

Privacy concern in mobile payment: A diary study on users' perception of information disclosure

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Abstract. Providing transactions with a mobile device in various use contexts, mobile payment transactions have prompted privacy concerns. However, there is still little knowledge about how users' perceptions match with the actual information disclosure in different payment scenarios in China. This study investigated users' perceived information disclosure in different use contexts of mobile payment transactions using a diary method. The results revealed that participants had serious misperception of information disclosure in the offline transactions. Findings from this study provide directions to reduce the misconception about perceived information disclosure for better adoption of mobile payment services.

Keywords: Perceived Information Disclosure · the Actual Information Disclosure · Mobile Payment · Quantitative Diary Study

1 Introduction

Mobile payments, which allow convenient and effective commerce transactions in various contexts, have raised increasing privacy concerns. In 2018, China consumers association reported that mobile applications had excessively collected users' personal information, including phone numbers, names, portraits, address lists, location data, identities, bank accounts and others [1]. Compared to other m-services, mobile payment services involve more sensitive information, such as identities, payment accounts, consumption information and asset information, and research has revealed that privacy concerns was a factor affecting mobile payment adoption in recent years [2], [3]. Despite both academic and public concerns about privacy, users' privacy awareness in mobile payment services is unclear yet. Previous research has focused on user intention to information disclosure and actual disclosure behaviors [4], [5], but very few studies have been done to understand users' awareness of information disclosure in mobile payment services.

On the other hand, context is an important factor for privacy concerns and privacy awareness [6], since mobile services can be accessed in anywhere anytime. Mobile payment services allow transactions in both offline and online scenarios, and personal data could be collected through different ways. Previous research has investigated the influence of privacy risks on online services [7], while the offline services could involve more privacy risks because of the variety of use contexts.

This paper aims to investigate users' perceived information disclosure in different payment contexts by answering these research questions: Does users' perceived information disclosure match with the actual disclosure? How does the misperception of information disclosure vary from the payment contexts? To address these questions, the quantitative diary study collected users' perception of information disclosure in real life and get insight into the influence of payment contexts to users' misperception of information disclosure. This paper contributes the insights of users' perceived information disclosure in different payment contexts and investigates the gap between perceived information disclosure and actual information disclosure in mobile payment services. The findings can contribute knowledge for privacy risk education and context awareness tool design, which help users with decision-making in information disclosure.

2 Method

In order to investigate users' perceived information disclosure across different payment contexts, an online quantitative diary study was conducted. With quantitative diary method, participants could

record the payment events and their perception with a pre-coded questionnaire [8]. Participants were required to record the types of information which perceived as being disclosed and the payment context in a pre-coded questionnaire. To be specific, ten types of information involved in mobile payment services were determined in this study, namely payment accounts, passwords, identities, phone numbers, address lists, social network accounts, consumption information, asset information, location data and cookies. The payment contexts were generated based on current popular payment methods in China [9], [10]. They are QR code pay, QuickPay, M-payment platform pay and In-app pay.

Participants were recruited through the social media. Each participant would firstly report their demographic information and evaluated the importance of each type of information, and then recorded payments event during 5 to 15 days. Each participant was required to report at least 10 payment events during their recoding period. Gift money was offered to compensate participants.

2.1 The Information Disclosure in Reality

The privacy policy of mobile payment platforms such as Alipay and WeChat Pay [11], [12], were investigated to allow details of information collected by the third parties in mobile payment transactions. According to the policy, only current consumption information is known by the third party when transactions are settled in offline payment scenarios (QR code pay and QuickPay), while the information disclosure in online payment scenarios (M-payment platform pay and In-app pay) is more complicated and context-based. This is because users might give away their information when they do online shopping in mobile phones.

Table 1. The actual disclosure of information in different payment contexts.

Payment context	con-	Types of information									
		Payment account	Pass-word	Iden tity	Phone num-ber	Ad-dress list	Social network account	Con-sump-tion infor-mation	Asset infor-mation	Loca-tion data	Cook ie
QR code pay (Of-fline)		N	N	N	N	N	N	Y	N	N	N
QuickPay (Of-fline)		N	N	N	N	N	N	Y	N	N	N
M-payment plat-form pay (Online)		U	N	U	U	U	U	U	U	U	U
In-app (Online)	pay	N	N	U	U	U	U	U	U	U	U

*Y: the information is disclosed; N: the information is not disclosed; U: the information disclosure is unclear. Whether the information is disclosed or not depends on the situation.

3 Result

Descriptive statistics analysis was applied to investigate the importance of information in mobile payment services. Then, we calculated and compared the proportion of misperception in disclosure of each type of information in different payment contexts.

3.1 Participants and Payment events

There are 67 participants with 1094 payment events used for this paper. Twenty-seven of them were male and forty of them were female participants. The majority of participants were aged from 18 to 30 (82.1%), part of them were aged from 31 to 40 (11.9%) and 6% of them were above 40 years old.

Users also evaluated the importance of each type of information with 5 point-Likert scale. It revealed that users were concerned about all types of information, since all of information were evaluated above 4 points of the mean of importance. However, it was obvious that users considered that password, identity and asset information were the most important (the means were above 4.5). Social network account, consume information and location data were regarded as less important information (the mean was below 4.1).

3.2 Comparison of Perceived Information Disclosure and Actual Disclosure

Figure 1 shows the proportion of misperception and correct recognition of information disclosure in four payment contexts. According to the Figure 1, users had the greatest misperception of information disclosure in payment accounts and consumption information in the offline payment contexts of QR code pay. Users mistakenly believed that payment accounts were disclosed in around 51.9% of payment events, and mistakenly thought the current consumption information was not disclosed in 53.2% of payment events in QR code pay. Users also had high proportion of misperception in location data disclosure in QR code pay, with 33.1% of events inconsistent with reality. Users correctly recognized that asset information and address list were not disclosed in most of the payment events (more than 90%) in QR code pay. In comparison, the misperception of disclosure of location data, payment accounts and consumption information were the most serious in QuickPay. Users correctly recognized that their consumption information were given out in about 53.6% of payment events in QuickPay, but they wrongly thought that payment accounts and location data were disclosed in around 50% of payment events in QuickPay. There was a big proportion of misperception in cookie disclosure in QuickPay, with 34.3% of payment events inconsistent with reality. Similar to QR code pay, users' perceptions of disclosure in asset information and address list were matched with reality in around 90% of payment events in the payment context of QuickPay. Regarding all payment events recorded in offline payment scenarios, only 13 payment events of QR code pay and 8 payment events of QuickPay were correctly recorded with the information disclosure of payment accounts and consumption information.

On the other hand, passwords would not be disclosed in both online payment scenarios of M-payment platform pay and In-app pay. Users' payment accounts are disclosed to payees in some payment contexts in M-payment platform pay, but would not be disclosed in the payment context of In-app pay according to the privacy policy of Alipay and WeChat Pay. However, users mistakenly believed that their payment accounts were disclosed in 67.7% of payment events in In-app pay. Users also mistakenly thought that their passwords were disclosed in 15.4% of payment events in M-payment platform pay and 17.2% of payment events in In-app pay. Because the disclosure of identity, phone number, address list, social network accounts, consumption information, asset information, location data and cookies were highly context-dependent, it was difficult to identify whether users' perceptions were consistent with reality or not in this study.

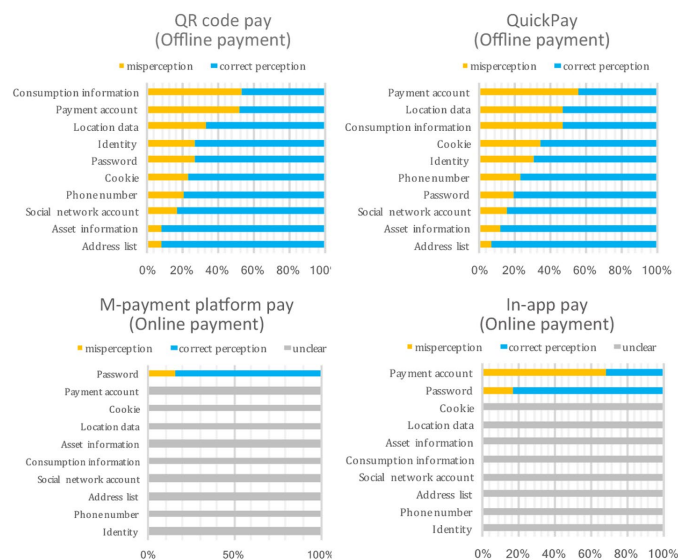


Fig. 1. Users' perception of information disclosure in four payment contexts.

4 Discussion

This study compared perceived information disclosure and actual information disclosure to understand users' privacy awareness in mobile payment services. The findings of this study revealed that users did not clearly realize what types of information were disclosed when using mobile payment services in most of the time. In the offline payment situation, users mostly believed that many types of information were disclosed, but it was not true. Many users mistakenly believed that payment accounts would be disclosed and current consumption information would not be disclosed, and location data would be disclosed in offline payment. Luckily, these three types of information were rated as less important types of information. However, the proportions of misperception in passwords and identities disclosure were remarkable, and between 18.9% and 30% of events were mistakenly believed to disclose these two types of information in offline payment scenarios. Since passwords and identities were rated as the most important information, users' misperception could increase perceived risk, which could lead to low trust to the service [13]. The results reflected that users were lacked of understating of information disclosure in offline mobile payment services. It suggested the necessity of improving users' awareness of information disclosure in mobile payment services, because perceived privacy risks could influence on the continuance adoption of mobile payment services [3]. Interface design could be a possible solution to help users better evaluate the information disclosure in mobile payment services. Notification and feedbacks about the information disclosure could be provided during the mobile payment transactions. In addition, mobile payment platforms should provide more privacy settings, and encourage users to customize the settings and control the privacy level.

This paper did not study the information disclosure in online payment contexts. The reason is that users' information disclosure behaviors in online payment contexts are highly context-dependent. Different online merchants may request users to authorize different privacy information to access the services. Since users believed that the context of In-app had involved the most information disclosure, further research about the actual information disclosure in this context would help to address users' privacy concerns better.

5 Conclusion

This paper examined users' perceived information disclosure in mobile payment services with the quantitative diary study. Comparing users perceived information disclosure and actual disclosure in offline payment contexts, results suggested that users had serious misperception in information disclosure in offline payment scenarios, and they were more likely to mistakenly perceived information disclosure in the payment context of QuickPay. This study revealed that users have not clearly recognized what kinds of information were disclosed in mobile payment services, which proposed related stakeholders an opportunity to educate or help mobile payment users with better perception of information disclosure.

Acknowledgments. The authors would like to thank the financial support provided by the UGC Funding Scheme from the Hong Kong Polytechnic University.

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