Customers' tolerance for validation in omnichannel retail stores

Enabling logistics and supply chain analytics

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Abstract

Purpose – Mobile technologies are increasingly used as a data source to enable big data analytics that enable inventory control and logistics planning for omnichannel businesses. The purpose of this paper is to focus on the use of mobile technologies to facilitate customers' shopping in physical retail stores and associated implementation challenges.

Design/methodology/approach – First, the authors introduce three emerging mobile shopping checkout processes in the retail store. Second, the authors suggest that new validation procedures (i.e. exit inspections) necessary for implementation of mobile-technology-enabled checkout processes may disrupt traditional retail service processes. The authors propose a construct labeled "tolerance for validation" defined as customer reactions to checkout procedures. The authors define and discuss five dimensions – tolerance for: unfair process; changes in validation process; inconvenience; mistrust; and privacy intrusion. The authors develop a measurement scale for the proposed construct and conduct a study among 239 customers.

Findings – The results show that customers have higher tolerance for validation under scenarios in which mobile technologies are used in the checkout processes, as compared to the traditional self-service scenario in which no mobile technology is used. In particular, the customers do not show a clear preference for specific mobile shopping scenarios.

Originality/value – These findings contribute to our understanding of a challenge that omnichannel businesses may face as they leverage data from digital technologies to enhance collaborative planning, forecasting, and replenishment processes. The proposed construct and measurement scales can be used in future work on omnichannel retailing.

Keywords North America, Survey, Information technology, Omnichannel, Retail logistics

Paper type Research paper

Introduction

Mobile technologies have enabled omnichannel businesses to provide a seamless shopping experience to customers. Retailers are exploring technology-enabled brick-and-mortar shopping formats that eliminate checkouts, cash registers, and waiting lines (Fosso Wamba, Akter, Coltman, and Ngai, 2015; Stevens and Safdar, 2016). On the one hand, the mobile channel empowers customers with more information about the products. As an emerging form of shopping, customers can search and find product information on their mobile devices and buy the product in a brick-and-mortar store (Hoehle *et al.*, 2012; Verhoef *et al.*, 2007). Customers can also search for product information in a brick-and-mortar store and simultaneously search on their mobile devices to get more information about promotional offers to aid in their purchase

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decision process (Kim *et al.*, 2013; Rapp *et al.*, 2015). On the other hand, mobile technologies enable firms to be more proactive in facilitating customers' purchases (Fosso Wamba, Akter, Edwards, Chopin, and Gnanzou, 2015; Maity and Dass, 2014). Firms can provide mobile devices (i.e. tablets) in the store, where customers can seek information about the products and order them (e.g. Apple Store) (Matook and Vessey, 2008; Verhoef *et al.*, 2015). Furthermore, through in-store wireless networks, firms can communicate with their customers through their mobile devices and also track their behaviors to create actionable insights (Aloysius, Hoehle, and Venkatesh, 2016; Matook *et al.*, 2015; Verhoef *et al.*, 2015). Digital technologies are increasingly a source of large volumes of data in real time from a source – the customer – that was not previously accessible to the retailer (Goyal *et al.*, 2016; Wu *et al.*, 2016).

Despite these benefits, significant challenges remain for omnichannel businesses to implement mobile technologies to facilitate customers' in-store shopping. Typically, a customer's checkout process at a retail store involves a scanning process in which the data of the products a customer wants to purchase are captured and a payment process in which the customer makes payment for the purchase (Aloysius, Hoehle, Goodarzi, and Venkatesh, 2016; Venkatesh *et al.*, 2017). The use of mobile technologies essentially disrupts traditional retail service processes because scanning and/or payment service can take place at any location in the store and not necessarily at a designated location, such as a cash register in a more traditional shopping process (Aloysius and Venkatesh, 2013). For example, customers may first scan items using their mobile phone when browsing for products in the store, then they may use their phone to make an electronic payment at an NFC terminal or walk up to a store employee who has a mobile device capable of processing an electronic payment (Aloysius, Hoehle, and Venkatesh, 2016). As a result, some of the existing checkout processes will need to be re-engineered to accommodate mobile checkout (Aloysius and Venkatesh, 2013). Thus, there is a need to better understand the impacts of using mobile technologies in an omnichannel retailing context.

One particular impact is that the customer autonomy for mobile scanning and payment may give rise to customers' misbehaviors, such as checkout fraud (i.e. customers not scanning items or scanning an item for less than its price) and shoplifting (Beck and Hopkins, 2017; Taylor, 2016a). Retailers face an increasing need to implement validation procedures, such as the use of electronic article surveillance (EAS) tags and exit inspections, to reduce malicious and operational shrink (see Aloysius and Venkatesh, 2013 for a discussion). These validation procedures, although effective and necessary, can disrupt the fluidity of mobile scanning and payment and even create a negative shopping experience. For example, the deactivation and removal of EAS tags requires store personnel intervention that consumes additional time in the checkout process. Exit inspections can make customers feel inconvenienced if they are carrying heavy shopping bags (Taylor, 2016a). Firms are cognizant of the need to consider implications for implementation of ubiquitous computing technologies in the supply chain (Kim *et al.*, 2012). Therefore, it is necessary to take into consideration customers' reactions to the validation procedures in order to optimize customers' mobile shopping experience.

Tolerance is a concept that has been used to understand customers' perceptions in the retailing context. In general, tolerance refers to a customer's willingness to be patient when the service delivery does not meet the customer's expectations of an adequate service (Yi and Gong, 2013). Prior research has examined customers' tolerance for different aspects of in-store shopping experience, such as tolerance for crowding (Machleit *et al.*, 2000; Matook, 2013), tolerance for waiting (Van Riel *et al.*, 2012), tolerance for price premium (Matook, 2014; Turhan, 2014), and tolerance for service encounter failures (Keh and Teo, 2001). These specific tolerance perceptions have been found to be associated with store image, customer satisfaction, and repurchase intention (e.g. Eroglu *et al.*, 2005; Machleit *et al.*, 2000; Van Riel *et al.*, 2012). This suggests the relevance of the concept of tolerance in understanding customers' perceptions of the new validation procedures that could alter status quo and also possibly wait times for a previously non-existent reason.

Against this backdrop, our objective is to develop a comprehensive understanding of customers' reactions to the validation procedures when using mobile shopping in retail stores. First, we introduce three emerging mobile shopping scenarios in which mobile technologies are used to facilitate checkout processes (i.e. scanning and payment). Second, we propose a construct labeled "tolerance for validation" defined as customer reactions to the procedures employed by the retailer to ensure that a customer has paid for all products in the basket they are taking out of the store. Based on prior research in consumer services and retailing, we identify and define five key dimensions of the construct: tolerance for unfair process; tolerance for changes in validation process; tolerance for inconvenience; tolerance for mistrust; and tolerance for privacy intrusion. We develop a measurement scale for the proposed construct and conduct a study to examine customers' perceptions under the emerging mobile shopping scenarios and other self-service shopping scenarios. Overall, our findings provide support for the relevance of the construct of tolerance for validation to the context of mobile shopping. The findings suggest that while the customers favor the use of mobile technologies, there remains a need for omnichannel businesses to optimize customers' mobile shopping experience through a careful design of validation procedures.

Background

In this section, we provide background information relevant to our work. First, we provide an overview of different checkout scenarios in the retail store. Second, we present three key emerging mobile shopping scenarios. Finally, we explain the growing importance of validation process in the mobile shopping context.

A checkout process at a retail store involves two sub-processes, i.e., scanning and payment, that correspond to the time and place in which a retail transaction is completed (Aloysius, Hoehle, and Venkatesh, 2016). Each of the scanning and payment processes has two modes, i.e., fixed and mobile. Under the fixed scanning condition, customers scan the products at a fixed point-of-sale (POS); under the mobile scanning condition, customers can scan the products using either a store mobile device or their own mobile phone as they shop on the sales floor. Similarly, under the fixed payment condition, payment is done at a fixed POS; under the mobile payment condition, payment can be done on the sales floor. Furthermore, the checkout process can vary in terms of autonomy, i.e., whether assistance from a store employee is involved in the scanning or payment processes. Table I lists different possible checkout scenarios and describes how they are or may be operational in stores.

Table I.
Checkout scenarios

	Autonomy			
	Scanning		Payment	
	Assisted	Unassisted	Assisted	Unassisted
Location				
Mobile	A store employee uses a mobile device to scan items for customers on the sales floor	A customer uses either a store mobile device or his/her own mobile phone to scan items as he/she shops on the sales floor	A store employee uses a mobile device to process credit/debit card payments for customers on the sales floor	A customer uses his/her mobile phone for virtual credit card or mobile wallet payments using Wi-Fi/3G or NFC terminals
Fixed	A store employee scans products at a fixed POS	A customer uses a fixed self-scan terminal	A store employee accepts cash or credit/debit cards at a fixed POS	A customer uses a fixed self-service register to pay using cash or credit/debit cards

Source: Adapted from Aloysius and Venkatesh (2013) and Aloysius, Hoehle, and Venkatesh (2016)

Emerging mobile shopping scenarios

Among the scenarios listed in Table I, some (e.g. fixed assisted scanning and fixed unassisted payment) are already commonly used in stores. Thus, we select and focus on three representative emerging mobile shopping scenarios, and discuss how mobile technologies can be used to facilitate customers' shopping and the associated advantages and disadvantages in each scenario.

Scenario A: mobile-assisted scanning and mobile-assisted payment. In this scenario, a store employee equipped with a mobile device on the sales floor processes a customer's transaction. The store employee scans the products in the customer's basket and uses a credit card terminal to accept payment. The key advantage of this shopping scenario is that customers can enjoy the convenience of being able to incorporate their browsing with their transaction without having to seek a cash register. Also, store employees have the opportunity to engage with customers and to cross-sell and/or up-sell. The key disadvantage is that it can cause customers some frustration if they are unable to locate a store employee for assistance, which is especially likely to happen during busy periods. Finally, the checkout process can be disrupted by technical problems, e.g., when an employee's mobile device cannot print a receipt.

Scenario B: mobile self-service scanning with store device and fixed self-service payment. In this scenario, customers registered with the store use a store mobile device to scan products as they shop on the sales floor. The mobile device records the scanned products and creates an electronic ID for the basket that can be transferred to the store system. As the customers exit the store, they use a self-service lane to make a payment based on the electronic basket ID. Like in Scenario A, the key advantage of this shopping scenario is that customers can incorporate their browsing with their transaction without having to seek a cash register. Moreover, the store mobile devices are retail rugged and have a long expected usable life. They are usually more reliable for scanning than a customer's device. The key disadvantage is the difficulty in self-scanning due to technical problems or customers lacking in proficiency to perform the scanning task effectively/accurately. Finally, some products, such as bulk grocery, loose items (e.g. bakery), and EAS tagged items, require separate processes and even employee intervention, thus causing inconvenience for customers.

Scenario C: mobile self-service scanning with smartphone and mobile self-service payment. In this scenario, customers registered with the store use their smartphone to scan products as they shop on the sales floor. The smartphone records the scanned products and creates an electronic ID for the basket that can be transferred to the store system. Before the customers exit the store, they use their smartphone to make a payment via a mobile wallet or virtual credit card terminal based on the electronic basket ID. Like in Scenarios A and B, the key advantage is that customers can incorporate their browsing with their transaction without having to seek a cash register. Moreover, the retailer can engage with the customers through their smartphones by providing product information, product reviews, social media content, and product recommendations. Also, the product recommendations can be targeted to the customers based on the preference information revealed by the products the customers have scanned. Another advantage is that the physical device does not cost the retailer anything and customers have the convenience of using a familiar device. Like in Scenario B, the main disadvantages of this scenario include the difficulty in self-scanning and the need for separate processes and employee intervention for certain types of products (e.g. bulk grocery, loose items, EAS tagged items).

Growing importance of validation process

The validation process allows the retailer to ensure that the customers have scanned and paid for all the items that they have with them when they leave the store (see Aloysius and Venkatesh, 2013 for a discussion). This process can take different forms. For example, cashiers at checkout counters visually inspect baskets, shopping carts, and the customer when they scan and accept payment for products. They are able to help the customer deal with operational errors that might result in shrink as well as act as a deterrent to malicious acts of theft. Moreover, some retailers use other forms of surveillance (e.g. video cameras, alert store employees walking the aisles, and stationed at the exits) to detect anomalous behavior that may indicate malicious acts of theft.

The emergence of mobile shopping has increased the importance of validation process. With the traditional fixed location checkout processes, validation is already partly integrated into the scanning and payment processes because employees involved in the transaction can be used to check baskets against payments without the need for a separate validation process. In contrast, under the emerging mobile shopping scenarios, customers can checkout using a mobile device without employee assistance (e.g. Scenarios B and C described above). Prior research has found that mobile and self-service technologies increase theft by customers and also increase losses due to their use, both malicious (e.g. customers deliberately not scanning items) and non-malicious (e.g. incorrect prices accidently being transacted) (Beck, 2011; Beck and Hopkins, 2017; Taylor, 2016b). Thus, the validation process becomes necessary and needs to be incorporated into the mobile shopping processes.

One popular validation process employed by retailers is exit inspection (or known as receipt-checking), which matches store receipts to the items in a shopping cart when a customer leaves the store (Salzmann, 2009). Although many retailers have found exit inspection to be an effective deterrent to shoplifting, its drawback is that it targets and affects all shoppers rather than the few who are likely to be stealing. Consequently, some innocent customers may become involved in detention and searches where they might not have before. This will likely create negative feelings (e.g. embarrassment, inconvenience, resentment) among customers. Some even argue that receipt-checking is an unlawful detention (Salzmann, 2009). Therefore, the introduction of exit inspections involves risks that should be carefully considered before integrating such procedures into the mobile shopping processes.

Construct of tolerance for validation

In this section, we propose the construct of "tolerance for validation." Here, we follow Aloysius and Venkatesh (2013) and define it as customer reactions to the procedures employed by the retailer to ensure that a customer has paid for all products in the basket they are taking out of the store. We draw from research in consumer services and retailing to identify key aspects of customers' reaction to the validation procedures (i.e. exit inspections). We define five key dimensions of the construct: tolerance for unfair process; tolerance for changes in validation process; tolerance for inconvenience; tolerance for mistrust; and tolerance for privacy intrusion.

In the consumer services context, tolerance refers to a customer's willingness to be patient when the service delivery does not meet the customer's expectations of an adequate service (Yi and Gong, 2013). We propose a construct labeled "tolerance for validation" defined as customer reactions to the procedures employed by the retailer to ensure that a customer has paid for all products in the basket they are taking out of the store. Based on this definition, tolerance for validation involves a customer's willingness to accept exit inspections and remain patient during the process. In the following, we discuss the plausible reasons why customers may have negative reactions to exit inspections, which pertain to the five dimensions of the proposed construct.

Tolerance for unfair process

In the consumer services context, fairness is a customer's perception of the degree of justice in a service firm's behavior (Seiders and Berry, 1998). Customers' judgments of service fairness surface when their experience conflicts with their fairness standards and they sense either injustice or uniquely fair behavior (Li *et al.*, 2011). Unfair perceptions can be triggered by events that are not particularly dramatic, e.g. a service provider's lack of attention. When customers believe they have been treated unfairly, their perceptions of unfairness will lead to lower customer satisfaction (e.g. Oliver and Swan, 1989; Teo and Lim, 2001).

Exit inspections might be viewed as an unfair process from a customer perspective because customers may view the inspections as a departure from the norm in the retail industry. Customers are not used to exit inspections and they would need to adjust their fairness perceptions when retailers introduce exit inspections. Unless under a strong receipt-checking system, not all customers are required to undergo exit inspections (Salzmann, 2009). When some innocent customers are randomly selected to be inspected, they may feel that they are being targeted because they are deemed to look suspicious (Taylor, 2016a). Unfair perceptions may be triggered among those customers due to the extra burden placed on them, leading to a negative impression of the mobile shopping experience. Therefore, it is critical to understand how tolerant customers are toward the unfairness of the validation procedure.

Tolerance for changes in validation process

Customers' habits play a central role in the retail shopping process. A habit refers to a person's psychological dispositions to repeat past behavior (Neal *et al.*, 2012). Customers are likely to form a habit with respect to virtually any temporally recurring interaction with a firm in a stable context (Shah *et al.*, 2014). Prior research has found that customers exhibit habitual behaviors in terms of store choice (e.g. Bell *et al.*, 1998), shopping time (e.g. East *et al.*, 1994), shopping frequency (e.g. Tang *et al.*, 2001), and average spending (e.g. Tang *et al.*, 2001). These habitual behaviors are important to retailers as they provide a basis for repeat patronage.

Incorporating exit inspections into the existing shopping process involves the risk that customers may view exit inspections as a disruption of their shopping routines. At present, exit inspections are not the norm in most retail stores and customers are used to leaving stores without being monitored and inspected. If exit inspections are introduced in combination with mobile shopping, the new validation procedures may interfere with a customer's habit with the shopping process. As a result, customers could feel annoyed, irritated, worried, scared, nervous, or puzzled. Therefore, it is critical to understand how tolerant customers are to the changes in the validation procedure.

Tolerance for inconvenience

Convenience is a key consideration in customers' decisions to purchase from a channel (Schoenbachler and Gordon, 2002). It refers to a customer's perception of the time and effort related to buying or using a service (Berry *et al.*, 2002). Convenience is a key factor driving the popularity of self-service technologies (Collier and Kimes, 2013; Collier and Sherrell, 2010; Meuter *et al.*, 2000). In the mobile shopping scenarios, the technologies help to generate more in-store fluidity and allow customers to conserve their time and effort by avoiding waiting in line or going to the cash register. This provides customers with a more convenient way of shopping and enhances their experience.

It is important to consider the inconvenience for customers when introducing exit inspections in combination with mobile shopping. Exit inspections can cause delays for customers if they have to wait in lines or undergo a time-consuming check before they can exit the stores. These delays are particularly likely in retail stores that have a high item-to-basket ratio because the validation procedure will take a considerable amount of time to match a customer's receipt with the shopping basket. Therefore, it is critical to understand how tolerant customers are to the inconvenience caused by the validation procedure.

Tolerance for mistrust

Trust is defined as a person's belief that the other person will perform actions that will result in positive outcomes, as well as not take unexpected actions that would result in negative outcomes (Anderson and Narus, 1990). In the retail context, trust is a critical element in the customer-to-store relationship (Bansal and Zahedi, 2015). Trusting relationships between customers, salespersons, and the stores they represent are associated with positive outcomes, such as purchase intention, store satisfaction, and store loyalty (e.g. Bloemer and Odekerken-Schroder, 2002; Macintosh and Lockshin, 1997; Wong and Sohal, 2002).

Mistrust of the customer by the retailer is an important concept to consider when introducing exit inspections in combination with mobile shopping. Mistrust refers to a general lack of trust in the motives of individuals and organizations (Omodei and McLennan, 2000). Surveillance and theft control measures signal distrust, which repels customers. Customers might feel that they are not being viewed as being sincere and retailers would not trust them. This seems particularly the case for recurring customers and frequent buyers because they believe to have established bonds with their retailers of choice. A possible negative reaction as a result of perceived lack of trust could be that customers are insulted and stop visiting the store. Therefore, it is critical to understand how tolerant customers are to the feeling of mistrust caused by the validation procedure.

Tolerance for privacy intrusion

Customers are increasingly concerned about the privacy of their personal information and their purchase behaviors. In the omnichannel retailing context, retailers can track customer behavior and collect customer-related data using technologies, such as RFID and mobile location analytics, and then target customers with product offerings (Farshidi, 2016). Although this allows retailers to adjust the content and offering to individual preferences, it can be perceived as a breach of privacy, especially if too much marketing "push" is applied (Piotrowicz and Cuthbertson, 2014). Thus, omnichannel businesses need to be careful with perceptions of privacy intrusion when using mobile technologies to optimize customers' shopping experience.

A customer's privacy concern is a critical aspect to take into account when introducing exit inspections in combination with mobile shopping. Customers value their privacy and checking their bags they purchased might lead to negative connotations. Exit inspections might be perceived as a privacy intrusion for customers because the inspections may reveal information that makes customers feel upset, nervous, or ashamed. For example, exit inspections can make customers feel embarrassed if the customers are buying items of a personal nature (Taylor, 2016a). Furthermore, some argue that customers should have a reasonable expectation of privacy and retailers do not have the automatic right to conduct exit inspections (Salzmann, 2009). Therefore, it is critical to understand how tolerant customers are to privacy intrusion by the validation procedure.

Method

To evaluate customers' perceptions of tolerance for validation under the emerging shopping scenarios, we first conducted an exploratory study to better understand customers' reactions to the emerging shopping scenarios and to inform the development of measurement scales. Second, we conducted an online survey to evaluate customers' tolerance for validation under the selected emerging mobile shopping scenarios (i.e. Scenarios A, B, and C) and other self-service shopping scenarios.

Exploratory study

We conducted store intercept surveys and focus group discussions to gain a deep understanding of customers' perceptions of the emerging shopping scenarios and help us in developing scales for measuring customers' tolerance for validation. We conducted the store intercept surveys at three retail stores (i.e. a home improvement retailer, a general merchandise retailer, and a department store) in the Southern USA. About 200 customers, who had finished their shopping, voluntarily participated in our study. They completed a ten-minute survey about their views on the emerging shopping scenarios. To help the participants understand the emerging scenarios, we used visuals and briefly explained the emerging mobile technologies and processes to them. Overall, the store intercept surveys suggested that customers were interested in the emerging shopping scenarios. Following the store intercept surveys, we conducted two focus group sessions to gain a better understanding of customers' perceptions toward mobile technologies in the retail context. The two focus groups consisted of 32 customers and 21 customers, respectively. The group sessions were semi-structured and consisted of open-ended questions. Each focus group discussion lasted more than an hour and was conducted by one of the authors. The interviews were taped and transcribed, and subsequently coded and analyzed by the authors. Overall, the results suggested that the participants found our emerging shopping scenarios to be interesting and also a valuable concept for retailers.

Online survey

Sample and procedures. We drew the sample from the target population of a general consumer pool representing the US population. All data were collected in Spring 2013 using an electronic survey that was administered by a professional research firm. The research firm e-mailed invitations to potential respondents in the sampling frame (residents of the USA, aged 18 and older) and asked them to complete an online survey. Each individual was asked to complete an online survey and those who completed the survey received small monetary incentives provided by the research firm. Our sample matched the sampling frame provided by the market research firm, so non-response bias was not a major concern. Also, because all responses were collected during a single week and the research firm did not send out reminders to respondents, a comparison of early vs late responses was not necessary (Hair *et al.*, 2010). In total, we received 239 responses. Table II shows the demographic characteristics of the respondents.

We collected data using a scenario-based study in which the respondents were presented with six shopping scenarios. The first three scenarios were the representative emerging mobile shopping scenarios that we discussed earlier (i.e. Scenarios A, B, and C), and the other three were common self-service shopping scenarios that were selected for the purpose of comparison. The respondents were provided with contextual information and visual illustrations of each shopping scenario. One example service scenario (i.e. Scenario C) is provided in Appendix 1.

Measurement. To operationalize the five proposed dimensions of tolerance for validation, we adapted scales from prior research. We also created additional items based on the description of each dimension of tolerance. The scales were developed and validated following the general guidelines outlined by Hoehle and Venkatesh (2015). In each step during the validation process, relevant criteria were examined. Overall, the thresholds, discussed in Hoehle and Venkatesh (2015), were met. In a few cases, we made adjustments to ensure the quality of our measurement items (see Hoehle and Venkateshm, 2015 for discussion). Next, we asked two researchers who had PhD degrees in business from US universities and were unfamiliar with our study to comment on the items. Some minor modifications were made based on their feedback. All items were measured using seven-point Likert scales ranging from 1 ("strongly disagree") to 7 ("strongly agree"). The final set of items and sources are shown in Appendix 2.

Demographic	Category	$n = 239$
Gender	Men	109
	Women	130
Age groups	Under 20	13
	20-29	138
	30-39	48
	40-49	19
	50-59	14
	60 or older	7
Income (annual, in USD)	0-10,000	26
	10,000-19,000	14
	20,000-29,000	31
	30,000-39,000	34
	40,000-49,000	25
	50,000-74,000	48
	75,000-99,000	30
	100,000-150,000	24
	Over 150,000	7
Job	ICT	87
	Banking and finance	65
	Insurance, real estate, and legal	32
	Government and military	5
	Construction and engineering	23
	Retail and wholesale	7
	Education	2
	Marketing and advertising	2
	Student	8
	Other	8

Table II.
Respondent demographics

Results

We used partial least squares (PLS), a component-based structural equation modeling technique, to assess the quality of the measurement scales. PLS places minimal restrictions on scales, sample size, and residual distributions, and can handle formative constructs with fewer restrictions than covariance-based techniques (Ringle *et al.*, 2012).

Measurement model: reliability and validity

First, we modeled the five dimensions of tolerance for validation as reflective constructs. We assessed the reliability and convergent validity of the reflective constructs using composite reliability and average variance extracted (AVE) (see Table III). The internal consistency reliabilities of all constructs exceeded 0.90. The AVE for each construct was greater than the recommended 0.50 level, which meant that more than 50 percent of the

	Mean	SD	ICR	1	2	3	4	5
1. Tolerance for unfair process	4.52	1.43	0.94	(0.86)				
2. Tolerance for changes in validation process	4.25	1.44	0.93	0.84***	(0.88)			
3. Tolerance for inconvenience	3.13	1.46	0.95	0.67***	0.76***	(0.88)		
4. Tolerance for mistrust	3.64	1.43	0.93	0.75***	0.81***	0.78***	(0.84)	
5. Tolerance for privacy intrusion	3.84	1.55	0.94	0.75***	0.82***	0.76***	0.78***	(0.84)

Notes: $n = 239$. ICR, internal consistency reliability. Square roots of AVEs appear on the diagonal in parenthesis. ***$p < 0.001$

Table III.
Descriptive statistics and correlations

variance observed in the items was explained by their respective hypothesized constructs. Discriminant validity was assessed by comparing the inter-construct correlations with the AVE of the individual constructs. The inter-construct correlations were all below the square root of the AVE of either construct. In sum, the various scales possessed adequate reliability and validity.

Second, we modeled tolerance for validation as a second-order formative construct consisting of five sub-constructs – i.e., tolerance for unfair process, tolerance for changes in validation process, tolerance for inconvenience, tolerance for mistrust, and tolerance for privacy intrusion – using a two-stage approach (Ringle *et al.*, 2012). In the first stage, the repeated indicators approach was used to obtain the latent variable scores for the five sub-constructs. In the second stage, the latent variable scores were used as manifest variables in the measurement model of tolerance for validation. The construct validity of tolerance for validation was assessed by examining the weights of the five sub-constructs, which indicated the relative importance of the sub-constructs (Cenfetelli and Bassellier, 2009). The results showed that all weights were of similar magnitude (ranging from 0.18 to 0.24) and significant ($p < 0.001$), indicating that all five sub-dimensions contributed to the formation of tolerance for validation fairly equally. The reliability of the formative construct was assessed by examining for possible multicollinearity among the sub-constructs (Cenfetelli and Bassellier, 2009). All variance inflation factor values were below 4, indicating a low threat of multicollinearity (Hair *et al.*, 2010). In sum, the second-order construct of tolerance for validation possessed adequate construct validity and reliability.

Tolerance for validation under different shopping scenarios

We examined customers' tolerance for validation under different shopping scenarios (see Table IV). Apart from the representative emerging mobile shopping scenarios we discussed earlier (i.e. Scenarios A, B, and C), we included the three additional self-service shopping scenarios for the purpose of comparison purpose (i.e. Scenarios D, E, and F). Specifically, Scenarios D and E represent combinations of mobile/fixed and assisted/self-service scenarios, and Scenario F represents the traditional fixed self-service scenario that is common in practice.

Table IV shows the mean values for the five tolerance dimensions and the overall tolerance in each of the six scenarios. The last column of the table shows the significant pairwise differences ($p < 0.05$). We made three observations from the results. First, among the five dimensions of tolerance for validation, tolerance for inconvenience was consistently

	Emerging mobile shopping scenarios			Other self-service shopping scenarios			
	A	B	C	D	E	F	Pairwise differences ($p < 0.05$)
Tolerance for unfair process	4.62	4.54	4.73	4.82	4.09	4.30	C > E; D > E
Tolerance for changes in validation process	4.33	4.08	4.27	4.76	4.01	4.09	B < D; D > E; D > F
Tolerance for inconvenience	3.11	3.05	3.00	3.74	2.95	2.92	B < D; C < D; D > E; D > F
Tolerance for mistrust	3.65	3.58	3.86	4.05	3.43	3.28	D > E; D > F
Tolerance for privacy intrusion	3.78	3.69	3.94	4.37	3.79	3.47	B < D; D > F
Tolerance for validation (overall)	3.85	3.73	3.91	4.31	3.61	3.57	D > E; D > F

Notes: Scenarios: A, mobile-assisted scanning/mobile-assisted payment; B, mobile self-service scanning with store device/fixed self-service payment; C, mobile self-service scanning with smartphone/mobile self-service payment; D, mobile self-service scanning with store device/fixed assisted payment; E, fixed assisted scanning/mobile self-service payment; F, fixed self-service scanning/fixed self-service payment

Table IV. Comparison of tolerance for validation under different shopping scenarios the lowest across all six scenarios. This suggests that customers think that exit inspections do cause much inconvenience. In contrast, tolerance for unfair process and tolerance for changes in validation process were relatively higher than the other dimensions. This may imply that customers understand the necessity of change in the form of exit inspections to prevent shop thefts and tend to think that exit inspections are fair practices.

Second, we found that the mean values for the various tolerance dimensions were generally higher in scenarios in which mobile technologies were used for scanning, as compared to the traditional scenarios in which mobile technology is used for payment only or is not used at all (i.e. Scenarios E and F). This suggests that customers have higher tolerance for exit inspections when mobile technologies are used to facilitate the checkout processes.

Third, we found that there were not many significant differences across the mobile shopping scenarios. The three representative emerging mobile shopping scenarios (i.e. Scenarios A, B, and C) did not show significantly higher mean values than the other scenarios. This could be due to the fact that these emerging scenarios are not yet commonly used in practice, so customers do not view them particularly favorably. Interestingly, Scenario D, in which mobile self-service scanning with store device and fixed assisted payment are used, has relatively higher mean values for tolerance than other scenarios. This may indirectly suggest that customers are not yet ready for a full mobile self-service solution (using their own device) and may be less resistant to processes which feature human assistance during the checkout. In sum, the results suggest that the customers do not have a clear, strong preference for specific mobile shopping scenarios.

Discussion

The objective of this work was to develop a better understanding of customers' reaction to the validation procedures necessary for implementation of mobile-technology-enabled shopping processes in retail stores. We presented representative emerging mobile shopping scenarios and proposed the construct of tolerance for validation. Overall, the results of the online survey provided support for the validity and relevance of our proposed concept. All of the five identified dimensions of tolerance loaded significantly on the overall concept of tolerance for validation. Also, we observed significant variation in tolerance for validation across the different shopping scenarios.

Implications for research

First, our work contributes to the literature by enhancing the understanding of the impacts of using mobile technologies in an omnichannel retailing context. We focused on customers' potential negative reaction to the validation procedures that are introduced in combination with mobile shopping that retailers promote in order to gain data sources. Drawing on prior research in consumer services and retailing, we proposed the construct of tolerance for validation. We identified five specific dimensions – i.e., tolerance for unfair process, tolerance for changes in validation process, tolerance for inconvenience, tolerance for mistrust, and tolerance for privacy intrusion – that correspond to different reasons for why customers may find the validation procedures to be unpleasant. While our proposed construct provides a nuanced understanding of the negative impacts associated with the supporting service processes for mobile shopping (i.e. exit inspections), future research could extend our work by examining customers' tolerance for technical problems associated with mobile technologies (e.g. non-scans, wireless failure, and battery life) to gain a more complete understanding of the mobile shopping experience.

Second, our work adds to the line of research that examines customers' tolerance for different aspects of in-store shopping experience, such as tolerance for crowding and tolerance for waiting (e.g. Machleit *et al.*, 2000; Van Riel *et al.*, 2012). With the emergence of omnichannel retailing, customers' in-store shopping experience will continue to be enriched by new technologies that give rise to new business practices, such as indoor customer location tracking with RFID (Yaeli *et al.*, 2014). Future research could use this tolerance concept to arrive at a set of relevant dimensions that measure customers' reactions to the emerging, perhaps unfavorable, business practices.

Third, our work makes an empirical contribution to the literature by developing and validating a comprehensive set of scales for the construct of tolerance for validation. Our results confirmed the second-order factor structure of the construct and also the relevance of the five sub-dimensions. Future research could integrate tolerance for validation into a nomological network to examine its effects on important business outcomes, such as customer satisfaction, repurchase intention, and loyalty (e.g. Eroglu *et al.*, 2005; Machleit *et al.*, 2000; Van Riel *et al.*, 2012). We should point out that although we validated our proposed construct in the context of mobile shopping, the concept of tolerance for validation is clearly generalizable to traditional or non-mobile shopping contexts.

Fourth, our findings introduce a new concept to different literatures on retail and thus inform future researchers in different contexts: researchers on inventory record inaccuracy (IRI) will better understand the need to take into account exit inspections as a factor (see DeHoratius and Raman, 2008 for an overview) that will influence IRI; and researchers on retail regard on-shelf availability not as a metric to be maximized but rather in terms of an optimal service level that balances the cost of lost sales with the cost of holding inventory (Moussaoui *et al.*, 2016). Similarly, our results highlight the need for researchers on retail to consider exit inspections not as a means to eliminate loss but to recognize the need to balance customer satisfaction with service processes in the store, with potential benefits from increased opportunities to collect technology-enabled data from customers, as well as potential losses due to theft and customer mistakes in the checkout process. Finally, studies in the field are necessary to quantify lost sales due to customer dissatisfaction with service processes that are a direct consequence of exit inspections.

Implications for practice

Our findings offer important implications for the implementation of exit inspections in retail stores. Retailers are disrupting their existing in-store service processes, motivated by the prospect of new and valuable real-time data that will improve their inventory control and logistics processes. The specific technologies (both hardware and software) that retailers and customers may adopt may be different across retailers but with increased customer autonomy due to automation, exit inspections are likely to be the last resort to keep operational and malicious shrink under control. Our findings suggest five different aspects by which customers may be intolerant of exit inspections. First, customers may view exit inspections to be an unfair process. To reduce customers' perception of unfairness, retailers can present the exit inspections not as a mandatory audit but as a process to assist customers with their transaction conducted by well-trained employees. For example, they can term the exit inspection "customer service checks" to create a positive customer perception of the inspection. The remedy here is therefore to manage customer perceptions by means of behavioral interventions.

Second, customers may find the changes in the validation process to be unpleasant as the exit inspections disrupt their shopping routines. Retailers can frame the inspection as a way to help customers to use the new technology. Also, retailers can explain that customers at other stores who use mobile POS are likely to be subject to similar checks. The key here is to make the change more palatable by drawing attention to positive benefits from the change and to normalize the perception of the process by highlighting the universal nature of the change.

Third, customers may consider that exit inspections make shopping inconvenient due to the extra time required. Some research has suggested that people are more tolerant of waiting if there is an identifiable reason (e.g. peak hours or security) (Davis and Heineke, 1998). Thus, retailers can frame exit inspections as an exercise to ensure that customers' purchases are error-free and to provide customers a fair, safe, and secure transaction. Furthermore, to the extent possible, retailers should minimize exit delay from the inspection either by streamlining the process or by using random test checks.

Fourth, exit inspections may give customers a sense of mistrust. To prevent the perception of mistrust from arising, retailers can stress the bond of loyalty with regular customers and exempt those who are trustworthy. Also, it could be effective to frame the inspection as a customer service intervention designed to facilitate the transaction and to de-emphasize the loss prevention aspect of the process.

Finally, customers may perceive exit inspections as a privacy intrusion. Store employees can initiate conversation to keep the focus away from the audit function of the inspection. Although it is natural for store employees to use the customer's purchases as a topic of conversation, it may not be desirable in some cases (e.g. when the customers are purchasing items of a personal nature). Thus, store employees should use other topics that do not have the potential to be perceived as an invasion of privacy (e.g. reminding the customers about the sales items). This measure, along with some of the others that we have brought up, will require training for employees to ensure effective implementation in the store.

Conclusions

We proposed the construct of tolerance for validation in the omnichannel retailing context. Based on an online scenario-based study on 239 customers, we found support for the relevance of our proposed dimensions – i.e., tolerance for unfair process, tolerance for changes in validation process, tolerance for inconvenience, tolerance for mistrust, and tolerance for privacy intrusion. The construct is of practical significance given the changes introduced by the mobile channel that result in improved logistics. In addition to theoretical implications for existing research on the topic, the construct can be used and adapted in future studies on omnichannel retailing.

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Appendix 1. Example of an emerging shopping scenario (see Aloysius and Venkatesh, 2013 for alternative scenarios) (Scenario C)

Thank you for agreeing to participate in our Mobile Shopping study. This is what mobile shopping means. Imagine that on your visit to the store you use your smartphone to scan all the items you would like to purchase as you shop on the sales floor. The picture below illustrates the mobile scanning process.

Once you have completed shopping, you take your shopping cart to the checkout area. The checkout area is equipped with mobile payment terminals that can access the information stored on your smartphone. To check out, you swipe your mobile phone over the terminal and authorize the payment on your mobile phone. The picture below illustrates the mobile payment process.

Appendix 2. Measurement items

Tolerance for unfair process (Jaworski and MacInnis, 1989; Maxham and Netemeyer, 2002; Ramaswami, 1996)

(1) Exit inspections are not fair (reverse-coded).[a]

(2) The store has the right to check customers as they exit.[a]

(3) Exit inspections are an unfair practice (reverse-coded).[a]

(4) I do not believe that stores should perform exit inspections because they are an unjust practice (reverse-coded).[a]

(5) Exit inspections are a fair practice to help prevent shoplifting.

(6) Exit inspections are fair practice because they help in monitoring the extent to which customers follow established sales procedures.

Tolerance for changes in validation process (Murry and Dacin, 1996)

(1) I think stores should stick to their current procedures and not introduce exit inspections (reverse-coded).[a]

(2) If the store introduced exit inspections and modified existing procedures, I would feel: Bitter (reverse-coded).

(3) If the store introduced exit inspections and modified existing procedures, I would feel: Angry (reverse-coded).

(4) If the store introduced exit inspections and modified existing procedures, I would feel: Afraid (reverse-coded).

(5) If the store introduced exit inspections and modified existing procedures, I would feel: Worried (reverse-coded).

(6) If the store introduced exit inspections and modified existing procedures, I would feel: Irritated (reverse-coded).

Tolerance for inconvenience (Andaleeb and Basu, 1994; Donthu and Gilliland, 1996; Mittal, 1994)

(1) Exit inspections are inconvenient for me because it involves extra effort to present my receipts and shopping bags (reverse-coded).[a]

(2) It is inconvenient to undergo exit inspections (reverse-coded).

(3) I hate to waste time on exit inspections (reverse-coded).

(4) Shopping becomes inconvenient due to exit inspections (reverse-coded).

(5) I am too busy for exit inspections (reverse-coded).

(6) Exit inspections would be inconvenient because I am often juggling my time between too many things (reverse-coded).

Tolerance for mistrust (Babin *et al.*, 1995; Ganesan, 1994)

(1) Exit inspections show that I am not viewed as trustworthy (reverse-coded).[a]

(2) Stores conduct exit inspections because they do not trust customers (reverse-coded).[a]

(3) I believe that stores conduct shopping inspections because they believe customers are: Suspicious (reverse-coded).

(4) I believe that stores conduct shopping inspections because they believe customers are: Not Trustworthy (reverse-coded).

(5) Having someone check my cart when I exit the store would be insulting (reverse-coded).

(6) Stores checking my cart as I leave the store would show a lack of trust in me personally (reverse-coded).

Tolerance for privacy intrusion (Watson *et al.*, 1988)

(1) Exit inspections may reveal more information about the products I buy than I am comfortable with (reverse-coded).[a]

(2) Exit inspections can expose information about me that I consider private (reverse-coded).[a]

(3) Exit inspections invade my privacy (reverse-coded).[a]

(4) Exit inspections require me to reveal highly personal information about my shopping habits (reverse-coded).[a]

(5) It would infringe on my privacy if the store had to check on purchases after I used my cell phone for my shopping and payment (reverse-coded).

(6) Exit inspections by the store would make me feel: Uncomfortable (reverse-coded).

Note: [a]Self-developed items.

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