Keeping Distance! How Infectious Disease Threat Lowers Consumers' Attitudes Toward Densely Displayed Products

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ABSTRACT

Infectious diseases have been posing frequent and significant threats to us. However, research on how disease threat affects consumer behavior, especially sensory responses, is still limited. In this study, drawing on the theory of compensatory consumption, we show that consumers under disease threat are less willing to buy products presented in a dense display. This is because disease threat activates a high-density avoidance mindset, which is carried over to the way in which products are placed. Moreover, this effect is mitigated when diseases are noninfectious or when disinfectant products are displayed. A set of four studies, which adopt lab and field settings, using different manipulations and measures, provide convergent evidence for these effects. Specifically, Study 1 examines the main effect of disease threat on product display. Study 2 tests the mediating role of high-density avoidance mindset as well as the moderating role of disease infectiousness. Study 3 proceeds to explore product type as the other boundary condition. Finally, Study 4 provides real world evidence through a field experiment. Furthermore, in these studies, five alternative explanations were ruled out to further clarify the psychological process. These findings offer valuable insights for retailers regarding product display strategies.

Keywords: disease threat, compensatory consumption, product display, sensory marketing

1. Introduction

Infectious diseases have been posing serious and frequent threats to humans from ancient times to date. For example, the Black Death stands as one of the most severe pandemics in human history. It spread throughout Europe in the 1440s and led to approximately 200 million deaths. During the seventeenth and eighteenth centuries, smallpox resulted in a 90% mortality rate in the Americas. The Spanish flu in 1918 infected approximately 500 million people globally, roughly one-third of the world's population then. Given the lack of effective drugs and vaccines, it ultimately caused nearly 50 million deaths. However, the impact of infectious diseases on marketing is largely overlooked (Das et al., 2021). Only recently, a number of researchers have examined how infectious diseases affect consumer psychology and behavior. For example, disease threat can increase preferences for more familiar products (Galoni et al., 2020) and pattern seeking in sequential choices (J. Park, Kim, Jhang et al., 2022). However, disease threat decreases consumers' preference for typical (vs. atypical) options (Huang & Sengupta, 2020). Although these studies shed some light on how disease threat affects consumer behavior, a sparse amount of literature has examined its impact on visual sensory marketing, which is one of the most classic and important research fields in marketing (Cascio Rizzo et al., 2023). This study contributes to the literature on disease threat by systematically investigating its one potential visual sensory outcome, that is, consumers' response to product display when the disease is salient.

Moreover, prior studies on diseases have pointed out how individuals respond to disease threat by exhibiting social avoidance. For instance, Mortensen et al. (2010) revealed that disease priming promotes individuals' avoidance of other people. In accordance with this notion, Thiebaut et al. (2021) found that during the outbreak of an infectious disease, people were reluctant to touch or be touched by others. Huang and Sengupta (2020) further showed that consumers under the threat of diseases are less likely to prefer typical (vs. atypical) products because typical ones are implicitly associated with many people. I. J. Park et al. (2021) found that when a pandemic is

salient, consumers prefer uncrowded travel options. Similarly, infectious diseases lower consumers' preference for anthropomorphic products (Ding & Xu, 2023). We significantly advance this line of findings by documenting that high density avoidance triggered by disease threat can transfer to densely displayed products.

Furthermore, given that changes to visual sensory elements are easy, understanding these visual sensory aspects of marketing has important practical relevance (Fürst et al., 2021; Y. Jia et al., 2017; Ouyang et al., 2022). However, as a key aspect of marketing that is closely linked to performance, visual display decisions are currently underexplored and thus require further research (H. Jia et al., 2023). To date, display management research has focused mainly on product location (Garrido-Morgado et al., 2021) and product categorization (Rooderkerk & Lehmann, 2021) rather than display formats, such as density. We contribute to this body of literature by introducing display density, which is defined as the number of visual elements within a unit area that a visual stimulus contains (Su et al., 2019), as a new dimension of display management.

2. Theoretical Background

2.1 Infectious disease threat and product display preferences

Infectious diseases can profoundly affect consumers (Slavich, 2022). For example, when threatened by infectious diseases, consumers exhibit a decreased preference for typical (vs. atypical) options because typical products are associated with sociality (Huang & Sengupta, 2020). Li et al. (2021) found that a higher level of perceived risk of a pandemic leads to more irrational consumption behaviors. Similarly, Islam et al. (2021) showed that consumers' level of arousal is elevated by a pandemic, which, in turn, enhances impulsive and obsessive buying behaviors. Moreover, disease threat triggers consumers' implicit nostalgia, thus eliciting nostalgic consumption (Barauskaitė et al., 2022) because nostalgia could counter the negative aftermaths of loneliness induced by the pandemic of an infectious disease (Zhou et al., 2022). We summarized the key findings from the related literature in Table 1.

Table 1: Summary of consumer research on disease threat

Articles	Main focuses	Key findings
Galoni et al. (2020)	Preference for familiar products	Cues of contagious disease increase both fear and disgust, thus increasing preference for more-familiar products asymmetrically over less-familiar ones.
Huang and Sengupta (2020)	Preference for typical options	Disease salience decreases relative preference for typical versus atypical options because typical products are implicitly associated with many people.
Kim (2020)	Variety seeking	Perceived threat of disease increases the number of different options selected by consumers in multiple choices.
Islam et al. (2021)	Impulsive and obsessive purchases	During the outbreak of an infectious disease , perceived arousal has a positive correlation with impulsive and obsessive buying.
Kim et al. (2021)	Preference for high quality options	Consumers have high safety-seeking tendencies under an infectious disease and thus prefer more expensive options.
Li et al. (2021)	Irrational consumption	A closer (vs. farther) distance to the virus epicenter is associated with a lower (vs. higher) level of perceived risk of the pandemic, leading to less (vs. more) irrational consumption.
I. J. Park et al. (2021)	Preference for crowded options	Travelers would have a diminished preference for crowded (vs. uncrowded) travel and hospitality options when the ongoing pandemic is salient.
Barauskaitė et al. (2022)	Nostalgic consumption	When facing a disease threat, but not an actual occurrence of disease, consumers experience a higher need for nostalgia and show an increased preference for nostalgic products.
Moldes et al. (2022)	Materialist consumption	People's materialistic attitudes increased under the threat of infectious disease.
J. Park, Kim, Jhang et al. (2022)	Pattern seeking in sequential choices	Consumers exhibit pattern-seeking behavior in sequential choices under the threat of disease.
J. Park, Kim, Lee et al. (2022)	Evaluation of advertising messages	Disease salience lowers consumers' uncertainty and increases their preference for products that have authentic advertising messages.
Ding and Xu (2023)	Preference for anthropomorphic products	When exposed to contagious disease cues, consumers exhibit a lower preference for anthropomorphic products.

Despite the interesting findings of prior studies, our knowledge of consumers' sensory responses under disease threat is still absent. This is surprising because prior studies have shown that people rely on sensory information, especially visual cues, to detect disease threats. For instance, appearance flaws are regarded as a sensory indicator of infectious diseases (Ryan et al., 2012). Thus, to reduce the potential risk of being infected, individuals exhibit a preference for individuals who have symmetric faces, which are evolutionarily associated with better physical health conditions (Tybur et al., 2022). Similarly, individuals are more likely to pay visual attention to people who are disfigured or disabled (Ackerman et al., 2009) because of the psychological associations with diseases (Miller & Maner, 2012). Further, individuals hold more negative attitudes toward the obese during pandemics because obesity may also serve as a heuristic signal of pathogen infection (Brown & Sacco, 2022).

According to the Compensatory Consumption Behavior Model, dissociation is a common compensatory strategy that can mitigate negative feelings when a self-discrepancy represents an undesired aspect of the self (Mandel et al., 2021). For example, Mende et al. (2019) documented that when receiving instructions from a humanoid service robot, participants feel more discomfort and thus are more likely to choose a group task that involves humans to seek social affiliation. Threats are also important triggers for compensatory consumption. For instance, when under identity threat, women primed with independent self-construal reported decreased preferences for masculine brands (Dariusz, 2022). Moreover, when consumers' identities are threatened, those that have independent self-construal tend to avoid identity-linked products to protect their positive self-worth (K. White et al., 2012).

In line with the findings that represent dissociation as a psychological compensatory strategy, and in accordance with individuals' tendency to prefer visual cues that are disassociated with disease threat, we propose that consumers tend to avoid purchasing densely displayed products under disease threat. Specifically, consumers' self-discrepancy related to physical health occurs when exposed to infectious disease cues. In this situation, consumers adopt the dissociation strategy to avoid cues that could represent disease threat. Visually speaking, densely displayed products are contrary to keeping social distance, as emphasized by infectious disease prevention, and represent a crowded environment that is linked to a higher level of risk of disease. Therefore, consumers avoid products in a dense display to dissociate from the disease threat.

H1. Consumers under infectious disease threat are less willing to buy products presented in a dense display.

2.2 Mediating role of high-density avoidance mindset

Mindset is defined as "the activation and use of a procedure that is stored in memory as part of declarative knowledge" (Wyer & Xu, 2010, p. 110). A body of literature has uncovered the prevalence and variety of types of mindsets, which create significant effects on consumers' emotions, information processing, and decision-making. For example, a maximizing mindset affects information processing and choices (Cheek & Schwartz, 2016) or a scarcity mindset can divert one's attention (Huijsmans et al., 2019). Importantly, prior studies have shown that mindsets primed by a previous task or induced by stimuli presented in the past can carry over to influence a subsequent yet unrelated context. For instance, Xu et al. (2020) showed that because comparative political advertisements are omnipresent during election years, managers are more likely to hold a comparative mindset. As a result, they spend more on their managerial decisions because the comparative mindset nudges them to make social comparison and spend more on business projects. In accordance with this notion, L. Jia et al. (2022) found that exposure to pets in a prior task induces different mindsets associated with different pets. Specifically, given that the stereotypical personality traits of dogs and cats are, respectively, eagerness and cautiousness, which are commonly employed strategies by a promotion or prevention focus, consumers generated and exhibited a promotion (prevention) mindset in later activities in which no pet cues were involved.

In line with this stream of literature, we propose that disease threat evokes a high-density avoidance mindset. A body of literature within evolutionary psychology has uncovered the Behavioral Immune System (BIS), a specialized mechanism through which people manage pathogenic threats (e.g., Mortensen et al., 2010). BIS can promote one's early detection and activate behavioral avoidance of others who exhibit disease-relevant cues (Schaller et al., 2003). When an infectious disease is prevalent, individuals' BIS activates and thus they exhibit heightened avoidant behaviors toward dense crowds, which may exacerbate the possibility of being infected (Ding & Xu, 2023). Under certain circumstances, a density avoidance mindset is activated. This guides individuals' avoidant behavior toward density,

spilling over from humans to other unrelated domains, such as products. Therefore, densely displayed products are less attractive to consumers who are under disease threat.

H2. A high-density avoidance mindset mediates the effect of infectious disease threat on consumers' purchase intentions of products in a dense display. Specifically, disease threat activates a high-density avoidance mindset, which, in turn, leads to a lower willingness to buy products in a dense display.

It is worth noting that the existence of alternative explanations may challenge our proposed mechanism. For example, given the potential physical and psychological damage of infectious diseases, prior studies have indicated the possible impact of infectious diseases on mood and arousal (Cohen & Herbert, 1996). In addition, product displays may introduce confounding factors. For instance, consumers may infer fewer (vs. more) products in a loose (vs. dense) display as more popular and unique (Berger & Heath, 2007; Chan et al., 2012), thus altering their preferences. Prior studies have also depicted that the way in which products are presented can affect their perceived aesthetics levels (Logkizidou et al., 2019). These alternative explanations will be tested in the empirical studies.

2.3 Moderating role of disease infectiousness and product type

If high-density avoidance mindset does underlie how disease threat decreases consumers' attitudes toward products in a dense display, then this effect should be mitigated when a high-density avoidance mindset is suppressed. Following this logic, we first propose that disease infectiousness (infectious vs. noninfectious vs. control) moderates the effect of disease threat on consumers' attitudes toward products in a dense display. Specifically, when infectious disease threat is salient, consumers' tendency to avoid products in a dense display is pronounced because a dense display does not correspond to consumers' high-density avoidance mindset. However, in the case of a noninfectious disease, the BIS should remain inactive because it requires specific cues or stimuli to be triggered, which is intimately linked to infectiousness. Without the BIS being activated, individuals are no longer sensitive to high density. Therefore, when a noninfectious disease is salient, its effect on densely displayed products is mitigated.

H3. Disease infectiousness moderates the effect of infectious disease threat on consumers' purchase intentions of products in a dense display. Specifically, when under a noninfectious disease threat, its effect on products in a dense display is mitigated.

In addition, product type (disinfection products vs. non-disinfection products) play a moderating role. In accordance with the Elaboration Likelihood Model (Petty & Cacioppo, 1986), when faced with an infectious disease threat, given that disinfection products can directly reduce disease threat, consumers tend to critically evaluate factors along the central route, thus focusing on key attributes (e.g., sterilizing rate that represents product performance) rather than those along the peripheral route (e.g., display formats). Therefore, when presented with disinfection products, disease threat no longer exerts significant effects on consumers' attitudes toward those densely displayed.

H4. Product type moderates the effect of infectious disease threat on consumers' purchase intentions of products in a dense display. Specifically, when disinfection products are presented, the effect of infectious disease threat on a dense display is mitigated.

We summarize our conceptual framework in Figure 1.

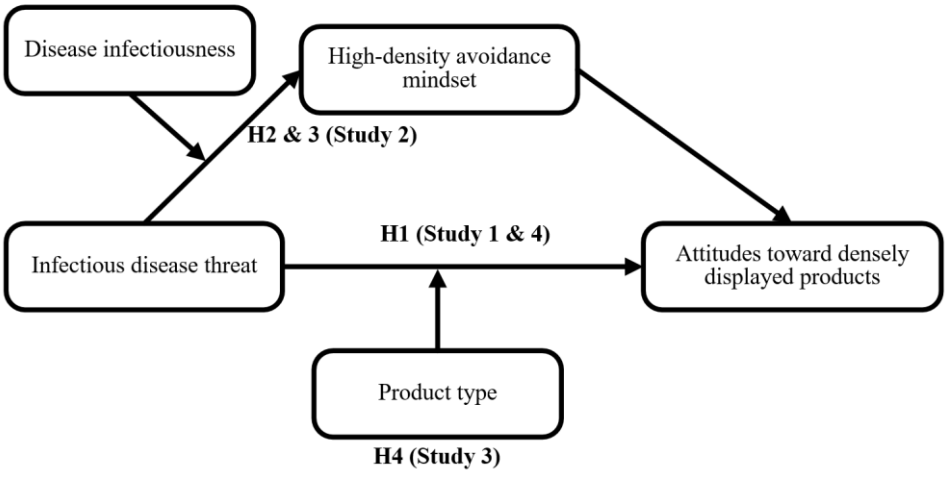

Figure 1: Research model

2.4 Study overview

We tested these hypotheses in a set of five studies. In Study 1, we examined the main effect—that is, consumers under disease threat are less willing to buy products in a dense display (H1). Study 2 tested the mediating role of high-density avoidance mindset (H2), as well as the moderating role of disease infectiousness (H3). Study 3 explored the moderating role of product type (H4). Finally, Study 4 was a field experiment that provided real world evidence for H1, improving the external validity of the present study. It is worth mentioning that pandemic situations create unchangeable effects on consumers' perceived disease threat in a relatively long-time interval; thus, we tried to conduct experiments when pandemics were less severe, which enabled us to manipulate the disease threat. However, when conducting Study 4, the research site was experiencing a severe COVID-19 pandemic. Given that it was a pre-scheduled field study, we adjusted the study design considering the ceiling effect of disease threat.

3. Study 1: Infectious Disease Threat and Product Display

The purpose of Study 1 was to examine H1 in a controlled setting. In addition, considering that individuals' perceived threat of infectious disease is highly susceptible to spatial size (Wang & Ackerman, 2019) and consumers may behave differently in the most common onsite shopping channels, specifically, supermarkets and convenience stores (Nilsson et al., 2015), which also largely diverge in size, we ruled in supermarkets and convenience stores as different consumption contexts to verify the robustness of the effect.

3.1 Method

3.1.1 Participants and design

Two hundred and twenty-three participants (56 males, M_{age} = 37.6 years, *SD* = 13.2) from Prolific were recruited for a monetary payment (approximately £1). This study followed a 3 (threat types: infectious disease threat vs. physical safety threat vs. unfamiliar environment threat) × 2 (consumption contexts: supermarket vs. store) mixed design, in which the threat types were a between-subject factor and the consumption contexts were a within-subject factor. We ruled in two threat control

conditions (i.e., physical safety threat and unfamiliar environment threat) to eliminate the mere threat as a potential confounding. In addition, we adopted two consumption contexts to check the robustness of the effect.

3.1.2 Procedure

To manipulate the threat, participants were randomly assigned to read one of three stories and instructed to imagine being in the described situation. Specifically, the disease threat story described the following: A person in your community was infected by an epidemic, and medical experts said that the disease was highly infectious. The physical safety threat story described the following: You returned home alone on a stormy night and suddenly realized that an intruder was in your house. The unfamiliar environment threat story described the following: It was the first day that you went to work, but you were not fully prepared for the unfamiliar environment you would soon face (Ahluwalia, 2002; A. E. White et al., 2013).

Next, participants were presented with promotional posters of a supermarket and convenience store (see Appendix A). The appearance order of the two stores was counterbalanced. In the two posters, a variety of store products were densely displayed. Purchase intention was then measured using five items (Cronbach's $\alpha_{supermarket} = 0.83$; Cronbach's $\alpha_{convenience\ store} = 0.88$) adapted from Hussain and Ali (2015) using a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). A sample item is: "I'm willing to buy the products in the poster" (see Appendix A for all items).

To assess whether these manipulations created the desired psychological states, participants indicated the extent to which they agreed with the following two statements that measure perceived threat: "I feel the threat of infectious diseases" and "I'm concerned about infectious diseases." Responses were provided on a 5-point scale (Cronbach's $\alpha = 0.86$; 1 = *strongly disagree*, 5 = *strongly agree*). To ensure the products on the two posters were displayed densely as intended, we asked the participants to answer two questions about the perceived density of the poster products on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*): "I think the products are very dense in terms of space" and "I don't think the products in the poster are sparsely presented." Finally, after reporting demographic information, participants were thanked and debriefed.

3.2 Results and discussion

3.2.1 Validity checks

The validity checks in this study consisted of two parts. First, a one-sample *t*-test confirmed that participants regarded the products to be densely displayed in the two posters, because the perceived density levels in the supermarket and convenience store were significantly higher than the median of 2.50 ($M_{supermarket}$ = 3.72, *SD* = 0.89, *t*(222) = 20.63, $p < 0.001$, *Cohen's d* = 2.76; $M_{convenience\ store}$ = 3.75, *SD* = 0.89, *t*(222) = 21.11, $p < 0.001$, *Cohen's d* = 2.83).

Second, to confirm the success of the threat type manipulation, participants' perceived disease threat was included as a dependent variable in a one-way analysis of variance (ANOVA) in which threat type served as the predictor. The results revealed a main effect of threat type ($F(2, 220) = 16.02$, $p < 0.001$, $\eta^2 = 0.75$). Planned contrasts further confirmed that participants in the disease threat condition reported higher levels of perceived disease threat than those in the physical safety and unfamiliar environment threat conditions ($M_{disease}$ vs. $M_{physical\ safety}$ vs. $M_{unfamiliar\ environment}$ = 4.09, 3.47, and 3.24; $F(1, 220)_{disease\ vs.\ physical\ safety}$ = 17.71, $p < 0.001$, $\eta^2 = 0.65$; $F(1, 220)_{disease\ vs.\ unfamiliar\ environment}$ = 26.82, $p < 0.001$, $\eta^2 = 0.89$) whereas the latter two conditions did not differ ($F(1, 220) = 1.80$, $p = 0.181$, $\eta^2 = 1.04$), thus confirming that the threat type manipulation worked as intended.

3.2.2 Main results

First, we conducted a mixed-designed ANOVA in which participants' purchase intention of the products in the posters was the dependent variable and the threat type manipulation and consumption context were the predictors. Consistent with expectations, the results revealed a significant main effect of threat type ($F(2, 220) = 4.93$, $p = 0.008$, $\eta^2 = 0.41$). Planned contrasts (see Figure 2) revealed that in the context of the supermarket participants in the disease threat condition reported lower levels of purchase intentions for the poster products that were displayed densely (*M* = 2.14, *SD* = 0.65) than those in the physical safety (*M* = 2.37, *SD* = 0.71) and unfamiliar environment conditions (*M* = 2.49, *SD* = 0.66; $F(1, 220)_{disease\ vs.\ physical\ safety}$ = 4.68, $p = 0.032$, $\eta^2 = 0.33$; $F(1, 220)_{disease\ vs.\ unfamiliar\ environment}$ = 8.88, $p = 0.003$,

η^2 = 0.51). The latter two conditions did not differ significantly (F(1, 220) = 0.99, p = 0.320, η^2 = 0.90).

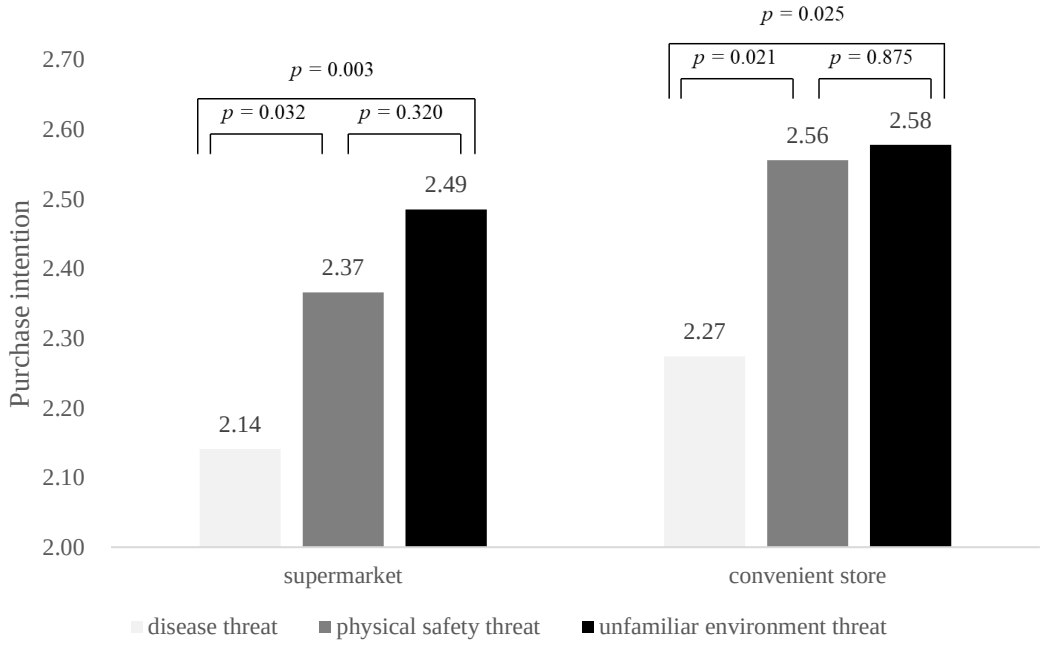

Figure 2: Participants' purchase intentions under three threat conditions (Study 1)

Similarly, the results in the context of the convenience store revealed that participants in the disease threat condition reported lower levels of purchase intentions for the poster products that were densely displayed (M = 2.27, SD = 0.82) than those in the physical safety (M = 2.56, SD = 0.80) and unfamiliar environment conditions (M = 2.58, SD = 0.71; $F(1, 220)_{disease\ vs.\ physical\ safety}$ = 5.38, p = 0.021, η^2 = 0.36; $F(1, 220)_{disease\ vs.\ unfamiliar\ environment}$ = 5.07, p = 0.025, η^2 = 0.39). The latter two conditions did not differ significantly (F(1, 220) = 0.03, p = 0.875, η^2 = 0.15). These results supported H1. In addition, they revealed a significant main effect of consumption contexts (F(2, 220) = 12.25, p < 0.001, η^2 = 0.33), which may indicate that consumers prefer shopping at convenience stores (M = 2.44, SD = 0.80) than supermarkets (M = 2.30, SD = 0.68). The interaction term was not significant (F(2, 220) = 0.47, p = 0.623).

3.2.3 Discussion

The results in Study 1 provide evidence for H1 by demonstrating that disease threat decreases consumers' purchase intentions of products in a dense display.

Moreover, by testing the potential impact of physical safety and unfamiliar environment conditions, we eliminated the possibility that the effect was driven by a general feeling of threat; instead, such an effect was unique to disease threat. In the next study, we further test the underlying mechanism through which disease threat affects consumers' purchase intention of products in a dense display.

4. Study 2: Mediating Role of High-Density Avoidance Mindset and Moderating Role of Disease Infectiousness

Study 2 had two purposes. First, we aimed to test whether consumers' high-density avoidance mindset underlies their attitudes toward densely displayed products when faced with disease threat (H2). Second, this study tested the moderating effect of disease infectiousness. We expected the effect to disappear in the noninfectious disease condition.

4.1 Method

4.1.1 Participants and design

Two hundred and seventy participants (100 males) were recruited from Credamo for a monetary payment (approximately ¥2). This study adopted a one-factor (disease types: infectious vs. noninfectious vs. control) between-subjects design.

4.1.2 Procedure

To manipulate disease types, participants were randomly assigned to read one of three stories and instructed to imagine being in the described situation. Those in the infectious disease condition read "Imagine when exercising in the gym that you suddenly receive a notification: There is an infectious disease patient in the gym." Participants in the noninfectious disease condition read "Imagine when exercising in the gym that you suddenly receive a notification: There is a heart-disease patient in the gym." Participants in the control condition read "Imagine you are exercising in the gym." To assess whether these manipulations created the desired psychological states, participants answered two items (Cronbach's $\alpha = 0.69$) that were identical to those in Study 1. Responses were provided on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*).

Participants then filled out a 5-item scale (Cronbach's $\alpha = 0.88$) that measured high-density avoidance mindset, which was adapted from O'Guinn et al. (2015) and Su et al. (2019; 1 = *strongly disagree* to 5 = *strongly agree*). A sample item is: "A high level of density reminds me of infection risk" (see Appendix B for all items). After that, participants were asked to answer four questions (Cronbach's $\alpha = 0.79$) about their attitudes toward densely displayed products. This was adapted from Neider and Zelinsky (2008) and Streicher and Estes (2016). A sample item is: "Products that are densely displayed on shelves are not attractive to me" (see Appendix B for all items). Responses were provided on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*). Finally, after reporting demographic information, participants were thanked and debriefed.

4.2 Main results and discussion

4.2.1 Manipulation check

To confirm the success of the manipulation, participants' perceived disease threat was included as the dependent variable in a one-way ANOVA. The results revealed a main effect of disease type ($F(2, 267) = 90.00$, $p < 0.001$, $\eta^2 = 1.73$). Planned contrasts further confirmed that participants in the infectious disease condition reported higher levels of perceived disease threat than those in the noninfectious disease and control conditions ($M_{infectious}$ vs. $M_{noninfectious}$ vs. $M_{control} = 4.62$, 2.83, and 2.99; $F(1, 267)_{infectious\ vs.\ noninfectious} = 147.09$, $p < 0.001$, $\eta^2 = 1.81$; $F(1, 267)_{infectious\ vs.\ control} = 121.72$, $p < 0.001$, $\eta^2 = 1.64$) whereas the latter two conditions did not differ ($F(1, 267) = 1.20$, $p = 0.274$, $\eta^2 = 0.16$).

4.2.2 Main results

Attitudes toward densely displayed products. We conducted a one-way ANOVA on participants' attitudes toward densely displayed products. Consistent with expectations, the results revealed a significant main effect of disease type ($F(2, 267) = 6.21$, $p = 0.002$, $\eta^2 = 0.44$). Planned contrasts (see Figure 3) further showed that participants in the infectious disease condition reported less favorable attitudes toward densely displayed products ($M = 4.06$, $SD = 0.71$) than those in the noninfectious disease ($M = 3.74$, $SD = 0.90$) and control conditions ($M = 3.62$, $SD = 0.99$; $F(1, 267)_{infectious\ vs.\ noninfectious} = 6.34$, $p = 0.012$, $\eta^2 = 0.38$; $F(1, 267)_{infectious}$

$_{vs.\ control}$ = 11.52, p = 0.001, η^2 = 0.51). The latter two conditions did not differ significantly (F(1, 267) = 0.77, p = 0.382, η^2 = 0.13). Taken together, these results supported H3.

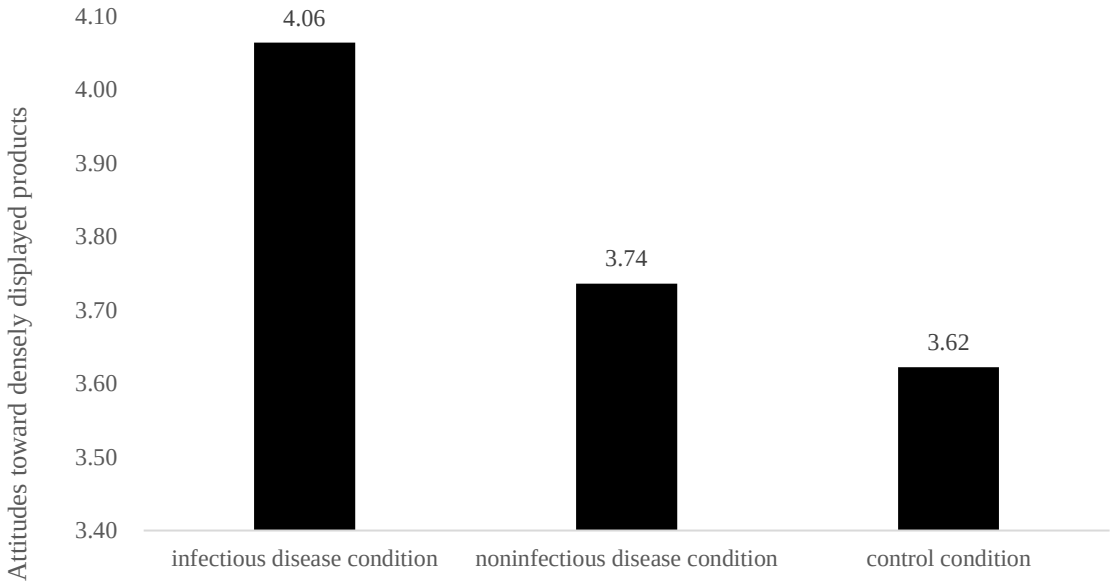

Figure 3: Attitudes toward densely displayed products (Study 2)

High-density avoidance mindset. We also conducted a one-way ANOVA on high-density avoidance mindset, which revealed a significant effect of disease type (F(2, 267) = 19.63, p < 0.001, η^2 = 0.81). Planned contrasts further showed that participants in the infectious disease condition reported higher levels of high-density avoidance mindset (M = 4.47, SD = 0.37) than those in the noninfectious disease (M = 3.79, SD = 0.92) and control conditions (M = 3.82, SD = 1.04; F(1, 267)$_{infectious\ vs.\ noninfectious}$ = 31.06, p < 0.001, η^2 = 0.83; F(1, 267)$_{infectious\ vs.\ control}$ = 27.74, p < 0.001, η^2 = 0.79). The latter two conditions did not differ significantly (F(1, 267) = 0.09, p = 0.759, η^2 = 0.04).

Mediation analysis. We performed a bootstrap analysis (Hayes, 2017; Model 4; using 2,000 samples) to test the mediating role of high-density avoidance mindset. The results revealed a significant mediation, indirect index = 0.46, se = 0.07, 95% CI = (0.323, 0.605), supporting H2.

4.2.3 Discussion

Study 2 provided evidence for the mediating role of high-density avoidance mindset (H2) and the moderating role of disease type (H3). We then proceeded to test the other boundary condition in the next study.

5. Study 3: Moderating Role of Product Type

Study 3 proceeds to test the moderating role of product type (H4). In addition, we planned to eliminate another alternative explanation inferred from previous literature, that is, perceived aesthetic.

5.1 Method

5.1.1 Participants and design

Two hundred and sixty participants (96 males) were recruited from Credamo for a monetary payment (approximately ¥2). This study employed a 2 (threat: disease threat vs. control) × 2 (product type: disinfection products vs. non-disinfection products) between-subjects design.

5.1.2 Procedure

Participants were randomly assigned to read one of two stories and instructed to imagine themselves in the situation described. The disease threat story described a person shopping in a mall who received an urgent notice: "A case of TOBA virus disease, which is highly infectious, was just detected in the mall" (Wang & Ackerman, 2019). The control condition story described a person organizing his or her office (A. E. White et al., 2013). The manipulation check questions (Cronbach's $\alpha = 0.69$) were identical to those in Study 1. Responses were provided on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*).

Next, participants were randomly shown a picture of a supermarket shelf featuring either hand sanitizer (a disinfection product) or olive oil (a non-disinfection product; see Appendix C). In each picture, the products were displayed densely. Purchase intentions were then assessed using three items (Cronbach's $\alpha = 0.85$) adapted from Hussain and Ali (2015), including: "I think that the products in the picture are attractive to me," "I would like to buy the products," and "I would like to

recommend these products to my friends." Responses were provided on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). As a confounding check, participants were also asked to indicate their perceived aesthetic levels of the products. Finally, after reporting demographic information, participants were thanked and debriefed.

5.2 Results and discussion

5.2.1 Manipulation check

A two-way ANOVA on perceived disease threat showed that participants in the disease threat condition reported greater levels of concern about disease threat (M = 4.67, SD = 0.08) compared with those in the control condition (M = 3.14, SD = 0.08, $F(1, 256) = 193.93$, $p < 0.001$, $\eta^2 = 0.11$). Importantly, neither the main effect of product type nor the interaction between the manipulations of the threat and product type was significant (p's > 0.82).

5.2.2 Confounding check

The results from a one-way (product type: disinfection products vs. non-disinfection products) ANOVA indicated that no significant difference ($F(1, 258) = 1.67$, $p = 0.198$, $\eta^2 = 0.16$) emerged in terms of participants' perceived aesthetic levels ($M_{disinfection\ product} = 3.13$ vs. $M_{non\text{-}disinfection\ product} = 2.87$), providing evidence that the product type manipulation did not inadvertently affect perceived aesthetic.

5.2.3 Main results

A 2 (threat: disease threat vs. control) × 2 (product type: disinfection products vs. non-disinfection products) ANOVA on purchase intentions yielded a significant interaction effect ($F(1, 256) = 6.13$, $p = 0.014$, $\eta^2 = 0.04$). Planned contrasts (see Figure 4) further revealed that consistent with H1 and the findings in Study 1, when presented with non-disinfection products, participants in the disease threat (vs. control) condition reported lower levels of purchase intentions for densely displayed products (M's = 3.38 and 3.78, SD's = 0.10 and 0.10, respectively, $F(1, 256) = 8.04$, $p = 0.005$, $\eta^2 = 0.60$). However, when presented with disinfection products, those in

the disease threat and control conditions reported similar levels of purchase intentions (*M*'s = 3.98 and 3.81, respectively, $F(1, 256) = 0.84$, $p = 0.361$, $\eta^2 = 0.18$). These results supported H4.

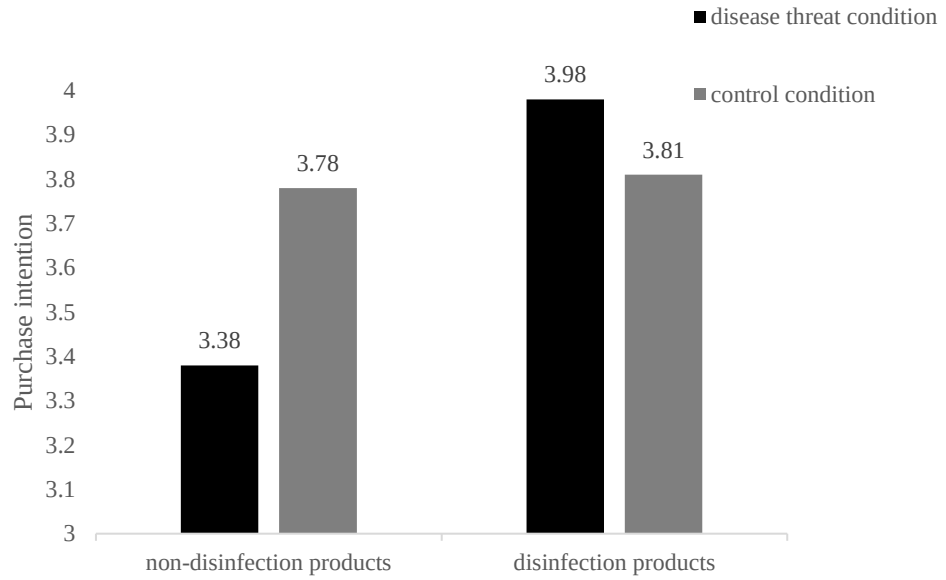

Figure 4: Moderating role of product type (Study 3)

5.2.3 Discussion

This study found that disinfection products eliminate consumers' avoidance of densely displayed products when threatened by infectious diseases. Although existing studies have provided evidence for how, why, and when disease threat affects consumers' attitudes toward densely displayed products, these were all conducted in lab settings. Thus, a question arose: Will the effects hold in the real world? Therefore, we designed the next study.

6. Study 4: Infectious Disease Threat and Product Display in Field Experiment

To enhance the external validity of our findings, we conducted a field experiment in Study 4. We expected that the findings from lab studies could be replicated in the real world.

6.1 Method

6.1.1 Design

This study employed a one-factor (product display: dense vs. loose) between-subjects design. We collaborated with a local fruit retailer in a college town in Shanghai to conduct this study. The reason that we did not rule in the disease threat factor was that the pandemic was quite severe when conducting this experiment, so the ceiling effect may have emerged. Therefore, we fixed the high level of disease threat and thus expected that more products would be sold when they were displayed loosely (vs. densely) according to H1.

6.1.2 Procedure

Given that apples were among the best-sold fruits in the store, we chose apples as the experiment stimuli in this study. We acquired permission from the store owner to change the display density of the apple shelf. To manipulate the apple display, 35 (15) apples were put on the shelf in the dense (loose) display condition. According to historical sales data, no significant fluctuation of in-store traffic emerged at weekend noon. Thus, we changed the apple display (dense/loose) at every one-hour interval (e.g., dense display: 11:00–12:00 am; loose display: 12:00 am–1:00 pm) on two consecutive weekdays around noon for a total of approximately 3.6 business hours. To further ensure that in-store traffic did not confound the results, we recorded the number of customers in the fruit store every minute through in-store cameras, yielding 217 data points, which served as the control variable for later analyses. The retail price of each apple was ¥3.5. The sales revenue of the apples during the experimental sessions was the dependent variable in this study.

To verify the inferred ceiling effect of disease salience, all in-store customers during the experimental sessions were invited to complete ostensibly a customer experience survey that embedded two questions ($\alpha = 0.98$) measuring perceived disease threat: “I feel the threat of infectious diseases” and “I’m concerned about infectious diseases.” Responses were provided on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*).

6.2 Results and discussion

6.2.1 Validity checks

The validity checks in this study consisted of two parts. First, given that the highest score of perceived disease threat in the aforementioned studies was 4.09 in the disease threat condition of Study 1, we set it as the ceiling point. A one-sample *t*-test confirmed that in-store customers reported even higher than 4.09 (M = 4.56, SD = 1.18, $t(126) = 4.48$, $p < 0.001$), showing that the natural disease threat situation during the experimental sessions was even more serious than that manipulated in the aforementioned experiments, thus supporting the ceiling effect of disease threat.

Second, a pretest was conducted to check the success of the product display manipulation and eliminate a list of alternative explanations, including (1) perceived popularity, given that customers may infer higher levels of popularity when products are scarce (Van Herpen et al., 2009), and (2) mood and arousal levels. The procedure and measures are in Appendix D. Briefly speaking, this pretest verified the effectiveness of product display manipulation and eliminated the three confoundings. Moreover, another pretest ruled out the perceived uniqueness of the apple display (dense vs. loose; see Appendix D for details).

6.2.2 Main results

We conducted a one-way ANCOVA in which product display served as the predictor, sales revenue of the apples served as the dependent variable, and in-store traffic was the covariate. The results revealed a significant main effect of product display ($F(1, 214) = 6.12$, $p = 0.014$, $\eta^2 = 0.42$). Consistent with H1, under disease threat, customers purchased more when apples were displayed loosely (M = 3.52,[1] SD = 4.47) than when displayed densely (M = 1.61, SD = 4.59).

6.2.3 Discussion

Study 4 replicated our central story, which stated that consumers purchased fewer products that were densely (vs. loosely) presented when threatened by an

[1] The number denotes the average sales revenue per minute.

infectious disease in the real world, showing the robustness of the effect and thus providing strong support for H1.

7. General Discussion

7.1 Main findings

In this study, we proposed that disease threat decreases consumers' preferences for products in a dense display. This effect is driven by enhanced high-density avoidance mindset. Moreover, this effect is mitigated when diseases are noninfectious or when evaluating disinfection products. Four studies provided convergent support for these notions. In Study 1, we tested the main effect by demonstrating that people exhibit lower levels of purchase intentions for products in a dense display if primed with an infectious disease threat (H1). Study 2 verified that high-density avoidance mindset serves as the underlying mechanism of the relationship between disease threat and consumers' attitudes toward densely displayed products (H2). In addition, Study 2 examined the moderating role of disease infectiousness, demonstrating that when under the threat of a noninfectious disease, its effect on consumers' attitudes toward densely displayed products is mitigated (H3). Furthermore, Study 3 explored the moderating role of product type, finding that when disinfection products are presented, the effect of infectious disease threat on product display is also attenuated (H4). Finally, Study 4 successfully replicated our central prediction (H1) in a real-world context, enhancing the external validity of this study.

Moreover, in these studies, five alternative explanations were ruled out, further clarifying the psychological process. Specifically, in Study 3, we tested and eliminated perceived aesthetics. More alternative explanations were ruled out in Study 4, including mood, arousal, perceived product popularity, and uniqueness. Though these alternative explanations were ruled out, it is still plausible that scarcity may also confound the observed results because product numbers in the loose condition were much lower than those in the dense one. According to the related literature, perceived scarcity is triggered when only a very limited amount of a resource is available (Roux et al., 2015). For example, consumers may feel that apples are scarce when five or fewer remain on the shelf. However, we had 15 apples in the loose product display condition in Study 4, which can hardly evoke scarcity perception. Taken together, these results further support high-density avoidance

mindset as the psychological mechanism explaining how infectious disease threat affects consumers' attitudes toward densely displayed products.

7.2 Theoretical contributions

Our study makes four important contributions. First, we extend the growing literature on how disease threat influences consumer behavior. Although the existing literature offers insights into how consumers respond to a disease threat, for example, preference for uncrowded travel and hospitality options (I. J. Park et al., 2021), destination logo design (Kim et al., 2022), nostalgic products (Barauskaitė et al., 2022), and pattern seeking in sequential choices (J. Park et al., 2022), our study, especially Studies 1 and 4, enriches this stream of literature by uncovering a novel downstream consequence of disease threat (i.e., decreased preference for densely displayed products) using lab and field data. Moreover, Studies 2 and 3, respectively, showed that the disease-density effect diminishes when diseases are not infectious or when disinfection products are displayed.

Second, prior studies have uncovered social avoidance as an important underlying process explaining a variety of behaviors triggered by disease threat (Huang & Sengupta, 2020; I. J. Park et al., 2021; Thiebaut et al., 2021) whereas Study 2 revealed that high-density avoidance mindset serves as the psychological mechanism in this study. Through demonstrating that high-density avoidance mindset triggered by infectious diseases can be transferred to a much more distant domain (i.e., a display format) compared with people, this study significantly broadens the scope of the social avoidance effect from animate persons to inanimate products. In other words, though prior and our study depict how disease threat shapes consumers' attitudes toward products, prior findings were driven by social avoidance whereas ours demonstrate a new process going beyond sociality.

Third, visual display decisions are calling for more research (H. Jia et al., 2023). Current in-store display management research focuses mainly on product location (Garrido-Morgado et al., 2021) and categorization (Rooderkerk & Lehmann, 2021). However, although display density plays an important role in consumers' information processing and product evaluation processes (H. Jia et al., 2023; Su et al., 2019) and is quite easy to be altered in an actual marketing or retailing setting, it, surprisingly, has seldom been examined in the existing literature. Therefore, this study

adds to the literature on display and layout management by introducing density as a new and important visual dimension.

7.3 Managerial implications

This study has a number of managerial contributions. It highlights the importance of including situational factors that create sensory responses (e.g., threat of infectious disease) in layout and display management. More specifically, findings show that retailing practice should consider the density of products, especially in pandemics. Similarly, the results in the present study offer practical implications for advertising. Given that Studies 1 and 4 show that consumers hold more negative attitudes toward products that are densely displayed in posters when they are threatened by infectious diseases, marketers should avoid densely display formats (e.g., too many items on a shelf or too many products in a poster) when communicating product features or brand images during pandemics.

Moreover, in an online setting where interfaces can be customized for each customer, retailers can also benefit from the findings in this study. For instance, online retailers could adapt the density of display depending on whether the consumer is undergoing a pandemic, using search behavior or tracking data about the consumer's location. Similarly, personalized recommender systems prevail among online retailers, which are designed for presenting more customized and thus more appealing products or services to consumers. Our findings highlight the necessity of customized display patterns, such that items recommended to online consumers who are undergoing pandemics should be placed loosely.

7.4 Limitations and future research directions

The limitations of this study point out future research directions. First, although this study revealed how disease threat affects consumers' preferences for product displays (i.e., the visual domain consequence), its potential effects on other sensory fields are also worth exploring. Second, though most relevant alternative explanations were ruled out in testing the psychological process, untested alternative explanations might still exist. For example, infectious diseases may also threaten locus of control, inducing negative emotions, such as fear and disgust. Third, this study identified source of disease as a boundary condition; however, we also noticed

other possible moderators. For instance, some individual differences and contextual factors can function as consumers' shields to fight against negative encounters, such as high sensation seeking, increased levels of nostalgia, and poor childhood socioeconomic status. In a similar vein, it is plausible that these factors can also attenuate the impact of disease threats and thus alleviate consumers' psychological compensation.

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