Usability and User Experience, Vol. 39, 2022, 288–296
https://doi.org/10.54941/ahfe1001719

Usability Study on the User Interface Design of Mobile Payment Applications

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ABSTRACT

Human consumption behavior has entered the digital age, and the payment methods have also emerged with different new styles. However, whether the new digital payment user experience meets the user's expectations is a question worthy of discussion. Three commonly used digital payment applications, i.e., Line Pay, PayPal, and WeChat Pay, were selected for this study. The experimental device was an iPhone X cell phone, and the convenience sampling method was adopted in this study. A total of 34 participants aged 18-28 were invited to take part in the experiment. The experiment recorded the time spent on each task and the results of completing the System Usability Scale (SUS) questionnaire after the task was performed. One-way ANOVA was used to determine the variance, while observational methods were used to observe the operating conditions of the participants. The results of the study were as follows: (1) The balance should be displayed at the first page, and the best way to display it is by "$" plus the amount of money supplemented by text. (2) QR Code payment is suitable for small amounts and quick payment. For large amounts, users should set up the correct payment recipient and follow the steps for more peace of mind. (3) The initial operation of the payment and receipt function should be integrated into a single function button or page, using the same operation mode, but using a different background page color, so that users can easily identify the current operation procedure as payment or receipt. (4) The setting function can be set on the top left of the home page, with the gear icon or avatar as the relevant design. (5) The design of the transaction history function can be combined with the balance display to provide sufficient information for users to operate, and it is not recommended to set the balance inquiry function in more than three pages or steps of the operation procedure. (6) Digital payment platform can integrate with other industry's services to generate more functions. (7) The functions are displayed in blocks, which will increase the operation time for users with no user experience. The results of the study can be used as a reference for digital payment platform and software design industry and designers and researchers

Keywords: Interface usability, Mobile payment application, System usability scale (SUS), Usability evaluation

INTRODUCTION

Due to the expansion of technology and usage areas, mobile payment has become popular in many countries and areas. It also encourages strong growth in global mobile payment market (Turban et al., 2018). The digital payment market has attracted many giant companies such as Google,

Apple, PayPal, etc. to enter the market (Santos et al., 2017). Many European countries and mainland China are vigorously promoting mobile payments, allowing digital financial services to flourish. Mobile payment is defined as the use of wireless and other communication technologies to conduct transactions for goods or services using mobile devices (Dahlberg, Guo, & Ondrus, 2015). Digital payment extends to every step of the consumer experience and provides room for diversified development of online and offline consumption. In the past, we have focused more on the technical and user-oriented aspects of the study (Dahlberg et al., 2015). However, there are still many problems with digital payments that need to be overcome, especially in terms of security issues and fraudulent transactions (Santos et al., 2017). The increased functionality and performance of cell phones and the increased complexity of software is a challenge for users (Da Costa, Canedo, De Sousa, Albuquerque, & Villalba, 2019). The purpose of this study examines the ease of use of digital payment software for cell phones. Among the many mobile payment applications (app), three representative digital payment apps were selected, namely PayPal, Line Bank and WeChat Pay, for further investigation. The results of the study can be used as a reference for digital payment industry, designers and researchers.

The Three Samples of Payment Applications

The three tablet payment App interfaces are shown in Table 1. PayPal: It is the preferred payment platform for many international traders, with cross-currency transactions and a good arbitration mechanism. If there are any consumer disputes, the platform will help both parties communicate and avoid fraudulent transactions. Line Bank is a payment tool under Line, a communication application, which offers free points as a promotion incentive. Line points can be converted into physical purchases or exchanged for stickers of communication application. WeChat Pay is a widely used communication application in mainland China, and its WeChat Pay is often used by people in mainland China as well. It not only has communication function, but also has social media function.

METHODS

The experiment was conducted mainly in quantitative manner, supplemented by qualitative investigations. The quantitative part included users' task performance and the questionnaire of System Usability Scale (SUS). The qualitative part includes post experiment interview and observation.

Participants, Experimental Tools and Procedure

A total of 34 participants ($M = 20.53$, $SD = 2.33$) were invited to take part in the experiment by using a convenience sampling method. They were all between 18 and 28 years old. The experimental period is from November 29th to December 21th, 2021. The operation was conducted by using an iPhone X. The experimental environment is free of interference and with well illumination in a university classroom. The experimental data were collected by Google forms.

Table 1. The three payment App samples for the experiment.

APP type	Sample 1: PayPal	Sample 2: Line Bank	Sample 3: WeChat Pay
Sample image			

The experimental design adopts a one-way ANOVA design. Before the experiment, the content of each task was clearly described to the participant. The tester records the task operating time, and participants must fill in the questionnaire of System Usability Scale (SUS) after all the tasks were completed.

Experimental Tasks

About the task design, in order to understand whether a user can operate the functions of the user interface when using the payment App, the task design is based on the main functions of each payment App. In the end, five tasks were planned for the experiment. The aim of the task design and its operation method are explained as follows:

Task1: Balance Inquiry

PayPal: Login from the App page, and Face ID will be displayed on the main page after recognition. There is no need to click any button or switch pages

Line Bank: After entering from the Line App and Face ID will perform recognition, the user will enter the main screen of Line Bank and the balance amount will be displayed on the main page.

WeChat Pay: After clicking icon and no identity verification, the user clicks on "Me" in the toolbar below, switch to the Pay page, and then click Wallet to enter the "Wallet" page, the balance will be displayed. The user can click again on the balance item to create a unique balance screen. In this screen, the user can also make deposits, withdrawals, and check the details of past transactions.

Task2: Payment

PayPal: On the main screen, click on the "$" symbol in the toolbar below, "Pay" and "Receive" will appear. The user can also use the search tool to find the recipient. After selecting the payee, the payment page will be created. After entering the payment amount, the user will enter the payment page and attach all the payment information to it, and then click the "Send" button

below to complete the payment task. There are six pages in total (including a confirmation page). In the PayPal payment and receipt function, the user must set the recipient as a contact person or enter his/her email address to make a payment or receipt. The recipient must also apply for a PayPal account in order to make a digital transaction.

Line Bank: Click on the two-way arrow symbol at the bottom right of the balance to switch to the payment selection page. The payment recipient can choose three payment methods, namely contact payment, bank account payment, and QR Code transfer. This task is designed to use the contact payment method. Click on it and switch to the select friend page, then the amount input page will appear. Enter the amount and click on the "Next" button, and the "Payment" button will appear at the bottom of the new page. In the end, click on it to complete the payment process. A total of six pages will be switched to complete the payment task.

WeChat Pay: After the Pay function button, enter the Pay page, and click on Receive and Pay. Then click the merchant payment option to generate the QR code and the successful scan screen appears. In total, the user will go through four pages.

Task3: Receipt

PayPal: Click the "$" symbol in the toolbar below, select "Receive," and then select the recipient. If the recipient is not on the page, the user can use the toolbar above to "Search" to send a request to the recipient and enter a text message to the recipient on the same page.

Line Bank: It is the same as the payment task, except that the user can click the "Receive" option on the main menu. The rest of the steps are the same as the payment process.

WeChat Pay: Select the "Pay" function button on the main page, enter the "Pay" page, click "Receive Payment", and then select "QR Code Receipt" after clicking on the "QR Code" button. A receipt barcode will be generated. After entering from the main page, the user will need to click three times to enter the third page.

Task4: Finding the Setting Function

PayPal: The setting function is placed in the top left of the avatar. After clicking on it, there will be a sub-category, and the user only needs to click once on the top left image of the person to switch between the two pages.

Line Bank: Click on the image on the top left to enter the personal information area. The "Settings" icon appears on the far-right side of the page. The user can click on it to adjust the relevant settings.

WeChat Pay: The "Settings" at the bottom of the Pay page will display all the setting functions when the user clicks on it. The user only needs to press the button once and switch between the two pages to display the setting functions from the main screen.

Table 2. Five tasks of operations and proposes.

Task	Content	Proposes
1	Balance inquiry	Find out how many balances are available
2	Payment	Payment using several platforms
3	Receipt	Receive money using several platforms
4	Finding the setting function	Customization and parameter adjustment are required for medium and heavy users
5	Querying past transaction records	Users have a need to understand past purchases and payment records

Task5: Querying Past Transaction Records

PayPal: The user can click on the right button in the lower toolbar, and the upper toolbar will show the "Transaction History" option which will display the transaction history.

Line Bank: Click on the balance block on the main screen to display the transaction history.

WeChat Pay: On the main page, click "Pay", and then click "Wallet" to enter the wallet page. The "Bill" option will be displayed on the top right corner, and the user can check the past transaction history. The user can also click "Balance" to enter the balance page and click the "Change Details" button in the upper right corner to view the transaction details. The second path is four pages and four clicks.

The five operational tasks and the purposes of these task designs are summarized (see Table 2).

Statistical Tool and Questionnaire

When the participants operated the tasks, the tester recorded each of their task completion time. After the operation is completed, the participants were asked to fill in the questionnaire of System Usability Scale (SUS). The SUS is divided into ten Questions. There are five positive questions and five negative questions designed with a Likert five-point scale. The participants' task completion time, the records of the SUS were analyzed by the one-way analysis of variance (ANOVA). When the participants operated the tasks, the tester would also observe the participant's response pertinent to each task and conduct post experiment interview with some participants. The content of the interview is about the task satisfaction of the experiment procedure and the advantages and disadvantages of each user interface. The participants were also encouraged to provide functional improvement suggestions.

RESULTS AND DISCUSSIONS

The Results of Task Completion Time

In the results section pertinent to task completion time, four of the five tasks were found to be significant by one-way ANOVA, namely Task 1, Task 2, Task 4, and Task 5. That is, the one-way ANOVA result of Task 1 revealed significant difference amount the three Apps ($F = 4.49$, $P = 0.019 < 0.05$).

Table 3. The one-way ANOVA results of all five tasks (in second).

	PayPal M(SD)	Line Bank M(SD)	WeChat Pay M(SD)	F	P	Post Hoc (LSD)
Task1	5.59 (4.77)	12.86 (7.65)	15.46 (11.21)	4.49	0.019*	PayPal > Line Bank=WeChat Pay
Task2	25.84 (13.45)	28.80 (4.80)	8.61 (2.54)	17.88	0.00*	WeChat Pay > PayPal = Line Bank
Task3	11.60 (4.92)	18.84 (11.86)	11.37 (5.88)	3.09	0.06	
Task4	4.83 (2.72)	8.60 (3.19)	3.02 (0.80)	14.59	0.00*	PayPal = WeChat Pay > Line Bank
Task5	5.57 (3.19)	20.88 (22.06)	55.03 (24.40)	20.64	0.00*	PayPal = Line Bank > WeChat Pay

*Significantly different at $\alpha = 0.05$ level (*P < 0.05).

Among them, participants task performance of the PayPal (M = 5.59, SD = 4.77) is better than the Line Bank (M = 12.86; SD = 7.65) and WeChat Pay (M = 15.46; SD = 11.21). In addition, the one-way ANOVA result of Task 2 illustrated significant difference amount the three Apps (F = 17.88, P = 0.000 < 0.05). More specifically, participants' task performance of the WeChat Pay (M = 8.61, SD = 2.54) was better than PayPal (M = 25.84, SD = 13.45) and the Line Bank (M = 28.80, SD = 4.80). For Task 4, the results were significantly different (F = 14.59, P = 0.000 < 0.05). Participants' task performance of the PayPal (M = 11.60, SD = 4.92) and WeChat Pay (M = 11.37, SD = 5.88) was better than Line Bank (M = 18.84; SD = 11.86). In Task 5, the results were significantly different (F = 20.64, P = 0.000 < 0.05). Participants' task performance of the PayPal (M = 5.57, SD = 3.19) and Line Bank (M = 20.88, SD = 22.06) better than WeChat Pay (M = 55.03; SD = 24.40). There was no significant difference among the results of Task 3 (F = 3.09, P = 0.06 > 0.05)

The results generated from the one-way ANOVA of all the five tasks are shown in Table 3.

The System Usability Scale (SUS) Result

The SUS is a fast and low-cost scale with a total of ten questions using the 5-point Likert scale. There are five positive questions and five negative questions, and the score ranges from 0 to 100(Brooke, 1996). The SUS items have been developed according to the three usability criteria defined by the ISO 9241-11: (1) The ability of users to complete tasks using the system, and the quality of the output of those tasks (i.e., effectiveness), (2) the level of resource consumed in performing tasks (i.e., efficiency), and (3) the users' subjective reactions using the system (i.e., satisfaction)(Borsci, Federici, & Lauriola, 2009). In the SUS, there was no significant difference in the results of the one-way ANOVA, with mean values of 79.38 for PayPal, 72.50 for Line Bank, and 65.45 for WeChat Pay. The participants viewed the usability all three Apps were in the marginal level(Bangor, Kortum, & Miller, 2009).

DISCUSSIONS

In the balance inquiry section, PayPal is displayed in the center of the page, using the "$" symbol with the amount. A text shows below the amount, which is the best display among the three samples, while Line Bank uses a color block with the "$" symbol and the amount. Line Bank uses a color block with the "$" symbol and the amount of money, but this design can still cause confusion for those who do not have any user experience, as it is not clear whether the amount of the last transaction or the balance is displayed. WeChat Pay has designed the balance display in the third subpage, so it takes time for those who do not have user experience to find this function.

In the payment task, WeChat Pay simplifies the payment process by using QR Code for all transactions, while PayPal and Line Bank need to select the user and then enter the amount when using the general payment function. However, this method is not suitable for all kinds of transactions, especially for cross-border payment and collection activities.

In the money receiving task, PayPal and Line Bank have the same operation steps as the payment process, including the user interface configuration and button position to maintain the same consistency with the payment process, while WeChat Pay also adopts the same steps as the payment process, with the payment function set to the default value and the payment display area occupied nearly 1/2 of the screen display, allowing users to focus on the payment function and ignore the receiving. The function button is set below the payment button, which affects the speed of operation tasks. It is recommended to differentiate the background color of payment and receipt and add a confirmation button or page. It is also recommended to adopt PayPal's design concept of using the "$" icon to integrate the functions of payment and receipt, so that users will not think that the larger area or button is the default value and misunderstand that it cannot be adjusted or modified.

PayPal is set at the top left of the home page, and the setting function is displayed by clicking the candidate icon. However, the multi-level setting affects the operation performance, and the frequency of adjusting the setting is determined by the user's usage habit. On the contrary, if users do not use the payment platform App frequently or tend to adapt to it without adjusting to personalized settings, the chance of using this function is relatively low. PayPal has set the transaction records in the integrated function area at the bottom right of the main page, and the "Transaction Activity" option will appear after clicking on it. This design is convenient, but it has no meaning and users still need to test it to find it. The second path is the "bill" text icon displayed at the top right of the wallet page, and the user can see the transaction history after clicking on it. It is recommended that the text language can be displayed consistently and that icon images can be used for the convenience of users from different cultural backgrounds.

WeChat Pay payment integrates many functions, and the button options are mostly text descriptions, which can be easily confused for users with different cultural backgrounds, so it is suggested to use graphic design to help users with different national backgrounds to operate. Line Bank uses a block design to provide payment by friend account, bank account, and QR Code

scanning payment, with multiple payment methods. WeChat integrates multiple functions, and WeChat Pay is one of the functions under WeChat Pay. WeChat Pay may have too many layers of design, and most of them use text to explain the function of the button.

CONCLUSION

According to the above discussion, the authors can generate the following analysis and improvement points: (1) For the balance display, the "$" symbol with Arabic numerals can be used in the money display and supplemented with text descriptions, which is more in line with the user's mental models. (2) The balance should be displayed at the top of the page for easy reference. (3) QR Code is the fastest way to receive and pay, which is suitable for small amounts and needs to be fast, while large amounts should be paid by setting up a contact person and then entering the information step by step, which can give users more peace of mind. (4) The background of user interface should be separated by setting different background colors but using the same operation mode to distinguish between receiving and paying. (5) The design of Line Bank can be used with supplemented instructions on how to generate transaction history after clicking or provide a separate icon or button at the bottom of the home page so that users can quickly find the function, especially it is not recommended to set the page or function under more than three pages or levels. (6) PayPal and Line Bank have block design for some functions, which may cause confusion to users without user experience and increase the time to figure out (Norman, 2013). In terms of the follow-up work and future suggestions, the digital payment App should provide multiple payment and receipt methods for the convenience of users with different usage habits. The payment buttons should be designed graphically so that users with different cultural backgrounds can understand the meaning of each function button more quickly. Using the research results as reference, the authors will redesign the user design interface for further investigation and compare with other mobile payment Apps by increasing the sample size, adding user experience or other variables, e.g., testing different mobile payment Apps or users of different cultures, and designing and testing the security pages of Apps.

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