

# Should I stay or should I go? Benefits of crowd-checking technology for a face-to-face shopping experience

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## Abstract

**Purpose** – Long sales periods (i.e. Christmas time, Black Friday, etc.) and the risk of contagion while shopping (i.e. during pandemics like COVID-19) showed the extent to which crowded shopping environments have negative effects on consumers' behavior. Hence, using terror management theory (TMT) and stimulus–organism–response (S–O–R) approach, the authors aims to develop a new model to investigate the effect of crowd-checking technology on shopping anxiety, the perceived value of shopping experience and willingness to pay.

**Design/methodology/approach** – Using a cross-sectional research design and with a help of an independent research company, the authors collected 1,000 valid responses from individuals residing in the UK.

**Findings** – Results showed that crowd-checking technology cues reduce shopping anxiety, improve value perceptions and increase willingness to pay. In addition, the efficacy of technology in reducing shopping anxiety is moderated by customers' shopping orientation.

**Originality/value** – To the best of the authors' knowledge, this research is the first one investigating crowd monitoring systems used at the initial stage of consumers' journey to show the number of consumers in-store in real-time. It contributes to the literature on technology applications in retailing by providing evidence that technology cues reduce shopping anxiety, which in turn enhances customer-perceived value from the shopping experience and increases the willingness to pay in stores with embedded crowd-checker technology. The study also extends the application of TMT in a new context.

**Keywords** Consumer behaviour, Technological cues, Crowd-checking technology, Shopping anxiety

**Paper type** Research paper

¿Me quedo o me voy? Ventajas de la tecnología de control de multitudes Para una experiencia de compra presencial

## Resumen

**Propósito** – Los largos periodos de rebajas (ej. Navidades, Black Friday, etc.) y el riesgo de contagio durante las compras (ej. durante pandemias como la COVID-19) mostraron hasta qué punto los entornos de compras abarrotados tienen efectos negativos en el comportamiento de los consumidores. Utilizando la Teoría de la



Gestión del Terror (TMT) y el enfoque Estímulo-Organismo-Respuesta (S-O-R), desarrollamos un nuevo modelo para investigar el efecto de la tecnología de control de multitudes sobre la ansiedad en las compras, el valor percibido de la experiencia de compra y la disposición a pagar.

**Metodología** – Utilizando un diseño de investigación transversal y con la ayuda de una empresa de investigación independiente, recogimos 1.000 respuestas válidas de personas residentes en el Reino Unido.

**Resultados** – Los resultados mostraron que las señales de la tecnología de comprobación de multitudes reducen la ansiedad en las compras, mejoran la percepción del valor y aumentan la disposición a pagar. Además, la eficacia de la tecnología en la reducción de la ansiedad de compra está moderada por la orientación de compra de los clientes.

**Originalidad** – Esta investigación es la primera que estudia los sistemas de seguimiento de multitudes utilizados en la fase inicial del viaje de los consumidores para mostrar el número de consumidores en la tienda en tiempo real. Contribuye a la literatura sobre aplicaciones tecnológicas en el comercio minorista aportando pruebas de que las señales tecnológicas reducen la ansiedad de compra, lo que a su vez mejora el valor percibido por el cliente de la experiencia de compra y aumenta la disposición a pagar en tiendas con tecnología de control de multitudes integrada. El estudio también amplía la aplicación de la Teoría de la Gestión del Terror en un nuevo contexto.

**Palabras clave** Comportamiento del consumidor, Señales tecnológicas, Tecnología crowd-checker, Ansiedad de compra

**Tipo de artículo** Trabajo de investigación

我应该留下还是应该离开？人群检查技术对面对面购物体验的好处

摘要

目的 – 漫长的销售期（即圣诞节时间、黑色星期五等）和购物时的传染风险（即在COVID-19等大流行病期间）显示了拥挤的购物环境对消费者行为的负面影响程度。因此，利用恐怖管理理论（TMT）和刺激-组织-反应（S-O-R）方法，我们建立了一个新的模型来研究人群检查技术对购物焦虑、购物体验的感知价值和支付意愿的影响。

方法 – 在一家独立研究公司的帮助下，我们采用横断面研究设计，从居住在英国的个人中收集了1000份有效的答复。

研究结果 – 结果显示，人群检查技术提示减少了购物焦虑，改善了价值认知，并提高了支付意愿。此外，技术在减少购物焦虑方面的功效受到顾客购物取向的调节。

原创性 – 这项研究是第一个调查在消费者旅程的初始阶段使用的人群监测系统，以实时显示店内消费者的数量。它为零售业技术应用的文献做出了贡献，提供了技术线索减少购物焦虑的证据，这反过来又提高了顾客从购物体验中感知到的价值，并增加了在有嵌入式人群检查器技术的商店中的支付意愿。该研究还扩展了恐怖管理理论在新环境中的应用。

关键词 消费者行为, 技术线索, 人群检查技术, 购物焦虑

文章类型 研究型论文

## 1. Introduction

Studies conducted before the COVID-19 pandemic showed the relationship between perceived crowding in a store and consumers' subsequent (negative) reactions (Mehta *et al.*, 2013; Hui and Bateson, 1991; Coskun *et al.*, 2019; Pan and Siemens, 2011). Stress caused by the pandemic, the fear of contracting the virus and social distancing rules had further put retailers under significant pressure to find strategies to reduce consumer misbehaviors. Such behaviors included panic buying (Barnes *et al.*, 2021) and stockpiling (Hall *et al.*, 2020), reducing the crowd in the psychical stores while reducing the virus spread via physical distancing (Untaru and Han, 2021; Mason *et al.*, 2020; Pantano *et al.*, 2021). Specific behaviors such as stockpiling and panic buying emerged against the backdrop of an increasing level of anxiety among the population, triggered by uncertain social and economic conditions people lived in during the pandemic (Herjanto *et al.*, 2021; Sim *et al.*, 2020; Lins *et al.*, 2021; Dwivedi *et al.*, 2020). Anxiety associated with crowding

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in stores had been reported as a disruptive factor in buyer behavior even before the pandemic.

The effects of anxiety while shopping in stores and changing buying patterns require reimagining the approaches to managing consumer experiences in stores to shape positive buyers' perceptions (Pamuksuz *et al.*, 2021; Untaru and Han, 2021). Hence, information communication technology, such as crowd-checking systems, can significantly help manage emerging consumer behaviors in the retail sector (Shankar *et al.*, 2021; Pantano *et al.*, 2020) and solicit positive and negative emotions in consumers (Pantano and Scarpi, 2022).

Crowd-checking information systems have emerged as a promising technology supporting customer decision-making. It is a system that uses sensors and cameras placed in shopping areas to count consumers and feeds back the information about the available capacity to the website or mobile applications (Adam *et al.*, 2020). The system works during the opening times and can provide several warning levels indicating whether shopping centers are open or not available for visits. The implementation of crowd-checking technologies has benefits for both consumers and managers. The information provided to consumers can reassure them about safety or warn them about the potential health risks of shopping in person. For managers, crowd-checking technology can help efficiently manage the flow of people inside stores and provide a safer and more pleasant shopping experience. More importantly, practitioners could limit consumers' shopping anxiety through crowd-checker, positively contributing to consumers' perceptions and behaviors toward the stores. The above benefits warrant research in consumer behavior to examine the implications of the crowd-checking technology and understand how its technological cues can affect emotions, the perceived value of shopping in stores with integrated technology and purchasing behavior.

Since the implementation of crowd-checking technology in the retail sector has started recently, research on its impacts is underdeveloped. Existing evidence about the benefits of technology in retail revolves around smart and self-service systems that can improve shopping experiences by making purchases more personalized and efficient (Dabholkar and Bagozzi, 2002; Mehta, 2013; Pantano, 2014). The implications of crowd-checking technological cues for consumers, their emotions, attitudes and behaviors have not been investigated yet. However, the conditions created by the health emergency events (i.e. the increasing usage of crowd-monitoring systems in stores and applications providing the status of crowding) enable us to provide a consumers' perspective on technology applications and benefits.

Therefore, this paper investigates the impact of crowd-checking technological cues on shopping anxiety, the perceived value of shopping and the willingness to pay in stores with such technology. The study uses terror management theory (TMT; Pyszczynski *et al.*, 1999) and stimulus–organism–response (S–O–R) model (Mehrabian and Russell, 1974). TMT is used to explain consumers' reactions to health emergencies and interventions, such as crowd-checking technology, to manage anxiety. The use of the S–O–R model guides the sequence of responses to crowd-checking technological cues in terms of individuals' psychological/emotional, behavioral and attitudinal factors. Accordingly, we investigate the moderating role of shopping orientation on the crowd-checking technological cues – shopping anxiety relationship.

The study has several potential contributions to the literature. First, it aims to contribute to research in retail settings, which has largely focused on self-service technology and smart devices supporting personalized experiences (Dabholkar and Bagozzi, 2002; Mehta, 2013) rather than technology to manage customers' anxiety while shopping. By testing the moderating role of functional and experiential shopping orientation, the study aims to shed

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light on the conditions under which technological cues have a stronger impact on individuals' emotional states. Second, focusing on anxiety in stores induced by the fears of contracting the virus, the study aims to extend the understanding of the role of innovative technology in diminishing negative psychological states. Prior studies have mainly examined such psychological states about technology complexity and time pressure (Babin *et al.*, 2007; Plangger and Montecchi, 2020). In addition, by using TMT to explore consumer behavior, the study expands insights into applying the theory in marketing.

## 2. Theoretical background

Technology solutions such as touch screens, digital assistants, augmented reality, etc. have been getting wider utilization in retail settings due to their benefits for the retailer and customers (Tran *et al.*, 2021; Pantano and Scarpi, 2022; Adapa *et al.*, 2020; Brown and Russell, 2007). Specifically, technologies increased productivity and service quality and reduced costs (Weijters *et al.*, 2007; Dabholkar and Bagozzi, 2002; Lee, 2015). Cost reduction stems from the decrease instore checkout time, which is positively related to consumers' overall experience (Weijters *et al.*, 2007). The positive role of self-service technologies in the retail sector can also be explained by the associated feeling of enjoyment and satisfaction with the shopping experience (Wang, 2012). Smart retailing technology (i.e. connected systems enabling seamless management of customer journey and automation of customer experience) decreased the feeling of uncertainty about the negative consequence of purchase and increased satisfaction (Roy *et al.*, 2017). Such perceptions, consequently, lead to positive word-of-mouth and perceived shopping effectiveness (Roy *et al.*, 2017). The far-reaching consequences of smart retailing technological cues include increased loyalty toward the retailer and perceived quality of life (Adapa *et al.*, 2020; Roy *et al.*, 2017). Apart from the functional benefits of innovative technologies in the retail sector, prior research also discussed the role of internet of things (IoT) and self-service technologies in reducing anxiety that happens when stores are overcrowded (Dabholkar and Bagozzi, 2002).

Social anxiety is defined as "the discomfort associated with the awareness of other individuals' perspective of oneself as a social object" (Fenigstein *et al.*, 1975, p. 523). Individuals' feelings of anxiety can be triggered by situational factors (Dabholkar and Bagozzi, 2002). In a similar vein, in the retail sector, anxiety can refer to the feeling of discomfort associated with crowding, which is a major stressor for consumers (Aylott and Mitchell, 1998) undermining the shopping experience (Hui and Bateson, 1991). The impact of crowding on people in stores can be explained by stimulus overload theory (Desor, 1972; Coskun *et al.*, 2019), which states that crowd density in public places leads to cognitive overload and a psychologically negative state. Shopping anxiety has implications for consumers and retailers (Hui and Bateson, 1991; Delacroix and Guillard, 2016). This feeling negatively influences individuals' psychological well-being (Smith *et al.*, 2020). This, in turn, determines consumers' behavioral response and attitude toward the retailer, as individuals with high anxiety experienced in retail settings tend to avoid social interactions (Blut and Iyer, 2020; Eroglu *et al.*, 2005; Mehta *et al.*, 2013; Pantano *et al.*, 2020). To improve individuals' in-store shopping experience and lower anxiety, many retailers use technologies, such as self-checkout stations (Mehta, 2013). However, health emergencies, such as COVID-19 outbreak significantly affected store consumer behavior due to social distancing measures and fear of contracting the virus (Shankar *et al.*, 2021; Pantano *et al.*, 2020; Kotb, 2020). The pandemic has amplified the impact of anxiety on the operation of retailers and the behavior of consumers. Such transformations have made retailers rethink the application of innovative technologies beyond self-service stations.

Crowd-checking systems emerged as a promising solution to manage store capacity and lessen the anxiety associated with health threats while shopping in stores. On the one hand, such technology has a significant instrumental value for retailers as it can signal a store's safety and, thus, shape favorable consumers' attitudes by indicating the degree to which the capacity of stores is occupied (Adam *et al.*, 2020). Consequently, the efficient regulation of the number of people in stores can potentially positively impact the overall supply chain system. On the other hand, the constraining effect of such technology on anxiety can be arguable because of the perception of potential privacy intrusion resulting from ubiquitous surveillance. Therefore, the impact of crowd-checking technology on an individual's psychological state and behavioral responses requires attention, as the literature still lacks evidence about the consequences of crowd-checking technological cues.

To examine the impact of crowd-checking technology cues on consumers' reactions and intentions, this study uses TMT and S-O-R model. TMT was developed to explain how people protect themselves when concerns about death arise (Pyszczynski *et al.*, 1999). Anxiety is a pivotal construct in individuals' responses, defined as a negative psychological consequence resulting from the awareness of death (Juhl and Routledge, 2016) that can occur anywhere and anytime in everyday activities. Anxiety is associated with cognitive concerns (e.g. fear of losing control), physical concerns (e.g. fear of harm) and social concerns (e.g. fear of ridicule; Gallagher *et al.*, 2017). TMT posits that as fear of death stems from the absolute elimination of the self, people would engage in conscious and unconscious behaviors to buffer such anxiety (examples range from religious beliefs to planning actions; Pyszczynski *et al.*, 1999). Pandemics and emergencies can emphasize the fear of a potential threat to one's health and life and induce individuals' responses to negative feelings (Maxfield *et al.*, 2014; Pyszczynski *et al.*, 2021). Therefore, the theory can be used to explain consumers' reactions to any situation where consumers feel risks from crowding, such as contagion and attacks. In this vein, crowd-checking technology becomes a tool to manage consumers' anxiety when shopping in person.

Although TMT can potentially interpret consumer responses during and after health emergencies, it has not been used to investigate consumers' behaviors in the context of health-related or stressful events. In the frame of this research, we contextualize anxiety (shopping anxiety) and define it as an experienced negative psychological state and associated responses manifested while shopping within the store environment. Such a conceptualization of shopping anxiety has particular relevance in the context of epidemics (Xiao *et al.*, 2020), where practitioners around the world have witnessed consumers' reluctance to shop in person, compulsive buying, hoarding, stockpiling and other instances of consumer misbehavior (Gallagher *et al.*, 2017; Xiao *et al.*, 2020). By using the theoretical lenses of TMT, these misbehaviors can be interpreted as psychological defensive mechanisms that individuals put in place to cope with anxiety (Maxfield *et al.*, 2014).

The use of S-O-R guides the conceptualization of individuals' psychological, behavioral and attitudinal responses to crowd-checking technological cues to cope with anxiety. The S-O-R model has been used in prior research examining individuals' behavior in the retail context to hypothesize the relationships between retail environment characteristics, consumers' emotions and shopping behavior (Chang *et al.*, 2011; Mummalaneni, 2005). The classical S-O-R model postulates that stimulus represents the factors that impact individuals' internal states. These factors are external to individuals. In the marketing context, they can be marketing communications affecting decisions. The organism variable refers to internal processes resulting from the effect of the stimulus, which can be in the form of thoughts, feelings and psychological states, triggering actions (Bagozzi, 1986). Also, processes can be measured as pleasure, arousal and dominance state, representing

emotional, cognitive and affective processes (Mehrabian and Russell, 1974). The response is the outcome variable representing behavior or behavioral intention (Mehrabian and Russell, 1974). In the context of this research, crowd-checking technological cues are the stimuli that are elicited to diminish shopping anxiety in consumers. Reduced anxiety activates behavioral responses, such as perception of shopping value and intention to pay.

### 3. Hypotheses development

Shopping anxiety caused by the fear of contracting the virus due to crowding can be explained in several ways. Following the principles of the stimulus overload theory, overcrowding is perceived in the condition of excessive environmental stimulation. In such conditions, people cannot process information resulting in cognitive overload, which can entail anxiety (Desor, 1972; Aylott and Mitchell, 1998) and negative behavioral outcomes (e.g. shopper confusion; Coskun *et al.*, 2019). After the COVID-19 outbreak, the negative impact of shopping anxiety on consumer behavior has largely been attributed to health threats, which are perceived as high in crowded public places, such as stores (Mason *et al.*, 2020). Digital retail technologies (e.g. self-service technologies, smart technologies and IoT) reduce in-store waiting time and increase individuals' satisfaction (Wang, 2012).

Similarly, crowd-checking technologies can represent an effective tool to manage capacity in stores (Adam *et al.*, 2020). They can help consumers feel that retailers have taken the necessary measures to avoid contagion exposition while shopping. According to the tenets of TMT, having put into action a potentially self-preserving behavior, such as using a technology that limits exposure to contagion, is an anxiety-buffering mechanism (Pyszczynski *et al.*, 2021). Based on the findings of the prior literature, the nature of crowd-checking technologies, and the tenets of TMT, we posit that:

*H1.* Crowd-checking technological cues reduce consumers' shopping anxiety.

The feeling of shopping an anxiety has serious implications for consumers' behavior and perceptions (Aylott and Mitchell, 1998; Lee *et al.*, 2010; Lee and Yang, 2013; Celik, 2016). It is strongly associated with a negative feeling of distress (Hyseni Duraku and Hoxha, 2018). For example, the positive impact of variables, such as facilitating conditions and utilitarian and hedonic factors, on behavior is diminished when individuals hold a high level of anxiety (Yang and Forney, 2013). In the retail context, anxiety while shopping can lead to a decline in either the number of visits to stores or purchases per visit (Thomas and Bromley, 1996; Celik, 2016). In addition, this emotional state can hinder individuals' behavioral intention and the perceived overall value of objects (Suri *et al.*, 2003; Turel *et al.*, 2007; Hackbarth *et al.*, 2003).

In contrast, this study assumes that consumers would have a stronger sense of the value of their behavior (i.e. shopping) by regulating anxiety with crowd-checker technology. Such an assumption is in line with TMT, which suggests that quelling anxiety assuages death concerns, and imbues one's actions with a sense of value (Pyszczynski *et al.*, 2021). Hence, the study posits that:

*H2.* Lower levels of shopping anxiety, induced by crowd-checking technological cues lead to a higher perceived value of the shopping experience.

The role of shopping anxiety in behavior draws on evidence from information systems management research and TMT. When it comes to interactions with technology, anxiety negatively contributes to individuals' behavior (Powell, 2013; Chiu and Wang, 2008).

Anxiety associated with information overload enhances reluctance to purchase knowledge-related products (Lin *et al.*, 2021).

Anxiety triggered by the lack of skills in using mobile technology diminishes the intention to purchase mobile devices (Lu and Su, 2009). Also, researchers found that the heightened feeling of anxiety reduces consumers' intention to purchase services from the provider with whom they do not identify (Lee *et al.*, 2011). Given that a high level of anxiety inhibits behavioral intention (Powell, 2013), low levels of such feeling can increase the willingness to engage in shopping transactions accordingly. From the perspective of TMT, the objects (tools, actions, events and ideas) that reduce anxiety tend to be rewarded (Pyszczynski *et al.*, 2021). In this research, such objects can be crowd-checking technological cues that help maintain social distancing and diminish the spread of the virus. Accordingly, we posit that consumers will be willing to spend more money in a store that offers them tools to relieve shopping anxiety. Therefore, the following hypothesis states:

*H3.* Lower shopping anxiety levels increase willingness to pay in stores with installed crowd-checking technology.

Several studies have shown that consumers could purchase based on necessity, seeking cognitively-oriented benefits and considering shopping a task to reach a goal (Hirschman and Holbrook, 1982; Childers *et al.*, 2001; Scarpi, 2021a). On the other hand, other consumers enjoy shopping and immerse themselves in the store environment, driven by the desire for exploration, sensory gratification, escapism and fun. They enjoy the experience of shopping *per se*, regardless of the products they might have purchased (Babin *et al.*, 1994; Desmichel and Kocher, 2020). These different orientations toward shopping are usually classified in terms of functional and experiential (or utilitarian and hedonic) shopping.

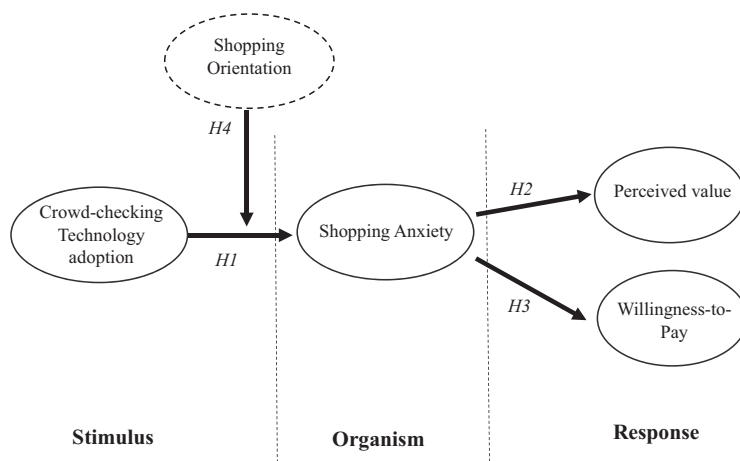
The studies published before COVID-19 documented that consumers with an experiential shopping orientation prefer high-arousal environments, whereas low-arousal environments were found to be important for consumers with a functional shopping orientation (Kaltcheva and Weitz, 2006; Van Rompay *et al.*, 2012). Similarly, perceptions of crowding levels and reactions to crowding were diverse for experientially and functionally-oriented shoppers. Task-focused shoppers overestimated people's density in the store space, while experiential shoppers underestimated it (Baker and Wakefield, 2012; Eroglu and Machleit, 1990). Consequently, experientially-oriented shoppers were less stressed by the high density of people in shopping areas than functionally-oriented customers (Baker and Wakefield, 2012). In light of the more negative reactions to crowding by functional shoppers as identified by previous studies, and considering that crowd-checker technology regulates the number of people in stores, we posit that:

*H4.* The relationship between crowd-checking technology and shopping anxiety is moderated so that anxiety will be higher for functional than experiential shoppers.

Figure 1 summarizes all hypotheses that are put forward in this study.

### 3. Method

*Data collection:* A total of 1,000 UK respondents (51% female; Mean age = 40; Median age = 41 years) from an online panel were recruited in February 2021 by a British market research company (Prolific). The research company ensured that the sample reflects the demographics of UK consumers. To ensure that respondents had fresh memories of shopping experience, the survey incorporated the filter question to include respondents who had shopped less than one week before taking the survey. The questionnaire was developed



**Figure 1.**  
The conceptual model

and distributed electronically. It consisted of questions measuring the constructs in the conceptual model and socio-demographic characteristics (age and gender). The participants were invited to fill in the online survey voluntarily for a monetary incentive. Filter questions ensured that half of the respondents had experienced the Crowd-Checker technology during their last shopping expedition, while the other half had not.

*Measures:* Participants were asked to think about their last shopping experience in a store. They answered the items measuring crowd-checker technological cues (Yen *et al.*, 2010), shopping anxiety (adapted from Sego and Stout, 1994), the perceived value of shopping (El-Haddadeh *et al.*, 2019) and willingness to pay in a store with crowd-checking technology (adapting Homburg *et al.*, 2005's one-item question). Respondents were also asked about their shopping orientation (experiential vs functional) (Babin *et al.*, 1994). Except for willingness to pay, all questions were measured using a seven-point Likert scale, with the lowest point being 1 – strongly disagree and the highest point being 7 – strongly agree. Willingness to pay was assessed with a one-item measure as in Scarpi (2021b). The items are presented in Table A1 in the Appendix.

Those respondents who had not had a shopping experience with a crowd-checker installed in stores were provided with a detailed explanation of the technology. All respondents read a description of the crowd-checker and saw pictures from the stores' websites implementing the technology (Appendix) with a short explanation of its functions. In addition, respondents' mood (Watson *et al.*, 1988), age and vaccination status were tested as possible covariates.

*Analysis:* Structural equation modeling by using SPSS AMOS 25 was conducted to test the hypothesized relationships. The first step was to estimate the measurement model and the reliability of scales to make sure that the constructs were valid and measured what they were supposed to measure. The second step was to estimate the significance of the paths. The third step was to run a moderation analysis. The functional and experiential shopping orientation moderation was estimated following Afthanorhan *et al.* (2014) approach. The approach required splitting the data set using the median-split method into two groups with low and high values for shopping orientation variables. The method implies the analysis of the same model with split data sets and the comparison of the effect sizes, assuming that the variance in the effects between the two samples is significant, as in prior research (Davlembayeva *et al.*, 2020; Davlembayeva *et al.*, 2021).



**4. Results**

*Scales and checks:* Factor analysis (oblimin rotation; 83.20% of variance explained) confirmed the constructs’ dimensionality and showed a satisfactory fit (Chi-square/df < 3; CFI = 0.96, NNFI = 0.95, RMSEA = 0.07; SRMR = 0.04).

Convergent validity is established, as Cronbach’s alphas exceeded the recommended minimum thresholds (> 0.78), the average variance extracted (AVE) values are greater than 0.5, the standardized factor loading of all items exceed 0.5 and the composite reliability (CR) is not less than 0.7 for each construct. Details are reported in [Table A1](#) in the [Appendix](#).

Discriminant validity is established, as the square root of each construct’s AVE is higher than its correlation with another construct, and each item loads highest on its associated construct ([Fornell and Larcker \(1981\)](#)). Details are reported in [Table 1](#) below and in [Table A1](#) in the [Appendix](#).

Finally, following [Kock \(2015\)](#), collinearity diagnostic ensured that VIF values were below the recommended threshold of 5 (maximum VIF = 1.76). In addition, Harman’s one-factor test shows a significant reduction in fit for the one-factor solution (Chi-square/df > 3;  $p < 0.001$ ), which reduces concerns about common method bias.

*Model estimation:* The results show a satisfactory model fit (Chi-square/df < 3; CFI = 0.95, NNFI = 0.95, RMSEA = 0.06; SRMR = 0.04) and reveal that crowd-checker technological cues reduced shopping anxiety levels ( $\beta = -0.64$ ;  $p < 0.001$ ), supporting *H1*. In turn, lower shopping anxiety led to higher levels of perceived value ( $\beta = -0.48$ ;  $p < 0.001$ ) and willingness to pay ( $\beta = -2.77$ ;  $p < 0.001$ ), as proposed in hypotheses *H2* and *H3*. Direct effects were found when examining the relationship of technology cues with perceived value ( $\beta = 0.33$ ;  $p < 0.001$ ) and willingness to pay ( $\beta = 1.53$ ;  $p = <0.001$ ). This evidence shows that shopping anxiety partially mediated the relationship between technology cues and the outcome variables.

The model was also tested by controlling for the effects of age and gender. As variance was not significant, we confirm that the results of the path analysis hold for different age and gender groups. Furthermore, results support *H4*. Shopping orientation positively moderated the relationship between technological cues and shopping anxiety ( $\beta = 0.34$ ,  $p = 0.04$ ). This evidence suggests that the crowd-checker was more effective as an anxiety buffer for customers with a prevalent functional-utilitarian shopping orientation than experiential shoppers. [Table 2](#) presents the model estimates results graphically presented in [Figure 2](#).

Respondents’ positive and negative moods and vaccination status were added as possible covariates to the model. None of them were confirmed to be significant

Construct	Shopping anxiety	Perceived value	Willingness to pay	Shopping orientation	Technological cues
<i>Shopping anxiety</i>	1	0.435**	0.172**	0.021	-0.142**
<i>Perceived value</i>	<i>0.189</i>	1	0.256**	-0.026	0.029
<i>Willingness to pay</i>	<i>0.029</i>	<i>0.066</i>	1	0.128*	0.160**
<i>Shopping orientation</i>	<i>0.001</i>	<i>0.001</i>	<i>0.017</i>	1	0.034
<i>Technological cues</i>	<i>0.020</i>	<i>0.001</i>	<i>0,026</i>	<i>0.001</i>	1

**Table 1.** Discriminant validity constructs’ correlations (above diagonal) and squared correlations

**Notes:** Constructs’ correlations (above diagonal) and squared correlations (in italics, below diagonal); \*\*correlation is significant at the <0.01 level (two tailed); \*correlation is significant at the <0.05 level (two tailed)

constraints when testing relationships ( $p$ -values ranging from 0.14 to 0.30 for negative mood; 0.26 to 0.79 for positive mood; 0.20 to 0.41 for age; and 0.21 to 0.98 for vaccination status).

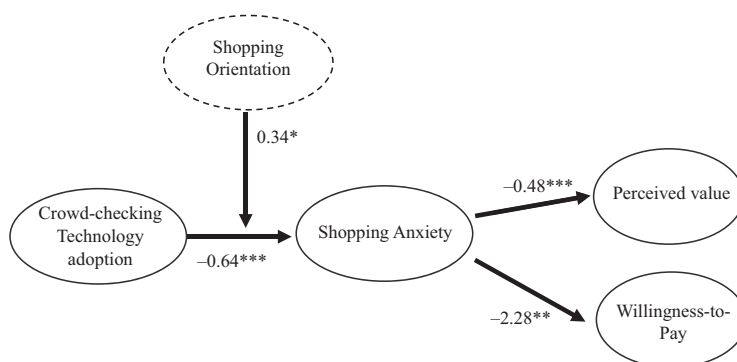
### 5. Discussion

The negative relationship between crowd-checking technology and shopping anxiety supports the hypothesis that crowd-checker technological cues would reduce shopping anxiety levels ( $H1$ ). Since the technologies can monitor and regulate the capacity in stores (Adam *et al.*, 2020), it is an effective tool to avoid overcrowding, which is one of the sources of anxiety. Prior research found that smart retailing and self-service technology can help manage the flow of people in stores and, thus, reduce anxiety (Coskun *et al.*, 2019). This research confirmed the role of emerging technology in coping with the anxiety associated with the threat that overpopulated places can cause to health by proposing a new technology (crowd-checking) that might reduce the negative consumer reactions caused by in-store crowding. Such a finding supports the assumptions of this study based on the tenets of TMT that the initiation of potentially self-preserving behavior, such as using a technology that limits exposure to contagion, serves as an anxiety-buffering mechanism (Pyszczyński *et al.*, 2021).

The path between shopping anxiety and perceived value confirmed the second hypothesis. That means that lower levels of shopping anxiety, induced by crowd-checking technological cues, lead to a higher perceived value of the shopping experience. High levels

Hypothesis	Path	Estimate (SE)	$p$ -value
$H1$	Technological cues → shopping anxiety	-0.635 (0.090)	< 0.001
$H2$	Shopping anxiety → perceived value	-0.484 (0.031)	< 0.001
$H3$	Shopping anxiety → willingness to pay	-1.277 (0.461)	0.002
$H4$	Moderation by shopping orientation:	0.342 (0.166)	0.040
	Direct effect on perceived value	0.334 (0.043)	< 0.001
	Direct effect on willingness to pay	1.532 (0.051)	< 0.001

**Table 2.**  
Model estimates



**Notes:** \*\*\*Correlation is significant at the < 0.001 level (2-tailed); \*\*correlation is significant at the < 0.01 level (2-tailed); \*correlation is significant at the < 0.05 level (2-tailed)

**Figure 2.**  
Model estimates

of anxiety can lead to negative implications (i.e. a decline in purchases, weak behavioral intention and low perceived value; Aylott and Mitchell, 1998; Lee *et al.*, 2010; Lee and Yang, 2013; Celik, 2016; Suri *et al.*, 2003; Turel *et al.*, 2007; Hackbarth *et al.*, 2003). However, managing anxiety levels can facilitate positive outcomes, such as an enhanced sense of the value of shopping. Such a finding confirms the initial proposition of the study stemming from TMT that quelling anxiety softens death concerns and imbues one's actions with a sense of value (Pyszczyński *et al.*, 2021).

The significant relationship between shopping anxiety and willingness to pay in a store equipped with crowd-checking technology supports *H3*. That means that consumers are willing to spend more money in a store that offers them tools for relieving shopping anxiety. This result is in line with the findings in prior research that a strong feeling of anxiety diminishes the intention to interact with technology (Powell, 2013; Chiu and Wang, 2008). A low level of such feeling can increase the willingness to engage in shopping transactions accordingly. This finding is consistent with TMT propositions that the objects that reduce anxiety, such as crowd-checking technological cues, tend to be rewarded (Pyszczyński *et al.*, 2021).

The significant moderating effect of shopping orientation means that a crowd-checker is more effective as an anxiety buffer for functionally-oriented shoppers than for experientially-oriented ones. The interpretation of the moderating effect stems from the literature suggesting that utility-driven functional shoppers tend to overestimate the people's density in-store (Baker and Wakefield, 2012; Eroglu and Machleit, 1990) and need to be exposed to a low-arousal store environment (Kaltcheva and Weitz, 2006; Van Rompay *et al.*, 2012). Consequently, the opportunity to manage crowding levels through crowd-checker technology is more important for functional shoppers than experiential ones.

*Theoretical contribution:* The study contributes to the literature on retail technology and the research using TMT. The contribution of the study to the retail technology stream is threefold. On the one hand, integrating the S-O-R theoretical framework and TMT tenets help explain the impact of crowd-checking technological cues on individuals' feelings of shopping anxiety and consequent behavioral and attitudinal responses. This study finds that technology reduces anxiety when shopping in physical stores. A low level of anxiety, in turn, translates into a high perceived value of shopping and the willingness to pay more in shops with deployed crowd-checkers. Such findings are novel in the research on the utilization of technology in retail settings for managing the customer journey and shopping anxiety, as prior studies largely focused on smart retailing systems and self-service technology, ensuring the efficiency and personalization of shopping services (Dabholkar and Bagozzi, 2002; Mehta, 2013). The study helps explain consumers' feelings toward stores that introduce measures to cope with health emergencies and manage customers' experiences in emergency conditions. It also helps address recent calls for more investigation into individuals' mental health due to the pandemic (Holmes *et al.*, 2020).

On the other hand, the study provides conditions under which technological cues have a stronger impact on individuals' emotional states by checking the moderating role of functional and experiential shopping orientation. The results show that technology has a more positive impact on consumers when they have a functional shopping orientation. The technology makes the shopping experience safer without compromising on consumers' fun and enjoyment, ultimately leading to more positive outcomes for customers and practitioners.

Second, the study contributes to the literature on social anxiety. Prior research usually examined social anxiety induced by technology complexity or time pressure (Babin *et al.*, 2007; Plangger and Montecchi, 2020). Instead, anxiety examined in this study is related to the cognitive and social concerns about the potential harm (Gallagher *et al.*, 2017) of contagion while shopping in-store during a pandemic.

Third, the study complements TMT literature by testing the theory's explanatory power in consumer behavior. Priorly, the theory was used in sociology and psychology to interpret social and psychological health emergency-related phenomena (Pyszczynski *et al.*, 2021). Consequently, this study provides a novel perspective on the application of TMT in retail and consumer studies. Finally, the paper contributes to the recent debate on the effect of technology on consumers' emotions (Pantano and Scarpi, 2022), with evidence from the impact on reducing a particular emotion (anxiety).

*Managerial Implications:* The main suggestion stemming from this research is deploying crowd-checking technology in stores. As opposed to Google's real-time crowd-checker, the deployment of a retailer's specific solution enables stores to have access to and control over historical data about the capacity at a particular time and in particular places in the store and make more precise predictions accordingly. Consequently, managers could think of solutions to reduce crowding in the points of sale by ensuring that customers are better distributed across the shopping area. The deployment of the technology could also help regulate the number of people inside the shopping area in real time by using crowd-checker alarm thresholds to indicate the optimal capacity in different store departments. Second, managers should ensure that the crowd-checker feature is readily available on their channels (online, mobile and before entering the store). Making sure that it is easily available will help alleviate the potential shopping anxiety of customers. To that end, managers could extend the functionality of a crowd-checking system by linking it with booking systems to manage the capacity of stores across working hours. This action would help improve the perceived value of the shopping experience and consumers' willingness to pay.

Third, the positive effect of crowd-checker technological cues on the perceived level of shopping anxiety suggests that the deployment of the technology would help reduce negative feelings while shopping in crowded areas, which, in turn, can facilitate purchasing behavior. Such findings have practical importance since managing customer experience in crowded places had been a challenge even before the pandemic (Blut and Iyer, 2020). Thus, practitioners could think of leveraging the use of technology in the postpandemic reality when distancing habits and reluctance to visit crowded public places will be most likely to persist. Incorporating crowd checkers can improve customers' shopping experience, which is crucial when it comes to improving sales and retaining customers.

Fourth, the findings of the moderating role of shopping experiences suggest that practitioners need to consider the challenge of designing shopping experiences that attract both functional and experiential shoppers. Functional shoppers are usually considered particularly difficult to keep and more likely to switch to online retail channels. However, our results demonstrate that crowd-checking systems can support managers in attracting and keeping functionally-oriented shoppers. Consequently, practitioners could communicate to consumers how to better manage their technology experience and decrease anxiety.

## 6. Conclusion

Even before the pandemic, the excessive concentration of people in space (crowding) was considered an anxiety-inducing factor that discouraged people from shopping

(Baker and Wakefield, 2012; Blut and Iyer, 2020; Rayport *et al.*, 2005). However, new technology has been developed and implemented in the retail sector, such as crowd-checking systems, potentially changing consumers' shopping experiences. Therefore, a new line of investigation is needed to explore technology's role in customers' perceptions, attitudes and behaviors (Hoyer *et al.*, 2020). This research is the first one investigating crowd monitoring systems used at the initial stage of consumers' journey by showing the number of consumers in-store in real time. It found that technological cues reduce shopping anxiety. Lower anxiety enhances customers' perceived value of the shopping experience and increases the willingness to pay in stores with integrated crowd-checker technology.

The summary of the main findings and theoretical and managerial implications is provided in Table 3.

### 7. Limitations and future research directions

This research has some limitations that open new lines of inquiry for future studies. First, since the study did not distinguish between different types of buyers (e.g. light and heavy buyers), future studies could explore whether the effects of crowd-checking technology differ among specific customer segments. Such an approach would add insight into the technology's anxiety-relieving potential by identifying market segments that benefit more from crowd-checking technology. Second, the proposed model was investigated by using a UK-based sample. Given that individuals' culture plays a significant role in shopping behavior (Stafford *et al.*, 2004; Gentina *et al.*, 2014), it is important to test the model using respondents from various geographical locations. Finally, due to the difference in the pace at which information systems are present in different countries, it may be worth investigating the effectiveness of new retail technologies in countries with different technological infrastructures. Similarly, future research could investigate whether different generational cohorts perceive different utilitarian and hedonic benefits from using crowd-checking technology.

Conclusions	Theoretical and managerial implications
<ul style="list-style-type: none"> <li>• Crowd-checker lowers shopping anxiety, raises perceived value and willingness to pay</li> <li>• Functionally-oriented (utilitarian) shoppers benefit most from crowd-checking technology</li> <li>• Shopping orientation moderates the crowd-checker's efficacy in anxiety reduction</li> </ul>	<ul style="list-style-type: none"> <li>• The study brings novel insights about the utilization of technology for managing the customer journey and shopping anxiety, thus, contributing to the research on technology use in retail settings</li> <li>• The findings extend the literature on technology-induced social anxiety by exploring shopping anxiety</li> <li>• The study complements the TMT literature by applying the theory to examine consumer behavior in the retail context</li> <li>• Retailers should deploy crowd-checking technology in stores to regulate the levels of shopping anxiety in the postpandemic reality</li> <li>• Managers should ensure the accessibility of the indicators of crowding level in stores via all online channels and in physical stores</li> <li>• Retailers could leverage the data collected by crowd-checkers to control and regulate the capacity of stores</li> </ul>

**Table 3.**  
Conclusions,  
theoretical and  
managerial  
implications

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#### Appendix. Example of crowd-checker on the website of a shopping center website



Figure A1.

Measures	Loadings
<i>Shopping anxiety</i> (from <a href="#">Sego and Stout, 1994</a> )	
Cronhbach's alpha = 0.87; AVE = 0.82: CR = 0.95	
Because of the possibility of contracting the virus when shopping, I felt . . .	
1. . . . restless or jittery	0.733
2. . . . tense	0.911
3. . . . anxious	0.999
4. . . . worried	0.947
<i>Perceived value</i> (from <a href="#">El-Haddadeh et al., 2019</a> )	
Cronhbach's alpha = 0.94; AVE = 0.84: CR = 0.94	
1. Compared to the effort I need to put in, using a crowd-checker would be beneficial to my shopping experience	0.922
2. Compared to the time I need to spend, using a crowd-checker is worthwhile to my shopping experience	0.980
3. Overall, the usage of a crowd-checker delivers good value for my shopping experience	0.839
<i>Willingness to pay</i> ( <a href="#">Homburg et al., 2005</a> )	
1. How much more/less do you think you would be spending in a store that offers you a technology like crowd-checker?	
-	
<i>Shopping orientation:</i> (from <a href="#">Babin et al., 1994</a> )	
<i>Experiential</i>	
Cronhbach's alpha = 0.91; AVE = 0.73: CR = 0.92	
1. I had a good time while shopping because I was able to act on the "spur of the moment"	0.922
2. I enjoyed shopping for its own sake, not just for the items I may have purchased	0.893
3. That shopping trip was truly a joy	0.764
4. I continued to shop, not because I had to, but because I wanted to	0.808
<i>Functional</i>	
Cronhbach's alpha = 0.78; AVE = 0.56: CR = 0.79	
1. While shopping, I found just the item(s) I am looking for	0.813
2. I bought what I needed	0.699
3. I would have been disappointed if I had to go to another store(s) to complete my shopping	0.721
<i>Technological cues</i> (from <a href="#">Yen et al., 2010</a> )	
Cronhbach's alpha = 0.93; AVE = 0.88: CR = 0.93	
1. Assuming the crowd-checker characteristics, I predict that it will help me	0.934
2. Overall, I'd appreciate a system like crowd-checker for my shopping, if available	0.938

**Table A1.**  
Construct measures

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