The First International Conference "Virtual Archaeology 2012", The State Hermitage Museum, Saint Petersburg, Russian Federation, 4-6 June 2012

Notes and photos from a memorable conference in a unique environment
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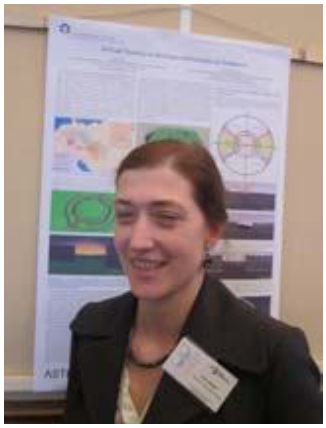
Objectives of the conference

Virtual Archaeology (VR) is a new term which has yet to be clearly defined. What is Virtual Reality (aka Augmented Reality, aka Mixed Reality)? The British archaeologist and computer scientist Paul Reilly first introduced the term VR in 1990 when he used 3D computer models for the visualisation of archaeological data and landscape. But is it sufficient to create digital data and perform simulation and displays on screen? Several questions remain, such as: what are the concepts behind this technology, what is the status of the art, what are the challenges that it presents?

Organisation and performance of the conference

The idea of holding such a innovative international conference was developed by Wolfgang Neubauer, LBI ArchPro, Vienna, in talks with the future chairperson of the organising committee, Daria Hookk, from the State Hermitage Museum, SPB. Visitors came from across Europe, America and Japan. The conference was held at the State Hermitage Museum, with the entrance from the riverside providing a beautiful view over the Neva to the Peter and Paul fortress. The talks were given in Russian and English and were translated by two interpreters. On the second day an excursion to the Treasure Gallery was taken, and on the 3rd day the new Restoration and Storage Centre of the Hermitage, "Staraya Derevnya," was presented. Also on the 3rd day, the prehistoric section of the State Hermitage was shown by Yuri Piotrovsky (esp. finds of the Kurgan Azan, excavated by H. Parzinger et al. in 2000). This summary of the conference will cover selected papers and events.



Chair-person of Organizing Committee
Daria Hookk
(The State Hermitage Museum, SPb)

Papers and posters of the conference

Two of the talks by Wolfgang Neubauer and Sorin Hermon presented a general concept of VR, whereas the other components of this conference were dedicated to specific aspects of this technology. Wolfgang Neubauer, director of the Ludwig Boltzmann Institut of Archaeological Prospection and Virtual Archaeology (LBI ArchPro), Vienna, (http://archpro.lbg.ac.at/ ; for its foundation in 2010 see http://www.portusproject.org/docs/ISAPNews26.pdf , p9-11) , showed a straight forward, bottom to top model which represented the successful development of archaeological prospection in Austria. It started with a common small-scale geophysical prospection about 15 to 20 years ago. Following the three 's' as defined by Helmut Becker (sensitivity, spatial resolution and speed, and perhaps a 4th 's' for small budget) the prospection speed and resolution developed at an accelerated rate. The areal unit used for the acquisition of high resolution images of the subsurface in magnetometry and GPR is currently square km, compared to hectars in the past (see paper by Immo Trinks et al.). The methodology of thorough, non-invasive geophysical subsurface investigation was complemented by air-born and terrestrial laser scanning and accompanied by special research projects like full wave-form analysis.
Archaeoastronomical research allows the study of the orientation of prehistoric structures toward astronomically-relevant directions, for example for the Neolithic Kreisgrabenanlagen (see paper by Georg Zotti et al.).

W. Neubauer elucidated that VR is technology mainly used for the visualisation of archaeological and prospection data, though basic research and the standardization of VR techniques are still missing from its fundamental definition. He elaborated on seven reasons for the use of VR and Augmented Reality (AR). He showed models and the VR reconstruction of the Neolithic Kreisgrabenanlagen, as well as Neolithic landscape reconstructions with settlements embedded in their natural environment. He also outlined the project to explore the huge Viking Age site Birka, a UNESCO World Cultural Heritage Site in Sweden, with latest non invasive archaeological prospection technology from the air and on the ground through a 'virtual dig'. Neubauer showed terrestrial laser scanning from the Great Pyramid and the Sphinx in Giza and its excavation with digital stratigraphic recording and virtual representation (see paper by Martin Fera et al.). Larger projects are, among others, the prospection by air and ground of the Roman town of Carnuntum (of which the remains extends over some 5 km²) and the megalithic rock monument Stronehenge and its environment. The LBI is dedicated to the development of new techniques and methodological concepts for landscape archaeology with a team of twenty seven people.

A slightly different concept was presented by Sorin Hermon, experienced in the field of Digital Cultural Heritage, managing and coordinating large scale EU-funded projects, and now the V-MusT project (http://www.vmust.net/). V-MusT is an EU FP7-funded network of excellence that aims to provide the heritage sector with the tools and support it needs to develop virtual museums that are educational, enjoyable, long-lasting and easy to maintain. The V-MusT network organises and hosts a range of activities including conferences, workshops, training sessions and exhibitions. The school introduces participants to the new field of web deployment of the VR and AR Applications ("VR/AR Apps") as well as related topics on applied CG technology in the area of virtual and augmented digital heritage, 3D reconstruction, technological tools dedicated to processing and integration into web front ends, ported to mobile smartphones and registered with the physical world.

In his talk entitled 'From Archaeological Research to Public Outreach; the 3D reconstruction contribution', Hermon developed a top to bottom guided approach starting with questions challenging the correctness of virtual reconstruction. We can think of the past like a foreign country: they do things differently there (L. P. Hartley 1953). What is the nature of archaeological reality? How much can we trust our knowledge of the past? What is the most suitable method of interrogation of the past? Can we estimate and evaluate the quality of archaeological data? How do we communicate archaeology? People tend to consider archaeology as the only science with the power to uncover the past (Kent V. Flannery 1982). Therefore, we need to educate the public about archaeology, because people want to know about the past. The task at hand is to raise awareness for this discipline, attract young researchers, and develop technology and make money! And Virtual Archaeology will help.

Hermon elaborated on how, where and who we should educate about archaeology. What is the best medium to use and how much technology should we involve? Here, virtual archaeology comes in. Where will this interaction with the public happen? In the museum, on the archaeological site and in virtual space (i.e. online). Who can communicate? With the new technologies there is a wide range of options: a museum curator, a technologist, an educator, a multimedia expert, an archaeologist, an art historian and the list goes on. Especially for new technologies, this initiative requires expertise in computer graphics, web design, computer animation, broadcast design, virtual reality, virtual cultural heritage and digital storytelling. It also requires students who are aiming for this new business branch to acquire skills specific to this technology.

Hermon showed as an example the Greco-Roman city Paestum, the ancient Poseidonia, founded in the 7th century B.C. and abandoned in the 7th century A.D. The area comprises 120 ha. of which only 20% is excavated. Regardless, new questions about this settlement can be answered using 3D virtual technology, ones about the experience of people living during times of urban development, as well as those about the accessibility and perception of space. With the visibility analysis provided by VR technology, relations between standing structures, living conditions and social spaces can be explored,

and interactions with their environment can be deduced. Another example is the virtual museum of an Etruscian tomb. The extraordinary objects found within this tomb – today preserved in the Etruscan-Gregorian section of the Vatican Museums - have been digitally restored and recontextualized. The tomb, surveyed by a laser scanner, has been reconstructed as it was in Etruscan age (mid 7th century BC), just after being closed.

Hermon persistently pointed to the uncertainty of our knowledge about the past, comparing it to the original façade of a building which requires the flexibility of model-building and the reconstruction of various options. An online semantic text annotation tool preserves the source integrity and provides the efficiency in retrieval of sources. Care has to be taken for the 3D semantic integration to ensure coherence between 3D geometry and semantics (http://www.isprs.org/proceedings/XXXVI/2-C43/Session1/paper_Stadler.pdf) (Example: In front of a door must be a platform or a step, but not the void).

Story-guided virtual museums were presented by Selma Rizvic, University of Sarajevo, Bosnia and Herzegovina, as a part of the V-MusT project. A digital story guides the visitor through the virtual exhibition, providing the user with the context of the exhibition, motivating them to explore other exhibits, and improving the visitor experience. She showed two examples of this from recent history. The Church of the Holy Trinity, one of the most beautiful Orthodox monuments in the Balkans built in Mostar in the 19th century, was destroyed in 1992, but virtually reconstructed by SSST in 2009 (movie with sound-resembles the reconstruction of the Frauenkirche in Dresden in the early '90s) and now the physical reconstruction is in progress. The second example is the siege of Sarajevo from 1992 to 1996 (1425 days), which is the subject of an exhibition entitled 'Sarajevo under the Siege' in the Historical Museum of Bosnia and Herzegovina. The component which most exhibitions lack is the sound during the siege, as well as the context and the atmosphere of the city during the siege. This is part of the experience that the virtual reality project can create. The 'Sarajevo Survival Tools' project is an outcome of cooperation between the Faculty of Electrical Engineering Sarajevo (ETF) and the Historical Museum of Bosnia and Herzegovina in the field of cultural heritage digitization. Part of this project is a virtual presentation of objects created and used by the citizens of Sarajevo during the siege http://h.etf.unsa.ba/srp/list.htm .

Special studies

A prerequisite for any kind of virtual archaeology is the precise, accurate and complete 3D digital imaging of archaeological objects in small scale (individual objects) as well in large scale (like excavation sites or landscape archaeology). Michael Neiß et al. presented the technology of 3D laser scanning as a tool for Viking age studies. In a pilot study, highly ornate broaches from Scandinavia and Russia were digitized with portable laser scanners, and the resulting 3D models were used for artefact reconstruction, tool mark analysis and motif documentation. The team gained much experience with the technique of 3D laser scanning and they are willing to share their experience (contact Michael Neiß, PhD Student archaeology, Upsala University http://michaelneiss.hardell.net).
Chisako MIYAMAE presented for the Digital Heritage Development Department in TOPPAN, Japan a multiclass production framework based on 3D scanning data for archaeological artefacts. Using a Mimizuku (horned owl) dogu, a type of ceramic figurine from the Jyōmon period (2000-1000 BC), she illustrated how high quality products from 3D scanning data may be used for various purposes. High class point-cloud models and mesh models are the basis for research and resources used for archives and digital drawing. Middle class representations in digital media are used for virtual reality, replica and computer graphics and low class products used for Youtube, videos and smartphones. (http://www.emuseum.jp)

'Digitizing Egyptian Heritages' was an exciting paper by Ichiro Kanaya, Yukinori Kawae, Kosuke Sato and Hiroyuki about a 3D digital modelling project of Egypt's oldest pyramid, the Djoser Step pyramid in Saqqara. Following this, the El-Zayyan Greco-Roman temple at Kharga Oasis and the monument of Queen Khentkawes at Giza Plateau were also modelled with the help of 3D technology. The Saqqara

Laser scanning team built a special 3D scanner named Djoser. With the help of a Nepalese mountaineer who climbed from the top down with more than 35kg on his back, a high resolution 3D digital data volume was acquired.
http://nagoyau.academia.edu/YukinoriKawae/Papers/682940/Saqqara_Laser_Scanning_Survey_2008

3D documentation and the visualisation of stratigraphic excavations was the theme of Martin Fera, et al., the representative from VIAS Vienna Institute of Archaeological Science, University Vienna. The authors describe an approach to monitoring stratigraphic excavations by using systematic 3D recording, as well as 3D terrestrial laser scanning in combination with digital imagery. This implies the construction of a Harris Matrix, which represents the relative temporal succession of the recorded units. A comprehensive full 3D volumetric approach allows the digital reconstruction of a site which has been destroyed by excavation. http://cipa.icomos.org/fileadmin/template/doc/TURIN/226.pdf

Sergei Gorbatenko (President of ICOMOS SPB) talked about Graphic and 3D modelling- an alternative to the real reconstruction of lost objects of cultural heritage. Restoration nowadays tends to radically reconstruct historical and cultural monuments, removing later layers and creating an image dating back to a certain optimal date. The result is often the loss of authenticity of a monument and its scientific significance, partly or completely. Gorbatenko specifically discussed the articles 3, 9, 11 and 12 of the ICOMOS Venice Charter for the Restoration of Monuments and Sites: article 3-the aim: …historic monuments… are living witnesses of their age-old traditions. Our duty is to hand them the full richness of their authenticity; article 9- restoration …to preserve and reveal the aesthetic and historic value of the monument using methods based on respect for original material and authentic documents. It must stop at the point where conjecture begins…; article 11- The valid contributions from all periods of a monument must be respected…; and article 12- Replacements … must be distinguished from the original. Gorbatenko illustrated the wrong way of restoring monuments, using several examples from St Petersburg. For example, the Kunstkamera, Kikin Hall and the Menshikov Palace looked differently before. The famous tower of the Kunstkamera was not part of the original building. In one case, the wrong picture from an old postcard was chosen for a restoration design. Additionally, the style architecture for various gardens, like the Summer Garden, the Konstantin Garden, Strelna, and Peterhof was changed. According to Gorbatenko, an example for a well performed restoration is the Neues Museum, Berlin, by David Chipperfield.

Gorbatenko insists that extensively graphic and computer modelling must be done on a monument before returning it to its 'former glory'. Detailed studies, analyses and a virtual presentation should be performed to show the monument's appearance in various epochs without losing authenticities.
The poster by Jörg Faßbinder et al. (LMU Munich and BLfD) detailed the 3D reconstruction of Roman sites in Bavaria based on geophysical results (Fortress of Burghoefe and Weißenburg). High definition magnetic, GPR and resistivity prospecting gave detailed information about the complete structures of

Roman forts and of previously unknown parts of the Limes. The authors of this project stress that non-destructive geophysical methods provide the means to further investigate sites such as the Roman Limes which have been classified by UNESCO World Heritage organization as a World Heritage Site. Classic archaeology will be limited to small scale excavation.

'Prospecting in the Kurgans using Magnetometry: case studies from Kazakhstan, Siberia and North-Caucasus' (J. Faßbinder, H. Parzinger et al.) was another topic discussed. Kurgans, the outstanding monuments of the pastoral nomadic sites in the steppe, were not only burial sites of the kings but were also considered sacred by the communities of these regions (Parzinger 2004). By means of deep penetrating caesium-magnetometry, it is possible to date these burial sites and to ascribe them to a specific period and culture. It was also possible to discover new structures in the vicinity of these burial sites.
http://lmumunich.academia.edu/JorgWEFassbinder/Papers/1668562/Classification_and_documentation_of_Kurgans_by_magnetometry_case_studies_from_Siberia_Kazakhstan_Northern_Caucasus_and_Kalmykia

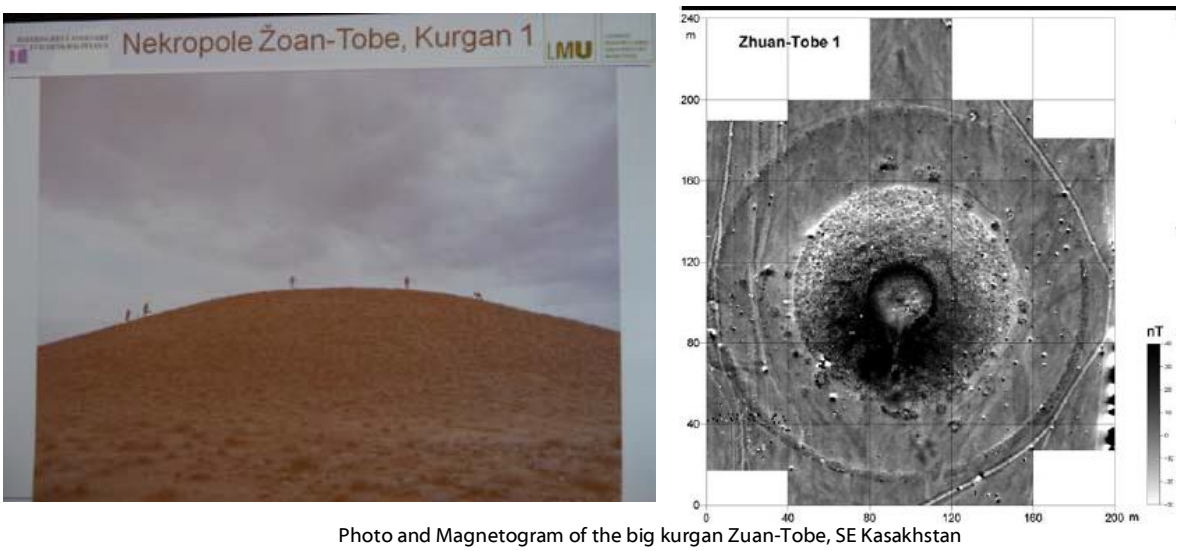


Photo and Magnetogram of the big kurgan Zuan-Tobe, SE Kasakhstan

The Gazprom or Okhta tower

Mock-up of Nyenschantz fortress and thetown of Nyen at the museum "Landskrona, the Neva Mouth, Nyenschantz", 2003-2007

Fierce public opposition erupted when energy monolith Gazprom received permission from St. Petersburg Mayor Matvinyenko in 2005 to build a needle-like tower next to the 18th century Smoly Cathedral. Critics of this project– from UNESCO to local residents – said the Okhta Centre's 400m tower would ruin the city's classic skyline. Because of the protest, the project was halted, but cape Okhta

(formed by the Neva and the right tributary Okhta) became the site of a large excavation. Pyotr Sorokin, the head of the St. Petersburg archaeological expedition of the Northwest Scientific Research Institute of Cultural and Natural Heritage, gave a short presentation. The place is now a multilayered archaeological monument with sites of the Neolithic and early metal age, a site of medieval settlement on the Okhta Cape, the 13th century Landskrona fortress, a late medieval burial ground of Nevskoye Ustye, a Russian settlement of the 16th-17th centuries, and the 17th century Nyenschantz fortress.

Nyenschantz - Maps from 1643 and 1681.
Note the large extent of the 13th century Landskrona fortress compared to Nyenschantz fortress (northern 5 star)

These archaeological discoveries increasingly disprove the legend that Russian tsar Peter the Great laid the foundation of the Northern Capital on the uninhabited and desolate banks of the Neva.
http://spbae.ru/arh_ochta_NR_2011eng.htm

The new Restoration and Storage Centre "Staraya Derevnya" of the State Hermitage

A guided tour was given of the new Restoration and Storage Centre "Staraya Derevnya" of the Hermitage. At present it comprises three buildings for Administration, Storage and Engineering. In accordance with the museum's General Plan of Development, in 2012 the Storage Facility became the largest complex of its kind in the world, consisting of eight specialized buildings. The unique feature of this museum project is that it accommodates visits to the Hermitage Storage Facility by tour groups. The itinerary for tours of this complex familiarizes visitors with works of painting and sculpture from the museum's reserve holdings, as well as with an extensive collection of furniture, carriages and other exhibit items previously inaccessible to the general public.

The new Restoration and Storage Centre "Staraya Derevnya"

Archaelogical school room for handicapped blind children (excavate in sand and touch!)

Conclusions and Outlook

In the course of the final discussion of this conference, participants came to the conclusion that there are two points of view on the definition of the term "virtual archaeology". The first one comes from the world of computer sciences, so-called virtual reality. The more modern approach based on archaeological science shows us that we should expand the initial definition, because the preliminary reconstruction of archaeological sites with the help of advanced computer methods have begun to play an important role in archaeological prospection, as well as in the representation of the results of archaeological excavations and historical research. One of the most important problems appears to be a poorly developed professional network. Participants shared the opinion that the discussion of methods, projects and events should be continued on the Virtual Archaeology webpage.

The prehistoric section (left) of the State Hermitage and the Treasure Gallery (right) and the were shown to participants Of the conference by Yuri Piotrovsky, senior researcher and deputy head of the Department of Archaeology of Eastern Europe and Siberia of the State Hermitage Museum

The growing importance of Virtual Archaeology creates new disciplines in archaeology and new study fields combining computer science, archaeology and presentation. These new technologies require expertise in computer graphics, web design, computer animation, broadcast design, virtual reality, virtual cultural heritage, and digital storytelling.