

Preface

The focus of this tutorial is a study of the techniques for solving visibility problems in virtual walkthroughs. The term walkthrough is referring not only to models of architectural models but rather to any large complex model, where the focus is on viewing and rendering the model. The tutorial touches on several applications such as fast visible surface determination, selection of relevant model sections to be transmitted on a client-server system, as well as improving image quality by shading algorithms.

In the introduction we start with a formal presentation of the problem. We look at the basic concepts behind visibility determination and culling techniques. We also discuss the notions of global visibility and the aspect graph. The rest of the course concentrates more on recent and practical methods, as well as on generic tools for visibility.

In the second part we first discuss the so-called "cells-and-portals" techniques, dedicated for indoor scenes. We then cover the recent methods introduced by Coorg and Teller, and by Hadson et al. for general walkthroughs. Then we look into methods designed for outdoors-urban remote walkthroughs, which use a view space partition of the scene. More general hierarchical methods are the subject of the next section of the tutorial. These are applicable to almost any environment making use of either specialized hardware or regular space subdivision.

We review one of the classic and most elegant generic tool for visibility determination – the BSP tree. After giving the necessary background, we show how to use them for visibility ordering and view volume and occlusion culling. We address the issues of using them in very complex or non-static environments.

Finally as a case study of visibility we will look at shadow algorithms. Shadows are of great importance in walkthroughs since they provide vital spatial cues and enhance the image quality. At the same time, the algorithms used for computing them have the same principles as those for visibility, since shadows can be thought of as what is not visible from the light source. We review some of the techniques for both point and area light sources highlighting some of the remaining unresolved issues, and compare them to pure visibility problems.

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