

# TINKERING WITH TINKERCAD

A Beginner's Guide to Creating 3D Printer Designs



**With Presenters:  
Michael Hibben & Sarah Holmes**

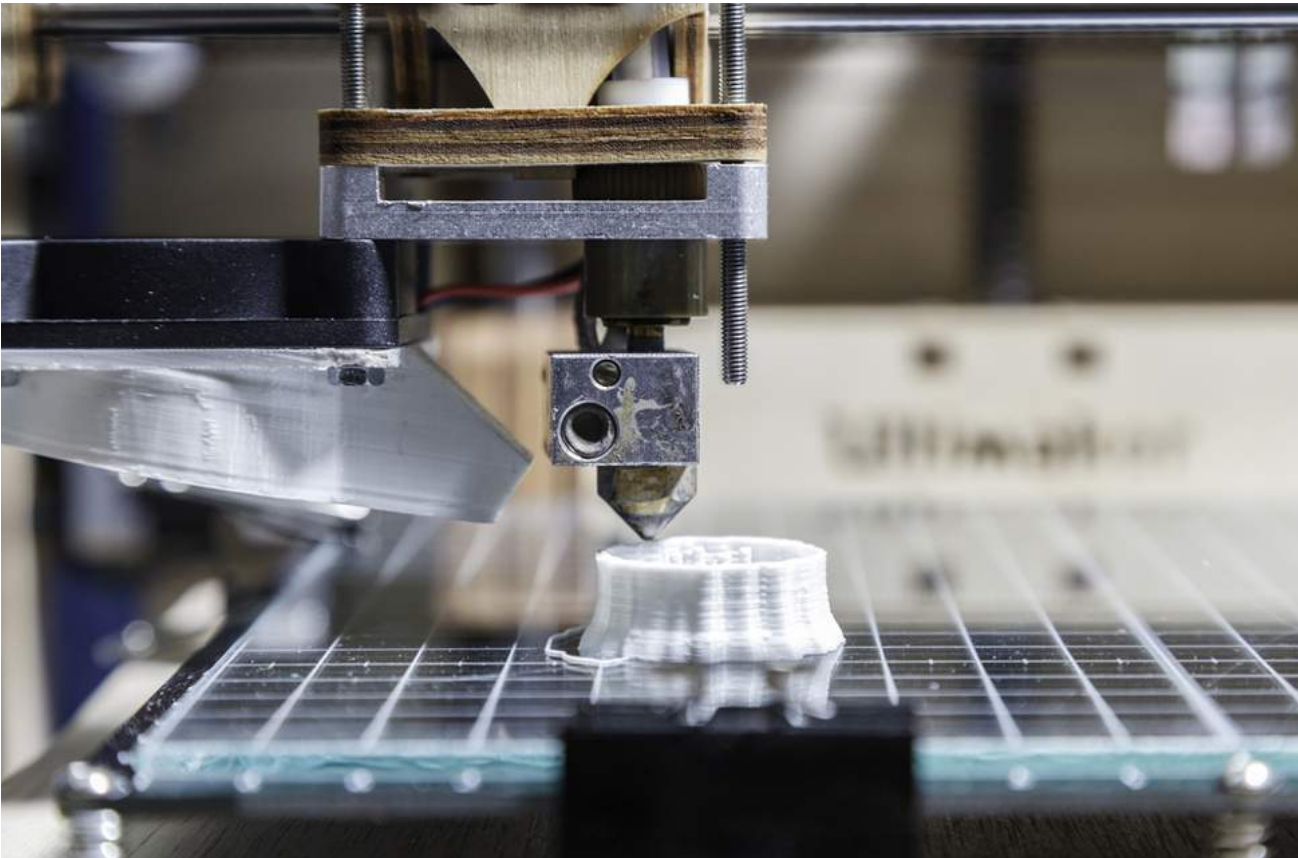


# Tinkering With Tinkercad

## Welcome!

In this workshop, you'll get a brief introduction to the world of 3D model file creation using Tinkercad. We'll learn what it is and how it works. We'll also create a 3D model file in class and you'll have the option of 3D printing it.

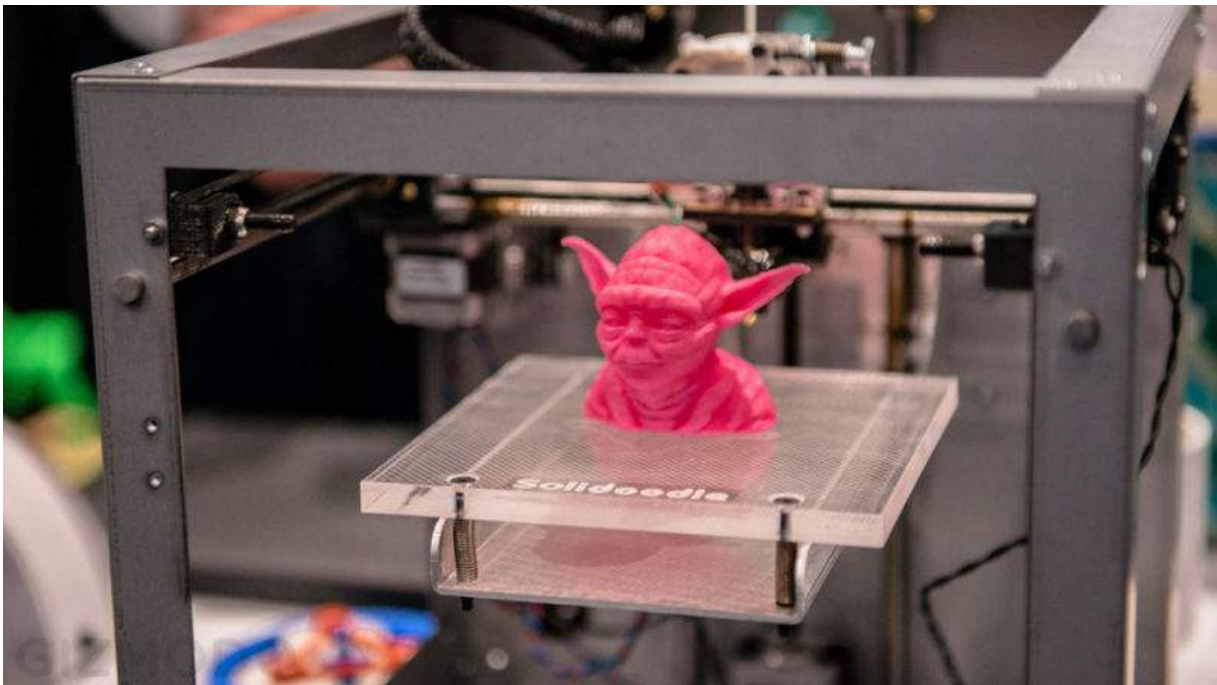
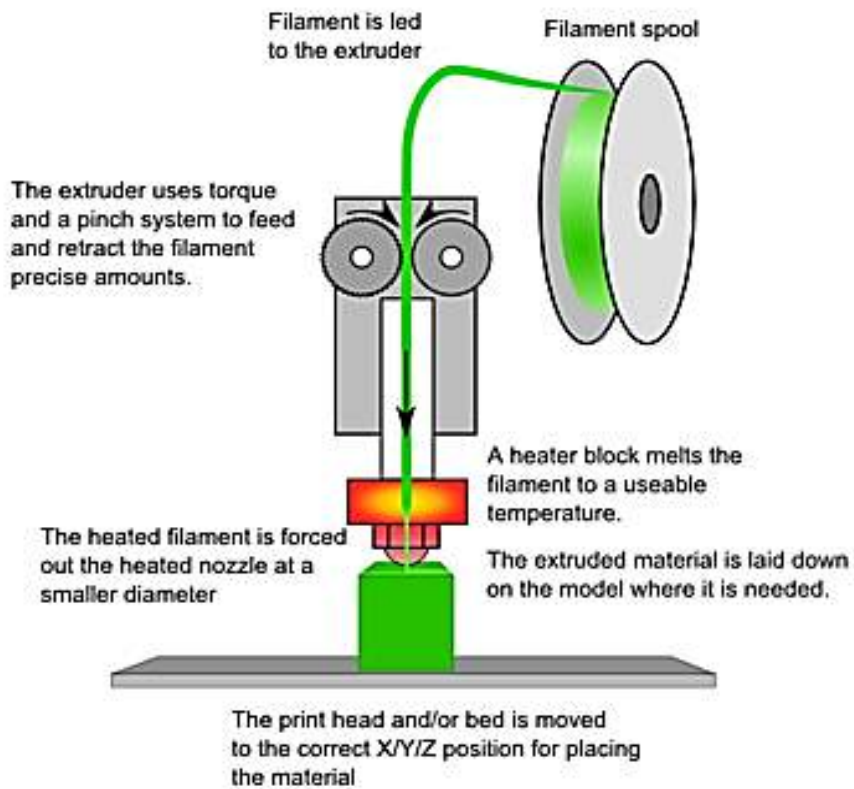
## What is 3D Printing?



3D printing -- also known as additive manufacturing -- turns digital 3D models into solid objects by building them up in layers. The 3D printing process turns a whole object into thousands of tiny little slices, then makes it from the bottom-up, slice by slice. Those tiny layers stick together to form a solid object.

3D printing was first developed in the 1980s for manufacturing and in recent years has been used for a variety of purposes - such as creating the models for stop motion films. 3D printing works through a process called material extrusion: the nozzle of a 3D printer pushes out a semi-liquid substance into the shape the computer tells it to form, and repeats the process - building thin layers which form the object being printed.

## MATERIAL EXTRUSION



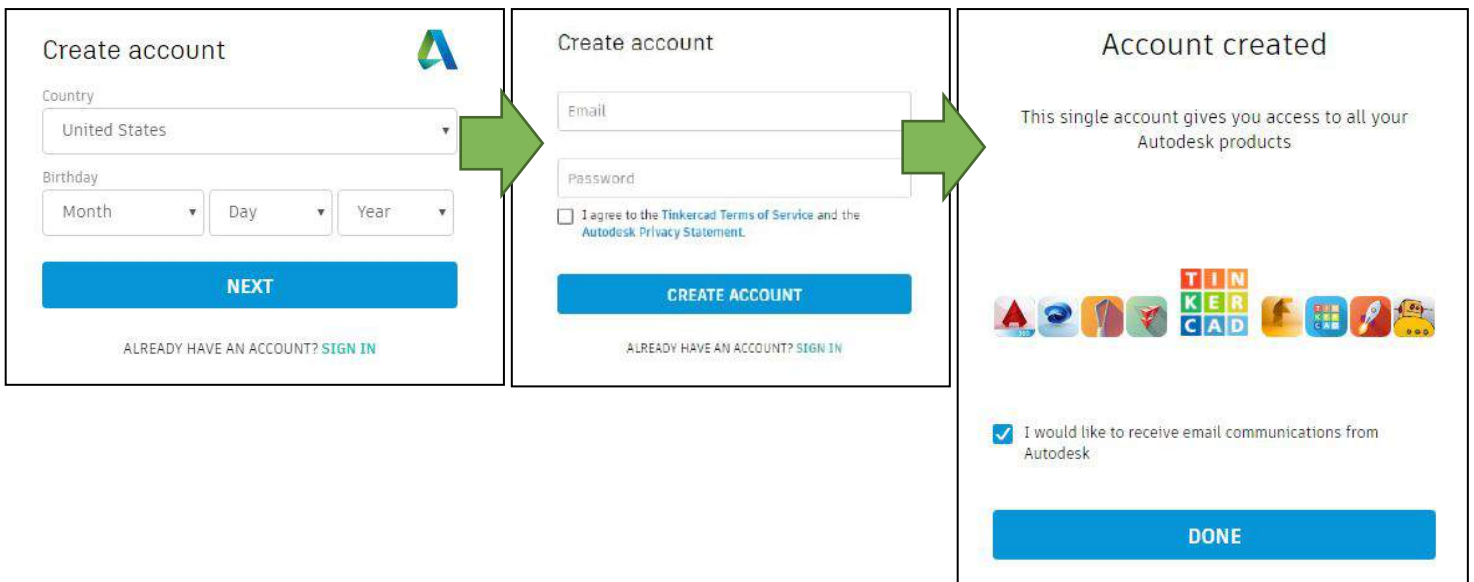
## How do people create 3D model files?

Generally 3D model files are created with 3D model software. There are a lot of software options to choose from: some are web-based and some desktop based. This class is an introduction to Tinkercad, which is web-based software used to create and share 3D model files. What makes Tinkercad so great is how easy it is to use. If you can click and drag, then you can use Tinkercad!



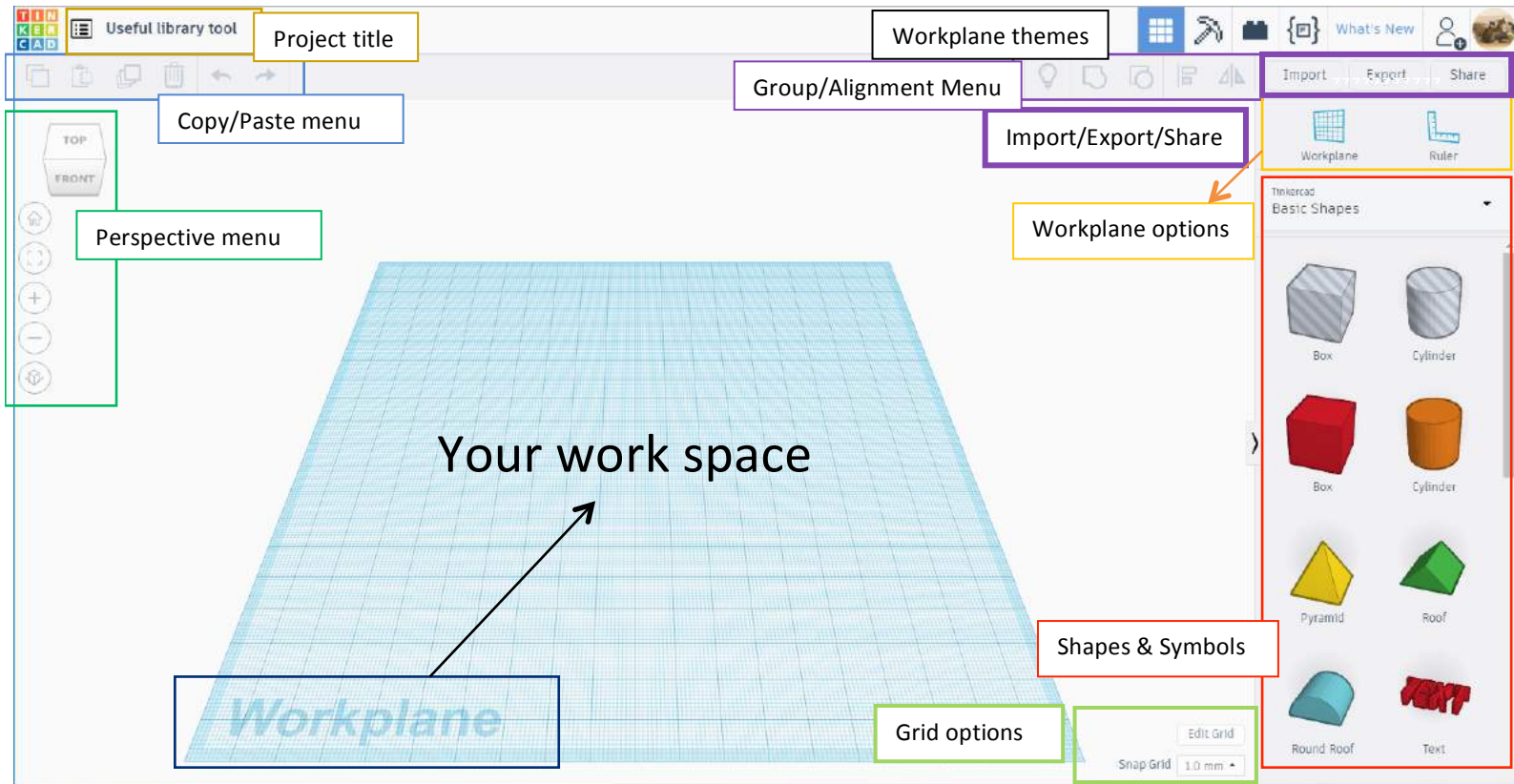
## Getting an account

1. Open the Internet and type in: [www.tinkercad.com](http://www.tinkercad.com)
2. Follow the steps to create your own account.





# Tinkercad workspace overview

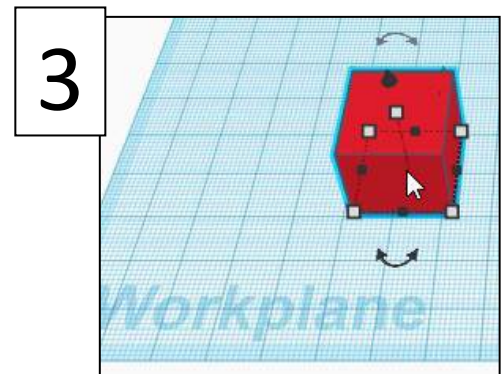
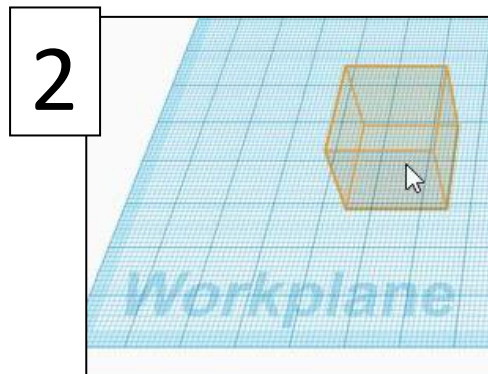
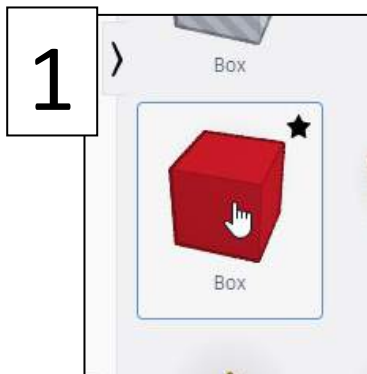


## Some Basic Shape Menu How-Tos

### I. Moving a shape or symbol from the basic shapes menu to your Workplane (clicking and dragging)

- Select which shape you would like to add to your Workplane.
- Move your mouse over the Workplane where you would like to "drop" your shape.
- Left click to "drop" shape and add it to the Workplane

\*Note: Alternatively, you can left click and hold the shape you want, drag your mouse to where you want to put it on the Workplane and then let go of the left click button on the mouse to drop your shape



## II. Resizing your shape.

- a. There are many different ways to edit your shape once it's on the Workplane.

Click and drag the small white circles when you have a shape selected to make changes.

Once a shape is selected on the workplane, carefully click a small gray box to change a specific measurement of a shape by left clicking within the white text boxes that appear.

\*Note: Selected points will change color from gray (unselected) to red (selected).

Shape

Solid Hole

Radius 0

Steps 10

Length 20

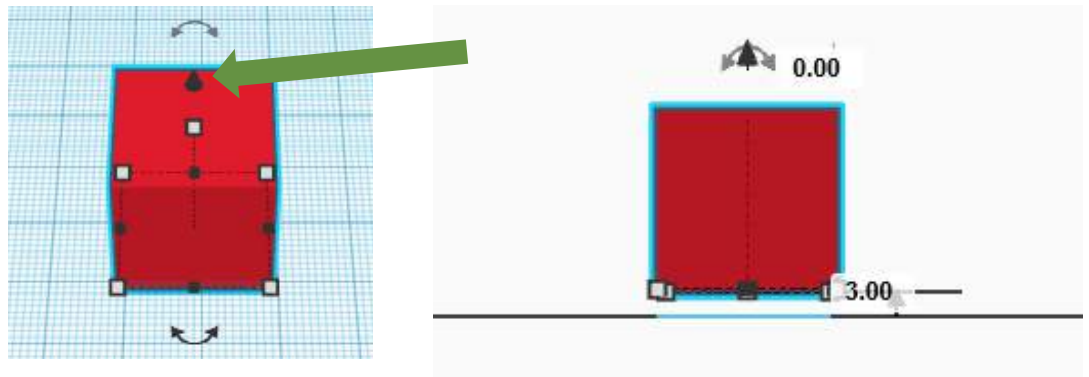
Width 20

Height 20

\*Note: Alternatively, you can left click and drag any of the points to change the size/shape of the object selected.

## III. Moving a shape above or below the Workplane.

- a. You can move a shape above the Workplane by clicking and dragging the cone-shaped handle above your shape. This function allows you to stack shapes on top of each other.
- b. Remember to view your shape from the front to make sure it's not floating above the Workplane. This could mess up your 3D print if the base of your project isn't touching the Workplane.

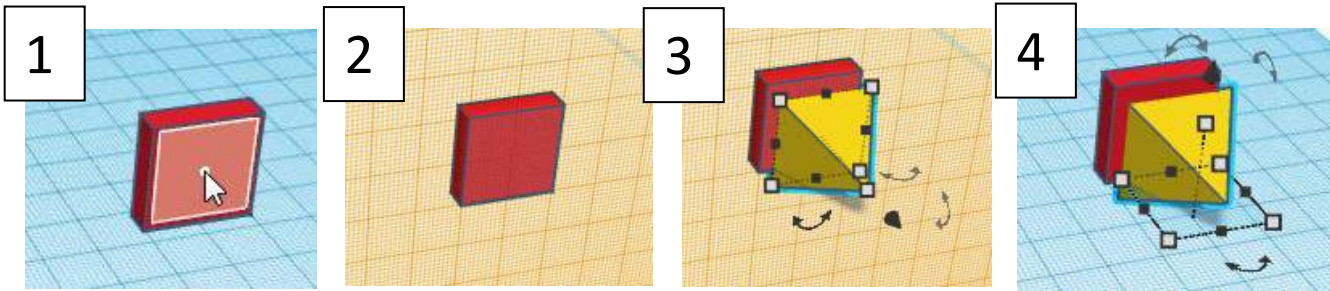




## The Workplane button:



If you would like to work or build on the side of a shape, you can change the Workplane to be the surface of a shape side by clicking this button and then clicking the side of a shape.

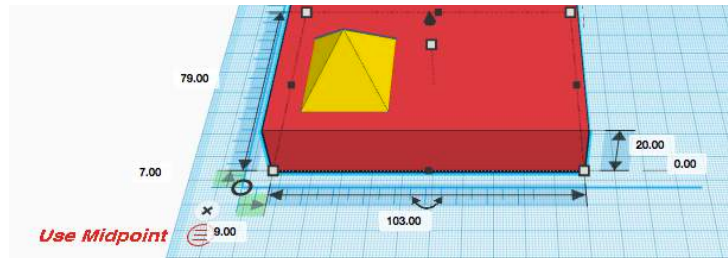


## The Ruler button:



To use the ruler, click on the ruler button and then click where you would like the ruler to appear on the Workplane.

Once you have the ruler on the Workplane, you can select an object and then have the option to view the midpoint of the object selected or the endpoint.



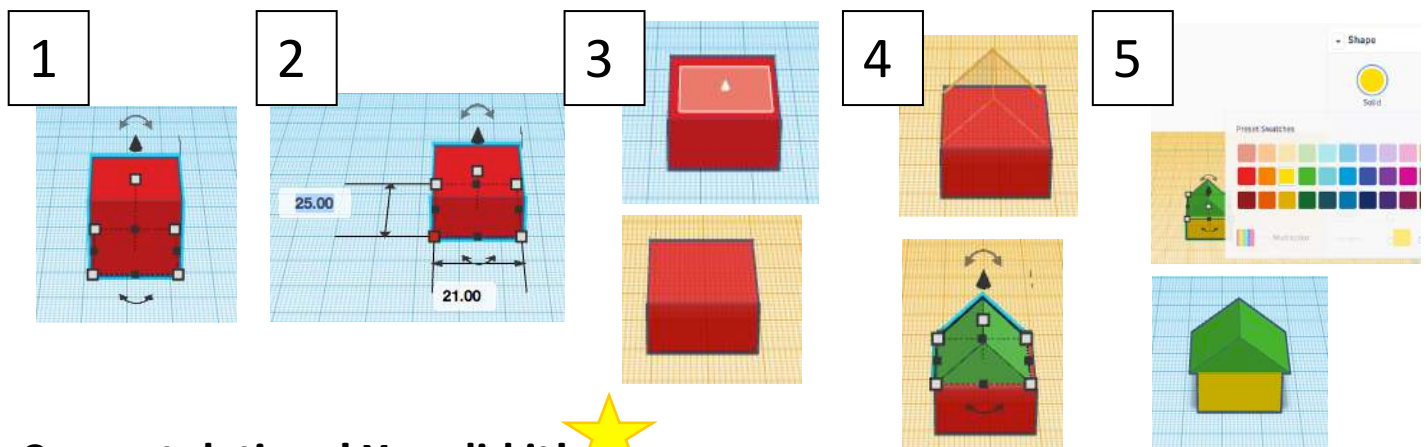
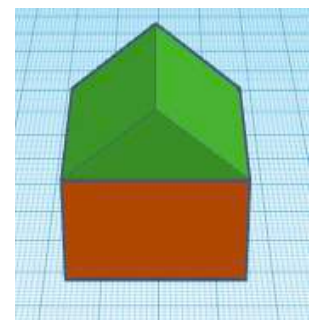
## Your turn. Become a master builder.



## Goal: basic house

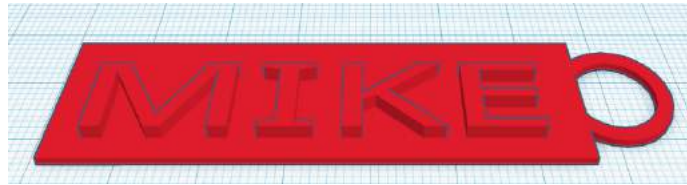
Start with a basic house (if you want to be really fancy, add a chimney).

- Step 1: Click and drag a "Box" shape from the Basic Shapes menu to your Workplane.
- Step 2: Change the size of your box to be the size of house that you prefer.
- Step 3: Change the area of your Workplane to the top of the box in order to add your roof.
- Step 4: Add a "Roof" shape on top of your box shape to make a house.
- Step 5: Change the color of your house.



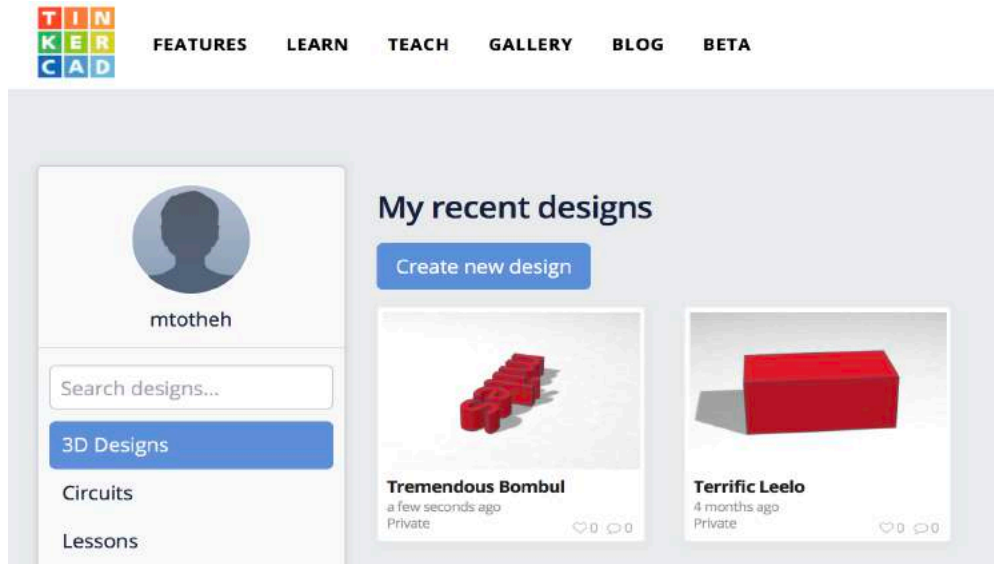
Congratulations! You did it! ★

## Creating your first project: A Keychain

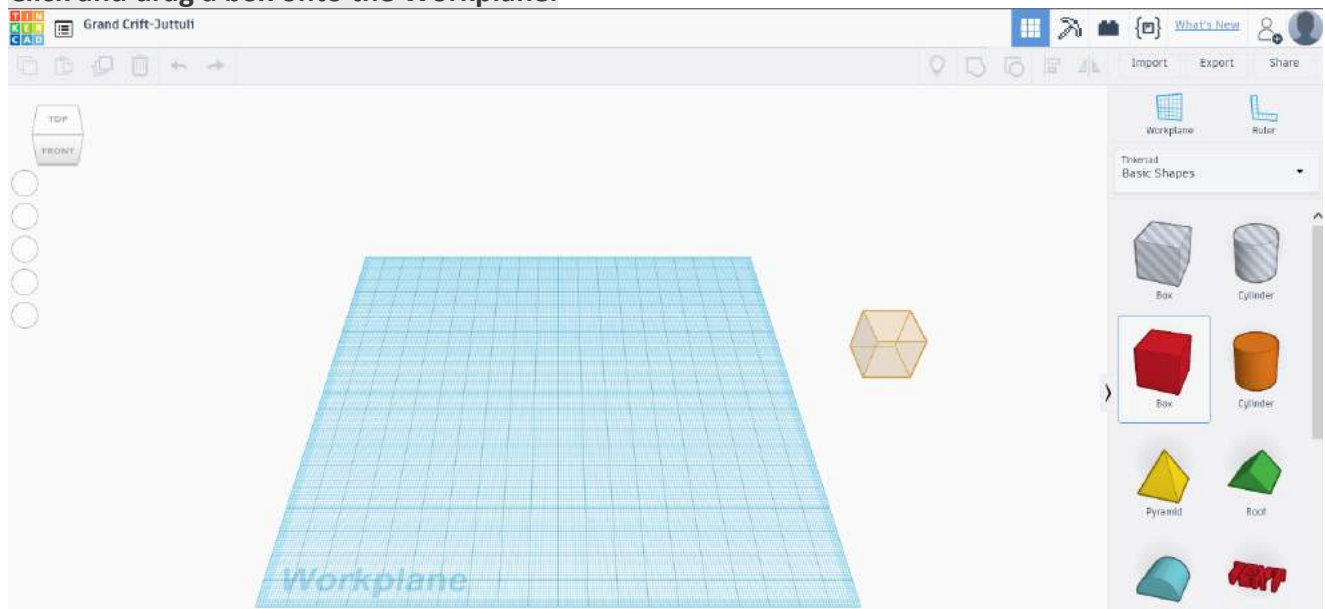


The best way to learn a new skill, is by practicing. And to practice what you've already been shown, we're going to create a personalized keychain.

1. Click on the Create new design button

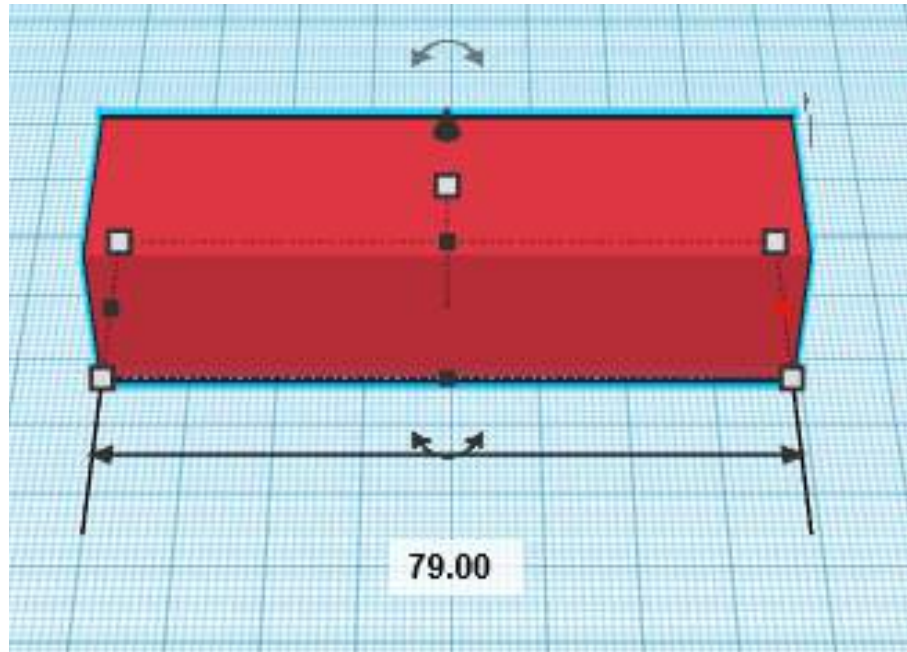


2. Click and drag a box onto the Workplane.

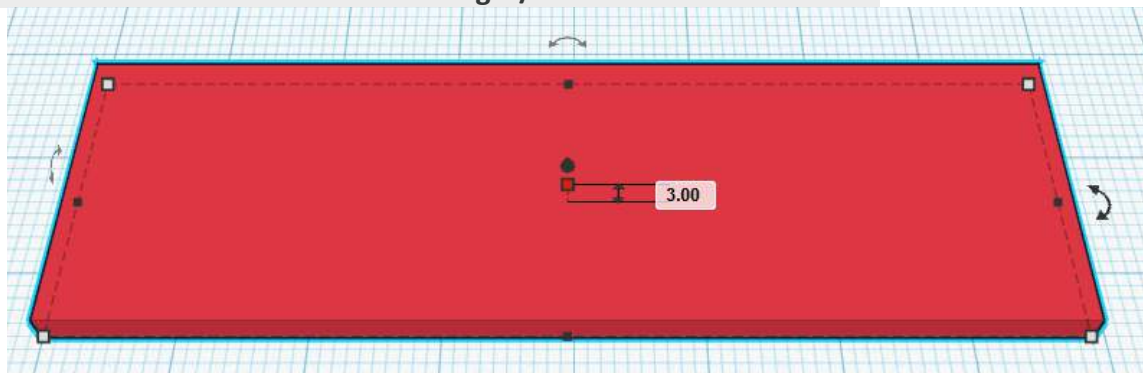




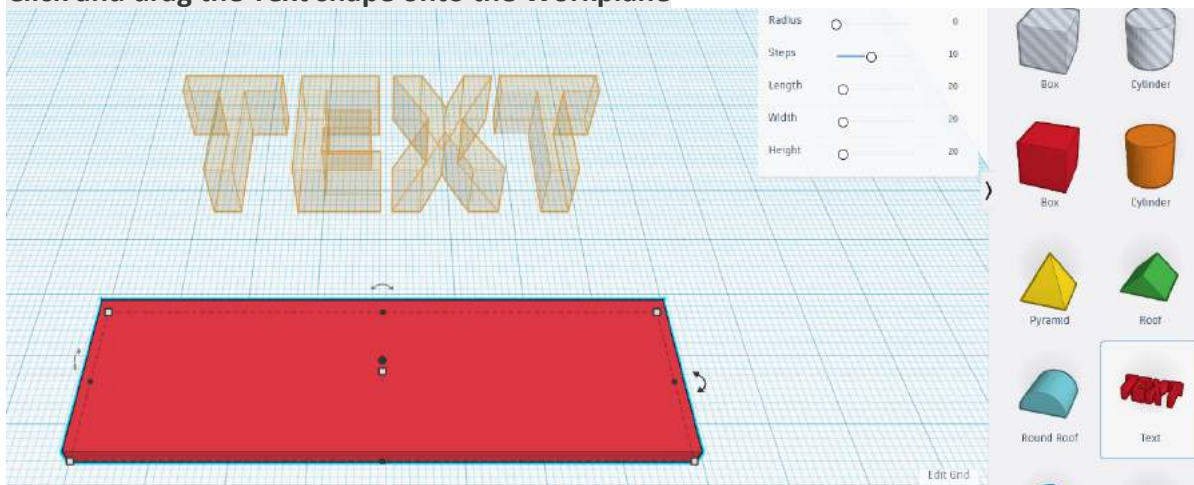
3. Click and drag the box into a rectangle, roughly 77mm long by 22mm deep



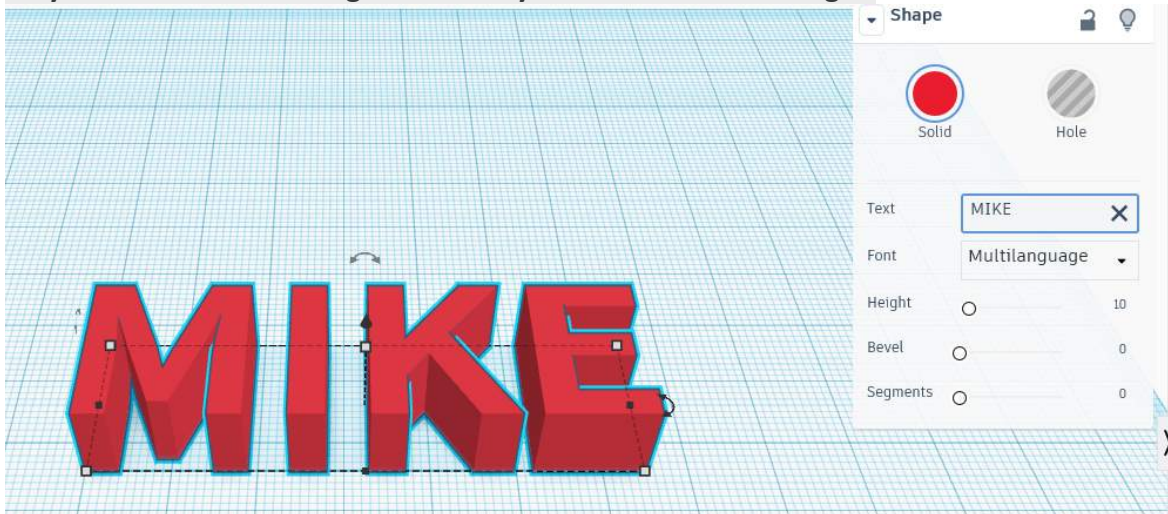
4. Grab the middle handle and reduce the height/thickness to around 3mm.



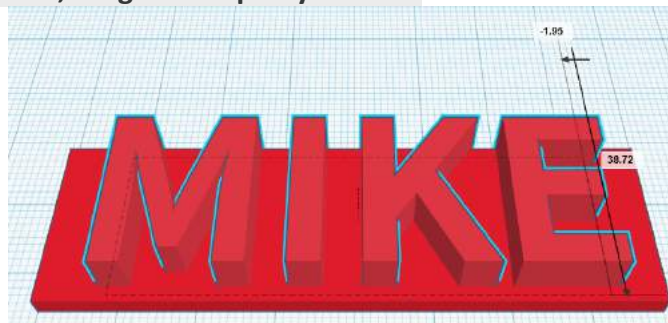
5. Click and drag the Text shape onto the Workplane



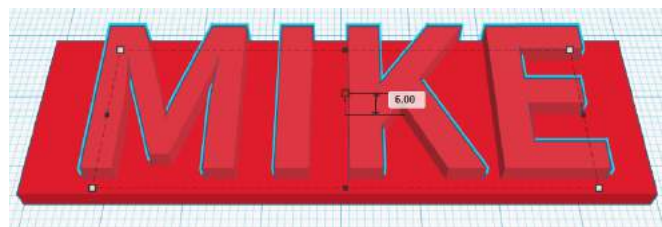
6. Type in your first name in the text box in the Shape menu appears. If your first name is long, you may need to click and drag the side of your box to make it longer.



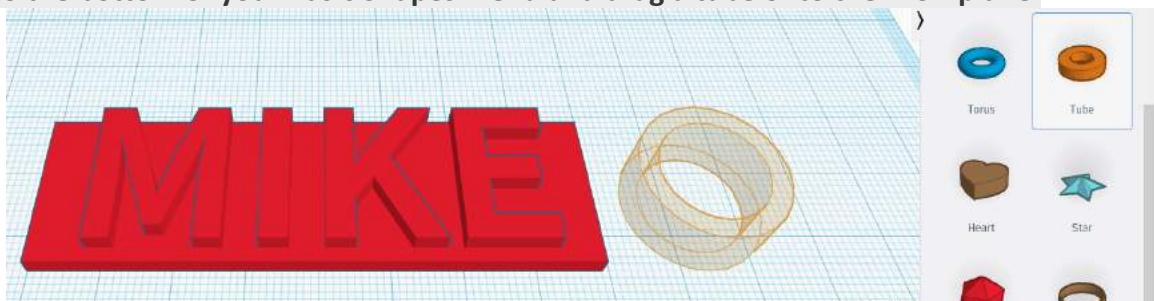
7. Once you've typed your name, drag it on top of your box.



8. Click your middle handle and decrease the thickness of your name to around 6mm.

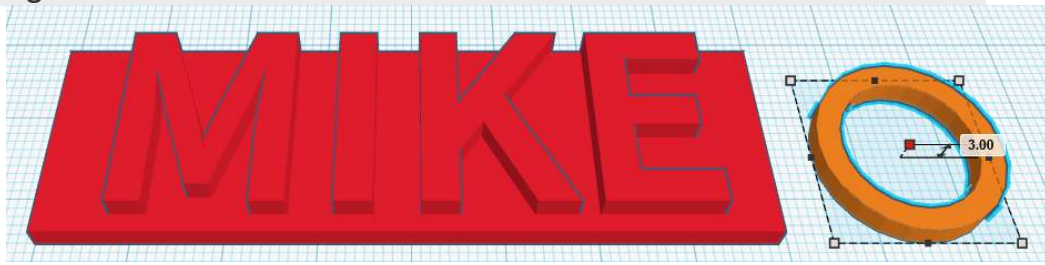


9. Scroll to the bottom of your Basic Shapes menu and drag a tube onto the Workplane.

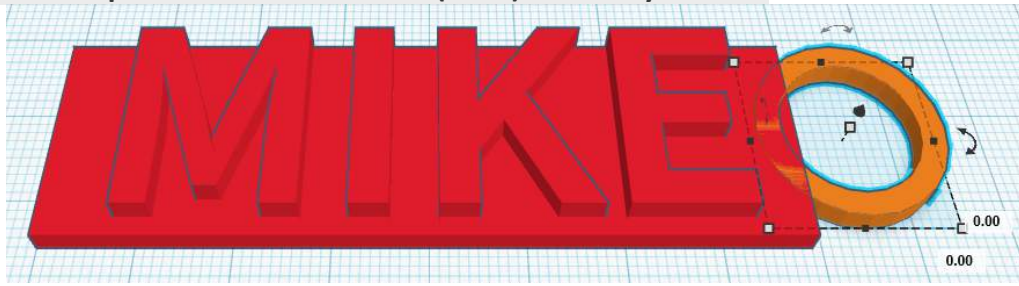




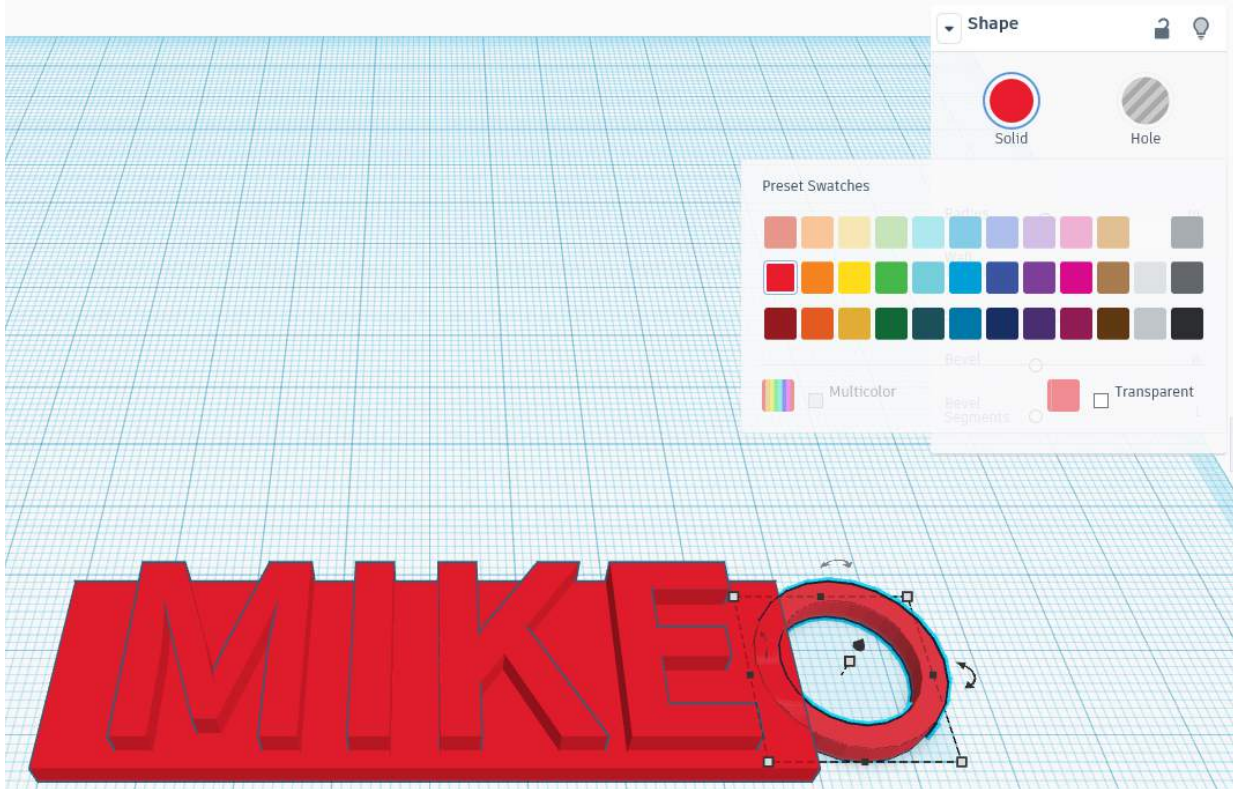
10. Click and drag the middle handle to reduce the thickness of the tube to around 3mm.



11. Drag your tube and place it so the bottom ¼ (or so) is inside your box.

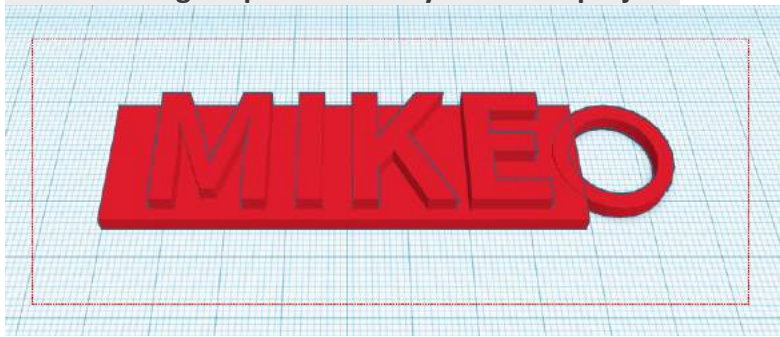


12. In the Shape menu, click on the Solid color dot, and then choose the color red from the color menu.

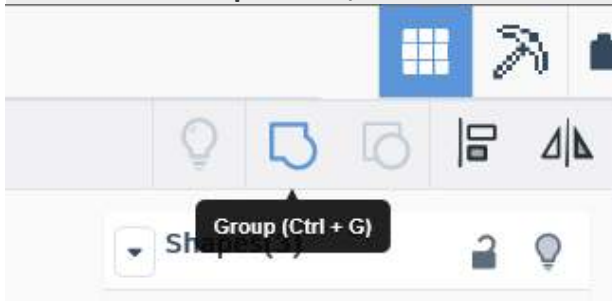




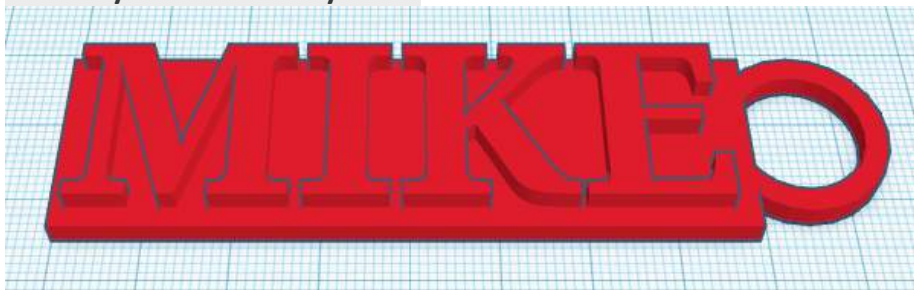
13. Click and drag a square around your entire project.



14. Click on the Group button, which will connect all the pieces of your project together.



15. Admire your finished keychain!

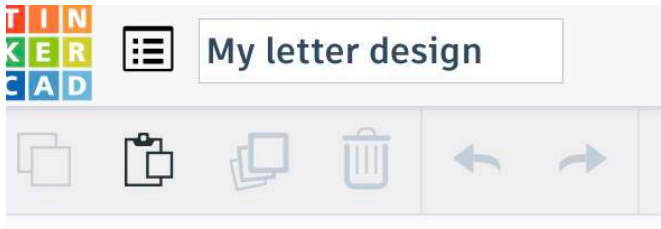


## Changing your project name

You'll notice that Tinkercad automatically assigns any new project you create a name - usually something silly sounding. You can change your project name by clicking on the Tinkercad-assigned project name in the upper left corner of your screen:

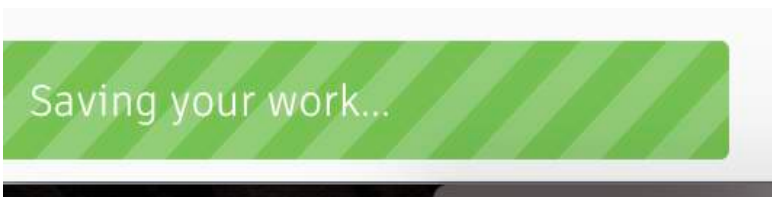


Once you click on the name, it becomes a highlighted text box that you can then type over and rename your project whatever you'd like.



## Saving your project

Saving a project you create in Tinkercad is easy because it's automatically done for you. When you choose to exit your project, you'll see a small green bar appear at the bottom of the screen that says *Saving your work...* Note, until you download your project, it's saved in the cloud (aka, servers at Tinkercad).



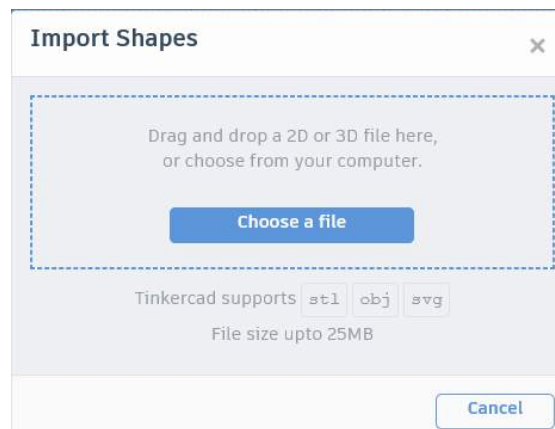
## The Import/Export/Share Menu



## Import

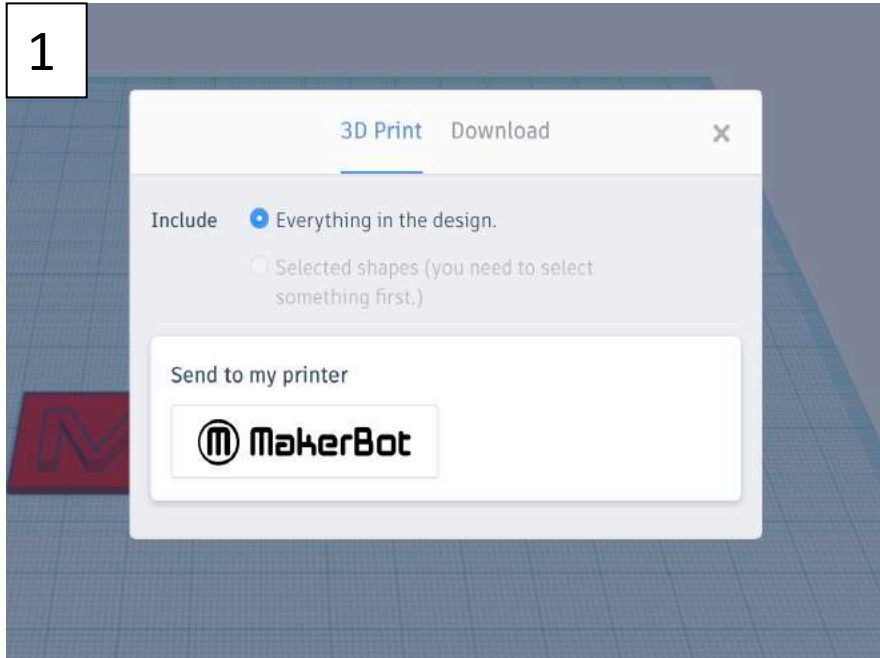
You'll use the Import button to drag and drop a 2D or 3D file, or you can choose one that you've saved from your computer.

- You can download files you want to modify from 3D repository websites (like Thingiverse and MyMiniFactory) onto your computer and upload them into your Tinkercad account here.
- You can also upload pictures saved from online that you want to turn into 3D objects (we'll cover this neat trick later)

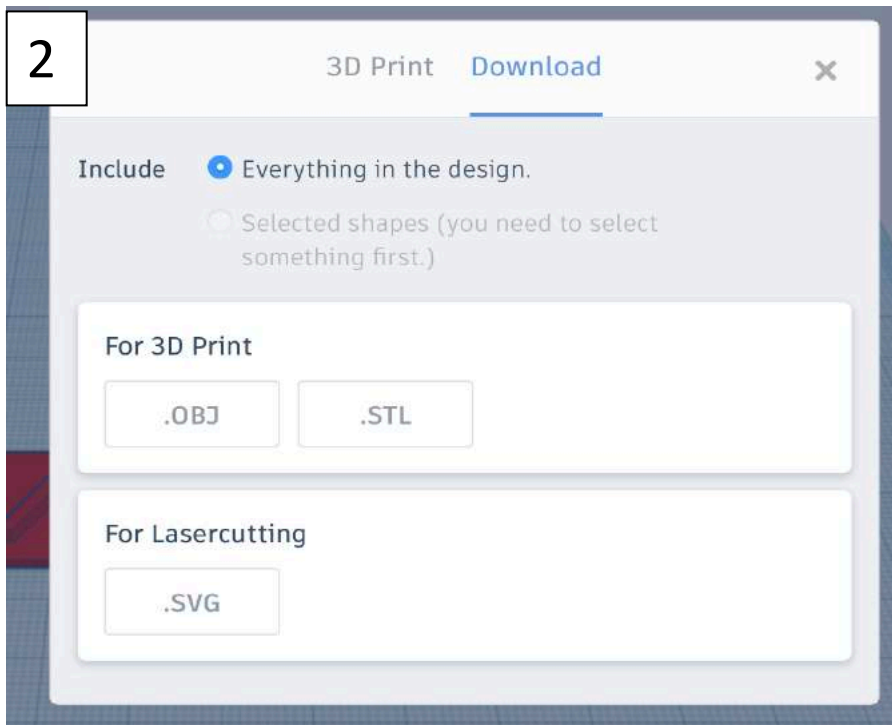


## Export

When you're completely finished with your project, you'll likely want to save it outside of Tinkercad, for later 3D printing. When you're ready for this step, click on the Export button and follow these steps.



1. Once you click the Export button, a menu appears giving you the option of 3D printing your project IF you have a MakerBot brand 3D printer. If you don't, or if you simply want to save your design, click Download from this same menu.



2. Once you click on Download, you'll be given a number of options. Choose to save your object in either the .OBJ or .STL format.



## What Are .STL and .OBJ File Formats for 3D Printing?

### .STL

.STL format is one of the most commonly used file formats for 3D printing. This is due to the fact that most CAD software has the feature of exporting models in .STL format and most 3D printers support it. Specifically, it is a file which "slices" a 3D model into a series of very thin 2D "layers." This output is then used to drive a stereolithography (or similar) machine which produces physical prototypes through layer-by-layer deposition the file generates the surface geometry of the modeled object only.

### .OBJ

.OBJ format is considered to be more complex than .STL file for the fact that it is capable of representing texture, color and other CAD attributes of the three-dimensional object. .OBJ is also easily exported from most CAD tools and is supported by 3D printers.

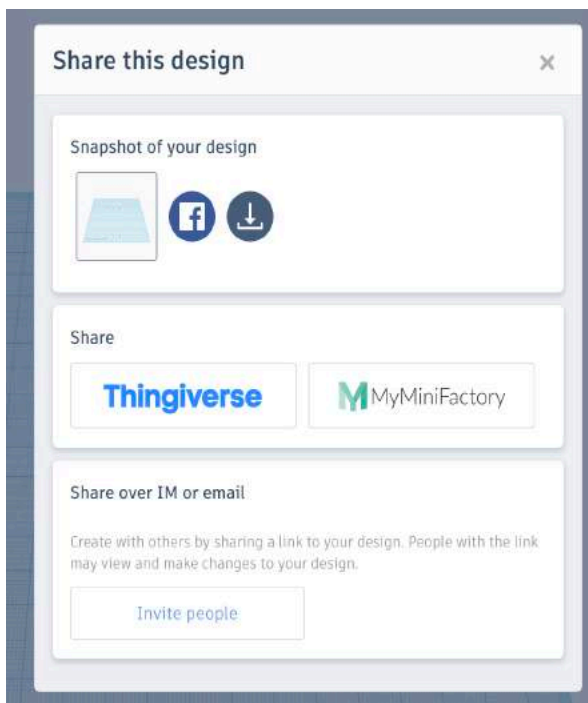
### Which to choose?

However, according to people's opinion on forums and 3D printing enthusiast platforms, .STL seems to hold a top spot in the list of preference of file formats for 3D printing. The main reason is that this type of file is simpler to use and most mesh repair tools work better with [STL files](#) than .OBJ.

On the other hand, if you are willing to print a multi-color 3D model, you would want to choose .OBJ file format.

### Share

The Share button allows you to share your design with others in a number of ways:



#### 1. Snapshot of your design

You can take a snapshot of your design and post it on Facebook. You can also take a snapshot of your design and download it onto your computer.

#### 2. Share

If you've created an account with either Thingiverse or MyMiniFactory (both are popular 3D model repository websites, where you can upload your own 3D model files or download other creators' files) these buttons will take you to a login window for those sites. Once you log in, you can automatically share your project on either (or both) sites.

#### 3. Share over IM or email

Clicking this button generates a link you can then send to other. People with this link may view and make changes to your design

## Top menu overview



The menu at the top right hand corner of your screen features a number of different functions and options, many of which

**Design:** This is the default screen which shows the standard workplane for your 3D designs.

**Blocks:** Allows you to design and view your work in “Minecraft” style.

**Bricks:** Allows you to design and view your work in “Lego” style.

**Shape generators:** With this function, you can create your own shapes using Javascript and save them to be used later by you or the Tinkercad community.

**What’s New:** Check out descriptions and modeling of the newest features in Tinkercad.

**Collaborate:** Click this button to share your work with others.

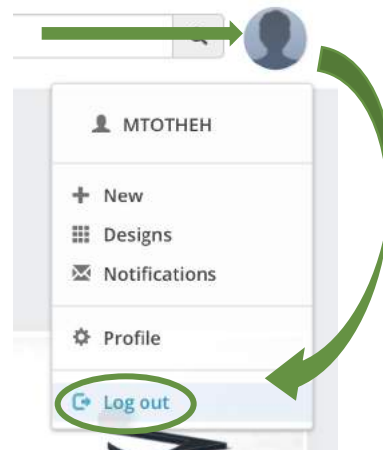
**You:** Your user profile. This button is a shortcut to your account page, to create a new design, to check out your designs, to view your notifications, change settings in your profile and log out.

## Logging out/Logging back in with saved designs

1. To log out of your Tinkercad account, click on the main Tinkercad button on the top left of your screen.

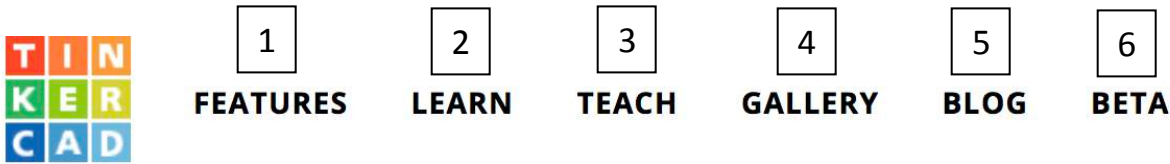


2. Click on the silhouette button on the top right corner of the screen. On the drop down menu that appears, click Log out.



## Website overview

Let's take a look at the website overview menu that appears at the top left corner of the screen when you first log in to your account.



1. **Features:** This gives you an overview of what Tinkercad is and what it does.
2. **Learn:** The section of the website gives you some step-by-step lessons on learning Tinkercad basics, and also created some actual projects.
3. **Teach:** A section for teachers who want to teach Tinkercad in the classroom
4. **Gallery:** This is the section of the website where you can see what others have created using Tinkercad.
5. **Blog:** Keep up with news and updates from the Tinkercad team by reading their blog.
6. **Beta:** This is where you can see, and sometimes test out, new functions and features before they are released to the full Tinkercad community.

## Limitations of Tinkercad and how to get around them

### What is difficult to do in Tinkercad

- Drawings – You can't free draw your project. You are limited to the shapes provided by Tinkercad.
- There are limited shapes to select from. Pre-loaded shapes can be limiting for complex parts.
- Due to its popularity in the education system, the website often slows down to a crawl during US school hours
- You will outgrow it very quickly.





# TIPS & TRICKS

Here are some tips and tricks to get around some of the limitations of Tinkercad.

## Importing pictures

You can turn pictures into 3D files. Simply follow these steps:

1. Find an image you want to try to turn into a 3D model and either save it to your computer or copy the web address.
2. Go to a free file conversion website that will convert picture files (like those ending in .jpg) into SVG files (Scalable Vector Graphics – a vector image format for two-dimensional graphics with support for interactivity and animation). A website your instructors have used is <https://convertio.co/jpg-svg/>.
3. Upload the file (or paste the web address) into the conversion site.
4. Download the newly converted file onto your computer.
5. Log in to Tinkercad and import the file using the import button.
6. Change or revise the file however you like. Note: This is a trial and error method of importing files into Tinkercad. Some picture files you convert into SVG files will look weird when imported into Tinkercad and make not be very usable.



The screenshot shows the Convertio website interface for converting JPG to SVG. The top navigation bar includes links for PDF to Excel Online, PDF to PPT, Merge PDF, Split PDF, Compress PDF, Compress PNG, DPI Converter, PNG to JPG, and Uber Promo Code. The main header features the Convertio logo, a 'Convert' dropdown menu, and links for OCR, API, Pricing, Login, and Sign Up. The central banner reads 'Convert JPG to SVG. Online & Free' and describes it as an advanced online tool for mac & windows. Below the banner is an advertisement for iCIMS Employee Onboarding Software. The main conversion area has a dark background with a red 'From Computer' button, icons for file upload, and a 'JPG to SVG' dropdown menu. It also displays '100 MB maximum file size' and 'Sign Up' links. At the bottom, there are links for 'How to convert JPG to SVG?' and 'How to convert SVG to .JPG?'. A three-step process is outlined: STEP 1: Upload JPG-file(s), STEP 2: Choose "to SVG", and STEP 3: Download your SVG.

## Building on other people's designs

Did you know you can use Tinkercad to modify previously designed objects? Simply visit a 3D model file repository (like Thingiverse or MyMiniFactory) and download an item from the site that you want to edit or add onto. Then, import it into Tinkercad using the Import button.

## Thingiverse

### Thingiverse ([www.thingiverse.com](http://www.thingiverse.com))

Thingiverse is one of the biggest and most popular databases. It has a very active maker community behind it and offers free-to-use STL files only. You don't even need to open an account in order to download a 3D model from their site.

## MyMiniFactory

### MyMiniFactory ([www.myminifactory.com](http://www.myminifactory.com))

MyMiniFactory, which launched in 2013, is the world's leading curated social platform for 3D printable objects. On MyMiniFactory, you can find tens of thousands of 3D designs ready for you to download for free.

## Other 3D printing modeling software/websites

Once you've learned Tinkercad, here are a few other free sites that could help you take your 3D modeling skills to a more advanced level.

## SketchUp

### SketchUp ([www.sketchup.com](http://www.sketchup.com))

SketchUp is fun and free, and is known for being easy to use. To build models in SketchUp, you draw edges and faces using a few simple tools that you can learn in a short time. With a Push/Pull tool you can extrude any flat surface into a 3D form.

## blender™

### Blender ([www.blender.org](http://www.blender.org))

Blender is a professional, free and open-source 3D computer graphics software toolset used for creating animated films, visual effects, art, 3D printed models, interactive 3D applications and video games. Blender's features include 3D modeling, UV unwrapping, texturing, raster graphics editing, rigging and skinning, fluid and smoke simulation, particle simulation, soft body simulation, sculpting, animating, match moving, camera tracking, rendering, video editing and compositing. It further features an integrated game engine.

## Useful resources

Here are some great additional Tinkercad tutorials that you can use in better learning Tinkercad:

<http://www.instructables.com/id/Tinkercad-Tutorial/>

<https://www.thingiverse.com/jumpstart/tinkercad>

[http://spolearninglab.com/curriculum/lessonPlans/hacking/resources/software/3d/tinkercad\\_intro.html](http://spolearninglab.com/curriculum/lessonPlans/hacking/resources/software/3d/tinkercad_intro.html)

YouTube is also a great Tinkercad tutorial resource!

# How'd we do?

We hope you enjoyed this session and that you now feel comfortable designing basic 3D model files using Tinkercad. Please evaluate our presentation here:

**[tinycloud.com/th2017vla](https://tinycloud.com/th2017vla)**

Thank you for attending and happy tinkering with Tinkercad!

