Visualizations - a Critical Survey on Opportunities and Limits

Wolfgang Knoll
University Stuttgart
Department of Architecture and Urban Planning
Institute of Presentation and Design, Chair 1

Peter Braumann
University Stuttgart
Department of Architecture and Urban Planning
Institute of Presentation and Design, Chair 1

Ildikó Frels
University Stuttgart
Department of Architecture and Urban Planning
Institute of Presentation and Design, Chair 1

see the CD for the extended version

Abstract

New visualization technologies developed in the last 15 years have yielded a wide variety of new presentation and design tools. These tools are having seminal influence on the character of scholarship in many fields of visual studies. In archaeology for instance, in the area of reconstruction and visualization of archaeological objects, the choice of and appropriate use of available presentation media is freeing scholarship from former restraints imposed by technical problems and limitations, and from the formerly high costs of archaeological object documentation. Reflection on the effects of this new scholarly freedom has led to an important insight: The kind of presentation media chosen by a scholar highly influences the quality of an archaeological objects initial statement, and consequently highly determines subsequent interpretation of the objects character.

Visualizations - a Critical Survey on Opportunities and Limits

The development of new visualization technologies in the past 15 years has yielded a wide new variety of presentation and design tools. To those who work in the field of reconstruction and visualization of archaeological objects, opportunities and limits that were typical to this field have become dramatically less bounded by technical problems and by formerly high costs of rigorous documentation or of good presentation materials. The choice of available media and their appropriate use have become far more central issues in field.

Today the range of presentation forms at our disposal includes traditional pencil drawings, perfect CAD - Simulations, cardboard models or CNC supported models. Each of these techniques offers distinguishing features and qualities advantageous to producing particular visualizations. An essential change in paradigm had occurred: Today the kind of presentation media chosen by an author highly influences the quality of an archaeological objects initial statement, and consequently highly determines subsequent interpretation of the objects character.

Meaning of Visualization

The term "Visualization" is generally taken to refer to computer-aided presentation. But visualization ideally comprises more than merely creating perfect renderings with an electronic instrument.

A maxim of Paul Klee was that art never shows the apparent but always unveils the invisible. Visualization has the potential to do both: The visible is shown, but also coherences which are not obvious, and their interpretations, are potentially unveiled. Simplified, visualizing is showing what one thinks about an object.
Especially in the field of reconstruction of archaeological objects, the suggestive power of the presentation is often difficult to distinguish from the realistic contents.

Naturally visualization of archaeological contents relies on facts, but at the same time visualization is subject to a different set of terms and parameters which very much lie in the field of art and design, rather than the traditional archaeological language and limits which lie more in the fields of science, natural history, and sociology.

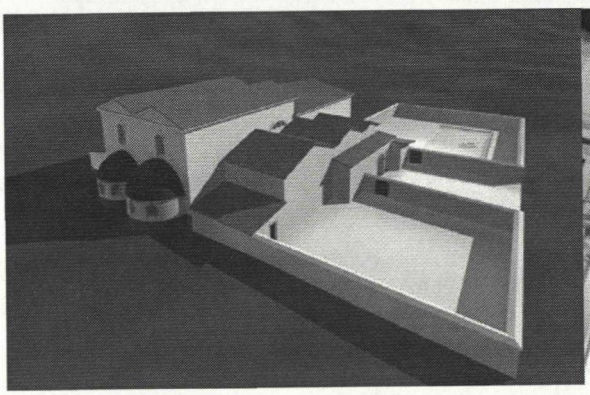

Figure 1 reconstruction - roman bath Baden-Baden 2003 © ArEP, Braumann, Frels, Knoll

Figure 2 reconstruction - San Giovanni dei Fiorentini 2001 © Idg1, Universität Stuttgart

Visualization - Manipulative or Cognitive Tool?

The starting point of every visualization is a scientific assumption or thesis, or archaeological on-site-findings. The Intention is to reconstruct buildings on a scientific basis. The distinction between

the aspects of a presentation that are based on facts and the aspects that are speculative or interpretative must be made clear. An essential task of any good visualization is to make these distinctions abundantly clear.

If this separation of scientific report and free interpretation is clearly made, then a widespread prejudice that visualization is a manipulative tool can be weakened and replaced with an understanding of the cognitive use of visualization. The suggestive power of images or models must be used to clearly differentiate the scientific root from fictive speculations and interpretations.

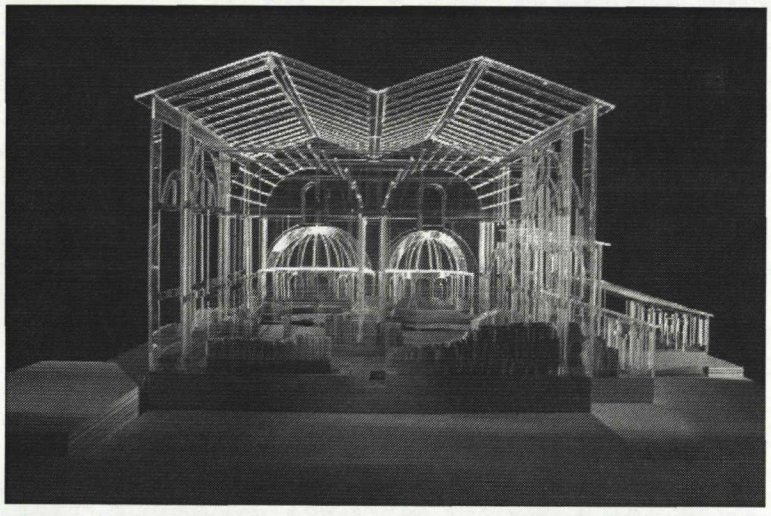

Figure 3 reconstruction - roman bath Baden-Baden 2001 © ArEP, Braumann, Frels, Knoll

Another responsibility of visualization, no matter what method, analogous or digital, is to make an audience understand abstract contents that would otherwise be hard to imagine. Visualization serves as interface in communication of scientists and laypersons.

When a visualization enables a laypersons basic attraction of an archaeological object to flourish, the layperson is in a better position to develop a relationship to the history of the object, to scholarship about the object and to interpretations of the object.

Figure 4 reconstruction - roman thermal bath Badenweiler © ArEP, Frels, Huster, Knoll

Finally, visualization is able to contribute to archaeological understanding and findings by checking assumptions and by facilitating the development of new theories based on speculations developed through visualization techniques.

Visualization as a Result of Teamwork

Ideally, visualization is created in close teamwork of experts in archaeology, history of art, sociology or engineering. A dialogue between these experts and specialists in visualization generates potential solutions for questions and problems such as the following.

[1] Range of Application and Target Group:

- Reconstruction of buildings/objects that exist only rudimentarily in written texts, drawings etc.
- Construction of buildings/objects that never were built and only exist in planning, for example competitions, architectural utopias etc.
- Buildings with constricted access to public
- To record a state, a condition before the restoration of a building
- To envision aspects of: reuse, rededication and remodel, computer as a tool for decision support
- Scientific-work related: checking assumptions, defining problems, computer as cognitive tool?

[2] The Didactic Concept:

- The application of media and the interconnection of different media
- What shall for whom and how be shown, with what kind of media, techniques and methods and which objective is set?
- What is the learning effect for the viewer and the user?

[3] Levels of Consideration:

- Sociocultural level:
  historic environment, building history, society and its involvement, perception of the subject in due time and today, cultural context, such as: art, inventions or technical achie vements at the time of origin
- Architectural level:
  architectural form, space, spatial composition, usage, geometry, construction, building technology, engineering structure, material, colour, light and illumination

Choice of Presentation

In choosing the most appropriate visualization between potential solutions to the questions and problems developed by teamwork each available presentation media should be tested. An analysis should be done of each potential visualization to determine its correspondence with the archaeological purpose. Examples of correspondences with archaeological purpose follow.

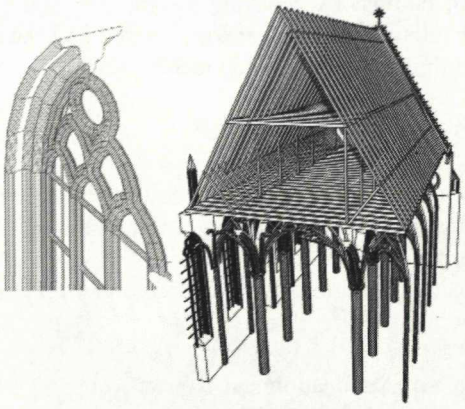

Figure 5 visualization - Heilig Kreuz Münster, Schwäbisch Gmünd 2001 © Dr. Zöller

Figure 6 visualization - Burg Falkenstein 2001 © Dr. Zöller

generate a different scene, according to his constitution which may not at all match the images of other readers. The reader is asked to give something towards the text actively. If he does not do this or if the text does not claim it, it will stay irrelevant for him.

One is asked to get involved creatively, to invest fantasy and ideas, in all levels of perception, similar to experiencing architectural objects.

Looking at drawings, pictures and sculptures also requires this creative input. Watching a photorealistic Animation in the computer, only little imagination and fantasy is needed, respectively the creative process of getting involved creatively is restrained.

Drawing

A Drawing, for example, offers the possibility of a graphically lively presentation. The particular drawing instrument, the expression and flow of the lines and the character of execution allow a high extent of individuality. In preliminary drawings, the process of finding forms can be revealed for instance through a series of lines which slowly condense to the final contour. Traces of work stay visible, the composition of a drawing is always understandable for the viewer. Still a drawing needs a skilled imagination to compose the single pieces into a spatial synthesis.

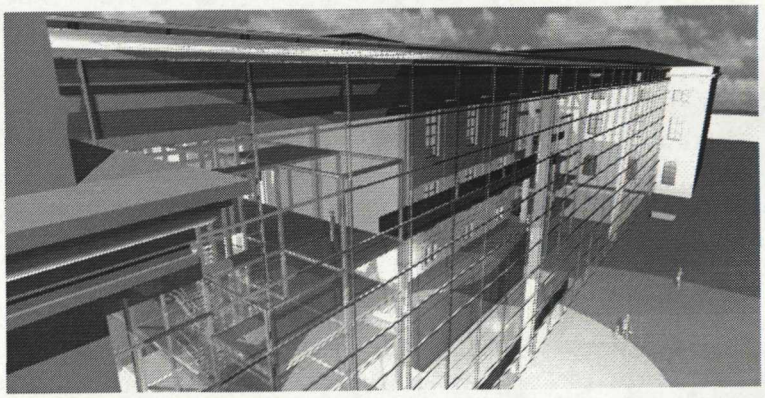

Figure 7 visualization - military historic museum, Dresden 2001 © Braumann, Frels, Huster

Model

The model is experienced visually and haptic. It shows the objects in their entity. Because of its three dimensions laypeople can generally more easily understand a model. The viewer is free to choose his or her position and point of view. The audience is able to look at volume, scale and proportion as a whole. This raises the comprehension for the observer. Since material and scale typically limit the degree of detailing in a model, its purpose is typically focussed on the characteristic marks of an object.

In addition to a CAD reconstruction of the project this model shows the essential parts of the building as: volume, roof, structure

Computer

Working with Computer Aided Design, the question that arises within this context is, if presentations on the computer activate fantasy and imagination or rather reduce or even anticipate them. To what extend is the viewer confronted with an illusionary world, being feigned by virtual reality?

In the experience of reading, for example a novel or poetry, in the readers mind, pictures emerge, notions of the world described. The reader will

Architecturally complex buildings are to be read and interpreted in multiple ways. Spaces are not experienced just by looking and watching, but particularly by moving, listening and touching. At the computer the viewer only gets this possibility as much as it is provided in the software program. In addition, the display screen shows a two-dimensional image, space exists only seemingly.

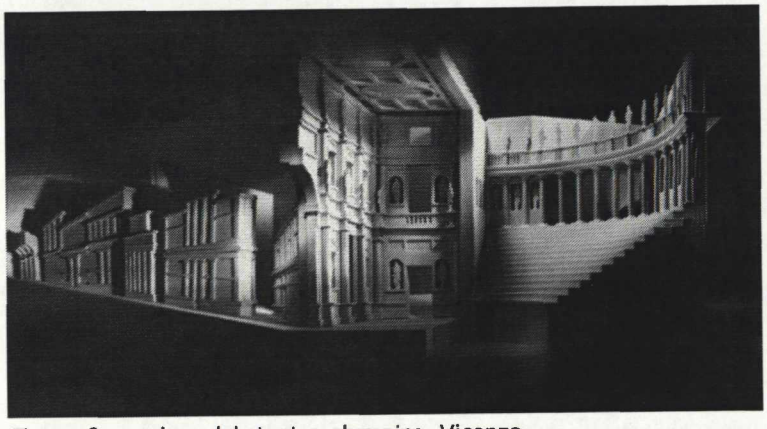

Figure 8 wood model: teatro olympico, Vicenza
The Section was chosen to emphasize the relationship between the different functional areas of the theatre 2001 © Idg1, Universität Stuttgart

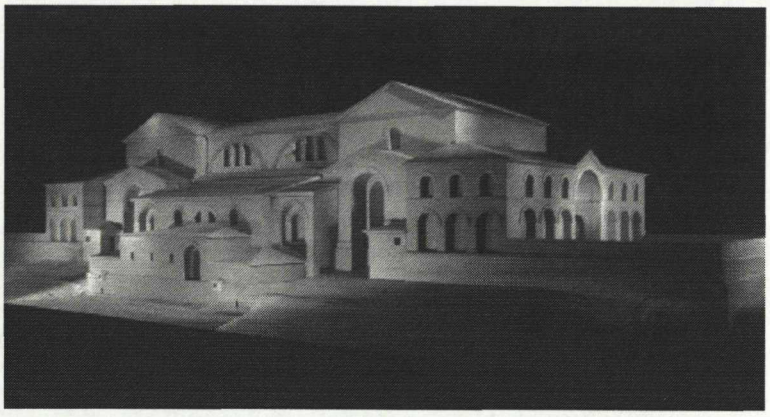

Figure 9 Reconstruction - roman thermal bath in Badenweiler, wood model. In addition to a CAD reconstruction of the project this model shows the essential parts of the building as: volume, roof, structure
2001© ArEP, Frels, Huster, Knoll

While watching a computer the viewer is bounded by the structure of the presentation. Even with interactive presentation media, the range of movement is predetermined and limited.

What is the capability that makes the computer in some respects more powerful than other media? Besides the great possibilities to develop forms and their coherences, the computer can show different levels of regard or build variants. The ability to simultaneously show different information gives the user the opportunity to depict time and to illustrate time-lap, for example the light on a building over the entire day.

The potential of computers can be found in their capacity to link different levels of examination together, for instance in the analysis of possible geometries, in the development of form and its coherences, or in the creation of virtual spaces, and most notably the demonstration of time.

Dangers and shortfalls of computer visualization lie within the shine of perfection and the compulsion to be concrete. As a helping tool the computer serves well in combination with analogue techniques. The greatest insight may be the result of overlapping computer and conventional analogue visualizations.

Conclusion

The most effective visualization for rich interpretation occurs when an interconnection of different media is possible, where different senses and sensibilities of the viewer are addressed. A palette for effective visualization includes drawing, photography, models, computer animation, computer networking of different information, sounds and tone, even samples of materials with different surfaces. Developers of visualization must persistently question what kind of media, what techniques, what vehicles of expression are most suitable for the insight being developed. For the realisation of data into a visualization, typographic, and graphic know-how is required, as well as the knowledge of composing a movie: directing camera, lights and time flow.

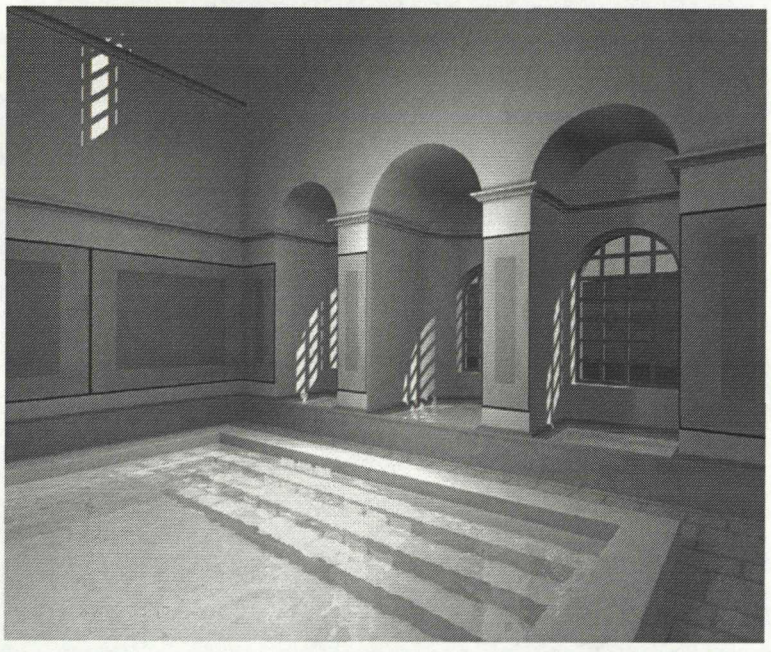

Figure 10 reconstruction - roman thermal bath, Badenweiler, interior
2001 © ArEP, Frels, Huster, Knoll

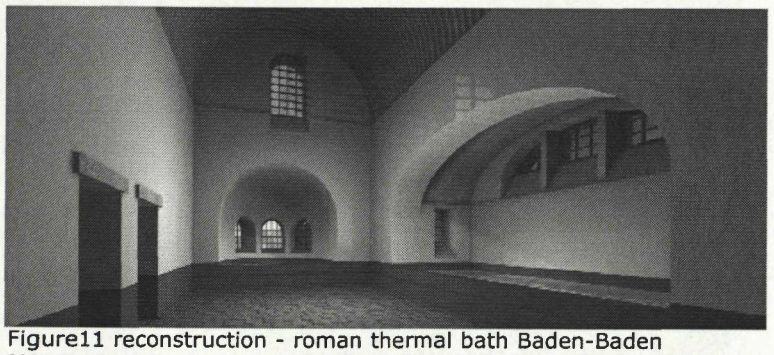

Figure11 reconstruction - roman thermal bath Baden-Baden
2001 © ArEP, Braumann, Frels, Knoll, Rometsch

Ideally, those who deal with presentation and visualization of archaeological buildings and objects have some of the skills and abilities of an architect: skills with building techniques, construction, structure, materials, geometry and free planes geometry. But more essential than these skills are architectural abilities: a feeling for architectural forms, spatial rhythm and spatial qualities - qualifications that reside in an artistic creative domain.

A precondition for successful visualization is teamwork - scientists, archaeologists, art historians, sociologists, engineers, and experts in visualization working together. Within that context, visualization has potential to exert far deeper significance to archaeological scholarship than simply drawing, modelling or animating with a range of different visual instruments could provide. It has the potential to reshape aspects of the character or this scholarship and of human understanding.