

Research on human-computer interaction and game design

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Abstract. Game design and human-computer interaction are two popular research fields, close cooperation connects rapidly in between. This paper focuses on the mechanisms between these two fields and how they influence each other during the collaboration. Literature review and qualitative research are used in this paper to analyze human-computer interaction and game design, as well as their connections. The game Diablo 2 Resurrected as a practical example of the theories shows that both theories of gaming and user interfaces affect the success of a game, only when these 2 fields work together will a game become attractive to the players.

Keywords: human-computer interface, game design, theory of gaming, user interface, Diablo 2 Resurrected

1. Introduction

Human-computer interaction (HCI) is a relatively new research area that emerged around 1980. It has grown rapidly in the last few decades to become one of the ten most popular areas according to computer science curricula in America [1], and is also one of the most famous interdisciplinary research areas. The realization of HCI is mainly based on the original information technology, transmitting specific and clear instructions to the computer system through a human-computer interface. After centralized processing by the computer, the data information is fed back to the user. The emergence of HCI integrates computers into the development of human life[1].

The gaming industry emerged with a simple FORTRAN code in the early 1970s, and it has shown explosive growth since then. A large proportion of the population has regular play time in many developed countries, and the gaming industry in North America is economically equivalent to Hollywood [2]. According to the famous game designer Bill Volk, the user interface is one of the most important parts of game design. This includes software and hardware, graphical user interface (GUI), tangible user interface (TUI), and attentive user interface (AUI). The vision, touch, and auditory senses are the main sources for humans to gain information, they need to be strongly combined in game design to maximize the user experience.

There were few interactions between HCI and game design in the beginning, but quite remarkable changes have emerged in the past few years in both gaming and academic fields. The relationship between game design theory and traditional HCI evaluation methods has not yet been clearly defined academically and is currently only at the initial stage of collaboration, but as technology develops, exciting collaborations will emerge in the future [3].

This paper analyzes and summarizes the current cooperation between HCI and Game Design through literature review and qualitative research, illustrates how these two areas influence and guide

each other, and takes Diablo 2 Resurrection (D2R) as an example to show the current practical application and the mechanism of their cooperation.

2. Theory of gaming

Gaming is a game mode based on the knowledge that designs and optimizes specific knowledge structures through games and expectations [4]. The essence of gaming is the understanding of goals in life, to upgrade the structure of goals and learning structures by a more comprehensive command of knowledge. Gaming is educational in terms of entertainment, enhancing the comprehensive abilities and behavioral manner within a specific situation. The theory of gaming mainly focuses on 3 aspects: recognition of situation, multivariant intelligence, and immersion [4].

The recognition of situation combines the content of the game with a real-life situation, such that the player improves the learning abilities in real-life-based content. This helps players with the ability to improvise and familiarize themselves with the characteristics of different situations. Multivariant intelligence aims to increase the point of view of human thoughts, and this is often combined with virtual reality. The virtual environment reflects the content in the real world and adds virtual patterns into human recognition.

Immersion is the focus in the current environment. This helps sustain attention and turns attention into a stable mental state.

3. User interface

The user interface is an area where humans and computers interact. It contains software interfaces and hardware interfaces that cooperate with human behavior and computer technology. Through the interaction between humans and computers, users will enjoy convenience and humanization when using them. Other important interactive rules are real-time feedback and the current state. Moreover, the excellent user interface finally presented to users is attractive and simple.

3.1. User interface in games

3.1.1. Software interfaces. There are some special requirements considering the game interface. Firstly, it shall minimize the influence of the computer, the user interface shall not remind the players of the computer, so the players will get into the game quickly without realizing it is simply a game [2].

Secondly, merge the game strategies into the game interface. It's boring to let the players read instructions or strategies in pure words, so a good strategy is to highlight the important parts and show them in pictures and graphs.

Thirdly, there should be a comprehensive integrated interface. The key information on the main interface shall be simplified, and the not important functions can be put aside. The functions shall be categorized before the design of game interfaces, and spaces shall be left for potential future needs.

Another important thing about the game interface is consistency. The layout does not necessarily be the same in the entire game, but the places to find items and execute orders shall be similar. Unified style is vital because good visual effects will sometimes have a higher influence than good scenarios.

Finally, artistry can be employed on the interfaces. The interface should follow the principle of comparison, rhyme, enjoyment, and tone, as well as the combination of dynamic and static states [2]. Game interfaces have different requirements according to their categories and needs, the design shall be based on real demands.

3.1.2. Hardware interfaces. Other than the software interfaces, hardware interfaces play an important role in the product, as they increase its functionality and operability. For better interactivity, new input and output methods are to be added. With the development of a multi-model user interface, new interactive channels, devices, and interactive technologies will be adopted, such as sight, voice, and gestures [2]. New devices, like handles, visual tracking devices, voice controllers, and VR devices, are

becoming more and more popular in the current gaming industry. The devices tend to integrate many functions together and be more intelligent.

With the development of new energy and materials, limited space and weight can contain more functions. A small device is capable of executing a number of functions. The update of hardware improves the user experience, including security and comfort. Moreover, as the use of hardware equipment is simple and clear, it can minimize misunderstandings and ambiguity.

The fundamental task of user interfaces is to find the target user and explore the user's needs, identify the interaction elements, and design the interaction logic, so as to make the players immerse themselves in the game. This requires the game interface designers to master the player's psychology and the characteristics of game interface design in addition to the capabilities of general interaction designers.

3.2. User interface for mobile games

Mobile games are the primary source of entertainment for people, especially the younger generation. With the development of 4G and 5G, as well as software technology, the quality of mobile games is improving dramatically. Researchers in game development have begun to analyze the user interface of mobile games, such as analyzing the success of FruitNinja by Xie (2012) [5], and the usage and combination of colors by Jiang (2014) [6].

The design of the mobile game interface should follow the rule of simplicity and be easy to operate by players. Unlike the user interface on a computer, the mobile game relies on the size of the mobile phone screen, the player's operating space is very limited. Therefore, the designer shall avoid placing graphics, words, and animations together to ensure that the players have a clear vision of the functions.



Figure 1. Mobile Game Interface.

A good interface conveys the information directly to the user, follows the users' habits and provides users with convenience, comfort, and enjoyment [7]. Taking the interface of "Honor of Kings" as an example, although there are many functions in the game interface, the functions responsible for each part are clear at a glance, the most frequently used functions are set in the middle of the screen. Safety during operation must be guaranteed. Due to the limitation of the screen size of the phone, there will be a mismatch between fingers and the screen area. Therefore, it is necessary to reduce the frequency of such problems. The important functions shall be combined with large buttons and be set in the middle of the screen. Reversible buttons are essential in mobile game interfaces and a warning should be given when it comes to the trading or deleting of an item, to increase credibility for the users [8].

The interface shall be user-friendly. People tend to play mobile games at night, so a light sensor helps with protecting the eyes of players. Playing mobile games can be more harmful to the eyes. Restrictions shall be given to teenagers and a reminder shall be given to the adult players for

consecutive playing.

3.3. Interactive interfaces of motion sensing

Motion-sensing games occupy a rather huge proportion of the gaming market, especially with the prevalence of indoor fitness during the pandemic situation. Players are able to make complicated controls by standing in front of the screen and making actions.

The interactive interface based on motion sensing has several advantages. It brings new feelings as most players are used to keyboards and mice. And the cost of studying the devices gets minimized, as it is similar to daily activities. The motion reduces the confusion of abounding buttons, making communication with devices more fluid [9].

The interaction interface contains many technologies, like multi-touch, gesture recognition, voice recognition, gravity acceleration, and brain monitoring [9]. These new technologies enrich the functions of motion sensing and help players engage in the games.

The high-quality feedback mechanisms provide a better sensory experience, this includes video, audio, and even sensory feedback. In most cases, players can't tell the difference between real life and games.

Motion sensing games keep players healthy. Many players play such games to exercise more and keep fit, and these games won't lead to some illnesses that keyboards and mice cause, such as mouse hands and high blood pressure.

However, there are some problems and challenges when considering interactive interfaces for motion sensing. Without the handle, the precision of the motion cannot be guaranteed, and players often can't get the fluency they need, as it takes some time for the machine to sense the motion of the players in real-time. It is extremely frustrating that the player loses due to the machine's fault. The category of games can't be guaranteed, many games that require extreme precision are out of the question, and some games that fit the motion-sensing technology don't get players' interest.

4. Interaction based on D2R

Diablo 2 Resurrected (D2R) is a highly immersive game that provides clear goals which are to beat each boss in the difficulty of normal, nightmare, and hell in the early stages of the game. Upgrade the gear and have a decent PVP or PVM character at a later stage, and find the most unique gear in the trophy room in the end. This session focuses on different aspects of the flow in the game, including diversity, challenges, the UI, the quests, the risks, and the trading of the game, to interpret that this game is one of the most successful games designed by the world-famous Blizzard Entertainment.

4.1. Recognition of situation

Diablo 2 Resurrected is a game that did a great job with diversity. There are 7 characters in the game and they are based on real-life human beings. These characters are composed of 4 men and 3 women, and the colors of their skin are white, black, and yellow. This game makes people with diverse backgrounds feel more amiable, as they will always find at least one character they are familiar with. Each character has its own gear and skills, leaving players much freedom to enjoy the game and to check their characteristics according to the play style.



Figure 2. Interface for choosing difficulty.

There are 3 difficulties in the game, namely normal, nightmare, and hell. 5 acts are to be completed in each difficulty, and the following difficulty can only be unlocked after finishing the former difficulty.

Players gain easy access to fun during the initial stages, since most beginners can finish the normal difficulty with a little help from the strategy, and deaths won't be punished. It can be challenging for players to beat late nightmare and hell difficulty, frustration comes, as well as hard fun. Players keep themselves engaged and their skills developed to meet obstacles and aims, the Fiero and relief bring the best joy after conquering the challenges. Players gain people fun by cooperating to make the game easier or by competing by means of dueling, both ways bring excitement and joy.

The difficulty arises along with the gear of the character and the skills of the player, such that the player will stay away from boredom and anxiety. Many quests and bosses ensure that there are no long sections of empty content, and various challenges offer surprise and variety to players[10].

By playing the game and enjoying different kinds of fun from it, players gain a better understanding of themselves, what style and challenges they prefer, with whom they prefer playing, and whether they are aggressive or not.

4.2. Multivariant intelligence

SEASON

CURRENT

GAME MODE

EXPANSION

CLASS

ALL

SEARCH

RANK	NAME	CLASS	LEVEL	EXPERIENCE
1	ICEQUEEN	SORCERESS	99	3,520,000,000
2	TRAPSN	ASSASSIN	99	3,520,000,000
3	BIGGUY	BARBARIAN	99	3,520,000,000
4	LIGHTBLASTER	SORCERESS	99	3,520,000,000
5	UTHERLIGHTBRINGER	PALADIN	99	3,520,000,000
6	BOWAZON	AMAZON	99	3,520,000,000
7	CORPSEPLESION	NECROMANCER	99	3,520,000,000
8	SPEEDOFLIGHT	SORCERESS	99	3,520,000,000
9	RAWR	BARBARIAN	99	3,520,000,000
10	WOLFMAN	DRUID	99	3,520,000,000
11	CLAW	ASSASSIN	99	3,520,000,000
12	HAMMETIME	PALADIN	99	3,520,000,000
13	ONESHOT	AMAZON	99	3,520,000,000

1

CHARACTER RANK

2732

MANBAT

NECROMANCER

95

3,520,000,000

Figure 3. Leader Board on ladder.

There's a leader board in this game. It records players with the highest experience in each ladder season. The first player to get to level 99 will always stay on top in a specific ladder season. This leader board can be searched according to the season, the game mode, and the character class. Many players fight hard in each season to get their name seen, especially the streamers, they use teamwork and optimal strategy to compete for the first level 99 character. There have been many different strategies for gaining experience, and these strategies are still evolving. These players keep inventing

new ideas for better experiences gain, they get serious fun during the process, the leader board creates meaning and allows them to engage with emotions, strategies, and deeds, and the value of the team gets expressed.

4.3. Immersion of the game

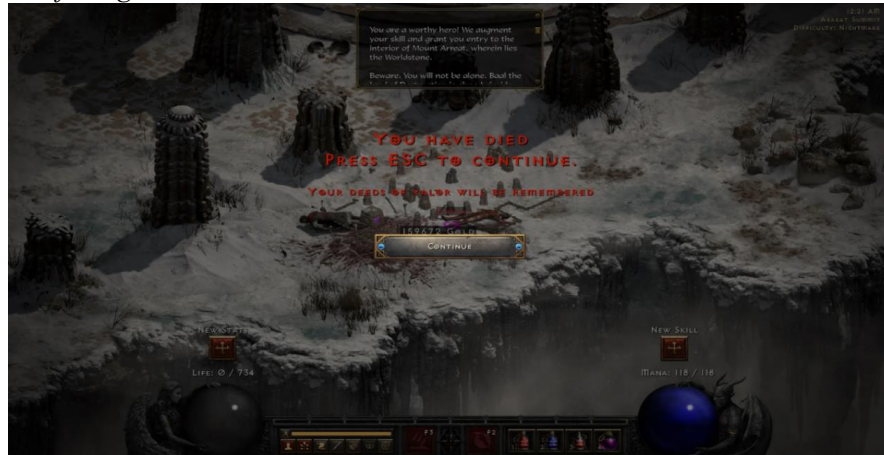


Figure 4. Death in Game.

Each time a character dies, it loses 10 percent of the experience of the current level. If the character gets its corpus 7.5 percent of experience will be returned, and a special mode multiplies this risk by a ton. A mode called hardcore does not tolerate any death. Every time a character dies, that character can never be played again, and all gear and items in the stash are gone together with the character. Only experienced players should start this mode as it requires much patience and caution. This mode gives players a chance to enjoy risks in the game, especially those who love and stay in the magic circle of the game, getting the pleasure of uncertainty while considering losing less threatening and more challenging [11]. However, this mode makes the game extremely immersive, players tend not to tell the difference between the game and reality, as they are fully concentrated so as not to die.



Figure 5. Trading in Game.

The trading function in D2R is another appealing system. Players experience a magic circle when trading with other players, and they can completely enjoy the fun of trading without processing capital or losing real money. Normally, each player makes one build at a time, using specific gear and skills to fight monsters or other players. But as time goes on, it gets boring to just play one specific build all the time. There are 7 characters in-game and each has at least 3 different popular builds. Players tend to trade the gear with other players so that they can enjoy different builds. The currency in D2R is runes,

which can drop from monsters and are considered the most important items in-game, as it takes runes to make Runewords, and many powerful Runewords are considered end-game gear in D2R. The price of gear is quite stable, especially in the latter stages of the game. It is safe to keep high runes and end-game gear in the stash, which allows them to trade for other GG items that are needed. There are many trading magic circles for a successful game, like forums, markets, and in-game trading. This allows players to simply enjoy the process of trading or gain real money by selling the gear they found or buying and selling to make a fortune.

4.4. Various user interfaces

After finishing Hell difficulty, players tend to upgrade their gear to have a decent PVM or PVP build. Farming is the best way to do it. To have magic on the gear and kill as many monsters as possible are the best ways to farm. It is extremely exciting to have a rare unique drop in this game, as the drop rate for many runes and gear is extremely low. The player is provided with not only high-quality videos but also intensive audio. The sound of casting, different skills, melee duels, and exciting drops bring excitement to the player. The dropping of different items is combined with different sounds, such as light armor, heavy armor, iron items, runes, and charms. The perfect combination of video and audio brings the greatest joy to the player.

5. Conclusion

This paper analyzes the current cooperation between HCI and Game Design, and how they influence each other based on Diablo 2 Resurrected. This paper is based on the author's experience and related literature to illustrate it, not the experience of a group of players, so there is a lack of market research. Therefore, it is planned to issue questionnaires to players of Diablo 2 Resurrected to collect their opinions about the game and to exchange opinions on the theme of the theory of gaming applies to the interaction between HCI and game design. The future of cooperation stands on XR, which is a combination of visual reality(VR), augmented reality(AR), and mixed reality(MR). AR overlays computer-generated information on what we see to enhance our view of the real world. Moreover, VR completely replaces the user's vision, immersing them in a computer-generated virtual environment. And MR is in between, merging the real and virtual worlds. The core of XR Vision is the ability to navigate the world using visual input methods, objects, gestures, and gaze tracking capabilities. All the XR devices are expected dramatic growth in the next few years, the device used for VR currently ranks first in output, but it is expected to be overtaken by AR devices. In addition, in the future, VR will be used for expert entertainment and professional training, while AR will gradually become a part of people's daily life through the extremely popular AR smart glasses.

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