Elements, Principles and Process Analysis of Electronic Game Interaction Design

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ABSTRACT

Electronic games have added a lot of entertainment and leisure fun to people's lives. This article first analyzes the medium and five components of electronic games: they are consoles, laptops or desktops, mobile phones, handhelds, and arcades. Then, starting from the activity theory, the electronic game is decomposed into five elements: subject, rules, tools, division of labor, and community. The paper then analyzes the purpose and stages of interaction design for electronic games. Finally, the hierarchy of interactions in video games and the corresponding design principles are researched, as well as the game's own hierarchical structure and the design process of iterative programs. In summary, the finalized game product after optimization is obtained and its deficiencies are perfected through testing.

Keywords: Electronic games, Tool media, Interactive design, Target orientation, Hierarchy, Interactivity.

1. INTRODUCTION

Due to the unique charm of electronic games, it is increasingly sought after as a form of leisure and entertainment. Jason Allaire of North Carolina State University's Gaming Benefit Lab points out that electronic gaming can have positive effects, especially psychologically. One of his studies also found that older adults who played electronic games were more emotionally healthy. With the incorporation of video games into sporting events, electronic games have become a form of entertainment for all ages. But players' frequent addiction to electronic games has made the activity often criticized, but accusing electronic games of causing social problems is undoubtedly an oversimplification of the problem. This article will reveal the elements, principles and processes of electronic game interaction design, so that people can look at the mechanism behind it more objectively.

2. MEDIA AND ELEMENTS OF ELECTRONIC GAMES

Humans have a natural need for games. Games stimulate the human brain to produce dopamine, which makes players feel relaxed and delighted, thus attracting players to actively participate in it. At the same time, as advanced animals, humans need to simulate and improve their living abilities through games, and games are not just mere entertainment. During toddler stage, children participate in games through language or role play, which is beneficial for them to learn, understand and master the basic relationship of human society, and obtain a certain skill or knowledge within a relaxed and safe environment. The pleasant gaming process promotes people's willingness to accept the ideas and content conveyed by the virtual world. Modern technology allows electronic games to become an entertainment and social activity for one or more players to participate in through network, which is both learnable and entertaining, allowing people to learn from games and further apply them in real world.

Electronic game is a special form of activities which uses electronic devices as media, with the purpose of entertainment, recreation and learning. The use of electronic devices and the interactive character greatly increases attractiveness, thus the number of game players increases every year[1]. In real life, electronic game media can be divided into five categories:

- Console. It stores electronic games, and requires an external display screen and a controller to input and operate the game.

- Personal computer, notebook or desktop. Game is operated through game software and its input devices such as keyboard and controller.

- Mobile phones. It operates games through a touch screen, as well as performs complex games through external controllers and other devices.

- Handheld game console. Game is pre-implanted into its hard disk and operated through joystick, buttons and display that come with the device.

- Arcade. An arcade is a commercial game machine installed in public businesses which is a large-scale electronic game. It consists of two basic parts: a frame and an arcade system board. Like the motherboard of a personal computer, an arcade system board is an electronic board made by game manufacturers.

Starting from the activity theory, electronic games include five elements: core, rules, tools, hierarchy and community.

- Core element. The core is the player, which is the main character in the game. According to Gamma Data's Gaming Industry Report, video games players are primarily made up by populations between the age of 20-40. Among them, male players prefer to practice a skill, compete in competitions, solve puzzles, and participate in destructive activities, while female players prefer games that gain emotional experience, real-world related and involve assisting other players, such as social gaming.

- Rule element. The rule element is the mechanism of the game, often refers to the entire set of directions that must be followed within the game. It may include the early stage of task triggering, reward and punishment standards. The rules are formulated and agreed upon by the player community, and ultimately form the game genre that players often refer to. According to iResearch's statistics, casual puzzle games are currently the most popular game genre, followed by chess and card and action-adventure games.

- Tool element. Players interact with the outside world through tool element. Tools may be physical, psychological, or symbols.

In games, tools refer to all resources used to complete game tasks, including interactive tools, resources for information interchange, symbols or language. According to online research data, Chinese online game industry is dominated by the mobile game industry which players generally use mobile phones. It is estimated that by the end of 2021, mobile games will account for 74.2% of online game, making it the most commonly used platform for game players.

- Hierarchy element. The player community has to undertake relevant task assignments in the process of mission accomplishment. This is the embodiment of the social nature of game activities. Community members communicate and cooperate to complete various game tasks.

- Game community elements. Various types of characters participating in the game form a game community, including players and non-player characters (NPCs). Great interaction design will make players and non-players form a positive sense of communication and cooperation. Players will experience the real social situation in the virtual game world, which will greatly improve game interactivity and player immersion.

3. PURPOSE AND STAGES OF INTERACTION DESIGN FOR ELECTRONIC GAMES

Interaction design refers to the process of designing a product with an improved user experience by considering the interaction between people and products, especially the user's identity, knowledge and experience during use. In general, electronic game interaction design is a creative process aimed at smooth communication and operation by creating a series form of dialogue between players and games through the design of tool and media.

In the software and hardware design of electronic games, it is necessary to consider the emotional needs of players. The implementation of interactive design is brought out through tools such as game display devices, input devices, and feedback devices. Creation of obstacles within the game stimulates the activeness within players, therefore improves the player's emotional, logical, physical and other aspects of experience[2].

Electronic game design has three stages: planning, visual designing and programming. In the planning stage, it is necessary to analyze the demand of customers, and design will take place accordingly afterward. In the visual designing stage, conceptual design and interface design are carried out, followed by development and testing of the program. The conceptual and interface design iterations are carried out according to the test results, and the game-related optimization is done repeatedly. For electronic game designers, the key is to concentrate and monitor the gaming experience of players, and to consider the worldview and style of games from the perspective of different players, especially the task mechanism of game and emotional expression. After the design requirements are clarified in the planning stage, the designer should analyze and interpret the elements included in the planning, put forward optimization proposals, and reach a consensus after repeated discussions and revisions. The basis of finalizing solution of iterations optimization is the common agreement among planning, visual designing and programming. During the process, visual designers provide professional interface art support, programmers deliver technical support[3]. The solution is brought out by interaction designer by continuously following up the fitting and matching of these two aspects, thus to achieve the visual effects and logical integrity of the game interface. Interaction designer of electronic game is the bridge connecting various positions and players in the entire game creation process, and plays a vital role in the management of the overall game development process.

Electronic game designers follow the principles of goal orientation, internalization and externalization, hierarchy, intermediate tool and development to improve player's experience. Effectively-defined tasks in the game urge players to explore, which is the intrinsic motivation of the player's gaming experience. It generates the player's emotional needs and intellectual challenges, which surfaces as the demand for simpleness and easy-to-operate operation mechanism and interface. The hierarchy of the game process includes activities, behaviors, and operations. Among them, activities and behaviors are consciousness-oriented, and design can promote players to have the willingness and motivation to perform game activities. Operation design is unconscious, which is to achieve fast, effective, clear and easy-to-understand feedback through simplistic and intuitive interfaces. Players and games interact with the assistance of

devices, so targeted designs are made according to the characteristics of the devices. Designs such as text, icons, and task completion methods are applied to boost the activeness of players' interactions during the game. As player's game progresses deeper, the design of matching skills and challenges is required, and the orderly-changed virtual environment decreases the player's experience of dullness.

4. INTERACTION HIERARCHIES AND DESIGN PRINCIPLES IN ELECTRONIC GAMES

In electronic game activities, a series of operations and behaviors constitute the interaction between people and the game. Players obtain tasks and missions in the game, and ultimately achieve the purpose of knowledge acquisition, emotional experience and skill improvement during the process to victory. In order to do so, players must complete a series of tasks. The tasks continuously provide stage goals to achieve, which form the interactive operation of the game. The realization of such requires the support of corresponding internal and external condition according to the game interaction hierarchies and design principles, which can be shown by the following model ("Figure 1"):
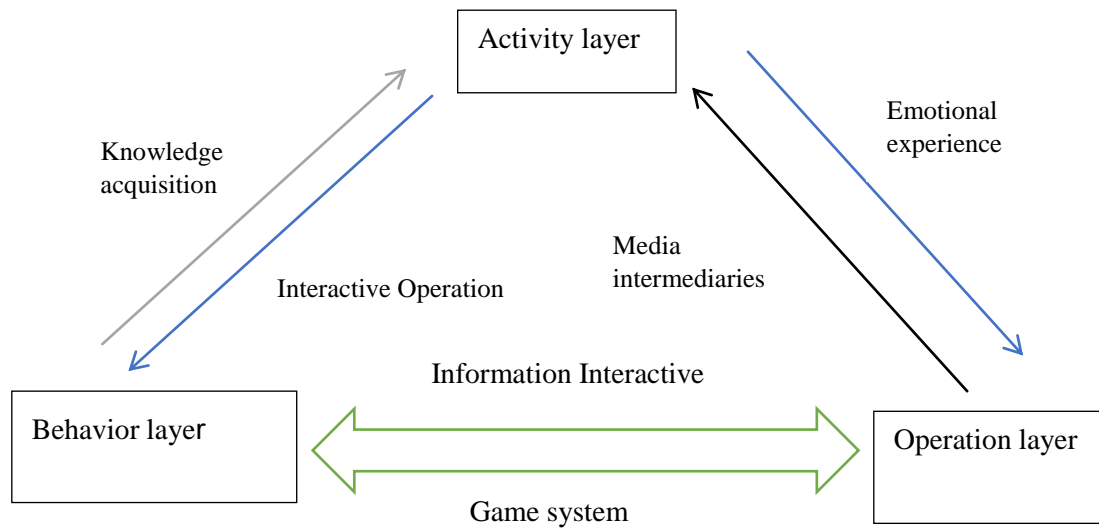
Figure 1 The game interaction hierarchies and design principles.

The activity layer of the game contains the overall worldview, story plot, background knowledge and other cognitive and emotional aspects of the game.

The behavior layer includes the game's rules and guidelines, tasks arrangement in the plot, the information methods and other interactive behaviors that need to be obeyed.

The operation layer contains the most direct media intermediaries that allow players to interact with the gaming system, such as audio-visual interaction, information and knowledge interaction.

Fundamentally speaking, the design of the activity layer, the behavior layer and the operation layer does not have clearly defined boundaries and can be transformed into each other. The final designed game is attractive for players to participate, with clear and challenging goals, mind-challenging game development, engaging operation mechanism, reasonably designed and intuitive human-computer information interchange interface, effective and easy-to-understand human-computer feedback, progressively increased mission difficulty as skill of players improves, and reasonably and delicately designed plot and development environment. According to the analysis of interview data with different players, the following three principles should be followed in the interaction design of electronic games:

- The playfulness of the activity layer design

The content and plot of the story should be able to mobilize player's empathy, drive player to devote energy and time to game activities, and bring pleasure to player, with the elevation of acquiring knowledge and ideological awareness. Characters in film and television should follow the principle of rationalization. That is, character behaviors are supported by their emotions, emotions are shaped by their experiences, and emotions drive character behaviors. So that audiences can understand the motivations of characters' behaviors and generate strong empathy. Game also allows players to have the emotions setting in the game, merge with the characters in the game, and become the main character of the game[4]. Yet, game is a fun experience for the transfer of knowledge and skills, as well as an enjoyable and motivated learning process.

- The progressiveness of the behavior layer design.

Game design should be player-centered, focusing on the role players play, so that players can experience playability in role-playing. The multi-level goal setting of the game allows players to gradually immerse themselves in it. The design of the game rules should skillfully integrate objective knowledge. By providing players with choices with plenty of freedom, player's sense of

control is improved and restraint from real-world rules is reduced. With the improvement of the player's ability in the game, the difficulty of the tasks gradually increases, which further improves the player's sense of achievement in reaching the goal.

- The convenience of the operation layer design.

Clearly-structured game information interface and layout guide players to obtain a sense of initiation and direction when interacting with the game. The cognitive burden of players is reduced by standardized specifications, especially the clear and identifiable object icons, which minimizes the difficulty of players when reading text. The efficient, concise and accurate feedback during human-computer interaction is essential, so that players can timely understand the corresponding results of their operations, and provide players with a sense of mission advancement. The design of the operation layer enhances the gaming experience of players by improving the smoothness of operation.

The starting point of electronic game interaction design is the analysis of the characteristics of the target player group. It can be done through the following processes:

Firstly, it is necessary to understand the needs of target players through research. The characteristics of target players group should be considered and relevant elements should be analyzed, including choice of country and region, gender and age, preferences and characteristics of target players. Therefore, the basic characteristics and conceptual understanding of games are clarified.

Secondly, research and analysis of similar game products is conducted, original sketching and production of their own products is completed accordingly. By applying demand analysis through the four elements of rules, tools, hierarchy and community, design is done from the activity layer, operation layer and behavior layer. Feasibility testing is carried out based on interaction design prototypes to iteratively optimize the design.

After finalizing the plan, art resources are engaged to determine the game interface and technical resources is utilized for program development. Repeated communication and iterative optimization are required before the completion of final interactive product[5].

Testing is critical to the optimization of a game's interaction design. Errors are inevitable in games, and testing runs through the entire process of game development, including the following aspects:

- System environment test. Test runs based on five media such as mobile touchscreens and PCs. The system should run smoothly so players can fully experience the game.

- Interface friendliness test. Whether the interface design is qualified is determined by if players can rely on game guidance to operate and toggle smoothly on each interface without external assistant.

- Game mechanism test. It includes scene display, character control, data transfer and feedback, UI design, various interactive audio feedback, and icon responses.

- Knowledge transfer effectiveness test. The knowledge conveyed by video games is consistent with the objective world and can be recognized by players.

5. CONCLUSION

In summary, electronic games are mainly run on the device media. Interactive design needs to fully consider the five elements of electronic games. Through three stages of planning, visual designing and programming, the playfulness of the game's activity layer, the progressiveness of the behavior layer and the convenience of the operation layer will be achieved[6]. By analyzing of the player's demand elements, after repeated communication and iterative optimization, the optimal interactive experience game product is finalized, possible deficiencies are repaired through testing. Based on the principles, layers and processes of electronic game interaction design, this paper provides a reference for improving the interactive experience of game players.

AUTHORS' CONTRIBUTIONS

This paper is independently completed by Shurong Peng.

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