POSTER

The creating serious games for historical subjects at the 1st level of primary school and such as a part of exhibition chosen historical buildings

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ABSTRACT

The aim of the study was create serious games for historical buildings which are important for each region of Czech Republic. These games are making guide to historical building and give to pupils the information about architecture, history of building and eventually about surroundings of historical building and the like.

For creating serious games are using tools of 3D graphic software 3Ds MAX in combination with developing software UNITY 3D. In the modelling software 3Ds MAX were creation 3D models of historical buildings. The gaming environment was creating in UNITY 3D with programming language C#.

Keywords
Serious games, education, 3D, UNITY 3D, interactive.

1. INTRODUCTION

For approaching a cultural heritage, especially historically important buildings, to students of the primary school with attractive way due to which is easier to remember their subject matter, is the best way to use elements of gamification. Children are confronted with a virtual environment from an early age, primarily through an entertainment industry, whether they are films (mainly animated cartoons), or computer games. Due to this fact students get up close to this environment and they are well-versed in this field.

As the main historical building in this series of serious game was chosen a medieval castle in Hradec Kralove for several reasons. Both because of close cooperation with primary schools in Hradec Kralove, secondly because it is burned-out and now non-existent castle.

Given the fact that the castle is no longer existed in any form (not even as a ruin) there is an opportunity of sub-objective research – a comparison of children´s way of learning, respectively they remember an information about historical buildings, which they are able to see both live (and to look at them indeed) and virtually and which they only learn about.

The castle complex of Hradec Kralove, a castle and Minorite monastery, was destroyed and burned out during The Hussite Wars (a civil war in the first half of 15 century), the monastery in 1419 and the castle in 1423 (Richter, Vokolek, 1995). The castle complex have never been rebuilt and later in its place were built town houses. An appearance of the castle is captured only on several vedutas, the other documentation does not exist. Due to this fact was a virtual 3D reconstruction of castle complex made by analogy with till now non-existent medieval castles, along with consultations with experts from Museum of Eastern Bohemia in Hradec Kralove. These information were supplemented by graphic designs, sketches and other documents, which originally served for a creation of paper model, which is the part of permanent exposition of Museum of Eastern Bohemia in Hradec Kralove.

The gamification required is achieved by insertion of 3D model of historical building into game environment and by interactivity. In this environment is able to browse through building, take a look at interiors and exteriors, get information about the specific architectural, historical and other elements and get acquainted with local legends and with history of everyday life. To verify the acquired knowledge there is a test as a part of this educational game.

2. The creation of serious games

The preparatory works

The preparatory work with proposed ground plans and cuts was carried in vector editor Inkscape. From proposals there were created concrete documents for the creation of 3D model of castle complex.

Textures of outdoor plasters used in 3D model of castle complex were created from real outdoor plasters´ photos of historical buildings situated in the centre of Hradec Kralove. Other textures was taken from photos of random objects, which had required colour and surface. A photo processing for creation of textures was carried in raster editor Gimp 2.8.

The 3D modelling

All modeling work were carried in 3Ds MAX 2011 and 3Ds MAX 2014 softwares.

3D virtual reconstruction of castle complex buildings were created in three ways:

a) The basic objects – *"Standard Primitives",*

mainly tip *"Box"* and *"Cylinder"* and with their deformations and modifications and further with combination with Boolean operations (*"Boolean"* or *"ProBoolean")* if it was necessary.

b) The objects *"AEC Extended"* and their modifications.

c) Sketching an outline with tool „*Line"* a its spatial rendering with command „*Extrude".*

A selection of tools for creation of particular part of castle was dependent on complexity of castle´s element. If it was a simple object with no need of other adjustments, for example to add windows only, then a castle part was created using objects as „Door" from offer „AEC Extended". If there was a castle element of irregular floor plan, a command „Convert to

Editable Poly"was used. By modifications of positions as „Vertex", „Edge", „Border" or „Polygon" was achieved an effective distortion of object and an irregular floor plan. With use of these deformations there were created roofs, church support system, battlements etc.

The Boolean operations were used mostly for creation of passages, passes (f.e. an entrance gate) and monastic arcades.

A tool „Line" from offer „Splines" and his spatial rendering with help of commands „Extrude" was used for creation of railings, galleries etc.
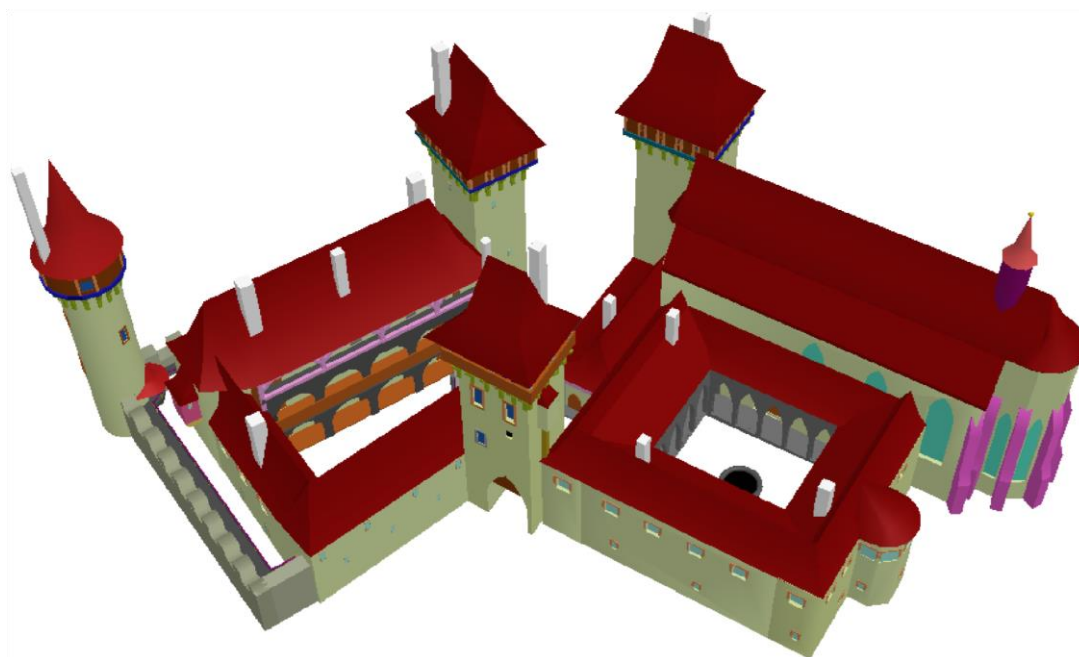

Fig. 1. Completed 3D model of the castle complex in Hradec Kralove. Source: The author.

After a finish of modelling works there were assigned to particular structural elements in advance performed textures, with help of tools from „Material Editor". The last step in software was an export of 3D model to FBX format.

The developing of gaming interface

The environment of interactive presentation enriched with elements of gamification was developer in software Unity 3D. After putting imported 3D model of medieval castle into scene, here was a completion of visual scene, as castle surroundings, trees, access road, green vegetation, sky etc. Here was set also a lightening of castle.

For creation of „walk-through" presentation with mini map, i.e. watching a movement of user from above, there were put tools *„First Person Controller"* to the scene, which form de facto a figure of user and at the same time scan the whole scene and *„Camera"*, which is situated above *„First Person Controller"* scans its movement. A performance properties and linking of these tools was defined by statements of C# language, which are scripts *„Keyboard Camera Control.cs"* and *„FollowCamera.cs"*. Due to the last named script there was created preview window Mini maps for monitoring a position of user.

The usage of a map is very important for secondary school children, because they have different spatial perception than adults. Without Mini map children would get lost in virtual 3D model of medieval castle.

This interactive presentation is followed by other elements of gamification. Among the most significant element is a menu, where a user choses a thematic area (History, Architecture, Legends etc.) and dropdown „information tables" with lessons, which will be unrolled after clicking on highlighted element (f.e. pointed window). All these interactive elements are defined in programming language C#.

Finished serious game is exported to the user environment on the platform „Web Player", where is boot file in HTML format and a source file in UNITY3D. This platform is chosen because of easy running. A school and institutions using these serious games, are not forced to buy a new technology.

3. The Gamification and pedagogical research

Gamification is a setting up new game elements to a different environment, in this case the environment of national history on a primary school. A term gamification is spread from 2010 (Detergding, 2011). The main goal of gamification is to motivate students (serious game users) by achieving rewards.

From a study from July 2012 follows, that gamification is approximately from 5 to 10 years before reaching the top of mass using, as the Garhnerov curve Hype cycle shows. (See Fig. 2) (Maněnová, Chadimová, 2014).

The aim of the pedagogical research was to test what influence had an implementation of serious games for historical buildings on communication between teacher and pupils and the whole interaction in the frame of subject matter. On the base of analysis of lessons, during which serious game was using, and inquiry questions (the interview was with teacher and with pupils) was by means of category system in modified scheme Flanders system of interaction analysis was detected the interaction is higher than 1, it means the pupils are more active than teacher during lessons. (Maněnová, Chadimová, 2014)

For basic quantitative processing and for obtaining demanded data program CodeNet was used. The program was developed at department of pedagogy and psychology of

Pedagogical Faculty, University of Hradec Králové (authors: T. Svatoš and V. Žák). The CodeNet defines up to 20 different followed categories of activity and allows them to assign a code interval and further it is possible to make time cuts in it . (Svatoš, Doležalová 2011).
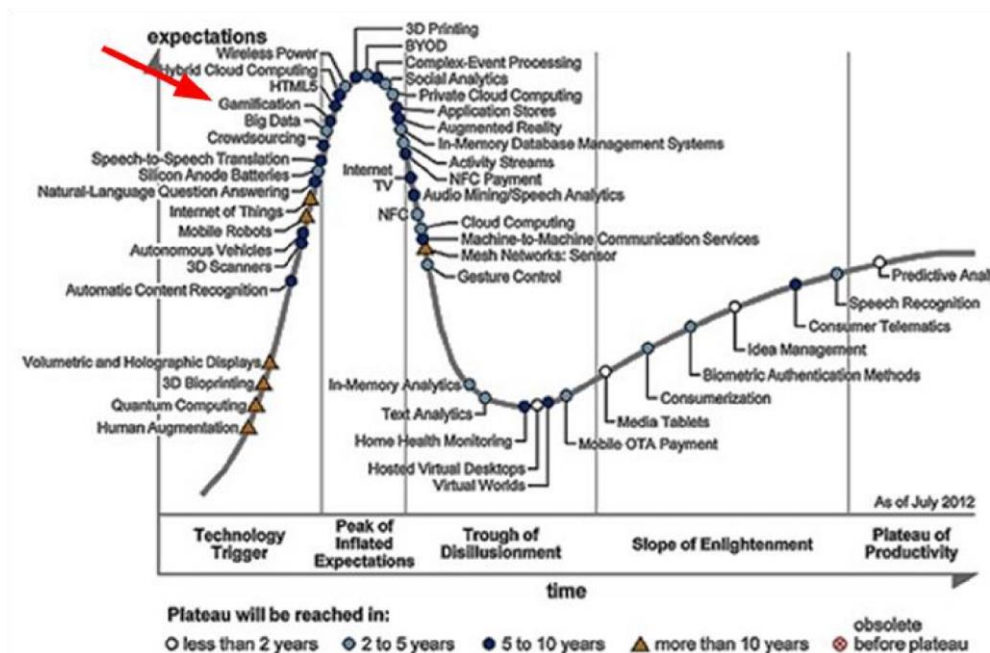
Fig. 2. Garthner curve of Hypo cycle
Source: Maněnová, Chadimová, 2014

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