The Interaction Design of AR Game Based on Hook Model for Children's Environmental Habit Formation

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Abstract. Human beings are facing the crisis of deteriorating ecological environment. To strengthen the cultivation of children's environmental awareness and make them develop the habit of environmental protection life are important parts of ecological environment improvement and protection.

This study investigate and analyze the current situation of children's environmental awareness education which had found that the limitations of it is the main reason why it's so difficult for children to form environmental awareness and habits. The purpose of this study is to conduct an interactive design which based on AR technology, to enhance children's environmental protection awareness, to further enable them to form eco-friendly habits in their daily lives. Based on Hook model, the study designs an AR game mechanics by considering children's psychological characteristics so as to trigger children take actions. The design of game interaction mode adopts the Hook model. This study attempts to build an ecosphere management model in the game and the main interaction mode of the game is that players can use AR scanning function based on image recognition technology to obtain virtual models of plants and animals to build their own unique ecosphere. Players can experience the actions of cognizing and managing their own ecosystem.

Keywords: Hook model · Children's environmental cognition and behavior development · Interaction design · AR technology · Embodied cognition

1 Introduction

The Emissions Gap Report 2020, published by the United Nations Environment Programme, shows that in 2019, global greenhouse gas emissions increased for the third consecutive year to 52.4 billion tons (excluding ±5.2) and 59.1 billion tons (including ±5.9), including greenhouse gas emissions from land use changes). [1] China, as the world's first total carbon emissions and the world' s fourth economy per capita, is facing great pressure to reduce emissions. In addition to carbon emissions, the water pollution, soil pollution and air pollution coming with industrialization also bring great challenges to the sustainable development of the ecological environment (Fig. 1).
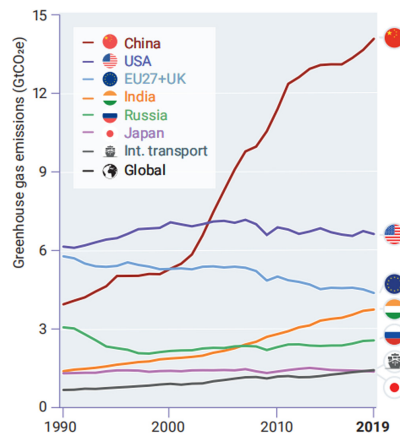
Fig. 1. Absolute GHG emissions of the top six emitters (excluding LUC emissions)

The importance of environmental education is self-evident, raising awareness of environmental issues and environmental action. In addition to the accumulation of knowledge, it also values people's participation and action [2]. The purpose of this research is to use AR games to study the interactive strategy based on the Hook model, to cultivate children's environmental awareness, and then to form environmental behavior habits.

2   Current Situation of Children's Environmental Protection Education

This study used an interview method to understand their ecological and environmental awareness and daily environmental behavior habits through communication with 20 children aged 7–12. In addition, through issuing 110 questionnaires for teachers and parents, they investigated the ecological awareness cultivation. The following problems exist in children's environmental education.

(1) Poor effect of the traditional education model

According to the research, the main model of environmental education that children receive on campus is the teachers' single theoretical introduction. This way makes the children feel boring. Simple theoretical indoctrination cannot get good behavior feedback, and the education effect is general. Through communication, children know that they should save food, not littering, but according to parents' observation of their children, they cannot practice environmental behavior in daily life.

(2) Insufficient environmental action force of children

According to the research, some schools have made a lot of efforts in the form of environmental education. The main forms are musicals, campus environmental protection activities, children's comic books, etc. These forms are more novel than the traditional environmental protection education, easy to arouse the interest of children [3]. It was found that while these forms make boring theories interesting, children are still less expressive throughout the study.

According to children's interviews, children were interested and curious about AR games, and 60% of the children interviewed knew or were exposed to AR products and expressed their willingness to try more AR games. Parents and teachers are also agree with the teaching methods with fun. AR has been widely used in children's teaching research, such as child safety education, space cognition, language teaching, and traditional learning methods have improved with the help of AR [4–6]. AR plays an important role in cultivating students 'interest in learning. Its visualization of virtual and reality improves students' content understanding, long-term memory retention, learning motivation and collaboration [7].

3 Embodied Cognition Enhances Environmental Awareness

Before cultivating children's environmental behavior habits, children need to form an awareness of ecological protection. Games start from the embodied cognition to help children understand the importance of environmental protection. The core concept of embodied cognitive theory is that human beings interact and communicate with themselves and the outside world, that is, body structure, nervous system, sensory organs, combined with the corresponding activity methods, to gain understanding of themselves and the outside world, and form cognition of the world in the brain. Cognition is the result of the body's interaction with objects in our living world in the appropriate way, that is, the proper and effective interaction between cognition, body and environment enables learning to occur [8]. In the AR game, children's players can not only form cognition on the senses, but also practice environmental behavior in the living environment through their own bodies. In the game experience, children constantly gain experience to form the cognition of ecological and environmental protection.

4 Eco-friendly AR Game Design

4.1 Children's Environmental Game Mode Design

The design of AR games is to comply with the cognitive development of children. 6–12-year-old children are more suitable for regular game forms [9]. In this study, the main rules of the game are to let each child build their own ecosystem. In the game, some small environmental tasks will be completed in reality, and children will receive certain game rewards, such as the reduction of the carbon emission. During the course of the game, children also realized the knowledge of what carbon emissions are and how to reduce carbon emissions. In addition, children can also build a wider ecosystem with other players. In the game, children can use image recognition technology to identify animals and plants in their surrounding environment which can be transformed into game models to build an ecosystem unique to the player. Players build the ecosystem with the things around themselves, and when the ecosystem is damaged, they can also feel deeper about how important it is to protect the environment around them.

(1) Game for the development of children's environmental awareness

The game lets children through the ecological crisis to feel the potential hazards that the environment breaks the ring. For example, the game ecosystem of players may face

greenhouse crises, air pollution and sea eutrophication. These crises will be reflected by the rising sea level of the islands, haze, and a large number of fish deaths in the ocean, so that children can intuitively feel the harm of environmental damage. To eliminate the crisis in the game, children need to make real-world environmental actions to protect their ecosystem. After children practice environmental behavior, such as the carbon emissions of the game ecosystem will be reduced, and the greenhouse effect crisis will be solved. The video in the game will further explain to children what carbon emissions are, what the greenhouse effect is, what the consequences of this phenomenon will cause. In the whole process of solving the crisis of the game ecosystem, children's awareness of ecological and environmental protection is based on their personal practice of children.

(2) Game helps children develop environmentally friendly behavioral habits

Children in order to protect their own ecosystem, fight with the ecological crisis, it needs them to complete in real life within the power of environmental tasks, such as not littering. Players in reality, through photos uploaded to the game, so as to protect their own ecosystem. Out to protect the emotions of the game ecosystem, players will continue to invest in daily environmental behavior, promote the formation of children's environmental behavior (Fig. 2).
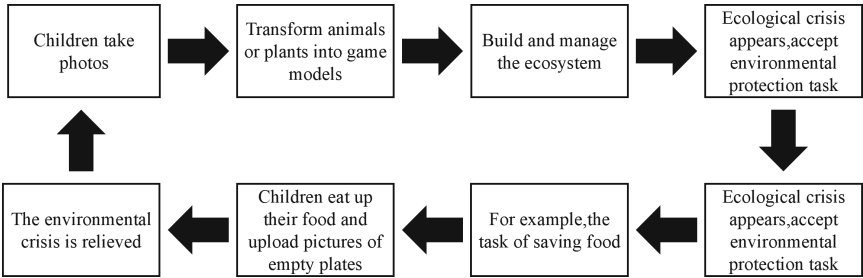

Fig. 2. The game process

4.2 Hook Model Application of the Model in the Cultivation of Children's Environmental Habits

The AR game interactive design strategy is based on the Hook model, proposed by Neil Yal, Ryan Hoover, author of Addiction, focusing on the four major product logic that allows users develop use habits, including four elements: trigger, action, reward, and investment [10]. The use of the Hook model is not to make children addicted to the game, but not to delay their study and life. The research aims to use Hook models to develop AR games, to attract children to continuously participate in games, so as to cultivate their ecological awareness and promote the formation of environmental behavior habits.

(1) Trigger

The game, dominated by internal triggers, internally triggers children's curiosity and the psychology of loving the game and everyday scenes in their lives, drawing interest from children and enabling them to form good behavior habits in happy games.

(2) Action

Action is the behavior that the product wants to complete after it reaches the user. Considering the scope of children's cognitive ability, the interactive design of the game needs to be easy to operate, reduce learning costs, and improve their mobility while also avoiding children spending a lot of time in the game. Depending on the age of the children, the difficulty of the tasks they need to complete in the game will also vary.

(3) Reward

The game offers random rewards and continuous updates, in addition, children can unlock new things step by step, increase the freshness of children, and keep them enthusiastic about the game.

(4) Investment

The focus of the game is not to give children a lot of time and money in it, but on the emotional input of children to realize that their environmental behavior can change the natural environment and protect the home on which humans live.

4.3   A Study on Interactive Strategies of Children's Environmental Games

(1) Sensory level

In order to establish a good immersive experience, the current augmented reality games on the market usually add pictures with strong light and dark contrast and sound effects with high intensity and high recognition, to attract the attention of users. However, the visual nerve and auditory nervous system of minors are still in the development period. Compared with adults, the corresponding threshold value of external stimulation is lower, and it is correspondingly more likely to produce damage due to excessive stimulation. From the perspective of maintaining the physical and mental health of minors, the production of design games for such groups, especially before the secondary sexual development, should appropriately reduce the picture saturation and contrast, and avoid too harsh sound effects [11].

As a supplement to attract users 'attention, it can be adjusted for the target group's preferences in the art design. Specifically, avoid complex art materials, and highly abstract and summarize the virtual image prototype. The overall color style adopts high lightness and low saturation, in order to reduce the sinking cost consumed by users in understanding the game.

(2) Interface and operating system

Considering the nature of the product and the target population, in order to reduce the risk of missed touch, too complex setting is not suitable to be set on the primary interface of such games. The appropriate addition of similar language effects can effectively attract the attention, with the appropriate changes of the screen to improve the efficiency of the understanding of the game. Considering the play platform and the target population, in order to avoid the excessive icon density, less operations should be done at the same interface than the common game. At the same time, when predicting the user behavior according to the operation logic, it should be unified with the overall art style in the icon design, and avoid forming the abrupt feeling between the picture and the operation experience during the process of playing [12].

(3) Immersive design

Considering the limitations of the mobile terminal platform in display technology, we can adopt fine model and optimization of real-time algorithms to improve the integration

of the picture and real environment. In addition to the technical methods, we can also improve the immersion of the game from the psychological level. According to the principle of uncanny valley, within a certain range, the closer the nonhuman image approaches to humans, the lower the inhuman feeling, but after the similarity reaches a certain extent, people will dislike it. In the process of art practice, we found that the more in a certain range of the image of the art increases the head and body ratio, reduce the ratio of the limbs and the length of the trunk, increase the proportion of the eye in the face or the closer to the "baby" image, the more likely to be favored by the audience. In the collection target virtual image of art design, can be in the above highly abstract summary concept, the virtual image to a certain degree of personification, or its "baby", to create intimacy, so as to enhance the user's immersion in the process of interaction.

5   Conclusion

This study based on the Hook model discuss interactive design strategies for environmental protection-class children's games and Analyses the behavioral mechanism of constructing "trigger-action-reward-investment" in the game to cultivate children's environmental behavior habits. At the same time, a specific plan is proposed to improve their experience in visual and hearing, interface and operating system, and immersion. It provides a theoretical basis for the next practice of developing environmental education games for children.

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