Article

Investigating Customer Behavior of Using Contactless Payment in China: A Comparative Study of Facial Recognition Payment and Mobile QR-Code Payment

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Abstract: Emerging technologies have made tremendous changes in people's daily lives, and they have profoundly influenced their economic and consumption activities. Recently, the COVID-19 pandemic has also drastically increased individuals' usage of contactless payment technologies, such as mobile and facial recognition payments, which has accelerated the transformation of digital transaction services in China. In this study, the findings show that perceived usefulness, perceived ease of use, and service security can affect the perceived value and user satisfaction of using contactless payment. Moreover, a higher perceived value and satisfaction level may encourage more post-adoption behaviors, such as continuous and habitual usage of contactless payment methods or encouraging others to use contactless payment methods via word-of-mouth; however, perceived value did not have a direct effect on continuous usage. In addition, there are certain differences in user behavior depending on whether facial recognition payment or mobile QR-code payment is used. For QR-code payment users, overall, their satisfaction and post-adoption behaviors are more strongly bonded with each other compared with the behaviors of facial recognition payment users. This study has generated more information and insight into the transformation of digital payment and can help managers align their strategies more efficiently in the post-pandemic era.

Keywords: facial recognition payment; mobile payment; QR-code payment; user satisfaction; perceived value; habit; continuous usage; word-of-mouth; post-adoption behaviors

1. Introduction

Along with the development of technology, Industry 4.0 has not only brought huge changes to people's daily lives, but also new challenges and opportunities to businesses. From the analog terminal to the digital terminal, the rapid development of technologies is far beyond most people's imagination. Moreover, driven by income growth within China, both online and offline transactions have been increasing exponentially, and customers are longing for more efficient and smarter payment methods to further meet their demands. Due to the rapid development of modern mobile communication technology, biometric technology, and other information technologies, digital payment methods such as QR-code and facial recognition payments have led to a new era of transaction services in China. Such new technologies have upgraded the shopping experience, making purchases much easier and more convenient than before. More importantly, as COVID-19 cases keep surging across the world, people are inclined to use digitalized contactless payments to avoid human contact and reduce infection risks. As a result, the pandemic has reshaped individuals' consumption behavior, and these contactless payment methods have become increasingly popular [1–3]. Following such changes, a huge number of businesses in retail,

hospitality, and other service sectors have actively implemented contactless payments to meet customers' needs more promptly and to achieve sustainable growth.

In the 1980s, mobile phones were luxurious products for many people, but they have now become a necessity for almost everyone. People have witnessed the rapid development of mobile equipment and mobile communication technology, and many have been amazed by how mobile payment has drastically changed their shopping experience. A survey conducted in 2018 suggested that in China, 92% of people from the largest cities were using WeChat Pay or Alipay as their main mobile payment tools, and 47% of people from rural areas were also reported to regularly use such mobile payment methods; by March 2020, there were 776.08 million people using mobile payments in China [4]. In recent years, mobile phones have not just become a communication tool but also a payment tool for the majority of people. In particular, mobile-based QR-code payments have leveraged a revolution in financial apps, and two dominant players in the field of mobile payment in the form of WeChat Pay and Alipay have accounted for a combined market share of 92%, and both have contributed tremendously to the growth of mobile payment in China. Payments made via one's mobile phone has become a part of people's daily lives, and the popularity of the QR-code payment has been especially dominant [5]. Chinese customers have led the world in paying by smartphone, and mobile payment has deeply penetrated their daily lives, with 85% of users reported as having used QR code payment in 2020 [6]. In recent years, by conveniently scanning a QR-code to pay, customers in China have been able to pay using cashless and contactless methods, and such payments have been widely accepted everywhere, from shopping centers to street food vendors; therefore, given that it is the most representative mobile payment method in China, the mobile QR-code payment was studied in this paper.

However, in accordance with the latest technological development, facial recognition payments have freed people from their mobile devices with a simple scanning of one's face that enables payment for everything [7]. Moreover, facial recognition payment has become increasingly popular since it can offer individuals a contactless and convenient way to pay. It is a new technology based on artificial intelligence, biometrics, 3D sensing, and big data technology. By utilizing this method while shopping, users neither need to use mobile phones to complete payment nor worry about battery-related phone problems. This remarkably improves people's purchasing experience and merchants' service efficiency [8]. For example, the "Smile to Pay" scheme, first introduced in 2017 by Alipay, takes just a few seconds to recognize and identify a face, and thus, the whole process is quite simple and convenient, which greatly improves service efficiency [9]. Seeing the huge potential in facial recognition payment, WeChat Pay, and some other dominant players in the digital payment market, also launched similar facial recognition payment systems for their customers, with those companies gearing up to seize their market share [7]. Currently, facial recognition payment has been applied in a multitude of places such as convenience stores, supermarkets, restaurants, hotels, shopping malls, and so on. It was reported that in 2019, there were 118 million people using facial recognition payment, and this number may exceed 700 million in 2022; in the future, this new method may even serve as a replacement for QR-codes and become the predominant payment method in China [10].

For service providers, customer satisfaction is the key to success. Thus, it is necessary to ensure that customers enjoy their shopping experience and feel satisfied with their chosen payment service. A satisfactory experience will lead to purchase behavior, and one's personal perception and evaluation of service performance may strongly shape customer satisfaction [11]. The service performance of QR-code and facial recognition payments are based on online systems. For online-based payment systems, perceived service quality dimensions such as security, efficiency, ease of use, accuracy, and reliability are critically important [12]. Factors such as perceived ease of use and perceived usefulness have been discussed, particularly with regard to internet banking-, mobile payment-, and online shopping-related studies [13–15]. The ease of use and usefulness of a payment method may greatly shape people's judgements of the payment service's quality. Service

security has also received increasing levels of attention in the online transaction sector [16]. Thus, in this study, the overall service quality of contactless payment was mainly based on the assessment of three dimensions: perceived ease of use, perceived usefulness, and service security. High quality service can not only enhance customers value perceptions, but it can also lead to positive behavioral intentions, a larger market share, and greater profits [16]. If customers enjoy a high-quality payment service, they will be inclined to perceive the service as having a greater value, and they will be satisfied with the service. Consequently, a satisfactory experience of IT usage could significantly impact users' intentions to continue using the service [17], and their satisfaction is also a vital determinant in terms of whether they will recommend the service to others, and whether they intend to repeat using the service [18]. Moreover, if a user regularly repeats a specific action and feels satisfied with the results, this kind of action may become habitual; when using an information system such that it becomes a part of one's daily routine, such habitual behavior could encourage people to continuously use this technology [19]. Post-adoption behaviors including continuous usage of the service, recommending the service to others via word-of-mouth, and habitually using the service, are indispensably important to fully understanding the behavioral patterns of contactless payment users.

Both facial recognition and mobile QR-code payments can increase efficiency during the shopping process. Such payment methods can save customers time and offer new shopping experiences by enabling them to go contactless. In order to improve service quality, meet customer needs, increase customer satisfaction, and sustain business growth, an increasing number of service providers have implemented contactless payment technology in stores, restaurants, and so on, during the post-pandemic era. Among these contactless payment methods, QR-code payment has become one of the most frequently used mobile payment methods in China. Facial recognition payment is also starting to enjoy growing popularity after first being introduced in 2017 in a KFC restaurant located in Hangzhou city [9]. It is widely acknowledged that different payment methods all provide respective advantages in terms of convenience, safety, cost, and user acceptability. When compared with the QR-code payment method, facial recognition can offer a greater level of convenience; however, it is still at a preliminary stage, experiencing problems such as security issues and system errors [7]. Some people still have concerns about their facial information and personal information being collected, and whether that information will be exposed, decoded, stolen, or misused by others during the facial recognition process, thus causing security problems [10]. Continuing to study what motivates customers to adopt contactless payment technologies is relatively significant in terms of understanding their current behaviors. To date, most previous studies have focused primarily on investigating antecedents that may drive people's intentions of using payment technology [20–22], but few have investigated users' post-adoption behaviors such as recommendations of the technology via word-of-mouth, habitual behaviors, and so on. Moreover, insufficient studies have tested the connections between the perceived value of a payment service and post-adoption behaviors. Additionally, although facial recognition payment has already attracted a growing number of users in different countries, prior studies on the adoption of facial recognition payment have been relatively insufficient [23], and almost none have compared the differences of user experience between mobile payment and facial recognition payment; therefore, to better address the above questions, we decided to form an improved approach to discussing how perceived value and user satisfaction are associated with post-adoption behaviors of contactless payment, and we compare mobile QR-code payment with facial recognition payment to examine how users' adoption behaviors differ.

In this study, we intended to establish the behavioral patterns of contactless payment use, especially with regard to facial recognition payment, which is still in the early stages of being adopted in many countries. We proposed a conceptual model with a special focus on people's post-adoption behaviors regarding contactless payment. This study will extensively enrich the practical and theoretical basis of contactless payment adoption, and ultimately deepen the understanding of the transformation of digital payment services

within society, which, in turn, may offer more extensive knowledge that enables managers to formulate their business strategies more promptly and efficiently. In this study, we seek to answer the following research questions: How are perceived ease of use, perceived usefulness, and service security correlated with consumer satisfaction and the perceived value of contactless payment? What are the internal relationships between user satisfaction, perceived value of the service, habitual behaviors, continuous usage of the service, and word-of-mouth recommendations of the service? Will the user experience of mobile QR-code payments differ from facial recognition payments, and can facial recognition payment replace mobile payment?

2. Literature Review

2.1. Contactless Payment Service Quality

Service quality can be defined in terms of the overall appraisal of the service. Moreover, whether the service can offer something which is relatively superior to that offered by other services is noted, and it is usually closely associated with customer attitudes toward the service provider [18]. Digital payment quality can be affected by issues such as access speed, ease of use, or visual appeal, and poor system quality would lead to an unfavorable user experience [24]. Unlike traditional services, mobile payment or facial recognition payment, as digital payment services, are mostly based on online transactions. Zeithaml et al. (2001) proposed that online service quality dimensions included efficiency, flexibility, reliability, security, responsiveness, and trust [25]. Other studies also frequently discussed efficiency, security, and ease of use in the online-based service context [26,27]. Thus, with regard to these previous studies, we believe that dimensions such as usefulness, ease of use, and service security can be of paramount importance to contactless payment service quality.

2.1.1. Perceived Ease of Use (PEOU)

Perceived ease of use can be defined as the level of mental effort required when adopting a new technology [28]. It is more closely related to the aspect of one's internal motivation that focuses on the process of improving outcomes [29]. Ease of use is one of the key factors in shaping user attitudes and their intention to accept information technology in their life [29,30]. According to previous studies, perceived ease of use has positive effects on customer satisfaction [18,31]. If customers believe that a payment system is easy to use and can offer convenience, they will tend to have a more positive attitude toward using such a system and they are more likely to feel satisfied about their user experience.

2.1.2. Perceived Usefulness (PU)

Perceived usefulness is closely related to users' subjective perceptions of improving task efficiency by using a specific technology [32], which relies on external motivation in terms of the tangible or intangible benefits of the utilization of a system [29]. Individuals are more likely to adopt a new technology if they perceive high potential usefulness [33]. Perceived usefulness is thus considered to be one of the fundamental antecedents to the acceptance of a technology. It can reflect customer beliefs toward transaction performance, and if customers can shop in a more efficient manner, they will be inclined to have greater repurchasing intentions [15] and feel satisfied with the service [31]. The use of contactless payment can significantly reduce transaction times and improve overall service performance, which enables people to enjoy their shopping experience to a greater extent. Consequently, they tend to be satisfied and more willing to reuse the same payment method.

2.1.3. Service Security

Privacy, safety, and security are vital aspects of online transactions. Security can be regarded as a company's capability to prevent clients' personal information and transaction information from being stolen during online transactions [34]. Customers may perceive certain risks if they are at risk of suffering a potential loss due to the misuse of their personal information [35]. Some studies have indicated that security may be more influential in

terms of online purchase behaviors than factors pertaining to perceived ease of use or perceived usefulness [34,36]. Along with the frequent use of mobile devices and wireless applications, customers may perceive risks if there is a high possibility of loss caused by the disclosure of personal information and security issues [16]. Security has become one of the most decisive factors driving customer behavior in online transactions. Whether sensitive information is protected during online transactions strongly shapes customer attitude and purchase intentions [37]. Contactless payment methods heavily rely on online transaction systems; therefore, customers may have more concerns about security and privacy issues when using these services. For example, if they do not feel sufficiently secure to provide their credit card information, they may hesitate to proceed with an online transaction [15]. We believe that service security is a crucial dimension that will influence customers' overall perceptions of payment service quality, and in turn, it may affect perceptions relating to the value of the service and user satisfaction.

As such, the following hypotheses are proposed:

Hypothesis 1 (H1). *PEOU has positive effects on user satisfaction.*

Hypothesis 2 (H2). *PU has positive effects on user satisfaction.*

Hypothesis 3 (H3). *Service security has positive effects on user satisfaction.*

2.2. Perceived Value

Value can be defined in terms of the overall assessment of a service or product based on an evaluation of the benefits and costs involved in using the service or product [38]. This requires considering what constitutes a received benefit in contrast to risk and effort [39]. Value is necessarily vital in order to understand customer consumption and purchasing behaviors, which is regarded as one of the most dominant factors in the service industry [40]. Customers' decisions to use a service rely on their overall evaluation of the service's value in terms of giving and receiving [35]; however, perceived value should not be ascertained solely from a monetary perspective, since a service can also offer value via other benefits [41]. In other words, unlike traditional measurements, value can be measured in a more diverse way. This not only reflects economic benefit, but also other values, such as the utility gained from a product or service [40].

In the context of online transactions, perceived value is closely connected with relational benefits such as ease of use and customers' sacrifices of money, time, and effort [42]. Given that it heavily relies on an online system, a contactless payment service's value greatly depends on the comparison of benefits against the perceived risks and efforts when using the transaction service. Previous studies have indicated that service quality is the key driver of value, and customers perceive greater value with higher service quality [38,43]. We believe that in this study, service dimensions of contactless payment (perceived usefulness, ease of use, and service security) could largely determine payment service quality, and ultimately shape customers' value perceptions; however, large numbers of studies have mainly focused on the relationships between the perceived ease of use, perceived usefulness, and satisfaction when using a service [13,17,44]; however, the connections between perceived ease of use, perceived usefulness, service security, and customers' perceptions of the value of the payment services have not yet been studied adequately, which emphasizes the need to examine these relationships in this study.

As such, the following hypotheses are proposed:

Hypothesis 4 (H4). *PEOU has positive effects on perceived value.*

Hypothesis 5 (H5). *PU has positive effects on perceived value.*

Hypothesis 6 (H6). *Service security has positive effects on perceived value.*

Customers perceive the value of a high-quality payment system via the overall evaluation of the utility [45], and such value perceptions are influential for critical outcomes such as consumer satisfaction and repurchasing intention [46]. As customer satisfaction is driven by perceptions of the overall evaluation of service performance, customers may compare their expectations to the experience gained from a service provider; a satisfying service with good value is key for differentiating a service company from its competitors [16]. Perceived value is a significant antecedent of user satisfaction, and poor payment service quality may lead to negative value perceptions, dissatisfaction, and it may even discourage adoption behavior.

As such, the following hypotheses are proposed:

Hypothesis 7 (H7). *Perceived value has positive effects on user satisfaction.*

2.3. User Satisfaction and Post-Adoption Behavior

User satisfaction can be defined here as individuals' emotional responses based on the experience of using information technology [17]. It can be derived from cumulative feelings based on multiple interactions when using a service [24]. Generally speaking, before/after the adoption of a product or service, customers may have certain expectations, and they may compare the actual performance of a service with the expected performance of a product or service; if the actual performance exceeds their expectations, they are more likely to experience positive feelings of satisfaction [47]. Such satisfaction reflects affection resulting from an interaction, and it will stimulate information system usage [44]. User satisfaction, as a salient variable, can influence the continuing usage of an information technology [48]. In this study, we proposed the post-adoption behaviors as the following aspects: continuous usage (behaviors of using the same contactless payment service continuously), word-of-mouth (positively conveying experiences to families/friends), and habit (habitual behaviors).

Some studies have pointed out that satisfaction will positively influence the word-of-mouth (WoM) behavior of making recommendations to other customers after consumption [49]. Customer satisfaction is also the most critical driver of continuing to use a service [47]. Customers' continued usage of contactless payment can be considered a derivative of service loyalty, which is closely connected to a sense of commitment, which might, in turn, lead to spreading positive recommendations via word-of-mouth, with regard to adopting a particular service. After using a certain product or service, customers may wish to pass on such experiences to others through WoM, who consequently, may have plans to buy the product or experience the service [45]. In particular, if people are constantly engaged and feel a sense of commitment to certain behaviors, they have a greater propensity to spread their positive purchasing experiences via WoM [50]; however, previously, the word-of-mouth effect was more frequently related to post-purchasing behaviors, and it has seldom been discussed in relation to post-adoption behaviors in the literature. In the context of contactless payment, if customers are satisfied with the payment service, they are inclined to use it continuously, and they might recommend the payment method to others. Ergo, in addition to the continuous use of a product/service, word-of-mouth is also regarded as one of the most significant post-adoption behaviors in this study.

Another post-adoption related behavior is habitual behavior; after using a specific technology for a while, users may begin to habitually use that technology. Habits are closely related to automatic response behaviors. This means that they comprise part of a routine behavior that is repeatedly and subconsciously perpetuated by an individual [51]. If customers are satisfied with a specific result, they may repetitively engage in that activity, but as time passes by, such an action tends to become a habitual behavior; when the use of a specific information technology becomes part of people's daily routines, their habitual behaviors will reinforce the continued use of the technology [19]. When people are satisfied with a payment method and are comfortable using such a method, the adopted behavior might transform into a habitual behavior, in that they use the same method of

payment every time. This habit will also result in the continuous usage of the method in the future. Based on current studies, limited evidence has revealed the correlations between satisfaction, continuous usage of contactless payment methods, recommending contactless payment methods or sharing experiences via word-of-mouth, and habitually using contactless payment methods, especially the facial recognition payment method; thus, we decided to further explore these internal connections.

As such, the following hypotheses are proposed:

Hypothesis 8 (H8). *User satisfaction has positive effects on continuous usage.*

Hypothesis 9 (H9). *User satisfaction has positive effects on word-of-mouth.*

Hypothesis 10 (H10). *Continuous usage has positive effects on word-of-mouth.*

Hypothesis 11 (H11). *User satisfaction has positive effects on habits.*

Hypothesis 12 (H12). *Habits have a positive effect on continuous usage.*

2.4. Perceived Value and Post-Adoption Behavior

Both service quality and perceived value can significantly shape the customers' decision-making processes [38]. Perceived value may change customers' perceptions by offering them certain benefits to mitigate perceived risks and effort [39]. Many studies have verified that people's value perceptions are of paramount importance to behavioral intentions. For example, Mou et al. (2019) found that perceived value is positively connected to repurchasing intentions on e-commerce platforms [35]. Other studies have also indicated that value plays a decisive role in driving customers' intentions to use services on mobile commerce platforms [52,53]; however, almost none of these studies have tested whether perceived value influences people's post-adoption behaviors, such as word-of-mouth and habitual behaviors, in a contactless payment-related context. If users perceived contactless payment usage as having a high value, they are more likely to continuously, repetitively, and habitually use such a payment method, and have positive words to say about their user experience. To generate a better understanding of contactless payment user behaviors, it is important to unveil the connections between the perceived value of contactless payment methods, recommendations of contactless payment methods made via word-of-mouth, continuous usage of contactless payment methods, and habitual use of contactless payment methods.

As such, the following hypotheses are proposed:

Hypothesis 13 (H13). *Perceived value has positive effects on word-of-mouth.*

Hypothesis 14 (H14). *Perceived value has positive effects on continuous usage.*

Hypothesis 15 (H15). *Perceived value has positive effects on habit.*

2.5. Contactless Payment: Facial Recognition Payment vs. Mobile QR-Code Payment

Both mobile and facial recognition payments are new, emerging digital payment methods; however, they have already proven hugely convenient to customers. Due to the prevalent use of 4G networks and smartphones in China, the QR-code payment has currently become an upgraded substitute for card or cash payments; however, it is likely that in the next few years, new and better payment technologies could emerge to replace the mobile payment method [54].

In terms of user experience, facial recognition payment can help provide a service with a higher value, by increasing service efficiency, enabling customers to no longer be limited by battery problems with mobile phones, and they are able to pay directly via facial scanning [55]. After years of development, facial recognition payment technology

has become fully commercialized. Unlike other biometric identification technologies, this technology recognizes human faces in a contactless manner and it is very convenient to use. For merchants, a process of self-service, that is based on facial recognition payment, can increase business efficiency and upgrade their services [8]. Taking Alipay's facial recognition payment system as an example, the entire payment process takes less than 10 s, without any need to queue or check out, which greatly saves users' time. At the same time, users no longer need to memorize complex and cumbersome passwords, so it is extremely friendly to all users, especially the elderly. Nowadays, facial recognition payment has been used in large-scale situations for commercial purposes, and it can be applied in various sectors such as the retail industry, catering industry, and so on [23]. During the COVID-19 pandemic, contactless facial recognition payment has not only increased in popularity within China, but it has been increasingly used across a diverse range of countries, including the US and Korea [2,3].

Another method that enables people to pay via smart and contactless means is mobile payment through simple QR-code scanning. The QR-code was first created by a Japanese company in the 1990s, but it has now become extremely popular in the US, France, Australia, Thailand and so on, and in China, it has experienced a particularly rapid growth [56]. Moreover, because of the pandemic, the world now heavily depends on social distancing and contactless payment, and just as with facial recognition payment, the use of QR-code payment has also been boosted. Currently, the QR-code system is one of the most convenient and safe payment methods, and it has been prevalently used in places such as restaurants, cafés, and bars [57]. This method is one of the most convenient and popular mobile payment methods because customers only need to scan the QR-code from the merchant's device to complete the payment, or the other way around, where merchants can scan the QR-code on a customer's mobile phone.

Mobile QR-code payment and facial recognition payment both offer certain advantages regarding convenience, safety, cost, and user acceptability. In light of the COVID-19 pandemic, contactless payment has enjoyed increasing popularity all over the world. By comparing the antecedents of customers' value perceptions, satisfaction, and post-adoption behaviors between these two payment methods, this paper can contribute to a better understanding of customers' experiences of contactless payment use, and it can offer greater insight that could enable managers to formulate strategies accordingly to improve service performance and achieve sustainable success during the post-pandemic era. It will also provide greater insight into technological transformation in society, as it has been postulated that in the near future, facial recognition payment might replace mobile QR-code payment.

As such, the following hypothesis is proposed:

Hypothesis 16 (H16). *User experience could be different between mobile payment and facial recognition payment.*

3. Methodology

3.1. Questionnaire

In this study, we intended to study the antecedents of user satisfaction and perceived value of contactless payment use, and we also intended to examine the internal relationships between user satisfaction, perceived value, and continuous usage of contactless payment methods, as well as recommendations made about contactless payments via word-of-mouth, and habitual contactless payment use. Eight variables were included in the conceptual model (Figure 1), and the majority of questionnaire items were designed based on previous studies, but a few were slightly modified to fit the research purposes of this study. A five-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree) was adopted.
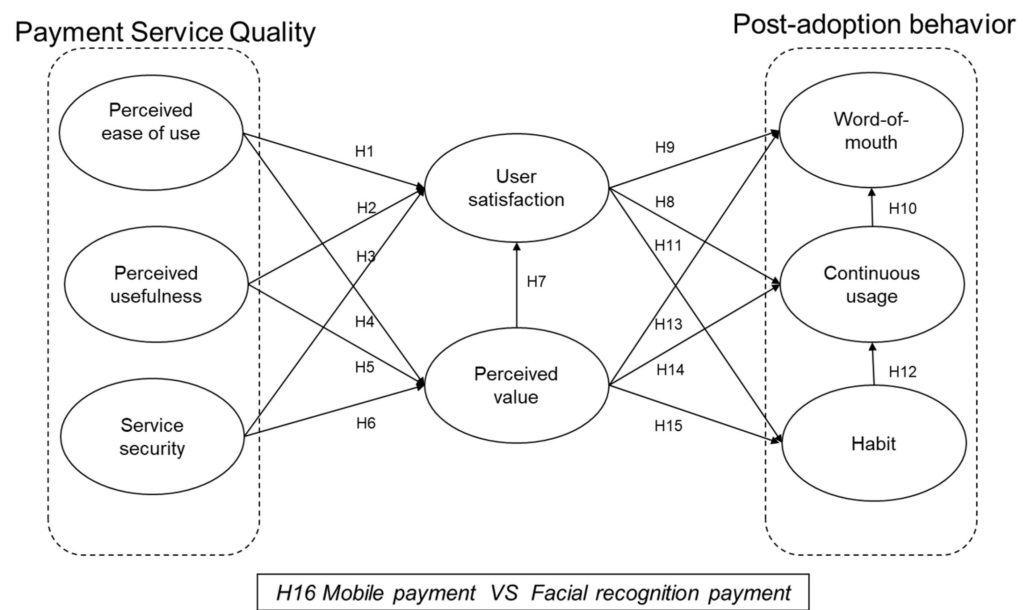
Figure 1. Conceptual model.

3.2. Data Collection

This study aimed to investigate contactless payment user behaviors by surveying those who have used facial recognition and mobile QR-code payments in China. In this study, we used a random sampling method, and online survey links were shared through WeChat, China's largest SNS platform. The whole sampling process took about 7 months, from May to December 2020. A total of 289 questionnaires were collected and used for the final analysis. In this study, we aimed to find out how the quality of payment service—including aspects such as the perceived usefulness, perceived ease of use, and service security of a contactless payment method—can positively influence the perceived value and user satisfaction of a payment service. Moreover, we also aimed to find out how user satisfaction, perceived value, and continuous usage of a contactless payment service, as well as recommendations of the service via word-of-mouth, and habitual use of the service are correlated with each other.

The demographic characteristics of the samples in this study can be found in Table 1. The questionnaires were randomly sent to WeChat users. A total of 289 respondents completed the survey. Respondents were asked to choose their most-used payment method and to answer the questionnaire based on their selected method. Most of them used contactless payment at restaurants, supermarkets, convenience stores, and shopping malls. Among the respondents, 60.55% were male and 39.45% female; 4.15% were 20 years old or younger; 57.79% of them were 21–30 years old; 34.26% were 31–40 years old; 2.42% were 41–50 years old; and 1.38% were over 50 years old. Of all the participants, 44.64% selected facial recognition payment as their most-used payment method, whereas 55.36% of them chose the QR-code payment. More than half of respondents had used contactless payment systems (mobile QR-code/facial recognition payment) for more than a year, and many of them had undergraduate degrees, graduate degrees, or higher.

Table 1. Sample profile.

Demographic Variables		Frequency	Percent
Gender	Male	175	60.55
	Female	114	39.45
Age	20 or younger	12	4.15
	21–30	167	57.79
	31–40	99	34.26
	41–50	7	2.42
	Above 50	4	1.38
Education	Below high school	16	5.54
	High school/vocational school	43	14.88
	Junior college	58	20.07
	Undergraduate	154	53.29
	Graduate or above	18	6.23
Income (RMB)	2000 or less	23	7.96
	2001–3000	29	10.03
	3001–5000	74	25.61
	5001–8000	117	40.48
	above 8000	46	15.92
Most-used payment method	Mobile QR-code payment	160	55.36
	Facial recognition payment	129	44.64
Experience of usage	Less than 6 months	24	8.3
	7–12 months	51	17.65
	13–24 months	86	29.76
	25–36 months	64	22.15
	Above 36 months	64	22.15
Total		289	100

4. Results

To test the proposed hypothesis, this study adopted the PLS–SEM method (partial least squares–structural equation modeling) [58–60]. PLS requires fewer restrictions on both sample size and residual distribution [61]. In addition, PLS is extremely suitable for analyzing complex relationships and can avoid inadmissible solutions and factor indeterminacy [62]; thus, this method was considered to be appropriate for this study. Moreover, this study adopted structural equation modeling (SEM) using SmartPLS 3.2.8 software with the 5000-subsample bootstrapping procedure recommended by Hair et al. (2016) [63].

4.1. Measurement Model

In this study, the reliability and validity of all measurement items were tested. In general, if Cronbach's α ranged from 0.6 to 0.7, it was considered acceptable; if the value was above 0.7, it was considered desirable. The Cronbach's α value of all the constructs was above 0.7, showing good internal consistency. Additionally, all factor loadings were 0.5 or above (Table 2), which was consistent with the recommended level and showed a good convergent validity [64]. According to the recommended threshold of Bagozi and Yi (1988) [65], the AVE (average variance extracted) level should be higher than 0.5, and the CR (composite reliability) level should be higher than 0.7. As such, the measurement model showed good construct reliability. Discriminant validity was verified by following Fornell and Larker's (1981) criteria [66], whereby the square root of AVE exceeded the inter-construct correlation, thus presenting proper discriminant validity. Based on the above criteria, both the reliability and validity of the proposed model were confirmed (Table 3).

Table 2. Survey items and factor loading.

Items	Content	Factor Loading	Source
PEOU1	Using this payment method is easy for me	0.700	
PEOU2	Using this payment method does not require a lot of mental effort	0.642	
PEOU3	Using this payment method is understandable and clear to me	0.776	[37,67]
PEOU4	It is easy to learn how to use this payment method	0.749	
PEOU5	It will not be hard for me to become good at using this payment method	0.732	
HB1	Using this payment method has become a habit for me	0.781	
HB2	Using this payment method has become natural for me	0.758	
HB3	Most of the time, this is the only payment method I use	0.644	[19,68]
HB4	Using this payment method has become part of my daily routine	0.801	
SA1	Using this payment method to pay is a good idea	0.657	
SA2	I like making purchases with this payment method	0.718	
SA3	I am satisfied with the use of this payment method	0.745	[48,49]
SA4	The payment service meets my expectations	0.685	
SA5	The overall purchasing experience was satisfactory	0.748	
SS1	It is relatively safe to provide transaction information during usage	0.761	
SS2	I think there are no security problems to offer personal information during usage	0.736	[37]
SS3	The risks associated with using this payment method are relatively low	0.865	
SS4	I think that overall, this payment method is safe	0.813	
CU1	I plan to use this payment method in the coming months	0.766	
CU2	I will continue to use this payment method to make purchases	0.777	[23,37]
CU3	I prefer to continue using this payment method over other methods	0.630	
CU4	Overall, I would like to use this payment method	0.761	
PU1	This payment method is a comparatively efficient way to pay	0.699	
PU2	This payment method will help me make payments smoothly	0.745	[67,69]
PU3	The use of this payment method is useful for me	0.768	
PU4	The use of this payment method is beneficial for me	0.766	
PV1	The merchant offered me good value from the experience	0.695	
PV2	The shopping experience was worth the money	0.702	
PV3	The merchant provided better service through this payment method	0.807	[35]
PV4	The merchant provided good payment service	0.743	
PV5	Overall, I am satisfied with the value I received from the service	0.746	
WOM1	I plan to recommend this payment method to my friends	0.699	
WOM2	I will say positive things about my payment experience at this store	0.732	
WOM3	I want to tell people around me about the payment experience at this store	0.790	[50]
WOM4	I will encourage people around me to try this payment method	0.846	

Note: PEOU = perceived ease of use; HB = habit; SA = user satisfaction; SS = service security; CU = continuous usage; PU = perceived usefulness; PV = perceived value; WOM = word-of-mouth.

Table 3. Fornell–Larcker Criterion, Construct Reliability, and Validity.

Variables	1	2	3	4	5	6	7	8	Cronbach's α	CR	AVE
Perceived ease of use	0.721								0.768	0.844	0.520
Habit	0.452	0.748							0.738	0.835	0.560
User satisfaction	0.572	0.582	0.711						0.755	0.836	0.506
Service Security	0.393	0.427	0.479	0.795					0.805	0.873	0.633
Continuous usage	0.454	0.619	0.606	0.410	0.736				0.717	0.824	0.542
Perceived usefulness	0.562	0.434	0.535	0.321	0.471	0.745			0.734	0.833	0.555
Perceived value	0.508	0.504	0.553	0.492	0.447	0.491	0.740		0.793	0.858	0.547
Word-of-mouth	0.385	0.574	0.630	0.434	0.559	0.396	0.472	0.769	0.769	0.852	0.591

4.2. Structural Model

4.2.1. Hypotheses Testing Results

Table 4 presents the testing results for the hypotheses. It showed that perceived ease of use (ß = 0.261, $p < 0.05$), perceived usefulness (ß = 0.218, $p < 0.05$), and service security (ß = 0.201, $p < 0.05$) can have positive effects on satisfaction, thus supporting H1, H2, and

H3. The findings for H4 and H5 demonstrated that both perceived ease of use (β = 0.239, p < 0.05) and perceived usefulness (β = 0.256, p < 0.05) played decisive roles in shaping customers' value perceptions. Among the three dimensions of payment service quality, service security (β = 0.315, p < 0.05) had the strongest implication on perceived value, thus supporting H6. In addition, it appears that perceived value can directly influence satisfaction (β = 0.216, p < 0.05), thus supporting H7. The data also suggests that satisfaction is statistically significant in terms of continuous usage (β = 0.349, p < 0.05), word-of-mouth (β = 0.397, p < 0.05), and habit (β = 0.436, p < 0.05), meaning H8, H9, and H11 are accepted. Moreover, continuous usage was identified as an important factor for recommendations made via word-of-mouth (β = 0.256, p < 0.05), thus supporting H10. It also emerged that habit can positively drive continuous usage (β = 0.384, p < 0.05), which supports H12. Finally, perceived value was positively connected with word-of-mouth (β = 0.140, p < 0.05) and habit (β = 0.264, p < 0.05), but not continuous usage (β = 0.060, p > 0.05), and thus, it only supports H13 and H15.

Table 4. Hypotheses Testing Results.

	Hypotheses	β	Standard Deviation	p Values	Results
H1	Perceived ease of use → user satisfaction	0.261	0.063	0.000	Accepted
H2	Perceived usefulness → user satisfaction	0.218	0.058	0.000	Accepted
H3	Service security → user satisfaction	0.201	0.064	0.002	Accepted
H4	Perceived ease of use → perceived value	0.239	0.065	0.000	Accepted
H5	Perceived usefulness → perceived value	0.256	0.066	0.000	Accepted
H6	Service security → perceived value	0.315	0.055	0.000	Accepted
H7	Perceived value → user satisfaction	0.216	0.065	0.001	Accepted
H8	User satisfaction → continuous usage	0.349	0.068	0.000	Accepted
H9	User satisfaction → word-of-mouth	0.397	0.067	0.000	Accepted
H10	Continuous usage → word-of-mouth	0.256	0.068	0.000	Accepted
H11	User satisfaction → habit	0.436	0.063	0.000	Accepted
H12	Habit → continuous usage	0.384	0.064	0.000	Accepted
H13	Perceived value → word-of-mouth	0.140	0.063	0.027	Accepted
H14	Perceived value → continuous usage	0.060	0.062	0.333	Rejected
H15	Perceived value → habit	0.264	0.062	0.000	Accepted

4.2.2. Partial Least Squares Multi–Group Analysis (PLS–MGA) Results

As a non-parametric significance test for difference in group-specific results, PLS–MGA usually builds on PLS–SEM bootstrapping results. The differences between group-specific path coefficients can be considered significant when the p-value is either smaller than 0.05 or larger than 0.95. The PLS–MGA method as an extension of the original nonparametric Henseler's MGA method [70], is one of the most important analysis methods in SmartPLS.

Based on the Partial Least Squares Multi–Group Analysis results, out of the fifteen hypotheses, five hypotheses showed some differences between these two groups (Table 5), thus partially supporting H16. Perceived ease of use more powerfully impacted facial recognition users' value perception (β^M = 0.131, β^F = 0.393, $p^{\text{M vs. F}}$ > 0.95). Satisfaction is less influential in terms of facial recognition users' word-of-mouth (β^M = 0.514, β^F = 0.274, $p^{\text{M vs. F}}$ < 0.05), whereas continuous usage played a more crucial role in driving word-of-mouth (β^M = 0.115, β^F = 0.415, $p^{\text{M vs. F}}$ > 0.95); however, for QR-code users, their habitual behaviors seemed to be more influenced by satisfaction (β^M = 0.570, β^F = 0.256, $p^{\text{M vs. F}}$ < 0.05) and such habitual behaviors more significantly affected continuous usage (β^M = 0.503, β^F = 0.248, $p^{\text{M vs. F}}$ < 0.05).

Table 5. Partial Least Squares Multi–Group Analysis results.

	Hypotheses	β (M)	β (F)	*p*-Values (M)	*p*-Values (F)	*p*-Value (M vs. F)
H1	Perceived ease of use → user satisfaction	0.346	0.219	0.000	0.024	0.162
H2	Perceived usefulness → user satisfaction	0.181	0.222	0.022	0.017	0.635
H3	Service security → user satisfaction	0.155	0.253	0.074	0.005	0.783
H4	Perceived ease of use → perceived value	0.131	0.393	0.196	0.000	**0.978**
H5	Perceived usefulness → perceived value	0.268	0.149	0.009	0.094	0.192
H6	Service security → perceived value	0.368	0.270	0.000	0.000	0.183
H7	Perceived value → user satisfaction	0.229	0.168	0.010	0.086	0.324
H8	User satisfaction → continuous usage	0.287	0.381	0.001	0.001	0.755
H9	User satisfaction → word-of-mouth	0.514	0.274	0.000	0.004	**0.040**
H10	Continuous usage → word-of-mouth	0.115	0.415	0.176	0.000	**0.987**
H11	User satisfaction → habit	0.570	0.256	0.000	0.006	**0.006**
H12	Habit → continuous usage	0.503	0.248	0.000	0.010	**0.020**
H13	Perceived value → word-of-mouth	0.127	0.090	0.131	0.356	0.386
H14	Perceived value → continuous usage	0.002	0.128	0.984	0.232	0.830
H15	Perceived value → habit	0.199	0.263	0.010	0.010	0.695

Note: M = mobile QR-code payment; F = facial recognition payment; group-specific path coefficients that are significantly different from each other have been highlighted in bold lettering.

5. Discussions

5.1. Theoretical Implications

In this study, we intended to investigate how payment service quality (perceived ease of use, perceived usefulness, and service security) can influence people's judgements of value and satisfaction when using contactless payment methods; how their value perceptions, user satisfaction, and post-adoption behavior (as word-of-mouth, continuous usage, and habit) are correlated; and how user behavior varies between mobile payment and facial recognition payment during use.

We found that both perceived ease of use and perceived usefulness can impact satisfaction, which is in line with Amin et al. (2014) [13], who noted that PEOU and PU were critical in shaping user satisfaction toward mobile website usage. At the same time, service security was found to be another significant predictor of user satisfaction. People may feel more satisfied if a payment service is secure and safe during the transaction process. When evaluating the service quality of a contactless payment method, if users consider it to be useful, easy, and secure to use during the transaction, it can lead to a positive attitude and increase satisfaction with regard to that method being used.

This study also presented some other findings by showing positive associations among PEOU, PU, service security, and perceived value. It turned out that these three dimensions (PEOU, PU, and service security) could not only significantly improve people's satisfaction level but also their value perceptions. We also found that value plays a key role in shaping consumer satisfaction. Such a result is consistent with Turel and Serenko's (2006) study [71], Karjaluoto's study (2019) [72] and Alalwan's (2020) study [53]. Thus, users' value perceptions heavily rely on payment service quality, which indicates that if payment methods are beneficial, convenient, and safe, they may perceive greater value from contactless payments. Eventually, higher value perceptions can result in a more satisfactory user experience.

Additionally, many studies only explored the antecedents of payment technology adoption, but little attention has been paid to post-adoption behaviors such as recommendations made via word-of-mouth and habitual use, especially for facial recognition payment; however, the continued study of post-adoption behaviors regarding contactless payment technologies is critically important for a better understanding of current customer behaviors. This study revealed that user satisfaction is positively associated with continuous usage, habit, and spreading positive word-of-mouth. It is significant to increase satisfaction with contactless payment, because a pleasant user experience can greatly promote repetitive use, habitual behaviors, and recommendations made via word-

of-mouth. The results also illustrated that habitual behaviors could encourage continuous usage and consequently lead to positive word-of-mouth. Habitual use can be a main driver to customers' intention to use contactless payment [73] and through continuous usage, they may intend to recommend the use of such a payment [74]. It seems that for many users, contactless payment use has become a matter of habit. Such habitual behaviors have become part of customers' daily routines and may enhance continuous usage in the post-pandemic era. If users then repeatedly and continuously use the same method to pay, they also tend to say positive things about the service and make recommendations to others to try it out. Furthermore, some studies have suggested that perceived value could be the major driver of behavioral intention [35], and these values can significantly affect customer intentions to use mobile-related banking services [75]; however, our result turned out to be different in this study. Even though we expected that people may intend to reuse the contactless payment if they received a high utility value, economic value and so on, unfortunately, it seems that perceived value is insignificant to people's continued usage of such payment. Nevertheless, perceived value was found to be an indispensable predictor in terms of recommendations made via word-of-mouth, in addition to forming habitual behaviors with regard to contactless payment use. Based on our knowledge, such findings firstly confirm that with higher value perceptions, users may have greater propensity to develop a habit of using contactless payment methods, spreading positive word-of-mouth, and making recommendations to friends or family members. Previously, relationships between perceived value and post-adoption behavior remained relatively unclear. This study may shed more light on this by discussing how perceived value is associated with post-adoption behaviors concerning new payment methods. The above findings also further verified the idea that word-of-mouth plays a vital role in payment technology adoption activities, although this is a variable that has more frequently been investigated in the post-purchasing context.

Finally, we confirmed that although mobile and facial recognition payments shared some similarities in offering a contactless way to pay, their user experience differs significantly from each other. A great deal of studies focused more on adoption of mobile payment rather than facial recognition payment, and almost none of them revealed the differences in user behaviors between mobile and facial recognition payments. By unveiling the behavioral patterns of adopting different payment technologies, this study can also contribute to a more comprehensive understanding of using contactless payments in the post pandemic era. For facial recognition users, perceived ease of use could more strongly impact their value perception, and their continuous usage could have more powerful effects on word-of-mouth. This might be related to the fact that facial recognition payment has reduced restrictions on hardware devices, and has offered people a more efficient and easier way to pay, so customers tend to receive greater value from such usage. With increasing usage, facial recognition payment users might obtain more extensive benefits from using this new method, and they may tend to have a greater propensity to spread positive words accordingly. For mobile QR-code payment users, however, their satisfaction is more influential in terms of word-of-mouth and habitual behaviors, and such habitual behaviors could greatly motivate continued usage. It seems that for QR-code payment users, their user satisfaction and post-adoption behaviors are more strongly correlated when compared with facial recognition payment users. This might be explained by the fact that most QR-code payment users in China have already used such methods to pay for a relatively long period of time, but many facial recognition payment users only started using this new method when we conducted this survey. A lot of facial recognition payment users are still in the early stages of using this new payment technology [23], and perhaps some still have not fully considered using this new method as a part of their daily routine; however, along with convenience and sales promotion, habitual behaviors were regarded as one of the top priorities that may drive individuals to use mobile payment [6].

Therefore, if customers regard contactless payment method as easy to use, convenient, useful, and safe, they are more likely to perceive the technology as having a greater value

and they are more likely to feel satisfied with such payment. Consequently, higher value perception and satisfaction level may activate more post-adoption behaviors. Such post-adoption behaviors of contactless payment may profoundly influence people's consumption activities in the long-term, which will encourage people continuously use contactless payment even after the pandemic. Overall, this study provides further insight into people's behavioral patterns when using contactless payment in society. By comparing the differences between mobile QR-code payment and facial recognition payment, this study also eminently contributes to the understanding of current user experiences in terms of different contactless payment methods.

5.2. Practical Implications

In this study, we investigated the antecedents of customers' perceived value and satisfaction of mobile QR-code and facial recognition payments. The findings revealed that PEOU, PU, and service security are all crucial influences on user satisfaction and perceived value. Managers should ensure that users can easily use contactless payment methods without needing to make extra efforts, and that they can enjoy greater convenience by virtue of such usage. Service providers should also continuously upgrade their payment systems to guarantee transaction safety. If contactless payment is easy to use, convenient, and trustworthy, people are inclined to perceive greater value and feel more satisfied. As a result, they will perhaps habitually and continuously use that method, and even engage in positive word-of-mouth behavior such as recommending others to use it.

According to the group comparison results, for facial recognition payment users, their value perceptions are more likely to be influenced by perceived ease of use and their continuous usage can have more powerful effects on word-of-mouth behavior than mobile payment users. Nevertheless, as facial recognition payment is relatively new to the majority, it suffers from many issues such as risks of exposure of biometric information, system failures regarding recognizing people's faces with masks, and so on. Currently, people still have certain concerns about the prospect of their personal data being stolen when using facial recognition payment technology [10]; thus, it is necessarily important to increase the utility of facial recognition payment, and ensure that personal information is secure during the transaction process. Facial recognition payment service providers should enable users to set their own limitations on transaction amounts. If a large transaction that exceeds a limitation is going to be processed, a private password should be required to complete the payment. Sometimes, facial recognition payment users have to enter their phone number (last four digits) for a second verification stage after scanning, but instead of using a phone number, a password might be more appropriate since others could have access to individuals' phone numbers but not a personalized password. Although facial recognition payment is comparatively easy to use and has brought certain values to users, it is also vital to further address technical problems by increasing facial recognition system accuracy and reducing the incidence of system errors, which, in turn, would improve system efficiency, stability, reliability, and security—consequently, this could encourage continued usage during/after the pandemic and lead to a positive word-of-mouth about use of facial recognition payment.

Another finding of the group comparison is that user satisfaction of facial recognition payment seems to be a less salient driver of word-of-mouth and habitual behaviors, and such habitual behaviors are not able to greatly fuel continued usage; therefore, the relationships among satisfaction and post-adoption behaviors of facial recognition payment tend to be weaker than mobile QR-code payments. Indeed, some respondents mentioned that they preferred to continuously use QR-code payments because it had become a habit for them. Moreover, a few respondents also noted that at the beginning, they were curious about facial recognition payment and thought that such methods could be more convenient; however, after trying this new technology a few times, they switched back to QR-code payment or other methods due to security concerns, system errors, and failures in recognizing faces with masks while using facial recognition payment methods. Thus,

managers may face some difficulties in motivating people's post-adoption behaviors, in terms of changing their habits and maintaining large groups of new facial recognition payment users. It might take longer for people to become familiar with facial recognition payment than expected. Nevertheless, facial recognition payment may be more popular among the elderly, because it is less reliant on the skilled use of smartphones and does not require a password to complete payment. As such, it is more user-friendly for the elderly. A large number of respondents mentioned that their parents learned how to use facial recognition payment even though they had previously experienced difficulties with using QR-code payment. Companies should prepare to consistently promote the use of facial recognition payment not only to the young, but elderly users should also be one of the target groups. In other words, service providers should make long-term plans to ensure payment service quality, market the use of facial recognition payment, enhance the growth of diverse users, and actively work to avoid the prospect of people switching back to mobile payment or other methods. Finally, giant financial service companies such as Tencent (owners of WeChat Pay) and Ant Group (owners of Alipay) have already been the dominant players for both mobile QR-code and facial recognition payment. A lack of competitors might hinder new technology development within the market. To further motivate the use of facial recognition payment in the future, governments should perhaps endeavor to provide adequate technical or financial support to create more opportunities for other financial service companies to develop and commercialize facial recognition technology. Consequently, this may encourage financial service companies to compete more actively to upgrade the current technology and offer a better transaction service.

All in all, currently, QR-code payment might be considered safer and preferred by many, but in fact, facial recognition payment based on biometrics can be more secure than QR-code payment and other mobile phone-based payment technologies [55]. It is probably true that mobile QR-codes will still be the dominant payment method in China for a while, but in the future, if service companies continuously upgrade the facial recognition payment system's efficiency, security, and accuracy, and if governments propose more extensive regulations and laws to restrict the misuse of sensitive data retrieved from facial recognition, this new technology may gradually be accepted by the majority. Facial recognition payment that offers a great deal of convenience by providing a contactless and efficient way to pay might also become extremely popular in other countries.

6. Conclusions and Limitations

In this study, we confirmed that perceived ease of use, perceived usefulness, and service security are vital antecedents of the perceived value of and user satisfaction when using contactless payment. The findings also clarified the correlations among the perceived value, user satisfaction, recommendations made via word-of-mouth, continuous usage, and habitual use. The group comparison results unveiled the differences in user behavior between mobile QR-code and facial recognition payments. We believe that this study offers more information about users' adoption behaviors regarding contactless payment in the post-pandemic era, which will serve to provide valuable insight for scholars and practitioners; however, there are still some limitations, as discussed below:

First, even though we tried to be more inclusive during sampling, most users were still members of the younger generations. In future studies, the sample could be more diverse in terms of age, jobs, and so on. Secondly, we found that some have become used to the method of QR-code payment and it is hard for them to change that habit; during the pandemic, whenever people have had to use facial recognition payment, they have needed to take off their masks, which makes this new method less convenient and efficient; sometimes, the facial recognition system may even fail to recognize users' faces without masks, which could result in an extremely unpleasant experience. As a result, some users tried facial recognition payment a few times, but switched back to other payment methods due to these problems. Such phenomena suggested that user behavior of using contactless payment methods seem to be relatively changeable and dynamic. It also means

that individuals' experiences might differ from time to time since some may switch between different payment methods until they find the best way to pay. It is therefore a significant finding, and scholars should conduct further research to obtain more diverse results. Third, we only discussed QR-code payment in this study, as it is one of the most popular non-contact payment methods in China, but it could be interesting to compare other contactless payment methods with facial recognition payment in the future, which may contribute to a deeper understanding of the current transformation of digital payment services.

References

1. Caminiti, S. Digital payments soared during the pandemic and are here to stay. *CNBC*, 17 August 2021.
2. Arirang News. Non-Contact Face Recognition Payment. Available online: https://www.youtube.com/watch?v=fo-wPKeeaw4 (accessed on 5 November 2021).
3. Dean, S. Forget credit cards—Now you can pay with your face. Creepy or cool? *Los Angeles Times*, 14 August 2020.
4. Daxueconsulting. Payment Methods in China: How China Became a Mobile-First Nation. Available online: https://daxueconsulting.com/payment-methods-in-china/ (accessed on 4 July 2021).
5. Saarinen, J. Mobile payments in China: Why foreign businesses should adopt a strategy. *China Briefing*, 29 August 2018.
6. China Daily. Report: 85% of users paid by scanning QR codes in 2020. *China Daily*, 2 February 2021.
7. People's Daily. Is Facial Recognition the Future of Smart Payment in China? Available online: http://en.people.cn/business/n3/2018/1218/c90778-9529645.html (accessed on 10 October 2021).
8. Alipay. Available online: https://openhome.alipay.com/docCenter/docCenter.html (accessed on 8 October 2021).
9. Lee, A. Alipay rolls out world's first "Smile to Pay" facial recognition system at KFC outlet In Hangzhou. *South China Morning Post*, 1 September 2017; p. 1.
10. Financial News of China. Pay by Your Face, Are You Ready? Available online: https://www.financialnews.com.cn/shanghai/201912/t20191216_173497.html (accessed on 12 October 2021).
11. Greenwell, T.C.; Fink, J.S.; Pastore, D.L. Assessing the influence of the physical sports facility on customer satisfaction within the context of the service experience. *Sport Manag. Rev.* **2002**, *5*, 129–148. [CrossRef]
12. Yang, Z.; Jun, M.; Peterson, R.T. Measuring customer perceived online service quality: Scale development and managerial implications. *Int. J. Oper. Prod. Manag.* **2004**, *24*, 1149–1174. [CrossRef]
13. Amin, M.; Rezaei, S.; Abolghasemi, M. User satisfaction with mobile websites: The impact of perceived usefulness (PU), perceived ease of use (PEOU) and trust. *Nankai Bus. Rev. Int.* **2014**, *5*, 258–274. [CrossRef]
14. Chauhan, V.; Yadav, R.; Choudhary, V. Analyzing the impact of consumer innovativeness and perceived risk in internet banking adoption: A study of Indian consumers. *Int. J. Bank Mark.* **2019**, *37*, 323–339. [CrossRef]
15. Chiu, C.M.; Chang, C.C.; Cheng, H.L.; Fang, Y.H. Determinants of customer repurchase intention in online shopping. *Online Inf. Rev.* **2009**, *33*, 761–784. [CrossRef]
16. Dai, H.; Luo, X.R.; Liao, Q.; Cao, M. Explaining consumer satisfaction of services: The role of innovativeness and emotion in an electronic mediated environment. *Decis. Support Syst.* **2015**, *70*, 97–106. [CrossRef]
17. Jumaan, I.A.; Hashim, N.H.; Al-Ghazali, B.M. The role of cognitive absorption in predicting mobile internet users' continuance intention: An extension of the expectation-confirmation model. *Technol. Soc.* **2020**, *63*, 101355. [CrossRef]
18. Kassim, N.; Abdullah, N.A. The effect of perceived service quality dimensions on customer satisfaction, trust, and loyalty in e-commerce settings: A cross cultural analysis. *Asia Pac. J. Mark. Logist.* **2010**, *22*, 351–371. [CrossRef]
19. Mouakket, S. Factors influencing continuance intention to use social network sites: The Facebook case. *Comput. Hum. Behav.* **2015**, *53*, 102–110. [CrossRef]

20. Bailey, A.A.; Pentina, I.; Mishra, A.S.; Mimoun, M.S.B. Mobile payments adoption by US consumers: An extended TAM. *Int. J. Retail. Distrib. Manag.* **2017**, *45*, 626–640. [CrossRef]

21. Leong, L.-Y.; Hew, T.-S.; Tan, G.W.-H.; Ooi, K.-B. Predicting the determinants of the NFC-enabled mobile credit card acceptance: A neural networks approach. *Expert Syst. Appl.* **2013**, *40*, 5604–5620. [CrossRef]

22. Zhang, W.K.; Kang, M.J. Factors affecting the use of facial-recognition payment: An example of Chinese consumers. *IEEE Access* **2019**, *7*, 154360–154374. [CrossRef]

23. Zhong, Y.; Oh, S.; Moon, H.C. Service transformation under industry 4.0: Investigating acceptance of facial recognition payment through an extended technology acceptance model. *Technol. Soc.* **2021**, *64*, 101515. [CrossRef]

24. Zhou, T. An empirical examination of continuance intention of mobile payment services. *Decis. Support Syst.* **2013**, *54*, 1085–1091. [CrossRef]

25. Zeithaml, V.A.; Parasuraman, A.; Malhotra, A. *A Conceptual Framework for Understanding E-Service Quality: Implications for Future Research and Managerial Practice*; Marketing Science Institute: Cambridge, MA, USA, 2000; Volume 115.

26. Zeithaml, V.A.; Parasuraman, A.; Malhotra, A. Service quality delivery through web sites: A critical review of extant knowledge. *J. Acad. Mark. Sci.* **2002**, *30*, 362–375. [CrossRef]

27. Wolfinbarger, M.; Gilly, M.C. eTailQ: Dimensionalizing, measuring and predicting etail quality. *J. Retail.* **2003**, *79*, 183–198. [CrossRef]

28. Davis, F.D. User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *Int. J. Man-Mach. Stud.* **1993**, *38*, 475–487. [CrossRef]

29. Venkatesh, V.; Davis, F.D. A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Manag. Sci.* **2000**, *46*, 186–204. [CrossRef]

30. Venkatesh, V. Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Inf. Syst. Res.* **2000**, *11*, 342–365. [CrossRef]

31. Wu, H.-C.; Cheng, C.-C. What drives experiential loyalty toward smart restaurants? The case study of KFC in Beijing. *J. Hosp. Mark. Manag.* **2018**, *27*, 151–177. [CrossRef]

32. Lu, J.; Yu, C.S.; Liu, C.; Yao, J.E. Technology acceptance model for wireless Internet. *Internet Res.* **2003**, *13*, 206–222. [CrossRef]

33. Morosan, C. Customers' adoption of biometric systems in restaurants: An extension of the technology acceptance model. *J. Hosp. Mark. Manag.* **2011**, *20*, 661–690. [CrossRef]

34. Hua, G. An experimental investigation of online banking adoption in China. In Proceedings of the 4th Americas Conference on Information Systems, AMCIS 2008, Toronto, ON, Canada, 14–17 August 2008; p. 36.

35. Mou, J.; Cohen, J.; Dou, Y.; Zhang, B. International buyers' repurchase intentions in a Chinese cross-border e-commerce platform: A valence framework perspective. *Internet Res.* **2019**, *30*, 403–437. [CrossRef]

36. Salisbury, W.D.; Pearson, R.A.; Pearson, A.W.; Miller, D.W. Perceived security and World Wide Web purchase intention. *Ind. Manag. Data Syst.* **2001**, *101*, 165–177. [CrossRef]

37. Chiu, Y.B.; Lin, C.P.; Tang, L.L. Gender differs: Assessing a model of online purchase intentions in e-tail service. *Int. J. Serv. Ind. Manag.* **2005**, *16*, 416–435. [CrossRef]

38. Sun, L.B.; Qu, H. Is there any gender effect on the relationship between service quality and word-of-mouth? *J. Travel Tour. Mark.* **2011**, *28*, 210–224. [CrossRef]

39. Kim, H.-W.; Xu, Y.; Gupta, S. Which is more important in Internet shopping, perceived price or trust? *Electron. Commer. Res. Appl.* **2012**, *11*, 241–252. [CrossRef]

40. Lee, D.H. The impact of exhibition service quality on general attendees' satisfaction through distinct mediating roles of perceived value. *Asia Pac. J. Mark. Logist.* **2019**, *32*, 793–816. [CrossRef]

41. Zeithaml, V.A. Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *J. Mark.* **1988**, *52*, 2–22. [CrossRef]

42. Wu, L.-Y.; Chen, K.-Y.; Chen, P.-Y.; Cheng, S.-L. Perceived value, transaction cost, and repurchase-intention in online shopping: A relational exchange perspective. *J. Bus. Res.* **2014**, *67*, 2768–2776. [CrossRef]

43. Huang, C.W.; Tai, A.P. A Cross-cultural comparison of customer value perceptions for products: Consumer aspects in East Asia. *Cross Cult. Manag. Int. J.* **2003**, *10*, 43–60. [CrossRef]

44. Liaw, S.-S.; Huang, H.-M. Perceived satisfaction, perceived usefulness and interactive learning environments as predictors to self-regulation in e-learning environments. *Comput. Educ.* **2013**, *60*, 14–24. [CrossRef]

45. Kuo, Y.-F.; Wu, C.-M.; Deng, W.-J. The relationships among service quality, perceived value, customer satisfaction, and post-purchase intention in mobile value-added services. *Comput. Hum. Behav.* **2009**, *25*, 887–896. [CrossRef]

46. Sullivan, Y.W.; Kim, D.J. Assessing the effects of consumers' product evaluations and trust on repurchase intention in e-commerce environments. *Int. J. Inf. Manag.* **2018**, *39*, 199–219. [CrossRef]

47. Zhao, L.; Lu, Y. Enhancing perceived interactivity through network externalities: An empirical study on micro-blogging service satisfaction and continuance intention. *Decis. Support Syst.* **2012**, *53*, 825–834. [CrossRef]

48. Zheng, Y.; Zhao, K.; Stylianou, A. The impacts of information quality and system quality on users' continuance intention in information-exchange virtual communities: An empirical investigation. *Decis. Support Syst.* **2013**, *56*, 513–524. [CrossRef]

49. Zhong, Y.; Moon, H.C. What drives customer satisfaction, loyalty, and happiness in fast-food restaurants in China? Perceived price, service quality, food quality, physical environment quality, and the moderating role of gender. *Foods* **2020**, *9*, 460. [CrossRef]

50. Ryu, S.; Park, J. The effects of benefit-driven commitment on usage of social media for shopping and positive word-of-mouth. *J. Retail. Consum. Serv.* **2020**, *55*, 102094. [CrossRef]

51. Shiau, W.-L.; Luo, M.M. Continuance intention of blog users: The impact of perceived enjoyment, habit, user involvement and blogging time. *Behav. Inf. Technol.* **2013**, *32*, 570–583. [CrossRef]

52. Shaw, N.; Sergueeva, K. The non-monetary benefits of mobile commerce: Extending UTAUT2 with perceived value. *Int. J. Inf. Manag.* **2019**, *45*, 44–55. [CrossRef]

53. Alalwan, A.A. Mobile food ordering apps: An empirical study of the factors affecting customer e-satisfaction and continued intention to reuse. *Int. J. Inf. Manag.* **2020**, *50*, 28–44. [CrossRef]

54. Globepay. Alipay and Wechat Pay's Facial Recognition in China. Available online: https://www.globepay.co/2020/01/13/alipay-and-wechat-pays-facial-recognition-in-china/ (accessed on 10 June 2020).

55. SinaFinance. Available online: https://finance.sina.com.cn/stock/relnews/hk/2019-10-25/doc-iicezuev4727877.shtml (accessed on 15 December 2021).

56. Digipay. Everything You Need to Know about QR Code Payments. Available online: https://www.digipay.guru/blog/everything-you-need-to-know-about-qr-code-payments/ (accessed on 12 December 2021).

57. Sorensen, E. QR Code Payments—What Is It and How Does It Work? Available online: https://www.mobiletransaction.org/qr-code-payment-works/ (accessed on 10 September 2021).

58. Gefen, D.; Straub, D.; Boudreau, M.-C. Structural equation modeling and regression: Guidelines for research practice. *Commun. Assoc. Inf. Syst.* **2000**, *4*, 7. [CrossRef]

59. Hair, J.F.; Sarstedt, M.; Pieper, T.M.; Ringle, C.M. The use of partial least squares structural equation modeling in strategic management research: A review of past practices and recommendations for future applications. *Long Range Plan.* **2012**, *45*, 320–340. [CrossRef]

60. Henseler, J. PLS-MGA: A non-parametric approach to partial least squares-based multi-group analysis. In *Challenges at the Interface of Data Analysis, Computer Science, and Optimization*; Springer: Berlin/Heidelberg, Germany, 2012; pp. 495–501.

61. Chin, W.W.; Marcelin, B.L.; Newsted, P.R. A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Inf. Syst. Res.* **2003**, *14*. [CrossRef]

62. Fornell, C.; Bookstein, F.L. Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory. *J. Mark. Res.* **1982**, *19*, 440–452. [CrossRef]

63. Hair, J.F., Jr.; Hult, G.T.M.; Ringle, C.; Sarstedt, M. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*; Sage Publications: Newbury Park, CA, USA, 2016.

64. Thompson, R.; Barclay, D.; Higgins, C.A. The partial least squares approach to causal modeling: Personal computer adoption and use as an illustration. *Technol. Stud.* **1995**, *2*, 284–324.

65. Bagozzi, R.P.; Yi, Y. On the evaluation of structural equation models. *J. Acad. Mark. Sci.* **1988**, *16*, 74–94. [CrossRef]

66. Fornell, C.; Larcker, D.F. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]

67. Ha, Y.; Im, H. Determinants of mobile coupon service adoption: Assessment of gender difference. *Int. J. Retail. Distrib. Manag.* **2014**, *42*, 441–459. [CrossRef]

68. Venkatesh, V.; Thong, J.Y.; Xu, X. Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Q.* **2012**, 157–178. [CrossRef]

69. Okumus, B.; Bilgihan, A. Proposing a model to test smartphone users' intention to use smart applications when ordering food in restaurants. *J. Hosp. Tour. Technol.* **2014**, *5*, 31–49. [CrossRef]

70. Henseler, J.; Ringle, C.M.; Sinkovics, R.R. The use of partial least squares path modeling in international marketing. In *New Challenges to International Marketing*; Emerald Group Publishing Limited: Bingley, UK, 2009.

71. Turel, O.; Serenko, A. Satisfaction with mobile services in Canada: An empirical investigation. *Telecommun. Policy* **2006**, *30*, 314–331. [CrossRef]

72. Karjaluoto, H.; Shaikh, A.A.; Saarijärvi, H.; Saraniemi, S. How perceived value drives the use of mobile financial services apps. *Int. J. Inf. Manag.* **2019**, *47*, 252–261. [CrossRef]

73. Karjaluoto, H.; Shaikh, A.A.; Leppäniemi, M.; Luomala, R. Examining consumers' usage intention of contactless payment systems. *Int. J. Bank Mark.* **2019**, *38*, 332–351. [CrossRef]

74. Suyunchaliyeva, M.M.; Nautiyal, R.; Shaikh, A.A.; Sharma, R. The Use of Mobile Payment Systems in Post-COVID-19 Economic Recovery: Primary Research on an Emerging Market for Experience Goods. *Sustainability* **2021**, *13*, 13511. [CrossRef]

75. Karjaluoto, H.; Glavee-Geo, R.; Ramdhony, D.; Shaikh, A.A.; Hurpaul, A. Consumption values and mobile banking services: Understanding the urban–rural dichotomy in a developing economy. *Int. J. Bank Mark.* **2021**, *39*, 272–293. [CrossRef]