THE USE OF VIRTUAL RECONSTRUCTION TECHNOLOGY TO PREPARE INTELLIGENT DESIGNERS IN KAZAN FEDERAL UNIVERSITY

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ABSTRACT
The society has focused on reconstruction of the lost historic and cultural heritage, and the state keeps giving of its best hereto, as for a long time of wasteful attitude towards historical sites a vast amount of remains of tumbledown buildings has emerged and most of them, unfortunately, could be only restored virtually. By efforts of creative teacher-and-student laboratory association Asyltash established on the basis of the Design and National Arts Department of Leo Tolstoy Philology and Intercultural Communication School of Kazan Federal University, 3D tours around the lost or dangerous cultural heritage sites of Trans-Kazan have been developed. The article describes the results of virtual reconstruction of Tatarstan cultural heritage sites situated in Arsk, Atnia, Vysokaya Gora and Kukmor regions; and 3D visualization of lost site virtual expositions which give an idea of these sites. Available multimedia expositions make it possible to save cultural heritage sites in virtual space for the further generations and guarantee their recreation in the future. Projects of the Asyltash laboratory are designed for any audience – even those people who cannot afford to travel in reality can move to any place in Tatarstan using the virtual reality technology. In addition, the methods developed can be also used to analyze particularities of the historic infrastructure development and to restore the lost sites of the cultural heritage.

Keywords: 3D-technologies, virtual historical reconstruction, cultural heritage sites, renovation, visualization methods.

1. INTRODUCTION
The site-preservation attitude towards an historic value of the past is a source of existence in the present day [Jokilehto J.A., 2002]. Guidelines of the 21st century bind the human to form humane attitudes towards historic values. Compared to the previous century which had the message “to raze and then…”, trends of this century sound much more in a humane way. Today’s society focuses on restoration of the lost historic and cultural heritage while it is still actual to restore some sites physically, however most of them unfortunately can be only restored in a virtual way.

The education of the youth to treat the national historic and cultural traditions with respect becomes a top-priority task of today’s Russian education [Karkina, S.V. + et al., 2014]. Hence, research teams from Saint-Petersburg, Moscow, Tambov, Yekaterinburg and Krasnoyarsk have started a serious work in the sphere...
of virtual historic reconstruction. In Kazan, the Design and National Arts Department of Leo Tolstoy Philology and Intercultural Communication School of Kazan Federal University has focused on development of 3D tours around the lost or dangerous cultural heritage sites of Trans-Kazan in the course of activities of creative teacher-and-student laboratory association Asyltash under the supervision of R.F. Salakhov and K.I. Musina.

Arsk, Atnia, Vysokaya Gora and Kukmor regions of the Tatarstan Republic are situated in Trans-Kazan. In compliance with the “Strategy of Tatarstan cultural heritage preservation” [http://oprt.tatarstan.ru/rus/file/pub/pub_101338.doc], this subzone includes historical places and complexes related to outstanding people of science, culture and art; the lands of Tatar ethnic development are also included in here.

If Kazan is figuratively called a “window to the East” [Geraci, Robert P., 2001], then Trans-Kazan is rightfully considered as the cradle of the language, religion, and culture of Tatar people. This land gave many outstanding people to the world: poets G.Tukai, S.Khakim, educator Sh.Mardjani, composers S.Gabashi, S.Saidashev, architects I.Gainutdinov, A.Bikchentayev and others. The beauty of Trans-Kazan, where the epic nature and works of craftsmen are the embodiment of harmony and the world, undoubtedly has a countrywide and universal human importance.

2. METHODS

A first event of the Asyltash laboratory was development of route “Around the sites of Trans-Kazan” (Figure 1). Expedition trips were run to the settlements which were known since the 16th century – Bolshiye Menghery and Atnia in Atnia Region, Maskara in Kukmor Region of the Republic of Tatarstan.

![Figure 1. Virtual Tour “Asyltash”. Map.](image-url)
Defense of the following graduate qualifying papers was the result of those expeditions: “Design project of the museum and recreational complex in Bolshiye Menghery of Atnia Region of the Republic of Tatarstan” (Figure 2); “Design project of the Bakirov House in Bolshiye Menghery of Atnia Region of the Republic of Tatarstan” (Figures 3, 4); “Conceptual design project of house renovation as in the case of the Mullin House in Staro-Tatarskaya Sloboda (Old Tatar Quarter) of Kazan” (Figure 5); “The Okonishnikov country seat in the Krutushka settlement of Kazan as a subject of local lore hike “A Nest of Gentlefolk” (Figure 6); “Design project of the Gortalov’s House in Kazan where Leo Tolstoy lived” (Figure 7).
Figure 2. Museum and Recreational Complex in the village of Bolshiye Mengery, Atnya Region, Republic of Tatarstan. Project by E.Ilyasova

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<tr>
<th>Дом к. Бакирова</th>
<th>Merchant Bakirov’s House</th>
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<tr>
<td>Оборудование</td>
<td>Equipment</td>
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<td>Встраиваемые светильники</td>
<td>Built-in lamps</td>
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<td>Ландшафтная подсветка</td>
<td>Landscape lighting</td>
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<td>Фасадные светильники</td>
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<td>Торшеры H=2,5 м</td>
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<td>Торшеры H=1,3 м</td>
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<td>Мебель</td>
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<td>Скамейки садовые</td>
<td>Garden seats</td>
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<td>Скамейки с тентом</td>
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<td>Урны</td>
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<td>Торговая палатка</td>
<td>Vendor kiosk</td>
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<td>Торговый прилавок</td>
<td>Market stall</td>
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Figure 3. M.Bakirov’s House in the village of Bolshiye Mengery, Atnya Region, Republic of Tatarstan. Project by E.Ilyasova

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<th>Дом М. Бакирова</th>
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<td>Проект визуализации ВКР ст.гр. 16-0701 Ильясовой Э. 2012 г.</td>
<td>Visualization Project. Graduate Qualification Work performed by student of group 16-0701 E.Ilyasova, 2012</td>
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Figure 4. Merchant Bakirov’s House in the village of Bolshiye Mengery, Atnya Region, Republic of Tatarstan. Interiors. Project by D.Bayanova

| Дом к. Бакирова | Merchant Bakirov’s House |
| Проект визуализации | Visualization Project |

Figure 5. B.Mullin’s House. Project by R.Garifullin
Figure 6. M.Okoneshnikov’s House. Project by N.Stamikova

Figure 7. The Gortalovs’ House where Leo Tolstoy lived. Project by Ye.Zilanova.
The obtained experience has enriched the innovation of the National Program “Cultural heritage preservation in regions of Tatarstan and acculturation of public consciousness regarding historic treasures” developed by the chief of the Public Assembly “Heritage” under the Academy of Sciences of the Republic of Tatarstan Mr. V.A. Demidov. The developed visualization projects of the lost sites which are part of the concept idea of the social and environmental museum “Alliance of Heritage Memorial Sites” have made the idea more actual as those sites are in the stage of turning into museums and are parts of local lore routes the “Alat Way”, “A Nest of Gentlefolk”, “Stone Mill Village” included in out-of-school programs of the ministry of Education and Sciences of the Republic of Tatarstan.

3. RESULTS

We would like to consider in detail some accomplished projects.

1. The village of Bolshiye Mengery was founded during the Kazan Khanate. Its people were public peasants and practiced farming, livestock breeding, bee-keeping, wool hardening, smithing and carpentry. 3 mosques, 2 maktabs, 7 inns, 2 windmills and 3 watermills, 3 blacksmith’s shops and 4 junk shops were in operation in the village [Gainutdinov IG, 1983]. A rundown, almost ruined three-storey wooden building of the first third of the 19th century still remains in the centre of the village. This is a former manor of merchant V.Bakirov where a village school had been located till 1970 [The Study, Restoration and Use of Historic and Cultural Monuments in the Republic of Tatarstan, 2013]. Now the building stands empty.

When superimposing plans of the central historic part of the village of 1880, a plan of 1970 [Gainutdinov IG, 1975] and an up-to-date electronic map of the Republic of Tatarstan, the historic street layout, mosques, cross-like Tatar buildings have been found out to be lost. Superimposition of cadastral land-use survey of 1212 has shown that the manor’s land is in private use.

Experts of the Asyltash laboratory have developed a conceptual design project to restore the museum and recreational complex of Bakirov’s manor. The manor is situated in the northeast part of the village on the hill bounded by the streams running to the Semit River. The aim of the project is to create space of the museum and recreational environment with the main house of the manor as a center of the composition. Visitors of the museum are supposed both to learn about the building as a separate site of the exposition and see the whole land of the manor with natural landscapes of the old village.

2. Maskara is a family village of the merchants Utyamyshevs. Merchant of the 1st guild Gabdulla bin Abdussalam ibn al-Utyamysh Muscari owned a soap factory in Novo-Tatarskaya Sloboda (New Tatar Quarter) and was a big wholesale dealer. In 1802 he funded construction of the Iske-Tash (“The Old Stone”) Mosque in Kazan. The legend tells that it was erected on the location of the mass grave of Muslim warriors defending Kazan in 1552. In the Maskara village of Kukmor region of the Republic of Tatarstan where the Utyamyshevs’ family house was built, the First Cathedral Mosque which is a third one in age (1791) among the mosques remained in Tatarstan is located.

At the request of the Utyamyshevs’ successor, Mr. Ildar Rustamovich Utyamyshev, Doctor of Engineering, member of the Russian Academy of natural Sciences, leader of the Tatar Nobility Assembly in Moscow and with support of the imam of the mosque in the Maskara Village, members of the Asyltash laboratory developed projects of the First Cathedral Mosque, and the Utyamyshevs’ house and the whole manor.
3. At proper time, a house of Burganudtin Fahrutdinovich Mullin was at the address: 11 and 13, Kayum Nasyri Street, Quarter No. 11714, Kazan, but in 2010 it was knocked down. The task of the Asyltash Creative Laboratory was to develop visualization of Mullin’s manor with the surrounding buildings of the quarter. It is known that to restore appearance of a building one has to study the history and trace back stages of construction of the building and its surroundings. To search for iconographic materials, members of the project studied the originals in the National Archives of the Republic of Tatarstan and holdings of the National Museum of the Republic of Tatarstan. To restore appearance of the manor, they used a restoration project of 1983 made in the Tatar Special Research and Restoration Shop “Rosrestavratsia”.

The manor was owned by member of Kazan City Council B.Mullin who besides was a big wholesale dealer, public man, and merchant of the 2nd guild. B.Mullin was a member of the administrative board of the city, knew Russian well and took an active part in any public events and charitable contributions of the Tatar merchants. All Mullin’s ideas and works were worthwhile for the goods of the Tatar people. Thus, his name must not disappear in history completely. However one of the memory guardian – his house – was lost in fire. In 2013, due to the community efforts, the manor was restored.

Mullin’s house, a two-storey building with a stone ground floor, is a street-view encased log building on a brick ground floor on Kayum Nasyri Street. It is a rectangular-plan one and has a gable roof. Square windows with narrow window casings, key stones and flat segmental tops are closed with wooden shutters. The upper floor is coated with horizontal rows of boards. Corbels, formed as a result of covering log protrusions, flank the principle front.

Mullin’s manor may be said to be an example of using elements of the classicism in a folk city architecture. Decoration of the house is emphasized in the upper gable part the center of which is occupied by a window with a pointed cover on coupled columns. A solar element “glow” is above the window. Cornices are supported with modillions. Multicolored painting of the building recreated by explorations of 1983 resembles a versicolored mosaic ornamentation of Central Asian mosques. “The national character of the Tatars seems to have been reflected so completely in no sphere of art as in ornamentation. Pure self-colors amaze by dare combinations which the Russians call the “Tatar style” [Khudyakov, 1996]. The material, form and expressive elements of decoration which are masterfully joined together in a single artistic whole create a harmonious artistic style of the dwelling [Akhmetova + et al., 2015].

4. An equally diligent work was at the next project – M.Okoneshnikov’s manor in the Krurushka village of Aviastroitelniy district of Kazan.

M.Okoneshnikov’s father, Mr. I.Okoneshnikov, was a merchant of the 1st guild of Kazan Government, owner of the first and biggest steam-mill in Kazan. He came from Sviyazhsk but moved to Kazan at a proper time. Together with his friend Ya.Shamov, they were engaged in granular-flour manufacture and were the main experts in flour-grinding business. In Kazan, M. Okoneshnikov built a mansion, enclosed with wrought iron fence and gates with monograms “OM” at 14, Mushtari Street [Kazan in Historic and Cultural Monuments, 1982]; now the Union of Writers of the Republic of Tatarstan sits here.

In 1914, a summer place of the merchant was built on the right bank of the Kazanka River, opposite the KulseitoVo Village. It was an art nouveau building, with towers to watch Kazan lights. Roads and 2 bridges through the Kazanka River were laid to the mansion. By the mills, 20 houses for workers, a diesel power plant, warehouses, cornlofts, a stable were built. On the left bank, a paved road was laid, a fir-tree avenue and apple garden were set out.
During the Great Patriotic War an evacuation hospital was within the mansion place; later, till 1968, there had been a Recreation House; nowadays there is a health resort “Krutushka”.

However M.Okoneshnikov’s mansion itself was lost. On the basis of photos from private archives of local lore experts, members of the Asyltash laboratory could get an idea of the mansion appearance and interior structure; then a visualization project of the original building appearance was developed.

4. CONCLUSIONS

Since 20s of the 20th century, problems of spatial coordination development, spatial views and imagination were studied in the artistic education [Petrov, 2015]. In the up-to-date situation, these tasks are solved using methods of 3-D visualization. Besides, the use of additive techniques and 3-D visualization methods attracts target groups of any age and any level of education to problems of history and culture by creating a complex interactive cognitive environment both in Internet and museum halls [Buyanov, 2014]. Nowadays, the environment availability for the public is one of the priorities of the national policy in Russia [Nigmatov, Nasibulov, 2015]. Only a small part of museum collections is usually available for the public. 3-D technologies “open” museum store-rooms for everyone while easily creating absolutely new, original virtual expositions with no restrictions of the reality (size of rooms, special conditions for keeping the exhibits). Projects of the Asyltash laboratory are designed at any-age audience – people who owing to age, health, financial difficulties or long distance are unable to travel in reality can “move” to any place of Tatarstan using the technology of virtual reality. Available 3-D models of old monuments make it easy to recreate a virtual ensemble and any visitor can be placed in there. This virtual exhibit can be interactive with navigation in the virtual space to show a model of the lost architectural site from any side. Historic and architectural facts and details would be available for everyone by clicking a mouse. The users can see an architectural ensemble in its previous form and know how the museum exhibit looks today. Methods of “virtual walks” in the time sample of a village or settlement, visits to the lost buildings including their interior make it possible for the user to see the past and feel a historic connection to the former generations.

The virtual reconstruction of emergency or lost sites requiring renovation in their original appearance can partly solve the problem of impossible restoration of historic sites in traditional ways. By creating realistic 3-D copies of unique cultural sites including ruining ones the latter can be saved intact in the virtual space for the following generations and this is a guarantee of their possible recreation in the future.

5. SUMMARY

The task of the creative teacher-and-student laboratory association Asyltash is to design external envelops of historic buildings, to reconstruct old villages, architectural ensembles of housing manors, mosques, landscapes, as well as to work out proposals regarding rehabilitation of the remained buildings and bringing new functions and meanings to them.

A practical importance of Asyltash is that results of this study can be used in the research and teaching activity to develop general and special courses in history of Tatarstan, study of national features of housing architecture and design, history of the Tatar art and culture, to create local-lore textbooks. The methods created and tested can be used within researches regarding development of virtual historic reconstructions of rural facilities and town buildings to analyze the infrastructure evolution and to restore the lost or emergency cultural monuments.

6. ACKNOWLEDGEMENTS
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