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slovakia - ukraine project

InovEduc

Innovative Methods in Education and Research 2017

norway grants

ÚRAD VLÁDY SLOVENSKEJ REPUBLIKY

„Slovakia – Ukraine: Cooperation across the Border“

„Cooperation with common values“

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Innovative Methods in Education and Research 2017

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ÚRAD VLÁDY SLOVENSKEJ REPUBLIKY

„Slovakia – Ukraine: Cooperation across the Border“

„EEA and Norway grants – Cooperation with common values“

Wolters Kluwer

Wolters Kluwer, a.s.

Prague 2017

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Preface

The present book of research papers “Innovative Methods in Education and Research 2017” contains papers which are summarizing the outcomes of the project “Innovative methods of education to support partnerships”.

The aim of the project between the Slovak, Ukraine and Norway was to create unique set of tools and methods in education, through which were used the 3D models, panoramas and multimedia of cultural heritage and natural features of eastern Slovakia and Carpathian Ukraine in schools. Modern and innovative methods of teaching students and teachers at schools and universities through virtual and augmented reality, 3D web viewing data and methodological materials for teachers, all cross-border cooperation with the latest trends in ICT will be presented. This cooperation promotes the important objects in the field of tourism and mediates further cooperation in education and research between Slovakia and Norway. This current situation shows that it is necessary to build a suitable visualisation of information so that people are able to take and use it.

Cross-border cooperation of Slovakia with Ukraine was included to the chapters of priorities with contribution from financial mechanisms supported by the Kingdom of Norway. The conference was organized within the framework of the project "Innovative methods of education to promote partnerships - InovEduc" within the Cross-border cooperation. This project was co-funded by grants from Norway and the state budget of the Slovak Republic. The information is available on the website www.InovEduc.eu .

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RESEARCH PAPERS

Innovative methods in education and the Schengen border (or any other)

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Abstract

Based on our long-term co-operation with partners in the Zakarpathia region and experience that we gained together, the Centre for European Politics together with Pan-European University prepared a project that was built upon four themes. We believe that the themes reflect the essential characteristics of the eastern Slovakia and Zakarpathia border region, and most importantly, they are common to both: history, spiritual culture, traditions and folk culture, and civil society.

The region's common features follow from centuries of shared development without a dividing border line. Pairs of 3D objects were selected to exemplify the four themes and bring evidence that eastern Slovakia and western Zakarpathia developed under identical circumstances. The border was established eighty years ago. Then life and relationships within this region changed profoundly. Mutual contact was significantly limited. As a consequence, people started to view one another differently.

To fulfil the project's goal, i.e. to lower barriers limiting the cross-border co-operation, it is necessary to change both educational content and the atmosphere in schools. The role of the family in this process is also indispensable.

Keywords: *border, barriers, openness, common features of the regions, civic education, democracy*

1. Introduction

CEP has worked in Zakarpathia since 2009. Our first project called "school without borders" was realized in co-operation with ZIPPO (Zacarpathian Institute of Postdiploma Pedagogical Education) Užhorod. The project, supported by Norwegian funds, was devoted to cross-border co-operation between Slovakia and Ukraine. The project provided experiences that were used in the preparation of the InovEduc project. We also reflected the situation on both sides: teachers from both sides meet only very rarely, students come together only occasionally, co-operation between towns and villages should be better, and the EU funds that support of cross-border mobility are not used adequately.

2. Co-operation is limited due to various dividing lines

As regards mobility, we realized that there were no organizational and technical difficulties preventing people from crossing the border to Ukraine. The only thing they have to do is to brace themselves with patience. To overcome mental walls was much harder. We also realized that our Ukrainian colleagues

had to overcome immense complications when they decided to cross the Slovak border. The obstacles were generated both by Ukraine and the EU, and they were both physical and bureaucratic.

There is yet another common barrier: people from either side have minimum knowledge about one another. We do not know each other. We only have mediated information, often limited so as to feed our biases, or related only to what it makes sense to buy in the neighbouring country, and at what price.

Therefore, we focused the project on themes that would demonstrate that this region is inhabited by people who are close to one another culturally [1] and also to a large degree mentally. However, many people from this region do not know about it. Our experiences from working in this region for ten years confirm the findings of cultural anthropologists that people primarily look for differences and unique features that would make them distinct from one another. It is as if, to feel secure, they did not want to break down their mental walls, and they showed no interest in talking to one another which would help them to gradually learn more about one another [2, 3].

But whoever embarks on a journey of learning and openness will immediately be surprised how false, simplifying and discouraging the myths, prejudices and information are. They will realize how they turn the other into someone who is not worthy of our attention and time. They will find out that people just like us live behind the border. Ingenuous people who are interested in things, who have their needs, who suffer from hardships, and also have their prejudices and complexities. They will have a chance to realize and experience how similar we are.

3. What does the region unite? / The region's shared features

As we worked on the project, we tried to identify as many common features as possible that are not limited by any border or that are limited by borders that can be easily crossed. We also tried to "evade" the border as much as we could. We know that it is not physically possible, but many walls can be overcome by knowing one another and learning from one another [4]. As is written above, such walls mainly exist in our minds.

Education is an effective way to open minds and destroy barriers. We studied, discussed and learned in our seminars about the region's common history, spiritual culture and religion, traditional culture, traditions and habits, and also how they are reflected in the life of civil society. An interesting way to make these themes attractive for schools is to use information technology in education. Our last seminar was devoted to this very idea.

The seminars and related activities were designed to make it possible to teach about selected topics on various courses during school hours and during after-school activities, and also within tourism-related activities, to be able to address as wide a community as possible, as explained by Martin Kríž [5].

The selected 3D models represent the diversity of the region's natural, cultural and technical heritage. They are concurrently intended for use along with methodical work sheets to support educational processes. Each 3D object has its counterpart on the other side of the border. The counterpart has a similar or identical function and purpose. Both point to common features that have remained evident despite tens of years of the border's existence.

I include a short description of the monuments that were transformed into virtual 3D objects, which will help us to learn more about them in an unlimited way.

Apart from fascinating nature, wooden churches are one of the symbols of the Carpathian forests of eastern Slovakia, also called the Poloniny. We included several of them: Greek Catholic churches in Hrabová Roztoka, Inovce, Šmigovec, and Topol, Slovakia, and in Danylovo, Ukraine, and Orthodox

churches in Ruský Potok, Slovakia, and Kostryna, Ukraine. The church in Šmigovec can be explored in detail thanks to virtual reality [6].

Late Romanesque churches and early Gothic churches are generally less known monuments of the region. Therefore, we included in the 3D models the church in Veľká Tŕňa and the rotunda in Horjany at Užhorod. Thanks to the creativity of computer experts, we can see a virtual reconstruction of what the church in Veľká Tŕňa could have looked like in the Romanesque period through the Gothic period up to today. We can also enjoy its precious architectural details.

The region's Jewish heritage - the Bardejov synagogue and cemeteries in Topoľa and Užhorod are almost forgotten.

The territory studied was a border region of the Hungarian Empire. So we included the Zborov and Nevice strongholds, which protected roads near its northern border. A virtual reconstruction of Zborov's and Nevice's architecture allows us to appreciate their approximate form at the end of the medieval ages. We similarly prepared representations of the Humenne castle and the Užhorod castle, which were linked by the Drugeth family and served as administrative centres of the respective regions.

In addition, we included among the 3D models idealized dwellings of common people. They bear witness to the historical period and people's lives: the house mill in Vyšná Jablkonka, a museum today that is part of the Vihorlat museum in the town of Humenné, and the Lemkov settlement close to the village of Zaryčevo.

We also covered objects of daily use. One common thread was metal: the viaduct (elevated road) in Hanušovce nad Topľou and the blacksmith shop in Lysyčevo were used by people on a daily basis. Each object tells its own story.

The other common thread is the vine and grape processing. Using 3D models, we can visit the Tokaj wine cellar in Veľká Tŕňa and wine cellars in Seredné. We can also admire natural heritage, which is protected in spite of some difficulties: animal species (European bison in primeval Carpathian forests) and plant species (The Daffodil Valley at Chust).

Our 3D models can be used for a variety of courses, not only for history, languages and civic education lessons. They can also be used on maths, physics, IT, and chemistry courses, as well as outside the educational scope in tourism, hiking, and in general for people who want to learn more about this region. The 3D models were described in detail by Ľubica Voľanská [7].

4. Project goals and results

When evaluating a project, it is necessary to weigh the project's results against the proposed goals. When we proposed the InovEduc project in January 2014, we set the following specific goals:

4.1 The project's participants and organisers will collect and process information about common features of the neighbouring region

This goal was fulfilled through the preparation and realization of seminars focused on theoretical and practical information about:

- The historical development of the studied region,
- Aspects of Christianity and related symbols, churches and church holidays,
- Traditions, habits, and the region's ethnic composition,
- Aspects of civil society and its current activities in the region,
- Opportunities for the use of information technologies in educational processes.

During field trips to towns where the 3D model represented objects are located we visited the mill from Vyšná Jablonka in the Vihorlat museum and the castle in Humenné, the wooden church and Jewish cemetary in Topoľa, the little church in Ruský Potok, the wooden church in Kostryna, the Romansque-Gothic church and wine cellars in Veľká Tŕňa, the cellars in Seredné, the Užhorod stronghold, and the breath-taking rotunda in Horjany near Užhorod.

In the partnership with the teachers we created activities that are partly documented in the methodical work sheets. The sheets were also created as a material to help teachers to conduct education in support of active citizenship and to boost students' interest in what is going on around them and focus their attention onto potential changes and development in their environment.

4.2 As follow-up to our work on the seminars, we will prepare innovative methods that will be used for school education

Many believe that the introduction of the 3D models to school education is innovative. But working with 3D models is quite common in natural and technical studies. So ways that are innovative in education depend on how the teacher approaches work with students. Within the current education standard, the emphasis should not be put on the quantity of information but instead on thinking, creating one's own opinion, and forming one's own views and attitudes. A combination of two approaches – original thinking and well-augmented opinion on one side, and IT-based processing of specific objects on the other side – possesses great potential that can confer on student's skills that are quite rare in our everyday school reality. To realize necessary changes, teachers must be prepared and willing to work with the suggested methods. The proposed teaching methods also have the potential to strengthen the democratic and civic attitudes of teachers and students, which are currently the subject of intensive public discourse.

4.3 Twenty teachers will receive instruction at five seminars, and they will disseminate the project's specific results after its completion

This goal was easily reached thanks to the natural migration of people. As more people took part in the project, its ideas will be spread more widely. At the same time, the goal was not fully met because not all participants attended each seminar.

4.4 The realization of individual seminars will result in the writing of working and methodical material for teachers. It will focus on using modern approaches to presenting information with the aim to teach about a range of relationships in the region. The material will be used by teachers in Slovakia and Ukraine

The goal was fulfilled. Prepared activities were tested at seminars in Užhorod and Prešov and some regional schools in spring 2017. The methodical work sheets are available in Slovak, Ukrainian and English. They are inter-subject oriented, and as a result, teachers can use complex information that is linked to other subjects.

4.5 The project has the potential to live on via a living network of contacts between Slovak and Ukrainian teachers and schools

This goal is mainly in the hands of our teacher participants. It has so far appeared to be sustainable as several participants started to co-operate in various ways. CEP will address teachers both in Slovakia and Zakarpathia, and it will continue to disseminate the InovEduc project results while working on other projects.

5. Conclusion

To have the general public adopt the idea of historical, religious, cultural and civil closeness between eastern Slovakia and western Zakarpathia, the idea needs to be developed at school and in families. Our countries need citizens that will show interest in the idea and will be willing to learn about it and develop it further. The countries need local patriots and regional patriots. With such people it will be possible to develop evenly individual regions in Slovakia and Ukraine.

I believe that the project results will be inspirational for further activities at schools and with the public. Not only in the west of the East or the east of the West, but even further eastwards and westwards. Now we can only hope that one day, when the mental walls preventing cross-border co-operation have been torn down, the demolition of the physical walls will follow suit.

References:

[1] Ľ. Voľanská, "The Common History of the Regions", Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 11-15.

[2] G. Kiliánová, "Identita a pamäť. Devín/Theben/Dévényakopamätnémiesto", Ústav etnológie SAV, Bratislava, (2005).

[3] H. Tužinská, "Questions of Description and Translation", Stimul, Bratislava, (2011).

[4] H. Tužinská – Ľ. Voľanská, "Interkultúrna komunikácia na Slovensku: ako sa rámcuje inakosť?" S. Gyarfáš Lutherová – M. Hlinčíková (eds.). Za hranicami vedy? Aplikovaná antropológia v spoločnosti. Veda, Ústav etnológie SAV, Bratislava, (2016), pp. 106 – 130.

[5] M. Kríž, "Innovative school education as the way to lower barriers between eastern Slovakia and Zakarpathia", Innovative methods in education and research 2017, Prague, Wolters Kluwer, (2017), pp. 18-22

[6] J. Lacko, "Storytelling in Virtual and augmented reality", Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 16-21.

[7] Ľ. Voľanská, "Stories related to the 3D objects in the InovEduc project", Innovative methods in education and research 2017, Prague, Wolters Kluwer, (2017), pp. 11-17

Stories related to the 3D objects in the InovEduc project

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Abstract

One of the goals of the project was to try to define the historical borderland region (eastern Slovakia and Zakarpatia) with a common historical experience that can be discerned in the longue durée. The objects selected for the 3D digitization shall demonstrate in what manner the common features of the region's history are more significant than the differences. To do this, it was necessary to elaborate on the concepts or ideological context related to the objects.
In this paper I describe the stories related to the pairs of selected objects (one from eastern Slovakia and one from Ukraine). The aim is to show the potential for the future development of the region hidden in the historical monuments, natural sites and the local traditions.
Regarding the example of a peasant's dwelling I describe the use of space as a phenomenon reflecting the everyday life and work of local communities as well as the hierarchy of particular groups of dwellers. The analysis of the space utilisation by a certain group of people can be used also by exploring other buildings/sites in our sample of 3D objects (churches, manors, cemeteries, etc.).

Keywords: *Eastern Slovakia, Zakarpatia Region, borderland, historical monuments, 3D object*

1. Cultures and borderlines

It is often discussed whether the border line dividing Central-Eastern Europe is identical to the one that separates the *East* from the *West*. However, the discourse goes on even without having a clear view of how the two parts should be understood. To make matters even more complex, further dividing borderlines are drawn by various cultural phenomena [1].

Slovakia and western Ukraine are lands that belong to two geographical zones whose climatic and natural conditions have influenced the traditional folk culture and daily life of people in the Slovak-Ukranian borderlands. The lowland in the south, which belongs to the oldest cultural European regions, is linked with the Panonian-Potin zone. Its climate is mild and land fertile. The region's northern part, belonging to the Carpathian geographical zone, is moutainous and submountainous. Hence the region's natural division into lowlands and highlands determined people's everyday life in the past in a similar way as other division lines [2].

In Zakarpathia, the division into north and south even determined the regions' names. Peter Šoltés refers to Highlands (Verchovina) in the north and Lowlands (Dolina) in the south, and in eastern Slovakia, the colloquial expressions *na Rusnaky* and *na Maďare* are still in use to refer to the northern and southern areas, respectively [3]. The borderlands are therefore a very diverse region culturally. This predominantly stems from specific aspects of immigration, with people adjusting to the natural environment and exploiting local natural resources. In the north, agriculture faced more severe conditions. As a consequence, certain features of traditional culture were preserved and transferred from past centuries to the mid 20th century. Use of less technically sophisticated tools was common there, and it determined how people worked and organized their work. The region can now benefit from the preserved archaic cultural forms that are as attractive and charming as its countryside, with nature often untouched by humans. One-hundred years ago Czech explorers and ethnographers were amazed at the region's wild natural beauty. For example, the ethnographer Amálie Kožmínová wrote: "As far as my eyes could see, there were high mountains with forests all around villages. They were calm and dark with beautiful sunsets and sunrises, and with a sky above eternally coloured wonderously as if by a painter." [4] As the local natural environment is so rich for presentation, our first example of a digitized object is naturally linked with it.

2. Selected 3D objects and their stories

2.1 The region's natural environment: Carpathian primaval beech forests – European bison and the Valley of Narcissi (Valley of Daffodils) at Chust

Carpathian primaval beech forests are a natural heritage reserve in Slovakia. They link the whole region, being part of the world's natural heritage that surpases state borders [5]. Several reasons led us to choose European bison to represent this forest reserve. According to European tradition, the bison was seen as a strong and courageous animal capable of resisting any challenge. The bison was a source of food and a symbol of bravery, courage, fertility and power, majesty and dignity. Several villages, including Zuberec, Zubrohlava, Zubrá, bear evidence that a large population of European bison lived in the Carpathian area. However, only 56 bisons lived in Europe in 1923. The International Union for the Protection of Europen bison was established in the same year. The Union's efforts and activities have been a success: the present popuation of European bison in Europe counts about 3,400 animals. The bison were also reintroduced to the Poloniny region in 2004 thanks to an international project. Some scientists consider the preservation and reintroduction of free-ranging European bison populations as the most successful European activity focused on the protection of critically endangered species.

The counterpart of the beech forest in Ukraine is the Valley of Narcissi near Chust. It is a unique botanical site with the largest population of the protected daffodil (Narcissus angustifolius) in Central Europe. The site was integrated in 1992 into the Carpathian Biosphere Reserve, which is part of a network of internationally important biosphere reserves under the umbrella of UNESCO [6]. One of the project's goals is to point to heritage sites that represent the region and have potential for diverse uses in education and tourism. The Valley of Narcissi is unfortunately also endangered mainly due to climate change and changes in the soil composition caused by human activities. Additionally, the flowers are picked by people, which gradually reduces the area upon which they grow every year. Hence the project is also aimed at contributing to the awareness of various types of endangerment.

2.2 Wine cellars in Veľká Tŕňa and Seredné

Growing vines in this region is also linked with the natural environment. Wine cellars in Veľká Tŕňa and Seredné are the oldest and largest producers of wine in Zakarpathia. The building of the cellars began in 1557, which is evidenced by the inscription at the entrance. Their establishment is associated with the family of Doboó, whose member Štefan was a well-known fighter in wars against the Ottoman Empire. Coincidentally, Ottoman soldiers are connected with both wine cellars: some captured Turks were transported to Seredné where they helped to reconstruct the castle and build wine cellars. And inhabitants of Veľká Tŕňa, situated in the Tokaj region in the south-east of Slovakia, dug out holes from the ash rock to create shelters against the Turks. Later on, the started to use them as wine cellars. According to a folk tale, the production of the unique aromatic sweet Tokaj wine is associated with the local pastor, teacher, historian, and poet Máté Laczkó Szepsi, who ordered wine grapes to be picked later than usual out of fear of the Ottoman armies. The delay caused some grapes to acquire noble rot and they were collected and pressed separately, and only then added to the must. The resulting wine was sold during the Easter holidays and quickly became very popular.

Comparing both objects allows us to realize how the contemporary production of wine is influenced by different historic and societal conditions. Diverse historical conditions diversified wine cellars and wine producers in Slovakia: they range from individual wine producers to large wine producing companies. However, on the other side of the border, the legal landscape and conditions are more complicated for small wine producers. Thus even wine cellars as historical heritage can make us think and compare how our modern society is arranged.

2.3 Design of living space as an expression of the (family) structure of its inhabitants - the Vyšná Jablonka mill and the Zaryčevo house

Farming populations lived in houses whose designs were influenced by the natural environment. The dwelling can tell us a lot about how this region‘s nature influenced people’s life and work in the past. The mill in Vyšná Jablonka has only two rooms – the grinding room and the living room. The region’s character is thus reflected in this simple design.

It holds that all good dwelling/living designs have already been realized. People built their houses usually on sunny sides facing the south. The houses were built at the perimeter of building plots so that the yard remained as large as possible. House floor plans were single unit type (one room), later double unit type (room and hall), and three unit type (room, hall and pantry), which developed between the 13th and 16th centuries. All rooms were oriented towards the yard. As more rooms were added later, the floor plan changed to an L shape, and the windows then faced both the street and – still – the yard. This design provided a great advantage because it transformed the yard into the house’s largest living room – space where most of the family’s life was played out throughout the year. The family was an economic unit as well: it worked to be self-sustained and self-supported.

The dwelling had to meet expectations that followed both from living and economic functions. They often overlapped: the work-related areas, such as the barn and pantry were often used for sleeping and, in turn, the living room was often used for work and as storage space for agricultural products, and even for keeping animals.

The multi-purpose living room, where the family spent their time together, exhibited several basic features. The family’s unity was symbolized by one fireplace and one table. The stove and fireplace were typically situated in the corner near the door. It provided for heating, cooking and bread baking,

but also for sleeping, fruit drying and splinter drying, as splinters were used for lighting. Kožmínová wrote: “In the winter time, people stick to the stove, as the floor made of stamped soil is freezing cold for children’s bare feet. The adults, dressed only in linen folk clothes regardless of the winter or summer seasons, also stay close to it. Women turn around it constantly, men sit by doing small jobs, and the elderly and children have a good time sitting right on top of it.” [4] The positioning of the stove and other equipment in the room was typical across large regions of northern and eastern Europe. The stove stood at the door and adjacent to it were beds arranged along the wall. The bed of the master and mistress usually stood at the facing wall. The other family members slept in the room at places that corresponded with their family status, age, and season of the year. The stove, bench, barn, shed, and pantry constituted the so-called female part of the room.

The table is the other symbol of family unity. Soňa Švecová calls it life “on one bread”, “at one bowl”, and “at one table” [7]. The table and benches were placed diagonally with respect to the stove between the window facing the yard and the window facing the street. The table manners reflected the hierarchy of status of individual family members. The rule was that adults ate separately from children. Children could sit at the table with adults only on annual holidays – especially on Christmas Eve. The sitting arrangement for the adults was a combination of status and practical reasons. The free part of the table was reserved for women because they took care of the food and children. The mistress women stood at the table and served others. Men sat on the benches at the walls, and their sitting arrangement corresponded with their status. The first place was reserved for the master, followed by sons that were followed by sons-in-law. The far end of the table was reserved for elderly men and teenagers. Their position was derived from the value of work they did for the family. Female positions at the table had a similar hierarchy. Daughters-in-law usually stood behind their husbands or they ate with children, or before or after them, but they usually did not eat at the table but rather sat on other benches near the stove and beds. Children and teenagers could sit at the table only after they finished their primary school education [1].

The corner behind the table was used for family representation, (the place on the bench in this corner was the most prestigious place in the room). It was the place where documents and bread were kept [1]. According to folk belief, guardians of the home resided in this corner; therefore, the table was considered a holy piece of furniture. Pictures of saints, icons, crosses, and candle stands with candles were hung above the table. We call this area a “devotional corner”. Photos of family members were included in the corner later. It was also decorated with paper flowers and other decorations. Just like at the stove, significant things happened around it: important rituals linked with annual holidays (Christmas, Easter, etc.) and rituals associated with cycles of human life.

The remaining corner of the room was reserved for jobs such as mending house tools, weaving baskets, etc. Kožmínová noted that each house master “is a jack of all trades, and can do anything that is useful for the house and farm, and he never walks without an axe in his hands.” [4] The half of the room that contained the table and the “shed” corner was the “male” part.

Apart from that the room was also partitioned into the fore and rear halves, the former being close to the street and further away from the door, and the latter being close to the door. The function of the front part of the room was representative and that of the back part was work-related. The bed of the master and mistress was placed in the front part. The most prestigious place was at the table. It was considered a privilege if the master invited a visitor to come inside and sit at the table rather than converse in the door area. Men and women were, of course, allowed to move freely across the room, and the symbolic meanings that were ascribed to specific areas of the room expressed the hierarchy that ruled between the family members.

2.4 Living space, cultural transfer, and aristocratic families that united the region

A similar analysis of room space can be made for castles and strongholds. It is not included in this study due to insufficient space. It would tell us a lot about everyday life and patriarchal cultural patterns. The strongholds (Zborov and Nevický hrad) and the castles (Humenné and Užhorod) that were selected for our sample are examples of cultural transfer and social mobility within predominantly aristocratic families in the past. Mobility was an integral part of the life of local aristocratic families, including the Rákoczis, the Bercsényis, the Tökölys, the Csákys, the Andrassys and the Drugeths.

Aristocratic families that had their seat far from the centre in the country's north-eastern areas constituted the core of opposition to the Habsburgs in the 17th century. In the period of aristocratic rebellion between 1604 and 1711, when the territory of the Hungarian Empire was reduced roughly to one third of the area it had had before the battle of Mohacs (1526), the part of the Empire that now constitutes eastern Slovakia and Zakarpathia enjoyed a significant increase in its economic, political and symbolic status. The towns of Košice, Prešov, Bardejov, Levoča, Mukačevo, and Užhorod saw important events that were significant in the context of the Hungarian Empire and the entire Habsburg monarchy. Important educational and cultural institutions gained significance, including the Jesuit University in Košice and colleges in Humenné and Užhorod, a reformed school in Sarospatak and an evangelical college in Prešov [8].

As an example of connection between aristocratic residencies in this region, we selected the family of the Drugeths that linked the Humenné castle and the Užhorod castle. The Drugeths chose their predicate after Humenné - Drugeth de Homonna. And the Užhorod castle was, apart from other things, important as the place where the Užhorod union was established in 1646 when the Orthodox episcopate and priests accepted the religious and legal authority of the Holy Seat. They joined the union on condition that the Orthodox liturgy would be preserved, and they would be directly subordinate to Rome in religious and legal matters, and legal equality and social emancipation were guaranteed according to the example of Latin clergy [9].

We focus on the importance of the Užhorod union because the eastern Slovakia and Zakarpathia region is unique also for a different aspect: diversity of denominations. This peripheral area of the Hungarian Kingdom saw the development of a very heterogeneous confessional environment during the 18th and 19th centuries. The religious plurality, which is unique in the European context, has survived up to now. The Roman Catholic Church, the Greek Catholic Church, the Orthodox Church, the Evangelical Church of Augsburg confession, the Calvinist Church (the Reformed tradition) and Jewish faith are all active in the region. Additionally, smaller protestant groups formed as a result of emigration and contacts with Western Europe and North America at the turn of the 19th and 20th centuries. They include Adventists, Jehovah's witnesses, Baptists, Nazarenes, and others [10].

2.5 Churches of various confessions and their specific aspects

Because of reasons above, church buildings of several confessions constitute a large part of our selection of 3D objects. As in the case of other buildings, the user can use virtual reality to visit the churches and see places that might otherwise be inaccessible because of a variety of reasons. One can also explore the spatial characteristics of the churches as an anthropological phenomenon [11]. The space in the front (nave of the church) is given a different meaning as compared with the space at the back (vestibule), or above (gallery reserved for aristocracy) and below (aisle reserved for subordinates), or in the centre or at the periphery. The floorplan of a church thus reflects the social hierarchy of people who visit it, the community concerned.

The oldest historically verified churches date back to between the 11th and 13th centuries. They belong to two generic types. One is the circular rotunda. The only original rotunda that has been preserved is located in Horjany near Užhorod. It dates back to the 12th century [12]. The rotunda is decorated by immensely valuable frescos, which amaze the visitor by their mastery and by the liveliness of depicted figures. The other more numerous type is the rectangular Romanesque church, which is exemplified in our selection by the 13th century Romanesque-Gothic church in Veľká Tŕňa. The most beautiful relic in this church is a preserved section of the original fresco decoration that is situated in the tympanum of the south-oriented portal. The half-figure of the Virgin Mary and child was covered by plaster during the Reformation. It was rediscovered during reconstruction works in 1936. At the same time, the facade also revealed decorative features that are typical for brick Romanesque churches: saw-like frieze, corner lesenes, relief stripes, and cornices with simple, double and even triple (northern side) dentils. The gallery in the western part of the nave is among the most beautiful Romanesque galleries in Slovakia.

Wooden Greek Catholic and Orthodox churches that are situated on both sides of the border belong to a variety of building types that stem from specific ethnographic regions. Their characteristic features were determined by the natural environment: the churches are not tall because of gust winds, and in many cases their floorplan is influenced by the humid climate and a lot of rain. The churches were built using a log house technique (open log house) with sturdy types of wood (oak, maple, ash, beech) and also soft-wood trees (spruce and fir). Only wooden shingles were used as the roof material [13].

The architecture of the little churches was determined by their location on the periphery of the poor region. It was less influenced by new artistic styles, which only slowly penetrated into the region. The churches preserved many archaic forms, which were elsewhere replaced by new architectural styles, more expensive materials and techniques. The examples of sacral architecture in our selection are unique for several reasons: building technique without the use of nails (the church of Virgin Mary in Kostryn), liturgical books and the stand for liturgical books (the church of Saint Michael Archangel in Ruský Potok and the church of Saint Michael Archangel in Inovce), icons whose form often deviated from accepted principles of icon painting, painting icons on canvas, or the chandelier motion control balance mechanism made of one piece of wood, situated in the loft (the church of Saint Basil the Great in Hrabová Roztoka), and finally the Deesis ikon (the church of Saint Michael in Topoľa).

We also considered it important to show little known Jewish monuments (the Bardejov synagogue and Jewish cemeteries in Topoľa and Užhorod). Jews were an important and integral part of the region's population in the past. We should not leave out part of the region's history because it was so painful.

4. Conclusion – appreciating slowness

One hundred years ago several ethnographers looked for "real charm, an oasis of subduing barbarism with gushing springs amidst loose sands of industrial civilization" in the region of eastern Slovakia and Zakarpathia [14]. This very perspective makes it attractive for visitors also today. It offers a bit of Europe's inhabitants' agricultural past – the heritage to which many people now increasingly return for its attractive intimacy and slowness and organic nature provided by the village way of life. People from "western" countries now love agro tourism, eat organic foods produced by local farmers, or they grow plants themselves, produce compost, and try to live in accord with nature, or at least listen to ethno music, and collect and wear things that are inspired by folk culture. The region of the Ukrainian-Slovak borderlands can provide a lot of inspiration in all these areas.

References

[1] S. Kovačevičová a kol., Etnografický atlas Slovenska, Veda, Ústav etnológie SAV, Bratislava, (1990).

[2] Ľ. Voľanská, "The Common History of the Regions", Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 11-15.

[3] P. Šoltés, "Zemplín – hraničný región na konfesionálnej mape Slovenska", Edited by J. Adam, M. Milnár, M. Starják, Kresťanstvo v dejinách Zemplína, Zemplínske múzeum, Michalovce, (2011), pp. 188-208.

[4] A. Kožmínová, Podkarpatská Rus: Práce a život lidu po stránce kulturní, hospodářské a národopisné. Dr. R. Kobosil, Praha, (1922).

[5] http://www.sopsr.sk/nppoloniny/sk/pralesy.php

[6] http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/europe-north-america/ukraine/carpathian/

[7] S. Švecová, "Rodina v dome a vo dvore", Edited M. Botíková, S. Švecová, K. Jakubíková, Tradície slovenskej rodiny, Veda, Bratislava, (1997), pp. 109-120.

[8] P. Šoltés, „Tri jazyky, štyri konfesie. Etnická a konfesionálna pluralita na Zemplíne, Spiši a v Šariši", Historický ústav SAV, Bratislava, (2009).

[9] M. Lacko, Užhorodská únia karpatských Rusínov s katolíckou Cirkvou. Seria Orientaia et Occidentalia, vol. 11, Dobrá Kniha, Košice, (2012).

[10] P. Šoltés, "Náboženský vývoj Zakarpatska a východného Slovenska", Pracovné metodické listy, Centrum pre európsku politiku, Bratislava, (2017).

[11] V. Feglová,"Priestor ako antropologický fenomén", Slovenský národopis, vol. 41, no. 2, (1993), pp. 131-139.

[12] P. Tajkov, "Súčasný stav výskumu počiatkov sakrálnej architektúry na Zemplíne a v Použí", Edited by J. Adam, M. Milnár, M. Starják, Kresťanstvo v dejinách Zemplína, Zemplínske múzeum, Michalovce, (2011), pp 26-84.

[13] I. Bojko, "Tradičné stavby v ukrajinsko-slovenskom pohraničí",Pracovné metodické listy, Centrum pre európsku politiku, Bratislava, (2017).

[14] S. K. Makovský, Lidové umění Podkarpatské Rusi. Praha, Plamja, (1925).

Innovative school education as the way to lower barriers between eastern Slovakia and Zakarpathia

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Abstract

The aim of the InovEdu project is to lower the barrier that is undoubtedly constituted by the border between Ukraine and Slovakia. We focused on removing the walls in the minds of people, namely those of teachers and their students. The pedagogical challenge was to determine how an educational process should be conceived so that it would be manageable for teachers and attractive for students. The project team put its stakes on modern technologies that are interesting for students (3D models of heritage sites) and on the training of teachers to teach them to incorporate the models in appropriate didactic contexts. One of the outputs of the project is the methodical material for teachers that will allow them to overcome the generational barrier between "digital natives" and "digital immigrants". At the same time, using the materials, the teachers should be able to create educational units that contain features of active learning based on the principles of constructivism. The contribution shortly deals with the experiences that we gained.

Keywords: *education, digital technologies, active learning*

1. Introduction

The establishment of the Schengen Area for the free movement of people and goods has had a double effect. For people inside this union, opportunities to co-operate, learn about one another and come closer to one another have significantly increased. People's feelings of togetherness, closeness and relatedness are being boosted by no visible borders, no border controls at check points, and no restriction of movement across borders (one can cross them anywhere). However, the outer perimeter of this space has become more difficult to cross. It has become more visible and is guarded better. A feeling is created that there is a different world, different people and a different culture on the other side of the fence – as if what lies behind the fence is foreign.

The aim of the InovEduc project (Innovative Educational Methods in Support of Partnership) was to lower the barrier that has been built by the Schengen border. The natural starting point is to refer to a thousand years of mutual history in the regions of eastern Slovakia and Zakarpathia. We can read about it not only in textbooks and historical monographies, but we can also observe it even today with the closeness of spiritual and folk culture in these regions. Yet, it is not possible that two regions that shared their history for a thousand years would suddenly become culturally estranged after being separated by a border for less than one hundred years [1].

We have realized that it necessary to carry over this shared history via the bridge of separated presence into a future in which we would like to see better communication and willingness to understand how

people behind the border live and to share life together with them. We have understandably focused our attention on young people who will make this future a reality. We primarily concentrated on those working with the youth (teachers) and then on young people themselves.

The pedagogical challenge was to find a way in which seemingly less attractive historical and cultural themes could be made interesting to a target group of young people. The project team focused on using modern technologies, which are naturally interesting for them. An ambitious idea was then conceived to combine state-of-the-art digital technologies with monuments of the past. The result is a set of 3D models of cultural and natural heritage from regions on either side of the border. They can be used for educational purposes in the environments of extended or virtual reality [2]. However, that would not enough on its own if we did not have a concept of how the models could be used for lessons in schools. Therefore, we worked intensively to prepare didactic methodical materials that will make it possible to bring historical topics processed by modern technology to the classroom in a way that is motivating, meaningful and instructive for students. The following task was to design an effective training model for teachers to teach them to use the proposed methodical steps for their work.

2. Digital natives versus digital immigrants

In 2001, pedagogical innovator Marc Prensky wrote a book about digital natives and digital immigrants [3]. The natives are people born after 1990 who have been surrounded by modern digital technologies since early childhood, and they cannot imagine their world without them. As the dividing line is not a strict one, some people born between 1980 and 1990 can also be included among digital natives. Older generations, people who were born, raised and educated in the analog world, if they did not catch the trends, can only enter the digital country as immigrants. If they do not catch on they will always remain behind the gates to this world. From this perspective it is important to realize that all students who attend schools today and will be going to schools in the future are digital natives. While the youngest teachers are digital natives, most of their older colleagues with years of practice are digital immigrants. This very reality is one of the most frequent reasons for generational misunderstandings at schools today. Conflicts between generations have always been present in schools, but “casus belli”, i.e. the reason behind those conflicts is always new.

To have an example from either side, we could, for example, look at a teacher who teaches students to find information resources only in classical libraries and instructs them to work with book catalogues. From the student’s perspective, such teachers may still be wise but are definitely unbearably inflexible, old-fashioned and ineffective if they are not able to find full versions of the same books on the Internet, or if they cannot grasp a book’s essentials before borrowing it by finding out relevant references published on-line. On the other hand, we can imagine a situation when a student writes his/her report on Australia based on information acquired on social media from contemporaries who live in Australia and on available amateur videos published on various web locations. While for such students information gained in this way is completely trustworthy, and they, in fact, do not even see the difference between life on-line and off-line, teachers will have serious doubts about the trustworthiness of their sources and will be inherently suspicious about whether the profiles on social media are in fact representative of real people.

The educational materials were designed to help to overcome this generational gap between the teacher and student. We took efforts to incorporate the digital into teaching in such a way that it would be considered sufficiently modern by young people and sufficiently trustworthy by teachers at the same time. The 3D models were just right to meet both requirements. If they are used with technologies of extended and virtual realities, they will definitely be intriguing enough for the student

and concurrently sufficiently trustworthy for the teacher. The teacher can rely on the fact that the digital representations of objects are really based on data collected in the off-line world, right in their real world locations.

3. A didactition's view

All teaching includes three basic phases from a didactics point of view. The attention of the student is gained in the first phase. It is important that the student is present at the lesson both physically and mentally. If it does not happen, everything that comes after amounts only to suffering for all involved in the teaching process. The second phase is about getting acquainted with the lesson content, be it a piece of knowledge, a skill or an attitude. This phase is traditionally considered to be the most important and it usually dominates over the others. However, it is true that if a lesson is focused on this phase only, students learn its content only superficially. What they learn in this way is short-lived, fragmented, unconnected, and incapable of forming a functional whole. To avoid such dangers, it is necessary, apart from good motivation (that will guarantee that the student will view their new acquired knowledge as the answer to their educational needs), to make sure that students properly look back and reflect upon what they have learnt. New knowledge will become lasting if it is internalized, interconnected with other pieces of knowledge, and sensible from the learner's point of view. We will look in the following sections at how we used the 3D models in all three phases of the educational process.

In one of the activities we start by showing students 3D models of two objects of folk architecture. Based on our pilot tests, we know that if a lesson begins with work using 3D models, students immediately become better engaged. To them, it is as if their teacher, usually a digital immigrant, visited their home in the digital world. They judge the quality of the graphics and check out various functionalities. It is similar when you listen to movie fans talk about the newest film on the scene. Before they even start talking about the plot, they will talk in detail about the professional quality of the movie aspects: the soundtrack, camera, special effects, size of scenery, etc. The film content is only secondary and discussion about it is never far away from commenting on the professionality of the movie: "The camera was so and so to stress a particular message." Students respond just like that. They at first judge the professionality of a 3D model, then start to read figure captions, and finally begin exploring the reasons why a specific real object was rendered into a 3D model representation. Here comes the moment when the teacher can ask questions leading closer to the aim of the lesson. Who might have lived in this house? Why does the house have this particular design? In this particular case, we used the 3D plan to lead the students to topics that are interesting for us and which should also be interesting for them.

In a different activity we invite students to consider the architectural development of the church in Veľká Tŕňa. By doing so they can not only learn about the changing architectural styles, but they will also learn about the confessional development of the local community of believers. Professional rendering of the architectural development along with well written figure captions, which explain how various denominations used the church, provide the students with a good starting point for their independent exploration. Instead of a field trip to Veľká Tŕňa, we "only" need technical means that will allow us to explore the monument in the environment of virtual reality. If it all feels a bit suspicious, it is likely that you are not a digital native, because for the digital native what is really virtual is simply real. It is real in a different way but equally true. They may then think it does not make sense to go for a real field trip.

And finally, in the activity devoted to comparing common and different features of various denominations, we begin to work with an analog material, and only later in the reflection phase can students work with 3D models. Using the models of specific churches, they are supposed to compare the number of features a particular church has with the number of features the church should have.

When reading about the examples above, the attentive reader will notice that the use of 3D models can result in different levels of innovativeness. It holds that the use of digital technologies on its own does not influence the quality of educational processes – because this quality always depends on the quality of pedagogics within which the technologies are used. In different words – digital technologies can increase the quality of education, but it primarily depends on the skills of the teacher [4].

Using the model by Ruben Puentadura, known as SAMR [5], we can conclude that along with 3D models we provide teachers with ideas for educational activities that can be used in schools both to boost educational results (3D model as a replacement for an analogue aid, or as an extension to visualize what students learn) and to modify educational goals (3D model as a means thanks to which the teacher can give students a task that would not be possible with analog tools). It depends only on teachers as to how daringly they will use the 3D models. In other words, how daringly the digital immigrants venture into the land of digital technologies in which their students have been at home since their childhood.

4. Preparing teachers

Even if educational media (digital objects and methodical materials) are prepared at the top professional level, they will not function effectively if teachers are not ready to use them. We prepared several 3D models and activities that show how the materials should be used in lessons. We also provided a manual on how to create one's own 3D models. In addition, we worked with a selected group of teachers and trained them to empower their skills in creating a didactically valuable educational unit. The teachers who completed this course will not encounter any barrier in the future to prevent them from preparing for their students even more valuable and better quality lessons than those that were created within the InovEduc project.

The training model was based on the teachers first attending the lectures and field trips, which introduced a particular topic to them, after which they attempted to process didactically the acquired knowledge. The proposed didactical procedures were then tested by other participants of the course. A thorough reflection then helped the teachers grasp the basic principles of this constructivist-based educational strategy.

Apart from the didactical training, the teachers were also instructed to reflect in an appropriate way on the border theme when preparing their educational units. They learnt to teach their students that borders between countries change and do not necessarily follow the historical and cultural borders, and that it is wise to be friendly and welcoming to people from the other side of the border and treat them based on principles of mutual equality.

The project is sustainable because the project partners were MPC (Metodological-Pedagogical Center Bratislava) and ZIPPO (Zacarpathian Institute of Postdiploma Pedagogical Education), who contributed to the training, and they can organize similar courses for the teachers to whom they provide services.

References

[1] Ľ. Voľanská, "The Common History of the Regions", Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 11-15.

[2] J. Lacko, "Storytelling in Virtual and augmented reality", Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 16-21.

[3] M. Prensky, „Digital Natives, Digital Immigrants." On the Horizon [online]., vol. 9, no. 5 (2001), pp. 1-6, [accessed on 2014-12-25], http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

[4] I. Kalaš, Editor, „Premeny školy v digitálnom veku", Slovenské pedagogické nakladateľstvo, Bratislava, (2013), http://www.kritickemysleni.cz/klisty.php?co=klisty24_eur.

[5] R. Puentedura, „SAMR In the Classroom: Developing Sustainable Practice" [accessed on 2017-02-07], http://www.hippasus.com/rrpweblog/archives/2014/11/28/SAMRInTheClassroom_DevelopingSustainablePractice.pdf.

Innovative Applications of Virtual and Augmented Reality in Education

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Abstract

In this paper we propose our research outcomes from project Innovative methods for supporting partnerships – InovEduc. We built the set of education software tools based on virtual and augmented reality and web-based tools, which we are using in teaching process of high-school students. We also propose the modelling methods respecting the purpose of the real-time visualization with the same 3D models for each software solution. We use traditional polygonal modelling and also photogrammetry for creating 3D models of 24 objects from Slovakia and Ukraine. The exterior of the objects was based on the 3D models as well as additional objects like wall cuts, etc. and interior of the objects was based on panoramas for almost every object. Some of the objects has additional features like destroying the train viaduct or possibility of virtually take apart of the wooden church. Our software solutions were based on Unity 3D engine.

Keywords: *virtual reality, augmented reality, modelling, visualization, education*

1. Introduction

Virtual and augmented reality are now very popular in the field of game industry, but also for serious games. In our project "InovEduc" we want to use it in the field of education, because it is something quite new for the students and they now live in the digital era, so we need to find some new forms of the education respecting their interests and experience. If they are educated in very traditional way, we can see, that they are mostly passive beneficiaries, but if the content is served them by digital solutions it is for them a game, and they are able to receive and accept more information. In our solutions we were focusing on the teaching of subjects like history, geography, traditional culture, religion and civic education based on modern information-communication technologies – virtual and augmented reality. We are also able to use this software in education of natural sciences like mathematics, physics or in technical sciences like informatics. We tested the proposed methods and software solutions in education process in the schools and also in their free time. For purposes of our project we found 24 interesting objects from eastern part of Slovakia (14 objects) and Western part of Ukraine (10 objects), which were digitized by us and we use the 3D models of them, and also interior panoramas for its real-time visualization in virtual and augmented reality and web-based visualization (Figure 1.).

The selection of the objects has several criteria for finding similarities on the both side of the Slovak-Ukraine border [1]. We found objects of similar types – castle ruins, folk housing, wine cellars, etc., similar history – castle in Uzhorod and castle in Humenne were connected by Drughets family, similar religion – churches (mostly wooden), etc.

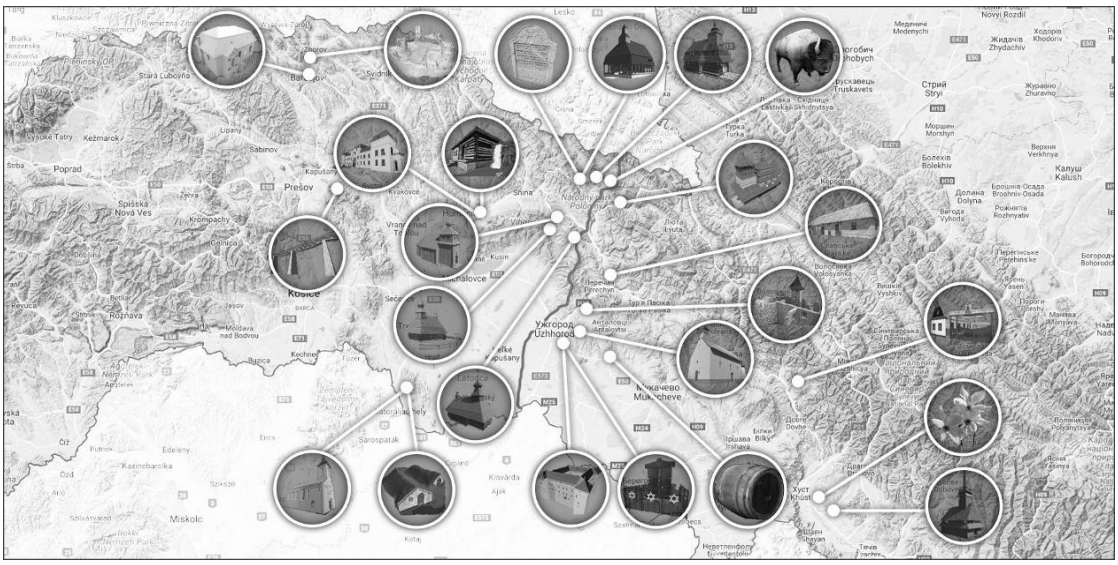

Figure 1. Map of the objects in Slovakia and Ukraine

2. Objects as the 3D models

In the InovEduc project we want to show to the students the real objects in their current state and for some of the objects in the different stages of their building. We want to be able to immerse them into the virtual scene and cover all object parts. That was the reason for using real 3D models of the object surrounded by environment. For most of the objects we have choose the form of the 3D models, but for some objects we use rather panoramas. It was the objects where the cost (number of vertices and faces) of the creating of the real environment was too high. The 3D models were acquired by two different methods – polygonal modelling and photogrammetry.

We choose the polygonal modelling for nearly every object, because we have better control on the number of vertices and faces in the object. For real-time visualization it is one of the critical values. With increasing number of vertices it is not possible to compute the lighting and some other features in real-time. On other side, we are not always be able to obtain real shape of the objects and this method of the modelling is fully dependent on the operator (skills are very important). We use for modelling Autodesk 3DS Max and Blender software for modelling the 3D models of the objects. After modelling we map the materials with uv coordinates consist of diffuse map, normal map and specular map as well. 3D models were exported into the OBJ and COLLADA file formats and imported into the Unity 3D game engine (Figure 2.).

Polygonal modelling works for almost every 3D models, but there was also the objects which has more details and it is impossible to create the 3D models in this way, because the consumption of the time is enormous. For these 3D models (castle ruins) we choose photogrammetry methods (Figure 3.). We obtain the data (photographs) from terrestrial photographs and from video from dron flying above the objects. The output 3D model from photogrammetry system were full of bugs, so we need to correct the topography and the geometry of the object by filling holes, removing artefacts, reduce the noise in the data as well as reducing the number of faces. Originally the 3D model has more than 3.5 million of the polygons and we need to reduce it to 65 000 polygons. So we remove terrain data (we

import it on the other way) and then we reduce the number of polygons. We need also to create some optimization process for textures (the colour information in the vertices was not enough).

Figure 2. 3D model of Humenne castle in 3D environment

Figure 3. Ruin of Zborov castle reconstructed by photogrammetry methods

For creating interiors we choose the panoramas. We use spherical 360° images. We try two methods for obtain the panoramas. First method was to use wide lens photographs for different angles and we connect them into one image. The benefit of this method is, that we can create high resolution image panoramas, but on the other side, there could be problems with stitching the source photographs into the final panorama (possible creation of artefacts). The other method was using Samsung Gear 360 camera, which can produce panorama at once, thanks to the two spherical lenses covering more than 180 degrees horizontally in two opposite directions. To avoid the stitching problems we use the set of the two photographs rotated in 90° horizontally and for HDR effect we took seven shots with different exposure level. Than we stitch it together and export as one spherical panorama (Figure 4.)

Figure 4. Spherical panorama of the interior of the object

After modelling the 3D models of the objects we make integration phase in the Unity 3D engine [2]. Where we add the terrain, 360° cylindrical panorama for environment and trees, bushes, grass and props to decorate the scenes. For some models we need to add water simulation, particle systems and some physics.

3. Software solutions for visualization

We use the same data (3D models, panoramas, texts) for each kind of software output. We build standalone application, web-based application, virtual reality application and augmented reality application. We need to optimize the 3D scenes and rendering pipeline, because each kind of software has different hardware requirements. For these reasons we need to find balanced ratio between quality of 3D models, rendering speed and quality of environment. We also try to use the same GUI (graphic user interface) for each kind of application (Figure 5.). In fact there were some differences based on kind of application. The standalone and web-based application have the same GUI and functionality. There is a difference in scene loading and data transfer on the web. Because we need to have different type of releases from one kind of scene, we decided to use Unity 3D engine, which is able to deploy the same content for various purposes.

Figure 5. Graphic user interface of the web application

Graphic user interface for application consist of two ribbons – one at the upper part of the screen and another one at the bottom of the screen. At upper part, there are basic information about objects and possibility of changing language, information about project, help and icon for menu – for choosing the object. At the bottom part of the UI, there are at the right part icons for turn on/off the sound and text information in the scene and at the left side there is the icon for start and stop automatic camera movement in the scene and if there are some additional data to the scene like wall cuts, different stages of the object, icon for destroying the object, there are also the set of icons for interaction. For Šmigovec wooden church there are also the buttons for toggle the different layers of the physical object.

Integration of the data was done in Unity 3D engine. For our purposes we need to develop some additional tools (scripts) for data management through different scenes and for management of 3D objects and panoramas (Level of detail, optimization). We also create some new tools for terrain use in virtual reality and augmented reality and for tree placement in different scenarios. We create the whole new tool for creating automatic camera movement through the scene by checking its actual position in the scene and interpolate through the checkpoints. For navigation in the panoramas, we use our own hotspot tool with transfer to another panorama or to the 3D models.

Virtual space offer us possibility of showing more features of the objects, which we are not able to show in the real physical space [3]. Most of the objects in the project are buildings and we can show them directly as are, but for some of them we are able to show more, from the point of view of teachers, interesting data.

For some objects we are showing the wall cuts, so we are able to teach the students about materials and technology of build of the buildings (church in Veľká Tŕňa, Water-mill in Humenné). These 3D models are enhanced by text description.

Virtual space offer us more possibilities in object presentation. When you are on site at the real object, you are not able to see historical events, different building stages or you are not able to turn off some layers from object. In InovEduc project we want to show to the users this possibilities and thanks to the virtual environment and 3D models of the object we can do that.

For 3D model of the Water-mill from Vyšná Polianka, which is now located at the Humenne, we add water, which is falling down through the wheel, which is animated (Figure 6. a). Train viaduct in Hanušovce nad Topľou is one of the biggest viaducts in Slovakia and at the end of world war 2, it was destroyed. In virtual space, we can show to the user, how it looks like more than 70 years ago, when it was damaged. We also add to the scene the steam train for enhance the historical perception of the object (Figure 6. b).

a. b.

Figure 6. a) Water-mill from Vyšná Polianka b) Destruction of the train Viaduct at the Hanušovce nad Topľou

The wooden church in Šmigovec was reconstructed and thanks to the reconstruction we were able to see different layers of he objects. We have seen the object without facing which was outside the object

and also we have seen the structure of roof and shingles. When we create the 3D model of this object, we divide it into eight different layers and in the software the user can turn on/off any of the layers. We are able to show the roof levitating above foundations. Another one interesting thing is, that iconostasis which was part of this object is now at the other wooden church, so we add it into it only virtually (Figure 7).

Figure 7. 3D model of the wooden church in Šmigovec with some layers removed

The Zborov castle is ruin and we use photogrammetry for creating the 3D model and manual modelling for creating reconstructed 3D model (Figure 8.). Our software solution is able to fluently switch between the objects in various phases of their buildings. Except the switching between the 3D models we need to create scripts for changing tree density and its location in the scene.

Figure 8. 3D model of the ideal reconstruction of the Zborov castle

The church in Veľká Tŕňa (Figure 9.) is one of the oldest churches in Slovakia and during centuries, it changes its shape, structure and geometry. We use the same access for showing the various stages of development of the building structure. We also need to solve the memory consumption when switching between the different 3D models and loading time.

a.

b. c.

Figure 9. 3D model of the church in Veľká Tŕňa

a.) Actual state b.) Romanesque building c.) Gothic building

The most of the objects in the project were buildings or environments with static position (Narcissi valley, jewish cemeteries,…). One of the objects in the project was European bison (Figure 10.). We created the 3D model with included skeleton and we also animate the object. Animation of the object is done without changing its position in the scene, because we use this object in observe camera mode.

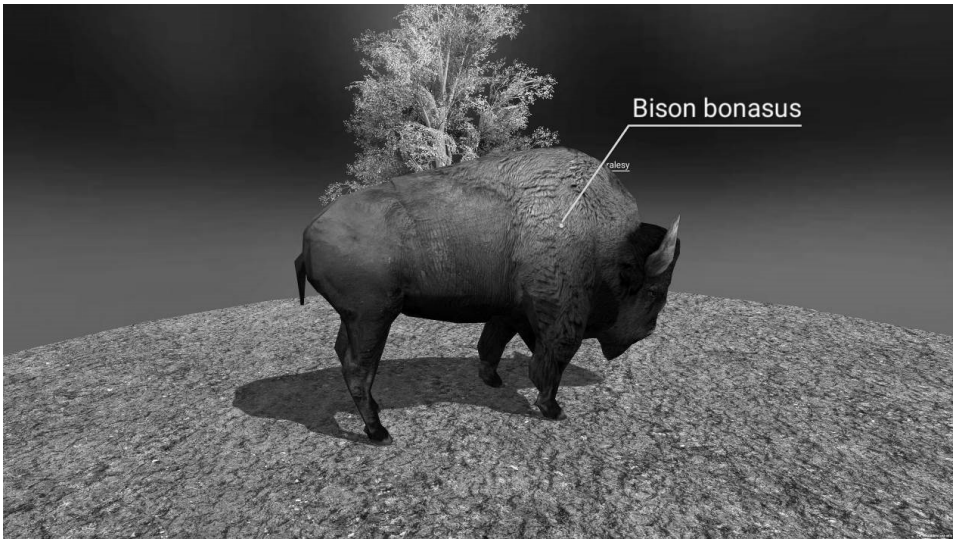

Figure 10. 3D model of European bison

4. Virtual reality

Virtual reality in education is used for introduce the content to students in the way, which is not traditional and could be more interesting for them. There are several practical implementations of the virtual reality software for presentation of the cultural heritage sites [4]. We are able to create positive or negative emotions in the virtual reality and by using the virtual reality, we can provide information in more memorable way. If there is any information connected with positive or negative emotion, it will store more deeply in mind of the user. For these reasons we build the InovEduc virtual reality application.

Our application in virtual reality is created for both HTC VIVE and OCULUS rift headsets. Application is working with Windows operating system. For navigation in the virtual space we use the HTC VIVE controllers or OCULUS TOUCH controllers.

There are several kinds of navigation in virtual environment of the InovEduc application due to various kind of content (3D scenes, panoramas). For 3D scenes user is able to teleport between its positions by using pointer, which uses raycast from controller to the terrain. User also is able to use nearby environment in physical space, because he is tracked by headset tracking cameras. In the panoramas you are not able to move in physical space (only rotation is provided), because, the data are fixed to the center of projection.

For some objects we use only the observe mode where you are positioned at the plane above the object and when the virtual ray from controller hits the terrain, the camera is positioned above that point at the height of the plane. This is used for castle ruins.

For changing the panoramas, or switching between panorama and 3D models we use the hotspots, which are used similar to changing the position in the scene. User point the hotspot and after using the trigger, the content is changed.

For changing the object or for showing menu, we use the spatial user interface. We use the info points (Figure 11.) in the scene where user can read information about objects and can interact with the icons.

Figure 11. Info point in Virtual reality application with icons for interaction

5. Augmented reality

By using augented reality we are able to use various kinds of presentation techniques [5]. For augmented reality we use the Vuforia augmented reality library and we create applications for Android and iOS devices. Augmented reality applications are used in the teaching for individual exploration of the objects by students. We use the image marker (Figure 12.) for estimation of the global coordinate system and then we render the 3D models at the position of the marker. For increasing rendering speed on smartphones or tablets, we remove the trees from the scene and also we add only the part of the terrain covering the near surrounding of the object. We also need to optimize the 3D models and its materials and textures for mobile devices.

If we want to render the panoramas we do not recognize the marker and its position, but we are using the internal device sensors like accelerometers, gyroscopes and magnetometer. When the user rotates the device around, he is able to see 360° of the spherical panorama.

Figure 12. Marker for Augmented reality application

All functionality of the web or standalone version of the InovEduc software is also provided in virtual and augmented reality applications.

6. Usability testing

We also provide some usability testing of our applications in our Usability testing labs. We use the Think-aloud method. The tests were done with 25 people (most of them were students of our faculty). The testing has two phases. At the first phase, we test the application with the people who see it for the first time and without previous instructions they must to fulfill the couple of tasks (like: found the way how to show the panorama at the model of wooden church in Inovce, etc.). At the second phase we provide them some instructions, and then they must to fulfill another set of tasks. After the testing we use the results for enhance the GUI of the applications (standalone, web, VR and AR) and also we use it for enhancing the interactivity and camera control in the applications.

7. Conclusion

The applications in the InovEduc project are used as the tools for innovative education at the both Slovakian and Ukrainian side of border. The 3D models and applications are also supported by working methodological sheets for teachers. Thanks to these sheets the teachers are able to use the applications as the part of educational process and from the point of methodology there are several themes which connect the both side of border.

The 3D models of the selected objects could be filled up by another 3D models, because we offer to the teachers and students opportunity to use the ModelShare web application, where they can add their own 3D models in COLLADA and OBJ format and they can create the database of other objects from their nearby surrounding.

There are some projects, which can use our research for their future implementations [6].

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References

[1] Ľ. Voľanská, “The Common History of the Regions”, Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 11-15.

[2] E.Ružický, F.Schindler, “Innovation in Research as the support for Cross-border Education in Slovakia and Ukraine”, Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 6-10.

[3] J. Lacko, “Storytelling in Virtual and augmented reality”, Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 16-21.

[4] Timothy Hyungsoo Jung, M. Claudia tom Dieck, (2017) "Augmented reality, virtual reality and 3D printing for the co-creation of value for the visitor experience at cultural heritage places", Journal of Place Management and Development, Vol. 10 Issue: 2, doi: 10.1108/JPMD-07-2016-0045

[5] M. Novotný, J. Lacko, M. Samuelčík, “Applications of multi-touch augmented reality system in education and presentation of cultural heritage”, Procedia Computer science. ISSN 1877-0509, (2013), Vol. 25, pp. 231-235

[6] J. Štefanovič, F.Schindler, “Education Support by Research in Local Transportation History”, Creative and Knowledge Society, Bratislava, Pan-european university, (2016), Vol. 6, Issue 1, ISSN: 1338-4465, pp. 96-110.

Object Presentation in InovEduc

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Abstract

In this paper we present the methods of modelling the 3D models of the Ukrainian objects in the InovEduc project. We focus on the process of the creation of the materials and also the diffuse and normal maps. We also present the possibilities in exporting the 3D models into the Unity3D game engine, which were used for integration of the 3D scenes.

Keywords: *3D model, material, textures, game engine*

1. Introduction

Today we're going to be looking at 3d models of objects we made. Those are going to be the wooden church in Danilovo, the "Gamora" forge in Lysychevo and the Holocaust memorial in Uzhgorod, which are objects in InovEduc - the collaboration project, aimed to bring high technology into classes. The main focus of this paper will be on steps and problems we can, and, inevitably will face during the process of making those 3d models, or modelling in general.

2. Wooden Church in Danilovo

The first object we'll look at is the wooden church in Danilovo, Ukraine, which is located 130km from Uzhgorod and is a small mountain village. The church itself was built in late XVIII century [1], it is of gothic style, its main architectural feature is long spire. Also worth mentioning that it is of greek catholic confession and is still active. The church sits on the hill, within thick forest so when you approach it by road you can clearly see from far away its long spire poking through the trees.

Figure 1. Wooden church in Danilovo

The model consists of roughly 2000 polys and 3000 verts. The front and the crosses are the most detailed parti of it.

Most of the textures were made from photos. Also normal maps or, more simple, bump maps and specular maps were made to achieve more realistic look. The main problem here was to find a good and reliable way to make arches, windows, doors, and generally make it so the sizes match and things work.

The next step is importing into Unity. We used FBX format which is neat and has many advantages. The ones worth noting is a relatively small file size and sufficient number of features to do the job. It allows to import geometry, materials, and also to convert axes. To keep the textures binded to their materials it is important to put them into the project folder. And although materials are imported they need tweaking, such as assigning all the secondary maps and so on. All materials use unity's standard shader which is optimal for most of the cases and has all features needed.

After importing we need to set up the scene. The main elements of the scene are the landscape, the model itself, and the lighting. In case of making the landscape the special terrain component was used. The way it works is by "sculpting" the terrain with different brushes with different parameters, such as intensity, opacity and so on. It also allows to add foliage and wind animation to give and immersive feel to the scene. All of the foliage assets are from the Standard Assets asset pack Unity offers. The tree models used are mobile friendly, so the performance hit is not as big.

Figure 2. 3D model of wooden church in Danilovo

3. Gamora Forge in Lysychevo

The next object we'll look at is the forge in Lysychevo which is also called Gamora. It's located 100km from Uzhgorod, and was also built in XVIII century [2]. The two main features it has are two big watermills which power two big hammers inside. It is still active and often hosts different forging festivals.

Figure 3. Gamora Forge in Lysychevo

The model is made of roughly 4000 polys and 5500 verts. The forge itself is a complex of 4 buildings and the courtyard in the middle. The buildings clockwise are: administrative building, annex building connected to the next with a small corridor, warehouse and the forge building with hammers inside.

Most of the textures were made from photos as well, but due to inaccessibility of certain parts of buildings (such as roof, back walls etc.) other textures were used. Those are generic roof texture, or wood planks.

Importing models from 3dsMax is not always as smooth as you may like. 3dsMax's UP axis is Z axis, while Unity's UP axis is Y, so sometimes after import you may find your model laying on its side. FBX format lets us convert axes to match the difference, in other words it fixes the problem. Another thing you may deal with is that 3dMax's specular maps are monochrome, while Unity uses alpha channel to represent the specular effect. This approach leaves other three channels free, thus allows to give the glossiness a color tint.

The terrain component mentioned before also allows us to "paint" created landscape with different textures. There can be numerous textures which also can have normal maps, so you're not limited with it. All the textures used here are from the Standard Assets asset pack Unity provides. Although some of those textures have slightly changed hue to create a proper atmosphere of a village in the mountains. This component also lets us to change a tint of the foliage.

Figure 4. 3D model of Gamora Forge in Lysychevo

4. Holocaust Memorial

The last object is the Holocaust Memorial, which is situated on jewish cemetery in Uzhgorod.

Figure 5. Holocaust memorial - Jewish cemetery in Uzhgorod

The model here is more detailed and made of 4000 verts and the same amount of polys. The main part of it are two polished marble slabs with the names carved on them. One has Ukrainian names, the other has them translated to English. Above it there is another carving which says “Eternal Memory” in Hebrew, Ukrainian and English. Because of the material being glossy it wasn’t possible to make a complete texture of it from photo. Only the basic marble texture was made. To reproduce the same glossy effect specular and normal map was used. The marble has a specific reflection pattern that somewhat resembles a smoke cloud and that is, essentially, how the specular map for it looks.

The last part of the scene we discussed earlier and the part which is responsible for realism is lighting. To achieve a certain level of that realism you should not forget about it as it is an essential part of every scene. Even a stylized one. Setting the right lighting color is of most importance. The way the light color is determined is by using a temperature scale which shows us what temperature must an object have to glow with that color [3]. This temperature is measured in Kelvin. For example, the temperature of the midday sunlight is roughly 5000-5500K and the sunset color is almost 2500K.

Figure 6. 3D model of Holocaust memorial

5. Conclusion

Although the process of creating 3d models and scenes are complex and has its difficulties, it is an engaging activity which involves and as a result develops your problem solving skills, and, as I noticed when you just start you do it very slowly as you try out new methods and approaches but with time your work speed constantly increases and you make every and each part of the model faster and faster. It also allows you to let your creative energy out as with everything you make you give your own touch to it and thus it becomes something unique. InovEduc project was a great opportunity to challenge skills and will, in fact, in future help many students to get to know the history of the land they live in [4].

References

[1] Wikipedia, „Миколаївська церква (Данилово)“, [accessed on 2017-03-10], https://uk.wikipedia.org/wiki/Миколаївська_церква_(Данилово)

[2] Wikipedia, „Водяна кузня Гамора“, [accessed on 2017-03-10], https://uk.wikipedia.org/wiki/Водяна_кузня_Гамора

[3] Wikipedia, „Color temperature“, [accessed on 2017-03-10], https://en.wikipedia.org/wiki/Color_temperature

[4] J. Lacko, “Storytelling in Virtual and augmented reality”, Innovative Methods in Education and Research, Prague, Wolters Kluwer, (2015), pp. 16-21.

EXTENDED ABSTRACT

Digitizing the regional musea in Hedmark County, Norway

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Abstract

Keywords: *digitization, museum, education*

1. Introduction

Anno museum is an umbrella organization for the local musea in the mostly rural county of Hedmark. There are 24 museum sites, with responsibility for about 700 buildings, 170 000 individual items with associated information, and 4.3 million photos. In total 128 full-time equivalent staff years are currently employed within Anno museum family which covers a wide field of themes of Culture and Nature, and receives over 250 000 visitors per year. Anno museum has as its motto: Knowledge of the past and Commitment to the present. The musea constituting its member sites therefore find themselves challenged in the transition between old museum practices and a digital age. The musea now not only require new types of information storage and retrieval systems for their collections. But they are also to provide for a completely new type of users that are trained in and expect instant access to all the musea have to offer, in terms of text, numbers, drawings and 2-dimensional and later 3-dimensional photos and models. The new users include the Anno museum people themselves who are becoming part of a global museum community with greatly increased new possibilities for information exchange and analysis. They also include visitors eager to know more of both the past and the present, whether they come as individuals and families of varying ages or are part of educational activities and tourism. At the same time there is an urgent need to conserve fragile items and to reduce the physical handling of them, vulnerable documents and fading photos. But unless musea can respond to a new age with new information technology for a new generation, the visitors will gradually disappear and the cultural inheritance the musea represent becomes irrelevant. The digital project in Anno is therefore also to prevent the musea from becoming obsolete.

2. Digitization

Since each and every museum site cannot be expected to have on their staff specialists familiar with new digital methods and maybe without modern digital equipment to assist them in this transition, the Anno museum has selected one grouping of smaller musea to undertake the digitizing project on behalf of them all. A digitizing unit with 8 work places training and employing local staff in the small town of Tynset has been established, with very modern equipment and headed by a very competent computer specialist. We have started the cumbersome work of scanning documents pertinent to the

170 000 items, and turning the descriptions into readable formats. Old handwriting and use of dialect words, some no longer in use, slow down the work but represent information that should not be lost. Once the descriptions of the items are completed (or well under way) the 3-dimensional scanning of selected objects will follow. That will also include – when possible - creating 3-D images from the architectural sketches, photos and drawings of the many buildings present in the musea, and potentially utilizing old and new photos both for buildings and sites. There are major registration and photography efforts required to obtain 3-D images for selected items, with priority given to those that are of particular interest for research and communication.

It is important for the project to train and employ local people, some of whom may be temporarily unemployed, to give them digital skills in the context of the project, skills that may become valuable to them in their future careers. That also ensures that they – and their families and friends - can more easily identify themselves with the values of local musea and the need to modernize them. The musea are – after all – the expressions of where they themselves came from, and that they can feel that they are "curators" for the next generations. In projects of this kind one should not allow technology to overshadow the very reasons why the musea exist now and in a small way give the project people pride in arming the musea to cater for the future, for their own families and for the community in which they live.

There are many challenges in this project, which is in its early stages. Our musea also include items that originate in quite another culture also present in our region: the reindeer-herding Sami. Their language is very different from standard Norwegian (in fact there are 3 Sami languages in Norway, all distinctly different, although only one is widely used in our region). To create openings for preserving items, sites and – wherever appropriate – buildings in the same digital system and to describe them adequately both for their own communities and for the mainstream Norwegian audience. are challenges we will need to tackle in the next few years.

3. Coclusion

In the end Anno museum is doing this project for its users, and to create modern interfaces for museum users, not the least the public. We believe schools and other educational institutions constitute prime targets for our work. And we trust that the increased tourist interests for our region will also benefit from the project when completed in 3-4 years time.

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Notes

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