Research on Interactive Design of Mobile Payment Based on Embodied Cognition

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Abstract. The purpose of interactive design is to achieve good usability and user experience, that is to say a good interactive design not only to help users achieve the basic operation, but also in the interactive process allows users to have a positive emotional experience. Because the usability and user experience focus on the direction is not consistent. Definition and evaluation criteria are different, which in many cases, the interaction design is difficult to meet the consistency of the two. Thus, the theory of Embodied cognition theory in psychology can provide an opportunity to establish a unified usability and user experience. Based on the current cognitive psychology of new orientation of Embodied cognitive research progress, combined with the development trend of mobile payment in recent years. The relationship between usability, user experience, and Embodied cognition is analyzed experimentally by interacting with the payment form. The discovery of usability and user experience is based on the cognitive orientation of the implicit measurement method and the traditional assessment of the design method of continuous iterative design evaluation. According to the idea of cognitive design, combined with people-centered design ideas, proposed to build a process based on specific cognitive payment form interaction. The biggest characteristic of this process is to unite the evaluation criteria of usability and user experience for the purpose of cognitive design, which lays the foundation for the establishment of systematic and scientific cognitive mobile interactive design method. Finally, our practical experiment applies the theoretical method of mobile interactive design based on cognitive knowledge and proves the availability of the method.

Keywords: Interactive design · Embodied cognition · Mobile payment · User experience · Usability assessment

1 Introduction

1.1 Hand-Held Mobile Payment Development

With the use of mobile phones as the representative of the mobile terminal more and more widely used, people in the mobile side to complete the complex payment opportunities are more and more, the payment form of the mobile side is more important than the design of the payment form at the web end. At the same time, due to the limitation of the screen size, the mobile payment form is more complicated than the

design of the web-side payment form. It is necessary to study the actual needs and difficulties of users when interacting and interacting with the interface design. In the process of developing software, a large amount of payment form pages did not do well in the transformation between needs and demands. The theoretical research and application of the interactive design of payment form does not keep up with the changes and development of consumer psychology and behavior. There is a lack of experience in interaction and user operation, therefore even with ultimate product functionality and visual richness, the product is still not qualified in terms of ease of use and order volume.

1.2   Forms of Interaction and Embodied Cognition Links

This article will proceed from the Embodied cognition point of view, to explore the use of people in the process of behavior and cognitive relationship. The core of Embodied cognition is the integration of perception, action and thinking process, cognitive thinking can not be separated from the sensory and behavioral processes, and behavior is the one that constitutes the understanding and cognition of the product, only from the user's needs, user-centric, through the analysis and study, improve the user experience, allowing users to use the product in the process of pleasure and value, in order to allow mobile payment really into the user's life. Embodied cognition emphasizes the importance of the body in the process of human cognition and gives the pivotal role and decisive significance of the body in the process of human cognition.

2   Analysis of User Requirements for Offline Payment Forms

The APP called "Illegal search assistant" is a necessary illegal information query tool. It helps owners check the violation record easily. To avoid overdue processing of illegal penalties caused by unnecessary losses. Payment form is the most important part in this APP, directly related to the query function behind the conversion of the order transaction is completed, so use APP as the carrier, to do research of form user requirements.

Analysis of user requirements was conducted through a questionnaire survey, understand the user distribution group, establishment of user model. First, segment the overall target market to identify the target audience, and conduct qualitative research.

User Research. In order to qualitatively study, we divided the age, professional, education, occupation, vehicle life, online proficiency and so on, and then integrated the data to find out the most closely related groups. The questionnaire was distributed in 100 cases, the age group is mainly divided between 18–25, 26–35, 36–45, 45–55, 56–65, 20 copies of each age level, 96 questionnaires and 96 valid questionnaires. According to the questionnaire results, we found that the use of specific categories of APP category of people mainly concentrated in the 26–45 year-old crowd, the age group of people using the product frequency was significantly higher than other age groups. According to the frequency of product use and related products familiarity. 67% of users have their own clear needs to pay proficiency on the Internet, They are

our main target groups; About 21% of users have a certain frequency of use and to meet their use of the scene will produce a corresponding payment behavior, optimize the potential users of products that can attract them; Leaving 12% of the users are independent users, the product associated with the use of low frequency. The target age in our target group is distributed at 25–45 years of age. The target age in our target group is distributed at 25–45 years of age. According to the age distribution, the target user occupies mainly for the enterprise white-collar workers, business organizations, private owners. The user model is clear and established, 25–35 year old enterprise white collar, 36–45 year old business staff and private owners.

3   Body-Based Assessment and Research Based on Embodied Cognition

Embodied cognition theory holds that physical experience is the basis of human cognitive activity. The body schema theory studies the unconscious adaptation of body posture and body movement. Human body structure and perceived behavior will affect and shape their cognition. Hand-held mobile terminal for the user is outside the body of things, people through their own body to understand the hand-held mobile terminal, but also by it to influence and shape their own, resulting in new cognitive and emotional. Accordingly, I have done the following experiment, observe the interaction between body schema and form interface.

3.1   Evaluation of the Experiment

The main elements of the form include the label text, pop-up window and the process of three buttons, before the experiment, according to the mobile side of the form of the arrangement to establish three different elements of the model. Set up five forms of labels that are different but have the same content. The category is "Top alignment", "Right alignment", "Left alignment", "Input box alignment", "Mixed alignment" five models (as Fig. 1); Create three button prototypes (as Fig. 2), the category is "prototype of suspending the middle button", "prototype of buttons appearing at the bottom of the right", "prototype of buttons appearing at the bottom of the right". Establishment three kinds of shells prototype (as Fig. 3), "Centered modal pop-up", "top discoloration
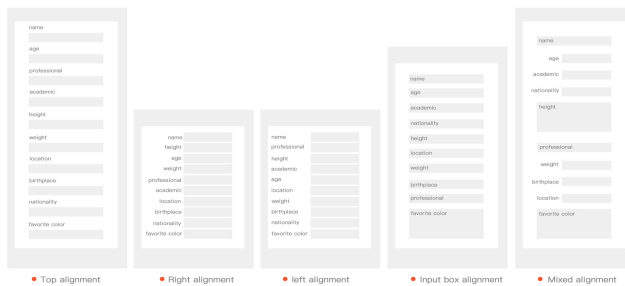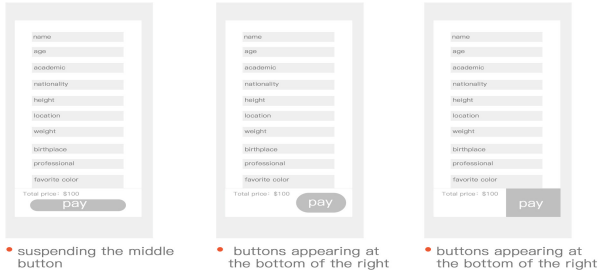

Fig. 1.   Five models
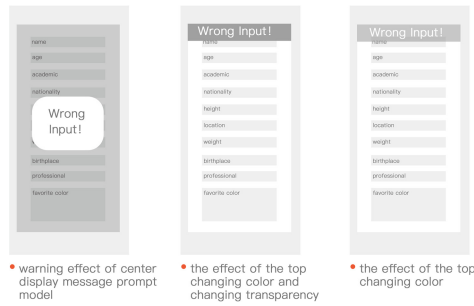
Fig. 2. Three button prototypes

Fig. 3. Three kinds of shells prototype

pop", "top discoloration and transparency pop". According to the experimental data collection comparison, to find the relationship between Embodied cognition and form interaction.

1. Number of tests: 30
2. Personnel requirements:

- Owners of vehicles with private owners, corporate white-collar workers and staff
- Age between 25–25 years old
- Users who have had access to the experience of illegal operations, including those who have experience with others and those who have no fee experience.

3. Test method:

- The first part of the test fill out the form, five form prototypes appear in turn;
- The second part of the test button click, the three button prototype in turn;
- The third part of the test window message, three kinds of pop-up prototype in turn;
- Record the time taken by each prototype to complete the steps and user steps to interact with the prototype.

3.2   User Interviews and Questionnaires

The interview was conducted on five prototype prototypes, three button prototypes, and three pop-up prototypes. The author creates a questionnaire based on the steps of the user's operation and collects the data for statistics.

3.3   Data Collection and Analysis

Test Part. The first part of the test length data shows operation part, the longest time consuming of adjusted data is 01:11. 45, which is form model aligned with the label entry box. The shortest is 00:55. 71, which is form model top-aligned with label. The reverse order of the reverse type is the most serious when the user enters the in-put box alignment and mixes the alignment form, the number of non - continuous fillings up to 4 times and 2 times. Test the first part of the synthesis of two indicators to give users a clear view of the line and efficient filling experience is mainly the top alignment and right-aligned label form prototype.

The second part, the longest time consuming is 00:01. 51, which is prototype of suspending the middle button. The shortest is 00:00. 37, which is prototype of buttons appearing at the bottom of the right. Invalid clicks of suspending the middle button is the most which up to 2 times. The third button–prototype of buttons appearing at the bottom of the right is the shortest time-consuming and the most precise.

The third part, the longest time-consuming of pop-up box is 00:03. 13. this model of pop-up box is top discoloration message. Middled modelized window consumes the shortest time—00:00. 81.

Interview and Questionnaires. In the course of interview and questionnaires, according to Interview information and questionnaire data, we have the following findings:

In the first test part, testers show satisfaction with the indicators are relatively high of the left alignment label model. 63% of the testers considers the longest time-consuming part is top alignment model. Testers think the form information is more than others (in fact, the content is the same, just the labels appear in different order). 53% of the test considers that right-aligned prototype is the most uncomfortable arrangement of the vision. 56% of the testers considers that input box label model repeat the highest number of clicks. Most of testers think that the label content will disappear to increase the memory burden after clicking on the input box. The testers mentions less of the description of mixed label model.

In the second test part, 56% of the testers think that suspending the middle button is the most usable. The given reason is more recognizable. 26% of the testers suggest that buttons full appearing at the bottom of the right is easier click. Few testers refer to the second button prototype.

In the third test part, 76% of the testers think warning effect of center display message prompt model is strongest. But most of them suggest that model presentation

will make people do not know how to close the tips and believe that the interface jumps mistakenly. 16% of the testers think that the effect of the top changing color and changing transparency is strong. 7% of the testers think that the effect of the top changing color is strong. In the course of interview, one of the testers indicates that he found the prompt message by looking for tips in the test of only color changing on the top. after further inquiries, we recognized that this tester is hypochromatopsia who can not distinguish similar colors.

Data Comparison. By comparing the two parts of the data, we find that most of the two parts of the data is consistent, but also a small part of the difference.

In the first part of the test data, testers' cognition about "aligned label entry box form model" are basically same in the interview and after interview, reflecting the problem of poor availability. The top-aligned label model is quite different which is the least one in the test, But because of its label arrangement led to the form is too long, resulting in the examination of the differences in testers' judges. Reverse to fill the situation is more serious in mixed alignment form, and users haven't realized the problem about complex browsing line reflected in the test.

In the second part of the test data, prototype of button suspended in the middle which is the most time-consuming and invalid clicks in the test is the most usable button in questionnaires. The ease of use reflected from actual operation and subjective feedback have a big difference.

In the third part of the test data, feedback data in the test and after the test are basically same. But feedback data from the second and third model which just differ from transparency have a difference. We also find the existence of hypochromatopsia in qualified test crowd during the latter part of the interview. Distinguishing these groups in prototype will make it more usable, and this is what we haven't take into consideration before test.

Summary. According to a comparative analysis of the data before and after the test, we discover that using implicit measurement method based on embodied cognition to assess increased reliability of design evaluation. Traditional design evaluation methods such as Observation, interview, copywriting, heuristic evaluation, usability test, questionnaire survey, card collection, and etc., can only assess the explicit behavior based on consciousness and hardly touch the embodied cognition in the interaction process between user and system. embodied cognition evaluates cognition behind behaviors by implicit measurement method, and explore the users' embodied cognition processing process. Comparing with traditional explicit behavior measurement, it increased reliability of design evaluation and provided an new interactive design process from user research to embodied test to awareness - based explicit assessment. The new interactive design process of payment form based on embodied cognition increased availability of mobile payment forms.

4 Optimization and Evaluation on Interactive Design of Mobile Payment Based on Embodied Cognition

Based on the cognitive-based implicit test combined with traditional knowledge based explicit behavioral data analysis mentioned above, the form tag is positioned and sort as "left alignment, supplemented by mixed arrangement", the process button is selected as "bottom right button", and message prompt mode is selected as "center dialog box".

4.1 Optimization Design

We have evaluated the original form interaction based on the above-mentioned cognitive approach, applied new analysis on the comparison of data and information, improved the way of interaction for different scenarios, also combined with the above test on the mobile payment form positioning thinking, and then deigned a new form of interaction.

4.2 Experiment Evaluation

Re-evaluate the new form with a method based on cognitive method of implicit measurement and traditional assessment design, combined with the two assessments, information for pre-test and post-test feedback is collected to visualize the integration. Re-compare the original form interface and optimize the page information data, we have clearly found that iterative design optimization of the form through the cognitive-based interactive design process, two assessments of availability data and information, significantly has more positive response than the original interface.

5 Conclusion

Overall, the cognitive and interactive cognitive design theory of the unified usability and user experience evaluation criteria provide a new direction for the interactive design of the system to establish the scientific theory and methods. In any one of a individual-centered interactive design process, design evaluation is the most significant element. In the past, usability and user experience was examined through measuring user's explicit behavior, thus often lead to inconsistencies and even contradictory conflict between multiple evaluation criteria.

Based on the theory of cognitive design, our paper puts forward the evaluation process of comprehensive evaluation standard with explicit index and explicit consciousness for users, we then accomplished and set standards to implement the harmonization of usability and user experience evaluation, and then build upon this core element to create a specific cognitive interaction design process. Finally, improve the design process through the mobile side of the illegal query payment interface, through a iterative design process for comprehensive evaluation of hand movement trajectory data and user's explicit awareness data. Effectively, not only improve the availability of

mobile payment forms and provide a more objective basis for judgments on its availability, but also brought a new vision to the payment form of interactive design research, which makes the validity of the theory and method of cognitive design.

In the future, we will also use the theory and method of cognitive interaction design to more applications, and strive to achieve continuous improvement and development in real practice.

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