Game Design and Implementation in Popular Science Education Based on Virtual Reality Maze

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Abstract. With the development of science and technology, VR technology has been widely used in various fields, and promoted the rapid development of various fields. It has become an important direction of market development in game design, and VR technology has many advantages in practical application. According to the research and development concept of popular science game and VR maze game, this paper designs the game by making use of what they have in common. Effective integration of knowledge popularization and electronic games, through the VR maze popular science games to open up new ways of knowledge dissemination.

1. Introduction
The original emphasis of electronic games is interaction, with the upgrading of picture quality and operating system, the immersion and imagination of the game are also improving. VR technology perfectly meets the needs of the design and experience of electronic games, so it has a great room for development in the field of games.[1] The purpose of popular science is to improve the public's scientific literacy, while the purpose of video games is to meet the needs of public entertainment. There are two kinds of "misunderstandings" in the design of popular science games, one is that the popularization of science is only a vassal or embellishment of the game, so that the scientific nature of the game is not enough. The other is to put popular science above the game, losing the entertainment and playability of the game. It is not that video games cannot spread scientific knowledge, but they cannot replace entertainment as the primary function.[2]

2. Analysis and solution
2.1. A brief introduction to the Development of popular Science Games
Domestic popular science games are still in their infancy. According to incomplete statistics, there are very few popular science animation channels in China's portal websites, special animation websites and popular science websites, and similar popular science websites such as China Digital Science and Technology Museum are even more rare.[3] In terms of research and development, China obviously lags behind foreign countries. Many games in Europe and the United States and other developed countries have a strong nature of popular science, such as "Enigmo", "Monument Valley", "Angry Birds" and so on.[4]

2.2. Game design based on the combination of VR maze and popular science education.
Today's popular science education needs to be presented in a new way, and the development
of VR technology, the popularity of the Internet and people's love for games have created a good development environment for electronic games to enter the market with the posture of popular science. With the combination of popular science education and VR technology, the research team developed a popular science game with the theme of maze for teenagers.

The difficulty of game design is to achieve scientific communication while retaining its entertainment. Some of the existing popular science games realize the dissemination of scientific ideas through the physics engine, and the type of knowledge is relatively single. Sometimes even after people have mastered the game skills, they no longer understand the knowledge conveyed by their feelings. Another type of game is to show knowledge through short animated videos or scene effects, which greatly reduces the playability of the game and makes players lose interest. This project makes use of the characteristics of the maze to realize the dissemination of knowledge without sacrificing its entertainment.

Table 1. Comparison between ordinary popular science games and VR maze popular science games

| Contrast                 | General popular science games                                                                 | VR maze popular science game                                                                 |
|-------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Playability and scientificity | There are two extreme states, and there are few cases in which the two characteristics are perfectly combined. Either the entertainment is too strong to ignore the scientific nature, or the scientific nature is too strong to lose the entertainment effect and lose the original intention. | The virtual image operated by the player takes the maze as the main content, uses the maze to stimulate people's psychology of exploration, and gives some hints by placing puzzle road signs at the fork in the road, which can not only retain the entertainment of the game, but also realize the dissemination of knowledge. |
| Advantage                | Game devices have become so popular that they can be operated by using a mobile phone or a computer. | Popular science games presented in the form of VR allow players to better integrate into the environment. It can not only exercise people's spatial cognition and thinking ability, but also enrich people's knowledge reserve, broaden their horizons and realize the dissemination of knowledge. |
| Disadvantage            | The game users with strong scientific nature have low viscosity and the knowledge dissemination degree with strong entertainment is low. | In the virtual reality environment, people's sense of direction will be weakened accordingly, and the virtual environment will bring people a certain sense of vertigo. |

3. Game design analysis

Place puzzle signs at the labyrinth fork in the road. Different options of the puzzle represent different forks, marked by corresponding symbols, and choose the right route by solving the puzzle. As a result, the difficulty of the maze is reduced, the entertainment of the maze is improved, and the dissemination of knowledge is realized at the same time.

The puzzle is screened out by this team of high-quality popular science knowledge questions that teenagers are interested in.

The scene and character model of VR maze are built with 3DMAX, and then rendering and programming are realized by importing Unity.

The scene design of the VR maze adopts a simple and fresh style to avoid the dizziness caused by the complex background.

Set the difficulty level for the game, which can be distinguished by mazes of different complexity.

The law of the game stipulates that the game is played from an immersive perspective relative to the maze; when the player changes the line of sight, the labyrinth itself rotates to complete this operation; the player moves freely in the maze and gets the correct hint by solving the puzzles at the fork in the road. Users can open the next map if they get to the exit.
4. Game design practice

4.1. Game design and implementation

Prototype: We will carry out the modeling design of the game map, screen scene and characters, and discuss the rules of the game. Discuss the rationality of the game and fix the rules.

Alpha phase: we will determine the game content attributes, build models, set the location of puzzles and test their effects, and design the number of levels and forms of expression.

We use 3DMAX to build the model, design the characters in the same style, and add animation to it. We use PS to make maps and virtual buttons for the model.

Beta version stage: we will complete the specific content of the game, including writing programs, realizing the player's control of movement, and designing UI, completion software.

Firstly, install two development tools: Vive input utility (HTC device development tools) and Steam VR plugin (Steam VR development tools from unity's asset store), drag two preforms into the scene: Vive Camera Rig (camera used for HTC device display screen), [ViveInputUtility] (used to detect the input of htc device handle keys)

Components added to characters: Rigidbody (Unity built-in physical components to simulate real physical properties), AudioSource (Unity built-in sound player), Capsulecollider (Unity built-in collider, objects with colliders release each other to trigger physical events), Trigger component (To handle post-collision logic), Movecomponent (Script that controls the state of the character)

Update: Unity script has a built-in loop function, in which we detect the player's handle operation.

Vector2 cc = ViveInput.GetPadAxis(HandRole.RightHand);

This sentence is to get the press position of the disc button on the right hand htc handle. Taking the disk plane as the two-dimensional coordinate system, it is divided into four regions, and the moving direction of the character is calculated by calculating the position where the handle is pressed.

Drive the character to move by attaching the direction and speed of movement to the rigidbody physical components of the character's body.

Rigidbody.MovePosition(head.transform.forward * speed * Time.deltaTime);
ShowWinUI (): Show UI
Here xxx.setactive means to control the display and hiding of the specified object, true is displayed, false is hidden, this method is called by the collision function above, execute this function when it touches the end object

OnNextBtnClick (): responsible for calling the function of switching scene logic, and button binding.
We find the start button in the scene and bind the function directly to the script, so that the function will be executed when the start button is clicked.

At the back of the scene is the subscript of the scene, adding 1 to each load, so that the loading of the new level can be completed.

InEndScene (): is responsible for checking whether the loaded scene is the last level.
return index == SceneManager.sceneCountInBuildSettings - 1;
Determine whether the last scene in the package list is consistent with the current scene subscript, and if so, the last scene.

Product stage: we will package the game, test it many times and improve the game.
Open Steam, to download Steam VR and start it, set it up according to the steps, and then run the project to see the effect.

4.2 Game effect
The start of the game and the main interface of the game, as shown in figure 3. The interface of the game fork in the road is shown in figure 4. The clearance interface is shown in figure 5, click the button directly to enter the next level. In the course of the game, the movement of the characters is operated by the handle, and the visual angle is controlled by the feedback of the helmet.

5. Conclusion
By analyzing what popular science education and video games have in common, we have developed a game. Use the powerful function of Unity game engine to build a physical model and simulate large-scale maze scenes. Take the virtual image of the player to walk the maze as the main content, using the maze to stimulate people's psychology of exploration. Players get hints by solving puzzles at the fork in the maze, which not only retains the entertainment of the game, but also realizes the dissemination of knowledge.

Acknowledgments
We would like to thank all those who helped us during the writing of this paper. We would like to thank all the members of VR Training Camp for their support and help to our project. We would also like to thank Li Guoqing, who has provided a lot of help for game development. The people we mentioned above are very important in the process of writing the paper.

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