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Contactless channel for shopping and delivery in the context of social distancing in response to COVID-19 pandemic

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ABSTRACT

Arising from the global COVID-19 pandemic, social distancing has become the new norm that shapes consumers' shopping and consumption activities. In response, the contactless channel (i.e., shopping online, self-collecting and returning parcels via delivery lockers) is ideally positioned to fulfil consumers' shopping/logistics needs while avoiding all unnecessary social interactions. Thus, this study examines the factors that motivate consumers' migration to the contactless channel by viewing consumers' channel choice as both health-related and shopping behaviours. Anchored on the synthesised insights of protection motivation theory and automation acceptance theory, the conceptual framework and a series of hypotheses are proposed. A survey instrument is used for data collection, and the data are analysed using structural equation modelling. Our findings reveal that perceived channel characteristics such as compatibility and trust directly contribute to the relative value of the contactless channel; these characteristics are also correlated where trust perception reinforces compatibility perception. The channel characteristics are further influenced by consumers' perceived susceptibility of COVID-19; that is, susceptibility perception enhances channel compatibility but decreases consumers' trust in the contactless channel. However, the impacts of susceptibility become insignificant with a low level of severity perception, confirming the stage-based conceptualisation of severity. Furthermore, the severity perception of COVID-19 is found to amplify the positive impacts of susceptibility perception but attenuate its negative impact. Our study promotes a deeper integration between the health and service literature and encourages more interdisciplinary studies in this nexus. Considering the practical context of social distancing, our findings suggest a struggle between compatibility perception and trust concern that shapes consumers' behaviours.

1. Introduction

In light of the COVID-19 pandemic, social distancing measures are practised globally, which include keeping a minimum distance between each other and staying away from crowded places (Wilder-Smith and Freedman, 2020). As the pandemic situation escalates, people are encouraged to stay at home as much as possible, and some cities even enforce different degrees of lockdowns where people are only allowed to go out for essential activities, such as buying groceries (WHO, 2020). In this regard, social distancing may become the new norm that shapes consumers' shopping and consumption activities in the near term (Lichfield, 2020; Maloney, 2020), and certain aspects of social distancing may be retained or evolve into the longer term (Wang et al., 2021).

With the proliferation of omni-channel retailing in recent years, consumers are empowered to migrate freely among multiple shopping channels (Hübner et al., 2016; Wollenburg et al., 2018). For example, consumers can make a purchase online or from a store offline, request for home delivery or self-collection, and return/exchange the purchase at a collection point or a physical store (Wang et al., 2019b). Herein, a contactless shopping channel is naturally embedded in the omni-channel options, characterised by shopping online, requesting for unattended home delivery or self-collection from a nearby parcel locker, and returning/exchanging the purchase via the parcel locker (Wang et al., 2021). Such a contactless channel is ideally positioned in the context of social distancing to effectively fulfil consumers' shopping and consumption needs while restricting all unnecessary social interactions. To this end, migrating to the contactless channel (e.g., contactless shopping, delivery and return) is of great social importance that contributes to the overall social distancing advocacy. Thus, what motivates

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consumers to migrate to the contactless channel becomes an emerging concern that requires immediate research attention. Thus, this study aims to timely examine consumers' channel choice behaviour in response to the COVID-19 pandemic.

To achieve this aim, this study views consumers' channel choice as both a *health-related response*, where consumers perceived health concerns play a deterministic role, and a *shopping behaviour*, where the channel characteristics matter. On a theoretical premise, this study adopts the protection motivation theory (PMT) (Rogers, 1975; Rogers, 1983). Focusing on responses to health-related threats, the PMT is one of the most well-regarded theories that explains individuals' motivation for self-protection (Floyd et al., 2000; McCullock and Perrault, 2020). Accordingly, the theory proposes two cognitive processes characterised by threat appraisal (e.g. assessing threats from COVID-19) followed by response appraisal (e.g. assessing the efficacy of contactless channel as the response strategy). Here, the two appraisal processes proposed in the PMT align well with the dual focuses of our study. Thus, the PMT is integrated into our study to establish the theoretical framework.

However, although the PMT provides the overarching theoretical premise, it is implicit about the specific channel characteristics that determine the contactless channel's efficacy. To fill this void, we consulted the automation acceptance model (AAM) (Ghazizadeh et al., 2012; Rahman et al., 2019). The model explains consumers' acceptance of automated service systems focusing on the trust and compatibility perceptions during human–automation interactions. Although the contactless channel is not an automation *per se*, it is essentially an unmanned channel facilitated by automated interfaces such as e-retailers' websites and collection locker interfaces. Consumers may have similar concerns on the contactless channel as those on automation. Thus, the AAM is selected to complement the PMT. Anchored on the synthesised insights from PMT and AAM, this study represents an avant-garde study that contributes to a fundamental understanding of consumers' channel choice in the context of social distancing.

The remainder of this manuscript is organised as follows. Section 2 reviews prior literature on consumers' channel choice and threat-induced consumption behaviour and thus establishes the research gap in the context of social distancing. Section 3 presents the conceptual framework which is built by integrating the insights of the AAM into the PMT. The theoretical model and a series of hypotheses are presented, pointing to the two cognitive processes of consumers' channel choice in response to the COVID-19 pandemic. Section 4 elaborates on the research method and data collection process. Section 5 presents the analysis results and validates the hypotheses based on exploratory factor analysis, structural equation modelling and multi-sampling analysis. Finally, Section 6 concludes this study with theoretical and managerial implications.

2. Literature review

2.1. Consumers' channel choice

From multi-channel (Noble et al., 2005; Rosenbloom, 2007), cross-channel (Avery et al., 2012; Piercy, 2012) and the more recent omni-channel shopping (Larke et al., 2018; Verhoef et al., 2015), consumers' channel choice has attracted much research attention. Phenomena such as 'research shopping', 'showrooming' and 'webrooming' are examined, revealing distinct motivations for consumers' channel choice (Rapp et al., 2015; Verhoef et al., 2007).

Some studies conceptualised the differentiated capabilities of different channels and explained consumers' behaviour as a choice of matching channel capabilities that allowed consumers to fulfil their shopping needs (Avery et al., 2012). Other studies adopted a value perspective and linked consumers' channel choice to the utilitarian and hedonic values that can be derived from different channels (Gawor and Hoberg, 2019; Hsiao et al., 2012). Focusing on consumers' loyalty across multiple channels, some studies examined the transferability of brand loyalty from the conventional channel to the newly introduced alternatives (Badrinarayanan et al., 2012; Verhagen et al., 2019). In addition, the logistics distribution channel is an integrated component of omni-channel shopping (DHL, 2015; Murfield et al., 2017). Hence, consumers' motivations for participating in different distribution channels (e.g. self-collection and self-return) were emphasised, addressing their needs for flexibility, empowerment and convenience (Vakulenko et al., 2018; Wang et al., 2020; Wang et al., 2019a).

2.2. Consumers' shopping behavioural changes due to social disruptions

In addition to the channel literature, a small stream of research has examined the specific changes related to consumers' shopping or consumption behaviours in face of seminal events.

Reviewing the relevant literature, two streams of research can be identified that have examined consumers' consumption behaviour as induced by external threats, albeit with some overlap among these studies. The first stream of studies emphasised negative emotions, such as panic, anxiety, distress and fear, created by the events (Ballantine et al., 2014; Forbes, 2017; Kemp et al., 2014; Kennett-Hensel et al., 2012). For example, Ballantine et al. (2014) found that consumers engaged in shopping behaviours as a coping mechanism that allowed them to better manage their emotional state during the aftermath of a major earthquake. Closely related to the first stream, the second stream addressed the fundamental reason for consumers' negative emotions which were rooted in human's psychological need for control and possession (Chen et al., 2016; Larson and Shin, 2018; Sneath et al., 2009). Among these studies, some studies found that the control-deprived consumers used shopping as a tool to regain a sense of control. For example, Chen et al. (2016) pointed out that consumers purchased utilitarian products (rather than hedonic products) to compensate for a loss of control due to the problem-solving quality of these products.

2.3. Research gap and proposed research focus

Although these studies provided rich insights into the motivations for consumers' shopping/consumption choice, none captured the unique context of social distancing due to the outbreak of COVID-19. Given the unique service context, consumers' channel choice is no longer simply a shopping behaviour, but also a health-related behaviour. The COVID-19 pandemic represents a threat that evokes consumers' protection motivation, which is likely to modify both health and shopping behaviours. Thus, the protection motivation in consumers' channel choice becomes a pertinent issue that requires immediate research attention, which is the major research gap to be addressed by this study.

To address this research gap, this study views consumers' channel choice as a health-related behaviour where consumers' responses to health threats play a deterministic role. In particular, different consumer groups may have different perceptions about the susceptibility and severity of the COVID-19. For example, individuals who are older and with underlying health conditions are generally found to be more susceptive to the COVID-19 and develop more severe symptoms (Forster, 2020). More importantly, despite the COVID-19 widespread, statistics show that about 80% of the patients develop only mild symptoms who can self-recover given appropriate care (Musto, 2020). To this end, the susceptibility and severity perceptions may interact with each other, thus shaping the individuals' health belief and health-related behaviours (Carpenter, 2010; Yuen et al., 2020). Therefore, we examine the heterogeneity in, and interplays between, the susceptibility and severity perceptions of the COVID-19 that explains consumers' channel choice. This is our first research focus.

Furthermore, focusing on consumers' shopping behaviour, the literature suggests that rather than utilising the contactless channel, panic-buying frenzy is often witnessed in offline stores, especially during the public announcement of any tightened social distancing measures.

Under such circumstances, consumers are inclined to buy large quantities of products to mitigate the potential risk of supply shortage (Ballantine et al., 2014; Larson and Shin, 2018). Such irregularities in consumers' shopping behaviour adversely affect the decisions made by the retailers and the upstream suppliers regarding their order and sourcing strategies (Yoon et al., 2018). The disrupted supply chain may lead to stock-outs of some essential products, which in turn sends an alarming signal to the consumers and causes a vicious cycle of panic buying (Yangui and Hajtaïeb El Aoud, 2015). In anticipation of upcoming disruptions, consumers seem to place their trust in the offline stores which allow for immediate possession of products (Noble et al., 2005; Rohm and Swaminathan, 2004); such a sense of assurance and trustworthiness is lacking in the contactless channel (e.g. delayed delivery, cancelled order and disrupted logistics) (Aw, 2019; Sunil, 2015). Herein, the external threat seems to initiate consumers' protection motivation in a way that it alters consumers' perception of channel characteristics, and the contactless channel is thus unfavoured. Therefore, this study examines the impact of channel characteristics as perceived by consumers who are under the COVID-19 threat on their channel choice. This is our second research focus.

Moreover, in line with channel literature, this study adopts a value perspective where consumers' value perception forms the basis for their channel choice (Gawor and Hoberg, 2019; Hsiao et al., 2012). Consumers' channel choice is conceptualised as the relative value of contactless channel versus channel with human contact. The two contrasting channels are decomposed into pairs of shopping/logistics activities occurring during the adoption of channels. The value of each activity is compared with its corresponding counterpart in the pair, and the relative value of the contactless channel is thus obtained as the summation. With a microfocus on the decomposed channel activities, we contribute to the omni-channel literature by revealing the constituent components that collectively predict consumers' channel choice. This is the third research focus.

3. Conceptual framework

This study synthesises the insights from the fear appeal literature originated in health communication studies and the technology acceptance literature which is well adapted to examine consumer behaviours. The AAM is integrated into the PMT to establish the conceptual framework (see Table 1).

Table 1
Theoretical premises of conceptual framework.

Theory	PMT	AAM
Paradigm	Fear appeal in health communication	Technology acceptance behaviour
Premise	When confronted with health threats, individuals initiate two cognitive stages: threat-appraisal process followed by response-appraisal process, the outcomes of which lead to attitudinal/intentional/ behavioural changes.	Smooth human–automation interactions depend on individuals' trust and compatibility perception towards the automation system.
Relevant construct	Threat appraisal: *perceived susceptibility* and *perceived severity* Attitudinal change: *perceived relative value of the contactless channel*	Response appraisal: *perceived compatibility* and *perceived trust*
Contribution to the current study	The theory explains the sequential cognitive stages (from threat appraisal to response appraisal) that lead to consumers' changes in value perceptions about the contactless channel in response to COVID-19.	The theory complements PMT by supplying the specific appraisal factors (compatibility and trust) that determine the efficacy of contactless channel as a coping strategy in response to COVID-19.

More specifically, the fear appeal literature attempts to initiate positive health-related behaviours through the threat of impending danger. Among a series of well-established models (Janz and Becker, 1984; Witte, 1992), the PMT is one of the most acknowledged theories that explain the cognitive processes leading to fear-induced behaviours (Maddux and Rogers, 1983; Rogers, 1975; Rogers, 1983). The theory posits that individuals react to health threats by engaging in two sequential cognitive stages. The threat-appraisal process is firstly initiated where individuals evaluate the likelihood of the threat's occurrence (perceived susceptibility) and the amount of harm resulting from the threat (perceived severity) (Floyd et al., 2000; Warkentin et al., 2016). Secondly, the threat appraisal prompts individuals to assess their response strategies, and the response-appraisal process ensues where the efficacy of the response strategies is considered (Maddux and Rogers, 1983; McCullock and Perrault, 2020). Ultimately, the outcomes of the appraisal processes lead to responsive behaviours to the threat.

Viewing consumers' adoption of contactless channel as a response behaviour to the COVID-19 threat, we can also apply the two sequential cognitive stages to our study. However, although the PMT clearly defines susceptibility and severity as the two appraisal dimensions for the threat-appraisal process, it is silent on the specific beliefs that determine the response efficacy. To fill the void, we turn to the broader acceptance literature and look for the relevant factors that address consumers' adoption of contactless channel.

In this regard, the AAM emerges as an applicable model that potentially complements the PMT. The AMM extends the classic technology acceptance model (TAM) by proposing perceived compatibility and perceived trust as two fundamental factors that promote consumers' acceptance of automation systems (Ghazizadeh et al., 2012). Similarly, the adoption of contactless channel also involves a high level of interactions with non-human systems such as e-commerce shopping website and self-collection lockers. The factors that are considered salient in the AAM are likely to determine the efficacy of the contactless channel as perceived by the consumers. Thus, we propose perceived compatibility and perceived trust as the two appraisal factors within the response-appraisal process.

Therefore, applying the synthesised theoretical insights of the PMT and AAM to our study, we established the conceptual framework (see Fig. 1) on the basis of the following central arguments:

1) In the context of social distancing, consumers initiate appraisal of the threats associated with COVID-19 followed by an appraisal of the contactless channel's efficacy as a response strategy to COVID-19, the outcomes of which determine their channel choice;

2) Perceptions on compatibility and trust of contactless channel reflect the response-appraisal outcome (i.e. Hypotheses 1–3 that are further illustrated in Section 3.1); and

3) Perceptions on susceptibility and severity of COVID-19 reflect the threat-appraisal outcome (i.e. Hypotheses 4–7 that are further illustrated in Section 3.2).

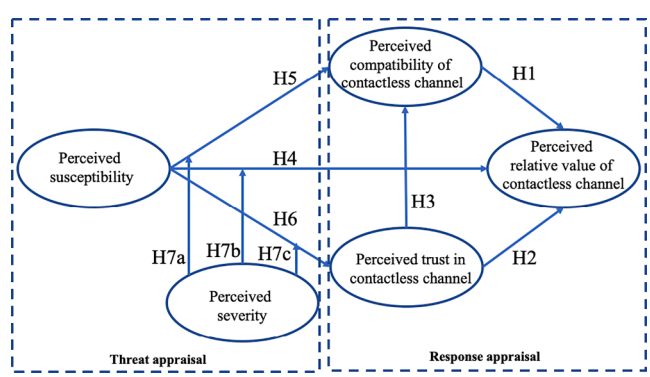

Fig. 1. Conceptual framework.

The remainder of this section further establishes the conceptual framework focusing on the two cognitive appraisal processes.

3.1. Integration of automation acceptance model into response-appraisal process

The response-appraisal process involves consumers' evaluation of the response efficacy to address the anticipated threat. Response efficacy refers to the belief that the response strategy will work and the protective action will be effective in protecting one's self (Floyd et al., 2000; Timpka et al., 2014). In this study, we propose adoption of contactless channel as a response strategy in anticipation of COVID-19 health threat. The channel characteristics are thus assessed to determine the channel's effectiveness in addressing consumers' health concerns and fulfilling their shopping needs.

Although various channel characteristics may be considered, the AAM posits compatibility and trust perceptions as key factors leading to harmonious human–automation interactions (Ghazizadeh et al., 2012; Rahman et al., 2019). Unlike the classic TAM wherein the intrinsic characteristics of technologies (e.g. ease of use and usefulness) are considered (Davis, 1989; Venkatesh et al., 2003), the AAM argues that individuals' acceptance of automation depends on smooth human–automation interactions (Ghazizadeh et al., 2012; Rahman et al., 2019). During the interactions, consumers' trust in the system and a sense of compatibility with the automation are what matter.

Indeed, as established in earlier sections, consumers' trust in the channel is a critical antecedent that impacts their channel choice. This is because external threats such as COVID-19 often create a feeling of anxiety and panic among consumers (Kennett-Hensel et al., 2012; Larson and Shin, 2018). Consequently, consumers seek trustworthiness in the shopping channel that is capable of delivering consumers' order with certainty, reliability and assurance. Furthermore, more pertinent to the concept of response efficacy, trust perception is related to the belief of channel efficacy. The trust perception is formed when consumers believe in the channel's effectiveness in meeting their needs in response to the COVID-19. Thus, the trust perception increases consumers' belief in the response efficacy, which leads to consumers' choice of contactless channel.

Although trust in the contactless channel may correspond to the belief of channel efficacy, the compatibility perception may be associated with consumers' self-efficacy. To illustrate, response compatibility refers to the extent of congruency between consumers' lifestyle and the response strategy (i.e. contactless channel) (Bunker et al., 2007; Karahanna et al., 2006). The more compatible the response is with the consumer's life and current situation, the more likely and willing the consumer is to draw relevant resources to initiate the response. As a result, consumers who are resourceful (e.g. possession of technological devices and prior experiences) are more confident and more willing to deal with the contactless channel. Thus, the compatibility perception contributes to consumers' self-efficacy in responding to the threat, which leads to their initiation of the response strategy, that is, the utilisation of contactless channel.

The empirical importance of the trust and compatibility perceptions in consumers' channel choice has been well established in the channel literature (Badrinarayanan et al., 2012; Hansen, 2005; Zhang et al., 2018). Consumers' perceived trust and compatibility are found to significantly increase the value as derived from the channel. Thus, we argue that the perceived trust and compatibility enhance the efficacy of the contactless channel as a response strategy to the COVID-19 threat, leading to consumers' choice of contactless channel (as reflected by the perceived relative value of contactless channel).

Hypothesis 1. The perceived compatibility of contactless channel is positively associated with the perceived relative value of contactless channel.

Hypothesis 2. The perceived trust in contactless channel is positively associated with the perceived relative value of contactless channel.

For the inter-relation between the trust and compatibility perceptions, no consensus has been established by the prior literature. The original AAM argues that a sense of compatibility is firstly established, leading to closer interactions characterised by a deeper level of trust (Ghazizadeh et al., 2012).

In this study, the context of social distancing creates natural compatibility of contactless channel with consumers' current situation. However, the COVID-19 threat has caused a large scale of panic buying from consumers worldwide, resulting in stock-out and scarcity of essential products (Tan, 2020). Despite the assurance from the government and retail representatives on sufficient supplies, consumers' worry and anxiety continue to grow. Against this background, we argue that the trust perception, that is, consumers' trust in the contactless channel to fulfil orders without cancellation and deliver them without delay, acts as a primary motivator that leads to any further perceptual responses. In other words, the trust perception establishes the initial assurance within consumers which subsequently enhances their compatibility perception. In line with such a rationale, the following hypothesis is proposed:

Hypothesis 3. The perceived trust in contactless channel is positively associated with the perceived compatibility of the channel.

3.2. Application of protection motivation theory to threat-appraisal process

The threat-appraisal process involves individuals' assessment of the personal susceptibility to the threat and severity of the associated consequences (Floyd et al., 2000; Rogers, 1975). In this study, perceived susceptibility refers to an individual's belief about the likelihood of contracting COVID-19 if the channel with human contact is used, whereas perceived severity is the belief about the amount of harm that can be created by COVID-19.

3.2.1. Impact of susceptibility perception on the threat-appraisal process

In reality, the high transmission rate of COVID-19 conveys an alarming signal to the consumers, which greatly influences their susceptibility perception. To this end, we propose that the susceptibility perception plays a leading role in the threat-appraisal process. According to the PMT, the susceptibility perception motivates consumers' protection action, that is, the favourable choice of contactless channel in the current study. Indeed, the impact of susceptibility on the adoption of healthy behaviours is well documented in the existing literature, and its statistical significance is widely supported (El-Toukhy, 2015; McCullock and Perrault, 2020; Weinstein et al., 1991). Thus, we propose the following hypothesis:

Hypothesis 4. The perceived susceptibility of the COVID-19 is positively associated with the perceived relative value of contactless channel.

Furthermore, as established in earlier sections, the PMT suggests a sequence of cognitive processes, that is, the threat appraisal followed by response appraisal (Maddux and Rogers, 1983; Witte, 1994). The individuals would only proceed with further assessments on response efficacy when the threat level is perceived to be high. Otherwise, when the perceived threat is assessed to be low, individuals would not be motivated for self-protection, hence resulting in a low level of response efficacy or an irrelevant response appraisal. Herein, a significant association between the threat appraisal and response appraisal is embedded in the PMT (Lin and Bautista, 2016). Given the leading role of susceptibility perception in the threat-appraisal process, and the established relevancy of compatibility and trust perceptions in the response-appraisal process, we propose the significant impact of susceptibility perception on consumers' compatibility and trust perceptions.

However, we expect the susceptibility perception to impact perceived compatibility and trust differently. More specifically, the

susceptibility of COVID-19 motivates consumers to comply with the social distancing practices, making the contactless channel a more compatible shopping choice. Thus, the perceived susceptibility of COVID-19 is likely to promote a sense of compatibility of the contactless channel.

Regarding the impact on trust, this study foresees that the susceptibility perception adds uncertainties to the order fulfilment and delivery process which weakens consumers' trust in the contactless channel. In addition, the widespread health threat may lead to intensified competitions for the channel resources (Yangui and Hajtaïeb El Aoud, 2015), which reduce consumers' trust in the channel capability in terms of order fulfilment and delivery. Therefore, we argue that the susceptibility perception is negatively associated with consumers' trust in the contactless channel. The following two hypotheses are thus proposed:

Hypothesis 5. The perceived susceptibility of the COVID-19 is positively associated with the perceived compatibility of contactless channel.

Hypothesis 6. The perceived susceptibility of the COVID-19 is negatively associated with the perceived trust in contactless channel.

3.2.2. *Impact of severity perception on the threat-appraisal process*

Severity perception is the second component of the threat-appraisal process. Although susceptibility and severity are generally the two fundamental components when assessing health threats, their relationship has been conceptualised in many different ways (e.g. addictive, multiplicative or independent) (El-Toukhy, 2015; Maddux and Rogers, 1983; Weinstein et al., 1991). In the context of the current study, we find the logic behind a multiplicative model convincing. To illustrate, the transmission rate (corresponding to susceptibility perception) of the COVID-19 is shown to be high, yet the relatively low fatality rate (corresponding to severity perception) lowers the overall threat perception. Herein, even the high-probability risk cannot stimulate sufficient protective motivation if the anticipated harm is trivial. Thus, the impacts of either susceptibility or severity cannot be determined without reference to the other, depicting a multiplicative relationship.

The multiplicative rule of severity and susceptibility perceptions is also observed in other behavioural theories such as the theory of reasoned action (Ajzen and Fishbein, 1980) and the technology threat avoidance theory (Liang and Xue, 2009). Moreover, the moderating effect of severity perception has been validated empirically (Arachchilage and Love, 2013; Ng et al., 2009). In these studies, the severity perception interacts with the susceptibility perception in the threat-appraisal process. An increased severity perception would enhance the impact of the susceptibility perception, whereas the multiplied impact would be minimal if either variable takes a small value.

In our study, we expect the same multiplicative rule to apply between severity and susceptibility perceptions. More specifically, with an increased severity perception, focusing on the three-pronged impacts of susceptibility perception, the positive impacts on the perceived compatibility and relative value are expected to be enhanced, and the negative impact on perceived trust is to be amplified.

Hypothesis 7. The perceived severity of the COVID-19 interacts with the perceived susceptibility so that when the perceived severity increases,

a) the positive relationship between perceived susceptibility and perceived compatibility is enhanced;
b) the positive relationship between perceived susceptibility and perceived relative value is enhanced; and
c) the negative relationship between perceived susceptibility and perceived trust is amplified.

4. Method

4.1. *Measurement items*

This study contains latent variables that are multidimensional; thus, the measurement items are developed or adapted from the prior literature to operationalise the variables. The constructs are perceived susceptibility (SUS), perceived severity (SER), perceived compatibility (COM), perceived trust (TRU) and perceived relative value of contactless channel (RLV-VAL).

As shown in Table 2, both SUS and SER are measured by two items. These items are adapted from the original study on the PMT (Maddux and Rogers, 1983) and a recent study focusing on the inter-relationship between susceptibility and severity perceptions from health communication literature (El-Toukhy, 2015).

Table 2
Constructs and measurement items.

Constructs and measurement items
Perceived susceptibility (SUS): adapted from Maddux and Rogers (1983) and El-Toukhy (2015)
SUS1: My health is vulnerable to the viral infection if I am in direct contact with others
SUS2: The likelihood of getting health problems due to frequent interactions with other people is high
Perceived severity (SEV): adapted from Maddux and Rogers (1983) and El-Toukhy (2015)
I am afraid that using services with direct human contact would
SEV1: threaten my health to a great extent
SEV2: make me sick and change my whole life
Perceived compatibility (COM): adapted from Ghazizadeh et al. (2012) and Moore and Benbasat (1991)
I feel that services with no direct human contact are compatible with
COM1: my lifestyle
COM2: my needs
COM3: the way I like the services to be
Perceived trust (TRU): adapted from Ghazizadeh et al. (2012) and Badrinarayanan et al. (2012)
To me, service systems with no direct human contact
TRU1: have necessary abilities to conduct the work
TRU2: are safe and reliable
TRU3: can be trusted to fulfil service obligations responsibly
TRU4: are sincere and honest
Perceived value of channel with no direct human contact (NON-CON): developed for this study
I feel that the following contactless shopping/logistics activities add value to my next purchase:
NON-CON1: Gathering product/shop information online from reviews or promotion
NON-CON2: Trying/feeling product online via VR technologies
NON-CON3: Chatting with e-retailers online regarding the purchase
NON-CON4: Selecting products online by comparing available alternatives
NON-CON5: Receiving unattended home delivery left at my doorstep
NON-CON6: Getting to parcel locker for self-collection and transporting the parcel back
NON-CON7: Retrieving parcels from the locker
NON-CON8: Returning parcel via parcel locker (in case of unsatisfactory purchase)
Perceived value of channel with direct human contact (WTH-CON): developed for this study
I feel that the following shopping/logistics activities with direct human contact add value to my next purchase:
WTH-CON1: Communicating face to face with friends, neighbours or sales personnel for product/store information
WTH-CON2: Trying/feeling product in physical showroom offline
WTH-CON3: Communicating with the sales personnel face to face for product details and pricing information
WTH-CON4: Selecting products by comparing alternatives in physical stores (e.g. within the same store and from different stores)
WTH-CON5: Receiving attended home delivery (e.g. confirming order and signing with the presence of delivery personnel)
WTH-CON6: Going to the attended delivery points (e.g. a convenience store nearby) for picking up parcels and transporting the parcels back
WTH-CON7: Communicating with the pickup point personnel face to face for picking up parcels
WTH-CON8: Returning parcel to the physical store where it is purchased (in case of unsatisfactory purchase)

To measure the construct of COM, we adapted three items from the original AAM study (Ghazizadeh et al., 2012). Moreover, COM is a well-established variable in the innovation diffusion literature; hence, we referenced relevant studies, such as Moore and Benbasat (1991), to develop the measures. The construct of TRU is measured by four items based on Ghazizadeh et al. (2012) and Badrinarayanan et al. (2012), the latter being a study on channel choice with a focus on consumers' trust.

RLV-VAL is a comparative construct that is measured by the difference between the perceived value of contactless channel (NON-CON) and perceived value of channel with human contact (WTH-CON). Eight items are developed in this study to measure NON-CON, which reflects a sequence of activities involved by consumers when using a contactless channel. Similarly, WTH-CON is measured by another eight activities occurring in the channel with human contact. The 16 items form eight pairs of activities, and activities within the same pair are directly comparable.

4.2. Survey design and administration

We adopted the survey instrument for data collection. Before administering the formal survey, the measurement items were tested internally by four researchers working in the related field. The researchers provided feedback regarding the clarity and consistency of the measurement items, and changes were made accordingly.

A survey questionnaire was thus designed based on the updated measures, which consisted of three sections. The first section provided an overview of the current development of the COVID-19 pandemic globally and locally. It then stated the objectives of our research and the specific purpose of data collection. Importantly, the respondents were assured of the confidentiality of the data collected, and they were instructed to answer the questionnaire according to their honest opinions.

The second section was the main part of the survey, in which the respondents were asked to rate the measurement items based on a 9-point Likert scale, ranging from '1 = completely disagree' to '9 = strongly agree'. Note that an 'attention checker' test question was built into this section. The question asked the respondent to only select '7'. We assumed that respondents who passed the test question paid sufficient attention to the survey, whereas data from those who failed the test were disqualified for further analysis.

Lastly, the third section collected demographic information of the respondents, including age and gender, and other specific attributes related to this study such as product types that were most frequently purchased online.

The survey was conducted in Singapore from 20 March to 30 March 2020, which was about ten days after the announcement of a pandemic by WHO. Concerning Fig. 2, Singapore reported considerably more confirmed cases of COVID-19 during this period compared with the earlier period. Subsequently, the country experienced a sharp increase in the confirmed cases, and the government enforced an island-wide lockdown beginning 6 April 2020. In this regard, our survey was conducted in an ideal period, although not by design, when the consumers were gradually feeling the impact of the COVID-19, but the direct human contacts were not yet restricted. Thus, this period may feature a transition of consumer behaviour in terms of their channel choice, which coincides with the objective of this research.

The survey was administered by undergraduate students who received prior survey training. The group surveyors were assigned to the east, west, south, north and central parts of Singapore to ensure the geographic representativeness of the sample. They approached the potential respondents by firstly introducing themselves followed by briefing the research study. If the respondents agreed to participate in the survey, the surveyors would start the interview by asking questions based on the structured questionnaire. If the respondents preferred to participate later when they were free, a survey link would be sent to them and they would take the survey online. The surveyors were paid for their time spent on training, transportation and field survey. They were also given additional incentives for each completed questionnaire. No reward was provided to the survey respondents given the short time required for each survey interview.

A total of 504 completes were collected, of which 51 were discarded due to the failed 'attention checker' question. The sample statistics for qualified completes (n = 453) are shown in Table 3. The sample has a relatively balanced distribution on gender, age and income level. The number of male respondents (55%) are slightly greater than the number of female respondents (45%); most survey respondents belong to the age group of 25–34 years old (36%) and the income level of 2,001–4,000 SGD/month (33%). In addition, the survey collected data about the respondents' past purchases. The results showed that the most frequently purchased products online are utilitarian products (vs. hedonic products), low-value products (vs. high-value products) and durable products (vs. perishable products). As suggested by prior literature, the type

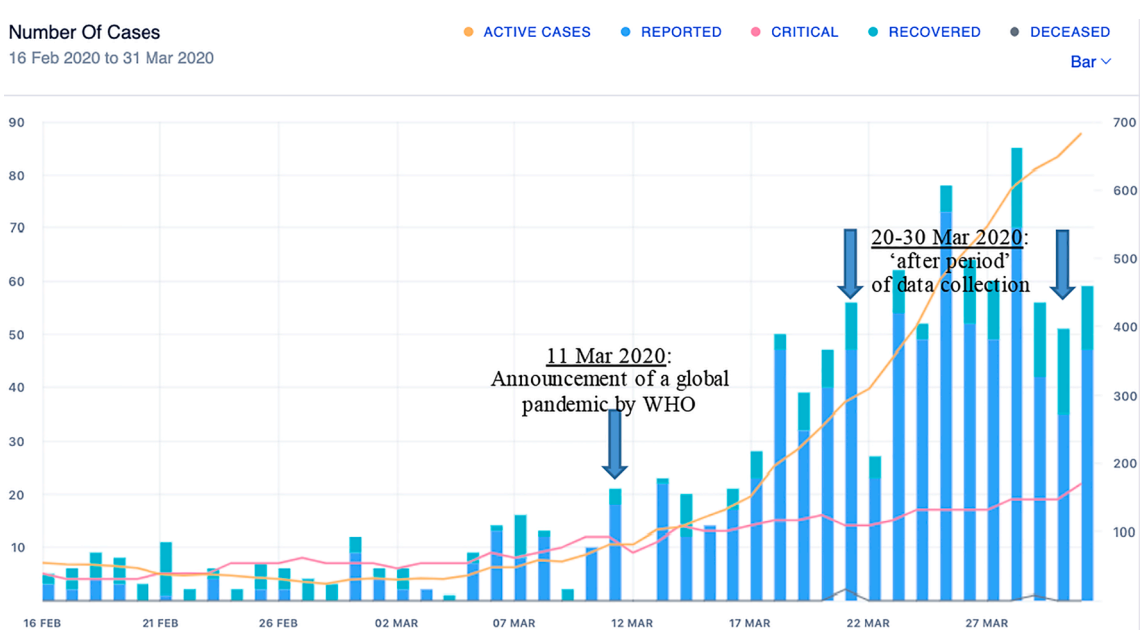

Fig. 2. Overview of COVID-19 outbreak in Singapore (Source: https://co.vid19.sg).

Table 3
Sample statistics.

	Sample frequency	Percentage (%)
Gender		
Male	249	55
Female	204	45
Age (years)		
16–24	123	27
25–34	163	36
35–44	101	22
45–54	41	9
>55	25	6
Income level (SGD/month)		
0–2000	145	32
2001–4000	150	33
4001–8000	136	30
>8000	22	5
Most frequent purchase online		
Utilitarian product	314	69
Hedonic product	139	31
Low-value product	341	75
High-value product	112	25
Durable product	400	88
Perishable product	53	12

of purchase influences consumers' channel choice (Pookulangara et al., 2011; Yurova et al., 2017); thus, these variables are included as control values in our model.

5. Results

This section begins with an exploratory factor analysis (EFA) to examine the dimensionality of the 16 channel activities. After identifying the distinct structure of the channel activities, we constructed the factor of the perceived relative value of contactless channel. Next, structural equation modelling (SEM) is conducted to test the proposed measurement model and structural relationships. Hypotheses 1–6 are thus validated during the structural model analysis. Finally, the moderation effects of the severity perception (Hypothesis 7) are validated via a multi-sampling analysis. IBM SPSS Statistics Version 23 was used for EFA, and the remaining analyses were performed using AMOS version 22.

5.1. Exploratory factor analysis: Dimensions of the relative value of contactless channel

To assess the latent dimensions of the proposed channel activities, an EFA was conducted subjecting to the extraction method of principal component analysis and the Oblimin method of rotation with Kaiser normalisation (Osborne, 2014). Based on the widely accepted Guttman 1.0 eigenvalue criterion, a four-factor solution was obtained. The scree plot also showed a clear break after the fourth factor. The analysis result is shown in Table 4. Note that we are interested in detecting the principal structure formed by items with factor loadings > 0.50. Items with smaller factor loadings are less critical when used for interpreting the clustering results; however, they may unnecessarily obscure the clear clustering pattern. To stress the principal factors, we omitted factor loadings < 0.40.

Each item loads onto its respective factor with factor loading > 0.5. No observable crossing loading can be detected. In addition, the reliability of the obtained factors is assessed by analysing the value of Cronbach's alpha. With reference to Table 4, the Cronbach's alpha for each factor is > 0.70, suggesting an acceptable level of reliability (Hair et al., 2010).

To interpret the EFA result, factor 1 is defined heavily by shopping activities in the contactless channel, whereas activities that fall under factor 2 are related to consumers' involvement in logistics services within the contactless channel. In other words, factor 1 describes the activities during the contactless shopping process, such as trying product (NON-CON2) and comparing alternatives (NON-CON4), whereas factor 2 relates to the post-shopping logistics activities, such as receiving unattended home delivery (NON-CON5) and returning product in case of unsatisfactory purchase (NON-CON8). Thus, we name factor 1 as NON-CON (shopping) and factor 2 as NON-CON (logistics). Similarly, factors 3 and 4 can be best defined by shopping and logistics activities belonging to the channel with human contact; thus, they are labelled as WTH-CON (shopping) and WTH-CON (logistics), respectively.

Table 4
Exploratory factor analysis.

	Factor 1: NON-CON (shopping)	Factor 2: NON-CON (logistics)	Factor 3: WTH-CON (shopping)	Factor 4: WTH-CON (logistics)
NON-CON1	0.83			
NON-CON2	0.79			
NON-CON4	0.77			
NON-CON3	0.74			
NON-CON7		0.95		
NON-CON6		0.91		
NON-CON8		0.87		
NON-CON5		0.56		
WTH-CON2			0.89	
WTH-CON1			0.80	
WTH-CON3			0.80	
WTH-CON4			0.76	
WTH-CON7				0.89
WTH-CON8				0.87
WTH-CON6				0.83
WTH-CON5				0.74
Cronbach's *Alpha*	0.87	0.90	0.89	0.90

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalisation.

Therefore, the EFA reveals the four dimensions of omni-channel activities that are valued differently from the consumers' perspective. More specifically, within both channels, consumers seem to make a clear distinction between shopping-related and logistics-related activities. Given the structured omni-channel activities, we further construct the following two factors: 1) relative shopping value of contactless channel which is measured by the difference between NON-CON (shopping) and WTH-CON (shopping), and 2) relative logistics value of contactless channel which is measured by the difference between NON-CON (logistics) and WTH-CON (logistics). These two factors are termed as RLT-VAL (shopping) and RLT-VAL (logistics), respectively. Finally, the overall relative value of contactless channel (RLT-VAL) can be obtained by treating RLT-VAL (shopping) and RLT-VAL (logistics) as the two measurement items.

5.2. Measurement model analysis

Before testing the structural model and the remaining hypotheses, we need to assess the overall fit of the measurement model. A confirmatory factor analysis was performed, and the analysis results are shown in Table 5.

Firstly, the absolute fit indices, such as standardised root mean square (SRMR = 0.03) and root mean square error of approximation (RMSEA = 0.07), are within the accepted level (<0.08). The incremental fit indices, such as the comparative fit index (CFI = 0.98) and normed-fit index (NFI = 0.98), are also above the recommended level (0.95) (Hair et al., 2010). Thus, the fit indices suggest a good fit of the measurement model overall.

Secondly, the model is assessed for reliability. The direct indicators are the composite reliability (CR) and Cronbach's alpha of the constructs, which are all above the recommended threshold level (>0.70). In addition, all the standardised factor loadings are > 0.70, suggesting

Table 5
Confirmatory factor analysis.

Construct	Measure	Standardised estimate	t-value	AVE	CR	CA
SUS	SUS1	0.92	—	0.83	0.91	0.91
	SUS2	0.90	26.69			
SEV	SEV1	0.95	—	0.90	0.95	0.95
	SEV2	0.95	37.11			
COM	COM1	0.90	—	0.78	0.92	0.91
	COM2	0.93	27.85			
	COM3	0.82	23.40			
TRU	TRU1	0.77	—	0.71	0.91	0.91
	TRU2	0.93	21.72			
	TRU3	0.88	20.63			
	TRU4	0.77	17.53			

Model fit statistics: $\chi^2 = 98.07$, df = 38, χ^2/df = 2.58, CFI = 0.98, TLI = 0.98, IFI = 0.98, NFI = 0.98, SRMR = 0.03, RMSEA = 0.07, AVE, average variance extracted; CR, composite reliability; CA, Cronbach's alpha

an acceptable reliability level of the measurement items.

Finally, the convergent validity and discriminant validity are analysed. With reference to Table 6, the values of average variance extracted (AVE) for all constructs are found to be > 0.50, which is the recommended reference level. The result confirms the measurement model' convergent validity. Regarding the discriminant validity, the AVEs are compared with the squared construct correlations. As all the AVEs are larger than the squared correlations, the discriminant validity is also confirmed.

5.3. Structural model analysis

Structural model analysis was performed to validate the proposed hypotheses. As shown in Table 7, the fit indices of the structural model demonstrate a good fit with the data overall ($\chi^2 = 139.68$, df = 71, χ^2/df = 1.97, CFI = 0.98, TLI = 0.97, SRMR = 0.05, RMSEA = 0.05). The standardised path coefficients (β) of all proposed structural paths are statistically significant at the 95% confidence level. More specifically, the results show that both perceived compatibility (β = 0.36***) and trust (β = 0.23***) lead to the perceived relative value of contactless channel, thereby supporting H1 and H2. The trust perception is also found to influence the compatibility perception, supporting H3. Herein, the relevance of AAM in predicting consumers' channel choice is validated.

Furthermore, viewing consumers' channel choice as a health-related behaviour, we can also observe the impacts of susceptibility perception of the COVID-19. The susceptibility perception positively contributes to the relative value of contactless channel (β = 0.10*); thus, H4 is supported. The perceived susceptibility not only directly influences the relative value of contactless channel but also exerts indirect impacts via consumers' compatibility and trust perceptions. As hypothesised in H5 and H6, although the susceptibility perception enhances consumers' compatibility perception (β = 0.17***), it reduces their trust in the contactless channel ((β = − 0.11*).

In addition, product type (utilitarian or hedonic), product nature (durable or perishable) and product value (low or high) were proposed

Table 6
AVE, construct correlation and squared correlation.

Constructs	SUS	SEV	COM	TRU
SUS	0.83[a]	0.81[b]	0.13	−0.11
SEV	0.66[c]	0.90	0.13	−0.07
COM	0.02	0.02	0.78	0.36
TRU	0.01	0.01	0.13	0.71

[a] Average variance extracted are along the main diagonal.
[b] Correlations between constructs are above the main diagonal.
[c] Squared correlations between constructs are below the main diagonal.

Table 7
Hypotheses testing.

Hypothesis	Path	Standardised path coefficient (β)	t-Value	P-Value	Test result
H1	COM to RLT-VAL	0.36	5.81	***	Yes
H2	TRU to RLT-VAL	0.23	4.01	***	Yes
H3	TRU to COM	0.37	7.65	***	Yes
H4	SUS to RLT-VAL	0.10	1.97	*	Yes
H5	SUS to COM	0.17	3.66	***	Yes
H6	SUS to TRU	−0.11	−2.14	*	Yes
Control variables	Product type [a]	−0.03	−0.58	>0.05	—
	Product nature [b]	0.01	0.30	>0.05	—
	Product value [c]	−0.10	−1.89	>0.05	—

Model fit statistics: $\chi^2 = 139.68$, df = 71, χ^2/df = 1.97, CFI = 0.98, TLI = 0.97, IFI = 0.98, SRMR = 0.05, RMSEA = 0.05, *P < 0.05, **P < 0.01, ***P < 0.001.
[a] Product type is coded as a categorical variable with '1′ representing utilitarian products and '−1′ representing hedonic products.
[b] Product nature is coded as a categorical variable with '1′ representing durable products and '−1′ representing perishable products.
[c] Product value is coded as a categorical variable with '1′ representing low-value products and '−1′ representing high-value products.

as the control variables. Their impacts on the relative value of the contactless channel were also analysed. However, none of the control variables was found to exert a significant impact on consumers' channel choice. Indirectly, the results suggest that the proposed latent constructs represent more powerful factors that explain consumers' channel choice.

5.4. Multi-sampling analysis

In this subsection, the moderation effects of severity perception are validated. Before the data analysis, the sample group was split into two sub-groups. To ensure a relatively balanced split, the mean score of the moderator perceived severity (SEV) was used as the split reference. Accordingly, the first sub-group was formed by respondents who perceived the situation of the COVID-19 as more severe (i.e. 239/453 respondents rated the construct of SEV higher than the mean score); the second sub-group consisted of respondents who perceived the situation as less severe (i.e. 214/453 respondents rated the construct of SEV lower than the mean score).

A standard multi-sampling analysis is adopted to validate the moderation effect, which includes a sequence of tests as follows: 1) configural invariance test, 2) measurement invariance test, and 3) structural invariance test. More specifically, the configural invariance test assesses the combined fit of the model considering the two sub-groups. Upon confirmation of configural invariance, measurement invariance is then assessed by adding equivalent constraints to all the factor loadings. The purpose is to ensure that the measurement items are interpreted consistently across the two sub-groups. Finally, the structural invariance test is conducted by adding equivalent constraints on the structural paths. By doing so, the equivalence of the structural paths is tested across the two sub-groups. χ^2 difference test is used to accept or reject the nested models. Table 8 shows the moderation test results.

The configural invariance was firstly assessed by examining the baseline model (M_1). It simultaneously estimated the model fit of the two sub-groups. As suggested by the fit indices of M_1 (($\chi^2 = 175.90$, df = 76, χ^2/df = 2.31, CFI = 0.97), the combined model showed an adequate fit with the data, indicating configural invariance. Next, M_2 was constructed by adding equality constraints to the factor loadings of M_1. To

Table 8
Moderation test.

Tests	Models	χ^2	df	χ^2/df	IFI	CFI	Nested models	$\Delta\chi^2$	Δdf	χ^2 test	Low SEV	High SEV	Test results
Configural invariance	M_1: Baseline	175.90	76	2.31	0.97	0.97	—	—	—	—	—	—	—
Measurement invariance	M_2: Equal loadings	186.49	83	2.25	0.97	0.97	2–1	10.59	7	$p > 0.05$			
Structural invariance	M_3: Equal structural estimate	220.24	89	2.48	0.96	0.96	3–2	33.75	6	$P < 0.05$			
H7a	M_{3a}: SUS to COM constrained	197.75	84	2.35	0.96	0.96	3a–2	11.26	1	$P < 0.05$	0.01 ^{ns}	0.30***	Accepted
H7b	M_{3b}: SUS to RLT-VAL constrained	193.55	84	2.30	0.96	0.96	3b–2	7.06	1	$P < 0.05$	0.08 ^{ns}	0.29***	Accepted
H7c	M_{3c}: SUS to TRU constrained	186.96	84	2.23	0.96	0.97	3c–2	0.47	1	$P > 0.05$	−0.15*	−0.06 ^{ns}	Not accepted

*P < 0.05, **P < 0.01, ***P < 0.001; ns, not significant.

test measurement invariance, M_2 was compared with M_1. The insignificant χ^2 difference ($\Delta\chi^2_{(M2–M1)} = 10.59$, $\Delta df = 7$, $p > 0.05$) suggested that the more constrained M_2 did not cause a significant loss of model fit. In other words, the insignificant difference between M_2 and M_1 indicated equivalence in the conceptual meanings of the constructs (SUS, COM, TRU and RLV-VAL) across the two sub-groups. Thus, measurement invariance was also established, which served as a pre-condition for further analysis. Finally, structural invariance was analysed by imposing equality constraints to all structural paths (M_3). Comparing M_3 to M_2, we detected a significant difference in terms of their χ^2 values ($\Delta\chi^2_{(M3–M2)} = 33.75$, $\Delta df = 6$, $p < 0.05$). Herein, structural invariance was not supported, suggesting significant differences in at least one of the structural paths between the sub-groups.

To ascertain the specific paths that caused the significant difference in χ^2, we constructed the path-specific constrained models and compared them with M_2. With reference to Table 8, the SUS–COM constrained model (M_{3a}) resulted in a significant difference when compared with M_2 ($\Delta\chi^2_{(M3a–M2)} = 11.26$, $\Delta df = 1$, $p < 0.05$). The result indicated that the SUS–COM linkage conveyed significantly different meanings to consumers from the two sub-groups. A closer examination of the path coefficients revealed that the impact of susceptibility perception on compatibility perception was significantly higher for the consumers who perceived the COVID-19 situation as more severe ($\beta = 0.30$***) than those as less severe ($\beta = 0.01$ ^{ns}). In fact, the impact of susceptibility on compatibility became insignificant within the sub-group that perceived the COVID-19 as less severe. Thus, the susceptibility perception would only make an impact on the compatibility level of the contactless channel when consumers associate the COVID-19 with certain severe consequences. Hence, H7a is supported.

Similarly, comparing the SUS to RLT-VAL constrained model (M_{3b}) to M_2, we also observed a significant difference in χ^2 ($\Delta\chi^2_{(M3b–M2)} = 7.06$, $\Delta df = 1$, $p < 0.05$). The path coefficients further suggested that the relationship between the perceived susceptibility of COVID-19 and the relative value of contactless channel was supported only within the sub-group that perceived the COVID-19 as more severe ($\beta = 0.29$***). To this end, the interaction impact of severity and susceptibility perceptions on the relative value of contactless channel is confirmed, thus supporting H7b.

Finally, the moderating effect of SEV on the relationship between SUS and TRU was analysed. The χ^2 difference between M_{3c} and M_2 was found to be insignificant ($\Delta\chi^2_{(M3c–M2)} = 0.47$, $\Delta df = 1$, $p > 0.05$). Thus, the moderating effect as proposed in H8c is not supported. However, although trust remained a significant concern for consumers who perceived the severity level to be low ($\beta = -0.15$*), it became insignificant for the sub-group that perceived high level of severity ($\beta = -0.06$ ^{ns}). In other words, when the health threat was perceived to be highly severe, consumers' trust concern on the contactless channel became irrelevant. Herein, the result suggests an unexpected attenuation effect, rather than an amplification effect as hypothesised in H8c, of the severity perception.

6. Discussion and conclusion

In response to the COVID-19 pandemic, this study proposes the contactless channel as an ideal solution to address consumers' shopping and consumption needs in the context of social distancing. Anchored on the synthesised insights of the PMT and AAM, motivational factors that lead to consumers' utilisation of the contactless channel are examined. Our findings reveal the salience of threat perceptions, channel characteristics and decomposed omni-channel activities (i.e. contactless channel vs. channel with human contact) when examining consumers' channel choice. Our findings reveal that perceived channel characteristics, such as compatibility and trust, directly contribute to the relative value of the contactless channel (confirming H 1 and H2); these characteristics are also correlated, where trust perception reinforces the compatibility perception (confirming H3). Furthermore, the perceived susceptibility of COVID-19 not only leads directly to the relative value of the contactless channel (confirming H4) but also exerts differentiated impacts indirectly via the channel characteristics. That is, susceptibility perception enhances channel compatibility (confirming H5) but decreases consumers' trust in contactless channel (confirming H6). In addition, the severity perception of COVID-19 is found to interact with the susceptibility perception, which amplifies the positive impacts of susceptibility perception (confirming H7a and H7b) but unexpectedly attenuates its negative impact (contradictory to H7c).

With the findings, this study makes several contributions theoretically and practically.

6.1. Theoretical contributions

6.1.1. E-commerce delivery in the context of COVID-19

This study examines the factors that motivate the utilisation of contactless e-commerce channel by viewing consumers' response as both shopping and health-related behaviours. On the one hand, we find that consumers evaluate the susceptibility and severity of COVID-19, which prompts the contactless channel as a response strategy to the external threat. On the other hand, we find that consumers further assess the compatibility and trustworthiness of the channel, which determines the channel efficacy as an adequate response to the threat. Collectively, the outcomes of threat appraisal and response appraisal lead to consumers' valuation of the contactless e-commerce deliveries. The findings corroborate with the two cognitive processes as specified in the PMT (McCullock and Perrault, 2020; Rogers, 1983) and the dual focus on compatibility and trust as highlighted in the AAM (Ghazizadeh et al., 2012).

To this end, we contribute to e-commerce literature by positioning contactless e-commerce as a response strategy by consumers, rather than a pure service offering, in the context of COVID-19. Different from prior

e-commerce studies that emphasised service qualities and costs (Deutsch and Golany, 2018; Murfield et al., 2017; Otter et al., 2017), our study stresses consumers' evaluations on the service compatibility and trustworthiness in coping with the COVID-19 health threats. Although these two features have been examined by prior literature (Wang et al., 2018), our study suggests an enhancement in compatibility but a deduction in trust due to the undergoing situation of COVID-19. Thus, we extend the e-commerce literature by providing insights on the added impacts of health concerns that considerably alter consumers' evaluation of e-commerce services. Considering the context of social distancing, consumers' health concerns emerge as a prevalent consideration that shapes consumers' behaviours. We expect a deeper integration between the health and e-commerce literature in the near future and encourage more interdisciplinary studies in this nexus.

6.1.2. The central role of trust in contactless e-commerce channel

Our findings suggest that the perceived threats from COVID-19 enhance consumers' valuations of contactless e-commerce services, but the valuation process is negatively mediated by consumers' trust concern. In this regard, our study contributes to the e-commerce literature by unveiling the unusual psychological state among consumers characterised by being more doubtful and hesitant towards trustfulness under the influence of COVID-19. The findings place the trust factor in the central role in consumers' acceptance of contactless services.

Furthermore, consumers' trust not only mediates the valuation process of contactless e-commerce but also leads to the formation of compatibility perception. To interpret, consumers must develop confidence in trusting the contactless services before they would perceive the services as a compatible option to cope with COVID-19. Thus, our study provides empirical evidence that supports the trust–compatibility relationship, which is the reverse of what is originally proposed in the AAM. We maintain that the health threats caused by COVID-19 prompt trust concern as the key deterministic factor that guides the consumers' subsequent perceptions and evaluations of the e-commerce services.

6.1.3. Stage-based conceptualisation on severity

The severity perception is found to attenuate the negative impact of susceptibility on consumers' trust in contactless channel. The attenuation effect is contrary to the hypothesis, although its statistical significance is not supported. The unexpected finding can also be explained by the threshold of severity perception. It seems that when the severity perception reaches a certain level, consumers purposively ignore their negative concerns on the contactless channel (e.g. trust concern), while focusing predominantly on its positive attributes (e.g. compatibility). Thus, we support the stage-based conceptualisation of threat appraisal by Weinstein (1988). We argue that the severity perception may be better described by a series of stages, rather than a single continuum. People start to favourably consider the contactless channel as a response strategy only when the severity level reaches a certain stage.

6.2. Practical implications

6.2.1. A struggle between compatibility and trust

During the response-appraisal process, compatibility and trust perceptions are found to be the direct contributors to consumers' channel choice. However, the risk perception (susceptibility) exerts opposite impacts on consumers' compatibility and trust perceptions. With an increased susceptibility perception, consumers perceive the contactless channel to be more compatible but less trustworthy. This is understandable because the susceptibility perception motivates consumers to comply with social distancing, which naturally prompts the contactless channel as a more compatible choice. However, assuming that the contactless channel becomes a more favourable choice for a much wider base of customers, consumers may raise concerns regarding the capacity and trustworthiness of the channel in order fulfilment and delivery. Consumers seem to experience a struggle between compatibility and trust, that is, 'I would feel compatible to use the contactless channel, but I am afraid too many people are using it so that my orders may be cancelled'.

To address such a struggle, the e-retailers and logistics service providers should work together to ensure that sufficient resources are allocated to meet the increasing demand from the contactless channel. Importantly, the product availability and delivery capacity should be consistently communicated along the channel. Situations causing consumers' trust concern, such as subsequent cancellation of placed orders due to lack of delivery capacity, or essential products being out of stock and excessive delivery capacity remaining idle, should be avoided. In essence, the contactless channel should offer a sense of assurance to consumers that the orders will arrive as promised.

6.2.2. Managing the high susceptibility and low severity health threat

Our findings suggest that the susceptibility and severity perceptions interact with influence consumers' channel choice. Of note, when severity is perceived to be low, consumers focus primarily on the trust concern, which demotivates them from using the contactless channel. The consumers will only start to realise the compatibility and relative value of the contactless channel when the perceived severity reaches a high level. As mentioned in the earlier section, the significant changes in consumers' appraisal of the contactless channel may be explained by the optimistic bias and the severity threshold. People tend to underestimate their own susceptibility, and severity perception only leads to tangible protection motivation when exceeding a threshold level. These misconceptions create great challenges in promoting the contactless channel as a response strategy to the high-susceptibility, low-severity COVID-19 threat.

To overcome the challenges, health agencies and organisations should properly communicate the COVID-19 threats to the public. The public should have a more realistic understanding of the health threat and thus the importance of using the contactless channel. For example, to correct the optimistic bias, the health agencies should emphasise the high transmission potential of COVID-19 regardless of people's age, gender, race and health condition. Moreover, to educate the public on the severity of COVID-19, the high pathogenicity and high fatality rate within certain vulnerable groups should be communicated to the public. The less vulnerable group should also take a part in practising social distancing and utilising the contactless channel so that the more vulnerable groups are protected.

6.3. Limitations

Despite this study's contributions, several limitations exist. Firstly, this study is conducted in Singapore where the infrastructure development of contactless channel (e.g. self-collection locker) is still at an early stage. The infrastructure restriction may play a role in consumers' channel choice. Hence, the research findings may not be generalised to other service contexts where the last-mile logistics infrastructure is more matured, such as China. Secondly, the data analysed in this study were collected during a stable period of COVID-19 local development (e.g. 50–80 confirmed cases/day for a resident population of five million). During this period, most cases were imported, whereas the community-level transmission was limited. As a result, the mean scores for both the susceptibility and severity variables are below the neutral point. In this regard, this study may only reflect consumers' channel choice when facing a low to moderate level of health threat due to COVID-19. Finally, this study examines the relative value of contactless channel by differentiating shopping- and logistics-related activities. However, the price difference between online and offline channels and the additional logistics costs associated with the offline channel are not considered. We would encourage future researchers to extend our research by looking into different aspects of channel value in determining consumers' channel choice, such as functional, emotional, relational and monetary.

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CRediT authorship contribution statement

Xueqin Wang: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. **Yiik Diew Wong:** Funding acquisition, Investigation, Resources, Software, Supervision, Writing – review & editing. **Guanqiu Qi:** Writing – review & editing. **Kum Fai Yuen:** Conceptualization, Data curation, Formal analysis, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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