

# SketchUp README for the Sandio 3D Mouse Driver

## I. Using 3D Mouse on SketchUp.

Sandio 3D Mouse helps you improve your productivity and your total 3D experiences on Google SketchUp. With Sandio 3D Mouse, you are able to operate x, y, z movements and rotations without going back and forth between menu and your artwork. You can operate on both camera mode and object mode.

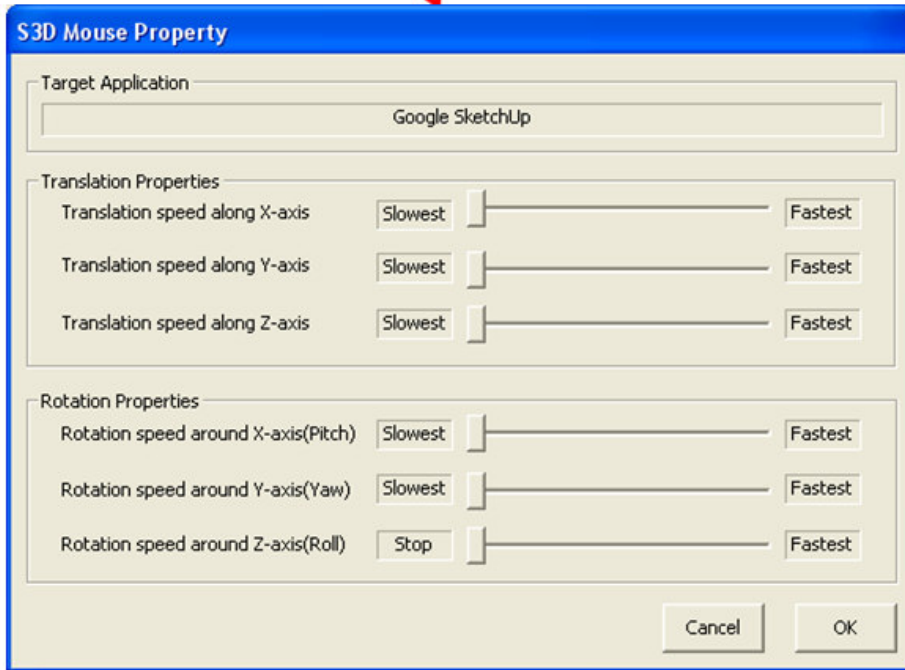
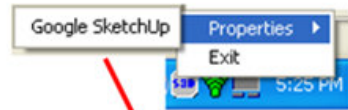
## II. Operation Manual

1. Connect the Sandio 3D Mouse first.
2. Install latest SketchUp software. (Available at: <http://sketchup.google.com/download.html>)
3. Run SketchUp.

The 3D mouse driver automatically starts and pop-up window will shows up in a task bar area.



4. You can change the speed of translation or rotation by right-clicking your mouse button and selecting Properties → Google SketchUp.  
The *S3D Mouse Property* Window that appears allows you to control and choose the sensitivity for the 3D Mouse's 6DOF commands. *Note: By default, the Roll ability is not turned on.*



## 5. Special Icons:

The Sandio 3D Mouse driver will display six icons in the upper-left corner of SketchUp. All these icons are toggle switch for specified function shown below.

The buttons are as follows:



Switch Control Mode - switch the mode between Camera View and Object Mode



Enable/Disable Translation - turn on or off movement along all three three axes



Enable/Disable Rotation - turn on or off rotation about all three axes



Center of Rotation - toggles the center of rotation between two modes. This sets the center of rotation (also known as the origin).

	Camera View	Object Mode
<b>Mode 1 (OFF):</b>	Sets the center of rotation at the center of your current screen display.	Make sure you have the object selected. This mode sets the center of rotation at the center of your current screen display.

	display.	the center of your current screen display.
<b>Mode 2 (ON):</b>	Sets the center of rotation at the component's center of mass.	Make sure you have the object selected. This mode sets the center of rotation at the selected component's center of mass.



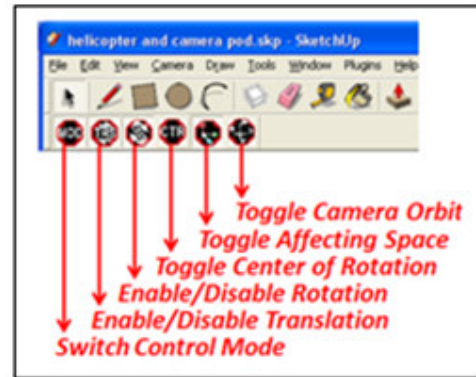
Affecting Space - toggles the affecting space between two modes. There is more detailed information regarding this below.



Camera Orbit - turns on or off camera orbit. There is more detailed information regarding this below.

**The default setting is:**

Control Mode: *Camera View*  
 Enable/Disabled Translation: *Enabled*  
 Enable/Disable Rotation: *Enabled*  
 Center of Rotation: *OFF*  
 Affecting Space: *ON*  
 Camera Orbit: *ON*

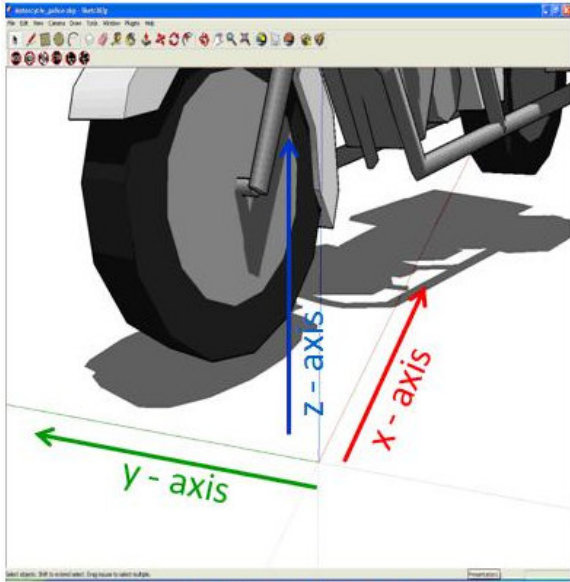


You can see current state of the icons at lower-left corner of SketchUp window.

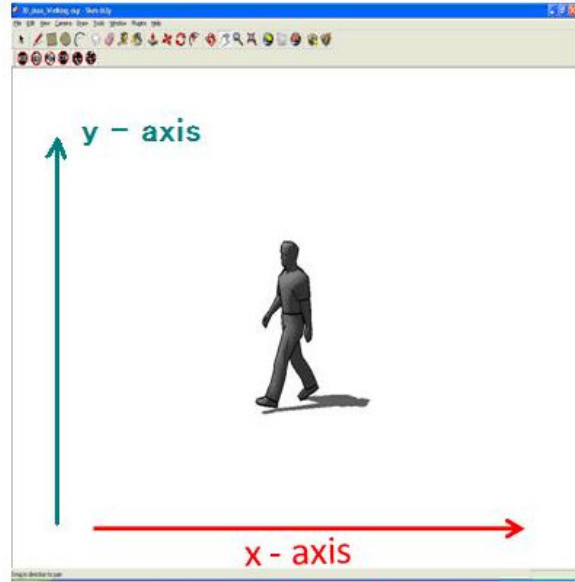


6. Coordinates in SketchUp.

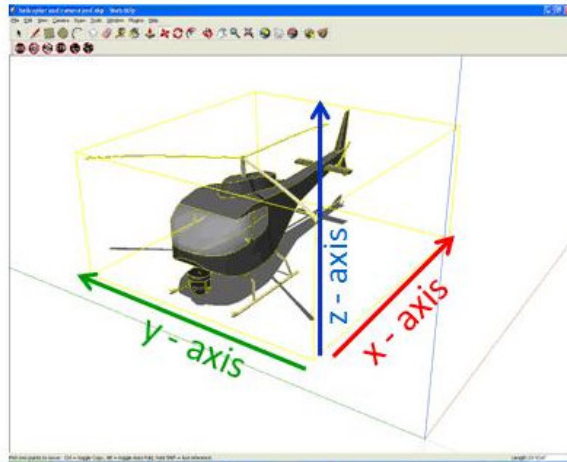
Sandio 3D mouse driver defines the following coordinates. Expected translation and rotation corresponding to the states of “Affecting Axis” and “Center of Rotation” are discussed further in *Table 1* of the *Appendix*.



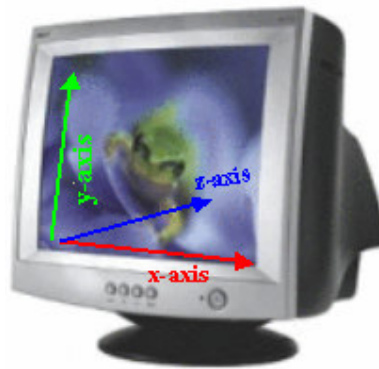
World Coordinates



Screen Coordinates



Local Coordinates



**Definition of Screen Coordinates:**

X-Axis = horizontal; Y-Axis = vertical; Z-Axis = perpendicular to computer screen

## Appendix:

Table 1: Expected Translation and Rotation

(Note: **the red text** = default selection)

### Initial Condition (the default settings):

Control Mode = **Camera View**

Rotation Center = **OFF**

Affecting Space = **ON**

Camera Orbit = **ON**

Coordinate System/Origin	Rotation Center <b>ON</b>	Rotation Center <b>OFF</b>
<b>Affecting Space <b>ON</b></b>	<b>Origin:</b> Local space or the center of all selected objects. <b>Axes:</b> Screen space axes.	<b>Origin:</b> Screen Space or the center of the viewport. <b>Axes:</b> Screen space axes.
<b>Affecting Space <b>OFF</b></b>	<b>Origin:</b> Local space or the center of all selected objects. <b>Axes:</b> World space axes, corresponding to the red, green and blue axes in SketchUp.	<b>Origin:</b> Screen space or the center of the viewport. <b>Axes:</b> World space axes, corresponding to the red, green and blue axes in SketchUp.

A coordinate system is defined by two components, the origin and a set of n (in 3d space, n is 3) vectors (axes). As you can see, '**Rotation Center**' defines the origin and '**Affecting Space**' defines the axes. Since we want to be able to rotate around the object (for either rotating the camera or the object itself), while moving in the screen space (panning), using 'pure' local/screen space coordinate system would not suffice. Rather, we want to use the mixture of both spaces to provide more natural navigation. As far as the coordinate system is concerned, we have used component(s) from 3 different coordinate systems to define the SketchUp coordinate system, namely, the screen space, the world space and the local space.

Each combination defines a valid coordinate system. Thus, we can summarize the effect of combining '**Rotation Center**' and '**Affecting Space**' buttons as following:  
The definition of the coordinate system for 'Object Mode' is exactly the same as that of 'Camera Mode' and is dependent on the button states of '**Rotation Center**' and '**Affecting Space**' (whether the icon is turned on or off). Since the default states for the buttons are '**Rotation Center**': Off and '**Affecting Space**': On, referring to the above table will give you a coordinate system whose

origin is the center of the viewport and the axes are the screen space axes.

### **Caveat: *Object Mode Control for Large 3D Object Structures***

**The issue:** Occasionally, a few object components in selected objects sometimes disassemble and never return at 3D control. Novice users should be warned that manipulation of large sized objects (which consist of many components) might experience slowing of their computers.

**The workaround:** In SketchUp, every model consists of faces, edges, arcs and other primitives. Now let's start with a triangle. Select two edges from this triangle (Yes, there is no such thing as triangle in SketchUp, all you are manipulating are primitives. Thus, you cannot select the 'triangle' itself.) and try to move it with the 3d mouse. What happens now is that the third edge also moves. This provides some insight into the internal management of models in SketchUp, which is that the transform applied on the edge directly affects the two points defining the edge, or the transform is actually applied on these two points. Now, create a square with 2 triangles. As you can see, there is one edge shared between these two triangles and the points defining this shared edge are each shared with 3 edges in total whereas the other points defining the square are only shared with 2 edges each. If we try to select all edges and move this shape, the transform applied on each point is not equal, thus resulting in shape bending. The very same thing happens to any shape with internal edges if you are trying to move/rotate the shape by selecting all edges. In order to make the transform result appear rigid, only the external edges should be selected. Although there is algorithm to determine external edges, it is insufficient to provide real time interaction with the user in terms of speed. What SketchUp does when you use the built-in move tool is that, it applies the transform on the points directly, which are not accessible from the Ruby script. The correct way to transform a large group of objects is to create a group out of the selection and apply the transform on the group. Here is how:

1. Select object you want to move/rotate.
2. Right click on the selected objects and choose 'Make Group'
3. Move the group freely without breaking its structure.

**NOTE:** If you encounter a "slow movement" or "PC Freeze", please read the section titled  
**Caveat: *SketchUp Regarding Control of Objects in Object Mode***