

Chapter 9

IMAGE-BASED 3D MODELING: MODELING FROM REALITY

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Abstract Increasingly, realistic object, scene, and event modeling is based on image data rather than manual synthesis. The paper describes a system for visits to a virtual, 3D archeological site. One can navigate through this environment, with a virtual guide as companion. One can ask questions using natural, fluent speech. The guide will respond and will bring the visitor to the desired place. Simple answers are given as changes in the orientations of his head, by him raising his eyebrows or by head nodding. In the near future the head will speak.

The idea to model directly from images is applied in three subcomponents of this system. First, there are two systems for 3D modeling. One is a shape-from-video system, that turns multiple, uncalibrated images into realistic 3D models. This system was used to model the landscape and buildings of the site. The second projects a special pattern and was used to model smaller pieces, like statues and ornaments that often had intricate shapes. Secondly, the model of the scene is only as convincing as the texture by which it is covered. As it is impossible to keep images of the texture of a complete landscape, images of the natural surface were used to synthesize more of similar texture, starting from a very compact yet effective texture model. Thirdly, natural lip motions were learned from observed, 3D face dynamics. These will be used to animate the virtual guide in future versions of the system.

1. INTRODUCTION

We describe preliminary results for a virtual tour operator system. The demonstrator is centered around a visit to virtual Sagalassos, an ancient city in Turkey, that is being excavated by archaeologists of the University of Leuven. This demonstrator—coined EAMOS—integrates research on speech (Univ. Leuven) and vision (Univ. Leuven and ETH

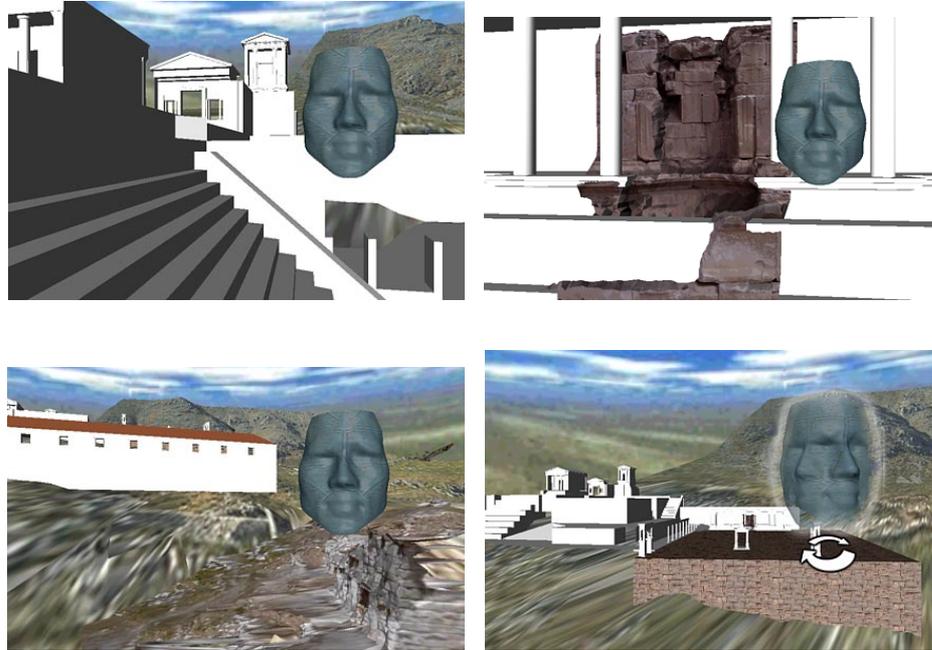


Figure 9.1 Holiday pictures from a trip to virtual Sagalassos. The guide was very helpful, but not very talkative. The weather was good: dry and room temperature throughout our stay. The figures show several of the components of which the site model is composed: a 3D landscape model, more detailed building models, CAD models that show the original shapes of the buildings and the context of the remaining ruins; the face mask of the virtual guide to whom questions can be asked in fluent speech and which reacts with emotional expressions.

2. TWO IMAGE-BASED 3D ACQUISITION SYSTEMS

A first requirement for the EAMOS demonstrator is that visually convincing 3D models of the site be built. In the end, this will have to include a 3D model of the terrain (landscape), of the existing ruins, of the statuary (sculptures and ornaments), and of the different finds such as pottery. For now, initial models have been produced for the terrain, for some of the ruins, and for a few sculptures.

This section describes the two 3D acquisition systems that were used. They share the underlying idea of building systems that are easy to use and only require off-the-shelf hardware. This is important, as the archaeologists should be able to use the equipment *in situ* and without causing lengthy interruptions in the excavations. The systems should be