

The Cross-Cultural Impact of Mobile Payment Technology: Fingerprint Scanning vs. QR-Code Scanning

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Abstract

Mobile payment is becoming increasingly popular among consumers, with convenient and more or less risky means of identification and authentication. This study aims to investigate the attitudinal and behavioural preferences for two mobile payment application technologies, namely fingerprint scanning and QR-code scanning. Specifically, a comparison is made of consumers from cultures with different levels of uncertainty avoidance. For this purpose, Asian and European consumers from China (N = 70) and the Netherlands (N = 110) participated in an online survey. The findings revealed that both cultural groups regularly used mobile payment technology, whereby they clearly preferred the fingerprint scan technology over QR-code scan technology. Some culture-related differences were found. The Chinese group had higher trust in fingerprint scan technology compared to the Dutch group. In addition to this, the Chinese had higher hedonic and utilitarian attitudes towards QR-scan technology compared to the Dutch.

Keywords: *Mobile payment, trust, uncertainty avoidance, cross-cultural, Asia, Europe*

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I. Introduction

Financial technology (FinTech) develops very fast with increasing impact on people's daily functioning (Ogbanufe & Kim 2018), Specifically, mobile payment technology enables consumers to save time when paying small amounts of money. Instead of taking out their debit card and entering a pin code, consumers are now able to simply swipe their phone along a payment module. All they need is a phone and a corresponding mobile payment application. Extant studies examined what factors influence mobile payment (see Dahlberg et al., 2015 for an overview). These studies focused mainly on the adoption and technological aspects of mobile payment. Actual mobile payment applications and cultural factors influencing their usage have not yet been investigated (Teng & Kwong, 2021). Research by Zhou (2014) and Cao et al. (2018) showed that trust is one of the important factors. Furthermore, culture plays an influential role in the formation of trust in new information systems and a relationship between trust and culture has already been found (Xin et al., 2015). Therefore, this study will examine user motives by presenting consumers with actual mobile payment applications. Specifically, this study aims to investigate the behavioural and attitudinal preferences of consumers for mobile payment application technologies, differentiated by cultural background.

The paper is organized as follows. First, two varieties of mobile payment applications, QR-code scanning and fingerprint scanning, are described. Assumptions will be made that their usage will be determined by specific technology attitudes and cultural differences in uncertainty avoidance of consumers. To this end, an investigation is introduced with Chinese and Dutch (the Netherlands) participants. After a detailed account of the method, the findings are presented as they pertain to the perceptions and preferences of consumers with different cultural backgrounds. The paper ends by offering suggestions for theoretical and managerial implications.

II. Premise formation

2.1 Mobile payment technology

Mobile payment is a transfer of funds in return for a good or service, where the mobile phone is involved in both the initiation and confirmation of the payment (De Bel & Gáza, 2011). There are various technologies and applications that enable consumers to pay with their mobile phone. The two most used mobile payment applications are QR-code scanning and fingerprint-scanning (Chandra et al., 2010).

First, QR-code scanning uses a two-dimensional (2D) Quick Response (QR) bare code. It was originally developed to improve the reading speed of complex, structured 2D barcodes. Initially, the use of QR-code scanning was used mainly concerned South Korea and Japan (Vazquez-Briseno et al., 2012). Moreover,

the use of QR-codes has increased enormously in other Asian markets, such as China (Ye et al., 2021), and India (Pal et al., 2021). This growth in usage was mainly due to an application called WeChat whereby a variety of these functions are combined into one app (Kontsevaia & Berger, 2016).

Second, fingerprint scanning is a biometric technology in mobile phones only recently started to gain popularity among smartphone producers (Goode, 2014). This is mostly attributed to Apple, who made fingerprint scan available to all their consumers by implementing their Touch ID technology in mobile devices. Additionally, Apple provided consumers with the option to pay for applications by combining the fingerprint scan technology with Near Field Communication (NFC) technology (Sharma et al., 2013). Specifically, investigations by Clodfelters (2010) showed that consumers are reluctant in accepting fingerprint authentication technology in retailing. The following premise is formulated:

Premise 1: For making a mobile payment, consumers prefer QR-technology over fingerprint scan technology.

2.2 Technology attitudes

Consumers' usage is influenced by their attitudes toward mobile payment technology as well (Yang & Yoo, 2004). A hedonic attitude refers to emotions and feelings immediately experienced while using the technology. In contrast, a utilitarian attitude relates to the instrumental benefits derived from using it. Utilitarian consumers can be characterised by their rational and task-centric way of thinking (Batra & Ahtola, 1991). The opposite accounts for hedonistic consumers who are more subjective and focused on the output. Instead of being task-centric, they are more process-centric (Babin et al., 1994). Vieira et al. (2018) is a general meta-analysis of the impact of hedonic and utilitarian shopping values of consumers. Specifically, reviews by Davis (1989), Dahlberg et al. (2015), and Karsen et al. (2019) identified personal attitudinal factors as most important for people to use mobile payment: that is, the (utilitarian) perceived ease of use and the (hedonic) perceived trust and risk. The following premise is formed:

Premise 2: Hedonic and utilitarian attitudes towards mobile payment technology influence the behavioural intentions of consumers.

2.3 Cultural differentiations

Users should trust specific mobile payment applications. This implies the ability to fulfil the scanning process without taking advantage of their vulnerabilities (Chandra et al., 2010). This trust will be related to the degree of uncertainty avoidance. This is one of the dimensions in Hofstede's (2021) most used cross-cultural paradigm. Uncertainty avoidance refers to the 'extent to which the members of a culture feel threatened by ambiguous or unknown situations and have created beliefs and institutions that try to avoid these'. For trust in the mobile payment application differentiated by culture, the following premise is formulated:

Premise 3: The cultural background (differentiated by uncertainty avoidance) of consumers influences the usage and attitudes towards mobile payment technologies.

In this study, a comparison was made between Chinese and Dutch consumers. China and The Netherlands were selected because of the cultural differences in the concept of uncertainty avoidance. According to Hofstede (2021), China has a low uncertainty avoidance culture (a score of 30 on a 0–100 scale) compared to the Netherlands, which has a slight preference for avoiding uncertainty (a score of 53 on the same 0–100 scale).

III. Materials and method

3.1 Sample

In total, 180 respondents—70 Chinese and 110 Dutch—filled in an online questionnaire: of which 86 were females and 94 were males, with a mean age of 24 years. (Age range 18–40 years). Their cultural background was checked through self-identification ("To what ethnic group do you belong?").

3.2 Stimuli

Images of two different varieties of mobile payment application were presented to the respondents. The type of application was also clearly labelled under the image. Figure 1 shows paying with fingerprint scanning. Figure 2 is the image showing payment by scanning a QR-code.



Fingerprint scan

Fig. 1. Mobile payment by fingerprint scanning technology.



QR-code scan

Fig. 2. Mobile payment by QR-code scanning technology.

3.3 Questionnaire

The Appendix gives all the items that were used in the scales of the online questionnaire.

- *Technology preference.* The respondents saw the two mobile payment applications (Figures 1 and 2) next to each other. First they were asked: “Which technology would prefer? Fingerprint scan or QR-code scan”?
- Then they expressed their *technology attitudes* for each application separately (“How do you feel about the technology?”). The scale consisted of five semantic differential items, for the hedonic attitude (e.g., “Bad – Good”) and the utilitarian attitude (e.g., “Pointless – Useful”).
- *Usage experience* concerned three facets: How often a mobile application was used, talked about with friends, and recommended to others. Finally, two questions asked whether the respondents thought, in general, using a mobile payment application would *save time* and was *risky*.

IV. Results

4.1 Usage experience

An overview of the reported experience with the two specific mobile payment technologies is given in Table 1. Both cultural groups reported regularly/often using a mobile payment application ($\chi^2(3) = 6.119, p = 0.105$ with Cramer's $V = .18, p = 0.105$). Differences were found between the Chinese and Dutch groups. The Chinese respondents reported more talking about these apps with friends ($\chi^2(3) = 15.252, p < 0.001$, with $V = .29, p = 0.001$, and they recommended more this app to others ($\chi^2(3) = 17.354, p = 0.001$ with $V = .31, p < 0.001$).

Table 1. Usage experiences with mobile payment applications.

"How often do you regularly/often ..."	Chinese (N = 110)	Dutch (N = 70)
use a mobile payment application.	80%	70%
talk with friends about mobile payment applications.	44%	24%
recommending others to use mobile payment applications.	38%	24%

On average, for both groups the risk level of using mobile payment applications was the same: for the Chinese, $M_{Chi} = 3.19$ with $SD_{Chi} = 1.01$, and for the Dutch, $M_{Dut} = 3.19$ with $SD_{Dut} = 0.99$. In contrast, the Chinese respondents were more convinced that using a mobile payment application would save time ($M_{Chi} = 4.36, SD_{Chi} = 0.57$), compared to the Dutch respondents ($M_{Dut} = 4.11, SD_{Dut} = 0.71$). This difference, 0.25, was significant, ($t(127,458) = -2.03, p < 0.44$).

4.2 Technology preferences

Figure 3 shows for each cultural group the preference in percentages for the specific mobile payment technologies. Both the Chinese and Dutch group preferred the scan technology over the QR-code scan technology. A Chi-square test (with Yates Continuity Correction) confirmed that there was no significant association between culture and technology preference, ($\chi^2(1) = 2.689, p = 0.101, phi = 0.135$).

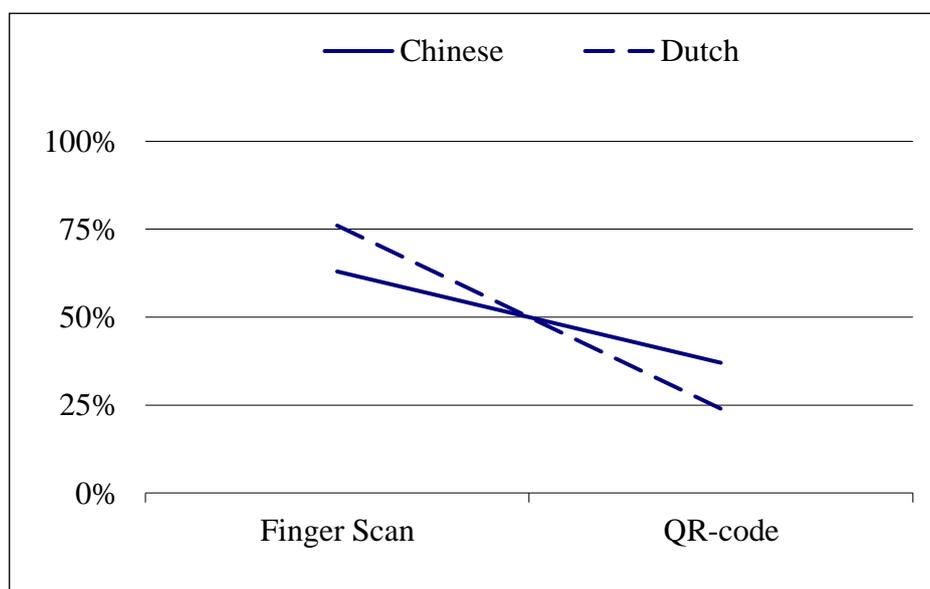


Fig. 3. Preferences for a mobile payment technology (% per group and scanning technology).

4.3 Attitudes towards fingerprint scan technology

The hedonic and utilitarian attitudes towards fingerprint scan technology are given in Table 2. A multiple analysis of variance was performed with cultural background as the predictor. The dependent variables were hedonic and utilitarian attitudes towards fingerprint scan technology. There were no statistically significant differences between the two cultural groups on the combined dependent variables ($F(2, 177) = 1.631, p = 0.199$). When the results for the dependent variables were considered separately, the only difference to reach statistical significance was the item trustworthiness ($F(5, 174) = 4.064, p = 0.045$). This indicated that the Chinese group had more trust in the fingerprint scan technology than the Dutch group.

Table 2. Attitudes towards fingerprint scan technology: means (\bar{x}) on a 5-point-scale, 1 = min and 5 = max, with standard deviations (*SD*).

"How do you feel about the fingerprint scan technology?"	Chinese		Dutch	
	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>
Hedonic				
Bad - Good	4.03	0.98	3.92	0.10
Negative - Positive	4.01	1.01	3.85	0.10
Sad - Happy	3.40	1.15	3.44	0.84
Utilitarian				
Pointless - Useful	4.09	1.02	3.98	0.89
(Un)trustworthy	3.99	1.10	3.63	1.20

4.4 Attitudes towards QR-code scan technology

Table 3 presents the hedonic and utilitarian attitudes towards QR-code scan technology. A second analysis of variance for the attitudes towards QR-scan technology revealed statistically significant differences between the two cultural groups on the combined dependent variables, $F(2, 177) = 17.633, p < 0.001, \eta_p^2 = 0.17$. This indicated that the Chinese group had more positive hedonic attitudes as well as more positive utilitarian attitudes towards the QR-code scan technology than the Dutch group. When the results for the dependent variables were considered separately, the only item that did not reach statistical significance was trustworthiness ($F(5, 174) = 1.059, p = 0.305$). This indicated that both cultural groups did not differ in the degree in which they were convinced of that the fingerprint scan technology trustworthy.

Table 3. Attitudes towards QR-scan technology: means (\bar{x}) on a 5-point-scale, 1 = min and 5 = max, with standard deviations (*SD*).

"How do you feel about the <u>QR-scan</u> technology?"	Chinese		Dutch	
	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>
Hedonic				
Bad - Good	4.00	0.87	3.14	1.03
Negative - Positive	3.94	0.95	3.10	0.93
Sad - Happy	3.46	1.07	3.00	0.75
Utilitarian				
Pointless - Useful	4.00	0.80	3.45	0.85
(Un)trustworthy	3.29	1.03	4.12	1.10

V. Discussion and conclusion

This study investigated the consumers' usage and attitude towards mobile payment application technologies, differentiated by their cultural background. Most of the Chinese and Dutch participants regularly/often used a mobile payment application. Specifically, the Chinese talked and recommended more with friends about these apps compared to the Dutch. Based on extant studies, a different level of uncertainty avoidance between the Chinese and Dutch cultures was assumed (Hofstede, 2021). However, this cultural difference was not observed in this study. For both cultural groups, using mobile payment applications was not seen as risky. These applications would save more time for the Chinese respondents compared to Dutch counterparts. Specifically, the fingerprint scan technology was dominantly preferred over QR-code scan technology. This was found for the Chinese and Dutch groups (Premise 1). For both varieties of scan technology, relatively high hedonic and utilitarian attitudes were reported (Premise 2). Some cultural differences could be pinpointed. The Chinese respondents had more positive attitudes towards QR-code scanning than the Dutch group (Premise 3).

In general, this study contributes to emerging investigations of the increasingly common cashless payment transaction methodology, as is observed in different regions worldwide including Chinese (Ye et al., 2021), Indian (Pal et al., 2021), and Western cultures (Holm et al., 2018). Specifically, the findings of this study support nascent investigations that people nowadays are much more willing to accept biometrical authentication compared to other (traditional) authentication methods for payments (Boden et al., 2020; Falk et al., 2016; Ogbanufu & Kim, 2018).

This study has limitations that give rise to some suggestions for further research. Firstly, the empirical observations in this study are self-reports of attitudes and behavioural intentions. The findings could be corroborated with other type of empirical data. Nascent investigations are, for example, Teng and Kong's (2021) big data analysis of facets of the actual usage, i.e., e-wallets, through posts on social media platforms. In a similar vein, Liao & Ho (2021) applied data mining techniques for modelling the behaviour of mobile payment applications users. A second limitation relates to lack of control for all other variables that could influence preferences of cultural group for the perceptions and intentions of applications. Interesting future investigations should consider facets of products and services (such as price) and product categories (such as fashion, electronics), consumer segments (such as gender, age), and paying context (such as shopping, restaurant,

online/offline). In this respect, nascent investigations by Liu et al. (2020), indeed showed that different mobile payment methods affect consumer behaviour. Elaborating on this, specifically, privacy concerns will have a substantial impact on the usage and adoption of the technology. Revealed personal information can get lost or used for different unintended purposes. Ultimately, with every payment method, the user is confronted with positive and negative features, and (un)consciously has to evaluate the balance between the level of convenience and privacy concerns. The cross-cultural impact of willingness of self-disclosure will be moderated by the ongoing process of a globalizing (internet) economy that cause traditions and beliefs to be transferred from one society to another, whereby individuals act locally within their cultural groups as well.

Appendix

Operationalization of the constructs

Cultural background

What country were you born in?

In what country do you live in at the moment?

To what ethnic group do you belong?

Technology preference

Which technology would prefer: Fingerprint scan or QR-code scan?

Technology attitude

How do you feel about the technology?

Hedonic attitude

Bad – Good

Negative – Positive

Sad – Happy

Utilitarian attitude

Pointless – Useful

Untrustworthy – Trustworthy

Usage experience

Frequency

How often do you do any of the following things?

Using a mobile payment application

Talking with friends about mobile payment applications

Recommending others to use a mobile payment application

Time saving

I can save time by using a mobile payment application

Risky

Using a mobile payment application is risky

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