Virtual 3D reconstructions – benefit or danger for modern archaeology?
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Abstract:
In recent years the importance of computer technology used in archaeological surveys has rapidly increased. Today there are numerous ways of “digital” support for the work of an archaeologist. Virtual 3D reconstruction is one of these methods. Although there are a lot of undisputed benefits of such digital work also dangers connected to this development exist. Due to the fact that it is pretty easy to rebuild objects virtually without much effort even people and companies with no primarily scientific approach or archaeological background are working on reconstructions. But to a major part every model is based on compromises and assumptions which need to be permanently reviewed by experts. This is necessary because 3D reconstructions mainly aim to look extremely realistic. So these models can be easily misunderstood as „resurrected reality“. Therefore there should be certain obligations to build the models on a scientific basement as well as to state that what is shown is only one out of numerous possible interpretations of the project’s “historic look”.

But beside the criticism some of the benefits which arise out of an interdisciplinary synergy between artists and scientists should be mentioned as well. Foremost, working on 3D models gives us the chance to try out different ways of interpretation without doing any harm to the original. New or renewed results could be implemented with a few mouse-clicks and mistakes could be easily erased. So there is a high significance of well converted digital 3D modeling for archaeological research and its demand to find, survey and preserve historic structures for our future.

Keywords: Archaeological 3D Modelling – Virtual Reconstruction – Public Presentations – Methodology – Critical Review

Introduction
This paper is concerned with the question in which way archaeology and other history-related disciplines may benefit or suffer from 3D-Reconstruction at its present state. Therefore we want to give a short overview of the actual situation and an outlook on what could be changed for the future to achieve even more scientifically accepted benefit from the work of 3D-artists. The continuous improvement of the quality of 3D-graphics used for archaeological purposes as well as for cultural education, cultural tourism and marketing in all its splendor has led to a sharp increase in demand for such depicted past life worlds. At the same rate with the increasing demand, also the interactive use of 3D-products has reached new dimensions.

This indeed raises a bunch of fundamental questions about the current state of virtual 3D reconstruction: How are available resources used today? What expectations do clients of such products have? Which are the producers’ demands? Where do these expectations and demands meet? And how do they affect the appearance and the educational effect of the final product? What responsibilities do clients and producers of 3D-reconstruction have in terms of conveying historical content?
All these questions touch upon different aspects of the workshop’s topic, “archiving”, because 3D virtual reality is a very essential factor in the building-up of both textual and visual historic archives. Especially in terms of preservation, cultivation and mediation of such archives the use of new media offers an enormous creative potential. However, one thing should be clarified from the beginning: The present paper deals exclusively with the use of three-dimensional visualization in a scientific and popular scientific context. In no case do the authors claim to create a kind of moral regulation. The foremost intention is to make those 3D-artists working in cooperation with conservators, museums, archaeologists and building researchers think about a critical engagement with their own work and agency. Imaging a historical reality, which is – in most cases - irretrievably lost in its uniqueness, is a highly sensitive activity. It can be equally put alongside other, more traditional methods of archaeological and historical scientific disciplines. But such equality is only to be achieved if there exists a general methodological awareness for the primarily historical-analytical nature of the visualization and its production.
This means that the production of virtual 3D models must not be seen only basically as an activity exercised by “craftsmen”. Quite on the contrary, this kind of work provides a massive cognitive potential, from the process of building up to the final details of design and accurate historic research. As soon as this fact is accepted by the contractors, the logical consequence is that scientific research activities can be offered to potential clients – in addition to the preparation of the 3D-model itself. This offer should result in a win-win situation, giving the opportunity to further increase the quality of the final product.

3D-Modelling of Archaeological Sites and Historic Buildings: Advantages and Problems
To properly understand this tension between paid work and scholarship in its various aspects it will be necessary to figure out the various pros and cons, starting with the positive aspects: First and foremost it is obvious that a virtual 3D reconstruction, compared to the likes of conventional modeling and full-scale reconstructions, is an extremely fast and cheap method to provide an impression of a historic content (Fig. 1).

![Fig. 1 – Castle and gardens of Pidhirci (Ukraine)](image)

Moreover, a key role is played by the otherwise unattainable interactivity of the generated objects: The models are not only suitable for traditional print media, but also for further production of videos and interactive tours to name but a few.

Apart from these basic components in terms of media which actually have made the boom of 3D reconstruction possible, there is also the chance to gain scientific value out of the designing process. Both commercial and non-profit visualization-projects are delivering valuable information in the evaluation of structural analysis and excavation-works. This is because, apart from a sheer documentary aspect, vital clues to the spatial analysis of buildings and landscapes can be gained from reconstruction or re-modeling. The interpretation of certain areas or construction-typologies receives a new impulse via the recovery of the third dimension.
Constructive options may be tested quickly and economically in terms of technical feasibility (Fig. 2). And only partly conserved but basically similar findings may be understood and analyzed in a better way\(^3\).

Fig. 2 – Roofing the chapel of the ruined castle of Emmerberg (Lower Austria)

Thus, 3D-reconstruction can make a substantial contribution to all these points for it reaches far beyond the possibilities of conventional modeling or reconstruction drawings. This can be seen for example in the simulation of natural light sources or in a walk-through of virtual spaces from the viewpoint of an ideal historical visitor. Terms such as “sense of space” or the “atmospheric effect” of spaces can be much better understood in their historical meaning. Purely theoretical approaches may provide a good basis here. But they cannot match with the power of images and certainly not with the impressions of an interactive first-person-perspective experience.

Virtual 3D reconstruction, thus, obtains an enormous heuristic potential to evolve from a pure digital building process towards the creation of “aesthetic space” which meets the demands of critical researchers on the one hand and can serve as a basis for further investigations on the other\(^4\). In this case each model must be developed in a continued dialogue between client and contractor. It should not be graphic designer’s aim to visualize a given template without further questions, but to engage in an intense discussion with the scientists, ideally in order to develop certain issues out of the visualization process.

However, there are also some essential problems of both a general and specific nature. These problems are not only encountered by the graphic designer, but they emerge more generally whenever the creation of virtual reality touches archaeological disciplines. We might claim that the responsibility for the conveying of historical content lies primarily in the immediacy of perception. Of course, also written works do have the intention to present preconceived historical opinions as truths, but pictures are working in a different way than texts. They are complex systems of signs without any binding to a decoding principle\(^5\). Images cannot be decoded in an universally valid way. They provide an incentive to interpret, but there are no clear one-to-one mediated messages. Therefore, the demonstration of a past historical reality extends well beyond the mere presentation: The historical reality might be experienced morally for example: all Roman buildings are white and clean whereas the ones in the Middle Ages are filthy and vermin or, in a revised version, too smooth and beautifully presented (Fig. 3). Virtual demonstrations can eventually also convey social issues, such as segregation or domestic cohabitation which allows for an immediate sociological reflection on today’s life experience. These factors are as much a problem for Virtual Reality as for the traditionally colorful pictures in history books. The photographic realism of many 3D-scenes, however, goes one step further in suggesting that what you see is actually a real snapshot of a hence lost and buried past.
So the graphic designer holds a significant amount of responsibility in creating a 3D reconstruction. Each constructed object exerts an optical effect. Therefore it might not only be perceived as very well crafted, but many viewers will directly relate it to a flawed "history as it really was". In addition, the sheer technical perfection of most virtual images automatically enters in a competition with older forms of presentation, in which the latter are in great difficulty standing their ground. Simply put, 3D-reconstruction is not only seen as a more advanced method in the depiction of the past, but also as a "truer version of the truth". 3D models are therefore not only used to just mediate content. Even if such content exists, the effect of the images is unpredictable. The visual presence of images offers a first guidance for the imagination of the viewer, but their associative course cannot be controlled any further.

For the client very similar issues should be at stake when they think about the intended effect and the context of the required 3D reconstructions. Clients roughly have to decide whether to give the visitors a mere stimulus to their imagination – for example in form of intentionally unfinished or barely textured objects - or whether to grant little room for the visitors’ interpretation by using photorealistic scenes and lighting concepts or by including perfectly animated human characters (Fig. 4).

Both can be justified depending on the context of use, but in each case their strengths and weaknesses must be taken into account and integrated into a compelling educational concept.
At several points the basic considerations of graphic designers and clients affect or should affect each other. First of all, the creation of a model is always based on a chronological selection. In most of the cases the displayed objects are historic buildings or landscapes which were subjected to a diachronic development. With archaeological and architectural analysis on hand this development is traced throughout the ages. An appropriate documentation of findings is recorded and the results are presented in texts and drawings. The resulting 3D model is mostly based on one of the stages of the “timeline” worked out with these traditional methods. Its basis therefore is a certain point of history selected by experts and evaluated as being representative. This leads to the problem that other possible interpretations are aggravated or sometimes even entirely excluded by a handful of people’s selection. Viewers are also often not consciously aware of the fact that an object has undergone a historical process. A very similar problem lies with the real-built environment shown in theme parks and outdoor museums, which, in the worst case, distorts the perception of historical reality. But here the negative effects are much more severe because any decision could cause irreversible damage to the core substance of respective buildings and archaeological landscapes. Such a distortion of historical perception sometimes is deliberately accepted by the recipient of three-dimensional virtual models. But this subsequently leads to the problem that in the public opinion whole epochs are reduced and marginalized to small segments of time without telling the visitors and observers to be aware of that fact.

A good example of such a distortion is provided by the famous fascist model of Constantinian Rome by Italo Gismondi in the Museo della Civiltà Romana (Fig. 5). This model not only does show a certain point in Rome’s history, but it also provides us with the complete opposite: the mix of different epochs. Many gaps in the historic timeline had to be closed by using objects of different eras. This leads to an assortment of questionable scientific value. Such a mix of times can also be seen in the interior design and equipment of objects often strongly shaped by the optical standards of film and entertainment industry. Especially in large-scaled 3D-models the fear of the unfilled area is overwhelming and causes an indiscriminate sequence of diachronic stages of construction.

Fig. 5 – The distortion of the timeline in Gismondis’ model of Rome
A compromise between “filled space” and the visualization of well researched chronologically related structures can be put forth very easily by simple means. For example, an outlined abstract visualization of buildings may give an impression of spatial volumes and covered areas (Fig. 6). Although the abstraction of the environment distorts the photo-realism of the representation, in exchange the historical and contextual situation is clearly shown to the observer.

A third level concerns the phenomenon of idealization. Throughout the years, subliminal but sometimes also quite explicit tendencies in historical sciences persistently have survived that tend towards the visualization of certain epochs in an idealized and touched up way. In this conception, a classical concept of culture is connected with the desire for historical purity. However, for other periods like the Middle Ages, the early modern period or even the Stone Age visual concepts of dirt, muddy roads and some quite primitive dwellings have been established. Such aesthetic problems already start with the question whether to present a historical type - for example an abstracted house - or to develop a reconstruction of an entire, animated scene, which takes the observer more or less into a sensually perceptible event10.

The proper form of presentation can only be chosen in the context of each specific assignment itself. However, just a general doubt about the idealized, not the abstracted, presentation based on considering general factors like physical aging, decay and destruction of buildings and landscapes should be brought in11 (Fig. 7). At any given time in history objects, buildings and landscapes have been subjected to these rules as well as to the forces of nature. Thus, in the sense of historical correctness a certain degree of wear and tear for any era should not matter, whether it concerns the high classicism of the Athenians or the “darkest” Middle Ages. In any case it is preferable to represent a historic architectural or landscape development rather than to merely show a specific state. Only a diachronic visualization is able to teach the history of objects or landscapes adequately and can combine the factors of time and place for the individual observer12.
An exception to this rule are those virtual reconstructions which have not been primarily intended to transport a historic impression but to visualize a construction project, a restoration process or other interferences with historic substances without compromising the building stock (Fig. 8). Such models serve as decision support in the discussion of historic conservation processes but they also get by without the premise of historical authenticity.

Coming back to the issue one has to bear in mind its most crucial, most sensitive point: In modern society the visual expectation of what 3D-products should look like is strongly linked to the film and computer game industry. At an unprecedented speed better textures and engines are designed to bring artificial movement and environment even closer to perfection. Interactive use of virtual spaces is in the centre of interest. As we have seen above, science-based models which also follow the optical requirements of a computer-gaming-society can easily be created. Likewise it is possible to work in terms of an interactive use. But as in the preservation of historic monuments also in 3D-visualization the question has been raised of whether and where to draw a clearly identifiable boundary between fiction and reality. So, for example, it would be easily possible to highlight the actual height of the original remains of an ancient wall in the corresponding simulations via color or material, creating a separation between the original substance and the reconstruction.13

However, such measures are often adopted to meet the needs of clients who want to create "experienceable" and real historical "worlds". Thus, the distinction between computer game and scientific reconstruction is threatened to disappear in the long term (Fig. 9).
To counter this kind of evolution all reconstructions of historic content, including their interactive mediation, should be thoroughly distinguished from game design either by using conscious abstractions or interposed teaching sequences. The resources are quite the same indeed, but the underlying scientific approach and claim is fundamentally different.

Fig. 9 – Historic content shown in computer games

**Conclusion**

Consequently, some important and thought-provoking suggestions for the immediate future of the digital visualization of historic content may be derived from this sketch of the current state-of-the-art: First and foremost, graphic artists as well as their clients need to be aware of the fact that their interests affect each other, not only with regards to the appearance of the model, but especially regarding the content and dimension of scientific knowledge used in the reconstruction. Second, an awareness of the responsibility in the visual mediation of historical content needs to be established. This applies especially to the power of images, an all too often underestimated aspect\(^{14}\). Intent and scientific basis of the shown reconstruction should be clearly declared to the costumer. Is it an ideal reconstruction? Which point or segment on a larger timeline is shown by the visualized structure? Is it generally only a proposal for a construction project to be implemented in reality?

Ideally the producers of 3D reconstructions are familiar with the scientific basis and willing to reflect this knowledge for themselves at every stage of their work. Such “Archeo-graphics” can certainly provide some very valuable and important input to the scientific community. In terms of experimental-virtual archeology they will significantly contribute to combining the superficially striking effect of the pictures with a profound historical meaning.
References


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Fig. 1 – Castle and gardens of Pidhirci (Ukraine)
"Castle and gardens of Pidhirci"; modeled by Liv’in past 2008; Origin: Liv’in past, www.livinpast.at

Fig. 2 – Roofing the chapel of the ruined castle of Emmerberg (Lower Austria)
"The chapel of Emmerberg – preserving a historic site"; modeled by Liv’in past 2007; Origin: Liv’in past, www.livinpast.at

Fig. 3 – How to morally experience a historical reality – the clean and colourful classicism vs. the filthy an vermin Middle Ages
left picture: © www.lsg.musin.de;
right picture: "Name of the Rose" by Jean Jaques Annaud, 1986; Origin: www.thisdistractedglobe.com

Fig. 4 – The differences dealing with visitors’ imagination – a mere stimulus vs. photorealism

Fig. 5 – The distortion of the timeline in Gismondis’ model of Rome

Fig. 6 – Filling the “unfilled space”
"Visualizing a roman insula" (St.Pölten, Lower Austria); modeled by Liv’in past 2007; Origin: Liv’in past, www.livinpast.at

Fig. 7 – The implementation of physical aging, decay and destruction in the texturing of 3D-objects
"Roman houses of the 3rd century"; modeled by Liv’in past 2009; Origin: Liv’in past, www.livinpast.at

Fig. 8 – Visualizing the results of a revitalization project as a basis for further decisions
left picture: “Castle of Pidhirci” – state 05/2008; Photo taken by Peter Schneyder
right picture: see Fig. 1

Fig. 9 – Historic content shown in computer games
“Assassins Creed II” by Ubisoft, 2009; Origin: www.play3.de

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