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y Desarrollo de Producto

Recreación en 3D de la parte antigua de la ciudad de Saarbrücken

(3D recreation of the old part of
the city of Saarbrücken)

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TFG REALIZADO EN PROGRAMA DE INTERCAMBIO

TÍTULO: **Recreación en 3D de la parte antigua de la ciudad de Saarbrücken**

   (3D recreation of the old part of the city of Saarbrücken)

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FECHA: **26 July 2016**

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RESUMEN

El presente proyecto consiste en hacer una recreación de la plaza mayor de Saarbrücken "St. Johanner Markt" a través de un modelo 3D, realizando a su vez una reinterpretación de la misma y caracterizándola con un estilo medieval.

Para poder llevarlo a cabo, y tras llevar a cabo primeramente por un trabajo de documentación, el proyecto se ha dividido en 4 partes: fase conceptual, en la que se presenta el trabajo inicial y el motivo de varias decisiones; fases de modelado y texturizado, en las que se detalla con precisión todo el proceso llevado a cabo en la creación de los gráficos; y fase final, en la que se presentan varios renders y se evalúa el comportamiento del modelo en un entorno de videojuegos mediante la utilización del software "Unreal Engine 4".

RESUME

The present project consists in doing a recreation of the main square of Saarbrücken "St. Johanner Markt" throughout a 3D model, while doing also a reinterpretation of it and characterization in a medieval style.

In order to carry it out, and after doing firstly a documentation work, the project has been divided into 4 parts: conceptual phase, in which the initial work and the reasons of several decisions is presented; modelling and texturing phases, that describe accurately the process performed in the graphics creation; and final phase, in which several renderings are presented as well as the behaviour of the model in a videogames environment by using the software "Unreal Engine 4".

PALABRAS CLAVE (KEYWORDS)

3D, Blender, ambiente, modelado, texturizado

3D, Blender, environment, modeling, texturing

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MEMORY

1. INTRODUCTION
1.1. Project motivation

During my studies of Engineering in Industrial Design and Product Development I have learned many things. One that caught most my attention was the 3D design. It all started in the early years of this race, when, thanks to the University, I was able to attend a conference given at the Architecture faculty about modelling and 3D animation. From that moment, being able to create something new and present it throughout those programs that I did not know before fascinated me. Later on we course several subjects related to computer graphics, such as "Computer Aided Design" or "Computer Graphics" (very accurate name). We also extrapolated that knowledge and used it for several projects that were presented in other subjects, such as "Design Workshop".

In addition, I have made other personal projects of this type. When I did an internship at a medical design company, I gladly kept working with 3D software both with previously known programmes and new ones, that enriched my knowledge on the subject. I can say I am very satisfied with the computer graphic results obtained in the 6 months of my internship.

So when it came the time to choose a degree thesis, this could not be otherwise but 3D-related, either with modelling, texturing... Fortunately, I was lucky to have the opportunity to choose the TFG, and after an initial period of reflexion and with the help of my tutor and professors of the University (HBK Saar), I opted to make a reinterpretation of the central square of the city where I was doing my Erasmus (Saarbrücken city, Germany), by doing a 3D modelling and rendering of the square in a medieval style. The fact of being able to be phisically there, whether to compare it with the model that I was doing, or to take measures or to ckeck certain details was a factor that motivated me greatly, since I based my work in something existing, something tangible.

Later I will inquire into the history of the city and the reasons why I chose the medieval style in concrete.

1.2.   Goals

Like I said before, I consider myself lucky to have had freedom in choosing the project to be carried out, since it allows me to focus on a particular area of the career, what then will be of much help at the time of choosing the speciality (Master studies).

My main goals of this project are as follows:

1. Learn more about 3D and its development with different programmes. In this case, I will work with the software Blender, never used before and which requires therefore and extra effort, since it is quite different to other programmes like CATIA or Solidworks. On the other hand, this will allow me to have a broad vision of different methods of work, which will be an advantage in the future once it comes to work or to continue studying.

2. In the background, behind the main goal, the author of this projects intends to get a closer look into the computer graphics in the field of videogames. This will be explained in detail later in chapter 2.2.

3. It is also intended to achieve other minor goals, such as the improvement of the distribution of time and the individual work, the improvement of the English language, both oral expression (several presentations were done to the professors throughout the project) and written, getting more ease when modelling and texturing in 3D, the ability of self-assessment and self-criticism…

1.3.   Acquired skills

The following is a list of the skills that I have acquired during the conduct of this project:

1.3.1. General skills

CG-1. Capacity for analysis and synthesis.

CG-2. Capacity for organization and time planning.

CG-3. Oral expression ability.

CG-4. Written expression ability.

CG-5.   Ability to learn and work independently.

CG-6.   Problem solving ability.

CG-7.   Logical analysis / critical reasoning ability.

CG-8.   Ability to apply knowledge to practice.

CG-9.   Ability to design and develop projects.

CG-10. Capacity for the creativity and the innovation.

CG-11. Capacity for motivation, achievement and continuous improvement.

CG-12. Ability to evaluate.

1.3.2. Specific skills

CE-9.   Ability to adapt the creativity, the methodological tools and the acquired knowledge to solve problems of different nature, related to graphical computing.

CE-1.   Understanding of the working environment of the open source software Blender.

CE-2.   Understanding of the working environment of the software Unreal Engine 4.

CE-3.   Understanding of the concepts of working in 3D animation and modeling environments.

CE-4.   Understanding of the meaning of the paremeters that control the application of a material with texture to an object.

CE-5.   Ability to model any object in 3D.

CE-6.   Capability of creating in 3D a virtual environment.

CE-7.   Ability to apply materials to objects and light scenes.

CE-8.   Ability to work and type UV texture with transparent and reflective materials.

CE-10. Capacity of spatial vision and knowledge of the techniques of graphic representation, both by traditional methods of descriptive geometry and metric geometry, and by computer aided design applications.

CE-11. Capacity of understanding of three-dimensional space, the basic elements that occupy it and the relationships between them.

CE-12. Ability to design and write projects effectively in a different language.

CE-13. Ability of comprenhension and oral and written expression, in a language other than the native one.

CE-14. Ability to transmit information, ideas, problems and solutions visually, in a quick way.

2. DOCUMENTATION

2.1. The city of Saarbrücken

The State Capital of Saarbrücken is the regional centre of the Saarland and is situated at the heart of the Saar-Lor-Lux Region. The city has approximately 180.000 inhabitants and is strongly influenced by its proximity to France and the chequered history of a French-German border town. The university, trade fair and conference city is set amidst vast woods and enchants visitors with its French charm, which is reflected in the narrow alleys at the foot of the castle and in the pedestrian precinct at the St. Johanner Market Square. Saarbrücken is currently evolving from a stagnant mining town to a vibrant centre of service, science, research and modern technology. Major companies and service providers, as well as almost all federal state authorities, are headquartered in Saarbrücken. The more than 200 specialist shops lining the modern pedestrian precinct and picturesque little streets and hidden courtyards around the St. Johanner Market Square are an excellent place to browse. A wide-ranging cultural programme and many different festivals and events attract thousands of visitors all year round.

2009 was a very special year for Saarbrücken, as the state capital celebrated its 100th anniversary. In 1909 the baroque town of Saarbrücken merged with the market town of St. Johann and the industrial town of Malstatt/Burbach to create the city of Saarbrücken as it is today [2].

2.1.1. St. Johanner Markt

Initially St. Johanner Markt is part of the fishing village of Sankt Johann. Currently the district Sankt Johann forms a part of the city of Saarbrücken.

Once the old fishing village had received in 1322 civil rights with a letter of freedom, it grew up and issued the marketplace as a local middle, surrounded by few streets and the town wall. During the thirty year's war, almost all medieval houses with the typical wooden galleries of the west part of the square were destroyed. In the mid-18th

century, and under the reign of Prince Wilhelm Heinrich, was held a Baroque renovation of the market, under the design of architect Friedrich Joachim Stengel.

St. Johanner Markt in the late 19th century [3]

Under the direction of Hermann Keuth, the leader of the Saarland museum and the curator's office, the Saint Johanner market was submitted from 1938 to a radical renovation programme, due t teh new interest of the Mayor Fritz Schiwitzgebel to be a center of tha main lines of transport. With the redevelopment measures in the Saint Johanner Markt all tracks of the historismus and the youthness were erased in the market cultivation to give a uniformly baroque style to the market. The new corrective actions are prolonged until the star of the Second World War.

During the bombing of 29th and 30th July, and October 5th, 1944, several buidings in the square were destroyed and had to be restores (fronts were rebuilt maintaining Baroque Style).

From May 1978 the square was established as pedestrian, thus keeping up to our days.

2.2.   3D Industry and videogames

Since its first appearance in the "Knight Lore" in 1983 video game developed by the British company "Ultimate", the inclusion of 3D technology in the design and

development of video games has increased each year. Nowadays, almost all the platform developed video games run in 3-dimensional environments.

But what the author really wants to emphasize, and finds most interesting, is the incredible improvement of graphic quality that has been produced in the last years. The characters and the scenes seem more real than ever, the movements have become more fluid, so subtle things like the grass flow in the wind or a sheet in the air take such perfection that lead the player to question if really all is done by computer [Figure 2.2., left].

The modelling and texturing of the environments has also suffered a significant improvement. One of the best examples that can be presented supporting this idea is the video game "Assassin's Creed Unity", created by "Ubisoft" and released on November 2014. The game takes place in the France of end of the 18th century, in the French Revolution. The graphics represent in a stunning quality the city of Paris in scale 1:1, as well as the crowds that are counted by thousands [Figure 2.2., right].

Head modelled in 3D [1]

Screenshot of Assassin's Creed Unity [2]

It is expected that the future video games will follow this course of improvements, both in graphics and movement. Virtual reality is also a theme that is revolutionizing the current industry, but it won't be the object of this project.

With all this, one of the goals of the author is to get an approach to all this industry, and investigate more on the modelling, creation and application of 3D materials.

3. WORK

3.1.   Conceptual phase

3.1.1. Software used

The programs chosen for this project have been Blender and Unreal Engine 4:

Blender

Blender is the free and open source 3D creation suite. It supports the entirety of the 3D pipeline – modelling, rigging, animation, simulation, rendering, compositing and motion tracking, even video editing and game creation. Advanced users employ Blender's API for Python scripting to customize the application and write specialized tools; often these are included in Blender's future releases. Blender is well suited to individuals and small studios who benefit from its unified pipeline and responsive development process [1].

Blender software has been chosen for this project because of two main reasons:

o   It is an open source software, which provides many advantages to the users, who can run, copy, distribute, modify and improve the software. Blender specifically has the GPLL (Geeral Public License), which has allowed to create a huge community around the program, that not only provide documentation, but create plugins, scripts, and all kinds of extensions, correct programming errors very quickly and never delay the incorporation of innovations. All this positions Blender as a dynamic and innovative program that can be used for several projects.

o   The reception University in Germany works a lot with this software, and they even impart a subject specifically about it. The author was offered the possibility of studying such subject during her Erasmus mobility, which she found very interesting and helpful for her career. In addition, one of the professors was present in both subjects, so it could make a more effective follow-up to the work answer many questions more quickly.

The main use of this software in the project includes the modelling and texturing of the buildings, as well as the renderings that can be observed on the "final results" chapter. (All of this will be seen in detail later in the next chapter).

Unreal Engine 4

Unreal Engine is a game engine developed by Epic Games. Their last version (UE4), is composed of a complete suite of game development tools made by game developers, for game developers. From 2D mobile games to console blockbusters and VR, Unreal Engine 4 has everything needed to start, ship and grow a new project.

This program, which is very powerful in the video games field, has been used in this project in order to test the possibility of using the 3D model made as an environment inside the atmosphere that would be created in a video game. Therefore, it has not been used as much as Blender, but some the aspects of export and display has been studied. For the future, this project leaves the doors opened to work and to study more in depth about the two programs together (chapter 5.2., future lines).

3.1.2. The medieval style

Why medieval style

The initial objective of this project was to make a recreation of the central square of the city of Saarbrücken in an earlier time. The author considers that the buildings of this time have a very attractive aesthetic, and that it could work well if the materials were chosen properly. In addition, another very important factor was the one of the current video games: medieval aesthetics has become very popular when it comes to environmental games. The author wanted to provoke an approach to this, give a first step that in the future could result in a video game, or a virtual tour that the user could do throughout the city.

Therefore is has been decided to make a reinterpretation of the square as it could be at the time of the late Middle Ages, during the 14th and 15th centuries, when the population received the charter of freedom of civil rights and before the Thirty Year War that would destroy part of the houses.

As annotation, say that the source of the square had not been built by those dates, and that is why it has not been modelled.

It is worth mentioning that this project is a reinterpretation, at any time it is asserting that the square had that aspect at the mentioned time. Although the access to old documents of the city was facilitated, the author considered that there wasn't enough data, and therefore the work would not be a completely real representation of that time; on the other hand, in this way more space would be left for creativity, of course respecting the overall dimensions of the buildings and the details that characterize this historical epoch.

Medieval style characteristics

The atmosphere is one of the key points of this work, that is why a research on materials, colours, textures, and forms that characterized medieval (more specifically, to the late Middle Ages in Europe) has been done.

In these centuries, stone, wood, metal and skin are basic to manufacture all kinds of elements. This, together with the provided colours for the sky, the sea, the field and the mountain, delimit the chromatic range to the Brown, sand, grey, blue and green. There is also a strong presence of the colours red and scarlet, not only referred to the blood, as usual in wars, but by its use as a dye, used only by the upper classes. All this results in a chromatic scale of colours dark, indistinct, which give a natural look. From here, you can play with the brightness, saturation…in order to achieve the visual aspect that most suits the intentions of the author. In addition, these materials set a type of texture also quite rural.

Similarly, it is essential to take into account the time light sources. Efforts are made to be played with sunlight, the weather (cloudy, sunny) and with artificial lights, coming mainly from torches and candles (fire in general), with red and orange colours[3].

3.1.3. Field work

With the aim of carrying out a reconnaissance of the square and its surroundings, initially a field work was done, during which the following tasks were performed:

- o Recognition of the area to model in first person. Prediction of the easiest and more difficult points of the modelling area, establishment of the boundaries of the square (number of houses that at the end will be modelled).
- o Taking pictures of all the buildings, especially from the front (later these images will be used as a reference).
- o Taking pictures of the details, windows, frames, signs, signals… Details in medieval style.

Here are some images taken that day with their corresponding annotations:

Panoramic photo from St. Johanner Markt, west, north and east

In the first picture you can see an overview of the faces West, North, and East of the square. The constructions are quite repetitive in the West part, their heights are similar and they use practically the same types of windows (only the size change from one building to another). In the North wing something similar occurs, the buildings are very similar themselves, the main differences can be found on the colours and the arcades, that contrast one with each other. On the East wing a significant change ca be observed. The heights are different (these buildings are lower), and the sizes too, since we move from what could be considered a block of flats to a House. The colours also differ, as well as the types of windows.

The form of the square is approximately the one of a rectangle.

Panoramic photo of St. Johanner Markt, east and south

In this second photo, formed by a combination of several images, some more details can be seen, in addition to the South wing of the square. The roofs are curved, allowing the water to slide easily when it rains, and the arcades are of different heights. You can observe that altogether is preserved that medieval air that the city had had in other times.

3.1.4. Selection of the 3D models

After performing the field work, the buildings that would formed the final 3D scene of the square were chosen. The main question was the amount of work required for each building, since each of them is unique and has different dimensions, so it would have to be modelled as a new object. The same thing happened with the application of materials and textures.

Finally it was decided to model a total of 21 buildings, that are the ones that directly surround the square. In the next images the plat of the buildings can be seen, as well as its situation:
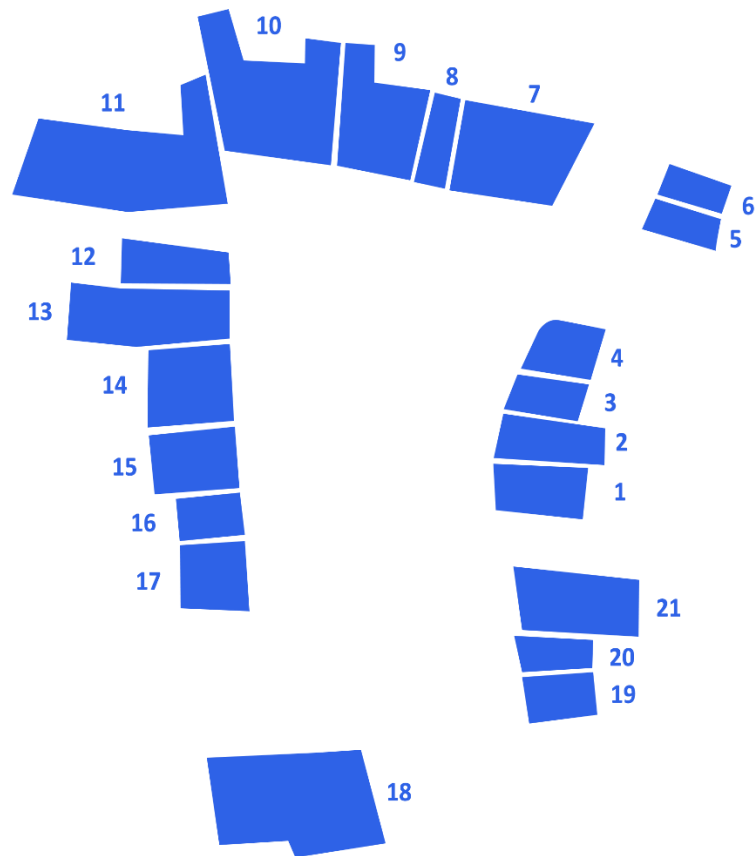
3.1.4. St. Johanner Markt buildings, numbered

From now, each of them will be referred to by its corresponding number, unless otherwise.

3.2.   Modelling phase

The project has already been defined, the documentation is searched and the inspiration and initial work of field has been done. The next step is the modelling phase, one of the most important ones of the project.

To be able to begin with, multiple dimensions are required.

It will begin with making the floor of the building (as seen in the previous picture). But, how to set precise dimensions and a correct location of the floors of the buildings? To answer this question, we will use a few maps from OSM.

3.2.1. The OSM maps

Open Street Map (OSM) is a collaborative project that creates free and editable maps.

The maps are created by using the geographical information captured by GPS devices. A large community of collaborators contribute by adding and maintaining data on roads, trails, cafes, railway stations and much more throughout the world.

This mapping both the images created as vector data stored in its database, is distributed under Open Database License.

OSM also works with Blender. So the next steps of the project were the following:

First enter the webpage www.openstreetmaps.org.

Go to Saarbrücken and selecting the area of interest. Save it.
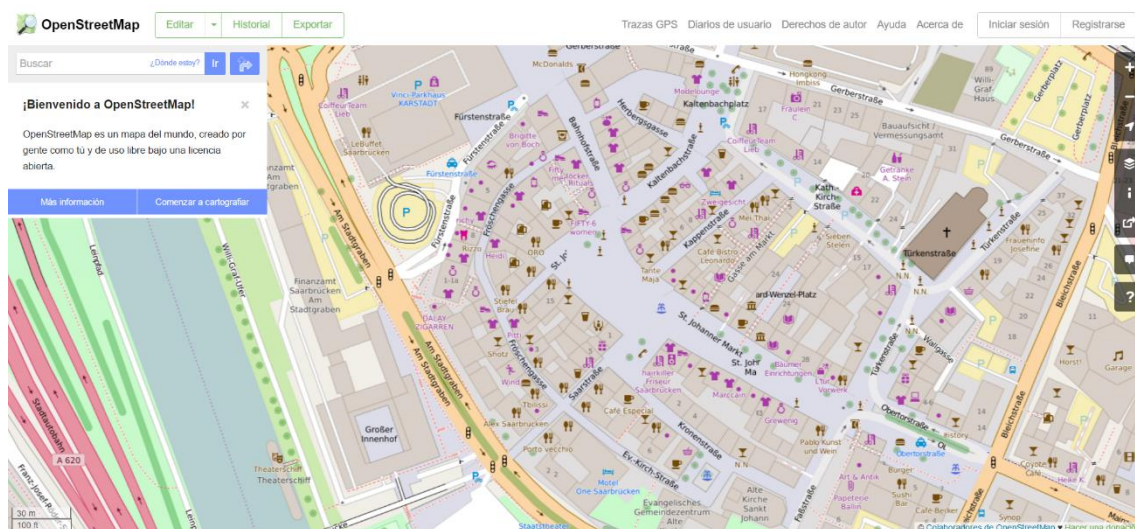
OSM area of interest, screenshot

In order to import the OSM map into Blender, an addon has to be installed. Once the installation is complete, it will appear in the programme as the image below:
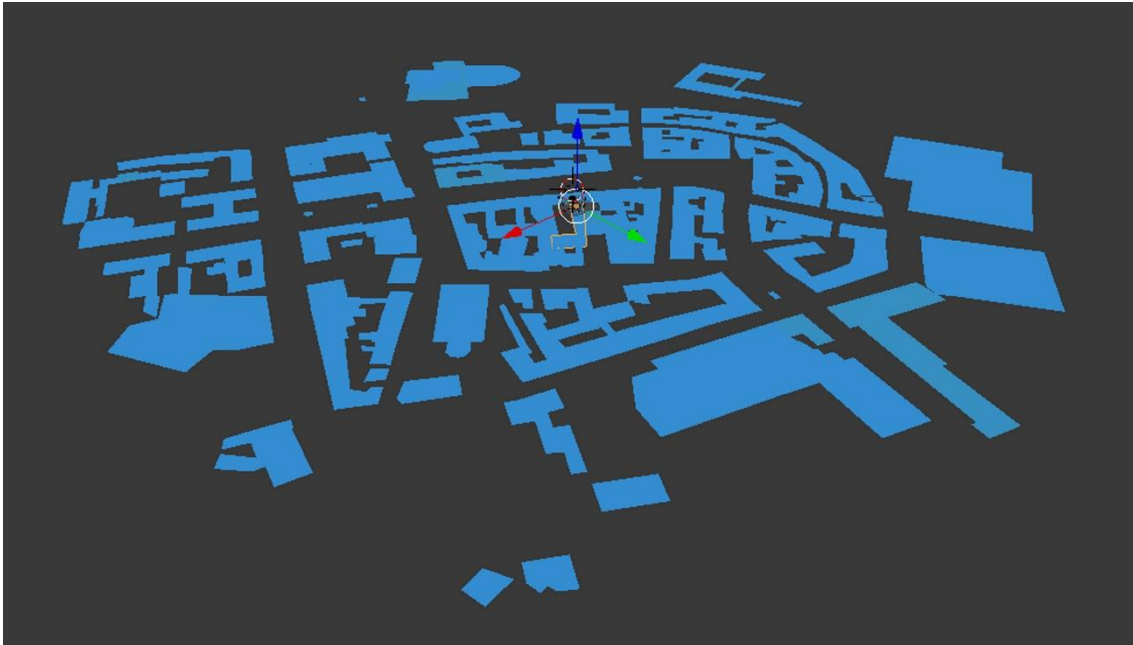
Blender screenshot, OSM

The first measures now are taken in a successful way.

3.2.2. Taking heights

Now the heights are the new problem. Sometimes, if the place is popular enough, these heights appear directly when importing the map. This is not the case, so another method will have to be used.

At this point, a different programme will be used: Google Earth Pro, one of the latest versions of Google Earth, has a new tool that allows the user to take measures in a 3D space.

Google Earth Pro counts with 3D map, but the quality of it on short distances is very low. Therefore, it is useful in order to take some height measures with the "rule" tool, and to see the general aspect of the buildings, but not to create a very detailed 3D model.
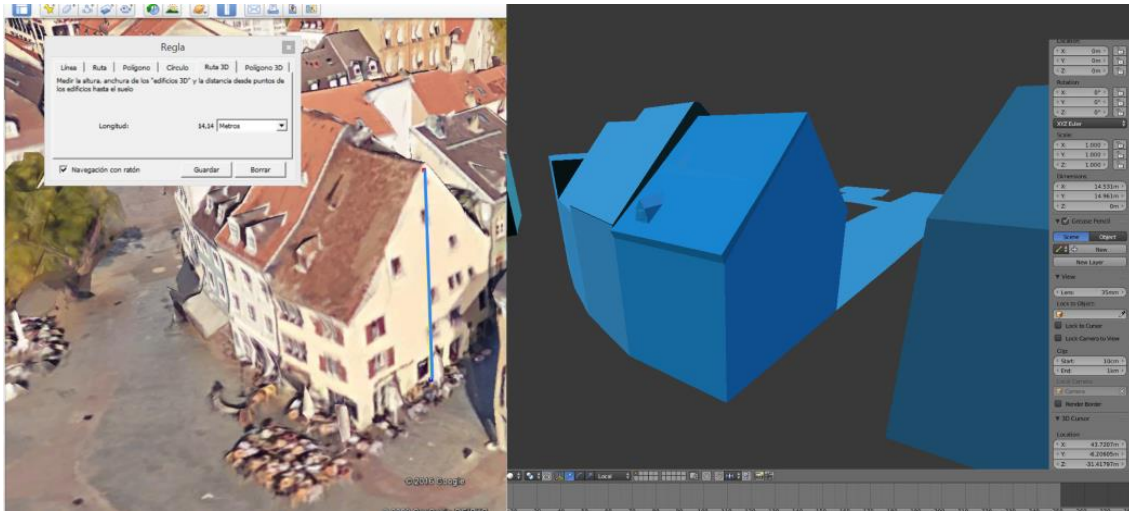
On the left, Google Earth Pro with the "rule" tool measuring. On the right, 3D model by using that measure.

At the end the heights were quite approximated and the results of the first shapes of the buildings were good. You can observe them on the next image.
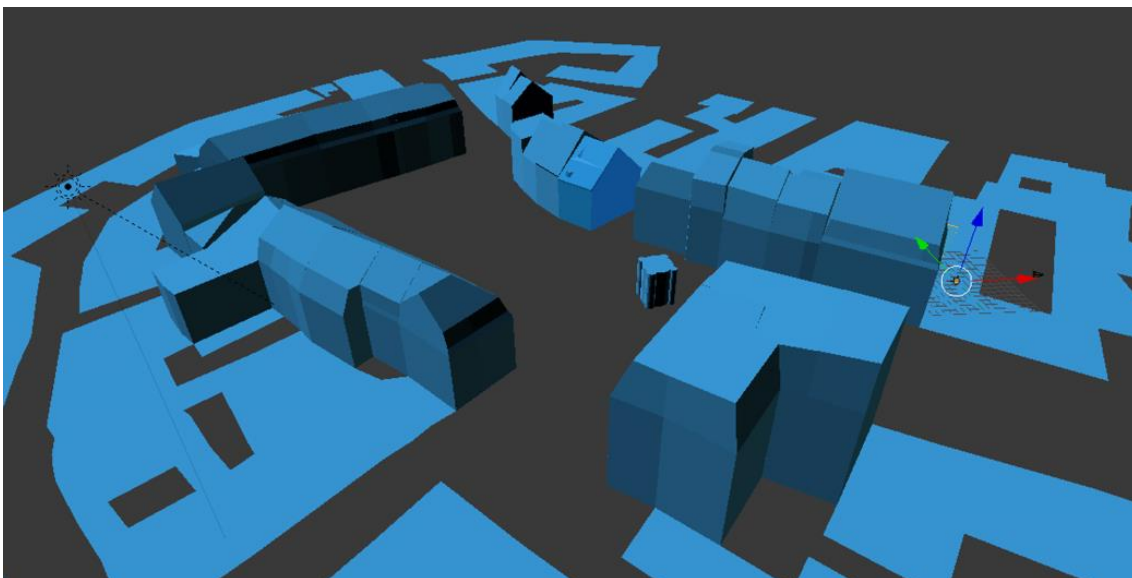
Blender screenshot, results of first shapes of the buildings

More parts of the map are also seen in the last image. They will be deleted in the following steps.

The process of initial modelling of the buildings was made from primitive, particularly from banks, which then have been modified and subdivided into the shape they have today. The recreation of 3D cities is characterized by widespread use of such primitive. Boxes, combined with the right texture, can lead to surprising results.

3.2.3. Initial texturization

The following step is a texturization, but it is included in modelling (3.2.) because it is used just in order to have a reference for building the details of the constructions. It is not the final texturization, but an initial one.

For doing this texturization, they were taken pictures of all the fronts of the square, and included in their respective constructions.

Initial texturization in Blender

The results are not very precise, but the author was not looking for perfection but for a quick and simple way of having a clear reference of the position of all the elements (windows, doors) in the scene.

3.2.4. Detail modelling and integration

After the evaluation of several options (remember that the author had not worked with Blender before), it was decided that the most effective way to proceed was doing the details (windows, doors ...) in another files and then import them to the scene, instead of working directly on the buildings. The reason is simple. There are many details that are repeated. If these were to build editing one of the buildings and be part of such a building, very difficult to use them for other buildings that need the same modification. So, it is better to build every detail and then duplicate it for use in other constructions, and keeping its properties.

Note: Most of the following details were designed with the software CATIA, because of comfort and time: Details have more accurate measurements and many constraints, which to the author were easier to establish with this software.

The details that were modelled are presented here:

6-parts window:

This window has been one of the most used in the project, in different sizes (depending on the building). In the left image, you can see four colours: each one of them corresponds to a different future material.
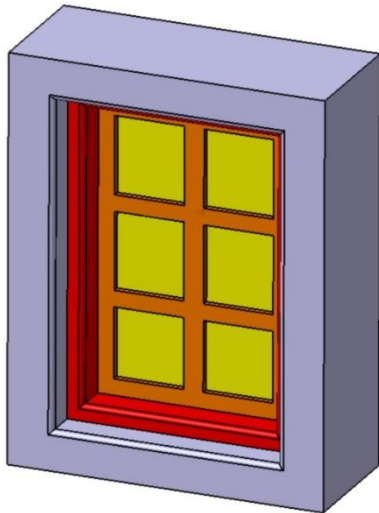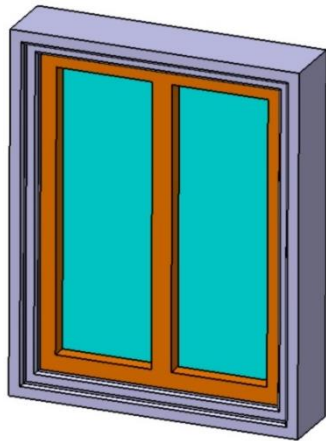

6-parts window with CATIA

6-parts window photo

2-parts window:

This window is bigger, and is designed for the lower parts of the buildings. The building of the right photo is the number 1 (image 3.1.4.).

2-parts window with CATIA

2-parts window photo

Window shutter type 1:

This window is only present in the building number 11 (image 3.1.4.)
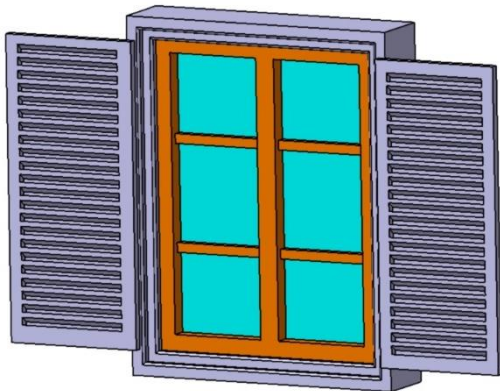
Window shutter tipe 1 with CATIA

Window shutter tipe 1 photo

Window shutter type 2:

This window is done directly in Blender, and it is only present in building number one (image 3.1.4.)
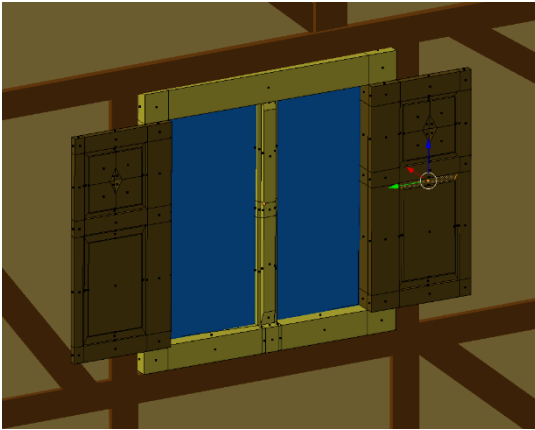
Window shutter type 2 with CATIA

Window shutter type 2 with CATIA

Arcade:

This arcade was totally created from zero. It wasn't a part of the scene, but it was incorporated to help creating the medieval atmosphere.
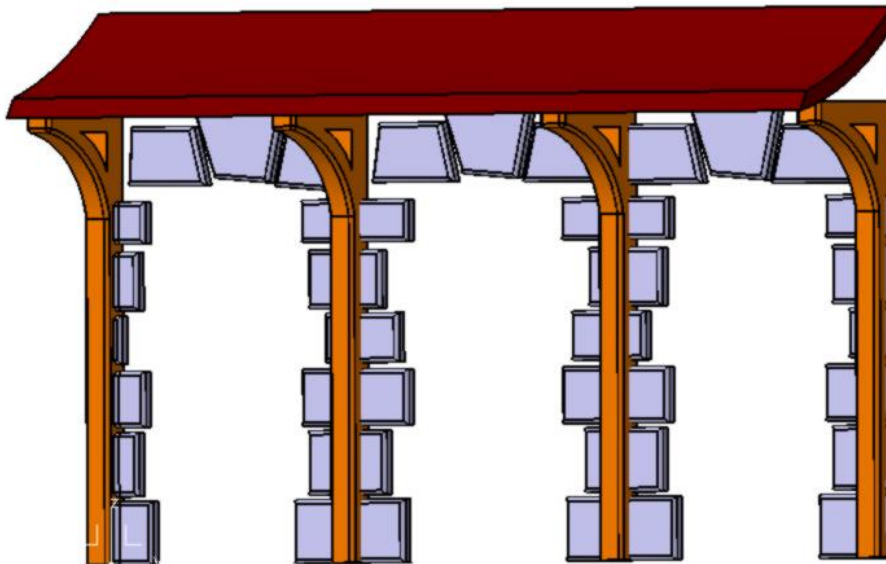
Arcade, with CATIA

Top window:

If you observe the top parts of the buildings, you will see that they have little windows coming out of the roofs. The window that has been designed has a lot of depth, so it can be adapted to all the types of roofs (some of them have more descent than others). In the lower right picture the windows are inserted in their respective position on the top of a couple of buildings.

Buildings, photo
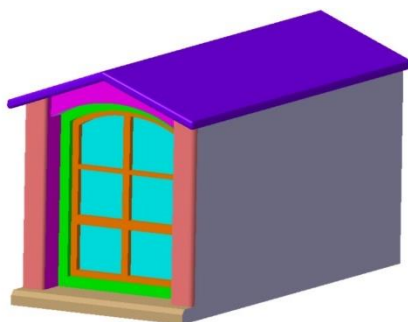
Top window, in CATIA
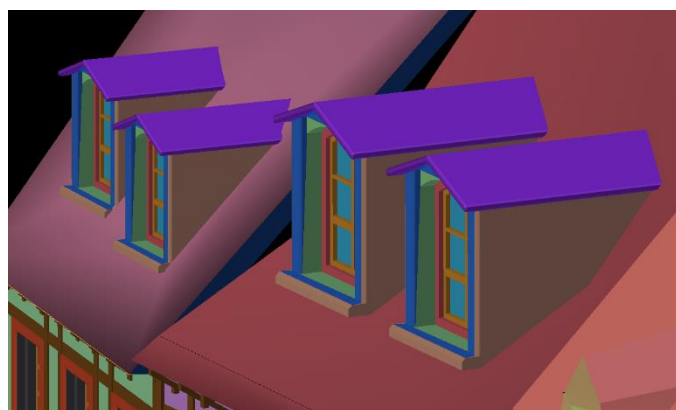
Top Windows placed on the buildings, Blender file

After designing the details, these are imported as objects in the Blender file (.obj).
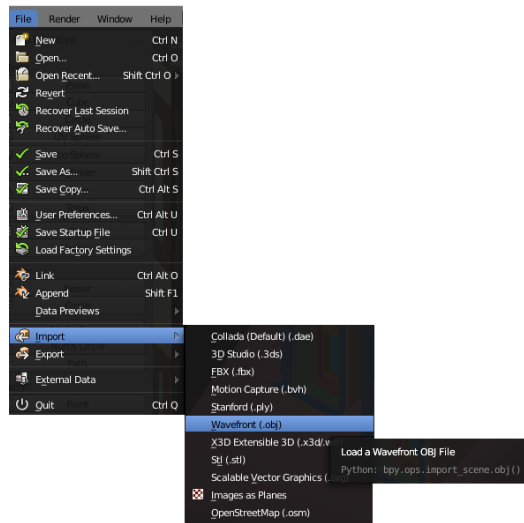
Importing an object in Blender

Details have to be inserted in the scene one by one, and then place them in their proper places. Many of them are repeated, so it is used the Ctrl + D on the keyboard in order to duplicate one of the objects. Thus, if a detail has been repeated 30 times and a modification to one of its copies is done, all the others will automaticly vary. This saves a lot of time when making changes or aplying materials.

3.2.5. Material separation

The details have already been added to the scene. Now each material is separated in a different colour, so that later it will be much easier to select and apply textures.

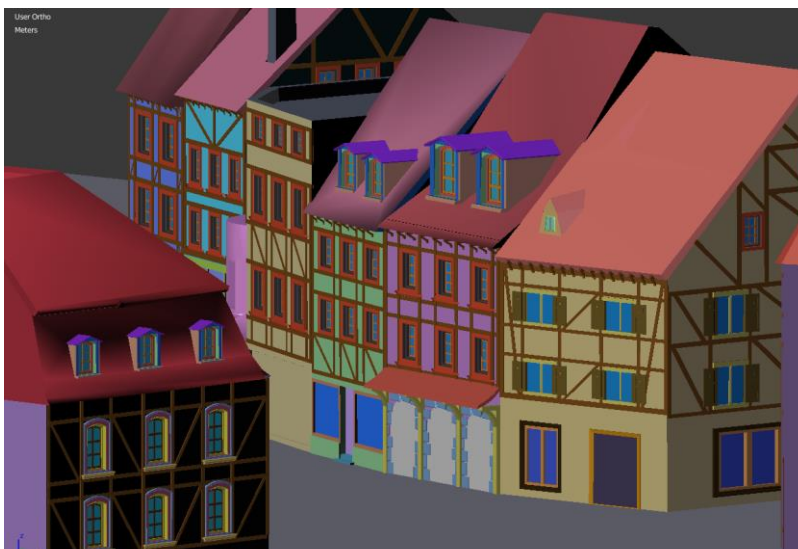These are some screenshots taken with all the materials properly placed:
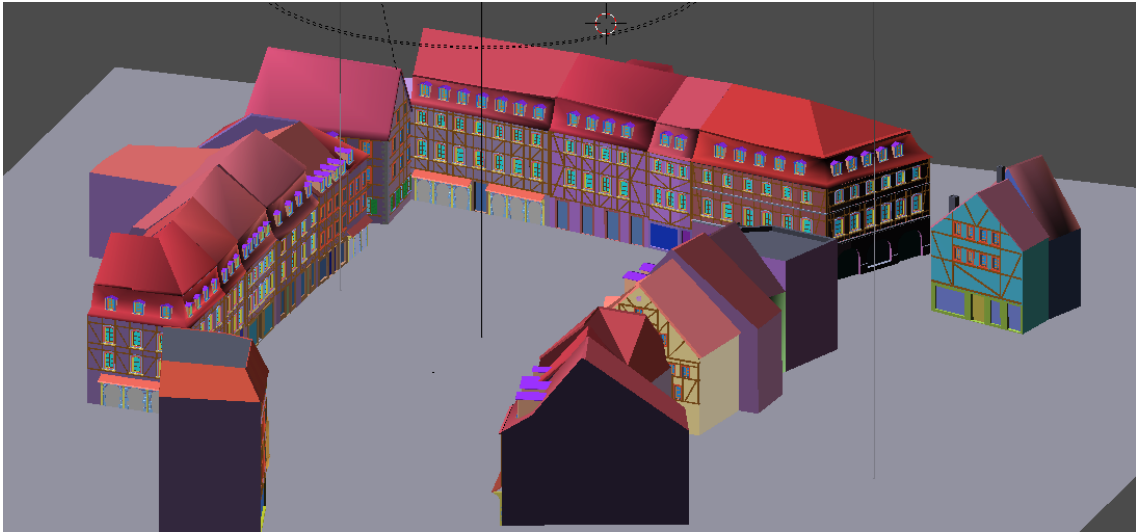
Blender screenshot, general
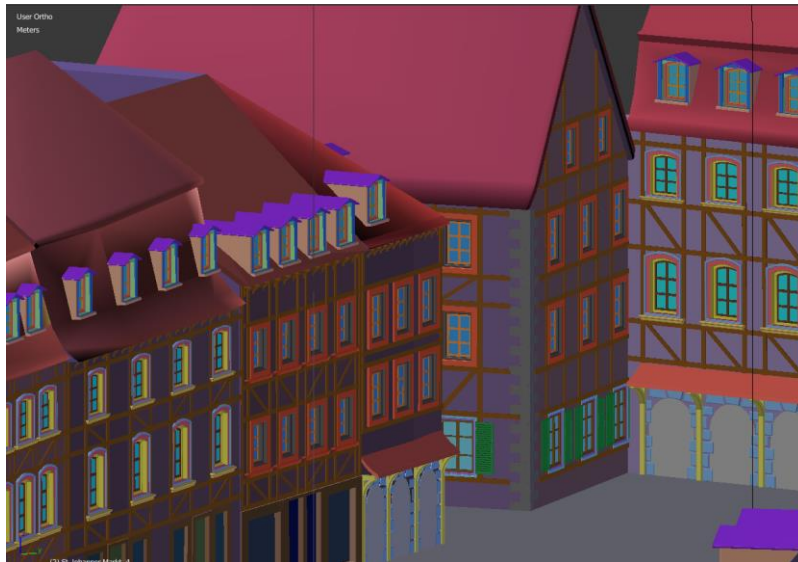
Blender screenshot, West wing

Blender screenshot, East wing

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The lower parts of buildings (ground floor) have been made one by one on the house own objects, ie, modifying the original file importing Blender and not, as previously done with the details.

Another thing that can be seen is that all the houses have been added decoration around the windows and the entire front consisting on bars, which subsequently take the appearance of wood. By this is meant to mimic a satisfactory way the medieval style of the late Middle Ages, but at the same time the current dimensions and shapes of the houses are maintained.

3.3.   Texture phase

The texturing phase is as important as the modelling, especially if what is sought is realism. Textured not only lets you add colour to the model, but also simulate different materials (stone, wood, etc.) and give more details. The textures we will use will be drawn from photographs of real textures.

The main texturing procedures are carried out using materials and maps. To understand this, we first have to know about the material editor. This editor provides functions for creating and editing materials and maps, and to assign these to different objects in the scene. Each of the areas that compose the publisher has a material, a map or a combination of both.

3.3.1. The maps

The map is a two dimensional image associated to a material to enhance its realism. Maps not only add colour to the model, but also can simulate other features such as roughness or relief, without altering the geometry. These effects are possible because

the program recognizes the brightness of each of the points on the map and assigns, from this, an effect of roughness, transparency, emboss, etc. [4]

If we modify the geometry to add detail to the object, the number of polygons increase, so the computer will need more power to process the object on the screen. It is therefore much more effective use maps, with which the image processing is so fast that in some games come to render in real time.

For this project will be used mainly 4 different maps: Colour map, bump map, normal or and reflection map.

Colour map:

It just adds the colour of the texture.

Bump map:

A bump map creates the illusion of depth on the surface of a model using very simple lighting trick. No additional resolution is added to the model as a result of a bump map. [5] Bump maps are grayscale images, and their work is very simple. When the values are lighter (the lightest one is white), the details appear to pull out of the surface. But when the values are darker (the darkest one is black), they appear to be pushing out of the surface.

Normal map

Normal maps are considered an improvement of bump maps. Instead of using a greyscale, a normal map uses RGB information that corresponds directly with the X, Y and Z axis in 3D space. This RGB information tells the 3D application the exact direction of the surface normal are oriented in for each and every polygon.

Reflection map

They are similar to the bump maps. They are greyscale images, and depending on the type of grey, the surface will reflect the light more or less (lighter, more reflection).

3.3.2. Mesh collocator: Unwrap modificator

In order to place the texture on the mesh of the object, it has to unwrap (bottom). For this, the UV mapping is used. UV mapping 3D modelling is the process of projecting a 2D image to a 3D model's Surface for texture mapping.
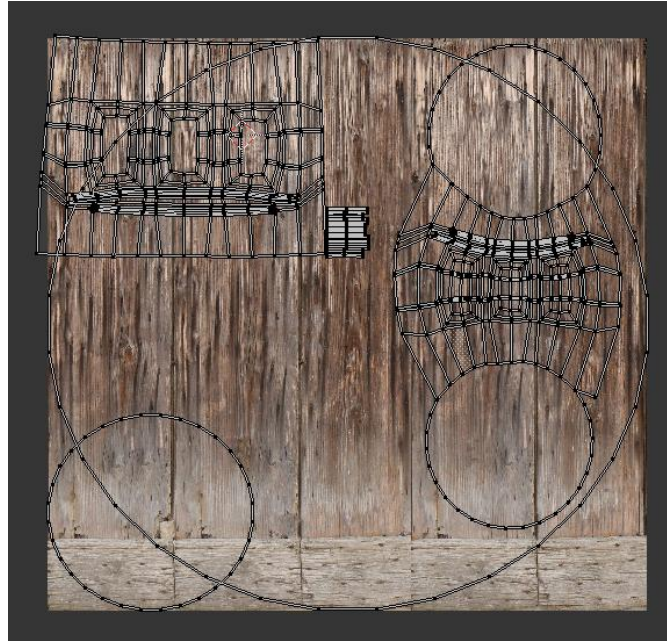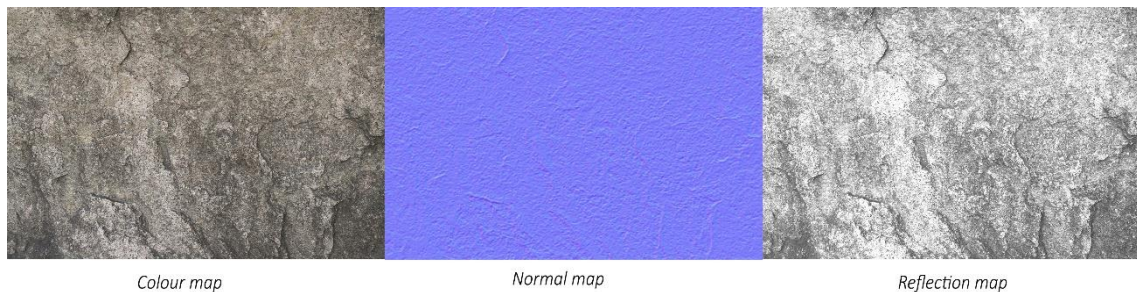

UV unwrap in Blender, part of the building number 18

3.3.3. Materials and maps used in the scene

Here are the materials used in the scene with their respective maps.

Stone

Two different materials were made out of Stone. The first one is the following:

| *Colour map* | *Normal map* | *Reflection map* |

As you can see, three different maps have been applied. The first one, the colour map, that works like a base: With the colour map you can easily scale the mesh and place it

in the correct place. Then there is a normal map, because the surface of the stone is very steep, and finally there is a map for the reflexions.

The next stone texture differs from the previous, because it represents a set of stones and not just one:
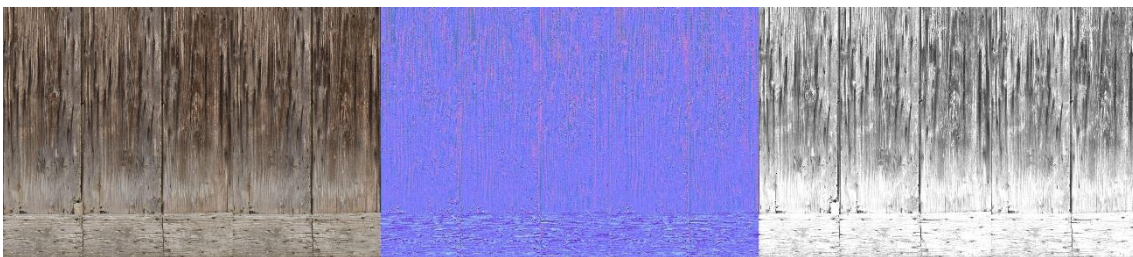

Colour map *Bump map*

In this case, just two textures are applied to the material.

Wood

The most popular texture in this project. The results with the Normal map were so much better than with the Bump map.

Colour map *Normal map* *Reflection map*

Glass

The author searched for an old and dirty white glass. At the end, this glass made a great effect in the final results. Just two textures were needed.

Colour map *Bump map*

Wall

You will see that here there are 3 colour textures. They are mixed in various combinations to get different final textures between neighboring buildings.
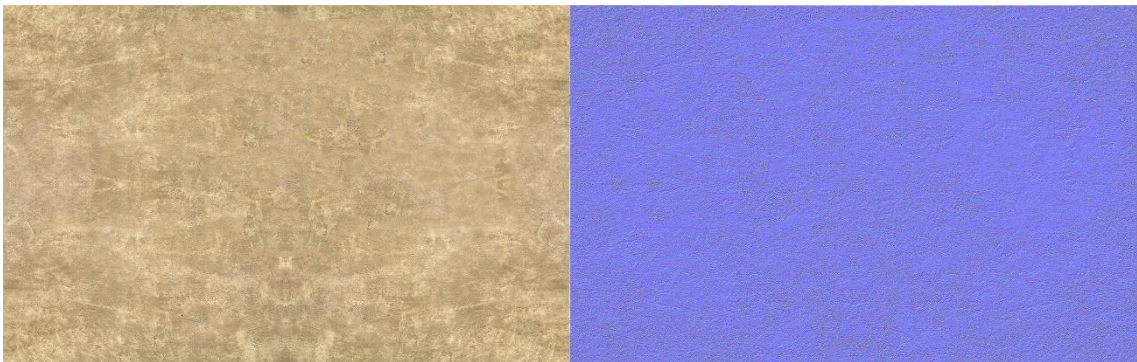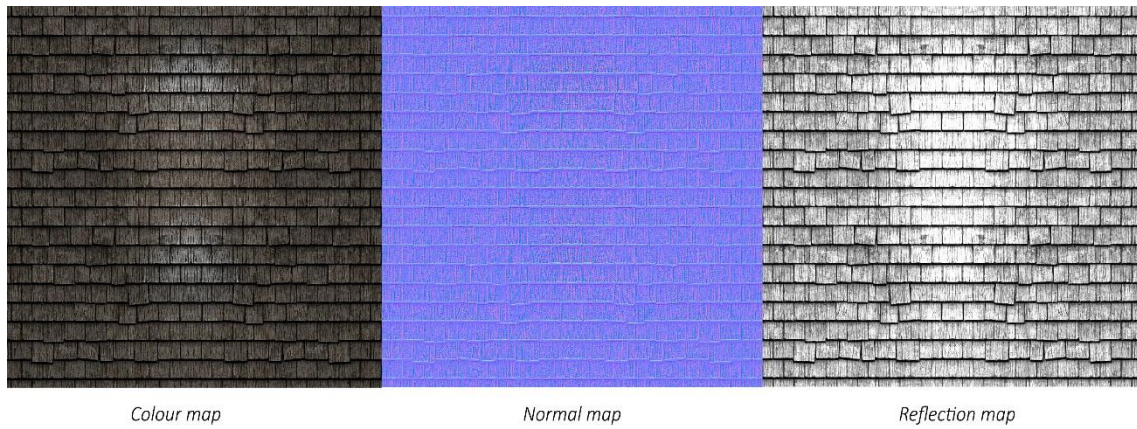

Colour map *Normal map*

Colour map 2 *Colour map 3*

Roof

Great selection of an old roof, that is better for the project medieval roofs.

Colour map   *Normal map*   *Reflection map*

Doors and windows

All the textures are reference on the chapter number 6.2., "references - images".

Colour maps

Bump maps

Floor

It was the last thing added to give more continuity to the scene and a greater sense of realism.
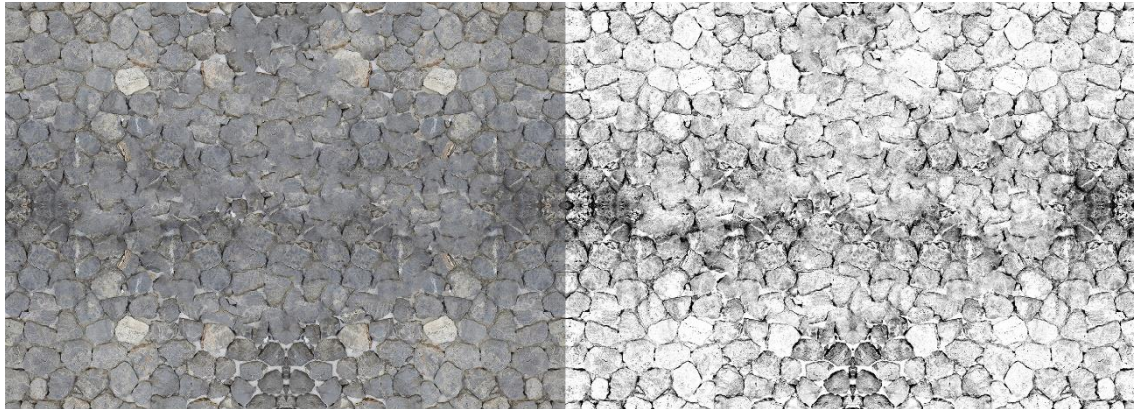
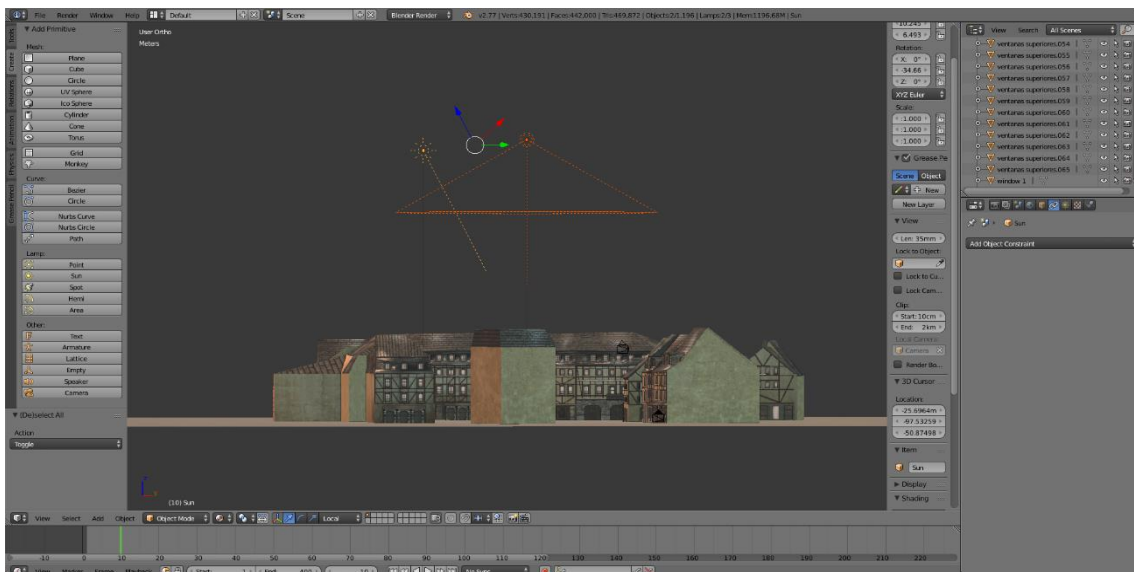*Colour map*   *Bump map*

3.4.   Final phase
3.4.1. Creating renders in Blender

In order to create renders in Blender, two main things have to be set: The camera and the light.

For this project, a nice sunset light has been created by using a spot light and a sun light in orange tone that illuminates with inclination.

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Light positions in Blender file

The camera was positioned on various points and several pictures were taken. (Results in chapter 4).

After taking the pictures, the sky was removed and a new one was added with photoshop, accorded to the light collocation.
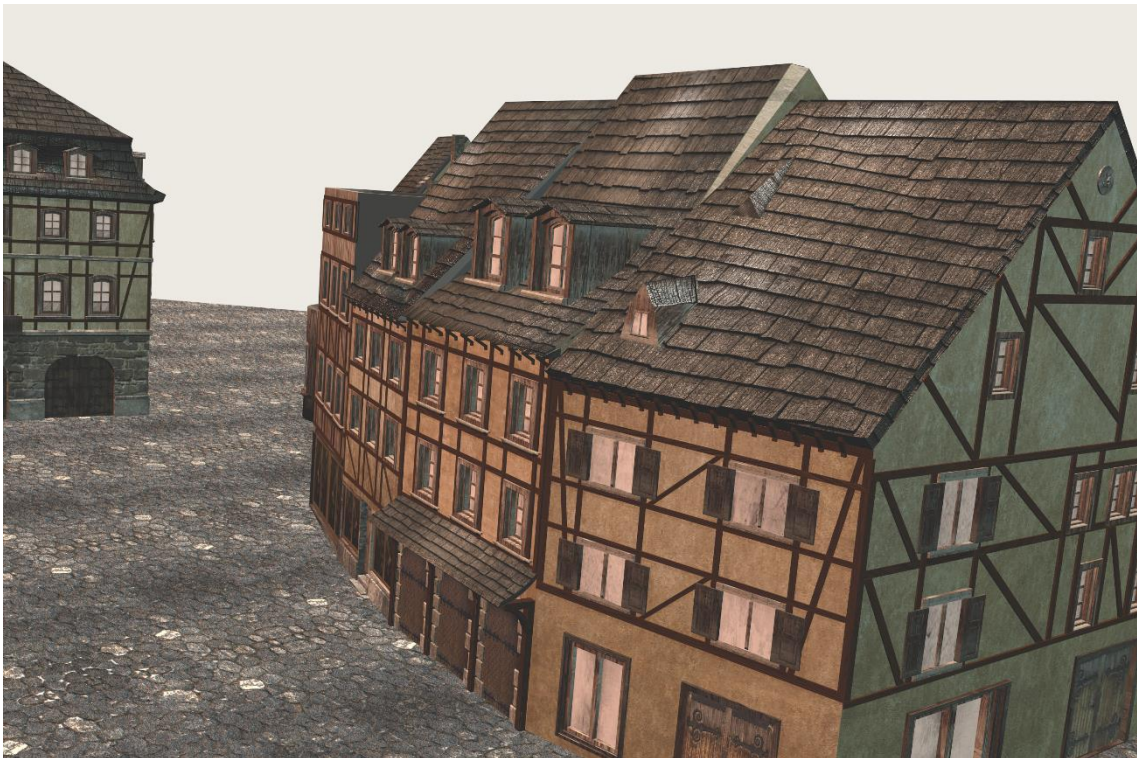
4. RESULTS
4.1. Renders

Here are some renders of the final result of the scene with all the houses together. You will see also some renders of details.

4.2. Comparison

Here it is represented each of the buildings separately in comparison with the corresponding photograph. They are all based on actual building except the constructions number 18-19-20-21, whose interpretation has been free.
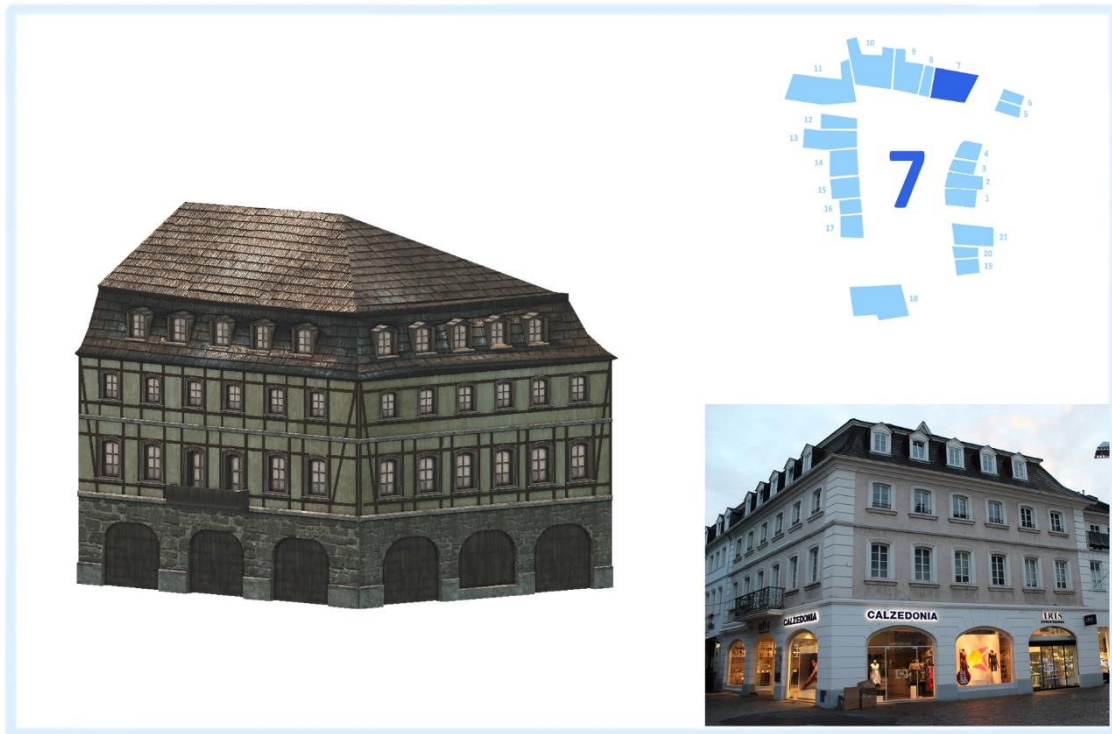
17

18
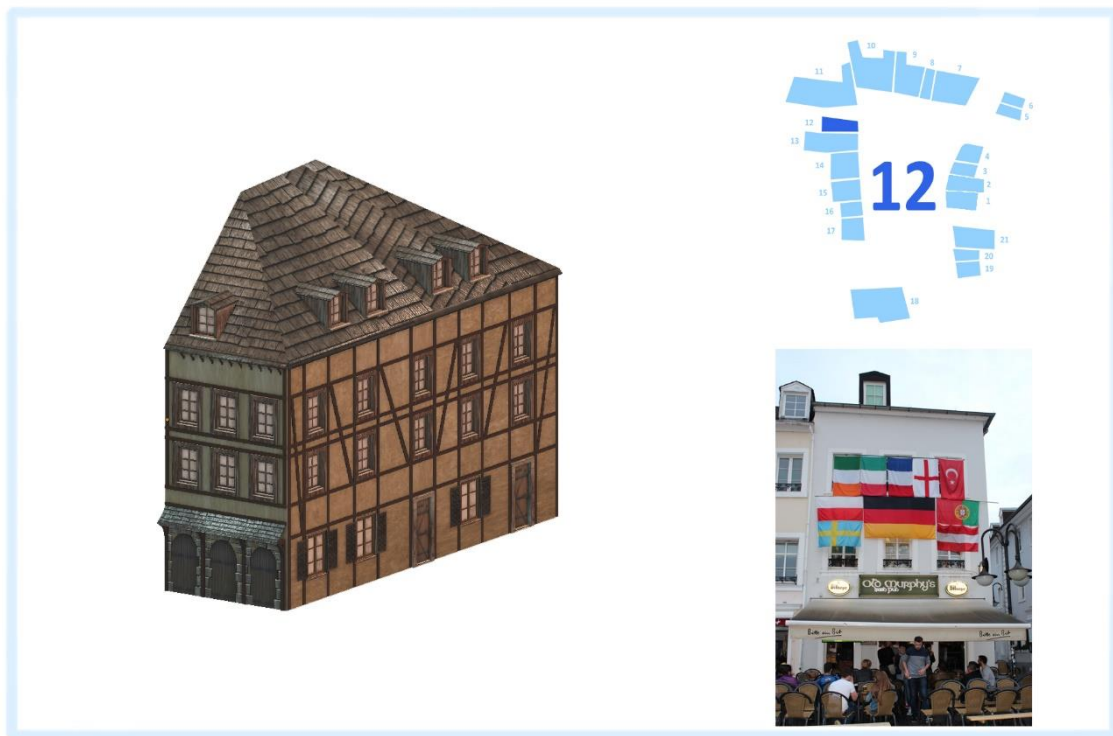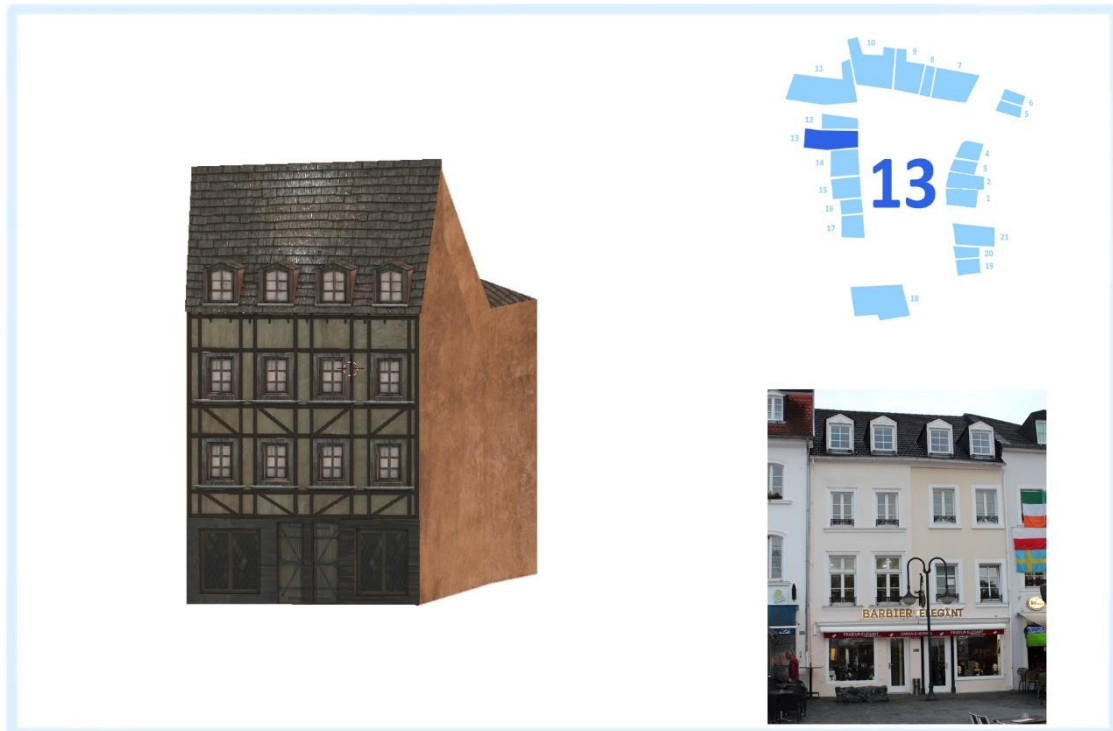
4.3. Incorporation of the scene in UE4

The scene was also imported into EU 4. The purpose of this was to know how it worked in a video game ambient, and if it could be used in the future as environment. To do this, we had to export the FBX file format in Blender, and then import it into Unreal Engine 4. After spending time testing and watching the scene reactions to different changes, several conclusions were conducted, both positive and negative.

Positives: Once you import the file gets, the atmosphere is more realistic than in Blender. Furthermore the scene is well integrated into the environment.

Negatives: It was very difficult to reach export the file correctly. There was also a fairly complex problem: UE4 also imports textures. If you only have a color texture is no problem, but at the moment you have more textures (normal map, reflection map), the program is confused and mistakenly placed. This causes the user must adjust all textures of all materials again.

In short, the scene itself is suitable for UE4, but should improve some things and work on it.

Scene in Unreal Engine 4, daylight

5. CONCLUSIONS AND FUTURE LINES

I consider that the work has been good in all aspects. The goals that were set at the beginning of the project have been accomplished, and the project has been developed during an Erasmus mobility, which has derived in new unsolved problems that would not have occur in a Spanish University.

The way students work at the HBK Saar is very different from the one at Valladolid University. The classes are more practical and the work groups are smaller, usually from 8 to 12 people. The project has been developed without problems, with several reviews and talks with the professors. I would like to notice that this is a graphical project, so the visual charge on the memory is obvious, being this one of the main values of the work.

The aspects of modelling and texturing have been the most important and the ones that required more time. The modelling required time because I had to compare constantly the 3D model with the photos of the actual square. In addition, the modelling wasn't just one building but a group of 21 one buildings each one of them with different dimensions. In the texturing, the most complicated parts have been the wood and the roofs. Both required an amount of time, but at the end the results have been really good.

The experience with Blender was good to. At first it was a challenge: Although I had worked with other 3D programs before, Blender work a little bit different, so the models are not built the same way. After doing this project, I can say that I can work with the software properly.

The general experience has been really good. Professors have guide me in a successful way throughout the project, and I have improved many skills, including the English and German languages.

For the future, I expect to do my master in 3D design and specialized in that area. I think this project has helped me to decide what to do in the next years.

In the next future I also want to work more with the other software, Unreal Engine 4, and see how to improve my results. I think it provides the user a lot of possibilities.

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