Public Feedback for Publicly Used Information Systems - Supporting Adoption of a Mobile Self-Checkout Application

Emergent Research Forum Paper

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Abstract

As the physical and digital world increasingly merge, more and more information systems are being used publicly. This paper outlines current gaps in information systems adoption and usage literature with respect to applications where usage happens in public and users can be observed. We present how a purely mobile self-checkout system can be supported with public feedback channels that are designed to make users more comfortable making purchases with the mobile artifact. We illustrate how users that felt uncomfortable yet satisfied with the self-checkout artifact were less likely to make future purchases with the mobile artifact. Furthermore, we outline a field experiment in which we aim to quantify the impact of public feedback on user satisfaction, comfortableness and future usage intention.

Keywords

Adoption, continued use, public feedback, mobile self-checkout, Bayesian inference.

Introduction

Mobile smartphones have not only become ubiquitous, but the applications they enable are increasingly merging with the physical world (OECD 2015). Information systems in the form of mobile applications increasingly entangle physical objects and are therefore now often consumed in public. Meanwhile, the growing adoption of mobile payment solutions have made purely mobile self-checkout alternatives viable. Most notably, Amazon presented its newest prototype, Amazon Go[1], which enables a checkout-less shopping experience, in December 2016. Since this solution is focused on new stores that are built from scratch, all customers are identical – users of a checkout-free retail store. Yet, in many other applications it is not feasible to separate users and non-users in a clear fashion. For such settings, public feedback is important in order to guarantee that actual users feel comfortable, without needing to fear strange looks or erroneous accusations of any form. Current self-checkout terminals, popular most notably in North America, allow for a more efficient shopping experience in existing stores (Bettelheim 2015). They have become relatively common and are often dominantly positioned within the store layout. Therefore, although self-checkout users and regular customers "coexist", self-checkout users are usually easy to identify. Thus, the risk of mistakenly accusing them of theft for example is relatively low.

[1] https://www.amazon.com/b?node=16008589011

In the previous months we have designed, implemented and evaluated a publicly used mobile self-checkout artifact that was deployed and tested at three pilot stores from a European retailer. The application allows users to scan and pay products at a store only by using their smartphone. The entire process requires no interaction with the regular Point of Sales (POS) or any other retailer-owned device. Because the system is aimed to be a solution that can be adopted by existing stores, it results in two distinct customer segments. One class of regular shoppers (which might not even be aware of the availability of a mobile self-checkout), the other mobile self-checkout users. This distinction was significantly highlighted during early testing of the application: users reported feeling uncomfortable when leaving the store after a successful payment, mostly for fear of being wrongly accused of theft by non-users. This feedback prompted the additional implementation of prominent public feedback in the system. Its purpose is to publicly signal successful transactions to not only app users, but also general store audience and personnel. Nevertheless, we find evidence that users who felt uncomfortable purchasing through the mobile application, refrained from using the app again – even if they were in general satisfied with the IS. Our current artifact is implemented according to what emerged as an optimal solution to this signaling problem during the design process. This implies we are unable to quantify the actual, isolated impact of public feedback on actual usage of the mobile self-checkout application. Thus, we outline an experiment we aim to conduct in order to further study the importance of public feedback for human computer interaction and the effective design of publicly consumed information systems.

Related Work

Among the many research areas in IS, adoption and diffusion research is regarded as one of the more mature ones (Jeyaraj et al. 2006). Recently, interest has been growing beyond just IS adoption increasingly focusing on individual continued use of information systems (Markus and de Guinea 2009). One stream within IS continuance builds on the theory of reasoned action and diffusion theory and essentially borrows from the adoption literature (Jasperson et al. 2005). Bhattacherjee (2001) on the other hand conceptualizes a model of IS continuance beyond applying the same pre-adoption variables. A special form of IS, namely Self-service technologies (SST) are defined as technological interfaces that allow customers to coproduce a service without employee interaction (Kallweit et al. 2014). Examples of such SST are self-checkout terminals (Dabholkar et al. 2003) or interactive in-store kiosks (Meuter et al. 2000). In the self-checkout context satisfaction of SST is mainly determined by functionality, enjoyment, design, assurance and convenience (Orel and Kara 2014). However, because the first trial and adoption of such solutions involves significant behavior change, it often constitutes the most prominent obstacle itself (Meuter et al. 2005).

As far back as the seminal paper on the Theory of Reasoned Action by Fishbein & Ajzen (1975), normative, exterior factors play an important role in IS research. In the TRA model, this “Subjective Norm” construct is defined as “whether important referent individuals approve or disapprove of performing the behavior”. This factor remains present throughout more recent models. Subjective norm for instance is added to the second version of Davis’ Technology Acceptance Model (Venkatesh et al. 2003). The Innovation Diffusion Theory, developed by Rogers (Rogers 1995), includes a construct referred to as “Image”. The UTAUT model by (Venkatesh et al. 2003) itself relies on social constructs as well. These social factors, though significant, apply in specific circumstances (e.g. for older workers, women) and especially during early adoption. These models provide an interesting look at user behavior and acceptance of information systems in general. However, the current research focuses specifically on SSTs. This constraint holds especially when looking at the social constructs. These are often externally imparted upon the user, while in the case of the mobile self-checkout application, an internal anxiety, related to the appearance of theft, is theorized. Further, Kulviwat et al. (2009) are among the first to distinguish between publicly and privately consumed IS. They find evidence that adoption decisions with respect to technological innovations are more susceptible to social influence when consumption of the product is visible to others, i.e. public. A special mention should be made with regards to Social Cognitive Theory (SCT), which includes a construct of particular interest to the current research, titled “Anxiety”. Their definition of anxiety shows a striking resemblance to the behavior observed during the usage of the proposed mobile self-checkout application. However, it does not take into account any interaction with social norms and further fails to account for the public or private characteristics of an IS. Aloysius et al. (2013) provide a topology of risks associated with mobile technologies in retail stores, most notably mobile POS.

Interestingly they identify what they call "erroneous customer accusation" as a risk with respect to the retailer perspective, yet miss to point out the same type of risk from an actual customer's perspective. This finding provides further vindication for our current research: so far, no models have taken into account the feeling of anxiety or alternatively discomfort, both internal and related to the perception of other customers and its impact on future usage.

Mobile Self-Checkout Implementation

We have designed, implemented and evaluated a mobile self-checkout app that allows users to buy products in a fast-paced convenience retail environment without using the regular POS. The mobile app was tested during a 7-month pilot in three stores. We proactively recruited customers during the first three months. In the subsequent four months, their purchase and usage behaviour was analyzed. We have obtained evidence that a significant share of current customers regularly abort purchases because of excessive waiting times (Vuckovac et al. 2017). Based on this information and on findings from SST literature, which highlight the importance of convenience and time saving advantages of self-checkout systems (Anitsal and Flint 2006), we postulate that the app needs to minimize transaction times. Consequentially, we can show that people using the mobile self-checkout are significantly faster than regular shoppers during peak times (Vuckovac et al. 2017).

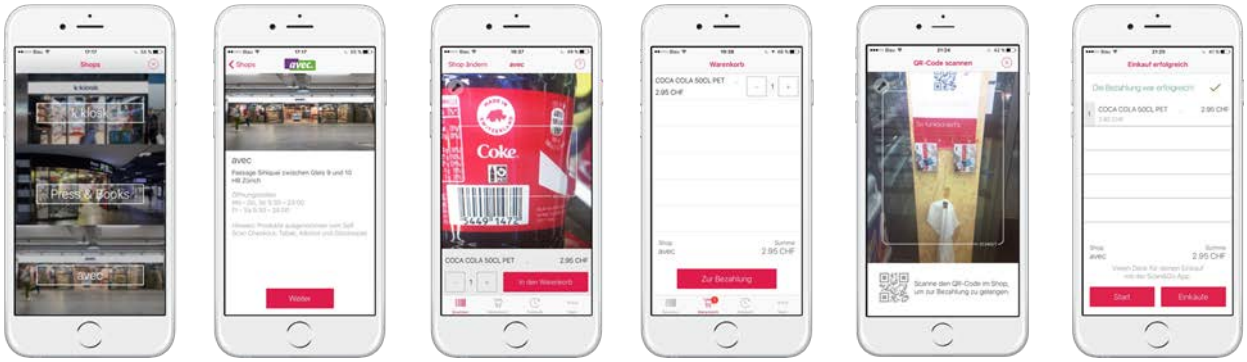

Figure 1. Overview of app usage flow (from left): 1) Store selection, 2) detailed store information and check-in, 3) scanning and product selection, 4) basket overview, 5) QR-code scanning and payment confirmation view, 6) transaction confirmation and digital receipt

During the development process we have found that people were reluctant to leave the store even after successfully paying and receiving confirmation in form of a digital receipt on their mobile phone. To counter this, we have decided to install an additional, in-store screen which provides public feedback after a successful payment. When a payment is approved, the screen turns green and plays a cash register-like sound. In total we have recruited 293 eligible and registered users through flyer advertising in our pilot stores, social network marketing and email. Of these, we record 92 paying users of which 62% have made repeated purchases with the app. Of all paying users, 25% have made 6 or more transactions. The top three customers have 63, 57 and 42 total transactions respectively. These statistics exclude any users involved in the development of the app.

Preliminary Results

In order to assess how satisfied app users are after using the mobile self-checkout app, a post-purchase survey was included, consisting of four questions and a free form feedback space. This survey is presented to users after a first, second and fifth purchase. We have obtained 59 responses in total. 28 respondents state to be very satisfied with the app, 29 respondents state to be satisfied (mean 4.4, st. dev. 0.7). Furthermore, we ask users how comfortable they felt using the app, whether scanning the QR-code in front of the screen helped them not to feel like stealing, and whether the additional public feedback provided additional confirmation and security. Responses were collected on a 5-point Likert scale. We find that the majority of users felt comfortable using the app (mean 4.4, st. dev. 0.9) – but less so than they are satisfied with the mobile application. In total six respondents were neutral about this statement,

while two disagreed to feeling comfortable using the app. In accordance with our hypothesis, both of these users have never again used the app for a second or third transaction. However, interestingly, at least one of these two users stated to be satisfied with the app. Furthermore, although the other respondent stated to be less satisfied with the app, he gives interesting insights through the free form feedback box. The customer states:

> *"It still feels like stealing. I'm especially afraid of the looks of other customers that do not know the system."*

In order to analyze the impact of how comfortable users felt after a purchase on the probability θ to reuse the mobile self-checkout for another purchase we follow a Bayesian approach to model the distribution of θ. Bayesian inference allows reallocating and quantifying both probabilities and uncertainties underlying these parameters. Further, Bayesian inference can perform well even with only little data (Kruschke n.d.). We therefore model the probability θ of using the app again depending on the degree to which users felt comfortable after an initial purchase. We use a mildly informed conjugate prior that is Beta distributed with alpha = 3 and beta = 2 as these parameters approximate the base probability of making a second purchase from our total sample (62%). Yet, the resulting prior is widely enough distributed to incorporate only little information and not bias our inference. We form two groups, one consisting of all users that were neutral, somewhat agreed or agreed to feeling comfortable while using the app and the group of users that explicitly stated to (somewhat) disagree and therefore did not feel comfortable in their first or second purchase. Out of all users two people felt not comfortable using the app. Of these none used the app for another time. 39 respondents were part of the first group of which 33 purchased at least one more time with the app. Figure 2 illustrates the resulting distribution and uncertainty related to the probability of purchasing again through the app depending on the degree to which respondents were comfortable. Because only 2 people were not comfortable, the distribution of this subsample is much more widely distributed and centered around 1/3 while respondents from the other group are expected to be on average 82% likely to make another purchase.

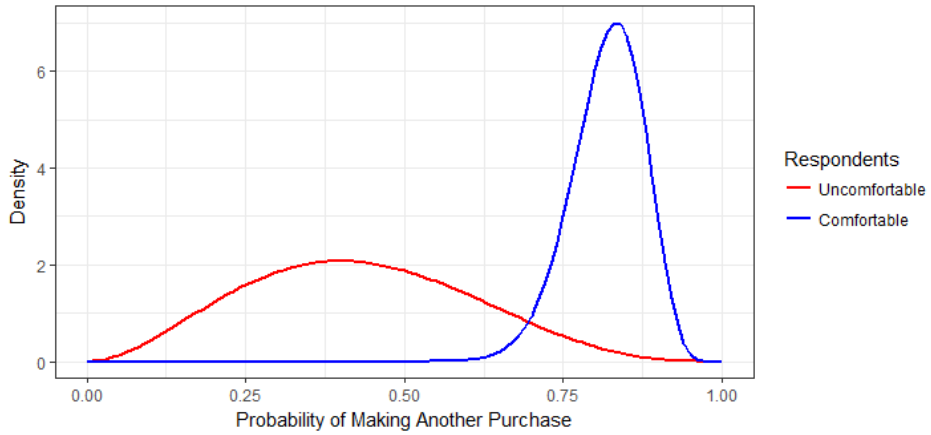

Figure 2. Probability of making another purchase given post-purchase comfortableness

Planned experiment

We are planning a field experiment comprised of 40 subjects at one of the current pilot stores following a within-subject experiment design. Thus, each individual will go through two run-throughs: one system will provide public feedback, the other run-through will not. The sequence of feedback/no feedback will be randomized between subjects. Each run-through of the app will be succeeded by the filling out of a questionnaire by the test subject. The questions, which make use of a seven-point Likert-scale, are based on findings from related literature, and are designed to provide insights on the intention to use the application (Dabholkar et al. 2003). Additionally, some general, open-ended questions are included to gather any additional data, including a question about the user's preference for any of the two versions.

Conclusion and Next Steps

Early on in our pilot we realized that public information systems, such as our mobile self-checkout artifact, require additional public feedback channels. This allows signaling successful purchases to everyone, thus distinguishing between proper self-checkout users and potential shoplifters. We hypothesize that correct signaling is important for first-time users to feel comfortable and thus supports adoption. We were able to show that users who initially felt uncomfortable using our mobile self-checkout app where much less likely to re-use the app. However, we cannot isolate and quantify the impact of public feedback on the degree of comfortableness, and the direct impact of this on future use. Thus, we outline a field experiment in order to further evaluate the impact of public feedback on publicly used IS.

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