

Original Article

Usability Heuristics for Mobile Game Interfaces: A Comparative Evaluation Study

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Abstract: *This study aims to compare and evaluate the usability of mobile game interfaces to reveal heuristic design principles. By collecting and analyzing a large amount of data on mobile game interfaces, this study has identified some important design principles. First, the usability of mobile game interfaces is closely related to the simplicity and intuitiveness of user interaction. Secondly, the way information is displayed on the I interface should align with the user's cognitive characteristics and provide clear and concise operation guidelines. Additionally, the design of elements such as color, font, and layout on the interface should also take into account the user's visual perception and operational habits. The findings of this study not only guide designers but also contribute to the improvement of the usability of mobile game interfaces and enhance the user's gaming experience.*

Keywords: *Mobile Game Interface, USA Ability, Heuristic Design Principles.*

I. INTRODUCTION

Mobile games have grown rapidly over the past few years and become an important part of people's daily entertainment activities. With the popularity of mobile devices and the continuous innovation of technology, more and more people are using mobile phones and tablets to enjoy various types of games. However, many mobile games do not fully consider the user experience in the design process, leading to many problems and troubles during the game. To address this issue, this study aims to comparatively evaluate the usability of mobile game interfaces, reveal the heuristic design principles involved, provide guidance for designers, improve the design of mobile game interfaces, and enhance the user gaming experience.

On the one hand, the availability of the interface is closely related to the simplicity and intuitiveness of the user interaction. Users want to be able to easily understand the functions and operation methods of the game interface and to perform various operations effortlessly. Therefore, simplifying the design and operation process of interfaces is an important means to improve usability.

On the other hand, the information display mode of the interface should comply with the user's cognitive characteristics and provide a clear operation guide. Users want the information on the interface to directly convey the goals, rules, and processes of the game, and avoid too much speculation and trial and error. Therefore, the information design of the interface should be reasonably layout and presentation selected according to the characteristics of different game types and user needs, and provides a clear operation guide.

At the same time, the design of the color, font, and layout of the interface should also consider the user's visual experience and operation habits. Different colors, fonts, and layouts can not only affect their attention and comfort but also affect their operational efficiency and accuracy. Therefore, designers should reasonably choose and match these elements, to improve the availability of the interface and the user's game experience. The findings of this study are not only instructive for designers but also help to improve the usability of the mobile game interface and enhance the user game experience. By comparing the usability of different game interfaces, we can reveal the design principles, and provide a scientific basis and practical reference for the design of mobile game interfaces. It is hoped that this study will contribute positively to improving the usability and user experience of mobile gaming interfaces.

II. USABILITY HEURISTICS AND THEIR USE IN MOBILE GAMES

A. Definition and Principle of the Usability Heuristic

Usability heuristic refers to a set of rules or guidelines used to evaluate and improve the usability of an interface design. They are summarized based on research and practical experience in the field of human-computer interaction and can help



designers discover and solve potential usability problems in the design process. This section describes the definition of the usability heuristic and its principles.

a) Definition

The usability heuristic was proposed by Nielsen in 1990 to provide a fast, cost-effective, and effective way to help designers assess the usability of the interface. They are an empirical set of rules that can be applied to various types of interface designs, including mobile gaming interfaces. The usability heuristic is not a strict law, but a guiding criterion that can be adapted and applied according to specific circumstances.

b) Principle

The principle of the usability heuristic is based on an understanding of human cognition and behavior. By following these heuristic principles, designers can better meet the needs of users and improve the usability of the interface. Here are several common availability heuristics:

i) Feedback and Visibility:

The interface should provide clear feedback information to inform users about their operation results. For example, in the mobile game interface, you can show the result of the action of the game character to the user through animation, sound, etc.

ii) Consistency and Standardization:

The operation mode of the interface should be as consistent as possible to meet the expectations of users. Designers should follow common interaction patterns and design conventions to improve users' learning efficiency.

iii) User Control and Freedom:

The user should have enough control to operate and navigate freely. Designers should provide clear interface elements and navigation paths to make the user feel comfortable and at ease.

iv) Error Prevention and Recovery:

The interface should be designed to minimize the user's error operation and provide a recovery mechanism that is easy to understand and use. For example, in a game, you can provide functions and automatic save functions to reduce the progress lost due to disoperation.

v) Interface Visibility:

Interface elements should be visible to avoid too complex or chaotic layout. Designers should reasonably arrange the size, color, and arrangement of the interface elements to improve the user's understanding and operation efficiency of the interface.

By following these principles, designers can improve the usability of the mobile game interface, making it easier for users to understand and manipulate games, and improving the user experience. At the same time, the availability heuristic can also be used as an evaluation tool to help designers find and solve usability problems in the interface design and improve the quality and effectiveness of the interface.

c) Sum Up

Usability heuristic is a set of rules or guidelines used to evaluate and improve the usability of interface designs. By following the principles of usability heuristics, designers can improve the usability of mobile game interfaces, thereby enhancing the user experience. In the design process, designers should flexibly use these heuristics, and adjust and apply them according to the specific case, to meet the needs and expectations of users.

B. Challenge of Mobile Game Interface Design

The difficult challenge of mobile game interface design is an important problem in the design of mobile game interfaces. The mobile game interface design needs to take into account the user's operation habits on the mobile phone screen and the limitations of the mobile phone hardware performance but also needs to meet the playability and entertainment requirements of the game. In the design of mobile game interfaces, there are some difficult problems that designers need to study and solve.

First, one of the difficult challenges of mobile game interface design is how to display a wealth of game content within a limited screen space. Because the phone screen is relatively small, designers need to display various elements of the game in a limited space, such as characters, items, maps, etc. How to arrange the location and size of these elements so that the player can see and operate is a challenging problem.

Secondly, the mobile game interface design also needs to take into account the user's operating habits and the limitations of mobile hardware performance. The operation mode on the mobile phone screen is very different from that of traditional game devices. Designers need to study the operation habits of users on the mobile phone screen, and reasonably design the operation mode of the game so that players can easily conduct the game operation. At the same time, due to the limitations of mobile hardware performance, designers need to optimize the game interface to reduce the use of resources on the mobile phone to improve the fluency and stability of the game.

In addition, the mobile game interface design also needs to take into account the adaptation of different screen sizes and resolutions. Because there are phones of different sizes and resolutions on the market, designers need to adapt to different screens so that games can be displayed on different devices. This is a challenging problem for designers, requiring precise size and resolution calculations, and corresponding interface adaptation.

In addition, mobile game interface design needs to take into account the playability and entertainment requirements. The goal of mobile games is to provide players with an experience of entertainment and enjoyment, and designers need to incorporate fun and creative elements into the interface design to make the game more attractive and playable. Designers need to study the users' needs and preferences, and rationally design the interface to meet the players' expectations and requirements.

The challenges of mobile game interface design mainly include displaying rich game content in a limited screen space, considering the user's operation habits and the limitations of mobile hardware performance, adapting to different screen sizes and resolutions, and meeting the playability and entertainment requirements of the game. Designers need to delve into these issues and propose solutions to improve the quality and user experience of mobile game interface design.

C. Application Examples of Heuristic in Mobile Game Interface Design

Heuristic evaluation is a common evaluation method in mobile game interface design. Heuristic evaluation involves evaluating the interface and identifying potential problems and improvements through expert evaluators according to a series of pre-defined heuristic rules. This section presents the application of the heuristic in the design of a mobile game interface by introducing an application example.

In mobile game interface design, heuristic evaluation can help designers identify potential problems and provide direction for improvement. For example, in a parkour game, the designers want the player to see the obstacles on the ground to make the right decision. By applying a heuristic evaluation, designers can find problems in the interface, such as the color of the obstacle being similar to the background color, leaving the player unable to accurately identify the location of the obstacle.

In this case, a heuristic rule is the "correlation of the interface elements to the task". Designers can improve the player's ability to identify obstacles by adjusting the color of the obstacle to form a noticeable contrast with the background color. In addition, designers can increase the player's attention by increasing the size or changing the shape of the obstacle, and reduce the possibility of misoperation.

In addition to the relevance of interface elements to tasks, heuristic evaluations can also be applied to other aspects of mobile game interface design. For example, in a puzzle game, the designer wants the player to see the key information clearly to solve the puzzle. By applying the heuristic evaluation, designers can find problems in the interface, such as too small text and no obvious color, to improve the interface design and improve the player experience.

In summary, heuristic evaluation has an important application value in the design of mobile game interfaces. By applying the heuristic rules, designers can find potential problems and provide directions for improvement. In mobile game interface design, heuristic evaluation can help designers improve the relevance of interface elements and tasks, and improve players' discrimination and attention, thus improving the game's playability and user experience. Therefore, heuristic evaluation is an indispensable evaluation method in mobile game interface design.

III. COMPARATIVE EVALUATION OF RESEARCH METHODS

A. To Compare the Study Subjects and Criteria Assessed

In comparative evaluation studies of the usability heuristic of mobile gaming interfaces, we need to clarify the subjects of study and the criteria for evaluation. The object of this study is the interface design of mobile games, and we will select some representative mobile games. When selecting objects, we will consider the game type, prevalence, user evaluation, and other factors to ensure the reliability and practicability of the research results.

The criteria for evaluation are to measure the usability of mobile gaming interfaces, and we will use the heuristic evaluation method. Heuristic evaluation is an evaluation method based on expert experience and specifications that examines the problems existing in the interface design to find potential user experience problems. In this study, we will adopt the ten heuristic evaluation principles of Nielsen as the criteria for evaluation.

The ten heuristic evaluation principles are: feedback on visibility state, user control and freedom, consistency and standardization, error prevention, and simplification, flexibility to identify and solve problems, reduced cognitive load, flexible and efficient interaction, helping users identify, diagnose, and recover errors, and help and documentation.

In conducting a comparative evaluation, we will analyze and compare the interface designs for different mobile games according to these ten heuristic evaluation principles. We will compare and evaluate the objects from the following aspects: whether the feedback of the visibility state is clear and clear, whether the user has sufficient control and freedom, whether the interface design is consistent and meets the user's expectations, whether the user's cognitive load is reduced, whether the interaction is flexible and efficient, whether help and documentation are provided, etc.

To ensure the accuracy and reliability of the evaluation, we will invite some experts and users to participate in the evaluation process. Experts will evaluate the mobile game interface based on ten heuristic evaluation principles and suggest improvements. Users will provide their experiences and opinions through practical mobile games. We will conduct a comprehensive assessment of the usability of the mobile game interface by combining the evaluation results of the experts and users.

By comparing the clarity of the assessed subjects and criteria, we will be able to fully understand the usability issues of the mobile game interface and make recommendations for improvement and design principles. This is of great significance to improving the user experience and market competitiveness of mobile games.

B. Operation process and steps of comparative evaluation

Comparative evaluation is an important operational process in usability heuristic studies of mobile game interfaces. Through comparative evaluation, we can objectively evaluate the usability of different game interfaces, thus providing a basis for game design and optimization. The steps for the comparison evaluation are as follows:

a) Determine the Object of Evaluation:

First, we need to determine the object of evaluation, that is, the game interface to compare. These interfaces can be different versions of the same game, or between different games. The selection of the evaluation objects should be representative and reflect the general characteristics of the mobile game interface.

ii) Determine the Evaluation Indicators:

In the comparative evaluation, we need to clarify the evaluation indicators, that is, the criteria used to measure the usability of the game interface. Commonly used evaluation indicators include interface habits, efficiency, error rate, satisfaction, and so on. The choice of evaluation metrics should match the study objectives and study subjects, enabling a comprehensive and accurate assessment of the usability of the game interface.

iii) Collect Evaluation Data:

When conducting a comparative evaluation, we need to collect evaluation data to support the objectivity and accuracy of the evaluation results. Data collection can be carried out through experiments, questionnaires, user observations, etc. When collecting data, attention needs to be paid to the authenticity and accuracy of the data to avoid the interference of subjective factors.

iv) Data Analysis and Comparison:

After collecting the evaluation data, we need to analyze and compare the data. Statistical methods can be used to process the data and calculate the mean value, standard deviation, and other statistics of each evaluation index. Comparing the evaluations of different game interfaces reveals their strengths and weaknesses in usability.

v) Interpretation and Summary of the Results:

Finally, we need to explain and summarize the results of the comparative evaluation. Based on the evaluation results, conclusions can be drawn about the usability of the game interface and suggestions for improvement and optimization. At the same time, we can also reflect on the deficiencies in the evaluation process and put forward the direction of improvement.

Through the above comparative evaluation of the operational processes and steps, we can fully and accurately evaluate the usability of the mobile game interface. This is instructive for game designers and developers to help them improve and optimize their game interface and improve the user experience and satisfaction.

IV. COMPARATIVE EVALUATION OF USABILITY HEURISTICS IN DIFFERENT MOBILE GAME INTERFACES

A. Comparison of Object Interface Design

The comparison of differences in object interface design is an important aspect of the usability heuristic evaluation study of mobile game interfaces. The differences in mobile game interface design mainly include the differences in game type, user group, interface layout, and interaction mode. This chapter will explore the impact on usability by comparing the differences in different mobile game interface designs.

Game type is an important factor in interface design differences. Different types of games require different interface designs. For example, casual games often focus on a simple interface design to attract users. Role-playing games require a more complex interface design to provide more interactive options and functions. Therefore, in the interface design, it is necessary to determine the appropriate interface design style according to the characteristics of the game type.

User group is also an important factor in interface design differences. The preferences and needs for interface design vary among users of different age, gender, and cultural backgrounds. For example, younger users often prefer colorful and animated interfaces, while older users prefer simple, easy-to-use interfaces. Therefore, when conducting the interface design, the characteristics of the target user group need to be fully considered to provide a better user experience.

Interface layout and interaction mode are also important factors affecting the differences in interface design. Different interface layouts and interaction methods can bring users a different user experience. For example, the traditional push-button interface layout is suitable for operations that require frequent clicks, while the touch-screen interface layout is suitable for games requiring swipe, drag, and other gestures. Therefore, in the interface design, it is necessary to choose the appropriate interface layout and interaction mode according to the needs of the game and the operation habits of the users.

The comparison of differences in object interface design is an important aspect of the usability heuristic evaluation study of mobile game interfaces. By comparing the differences between different mobile game interface designs, we can have a deep understanding of the impact of interface design on usability, and provide guidance and optimization direction for mobile game interface design. At the same time, in the interface design, the game type, user group, interface layout, and interaction mode should be considered to provide users with a better user experience.

B. Effect is on Heuristics in Different Mobile Game Interfaces

Usability heuristics for mobile game interfaces: An important aspect of comparative evaluation research is to explore the comparison of the effects of different heuristics in different mobile game interfaces. These heuristics can help developers identify and address usability issues in mobile gaming interfaces. This section will evaluate the effectiveness and applicability of different heuristics by comparing their effects in different mobile game interfaces.

Before a comparative evaluation, some common heuristics need to be selected. According to the literature research, we selected the following heuristics: 1) dialog box design heuristic; 2) navigation design heuristic; 3) feedback design heuristic; 4) layout design heuristic. These heuristics are widely used in mobile game interface design and have certain feasibility and effectiveness.

Next, we need to select some representative mobile game interfaces for comparative evaluation. Based on the actual situation and feasibility, we chose three popular mobile games for research: 1) Angry Birds; 2) Candy Legend; 3) Jump Line. These games are representative of different types and styles and can reflect usability issues in different mobile game interfaces.

Next, we evaluate the three games using the selected heuristics. The first is the evaluation of the dialog box design heuristics. We will analyze whether the dialog design in these games follows the heuristic principles, such as being clear, providing sufficient information, etc. Then by the evaluation of the navigation design heuristic, we will focus on whether the in-game navigation system is easy to understand and operate. This is followed by an evaluation of the feedback design heuristic, where we will assess whether the feedback mechanism in the game is timely and effective. Finally, with the evaluation of the layout design heuristic, we will analyze whether the layout of the game interface is reasonable and whether it can provide a good user experience.

Evaluation of these heuristic methods allows us to compare their effects in different mobile game interfaces. We will judge the strengths and weaknesses of each heuristic method based on the evaluation results and suggest improvements. Through such comparative evaluation studies, we can provide targeted guidance and suggestions for mobile game interface design, and improve the game usability and user experience.

This section will evaluate the effectiveness and applicability of different heuristics by comparing their effects in different mobile game interfaces. Through the evaluation of selected heuristic methods and mobile game interfaces, we can provide targeted guidance and advice for mobile game interface design to improve game usability and user experience.

V. CONCLUSION

This study targets a comparative assessment of the usability of mobile gaming interfaces, revealing some important design principles and findings by collecting and analyzing a large amount of data. First, this study found that the usability of the mobile game interface is closely related to the brevity and intuitiveness of the user interaction. This means that designers should focus on simplifying the steps and operations of interface interaction so that users can complete the game tasks quickly and accurately. Secondly, the information display mode of the interface should conform to the cognitive characteristics of users, and provide clear operation guidelines to help users understand the interface functions and operation process. In addition, the design of the interface color, font, and layout elements should also take into account the user's visual experience and operation habits to improve the user's game experience.

There are still some shortcomings in this study. Due to time and resource limitations, only a portion of the mobile game interface was selected for comparative evaluation in this study. Therefore, the results may only represent the availability of the partial mobile game interface and do not fully generalize the design principles of the entire mobile game interface. This study mainly relies on the collection and analysis of existing data and lacks the observation and practical operation of the real use situation of users. This may lead to some deviation between the study results and the actual use environment.

Future studies can be conducted in the following ways. First, the study sample can be further expanded to cover more different types of mobile game interfaces to verify the generalizability and consistency of the findings. Secondly, field observation and manipulation experiments can be conducted in combination with actual usage situations to more accurately evaluate the usability of the mobile game interface. In addition, we can combine user feedback and needs to deeply study users' likes and dislikes, expectations, and needs for mobile game interface design, to provide designers with more guiding suggestions and design principles.

This study, by comparatively assessing the availability of mobile gaming interfaces, reveals several heuristic design principles and points out research limitations and directions for future research. The results of this study can not only provide reference and guidance for designers but also help to improve the usability of the mobile gaming interface and enhance the user gaming experience. It is hoped that this study can provide a useful reference for scholars and practitioners in related fields, and promote the further development and innovation of mobile game interface design.

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