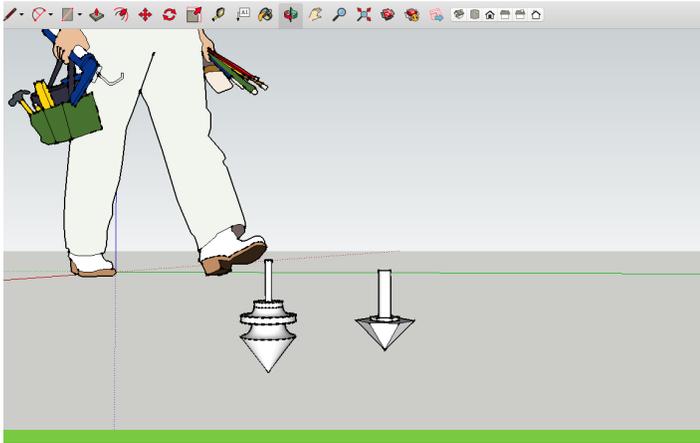


## Spinning tops



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**Public**

7-12 y-o

adult

**Software**

SketchUp

### Description

#### Learning goals:

- master the basics of SketchUp

Learn the basics of SketchUp by 3D modeling a spinning top. Two methods are detailed for different levels of technical challenge (easy and intermediate). Depending on the size of the spinning tops, there will likely be enough time to print them all.

### Timing

#### 1. Introduction and presentation of 3D printing - 15 mins

Introduction of the world of 3D printing with video (<http://www.dragontape.com/#!/6319966877908992>) and presentation.

#### 2. Overview of the activity - 5 mins

Briefly explain the flow of steps for the day's activity.  
What will the participants do? : Create a spinning top  
Which software will be used? : SketchUp

#### 3. Open SketchUp for all participants - 2 min

#### 4. Introduction to SketchUp - 20 min

- Interface (menu, tools, workplane)
- Changing the viewpoint (orbit, pan, zoom)
- Sketching lines (pencil, shape, arc), snap and alignment to the three axes (red, blue, green)
- Sequence for creating specific measurements (e.g., rectangle measuring 5 x 10 cm)
- Push/pull tool
- Deleting faces (e.g., from a rectangle) and re-creating the face with the pencil tool
- Offset tool for making windows
- Move and rotate tools (holding the shift-key to lock transformation to an axis)
- Measure tool and creating guides for sketching
- Make sure to draw attention to the need for models to be watertight (demonstrate what this is and how to fix it)

Also, see the user guide and tips in the software resources page for SketchUp

#### 5. Demonstrate the modeling of a spinning top

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## METHOD 1 : easy difficulty level - 15 min

### The base of the spinning top

1. Using the polygon tool, create a hexagon with a 25mm radius.
2. Use the push/pull tool to give it some height (25mm)
3. Using the scale tool, select the bottom face of the hexagonal cylinder.
4. While holding down the Ctrl-key, scale down the bottom face. Since we want to create a prism with a point, reduce the scale of the face down to 0.01
5. In the center of the base of the prism, create a new hexagon with a 12mm radius.
6. Using the push/pull tool, inset the hexagon face into the prism by 3mm.
7. This inset will be used to connect the handle of the spinning top.

### The handle of the spinning top

The handle of the spinning top will connect to the base of the spinning top via the hexagonal inset.

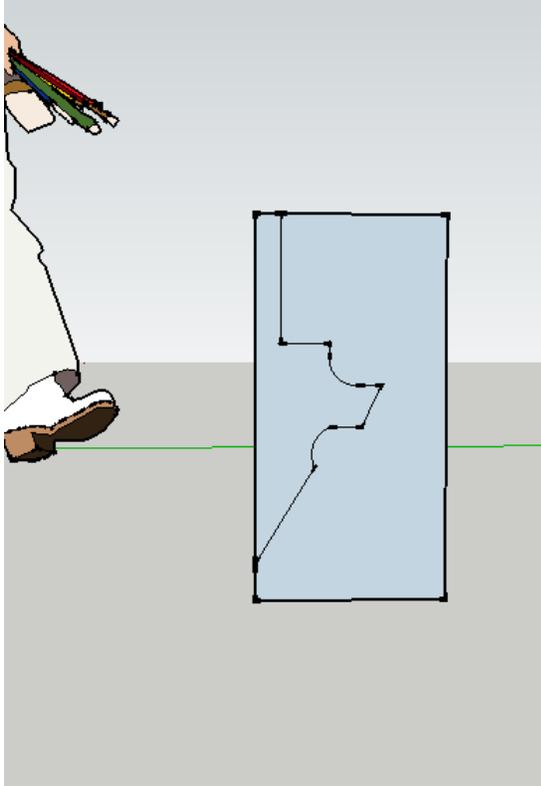
1. Next to the spinning top, create a new hexagon with a radius of 11.95mm.
2. With the push/pull tool, select the hexagon, and pull it up 2.95mm.
3. In the center of this hexagonal cylinder, create a circle with a 5mm radius.
4. Using the push/pull tool, pull the circle up 40mm.

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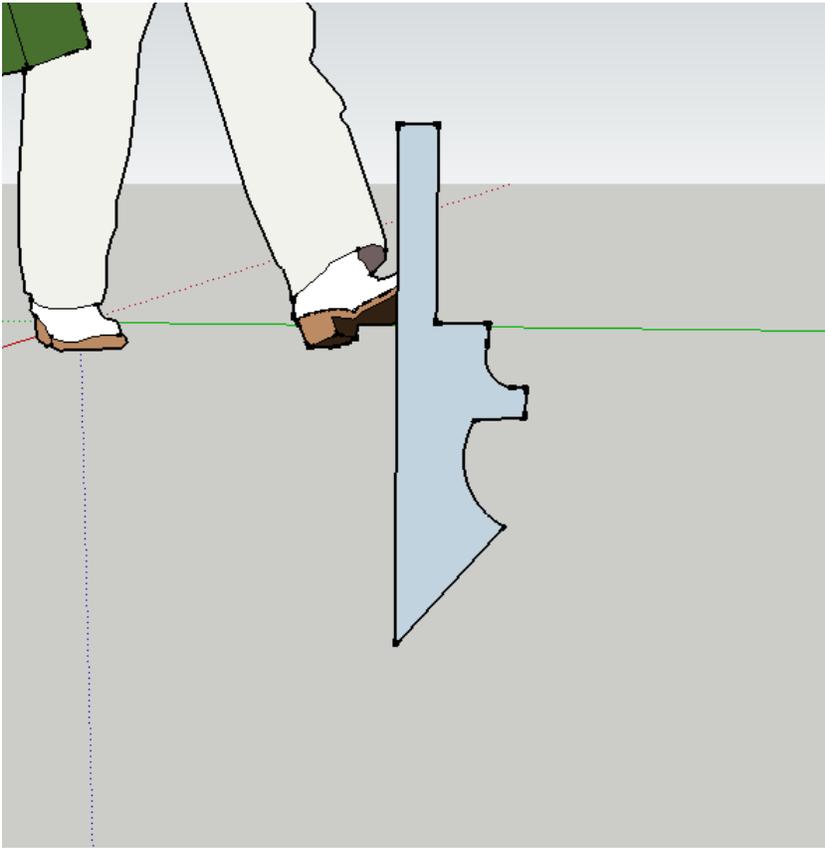
## METHOD 2 : intermediate difficulty level - 20 min

If there is enough time after having shown the first method, you can also demonstrate a more creative method using the follow-me tool.

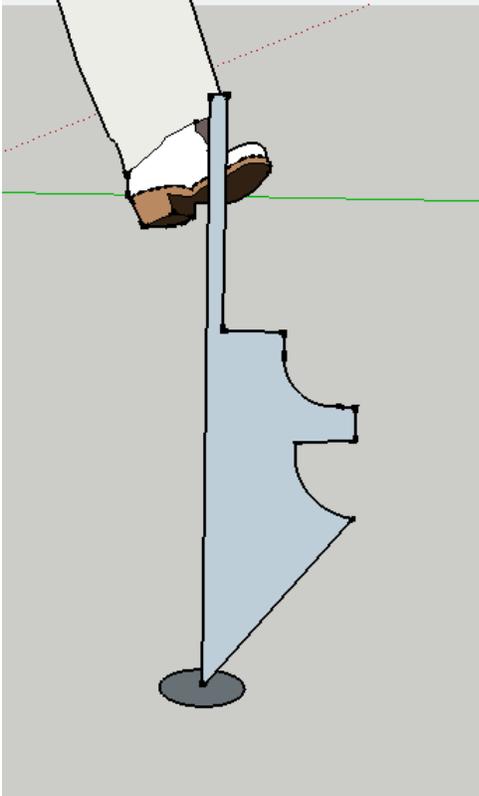
1. Create a 300mm x 300mm square on the front plane (red-blue plane).
2. On the face of the square, use the pencil tool to draw a contour for the handle, starting from the top edge and going down 50mm.
3. Still using the pencil tool, draw the profile of half of a spinning top. See the image below for an example.



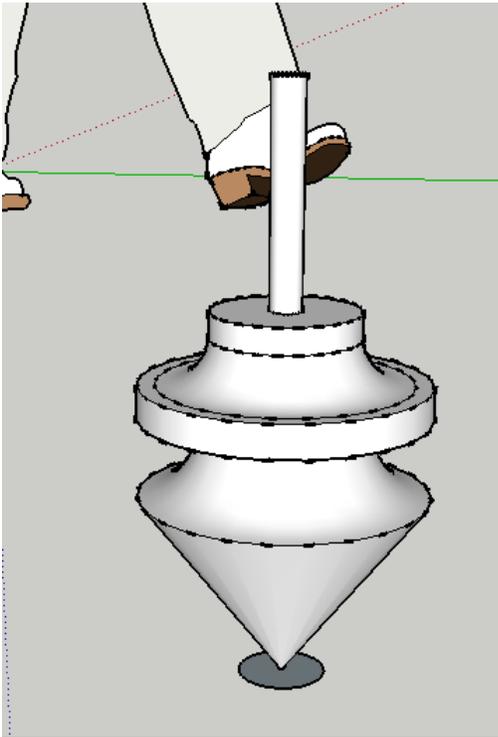
4. Using the eraser tool, remove the lines which do not make up the profile of the spinning top, as in the image below.



5. Draw a circle with a 10mm radius centred at the tip of the spinning top profile. Make sure that the circle is drawn on the floor (red-green plane).



6. Using the select tool, click on the circle outline.
7. With the circle outline still selected, select the "Follow Me" tool (under the "Tools" menu bar) and click on the face of the spinning top profile. Voila you now have a spinning top volume!
8. Using the eraser tool, delete the circle created earlier.



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## 6. Saving the STL file

Ask participants to export their files (see instructions above) and to name their files using their name.  
Use a USB key to gather the STL files from participants.

## 7. Import the files in Tinkerine or Cura - 5 min

Open the preferred slicer software  
Import the STL file  
Adjust the print settings (fill, wall thickness, speed, height, ...)  
Save the file (.Gcode) to the SD card

## 8. 3D Printing - 30–45 mins

Insert the SD card in the 3D printer  
Select the previously saved file (.Gcode)  
Start the print!

## 9. Feedback - 5 min

Ask the participants to provide feedback on the workshop while the models are being printed.

## Participant's guide

### METHOD 1 : easy difficulty level

#### The base of the spinning top

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2. Use the push/pull tool to give it some height (25mm)
3. Using the scale tool, select the bottom face of the hexagonal cylinder.
4. While holding down the Ctrl-key, scale down the bottom face. Since we want to create a prism with a point, reduce the scale of the face down to 0.01
5. In the center of the base of the prism, create a new hexagon with a 12mm radius.
6. Using the push/pull tool, inset the hexagon face into the prism by 3mm.
7. This inset will be used to connect the handle of the spinning top.

#### The handle of the spinning top

The handle of the spinning top will connect to the base of the spinning top via the hexagonal inset.

1. Next to the spinning top, create a new hexagon with a radius of 11.95mm.
  2. With the push/pull tool, select the hexagon, and pull it up 2.95mm.
  3. In the center of this hexagonal cylinder, create a circle with a 5mm radius.
  4. Using the push/pull tool, pull the circle up 40mm.
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### METHOD 2 : intermediate difficulty level

If there is enough time after having shown the first method, you can also demonstrate a more creative method using the follow-me tool.

1. Create a 300mm x 300mm square on the front plane (red-blue plane).
2. On the face of the square, use the pencil tool to draw a contour for the handle, starting from the top edge and going down 50mm.
3. Still using the pencil tool, draw the profile of half of a spinning top. See the image below for an example.
4. Using the eraser tool, remove the lines which do not make up the profile of the spinning top, as in the image below.
5. Draw a circle with a 10mm radius centered at the tip of the spinning top profile. Make sure that the circle is drawn on the floor (red-green plane).
6. Using the select tool, click on the circle outline.
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