

# 3d Modelling:

## Blender - Up and running



# The small print

## Prerequisites

Time in the workshop is precious – it is an opportunity for you to interact with the workshop leader and other participants through questions and discussions and to share your experiences and concerns. To make the most of this time we sometimes ask you to carry out learning activities ahead of the workshop so that everyone comes into the class with the same basic knowledge. We keep this prior learning to a minimum and often make use of online videos. Online videos provided through LinkedIn Learning can be accessed free of charge by University members anytime, anywhere, through a browser or app.

Your course booking will tell you if any prior learning activity is required. If you don't have an environment where you can do this learning, you can come along to one of our LinkedIn Learning sessions. These are a quiet space where you can work through videos or other workshop resources.

If you arrive for a workshop without having done the prior learning, the workshop leader may suggest that you come back on another session.

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## About the workshop designer

Carl Wenczek is a very experienced architectural illustrator and an expert in 3d modelling and 2d imaging. He is a Director of his own small company and over the last 18 years has built long lasting relationships with his clients, creating 100's of illustrations and helping them convey their ideas and designs.

Running parallel to his commercial work, Carl is also a part-time lecturer in multimedia and has been teaching at Oxford University's IT Services for the last 17 years, delivering courses in Photoshop, Illustrator, InDesign, After Effects, Blender, GIMP, Inkscape and digital photography.

Carl also coaches Paddlesport (kayaking, canoeing and stand up paddling) and Indoor Climbing. These sports are often coached in demanding and dynamic environments and require strong leadership skills and a calm persona!

## Revision history

Version	Date	Author	Comments
1.0	November 2019	Carl Wenczek	First version
2.0	May 2020	Carl Wenczek	Adapted to workshop format, added and updated further information
2.1	May 2021	Carl Wenczek	Removed 2 tasks
2.2	August 2022	Carl Wenczek	Addition of L.O. 04 and 07

## About this workshop

Does your research paper or departmental website need eye-catching 3d visuals? Do you have information that could be presented attractively in 3d?

### What you will learn

This workshop covers 3d modelling and basic animation using the free 3d modelling application, Blender. This is a follow-on workshop to 3d modelling: Kick-off and assumes you have a firm understanding of the basics of using a 3d modelling application. We will be creating our own 3d models.

### What you need to know

You must either have been on the 3d modelling: Kick-off course first, or have a firm understanding of the basics of using 3d modelling applications.

This workshop will cover:

- Build and edit 3d models
- Create and edit materials
- Set up and adjust lights and the camera
- Create a simple animation

If you need to review these activities, LinkedIn Learning is a great place to get guidance. There is an activity with relevant videos in the IT Learning Portfolio: visit [skills.it.ox.ac.uk/it-learning-portfolio](https://skills.it.ox.ac.uk/it-learning-portfolio) and search for “Blender” or “3d modelling activity”.

### The resources you need

Sample documents that you can use to experiment with will be made available, but you may like to bring along your own.

The resources for most workshops, including any pre-course activity, are in the IT Learning Portfolio: visit [skills.it.ox.ac.uk/it-learning-portfolio](https://skills.it.ox.ac.uk/it-learning-portfolio) and search for “Blender” or “3d modelling”.

Unless you have been told otherwise, in classroom workshops there will be a computer available for you to use with Blender installed.

You can use your own computer with your preferred app installed if you want to – just bear in mind that I am not an expert in every app (although I am sure that between us we will be able to sort out most problems!)

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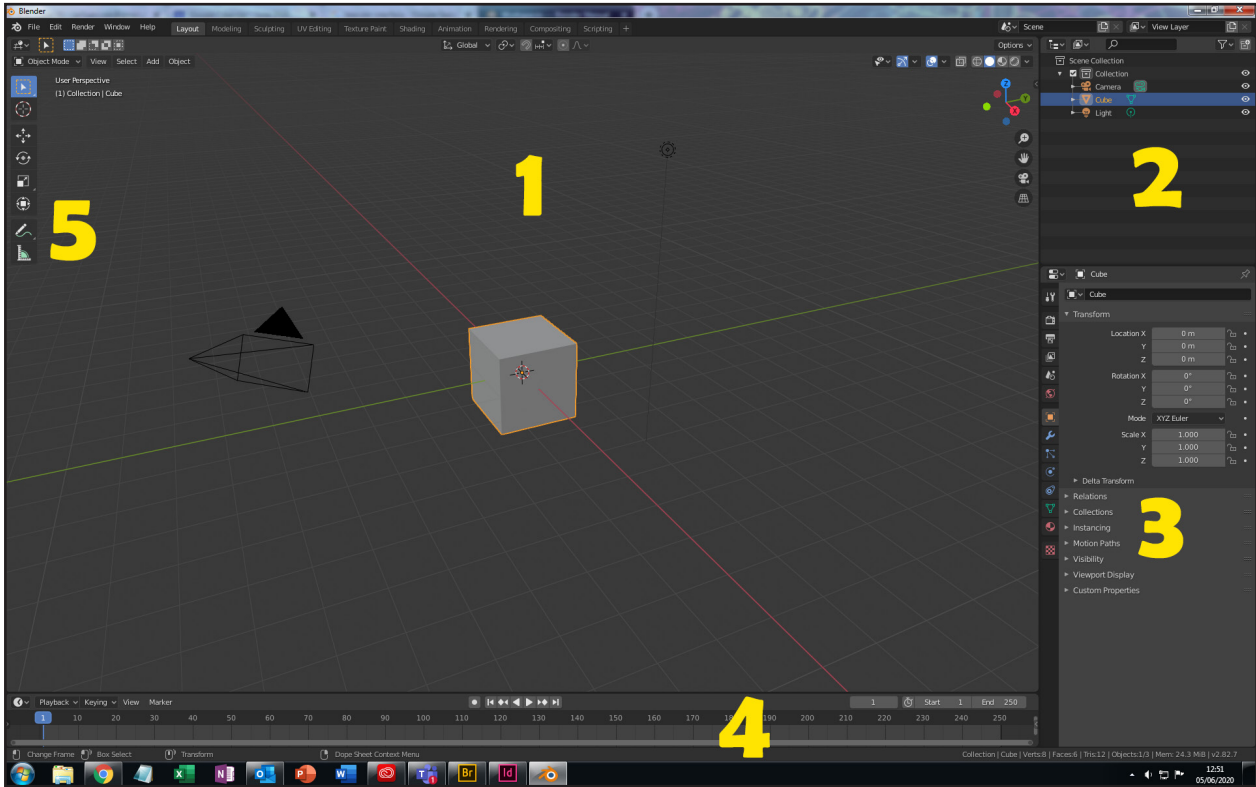
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# Learning Objective 01 - Introduction and the interface



**What can Blender do?** Blender is a computer graphics program that allows you to produce high-quality still images and animations using three-dimensional geometry.

1 = **3d Viewport** (the 3d Viewport is used to interact with the 3d scene for a variety of purposes, such as modelling and animating).

2 = **Outliner** (the Outliner is a list that organizes scene data).

3 = **Properties editor** (The Properties editor shows and allows editing of many active data, including the active scene and object).

4 = **Timeline** (the Timeline gives the user a broad overview of a scene's animation, by showing the current frame, the keyframes of the active object and the start and end frames of your animation sequence).

5 = **Toolbar** (The Toolbar contains a set of interactive tools.)



## Learning Objective 02 - Setting preferences

The Blender Preferences dialog contains settings to control how Blender behaves.

### Task

- Choose **Edit>Preferences...**

Options are listed to the left of the preferences dialog box.

- Choose the following preferences:

**Viewport**>3D Viewport Axis>Interactive Navigation

**Navigation**>Zoom to Mouse Position

**Keymap**>Industry Compatible (from dropdown menu at the top)

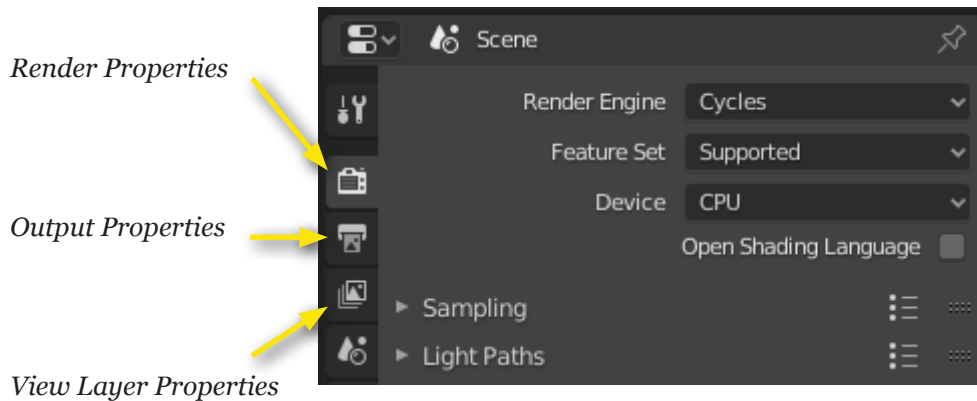
**System**>Undo Steps

**Save & Load**>Auto Save>Timer (mins)

**File Paths**>



## Learning Objective 03 - Renderer and render settings



### Task

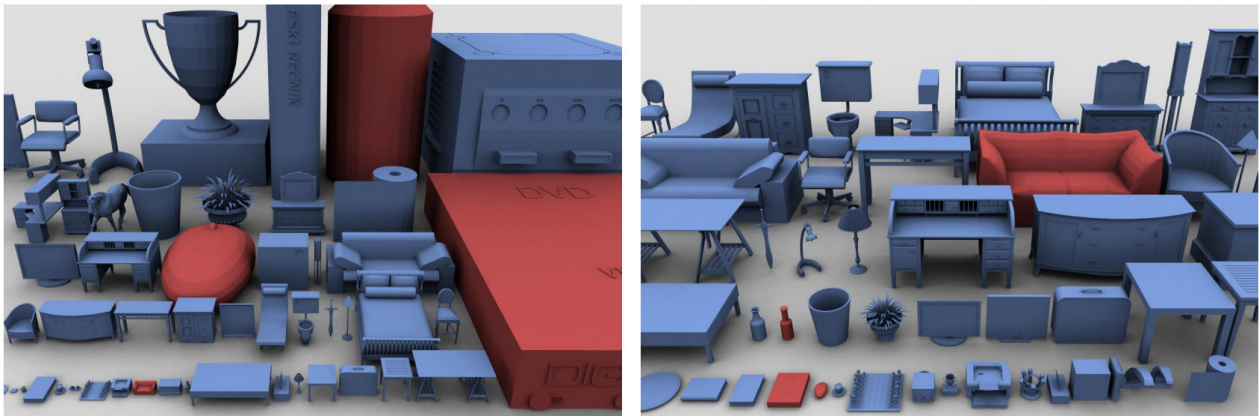
From the **Properties** panel set the following:

- **Render Properties tab** - set the render engine to **Cycles**.
- **Output Properties tab** - set the render size to TV NTSC 4:3
- **View Layer Properties tab** - tick/enable **Denoising** to denoise the rendered image when using the Cycles render engine.
- **Quad View** - Select the Quad View (**View>Area>Toggle Quad View**).

Now that you have setup Blender, you could save this file as a blank file for use as a **template**. For future projects you would only need to open this blank file and start modelling without having to run through this setup process each time.



## Learning Objective 04 - Issues of scale



It is important to build your 3d models to actual, real-world sizes.

This will enable you to combine models together in a scene and they will all be sized correctly relative to each other.

Looking at the two examples above, you can see that the scene on the left contains objects that are too big or small (red) relative to the correctly sized objects (blue).

The scene on the right shows the red objects at the correct sizes relative to the blue objects.

### Task

- **Import** an object.
- Choose **File>Import>Collada (Default) (.dae)**
- Select the *pencil 01.dae* file and choose **Import COLLADA**.

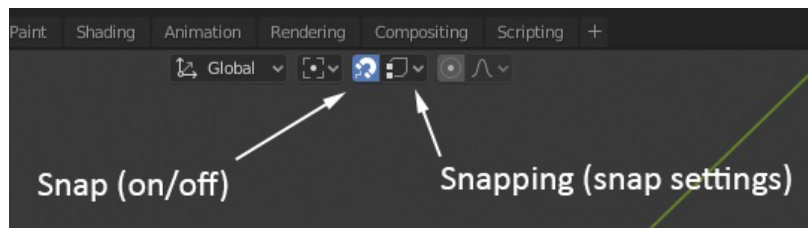




## Learning Objective 05 - Revision exercise

### Task

- **Transforming** - Select the cube and resize it using the Transform panel (**Dimensions** as follows  $x=0.06m$ ,  $y=1m$ ,  $z=0.02m$ ).
- **Renaming** - Select one of the cubes and rename it “*table top 01*” using the Outliner panel (*discuss importance of naming objects*).
- **Duplicating** - Select “*table top 01*” and duplicate it (*discuss difference between Duplicate Objects and Duplicate Linked (works in Edit Mode)*).



### Task

- **Snap** - turn on Snap.
- **Snapping** - from the Snapping drop-down menu choose the following:
  - Snap to = Vertex
  - Snap with = Closest
  - Affect = Move

### Task

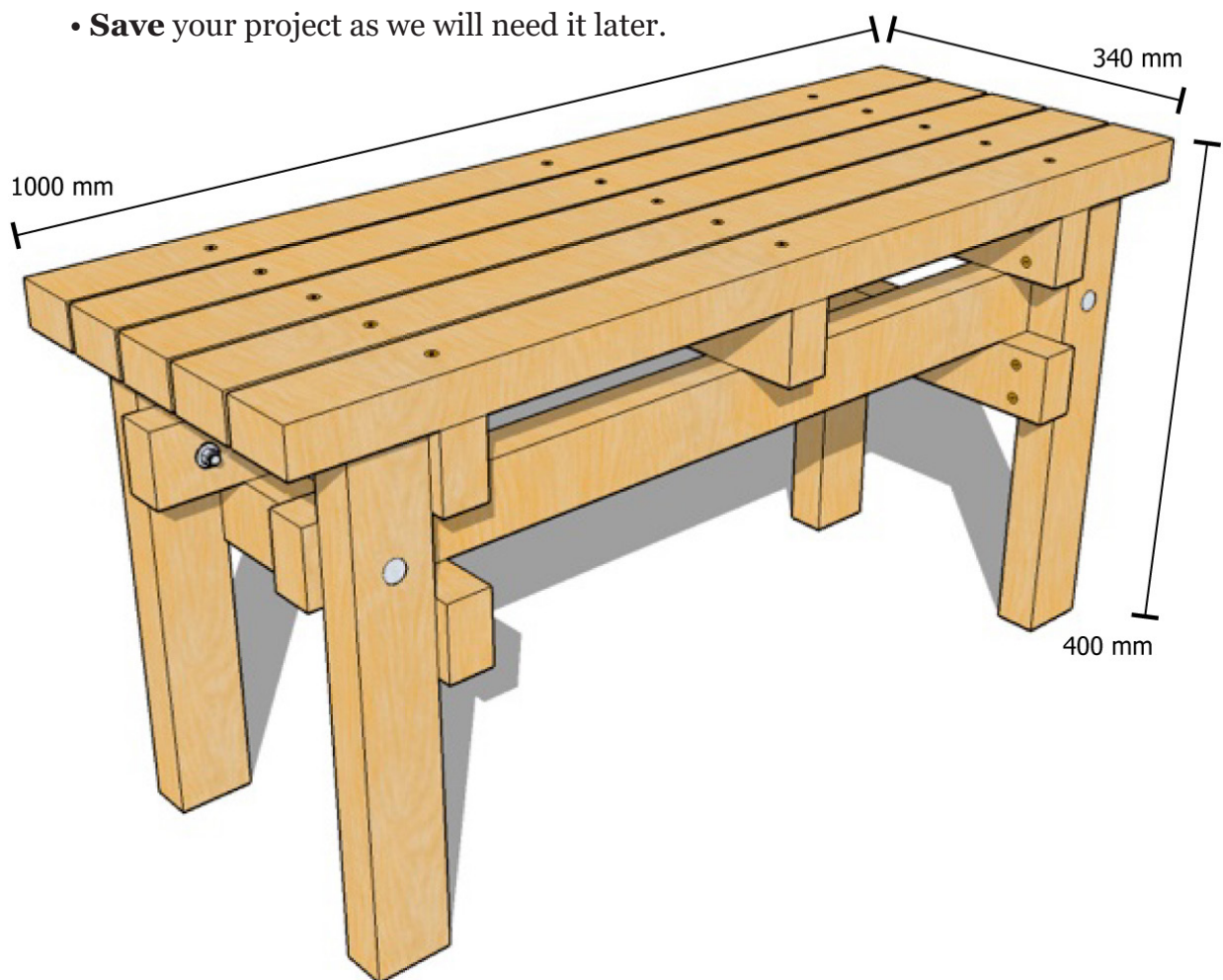
- **Move and snap** - move and snap the duplicate to the original.
- The **Move panel** - move a specified amount ( $0.01m$ ) along a specified axis ( $x$ ) using the Move panel that appears at the bottom left of the 3d Viewport.



## Exercise 01 - Table

### Task

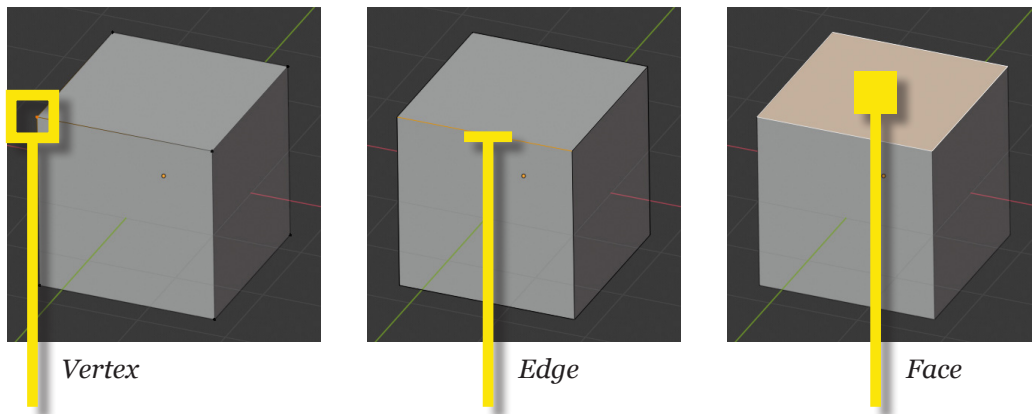
- A table is illustrated in the image below. Build as much as you can. Prioritise the table top and the legs.
- Add a material/texture.
- Set up lighting.
- Compose the camera view.
- Generate a render and save it as a JPEG file.
- **Save** your project as we will need it later.



*Width of table top boards is 6cm or 60mm the gap between them is 10mm or 0.01m*



## Learning Objective 06 - Vertex, edge and face

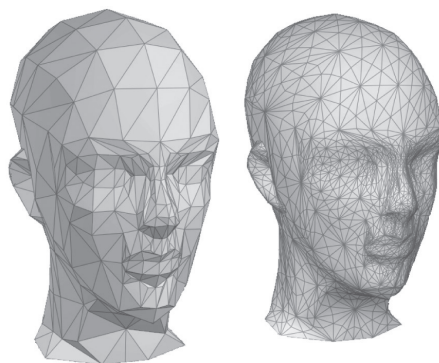


A 3d shape is made of vertices, edges and faces (vertex is the singular form of vertices).

A face is a 2d shape that makes up one surface of a 3d shape, an edge is where two faces meet and a vertex is the point or corner of a geometric shape.

The number of faces a 3d object contains is also called it's polygon count.

Detailed or smooth 3d objects may contain lots of faces (high polygon count). This will increase the file size of your project and increase the time it takes to generate renders. Models with fewer faces (low polygon count) are recommended for real-time renderings/applications (e.g. video games).

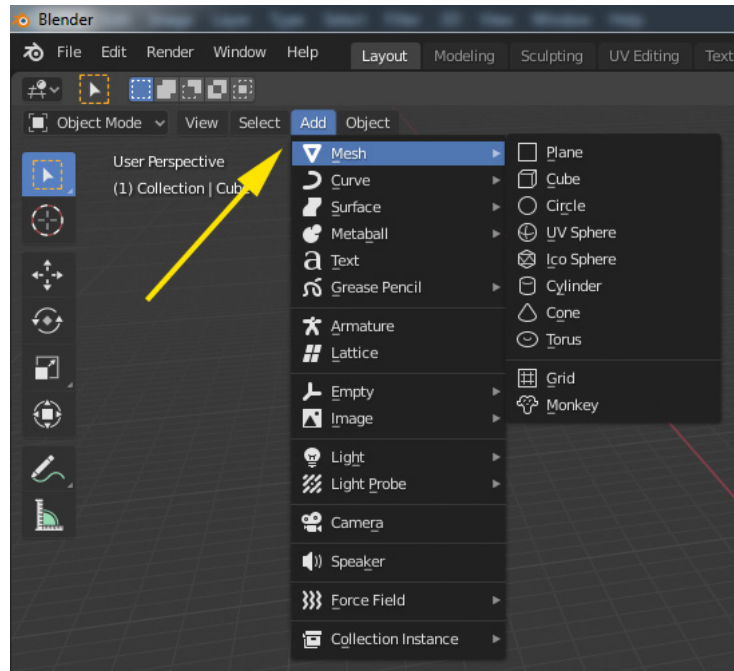


*Low polygon*

*High polygon*



## Learning Objective 07 - Adding new objects

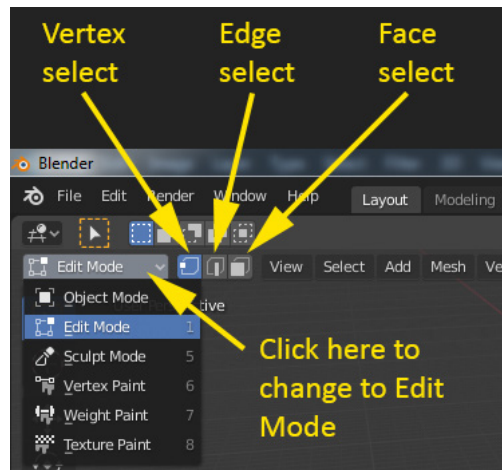


### Task

- **Add** additional objects into your scene.
- Move, scale and rotate these new objects.



## Learning Objective 08 - Edit Mode



**Edit mode** is the main mode where modeling takes place.

While in Edit Mode you can only modify the selected object. To modify other objects you must leave Edit Mode and return to Object Mode, select another object and re-enter Edit Mode.

### Task

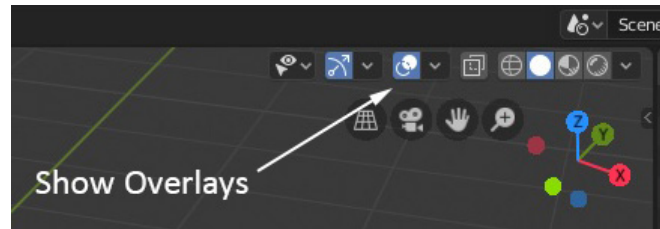
- Move your cube and then **Add** a **UV Sphere** with the following parameters: Segments and Rings = 12, Radius = 1.4m
- **Select** the **cube**.
- Enter **Edit Mode**.

Note how the toolbar changes.

- **Select** either Vertex select, Edge select or Face select.
- **Select** some vertices, an edge or a face and then move, scale or rotate (*hold down the SHIFT key while selecting to select more than one vertex, edge or face or click-and-drag to create a selection box*).



## Learning Objective 09 - Normals



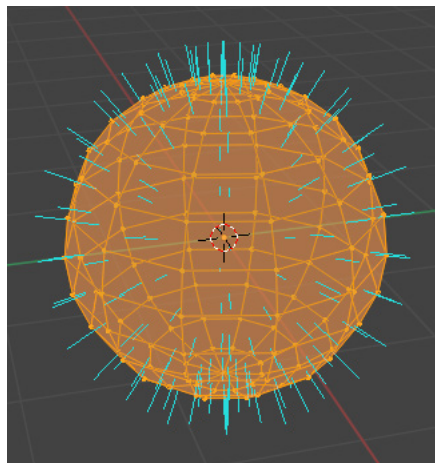
A normal is essentially the direction a face is facing! A normal is a line at right angles or perpendicular to a given face. Normals are important because they affect the appearance of an object's surface and they influence how faces behave when they are edited e.g. moved, extruded, bevelled and inset.

We can view an object's normals.

### Task

- **Select** the sphere.
- Enter **Edit Mode**.
- Choose **Show Overlays** (see image above).
- From the **Overlays** drop down menu select **Display face normals as lines**.

Your sphere will now display the face normals (see image below).



## Learning Objective 10 - Modelling with faces

Blender's primary method of modelling is akin to sculpting. We have already practiced sculpting our models by moving, scaling and rotating vertices, edges and faces.

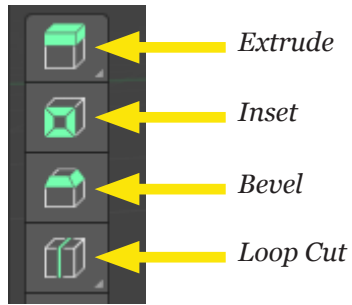
Now we will examine this method in more detail by looking at how we can extrude, inset and bevel faces.

But first let's reinforce how normals affect this process.

### Task

- **Select** the sphere.
- Enter **Edit Mode**.
- **Select** Face select (*see Learning Objective 06*).
- **Select** a face.
- Set the **Transformation orientation** to **Normal** and then select the **Move** tool and move the face along its normal (along the blue, z-axis).





Continue working with the sphere and remain in Edit Mode. Notice how the Toolbar changes when you are in Edit Mode (see image above).

### **Task**

- **Select** a face and try the **Extrude** tool.
- Experiment with the **Inset** and **Bevel** tools, selecting different faces for each tool.

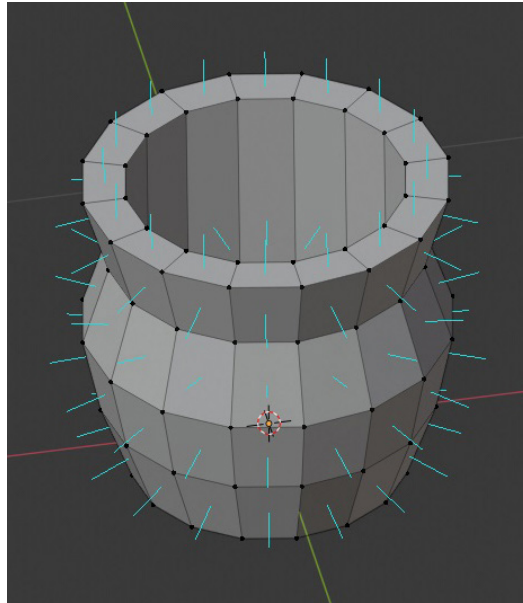
Notice the dialog box that appears at the bottom left of your 3d Viewport.

- Try the **Bevel** tool again and use the dialog box to adjust the **Segments** and **Profile**. What happens?





## Exercise 02 - Vase



### Task

- Start a **new**, general file.
- **Delete** the cube.
- Begin by adding a **cylinder** with the following parameters: Vertices = 16, Radius = 0.1m, Depth = 0.1m.
- **Extrude** the top faces at least **4** times to achieve the successive bands.
- **Scale** the vertices to create the profile (you will need to change Viewport Shading to **wire edges**).
- **Extrude** the top faces **down** to make the vase hollow.
- Add a **material**, set up **lighting**, compose view and generate and save a **render**.
- **Save** your project as we will need it later.

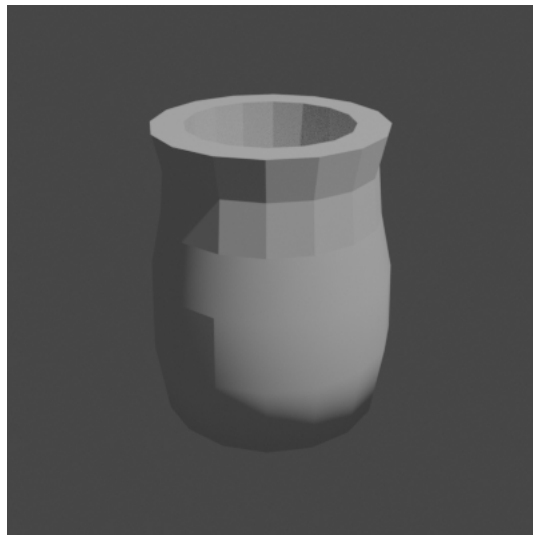


## Learning Objective 11 - Smoothing

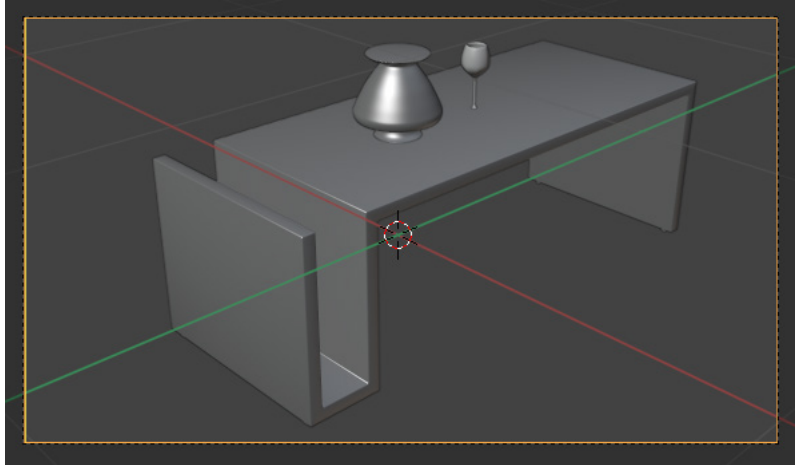
When rendering your scenes, you may notice that the surfaces of your objects appear faceted. Sometimes this is a desirable effect, but we may want our objects to look smooth.

### Task

- Ensure that you have your vase selected and that you are in **Edit Mode**.
- Select **Face select** (see *Learning Objective 06*).
- Set Viewport Shading to **wire edges**.
- **Select** faces.
- **Right-click** over your selected faces and choose **Shade Smooth**.
- **Render** your scene to see the effect of smoothing the selected faces.



## Exercise 03 - Bringing it all together



You should now have 2 separate Blender files:

1. Table
2. Vase

We are now going to bring them all together into a single scene.

### Task

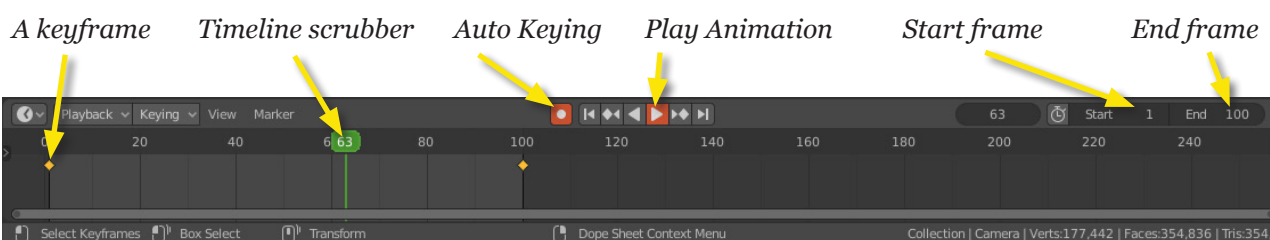
- Open the Vase file, delete the camera and light and **export** as a COLLADA (.dae) file. Repeat for the Wine glass file.
- **Open** the table file.
- Import the Vase COLLADA (.dae) file. Move the vase into position on the table. Repeat for the Wine glass COLLADA (.dae) file.
- **Save** your project with a **new name** so that it does not overwrite the original Table file.



## Learning Objective 12 - Animation

### Task

- Set the render engine to **Eevee** (Properties panel>Render Engine>Eevee).
- Set the **render size** (Properties panel>Output> and set the x and y resolution to **400 px, 400 px**).
- Set the **End** frame to **100**.
- Choose the output path, file name and file format (**AVI JPEG**).
- Move your objects, lights and cameras into their start positions and set their starting parameters.
- **Start at frame 001**
- Select the camera.
- Turn on **Auto Keying**.
- **Right-click** on the camera and choose **Insert Keyframe...>Location**.
- **Scrub** to frame **100** and **move** the camera to it's finish position.
- Press the **Play Animation** button to preview the animation.
- From the Properties panel use the **Animate property** dot/diamond to animate other properties such as light colour/brightness and camera lens.
- Choose **Render>Render Animation** to create the AVI file.



## Further information

### Getting extra help

#### Course Clinics

The IT Learning Centre offers bookable clinics where you can get pre- or post-course advice. Contact us using [courses@it.ox.ac.uk](mailto:courses@it.ox.ac.uk).

#### Study Videos from LinkedIn Learning

On our website, you will find our collection of self-service courses and resources. This includes providing LinkedIn Learning video-based courses free to all members of the University. Visit [skills.it.ox.ac.uk/linkedin-learning](https://skills.it.ox.ac.uk/linkedin-learning) and sign in with your Single Sign-On (SSO) credentials.

Some courses recommend pre- and/or post-course activities to support your learning. You can watch the online videos anywhere, anytime, and even download them onto a tablet or smartphone for off line viewing.

#### About the IT Learning Portfolio online

Many of the resources used in the IT Learning Centre courses and workshops are made available as Open Educational Resources (OER) via our Portfolio website at [skills.it.ox.ac.uk/it-learning-portfolio](https://skills.it.ox.ac.uk/it-learning-portfolio).

Find the pre-course activity for this course in the IT Learning Portfolio: visit [skills.it.ox.ac.uk/it-learning-portfolio](https://skills.it.ox.ac.uk/it-learning-portfolio) and search for “Blender” or “3d modelling activity”.

#### About the IT Learning Centre

The IT Learning Centre delivers over 100 IT-related teacher-led courses, which are provided in our teaching rooms and online, and we give you access to thousands of on-line self-service courses through LinkedIn Learning.

Our team of teachers have backgrounds in academia, research, business and education and are supported by other experts from around the University and beyond.

Our courses are open to all members of the University at a small charge. Where resources allow, we can deliver private courses to departments and colleges, which can be more cost-effective than signing up individually. We can also customize courses to suit your needs.

Our fully equipped suite of seven teaching and training rooms are usually available for hire for your own events and courses.

For more information, contact us at [courses@it.ox.ac.uk](mailto:courses@it.ox.ac.uk).

### **About IT Customer Services**

The IT Learning Centre is part of the Customer Services Group. The group provides the main user support services for the department, assisting all staff and students within the University as well as retired staff and other users of University IT services. It supports all the services offered by IT Services plus general IT support queries from any user, working in collaboration with local IT support units.

The Customer Services Group also offers a data back-up service; an online shop; and a computer maintenance scheme. Customer Services is further responsible for desktop computing services – for staff and in public/shared areas – throughout UAS and the Bodleian Libraries.