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3D MODELING AND VIRTUAL REALITY AS A TOOL FOR PRESENTING
ARCHITECTURE TO A CUSTOMER

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3D modelling and Virtual Reality as a Tool for Presenting Architecture to a Customer

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Abstract

Nowadays, modern technologies are becoming more and more developed and they are used in different fields. Virtual reality is a new technological boom. Subsequently, it is possible to combine virtual reality and the design field.

This thesis is a research about virtual reality, 3D modelling and how it can be used in the architectural sphere. Tyris Software, a company in Valencia, Spain, commissioned the project. The main goal was to invent and develop a platform for architects and customers where virtual reality would be used as a helping tool in the construction of new houses.

The idea of this project appeared due to people's poor visual thinking and difficulty in imagining a house from plans or 3D renders. Thereby, the research is based on a real project with a client and an architect. The platform was developed and tested with the help of the team from Tyris Software and quantitative research.

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1 INTRODUCTION

Nowadays, architecture is becoming more and more interesting: complicated constructions, various shape and better adaptation for humans. “There is an inevitable, powerful relationship between the new digital tools on the one hand and the new organizational patterns, compositional tropes, stylistic characteristics and aesthetic values on the other hand” (Taylor 2008, 69-70).

Moreover, it is popular to turn to architects to construct a unique villa, countryside house or chalet. However, sometimes customers are not satisfied because they do not get what they really wanted due to the point that not all people have good imaginations and visual thinking. Regarding the book *Visual Thinking for Design* by Colin Ware, people even have not received the full image of what is around: “Now we know that we only have the illusion of seeing the world in detail” (Ware 2008, preface ix). Furthermore, the community of visual researches claim that most people cannot generate 3D models in their heads, even simple ones; only some groups of people, for example, who relate to the engineering, architectural or art fields and carpentry are able to imagine 3D models in their heads.

Consequently, it is not enough for a customer just to have plans and realistic 3D renders to have a full imagination about his future house. Thus, there is a big possibility that misunderstandings can add up between the client and architect.

The solution can be showing 3D models of houses to the customers in virtual reality so that they can take a walk through their houses before the construction has even started and make proper changes in advance.



Picture 1. Virtual reality as a tool for presenting architecture.

Subsequently, my thesis is based on the project which I made in collaboration with Tyris Software – a software development company in Valencia. The goal was to develop a good system/platform for architects and customers with the help of 3D modeling and virtual reality.

My thesis consists of theoretical parts and visualizations; there is information about the company with which I am working on in this project, a little bit of history of virtual reality and interesting facts. Thus, there is basic research about the Mediterranean style in architecture due to the project being located in the southern part of Spain. The thesis also includes the framework, which methods have been used during the research, design process and teamwork. The difficulties and problems is an essential part too; consequently, there is a section about these and a manual for the future modelers. At the end of the thesis, the final project, a description, an explanation and a link to a video are located. Moreover, there is information about competitors in Spain and all over the world and the analysis of the offers, in which way the platform My Virtual House is different and why service of Tyris Software is better.

2 FRAMEWORK

There are three main participants in the process: the customer, the architectural company and Tyris Software. At Tyris Software there is a group of people who are working on this project. The structure is that an architect gets an order from a client, he makes plans in CAD and then passes them to the company. Depending on a rate a 3D model is built, then the company organize a virtual tour and later changes are applied.



Picture 2. Concept.

The project is practice based; consequently, an essential part is qualitative research. The thesis is focused on the results from virtual reality tests, questionnaires and interviews. The main target of the involved people is architects and potential clients.

3 BACKGROUND INFORMATION

3.1. About the company

Tyris Software (<http://www.tyris-software.com>) – is a visual and graphic technologies company located in Valencia, Spain. It is a start-up company which was founded in 2014. The size of the company is quiet small; it consists of 11 workers.



Picture 3. Logo

The company provides services and develops products. The main focus is on modern and future technologies like augmented and virtual reality, natural interfaces, 3D mapping etc. Although the company is new, they have already done big projects for famous companies like La Liga (Spanish professional football association), Oceanografic (Oceanographic in Valencia), Sonepar and in cooperation with Red Bull and Coca-Cola. In November 2015

the company started to develop a new service “My Virtual House”, in which I was accepted as a 3D modeler.

3.2. Virtual reality

“...when VR tech matures, it's going be more powerful than cocaine.” - Olivier Demangel, a designer and visualizer, who works for London 3D imaging company IVR NATION (online magazine Dezeen 2015). What is virtual reality, where is it used nowadays and why it should be powerful in the future?

3.2.1. Basic information

Virtual reality is a three-dimensional environment which is experienced by humans. The point is that with 3D goggles it is possible to trick the brain and immerse in another world.

There are different versions of when virtual reality was appeared. According to several references, for instance, the article “Virtual reality gets real” the father of virtual reality is Morton Heilig – a cinematographer (Williams 2015). In 1962 he made a pattern of Sensorama Simulator. He has invented a machine that stimulated all the senses with the help of a stereoscopic 3d screen, speakers, a moving chair, fans and smell generators (Williams 2015).



Picture 4. Sensorama (<http://www.mortonheilig.com>).

However, the term of “virtual reality” appeared only in 1987. Jaron Lanier, the founder of a visual programming lab, gave the name to this research area - “virtual reality”. (online article Virtual reality society 2016.)

Year by year VR has been developing and nowadays it is used in different fields. For instance, it found a wide range in the field of design, engineering, journalism and even medicine. The next paragraphs include some information about how virtual reality has affected these fields, information which proves that virtual reality is real and why it should have huge success in the future.

3.2.2. Sense of presence

The number of tests have shown that virtual reality makes people feel the environment they see through the 3D glasses. Of course, not all people feel that they are 100 percent in another reality but at least they feel themselves in 2 places at the same time.

In the experiment “Hunger in Los Angeles” which was made by Nonny de la Peña and her team, a real life situation was imitated with the help of virtual reality. This took place in a long queue to a food bank in which one man with a diabetes fell into a coma because he had not received the food in time. Even though the graphics were not that realistic, people who took part in this experiment desired to somehow help the man. Thus, in combination with 3D models and sounds it is possible to make humans feel another reality (Peña 2015 TED Talks).

Moreover, the use of VR has found practice in medicine - in the field of mental healthcare. For instance, according to BBC article “2016: The Year When VR Goes from Virtual to Reality” by technology correspondent Rory Cellan-Jones, nowadays VR is used to treat phobias. Dr Ashley Conway and Dr Vanessa Ruspoli – psychologists from London, have invented a therapy with Oculus Rift headsets to help people with phobias. This therapy can help people with different phobias, from fear of flying to agoraphobia. "It's not the real world but a very visceral experience," Dr Ashley Conway (Cellan-Jones 2015). One interesting example, about a girl who feared getting into the elevators, was mentioned in the article. The point is that after the virtual trips in the lifts, she could enter an old and noisy elevator. She have overcame her fear with the help of VR treatment.



Picture 5. VR therapy (Source: Cellan-Jones 2015 BBC News).

There is a huge number of examples in different spheres, which proves that VR has a sense of presence. Moreover, not only is VR used in an entertainment way, but also it has found usage in practical things.

3.2.3. VR in product design

Referring to the article “A New Product Design Based on Virtual Reality, Gaming and Scenarios” by Martijn Tideman, Mascha C. van der Voort and Fred J.M. van Houten (2008), in recent years different tools and methods have been developed to support product design progress. For instance, virtual reality has found widespread use. With the help of VR it is possible to simulate the environment in which a testing product should be used. The point is that a simulation model is a foundation of the design process. This model consists of two databases: an environmental and a technological. “The environment database contains the set of elements that represent the world relevant to the product. The technology database contains the set of technology that might be relevant to the product. By means of a VR simulation system, stakeholders can have lifelike interaction with the contents of both databases. By means of configuration panels,

stakeholders can adapt parameters of both databases, thus generating candidate designs and test environments for the candidate designs”. (Tideman, Voort and Houten 2008, 195-197)

According to the book *Virtual Reality - Human Computer Interaction* in Chapter 6 “Facilitating User Involvement in Product Design Through Virtual Reality” by J.P. Thalen and M.C. van der Voort (2012), virtual reality should be used in product design to make a concept representation in the first stages. Thus, not only do stakeholders have a chance to see the future product, but also to experience it and to see its interaction with other objects. Moreover, there is less possibility that misunderstanding can occur with virtual reality than with other ways of concept presentation. There are several examples in this chapter, where VR simulation was used, and it has been proved that it was the best option. Take for instance the case with an aircraft galley. The purpose was to redesign an aircraft galley and to find out better solutions for spaces, parameters, and ergonomics and to put in easy exchangeable equipment. “In the end, the design agency decided to use an interactive walk-through model of the aircraft galley, projected on a large multi-touch wall display. The application for instance allowed designers to virtually walk through the galley, and open doors or trays. The space in front of the multi-touch wall display is furnished such that it represents the space in the galley.” (Thalen and van der Voort 2012, 105-124.)



Picture 6. Interaction with the 3D model (Thalen and van der Voort 2012, 112).

VR reality has found practical use in the sphere of design, especially in product design for mass production and for public spaces. Thereby, VR provides better design solutions and gives profit in the sense that it helps to save money.

3.2.4. Why to work with VR or VR as a future technology

“Product design via VR is probably the number-one business application right now” (online magazine Raconteur 2015, 6). So, why is virtual reality going to be popular in the future?

According to analysts, 2016 is the year of virtual reality (BBC News). A number of new goggles are going to be presented in 2016. For example, Oculus has announced a new Rift headset and Samsung Gear VR. Moreover, companies like Sony and HTC are ready to present novelties too. Virtual reality is getting popular in different spheres; the magazine “Virtual reality” mentions that by the end of 2016 a great deal of new movies will have 360-degree trailers, which is possible to see in VR goggles. “The prospects for VR could be endless with the ability to draw users into virtual spaces providing a disruptive element to a host of sectors” (online magazine Raconteur 2015, 3).

GLOBAL CONSUMER VIRTUAL REALITY MARKET REVENUE (\$BN)

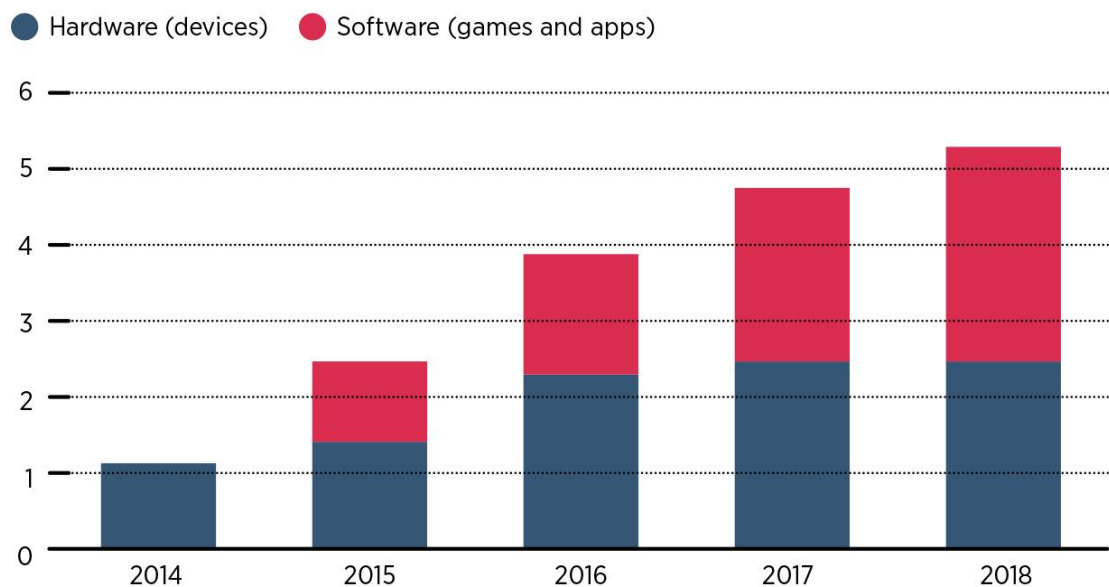


Figure 1. Global consumer VR market revenue (online magazine Raconteur 2015, 11)

Figure 1 describes the ratio of money spent by customers on hardware and software in the VR market over a period of 4 years. As can be seen, from 2015 people started to spend

money on VR software, and the amount of money is going to increase. Furthermore, it is expected that in 2018 the benefit from VR will consist of more than 5 billion dollars and the amount spent on hardware and software is going to be equal to that.

As a result, in the nearest future, VR software is going to be very popular and it should get a satisfactory income. Thus, it can be a good idea to start a business with virtual reality nowadays, so that there is enough time to develop the business.

4 MEDITERRANEAN HOUSES

Another vital research that I needed to do from the beginning was to understand the style of chalets in the southern part of Spain. The architect with whom I was working in cooperation, was following the traditional Mediterranean style but with modern features.

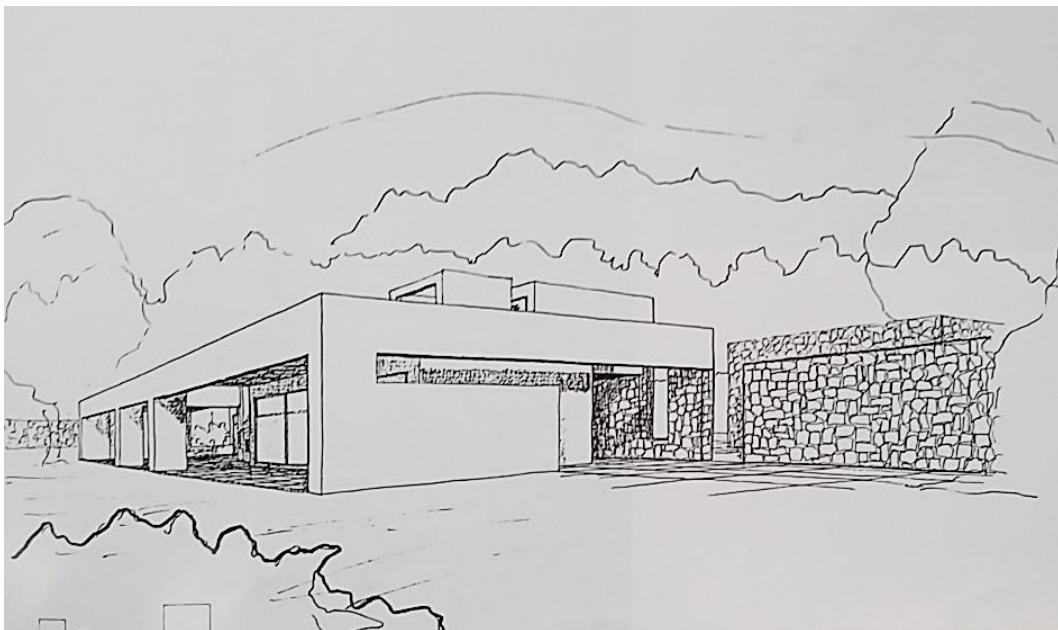
To begin with, there are facts like weather conditions and landscape, which had influenced the architecture style in this area. Relying on the book *Private Mediterranean Houses* by Francisco Asensio Cerver, houses were built far from each other because of the hot climate, so that there is air circulation. Moreover, big windows and doors are typical for Mediterranean houses due to the allowance of inside ventilation. In order to provide shade, it is common to have eaves, porches and covered terraces.

One of the typical examples from this book is “Vertebral wall”. This house was created by two architects from Madrid: Luz Puerta Lopez and Beatriz Guijarro Regalado, and located in Ibizan valley of Es Cubells.



Picture 7. Verberal wall (Cerver 1993, 47).

The shape of the house consists of simple geometries; white colour prevails due to the weather conditions. The idea of the architects was that the construction should suit the surroundings. Thus, the dwelling faces the seaside, and there is a stone wall, which was constructed from local materials, in the middle of the construction.



Picture 8. Verberal wall sketch (Cerver 1993, 49).

The wall divides the building into two parts. On one hand, there is construction with huge windows and a great deal of open spaces, which looks to the sea, and on the other hand, “areas which deliberately shy away” with small windows and recesses. “With this original design based on a vertebral wall, Luz Puerta and Beatriz Guijarro have succeeded in thrusting this construction towards the sea, transforming it into a refuge, and likewise an escape valve for the Mediterranean soul” (Cerver 1993, 41-52).

Another bright and interesting example is “Sea views to the south” – a single-family house in Aigua Gelida, in Girona province (Spain) by Norman Cinnamond - an architect from Barcelona. As well, the dwelling consists of simple and symmetrical shapes: it is a cube 15 by 15 meters. A unique feature of this building is that it is only possible to enter the building through the upper floor.



Picture 9. Sea views to the south (Cerver 1993, 142).



Picture 10. Sea views to the south view of the entrance (Cerver 1993, 144).

Moreover, “the pure form of the facade is broken by the black-painted metal helicoidal exterior stair-way” and the swimming pool is constructed between two floors. However, this house has the same principle as previous one. The part of the dwelling which faces the seaside has big windows and open areas. The other part of the house has the opposite characteristics.



Picture 11. Sea views to the south swimming pool view (Cerver 1993, 146).

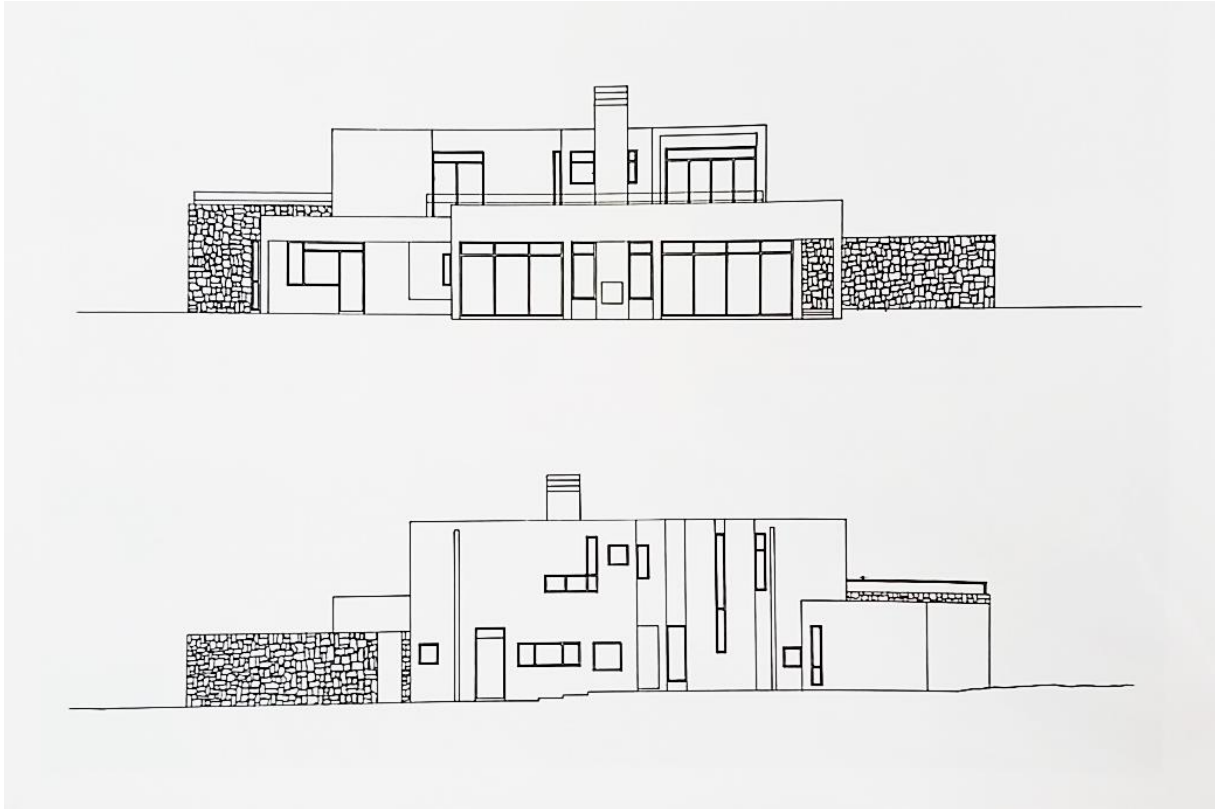
The appearance of the building is simple and practical: the whitewashed walls with the combination of a stone wall; all the elements such as doors and window frames and the exterior staircase are made from black anodized aluminum. The swimming pool area is decorated with wooden bars treated with copper (Cerver 1993, 141-150).

“Traditional Ibiza” was made by Jaime Segui Alea and is located in San Jose, Ibiza. The chalet is built on a hill with a fascinating view; it surrounded by bushy forest that creates some kind of fence and protects from the hot sun.



Picture 12. Traditional Ibiza (Cerver 1993, 33).

This villa is a bright example of the traditional style: “the old white facings, the furniture built into the architecture itself, the staircases connecting both the inside and the outside of the building, the brilliant white colour of the structure, the appearance of the structure itself as a series of superimposed cubes, are all typical features of the Ibizan tradition ”.



Picture 13. Traditional Ibiza technical drawings (Cerver 1993, 40).

To sum up, one of the most vital parts for the architects is that the dwellings have to be practical and should suit the surroundings. Moreover, architects try to support local materials, as proof notice the stone walls. Although all houses have the same shapes, colour and materials, all of them are unique with their own special features (Cerver 1993, 29-40).

5 DESIGN PROCESS

5.1. Equipment and software

For virtual reality one of the most essential elements is 3D goggles. In our case the Oculus Rift headset was used. Here is a little bit of information about Oculus Rift: it is a 3D headset; the system of the 3D images is side-by-side, which makes for better 3D effects.



Picture 14. Oculus Rift headset (<https://www.oculus.com>).

Oculus Rift catches the movements of the head at a frequency of 1,000 times per second. The widest viewing angle is 110 degrees (<http://oculus-rift.ru> 2016). A headset was provided by Tyrus Software.

However, to support Oculus Rift, it is necessary to have a very powerful computer with enough memory and proper NVIDIA. From the beginning in the office there were not

many powerful computers, but later I was provided with a new laptop from the company, so that not only did I work with 3D models but also with 3D goggles.

As for programs, for the 3D modelling I was using Autodesk 3Ds Max. The point why I have used this program is because this one is more familiar to me than other 3D programs. Moreover, for the company it was only important that the 3D models are compatible with Unity, because the programmers were using Unity for virtual reality. Nowadays, there are two types of software which support virtual reality: UDK and Unity 3D. According to the programmers from our team, despite the fact that UDK is better for high quality performance, it can be used only for a single project. Thereby, Unity was the better choice for us due to our aim of making a platform.

5.2. 3D modelling

From the beginning, I had the task of conducting research about the databases of 3D models. As a result, I have found that there is huge number of websites with free and non-free models. However, later I heard about the BIM (Building Information Modelling) system and that nowadays there is a free database of 3D models for architects, designers and engineers. The idea of this website (bim.archiproducts.com) is that the manufacturers provide the models of their products for free as an advertisement. There is then information about the company, contact information, shops' locations and sometimes the price of the product. In my opinion, it is a great idea due to benefits for both sides: architects, designers, engineers and manufactures.

Furthermore, some famous companies provide free 3D models on their websites, for instance, with the fireplace company Focus. Moreover, there are websites with free 3D models, which I was using to find decorative elements such as dishes, vases, towels and clothes. Here are links to some of them: <http://archive3d.net>, <http://3dlancer.net> and <http://www.3dklad.com>.

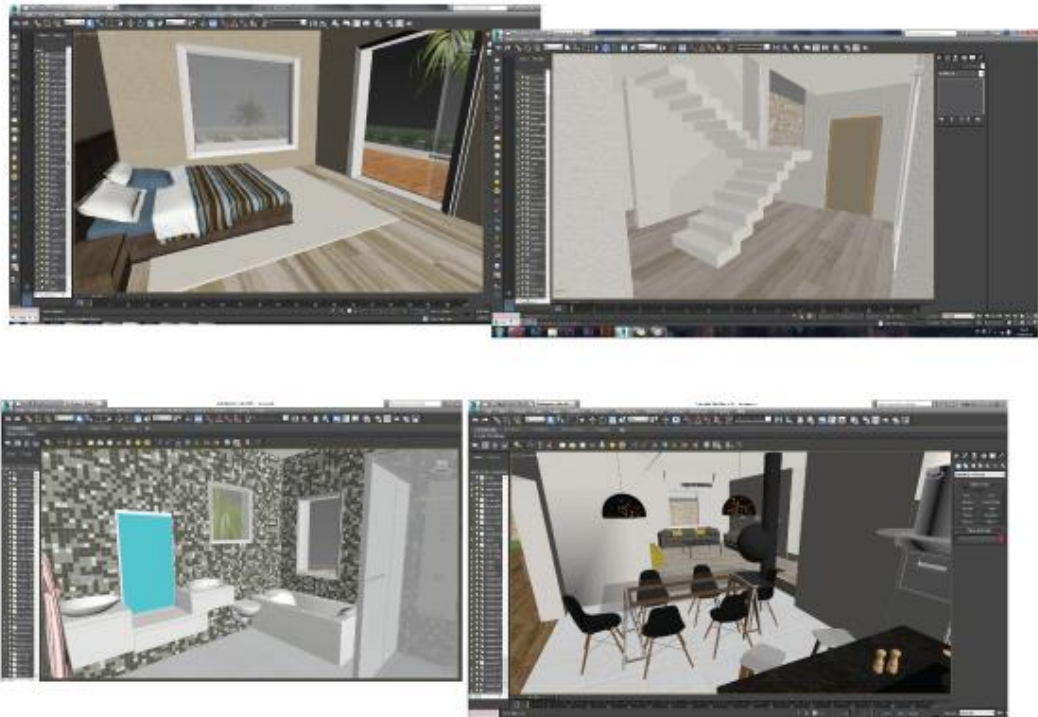
As for the modeling process, the architect from Pool&Pool gave me the plans of floors in PDF format and I imported them to 3Ds Max. Firstly, I built the appearance of the house with surroundings and later interiors. Some of the spaces I needed to model by myself,

such as kitchen furniture, but the objects like beds, sofas and lamps I downloaded from bim.archiproducts.com.

1. plans from the architect



2. simple version



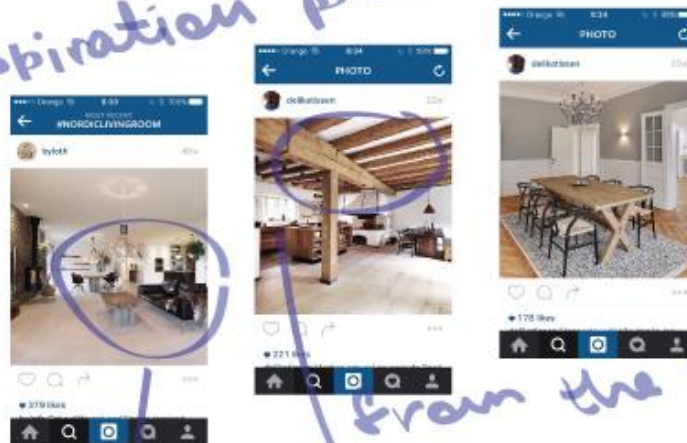
Picture 15. Design process 1.

The idea of a simple version was to make a customer to focus on the spaces of the chalet. The interior is not important in this part. During the virtual tour, the client should pay attention to planning the house: the sizes of the rooms, the levels of the ceilings and floors, and the number of windows, etc.

3. new plans

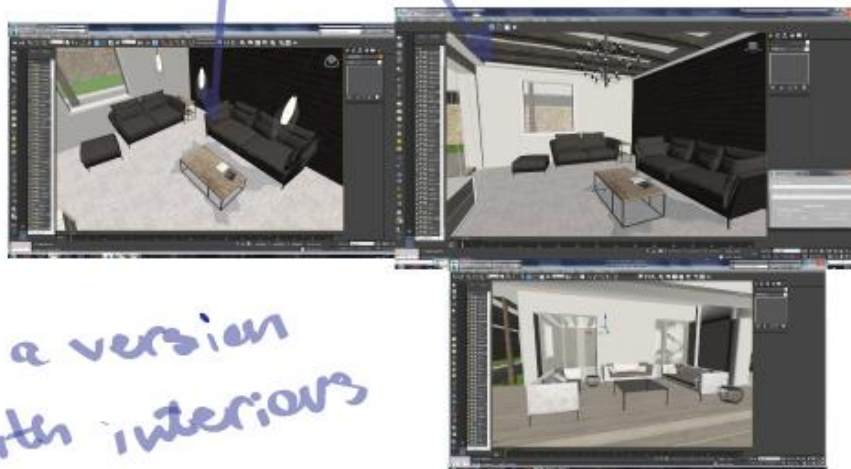


4. inspiration pics



from the client

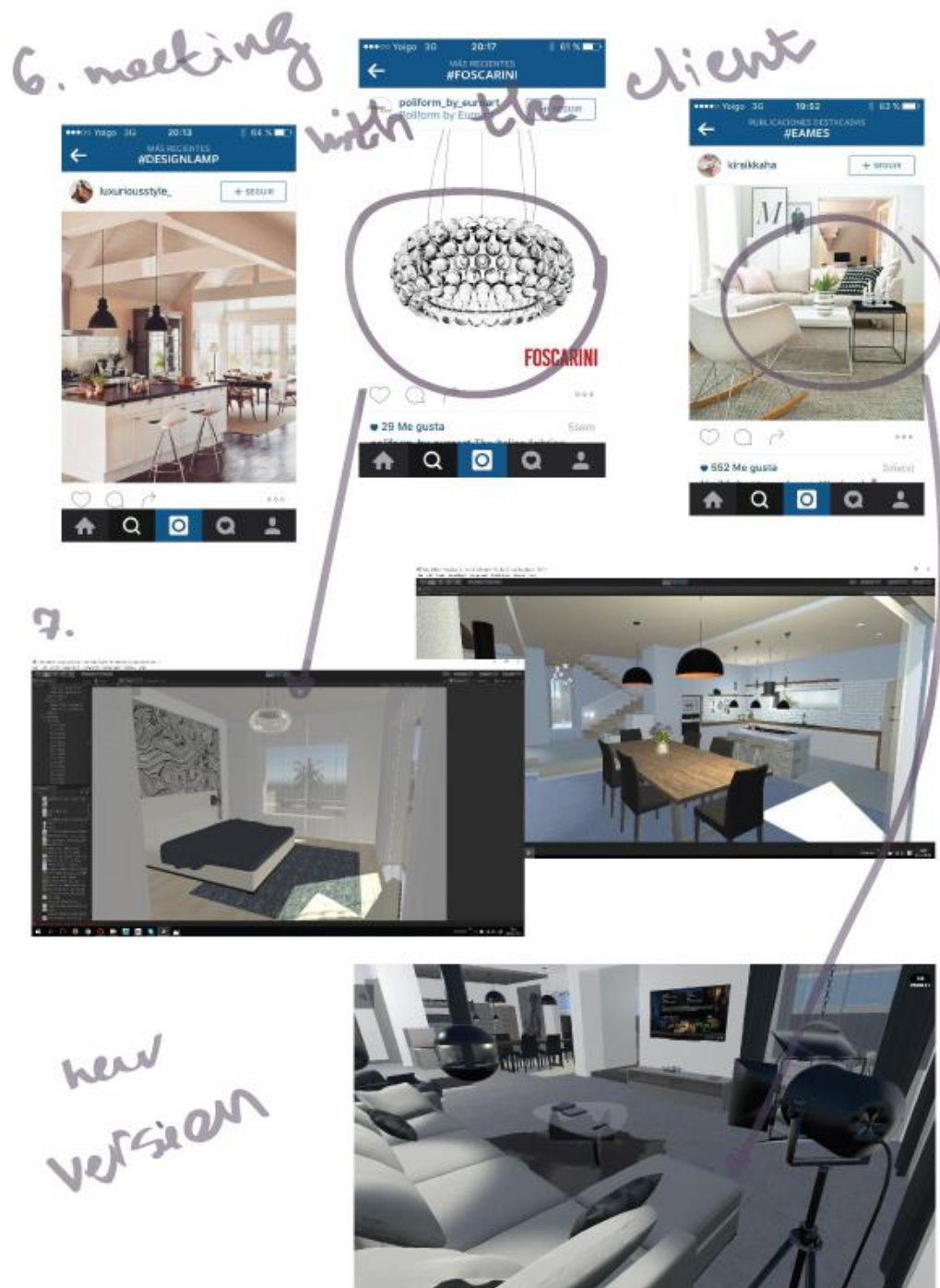
5



a version with interiors

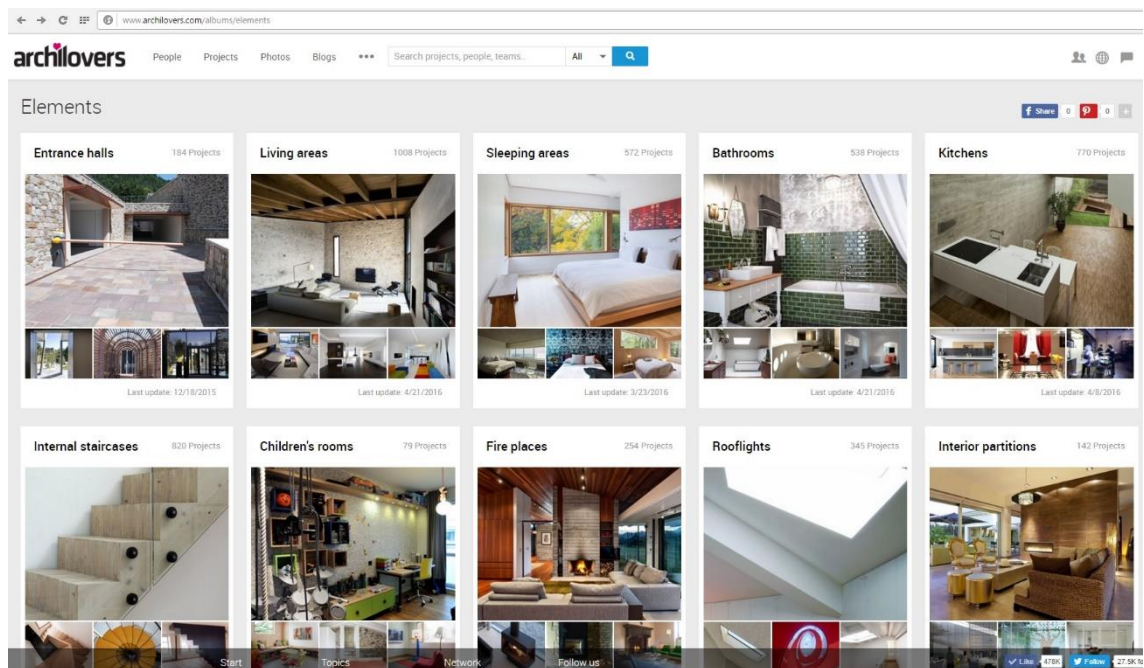
Picture 16. Design process 2.

Later I have received the new plans from the architect with corrections. For instance, the size of the living room was changed, as were the levels of the floors and so on. Moreover, I got inspiration pictures from the client about the interior style and I tried to imitate it. However, later we realized that it is better to meet and go through the materials.



Picture 17. Design process 3.

During the process, it was clear that it is necessary to find good databases with interiors' examples and textures, which clients could check by themselves. Thus, I have found databases with good quality and free textures: <https://www.textures.com> and <http://render911.ru>. Furthermore, for the interior inspiration my suggestion was to use <http://www.archilovers.com>, where modern and interesting projects can be found. Moreover, this website works in cooperation with bim.archiproducts.com, so, it makes it easier to find some 3D models because sometimes there are tags for the products.



Picture 18. Archilovers catalogue example (<http://www.archilovers.com>).

In this way, I changed the interiors and made them more detailed to give more realism. The next stage was putting lights in Unity 3D. The lights and shadows played a vital role in the aspect of realism.

8. putting lights



Picture 19. Design process 4.

5.3. Difficulties which I have faced

Virtual reality is a new sphere in technologies and it has just started to develop. Our team has faced a number of problems to which it was difficult to find answers in literature or web resources. As a result, we needed to make experiments and find out solutions by ourselves.

For example, the first problem was with object transportation from 3Ds Max to Unity. There are three main disadvantages: the disappearance of very slim objects, upside down objects and missing textures. Thus, we started to make tests with small scenes and with different sizes and quality of objects. In conclusion, it is better to use boxes instead of plane; in most cases plains disappeared; however, even very thin boxes did not. Apart from this, it is necessary to group all elements of the objects, plus to group objects as different zones. In this way, it is possible to avoid changes in the structure of the objects, for instance, upside down accidents.

Another huge problem occurred with the Oculus Rift headset: it was impossible to see several detailed objects with a huge number of polygons at the same time. The rippling appeared in the scene and it spoiled the performance. A good example are the bricks seen in Picture 20.



Picture 20. Example of the huge number of objects concentrated in the same place.

The cooperation work with programmers in this case was essential. Some of the problems with aliasing were eliminated with some settings for virtual reality in Unity 3D. Nevertheless, still some things such as kitchen bricks have not worked. Thus, we started to look for some tricks which could be applied. The best solution was to use bumping maps, which gives volumes to the texture during the rendering.

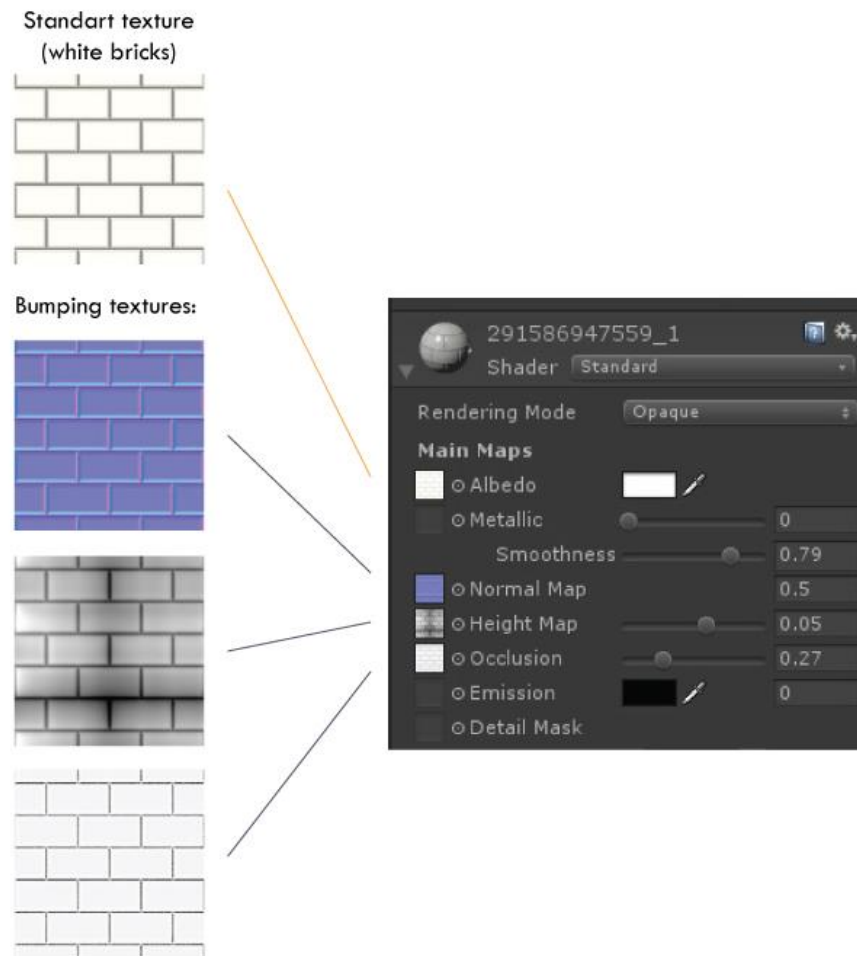


Figure 2. Example of bumping maps

There are three main maps: normal map, height map and occlusion. As reported in the Unity manual (<http://docs.unity3d.com>), with a normal map it is possible to add the extra details to the surface “such as bumps, grooves, and scratches to a model which catch the light as if they are represented by real geometry” (2016). “Height maps are usually used in conjunction with normal maps, and often they are used to give extra definition to surfaces where the texture maps are responsible for rendering large bumps and

protrusions” (Unity Technologies 2016). The last one is occlusion, which is responsible for the light distribution. This maps show which areas should get more light and which less.

Although bumping is an adequate solution, still it does not replace the features of a real object until the end. Thus, I needed to do object separation: essential for the scene and backstage objects. For instance, high quality furniture is more important than laminate or stones, so objects like grass, laminate, bricks, tiles and stones were replaced by textures with mapping. It is possible to see a comparison example in Picture 21.



Picture 21. On the left side - kitchen bricks as separated objects; on the left side – bumping texture.

In Appendix 1 there is a manual for the designers who are going to send projects in the future about exportation to the platform. The instructions were created based on our tests and experience.

5.4. Teamwork

From the beginning there were four of us who were working on this project: two supervisors, one programmer, who was responsible for VR, and me as a 3D modeler. Later one more programmer joined our group to help us with the coding for the PC application.

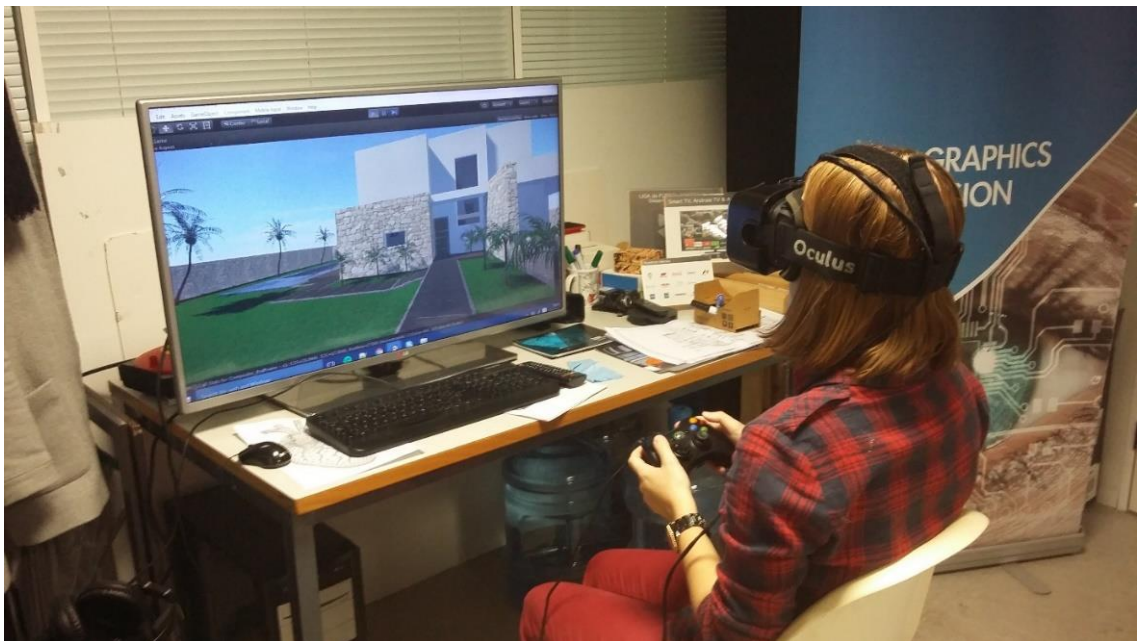
I was the newest in the company and the only one whose level of Spanish was not enough to communicate at work. However, it was not a problem at all because almost everybody in the company has a good level of English. Every morning we had a 10-20 minutes

discussion together and later more talks during the day if it was necessary. Although we are from different fields, we tried to help each other with useful information, links, assets etc.

The teamwork is one of the most essential things in any project. In my opinion, our team worked very well, cohesively and effectively. To sum up, I have learnt a lot about how to cooperate with people from other fields and cultures.

5.5. Playtests

The first test was very vital because the goal was to realize whether people are ready to pay for this type of service or not. The number of people who took part in this test was 9: 8 potential clients between 28-35 years and 1 architect. The program included an introduction - basic information about the project, play test and a questionnaire.



Picture 22. Test with the client



Picture 23. Test with a potential customer.

The questionnaire was focused on whether customers prefer hyper realistic renders or a VR tour through their house. As a result, people preferred virtual reality even if our first testing model was far from realistic. They found the virtual tour more useful and entertaining. The test has shown that clients are ready to pay up to 2,000 EUR for this kind of service.

Later while improving the 3D model and PC application, a number of tests have been performed. As a result, it is necessary to work more on the UX and UI of the application.



Picture 24. One of playtests.

On one hand there are potential clients who were easy to impress with new technologies, but on the other hand there are architects who are used to working in a way familiar to them. During the last two months around ten architects were invited to test the platform, and the result is not as positive as with customers. In general they liked the idea and experience; however, the model is not hyper-realistic and they said that most probably they prefer hyper realistic renders than this type of tour.

In conclusion, to launch the platform it is necessary for us to improve the quality of the performance and do the tour as realistically as possible. However, it is a very difficult task nowadays, because when we increase the number of polygons, put more lights and shadows in the scene to do it more realistic, the quality of performance is going down. Oculus glasses start to react slowly to the movements or aliasing appears in the scene, something that makes a user feel uncomfortable can cause the sense of presence to disappear.

6 FINAL PRODUCT

The topic of this chapter is the platform “My Virtual House”. In following section there is information about the product, how it works, what should be improved and the plans for the future. The last part is about our competitors and the difference between us.

6.1. My Virtual House

At this moment there is a PC application for Windows which allows downloading from the official website, <http://myvirtual.house>. The idea of this platform is that there are two types of projects: public and private. Thus, everybody can download this application and see the projects which are on our platform. However, if a customer would not like that anybody else can see his house besides himself and the architect, it is possible to put the chalet in a private mode, so that only people who know the login name and password can have an access to the house. Moreover, customers can add the comments about their house for the architect. Please note that the application is still under construction; we are improving UX and UI design with the help of feedback.



Picture 25. Application interface example.

There are several examples now in the application for different target groups. Consequently, it is possible to make virtual tours through a flat, a small factory, a car exhibition and the villa. This application is capable with the Oculus Rift glasses; however, if a customer wants to take a look at the house outside of our office and he is not an owner of the headset, he can just walk through the house and see everything on a screen.

To sum up, there are three types of packages which we can offer: simple, standard and realistic. The simple package means that we built a 3D environment from the plans provided by the architects. The main point in this package is that the client can understand the sizes of the rooms, windows and so on. There is no furniture, just spaces with basic textures (Picture 26). The standard plan includes simple interiors without extra details and basic lightning, and it is possible to choose and change different types of textures (Picture 27). The realistic package includes detailed interiors with different types of lights. The point in this plan is to do the building as much realistically as possible (Picture 28).



Picture 26. Simple package example.



Picture 27. Standard package example.



Picture 28. Realistic package example.

My final result is a realistic villa in a 3D environment. In the previous chapters there is a description of my design process and screenshots as examples. Due to the reason that the final scene was built in Unity 3D, there is no purpose in making 3D renders into pictures. However, there is a possibility to make a video of a walk through the chalet. There is a link to YouTube for the video of the house, I have modeled for virtual reality: <https://youtu.be/t6Q9ffTQmEY>

6.2. Things to improve

This is a new type of project; subsequently, there will be always things upon which to improve. Despite the fact that this platform was made based on practical knowledge with

a client, when we get more customers, there will be more things to improve, for instance, the database of 3D models.

As for now, the next step is to make an application for the Android platform. Moreover, it is necessary to improve graphics and web design because until now we were focused mostly on functionality and 3D environments.

One more thing to improve is 3D models. Nowadays, we have done the model as realistically as we can, because more detailed models start to fail with the current Oculus Rift glasses. However, during the summer time the company is planning to get the newest Oculus Rift headset which should work better. Consequently, it will be possible to reach the goal of a realistic house, maybe even hyper realistic.

6.3. Existing products near our platform

In my opinion, our main competitor is ArqVR, a company located in Barcelona. Not only is it our competitor in Spain, but they also offer similar services and packages. The difference is that our company offers the platform with My Virtual House application that can be an advantage for our clients.

Nowadays, ArqVR is the only competitor for us in Spain. In the Valencia area we are the only company who offers this kind of service. However, worldwide research has been done too. There is a number of companies in the USA that offer virtual reality service. Although they are also connected with virtual reality, there are differences between our services or methods. For example, IrisVR (irisvr.com), located in New York City, has the same idea with a platform for a PC. However, the quality of 3D models is low. Moreover, it is only possible to move through a building point by point, meaning jumping from one place to another. In my opinion, IrisVR is not focused on giving the feeling of reality to their customers.

One more company in the USA is Arch Virtual (archirtual.com), which is located in Madison, Wisconsin. The portfolio on their website is good and impressive with video examples of walkthroughs. As well, they offer VR applications for Oculus Rift and

Google cupboard and non-VR applications for Windows and Mac Os. Although the company looks good and has a big team, the quality of their models is good but not highly realistic.

As for competitors in Europe, Archilogic – a company from Zürich, Switzerland, offers virtual tours with goggles. Nevertheless, they are focused on a different level of customers due to the duration of the project and quality. The 3D models are very simple and non-realistic and the company is ready to demonstrate the project during 24 hours. Thus, the price for the service is lower.

In conclusion, the main target of our company is customers who can afford to order a private house from the architect. However, there are different types of packages, and the price is different, too. Furthermore, the aim is to reach the maximum realism in the 3D models, differentiating us from our competitors.

7 CONCLUSION

To sum up, this is a very huge project; our team has already spent around six months working hard on it, and still there are things to do and to improve. The main goal now is to reach more realism in the 3d models, finish the platform and push the project to the society. Thus, a good advertisement is required nowadays.

In my opinion, presenting architecture through virtual reality is a very interesting idea and I am looking forward to continue working on this platform. Moreover, it should be really useful in practice because it should help to save time and money for everyone who involved in the construction of a building and a customer.

As for me, I am very satisfied with the result we have reached. During this project I got great experience in team working. I especially learned how to cooperate with people from other fields, like programmers. Moreover, I have learned Unity 3D, I have improved my 3D modelling skills and I got experience with virtual reality. I tried the Oculus Rift

headset for the first time in Tyrus Software, and the feelings are incredible. It is impossible to realize how great virtual reality is, if one has never tried it.

In conclusion, the best thing for me is that after this project I now know on which field of design I am going to focus in the nearest future. I have realized that the modern technologies are incredible and exiting; furthermore, it is interesting to learn more and more, and technologies are always going ahead.

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Manual for exporting from 3ds Max to Unity for VR (FBX format):

- Group all elements of an object
- Group zones (like bedroom, bathroom etc.)
- Plane objects don't work good in Unity => better to use boxes
- Plane + shell modifier also doesn't work good
(All walls and floors better to do as boxes)
- Maximum 1 mirror per floor
- With mental ray and Vray renders modifier "hair and fur" doesn't work in Unity
- Textures (Bitmaps) should be done through Materials -> Standard, otherwise textures wouldn't export correctly to Unity
- Delete all surfaces which are impossible to see (like back side of wardrobes)
- Reduce number of polygons in the objects where it is possible
- **Pass all the textures**