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Abstract:

Purpose:

Few studies have examined technology-enhanced atmospheres for strengthening customer experience and brand engagement in physical store settings. This study builds on the Social Presence Theory to test for the first time the moderating effects of virtual social presence on customer responses, through AR adoption in-store. Our study aims to understand the impact of technology-enhanced in-store atmospherics (TEISAs) with emphasis on AR elements and virtual social presence on customer experience and engagement behaviours (CEBs) in luxury settings.

Design/methodology/approach: Hypotheses are developed and a survey using 566 responses were collected using Qualtrics. T-tests, Two-way ANOVA and structural equation modeling was used for analysis of CEBs. Moreover, using PLS-SEM, we test whether virtual social presence moderates' this relationship in a cross-country context; Britain and China, two of the largest economies for luxury growth.

Findings: The findings demonstrate that TEISAs have a positive impact on emotion and perceived value, with virtual social presence moderating this relationship. The cross-cultural comparison results show that the impact of TEISAs on emotion and perceived value is stronger for British than for Chinese millennials.

Originality: Our model is the first to incorporate technology into various store atmospherics and employs virtual social presence as a new moderator, and to provide empirical evidence on the effects of AR on customer experience and CEBs in the real-time luxury retail environment. This study is also the first to consider virtual social presence on social media as a moderating variable.

Keywords: Technology-enhanced in-store atmospherics (TEISAs); Augmented reality; Emotion; Perceived value; Customer experience, Virtual social presence; Customer engagement; Millennials

Paper type: Research paper

1.Introduction

The retail landscape is witnessing the use of interactive technologies, such as mobile technology, augmented reality (AR) (Petit *et al*., 2022; Hollebeek *et al.,* 2019) and artificial intelligence to engage customers and enhance the customer experience (Sharma and Dutta, 2023). Javornik *et al*., (2021) refer to the use of in-store interactive technologies to stimulate the effective and sensory consumer responses as ephemeral-elevation. This form of customer engagement (CE) (Petit *et al*., 2022) can be achieved by activating brand related content within the store environment. The importance of customer experience and CE in the marketing literature is much more prominent with the emergence of the service-dominant logic (S-D logic). However, whilst interactive technologies are expected to improve customer experience and drive CE, there is a current gap in knowledge within this realm, and much more research is needed (Hollebeek *et al*., 2022; Lyu *et al*., 2022).

Studies related to the application of interactive technologies within physical stores has gained traction (Pantano *et al*., 2019). This research builds on the work by Sharma and Dutta (2023) which examines interactive technologies on improving customer experience and the desire to buy products. However, the values of luxury brands differ from other brands. Luxury brands exuberate luxuriousness, exclusivity, and symbolic value. Luxury brands reflect lifestyle, social status, and exclusivity (Dion and Borraz, 2017), and thus retailers have been reluctant to use in-store technology (Pantano *et al*., 2022a). Another gap in knowledge within the customer engagement and behaviour literature, is understanding the extent to which technologies can deliver innovative experiences without compromising their brand identity. AR is one of the leading interactive technologies predicted to reshape the customer experience (Tan *et al*., 2022) and boost CE (Grewal *et al*., 2020). Javornik *et al*., (2021) provide a chronological overview of 19 different luxury brand AR cases, five of which focus on the influence of the implementation of AR via mobile technology and digital in-store signage. They mention that luxury attributes could be displayed through AR. The investment in AR is expected to increase from approximately $3.5 billion in 2017 to more than $198 billion U.S. by 2025 (Statista, 2022). Luxury brands have already employed AR, (Gucci, Dior and Louis Vuitton), which reflects the increasingly important role of AR in luxury retail. As the investment and customer use of AR increases, understanding how AR affects customer experience, a term used to capture emotion (Pleasure, Arousal and Dominance), perceived values (Functional/instrumental value, Experiential/hedonic value, Symbolic/expressive value and Cost/sacrifice value) is key. Important also is to understand how these responses affect CEBs (Purchase, Influence, Referral and Knowledge behaviour) in luxury retail. Prior research has examined the effects of AR on customer experience (Javornik *et al.* 2021; Tan *et al*., 2022;), but empirical research on how AR affects customer experience and CE in luxury physical stores is scarce. CE has been heralded as crucial in contributing towards sales growth, improved brand strength and equity, referrals, competitive advantage, and stock returns (Pansari and Kumar, 2017); thus, this highlights an important gap in research for luxury retailers.

Finally, another underexamined category of store atmospherics is the extent to which third party interactive social encounters impacts on customer experience and CE (Tombs and McColl-Kennedy, 2003). The literature highlights that third party social presence (for example

other customers or reference groups involved within the consumption process) has a moderating effect on the behavioural outcomes within service research (Lucia-Palacios et al., 2018; Jiang et al., 2019; Kim and Baker, 2020). However, there is no research to date which examines the impact of third-party interaction on customer experience and the CEBs of customers in a luxury retailing context. Furthermore, with a surge in the use of social media (Argo and Dahl, 2020), and the popularity of virtual online brand communities amongst millennials, (Caratù *et al*., 2023) an underexamined area, is the potential impact of third-party interaction in a virtual context on customer experience and CEBs. Many millennials for example, interact with third party customers and/or reference groups such as friends, using digital devices when they are shopping in-store (Pantano and Gandini,2017). In summary, there is evidently a need to investigate the impact of interactive technology and other moderating effects on cognitive reactions within physical stores with a focus on luxury retail (Roggeveen *et al*., 2020).

At the backdrop of these theoretical gaps in knowledge, this study thus sets out to 1) examine the impact of AR on emotion, perceived value and subsequent CEBs in luxury physical retail stores and 2) test whether virtual social presence moderates this relationship. Since culture impacts customer responses toward store atmospherics (Mazaheri *et al*., 2014) the authors adopt a cross-country comparison of customers for Britain and China; two of the largest economies for luxury consumption amongst millennials. The paper first sets out to provide theoretical context on the overarching research gaps presented within this introduction.

2. Theoretical background

2.1The stimulus–organism–response (S-O-R) framework and TEISAs

Mehrabian and Russell (1974) developed the S-O-R framework, which suggests that environmental stimuli impact positively on emotional behaviours such as pleasure, arousal, and dominance and leads to their approach or avoidance behaviours. Based on Mehrabian and Russell (1974) model, Fiore and Kim (2007) propose a comprehensive S-O-R framework based on the shopping experience and they consider personal traits, demographic traits, market segments and situations as moderators, and value as one of the organisms of the S-O-R framework. Furthermore, Itani et al. (2023) extended the S-O-R model to the omnichannel retailing context. With the implementation of interactive technology in physical stores, traditional environmental stimuli are reshaping by the interaction between customers and automated systems, resulting in new shopping experiences for customers and the creation of new innovative and technology-enriched environments. The S-O-R model is one of most common models which is used to explain that the impact of interactive technology on affective and cognitive responses of customers, and lead to their behaviour responses (Lazaris et al., 2022).

Interactive technology impacts several elements of the store atmosphere and have been considered as part of point-of-purchase and the decoration variables, to explore their effect on customer behaviours (Poncin and Mimoun, 2014). Also of importance is the aesthetical appeal which requires more research, while demonstrating that interactive technology in-store front windows has a positive impact on Word of Mouth (WOM), such as sharing experiences with

friends (Pantano *et al*, 2019). Moreover, the DAST framework has been proposed to understand the influence of multiple retail touchpoints that customers may encounter during their shopping journey on emotional and cognitive responses, which in turn affect shopping behaviours (Roggeveen *et al*., 2020). They consider technologies as individual dimensions, called trialability. However, with the development of technological innovations, it has been widely used to enhance store atmospherics. Important to understand is the application of technology in various store atmospherics, to obtain a comprehensive understanding of how technology-enhanced stimuli affects customer experience and engagement. Therefore, this research introduces TEISA (technology-enhanced in-store atmosphere) by adapting traditional store atmospheric dimensions to include technology-enhanced interior ambience, exterior ambience, aesthetic, and social variables. Given that AR is a leading interactive technology predicted to reshape the customer experience, and little is known about the impacts of AR in physical luxury stores (Javornik *et al*., 2021) on customer experience and CEBs (Hollebeek *et al*. 2022). Therefore, greater academic focus is needed in this area.

2.2.1 Augmented reality in luxury retailing

AR incorporates virtual components into real-world environments to enrich customers' visual and auditory perceptions of reality and deliver unique experiences (Tan *et al*., 2022). It provides luxury retailers with chances and challenges to improve the shopping experience. For instant, AR enables customers to manipulate and interact with virtual items to integrate them into the real world and the features of AR can present luxury attributes in innovative ways (Javornik, *et al*., 2021). It offers an interactive experience of a real retail environment.

AR can provide value to customers and retailers within physical stores (Rauschnabel *et al*, 2019). Through sensory stimulation, AR improves engagement and has a meaningful influence on customer responses creating immersion, hedonism, and satisfaction. Thus, AR is capable of boosting and increasing immersive customer experiences that resemble those experienced in offline stores (Rejeb *et al*., 2023). They also state that some marketing metrics, such as WOM, positive intent and willingness to pay for the products, may be influenced by AR. Poorly designed applications may impact negatively on the user experience, which may in turn have a negative impact on retail brand image (Rauschnabel *et al*., 2019). Most AR research is conducted in laboratories, but few studies have examined the applicability of AR in physical contexts (Scholz and Duffy, 2018; Rejeb *et al*., 2023).

2.3 Emotion

An emotion is a state of mental readiness arising from an evaluation of marketing stimuli or from the own thoughts of customers, which have an impact on information processing. (Bagozzi *et al*., 1999). Retailers must understand the emotions of customers, to provide a competitive advantage (Pantano *et al*., 2022b). In prior studies, much literature focuses on the measurement scale of emotion, for example, the Pleasure- Arousal- Dominance scale (PAD scale) (Mehrabian and Russell, 1974), Plutchik's eight basic emotion categories (Plutchik,1980), PANAS scale (Watson *et al*., 1988).

Technological innovations, as environmental stimuli, influence emotions and enhance satisfaction, patronage, and recommendations (Poncin and Mimoun, 2014). Positive emotions mediate the relationship between technology, satisfaction, and emotional attachment (Pantano and Scarpi, 2022). Javornik et al. (2021) note that while many studies explore digital technology in luxury brands, research on AR, in particular impacts on emotions is limited.

2.4 Perceived value

Smith and Colgate (2007), propose four kinds of customer value: experiential/hedonic value, functional/instrumental value, symbolic/expressive value, and cost/sacrificial value. Luxury brands exuberate luxuriousness and exclusivity as well as reflecting aspects of customer value related to emotional and symbolic value (Kim et al., 2016). Prior research on luxury value has predominantly focused on the tangible aspects of value in terms of product (Pantano *et al*., 2022a). Furthermore, the application of interactive technology may change the perception of customers. However, limited studies examine the perceived customer value of the luxury service experience, and the impact of TEISA. Specially, AR could create a better customer experience and present the desired brand value (Pantano *et al*., 2022a). AR as a trigger in physical stores may stimulate emotional responses and perceived value, in turn, informing CEBs.

2.5 Customer engagement behaviour

Research in the CE field is a developing phenomenon (Blut *et al*., 2023). Whilst there is no universally accepted definition of CE in the literature, there is a common-sense definition. Engagement is known has been defined as a multidimensional concept with cognitive, affective, and behavioural dimensions and is a psychological state. Although researchers have discussed the concept of CE and developed conceptual models of the antecedents and consequents of CEBs, there are limited empirical models which identify antecedents of CEBs in luxury retailing, particularly by considering store atmospherics and perceived value as influence elements of CE. While previous studies have examined the impact of store atmospherics on customer behaviours, few have focused on the impact of store atmosphere on CE (Lyu *et al*., 2022). Mohd-Ramly and Omar (2017) point out that interactive factors within the in-store atmosphere will affect the relationship between store atmosphere and CE. Thus, how the store atmosphere affects emotion and perceived value, and leads to CEBs in physical retail luxury store deserves more attention. Particularly, the use of AR technology has the potential to alter the lifestyles of customers and the way they purchase, interact and engage (Moriuchi *et al*., 2021). In this study, AR would be considered as an interactive factor. It is widely accepted by academia that AR affects the perceived value of customers (Jiang *et al*., 2021).

2.6 Social presence theory extended to virtual social presence

The development of social media platforms and the increasing willingness to seek advice online before buying offline, infers a need to understand the potential impact of virtual social presence on customer behaviours (Grewal *et al*., 2020; Hamilton *et al*., 2021; Siregar *et al*., 2023). The Social Presence Theory explores how the sense of being with another is influenced within digital interfaces, and within an interaction process (Osei-Frimpong and McLean, 2018;

Jiang *et al*., 2019). In the retail environment, the thoughts, feelings, and behaviours of customers can be influenced by third-party involvement; which might be defined as other customers or alternatively associated reference groups (Argo and Dahl, 2020). Previous research indicates that the virtual presence of others influences the forgiveness of focal customers during online complaint handling, thereby enhancing their engagement (Honora et al., 2024). Despite an increase in studies on the influence of other third-party customers in services, there are limited studies which examine the impact of third-party influence within physical luxury retail settings (Kim and Baker, 2020).

Given the importance of socialisation within the retail fashion environment, in-store customers enjoy the presence of friends and family particularly for the purpose of fashion purchase decision making, for example, customers would like to seek recommendation from influencers, friends and families before they decide to buy a product or enter into a store (Hamilton *et al*., 2021). With the growth of social media platforms, the physical presence of friends and family can be replaced by virtual ones via social networking (Pantano and Gandini, 2017). Social media platforms allow customers to virtually connect with friends and family, to receive real-time feedback and suggestions (Argo and Dahl *et al*., 2020; Roggeveen *et al*., 2020). This study is the first to consider the impact of virtual social presence on customer response within physical luxury retail shopping interactions (Hamilton *et al*., 2021).

2.7 The cross-country comparison

Chinese and Western millennials have similarities as well as differences. Customer responses towards physical retail store atmospherics will be influenced by culture (Lyu *et al*., 2022). Chinese millennials, the largest group of the millennial population, have been responsible for almost one third of Chinese luxury consumption (McKinsey and Company, 2019). They are also an important subset of vital forces in global luxury consumption, which makes this generational cohort, the main target customers for many luxury brands (Bain and Company, 2020). Due to the one-child policy and economic reforms, Chinese millennials differ from those in other countries, tending to be economic freedom and self-centred (Su et al.,2019; Diaz Ruiz and Cruz et al., 2023). It is necessary to highlight a particular juxtaposition of the analogue and digital worlds in the consumption behaviour of Chinese millennials, in that physical retail stores create atmosphere which encourages them to shop offline while, at the same time, engaging in both offline and online processes. The UK represents a mature market for luxury retailing, which is different from China. Furthermore, Nam and Kannan (2020) call for further cross-country research on the effect of AR on customer experience and CE in collectivist cultures and individualist cultures. Thus, investigating the difference between Chinese and British millennials is needed. Future research could focus on emotional responses and perception of customers from different cultures in physical retail luxury stores (Kim *et al*., 2016). For these reasons, this research compares the different emotional responses and perceived value of Chinese and British millennials toward TEISAs.

3. Hypotheses development

To investigate the impact of AR on customer responses and CEBs, this study adapts Mehrabian and Russell's (1974) S-O-R framework. AR as a type of technology-enhanced in-store atmospheric (TEISA), provides the stimulus (S), the emotion and perceived value are considered as organisms, and CEB as responses (R).

3.1 Emotion toward TEISA (AR)

Emotional state as an organism was proposed by Mehrabian and Russell (1974) in the initial S-O-R framework. Until now, emotions remain a key organismic response on the S-O-R framework. Furthermore, it is generally believed that store atmosphere has an impact on customers' perception of the value, emotion, and specific products (Fiore and Kim, 2007; Lyu *et al*., 2022). When customers become more engaged in shopping experience supported by technologies, TEISAs will affect customer emotion and perceived value. For example, technologies have a positive effect on positive emotion and subsequently enhance satisfaction and positive patronage and recommendation intentions (Poncin and Mimoun, 2014). While technologies have been proven to influence customer emotions, there is still a scarcity of empirical research on the impact of AR technology on the emotions of luxury customers.

This study investigates if AR technology may also elicit emotional responses, in which case the AR technology serves as the stimulus. Thus,

H1: TEISA (AR) positively affect emotions.

3.2 Perceived value toward TEISA (AR)

In luxury fashion retailing, the aesthetics of a physical retail luxury store reflects luxury value. The attributes of luxury will be improved by AR, which will enhance brand experience and customer journey (Javornik et al, 2021). Moreover, Fiore and Kim (2007) propose a comprehensive S-O-R framework based on the shopping experience and they believe that value could one of organism. In other words, customers could perceive value from their customer experience. Thus, the following research hypothesis is proposed that:

H2: TEISA (AR) positively affect perceived values.

3.3 Customer engagement behaviour as "response"

Lim *et al*., (2022) recommends that further research should examine CE in the physical world. Store atmosphere, as an important element in the physical retail store, could enhance customer experience. Choi and Kandampully (2019) suggest that store atmosphere could create an emotional connection leading to CE. Similarly, Pansari and Kumar (2017) find that emotion is an antecedent of CE and the influence of emotions on CEBs can be strengthened by brand value. Therefore, it is necessary to explore the impact of store atmospherics on emotion. Thus,

H3. The emotion, which is generated by TEISA (AR), will positively affect CEBs.

Perceived value is a vital research construct, which leads to behavioural intentions (Jiang *et al*., 2021). At this highest level of CE, customers might want to share their opinions and perceptions with retailers or others (Grewal *et al*., 2020). Customers will be willing to become

the ambassadors of a brand and help in its promotion, which could be referred to as CEB. CEBs are described as purchasing behaviour, knowledge behaviour, influence behaviour and referral behaviour (Pansari and Kumar, 2017). Therefore, perceived value might affect customers engagement behaviour. Thus,

H4. The perceived value, which are generated by TEISA (AR), will positively affect CEBs.

3.4 The moderating effect of virtual social presence

Argo and Dahl (2020) argue that social presence can influence customers' attitude and behaviours in the retail environment. For example, the presence of other customers (friends or family for example), makes the shopping experience more enjoyable than shopping alone, because companions provide emotional support (Rosenbaum et al, 2017). Furthermore, other customers who are acquaintances usually give advice to focal customers, also enhancing the positive emotions (Lindsey-Mullikin and Munger, 2011). Kinard *et al*. (2009) exhibit that noninteractive social presence has a negative effect on emotional responses and behavioural intentions toward self-service technologies. They explain that additional persons may decrease the perceived risk of using the self-technologies by decreasing the risk of revealing in the event of a mistake, making the experience more positive. Heinonen et al. (2018) indicate that other customers may have influence on perceived value. Thus, virtual social presence may moderate the influence of TEISAs on emotions and perceived values in luxury retail.

H5a: Virtual social presence moderates the influence of TEISA (AR) on the emotions.

H5b: Virtual social presence moderates the influence of TEISA (AR) on perceived values.

Based on prior studies, this paper proposes a research framework (Figure1).

Insert Figure 1 here

4.Methodology

4.1 Participants and procedure

A questionnaire was adopted to test the hypotheses amongst the millennial generation, a large target group of luxury brands (Bain and Company, 2020). Although there is no universal definition of the millennial generation, the consensus points towards individuals born between 1980 and 2000 (Slaton and Hurst, 2023). To understand the perceptions and attitudes of millennials towards TEISA(AR) and to provide valuable and comparable insights to luxury retailers, this study specifically focused on millennials aged between 18 and 30, also known as post-90s in China. The final version of the questionnaire was determined and released through Qualtrics (https://www.qualtrics.com/uk/) post-pilot. Two screening questions were asked to ensure appropriateness of the sample: "When shopping in luxury store do you use any of the technology-enhanced in-store atmospherics listed" and "What is your age". A total of 566 are valid responses. The questionnaire was distributed to individuals aged between 18 and 30 years old (those born between 1990 and 2002) who have had a shopping experience and have used AR technology at least once in a physical retail luxury store in last 12 months. 379 respondents are British, 103 are from China living in the UK, and the remaining 87 participants

from other countries. All of participants are currently living in the UK. However, the Chinese participants did not grow up in the UK; they were only temporary residents. The questionnaire design included images of some augmented reality (AR) to familiarise the participants with the focus of AR technologies used in the physical luxury retail store.

The questionnaire was designed with each sentence presented in both Chinese and English allowing individuals choice of both languages to evaluate the questionnaire.

4.2 Measurement and data analysis

The demographic questions were designed based on the sample criteria and research context. Emotion (please, arousal and dominance) was measured on a thirteen-item scale adapted from Mehrabian and Russell (1974). An example of questions used in the emotion part included "While using the technology-enhanced in-store atmospherics (AR) in luxury stores, I felt happy/ unhappy". This study modified the measurement of perceived value from Smith and Colgate (functional/instrumental, experiential/hedonic, symbolic/expressive and cost/sacrifice value), fifteen items were retained. For example, "Technology-enhanced in-store atmospherics (AR) provide useful services and information, helping me realise the performance and outcomes of products in luxury stores". The CEB (Purchase, Influence, Referral and Knowledge behaviour) (2007) scale contains sixteen items adapted from Kumar and Pansari (2016). Example of questions used in the questionnaire included "Technology-enhanced in-store atmospherics (AR) in luxury stores encourages me to return and buy items from these stores". In this research, emotion, perceive value and CEB were proposed as second-order construct.

The process was divided into three parts. 1. The PLS-SEM was used to understand the influence of TEISA (AR) on emotion; perceived value and customer engagement behaviour. This was used instead of CB-SEM as the measurement scales have been modified based on the research context of this research and pilot study (Hair et al 2017). 2. The moderating effect: two-way ANOVA was used to understand how virtual social presence acts as a moderator given virtual social presence and the independent variable are both categorical variables (Light et al 1971). Moreover, TEISA (AR) is included in the model as dummy variables with zero representing did not used AR and one representing used AR.

The normality check for all datasets reported that skewness and kurtosis values were within the recommended range of -1.00 to + 1.00, and −7.00 to + 7.00.Thus, the dataset conforms to normal distribution. Additionally, PLS-SEM method used in the analysis is known for its tolerance to normal distributions of data.

5.Results

The aims of this study are to 1) examine the impact of AR on emotion, perceived value and subsequent CEBs in luxury retail and 2) test whether virtual social presence moderates this relationship, using a sample of British and Chinese millennial consumers. 100% of participants aged between 18-30, visited a physical retail luxury store at least once per month before and during Covid-19 pandemic. The number of female (46.9%) and male (52.2%) participants and the majority of (82.9%) respondents are students or in full-time employment. Most of the

respondents have a bachelor's degree (52.7%), or master's degree (25.8%) or doctoral degree (3.7%). 412 participants have used AR and 154 have not but used other technologies.

5.1. Measurement model assessment

To test the measurement model, factor loading, Cronbach's alpha values, composite reliability (CR), average variance extracted (AVE), and discriminant validity were evaluated. All the factor loadings of the items are above the threshold value (> 0.7), and Cronbach's alpha values and CR values for all constructs exceeded the standard threshold of 0.7. AVE values exceeded the cut-off values of 0.5 (Hair *et al*., 2019). The Heterotrait-Monotrait ratio (HTMT) criteria was used to confirm the discriminant validity. The variance inflation factor (VIF) values for all items were all less than 3, confirming collinearity is not an issue and suggesting this model are free of common method variance (CMV). The model was also checked for the presence of common method bias (CMB) in the entire dataset using the Harman one-factor method with the principal component analysis in SPSS 28, the single largest factors accounted for only 33.35% (<50%). The HTMT ratio values for second-order constructs, are below the conservative threshold of 0.90 (Hair *et al*., 2019).

5.2 Structural model assessment

The bootstrapping technique was employed to establish a repeated sampling value of 5000, enabling the generation of statistical conclusions regarding the significance of the model coefficients. The results (Figure 2) show that the TEISA (AR) have positive influence on emotion (β=0.807;t= P<0.001) and perceived value (β=0.79; P<0.001). Thus, the H1 and H2 is supported for the full sample. Emotion (β=0.058; P<0.05) and perceived value (β=0.812; P<0.001), which is generated by technology-enhanced atmospherics, have a positive effect on CEB. Therefore, H3 and H4 are supported. Moreover, Stone-Geisser Q^2 was evaluated for verifying overall quality of model. The Q^2 value is greater than 0 for emotion (0.364), perceived value (0.362), and purchase intention (0.396). This indicates that the model is predictively valid. The standardized root mean square residual (SRMR) (0.076) value was below the acceptable cutoff value of 0.08.

Insert Figure 2 here

5.3 The moderating effect: H5a and H5b

To examine the moderating effect of virtual social presence, a two-way ANOVA was conducted and was run on SPSS 28. Participants were divided into three group (group1: alone, group2: physical social presence, group3: virtual social presence).

The interaction effect between TEISA (AR) and virtual social presence has a significant effect on emotion (F=13.88, P<0.05) and perceived value (F=17.68, P<0.05). Participants who used TEISA (AR) have more positive emotion and perceived higher value when they are shopping with virtual social presence, compared to those who shop alone.

The post-hoc comparisons using the Tukey HSD test illustrated that there was a significant difference between groups at level of P<0.05. H5a and H5b are supported by the results.

5.4 Comparing the customer responses of Chinese and British millennials.

Independent-samples t-test were used to compare the mean scores of two different groups of participants. There are 98 Chinese and 277 British millennials that have used TEISAs in this research. The mean scores of Chinese (M_{TTE}=83.84, M_{TTPV}=100.82) and British millennials(M_{TTE}=103.14, M_{TTPV}=116.07) support this.

The P value of Levene's test for TTE and TTPV are less than 0.05, indicating that the variances for Chinese and British millennials are different. Therefore, it could be concluded that there is significant difference for TTE and TTPV between Chinese and British millennials. Additionally, the mean scores of Chinese millennials on emotion and perceived value are lower than those of the whole data set. A possible explanation for this might be that the interactive technologies in the UK are different from those in China. This study responds to research gaps by empirically comparing customer reactions toward TEISAs in a less studied market like China and a more widely investigated market like the UK, with a focus on the luxury fashion context.

6. Discussion

This study demonstrates that AR has a positive impact on emotion (H1) and perceived value (H2) and leads to positive CEB (H3 and H4). It is worth noting that the effect of perceived value is greater than the effect of emotion on CEB.

Recently, the development of social media platforms is reshaping the form of social presence. For example, customers could still shop with family members and friends even if they are not physically present in the store, by chatting with them on social media platforms to obtain their advice and opinions (Roggeveen et al., 2020). This new form is called "virtual social presence" in our study. Virtual social presence positively moderated the effect of TEISA (AR) on emotion (H5a) and perceived value (H5b). These findings provide empirical evidence for the pervious conceptual research (Grewal *et al*., 2020; Roggeveen et al., 2020; Hamilton *et al*., 2021), particularly in how luxury customers use social media platforms to interactive with their family and friends to share their experience. Notably, the results of this study demonstrate that the moderating effect of virtual social presence on customer responses is greater than physical social presence in luxury retail. A possible explanation is that virtual social presence reduces feelings of competition and comparison, while enhancing the feeling of positive emotion, just as physical social presence does.

The results of the cross-country comparison show that the TEISAs have a positive influence on the customer responses of both Chinese and Britain millennials. However, the impact of TEISAs on emotion and perceived value are lower for Chinese millennials compared with British millennials.

6.1 Theoretical contribution

Several new theoretical insights are presented. First, the S-O-R framework, is newly extended to consider TEISAs as stimuli to understand the impact of interactive technology on emotion

and perceived value and continued CEBs. The results demonstrate that the TEISA(AR) have a positive effect on emotional responses and perceived value in the context of luxury fashion retail, adding corroborating evidence to the results of Poncin and Mimoun (2014) and to the call by Roggeveen *et al*, (2020). A a pivotal contribution is made to the literature and methodology in the AR field, since its findings are based on actual shopping experiences.

Second, although previous research acknowledges the influence of social presence on customer experience and CE (Lucia-Palacios *et al*., 2018; Argo and Dahl, 2020), few studies investigate the influence of virtual social presence in the in-store environment (Grewal *et al*., 2020; Hamilton *et al*., 2021). The empirical results from this research confirm that virtual social presence positively moderates the influence of TEISAs (AR) on emotion and perceived value. Notably, existing research based on the S-O-R framework typically considers social factors as stimuli (Choi and Kandampully, 2019; Lyu et al., 2022) but has not explored the moderating effect of virtual social presence on customer responses. This study is thus the first to reveal insights into the moderating effect of virtual social presence on the relationship between stimuli and organisms within the luxury fashion context. Virtual social presence and the AR context is newly incorporated into the S-O-R framework, and thus together with the role of interactive technology, contributes to the store atmosphere and the CE literature by providing further frameworks (Lim et al., 2022) to improve our understanding of atmospheric impacts on customer experiences. Consequently, these findings contribute to the literature, extending previous studies on social presence theory (Argo and Dahl, 2020), by extending it to a virtual social presence and AR context.

Furthermore, significant cultural difference in the effect of AR technology on emotion and perceived value are presented; the impact of AR on emotion and perceived value being stronger for British rather than Chinese millennials. This is contrary to Nam and Kannan (2020) proposition 4_c which claims AR technologies are more effective in enhancing the customer experience in collectivist cultures than in individualist cultures.

6.2 Managerial contribution

The results show that emotion and perceived value are influencing factors to CEBs in luxury fashion retail. Luxury fashion retailers should consider how to integrate the physical and virtual worlds to deliver a more immersive customer experience in the physical store, and the potential of AR to enhance aesthetics of stores or products. Understanding the moderating effect of virtual social presence on emotional responses and perceived value towards TEISAs, can help retailers devise approaches to encourage customers to interact with their friends and family through social media platforms during their shopper decision-making process and customer journey. The moderating effect of virtual social presence on emotional responses and perceived value toward TEISAs is useful in that retailers can better target customers with their in-store strategies related to social media marketing.

Finally, a social impact contribution is made, since the results highlight the importance of virtual social presence on (positive) emotion in the retail context, which might be particularly relevant for those customers with vulnerabilities or disabilities that make their physical visits to the store very stressing or limited. Joint forces of retailers and Councils and municipalities

might help also consumers with disabilities to access these retail settings and enjoy the experience.

7. Limitation and future research directions

Future research might investigate the impact of other types of TEISAs such as technology-enhanced social atmospherics as to be considered as a priority on customer reactions and CEBs. AI is commonly used in the retail sector and has an influence on the emotional responses (Pantano and Scarpi, 2022), which could be considered technology-enhanced social atmospherics (employee-driven). Moreover, this study only investigated virtual social presence from acquaintances. Future research might examine the influence of perceived holistic TEISAs on customer experience and CE, and the influence of virtual social presence with strangers on social media platforms. With the development of AI, there has been a new form of influencer, called virtual influencers or avatars. It would be interesting to examine the impact of virtual influencers on customer responses and CE. Meanwhile, future research could focus on consumers with vulnerabilities or disabilities to understand the extent to which these technologies might be beneficial for them from different perspectives (e.g., wellbeing). Finally, future cross-cultural studies could compare the responses to interactive technology between individuals residing in China and those in other Western countries.

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Figure 1: The research model of this research

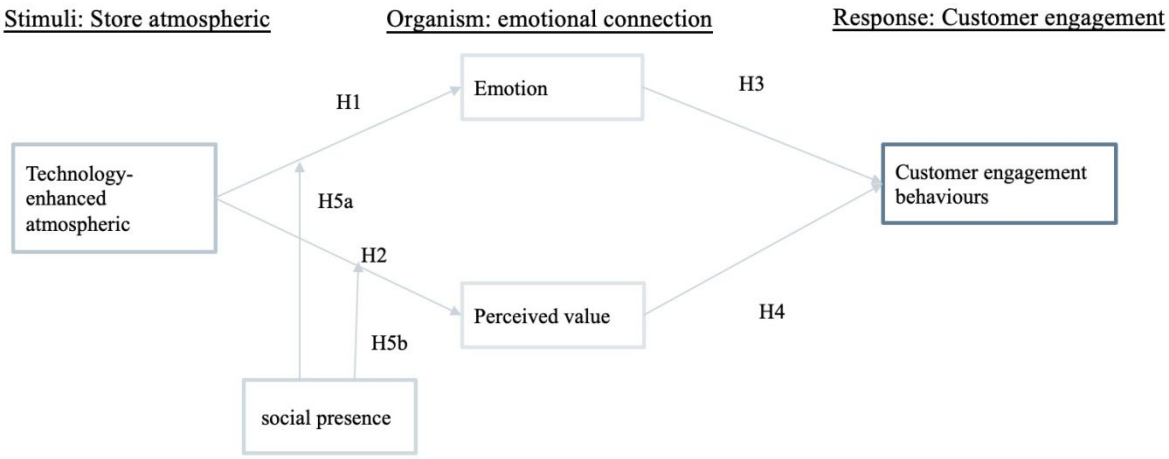
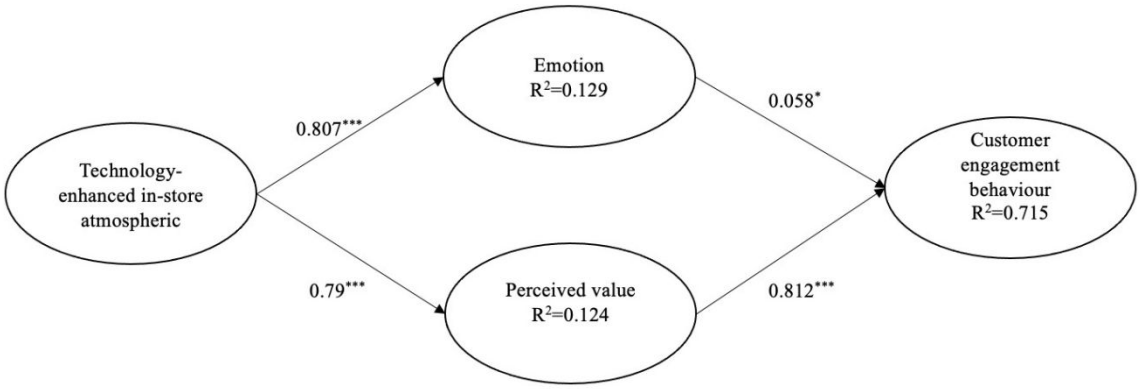


Figure 2: Structural model test results



Recommended changes	Change made	Location in manuscript
Reviewer 1: Minor Revision		
I didn't see the appendix with the full survey questions in your submission, possibly due to word limits. To enhance the methodology section, consider including a few essential survey questions. This would provide crucial context about the data collection process without significantly lengthening the document.	Thanks you for your feedback and review, yes the questionniare was not included due to word limits. However, two screening questions have been added, including “When shopping in luxury store do you use any of the technology-enhanced in-store atmospherics listed” and “What is your age”. Furthemore, Each influencing factor has been accompanied by a questionnaire item as an example, which has been added to the manuscript.	Section 4.1 and 4.2
Also it could be enhanced by justifying why the specific age range of 18 to 30 was chosen and how it relates to the study’s objectives.	Thank you for your valuable feedback. We appreciate your suggestion regarding the justification of the specific age range of 18 to 30. In the revised manuscript, a detailed explanation of why this age range was selected have been included.-Although there is no widespread agreement on how to define the millennial generation, researchers have similar starting and ending points for millennials, e.g., individuals born between 1980 and 2000 (Slaton and Hurst, 2023). To better understand the perceptions and attitudes of millennials towards TEISA(AR) and to provide valuable and comparable insights to luxury retailers, this study specifically focuses on young millennials aged between 18 and 30.	Section 4.1
The explanation of the moderating effects of virtual social presence is compelling. However, it would be beneficial to deepen the discussion on why these effects are significant and how they compare with existing literature, possibly integrating more comparative analysis within the text.	Thank you very much for your insightful feedback. We appreciate your recognition of the explanation of the moderating effects of virtual social presence. In response to your suggestion, we have deepened our discussion on why these effects are significant and have integrated a comparative analysis to align our findings more closely with the existing literature.	Section 2.6 and Section 6

The cross-cultural analysis between Chinese and British millennials is an excellent addition, offering valuable insights into regional differences. It could be enhanced by more deeply exploring cultural factors that might influence these differences, providing a richer context for the findings.	Thank you sincerely for the valuable suggestion. Additional information related to cultural factors has been incorporated into Section 2.7 to provide a richer context for the findings. Specifically, the discussion now includes why Chinese millennials differ from those in other countries.-Due to the one-child policy and economic reforms, Chinese millennials differ from those in other countries, tending to be economic freedom and self-centred (Su et al.,2019; Diaz Ruiz and Cruz et al., 2023).	Section 2.7
Overall, the paper outlines implications for multiple stakeholders and provides a comprehensive link between theoretical research and practical application. However, the societal impact could be elaborated further, particularly in terms of how these technologies might affect consumer behaviour broadly and societal norms.	Thank you for your insightful comments and constructive feedback. We appreciate the recognition of our work. In response to your suggestion that the societal impact could be elaborated further, we have made several revisions to our paper.Our results highlight the significant impact of virtual social presence on positive emotions in a retail context. This is particularly relevant for customers with vulnerabilities or disabilities, for whom physical visits to stores can be stressful or limited. Thus, the revised manuscript includes a new managerial contribution and a new limitation	Section 6.2 and 7