

*Accepted and presented at the:*

The 12th International Conference on

Education and Information Systems, Technologies and Applications: EISTA 2014

July 15 - 18, 2014 – Orlando, Florida, USA

## **3D Modeling Programs: Comparison of SketchUp and Blender**

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3D modeling is used by hundreds of thousands of professionals in landscape architecture, construction, interior design, film & stage, kitchen & bath design, urban planning, game design, and woodworking. 3D models allow the creation of realistic objects that can be displayed from any angle. These models can be used for numerous reasons including: instruction manuals to show how pieces of an object are assembled, visualizations and animations to show concepts and plans for marketing purposes, and simulation studies to help model everything from tornados to how a new 10 story building will affect the sunlight on adjacent buildings. In this paper, two commonly used 3D modeling software applications, Blender and SketchUp, will be compared and contrasted.

### **Introduction**

The 3D modeling programs Blender and SketchUp both allow three dimensional objects to be created, manipulated, and displayed. How these applications perform these tasks, along with costs associated with purchasing these tools, and best uses of these programs vary drastically. By knowing some of the strengths and weakness of these applications, the end-users can make a more informed decision – allowing them to be both more creative and productive. In particular, this paper will discuss the license agreements of these applications, the graphical user interfaces of these tools, and the drawing primitives each application supports. Finally, some overall differences and similarities between these two applications will be examined.

### **License Agreements**

Blender is free and open source. This implies anyone can freely use, copy, study, and change the software in any way. The source code is also openly shared so other people can improve the software to meet their needs. This software can be downloaded at: <http://www.blender.org>

SketchUp is often classified as “freemium”. This is a pricing strategy in which the basic software is provided free of charge. The current product line for SketchUp includes:

“SketchUp Make” and “SketchUp Pro”. SketchUp Make is free for anyone to download and use. On the other hand, SketchUp Pro currently costs \$590. For students and educators there is a special lower price. This software can be download at:

<http://www.sketchup.com/>

## **Graphical User Interfaces**

When you first open up the Blender 3D modeling program five editor windows are displayed as identified in Figure 1. Each of these windows contain numerous options, tabs, buttons, and pull down menus. Initially all of this seems overwhelming. However, as you get use to Blender, many people find this graphic user interface provides an efficient approach for creating and animating 3D models. Below is a brief description of the five editor windows.

1. Information editor - contains pull down menus, information on the scene, and objects selected.
2. Outline editor - contains an outline of the various elements in the scene.
3. Properties editor - controls the scene, rendering, lighting, and texturing.
4. Timeline editor - contains playback controls, a running timeline, and displays the position of the playback head.
5. Viewport editor window - is where you create, select, manipulate, transform, and view 3D objects.

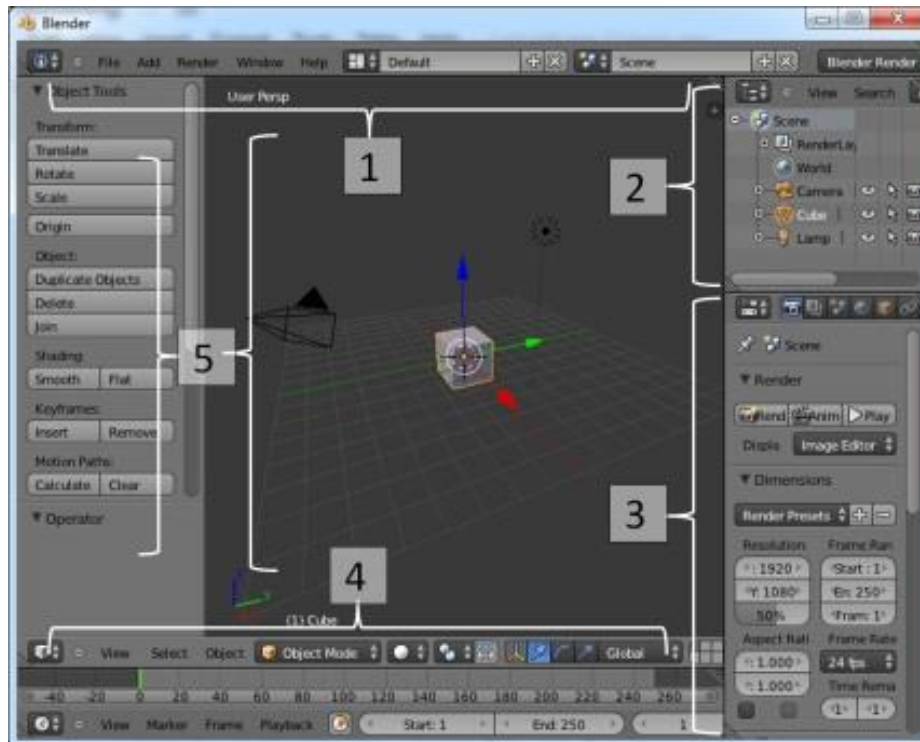


Figure 1: Illustrates the basic Blender graphical user interface.

When you first open up the SketchUp 3D modeling program, you will find a very simple interface is initially displayed as shown in Figure 2. Many additional interface elements can be displayed, but are not initially visible when the application is first loaded.

Examples of other windows that can be displayed include: the scene window, the layer window, the styles window, the components window, the materials window, etc. Below is a brief description of the elements that are displayed when the application is first opened as identified in Figure 2.

1. Menu bar – contains a long list of options, commands, and settings that allow you to perform numerous tasks.
2. Getting started toolbar – contains buttons that you can use to active commands and tools.
3. Status bar – contains contextual information and dimensions that you use while modeling.
4. Modeling window – is where you create, select, manipulate, transform, and view 3D objects.

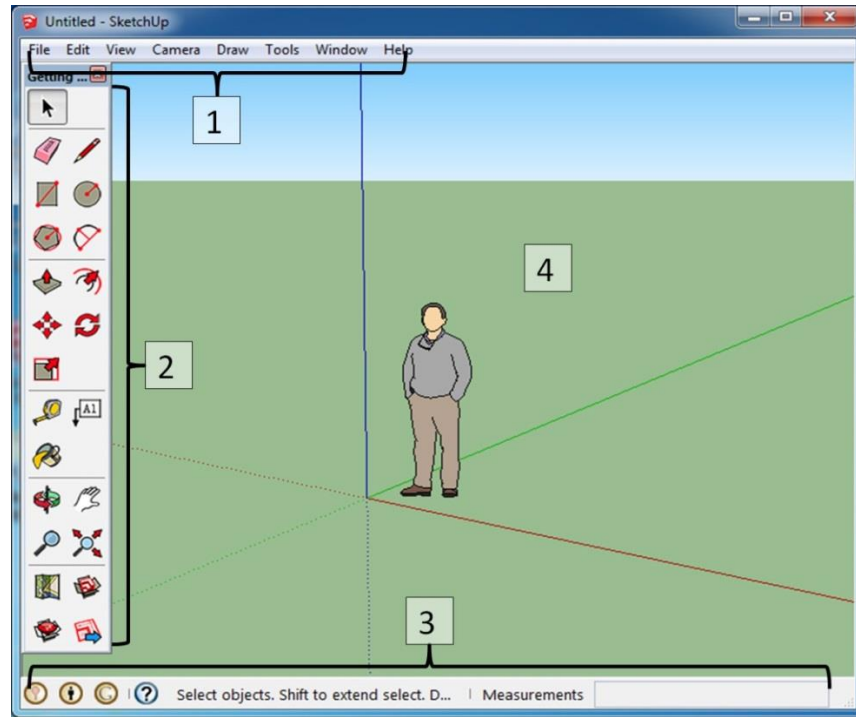


Figure 2: Illustrates the basic SketchUp graphical user interface.

### **Primitive Drawing Objects**

Primitives drawing objects are the simplest geometric objects that a system can draw. Blender provides 10 primitive drawing objects as identified in Figure 3. These objects include a cube, cylinder, cone, monkey, plane, torus, sphere, icosphere, grid, and circle.

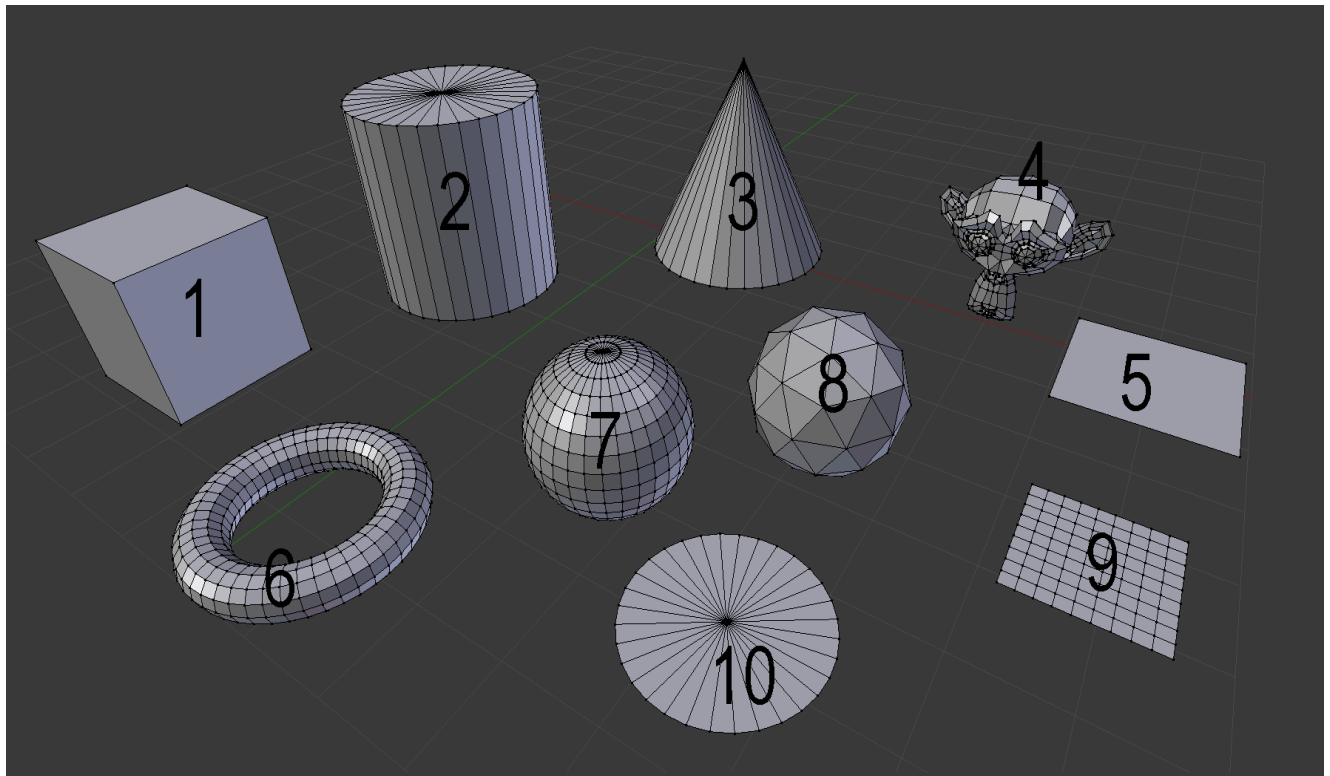


Figure 3: The drawing primitives that Blender provides.

1. Cube – draws eight vertices and six faces. It is like a box or dice.
2. Cylinder – draws a cylinder or tube made from  $n$  vertices. If the cap fill type is set to none on both ends, then a tube (pipe) is created. If the cap fill types are set to any other value for example “triangle fill” then a closed cylinder is created.
3. Cone – draws a standard cone with  $n$  vertices. If the Base Fill Type is set to none, and the top radius is greater than zero, then a funnel is created.
4. Monkey – creates a monkey head. In 3D modeling, this image is considered the equivalent of a “hello world” to computer programmers.
5. Plane – draws four edges connecting four vertices and one face. It is like a piece of paper lying on a table.
6. Torus – creates a doughnut shaped object.
7. Sphere – draws  $n$  segments and  $m$  rings. The segments are like latitude rings parallel to the center (equator) and the rings are like longitude lines from top to bottom dividing the sphere up like the segments of an orange.

8. Icosphere – draws a polyhedra sphere made up of triangles.
9. Grid – creates a grid made from  $n \times m$  vertices. Similar to a table.
10. Circle – draws a circle of  $n$  vertices. The circle can be filled with triangular faces as shown in Figure 3. This is the standard method of adding triangles and polygons. For example, to create a triangle, a circle is created with only 3 vertices.

SketchUp on the other hand, only provides 6 drawing objects or tools as identified in Figure 4. These include a circle, rectangle, polygon, line, arc, and freehand.

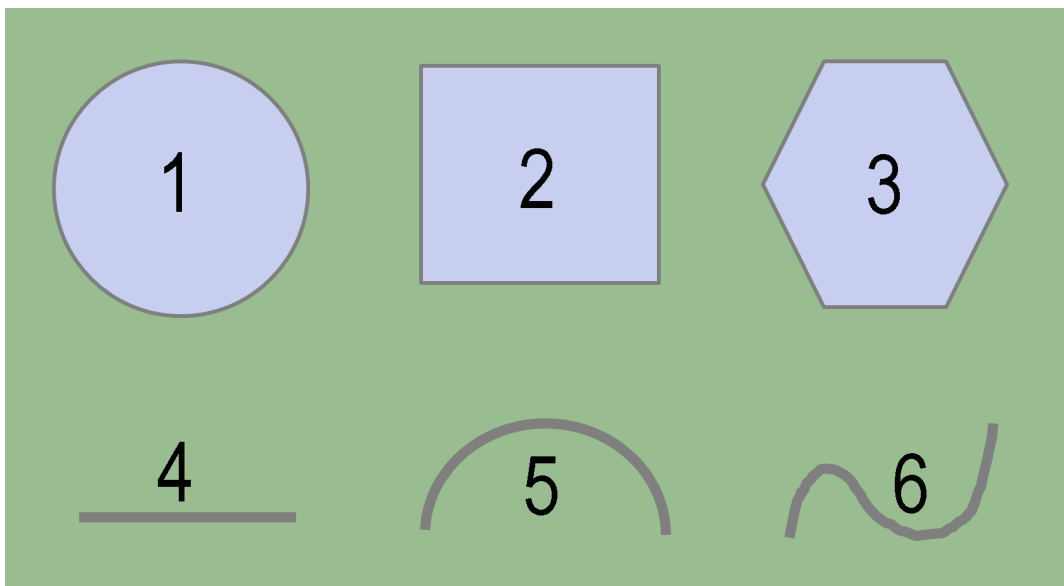


Figure 4: The drawing primitives that SketchUp provides.

These drawing primitives include:

1. Circle – draws a circle object.
2. Rectangle – draws four intersecting edges and a subsequent face.
3. Polygon – draws a polygon object, consisting of 3 to 100 sides.
4. Line – draws lines or connected lines, and edges.
5. Arc – draws a single curve.
6. Freehand – draws irregular, coplanar connected lines.

Once a rectangle, circle, or polygon has been created in SketchUp, it can easily be converted into 3D objects using the Push/Pull tool. For example, the rectangle can be converted to a cube, and the circle can be converted to either a cylinder or a cone.

## Differences

Some of the main differences between these two applications include:

Modes:

- Blender has two modes. The “Edit Mode” allows the user to make changes to the internal parts of an element, whereas the “Object mode” allows the user to operate on objects as whole elements.
- SketchUp has only one mode “Edit”. Depending on the selection, you can either edit individual parts (for example, vertices, or faces) or the entire object at once.

Uses:

- Blender is a 3D visualization tool used primarily for visual effects, interactive applications, and video games. It has an excellent animation timeline and a wide selection of lighting effects. It is not designed for architectural or engineering. The default scale uses “Blender units” rather than exact units of measurement.
- SketchUp is a 3D modeling program that can be used for such applications as civil and mechanical engineering, architectural, and interior designs. The user can enter exact measurements using either the metric system (millimeters, centimeters, meters) or the imperial system (inches, feet).

Creating new objects:

- Blender uses the location of the 3D cursor to determine the placement of new objects.
- SketchUp places new objects at the location of where the mouse begins dragging-out/creating the new object.

A feature unique to Blender is the “Display Quad view”. This view displays the top, front, right, and camera perspective all simultaneously. When changes are made in one viewport changes are automatically made to the other viewports. Blender can also display a wire-frame in one view and solid in another view.

## Similarities between Blender and SketchUp

Both Blender and SketchUp use the same colors to specify the 3 dimension or directions. The x axis is red and denotes east and west directions. The Y axis is green and denotes north and south directions. The Z axis is blue and denotes up and down directions.

Both Blender and SketchUp also use the same mouse movements for changing the viewport. Rolling the center scroll wheel back and forth zooms in or out. Pressing down on the center scroll wheel orbits the scene. Finally, holding the Shift key while pressing down on the scroll wheel pans the scene.

Both Blender and SketchUp are 3D applications that can save the designer or engineer significant time when modeling 3D objects. For example, when modeling a 3D object with 2D software, the designer typically creates a front, right, and top view as shown in Figures 5, 6, and 7. However, when using Blender or SketchUp, the designer only needs to create one object. Once this object is created, the designer can easily produce the other views by simply changing the viewport. Furthermore, a 3D representation as shown in Figure 8, often provides an image that is more easily understood than viewing the individual front, right, and top views separately.

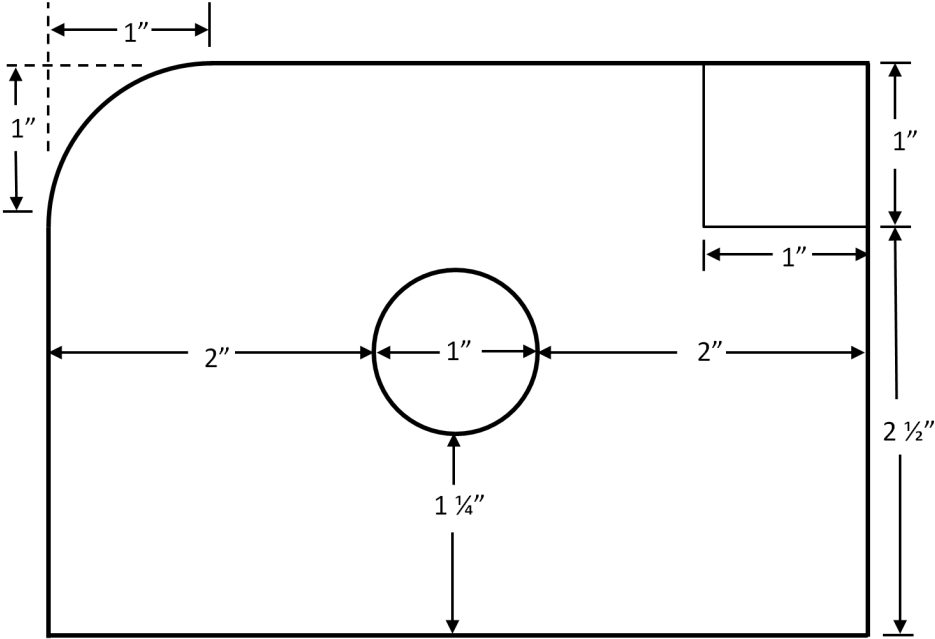


Figure 5: Front view of the 3D object shown in Figure 8.



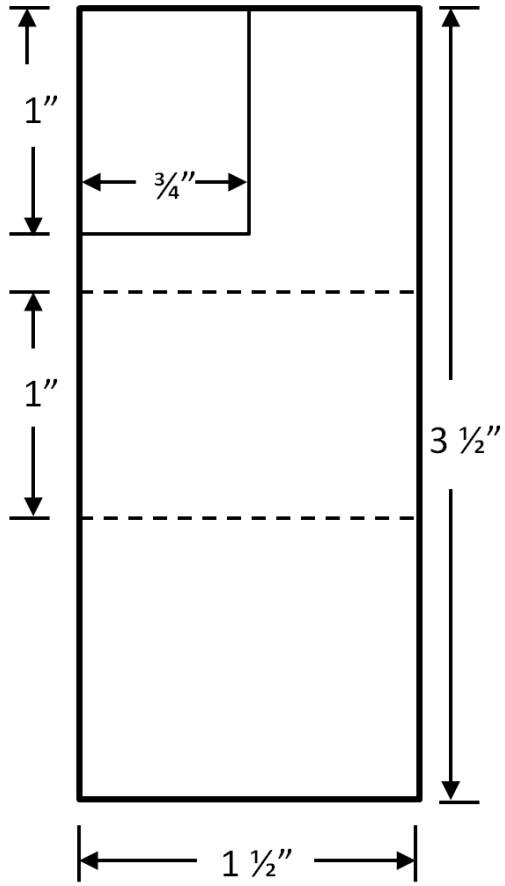


Figure 6: Right view of the 3D object shown in Figure 8.

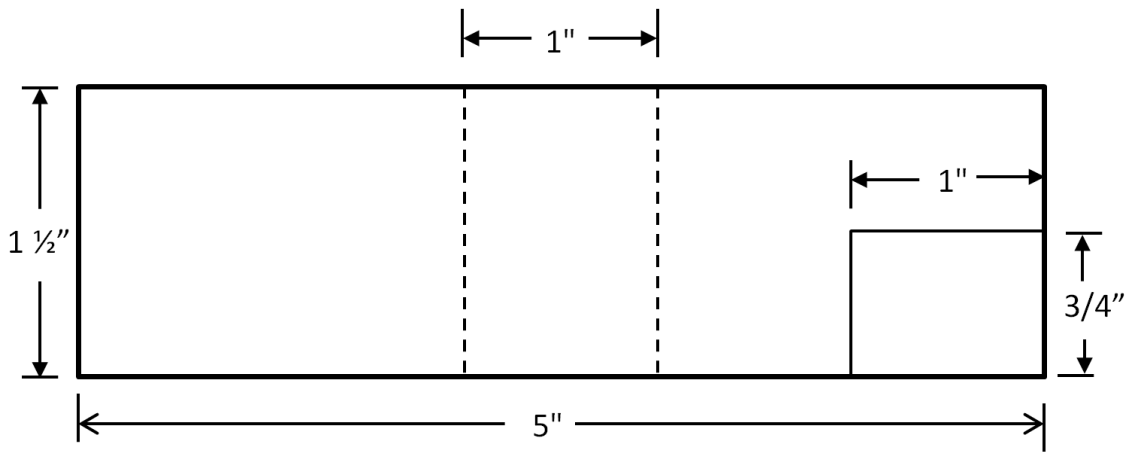


Figure 7: Top view of the 3D object shown in Figure 8.

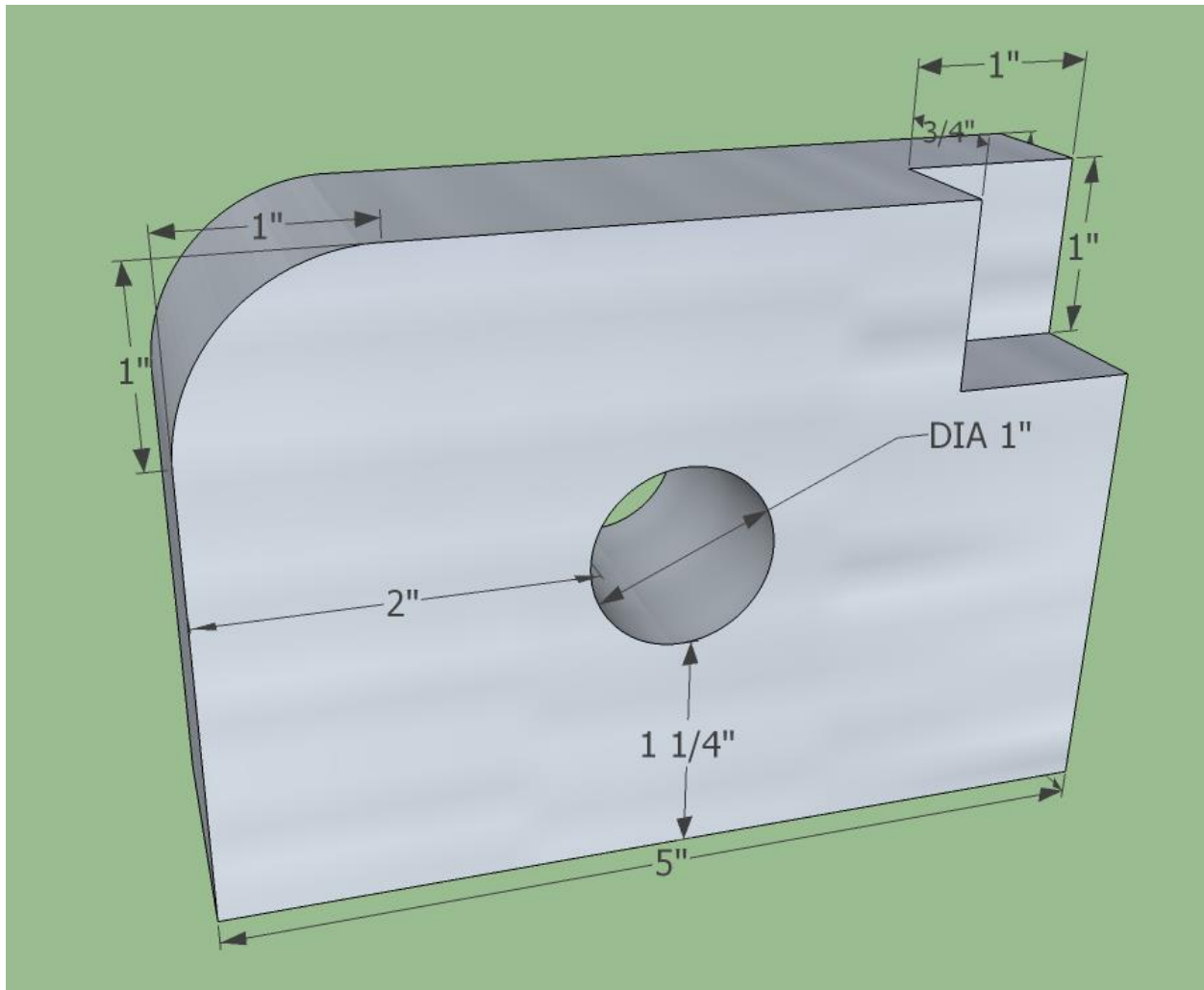


Figure 8: Showing a 3D model in 3D space.

### Conclusion

In this paper, two commonly used 3D modeling software applications, Blender and SketchUp, were compared. Which application is better all depends on what you want to do with it. If you are looking for outstanding lighting effects and 3D animations then you might want to consider using Blender. On the other hand, if you are trying to produce engineering or architectural designs then SketchUp might be your better choice.