

DYNAMIC VISUAL REFERENCE SYSTEM (NEZ SYSTEM) FOR ASSISTING ENVIRONMENTAL DESIGN

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Abstract. In a design process, it is necessary to recognize the circumference environment, analyze human activities in the environment, and consider the locations and space where the activities occur. Dynamic Visual Reference System (Nez system) is a useful reference tool for these purposes in environmental design. The system enables the direct visualization of various proposed reference multi-media data or analysis of human activity and thus the thorough comprehension of the client. The architect and the client may therefore communicate with each other at ease, which in turn facilitates the reflection and creativity of the environmental designer.

1. BACKGROUND AND AIM

With the rapid development of computer, internet and multi-media technologies, the methods and philosophy of environmental design, including urban design and architectural design, have undergone drastic changes. Currently, it is common to present large environmental space by 2 dimensional or 3 dimensional computer graphics. In the design process, 2D

and 3D presentations as references and tools are constantly improved by multi-media technologies.

In a design process, it is necessary to recognize the circumference environment, analyze human activities in the environment, and consider the locations and space where the activities occur. 3 dimensional computer graphics have already been used to show a circumference environment made from terrestrial model with aerial photographs mapping resembling real space. In addition, multi-media technologies may be employed to express or propose the mode of human activity in the 3D environmental model.

In order to analyze the relation of human activities in the environment for progressing design, the reference figures are often overlaid on the figure of the environment forms. However, no tool is available to show simultaneously the difference of form's reference data generated by multi-media on the computer. Therefore, this study aims to construct a Dynamic Visual Reference System (Nez system) for presenting multi-media data on the 3DCG of the circumference environment that shows the real space situation. The System facilitates the direct analysis of the relation of human activities in the circumference environment.

2. Methods-Construction of Dynamic Visual Reference System(Nez System)

In order to integrate the reference data including multi-media data into the 3DCG of the circumference environmental model, the present study uses a method of simultaneous direct presentation in 3 dimensional space for various types of data such as 2D pictures, 3 D model, video and audio, with an additional function of view using walk /fly threw free movement. By applying this function, the situation from any viewpoint can be examined. In order to facilitate the designers' ideas, we create another function that is able to save any data at his/her most convenient positions and can change them at any time in the environment to be designed based on their own needs. The positions of stored data and its observatory directions can be changed at different stages of the design process and be seen from different view points. Therefore, the designer is able to carry out data referring with the most suitable form. Direct reference in large space environmental design is enabled if those directly visible data are positioned in the space. One example of applying our method is at the initial stage of urban design. Data of human activities are collected based on our method. Subsequently, reference data, images and digital models on buildings of diverse functions are positioned in the large space 3 dimensional environment to analyze human activities and movements and then accordingly to determine the

suitability of the various places including the buildings or the institutions in relation to their proposed function.

2.1. APPLYING IN THE INTERACTIVE DESIGN

We constructed the NEZ system applying in the interactive design with real time function. In the initial stage of urban design, usually the large space environment of the project is shown by 3DCG. Real environmental situation can be grasped from the space of the 3DCG. If various design reference information is corresponded with the real space 3DCG, not only the relation of reference data and the real space is comprehended easily, but also visible reference data and visible environmental space can be strengthened for visualization because vision of various design reference data directly corresponding to the real space or the various virtual spaces/models including in the real space are shown. For example, we can plug-in other area's 2D or 3D models / pictures or audio into the space and examine if they are suitable. This method uses a layer information space to integrate various real space information and virtual space information, and various design elements of the 'environment', 'activity', 'places' are considered synthetically for the design of buildings and circumference environment. Therefore, a variety of ideas may be created through this process.

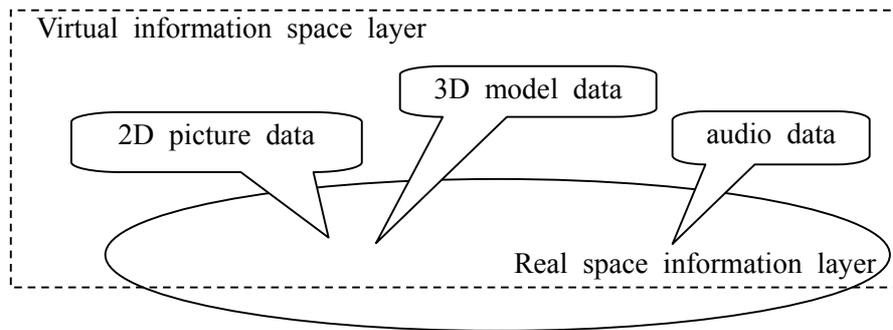


Figure 1. Layer information space

2.2. RELATION FOR VARIOUS REFERENCE MULTI INFORMATION

The idea on design is gradually sharpen during the design process. It is generated among 'environment', 'activity', and 'places'. The information is referenced and various scales or elements are expressed at same time, and the design concepts form gradually while referencing. Finally each design element is advanced for a synthetic design result. In other words, systematized design reference information and the design element generated by the discreteness thinking resulting from various stages of idea evolution

of the designer can help to comprehend the whole design idea clearly. Our system (Nez system) enacts the duty of systematization for various information generated by multimedia and the idea evolution. Since ideas change frequently during the design process, the system is also equipped with adjustment function for flexible correspondence, including the function of free viewpoint, walk threw, and a free addition and deletion.

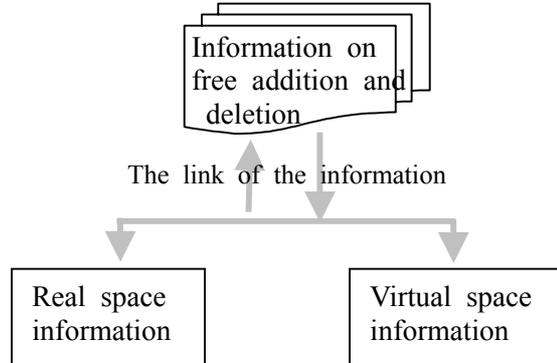


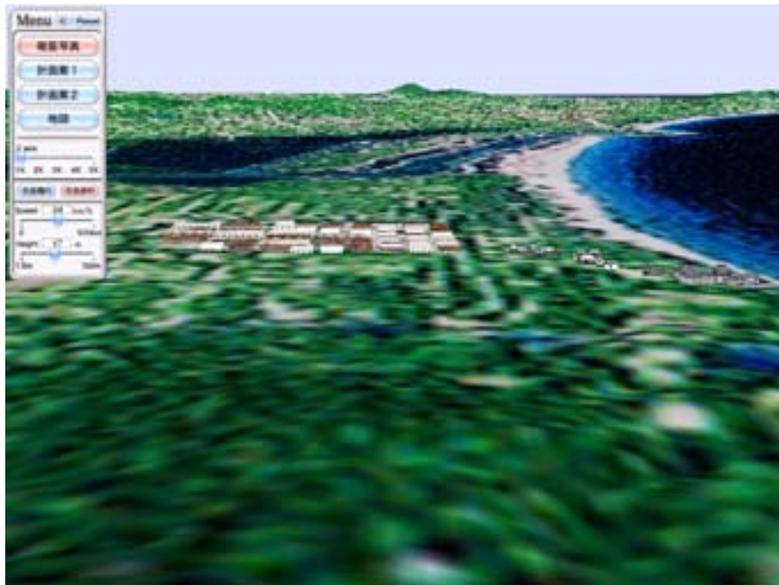
Figure 2. The link of the information layers

3. Application

We have applied our Dynamic Visual Reference System (NEZ System) in the project of Qingdao, China, which is a city planning project for a tourist resource of 25 square kilometers. In the early stage of design, we firstly made the actual circumference environmental model by real time 3DCG and collected over 3000 relevant image data of holiday destinations around the world via the internet. More than 100 pieces were then selected and directly positioned into the actual environment model. The collected reference data could be added, erased and copied at user's disposal. Their positions in the actual space to be designed could also be moved on demand. Therefore, it was possible that the design plans were analyzed and various options were compared directly with 3D images in real time. This direct visual presentation of the design enabled the participation of the client in the process, which greatly assisted their reaching agreement with the environmental design architect of the project.

3.1. EXPRESSION BY MULTIMEDIA TOOLS AND APPLICATION OF THE NEZ SYSTEM

We examined various design elements from each viewpoint of 'environment', 'activity', and 'places' by using design information generated by a number of multimedia tools like 3DCG, VR, PhotoCinema, Photowalker, photos for fixation and transfer of ideas in each design stage. For instance, in the initial design stage, we firstly expressed the circumference environment using real time 3DCG, including the mountain range, basin system, factors such monsoon and air current in a season, and the existing visit centre and the buildings and other architectural structures of village.



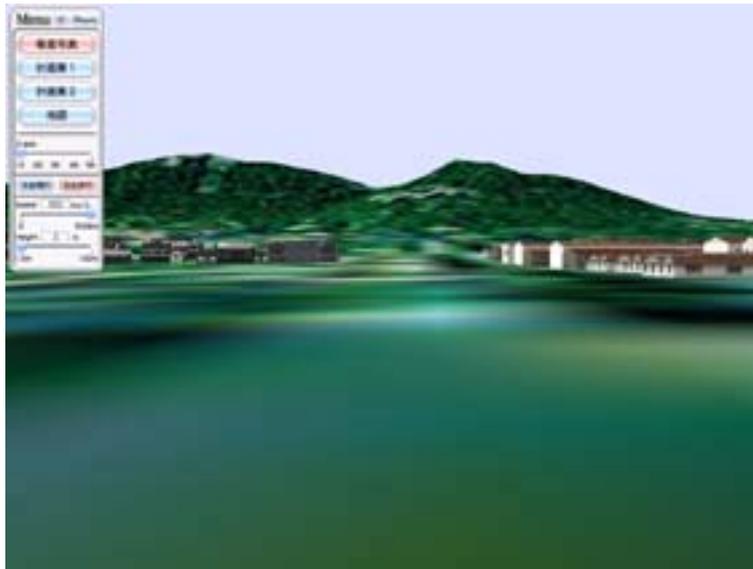


Figure 3. Present condition circumference environments

It enables us know the circumference environment in details. Since this is a resort area facing water at front and connecting a mountain at back, we collected many sightseeing data. The data was animated using a scriptwriting method. The flow of the activity of people can be seen. As opposed to these concrete purposes described above, the design information was created by many kinds of tools. The information on CG, animation, or sound has their features and is used according to difference purposes. After the planning of the activities of people, the places for the activities should be considered. Since the real time 3DCG describing circumference environment is available, it may be used to investigate synthetically on where, how, and what style people's activities can be imposed in this environment. Then, the places including buildings and construction are designed according to the results. As a premise, NEZ system generated a database by various multimedia describing people's activities to construct a virtual space, and exhibited this information on the visualized database in the real time 3DCG environment space. Based on the judgment of the designer, the relationship between the real space and virtual space was decided. Furthermore, it can change a spatial relative position freely so that it can respond to change of idea of the designer. While these functions consult various design elements, it becomes possible to stimulate idea evolution.

DYNAMIC VISUAL REFERENCE SYSTEM FOR ASSISTING...



Figure 4. Reference in the design process

3.2. THE RESULT OF ACTUAL APPLICATION

During the Qingdao design process, NEZ system was used effectively. The application method and the effect are as follows:

1. The design information for reference is created using the tools which correspond to concrete purposes.

In order to understand the 'environmental' feature of the place, 3 dimensional CG of real time and Photowalker tool are expressed in circumference environment. Using these tools, the designers and clients can operate and understand the design easily. The purpose of recognition and understanding of environment was attained. And we edited the arrangement of thousands of photographs that showed possible human activity at tourists resort using Photocinema tool and created an animation. It formed the concept of 'activity' with a series of natural environments that suit here. Not only does it enable the designer take activity into consideration extensively, but also it facilitates clients to view abundant tourists attractions, and thus plan to establish a high level tourists resort.

2. Integration of various reference design elements

In order to take the design elements into account extensively, various design reference elements made by multimedia, including pictures, animations, music, and sound information, were unified into NEZ system. Therefore, the designer can grasp the relevance of each design element clearly. In view of the rapid development of the multimedia technology, we may expect more extensive multi-information applications in design processes.

3. The flexible correspondence of the reference system to the evolution of design ideas

Since the situation and the contents of reference information influence designers in the design process, the reference information on flexible correspondence is important. Our system is able to accumulate freely various multimedia information data in a database, therefore, when arranging visualization information to real space, it can be moved freely for referring.

4. Conclusions

Dynamic Visual Reference System (NEZ System) is a useful reference tool in environmental design. The system enables the direct visualization of various proposed references or analysis and thus the thorough comprehension of the client. The architect and the client may therefore communicate with each other at ease, which in turn facilitates the reflection and creativity of the environmental designer..

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