

Comparative analysis of 3D Blender and 3ds Max modeling methods*

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Abstract

The article discusses the methods of modeling 3D objects in Blender and 3Ds Max programs. The comparative analysis of possibilities of each of programs for work on certain methods of modeling is carried out and the main advantages and disadvantages of each of programs are revealed.

1 Introduction

Today, in the field of 3D object modeling, there are many different software. This is due to the fact that 3D graphics are very widely used in almost all spheres of life and depending on this area requires its own detail of 3D objects and their accuracy. In other words, the choice of the necessary software is made based on the final goals of the simulation, the selected modeling methods and preferences for the modeling method.

For this study, important methods of modeling such 3D objects that are suitable for use in computer 3D games, that is, the object must be realistic enough, but have a light weight, for fast loading in the game. For comparison, such programs as Blender [1] and 3Ds Max[3] were chosen, as they fit our requirements.

The comparison was carried out according to the main modeling methods:

- Modeling from primitives;
- Sculpturing;
- Simulation of tight mesh;
- Modeling by extrusion of polygons [2].

2 Modeling from primitives

When using this method of modeling, as a rule, it is necessary to determine in advance of what components the simulated object consists of. The primitives that make up the object you can just add everything to the scene, but it is better to do it step by step.

In Blender primitives when added to the scene are polygonal objects and all work with them is carried out as in polygon modeling standard functions: this change of location and rotation. You can also work with vertices, edges, and polygons. It should also be noted that all primitives when added to the scene already have certain sizes, which can be further changed. In 3Ds Max, primitives are not polygon objects and in order for a primitive to become a polygon, it must be converted to Editable poly. Also, the proportions and size of primitives are not set rigidly in the system, they must be set when adding a primitive to the scene

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Both programs have a number of basic functions for working with polygon primitives, these are:

- extrusion;
- Inset;
- Ring cut;
- Thread;
- Bridge;
- Closing the hole (connecting the vertices/edges of polygons);
- Gluing of vertices;
- Cleaning of the mesh (remove vertices);
- Create a chamfer;
- Increase The Weight.

Let's look at some new possibilities of creating 3D objects. In Blender if you need a little flattening primitive single-axis scale function is applied to select the axis you must enter the name of the desired axis in 3Ds Max is also used a function of scale, thus the object appear axis on which to scale the object, the main difference is that 3Ds Max is the ability to scale on two axes, which is not stipulated in the Blender. If you apply the zoom function on all axes, the size of the entire object in both programs will change.

If you need to change a part of the primitive, the position function is used, but in Blender, it is used in proportional editing mode with a radius of action. The lower vertex of the sphere is selected, and the move function changes the location of the point to the desired one, while the points located in the radius of action also change their location. In 3Ds Max, this is also done by moving vertices, but here the soft Selection Toolkit is used for this, it, as well as in Blender, provides a selection of the radius of action.

Since the work is carried out directly with the vertices, we have the ability to select some vertices. At the same time, when you change their location, the distance between the selected vertices will be preserved, and all changes will occur at the expense of unselected vertices within the radius of action. This works the same in both programs. In addition, for selected vertices, you can use the zoom function, while the proportional editing mode will still work. The size will change not only for the selected points, but also for points within the radius of proportional editing.

The rotation function is used to rotate an object around an axis. If you use it, selecting all points of the object, the object will rotate around the selected axis. Also, this function can be applied only to some vertices. The rotation point will be selected as the middle of the selected points. And not only the selected vertices will change their location, but also the vertices included in the proportional editing radius, if it is enabled.

When an object is ready, you can apply the Subdivision Surface modifier to it in Blender, which increases the number of polygons on the object and makes the object more rounded rather than angular. In 3Ds Max, the Turbo Smooth modifier, Relax, the Use NURMS Subdivision check box, and the Smooth check box are used for smoothing.

Thus, we can create an object consisting of parts, and then the resulting parts can be combined into one complex object, or left alone, then the application of materials can be done by binding to a certain independent part of the object.

The method of modeling from primitives is convenient for creating spherical objects, if you do not have the skills of drawing perfect circles. The creation of objects by this method is quite fast, because the parts of the object are created separately large, and then combined into a whole. It should also be noted that the chance of polygon creases with this method of modeling is very low. Both programs are easy to use and have good functionality.

3 Sculpturing

Modeling by sculpting does not require determining the primitives of which the object consists, it is enough to have a cube on the stage, from which the object will be molded. Getting started, you can leave a small cube, and in the process of sculpting gradually increase its size, or increase the size of the cube to some desired size. This modeling method is available only in Blender, there is no such mode in 3Ds Max.

With this method of modeling, the work is carried out, as well as with primitive modeling, with a polygonal grid, while polygons are used triangular, and the impact on the grid is not standard functions, but with the help of various brushes. In order for the sculpting process to go as it should, it is necessary to enable Dyntopo mode, only in this mode, when using

brushes, new polygons will be created, otherwise the brushes will work only with existing polygons. Disabling this mode may be appropriate when the model will have a very large number of polygons. In order to sculpt symmetrical objects, this method has a symmetry function, where you can choose which axis to take into account the symmetry. Symmetry can be chosen with respect to one axis, as well as two and all three. If you select all three axes, the program will be heavily overloaded and there may be delays.

In order to resize the object, the standard scale function will not work, you need to increase the size of the object with brushes. It is best for these purposes will suit the brush Clay strips. It makes flat extrusions, therefore, this brush is convenient not only for increasing the size, but also for creating relatively flat parts.

In order to quickly enough lengthen the object is perfect brush SnakeHook. It works by moving part of the polygons, while creating new ones. With this brush, it is convenient to create a dummy of the simulated object, and then idealize each part in more detail. As mentioned earlier, all manipulations are performed using brushes, to move polygons there is also a special brush-Grab. It captures the vertex area and moves them in the desired direction.

When sculpting, brushes affect only a certain part of the vertices. Therefore, the resulting model must be constantly rotated in order not to miss any part of the vertices. The radius of the simultaneously captured points can of course be changed, for this purpose the brush size changes. In addition, it should be noted that when sculpting, if you are close to the object, the number of polygons increases, and they are smaller, if you apply the brush to the object from a long distance, the polygons will be enlarged and merged.

For rotation of the polygons there is also a specific brush. Also, like others, the brush has its own size. The center of rotation is the center of the brush. At the same time it is not possible to rotate the entire object.

There are several ways to smooth an object. The first of them is when using brushes designed to create new polygons, use them while holding the Shift button. Then the polygons will be smoothed. In addition, there are special brushes, it Scrape/Peaks and Smooth. The first makes a flatter alignment, and the second is aimed at smoothing the polygons while maintaining the original shape.

In the process of sculpting, one whole object is obtained. In contrast to the modeling primitives, spherical objects, you must create manually. If there is a need to obtain ideal spherical surfaces, then this method requires a very long work. With this method, the probability of polygon creases is also small, since all polygons are pulled manually.

4 Modeling with mesh wrap modifier

In Blender, modeling is done with polygons, and you can only mesh the vertices of a polygon shape, for Bezier curves, this modifier is no longer applicable. In addition, it should be noted that if you apply this modifier, for an object that has many vertices, it will cause difficulty of the program, to the point that the program will cease to respond, so difficult will be the calculation of creating a grid for each available vertex.

In this type of modeling, we have the ability to create only a frame, around the points will automatically create a polygon grid, but to affect it directly, we can not. It is possible only to change the radius of the area created around the point, and to accept various modifiers for rounding, mirroring, etc. Access to editing the polygon grid we will have only after applying the modifier, while the frame that was created will disappear.

As mentioned earlier, to create a simulated object, you need to draw its frame / skeleton. Here, standard functions are applied to the vertices as in primitive modeling, but these vertices, unlike primitive modeling, will be hidden under the grid created by the Skin modifier. If you want to create an oval for the body, you need to use about 4 points: the lowest on the smallest radius of the created grid, the second, slightly higher, with an increase in the radius to the necessary, and the top two points in reverse order.

In 3Ds Max, there is also the possibility of mesh wrapping, however, it is applied to splines, and there is no possibility for each point to choose its own dimension. The number of segments can be adjusted.

5 Modeling by extrusion of polygons

This method is quite similar to primitive modeling in terms of the use of functions, but as with sculpting there is no need to determine the shapes of which the object should consist. In both programs, the modeling method works the same.

In this method, as a rule, proportional editing of vertices is not used, and each vertex, edge, polygon moves and rotates independently, changing the shape of individual polygons and the object as a whole.

When you create a model, you can work in vertex mode, because when you select multiple vertices and extrude them, the result will be obtained as when you work in edge or face mode.

To connect two separate vertices with a segment, two segments, 3 or more vertices with a polygon, use the Make Edge/Face fill function in Blender and .In 3Ds Max, there are several ways to close the "holes": it is in the border mode to select the desired hole and press cap, or use the cap holes modifier, but then the model will need to be transferred back to the polygon mode. But these two options are only suitable for simple holes. To create more complex polygons, you need to extrude the edges and close the holes with a vertex spike.

When modeling by extrusion of vertices and polygons, as well as when sculpting, a complete object is obtained. Creating spherical parts is done by eye, but it is easier to adjust the location of the vertices than when sculpting. The probability of creases on the model surface is also low here.

Table 1: Sample table

	Modeling from primitives		Sculpturing		Simulation of tight mesh		Modeling by extrusion of polygons	
	Blender	3Ds Max	Blender	3Ds Max	Blender	3Ds Max	Blender	3Ds Max
The probability of formation of creases	Low	Low	Low	-	High	Low	Low	Low
Polygon view	Depends on the polygons used in the primitive, in the end there can be all kinds	Quadrangular	Triangular	-	Quadrangular	Quadrangular	Depends on how you create polygons. When connecting points, triangular and polygonal points can be formed. When working with edges and faces – quadrangular ..	Depends on how you create polygons. When connecting points, triangular and polygonal points can be formed. When working with edges and faces – quadrangular ..
Method of influence on the polygon grid	Use of standard functions of influence on vertices directly, the ability to set the coordinates of vertices manually	Use of standard functions of influence on vertices directly, the ability to set the coordinates of vertices manually	Using brushes, changing the polygonal grid «on the eye»	-	Intuitive impact on the grid, using a point frame	Setting radius in properties	Use of standard functions of influence on vertices directly, the ability to set the coordinates of vertices manually	Use of standard functions of influence on vertices directly, the ability to set the coordinates of vertices manually
The need to determine which simple shapes an object consists of	Yes	Yes	No	-	No	No	No	No

Changing the size of an object/its parts	Using the standard Scale function, by increasing the length of the edges	Using the standard Scale function, by increasing the length of the edges	With the help of a brush build-up or moving polygons	-	Using the standard Scale function, by increasing the radius created around the vertex of the grid	Setting radius in properties	Using the standard Scale function, by increasing the length of the edges	Using the standard Scale function, by increasing the length of the edges
Changing the location of parts of an object	Move selected vertices in space	Move selected vertices in space	With a special brush	-	Change the location of the vertex responsible for a particular part	Change the location of the vertex responsible for a particular part	Move selected vertices in space	Move selected vertices in space
Selection of vertices with which we work	Ability to manually select the required specific vertices	Ability to manually select the required specific vertices	Resizing the brush radius of influence	-	Ability to manually select the required vertices of the frame	Ability to manually select the required vertices of the frame	Ability to manually select the required specific vertices	Ability to manually select the required specific vertices
Creating symmetric objects	With a modifier	With a modifier	Using symmetry mode	-	With a modifier	With a modifier	With a modifier	With a modifier
Ability to work with symmetrically created part	Only after the simulation is complete and the modifier is applied	During operation	In the process of sculpting	-	Only after the simulation is complete and the modifier is applied	During operation	Only after the simulation is complete and the modifier is applied	During operation
Ability to rotate parts of an object	With the help of standard functions of translation and rotation	With the help of standard functions of translation and rotation	With a special brush	-	Change the location of the vertex responsible for a particular part	Change the location of the vertex responsible for a particular part	With the help of standard functions of translation and rotation	With the help of standard functions of translation and rotation
Ability to use modifiers	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
The resulting object	Consists of separate parts, requires unification	Consists of separate parts, requires unification	Solid object, without separate vertices and polygons	-	Solid object, without separate vertices and polygons	Solid object, without separate vertices and polygons	Solid object, without separate vertices and polygons	Solid object, without separate vertices and polygons
The complexity of creating spherical surfaces	Simple	Simple	Difficult	-	Simple	Simple	Medium	Medium
Speed of operation	A quick change of ready-made polygons	A quick change of ready-made polygons	Requires careful study of each site	-	The selection of the radii of the meshing around the vertices	It is intended for fast creation of objects having one thickness on all length	Requires careful study of each landfill	Requires careful study of each landfill
A method of smoothing shapes	The use of a modifier	The use of a modifier	With a special brush	-	The use of a modifier	The use of a modifier	Application of modifiers/ initial more detailed modeling	Application of modifiers/ initial more detailed modeling

6 Conclusion

As a result of this work, the advantages and disadvantages of various modeling methods in Blender and 3Ds Max programs were revealed. The results obtained will be used in drawing up instructions for students to choose a modeling program depending on their goals and modeling method, and this information is also used to create instructions to eliminate the shortcomings of modeling methods.

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