Sketches are suggestions. This goes along with architecture all the time. The depictive sketch works out the essences, the design sketch materializes a thought. Sketches can look rough and unsharp. The ideas that they represent can also be unsharp – or – uncertain. (Fig. 1)

So, being architect, we are familiar with the visualisation of uncertainty – intended uncertainty.

And this uncertainty is the link between architectural design and archaeological research. In short form: design does not want yet, archaeology does not know yet.

In archaeology, reconstructions reflect the state of research. In some cases though, the information is not sufficient for a reconstruction. It depends on the state of the ruins, if you can reliably reconstruct in three dimensions. In other cases it is only sufficient for an outline.

A complete antic city’s appearance can therefore only partly base on scientific research. In this case, a reconstruction is based on analogies or hypotheses. And furthermore, the degree of uncertainty varies as well.

The aim of our research is to establish methods of representing uncertainty and its degrees – and to visually emphasize, that uncertainty actually exists.

Archaeologists have established two dimensional methods for representing uncertainty. They look from selected points of view or hide those areas that are uncertain. If you look at a physical model, you can freely look around, so physical models cannot fulfill our demands. (Fig. 2)

On the contrary virtual computer models do. But we have to reconsider the idea of a model. A model is a theoretical construction, far more than geometry. A model may contain a multitude of geometries, several states, links, constraints or any other kind of information.

Projecting spaces out of a virtual computer model is like looking at something in different ways. This means, that the representation of the model changes and varies in any aspect.

In our case the model respects the complexity of remains, hypotheses and reconstructions.

A brief history of the project will clarify our strategy.

We first started to work on the general atmosphere of computer visualisations. Endoscopy manifests eye level perspectives. In addition, we suggested enhancements like Reanimated Stills (Fig. 3), Simultaneous Visions or Living Clay (Fig. 7). Quite alike, we visualized building heights for the city of Cologne. (Fig. 4)
It is the combination of simplification and atmosphere that made our method seem capable of solving the difficulties that archaeologists actually have.

So we agreed in searching for a method for representing uncertainty in archaeology.

During the last two years, together with the Chair for Building History, Prof. Dr. Klaus Rheidt, we experimented on several historical sites: the city of Pergamon, the fortress of Karasis (Fig. 5) and the city of Baalbek.

These experiments lead us to an agreement of collaboration with the Sculpture Network Berlin as well as the Excellence Cluster TOPOI, set up by the German Research Foundation, that also finances our research. The TOPOI cluster is described as „The Formation and Transformation of Space and Knowledge in Ancient Civilizations“. It is the Space of it, that we’re going to project.

From the cluster, we get the information and knowledge that we base our work on, especially from the German Archaeological Institute’s office in Istanbul, that regularly runs campaigns in Pergamon. We also agreed to closely cooperate in modeling.

Representing uncertainty definitely excludes one thing – fotorealism. Whatever the reasons are, that architectural design or abstract art avoids fotorealism, the reason why we cannot use it, is simply the fact, that there is nothing realistic to be shown. All we have is uncertainty and vague hypotheses.
We cannot go as far as the Malevich's black square. But we cannot either insist on precise information from the archaeologists. So there must be something in between. A certain formal and visual constraint to get convincing images.

We will explain this with one of our projects shown before: (Fig. 7)

As you can assume, we have not invented the surroundings of the Pantheon. But we do not need all details to explain the concept of Living Clay. It is all about the idea of a homogeneous roof landscape. To formalize this simplification we introduced a spatial grid, that we will explain later.

We first searched randomly and individually for ways of representing uncertainty. This lead us to a set of methods that we structured as follows:

Geometric Simplification is the most direct way, as we explained above. Simplified geometry immediately suggests uncertainty. In other circumstances you would probably misunderstand this as contemporary design. But within the context of archaeology, this will not happen. (Fig. 6)

Geometric contrasts show clearly, that some parts are more certain than others. Again, it is the context of archaeology that prevents you from taking it as a design sketch. (Fig. 8)

Transparency seemed very obvious at the beginning. But in the end, we consider transparency quite disturbing, because it suppresses and distorts the natural spatial impression. This is why
we apply transparency only in axonometries. Axonometries underline the diagrammatic value of the transparency. (Fig. 9)

Lines in space are much better to read. Wires in space do not suppress the natural impression. Still they indicate that there might be something else. In this case, the smaller temple relies on quite certain reconstructions. The wires show an outline of a former temple that might have been there. The hypothesis is quite vague though. (Fig. 10)

If there are several contradictory hypotheses, it is difficult to maintain the spatial qualities and the ambiguity at the same time. In this case, we show the hypotheses separately, so it is clear, that all hypotheses are equally significant. (Fig. 11)

Levels of detail let us find out, in which way we had to detail a reconstruction. Too many details contradict the uncertainty, while too little details obscure the spatial character. Flat roofs for instance suggest a completely different cultural area than pitched roofs. On the other hand, it seems that windows do not have an effect on the legibility of buildings. (Fig. 12)

Time phases are an independent field. They work in any mentioned aspect of representing uncertainty. But in order to compare time phases, they require a similar level of detail. Otherwise the comparison in time would be obscured. (Fig. 13)
We summed up this experience and defined a set of conventions:

The first convention ensures that the spatial impression is the first priority. That means, that whatever individual solution we found to represent a building’s uncertainty, it nevertheless has to respect the natural spatial impression. In other words, if a representation distorts the spatial impression, we will reject it. For this, there are three points to consider:

Just like in architectural photography, we follow the natural perception: First, a perspective is either viewed from a bird’s eye or from eye level. Second, the projection plane is either perfectly vertical or undoubtedly tilt. And, there is nothing in between. (Fig. 14)

Transparencies do not help to understand a spatial situation. Either there is an object, and in this case you cannot see what is behind, or there is not an object and you have a clear view. With transparency, the spatial impression is distorted. (Fig. 15)

Finally the spatial impression depends on the lighting. The lighting must not cover important information about uncertainty. Light must not interfere with code. Shadowing must not interfere with shading. (Fig. 16)

The second convention ensures the entity of the whole, or in other words, the compatibility of the fragments. Because you can only get an image of a large city, if the buildings suit one another. And this means, that they must be equally simplified.

This is far more important than the individual uncertainty. Otherwise, if some buildings were detailed while others were rough sketches, an overall impression would be improper. (Fig. 17)

We are working on the balance between the highest detail possible and the least detail necessary, to achieve a look that is adequate and homogeneous at the same time.

This is why we applied a cubic grid of 1 by 1 by 1 meters, as mentioned before at the Pantheon project. It is quite like an algorithm: objects, that fill more than half of this one meter cube, are shown, while objects, that do not fill half of the cube, are not shown.

This does not work down-the-line, so there are exceptions to the rule. Columns for example clearly fill less than half of the space. But if you consequently left them away, colonnades would simply disappear.

It is the same with steps and sculptures. And there will certainly be more exceptions than this. (Fig. 18)
The third convention concerns the flexibility of the virtual model. We will associate the viewer’s distance with the individuality of the method of representing uncertainty. This means, that the closer you get to a single building, the more individual its uncertainty may look. And the farther you get, the more the look becomes homogeneous. This dynamic change again excludes the use of physical models. (Fig. 19)

After all, there is a timeline to consider as well.

We have implemented different temporal states according to the building history. But every building complex has its own particular history. Now, there is too little information to show the whole process continuously over the centuries, so we restricted ourselves to discreet points in time.

A set of methods, three conventions and a timeline, and we have dedicated ourselves to the entire mountain of Pergamon. The city of Pergamon is a large area. It contains the fortress, the ancient city on the mountain, the roman extension in the valley, fortifications from the byzantine time and, of course, the today’s town of Bergama.

To accomplish this, there are three more things to consider – space, time and status:

The project within TOPOI concentrates on the area inside the ancient city walls. So far the contour. Inside this, we divided the area into sections.

The sections mainly follow the archaeologic entities used in the literature.

The era that we are going to represent, is the phase around 200 AD. This is the most prosperous epoch. At 200 AD, most of the buildings are erected and the least are destroyed. Again, there will be some exceptions. We will also show selected areas at selected other points in time. The library complex for instance might be shown before the erection of the Athena temple.

The status definition includes the state of the site today, that is the ruins.

So altogether we have three states: the remains and twice a reconstruction, the simplified one and the detailed one. (Fig. 20)

We set up a building catalog, not only to keep an overview, but because the authorship is very diverse. Some reconstructions match the literature. Others would get completed or altered by one of our involved archaeologist.

Some of them in general, others to enable us to reconstruct the third dimension. Some are simply outdated and need correction, others are currently being authored in dissertations.
The catalogue also allows us to spread the tasks. It mainly helps us to keep track of the architectural decisions, since their hypotheses may someday be substituted. (Fig. 21)

Our work is directed towards two different audiences. The first is the archaeological research itself. Having our model at hand on site, archaeologists hope to get inspirations for their work. They can validate hypotheses in space and instantly – with the remains in real reality and the reconstruction in virtual reality.

The second audience is the public. Our model is intended to promote the comprehension of the history of Pergamon. And it should furthermore explain the archaeological work itself to the public.

General bird’s eye overviews will introduce into the terrain and the development of Pergamon. From this distance you get the balance between the highest detail possible and the least detail necessary, as mentioned before.

Carefully selected view points will introduce into the spatial qualities of the site. (Fig. 20) These view points will show the detailed reconstruction, while the simplified version would be used in distant prospection.

Finally an interactive walk up and down the main street is planned – from Eumenes’ Gate at the bottom to the Arsenal on top of the mountain. It is intended that at every point on the path you can freely look around.

We’ll present the model in a capital exhibition about the city of Pergamon at the Pergamon Museum in Berlin in 2011.

Research partners

Archaeology: Chair for Building History, Brandenburg University of Technology Cottbus, German Archaeological Institute/Department Istanbul, Staatliche Museen Berlin – Antikensammlung, University Freiburg / Institut für Archäologische Wissenschaften (DFG-SPP 1209)
Measurement and model of remains: Hochschule Karlsruhe/Institut für Geomatik