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Research on virtual reality design of scene simulation theme park

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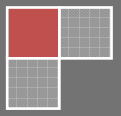
ABSTRACT

In computer technology, virtual reality is an interaction technique, aiming to provide users various feelings such as hearing, seeing, smelling and touching through human-machine interaction instead by operating the keyboard, which highly improves work efficiency of system. The application of virtual reality to theme park design and project scene simulation parks from the angle of virtual aesthetic will not only enrich theme parks' content and the research of virtual reality, but also expand users' traveling experience. Technically, the theme park design with virtual reality embodies three basic features: immersion, conception and interaction of visual reality. Using the technique, the plan and effects of theme parks can be within a full range of observation, and their spatial information will present to us in order to actualize long-distance services including information browsing, aided design, aided decision-making and public participation. Under the influence of visual reality, there is an increasingly number of theme park designers working on it. Practically, its application to the landscape design of theme park contributes to methodology research on park design, but also realizes the fundamental innovation of it.

KEYWORDS

Scene simulation; Theme park; Visual reality; Computer-aided design.



INTRODUCTION

In visual reality, the key technology to park design mainly consists of visual environment modeling, system integration, interaction and real-time 3D image generation. As users' interface of intelligent computers, its advanced technology now has achieved a variety of perception interaction. Through touching, seeing and hearing, users can directly experience the information that computer provides to them, thus forming a real touching environment of human-machine interaction. Technically, visual reality is mainly based on visual aesthetic. By utilizing its art design techniques to the design of scene simulation theme parks and forming an effect of visual reality, tourism experience in theme parks will be enlarged as well.

By using visual reality in theme park, there are different display modes. Under interaction techniques, scene simulation theme park combining the real and unreal presents a colorful and rich picture, which gives users' kinds of feelings. Each character in the scene will be introduced to a 3D visual world by means of relative techniques so as to obtain a strong feeling of reality. The realistic effect owes to the use of visual reality, visual display technique, different simulation types and expression of sound matching, and it makes the scene simulation types vary, and the effects vary as well.

The so-called "Theme-park" refers to a venue for leisure and tourism. It can satisfy tourists' need for entertainment, but also provide a creative action model. In the information age, the scene simulation theme parks have sprung up with the application of visual reality. It is a combination of technology and culture, offering tourists a fresh new experience in diversified expression patterns.

VISUAL REALITY AESTHETIC APPLICATION IN SCENE SIMULATION THEME PARK

The use of visual reality is supported by the 3D dynamic technology, and its full digital stereo effect can make the users enjoy the feeling in visual reality. In the cartoon-themed works production of visual reality, it is necessary to get a comprehensive understanding of vision in visual reality aesthetic design.

The use of colorful words

In visual reality aesthetic design, there are numbers of colorful words with strong vision impact, which is also an important element to attract audience. The scene design of visual reality theme park has commonly used colors with strong contrast to render the environment, making the animation more vivid and beautiful.

Production of modeling

The production of modeling generally adopts the polygon modeling method. Take Polygon for example, it is a network-made polygon, but after technical processing, it becomes a model which is needed. In model production, it is of great importance to adopt a proper proportion. In order to avoid deformation of focal length, it is a must to adjust the focal length to 80 in the Persp Window. When making modeling, be sure to adjust it in accordance with the original design, in which it is allowed to add proper vertex or sidelines to make the modeling as it is needed. After remaking, it is required to rename and clean the extra work for the next step.

Texture mapping

After modeling making, it is time to do the drawing of texture mapping. The texture mapping will be processed by MAYA software. During its making, the tensile range should not be too large, or it will cause drawing problems in the process of post-production. Texture mapping can be processed with Photoshop, after drawing for a period of time, it should be put back to MAYA and adjust its color and location.

Light process

A proper light layout and reasonable setting of colors will give users a real vision feeling. When setting the lights with MAYA, the light should be just fine, but not too much, and its distribution should provide a sense of hierarchy. Too much light will make the scene in a mess, therefore it is a request to handle the light projection and its shadow, and it will be better if light is replaced by texture.

In terms of projection, especially cylindrical projection, the transformation formula is the key. Because there is no boundary or surface on the horizontal axis in cylindrical projection, as the initial input of panoramic image modeling, the projection can only be completed by adopting a method of flip photography. Below Figure 1 is a cylindrical projection change chart.

As it is shown in (a) above, K is the initial image, I is the space for cylindrical projection, and it makes the initial image K form its projection K'. Assuming the cylindrical coordinate origin is O, the camera moves along X-Z, and then the image plane and the optic axis will form a focal point, that is the central point of the image. As to any pixel on the image F(x,y), the corresponding point is F(x',y'), when it slides in the plan X-Y and Y-Z, it will form cross sections as it is shown in (b) and (c), then the transformation formula is obtained:

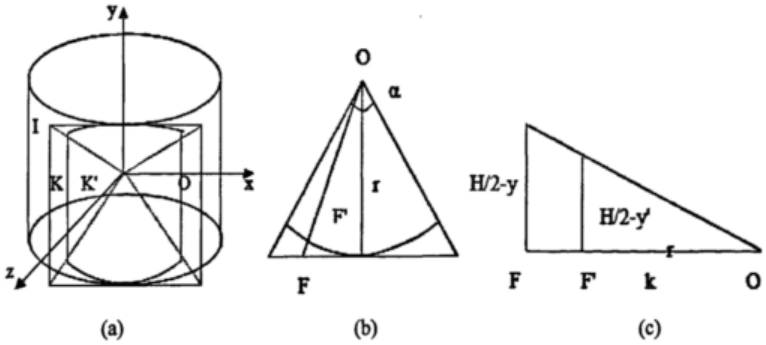


Figure 1 : Variation diagram of cylindrical projection

$$x' = r\sin(\frac{a}{2}) + r\sin(\arctan(\frac{x-\frac{w}{2}}{r})) \quad (1)$$

$$y' = \frac{H}{2} + \frac{r(y-\frac{H}{2})}{k} \quad (2)$$

$$r = \frac{w}{2\tan(\frac{a}{2})} \quad (3)$$

When the camera is filming, the panoramic image should be covered in a full angle of 360°. When the rotation angles are equal, the two adjacent images will overlap each other with the overlapping angle being μ. If the graph number is set by n, then the radian should be calculated as follows:

$$a = \frac{2\pi}{n} \times \frac{1}{1-\mu} \quad (4)$$

However, when it comes to the light processing, it should not be processed in the same way, but selected according to the needs of scene. To strengthen the authenticity of the scene, it's required to attenuate the light. And shut off these lights to avoid suppress interference and set according to the needs of scene design.

EVALUATION OF THE USE OF VISUAL REALITY AESTHETIC DESIGN IN SCENE SIMULATION THEME PARK

After discussion about the visual reality aesthetic design of scene simulation park, it is necessary to set the evaluation norms and corresponding evaluation index, establishing a system of hierarchy.

Construct the judgment matrix by using analytic hierarchy process

Under the goal of software evaluation, the evaluation norms of the authenticity, interactivity, functionality, expansion and usability are made.(Sequence of weights of judgments, see TABLE 1)

TABLE 1 : Criteria of evaluation objectives

Evaluation objective	Authenticity	Interactivity	Functionality	Expansion	Usability	Index
Authenticity	1	1/5	3	4	4	0.214
Interactivity	5	1	5	7	6	0.279
Functionality	1/4	1/6	1	3	4	0.131
Expansion	1/5	1/7	1/4	1	1	0.049
Usability	1/5	1/6	1/4	1	1	0.052

Under the criteria of evaluation objective, the indexes of the authenticity, interactivity, functionality, expansion and usability are respectively shown in TABLE 2, TABLE 3, TABLE 4, TABLE 5 and TABLE 6. TABLE 2 shows the authenticity index, respectively being optical quality, visual quality and acoustic quality. TABLE 3 exhibits two indexes under the interactivity index, respectively being accuracy and fast-speed index. TABLE 4 displays functionality index, including elements of garden simulation, physical expression of garden elements and movement attribute expression of man of simulation. TABLE 5 is the index of expansion, respectively shown in the expansion index of virtual reality for web and geographic information system. TABLE 6 is the index of usability, separately being index of interface and renewable ability, mastery of difficulty and speed to create visual scene.

TABLE 2 : Index of authenticity criteria

Authenticity Index	Optical quality	Visual quality	Acoustic quality	Index
Optical quality	1	1/7	1	0.112
Vision quality	8	1	6	0.812
Acoustic quality	1	1/6	1	0.107

TABLE 3 : Index of interactivity criteria

Interactivity Index	Accuracy	Fast-speed	Index
Accuracy	6	1/6	0.172
Fast-speed	6	1	0.821

TABLE 4 : Index of functionality criteria

Functionality index	elements of garden simulation	physical expression of garden elements	movement attribute expression of man of simulation	Index
elements of garden simulation	1	2	1/5	0.194
physical expression of garden elements	1/2	1	1/6	0.126
movement attribute expression of man of simulation	5	4	1	0.682

TABLE 5 : Index of expansion criteria

Expansion index	virtual reality for web	geographic information system	Index
virtual reality for web	4	1	0.752
geographic information system	1	1/4	0.146

TABLE 6 : Index of usability criteria

Usability index	interface and renewable ability	mastery of difficulty	speed to create visual scene	Index
interface and renewable ability	1	1/6	4	0，178
mastery of difficulty	6	1	6	0.729
speed to create visual scene	1/4	1/7	1	0.078

As to the index results, a technical analysis should be made and it's required to compare the seven visual reality aesthetic design techniques: Multigen Vega(M-V), VRML(VRM), Viewpoint(VirT), EONStudio(EON), Virtools(View), Shockwave3D(sh3D) and Quest3D(Qu3D). Then evaluate all indexes rating on the platform of experimental mainframe.

The evaluation of various virtual implementation method of final evaluation results in TABLE 7.

From the above methods for visual reality aesthetic design, it is clearly that VRML visual reality technique is the most proper way to plan and design the theme park, the following being Quest 3D. If combining geographical system with Multigen Vega, the effect will be better. When dealing with the network design of scene simulation theme park, Quest 3D and Viewpoint will be better choices, however, the two techniques are not suitable while planning and designing the landscape.

TABLE 7 : The final evaluation results of all visual reality implementation

Index	A(M-V)	B(VRM)	C(VirT)	D(EON)	E(View)	F(sh3D)	G(Qu3D)	Relative Weights
Optical quality	0.185	0.176	0.167	0.158	0.054	0.069	0.185	0.024
Vision quality	0.162	0.162	0.162	0.162	0.053	0.162	0.162	0.162
Acoustic quality	0.092	0.274	0.274	0.088	0.088	0.088	0.088	0.026
accuracy	0.159	0.159	0.159	0.054	0.159	0.159	0.159	0.098
Fast-speed	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.502
Elements of garden simulation	0.224	0.224	0.058	0.058	0.058	0.195	0.203	0.024
Physical expression of garden elements	0.074	0.193	0.199	0.076	0.202	0.035	0.212	0.015
movement attribute expression of man of simulation	0.056	0.252	0.252	0.110	0.058	0.058	0.252	0.076
Expansion of virtual reality for web	0.022	0.173	0.157	0.162	0.167	0.135	0.197	0.013
Expansion of geographic information system	0.231	0.472	0.051	0.046	0.048	0.045	0.119	0.036
interface and renewable ability	0.201	0.123	0.201	0.067	0.201	0.155	0.076	0.008
mastery of difficulty	0.072	0.245	0.002	0.225	0.071	0.076	0.244	0.038
speed to create visual scene	0.102	0.349	0.109	0.109	0.092	0.122	0.125	0.005
Evaluation results		0.141	0.176	0.156	0.130	0.110	0.133	0.162

CONCLUSION

To sum up, theme park has been a hot research topic in 3D animation design. By combining the 3D visual aesthetic design with theme park, scene simulation theme park can be possibly created. In the study on visual reality aesthetic design, some problems have revealed in the scenario planning. In order to obtain a good vision effect, it is of great importance to improve cooperation between machines and vision of men, and research deeper from the aspect of innovation, making the designed visual scene more operable and interactive.

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