Blender exercise (using Blender 2.77)

Computer Graphics & Visualization

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If you don't have Blender yet, get it at `http://www.blender.org` (Windows/OSX) or use your package manager (Linux). Its free and open source. Older versions are also fine, as long as its ≥ 2.6.

1 Interface

When in doubt, press `Esc`. If you pressed the wrong key and things happen which you dont want, press `Esc` to get out of the wrong mode. Usually the changes will also be undone. Otherwise `Ctrl+Z` undoes a change while `Ctrl+Shift+Z` redoes an undone change.

Some interactions will pop-up small dialogs that are only visible as long as the mouse is kept over them. When you move the mouse away from them, the whole interaction will be regarded as cancelled. Therefore, its sometimes necessary to keep the mouse steady instead of moving it around wildly.

1.1 Windows

- Windows are separated by a small black line from each other. When hovering the mouse over it, the cursor changes.

- At the left bottom or top of each window, the content can be changed ("3D View", "Properties" etc.).
- Two neighboring windows can be joined or a single window can be split by `right clicking` the black separation line. The size of a window can be changed by `left clicking` and dragging the line.

- The "3D View" and "Properties" windows are the most important. In the former you edit your scene (including objects, lights and cameras), in the latter you change the properties of the scene's content.

- The "Properties" window content depends on the selected object in the "3D View". The buttons on its top part are ordered in an hierarchical sense from render settings over the scene and world to individual object settings. When a mesh object is selected, you will see mesh and material setting buttons. When a light or a camera is selected, their respective settings are available.
- For some functions to work, the mouse cursor must hover above the correct window (for example, when deleting an object using X, the mouse cursor must be above the the "3D View").
- For text and numerical input boxes, values can be copied by hovering the mouse over the box (not clicking into the box!) and pressing `Ctrl+C` and be pasted the same way with `Ctrl+V`.

1.2 Camera and "3D View"

- Reset the view: `Shift+C`.
- In the "3D View" a virtual camera is used to look at the scene.

Camera Control	
Rotation	`middle mouse button`
Translation	`Shift+middle mouse button`
Zoom	`mouse wheel`

- Predefined camera views allow quickly switching to different points of view:

Predefined orthographic cameras views (using the `numpad`)	
Top	7
Left	1
Front	3
Orthographic/perspective projection	5

  Because Blender makes use of the numpad, using a laptop keyboard makes it much harder to work with Blender than necessary.
- Center and scale view at currently selected object: `numpad,` (comma) or `numpad.` (dot) (depending on the numpad)
- Wireframe/solid mode: `Z`

1.3 Selection

- Selected objects have an orange outline around them.
- Selecting an object: `right click` (`left click` will only change the position of the *3D cursor*). Multiple (de-)selection: Keeping `Shift` pressed during selection

- (De-)selecting everything: If something is selected, `A` deselects everything. When nothing is selected, `A` selects everything. Its not possible to deselect everything by clicking into "empty" space as is usual in other applications.
- Several objects can also be selected by using a "lasso selection" by holding `Ctrl` and dragging the lasso around the objects (actually their centers) with the left mouse button.

1.4 Adding/Deleting Objects in the "3D View"

- Adding meshes, lights, lamps etc.: `Shift+A`. When adding objects, make sure "Object Mode" is selected (not "Edit Mode" (see below)). Otherwise, your new object will be joined with the object you are currently editing.
- Deleting all selected objects: `Del` or `X`.

1.5 Layers

- Blender uses layers to allow the user to order the objects in his scene. These layers impose no order on the objects, they are merely a means of arranging (for example having different light arrangements on different layers or grouping complex objects etc.).

- Each object can lie in one or more of the 20 provided layers. The layers can be set visible by the 2 by 10 grid on the "3D View" title bar or by pressing 1-10 (10 = 0) or Alt+1-10 (for layers 11-20) on the normal number keys (not the numpad). Holding Shift during this will enable/disable the layers visibility.
- Moving objects between layers: selecting the object(s) and pressing `M` opens a pop-up menu allowing to select the wanted layer(s) (layers, as an object can be part of more than one layer at a time).

1.6 Editing in "Object Mode"

- There are two basic modes for editing in the "3D View": "Object Mode" to edit objects as a whole and "Edit Mode" to edit the mesh of the selected object (i.e. its vertices, faces etc.).
- Chaniging between "Object" and "Edit Mode": Icon on the "3D View" title bar or `Tab`. Always make sure you are in the right mode when editing!

- Basic object editing in "Object Mode": Select the object(s) to transform, press one of the manipulation type buttons (see table) to enter the transformation mode. Make the transformation and confirm with `Return/left click` or cancel with `Esc/right click`.

Object manipulation	
Grab (move)	`G`
Rotate	`R`
Scale	`S`

  Rotation and scaling is always relative to the chosen pivot point (can be switched in the title bar of the "3D View").

- Constraining transformations: All transformations can be constrained by first pressing the key for the respective transformation and then the key for the axis (X,Y,Z) in which you want the transformation to go. For constraining the transformation to a plane (i. e., two axes at the same time) press `Shift` + the key for the axis that is not part of the plane. For example, to move an object in the xy-plane, select the object, press `G` and then `Shift+Z`.

- Translation and rotation are best executed in the orthogonal camera views that can be reached using the numpad as this will automatically constrain their transformation.

- Numerical transformation input: For more precision, transformations can also be entered numerically while in transformation mode. E.g., to rotate an object by 90 degrees, press R to enter the rotation mode and type 90 (the input is visible in the "3D View" title bar). Holding `Ctrl` while transforming will snap the transformation to discrete values.

- Alternatively, the "Transform manipulator" can be used which is always at the selected object (or the center point). Disable/enable it with the "three colored axes" icon in the "3D View" title bar or by using `Ctrl+Space`.

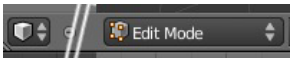
- Other ways transform and manipulate objects are on the "Object Tools" panel (press `T` in the "3D View").

- To move an object, do not click and drag directly on the object with the mouse. Always either click on one of the manipulators directly or use the keyboard transformation keys.

- Numerical transformations and additional view properties for the view camera and the objects display can be found by pressing N in the "3D View".

- Every transformation type can also be reset to the initial value by pressing `Alt` + the key for the respective transformation (`G`,`R`,`S`).

- All transformations are executed with respect to the chosen "Pivot Point" in the "3D View" title bar. Setting it to "Bounding Box Center" is the usual choice unless something special is needed.



1.7 "Edit Mode" for Mesh Objects

- The "Edit Mode" for meshes allows moving individual vertices, edges or faces.
- The currently active mode can be seen in the title bar of the "3D View".
- Switching into "Edit Mode": Tab (works also in other cases than mesh editing) or the mode selector on the title bar of the "3D View" window.
- Once in "Edit Mode", only the currently active object can be edited. To edit another object, leave the "Edit Mode" by pressing Tab again, which brings you back to "Object Mode". Then select the other object you want to edit and enter "Edit Mode" again.
- In "Edit Mode" you can switch between vertex, edge and face selection in the "3D View" title bar. Selection and editing works as in "Object Mode".
- When deleting in this mode and more than a single vertex is selected (i.e., an edge or a face, even when in "Vertex" mode), a dialog will pop-up requesting the sort of geometry that should be removed.
- All available functions for editing the mesh can be found in the "Mesh Tools" panel (`T`) in the "3D View". For often-used functions, their shortcut can be seen by hovering the mouse over the button.
- Tools that have additional options will show them below the "Mesh Tools" panel.
- To find a function whose name is known: `spacebar`

1.8 "Sculpt Mode" for Mesh Objects

- Mesh needs a high resolution to make sculpting viable. Easiest way: Add the "Multiresolution" modifier to the mesh and click several times on "Subdivide" until the resolution is high enough.
- Make sure the "Tools" bar is visible in the "3D View" (`T` or the "+" icon in the top left of the view).

- Drag the mouse while left clicking over the mesh to sculpt it.
- Different brush types (the icon on the top of the "Tools" bar) have different effects on the sculpting.
- Different tools have different settings, the "Grab" brush for example allows intuitive controls by pushing and pulling the mesh surface (especially when using a high "Normal Weight" value.

1.9 Materials

- In general, edit materials by first selecting the object that uses (or will use) the material, then chose the "Material" button in the "Properties" window.
- If the object does not yet have a material, use "New".
- To change the material of an object to another existing one, select it from the list of materials by clicking on the button to the left of the materials name.
- When you edit the material properties, the material will be changed for all objects which have the same material.

1.10 Light and camera objects

- Lights and cameras are special objects that have their own properties in the "Properties" window. Most important ones: The viewing angle for cameras and the light type and energy for the lights.
- Lights can be point light sources (with no extent) or (more realistically) area lights with a certain size. Use the "Soft Size" value to set the light sources size and give it more than one sample to make it an area light. Very important: enable "Ray Shadow" to get nice shadows!
- The camera used to render an image is an actual object in the scene (which can be deleted, added, transformed etc.). While there can be several camera objects in the scene, the one used for the actual rendering is called the active camera.

Camera object editing	
Go into active cameras view	`numpad0`
Selected camera to the active camera (view jumps into that view)	`Ctrl+numpad0`
Move active camera into current free view (very convenient way to place cameras)	`Ctrl+Alt+numpad0`

In the active cameras view, a frame in the current "3D View" is indicating the camera crop.

1.11 World and Rendering

- The "World" tab in the "Properties" window allows to change the world settings like background color/texture, ambient occlusion, fog etc.
- Render the scene into an image: `F12`
  Hide/Show the last render: `Esc/F11`.
- You can also split your "3D View" and add a "UV/Image Editor" window where you can keep the result of the last rendering visible.
- The resolution of the rendering can be set in the "Render" tab of the "Properties" window under "Dimensions".

1.12 Saving & Loading

- Load a scene: `F1`
  Save a scene: `F2`
  Save a rendered image: `F3` (when the image window is opened and the mouse cursor hovers over that window)
- Import models of other types (like PLY, OBJ etc.) in the "File → Import" menu. Imported models are joined into the current scene and depending on their scaling can be very small or huge compared to the Blender scene. Check the "Dimensions" box in the "Transform" panel to verify (`N` in the "3D View").
- Export models to exchange formats like OBJ in the "File → Export" menu. Most exporters have a number of options that usually pop up when exporting.

2 Practical exercise

Goal: Create a small scene by modelling (very!) basic objects. You can model whatever you feel like but if you dont feel particularly creative today, here are

some ideas what you could model. And remember: Dont be disappointed if your results look like a 3D scene from the early 80s, thats how everybody starts.

This exercise is meant to help you familiarize yourself with 3D tools, meshes, etc..

2.1 Modelling/Scene setup

- Remove everything from the scene.
- Add a plane (ground).
- Add a cylinder and a sphere, scale and arrange them into a simple "tree" (possibly add several trees with different shapes by duplicating and scaling). Maybe play around with the trunk, make it a crooked tree or whatever you can think of.
- Add two cubes and deform one of them into a rooftop. Arrange the two objects into a simple "house".
- Add/model other objects that could fit in that scene.
- You can make use of sculpting or any other modelling tools/techniques. For example, you can sculpt the tree or the terrain to give it a more natural, organic look.

2.2 Materials

- Add materials to the objects in your scene.
- Give them appropriate names and appearance (color and shader, e. g., a brown tree trunk and a green top).

2.3 Camera

- Add a camera to your scene and set it up so it faces your scene.

2.4 Lights

- Add a light of the type "point" or "sun" and position it in your scene (for the "sun" only the direction matters).
- Render the image (you should render whenever you want to see the result of changes you make which are not immediately visible in the 3D viewport).

If you like to play around with some great models, you can download the files from the Open Source movies Sintel and Big Buck Bunny or have a look at http://www.blendswap.com.