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All-Russian Scientific and Methodological Workshop "The Virtual Reconstruction of the Objects of Historical and Cultural Heritage in the Format of the Scientific Research and Educational Process"

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The article gives an overview of reports presented at the All-Russian scientific and methodological workshop which was organized by the Association "History and Computers" and the Institute for the Humanities of Siberian Federal University in Krasnoyarsk on April 22-23, 2011. The workshop allowed to summarize and analyze the experience of preserving the objects of historical and cultural heritage by means of computer technologies, in particular the experience of creating virtual historical reconstructions. The participants discussed prospects of using virtual reconstructions in research activities; issues connected with the quality of references and resources, criteria of the scientific rationale, necessities of interdisciplinary study in the process of creating virtual reconstructions. Special attention was paid to implementation of computer reconstructions in the educational process, as well as to opportunities of using virtual reconstructions in research and educational activities of museums, educational centres and other institutions of culture and education.

Keywords: virtual reconstruction, historical and cultural heritage, 3D modelling, representation, visualization, interdisciplinary approach.

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On April 22-23, 2011, the Association "History and Computers" and the Institute for the Humanities of Siberian Federal University organized the All-Russian scientific and methodological workshop. Leading specialists representing research centres of Russia and the Ukraine took part in the Workshop.

The issue of preserving historical and cultural heritage today is quite topical due to the constantly increasing threat to its existence caused

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by the lack of financial resources for restoration or reconstruction, industrial development of territories where these monuments are located, etc. The virtual reconstruction of cultural monuments can help to solve the problem to a certain degree – implementing modern computer technologies with the 3D modeling methods. In today Russia serious work in the field of virtual reconstructions is done by research teams from Moscow, Saint Petersburg, Tambov, Krasnoyarsk and Yekaterinburg. The experience that already exists, should be broadcasted and generalized, as well as analyzed. This will allow to identify problems, to determine tendencies of virtual constructions' development, to develop common methodological space that will give researchers an opportunity to use adequate tools in their work on creating the Russian resource of virtual reconstructions of cultural monuments.

The objective of the Workshop was to present and summarize Russian experience of creating virtual reconstructions of historical and cultural objects in the research and education space; to discuss problems concerning technologies, references and resources base for virtual reconstructions.

During the Workshop the following issues were considered:

- Reality and prospects of using the methods of the virtual reconstruction (VR) in research;
- Results of using the VR technologies in the educational process;
- Opportunities for using the VR in research and education activities of museums, educational centres, etc.;
- Problems concerning peculiarities of the complex use of various types of references and resources during development of virtual constructions.

The first day of the Workshop was devoted to summarizing and analyzing the *research* experience in the field of the virtual reconstruction of historical and cultural heritage.

L.I. Borodkin and D.I. Zherebyatyev (MSU named after M. V. Lomonosov, Moscow) in the report "Modern tendencies in development of virtual reconstructions of the objects of cultural and historical heritage: international experience" presented the role of 3D models within the framework of computer methods for modeling historical processes and phenomena. They also shared the existing approaches to determining tasks of virtual reconstructions and their types with the participants of the Workshop. The authors pointed out two main groups of works on creating virtual reconstructions of historical and cultural heritage: scientifically based, "academic", and educational, "popular science". The first group is presented less widely and is characterized by a strict approach to selection of references and their complex use. It is this group the report was mostly devoted to. The approach of Paul Reilly to the VR was presented as the one deserving special attention. Paul Reilly considers the VR as a technology that allows to substitute the artifact being under study by a 3D model; he uses it as a computer experiment, offers 3D technologies as a tool of computer-aided reconstruction of the object of historical and cultural heritage and considers implementation of the 3D modeling as a useful tool of spatial analysis for historians. They also analyzed the experience of implementing the technologies of 3D modeling for evaluation of hypotheses regarding peculiarities of the spatial structure of the objects of cultural heritage of the remote past.

V.A. Goroncharovsky (IHMS RAS, Saint Petersburg) in his report "Experience of virtual reconstructions of architectural monuments of the antique Bosporus" spoke about the main field of activities of the Department of History of Antique Culture of the Institute of the History of Material Culture of the Russian Academy of

Sciences (together with the Department of Arts of Saint Petersburg State University), concerning 3D modeling of the monuments of historical and cultural heritage at the territory of the Bosporan kingdom (VI century BC – III century). The virtual reconstruction he presented demonstrated the possibilities for representing the external view and the interior of the modeled objects; showed that scientifically based 3D reconstructions of architectural complexes could be used as a good historical resource with a high level of aesthetic and historical authenticity which allowed to create the basis for design of archeological parks in the open air, popularize archeological heritage of the antiquity by adapting scientific materials for presenting them in an available form.

The multimedia laboratory of the Department of Arts of Saint Petersburg State University also works with historical 3D reconstructions. P.P Shcherbakov (SPSU, Saint Petersburg) spoke about it in his report "Technologies of publishing computer reconstructions of historical monuments in the Internet". Historical 3D reconstructions of Ilurat, Staraya Ladoga, interiors of the family estate of V. Nabokov, the Saviour Church on Nereditsa, sanctuaries and tombs in the Black Sea region demonstrate variability of the VR methods: these are collections of 3D models of archeological discoveries, reconstruction of industrial processes and historical build-up, animation of battles, restoration of historical maps, development, etc. For the last 15 years the laboratory team has completed a number of projects concerning 3D historical reconstructions; in 2006 the book by S.V. Shvemberg, P.P Shcherbakov, V.A. Goroncharovsky "3DS MAX Art modelling and special effects" was published. The projects are available at the website http://3Dmultimedialab.ru.

The laboratory of social history of Tambov State University named after G.R. Derzhavin is oriented not only at the virtual reconstruction of cultural monuments, but also at technologies of their representation. The experience of the laboratory was presented by R.B. Konchakov (TSU named after G.R. Derzhavin, Tambov) in his report "Multidimensional reality: tendencies and technologies of representation of 3D constructions". The laboratory has been working on creation and development of electronic databases, historical geoinformation systems, 3D reconstruction and visualization of historical monuments and museum artefacts, studying prospects of using information technologies in historical research. In the report some modern techniques of 3D visualization were demonstrated, including technologies of a multi-layer projection: video mapping, grisaille, dynamic lighting, etc. The problems concerning an insufficient methodological base necessary for representation of 3D reconstructions were indicated.

V.V. Moor (Kharkov State Technical University of Construction and Architecture, Kharkov) in his report "Architectural computer modelling in the study of architectural monuments" presented an interesting experience in the virtual historical reconstruction. The method of reconstruction is based on a specialized graphic package ArchiCad of a volume parametric model corresponding to a real architectural and archeological object. Composition analysis, consideration of construction elements and schemes, construction technologies and applied materials allow to systemize the accumulated theoretical and practical materials about the object and do the virtual reconstruction of the lost monument of the heritage with quite high accuracy.

Almost all the speakers in their reports on the experience of developing VRs paid attention to the problem of the references and resources base for the virtual reconstruction. D.I. Zherebyatyev (MSU named after M.V. Lomonosov) spoke about the problem in more

details on the example of the VR of a monastery complex (end of the 19th century – beginning of the 20th century). Due to the access to descriptive materials (records keeping, personal documents (memoirs, diaries, correspondence), graphic materials (layouts, maps, photos), materials of archeological excavations it became possible to do a virtual reconstruction which gave a full and precise idea of the monastery complex and can claim to provide an exhaustive authenticity.

M.V. Rumyantsev, A.A. Smolin (SibFU, Krasnoyarsk) presented the experience of virtual reconstructions of the monuments of cultural and historical heritage of Yeniseisk city. During the work on the virtual reconstruction of the city landmarks, the main principles of VR were developed: a project approach (composition of a project team: a supervisor, a historian, an architect, three IT specialists), modelling of all authentic elements of the objects (including fine décor) in volume; optimization of the model in order to export it into 3D-engine; development of the virtual reconstruction for a mainstream audience (from specialists to ordinary users). During 1,5 years within the framework of the project "Updating of historical and cultural heritage" the partially lost orthodox monuments of the 17th-19th centuries have been reconstructed: Saviour Monastery, Epiphany cathedral, Assumption church and Trinity church.

I.N. Rudov, N.O. Pikov (SibFU, Krasnoyarsk) in the report "Technological aspects of creating interactive VRs" spoke about the development of an authentic environment in interactive applications, use of up-to-date visualization technologies which allow to create visually attractive images of virtual reconstructions: a vertex shader, multitexturing, anti-aliasing, levels of detailization (LOD), screen space ambient occlusion (SSAO), etc.

The first day of the Workshop showed quite a high level of works in the field of virtual reconstructions of the objects of cultural and historical heritage. The reconstruction methods that were offered can and should be used in the educational process.

On April 23 within the framework of the section "The virtual reconstruction of historical and cultural heritage in the format of the educational process" the issues of introducing the experience of virtual reconstructions into the educational process were discussed.

D.I. Zherebyatyev (MSU named after M.V. Lomonosov) spoke about the experience of MSU in fulfilment of the special course "3D reconstructions of the objects of historical and cultural heritage: computer modelling" for students of the Historical Department. The speaker pointed out the peculiarities of the course, determined its main didactic units, outlined the efficiency of students' project work oriented at development of the VR of the objects of cultural heritage they had chosen. The special course is provided with the electronic materials available at the website of MSU (free access): http://www.hist.msu.ru/Labs/HisLab/3D/index.html.

A.A. Smolin (SibFU, Krasnoyarsk) presented the experience of including the course "Applied computer technologies in museum studies" into the curricula of "Virtual Reconstructions" programme. The objective of the programme is to obtain competencies and skills for reconstruction of historical and archeological objects or processes with the use of a personal computer, as well as 2D and 3D graphic editors. The content of the programme assumes that students will study the history of the VR development, their classification; software and special equipment necessary for virtual reconstructions; international and Russian developments; methods and specificity of developing various types of VRs. Special attention is paid to project work which includes participation in realization of a specific project.

The idea of the interdisciplinary approach in the process of the virtual reconstruction was supported by V.V. Moor (HSTUCA, Kharkov) when he shared the experience of implementing the special course “Methods of architectural computer modelling in the study of archeological objects”. He pointed out the importance of the architect’s participation in the work of the team. The value of the special course is in its focus on the project approach: the theoretical knowledge that the student get is a tool for solving a specific task – a virtual reconstruction of an architectural object.

R.A. Baryshev (SibFU, Krasnoyarsk) shared his experience of research and methodological maintenance of the projects connected with the VR of the objects of cultural heritage (on the example of the research work of the Institute for the Humanities of SibFU). In the report special attention was paid to detailization of the structure and content of works in the field of the VR, planning of the stages of its realization and responsibility binding between the project team members for each stage of the project. Such organization allowed a multidisciplinary team involved in the project to work with the maximum efficiency.

At the end of the Workshop a round-table discussion “Technologies of 3D modelling in historical research: criteria of developing a research virtual reconstruction” was organized. At the round-table discussion the issues of the interdisciplinary approach in the process of creating VRs, their methodological fundamentals, quality of the references and recourses base were discussed. Special attention was paid to the criteria of scientific basis for VRs, issues of historical analysis, interaction and cooperation of historians, archaeologists, IT specialists, architects and restorers during the VR development. It was noted that in the modern scientific context the VR can be not only a visual aid for research, but can also be a new method of the historical study, verification of hypotheses.

Participants of the round-table discussion discussed the plans for developing a textbook on the methods of 3D reconstruction of the objects of historical and cultural heritage, as well as holding seminars and conferences on this topic in 2012.

Taking into consideration the increasing significance of the projects in the field of research virtual reconstructions, the participants of the Workshop decided to apply to the UNESCO Bureau in Moscow and the Committee of the Russian Federation for UNESCO with a proposal to develop a portal of virtual reconstructions of the objects of cultural and historical heritage of the Russian Federation.

Всероссийский научно-методический семинар «Виртуальная реконструкция историко-культурного наследия в форматах научного исследования и образовательного процесса»

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В статье дается обзор докладов, представленных на Всероссийском научно-методическом семинаре, проведенном 22-23 апреля 2011 года в Красноярске Ассоциацией «История и компьютер» и Гуманитарным институтом Сибирского федерального университета. На семинаре был обобщен и проанализирован опыт сохранения объектов историко-культурного наследия средствами компьютерных технологий, в частности опыт построения виртуальных исторических реконструкций. Обсуждались перспективы использования виртуальных реконструкций в научно-исследовательской деятельности: вопросы, связанные с качеством источниковой базы, критериями научного обоснования, необходимостью междисциплинарного исследования в процессе создания виртуальных реконструкций. Особенное внимание уделялось применению технологий компьютерной реконструкции в образовательном процессе, а также возможностям использования виртуальных реконструкций в научно-просветительской деятельности музеев, образовательных центров и иных учреждений культуры и образования.

Ключевые слова: виртуальная реконструкция, историко-культурное наследие, 3D-моделирование, репрезентация, визуализация, междисциплинарный подход.

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