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CREATING 3D MODEL OF ARCHITECTURAL OBJECTS IN DIFFERENT SOFTWARE

Abstract: Producing professional-quality 3D models is one of the main requirements in the work of architect. Behind photorealistic renderings lies the precise modeling of the building. The development of technology has led to the fact that today is very easy to get from 2D sketches to 3D models. That's why it's important to minimize the time required to finish this part of work and choose the right software for it. In architectural education in Serbia, the most used programs are AutoCAD and 3ds Max. Software as AutoCAD provide simple drawing of 2D plans of any object, while the realistic rendering can be easily obtained in 3ds Max. The question is which program to choose for the middle phase-creating a 3D model. In this paper we will compare the time needed for the same tasks as well as advantages and disadvantages of both programs. Based on the results, conclusions provide recommendations for the most effective solution: 2D drawing and modeling in AutoCAD, and rendering in 3ds Max.

Key words: Modelling, AutoCAD, 3ds Max, 3D model, drawing, architecture

1. INTRODUCTION

3D modelling is very important for the profession of architects and engineers. Technology development allows faster, easier and more realistic presentation of the look of the desired objects. With the drawing and modelling programs, the idea can easily be realized. [1] Today, you can simply come from 2D drawings to 3D model. Therefore, it is important that the time needed is reduced to a minimum. There are various software used. The choice depends on a number of factors, and of course, on your personal skills and program management.

Universities all over the world offer students courses of different programs. In Serbia, in the domain of education, the programs that are used the most are AutoCAD and 3ds Max. Therefore, this paper will present their comparison. Weekend cottage will be modelled in AutoCAD first, with the measurement of the time needed for certain operations. The same object will then be modelled in 3ds Max. The aim of the paper is to prove that the advantages of the 3d modelling in AutoCAD are greater than the disadvantages.

On the basis of an analysis of the results will give answers to the following questions:

1. What are the advantages and disadvantages of both programs when modelling,
2. Which program gives better results for simple forms,
3. Which tools are used for creating the same forms,
4. Which program leads to the goal faster.

2. OPTIONS FOR MODELING

AutoCAD is intended for designing and drafting in two and three dimensions. It remains an industry standard even to this day, almost four decades later. It is mostly used in construction and manufacturing. It allows users to use lines, polylines, polygon, shapes, text and other visual items to create designed structures. Therefore, it is often applied in architecture projects. [2]

3ds Max is used for modelling and rendering, animations, games, design visualization. It is easy to get irregular geometric and organic forms.

2.1 Modelling in AutoCAD

With 2D AutoCAD drawing, with several options, it is easy to get 3D model of simple forms. There are different ways for creating a 3D solid face. With tool "Presspull", closed polygon of lines or polylines will be recognized and converted to 3D form:

1. From 3D Tools card, choose option "Presspull",
2. Select an area formed by s closed boundary,
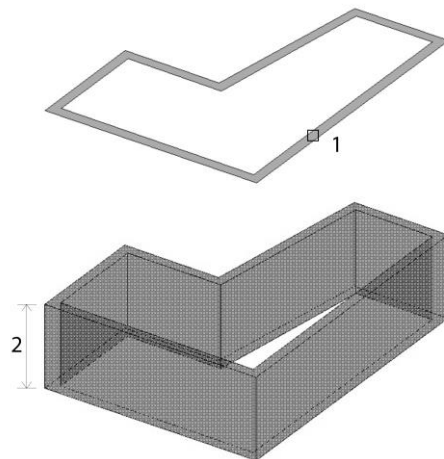3. Specify extrusion height manually or by typing a number (Fig. 1). [3]

Fig. 1 Usage of the option "Presspull"

If the sides of the walls are in the direction of the axis of the coordinate system, we can also use tool "Box". The base of the box is always drawn parallel to the XY plane of the current USC (User Coordinate System). The high of the box is specified in the Z-axis direction.

1. Choose "Box" from Modelling Panel,

2. Specify the first corner of the base,
3. Specify the opposite corner of the base,
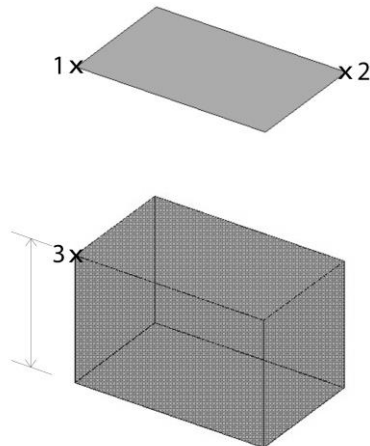4. Specify the height (Fig. 2). [3]

Fig. 2 Usage of the option "Box"

The openings in the wall can be obtained from two boxes above and below the window, or by subtracting hole-sized box from the wall.

The frame and window are the easiest to get from the side view. You can use the tool "Subtract":

1. Select the objects that you want to keep,
2. Press Enter,
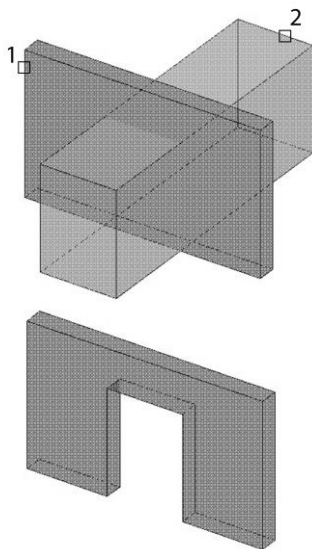3. Then select the objects that you want to subtract (Fig. 3).

Fig. 3 Usage of the option "Subtract"

When there are elements that are at an angle in relation to USC, you can use option "Object". It aligns the UCS to a selected 2D or 3D object:

1. Choose command "Object",
2. Move the cursor over an object to see a preview of how the UCS will align,
3. Click to place the UCS (Fig. 4).

The UCS origin will be located at the specified point, the X-axis will align to an edge, and the Z-axis will align perpendicular to the object. With option "World" you can easily align the UCS with the world coordinate system (WCS) again. [3]
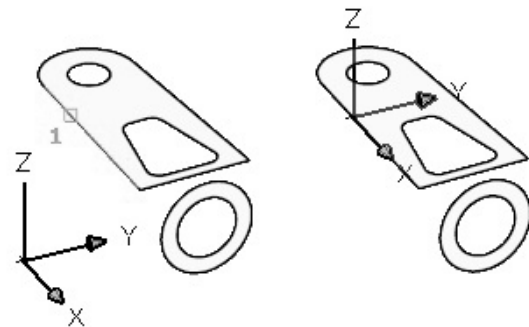

Fig. 4 Usage of the option "Object"

2.2 Modelling in 3ds Max

For modelling in 3ds Max, 2D drawing doesn't need to be drawn in it. Drawing imported from AutoCAD behaves exactly the same. 3ds Max treats lines as an image that helps in orientation during modelling, but can not use 2D elements to directly get 3D forms.

Using the option "Create/Standard Primitives/Box", the wall can be lifted in a similar way as in AutoCAD (Fig. 5).
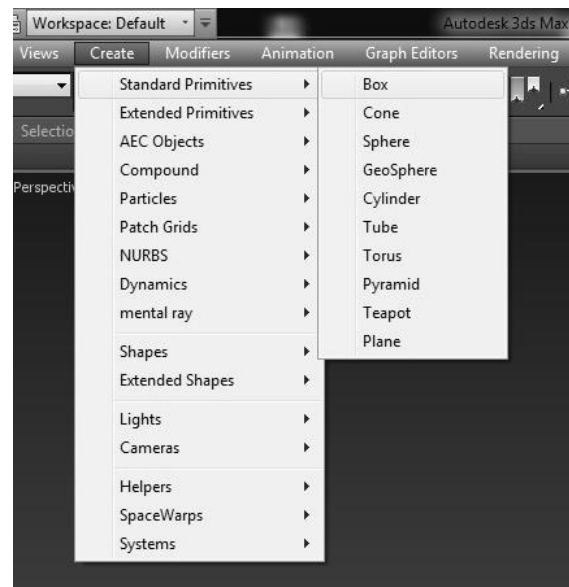

Fig. 5 Procedure for the option "Box"

One of the problems is that all 3D objects are created in USC and there is no option to change its orientation. Only after the formation of the 3D object, the wanted form can be obtained by its modification. You can convert the object into an editable object such as editable poly:

1. Select the Object,
2. Click on the Modify card,
3. From Modifier List choose option "Edit Poly" (Fig. 6a),

4. On the stack display, you can choose the kind of sub-object geometry you want to work with: Vertex, Edge, Border, Polygon or Element (Fig. 6b). [4]

This requires a number of steps, and it takes more time.
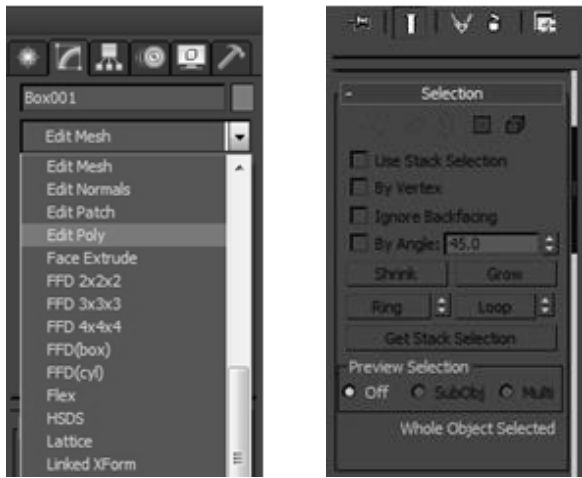
a: Drop-down menu   b: **S**tack display

Fig. 6 Option "Edit Poly" with selection of geometry of objects

Subtraction can be done with option "ProBoolean":
1. Select the Object,
2. From drop-dawn menu choose Compound Objects (Fig. 7a),
3. On the Object Type rollout, turn on ProBoolean,
4. On the Parameters rollout, choose the type of Boolean operation you want to use: Subtraction. Also choose how 3ds Max will transfer the next operand you pick into the Boolean object: Remove,
5. Click the Start Picking button (Fig. 7b),
6. Pick one or more objects to participate in the operation. [4]
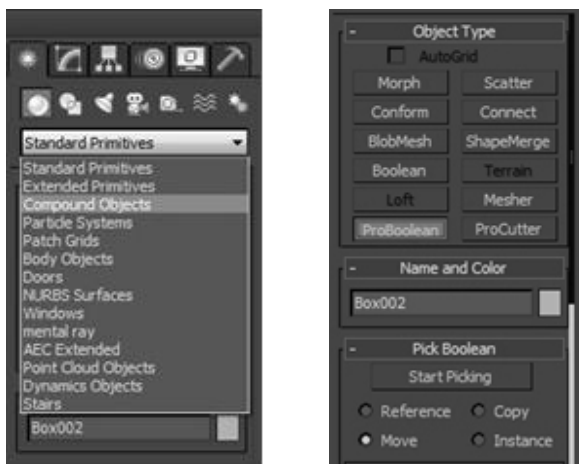
a: Drop-down menu   b: **S**tack display

Fig. 7 Option "Compound objects" and "ProBoolean"

3. COMPARATION OF TWO PROGRAMS

Using mentioned options, the weekend house was modelled in both programs: AutoCAD and 3ds Max. For creating the same elements the time was measured and the results are shown in the table 1.

Table 1

Time required for modelling

Elements	Time in AutoCAD [min]	Time in 3ds Max [min]
Slabs	2	6
Walls	1	5.5
Holes	3	7
Frames	5.5	11
Glass	4.5	10
Doors	5	10
Fence	4	7.5
Brise soleil	3	7
Total	28	64

In AutoCAD, full-sized walls are obtained with options "Presspull" and "Box". Where there are windows and doors, certain boxes were moved, because manoeuvring in 3D environment is easy in CAD (Fig. 8). Option "Box" was used in 3ds Max. More time is spent on west wall, because it's at an angle of 60 degrees. Wall was converted do Editable Poly. Then, moving the vertices gave the wanted position.
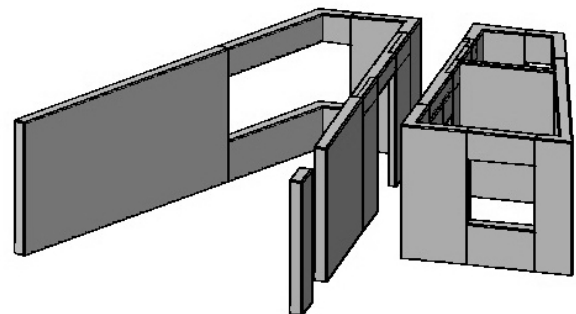

Fig. 8 Walls in 3D

For slabs of floor and roof construction, the contour of the object was drawn with option "Polyline". 3D form was obtained with "Presspull" (Fig. 9). In 3ds Max, formed box was modified to get a polygonal shape. It took three times more time.

Glass surfaces-windows and doors, were obtained by options "Box" and "Subtract". In AutoCAD, there was no problem with parts that are not orthogonal to the USC. Options "Box" and "ProBoolean" were used in 3ds Max. More time was spent for windows on non-orthogonal walls (Fig. 10).

Fences and brise soleils were formed by multiplying the boxes. The elements on the non-orthogonal side were modified and rotated (Fig. 11).
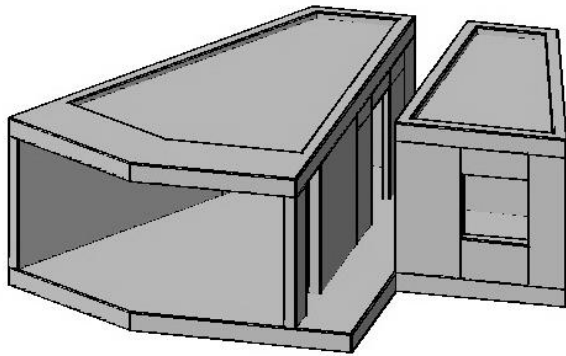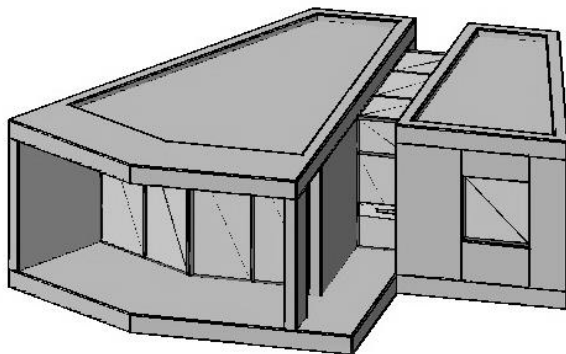
Fig. 9 3D model with walls and slabs

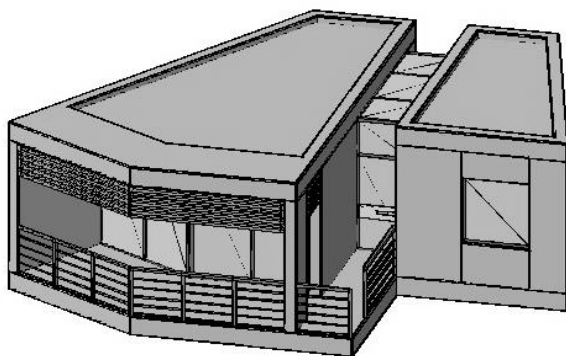**Fig. 10** Formed glass surfaces

Fig. 11 3D model of weekend house

8. CONCLUSION

Visualization and presentation of designed objects are very important in architecture in order to provide the client with a vivid presentation of the project.

Development of technology significantly improved drawing and modelling programs. So, today it is very easy to get 3D model from 2D drawing. Therefore, the question is which program to use for this part of the process.

At the Faculties of Architecture in Serbia, the programs that are taught the most are AutoCAD and 3ds Max, which are also used in other European and world countries. In case when these programs are used, it is concluded that it is much easier and faster to get the 3D model in AutoCAD. Of course, it should be noted that we were working with regular, simple shapes, without curved and complicated surfaces. The options used to get the same forms were compared and the time for modelling the same elements in both programs was measured. Total time spent in 3ds Max is 64 minutes, which is as twice as high than time spent in AutoCAD (28 minutes).

Therefore, if the plan of the object is simple and polygonal, it is recommended that 2D drawings and 3D model are done in AutoCAD, and render in 3ds Max. Other programs can be used for architectural modelling, such as ArchiCAD, Autodesk Revit or Rhinoceros, which will be the subject of future research. For sure, in each program is possible to gain the same final model, depending on your ability to manage it.

REFERENCES

[1] Helmut Pottmann, Andreas Asperl, Michael Hofer, Axel Kilian. (2007). Architectural geometry, (eBook) Bentley Institute Pres, ISBN: 978-0-934493-04-5 Exton, Pennsylvania, USA

[2] https://www.cad-notes.com/a-simple-guide-12-steps-to-mastering-autocad/
   Accessed: 2019-01-20

[3] https://knowledge.autodesk.com/support/autocad/learn-explore?sort=score
   Accessed: 2019-01-20

[4] https://knowledge.autodesk.com/support/3ds-max/learn-explore?sort=score
   Accessed: 2019-01-20

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