

SESAME: 3D Conceptual Design System

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ABSTRACT

We present a system for a conceptual design session in the desktop Virtual Environment (DVE) and Computer Aided Design (CAD). We consider easy modification to be important for conceptual sessions, as users alter the design frequently in those sessions. The system presents new techniques to make the modification of a scene easy.

KEYWORDS: Conceptual design, Desktop Virtual Environment, Computer-Aided Design.

INTRODUCTION

The conceptual design session is an early stage of a design process. During this session, the designer has to make important decisions on parameters of a model that satisfy a set of design criteria. To do this, he produces many sketches of various possible solutions. However, the design is produced not only by a designer himself, but also through collaboration among clients, engineers and other designers of various expertise. As sketches are restricted to one viewpoint, it is difficult to communicate with the general public. In contrast, a 3D computer model communicates an idea more easily than the 2D sketches. Furthermore, the model can be evaluated using a simulation program for design criteria. Therefore, easy-to-use CAD systems are beneficial for collaboration and evaluation of temporary design solutions.

THE SYSTEM INTERFACE

SESAME (Sketch, Extrude, Sculpt, and Manipulate Easily) targets to support 3D conceptual design sessions in a typical desktop environment, which is composed of a non-stereo monitor, a keyboard and a mouse. As a 3D model is rather susceptible to change in this session, we consider easy modification an important criterion. In our system, we allow creating and editing of volumetric geometry by extruding a 2D contour and by sculpting a 3D volume. For easy scene modification, we support automatic grouping and natural object motion in 3D. SESAME can be compared with other 3D sketch systems such as SketchUp (<http://www.sketchup.com>) or Sketch [1]. SketchUp is polygon-based, as opposed to our system, which is volumetric. Compared with Sketch, our system has a simplified and generalized set of gestures to create a scene and the gestures are easier to learn and remember.

AUTOMATIC GROUPING

Automatic grouping is to group objects in bi-directional relationships (*i.e.* side by side). When a user drags an object, the direction of the drag *pushes* an object beside the selected object away.

Then, the pushed object and objects on top of it are considered part of the new group. For example, if a user pushes a row of desks from left to right, then all the desks on the right side and objects (e.g., cups and books) on top of the desks should move together. This is implemented by investigating the relative position between objects that are in contact and constitutes a generalized version of methods pioneered in Virtual Lego [3].

3D OBJECT MOTION USING A MOUSE

Existing systems use the cursor position to identify the 3D motion of an object [2]. There, the motion depends only on the cursor position, rather than the object position relative to the scene. However, in general, humans consider the whole visual area of an object against the background scene. That is, users expect the manipulated object to be sliding on all surfaces that are hidden behind the object. Existing approaches do not follow this expectation reliably. In SESAME, we select the movement plane according to the object surface that is closest to the viewpoint in the region that is *occluded* by the moving object. For efficiency, we identify the occluded surface with the aid of graphics hardware. User tests showed that our approach is four times faster than existing techniques.

CONCLUSION

In SEMSAME, users can build a complex scene by sketching, sculpting and rearranging objects using simple gestures. In the future, we wish to evaluate the system in a conceptual design session.

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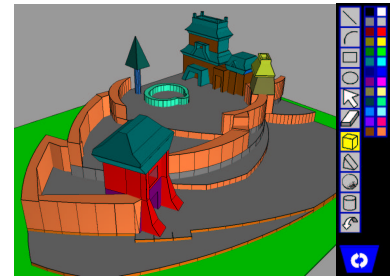


Fig. 1. Screen capture of SESAME
(The scene sketched in 40 min)