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THEME ISSUE

architecture in the digital age:
the effect of digital media on built environment

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Real Time Visualization

Public Participation

Shape Grammar

Design Model & Fractals

CAAD Education

Virtualization

Digital Media

Smart Homes

In this issue:

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REAL-TIME VISUALIZATION IN THE DESIGN CONTEXT

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Abstract

Having been a promising visualization tool since 1950s, ironically, virtual reality is not widely used in the architectural design and evaluation process due to several constrains, such as the high cost of equipments and advanced programming skills required. This paper described the collaboration between design computing courses and architecture design studios that have been taught at Savannah College of Art and Design (SCAD) in 2004 and 2005. These courses explored several practical methods to integrate Low Cost Virtual Reality Aided Design (LC-VRAD) in the architectural design process. As a summary of the collaboration, this paper refers to three main aspects: (1) How to use game engine to design an affordable VR system in the ordinary studio environment. (2) How to integrate VR, into the design process, not only as a visualization tool, but also as a design instrument. (3) How to evaluate different methods of representing architectural models based on the efficiency of workflow, rendering quality and users' feedback.

Support by the Game and Interactive Design Department at SCAD, students in the School of Building Arts implemented two Low Cost VRAD methods in various design phases, starting from site analysis, schematic design, design development to the final presentation. Two popular game engines, Epic Game's Unreal engine and Director MX's Shockwave engine, were introduced to students to visualize their project in real-time. We discussed computer-aided design theories including the application of VR, as well as digital computing and human computer interaction. At the end of each quarter, feedbacks from students and faculties were collected and analyzed. These methods were revised and improved consistently across 2004 and 2005 academic year.

Keywords: Virtual Reality, Real-Time Visualization, Game Engine .

INTRODUCTION: PEDAGOGICAL OBJECTIVES

As visualization and communication tools, computer renderings and fly through animations are widely used by students in the Architecture Department at Savannah College of Art and Design (SCAD). However, we find these digital tools are only used for producing the final presentation at the end of the design stage rather than being integrated into the design process at the early beginning. Many students stick with the conventional design methods by using hand drawings and physical models in the schematic design, and only use computer to generate presentation boards after the design is completed. This workflow currently widely used in the architecture design studio does not provide an efficient way to study, experience, and evaluate the design within the digital environment.

Another constrain we find in the studio is the dis-

connection between good-looking computer-generated (CG) renderings and the actual design quality. Although with the fast growing digital technology, CG renderings are getting more and more photorealistic, neither still-renderings nor animations can provide an interactive approach to visualize the design. The viewer's path and viewpoints are not self-chosen but pre-defined. Therefore, an important feature of spatial experiencing in the real world is missing in these visualization tools ---the interaction between viewers and the environment. Students usually spend a significant amount of time to render an animation. However, a pre-defined camera path fails to provide the freedom to interact with the design during the review. As the result, students are discouraged to spend time to create animations.

To overcome these constrains, we have explored the real-time rendering techniques and several virtual reality¹ applications, which provide students and faculties an instant 3D visualization and inter-

¹ Virtual Reality (VR) opened a new field for architecture design. The key point is the user's autonomy of movement within the virtual space (Conway Lloyd Morgan, Giuiano Zampi. 1995). With real time technology, viewers could navigate a 3D environment with external devices (joystick, mouse, keyboard or motion tracking system). The

display devices such as head mount display (HMD), stereo panorama screen, and CAVE system create a fully immersive virtual environment. Also, latest web based 3D technology turned Internet into a powerful media for VR. Based on the devices and presence level, VR could be classified as "immersive VR" and "desktop VR" (John Vince. 2004).