3D: DISCOVER, DESIGN, DEVELOP WORKSHOP:

AUTHENTIC USES OF 3D SOFTWARE & PRINTERS IN THE CLASSROOM

3D Modeling Software Resources

and Tinkercad Tips & Shortcuts

by Marcy Seavey, UNI STEM Coordinator

images are tinkercad screenshots unless otherwise noted

3D MODELING PROGRAMS

Free

- TinkerCAD – Easy
  https://www.tinkercad.com

- 3D Slash – Easy https://www.3dslash.net/

- 123D Design – Easy/Powerful
  http://www.123dapp.com/design

- FreeCAD –
  Intermediate/Parametric/Scriptable
  http://www.freecadweb.org/

- Blender – Intermediate/Flexible
  https://www.blender.org/

- MeshMixer – Advanced/3D Scans
  http://meshmixer.com/

- OpenSCAD – Advanced/Compiler
  http://www.openscad.org/

Fee

- SketchUp –
  Easy/Intermediate/Requires
  Extensions/Free to Fee
  http://www.sketchup.com/

- Photoshop CC v14.1 –
  Flexible/School May Have
  http://www.adobe.com/Photoshop

- 3ds MAX –
  Advanced/Powerful/Industry
  http://www.autodesk.com/product
  s/3ds-max/overview

- AutoCAD –
  Advanced/Powerful/Industry
  http://www.autodesk.com/product
  s/autocad/overview

More Software Ideas: https://all3dp.com/best-3d-modeling-software/

GETTING STARTED WITH TINKERCAD

Log-In

- www.tinkercad.com

- Create a new account using your Facebook login or email address

- Login

- If this is your first time, you will be invited to the beginner tutorials, if not click on the Learn link

Built-In Tutorials

With a partner complete the tutorials:

- Learn the Movies

- Camera Controls

- Creating Holes

- Scale, Copy, & Paste

- Key Ring Letters

- Die on the Workplane*

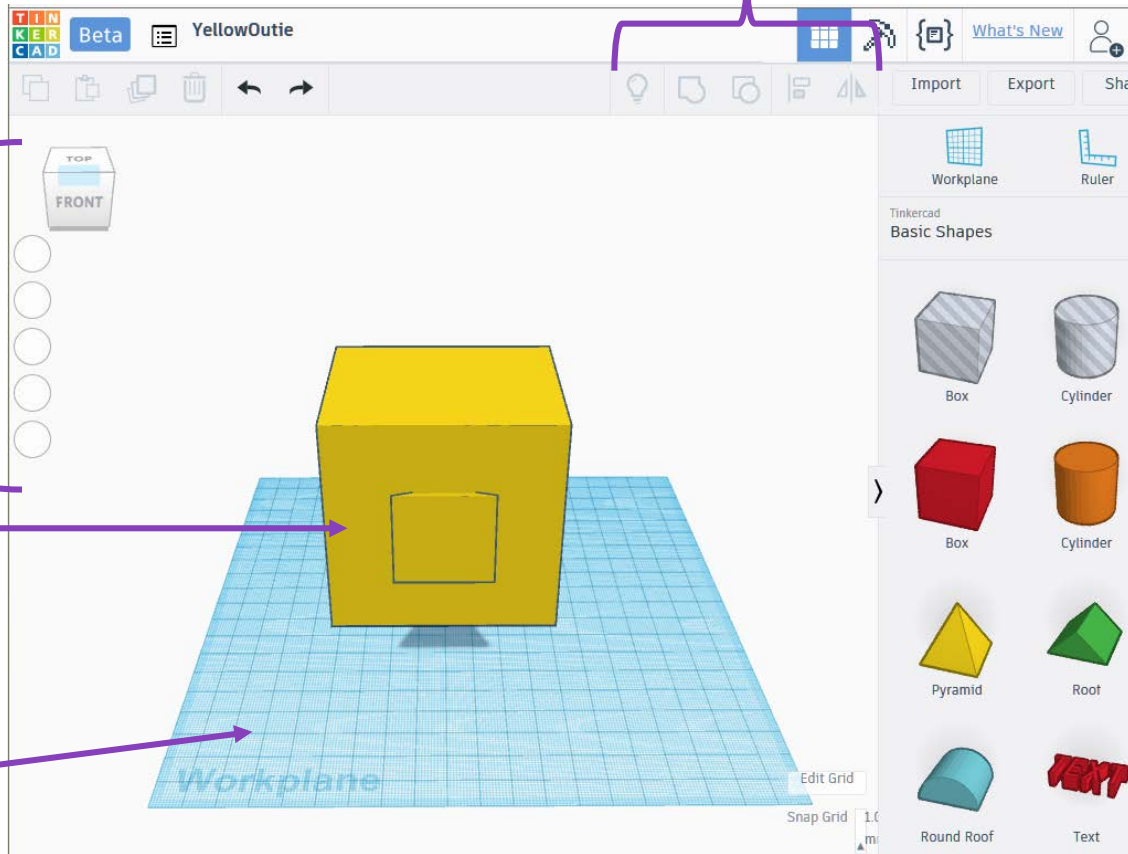 *Numbers* and *Letters* Sections are now *TEXT*

TINKERCAD BASICS

Transform Tools

Back to Designs

Save, I/E, Share

View Cube & Tools

Object(s)

Workplane

Build Tools (Objects & Holes)

CONTROLLING YOUR VIEW

- Building a 3D object on a 2D screen can be a tricky concept. Understanding how to change the camera view so that you can see the objects from all sides is key to thinking as a 3D designer.

- Use the View Cube and other view tools, mouse scroll wheel (zoom in and out), and right mouse button (click and hold, then move the mouse to swing the camera view) to view the model from difference angles.

View Tools

TOP
FRONT - Click and Drag the Cube by any face or edge to move.

⌂ - Reset to Home View

⟦ ⟧ - Fit all in View

＋ - Zoom In

－ - Zoom Out

◈ - Switch to Orth. View (2d for 3d)

BUILDING FROM SOLIDS AND HOLES

- In Tinkercad you build an object by merging (grouping) solid objects and holes.

- Any shape can begin as a solid or a whole.

- All solids can become holes.

- All holes can become solids.
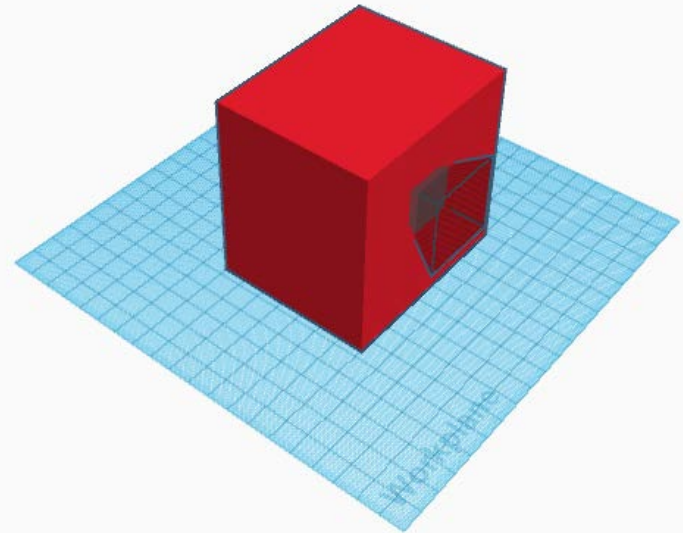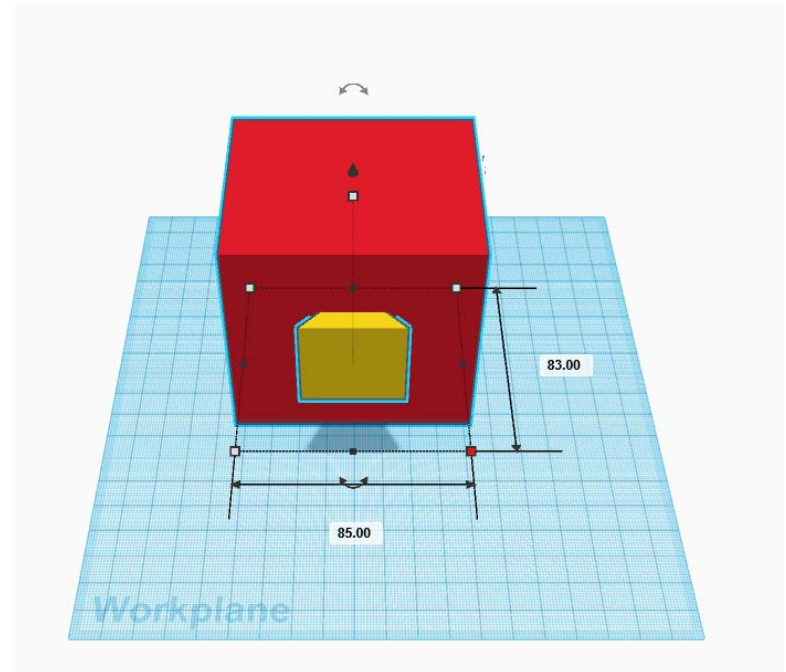
RESIZING OBJECTS

- Use the white and black dots to resize objects by hand or to a specific size. Click and drag to resize by hand.

- Lift the object off the plane by clicking and dragging the Lift Arrow

- Rotate the object in 3 directions by clicking and dragging the Rotation Controls.

- Click once on any of these tools and type into the popup to set a specific value.

Lift Arrow

Rotation Control

Height White Dot

Black Dot

Length and Depth White Dot

Rotation Control
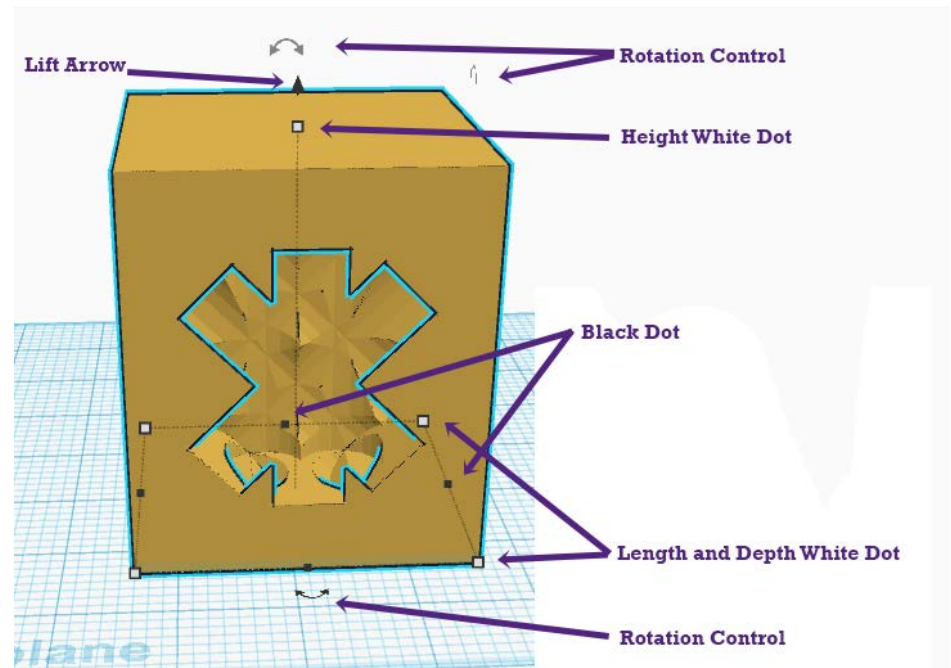
MOVING OBJECTS ON THE WORKPLANE

TinkerCAD offers several ways to move an object or objects:

- Click on the object and drag it.

- Click on the object and use the arrow keys.

- Click on multiple objects and select the align tool, then click on the guides to align along a side or a middle. Gray align circles mean the objects are alright aligned to that option.

- TinkerCAD does not have a distribute tool.*
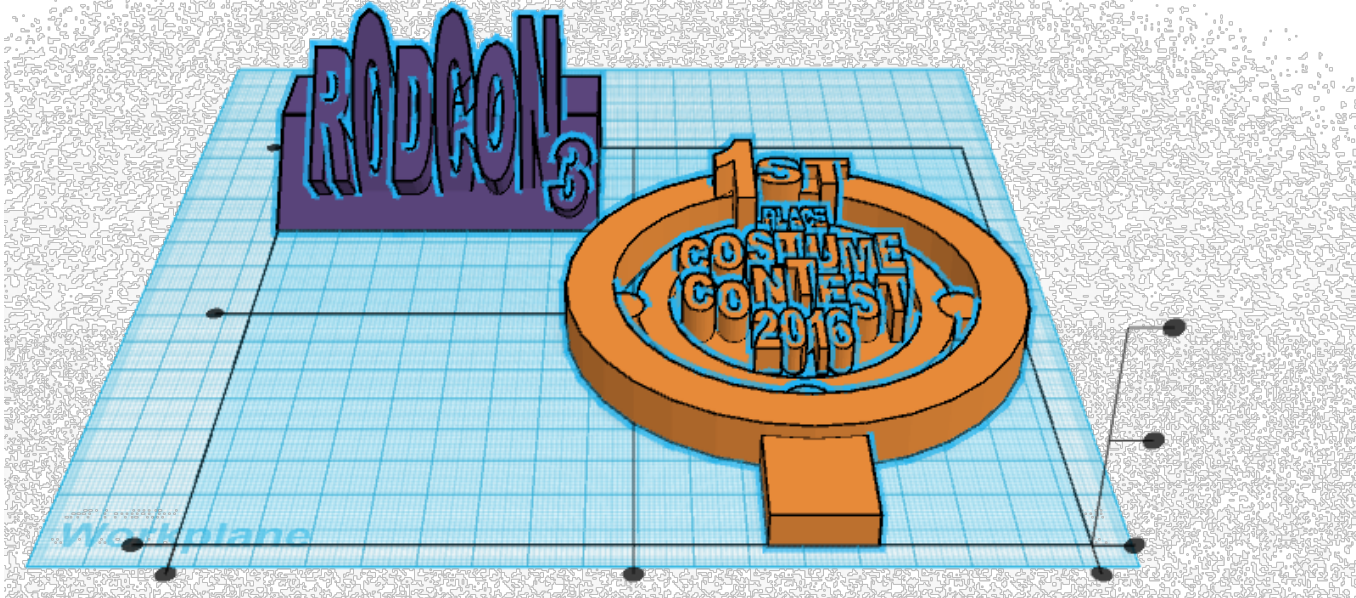
TRANSFORM TOOLS

Group and Ungroup

- Select multiple objects and click the group tool to create a group. This merges the objects into a single object.

- The top three objects below are ungrouped.

- The bottom is a single object created by grouping the 3 objects.

- Grouping works in layers. This can be helpful in extending the value of the ALIGN and MIRROR tools.
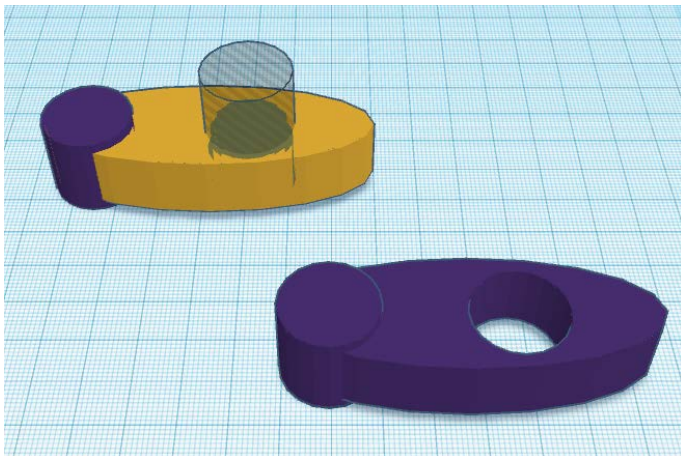
Align & Mirror/Flip

- Select multiple objects and then click the align tool for alignment options (see slide on moving objects)

- To flip or create a mirror image of an object. Select an object(s) and then click on the flip/mirror tool. Click on the double headed arrow to flip along that line.

- The purple object below was duplicates and then flipped along the right/left line to create a mirror image.
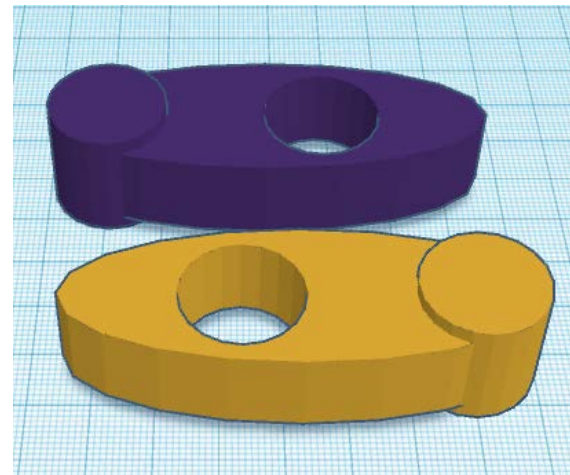
SAVE, IMPORT, EXPORT, SHARE

- TinkerCAD saves as you go!

- TinkerCAD Undo can return your model to a previous step.

- Create a copy from your designs page if you want to make changes but also want access to your original – don't trust undo for major changes!

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- Import a stl, obj, or svg file from another source.

- Export everything or just the currently selected shapes into stl, obj and svg files.

- For our printers, use stl.

- Share offers 2 options –
  - send your model to the Thingiverse (make it public so others can use it too)
  - or invite specific people to share/edit your design.

FILE TYPES AND LICENSING MODELS

- stl – STereoLithography – 3D - widely used for [rapid prototyping](), [3D printing]() and [computer-aided manufacturing](); only record surfaces

- obj – 3D, used in 3D graphics

- svg - Scalable Vector Graphics - 2D, saves an outline of where the model meets the workplane, used by laser cutters or import to illustrator

- .makerbot – 3D, the MakerBot Print App converts stl, obj, and other common 3D files into a file printable by a MakerBot brand printer. You can save specific printing options for the model in the .makerbox file.

- New models begin as private.

- Keep in mind, once you share a model with the public, you can not take the license back.

- Sharing a model to the 3D Gallery/Thingiverse makes the model available to others under the Attribution-ShareAlike 3.0 license (by default).

- From your gallery, you can select other Creative Commons Licenses.

TIPS & SHORTCUTS

Tinkercad keyboard shortcuts

Moving object(s)

`↑` / `→` / `←` / `↓`	**Move** object(s) along X/Y
`ctrl` + `↑` / `↓`	**Move** object(s) along Z
`Shift` + `↑` / `→` / `←` / `↓`	**×10 Nudge** along X/Y
`ctrl` + `Shift` + `↑` / `↓`	**×10 Nudge** along Z

Keyboard + Mouse shortcuts. (Press and hold the keys, then click or drag the mouse.)

`Alt` + drag left mouse button	**Duplicate** dragged object(s)
`Shift` + left mouse button	**Select** multiple object(s)
`Shift` + hold while rotating	**45° rotation**
`Alt` + hold *side handle*	**Scale (1D)**
`Alt` + hold *corner handle*	**Scale (2D)**
`Shift` + hold *corner handle*	**Scale (3D)**
`Shift` + `Alt` + hold *corner handle*	**Scale (3D)**
`Shift` + `Alt` + hold *top handle*	**Scale (3D)**

Object settings

`H`	**Hole** turn object(s) into Holes
`S`	**Solid** turn object(s) into Solids
`ctrl` + `L`	**Lock** or **Unlock** object(s)
`ctrl` + `H`	**Hide** object(s)

Viewing designs

`spacebar` + left mouse button	**Orbit** the view
`spacebar` + left mouse button	**Pan** the view
`Shift` + right mouse button	**Pan** the view
`ctrl` + `Shift` + left mouse button	**Pan** the view
`scroll wheel`	**Zoom** the view in or out
`F`	**Fit** selected object(s) into the view

Tools and commands

`ctrl` + `C`	**Copy** object(s)
`ctrl` + `V`	**Paste** object(s)
`ctrl` + `D`	**Duplicate** object(s) in place. (Repeat with move, rotate and scaling for interesting effects.)
`Del`	**Delete** object(s)
`ctrl` + `Z`	**Undo** action(s)
`ctrl` + `Shift` + `Z`	**Re-do** action(s)
`ctrl` + `Shift` + `H`	**Show All** hidden object(s)
`ctrl` + `G`	**Group** object(s)
`ctrl` + `Shift` + `G`	**Un-group** object(s)
`L`	**Align** object(s)
`M`	**Flip** (or Mirror) objects(s)
`ctrl` + `A`	**Select All** object(s)
`W`	**Workplane** place a workplane
`R`	**Ruler** place a ruler
`D`	**Drop** object(s) to the work plane

Legend

`ctrl` = ⌘ Cmd / `Alt` = ⌥ Option

Notes:

Tinkercad keyboard shortcuts

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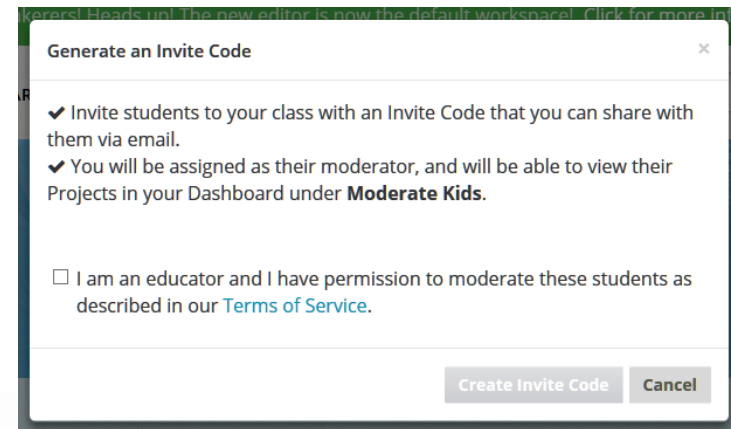|	
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TINKERCAD TEACHER/STUDENT PROJECTS

Students UNDER 13:

- Log into Teacher Account

- Click on the Teach Tab

- Click on Create an invite code

- Post the Invite Code to your class and have students create their accounts & enter the code within 7 days*

- Students will show up on Teacher's Moderated Kids

- Teachers and Students can share models.

Generate an Invite Code

✔ Invite students to your class with an Invite Code that you can share with them via email.
✔ You will be assigned as their moderator, and will be able to view their Projects in your Dashboard under **Moderate Kids**.

☐ I am an educator and I have permission to moderate these students as described in our Terms of Service.

Create Invite Code   Cancel

How does this work?

1. Teachers: sign in to your account to create an **Invite Code** from the **Teach** page and share it with your students. Many teachers write the code on the board.
2. Students create their own Tinkercad accounts*.
3. Students log in and access their dashboard by clicking the Tinkercad logo.
4. Students then must enter the **Invite Code** in the **Get Approved** box. They will immediately be added to teacher's **Moderated Kids** as approved Tinkercad users.

Be sure to check out the Learn page for Skills Lessons and Classroom Projects!

*Students **age 13+** may create their own Tinkercad account and start designing immediately. Students **age 12 and under** will need your Invite Code for instant approval of their accounts.

TINKERCAD TEACHER/STUDENT PROJECTS

Students13 & OVER:

- Log into Teacher Account

- Open your designs.

- Click "Tinker This" on the desired design.

- Click the Share button

- Copy the link & send it to the students who you wish to share with.

- Anyone you share with can edit the model, so you might want to share COPIES rather than originals.

Share this design

Share this link over IM or Email
People with this link may view and make changes to your design.

https://www.tinkercad.com/things/4bczVEnYhVF   Copy

About 336 hours till the link expires.   Generate new link