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The impact of color on players in human-machine interaction in games

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Abstract. The objective of this research is to identify how color affects game players in human-machine interaction. Recently, driven by the faster development and popularity of computer games, the game designers start to use a variety of techniques to enhance players' experiences and interests in a certain video game. Colors influence game players' experiences and their behaviors. To make this research influential and convincing, the author mainly utilizes the quantitative research method to explore how color affects the users' emotions in games. Questionnaires are adopted by randomly selecting almost 100 video game players, who are suggested to respond to their attitudes towards and options for color in influencing their interests and perceptions of a certain game. The findings show that colors can allow players to feel interaction and vitality, provide visual continuity, enhance data visualization, etc. Above all, colors convey more useful information for the human-machine interaction in games, and colors first come to players' eyes. Therefore, the application of colors plays an essential role in the interface of human-machine interaction to some extent.

Keywords: colors, human-machine interaction, interface, roles.

1. Introduction

Colors are an indispensable part of people's everyday life and people have different perceptions of and preferences for colors, which plays an important role in human minds and behaviors, like aesthetics and perceptions of different scenes [1]. The use of interface colors in game interfaces is an important factor in psychology, as they can affect people's feelings about the surrounding environment. Recently, video games and human-machine interaction techniques have been widely adopted by game designers, leading to intense competition. Therefore, successful game designers pay more attention to the appropriate use of colors in the game interface when using VR technology [2]. Colors are important for game players, and user experience is a competitive factor for gaming design and future simulation. To create a game interface, game designers emphasize colors to attract more users. Jakubowski argued that the advanced technologies, like VR and AI, has made game players have their fastidious attitudes towards color using [3]. Due to the significance of color in enhancing players' affection in human-machine interaction, studies on it are rarely conducted. Therefore, this research conducts specific studies on it by using a quantitative research method for reliable data collection.

Two questions are identified for guiding the research direction, and will be answered through this research. All of this research points are surrounding these two questions for the focus.

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(1). What is the role of colors in helping game players enhance their experiences in human-machine interaction?

(2). How do the game designers use color appropriately in game design?

This research aims to help people familiarize the function of colors for games designers in creating the successful video games. Colors have an irreplaceable role in human-machine interaction, because different colors evoke various psychological feelings for users and because colors directly affect users' experiences and perceptions of the games. In addition, this research also allows the game designers to make the most appropriate and humanistic color design according to different functions and scenes. Still, through this study, the game users are able to clearly identify their appropriate colors in the process of playing video games.

2. Literature review

People in different periods of time have different preferences for colors. A number of scholars conduct research on colors and the application of colors from different perspectives. Burchett argues that color harmony and combination can help produce a happy and pleasing affective response [4]. Color harmony can be the order, tone, configuration, interaction and association, etc [4]. The traditional role of color aims to realize object recognition and representation. For instance, the color of an Apple is red and the the color of a banana is yellow, which helps people clearly distinguish their different colors [5]. To some extent, colors play an important role in identifying artificial products and natural objects and making all kinds of objects clear [6]. From this point, it means that the traditional role of color is to identify different objects in the natural world.

Based on all kinds of video games in the digital era, it finds that all of them have different colors to conform with their corresponding themes of games in fact. When it comes to the popularity of video games, it shows that color counts for excellent user experiences and perceptions. Color is closely linked to people's emotional expression. According to Norman and Scott, they argue that color has a semantic meaning, because colors have a tremendous richness and complexity of affective significance in their everyday lives and experiences [7]. In affective computing, the function of color exerts its influence by virtue of light. Sokolova and Fernandez-Caballero state that the role of color and light can help enhance users' visual sensations and provide an excellent experience for them. Different colors create different lighting that can be set in different themes of video games. Furthermore, they also believe that both female and male game players have their unique preferences for colors that create different feelings of light all the time [8]. In this sense, the role and function of color are indispensable and valuable for users at any time.

Moreover, in the video game field, the game designers attempt to design a more beautiful and humanistic interface with suitable colors by catching up with the users' preferences and interests. According to Tulleken, he believes that technologies have greatly improved color display and that human biological characteristics have affected people's perception of color in most cases [9]. Meanwhile, the game designers make the most of color psychology in the process of game design, because colors can help designers create more beautiful and better games. From the study conducted by Cieslak, it has discussed some roles and functions of colors, which will help shape the users' behaviors, control the players' attention and give the users an important feedback about their personalities and signal that will improve the game world [10]. It can be seen that color is an important factor that allows users to better understand the quality and popularity of a video game.

Apart from that, colors will affect users' emotions in video games. Joosten, et al. pay attention to users' emotional experiences when they are playing video games. These emotions are the principal reasons for playing games. Within this research, the authors adopted the questionnaire to identify the respondents' responses in using four kinds of colors. The result shows that red color triggers users' excited negative emotions and yellow color arouses the positive emotional response [11]. Still, Geslin, et al also conduct the similar study on the relationship between colors and emotions in video games. They believe that some colors will arouse the emotions of joy, sadness, fear, and serenity, and other

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colors will trigger lightness, saturation, luminance, etc [12]. This means that color's role in human-machine interaction video games is indispensable and significant to some extent.

3. Research methodology

In order to make this research reliable and convincing, the quantitative research method will be adopted. In detail, the online questionnaire will be adopted by selecting 100 video games players randomly. Among these different research methods, an online questionnaire is more beneficial for this research outcome for data collection, because this will help the researcher find the maximized response rates and deal with non-responses to a larger degree [13]. This means that the total amount of data collected can be used to support the main arguments of this research. Meanwhile, the elements of questionnaires include the amount of data and reliable data collection, in a logical, systematic, and structured method as well, which will prove the reliability and validity of the measurement [14]. Under this condition, it can be seen that it is wiser for the author to adopt the questionnaire for data collection in this research.

For the data collection part, there are almost 10 questions prepared for these 100 respondents, who can share their different opinions about the role of colors in the process of playing their games. These questions were based on the respondents' interest in video games, the length and frequency of play, as well as their attention to the color of the game and whether the color affected their emotions, which helps the researcher understand their attitudes and perceptions of colors in the games that they are designing and playing all the time. These questions are closely related to colors and video games, which is beneficial for the data collection for this research.

4. Findings and discussion

According to the research method analyzed above, there are several findings from the questionnaire. Firstly, according to these 100 respondents, nearly 80 of them are heavily interested in video games playing(Are you interested in video games playing? A Yes B No How often do you usually play games in your everyday life? A once a month B once a week C once a day). This result is consistent with the newest data collected. According to Howarth, he believes that the gaming market has come to the valuation adding up to 197.11 billion dollars [15]. Around the world, there are almost 3.09 billion active game users. Due to the rising development of video games globally, there will be intense competition in this field. Therefore, a number of game designers improve their designing techniques all the time to attract users' attention and interests. Most of designers pay particular attention to the colors used in various video games.

As for the importance of the role of color in game design(What do you think of the role of color in the process of your games playing? A very important B important C unimportant D have no idea), 72 percent of these respondents believe that color plays an important role in human-machine interaction games designing. They also state that in the human-machine interaction interface, the color used determines the users' emotions and feelings. A suitable and comfortable color combination in the interface will allow users to concentrate on the quality of the games as a matter of fact. However, only 28 of them think that color is unimportant to them while playing the games(What do you think of the role of color in the process of your games playing? A very important B important C unimportant D have no idea). They explain that they emphasize the roles and characters, the theme of the games as their primary choices in playing the games. Therefore, the role of color for game players in human-machine interaction games is indispensable and valuable to a greater degree.

Furthermore, based on the player's perspective, game designers focus on the color aspect of the design to be able to let the color arouse the game players' emotions. For instance, when they are pleased with the color use in the interface, they have a good impression of the game's design, or vice versa. In the newly designed games, color is used to cooperate with the game principles and technologies, improve the digital system, and attract more professional users[16]. For the chosen colors of the video games, some themes are suitable for using the darker color, and some of them need to use the lighter color instead. The darker colors represent melancholy and mysterious feelings, while

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the lighter colors present people with vitality and happiness. In spite of that, the players are willing to accept the colors that can be suited to the different themes of video games(Which color do you like to use in playing video games? A red B black C yellow D white E other colors). For instance, when they see a cruel killing game, they prefer to enjoy the black and gray colors rather than yellow and pink. This means that the use of colors is particularly designed by game designers for the sustainable development of games in the digital era.

What's more, among these 100 respondents, 90 percent of them believe that the game designers will spend more time on colors adoption and technique by using colors in order to create strong visual sensations for players in reality.(Do you think game designers focus on color use in designing the different characteristics? A Yes B No) This deserves particular attention. In human-machine interaction games, the game designers primarily consider what colors will be used to grasp the players' attention and interests to some extent. In most cases, this can be an effective way for them to develop and create the most successful and attractive games for users.

5. Conclusion

In conclusion, this research discusses the role of colors in helping game players enhance their feelings and experiences in human-machine interaction. Driven by the popularity and dominance of human-machine interaction techniques, a number of games focus on the use of color, to arouse users' visual sensations and trigger their determination to become addicted to the game playing. Different colors present different feelings for users, and the game players are also influenced by the chosen colors in the interface of the games as a matter of fact. This study uses the quantitative research method by using online questionnaires to collect data. However, this research also has its limitations, which need particular attention. To identify the role of color in human-machine interaction of games is relatively broader and extensive, which should be narrowed down for more accurate exploration and discussion all the time. In the future, this study requires the further research, aiming to provide valuable guidance for game players and game designers to satisfy the global market trend in the game industry.

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