Bio Visualisation with Blender and MembraneEditor Part 1
Blender Basics

Konstanz Research School Chemical Biology (KoRS-CB) Workshop
Björn Sommer, University of Konstanz & Mehmood Ghaffar, IPK Gatersleben
Version 20.02.2019

Forum:
http://www.cellmicrocosmos.org/Cmforum/viewforum.php?f=63

Actual Version of Blender:
http://www.blender.org

Here, Blender 2.79 is used.

Target

This tutorial describes the basic functionality of Blender. It is important to go through the whole tutorial, because this basic knowledge will be required in the following tutorials and most of it will not be repeated!

What is Blender?

Wikipedia

Blender was developed as an in-house application by the Dutch animation studio Neo Geo and *Not a Number Technologies (NaN)*. It was primarily authored by *Ton Roosendaal*, who had previously written a ray tracer called Traces for Amiga in 1989. The name "Blender" was inspired by a song by Yello, from the album Baby.

Roosendaal founded *NaN* in June 1998 to further develop and distribute the program. The program was initially distributed as shareware until NaN went bankrupt in 2002.

The creditors agreed to release Blender under the terms of the *GNU General Public License*, for a one-time payment of €100,000 (US$100,670 at the time). On July 18, 2002, a Blender funding campaign was started by Roosendaal in order to collect donations and on September 7, 2002 it was announced that enough funds had been collected and that the Blender source code would be released. Today, Blender is free, open-source software and is, apart from the two half-time employees and the two full-time employees of the Blender Institute, developed by the community.

The *Blender Foundation* initially reserved the right to use dual licensing, so that, in addition to GNU GPL, Blender would have been available also under the "Blender License", which did not require disclosing source code but required payments to the Blender Foundation. However, this option was never exercised and was suspended indefinitely in 2005.[5] Currently, Blender is solely available under GNU GPL

Watch the Show Reel

http://www.youtube.com/watch?v=QbzE8jOO7_0&hd=1

And be sure to do not miss this part:

http://www.youtube.com/watch?v=QbzE8jOO7_0&hd=1&t=180

Installation

We will be working with Blender version 2.67b, because it is quite stable. Go to the Blender

website, locate the older versions, and download the version for your OS.

Preparations

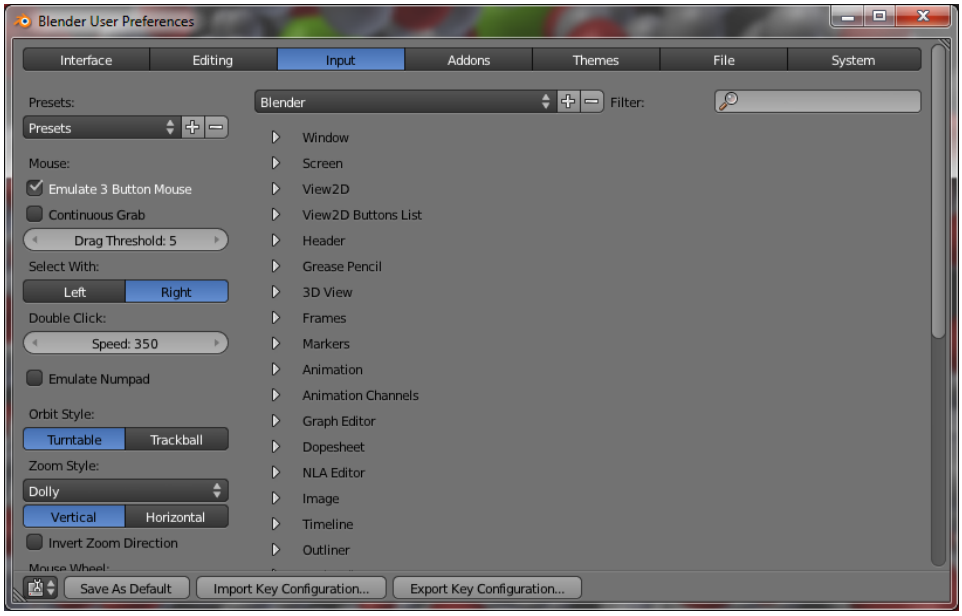
Menu → File → User Preferences

→ Addons:

activate:
Import-Export: Import Images as Planes

→ Input

activate “Emulate 3 Button Mouse” for using Blender with a Mobile PC



Press: “Save As Default/Save User Settings” to make sure, next time you start Blender, you do not have to redo these settings again.

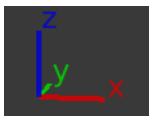
Shortcut keys

Now, a number of shortcuts will follow. Of course it is a good idea to remember most of the shortcuts in the future on your own, because working with Blender is much faster with shortcuts instead of using the menus. However, to support you during your work, KatsBits provides a very nice keyboard chart which you can download here for free:

http://www.katsbits.com/tutorials/blender/useful-keyboard-shortcuts.php

Important: All shortcuts are context-/window-dependent!
The following shortcuts are based on the 3D View!

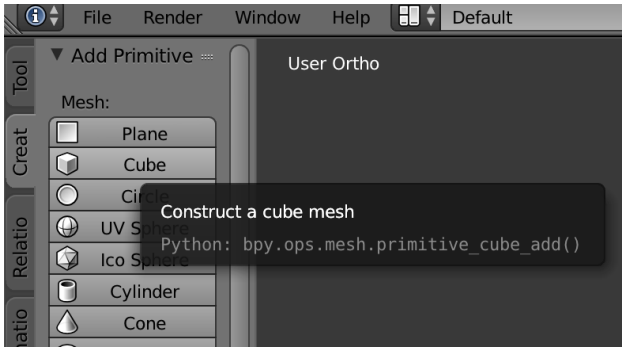
Coordinate System in Blender



Z is vertical, X horizontal, Y is forward

Object Mode

First, create a Cube:



Selections

Right Click: Select

Left Click: Set Center Point (we will learn, what to do with this)

Center Mouse Button or Alt+Left-Click: Emulate Center Mouse Button & Rotate
Center-Click+Shift: move horizontally/vertically
Center-Click+Ctrl: zoom in/out

Ctrl+Left-Click: Draw Shape and Select

Ctrl+Alt+Left-Click: Zoom

ESC → Back to 3D View if e.g. in Render Mode

Perspectives

Num-Pad	
1	: Front
3	: Side
7	: Top
CTRL+#	: Opposite (e.g. CTRL+1: Rear)
5	: Orthographic/Perspective View
4,2,6,8	: Rotate in 45° steps
0	: Switch Camera View/Perspective View
Shift+F	: Free Floating Mode for Camera/Perspective View, Use WASD to navigate, finish with left click
+/–	: Zoom in/out
Pos1	: Show all objects
Shift-C	: The view is shifted to show all objects

Manipulation Modes

G : Grap
R : Rotate
S : Scale

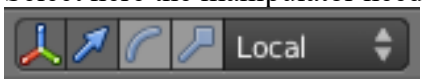
G/R/S+Axis : Translation/Rotation/Scale along the chosen *Global* Axis (X, Y, Z)
G/R/S+2xAxis: Translation/Rotation/Scale along the chosen *Local* Axis (X, Y, Z)
+Shift : Translation/Rotation/Scale along the chosen Plane (X/Y, Y/Z, Z/X)
(e.g., press Y (as the normal) → X/Z plane is used)

G/R/S combined with ALT: Undoes the last sequence of actions ("Object Mode"; not in "Edit Mode")

G/R/S combined with numbers → using the exact number, better use this only in combination with concrete axis dependency

Ctrl+Space: Show/Hide Manipulators

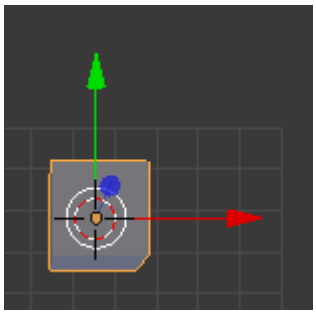
Select here the manipulator needed (in this case the arrow):



Transform Orientations

- Global
- Local
- View
- Normal
- Gimbal (interesting for rotations)

Transformation orientation, e.g. "Local" or "Global" are used, to define the base coordination system for the manipulators



Left-Click on Arrows of Object → Movement along the chosen axis
Ctrl+Movement: in full Blender steps
Ctrl+Shift: Movement in 1/10 Blender steps

Scrolling with the Mouse wheel

normal:	zoom in/zoom out
+Shift:	Shift up or down [dt. Hochschieben]
+Control:	Move to left and right
+Shift+Control:	Rotate (Counter-)clock-wise
+Alt:	Change time [dt. Alter/Age]
+Shift+Alt:	Rotate Forward/Backward

Multiple selection with LM+CTRL

Selection modes

Shift+A in Edit Mode

Shift+J joins selected objects in Object Mode

Limit selection to visible

Tasks

Task I

To try the local axis movement, first rotate an object, then grab it, snap it to one axis which alignment has been changed after the rotation, and press the corresponding axis 2 times

Task II

We build a simple lipid!

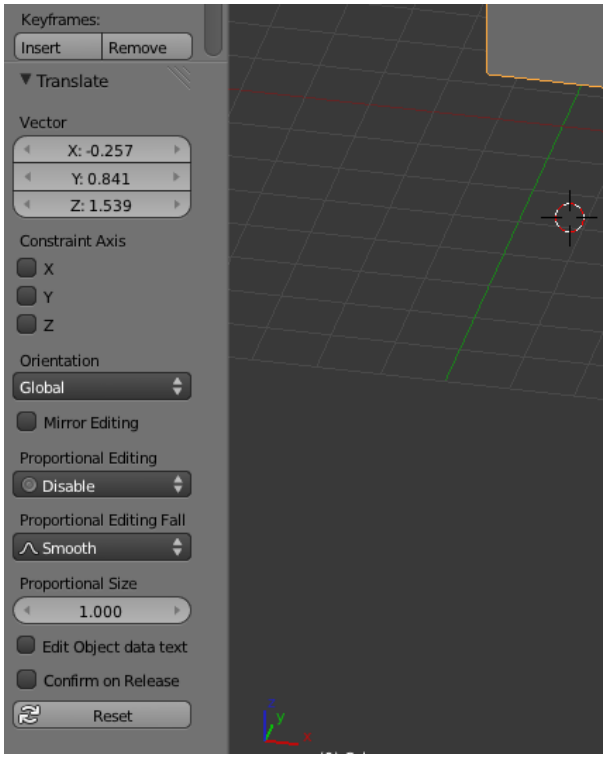
Options:

- Take sphere, drag one of the faces
- Take sphere, extrude one of the faces (multiple times)
- Take a sphere and copy the atoms
- Combine different spheres

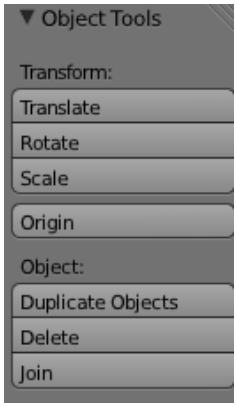
Undo Options

Ctrl-Z: Undo (32 Undos, can be changed File → Preferences → „Editing“ → Change Size of UnDo History)

Ctrl-Shift-Z: Redo



The Last Action/Transformation is shown here and can be manipulated



Origin → change the Gizmo of an object

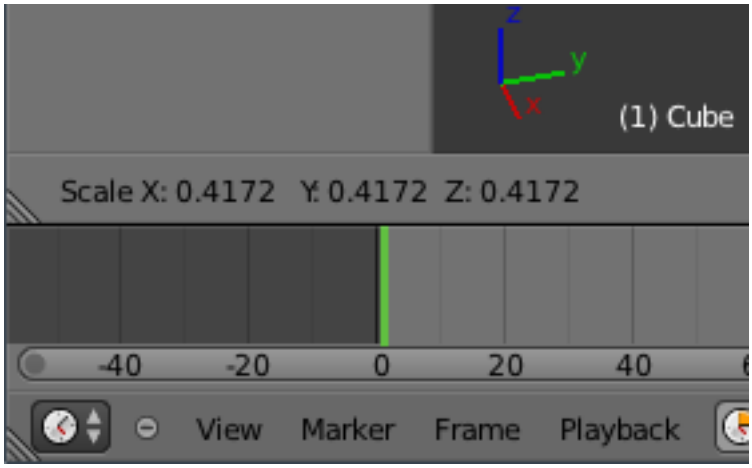
Edit Mode

Tab: Edit Mode (toggle between Object and Edit Mode)

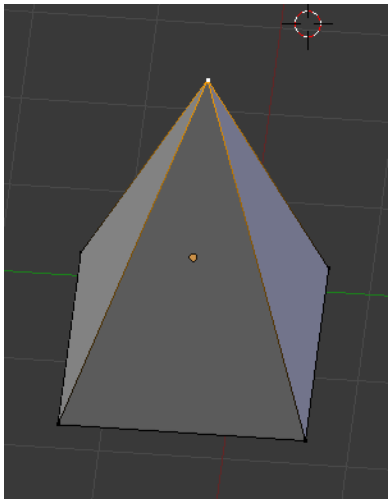
select with Right Mouse Button single vertices

Shift: Multiple Selection, keep pressed by selecting 4 nodes

S + 0 + Enter → Place all selected nodes in one place
(S for scale, 0 Scales the distances between all selected nodes to 0;
pressing S + 10 would scale the distances between all selected nodes to the 10th of their length;
this method can again be combined with X, Y and Z restraints, e.g. by selecting S + X + 0;
watch the actual scale on the left bottom corner shown below)



W : “Specials” Pup-Up for Edit Mode appears, select:
Remove Doubles: Removes all overlapping vertices in one position,
e.g. after using S+0



Further ShortCuts:

X *or* DEL : Delete Objects

Shift+A: Add Objects to actual object (remember, we are in Edit Mode, these objects will be not a single object, but they will be added to the actually edited object) or

Selection Modes

Ctrl+Left Click : Selection in Pencil Mode

C : Brush Mode (ESC to exit)

Ctrl + Tab : Change Sub-Edit Mode: Vertex, Edge, or Face

A : (De-)Select All

Manipulation Modes

Vertex select : Select vertices
Edge select : Select edges
Face select : Select faces
+Shift : Select multiple vertices/edges/faces
+Ctrl : Select all vertices/edges/faces between previous and actual selection

E : Extrude vertices/edges/faces

first select two unconnected vertices and
W → Merge ... : Combine and merge two vertices
or
F : A direct edge between both vertices is added

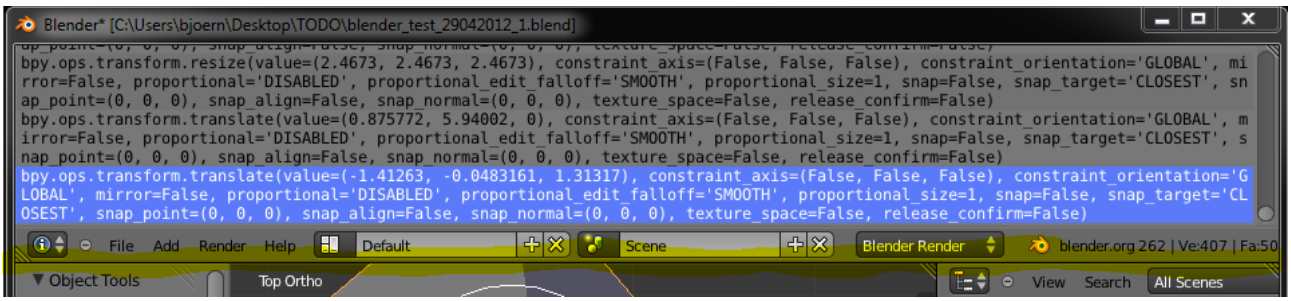
first select three or more vertices connected by edges (but without a face in between)
F : create face between vertices

first select two connected vertices and
W → Subdivide ... : A new node is added between the preselected two vertices

first select a single node as starting vertex
CTRL + LM : A new vertex plus edge between the preselected vertex is added

API-Navigator

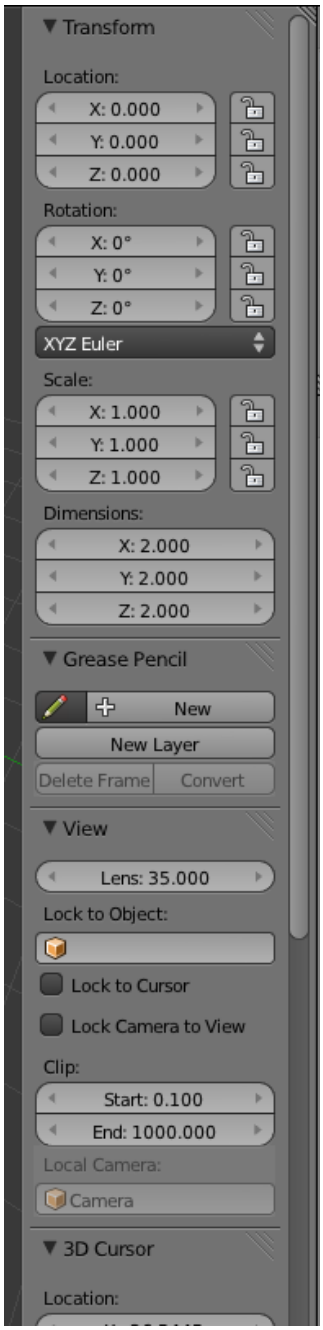
Help → Python API Reference



The Python-Scripts executed by Blender are always shown in the top section which is normally hidden. To open this section, the yellow marked line (see screen shot) has to be dragged down with the Mouse+LeftPress.

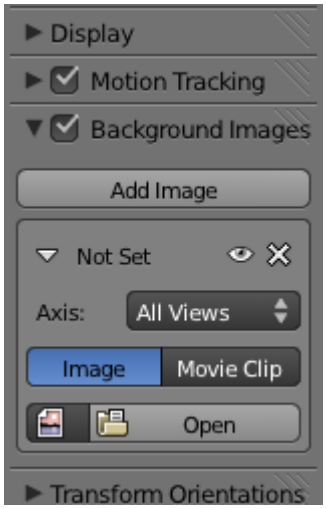
Properties Window

N → Properties of the selected object



Background Image

This image is only shown in view ports (only Orthographic view) or in the camera perspectives:



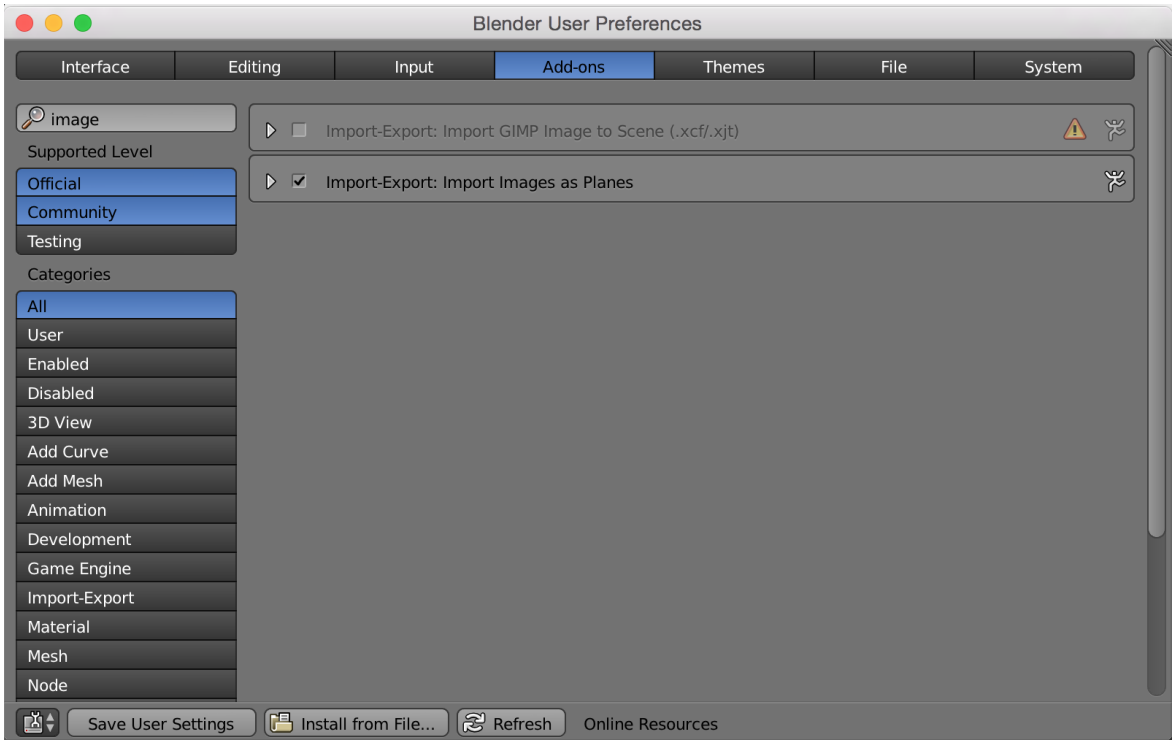
(this is still the properties dialog)

This maybe useful if an image should be used as a base for a three-dimensional object, e.g. image segmentation. Important: If “All Views” is chosen, the images are only shown in orthographic perspective, which is toggled by “5” on the NumPad

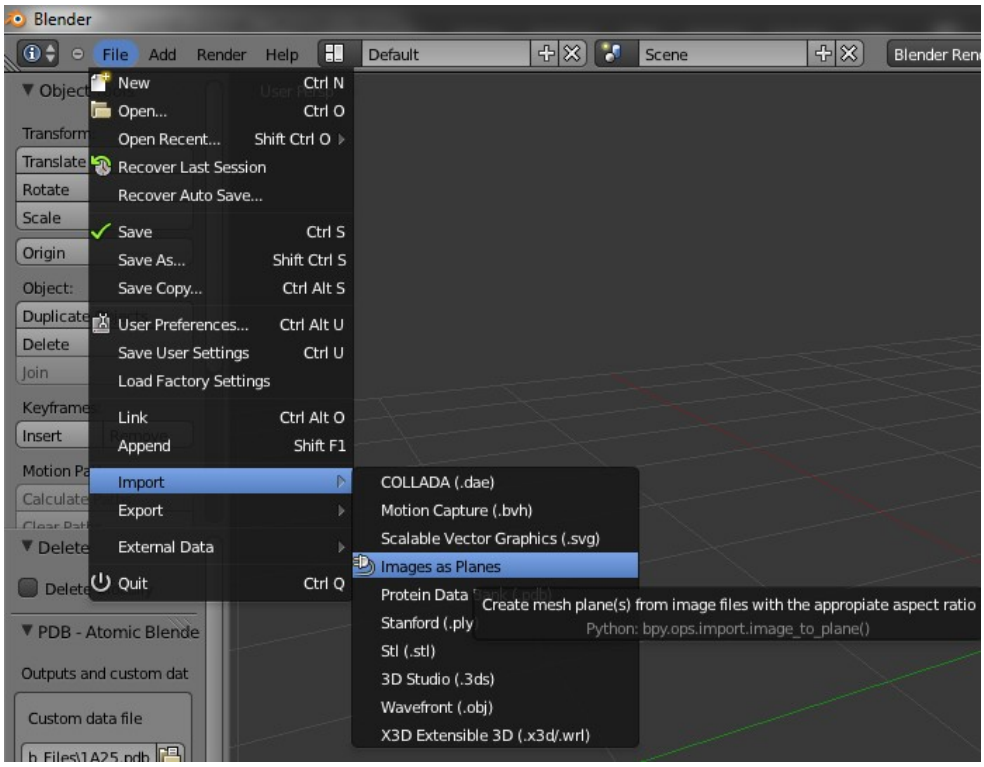
→ Therefore, usually it will be needed to correlate an image with a plane:

A Plane with an Image

First, the option “Import Image as plane must be activated” in: File → User Preferences

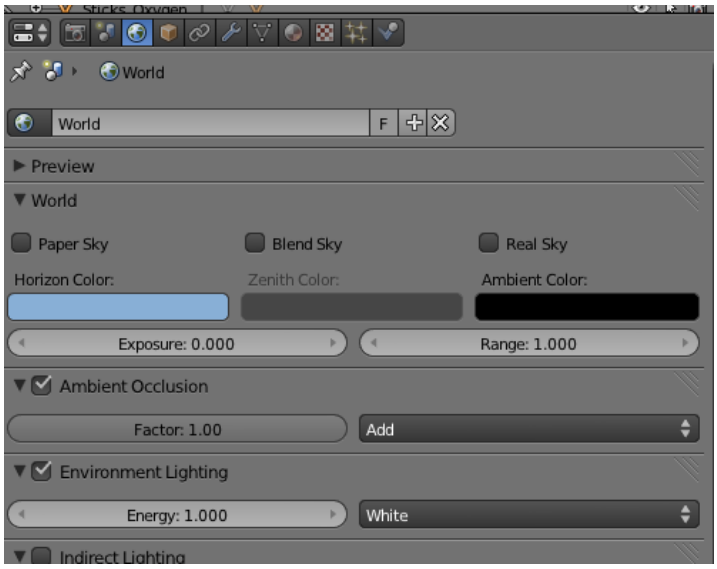


Then, it is simple:



World Background Settings

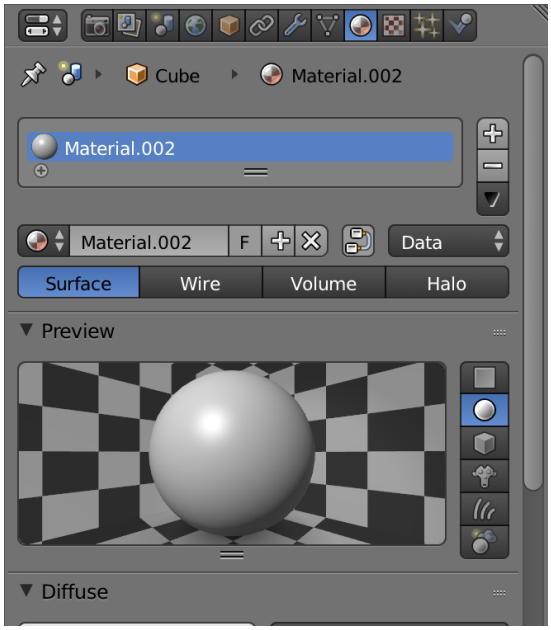
Change the Light/Background Settings in the World Options:



Blender Renderer

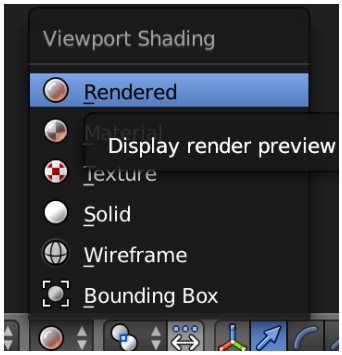
What we are using here, it the Blender Renderer for the images. Now, only a short intro how to use these materials:
Select an objet, and change to the Material tab in the Properties window:

Press New:



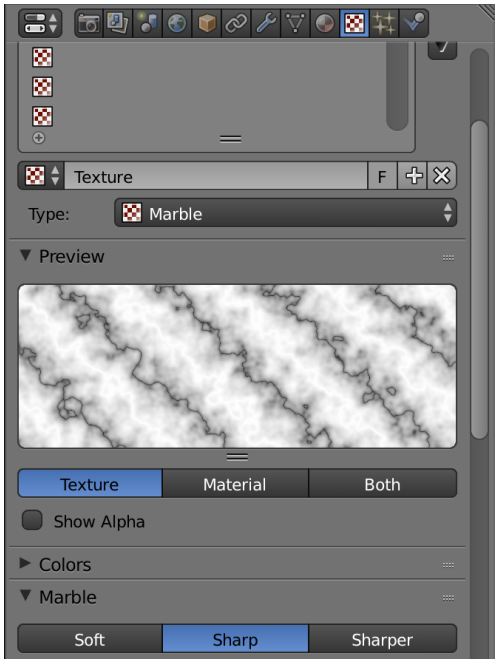
Change in the Viewport Shading now to:

Rendered

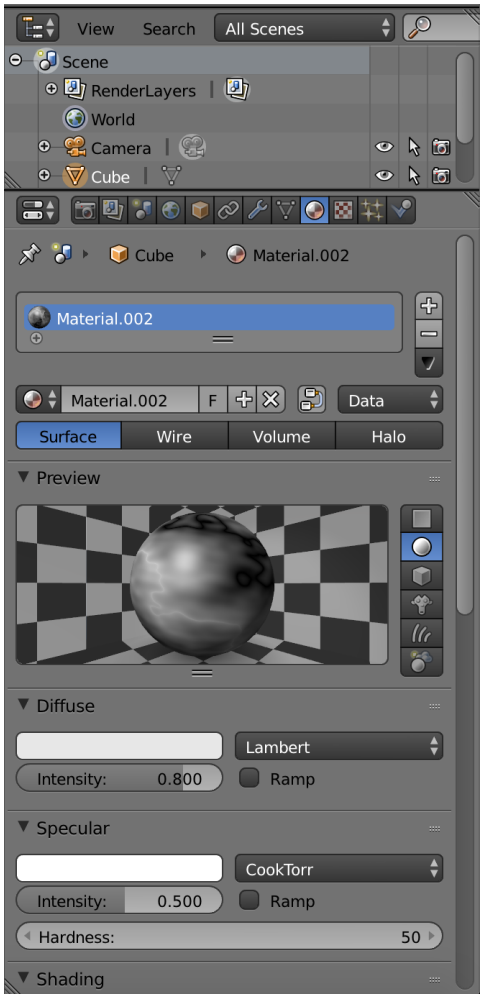


Now you can directly see the results in the window.

Try now different textures. Go to the next tab, here, for example, marble:



If you go now back to the material tab you will see, that you can see the changed texture, and in the 3D view you can see the changes directly applied to the object.



Some new Options and a few Repetitions

B → Border Select

H → Hide all selected

Shift+H → Hide all unselected

Alt+H → Unhide all

A → De-Select All

W → Specials: Subdivide line between selected vertices

Shift+D → Duplicate

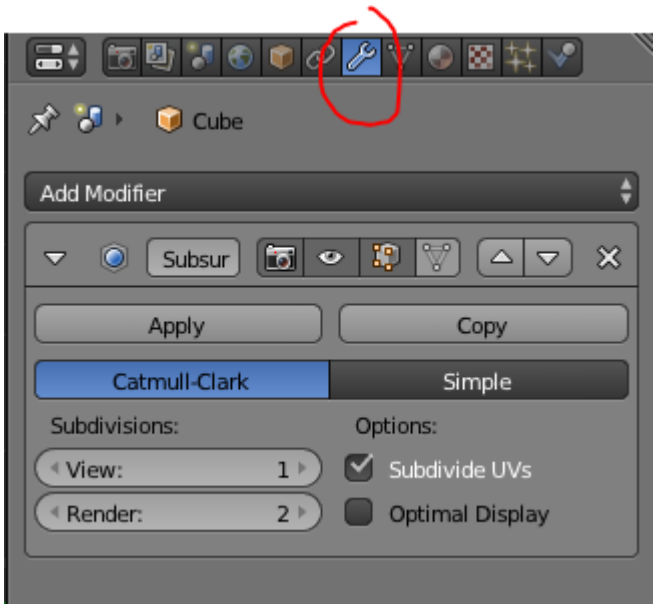
Alt+M → Merge selected nodes (Edit Mode only)

E → Extrude selected nodes or shapes

F → create face between selected vertexes

Modifiers

Modifiers can be used to change the appearance of an object without changing the original shape. Modifiers can be temporarily deactivated. If you want to unite the object with its modifier, just press “Apply”.



Generate/Subdivision Surface

Generates a smoother surface.
View: Subdivision surface factor for the actual 3D view.
Render: Subdivision surface factor for the next rendering.

Generate/Mirror Modifier

Mirror the next manipulations along one or more predefined axes