

# Study of the User-Involvement Iterative Computer Game Interface Design Method

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## **Abstract**

The computer game interface is the outward manifestation of a computer game, and it is also the direct interaction part between the game and the game user. Well-designed game interface will make the game user completely immerse into the virtual world created by the game, otherwise it would make the game user be at loss or upset due to the poor designed interface elements. Therefore, in the computer game interface design, user-involvement is very important. This paper mainly discusses the method of building a user-involvement iterative computer game interface, including the objective and main features of the method, the user's fatigue analysis, and the complete design flow.

**Keywords:** *Computer Game; Interface Design; User-involvement*

## **1 INTRODUCTION**

As the linkage between the computer game and user, the interface design in the entire game is pivotal, which is a bridge of communication between the human and computer games. The game interface refers to the user's interface of the game software, including the game design elements, such as the button in the game screen, animation, text, sound, window and other direct or indirect contact with the game user. Computer Game Interface Design, for short: CGID, refers to the planning and design activities of the visual elements running electronic games and interactive features with the game user on a computer platform. The user-involvement iterative CGID is put forward in the integration of participatory design and iterative design, which uses the primary means of user-involvement and the iterative design form to ultimately meet the client's requirements.

## **2 THE OBJECTIVE OF THE USER-INVOLVEMENT ITERATIVE CGID METHOD**

### **2.1 Usability**

Usability refers to the game interface's effectiveness, efficiency and user satisfaction assessed by specific groups for specific purposes. Currently, many computer game interface design excessively use the new graphics technology while ignoring the phenomenon of game user factors, resulting in many problems of usability of the game interface itself. The forms of the problems are that: there are many operations cannot be completed on this game interface; the game interface itself does not have the full interactive features of human and machine; interface confusing caused by the excessive functions; many unwanted idle interface functions, which all illustrate the importance of usability metrics on the computer game interface.

### **2.2 Second-order Headings**

User's experience on CGID, in a way, complements and improves the objective of usability. It refers to the feeling of the game user when they interact with the entire game system and when they play games. If the usability is based on the objective requirements of the game interface functions, the user's experience is the subjective requirement based on game user's subjective experience. For example: we can design a game interface into the very "colourful", "attractive", "interesting" novelty fun" and so on. In the game interface design process, we should focus on studying the happy experience and emotional factors which can affect the game user. There are a lot of factors that can

generate happiness, such as: interesting interface performance, cheerful and lively animation and sound, interesting interaction, which all will enable the user to be happy and satisfied.

### **3 THE MAIN CHARACTERISTICS OF THE USER-INVOLVEMENT ITERATIVE CGID METHOD**

The main characteristics of the user-involvement iterative CGID method are user- involvement and iterative design.

#### ***3.1 User Participation***

User-involvement design refers to the process of the game users, who are the end-user of the game interface; participate in the entire game interface design, which is from the design and research of the game user to the final game interface design assessment. User-involvement design makes it easy to get more accurate information about tasks; providing opportunities for game users to make their ideas have an effect on the design decisions and allowing users to establish the awareness of active participation of the interface design related to themselves, as well as making the final game interface acceptable for the game users, so as to improve the usability of game interface design. The careful selection of the involved users will contribute to the success of participatory design.

#### ***3.2 The Iterative Design***

As an interactive interface, the game interface's needs are not be fully determined at the beginning of the design life cycle. The only way to determine the potential design features is to create them and take advantage of the real users to test them. Then, improve the design by the correction of any problems exposed in the test, which is the essence of the iterative design. The iterative design is a purposeful design process, which is overcoming the inherent problem specialized by completely demand through several design iterations, each of which can improve the final game interface.

### **4 FATIGUE ANALYSIS OF THE USER-INVOLVEMENT ITERATIVE CGID METHOD**

The analysis of the game user's fatigue has great reference value for the game interface design. The research and analysis of the user's physical and mental fatigue can be regarded as the game user's fatigue factors, which play a significant role in improving the efficiency of the implementation of the game interface.

#### ***4.1 Physiology Fatigue Analysis***

The computer game user's physiological fatigue is due to the physical discomfort caused by the sitting status; the physical state of the pain, numbness of fingers, arms, shoulders, and other parts of body of prolonged operation of the mouse and keyboard, as well as other game control devices; the physical state of neck pain, sore eyes caused by the long time of facing of the display device.

The fundamental reason for the game user's operation fatigue is that the game interface design does not fully take into account the user's task status. For example, in a RPG game, if you want the game users to keep clicking the mouse to control the game protagonists to attack the enemy, the game user will feel a slight finger fatigue after one to two hours of continuous operation; and they will feel a slight arm fatigue, finger vaguely painful after three to six hours. Too small text design, uncoordinated colour mix will cause the user's visual fatigue of the game.

#### ***4.2 Psychological Fatigue Analyses***

The game user's mental fatigue is caused by the poor experience from the irrationality in game interface design. The cognition and learning of the game interface will largely affect the user's impression on the game interface itself. The game interface which is easy to be cognized and easy to learn allows the user to quickly adapt to the whole game, and to start their joyful experience. But those interface design icons, mouse shape, as well as windows which are not easy to be cognized and more difficult to learn will let users generate the resentment and decrease the sense of identity to the game itself. There will display the result of the operation, or the appropriate prompts after the user performs an operation. Without these, users will feel perplexity. In addition, the response time of the game interface is also an important factor that affects the user's experience.

## 5 THE DESIGN FLOW OF THE USER-INVOLVEMENT ITERATIVE CGID METHOD

The main activities of the user-involvement iterative CGID method include: the determination of the game type, interface design research, user-involvement interface concept design, the realization of the design, and the design assessment. Apart from the determination of the game type, the four basic design activity is an iterative process, which is a constant repeated iterative process of “Design - Assessment - redesign - the re-evaluation” at every stage. After the completion of the above five basic design activity, there will be some assessments and recommendations from experts and users, who will determine the improved content of program of the next iterative design after the discussion. The design flow of the user-involvement iterative CGID method is shown in Figure 1.

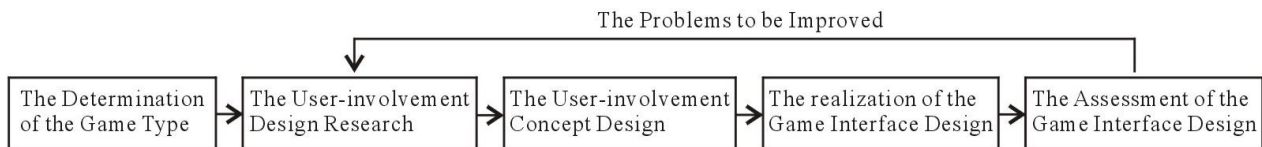


FIG. 1 USER-INVOLVEMENT ITERATIVE CGID FLOW CHART

### 5.1 The Determination of the Game Type

The first step of the game interface design is to determine the type of game, and the determination of the type of computer games has binding force for the interface design itself. In general, the determination of the game type is determined by the sponsor of the game development team, who has a detailed investigation and analysis of the current gaming market, and then reports its findings to the sponsor to propose what type of game should be developed.

### 5.2 The Game User-involvement Design Research

The game interface design research mainly refers to the investigation stage of the game users, including the contents of three aspects: the determination of the surveyed users, the investigation of the users using specific survey methods, the analysis and collocation of the results of the survey.

#### 1) The determination of the surveyed users

In order to let the preliminary research of the CGID be more valuable, we should filter the investigated object. As a special computer software user groups, the game users range from the 12-year-old to 40-year-old men and women in the crowd even a broader range. Groups under the age of 14 do not understand the game itself enough and not play the game for a very long time, so they can not feel the importance of the human-computer interaction in the game interface; while the people above the age of 30 plays the games for a short time as a result of work. Even when in their teenage years, they seldom played computer games and didn't understand the game.

#### 2) The way of the user survey

The ways that can be used for user survey are: user interviews, questionnaires, observation, thinking and recalling. In the user-involvement iterative CGID method, it will use user interviews and questionnaires as main method, with other supplement method to investigate the computer game users.

#### 3) The survey content

The objective of the computer game interface design survey is to understand the user. In the survey, we should take full account of the interaction of human, machine, and environment, establishing the psychological and physiological characteristics model of the user to understand the user's cognitive stations on which type of game will be design.

The investigation on the physiological characteristics of the game users refers to the physiological state of the user when they play the games, the cognitive states for the game interface of the game user on physiology, and the physical fatigue under the state of the game for a long time.

The investigation of the psychological characteristics of the game user refers to the game user's cognitive states for the current user interface operation, the acceptable levels of the game when the game user learn the game interface

operation. In addition, it also contains the attention degree for the game interface of the user when they immerse in the game.

#### *4) The analysis of the survey results*

After the user interviews and user questionnaire survey, we should make an analysis of the results of the survey design and write the survey analysis report. For the survey results analysis, we should mainly consider the following aspects: the game user's expectations for the game interface, the cognitive level of the game interface, the game user's physiological characteristics model and psychological characteristics of the model, the error analysis of the operation of the game interface, user's thinking and behavioural characteristics appeared in the abnormal environments and situations or abnormal situation, the smoothness of the user's learning of the game interface's operation.

### ***5.3 The User-involvement Conceptual Design Based on the Design Principles***

The conceptual design summarizes the high-level description, refining and information in general, which provides a blueprint of the game interface and the game interface structure for the designers and end-users. After the completion of the data collection and analysis of user research, it will go into the conceptual design stage, which is also be said that the concept creation phrase of the interface design. This phase consists of two major steps: construct the model of user tasks and start the initial concept design.

#### *1) Construct the model of user tasks*

The purpose of the data analysis and processing in the design research phase is to be able to build a user task model for the next interface design, which is able to create user information file and user task file. All of the designs should start from the understanding of the needs of the computer game users, and carry out a detailed analysis on the needs of the game users with reference to the data analysis results on the design research and the game user's physiological and psychological characteristics model. After determining the user's needs, it is needed to build the related users' live and work scenarios and users' task models and then to determine the users' task. We can understand the details of the problem to be solved by these users. Observe their reflection and collect their feedback and create charts and scene model to determine the critical design structure.

#### *2) The user-involvement conceptual design*

The central work on the CGID conceptual design stage is the conceptual design of the game interface based on the established model of the user's tasks. This stage is the game interface designers' creation and conception of the game interface. In the user-involvement iterative CGID method, we can appropriately select some user to involve in this stage, jointly conceiving the design of the entire game interface with the designers.

The game interface designers can refer to some of the similar successful game interface design to draw their successful design factors and do the conceptual design in accordance with the data from the design research; or incorporate with the game features that you want to design as well as the game's cultural background. A detailed analysis of all the elements of the referent game interface design, including user's physiological and psychological characteristics, game types, and other factors related to the special design should be made, when in reference to the similar game interfaces. Then the staff should compare the results of the analysis with the game to be designed to identify the referent way and elements of the human-computer interaction so as to further refine the design of the game interface.

Another method is to have a simple idea of the game interface on the hearts of user's to communicating with the users so as to design a game interface to satisfy users. In the communication with the selected game users (expert users), they should try to make the use describe their own ideal man-machine interface in their minds, instead of unnecessary guiding and intervening them. It is needed to write down the user's ideal interface and compile it into a report. Then they should discuss with other designers to determine the design proposal and the human-computer interaction way. The designers can carry out the preliminary creation and conception according to the results of the discussions.

#### **5.4 The Realization Process of the Game User-involvement CGID**

After the design, there is the implementation phase of the design. What is needed to say is that the realization of this stage is not the interface elements in the application of the later game. It is to make out the design program's prototypes which is determine, whose human-computer interaction function should be the same with the final game. The interface designers make out the determined program through the software which can simulate the dynamic effects of human-computer interaction, for further testing and evaluation.

When the computer game interface design begins, they should make sure the consistence of the game interface and cognitive processes of users when they perform tasks (such as paying attention, perception, learning and memory). It is inevitable to consider some experimental design details when making the prototype, allowing the free playing of the imagination and not restricted prematurely by the interface, otherwise it will affect the creativity. The whole implementation process of CGID can refer to the following order: the screen layout design, window design, button design, menu design, mouse style design and realization of the organizational layout of the interactive elements and the effects of the dynamic interaction.

##### **1) The Screen Layout Design**

The game interface screen layout should be based on reflecting the maximal game content, and reduce as much as possible the interface design elements which has nothing to do with the game controlling on the premise of ensuring the interface functions of human-computer interaction. The following issues in screen layout design should be paid attention: the overcrowding display makes the game user generate visual fatigue and error information; the consistent interface design style not only allows users to produce visual aesthetic, but also makes the object of the action be expected; at the same time providing enough amount of information ,the concise, clear and removal of redundant features interactive elements should be considered; the interactive interface elements should be arranged in a certain order, which is based on using frequency as reference; trying to keep enough space to display the contents of the game.

##### **2) Window Design**

As the carrier to display game information, the window's location and content is the focus of the design. In addition, the main window colour design should be consistent with the overall style of the game, and the text style within the window should be designed to meet the visual needs of game users.

The window display in the game interface should be placed at the edge of the screen, without affecting the content of the game screen display. The display contents in the window should be arranged in a certain order to facilitate user's browser and at the same time taking into account the principle of the layout beauty. The representation of the text should be as simple as possible so that it is easy for the users to understand; if the text is too much, the designer should use the scroll bar to split screen or paging; the window's colour design should be consistent with the plot of the game and the atmosphere, and the number of colours should not be displayed too much (note the taboo of the colour), so as not to allow users to easily produce visual fatigue. After the completion of the entire window design effects, the designer should add window buttons, text and other elements.

##### **3) Button Design**

The button is used the most in the game interface, and is also the most used element in the process of the game user interaction. The button design's focus should be on the design of the button dynamic effects, allowing a more interactive experience of the interaction.

The complete state of the button contains four parts: the mouse's pass, press, bounce, and clicking region. Generally speaking, when the mouse passes over a button, the button should have a certain visual reaction (can also be combined with the corresponding sound), so that the users can know that this button can be operated, and the luminous and projected button is a better choice; the mouse's press design should simulate the effects after giving the force to a real objects, and the general reaction is that the position of the button will move some distance down slightly in order to make the users produce more realistic experience and feel as if there is an object which is under the user's own press. It can also be designed as another effect, but the design should not let users generate

psychological confusion; the click area design should be designed to comply with human cognitive habits of graphics, such as the click area design of a 4 \* 4 size of button should be mediated between 3 \* 3 and 5 \* 5, the too small and too large click area will increase the risk of misuse.

#### *4) Menu Design*

The menu design can be divided into the main menu design and sub-menu design. The main menu is usually placed around the screen, which will be seen by the user at any time. When the users click the appropriate options of the main menu, they can tune out the drop-down or pop-up (based on the different position of the main menu) sub-menu. The sub menu belongs to the menu that is under the second class, which is not directly displayed on the screen, but transferred out by the mouse's operation of the main menu item.

The menus is generally placed on the top of the screen that corresponds with the information displaying window below, and at the same time, is also in line with the user's operating habits of displaying the sub-menu from top to bottom. The main menu can also be hidden. When the user needs to pull up the main menu through the button, so as to save more screen space, but the designer should pay attention to the careful design of the button, so that the users can easily find the button to pull up the main menu. In the game interface design, the menu displaying mode should have more changes than other computer softwares, which mainly depends on the functions of the corresponding operating processes and classification.

#### *5) Mouse Style Design*

The variation of the mouse style is also an important means of interaction in the game. When the user moves the mouse on the objects or characters in different games, the mouse should be displayed in different style, showing the operability of the current objects.

When the mouse select or suspend on the enemy's unit or area, it should have the differences with the selection and suspension on one's own and friendly units and regions. When the mouse moves to the operational game props, it should have the shape of "hand" or similar hand-shaped style, so that the user can know the operative props, for example, when designing the operation of the -opening, the mouse style should be designed into a dynamic action of door-opening style, which similarly can make the game easier for users to understand the contents of the current operation, and adapt more quickly to the operation of the game. The hot spot of the mouse is a factor that needs special consideration. For the more precise operation, a very clear mouse hot spot is needed, so that the users can easily identify the location of the hot spot to operate more efficiently. Otherwise, the user will find it difficult to use the mouse to point the smaller target.

For a slightly longer operation, it should be designed as the "ongoing" mouse style, telling the user that the requested operation is underway, to reduce the anxiety of the user. The rotating hourglass is the most classic representative to resolve this issue.

#### *6) Organization Layout of the Interactive Elements*

After completing all of the game design interface elements, all of the elements should further the layout design based on following the on-screen layout. At this time, it should be noted the unification of the displaying order of all the interactive elements, as well as the overall style of the screen.

The designer should consider the views of participating users in terms of the organizational layout design of the interactive elements of the game interface. Because they are the terminal interface users who should have a certain degree of discretion for the arrangements of the layout of the interface elements. And the designer should do many discussions and iterative designs about the interface elements' layout with the game users to determine ultimately the best design for the realization of the dynamic interaction effect.

#### *7) The Realization of the Effects of the Dynamic Interaction*

In designing the dynamic effects, the designer should note the cognitive situation of the users to the dynamic interface. And the main factors affecting the user's learning and cognizing of the game interface is whether the dynamic effects makes users expect, whether it has a certain intrinsic logical relations, and whether it makes the users create confusion.

On the design of the dynamic interaction effect, it should not have too many changes, but should focus on the consistency of the dynamic effects. For example, in the same game interface, the effect of the button should use a unified interaction effect, allowing the users to have certain expectations on the button operation to prevent confusion. The effects of the pop-up window should have a consistent action design. After using the pop-up which is from the top to bottom, the design of other window actions should make full use of this effect, instead of adopting the pattern of popping up from the bottom of the screen, from left to right or from right to left.

### ***5.5 The Design Evaluation of the User-involvement Iterative Design***

After the completion of the game interface prototype, the assessment phase of the design program begins. In the period of the user-involvement iterative design CGID, the user's usability assessment is constantly repeated along with the interface design development process. User-involvement itself is fully the reflection of the thinking of the user-centred design. Throughout the development of design process, the designer should consider the needs of the user at any time and improve the game interface according to user suggestions and comments. So, in all the stages of the game interface design, the designer should have some necessary and targeted assessment with reference to the CGID principle.

#### ***1) The Assessment Objectives***

The functionality of the game interface is the most important, which must be consistent with the needs of users. The game interface design should make it easier for users to perform the functions of game control. This includes not only making the game interface have suitable functions, but also making the user clearly understand a series of target actions which is required, which depends on the user's cognition degree to the game interface design; it also includes matching the application of the game interface to the task expectations of the user. For example, we have got a quick execution when we are familiar with the task.

Apart from evaluating the game interface design through the game interface's functionality, it is also important to assess the user's interactive experience and the effects on the system users. This includes whether the game interface is easy to learn, its usability and user's satisfaction. It also includes the love of the user's and the emotional response, which also has an important role in the game interface design.

The ultimate goal of the game interface design assessment is to determine the specific issues in the design. When the design is applied to a specific game, it may cause undesirable results or confusion among users. Of course, this has the direct reality with the two aspects of interface design: functionality and usability.

#### ***2) The Design Evaluation of the User-involvement Iterative Design***

The CGID program's evaluation can be achieved by two ways: the assessment based on expert and user-involvement assessment. The assessment based on expert contains analysis, review, and model-based approach; while the user-involvement assessment contains observation and questionnaire approach. In the practical application, the two ways are used jointly. On the one hand, the widespread adoption of interface design experts' opinion; on the other hand, the observation of the reaction of the user when they use the prototype, and listening to the assessment-involved user's after using feeling and the recognition degree and learning progress of the interface.

The evaluation of the user-involvement iterative CGID method stresses the assessment of the involved users. On each stage of the interface's design development, it should have the user-involvement assessment. And every dialogue between the designers and the users, as well as the discussion on the usability of the game interface itself is the user-involvement assessment process. After the completion of the CGID prototype, the designer should make an overall assessment on the game interface design using the observation and questioning method to the involved users.

The observation method will provide a test environment for the involved users, including all the equipments and a good environment when using the game interface. Then, it will observe the reaction of the users when they are using the game interface prototype, and the next step is to record the user's feedback information. Another assessment technique is directly asking the user about the questions of the game interface. The inquiry skills can lead to the detail views of the game interface design program of the users for the game. The best method is combining the assessment of user-involvement questionnaire with interviews to evaluate the game interface design. After finishing

the collection of the assessment views, they should make a further analysis, organization and discussion of the expert's opinions and user's feedback, so as to ultimately determine the contents of the whole program to be improved and redesigned on the next step of the iterative design.

## 6 CONCLUSIONS

Given the importance of the game interface design, based on the theory of game design, human-computer interface design, cognitive psychology and other theories, the paper tries to build the game user's psychological characteristics and physiological characteristics model, and then makes the game interface design principles based on the game users' psychological and physiological characteristics model, and proposes a set of methods of user-involvement iterative CGID in reference to the general game interface design method. This method takes advantage on the following aspects: such as, it meets the game user's needs in the process of game interface design intuitively and understands the most suitable way of interaction between game players and game platform; in addition, it holds clear design goals and design line; as well as goes throughout the game design process to make the game interface design further meet the demand of the game users.

## ACKNOWLEDGMENT

I am very appreciated that during the process of writing this paper, Ms. Wang Min has given me many invaluable suggestions and ideas to inspire me and assist me to complete the writing successfully.

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