

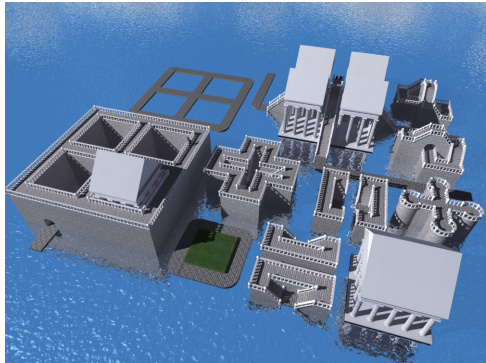


Example-Based Model Synthesis

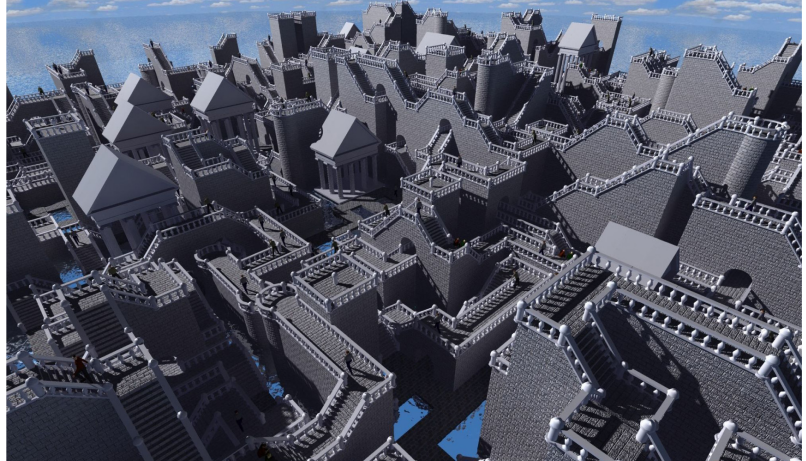
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(a)



(b)

Figure 1: From the example model (a), a larger model (b) composed of 5.3 million polygons and which contains complex maze-like paths is automatically created using model synthesis.

Overview

Model synthesis is a new tool designed to assist game developers and animators in creating 3D environments that players or characters can then interact with. For example, if a game developer wanted to create a large city, an artist would be able to create only a few buildings and then from those buildings the model synthesis tool can automatically generate a larger and more complex city. This tool is designed to increase the productivity of artists creating 3D environments and it can be used to design all different types of environments such as cities, canyons, building interiors, castles, and forests.

Introduction

Many of the most visually exciting environments such as vast landscapes and cityscapes are quite large and quite intricate. Due to their size and complexity, the task of modeling these environments is often a long and tedious process. This difficult task could be eliminated if there were a suitable method to model these types of environments automatically. Example-based techniques have been used to solve numerous problems in computer graphics. Model synthesis uses an example-based approach to create large models. An artist creates a small example model and then model synthesis generates a larger model that resembles the example model. This process is illustrated in Figure 1. Figure 1(a) shows an example model and Figure 1(b) shows the new synthesized model generated by computer. The new model looks similar to the example model, but is larger and more complex. Model synthesis can produce any type of model for which an artist can produce an example model.

Model synthesis is a general purpose procedural modeling tool. 3D artists need considerable creative freedom to be able to create models that look both realistic and artistically interesting. This is why it is important for them to have general purpose modeling tools. Existing procedural modeling techniques are only designed to model specific types of object and as soon as a significantly different object is needed, the technique must be reprogrammed.

Creating Seamless Models

Model synthesis creates new models by building them up piece by piece from small building blocks. Figure 2(a) shows a pillar created out of these building blocks. Each of the building blocks can only seamlessly connect with a few other building blocks. If they are not connected seamlessly, the models may end up looking like Figure 2(b). Model synthesis is designed to build up a new model where all of the building blocks fit seamlessly together. This is accomplished by building and maintaining a list of places where it is safe to add each building block.

Members

Paul Merrell

Sponsors

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Publications

P. Merrell. "Example-Based Model Synthesis," *Proceedings of the Symposium on Interactive 3D Graphics and Games (i3D)*, April 2007.

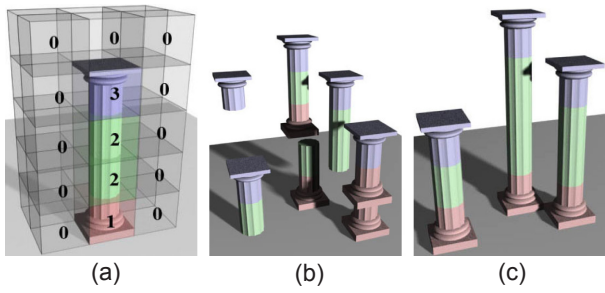
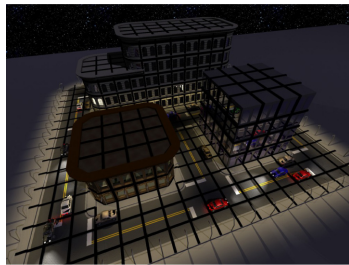


Figure 2: (a) A model composed of four model pieces, (b) An Inconsistent Model, (c) A Seamless Consistent Model

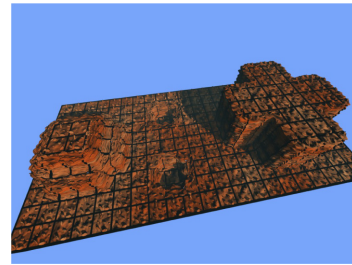


(a) Example Model

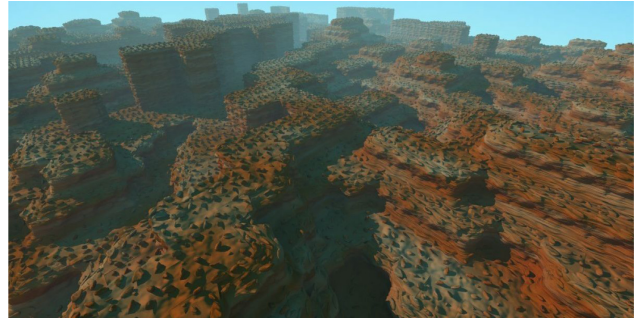


(b) Synthesized Model

Figure 3: Given a few buildings (a), model synthesis produces a city (b) with 2.6 million polygons. Grid lines are drawn in the example model.



(a) Example Model



(b) Synthesized Model

Figure 4: Model synthesis produces a landscape (b) with 6.4 million polygons from a patch of land (a).

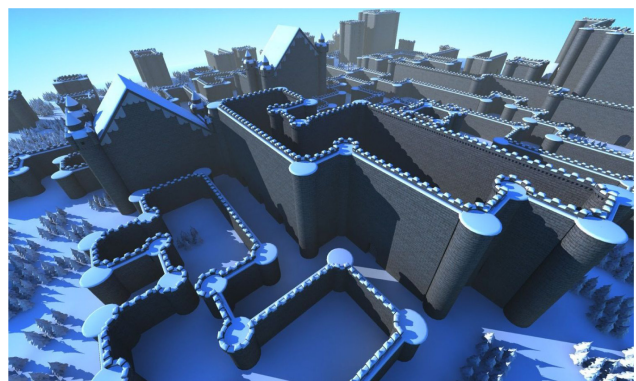
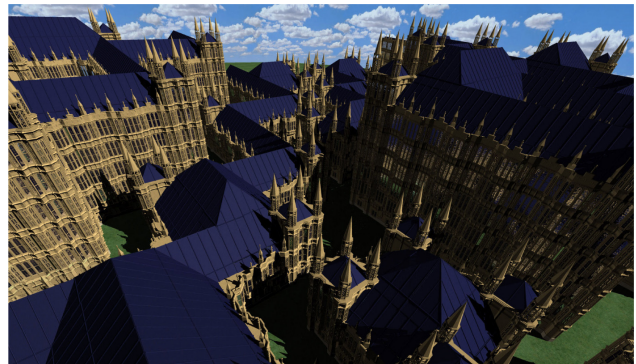


Figure 5: Several buildings with a complex roof structure (6.7 million polygons) and a labyrinth of fortifications (7.2 million polygons) were produced using model synthesis. The example models are not shown.