Room Designer: A Virtual Reality-Based Furniture Layout Tool

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Abstract

Room Designer is a prototype virtual environment application for populating architectural spaces with furniture and other interior decorations which combines hand gestures and speech in a natural and intuitive interface.

Introduction

Room Designer is an application prototype for populating simple architectural spaces with furniture and other interior decorations in a natural and intuitive manner. By utilizing a TAN-Cube (a four-sided immersive virtual environment display) and a multimodal interface consisting of hand gestures and speech input, novice users can prototype possible furniture layouts and interior designs in a conceptual manner and perform these tasks on a one-to-one, life size scale.

Room Designer is loosely related to systems such as The Conceptual Design Space [1], which allows users to inspect, inhabit, and perform modifications on conceptual building designs, and the Virtual Architectural Design Tool (VADet) [2], where users can create both architectural and interior structures in the C2 (a Cave-like device). Room Designer distinguishes itself from these systems by using more complex graphics primitives and providing an interface which

Room Designer Interaction

Room Designer allows the user to conceptually perform room layouts and interior design in an architectural space while present in that space. Some simple room layouts are shown in Figures 1 and 2. Users create, place, modify, and manipulate furniture and interior decorations so they can quickly try out different designs that would otherwise be costly and time consuming in the physical world.

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Figure 1: A user in the process of creating a conceptual model of his living room.

Users navigate through the architectural space with a technique that is similar to Multigen's SmartScene navigation [3] except translation and rotation about the user's position can be performed with one hand. User movement is based on a sphere that attaches itself to objects using a ray cast into the scene from the hand tracker. As the hand tracker's position and orientation update, a ray is cast into the scene and the sphere attaches itself to the ray intersection surface point. Users can then extend a hand and pull themselves toward the sphere. Only one motion is required no matter what the distance between the user and the sphere is because it is mapped onto the distance between the user's hand and head. Users can rotate about their position when they move their hand in a side-to-side manner.

Furniture and the other interior decorations are instantiated in Room Designer using a "point, speak, and cycle" interaction metaphor. When users pinch and hold the left hand's thumb and middle finger a virtual laser pointer is created which extends from the left index finger. In addition, the speech recognition interface activates allowing users to utter voice commands. Using the virtual laser pointer, users point at a particular location and ask for a particular type of object. For example, when a user points to the floor and says "GIVE ME A CHAIR PLEASE", a chair appears in the requested location facing the user. The chair that was instantiated may not be the one the user was looking for. So, the user can cycle through the available chairs in the furniture database by moving their left hand across their body. We use this approach over other

Figure 2: A user examines a conceptual model of his bedroom.

techniques such as simply picking from a 3D menu [2] or virtual palette [4] because we do not want the user to have to continuously look from the place of object selection to the place of object instantiation. With this technique, the user can try out different types of furniture without having to visually and cognitively move away from the area of interest each time a different piece of furniture is created.

Already placed furniture or interior decorations can be moved about the architectural space with simple direct manipulation. Using either the left or right hand, users can grab an existing object by moving a hand to the approximate location of the object. When the hand-tracked sphere, used to provide feedback on where the user's hands are in the virtual environment is in close proximity to the given object, it's bounding box will highlight indicating that the object can be picked up. Using a thumb to index finger pinching posture, users can pick up the object and transfer it to a different location. Users can also delete objects in the environment. Our deletion technique is taken from Mine's proprioceptive work [5]. To delete an object, users grab and hold the object and then throw it over their shoulder. The over-the-shoulder deletion technique has a number of advantages in that it is easy to remember and not easily invoked so unintendwd deletions do not normally occur.

Conclusions and Future Work

In this note, we have presented Room Designer, an application prototype that allows user to populate simple architectural spaces with furniture and interior decorations. The application utilizes both virtual reality and multimodal interaction which provides a life size environment and a natural and intuitive interface. The Room Designer project is still in its infancy and, as such, there are a number of areas for future work. Making the application more realistic in terms of adding more detail to the architectural spaces and furniture, increasing the size of the furniture database, and determining how users can intuitively interact with a large set of graphics primitives are all important areas that must be addressed to make Room Designer a better and more realistic application.

References

[1] Bowman, Doug. Conceptual Design Space - Beyond Walk-Through to Immersive Design. In Designing Digital Space, D. Bertol (ed.), Jon Wiley and Sons, New York, 1996.

[2] Hill, Lewis C., Chan, Chiu-Shui Chan, and Carolina Cruz-Niera. Virtual Architectural Design Tool (VADet), In The Third International Immersive Projection Technology Workshop, Stuttgart, Germany, 1999.

[3] Multigen. SmartScene(TM) Video Clip, Discovery Channel's NextStep program, 1998.

[4] Coquillart, S. and G. Wesche. The Virtual Palette and the Virtual Remote Control Panel: A Device and Interaction Paradigm for the Responsive Workbench. IEEE VR'99, 213-217, 1999.

[5] Mine, Mark. Moving Objects In Space: Exploiting Proprioception In Virtual Environment Interaction. Proceedings of SIGGRAPH'97, ACM Press, 19-26, 1997.