Intelligent Human Systems Integration (IHSI 2023), Vol. 69, 2023, 936–945
https://doi.org/10.54941/ahfe1002919

A Comparative Study on User Experience of Four Apps for Renting House Based on D-Lab Eye-Tracking Experiment

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ABSTRACT

This study uses objective physiological measurement and subjective user evaluation methods to compare and study the user experience of four representative rental apps. Fifteen participants were required to complete the task of renting apartments by using four apps according to the set task conditions. In this experiment, D-LAB experimental platform was used to record real-time video of participants' interactive behaviors and track their eye movements. After the experiment, participants' subjective evaluation of APP use experience was recorded by interview. Finally, this paper compares and analyzes the four apps from two aspects of interactive process and interface layout design, and puts forward optimization suggestions, which provides reference value for the design of similar apps.

Keywords: Apps for renting house, User experience, Eye-tracking, Interactive process, Interface layout design

INTRODUCTION

The popularity of mobile Internet and the application of big data and artificial intelligence technology have brought new development opportunities for the online rental industry. A large number of rental apps have rapidly occupied the market. Rental apps can reasonably match the housing information with the needs of tenants and help them to screen and reserve housing in real time. Therefore, users' demand for products has gradually changed from satisfying basic functional needs to providing good user experience (Lu et al. 2013).

To put it simply, user experience refers to the subjective psychological feelings generated by the use of a product or service. User experience design aims to improve product experience and focuses on user behavior and usage design, rather than making users learn how to operate based on product operation principles (Li et al. 2005). As a product developed for the purpose of searching housing resources, the evaluation of the interactive performance of mobile rental APP is an important content in the field of mobile rental research. Some scholars have carried out researches on the theoretical and

practical aspects of mobile rental APP user experience. The following will review the existing research from these two aspects.

Theoretical Research on Evaluation Indexes of Mobile Rental APP

Xie et al. took the thought of cognitive psychology as the theoretical basis to explore the feasibility and advantages of cognitive psychology in the design of mobile rental App. The paper analyzed the cognitive characteristics of the perception system, control system, memory system and response system of brain information processing, and concluded that the application scope of cognitive psychology in the design of mobile rental App mainly includes the following: Consistency, user orientation, fault tolerance, aesthetics, ergonomics (Xie et al. 2019).

Practical Research on the Evaluation and Design of Mobile Rental APP

Xu et al. studied the four frequently used rental apps: Ziroom, Airbnb, Anjuke and Xiaozhu, and compared the advantages and disadvantages of the four apps from the aspects of user positioning, main functions and interactive experience (Xu et al. 2019). In view of the rental problems of college graduates, Tang proposed that the user experience could be improved from two aspects of "reducing the burden for users" and "optimizing product details". In addition, market research and user demand analysis were conducted according to the design objectives, and product information architecture, task flow design and interface visual design were completed (Tang, 2017). Xu took the overseas rental platform for overseas students as the design subject, summarized the advantages and disadvantages of the current popular products in the market, and finally established a general O2O rental platform, optimized the user browsing efficiency and operation process, and provided a reference direction for the design of similar products (Xu, 2019).

It can be seen that few scholars have conducted in-depth studies on the user experience of rental apps based on physiological experiments, and eye movement technology can provide strong support for the user experience evaluation of mobile apps. Dewi et al. used the eye tracker to obtain the eye movement data of the elderly, including fixation times and duration, and analyzed the interface design of Grab's online traffic application (Dewi et al. 2020). Zhou et al. selected four typical mobile applications of social services for the elderly to evaluate the impact of interface design on task performance of the elderly based on data such as fixation duration and pupil diameter change by combining eye movement measurement and subjective evaluation (Zhou et al. 2022). Hosam et al. used eye tracker to capture users' preferences for interface design elements to build a predictive model of interface design. They confirmed that the predictive model based on user' eye movement data including gaze and saccade movement has great potential to predict user preference for interface design (AI et al. 2016).

Therefore, this study hopes to apply the D-lab experimental platform to conduct a comparative study on the user experience of several existing representative rental apps based on eye movement technology, and according to

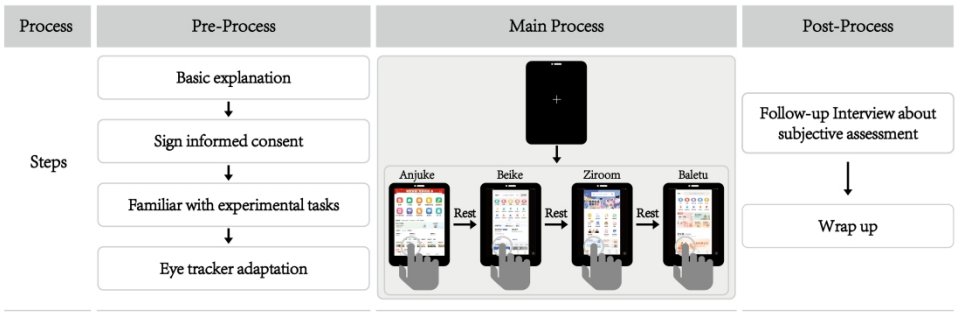

Figure 1: Experimental procedure.

the user experience theory of mobile APP design proposed by Jesse James Garrett (Jesse, 2011), The function, interaction process and interface layout design of different apps are compared to provide reliable theoretical support for APP design.

METHOD

Equipment and Participants

All experiments were carried out under normal office lighting (~ 300Lux) in the Human Factors Engineering Laboratory of Southeast University. Instruments include a computer and eye tracker on the D-Lab platform, and a 9.7-inch iPad. The D-Lab platform was used to record real-time eye movement data and behavioral videos of participants during the experiment. The experimental materials are displayed on the iPad screen. Participants need to adjust the appropriate distance according to their own situation to ensure that they can clearly watch the experimental materials and conduct interactive operation on the screen with their hands.

The participants were 15 graduate students (8 male and 7 female, aged 20–25 years) recruited from Southeast University. All participants had experience using smartphone apps and had never taken part in a similar experiment.

Materials

The experimental materials are four representative rental apps, namely, Anjuke, Beike, Ziroom and Baletu. There are significant differences in their interaction architecture, interface layout and color style.

Experimental Procedure

Figure 1 shows the experimental procedure. Before the experiment began, each participant was given a brief introduction to the experiment procedure and signed an informed consent. And participants were required to be familiar with the task. Then participants were asked to complete the interactive tasks of the four apps in turn according to the given rental conditions. The description of the task was as follows:

Table 1. Descriptive statistics of fixation duration, fixation frequency and saccade frequency of participants.

Measure(unit)		Anjuke	Beike	Ziroom	Baletu
Fixation duration (ms)	Mean	962.07	867.22	870.73	655.11
	SD	56.45	195.32	225.01	182.72
Number of fixations (count)	Mean	303.50	130.38	162.63	236.88
	SD	62.35	46.64	29.31	68.25
Number of saccades (count)	Mean	245.88	127.25	153.63	172.75
	SD	58.03	45.19	31.87	70.51

Use the four rental Apps to select the house you like according to the given conditions and click "Favorites" (multiple houses can be selected from each APP, or if there is no suitable house, it is optional).

If you are a recent graduate, you need to rent a house near Andemen (Metro Line 1), Yuhuatai District, Nanjing for about one year, and you want to meet the following conditions: (1) A small apartment with one bedroom and one living room, including a bathroom, and a kitchen would be better; (2) The budget is not more than 3500 yuan a month, the deposit is best to pay one, the rent is best to support monthly payment; (3) The closer to the subway, the better; (4) The decoration style conforms to your aesthetic taste.

During the experiment, participants' eye movement data and interaction behaviors were recorded in real time. When participants finished using an APP, the recording stopped, and they began to use the next APP after a short rest to continue the recording. Participants were asked to stay focused during the interaction. There is no time limit for the experiment, until the participants have used the four apps and selected the appropriate house. After the experiment, participants were interviewed for subjective evaluation, and the question was "Which APP do you think has the best use experience? Please explain why."

RESULTS

Eye-Tracking Data Analysis

After the experiment, the eye movement data of the participants recorded by the eye tracker was exported, and the data types that have research value for the experiment were selected for statistical analysis. The results were as follows.

Table 1 shows the mean value and standard deviation of annotation duration, fixation number and saccade number of participants during the completion of the interactive task. The results showed that (average fixation duration Anjuke > Ziroom > Beike > Baletu), Anjuke had the longest average gaze duration, indicating that participants had the largest visual load when using the APP, consumed more attention resources, and completed the task with low efficiency. The average fixation duration of Baletu was the shortest, indicating that participants did not need to consume too much attention resources during the task and completed the task efficiently.

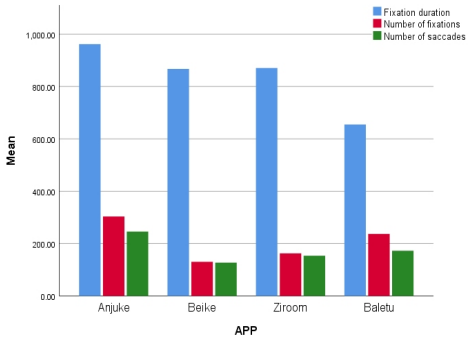

Figure 2: Average value of fixation duration, fixation number and saccade number of participants.

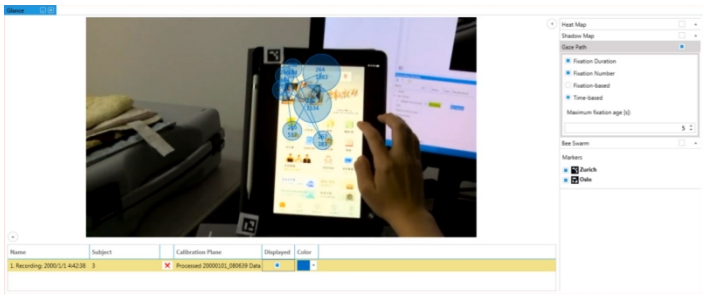

Figure 3: Video record of participants' behavior process and fixation path.

The results show that (average fixation times and average saccade times Anjuke > Baletu > Ziroom > Beike), Anjuke has the highest average fixation count and saccade. It may be because the interface information density of the APP is relatively large and the layout lacks regularity, which makes it difficult for users to search for target information. The layout of the interface of Ziroom and Beike is sparse, and the interest area of users is less.

Interactive Flow

Through the analysis of the operation process and the video recording of the fixation path of all participants during the completion of the task (see Figure 3), various interaction processes of participants using each APP are summarized, and the information structure of the interface is reasonable and whether users can quickly find the module they want to reach is explored. The results are as follows.

Figure 4 shows the interaction flow chart of Anjuke. Most participants choose Method 1, that is, select "rent" in the navigation area of the home page and then select "whole rent" on the secondary page. In this process, page hops are frequent, so the efficiency is low. A small number of participants chose Method 2, in which participants entered the destination in the search box at the top of the home page to locate the rental area. This process avoided

Figure 4: Interactive flow chart of Anjuke.

Figure 5: Interactive flow chart of Beike.

Figure 6: Interaction flow chart of Ziroom.

frequent interface switching and improved the operation efficiency. But the search box on the home page isn't eye-catching enough, so few users notice it.

Figure 5 shows the interaction flow chart of Beike. Most participants choose Method 1. First, select "Rent" from the navigation icon on the home page, and after jumping to the secondary page, select the area, price and rental mode through the selection box for accurate positioning; Few participants chose Method 2, which is similar to Method 1. The difference is that, participants choose the rental mode "whole rent" in the navigation area below the selection box. Both of these approaches lead users to their goals clearly and quickly.

Figure 6 is the interaction flow chart of Ziroom. Some participants choose Method 1. First, select "Master bedroom alone bathroom" or "whole rent" or "whole rent 1 house" in the navigation area of the home page, and then

Figure 7: Interaction flow chart of Baletu.

select the rental type on the secondary page. Part of the participants chose Method 2, which is shorter. By locating the rental area through the search box at the top of the home page, the interface of the rental list can be reached more quickly. Then, the drop-down menu at the top of the interface can be used for accurate screening of conditions.

Figure 7 shows the interaction flow chart of Baletu. Most participants choose Method 1: First, select the rental type in the navigation area of the home page, then jump directly to the rental list page, and perform accurate condition screening through the drop-down menu. A small number of participants chose Method 2. First, enter the destination in the search box at the top of the home page to locate the rental area, and then jump to the rental list page. Both Method 1 and 2 require only two page jumps. Very few participants chose Method 3, because few users notice the filter bar at the bottom of the home page.

Interface Layout Design

By analyzing the fixation duration, heat maps and gaze path diagrams of the participants' browsing interface, we can observe whether the interface layout of each rental APP is clear and reasonable, whether it conforms to the user's psychological model and operation habit. The following will fuse the heat maps of fixation points of all participants, and make a comparative analysis of the interface layout of each APP.

As can be seen in Figure 8 (a), participants' attention area is mainly concentrated in the navigation area of the Anjuke's home page. The participants gaze for a long time in this area, indicating that there are many ICONS in this area and the lack of primary and secondary relationship, making it difficult for users to quickly search for the target function. Only few participants focused on the recommended housing area at the bottom of the interface, indicating that the area failed to attract users' attention.

As can be seen in Figure 8 (b), participants' attention area is mainly concentrated in the main functional navigation area of the Beike's home page. The main function is emphasized by increasing the icon background color and enlarging the icon size to attract user quickly. The other information areas

Figure 8: Heat map of four APPs' homepage.

at the bottom of the interface are hardly noticed by users, indicating that the information provided in this area is not important, and the information content in this area should be appropriately deleted to reduce the waste of page space.

As can be seen in Figure 8 (c), participants' attention areas are mainly concentrated in the navigation area and the banner at the top of the Ziroom's home page. Navigation ICONS use skeuomorphic design with high identification and search efficiency. However, the division of navigation functions is repeated, which affects the user's quick choice. In addition, Ziroom pays attention to the shaping of brand image, in the design of banner to use illustrations to convey the concept of youth and vitality to the users. The search box at the top of the interface provides a color contrast with the banner background, which can attract the user's attention and provide a quick way for the user to locate the area.

As can be seen in Figure 8 (d), in the home page of Baletu, participants' attention areas mainly focus on the main functional navigation area and recommendation area. In the navigation area, the presence or absence of background color distinguish the main functions from the secondary functions to improve the decision-making efficiency of users. In the recommended area, the card type design is adopted, and the different modules are distinguished by color, and the identification is high. In addition, the card uses a warm and bright home background picture to attract users' attention and improve their browsing rate.

DISCUSSION

Compared with previous studies, new research methods were developed in this study: (a) Physiological data including fixation duration, fixation number and saccade number of participants were measured with the help of eye movement technology. And the behavioral process of users were recorded by video, which more objectively explored the user experience of the rental APP. (b) Combine the objective physiological data of users with the

subjective interview results to evaluate the user experience of the APP more comprehensively and accurately;

According to the research results, this section will put forward some of my own understandings on the user experience improvement of some apps. For Anjuke, the interface layout should be clear about the division of each functional area, highlighting the primary and secondary relationship; And it is necessary to reduce the irrelevant information in the interface to reduce the visual load of users; The overall style of the interface should be unified to improve the appearance. For Ziroom, the division of different functions in the navigation should be more clear, to ensure that users can quickly find the demand entry;

Therefore, in order to improve the user experience of the APP, the following aspects should be paid attention to: (a) Reasonable information architecture and functional entry: the overall information architecture should meet the business attributes of each region and be simple and easy to understand; Module entrance must meet the user's mental model, so that the user can quickly search the demand module; (b) Highlight the main body of the interface: A page only requires the user to focus on one important thing, which is the theme of the interface. Common ways to highlight the theme are contrast, hide, and remove. (c) Reasonable information richness of the interface: the information in the interface should not be too miscellaneous and lead to excessive visual load of users, nor should it be too sparse and reduce users' interest.

CONCLUSION

The results show that (a) From the perspective of interaction process, the information structure of Beike and Baletu is more explicit than that of Ziroom and Anjuke, with clear functional hierarchy and short operation process; (b) From the perspective of interface layout, the home page of Anjuke is disorganized, with low usability and lack of unity in overall style; Beike' home page layout is clear, with high operation efficiency; The Ziroom' interface layout is clear, with prominent brand image, and color matching and poster design enhance the pleasure of the interface. The interface layout of Baletu is compact, the structure is clear, and the color style is unified, with identification and aesthetics.

LIMITATION

Although this study provides some suggested methods for the interaction process and interface layout design of apps of the same type, there are still limitations: (a) The selection of experimental materials lacks rigor, and the selected APP may be interfered by user familiarity and bias. Therefore, pre-experiments should be conducted before the start of the experiment to reduce the bias of experimental results. (b) There were non-standard details in the experiment. The marker used for eye tracking and positioning was placed irrationally, which resulted in the user's hand blocking the marker in the interaction process and no eye movement data was collected in part of the

process; In addition, the head movement of the user during the experiment may lead to the position deviation of the eye tracking. (c) The small number of participants may affect the scientific nature of the experimental results.

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