

Thomas Mc Donald

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Introduction

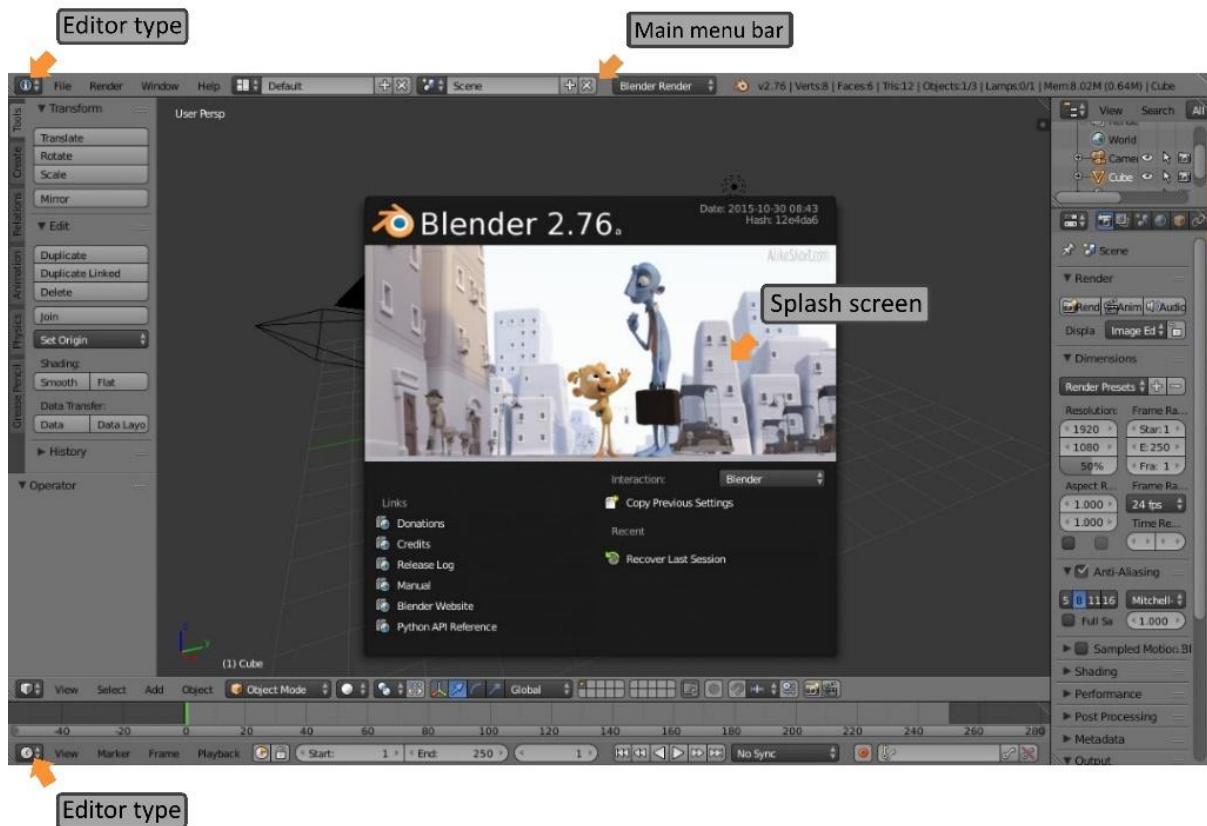
This book is designed to guide new users of the Blender 3D software through the interface and as the book progresses we take on some practical exercises the reader can follow along to. The exercises provides a “learn by doing approach” that is fundamental to understanding and mastering Blender. The first section provides information on the different areas within Blender when you first open the program. Here we quickly cover the main areas and their functions. The secret to Blender is gaining an understanding of the process, and theory, and by putting that understanding into practice, *practice, practice*. You can quickly go through this book in a day and the reality is most people don’t have a whole lot of time to spare. If you assign 30 minutes to an hour a day and follow the exercises, then repeat those exercises until you no longer need the book. This will give you a strong foundation in understanding the fundamentals of Blender. Visit <https://blenderzen.com/> for more resources.

Getting Started

You may already have a copy of Blender installed on your computer. To get the latest version of Blender visit www.Blender.org and click the Download button. This will bring you to the download page. Here you can simply select a Blender suitable for the operating system you have installed on your computer. There are three supported, Windows, Mac and the Linux operating system. Choose between 32bit or 64bit, this will depend on your system hardware, go to your system settings and check the system type if you are unsure.

Blenders user interface

When you start Blender the program will display the current splash screen. The splash screen allows you to open a recent project, link to useful resources or copy saved setting from a previous version. If you are coming from Maya or 3Dsmax you can chose the button configuration of either program. To exit the splash screen you can simply click into the 3D view or hit the Esc key.



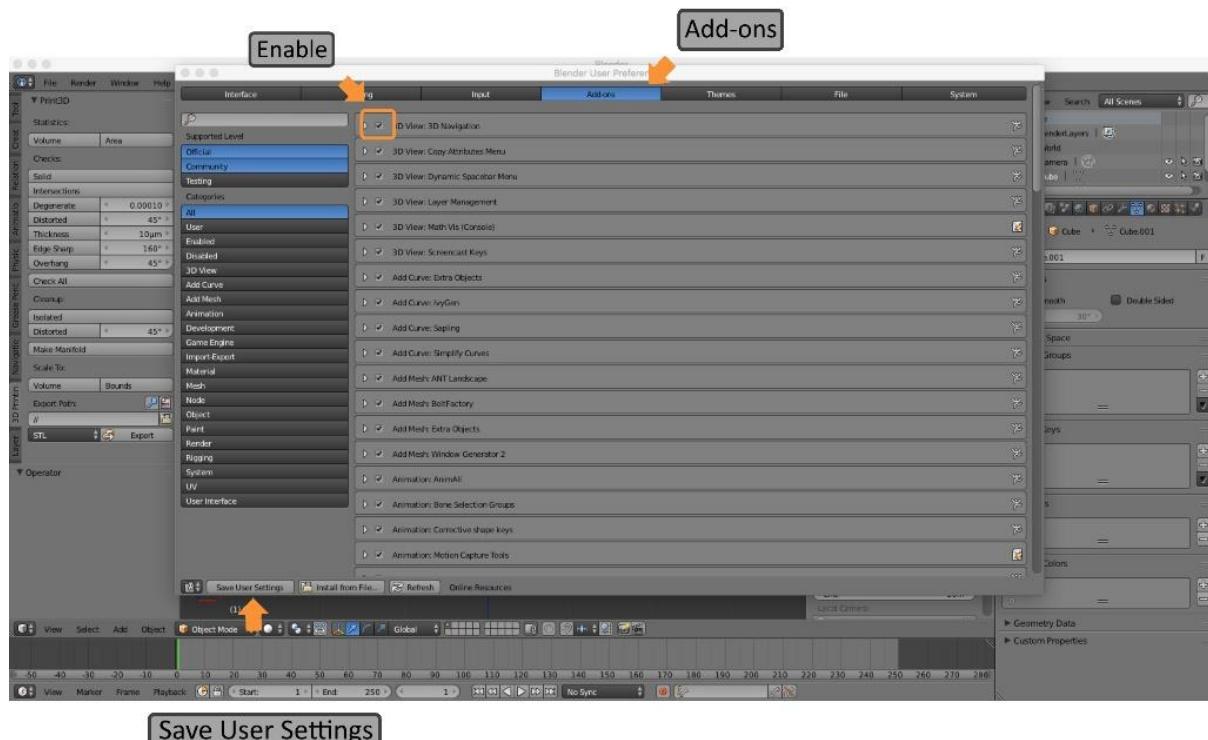
Getting Set up

Blender uses add-on, a feature that extends its functionality through the use of scripts. These pieces of software code written in python can be enabled or disabled by going to:

File > User Preferences > Add-ons > Enable the **Add-on** by clicking and placing a check mark inside the box. The **Add-on** will now be activated once you select **Save User Settings**. Some **Add-ons** are switched on by default but please note the following add-ons need to be enabled to follow along to the exercises in this book:

Go to File - User Preferences - Add-ons: Enable Mesh: LoopTools

User Interface: Pie Menus Official: Enables short cut keys for efficient workflow.



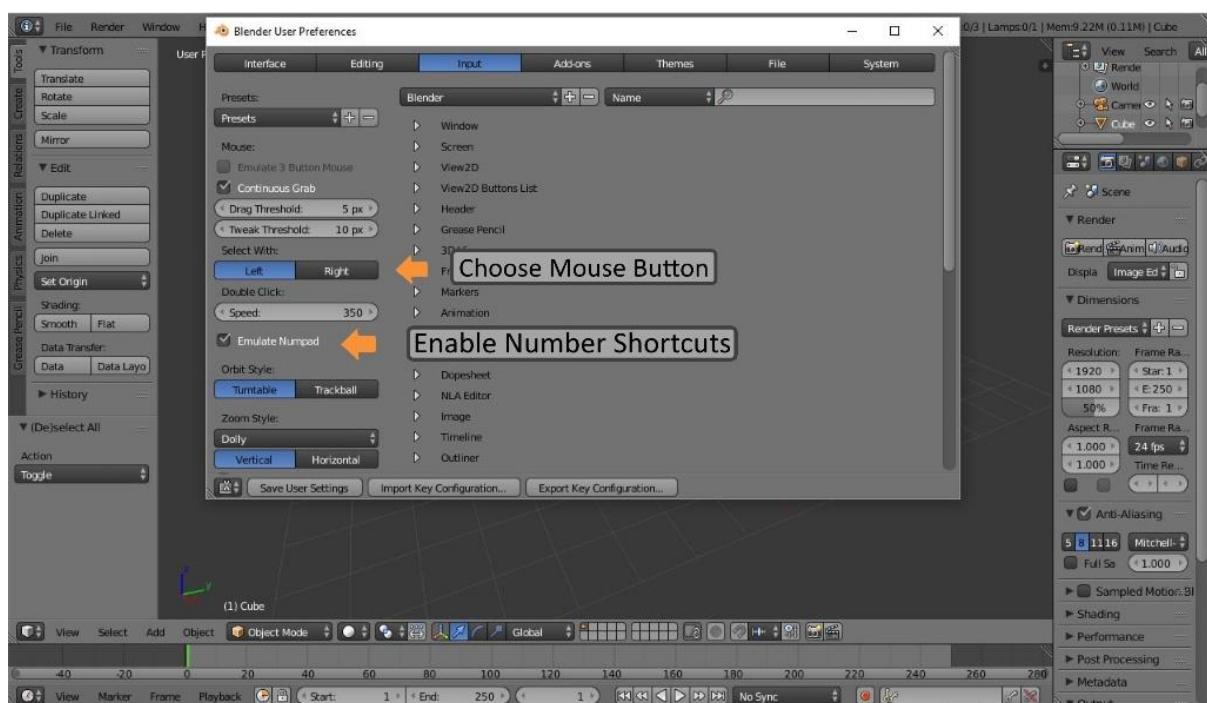
Input Devices and Add-ons

The basics requirements to use Blender successfully are a **3 Button Mouse** with scroll wheel and a **Keyboard with Numeric Keypad**. For keyboards without Numeric Keypads please follow the instructions below. Blenders default mouse select mode is with **RMB** (Right mouse button). To switch this to **LMB** (Left mouse button) go to:

File > User Preferences > Input > Select with > Left.

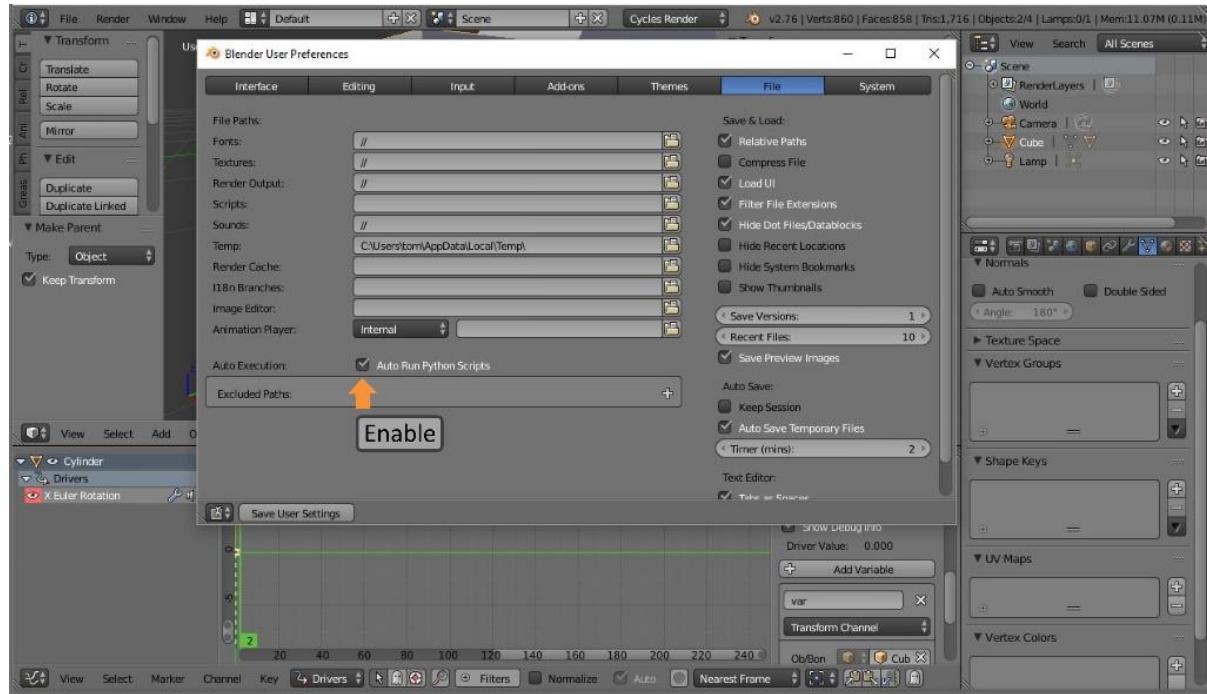
For keyboards without a **Numeric Keypad** go to:

File > User Preferences > Input > Emulate Numpad > Enable this option by clicking and placing a check mark inside the box



Another **Add-on** that needs to be enabled for the exercises that follow in this book is the **Auto Run Python Scripts**. To enable this add-on go to:

File > User Preferences > File > Enable > Auto Run Python Scripts



Note: After making changes in **User Preferences** always **Save User Settings** before exiting to update those changes.

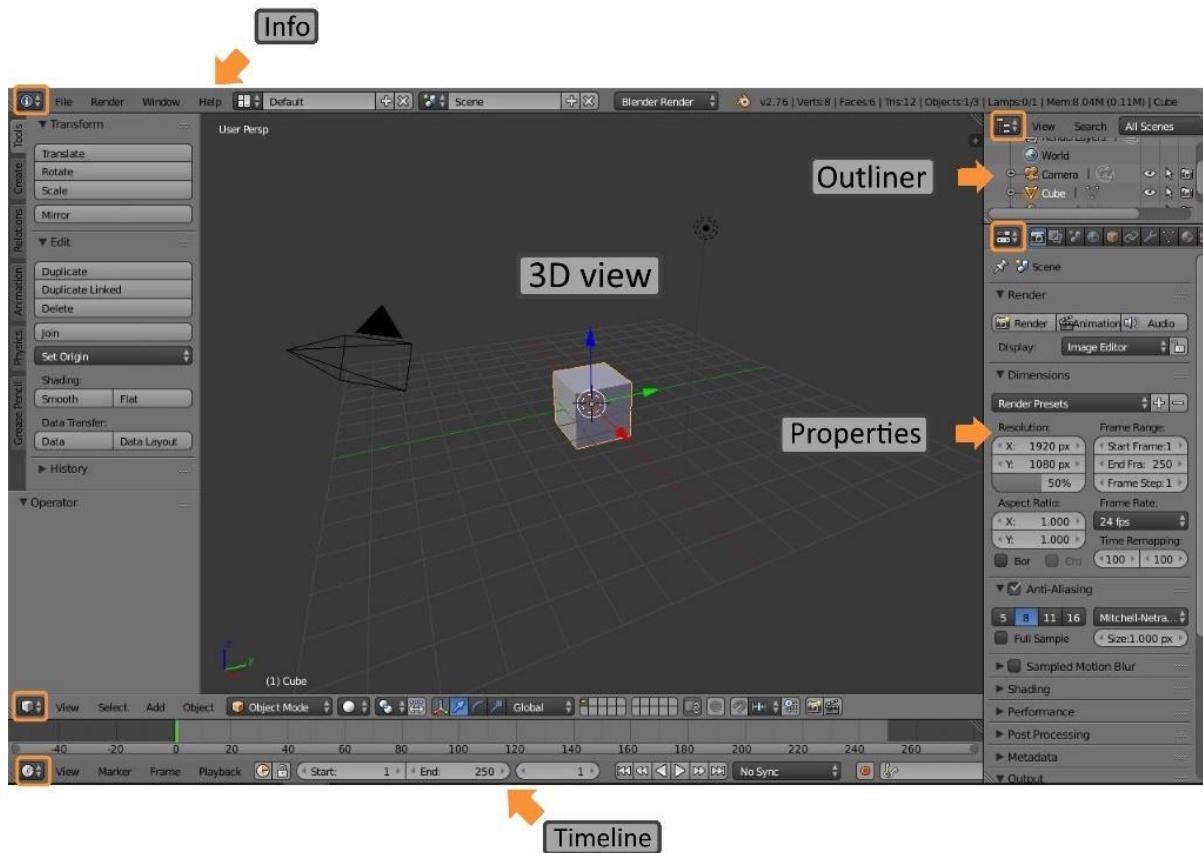
The Default screen layout

Blender's default screen layout (pictured below) is highly customizable and is arranged into 5 **areas** containing 5 editors.

The **Areas** form the screen layout and contain the **Editors**. They can be dragged out or squeezed into an arrangement that best suits the user's workflow and interface needs.

Editors consist of a **header** and one or more region. **Headers** are horizontal panels top or bottom containing menus and commonly used tools.

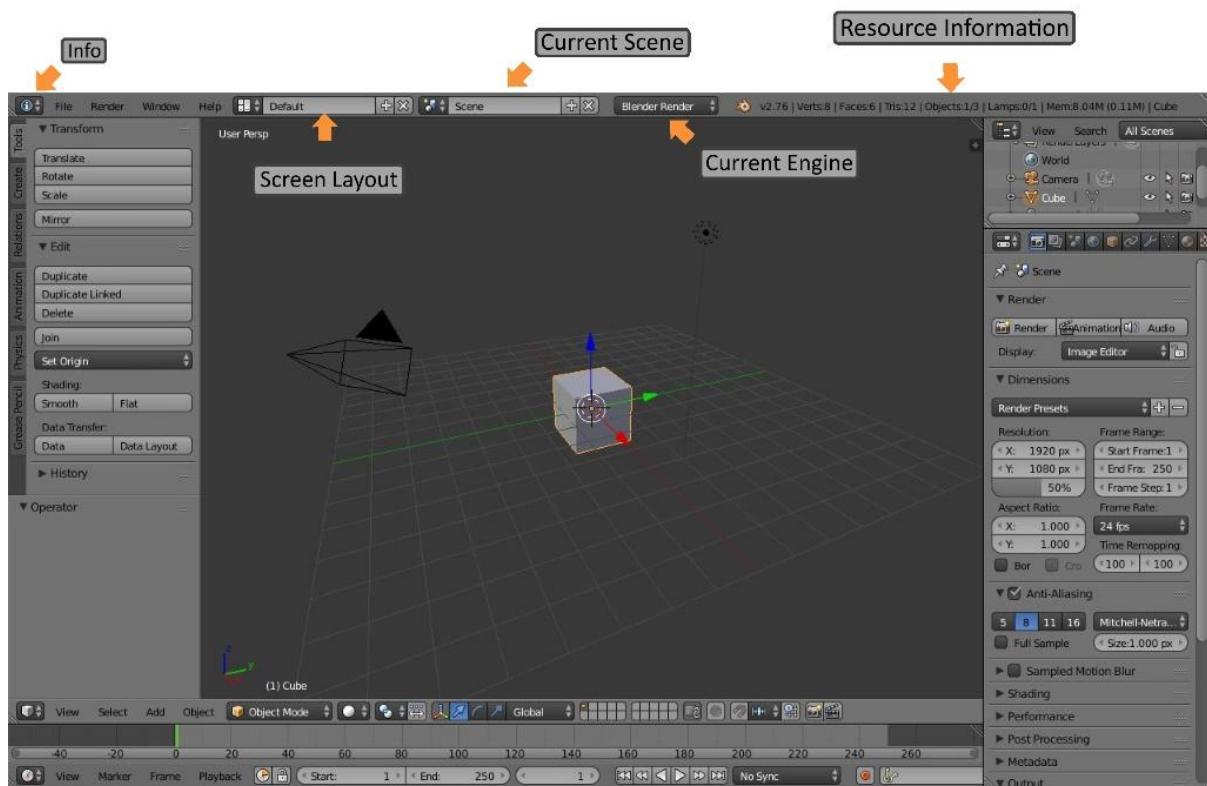
Regions contain buttons, menus, and checkboxes. These can be rearranged to the user's preferences.



The Editors

The **Outliner Editor** lists alphabetically by default every object within your scenes. Here you can easily maintain control of an objects visibility in the scene or during rendering. Here you can double click an object to rename, select it or delete it. In a large scene with many objects press the period key to quickly bring the outliner window right to that object. To avoid accidentally selecting or modifying an object in a scene you can make it disable its selection option.

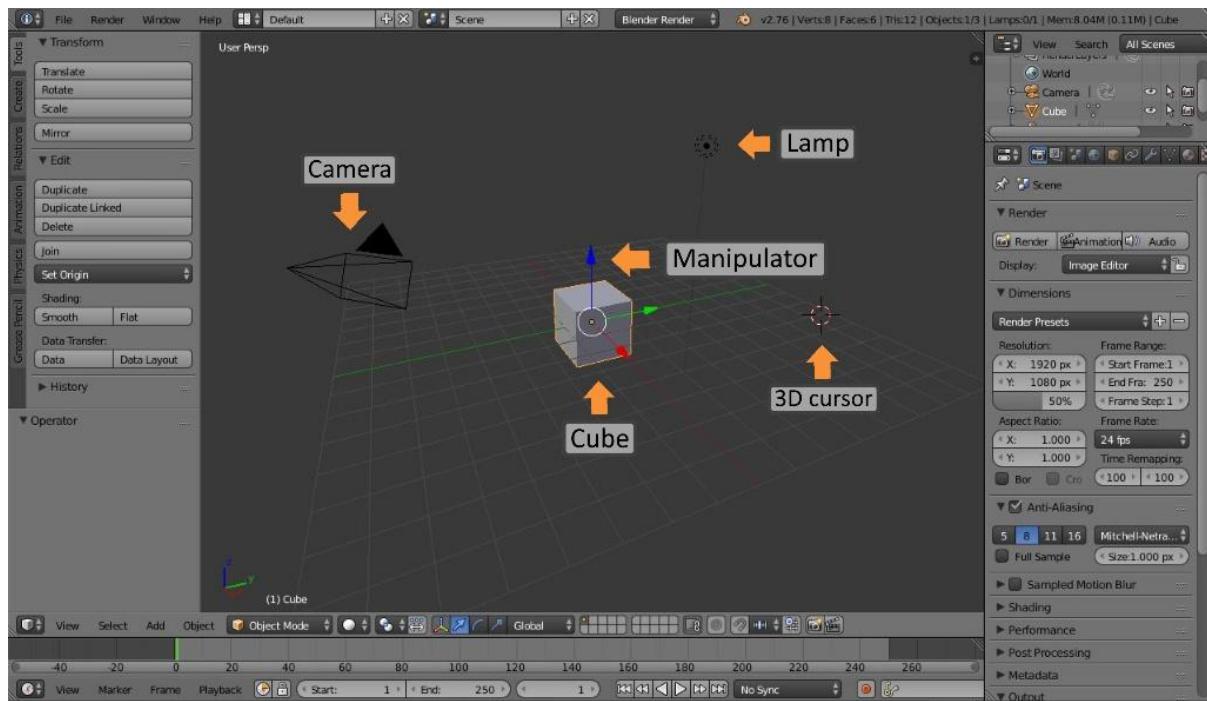
The **Info Editor** by default is displayed horizontally across the top of the screen. This **editor** contains the main menu bar displaying your current **screen layout**, current scene, current engine and resource information.



The **Timeline Editor** runs horizontally along the bottom of the screen and provides a visual display for the placement of key frames. These key frames store an object's properties (position, scale etc) at a moment in time, allowing for interpolated animation between a second key frame.

The **Properties Editor** stores data for the active object and current scene. We will take a closer look at each tab on the **Properties Editor** later in this book.

The **3D View** is your view to the virtual environment controlled with a combination of **short cut keys** and **mouse button inputs** to model, composite, animate, and edit within. You can select an object inside the 3D View with the LMB (Left mouse Button) unless you have chosen the RMB (Right Mouse Button) as the selection method. Press and hold the MMB (Middle Mouse Button) to rotate the view or roll the MMB to zoom in and out. The RMB places the 3D Cursor at a point in 3D space. The default 3D view contains the objects pictured below. These include the Camera, Lamp, 3D manipulator, 3D Cursor and the default Cube.



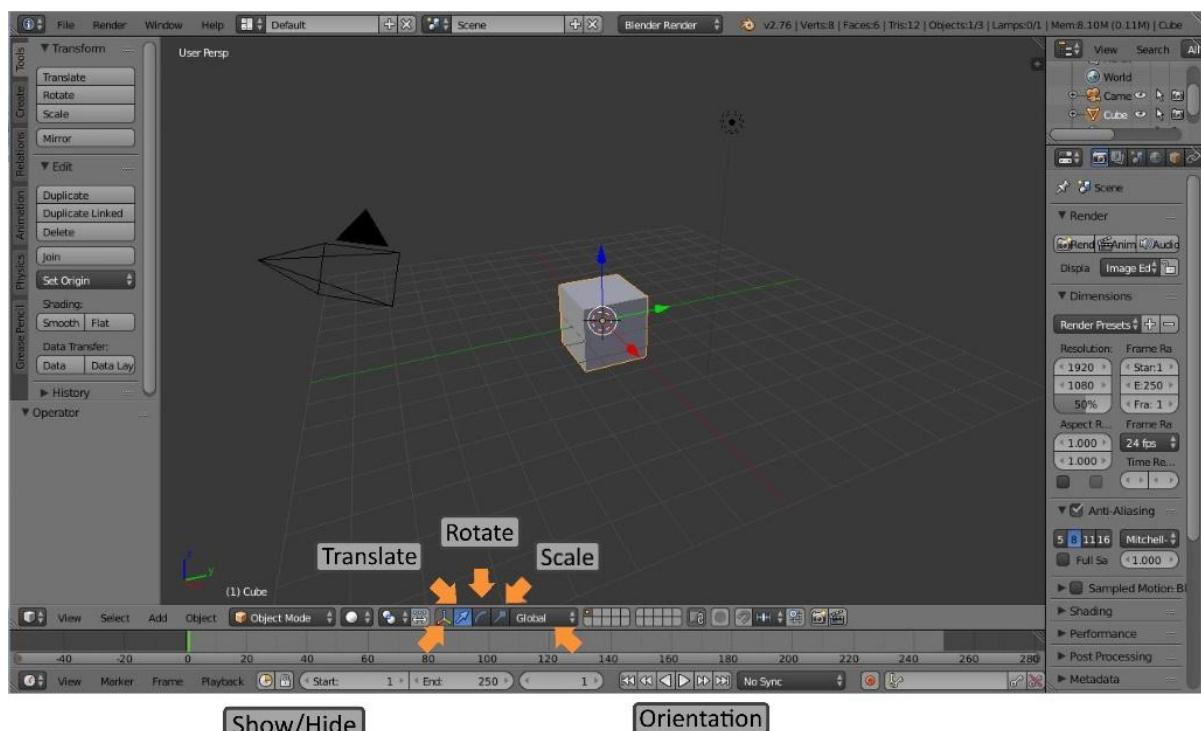
The Objects within the 3D View

The **Camera** object within Blender acts much like a real world camera. The rendered scene displayed from the cameras view can be outputted as images or video. With the Camera selected the **properties editor** Header contains the **Camera's settings**. The lens type, focal length and depth of field settings etc can be adjusted here. Everything created in the 3D view will be displayed with the camera either as an image or image sequence. For this reason it is important to understand how the camera is controlled.

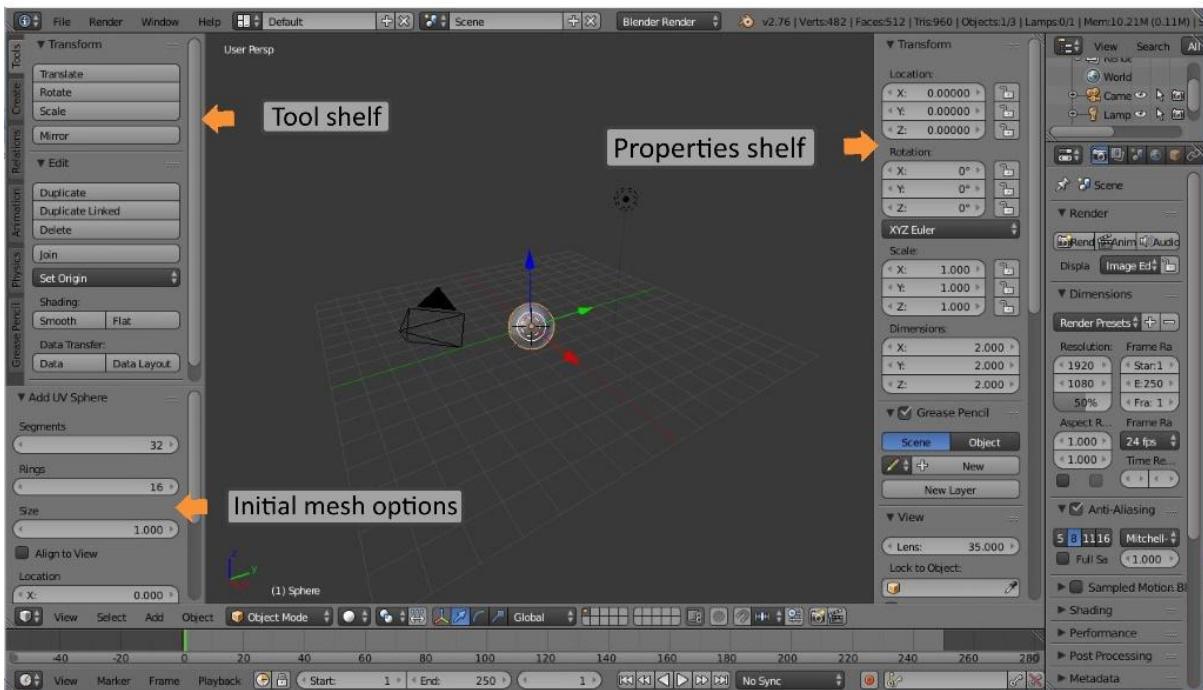
The default **Cube** is a mesh object and one of a number of primitive mesh shapes you can begin modelling with. Press **Shift + A** (Add menu) to view or add the other primitive mesh shapes.

The **Lamp** object is used to add light to a scene. There are four lamp types supported in Blender each one offering unique shadow and shading options. Lamps can be easily moved, duplicated and controlled within the scene. The properties editor header has the settings related to the lamp.

The **Manipulator** has three separate icons to represent each type of transform option currently selected. These transform options are **Translate**, **Rotate** and **Scale**. Used together or separately and accessed through the short cut keys **Ctrl + Spacebar** they provide a way of manipulating certain parts of the mesh quickly. You can change the orientation of the transform manipulator using the transform orientation menu. These options allow the object, its faces and edges to be edited in a variety of different rotations relative to themselves or the global orientation.



The Tool and Properties Shelf

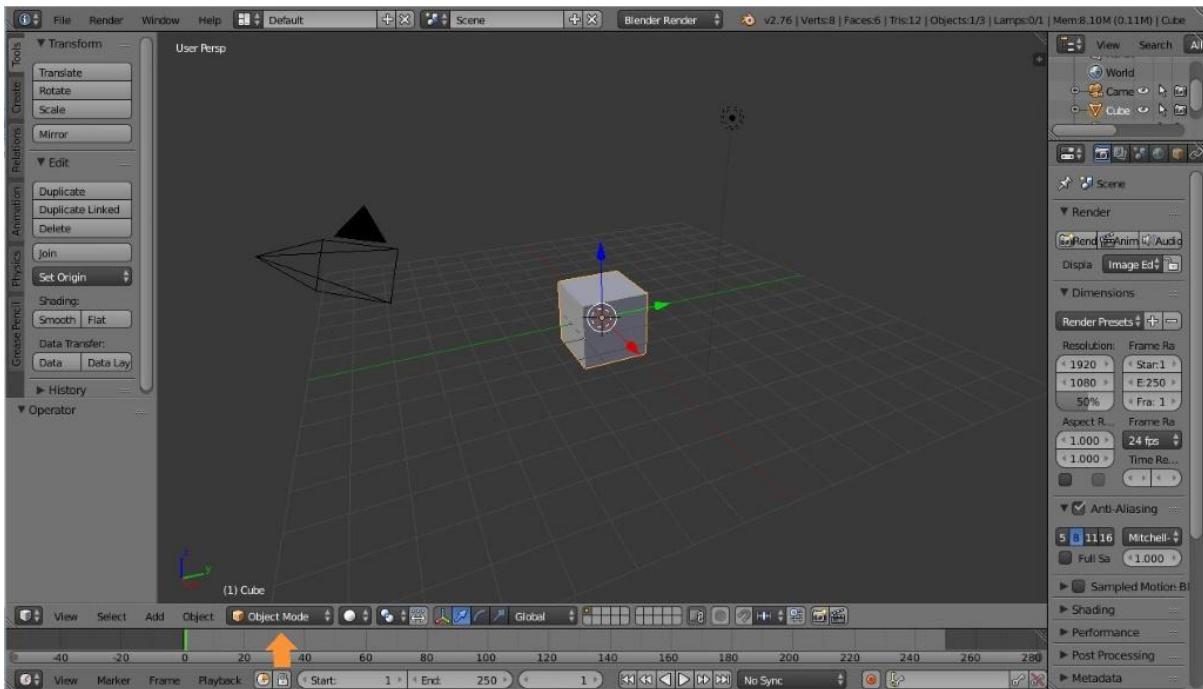


The **tool shelf** is located on the left hand side of the 3D editor and can be accessed by the short cut key **T**. This shelf contains tools that you will access frequently either from this area or by the use of short cut keys. The tool shelf options will change depending on the mode selected (Object mode, Edit mode etc).

When adding a new mesh to the scene initial mesh options become available on the tool shelf for that mesh. Here you can make any modifications to the default mesh before continuing. Please note that once any modifications are made to the mesh in the 3D view, e.g. transform, scale etc these initial options on the tool shelf will no longer be available. Any further modification will have to be performed in Edit mode.

The properties shelf is located on the right hand side of the **3D Editor** and can be accessed by the short cut key **N**. The properties shelf has transform data for the selected object. The location of the 3D cursor can be controlled here. The display options for the scene, such as the grid floor and relationship lines can be controlled here. It also has scene shading options that can be used to improve visibility while modelling, for example. You can add background images to the scene to aid in the modelling of objects etc. The properties shelf data will change depending on the mode selected (Object mode, Edit mode etc).

Object Interaction Mode



Object Interaction Mode

By default Blender begins in **Object Mode**. Blender is mode based and each mode within Blender has a specific function. **Modes** can be accessed through the shortcut key **Tab** once an object has been selected. This shortcut displays the **Object interaction menu**. The remainder of this book will be dealing with **Object mode** and **Edit mode**. Edit mode is where an object will be modelled into the desired shape. In Edit mode only the selected mesh object can be edited. Objects can be joined and edited together or parts of an object can be separated to form individual objects.

Exercises

The following exercises are conducted with the default Blender setup.

It is important to start by beginning a new scene so go to:

File: New: Reload: Start-Up File

The following add-ons must be enabled in order to complete these exercises:

Go to:

File - User Preferences

Add-ons - Enable: Mesh: [LoopTools](#) (Allows the user add additional edges to the mesh in Edit Mode)

Add-ons - [Pie Menus Official](#) (Enables short cut keys for efficient workflow) Very last one on list

File - User Preferences

File – Enable - [Auto Run Python Scripts](#)

File - User Preferences - Input - Select with [Left](#)

For keyboards without a Numeric Keypad go to:

Input - [Emulate Numpad](#) (Enable this option by clicking and placing a check mark inside the box)

When all 5 have been enabled be sure and [Save User Settings](#). This ensures the next time you open Blender that these settings will still be enabled.

The following abbreviations will be used throughout this book and are as follows:

[LMB](#) >Left Mouse Button

[RMB](#) > Right Mouse Button

[MMB](#)> Middle Mouse Button

Each Exercise has a video available to watch on YouTube where the entire series can be viewed from the playlist “Exercises”.

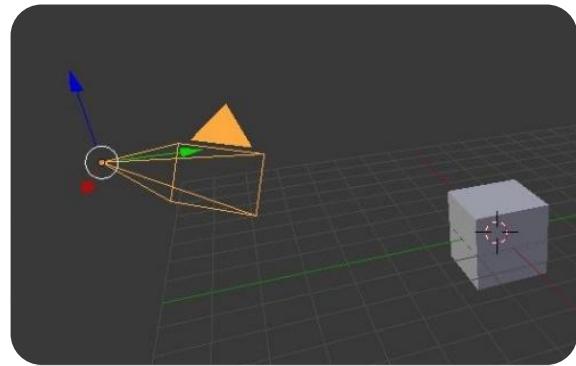
Exercise

1

Manipulating the Camera

1 | Go to File **Select** New then Select Reload Start-up File

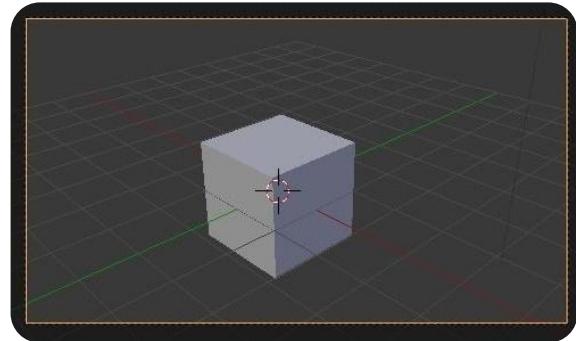
2 | Select the Camera with the L.M.B (Left Mouse Button)



(Notice an orange outline around the object once it has been selected)

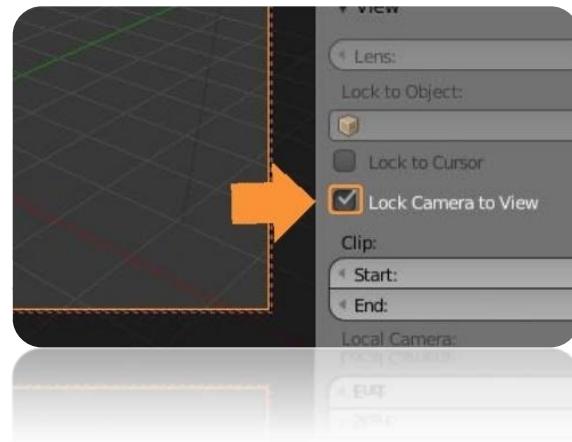
3 | Press Zero (Camera View) with the Cursor in the 3D view

4 | Roll Your MMB Once or Twice. Notice the Camera View is Fixed in Position



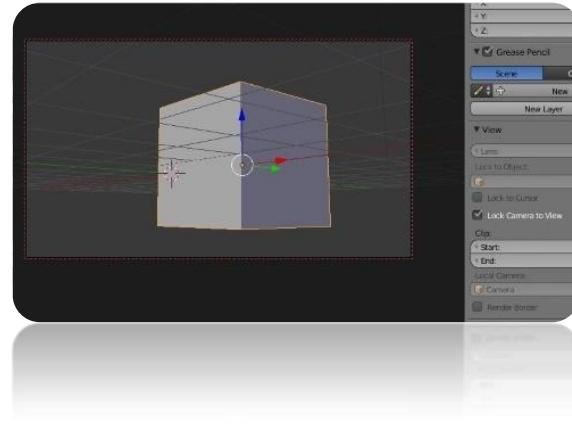
5 | Press > N (Properties Shelf)

6 | Put a Check Mark in the “Lock Camera to View” Box



7 | With the Cursor in the 3D View you can now roll the MMB to zoom in and Out.

8 | Press and Hold the MMB and slowly drag the Mouse to Rotate the Camera View to a position you require.



That completes the exercise

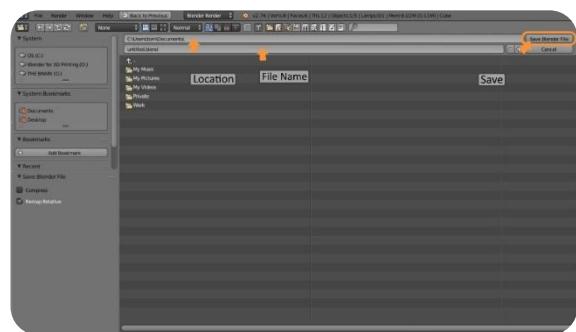
Summary: You Can Toggle back and forth between the Camera view and the previous view by pressing zero. When there are multiple cameras in the scene, select the camera and press Ctrl + Zero to make it the active Camera.

Exercise

2

Saving Your Work

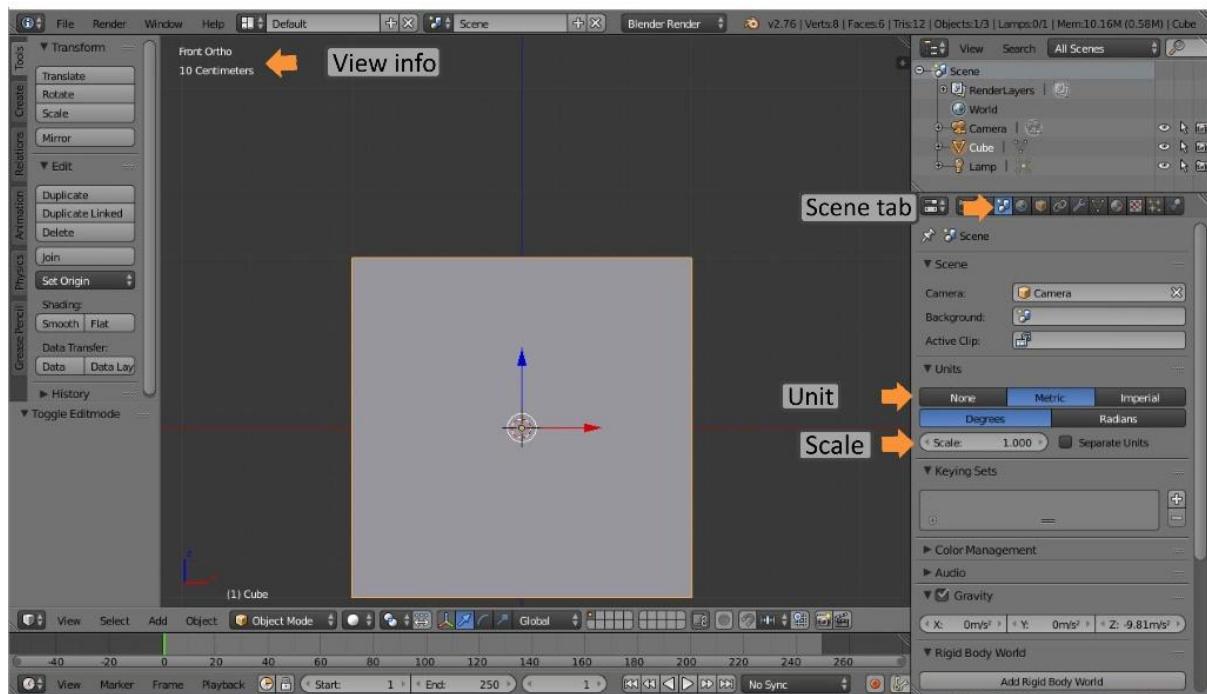
- 1 Go to > File > Select Save
- 2 Choose the Location you wish to save to
- 3 Enter a File Name
- 4 Select the Save Blender File Button on the Top Right of the screen



That completes the exercise

Summary: Save your work often. Blender has a nice feature when you save your work; it saves a copy with the file extension .Blend1. This contains the data prior to you saving your work and can prove very useful if something gets corrupted or deleted by accident.

Unit of measurement

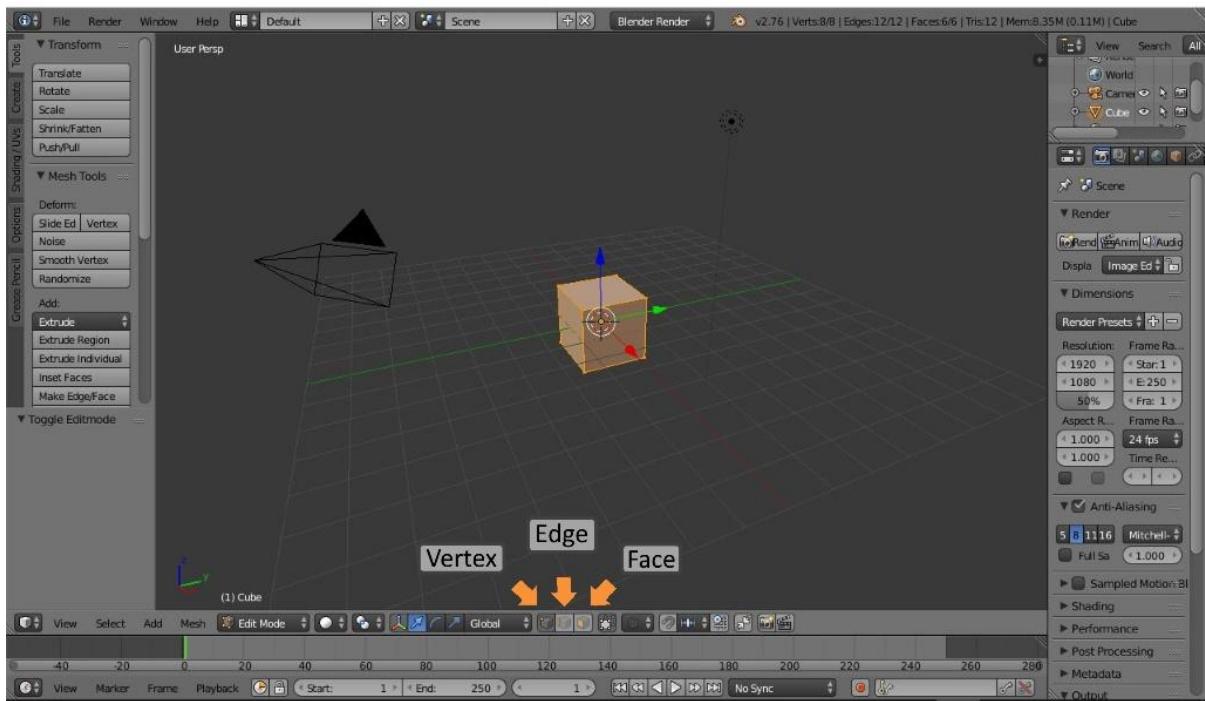


To set up the **unit of measurement** in Blender go to the **Properties Panel** and select the scene tab. The **unit panel** contains the unit type. By default the units are set to blender units with a **scale** of 1.

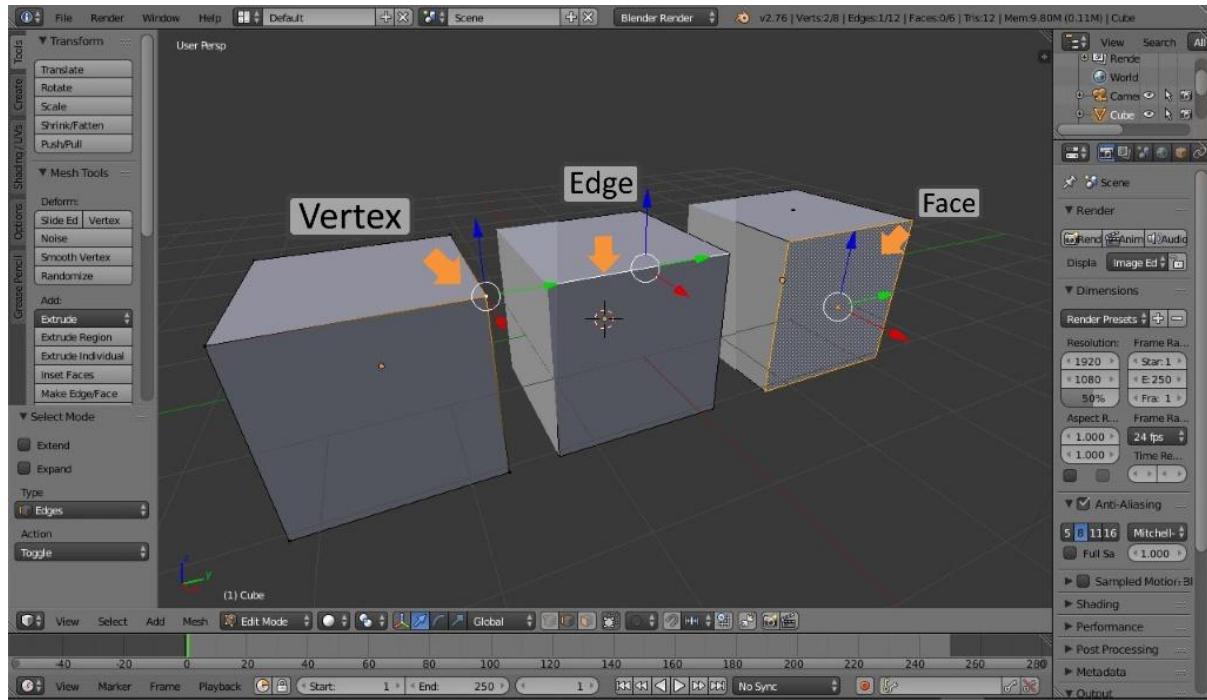
The image above shows the cube in **front orthographic view**. (Press 1 for front view, press 5 for orthographical view, and roll the mouse wheel to zoom in.) You will notice the screen is divided into grids of equal length and height. The cube on screen measures 2 meters and equal in length to two large grid divisions, each one measuring 1 meter. Zoom in further to reveal each grid divided into ten equal parts, each measuring 10 centimetres with these divided into 1mm divisions.

The **view info** is located at the top left hand side of the screen and displays the current view type and unit range.

Mesh Selection Mode



The first picture above shows the selected cube in Edit mode (With the cube selected in object mode press: Tab > Edit mode). You will notice the header of the 3D view will change to include **Vertex**, **Edge** and **Face select**.



Take the cube in the second picture as an example of selection methods within Blender. The default cube is a mesh object consisting of three basic elements. The Cube has **6 Faces, 12 Edges and 8 Vertices**. The **vertex** is a point in 3D space while 2 connected vertices form an edge and four edges connected form a face. Each element of the structure **Face, edge and vertex** are used to edit the cube.

Exercise

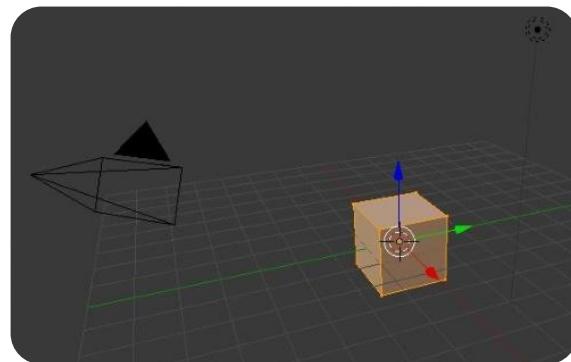
3

Manipulating the Cube

1 | **Select the Cube LMB**

2 | **Press Tab Select Edit Mode**

The cube will be highlighted in orange indicating all parts of it are selected. If not press A once or twice. (Pressing A selects all or deselects the current selection)

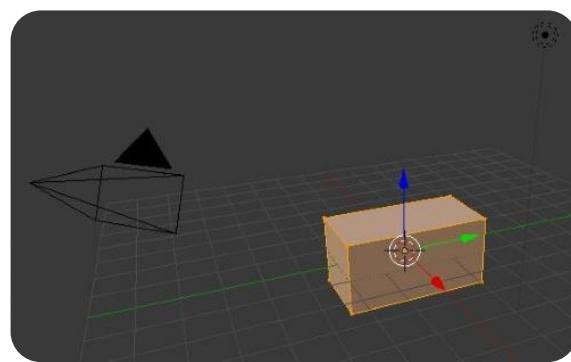


3 | **Press S (For Scale)**

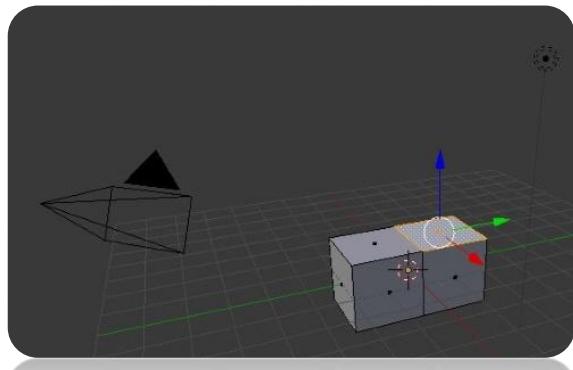
4 | **Press Y (Restricts the scaling to the Y Axis)**

5 | **Press 2 (Scales the cube in the Y axis by a factor of 2)**

6 | **Press Enter (Confirms the operation)**

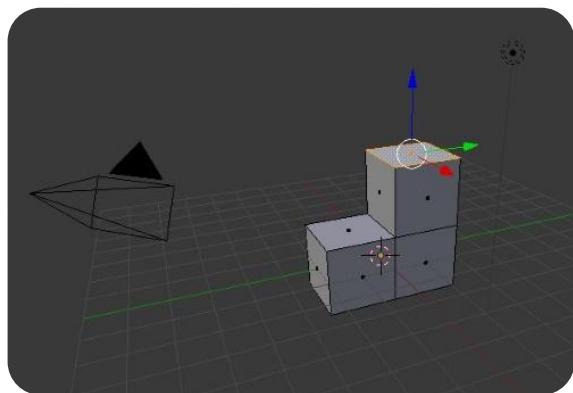


- 7 **Press Ctrl + R (Insert a loop cut)**
Bring the cursor near to the edge you want to insert the cut
In this case along the X axis
- 8 **Left click once you have the correct position**
(Left click again to place it at its current location. Notice that after the first left click you can edge slide it into position. To be sure of the correct position right click to place it at the centre of the cube, press ctrl + Z to undo an operation)
- 9 **Right click to place it at centre**
- 10 **Press Ctrl + tab (Mesh Select Mode)**
- 11 **Select Face**
- 12 **Select the top right face on the cube with the LMB**



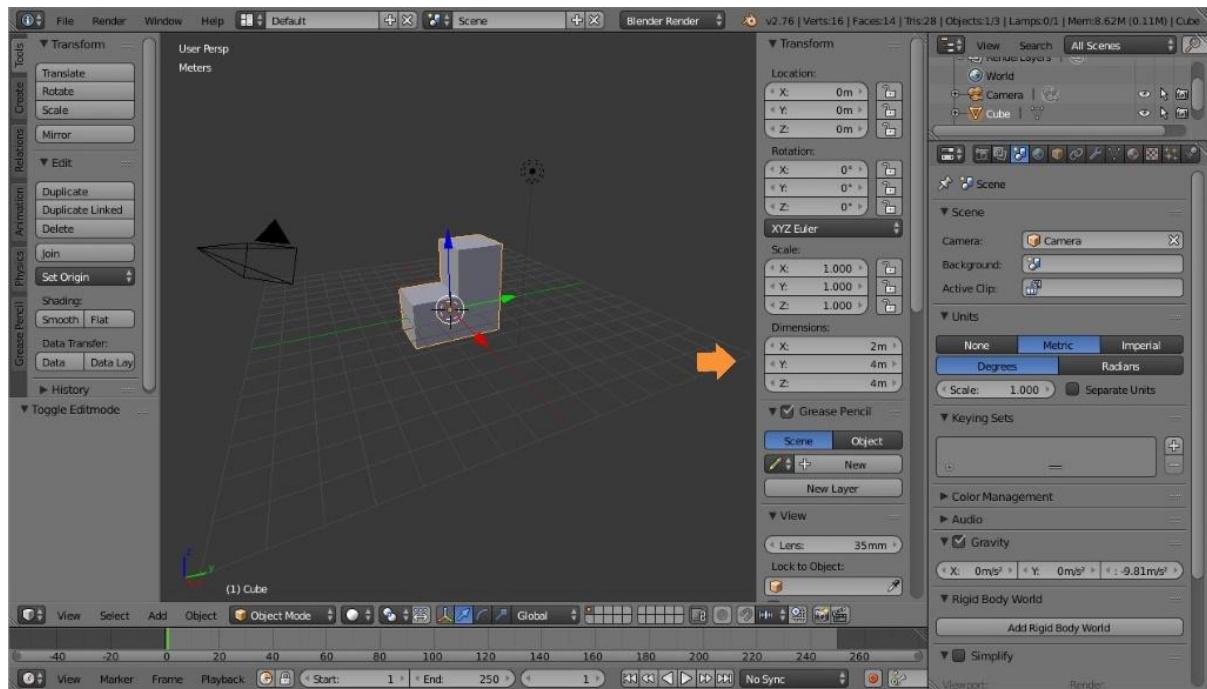
- 13 **Press E (Extrude)**
- 14 **Type 2 and Press Enter**

This command extrudes the face in the positive Z direction by 2 units. By default the cubes dimensions are 2 blender units x 2 x 2



15 | Press Tab and Select Object mode

16 | Press N (opens the properties shelf)
(In the Transform panel you will find the dimensions of our cube)



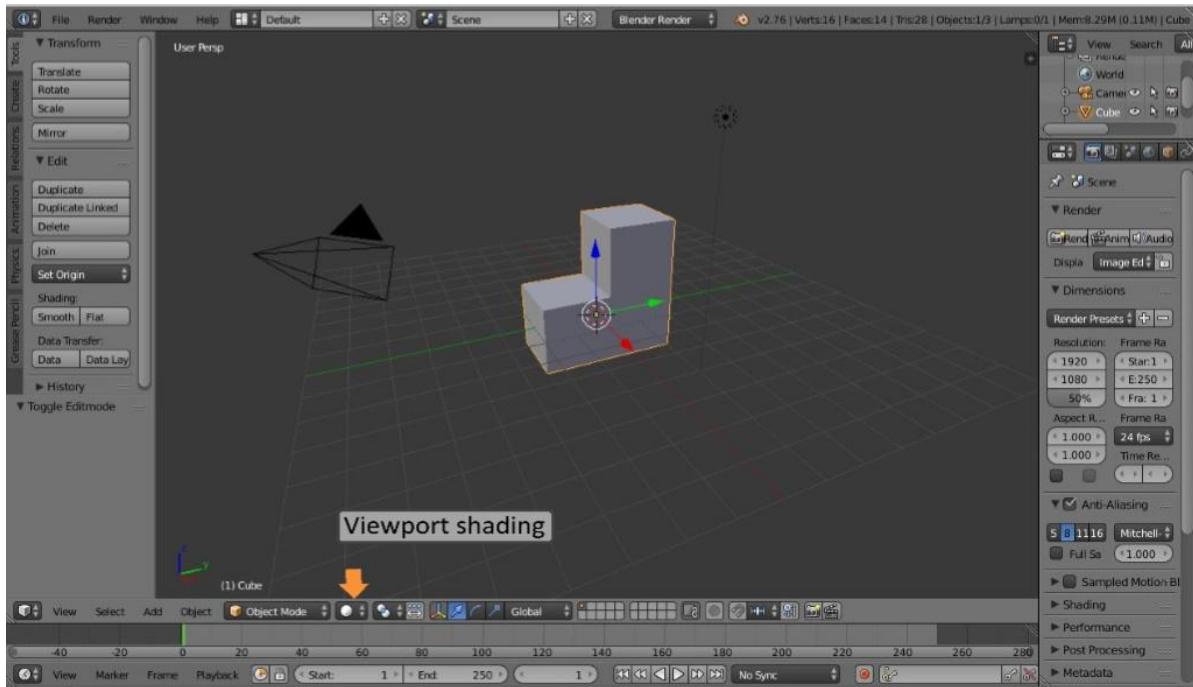
17 | Press Ctrl + S (Save your Work)



That completes the exercise

Summary: The dimensions of the cube can be modified in object mode. It is possible to change the x, y and z dimensions. The scale of the cube must be applied once these dimensions have been changed (Ctrl + A calls up the apply menu. Then select apply) By applying the scale you are essentially telling Blender this new size is the cubes actual scale. In Edit Mode however every face edge and vertex can be extended without having to apply the scale.

Viewport Shading



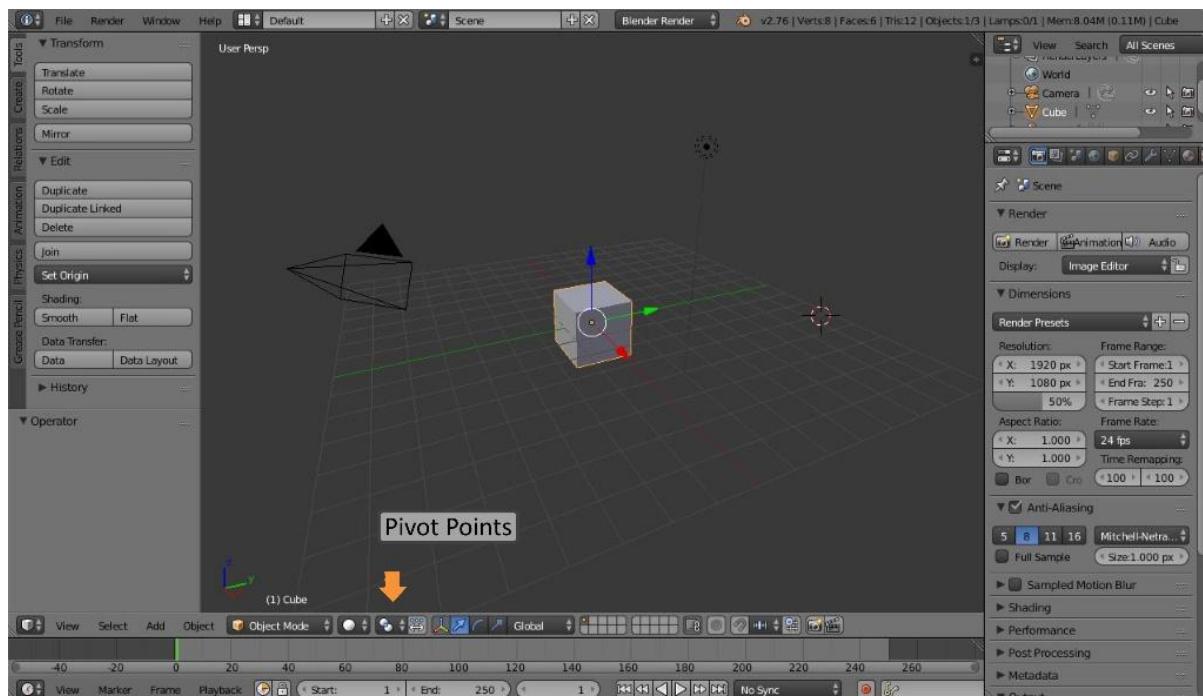
The **Viewport Shading** menu (Pictured below) and set to solid as default, can be accessed through the shortcut key Z. The shading menu options display the object depending on the material applied and or the lighting setup. The most commonly used shading options when modelling are solid and wireframe shading.

The 3D Cursor

The **3D Cursor** is Blenders placement and pivot tool. The properties shelf holds the 3D Cursor panel with its x, y and z coordinates. To accurately place objects within the scene or to one another use the snap menu Shift + S.

Pivot Points

Pivot Points allow for the rotation, scaling and mirroring of objects around a point in space. The Pivot Point menu provides a list of 5 to choose from each with their own uses. The **Medium Point** is the default **Pivot Point**, uses the centre mass of an object for determination and is the most commonly used.

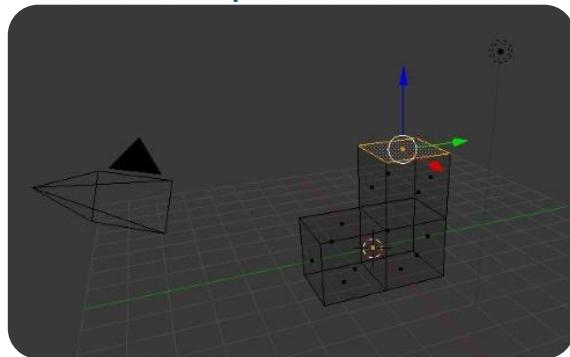


Exercise

4

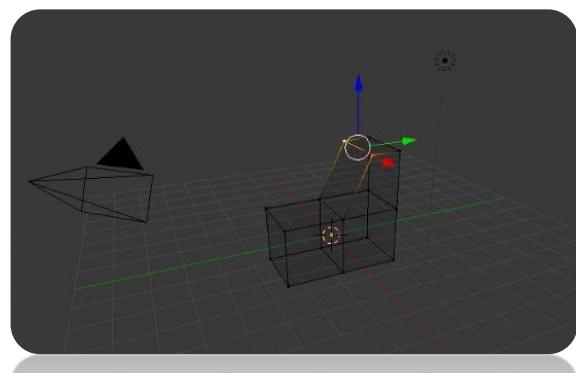
Wireframe Shading

- 1 In Object Mode Select the Cube
- 2 Press Tab and Select Edit Mode
- 3 Press A (Once or twice until everything is deselected)
- 4 Press Z (Viewport Shading Menu)
- 5 Select Wireframe
- 6 Press Ctrl + tab (Mesh select mode)
- 7 Select Face
(Notice how the small black dot now represents each face of the mesh)



- 8 Press Ctrl + tab (Mesh select mode)
- 9 Select Edge
Now notice how all the edges of the modified cube become the selectable regions
- 10 Press Ctrl + Tab (Mesh select mode)
- 11 Select Vertex
Notice how the all the vertices become selectable

- 12 **Select one Top Left Vertex with the LMB**
- 13 **Press and hold the Shift key**
- 14 **Select the second top Vertex**
- 15 **Press G (More or Translate)**
- 16 **Press Y (Restrict the direction to the Y direction)**
- 17 **Press 1 (Move 1 Unit or 1 Meter)**
- 18 **Press Enter (Confirm the operation)**



That completes the exercise

Summary: This exercise highlights the difference between the mesh selection methods and what can be selected when one of the options is active. It is possible to have all three methods active at once (On the 3D view editor header, with the shift key held, select the first, second and third)

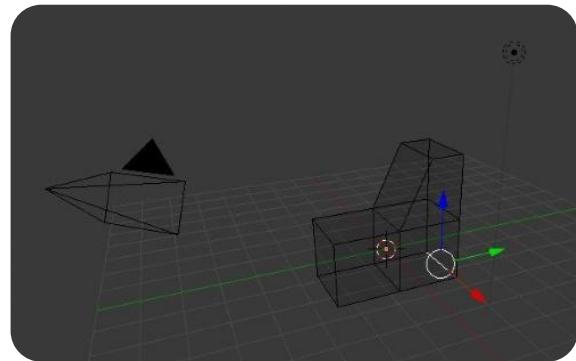
Exercise

5

Pivot Points

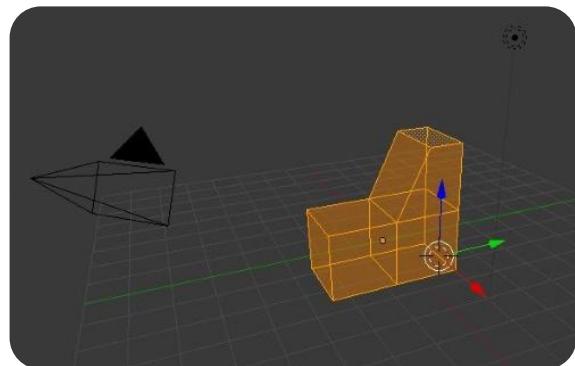
We continue on in Edit Mode:

- 1 Press **A** once or twice to deselect everything
- 2 Press **Ctrl + Tab (Mesh select Mode)**
- 3 Select **Edge**
- 4 Select the Bottom right side edge with the **LMB**



- 5 Press **Shift + S (Snap Menu)**
- 6 Select **Cursor to selected**
- 7 Press the **Period Key (Or Full Stop key for Pivot Menu)**
- 8 Select **3D Cursor**
Next we will now duplicate the object and use the 3D Cursor as the pivot point

9 | Press A once or twice to select everything to mirror with



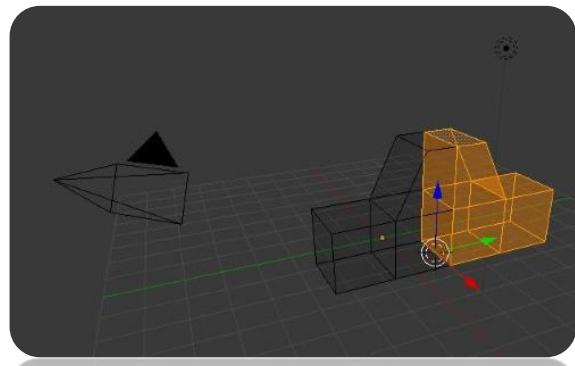
10 | Press Shift + D (Duplicate)

11 | Press the RMB (Right Mouse Button) to snap the duplicate to its origin

12 | Press Ctrl + M (Mirror)

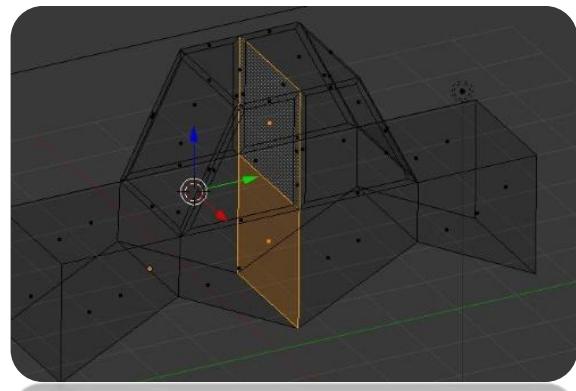
13 | Press Y (Selects the Axis to mirror along)

14 | Press Enter (Confirms the Operation)



Next we need to delete unwanted internal walls

- 15 | Press **Ctrl + Tab**
- 16 | Select **Face**
- 17 | Select the two internal faces in the centre by holding the shift key and selecting both.
- 18 | Press **X (Delete)**
- 19 | Press **Z** and Select **Solid** (Notice how the new faces are a darker shading indicating their normal's are pointing inward)



- 20 | Select all the faces by pressing **A** once or twice
- 21 | With all the faces selected Press **Ctrl + N** (Recalculates the direction the faces are pointing)

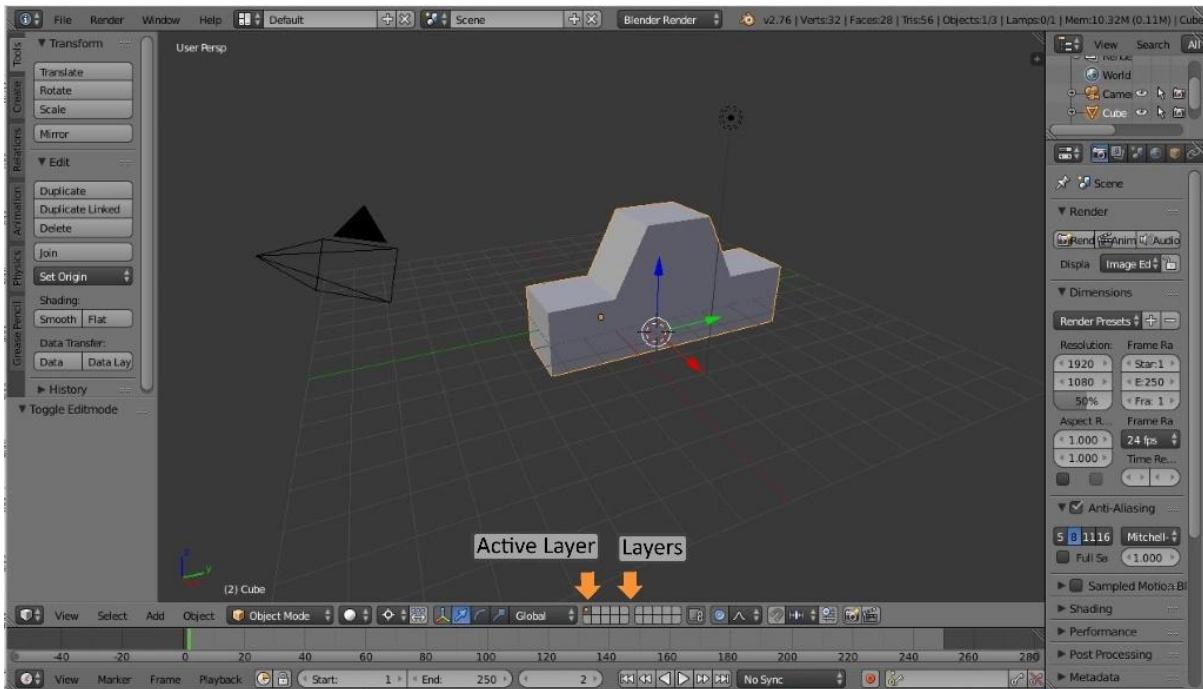


That completes the exercise

Summary: When an object is duplicated in **Edit mode** the duplicate becomes part of that object. In **Object Mode** when an object is duplicated it becomes an individual object. To join two separate objects in **Object Mode** simply select them by press and holding **Shift**, once selected press **Ctrl + J** (Join). To separate an object or part of an object in edit mode select the piece you want separated and press **P** (Separate Menu) and select selection. When you tab back to object mode this separated part will now be a separate object.

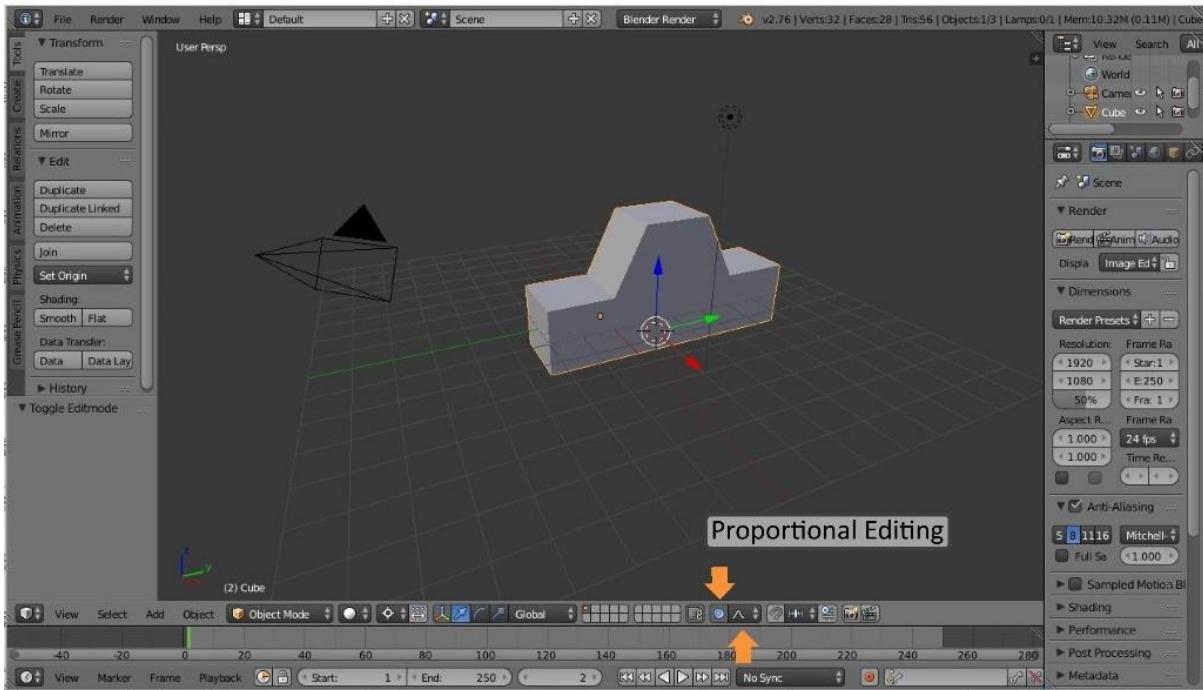
Using the **3D Cursor as a pivot point** allows rotation, scaling, mirroring etc around a chosen point.

Layers



Layers are used as a way to separate objects within the scene and provides the user control over how an object is lit, how forces affect them and how they are rendered and the properties applied. In this way layers help organise the objects within the scene allowing efficiency and creating the ability for uncluttered workflow. The Active layer has a darker shade when on. When an object is selected a small orange circle indicates the layer the object is placed on. To move an object to a different layer select the object, press M and select the layer you wish to move it to.

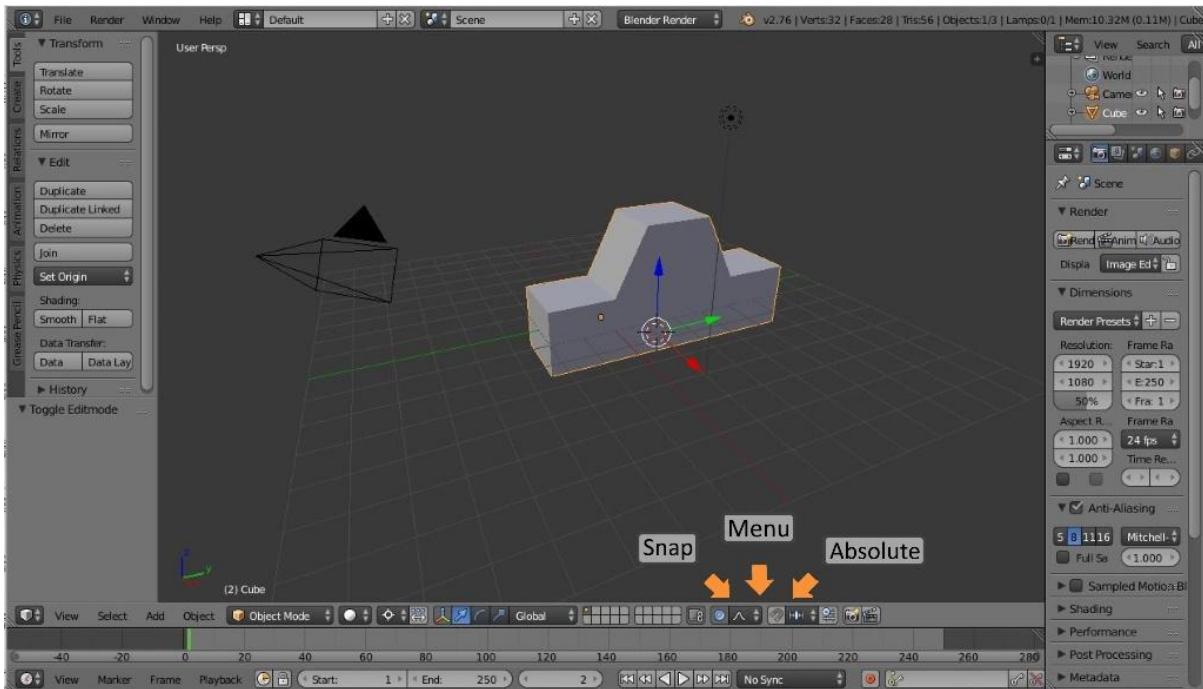
Proportional Editing



Falloff type

Proportional Editing Shortcut key “O” is a transformational tool for editing faces, edges and vertices. Using proportional editing on one or more parts of the mesh causes connected mesh elements to be affected depending on their location relative to that element being transformed. Mesh elements will be affected greater or less depending on the area of influence being exerted. The area of influence can be adjusted with the Middle Mouse Button. **Proportional editing** allows for smooth deformation of the mesh without leaving bumps and uneven patches that can happen when using the normal transformation options. Proportional editing has Falloff options that provide many ways to deform the mesh. The smooth option is set as the default option.

Snap Options



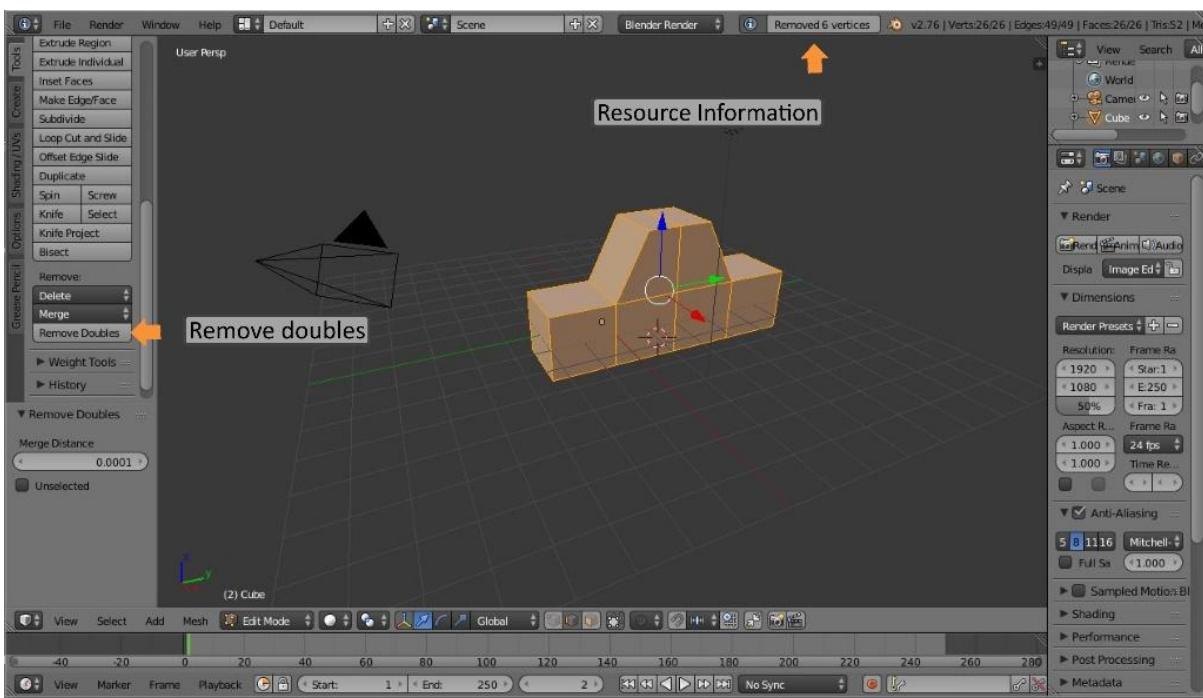
There are two **Snap** features in Blender. The first one we discuss is contained on the **3D Editor's Header** and is represented by the magnet icon. This feature is referred to as **Snap** during transform and when enabled the selected object will translate, scale or rotate in increments based on the zoom level and the element selected. Snap is set to increment as default and can be changed to the other options through the menu.

The second snap feature allows your selection or cursor to be placed at a chosen point by using the shortcut keys Shift +S or from the 3D Editor Mesh menu Snap. This option is very useful for setting origin points of objects or accurately adding mesh objects to a predetermined point in the scene.

Exercise 6 Snapping

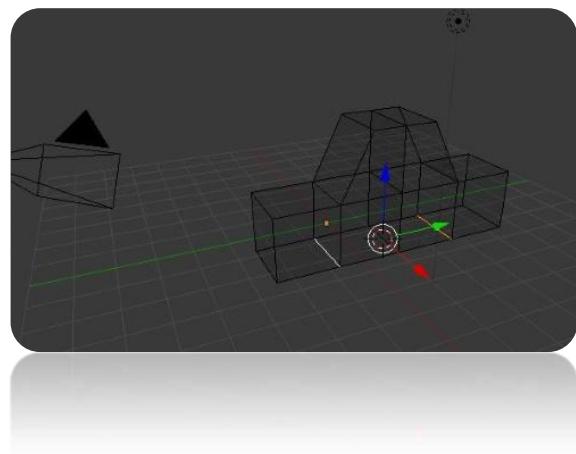
To begin put the 3D cursor back to Median Point

- 1 Press the period key > choose > Median
With the object selected
- 2 Press Tab and Select Edit Mode
- 3 Press A once or twice to select everything
- 4 Press T to open the Tool Shelf (Unless already open)
- 5 With the tool tab selected scroll down and Select remove doubles
(This removes any extra mesh geometry like faces or edges etc
that get created by performing the same operation such as
duplicate or extrude more than once)



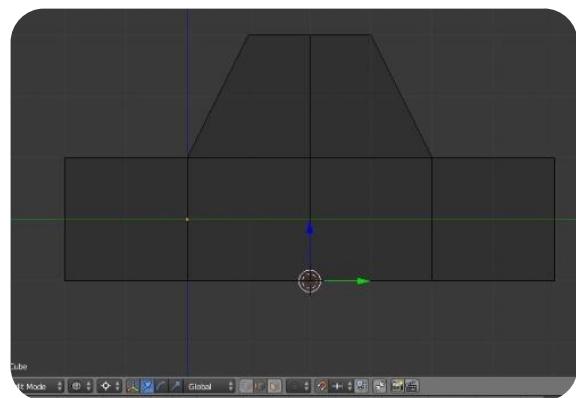
Notice the Info editor on the Resource Information tab that 6 Vertices have been removed. Extra geometry can inhibit our ability to select the edges or vertices we want to and should be removed when possible.

- 6 | **Press Ctrl +Tab**
- 7 | **Select Edge**
- 8 | **Press Z and Select Wireframe and Press A to deselect everything**
- 9 | **Press and hold the Shift key and Select the two edges shown in the picture**

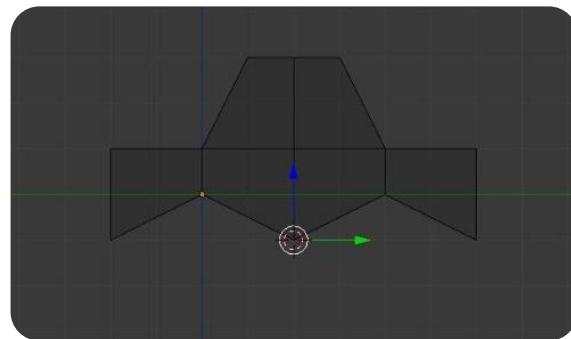


- 10 | **Type 3 (Right Perspective)**
- 11 | **Type 5 (Right Orthographic)**

Turn on Snap (Select the magnet icon on the 3D View Header)



12 | **Select** the Z directional arrow on the 3D cursor by selecting it and holding down the mouse button. **Drag** the cursor upwards and notice the edge snapping to the grid divisions. Please note that depending on the distance of the zoom the snapping will be in increments of centimetres or millimetres. This will be displayed on the top left of the 3D View. We want to go up 1 meter or in this instance to the green line.



That completes the exercise

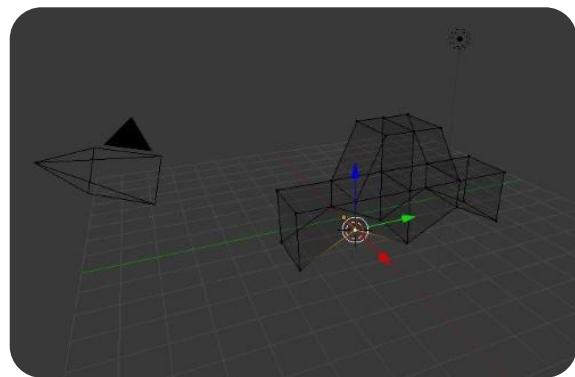
Summary: Use the Snap during transform option whenever you need to accurately place or move objects within your scene. There are multiple options available to choose from in the menu.

Exercise

7

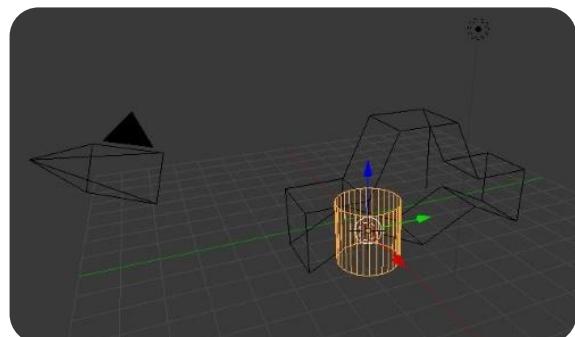
Adding Objects

- 1 Press and hold the middle mouse button and Rotate the view back around out of orthographic
- 2 Select the front Vertex shown in the picture with the LMB



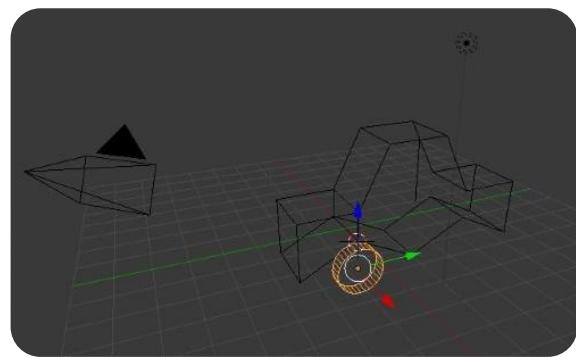
- 3 Press Shift + S (Snap Menu)
- 4 Select Cursor to Selected
- 5 Press Tab and Select Object Mode
- 6 Press Shift + A (Add Menu)
- 7 Select Cylinder

Notice how the cylinder has been added to the scene with its origin at the 3D cursor.



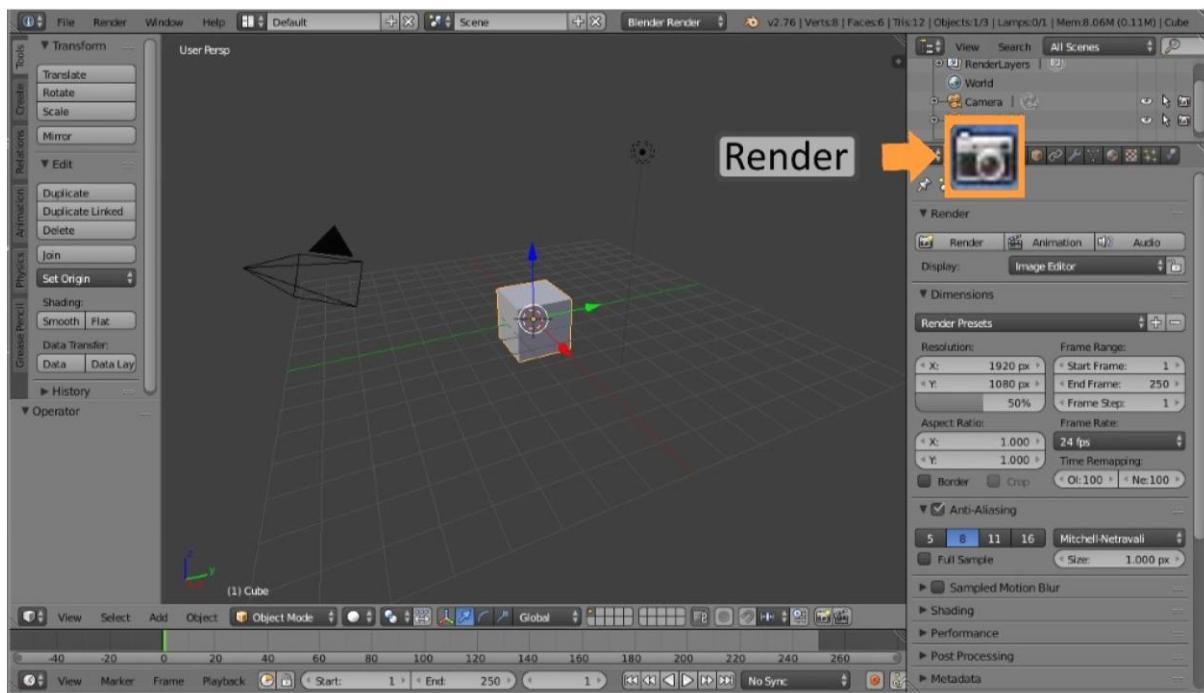
Notice on the Tool Shelf the initial settings for the cylinder that include the vertices count, Radius, depth and Cap Fill Type. We will leave these unchanged but for future reference once you move, rotate etc these settings will no longer be available and any changes will have to be done manually in Edit Mode.

- 8 Press R (Rotate)
- 9 Press Y (Restrict the operation to the Y Axis)
- 10 Type 90 (Rotates the object along the Y Axis by 90 degrees)
- 11 Press S (To scale)
- 12 Type .8 and Press Enter (Scales it down by 20 percent)
- 13 Press G (Translate)
- 14 Press Z (Restrict to the Z Axis)
- 15 Type -1 and Press Enter (Move the cylinder down the Z Axis by 1 unit)
- 16 Press S (Scale)
- 17 Press X (Restrict to the X Axis)
- 18 Type .3 (Reduces the cylinder by 70 percent in the X Axis)
- 19 Press Enter (Confirms the operation)



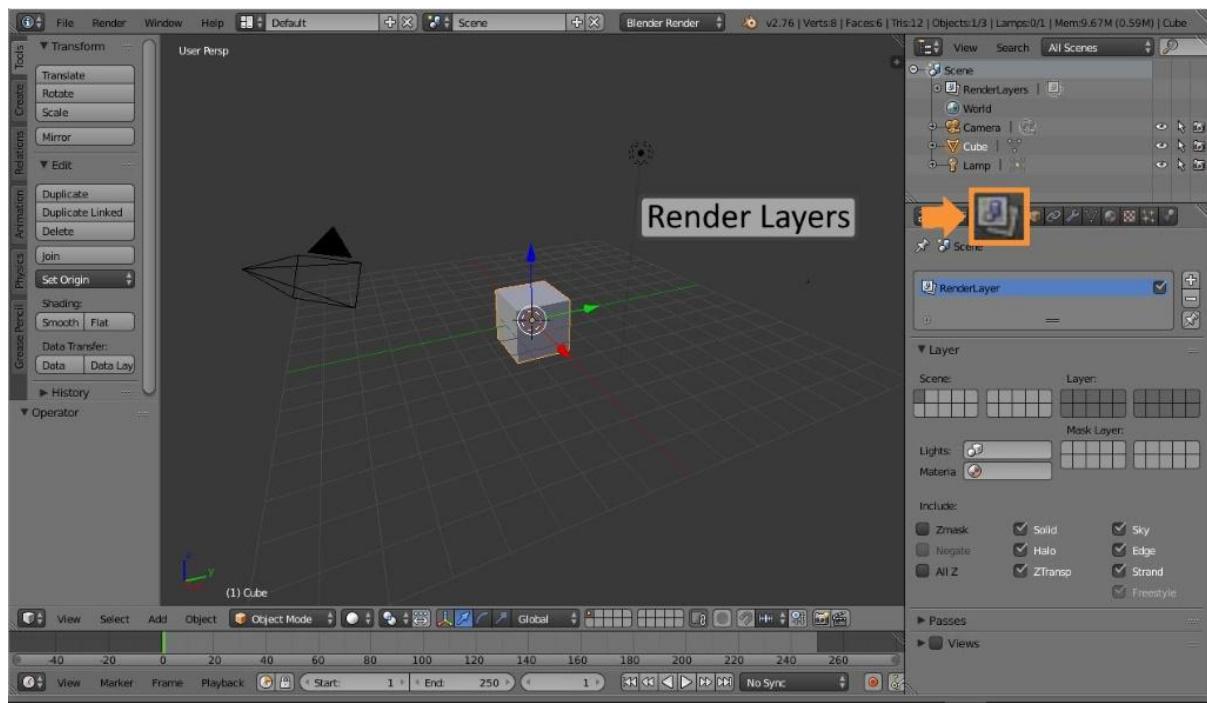
That completes the exercise

Summary: This is an example of both snapping features in Blender, the first using the incremental snap feature to accurately adjust edge positions and allow units of measure to determine their movement. The second one involved placing the 3D cursor at a specific point then adding an object into the scene at that exact point. This second method is also used to change the origin point of an object quickly and accurately.

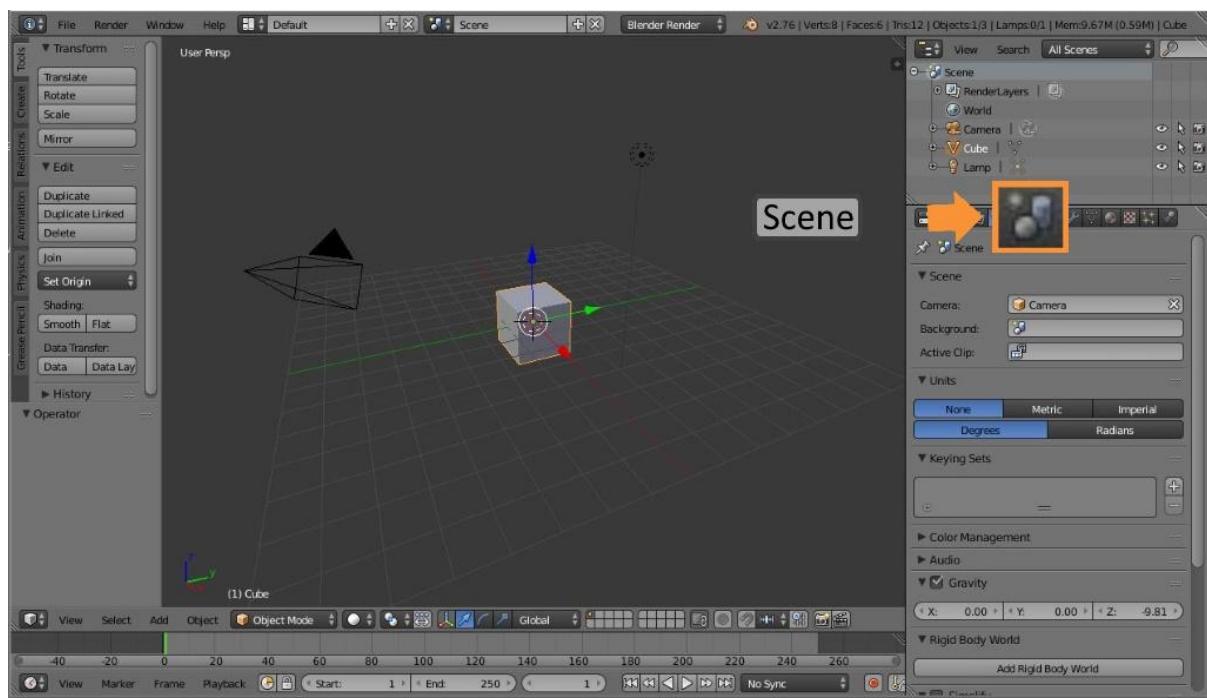


The Properties Editor

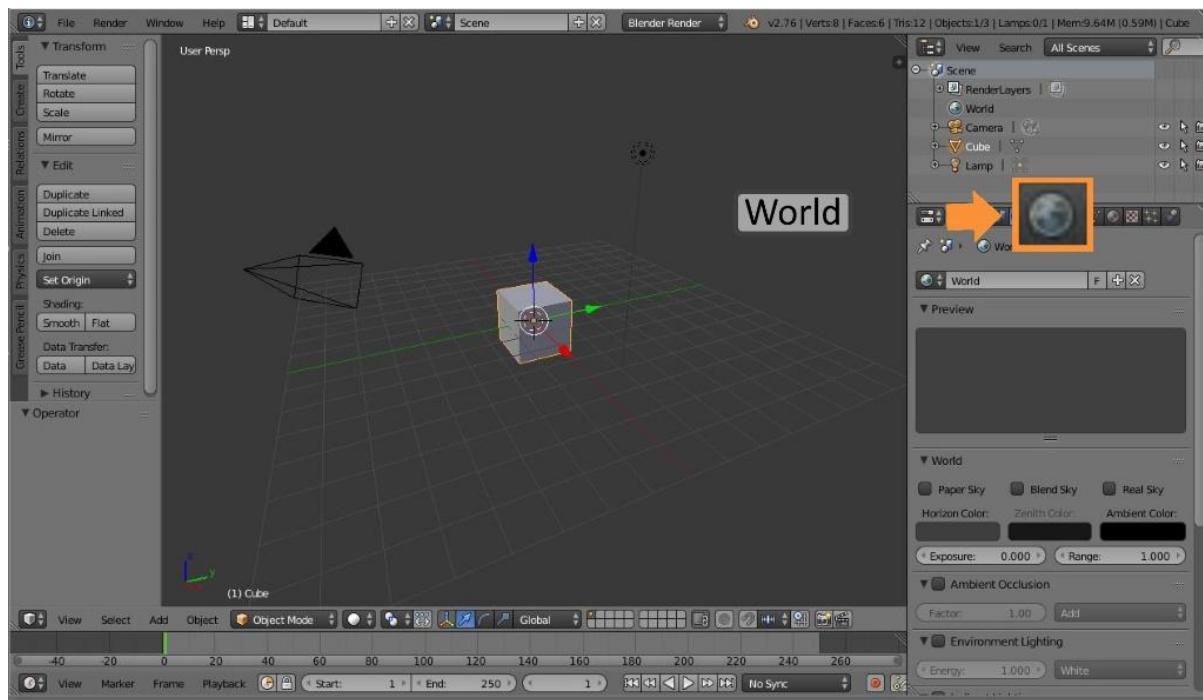
The Properties Editor has a row of icons displayed on its header and used to change properties for the active object and active scene. The first is the **Render** tab and allows control over the render output properties. The options include the render button that will render the current frame and the animation button that will render all frames in the current frame range. Other options include setting the image size, the image quality, or when setting up an image sequence, the frame rate. In order to render the scene must have an active camera.



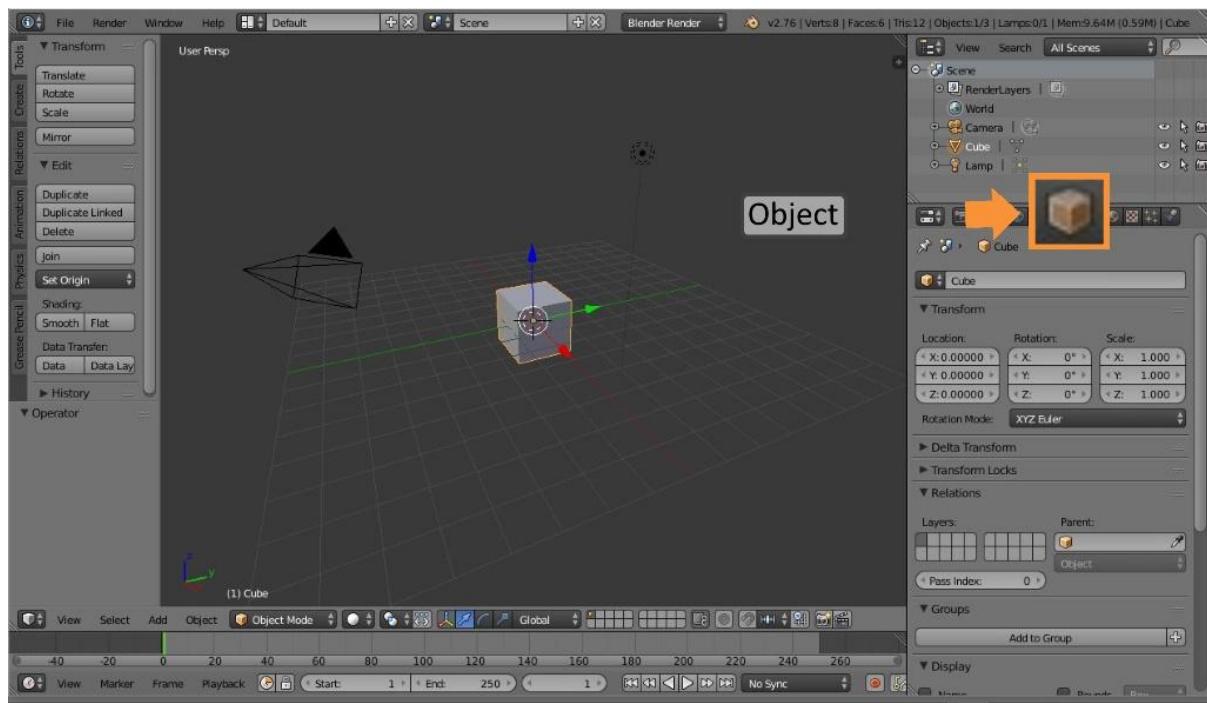
Render Layers allow you render certain layers of your scene separately. The advantage to this is in compositing where you can adjust individual elements differently. This also allows you to re-render individual layers rather than having to waste time rendering everything in the scene.



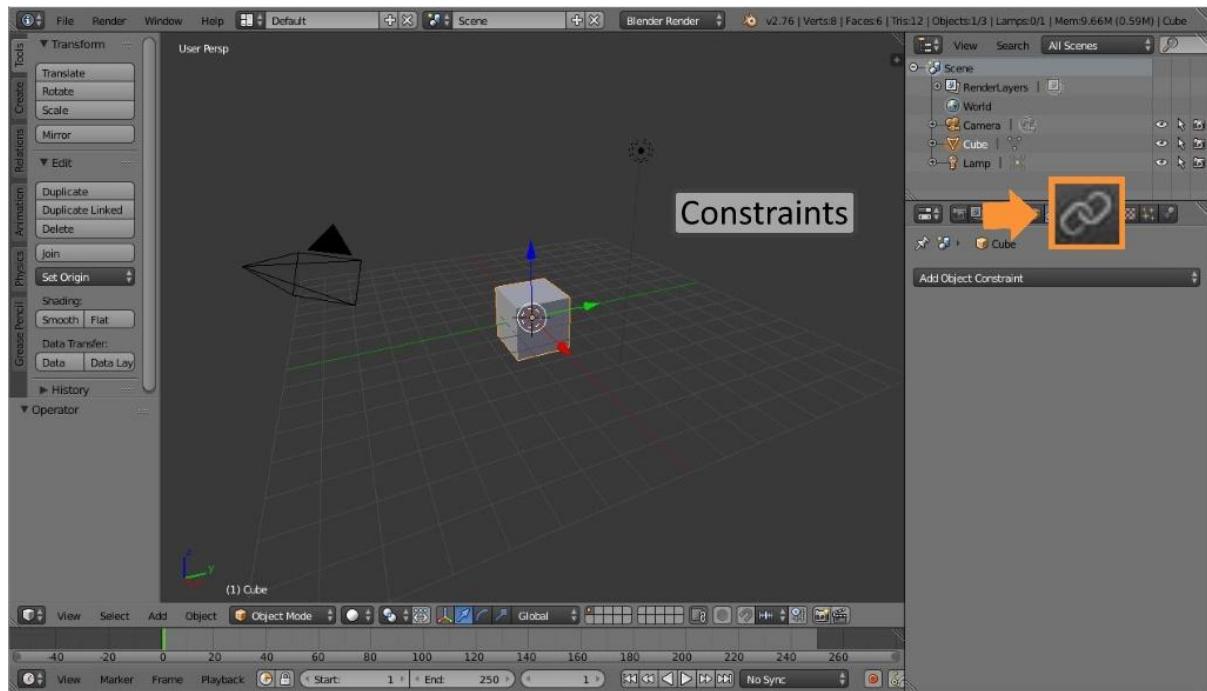
The **Scene** tab contains properties relating to the active scene including units, physics and colour management. Also switch between cameras within the scene.



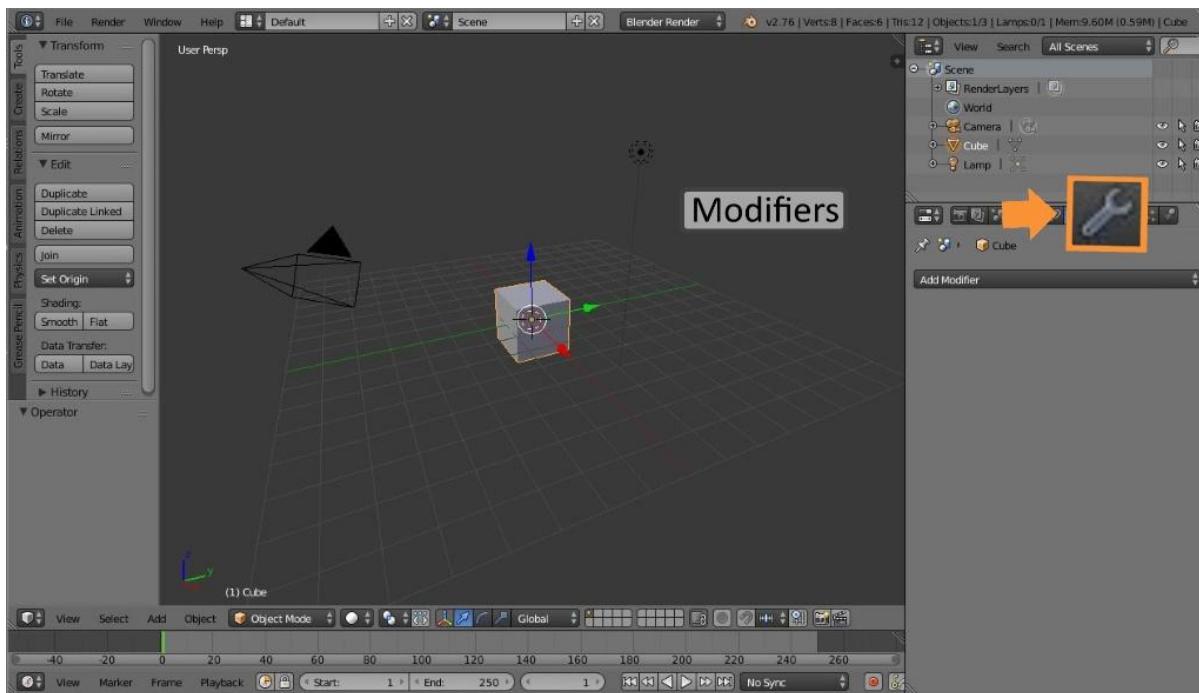
The **World** tab provides properties for the environment lighting, ambient occlusion, mist and sky colour. Depending on the render engine used, the options for the world settings will change. Here you can add HDR images for effective lighting.



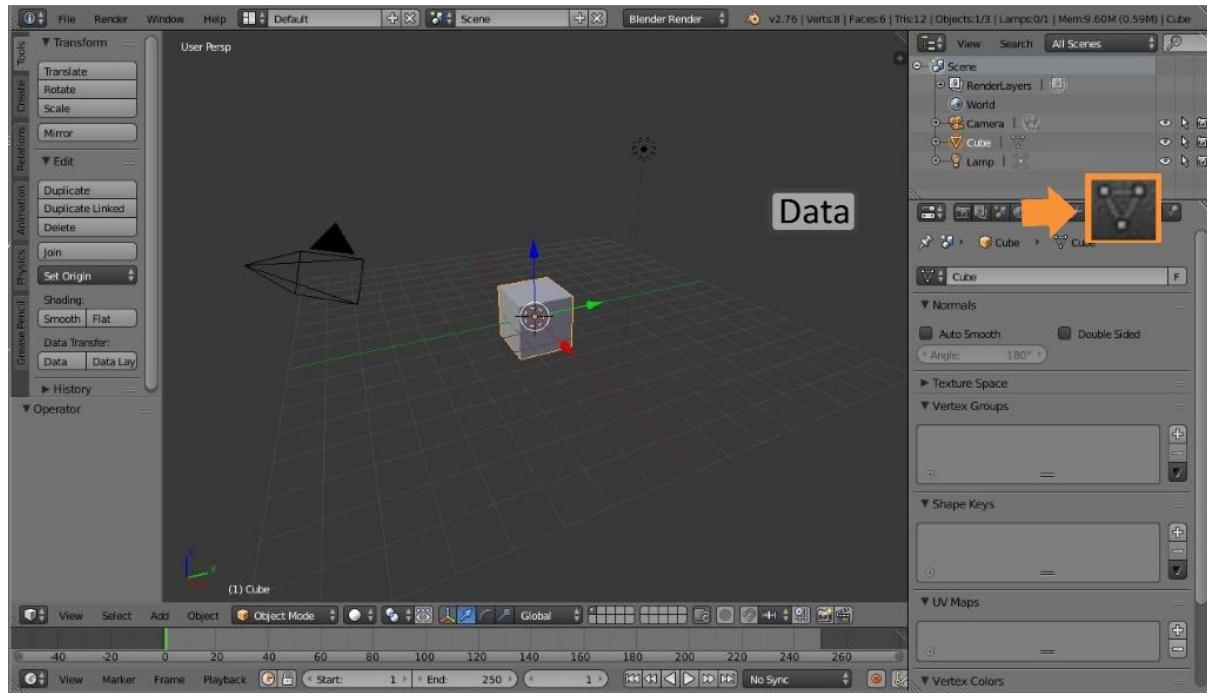
The **Object** tab displays data for the selected or active object including transformation, display and duplication setting.



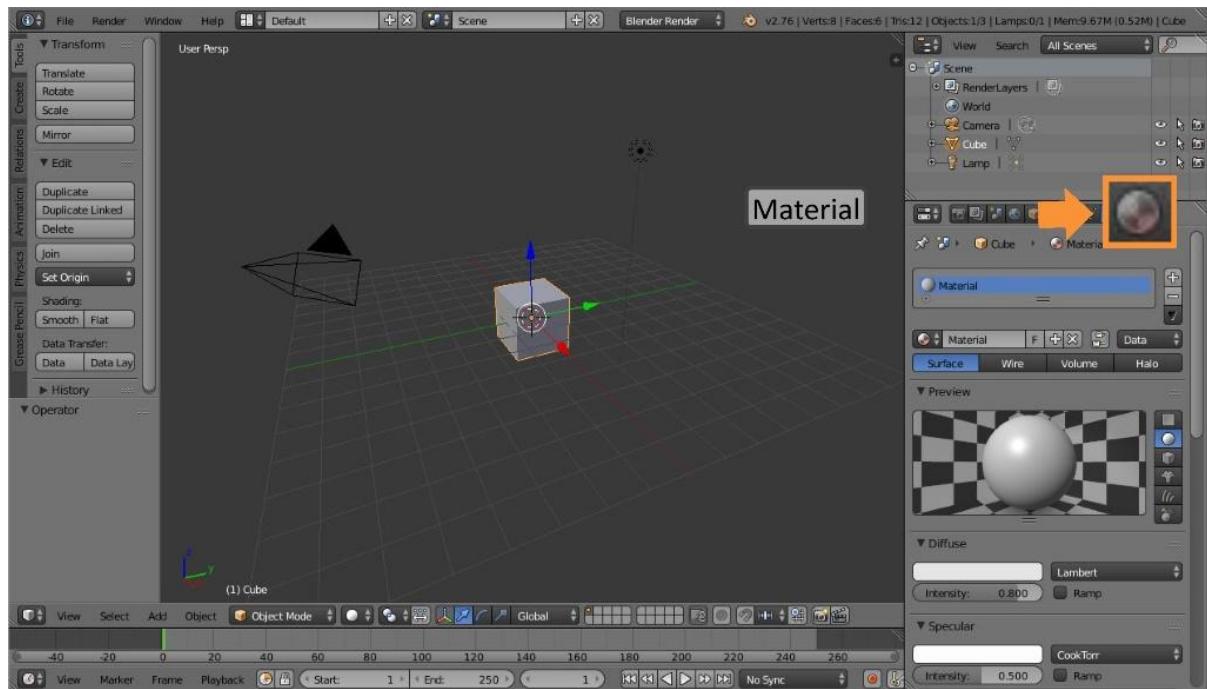
The **constraints** tab provides the ability to control an object's behaviour with tracking, transformation and other aspects of the relationships with other objects within the scene.



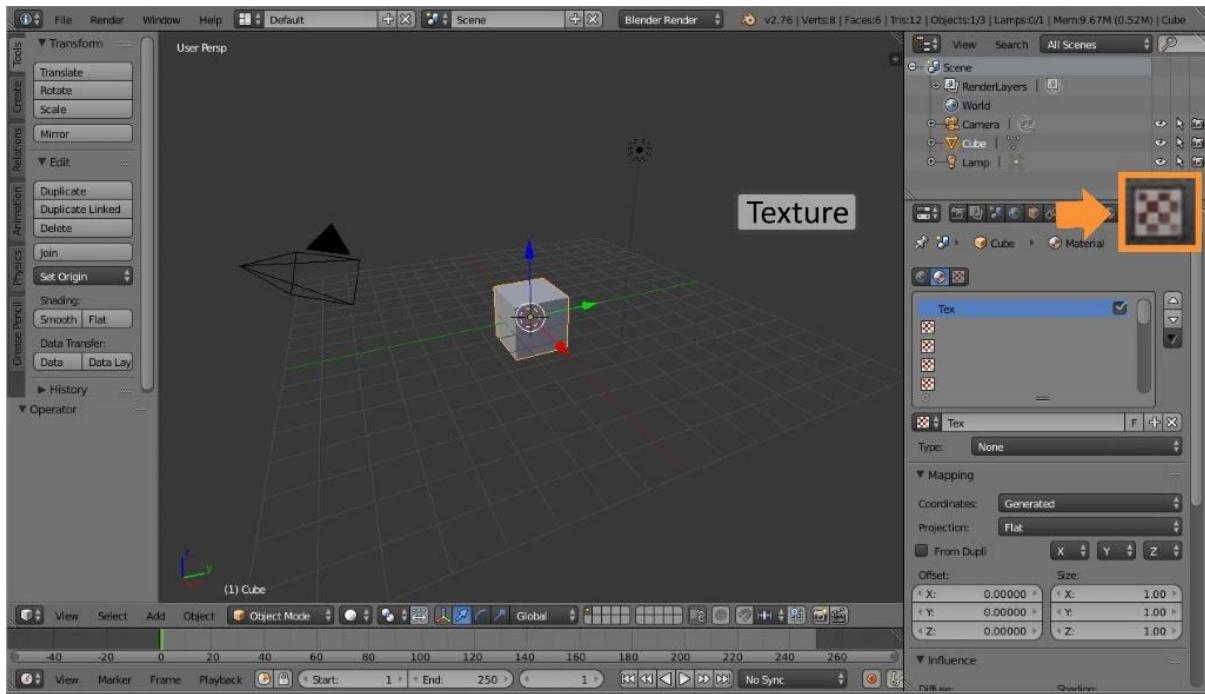
The **Object Modifiers** tab provides time saving operations to complicated tasks such as subdividing the surface of an object, adding a mirror modifier to duplicate in real time the modifications to the mesh on the opposite side. They also include simulate modifiers



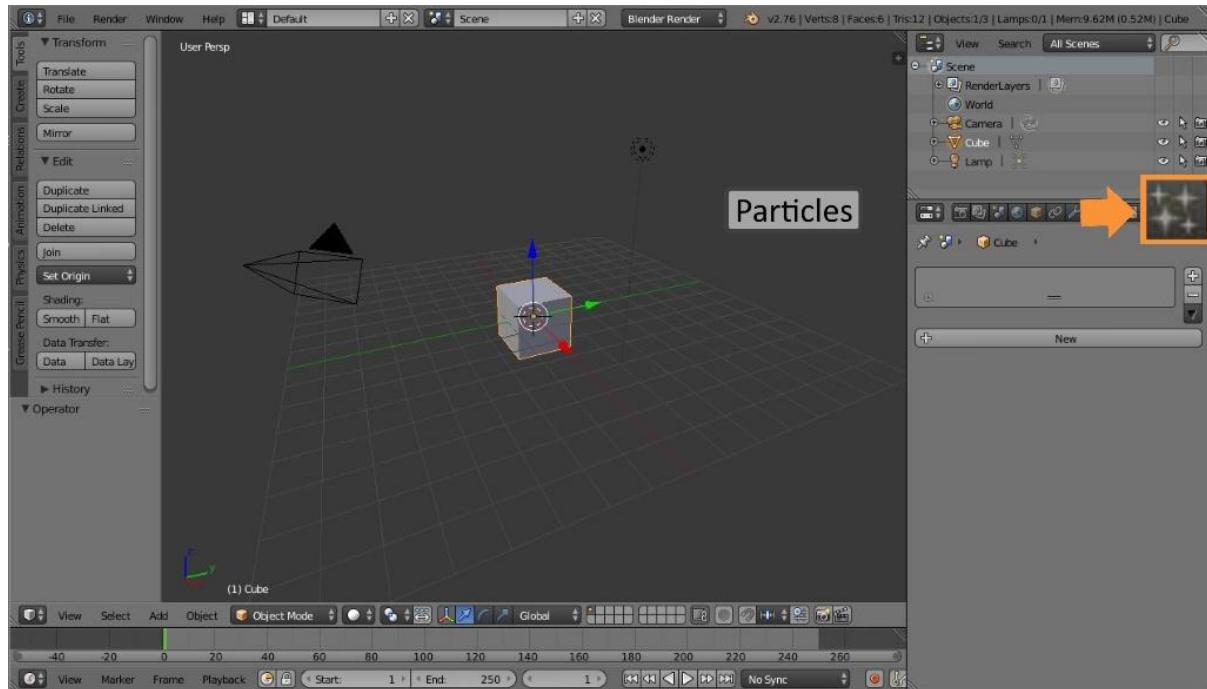
The **Object Data** tab contains information specific to the current object such as vertex groups, shape keys and UV Maps etc.



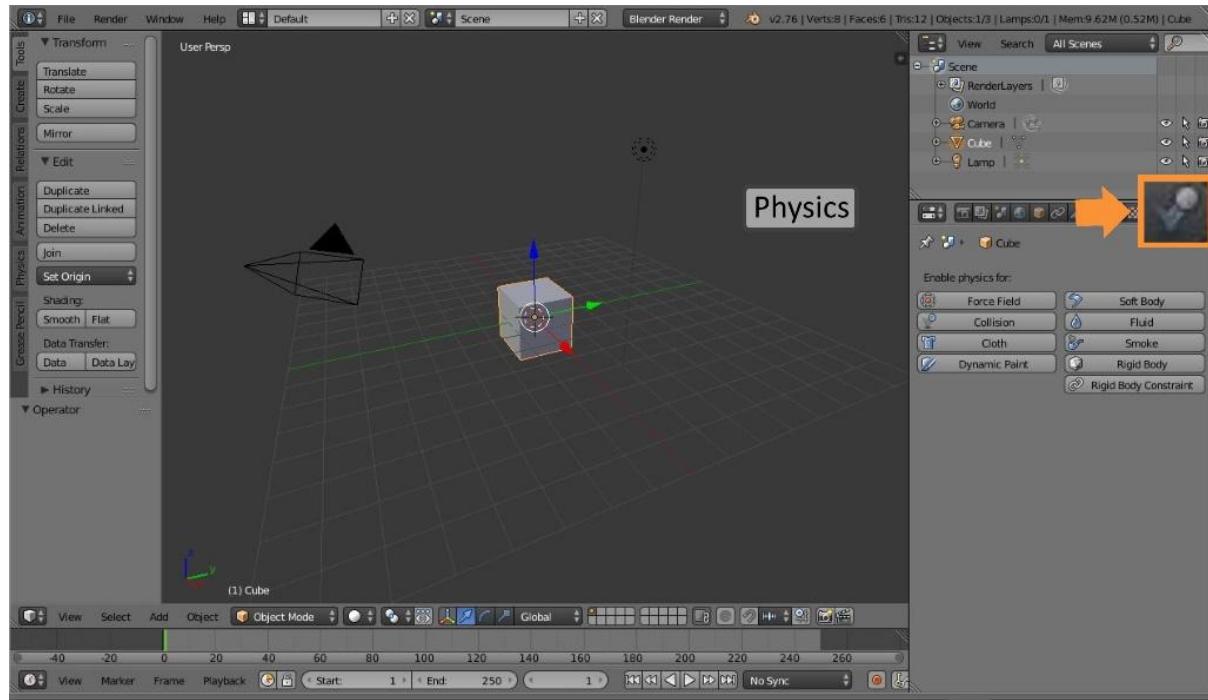
The **Material** tab allows you to set up material for an object or part of an object. Depending on the render engine chosen the results will vary. With the cycles render engine enabled the nodes tabs provides a graphical node setup.



The **Textures** tab provides the mapping options to apply a texture to a material. The texture can be added to display specularity, reflections, or a pattern with apparent 3-dimensional depth.



The **Particles** tab controls any Particles systems deployed in the scene. There are two main types of particle systems you can choose from, **Emitter** and **Hair**, each with their own unique properties. Particles systems can be used to simulate hair, fur, grass or birds and fish. Particles systems are emitted from the selected mesh object up to a maximum of 100,000 and each mesh may contain many particle systems. Particle systems can be influenced by force fields etc and require large amounts of computer memory.



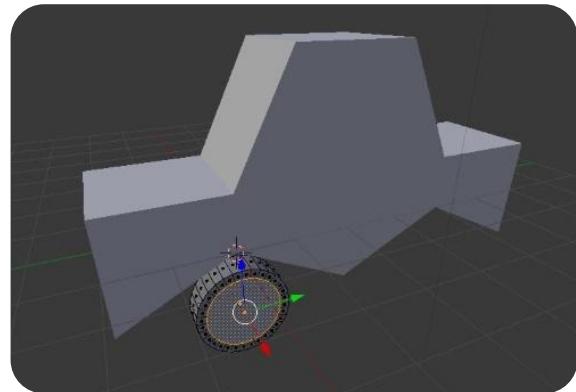
The physics tab has controls for simulating real world phenomena in Blender.

With an object selected you can choose from a range of options each with their own unique properties.

Exercise 8 Modifiers

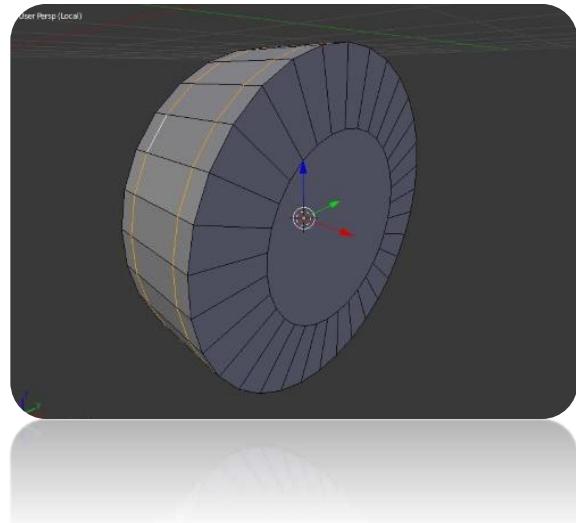
With the Cylinder selected, Press Z and select Solid

- 1 Press Tab and Select Edit Mode
- 2 Press Ctrl + Tab (Mesh select mode) and Select Face
- 3 Press A (To De-select everything)
- 4 Select the front face and Press I (Insert)
- 5 Type .2 and Press Enter (Inserts a new ring of faces)

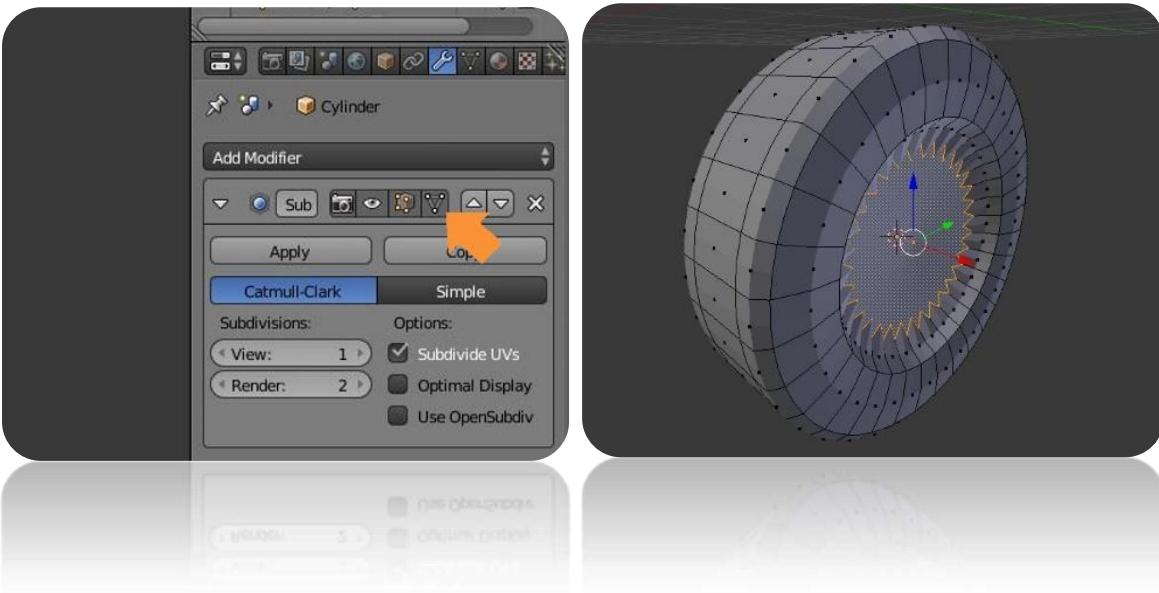


- 6 Press the Backslash key or the ~ line (Isolates the object)
- 7 Press Ctrl + R (Insert Loop cuts)
- 8 Hover the cursor over the outer faces of the cylinder and begin by placing the edge along the Y axis
- 9 Roll the MMB forward once until a second edge is displayed
- 10 Press the Left mouse button once and
- 11 Press the Right mouse button to snap them at insertion point

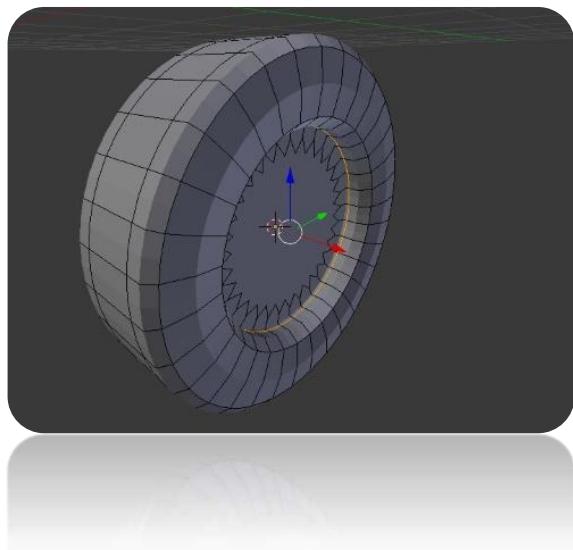
- 12 | Press S then X (Scale along the X axis)
- 13 | Drag the edge loops out towards the edge by dragging the cursor
- 14 | Press the LMB to confirm position



- 15 | Press Ctrl + Tab (Mesh Select Mode)
- 16 | Select Face
- 17 | Select the Centre Face
- 18 | Press E (Extrude)
- 19 | Press X then -.15
- 20 | Press Enter (Extrudes the Face along the X axis in the negative direction)
- 21 | Go to the Modifiers tab on the properties editor (You may have to drag this editor out to find the modifier tab)
- 22 | Select Add modifier
- 23 | Select Subdivision Surface (A Subdivision modifier is added)
- 24 | On the modifier properties enable “Adjust modifier cage to modifier result”



- 25 **Press `Ctrl + R` (Insert Edge Loop)**
- 26 **Hover the mouse around the internal edge**
- 27 **Press the Left mouse button to place it**
- 28 **Push the cursor inwards until the edge loop goes as far as it can**
- 29 **Press the Left mouse button to lock it into place**
- 30 **Press the Backslash key to exit local view**



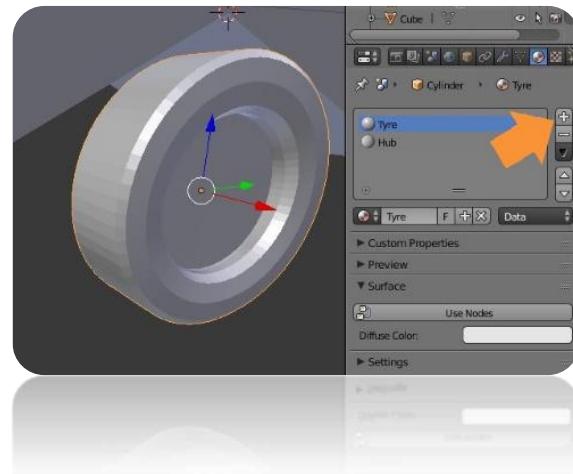
That completes the exercise

Summary: The subdivision modifier is now added to this object and displayed in the modifier section. The subdivision modifier provides a smoothing effect to the faces of the mesh. Multiple modifiers can be added to an object and “stacked” one underneath the other. The order of this stack will influence the modifier and the affect it has on the object. The modifiers can be rearranged by using the up and down arrows on the header. To apply a modifier the object must be in Object mode. Applying modifiers causes a permanent change to the object, in the case of the subdivision surface modifier it increases the number of faces and can affect the response of the computer’s memory if the scene has lots of these modifiers.

Exercise 9 Material

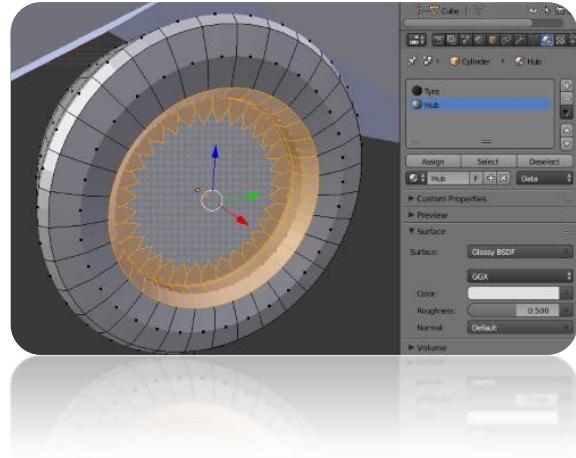
We are going to use the cycles render engine to render material in the following exercise. Please go to the Info Editor and change the engine type to Cycles.

- 1 With the Cylinder selected go to the properties editor and **Select the Material tab**
- 2 **Select New**
- 3 **Double click “Material” and rename to Tyre**
- 4 **Select the + sign to the right of the material slot**

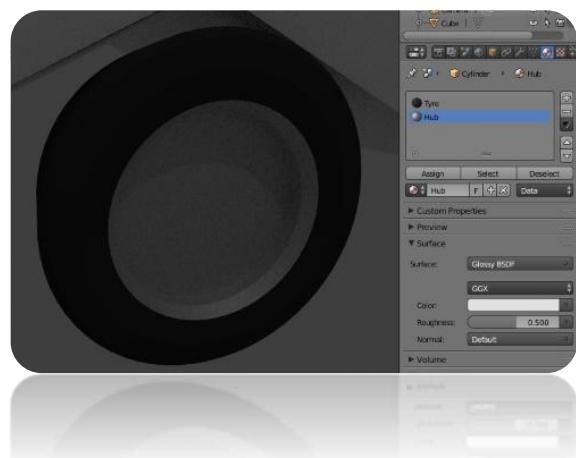


- 5 **Select new**
- 6 **Double click this new material and rename it “Hub”**
- 7 **Left Click into the Colour swatch and drag down the slider on the right hand side until it becomes a dark colour**
- 8 **Select the Hub material**
- 9 **Change the surface type to Glossy**
- 10 **Change the roughness value to .5**
Now back in the 3D View

- 11 Press Tab Select Edit Mode
- 12 Press Ctrl + tab (Mesh select mode)
- 13 Select Face
- 14 Select the inner face of the cylinder
- 15 Press Ctrl and "+" Twice (Increases the face selection)



- 16 Select the material "Hub"
- 17 Select Assign
- 18 Save you work
We will need to change lighting and world settings later but to ensure that the material applied back in the 3D view -
- 19 Press Z and Select Rendered (Shows a Rendered Preview)



That completes the exercise

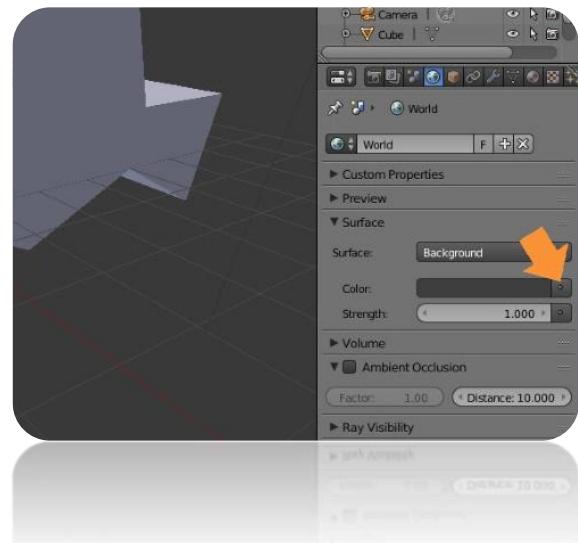
Exercise

10

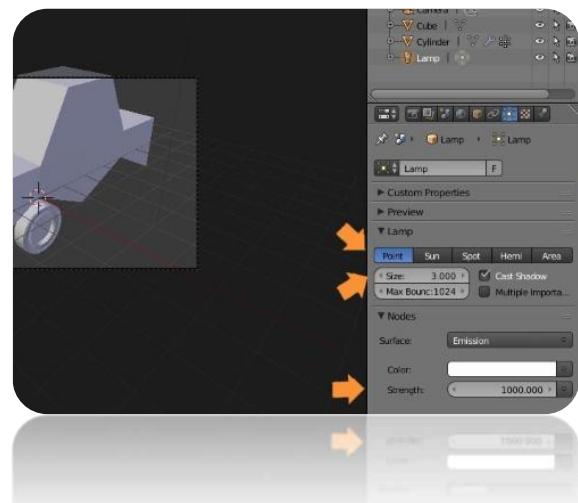
World Settings and Lamp

Go to the World tab on the properties editor:

- 1 | **Select Use Nodes**
- 2 | **Go to the colour setting and Select the small tab to the right side of the colour swatch**



- 3 | **Select Sky Texture from the list of textures**
- 4 | **Set the strength value to 4 (Increases the brightness)**
- 5 | **Go to the Outliner Editor and Select the Lamp**
- 6 | **Now go to the Properties Editor Header and select the object data tab**
- 7 | **With the point lamp setting selected set the size to 3**
- 8 | **Select the Use Nodes button**
- 9 | **Set the strength to 1000**



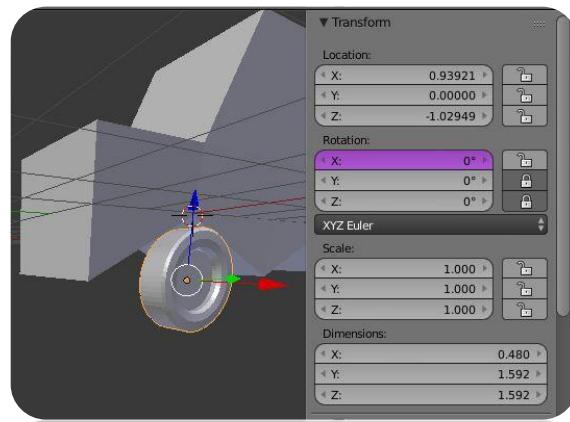
That completes the exercise

Exercise

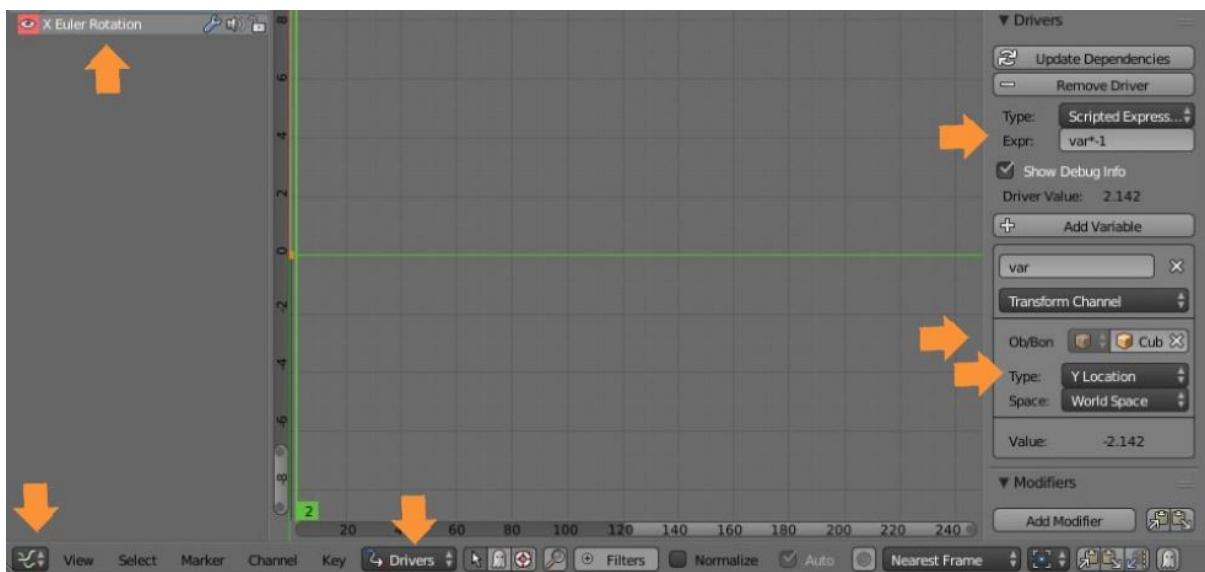
11

Rotating the Wheels

- 1 In the 3D view with the wheel selected Press N
We now need to Apply our rotation and scale transforms to '0's and '1's respectively.
- 2 Press Ctrl + A (Apply menu)
- 3 Select Rotation & Scale (They return to '0's and '1's)
- 4 Right click on the X Rotation and Select Add single Driver
- 5 Lock both the Y and Z Axis by clicking the lock icons to the right hand side of the rotation box

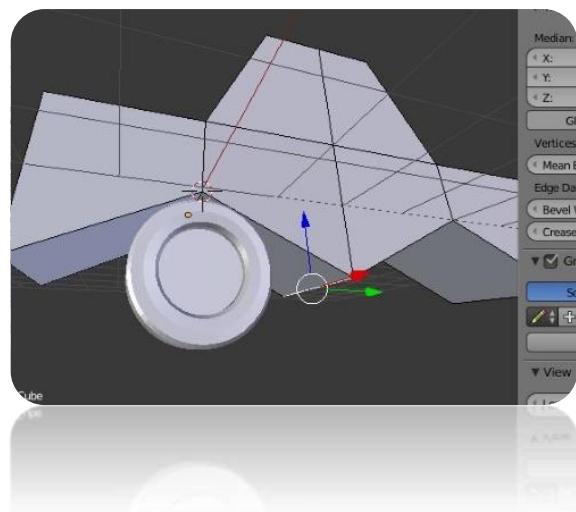


- 6 Change the Timeline Editor to the Graph Editor and expand the Graph Editor Area
- 7 On the Graph Editor header change F-Curve to Drivers mode
- 8 Select the X Euler Rotation
- 9 In the graph area press N (Properties Shelf)
- 10 Scroll down to the bottom of the properties shelf and change X Location to Y Location
- 11 In the Expr box change the value to Var*-1
- 12 In the OB/Bon box Select Cube



- 13 Back in the 3D View with the wheel selected Press and hold shift and select the main body (Cube)
- 14 Press Ctrl + P (Set Parent Menu)
- 15 Select Object (Keep Transforms)
Next we want to mirror the Wheel to the four corners of the car

- 16 **Select the main body (Cube)**
- 17 **Press Tab Select Edit Mode**
- 18 **Press Ctrl + Tab (Mesh Select Mode)**
- 19 **Select Edge**
- 20 **Press the MMB and rotate the car until you can see the underneath**
- 21 **Select the middle edge on the bottom**



- 22 **Press Shift + S (Snap Menu)**
- 23 **Select Cursor to Selected**
- 24 **Press the period key or full stop**
- 25 **Select 3D Cursor**
- 26 **Press Tab Select Object Mode**
- 27 **Select the Wheel**
- 28 **Press Shift + D (Duplicate)**
- 29 **Right Click to place it at its origin**
- 30 **Press Ctrl + M (Mirror)**
- 31 **Press Y (To Mirror along the Y axis)**
- 32 **Press Enter (Confirms the operation)**
With the new wheel still selected

- 33 Press **Ctrl + A (Apply Menu)**
- 34 Select **Scale**
- 35 Press **Tab Select Edit Mode**
- 36 Press **A** to select all the vertices
- 37 Press **T** for the Tool Shelf (Unless otherwise open)
- 38 Select the shading/UV's tab on the tool shelf
- 39 Select **Recalculate** (Flips the direction of the meshes faces)
- 40 Press **tab** Select Object Mode
- 41 Press and hold Shift and select the second wheel
- 42 Press **Shift + D (Duplicate)**
- 43 Right Click to place them at their origin
- 44 Press **Ctrl + M (Mirror)**
- 45 Press **X (Mirror along the X axis)**
- 46 Press **Enter (To confirm the operation)**
- 47 In the Outliner Editor expand the cube hierarchy by clicking the plus sign beside Cube. You will notice four cylinders listed, these are the four wheels and can be renamed if you wish. Click the white arrow beside each of the cylinders. This restricts accidental movement or changes in the viewport. If there are more than 4 cylinders listed you can delete the extra ones in the 3D view. Note **Ctrl + Z** to undo an unexpected operation.



That completes the exercise

Summary: The four wheels can now be controlled by the movement of the main car body (Cube).

You can now change the bottom editor back from the graph editor to the timeline Editor for use in later exercises.

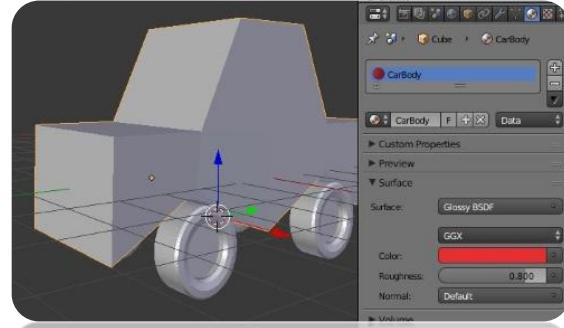
Exercise

12

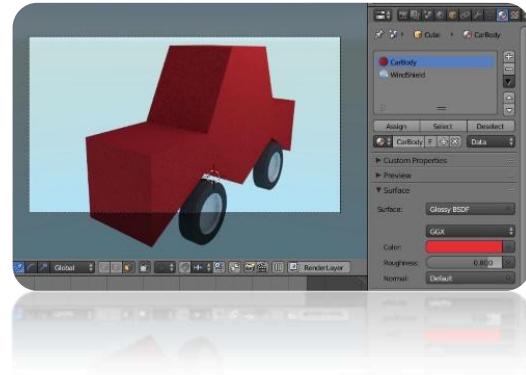
Adding Material to the car

In this exercise we will add material to the cars main body

- 1 First **Select** the car body
On the properties editor **Select** the material tab
- 2 **Select New** and **Double Click** and rename to Car body
- 3 **Select Use Nodes**
- 4 **Click** into Diffuse and **Select Glossy BSDF**
- 5 **Click** into the colour swatch and select a colour
- 6 **Change** the roughness to .8



- 7 Back in the 3D view bring the car into view, rotate and zoom if necessary. When you have the car in a good viewing position Press **Ctrl + Alt + Zero**
- 8 Press **N (Properties Shelf)**
- 9 Put a **Check** mark in lock camera to view and position the car so you have a good view of the front and near side
- 10 You can **uncheck** Lock camera to view
- 11 Press **Z Select Rendered**

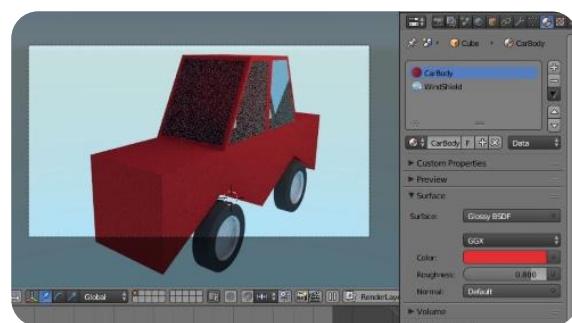


This gives a preview of the scene and the materials

- 12 Press Z and Select Solid
- 13 Press Tab Select Edit Mode
- 14 Press Ctrl + Tab (Mesh Select Mode)
- 15 Select Face
- 16 Select the windshield
- 17 Press I (Insert)
- 18 Type .1
- 19 Press Enter
- 20 Now on the Material tab Press the plus sign to add a new material slot
- 21 Double click it and rename it to Windshield
- 22 Change the surface type to Glass BSDF
- 23 Select the Assign Button (This assigns the windshield material to the selected face)
- 24 Press Z and Select Rendered

- 25 Repeat this process for all the windows in the car
- 26 You can Press zero to exit camera view to select the windows at the opposite side of the car and press Zero anytime to return to the camera view

The Process: Select the face Press I (Insert) Type .1 Press Enter (Confirms operation)



That completes the exercise

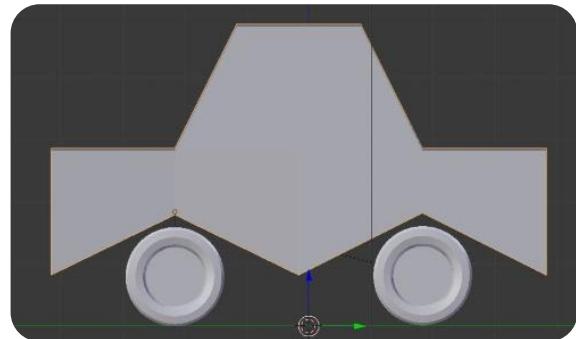
Exercise

13

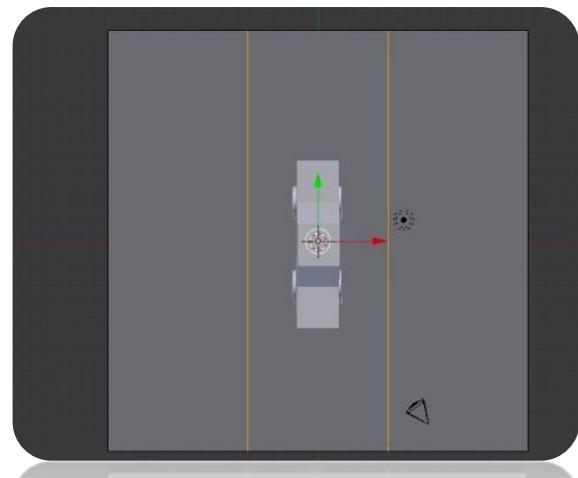
Adding a ground plane

We begin this exercise in Object mode and out of camera view. First we need to position the car on the grid floor

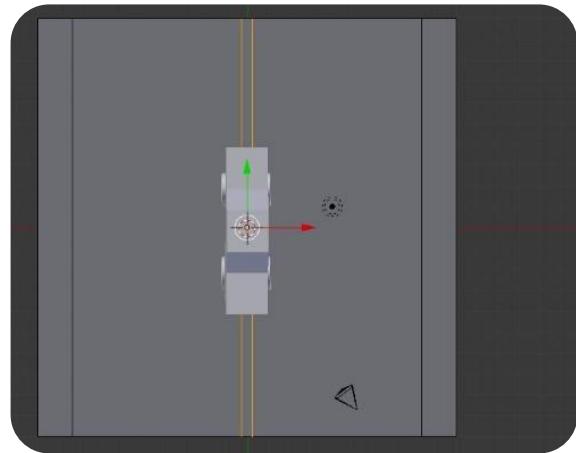
- 1 With the car selected Turn on snapping on the 3D view header and choose increment from the menu
- 2 Press 3 (Right View)
- 3 Press 5 if necessary for right orthographic view
- 4 Select the manipulator by the Z directional arrow and drag it up (Zoom in if necessary and the car should snap incrementally up until it reaches the green line)
- 5 Turn snapping off (Shift + Tab)



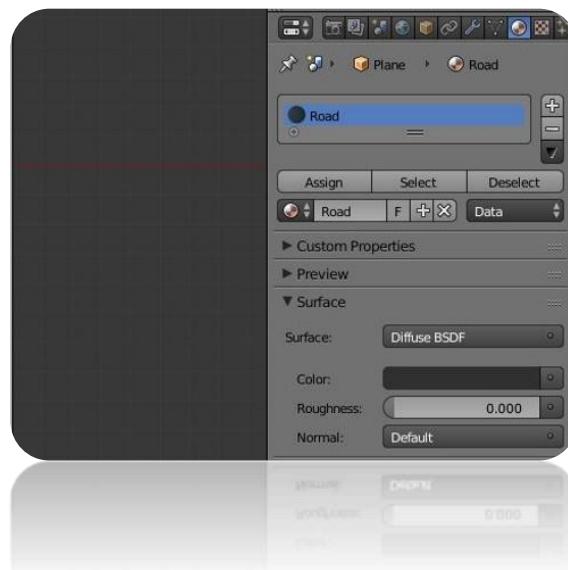
- 6 Press Shift + S (Snap Menu) Select Cursor to Centre
- 7 Press Shift + A (Add Menu)
- 8 Select Mesh Plane
- 9 Press and hold the MMB to rotate the plane to a better viewing angle
- 10 Press S (Scale)
- 11 Type 10 (Scales the plane up by a factor of 10)
- 12 Press Tab Select Edit Mode
- 13 Press 7 (Top View)
- 14 Press Ctrl + R (Insert edge loop)
- 15 Bring your cursor to the Y axis and Roll the MMB to add a second edge loop



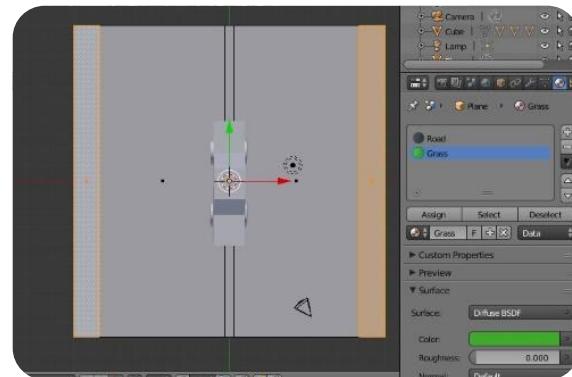
- 16 **Left click once when the direction is correct**
- 17 **Right click to snap them to centre**
- 18 **Press S (Scale)**
- 19 **Press X (Scales them along the X axis)**
- 20 **Drag the cursor and bring them out to the edge**
- 21 **Left click to confirm the operation**
- 22 **Press Ctrl + R (Add two more edge loops)**
- 23 **Position over the Y axis and Roll the MMB once to add a second loop cut**
- 24 **Left click once when the direction is correct**
- 25 **Right click to snap them to centre**
- 26 **Press S (Scale)**
- 27 **Press X (Scales them along the X axis)**
- 28 **Drag the cursor and move them inwards**
- 29 **Left click to confirm the operation**



- 30 | **Press Ctrl + Tab (Mesh Select Mode)**
- 31 | **Select Face**
- 32 | **Go to the Properties Editor and Select the Materials Tab**
- 33 | **Select New**
- 34 | **Double Click on the material name and rename it Road**
- 35 | **Click into the colour swatch and drag the cursor on the right down to darken the colour**



- 36 | **Select the two outer faces, one on the left and the other on the right
(Select the first, press and hold shift to select the second)**
- 37 | **On the material tab click the plus sign to add a new material slot**
- 38 | **Select New**
- 39 | **Double click the new material and rename it to Grass**
- 40 | **Change the colour to a dark green**
- 41 | **Select Assign (This assigned the material to the selected parts of the plane)**



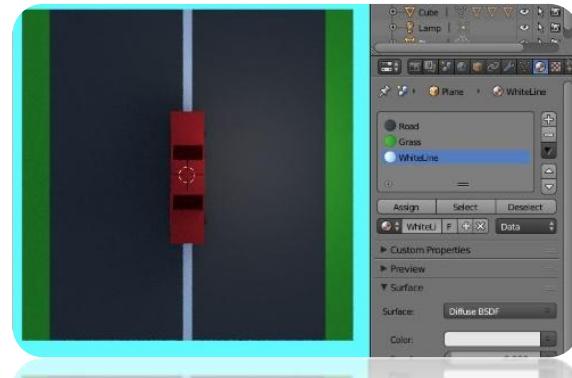
42 Select the centre face

43 Click the plus sign to add a new material slot

44 Select New

45 Double click this new material and rename it White Line

46 Select Assign



That completes the exercise

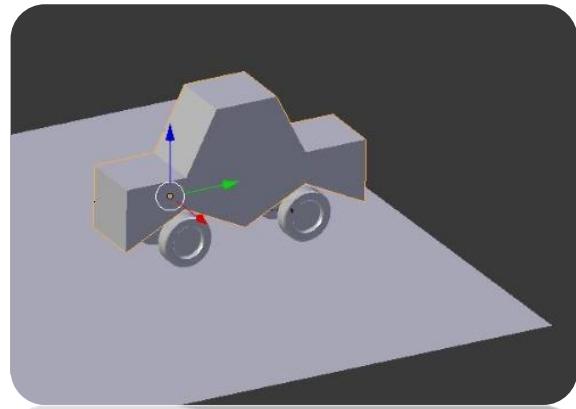
Exercise

14

Key frames

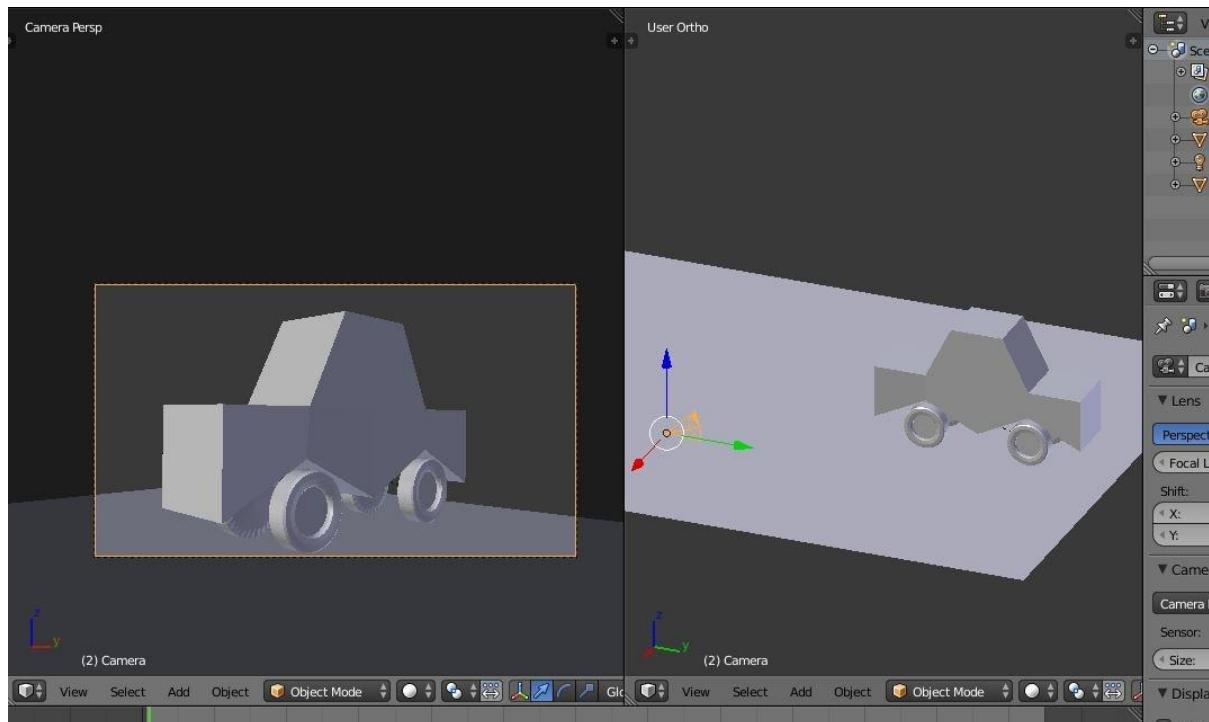
The next exercise looks at adding animation to the scene. Here we will have the car travel along the road with the camera capturing the action. With the Road selected:

- 1 Press the period key and select Median point
- 2 Press Tab Select Object Mode
- 3 Press S (Scale)
- 4 Press Y (Scale the plane in the Y axis)
- 5 Type 10 (Scales the plane along the Y axis by a factor of 10)
- 6 Enter (Confirms the operation)
- 7 Select the car and drag it back along the Y axis to the beginning of the road

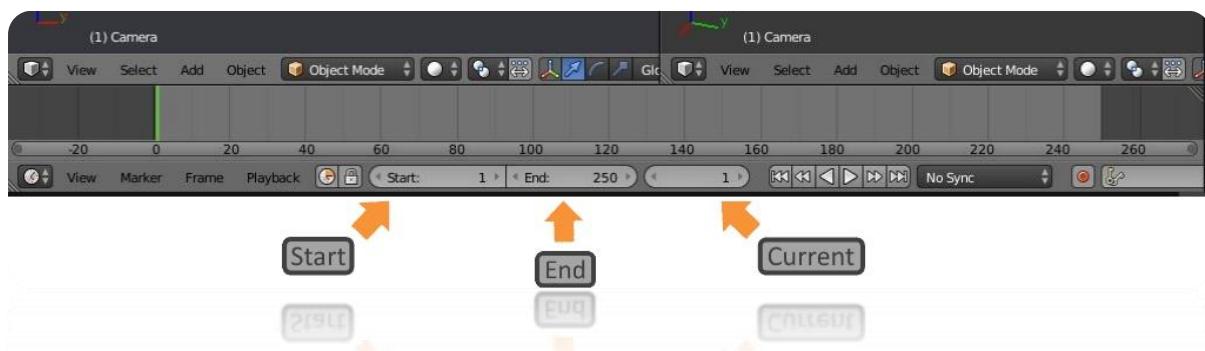


- 8 Next select the camera
- 9 Press N (Properties Shelf)
- 10 In the transform panel in the rotation settings Enter a value of X = 90

11 | **Next**, hover the cursor in the top right hand corner of the 3D view until the cursor changes to a narrow cross icon, then **Press** and hold the LMB and drag this new window out into the centre of the screen. In the Left hand window over the cursor and **Press** Zero (Camera View) and in the Right hand window with the camera selected drag the camera nearer the car with the manipulator and frame it up



Next we will add key frames for both the camera and the car. The timeline will need to be the Editor at the bottom of the screen

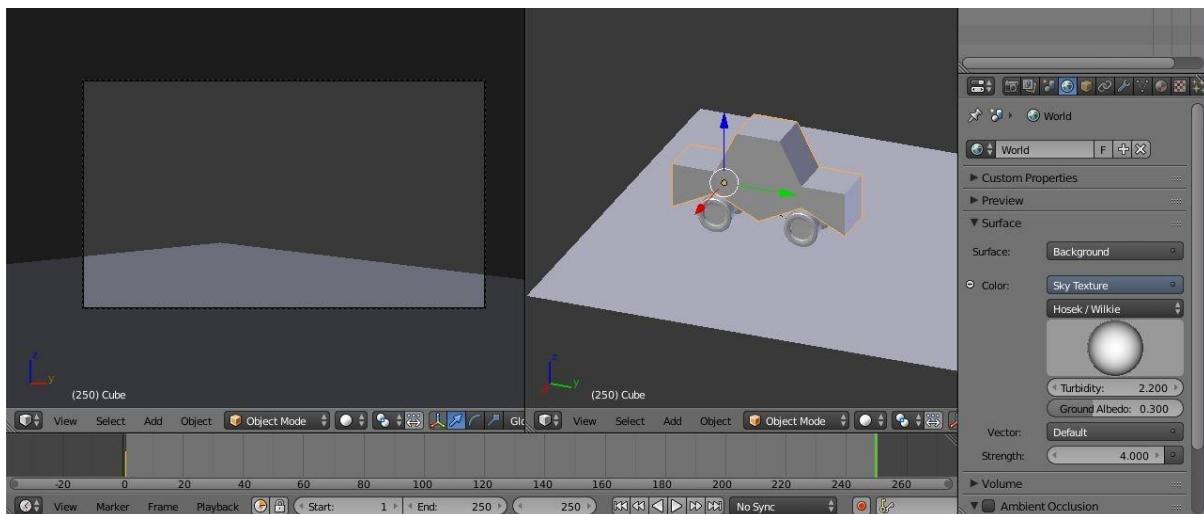


Start frame =1, End Frame =250 and Current Frame =1

These are the three frame settings we change as we progress through this exercise. Notice the start frame is set to 1 the end is set to 250, which will be the length of the animation. 250 is the number of frames @ 24 frames per second will produce an animation of just over 10 seconds.

With the start frame set at 1

- 12 Select the car and Press I (Inserts a Key Frame represented by a small yellow line on the TimeLine)
- 13 Select Location (Inserts a key frame for the car at the current location)
- 14 Type 250 into the current frame box and press enter
- 15 Drag the manipulator Gizmo along the Y axis with the Y (Green) directional arrow until you reach the end of the road



- 16 Press I and Select Location (Inserts a key frame for the cars location at the current frame of 250)
- 17 Type 1 into the current frame box and press enter
Notice how the car now goes back to its saved position on the first key frame

18 **Next Select the camera**

Now let's add a marker to the first frame and bind the camera to this marker

With the current frame at 1 and with the cursor on the timeline

19 **Press M (Adds Marker to the timeline)**

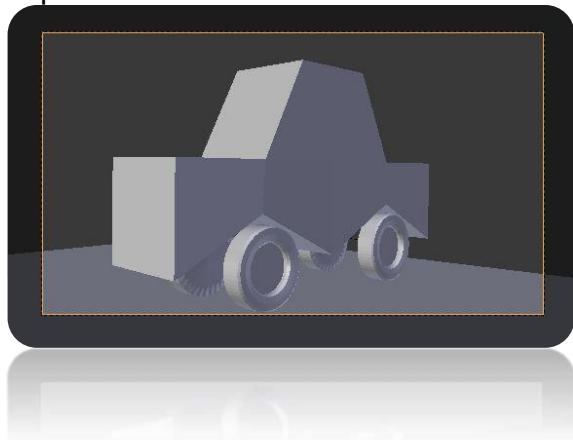
Next we want to bind the camera to the marker

With the camera still selected and with the cursor in the timeline

20 **Press Ctrl + B (Binds the Camera to the marker)**

To confirm this action has been successful press T for the Tool Shelf. On the bottom should be a new panel with a simple text reading Bind Camera to Markers. You may have to scroll the MMB to bring the text into view.

Now back in the 3D View and the camera set up with the car in view



21 **Press I (Inserts a Key Frame)**

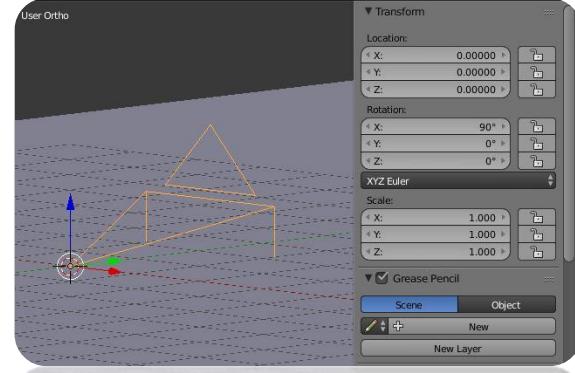
22 **Select LocRot (Inserts a key frame for the cameras current location and rotation)**

23 **Type 48 into the current key frame box**

Notice the car has moved forward

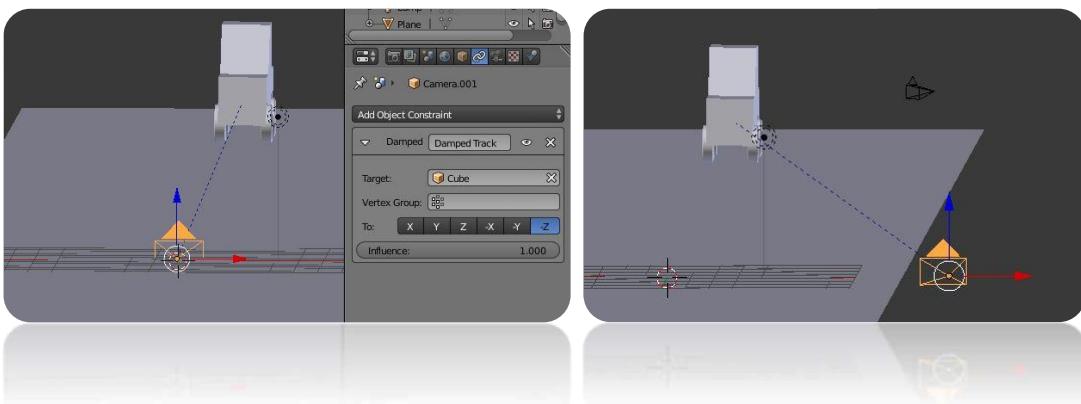
For the next camera position use the manipulator and rotate the camera to keep the car in shot

- 24 **Press R (Rotate)**
- 25 **Press Z (Restricts the rotation to the Z Axis)**
- 26 **Drag the cursor to rotate the camera and get the car in shot and Press the LMB to confirm the operation**
- 27 **Press I (Insert menu)**
- 28 **Select LocRot (Inserts a Key frame for the cameras current location and rotation)**
Now let's add a second camera to the scene and jump from one camera to the other as the car travels along the road
- 29 **Press Shift + S (Snap Menu)**
- 30 **Select Cursor to centre**
- 31 **Press Shift + A (Add Menu)**
- 32 **Select Camera from the list**
- 33 **Press N (Properties Shelf)**
- 34 **In the Transform panel in the rotation options Enter X: 90 Y:0 Z:0**



Next we want to add a tracking constraint to the camera and have it track the car as it approaches and passes by.

- 35 **Go to the Properties Editor and Select the Constraints tab**
- 36 **Select Add Object Constraint**
- 37 **Select Damped Track**
- 38 **Select the Target (The icon of the box)**
- 39 **Select Cube (This is the car object)**
- 40 **Select the “To” Axis and select the one that points the camera in the direction of the car**
In my scene it is the -Z axis
- 41 **Next drag the camera forward along the X Axis to the front of the road and drag it up slightly in the Z direction so it is above the road**



- 42 **Now let's add a marker for this camera on the Timeline Editor**
- 43 **Set the current frame to 48**
With the new camera selected and the cursor on the timeline
- 44 **Press M (Adds a marker to the timeline at the current frame)**
- 45 **Press Ctrl + B (Binds the selected camera to that marker)**
- 46 **Now set the current frame to 1**
- 47 **Press play on the Timeline controls and the cameras should switch from one to the other at the markers as the animation is played out through the cameras**



That completes the exercise

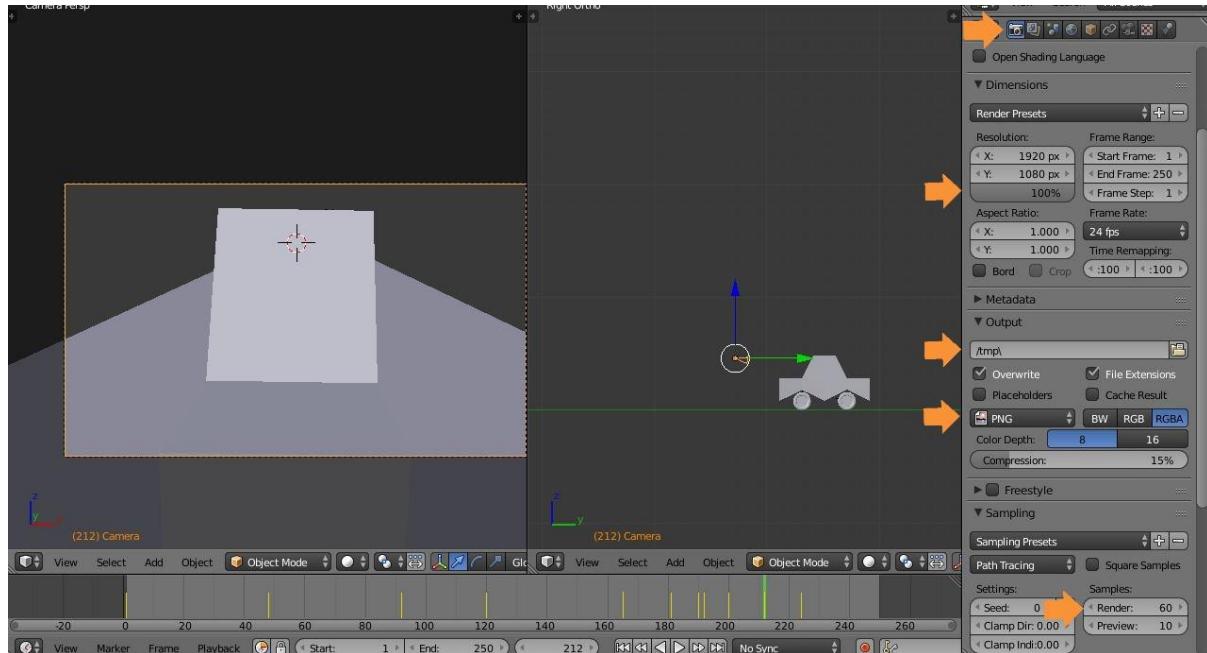
Summary: This is a very simple exercise on the timeline and animation within Blender. You can delete key frames if you are unhappy with the result by placing the green Timeline marker on the yellow key frame and Pressing Alt + I and Selecting Delete Key frame.

Exercise

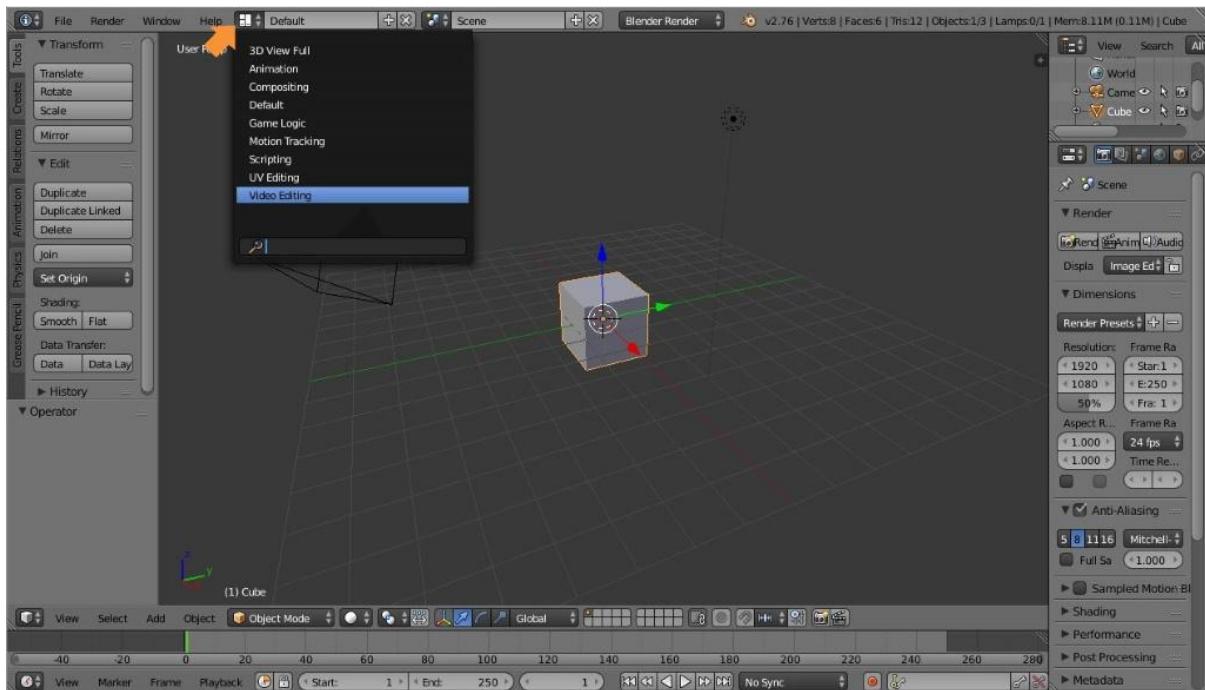
15

Render the Animation

- 1 Go to the Render Tab on the Properties Editor
- 2 In the Dimensions Panel increase the resolution to 100% if you want the image to be full size.
- 3 Select a destination folder in the Output Panel (This is where the rendered PNG's will be saved)
- 4 Also in the Output Panel ensure that the file format is PNG
- 5 Open the Sampling Panel and change the render samples to something greater than 10. (This creates a trade off .The higher the value the better quality of the rendered image, but the longer each image will take to render. The preview value is the quality you see when you Press Z and select rendered)
If you are test rendering leave these value low as the render time will increase. Once the scene is how you want it increase the values for the best quality you desire.



- 6 With those basic settings in place you can **Click** the animation button. It is a good idea to save your work prior to rendering just in case of a crash.
- Blender will then begin to render each frame into the folder you selected. When this rendering process is complete I like to start a New Project to keep the editing separate from the final scene, that way the changes made won't affect the final scene if I need to return to change something.
- 7 **Go to File and Select New Reload Start-up File**
- 8 **Go to the Info Editor and the scene layout tab**
- 9 **Click** in the menu and select **Video Editing Screen Layout**

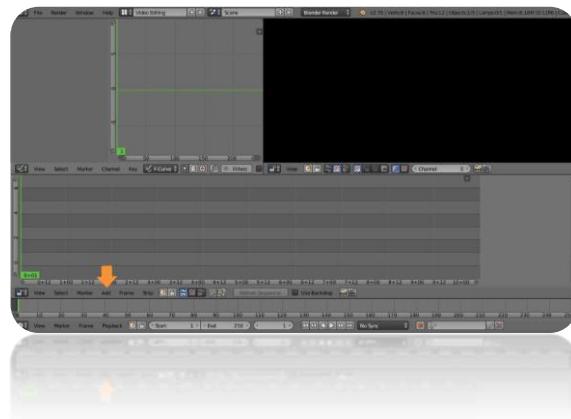


10 **Save the .Blend file**

This is Blenders very powerful and easy to use video editor. This screen arrangement provides you with everything you need to add back in the images, add sound, view the results and export to a wide selection of available formats.

11 **Select Add on the video Sequence Editor**

12 **Select Image**



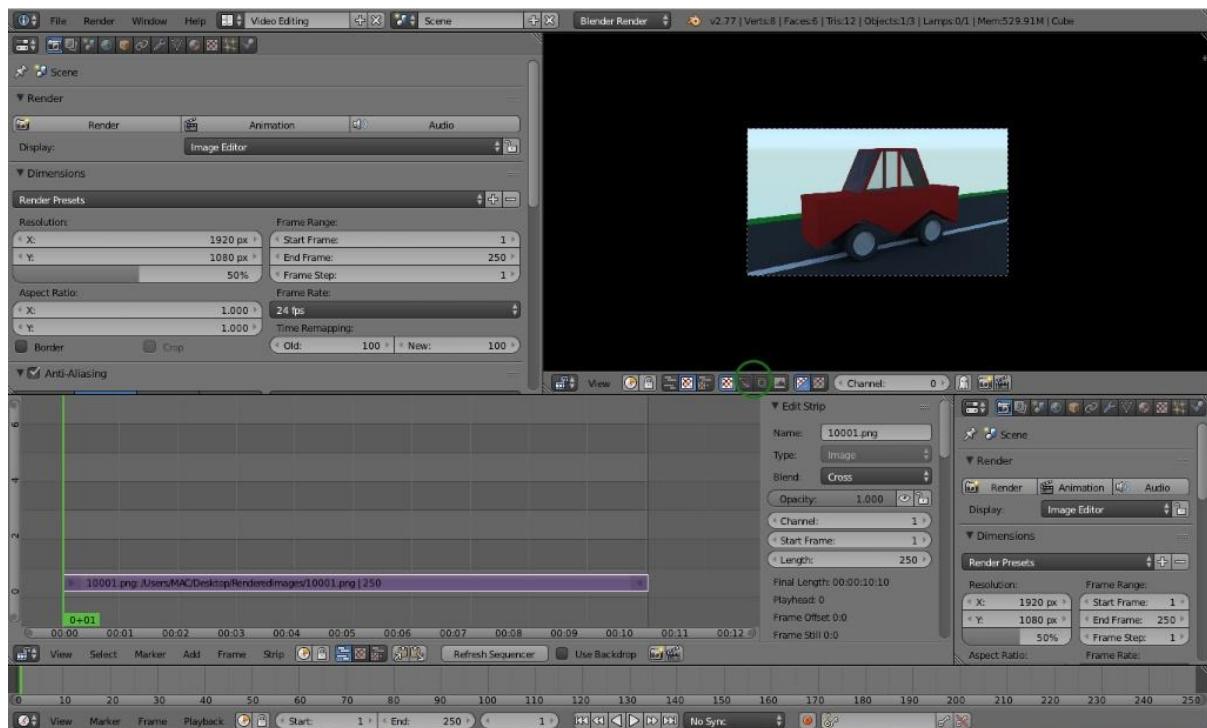
13 **Navigate to the folder where you saved the rendered images and Press A to select all the Images**

14 **Press the add images button on the top right hand side of the page**

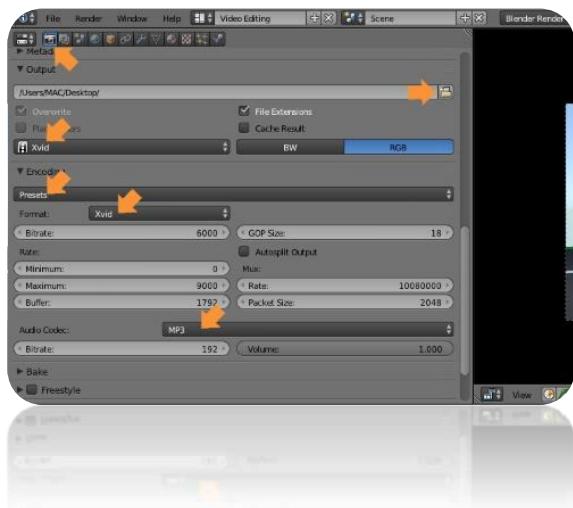
15 **Back in the video editor you can Press play to view the image strip in sequence**

16 **Next we need to open a properties Editor attention**

17 **Next we need to change the Graph Editor on the top left hand side to a Properties Editor.**



- 18 **Select the Render Tab**
- 19 **Go to the Dimension panel and select HDTV 720p from the render presets menu**
- 20 **Increase the resolution to 100%**
- 21 **Select an output folder**
 - Next go to the output section**
- 22 **Change PNG to Xvid**
 - Next go to the Encoding Panel**
- 23 **Change the format to Xvid**
- 24 **Select MP3 from the Audio Codex Menu**



25 | **Scroll back to the top and Select Animation**



That completes the exercise

The images will be outputted in Xvid format and can be played on a media player such as VLC which is available to download online.

Well Done! By completing the foregoing exercises you now have the tools to create images limited only by your imagination.

Remember to re-do the exercises until you are completely familiar with the commands.

Have fun devising your creations.

Visit <https://blenderzen.com/> for more Blender information and tutorials.