in real time could have provided more accurate and immediate insights into user experiences.

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Table 1. Measurement model's convergent validity.

Construct /Items	(λ)	Mean	S.D	VIF
Perceived AR social experience (ARC): (α = 0.83, CR = 0.88, AVE = 0.60)				
Using AR menus in restaurants to order or navigate food items enhances the sense of user interactivity.	0.76	5.84	1.0	1.60
The restaurants' AR menu apps engage customers and sustain their attention.	0.71	5.95	0.9	1.40
The use of a restaurant's AR menu app encourages customer collaboration during navigation.	0.79	5.77	1.1	1.7
The restaurant's AR menu app fosters customer belonging by creating a sense of connection.	0.8	5.74	1.20	1.82
The restaurant's AR menu app promotes a sense of community and togetherness by encouraging shared interaction and information among customers	0.8	5.65	1.23	1.87
Brand information sharing (BIS): (α = 0.88, CR = 0.92, AVE = 0.74)				
I will provide details about upcoming promotions and available discounts for x brand.	0.87	5.51	1.31	2.50
I will provide extra details about the brand (e.g., price, store locations, availability of discounts, or a link to a website).	0.88	5.51	1.28	2.52
I will share information about available or upcoming promotions (discounts) for x brand.	0.87	5.58	1.32	2.47
I will provide lengthy explanations as to why x brand is better than other brands.	0.82	5.55	1.39	1.95
Brand positivity (BP): (α = 0.86, CR = 0.91, AVE = 0.71)				
Say positive things about x brand	0.85	5.98	1.0	2.14
Mention I am happy with its performance	0.85	5.83	1.13	2.05
*Talk about x brand favorably				
Say x brand is great	0.83	5.76	1.21	1.97
Express my fondness for the brand	0.85	5.73	1.20	2.18
AR Reality congruence (ARC): (α = 0.86, CR = 0.89, AVE = 0.59)				
The AR menu presents virtual food items impressively.	0.77	6.0	1.0	1.78
The AR menu presents virtual food items attractively.	0.75	6.13	0.94	1.76
The design of the virtual food items is visually pleasant.	0.77	5.93	1.05	1.85
The restaurant's AR menu visually appealingly presents food items.	0.77	5.96	1.01	1.81
The AR menu presents the design of virtual food items (e.g., colors, shapes) realistically.	0.75	5.9	1.10	1.69
The AR menu presents virtual food items as if they were real	0.78	5.95	0.98	1.81
AR Usefulness (ARU): (α = 0.83, CR = 0.89, AVE = 0.67)				
I find the AR menu very helpful	0.84	5.89	1.01	1.96
I find the AR menu very useful	0.83	5.89	1.14	1.90
I find the AR menu very informative	0.81	5.82	1.13	1.84
The AR menu gave me the information I needed	0.78	5.78	1.12	1.69

Note: P < *0.05 for all items. Item excluded to ensure discriminant validity: *. Items were*

removed due to low loading.

[Table 2 here]

Table 2. Discriminant validity (Fornell-Larcker criterion and HTMT)

Constructs	1	2	3	4	5
1. Brand Information Sharing	**0.864**	0.883	0.830	0.603	0.762
2. Brand Positivity	0.774	**0.846**	0.891	0.783	0.899
3. Perceived AR social experience	0.704	0.772	**0.775**	0.810	0.898
4. Reality Congruence of AR-Menu	0.53	0.679	0.721	**0.771**	0.858
5. Usefulness of AR -Menu	0.659	0.771	0.772	0.734	**0.821**

***Note**: Values in bold = square root of AVE, The Fornell-Larcker criterion is located in the lower-left corner, while the HTMT values are in the upper-right corner of values in bold.*

[Table 3 here]

Table 3. Results of the study

Hypothesis:	**β**	**T-value**	***P*-value**	f^2	**VIF**
Direct Effect					
H1a: ARS→BIS	0.510***	9.5	0.000	0.196	2.84
H1b: ARS→BP	0.392***	8.9	0.000	0.167	2.84
H2: ARS→ARU	0.506***	10.4	0.000	0.363	2.08
H3a: ARU→BIS	0.317***	5.9	0.000	0.073	2.95
H3b: ARU→BP	0.385***	8.3	0.000	0.156	2.95
H5: ARS→ARC	0.721***	25.3	0.000	1.084	1.00
H6a: ARC→BIS	-0.07	1.5	0.132	0.004	2.48
H6b: ARC→BP	0.114**	2.7	0.008	0.016	2.48
H7: ARC→ARU	0.369***	7.7	0.000	0.192	2.08
Indirect Effect					
H4a: ARS→ARU→BIS	0.160***	4.9	0.000		
H4b: ARS→ARU→BP	0.195***	6.23	0.000		
H8a: ARS→ARC→BIS	-0.051	1.48	0.14		
H8b: ARS→ARC→BP	0.082**	2.6	0.009		
H9a: ARS→ARC→ARU→BIS	0.084***	4.6	0.000		
H9b: ARS→ARC→ARU→BP	0.102***	5.6	0.000		

Note: *** P < 0.001, ** P < 0.01,

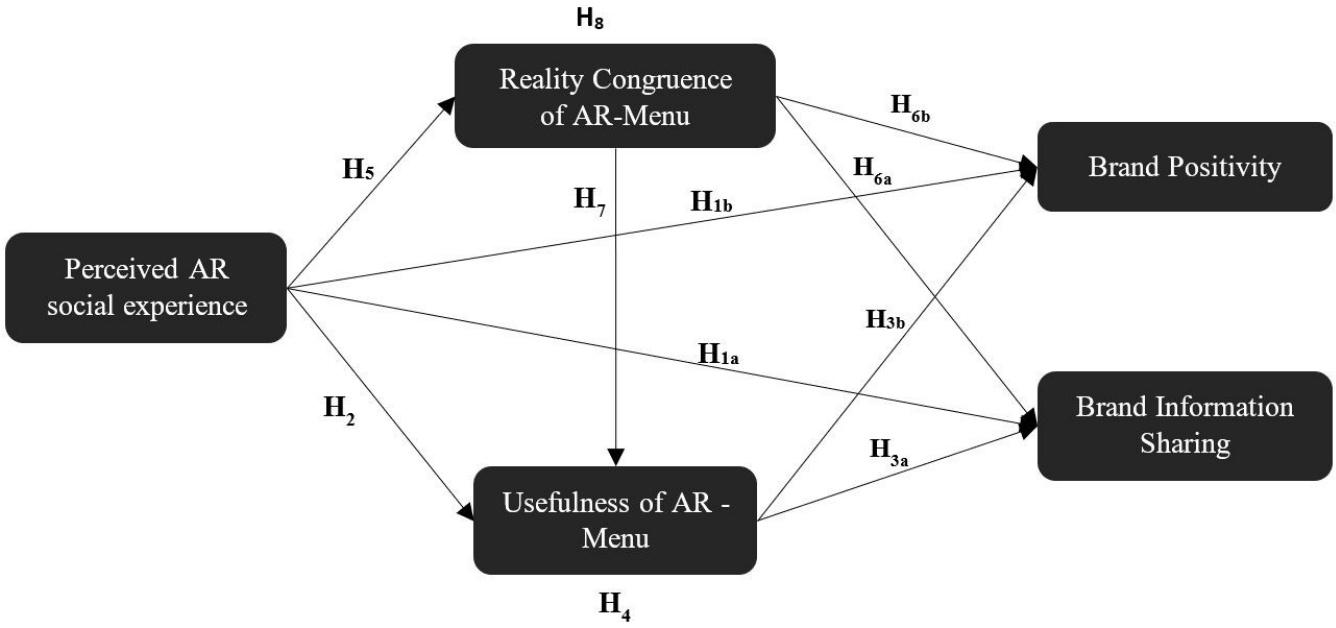

Figure 1. Research Conceptual Model