Sketching Non Linear Projections

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1 Introduction

We present a user friendly and intuitive GUI for creating nonlinear projections and animated sequences.

1.1 Motivation

Traditional computer graphics uses linear perspective for rendering three dimensional scenes because linear perspective is a good approximation of the human visual system. However, artists often deviate from the confines of a strictly linear perspective because of their desire to balance their linear perspective view with elements of aesthetic style, layout and relative importance of the scene objects. [Singh 2002]

Trying to create interesting projections of complex scenes using current camera control techniques is extremely difficult. There are 11 camera parameters to manipulate for each camera. Several cameras can be placed around a scene. Each scene object can be influenced by several cameras in the scene. Hence trying to obtain a specific local projection is difficult.

1.2 Previous Work

Previous techniques use multiple linear projections to construct nonlinear projections [Agrawala et al. 2000; Singh 2002]. However, these systems require the user to place the cameras individually.

Through-the-lens [Gleicher and Witkin 1992]is another technique which uses image based features to manipulate a virtual camera.

We expand on Gleicher's method by defining a larger set of feature primitives as means for camera control and allowing multiple feature primitives to be introduced in the scene. Each feature primitive has a well defined behaviour.

2 Approach

Artists traditionally use geometric proxies such as points, lines and boxes to layout a 3D scene on a canvas. Similarly, in our interface, the user sketches out points, lines and boxes on objects in the 3D scene. These elements, called *feature primitives* are projected to 2D to become visual handles in the image that the user manipulates to control the projection of the object.

Changes made by the user to the 2D projections of these feature primitives define a set of constraints which are solved to obtain the camera parameters. Figure 1 shows an initial scene that has the interesting features sketched in 3D (in red). The desired transformation of these features are then sketched in 2D. The resulting scene is a nonlinear projection of the initial scene.

Feature primitives are grouped and the cameras corresponding to each of those groups are solved for. The nonlinear projection of any point in space can be computed as a weighted blend of the projections of the cameras $C_1 ... C_n$.

The user can construct a set of keyframes which correspond to different nonlinear projections of the scene. The keyframes are then interpolated to obtain an animated sequence of the three dimensional scene.

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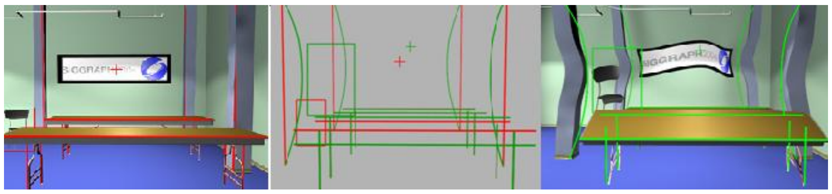
Figure 1: Sketching Features

2.1 Working of the GUI

The user first builds the scene by arranging the scene objects. Feature primitives are used to place objects instead of changing camera parameters. At this stage, there are one or more fixed single linear perspective cameras looking at the scene. Once the scene has been constructed the user enters the nonlinear perspective mode. In this mode, feature primitives specified are used to specify the camera parameters of the multiple cameras present in the scene. The nonlinear projections generated are then interpolated in time to generate an animated sequence.

3 Conclusion

Our goal is to create interesting non linear perspective projections easily. To achieve this we introduce a simple yet comprehensive set of feature primitives to build a scene, manipulate cameras and generate animated sequences of nonlinear projections.

References

AGRAWALA, M., ZORIN, D., AND MUNZNER, T. 2000. Artistic multiprojection rendering. In *Eurographics Rendering Workshop 2000*, Eurographics, 125–136.

GLEICHER, M., AND WITKIN, A. 1992. Through-the-lens camera control. *Computer Graphics 26*, 2, 331–340.

SINGH, K. 2002. A fresh perspective. In *Graphics Interface 2002*, 17–24.