Identifying the Design Inhibitors of In-store Shopping Apps

Completed Research Paper

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Abstract

In-store mobile shopping apps can reduce queues in supermarkets and improve the consumer's shopping experience, yet their usage rates remain low. Despite the advances in mobile commerce literature, only scant research discusses the design inhibitors of in-store mobile shopping apps. This paper uses the Theory of Technology Usage Inhibitors to investigate inhibitors in designing in-store mobile shopping apps. We adopt a topic modelling approach to analyse 1800 Apple store reviews to identify the most significant inhibitors in a UK supermarket in-store mobile shopping app. Our findings identify redundancy, malfunctioning, overcharging, fiddliness, poor support, difficulty registering and objecting benefits as the critical design inhibitors. Our study expands the theory of technology usage inhibitors (Cenfetelli 2004) in the context of in-store shopping apps by identifying and conceptualising design-based inhibitors that discourage use. This paper contributes important design insights and recommendations to support app designers and retailers in effectively designing in-store shopping apps.

Keywords: Design Inhibitors, Usage Inhibitors, Shopping Apps

Introduction

In-store mobile shopping apps are a recent and evolving development emerging as an important approach to improving the consumers' shopping experience (Johnson et al. 2021). For example, consumers can avoid unloading products at the checkouts (Andriulo et al. 2015; Vučkovac et al. 2017a), thus saving time. On the other hand, retailers can also use the app to reduce handling costs, i.e. cutting down labour costs (Andriulo et al. 2015) and gain a competitive edge against online retailers (Johnson et al. 2021). Retailers and consumers in physical stores identify waiting in supermarkets checkout queues as one of the most uncomfortable activities (Borges et al. 2015). Therefore, in-store mobile shopping apps can significantly reduce the queue challenge (Johnson et al. 2020). In-store mobile shopping apps allow consumers to scan products and put them into their bags instead of scanning them at the staffed or self-checkout points. There are several scenarios regarding payment when using these apps (Aloysius et al. 2016a), albeit this study investigates the scenario where consumers pay at a fixed self-checkout point by scanning a QR code.

Although a large body of IS research helps to understand the factors that enable and drive IS use, it appears that there is scant research regarding in-store shopping apps, as demonstrated in a recent IS use review by Burton-Jones et al. (2020). While previous research focused primarily on technology acceptance, a few studies emphasise the intertwined impact of system design on hindering technology acceptance. The theory of technology usage inhibitors (Cenfetelli 2004; Cenfetelli and Schwarz 2011) sheds light on factors that

contribute to use intention and further lead to technology rejection rather than acceptance. Inhibitors are users' perceptions about a system that discourages adoption (ibid.). Although the existence of inhibitors has been conceptualised, one survey demonstrates that there is less attention paid to factors that inhibit or discourage IS use (Laumer and Eckhardt 2012). For example, research is limited to object-based, normative-based, behavioural-based, and affective-based inhibitors (Sullivan and Koh. 2019). It seems that very little research discusses design-based inhibitors that work to discourage use. Therefore, there is a need for additional exploratory studies that identify inhibitors across different contexts (Sullivan and Koh. 2019).

Designing mobile shopping apps is a challenge that can significantly dissuade users if not done carefully (Cenfetelli 2004; Wulfert 2019). For instance, a recent study shows that the designer's choice to include or exclude some IT features can trigger disconfirmation (Zamani and Poulodi 2021). Such designers' choices and actions can potentially lead to low use. Joorabchi and Mesbah (2017) emphasise that both users and developers are generally interested in addressing problems associated with the systems that hinder IS use. Therefore, it seems improbable that acceptance and usage can occur without addressing design inhibitors. Further, system design is considered an important area of interest to IS researchers (Cenfetelli 2004). This paper, therefore, focuses on design-based challenges to understand the effects of inhibitors on using in-store mobile shopping apps. To better understand inhibitors to in-store shopping apps, we utilise the theory of technology usage inhibitors to qualitatively identify design-based inhibitors in order to generate fresh insights into the designers' actions and their consequences for consumer use. The research focuses on the usage of a UK supermarket in-store mobile shopping app applying the Theory of Technology Usage Inhibitors. Utilising a topic modelling approach to identify design-based inhibitors, we identified seven design inhibitors. The study seeks to expand knowledge of technology usage inhibitors through these findings by classifying and ranking intrinsic-app and environment inhibitors that discourage use.

This paper is comprised of six sections; the second section discusses related work and literature, while the third section outlines the research method and the topic modelling approach used to elicit topics from the user reviews. The fourth section presents the results. The fifth section discusses the findings. Finally, the sixth section concludes the paper and provides an outlook on the remaining work.

Literature Review

In-store Shopping Apps

Kang et al. (2015) investigated the in-store mobile usage of mobile location-based service (LBS) apps, where they found that affective involvement influenced the intention to download and use these retail apps. In contrast, Kim (2021) found that consumers' value perception influences the intention to use LBS apps and their behavioural responses. In Aloysius et al. (2016a), authors found that computer self-efficacy, personal innovativeness, and technology anxiety were strong predictors of the adoption of mobile self-checkout apps. In another study, Johnson et al. (2021) found that relative advantage (reducing consumer confusion), triability and compatibility influence consumers usage intention of mobile self-checkout apps. While Vučkovac et al. (2017a) found that the transaction time is lower for mobile self-checkout app users during peak hours than non-users, some studies highlight the challenges of in-store mobile technologies. For example, Vučkovac et al. (2017b) found that users felt uncomfortable using mobile self-checkout apps because they feared they might be erroneously accused of theft. Aloysius et al. (2016b) reported that technology, employee, retailer, product, and customer risks emerged from customers' concerns about adopting and using mobile self-checkout systems. Most of these studies seem to focus more on what enables and drives the adoption of mobile shopping apps.

Little is offered from the users' perspective, particularly the design problems that may discourage the use of in-store shopping apps. Therefore, this study endeavours to investigate problems that may discourage the use of in-store shopping apps. This investigation is important because low usage rates mean a waste of precious capital and resources as well as missed opportunities for gaining a strategic advantage by pursuing mobile technology strategies that customers may not use. Moreover, insights regarding inhibitors can inform the approaches for designing new in-store shopping apps technologies.

Technology Acceptance and Use

To date, several studies have investigated enablers of IS use in the physical retail environment. Such enablers include e.g. effort expectancy, performance expectancy, and hedonic motivation in consumer-facing technologies (Venkatesh et al. 2012). A recent review developed a summary of enablers of self-service technology adoption such as attitude towards using technology, perceived control, self-efficacy, satisfaction, perceived usefulness, perceived ease of use, need for interaction, and perceived enjoyment (Baer et al. 2018). Similarly, Venkatesh et al. (2017) found that perceived usefulness and perceived ease of use influenced the intention to use Auto-ID enabled shopping assistance artefacts. Moreover, Beek et al. (2018) found that value contributes to the intention to use in-store shopping apps. Together, these studies indicate the tendency to focus on the drivers and enablers of IS use.

The existing theories and models used to study IS use are extensive and also seem to focus mainly on enablers and drivers. Reigning theories and models such as the technology acceptance model, diffusion of innovation, unified theory of acceptance and use, theory of planned behaviour and technology-organisation-environment framework (Rad et al. 2018) predominantly emphasise drivers and enablers of use. More recent conceptualisations of IS, i.e., effective use, also focus on drivers (Burton-Jones and Grange 2013). These models and theories have been helpful in understanding IS use. However, the models and theories are mostly framed from the perspective of drivers and enablers, i.e., positive determinants of use.

While previous research has tended to focus on positive determinants of use, there has been little investigation of negatively oriented factors that discourage or inhibit use. For example, Vučkovac et al. (2017b) theorised that the anxiety of being accused of stealing when using mobile self-checkout systems influenced use negatively. In other words, users who felt uncomfortable using mobile self-checkout apps were less likely to use them in the future. The study indicates that failure to incorporate some features (e.g. feedback noise to make users feel comfortable) inhibited use. Beduè et al. (2018) investigated both positive and negative determinants of the intention to switch to mobile self-service technologies and suggested that switching can still be difficult due to privacy risks, routine seeking or fear of complex user interfaces. Considering all of these studies, one may surmise that additional factors exist beyond the positive determinants of use that can discourage usage. This view is supported by Cenfetelli and Schwarz (2011), who theorised that such factors are separate and not a mere reverse of the positive determinants of use. Similarly, we extend this discussion by focusing on design-based inhibitors.

An investigation of design-based inhibitors is significant because Salo and Frank (2017) found that users responded negatively to unusually negative incidents that took place in-store. It is plausible that these incidents can be problematic in that they can discourage subsequent use in the future. There have been studies that have investigated negative determinants of use in other contexts. For instance, Fries et al. (2016) used the diffusion of innovation theory to explore the six hateful factors, i.e., the crucial factors hindering SMEs adoption of innovations. They flipped the diffusion of innovation theory constructs into negative determinants, thus finding that compatibility with daily work routine, perceived unbalance of risks and chances, lacking fit in individual business processes, IT know-how, complexity in infrastructure investments and amount of costs for setup led to the low rate of adoption within SMEs. However, flipping the positive determinants of use into negative determinants of use has been argued against by Cenfetelli and Schwarz (2011). The pair argued that factors that inhibit use are more than just a flip of the positive determinants of use, but rather a separate phenomenon that warrants its own investigation.

In their study, Cenfetelli and Schwarz (2011) urged researchers to ask the reverse of the research question on why individuals choose to use technology? Accordingly, researchers who asked similar questions got exciting results. For example, Apanasevic et al. (2013) investigated factors that influence the slow rate of penetration of NFC based mobile payment in Western Europe and identified that factors such as lack of network externalities, and the lack of consumer awareness about NFC services, contributed towards low rates of use of NFC mobile payment. Relatedly, Beduè et al. (2018) outline the importance of investigating negative determinants in the context of mobile self-service technologies. Although not labelled as inhibitors, together, these studies demonstrate the value of exploring the negative determinants of use, i.e., the crucial discouraging factors that contribute towards the low use of information systems.

Inhibitors are specifically essential to investigate, considering what research conveys about negative determinants and low IS usage. For example, expectation disconfirmation theory holds that disconfirmation of an expectation results in low behavioural intention towards use (Venkatesh and Goyal

2010). In other words, when users' expectations are not met, it is plausible that their use rate will be low. This argument is supported by Cho et al. (2001), who found that users' online complaints were generated from a disparity between their expectations during the pre-purchase stage and disconfirmation in the post-purchase stage. As noted earlier in this paper, the major advantage of in-store shopping apps is that users can avoid unpacking, scanning and re-packing their products at self-checkout terminals, thus saving time. Another advantage is that the app can enhance consumer's shopping experience. Given these advantages, users will expect to save time and have an overall improved shopping experience when using in-store shopping apps. A disconfirmation of these expectations may be viewed as a discouraging factor.

Meeting customer's expectations when designing systems that integrate the physical and digital aspects is challenging (Hauser et al. 2019). For example, a study that investigated the expectations of users of companion shopping apps (apps that assist with shopping, e.g., by providing information) found that most of the expectations were about the design of the app (Wulfert et al. 2019). These findings give credence to an investigation of design-based inhibitors in the context of in-store shopping apps.

The Theory of Technology Usage Inhibitors

On proposing a theory of the existence of design attributes that discourage use, Cenfetelli (2004) argued that although companies may not purposefully design information systems that include inhibitors to their use, such inhibitors exist and can explain low usage rates. This theory argues that although environmental and individual factors can contribute towards low IS usage, the system's design and function can also play a role in discouraging use (ibid.). In other words, the presence of some design attributes can solemnly discourage use. According to Cenfetelli (2004), if a system is perceived to have irritating features, a poor design or is not functioning properly, users are unlikely to adopt it. If they do, they are likely to discontinue use. The main aim of this theory is to extend the understanding of IS use beyond the bounds of acceptance, adoption and diffusion models and theories such as TAM (Davis et al. 1989) and the diffusion of innovation theory (Rogers 1995), which have predominantly focused on the positive determinants of IS use. Such extension of understanding is achieved by identifying qualitatively unique negative factors that discourage use (Cenfetelli 2004). According to the theory, decisions of system rejection and non-adoption are influenced by inhibitors and, therefore important to understanding low use rates of in-store shopping apps. The concept of usage inhibitors is relevant because it enables the discovery of key design concerns that discourage use. It is especially important to investigate these hitherto relatively neglected design concerns to collect a list of design-based inhibitors to be considered when designing in-store shopping apps. Additionally, exploring these inhibitors might enhance a mindset shift towards the development of quality shopping apps through a consideration of pertinent usage factors.

Methodology

We aim to understand "qualitatively unique" factors that discourage the use of an in-store shopping app (Cenfetelli 2004). Hence, an inductive approach seemed appropriate because the concept of design inhibitors among in-store shopping apps is not well defined. Therefore, this paper used rich online reviews to explore users' behaviours to better understand design-based inhibitors (Saunders et al. 2016). Cenfetelli (2004) also supports the use of an inductive approach to discover inhibitors. The strength of building a typology inductively from empirical data is that it enables the discovery and theorisation of new concepts (Cecez-Kecmanovic et al. 2020). We use an in-depth single case study to identify the design-based inhibitors inductively, grounded in empirical online review data (Eisenhardt 1989). An in-depth single case study is specifically appropriate in investigating new research areas (Eisenhardt 1989). Our case study uses one of the largest chains of supermarkets in the UK as a unit of analysis. Given the popularity and high profile of the supermarket, a rich body of secondary data is generated online, making the app a subject of discussion, thereby presenting an opportunity for an in-depth empirical analysis for new insights.

Data

Following Debortoli et al. (2016), a paid online scraping software was used to collect 1857 online consumer reviews from the Apple store from April 2016 to January 2021 into an excel sheet dataset. The scraping software was useful in organising the review data into the reviewers' pseudo names, date, title, and the full review. Online consumer data, such as Apple store reviews, typically contain multiple topics, such as bug

reports, user experience and feature requests (Pagano and Maalej 2013). On these platforms, users frequently review the design and usability aspects of apps (Wulfert et al. 2019). As such, app store consumer reviews are considered appropriate for this study.

Data Analysis

Online consumer reviews are unstructured and unsystematic, thus posing an analytical challenge because the data size makes manual coding time-consuming (Debortoli et al. 2016). Therefore, we use a topic modelling approach to analyse the data (Blei et al. 2003). The excel data scrabbed from a website comes with a lot of noise. Therefore, the first step in pre-processing is to subject the data to manual pruning by removing non-informational reviews such as "Great app!" and "Useless app!" before using the topic modelling algorithm (Wulfert et al. 2019). This pre-processing step also involved removing duplicate reviews, developers' feedback comments, and reviews about unrelated matters. This step reduced the number of reviews from 1857 to 1800. We then used python to clean the data further. The pre-processing step involved using a Natural Language Toolkit library (NLTK) to lower cases, remove numbers, and stop words (including custom stop words), then lemmatise and tokenize the words. These pre-processing steps were essential to get better topic modelling results (Debortoli et al. 2016). The next step was fitting and validating a topic model using Latent Dirichlet Allocation (LDA). LDA is a generative model that allows for collections of discrete data such as text corpora (Blei et al. 2003). LDA is one of the most frequently used approaches for topic modelling in IS research (Debortoli et al. 2016). The top ten words for each topic and weights (importance) for each word were generated. A topic significance ranking was established using a weighted combination approach (AlSumait et al. 2009). Consequently, the inhibitor with more weights (greatest importance) is considered the worst inhibitor. The study reported by Jeyasudha and Usha (2021) on covid 19 hashtags used a similar algorithm to rank the most popular hashtags.

Furthermore, a few algorithms have been established by (Cao et al. 2009), (Griffiths and Steyvers 2004), (Deveaud et al. 2014), (Arun 2010) and (Blei et al. 2003) to select the best number of topics. However, the number of topics discovered with these metrics often does not conform to human judgments (Bian et al. 2017). Thus, additional human interpretation of the generated topics to determine the right number of topics is still required, especially when the goal of the study is seeking a topic model that can be interpreted (Debortoli et al. 2016). Therefore, in this paper, we used a perplexity metric (Blei et al. 2003) and human interpretation of the topics to determine the best number. We ran ten LDA models by setting the topic number from 10 to 100 with an interval of 10 and calculated the corresponding perplexity metrics. Considering that human interpretability is essential to discover design inhibitors, we chose 50 topics even though the perplexity dropped to a lower level because 50 topics had better interpretability. Debortoli et al. (2016) also supported a few topics, e.g., up to 50 topics, when the goal of the study is to interpret the topic model.

To fine-tune the topic model, we experimented with different pre-processing options to evaluate the resulting model's interpretability. Then, the word intrusion technique was used to check topic coherence. A word intrusion technique is the use of humans to assess if they can single out word intruders that do not belong with other sets of words in a topic (Chang et al. 2009). Four topics were randomly selected to perform this task, as shown in figure 1.

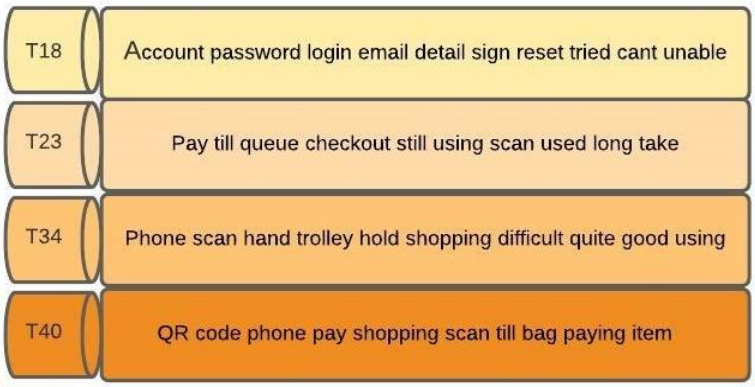

Figure 1: Word Intrusion

As shown in figure 1, Topics 18, 23, and 40 do not appear to have intruder words. On the other hand, the word *good* in topic 34 appears like an intruder. Overall, the topics were found to be coherent.

Since the LDA algorithm does not include labelling topics, the researcher must interpret the topics. Therefore, to discover the meaning of the topics, we employed a qualitative approach for coding the topics. We analysed the topics according to three analytical levels to infer the design-based inhibitors of in-store shopping apps, as shown in Table 1, by progressing from topics to themes and ultimately to inhibitors.

First-order coding: topics	**Second-order coding: themes**	**Aggregate code: inhibitors**
30 Card loyalty use phone need scan register don't detail one 24 Error register tried message cannot try checkout staff problem get	Presumptuous requirements Overbearing registration process	Difficulty registering
25 Using use Wi-Fi data shop screen mobile kept good unfortunately 29 Signal Wi-Fi 4G phone even issue doesn't good would work 49 Wi-Fi something trying free good got connected phone item like 21 Idea connect connection available Wi-Fi use great get user 26 Time great work shop scanning double day don't check mean T22 Connection internet shop item due twice saying check back say	Driving users to use mobile data Poor Wi-Fi Users prefer free quality Wi-Fi Overcharging users (double/twice due to poor connection)	Overcharging
45 Shop crash big item every check often scanned bag crashed 37 Shop scanned checkout way tried scan back item crashed shopping 19 Multiple time item scan froze get went till 48 Pack go scan bag end item get screen fails need 46 Work working fine worked start stopped week doesn't fix good 18 Account password login email detail sign reset tried cant unable 39 Log cant useless wont even let login used back since 6 Poor email receipt password reset would tried given totally 42 Work doesn't time well get experience better login every however	App malfunction Unstable performance Draining login process	Malfunctioning
20 Service let wouldn't always use poor rubbish customer many going 9 Log update problem still wont get support really go never 5 Staff member use item price checkout time didn't scan problem	Poor customer service Nonresponsive customer support Incompetent staff	Poor Support
34 Phone scan hand trolley hold shopping difficult quite good using	Demanding to operate	Fiddliness

50 Scanner one button scan much scanning like thing almost would 47 Item scan shopping list one barcode would annoying next screen 38 Button screen right help left great make hand move please	Interface incompatible with left-hand users	
33 Time waste shop last re-scan complete scanned work everything first 2 Check time staff random covid customer wait checked shopping	Blocking time saving benefits Blocking Covid safety benefits	Obstructing benefits
23 Pay till queue checkout still using scan used long take 32 Time first couple used thing till go everything got end 44 Self checkout pay scan better payment queue would competitor machine T40 QR code phone pay shopping scan till bag paying item 14 Take longer bad part much time really scan using self 7 Would list could shopping add item good better scanning great 3 Don't pay want use apple need time like good actually	Feature redundancy (paying at the till) More time consuming Preference for better features (shopping list) Preference for better features (pay on the app)	Redundancy

Table 1: Data Coding Structure

Results

Seven inhibitors emerged from the topic modelling analyses defining design-based inhibitors that hinder the use of in-store shopping apps as follows: 1) redundancy, 2) malfunctioning, 3) overcharging, 4) fiddliness, 5) poor support, 6) difficulty registering and 7) obstructing benefits. Based on the analyses of 50 topics, 14 topics were associated with redundancy, 10 with malfunctioning, 7 with overcharging, 4 with fiddliness, 3 with poor support, 2 with difficulty registering, and 3 with obstructing benefits. Our ranking results show that redundancy is the worst inhibitor followed by malfunctioning, overcharging, fiddliness, poor support, difficulty registering, and obstructing benefits. In the following sub-sections, we present results to demonstrate how inhibitors emerged from the raw data.

Inhibitor#1: Redundancy

Our results show that topics identified under redundancy carry more weight, representing the most important and, therefore, the 'worst' inhibitor. A major flaw that users noticed was that they still had to queue when using the in-store shopping app. This problem suggests that the design is redundant. Redundancy in this context means that the app is not solving the main problem of queuing. Users questioned how they could save time if they ended up in queues along with non-users. In the user's view, the design does not fulfil its time-saving potential but instead exacerbates the problem. Table 2 shows samples of reviews that support the apps' redundancy.

Topic	**Most Probable Words**	**Sample Reviews**
T23	Pay till queue checkout still using scan used long take	*"Staff informed me that I would need to pay at the self-serve checkout each time even when using the app. How does this save you from queuing? Your description says "Pay in a flash ..". Seems a bit pointless in my opinion."*

		"If I have to queue with everyone else to checkout then the benefits are minimal." *"I still had to wait in the self-service checkout queue as to scan the QR code and pay there. Why do I still have to queue? It's (the app) not fulfilling its time saving potential for the customer."* *"I then have to go to the self-checkouts to scan the QR code and pay. No big deal? It is if there is a checkout queue and i then have to queue up and wait to pay, therefore paying AFTER people who are NOT using the "quicker" system. I want to "scan and bag" and then to be able to pay immediately when I've finished."* *"I still had to wait for the queue to get to the QR code at a self-checkout till so it defeated the point of a speedy shop."* *"At the self-scan points where you pay you still have to wait for other people, so the overall shopping experience wasn't any quicker."*

Table 2: Reviews Indicating the App is Redundant

Users seem to prefer to complete their shopping experience on the app and eliminate queues as intended. This preference was evident in topic 3 where users suggested the app would be helpful if it had a payment feature built within it. The statement below represents many of the user's views regarding payment features:

> *"There are often queues for these machines even at times when you'd expect it to be quiet. Whilst you can finish your shop and pay at any of the self-scan machines it would be a really nice feature if you could just pay using Apple Pay directly within the app and not have to use a terminal at all." Topic 3.*

The above review indicates that users would find the in-store mobile shopping app more beneficial if a paying function was designed within the app.

Inhibitor#2: Malfunctioning

Malfunctioning emerged as the second-worst design-based inhibitor to use. Most users narrated episodes of the app crashing, freezing, and some buttons disappearing from the screen during shopping and checkout. The users also indicated that the app was unstable, i.e., working one minute and crashing or freezing the next minute. Consequently, users were left frustrated and annoyed. Table 3 shows examples of reviews that emphasise the apps' functionality problems.

Topic	**Most Probable Words**	**Sample Reviews**
T45	Shop crash big item every check often scanned bag crashed	*"On two of the last big shops, the app crashed, and I had to unload all the bags and go through a checkout."* *"DO NOT USE FOR BIG SHOPS. I'd carefully packed an enormous family shop into bags in the trolley only to have the self-service till crash and loose the transaction during the QR scan stage - the whole lot was lost from the app as well."* *"The app often crashes and can't be reloaded. Therefore, you have to take your packed shopping to the till, unpack, manually scan and re-pack. Complete pain."* *"The app can't process the item then crashes and deletes everything you've scanned. Cue unpacking, re-scanning and re-packing of everything once again."*

T19	Excellent multiple time item scan froze get went good till	*"It froze over and over,… I ended up having to unpack my large weekly shop at the till for it to be scanned in the normal way. Worst of both worlds and very disappointing. I'll be back at Aldi next week."* *"On a big shop it froze halfway round the store. Managed to get going but froze at the till so had to empty all the shopping and scan normally. Wasted a lot of time so probably won't use again."* *"It continually froze, blanked the screen."* *"The screen started to freeze up, I had to unpack everything and go through the normal checkout - after spending way longer selecting my stuff than usual. It's useless. I'm traumatised."*
T47	Item scan shopping list one barcode would annoying next screen	*"One annoying bug I've encountered is that sometimes the button for the list gets hidden and doesn't reappear - very annoying when you've just started shopping and have a long list."*

Table 3: Reviews Indicating the App Malfunctions

The above topics illustrate that users are forced to unpack their entire shopping, re-scan, and re-pack when the app freezes or crashes. This activity undermines time-saving benefits. Another glitch is that users found it challenging to log in to the app. Most users stated that the app would not accept their login details, and they could not reset their passwords either. A surprising finding was that the app required users to log in several times during shopping. This constant need to log in seems to spoil users' shopping experience. Table 4 shows samples of reviews that suggest login problems.

Topic	Most Probable Words	Sample Review
T18	Account password login email detail sign reset tried cant unable	*"Unable to sign in, the app rejects my credentials. Ask to reset password and told me an email has been sent. No email arrives."* *"It's not remembering my details, and when I put my email address and password in, it just crashes."*
T39	Log cant useless wont even let login used back since	*"I can't even login, it keeps coming up with an error. I tried re-registering and deleting the app and re-installing, same thing."*
T42	Work doesn't time well get experience better login every however	*"Keeps wiping my login details which require re-entry every time I go. Which is not the point of the phone app. It is hardly a state secret as to what I'm buying."*

Table 4: Reviews Indicating Login Problems

As shown above, in topic 42, consumers were annoyed by the multiple login requests. These constant requests, coupled with the struggle to log in, seem to ruin the shopping experience. Consequently, users give up when they cannot log in. These findings suggest that requiring users to frequently log in can discourage use. These results are significant because when the app is malfunctioning, it undermines the benefits of a frictionless shopping experience.

Inhibitor# 3: Overcharging

Users also cited overcharging as a significant problem associated with the design of the app. Many users complained that they had to use their mobile data because the Wi-Fi connection was poor. The issue of poor Wi-Fi leads to customers using their mobile data, thus adding to their shopping costs. Table 5 shows examples of reviews that indicate Wi-Fi connection issues.

Topic	Most Probable Words	Sample Review
T29	Signal Wi-Fi 4G phone even issue doesn't good would work	*"Good idea- flawed in practice, store have no phone signal, and no Wi-Fi, that it renders the app pointless. On my last shop (with intermittent connection), it allowed me to scan items with apparent success - only to discover when I got to the tills that 50% of my items hadn't been added to my 'basket'. "* *"It requires a constant connection to the internet- not helpful if signal drops in the supermarket and the Wi-Fi disconnects every time the phone is put down."* *"I got 5 items onto my list then my signal disappeared. I had to keep walking towards the entrance to get signal again. I tried again with my husband's phone different phone carrier, and again got a few items loaded and into my basket but had to abandon (it) again as (the) phone signal lost again."*
T25	Using use Wi-Fi data shop screen mobile kept good unfortunately	*"Costs to shop. I didn't know this app uses my data until I switched the data off as I was running low. Why do I have to pay to shop?"*

Table 5: Reviews Indicating Overcharging Problems

The other problem regarding overcharging is that users complained that the app scans products on sale at full price. In some instances, using the app to scan some items resulted in duplicate charges. Many users realised they were overcharged when they reached the till or when they arrived at home, requiring a return visit to claim a refund, thus causing more inconvenience. What is surprising is that the supermarket seems to be aware that the app overcharges users but chooses to do nothing about it. The statement below sums up the problem;

> *"Don't use. The supermarket admits it overcharges. My basket was subject to a re-scan. The app said £126, but the re-scan through the checkout was £117. (The) customer service team say this is a glitch in the app where you can scan something once, but if the Wi-Fi ain't great, it can add it twice or even three times." Topic 26.*

As highlighted above, most users were generally displeased by the overcharging problem. These findings suggest that overcharging users is highly likely to set them back from using the app.

Inhibitor#4: Fiddliness

Regarding fiddliness, users found that the main issues making the app awkward and cumbersome to use are i) juggling the phone, products, bag, shopping list and ii) manually switching between the digital shopping list, the loyalty scheme app, and the scanning page simultaneously. Regarding juggling many things, users found this to be very cumbersome and stressful. On the other hand, the lack of integration of the shopping apps and the loyalty scheme app resulted in users switching between them manually. Table 6 shows examples of reviews that demonstrate the apps' fiddliness.

Topic	Most Probable Words	Sample Reviews
T34	Phone scan hand trolley hold shopping difficult quite good using	*"Too difficult to use efficiently. Trying to juggle your phone, list, item to be scanned, keeping 2m apart, packing bags."* *"It is awkward to use (you need three hands)"* *"Just wish I had another pair of hands to hold phone, scan items and bag !!!."* *"Painfully slow and very stressful - trying to hold shopping list, phone and item with barcode showing wasn't easy; didn't even have the phone the right way to begin with."*

		"I did find it a nuisance having to keep juggling my phone and the shopping list and pen." *"It is a bit fiddly to be constantly switching apps to see what I've saved on the loyalty scheme app."*
T50	Scanner one button scan much scanning like thing almost would	"*Only gripe is that i have to press the scanner button to return to the scanner after I put an item in the basket, not easy when you're trying to use one hand!"* *"I find it awkward to use my phone in one hand, tapping the scan button with my thumb, hang onto my shopping list which I've now reverted to paper to avoid switching in and out of the app, and manipulate items under the camera with my other hand, especially difficult when the barcode location isn't obvious or the item is heavy or squishy."*
T47	Item scan shopping list one barcode would annoying next screen	*"One thing I found a bit awkward was having the shopping list and scanning functionality on separate pages"* *"It's fiddly to use. It's such a pain to have to switch between screens when you are also carrying/pulling a shopping basket. Again, a complete pain to have to keep unlocking your phone when you're hands are full of shopping."*
T38	Button screen right help left great make hand move please	*"The scan button is also on the right of the screen which is incredibly tricky to use with your left hand. Hence causing my phone to slip out of my hand. Smashing front and back screens £400 repair because of this poor design."* *"However, as I am left-handed, I do find it rather awkward due to the scanning button being in the bottom right hand corner, which makes it very difficult to use the phone in one hand."*

Table 6: Reviews Indicating the App's Fiddliness

The above reviews support the idea that the design of the app leads to fiddliness in use. These are significant findings because they indicate that the apps' fiddliness hampers a frictionless shopping experience contrary to the expected benefits of the app.

Inhibitor#5: Poor Support

This design-based inhibitor is about the lack of technical support regarding issues raised by users. Most users highlighted that the in-store support staff is less helpful in technical issues associated with the app. This finding suggests that the in-store team lack the requisite skills to assist users. Table 7 shows sample reviews that demonstrate poor support.

Topic	**Most Probable Words**	**Sample Reviews**
T20	Service let wouldn't always use poor rubbish customer many going	*"Required to ask for help too many times, and some staff proved to be no more clued up than me."* *"I went to the customer services desk at the store today to see what I was doing wrong, and the lady said that she was also having problems with it herself. She said she hadn't received any response from the help desk when she contacted them online."* *"I've spoken to customer service/tech twice by phone to no avail, they either suggest I speak to someone in-store or say the app isn't compatible with iPhone. In-store customer services have no idea what to do."* *"No one even bothers to help solve the problem. Dreadful service. Staff also have a low opinion of them (the app) and don't know how to resolve issues."*

Table 7: Reviews Indicating Poor Support

These findings suggest that the employees need to be adequately trained (and invested) in resolving technical issues about the app to be in a position to help users.

Sin#6: Difficulty Registering

Regarding difficulty registering, the app is designed with some pre-requisite requirements for registration. First, results show that customers must have a loyalty card to register. Second, couples can only use one loyalty card. These conditions make the registration process quite difficult. Another problem with difficulty registering identified by users was the challenges with the registration process. Users reported error messages when setting up their accounts. Table 8 shows examples of reviews indicating the difficulty when registering.

Topic	Most Probable Words	Sample Review
T30	Card loyalty use phone need scan register don't detail one	*"Unable to sign up without a loyalty card."* *"Pain for couples. My husband downloaded it only to be told our loyalty card details have already been used (by me), and he can't link up to our loyalty card."* *"My husband downloaded this app and said it was great, so I downloaded it too. We share a loyalty account, and both have a card each, but using this app, our loyalty account can only be used on my husband's account as he registered it first. When I tried to enter my card details, it wouldn't let me because they were registered to his account."*
T24	Error register tried message cannot try checkout staff problem get	*"After weeks of trying to register, I called the customer helpline and was told that the app isn't working and the only way to register is in-store. Having tried to register in-store, I was greeted with long queues of people clearly having problems registering. I have input all the information, and then it just hangs with a registering message. Sadly, despite waiting for 10 minutes, nothing happens, and I am still not registered."* *"Not very well designed, not impressed so far - just signing up is unnecessarily difficult as the app crashes when you enter a password, no hint why it crashes."* *"I have downloaded the app twice but cannot register. It just says unknown error occurred try later. I've tried lots of times, but it just won't let me register."* *"I can't even register. I have the app, and I've been trying - on and off - to register so i can use it for the last month without success. I always get an unknown error message."*

Table 8: Reviews Indicating the Difficulty in Registering

Topic 24 shows the frustration consumers encountered when trying to register. Some of the consumers shared that they ultimately deleted the app because they failed to register. These findings indicate that putting users through an unnecessarily arduous registration process can deter them from using the app.

Sin#7: Obstructing Benefits

Obstructing benefits means impeding or blocking the advantages users can gain when using the app. Users were informed that using the app during the Covid-19 pandemic would reduce contact with employees. However, the app is designed to choose customers for a physical security check randomly. Users viewed this feature as obstructive and felt it undermined the benefits they were seeking from the app. For example, during the random security check, staff touch users' shopping bags and products as they re-scan them,

undermining the benefits associated with reduced physical contact with staff. Table 9 shows samples of reviews that suggest the random check feature is obstructive.

Topic	Most probable words	Sample Reviews
T2	Check time staff random covid-19 customer wait checked shopping	*"The app randomly chooses you for extra checking, the staff member will then handle your shopping in your bag with their COVID fingers. Don't recommend customers (to) use it for Covid safety when you are going to manhandle all contents of my bag …Don't use it, it's not useful unless you like to be accused of shoplifting."* *"Pointless. What is the point in scanning and packing all your items to prevent having interaction with staff if every time used the staff end up emptying half of the shopping to re-scan?."* *"We are diligent with our Covid precautions and chose to go with the app which limits the contact with staff and handling of products. Stopped at the checkout for a "random" basket check AGAIN!. Shopping handled by staff and close contact with staff (who were not wearing a mask) eliminates the upside of the concept. I will leave the basket at the store and the supermarket will not see me again."*
T15	Option item scan shopping use distancing go little make basket	*"No point using the app if every time I use it recently goods are re-scanned (no chance of social distancing whilst you retrieve stuff from your bag whilst the staff member works out what to do). Will go back to the till as at least I expect to scan things there and can keep a distance from the person."*
T33	Time waste shop last re-scan complete scanned work everything first	*"Got to the checkout to get message that member of staff will be with me soon. Staff had to re-scan everything, so now double scanned once by me then by them. They walked away saying to scan code again and just checkout but get problem again! Exasperating. Ended up going to self-checkouts so scanned 3 times in all. What a waste of time."* *"When you are selected for a random check, first up, you've got to wait for the checker to get a scanner, then unpack everything, re-scan everything and re-pack. Pretty humiliating and a waste of any time you saved using the app. It's quicker to just go to a till."*

Table 9: Reviews Indicating that the Security Feature Obstracts Intended Benefits

The above reviews indicate that the random security feature erodes the anticipated time-saving and reduced contact benefits. Therefore, the random security feature obstructs users from effectively using the app.

Discussion

From the analyses of the results, redundancy was ranked as the worst design-based inhibitor. The main problem causing redundancy is the lack of critical features that can reduce checkout queues, such as an in-built payment function. This design-based limitation inhibits use. This finding aligns with Borges et al. (2015), who emphasise that queuing is one of the most uncomfortable activities in supermarkets. Atkins and Kim (2012) also highlight that consumers generally seek to minimise their in-store time when using smart shopping gadgets. Therefore, our finding emphasises that the in-store shopping app lacks notable features, thus rendering it redundant to users. In our analyses, redundancy was followed by the continuous malfunctioning of the app; that is, even features which users attempted to use were not reliable. This design-based inhibitor interrupts consumers from a frictionless shopping experience, thus annoying customers and reducing the chances of re-use. Johnson et al. (2021) highlighted that in-store mobile shopping apps are essential to improving customers' experience. Overcharging was the third-ranked design-based inhibitor that minimises use. Our analysis of the results demonstrated that using the app increases customer's expenditure, thus discouraging use. This finding is in line with Atkins and Kim (2012), who found that consumers seek to minimise costs when using smart shopping technologies.

Based on our ranking, fiddliness was the fourth-worst design-based inhibitor. Our study shows that the lack of integration of the in-store shopping app with other shopping apps, such as the loyalty scheme app makes it awkward to use. Additionally, the task of scanning and bagging items is cumbersome. In a similar study (Aloysius et al. 2016a), the researchers highlighted the awkwardness of handling and scanning barcodes during shopping, which seems to require more than two hands. Therefore, we found that the fiddliness of the app discourages use. Similarly, poor support was identified as the fifth-worst inhibitor. This inhibitor implies that the staff is not adequately trained to resolve user's issues. Having competent in-store staff and a technical team is essential to offer users support whenever they need it. A study by Retana et al. (2018) showed that users who received full support were more likely to use the cloud system than others. Therefore, our study adds to this discussion by indicating that users who receive poor app support are less likely to use the in-store shopping app. Further, our analyses of the results indicate difficulty registering as the sixth-worst design-based inhibitor. Although users' registration has been recognised as an important pre-requisite to gaining access to a system (Li 2013), our findings suggest that having a difficult and cumbersome registration process significantly discourages use.

Based on our ranking, obstructing benefits was ranked the last design-based inhibitor. We found that a security feature designed within the app to randomly select users for a physical security check blocks the benefits sought by users. A similar study (Vučkovac et al. 2017b), found that mobile self-checkout app users have anxiety about using them due to potential false theft accusations. Our study extends this discussion by demonstrating how physical security checks discourage in-store shopping app use.

Our theoretical discussion of inhibitors highlights a disconnect between the app designers and in-store shopping app users, rooted in design problems that inhibit in-store shopping app use. The design-based inhibitors can be classified into intrinsic app inhibitors (i.e. redundancy, malfunctioning, fiddliness, difficulty registering and obstructing benefits) and environmental inhibitors (i.e., overcharging and poor support). Therefore, our study reveals that the usage inhibitors of in-store applications can be driven by intrinsic app features and the environmental factors that uniquely affect user behaviour within the store. Furthermore, our study indicates that intrinsic app inhibitors, such as redundancy and malfunctioning, are the worst and most important to consider when designing in-store mobile shopping apps.

Theoretical Contributions

Our study expands the theory of technology usage inhibitors (Cenfetelli 2004) in the context of in-store shopping apps by identifying and conceptualising design-based inhibitors that discourage use. We theorised the seven design-based inhibitors associated with intrinsic app inhibitors (i.e. redundancy, malfunctioning, fiddliness, difficulty registering and obstructing benefits) and environmental based inhibitors (i.e. overcharging and poor support). The design-based inhibitors conceptualised in this study are generalisable to other in-store shopping apps and in-store environments exhibiting similar attributes to this case study.

Practical Contributions

We offer insights and recommendations to app designers and retailers on what design-based inhibitors need to be taken into consideration when designing in-store shopping apps as below:

Redundancy: The findings of this study suggest that creating a shopping experience that eliminates queues is very relevant. However, the design for such an experience should eliminate queuing altogether. For example, other retailers such as Amazon have eliminated lines by using the 'just walk out technology' where payment is automatically charged to consumer's accounts. Therefore, we recommend the addition of more features, e.g. a paying feature within the app. Creating the paying feature within the app is likely to fulfil the app's time-saving potential and, as a result, appeal more to users who want to avoid queues.

Malfunctioning: Having a frictionless shopping experience is very important for consumers. However, a malfunctioning app leaves users agitated and pessimistic about the app. There should be an effort to remove bugs that cause the app to malfunction because if the app operates smoothly, users may feel motivated to use it.

Fiddliness: In-store mobile shopping apps need to be simple and easy to use. The two major problems preventing this simplicity appear to be juggling many items and the lack of integration of functions in the

app. Therefore, we recommend that a device may be mounted on the trolley to hold the phone and make the app more comfortable to use. Additionally, we recommend integration of all the apps/pages necessary for shopping, e.g. the loyalty scheme app and shopping list page, to reduce the awkwardness of switching apps during shopping.

Overcharging: Users are uncomfortable with spending more when using the app. We recommend that the supermarket remove all costs associated with using the in-store shopping apps, e.g. mobile data costs. These costs can be addressed through the provision of free Wi-Fi for all users.

Poor support: Having competent in-store staff and a technical team is essential to offer users support whenever they need it. Therefore, we recommend training of staff to ensure users have adequate support. Similarly, efforts may be made to have a dedicated technical support team to help users with any technical issues. For example, some systems have a live chat option for users to log their problems with the technical support team. This form of reliable system support can be instrumental in keeping users interested in using the app.

Difficulty registering: Users do not seem to have the patience for difficult registration requirements. We recommend that stores need to implement straightforward registration by removing the pre-requisites registration requirements, e.g. requirement to have a loyalty scheme card. For example, applications such as Zoom and Miro make it easy for users to use their platform by simply clicking on a link.

Obstructing benefits: Shoplifting is a concern in the retail sector. However, efforts must be made to tackle trust between users and retailers appropriately, especially when trying to attract customers to commit to new technology. We recommend that supermarkets may avoid physical security checks by using non-obstructive sensors such as cameras.

Conclusion and Future Work

In-store mobile shopping apps are emerging as an important approach to improving consumers' shopping experience. This article adds knowledge to a new discussion about in-store shopping apps' design-based inhibitors. We identified the seven worst design-based inhibitors that discourage use, thus extending work supporting the technology usage inhibitors theory (Cenfetelli 2004). Unlike the dominant IS acceptance adoption and use theory, which focuses on drivers and enablers of use, we identify highly overlooked important design-based inhibitors. The paper contributes important design guidelines that can support app developers in more effectively designing in-store mobile shopping apps.

This study has a number of limitations. First, our work considered a single app used by one major supermarket chain; further research on other in-store shopping apps in different contexts might expand the validity of our findings. Second, online customer reviews have inherent limitations (see, for example, Wulfert et al 2019), although they can also offer indispensable insights. Third, the study did not use Google play reviews. Additional work is now needed to explore other online reviews such as google play reviews to extend our analysis, compare the different data sources, and thereby also mitigate the impacts and limitations highlighted above.

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