

Tutorial - 3D Printing

How to design a model compatible with 3D printing?

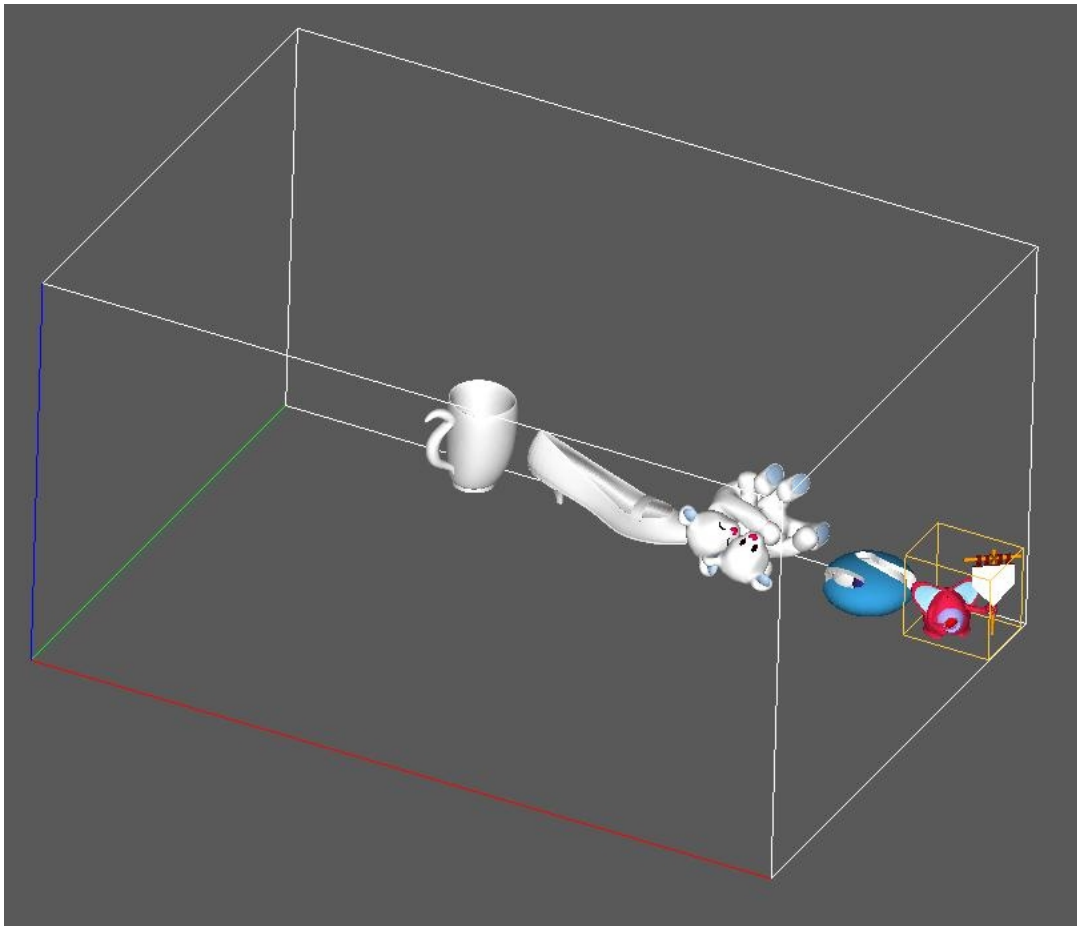
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1. 3D printing by Sculpteo

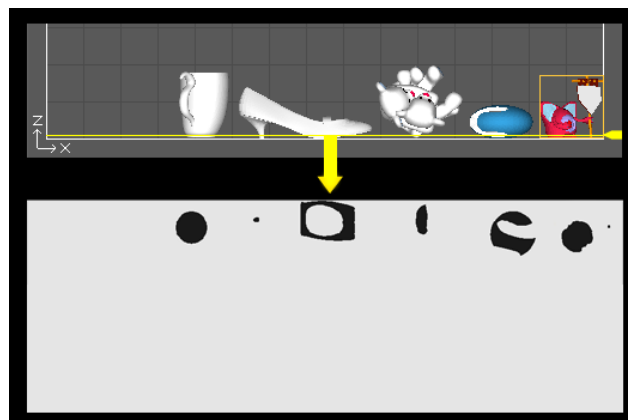
α) Process

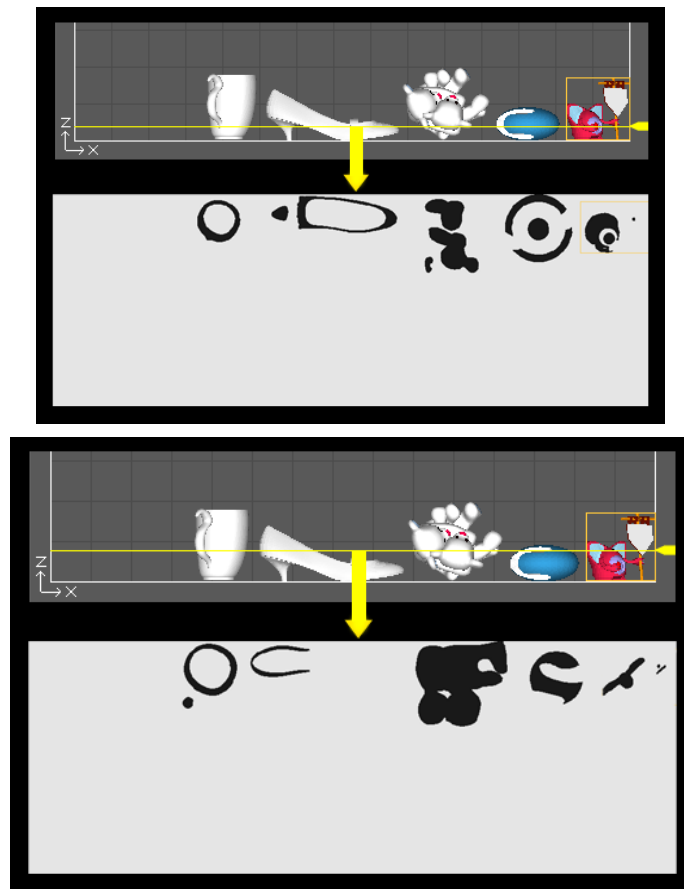
Sculpteo's 3D printing technologies produce objects by assembling successive layers of material. When preparing for printing, several 3D models are placed in a virtual tray for production.

In this example, 5 objects have been selected and placed like this on the tray:



This tray is a virtual simulation of the actual one in which the physical objects will be produced.





When printing, layers of plastic powder are deposited over the entire surface of the tray, each 0.1 mm thick. In parts of the tray where an object must appear, the powder is transformed into plastic. Outside these areas, the powder is left intact. The object gradually appears, layer by layer.

Pour savoir où elle doit créer la matière, l'imprimante scanne le modèle 3D du bac de gauche à droite : In order to decide where it must solidify the material, the printer scans the 3D model in the tray, from left to right: when it encounters a facet, it considers that this corresponds to a volume of material, and deposits a bonding agent to agglomerate the plastic powder - until it finds a facet oriented in the opposite direction. At this point, it considers that it has left the volume and stops agglomerating the plastic powder, which remains in its powder state. When the printer encounters a new facet, it agglomerates the powder until the next opposite facet, and so on.

At the end of the printing process, the tray is full of plastic powder with agglomerated objects inside. The objects are then removed by hand, dusted, and treated to make them more resistant.

a. Materials offered by Sculpteo

Sculpteo offers a choice of three materials for printed objects:



White, strong, slightly flexible material that can withstand some pressure when bent. The surface has a grainy, sanded appearance and is slightly porous. White plastic objects are produced by laser sintering of polyamide powder. The models are printed layer by layer by a laser that draws the object in the powder, by solidifying the material. Layer thickness is 0.1 mm and the minimum size of visible details on the model is 0.3 mm. Minimum wall thickness for this technology is 0.8 mm (flexible and bendable), and the object is rigid when more than 2 mm thick.

Black, strong, slightly flexible material that can withstand light impact and pressure when bent. This material is white plastic dyed black. The surface has a grainy, sanded appearance and is slightly porous. Black plastic objects are produced by laser sintering of polyamide powder. The models are printed layer by layer by a laser that draws the object in the powder, by solidifying the material. Following 3D Printing, the item is coloured by being plunged in a bath of black dye. The layer thickness is 0.1 mm and the minimum size of visible details on the model is 0.3 mm. Minimum wall thickness for this technology is 0.8 mm (flexible and bendable), and the object is rigid when more than 2 mm thick.



This material is composed of fine mineral powder. 0.1mm layers are constructed one-at-a-time. This is the only material allowing full colour (16 million different colours) items in a single pass. This is the cheapest way to build multicolour objects. The object is as hard and brittle as porcelain, and should therefore only be used for ornaments. The surface has a grainy, sanded appearance. Object is shipped in its finished state, and should not be sandpapered, as it would damage the surface. This material should not be exposed to water. ZCorp's mineral-based powder is bonded in successive layers using a specific ink-jet 3D printer. After printing, the object is carefully cleaned and infiltrated with cyanoacrylate glue.

Both materials allow production of objects with 0.1 millimetre accuracy, which is visible to the naked eye. Precision is limited for details under one millimetre (the equivalent of 10 layers of material).





b. Sculpteo step by step

Using Sculpteo's 3D printing services means you need a design. You can create one with 3D modelling software and upload it to Sculpteo. Several free solutions are available, such as Blender ([download here](#)) or Wings 3D ([download here](#)). You can also create one online using Sculpteo's "Create" tab, or even pick a design in the public gallery by clicking on the site's "Gallery" tab.



The screenshot shows the Sculpteo website interface. At the top, there is a navigation bar with links for HOME, GALLERY, CREATE, COMMUNITY, and PROFESSIONALS. The main banner features a large blue 'S' logo and the text "You design your objects we make them real" with a button to "Upload your design". Below the banner, there is a news section titled "How Selective Laser Sintering works? (video) - June 20, 2011". The main content area is divided into several promotional tiles: "Make your own custom objects" with an "UPLOAD" button, "Customize gallery items" with a "CUSTOMIZE AN OBJECT" button, "Your keyring" with a "CREATE A KEYRING" button, and "Your unique figurine" with a "YOUR MINI-YOU IN 3 CLICKS" button. The "Your unique figurine" tile also includes a sub-section for "Manga figurine" with a "From €59.90" price tag.

All you then need to do is order a 3D print of your chosen design(s), with a click on « See the price ».

SEE THE PRICE


A window will appear, asking you to select your design's print settings:

- Choose a print size with the scale slider or enter your object's dimensions by hand.
- Select the material: white or black plastic, multicolor material. **The cost is calculated automatically, based on your settings.**

HOME | GALLERY | CREATE | COMMUNITY | >> PROFESSIONALS

Souris à brushing insupportable

designed by **oyo**



2 cm
1 in

3D technology : Auto | WebGL | Java | Flash | JS

Printing size (originally: 4.96 mm x 6.77 mm x 5.69 mm) [Reset]

Size


49.60 x 67.71 x 56.85

Unit
mm


Scale

% 1000


Printing material >> MORE DETAILS

☐


White plastic
 White, strong, slightly flexible material that can withstand some pressure when bent. The surface has a grainy, sanded appearance and is slightly porous.


☐


Black plastic
 Black, strong, slightly flexible material that can withstand light impact and pressure when bent. This material is white plastic dyed black. The surface has a grainy, sanded appearance and is slightly porous.

☒


Multicolor
 A high-performance compound, which has the appearance of a plaster casting. Quite breakable for small details. Non optimal use for jointed objects. Colored during building of the part.

Check solidity

☐


The material you selected has a solidity threshold around **2.0mm**. Below this limit, the object may be fragile, and even, in certain cases, un-printable. The preview on the left shows you where problems may happen.

Currency

€ \$ £

Quantity

- 1 +

Unit price

€70.78

Total

€70.78

(shipping cost not included)

ADD TO BASKET

Click on « Add to basket ».


The summary page for your items displays.




You can also open the summary page of your items, by clicking on « your basket ».


Basket : 3 items
\$152.19

6

Orders in your basket



	Item	Quantity	Price
Remove	 <p>Design Souris à brushing insupportable</p> <p>Material Multicolor</p> <p>Size (cm) 4.9 x 5.6 x 6.7</p>	- <input type="text" value="1"/> +	\$100.66
Remove	 <p>Design Petit Boudha</p> <p>Material White plastic</p> <p>Size (cm) 2.8 x 4.9 x 3</p>	- <input type="text" value="1"/> +	\$35.41
Remove	 <p>Design Nœud borroméen</p> <p>Material Black plastic</p> <p>Size (cm) 3.4 x 3.2 x 1</p>	- <input type="text" value="1"/> +	\$16.12
Total (V.A.T included, shipping not included)			\$152.19



Your item will reach you by **July 5, 2011**, if you select Express delivery.

If your order is urgent, [please contact us](#).

[Continue shopping](#) or [CHECK OUT](#)

You can cancel the order for any item you wish by clicking “Delete”.

Once you are satisfied, click on “Check out” to open the form and enter your contact information.


Ship/Bill

Payment

Confirmation

You are

☒ Individual
☐ Company



*Title *Last name *First name

Mlle BASSET Marie

*Email

marie.basset@adresse.com

*Bill to (If different from the first and last names above)

Marie BASSET

*Address (billing)

20 rue de Paris

*Zip code *City *Country

75001 Paris France

State/Province

Not Applicable



☐ Shipping address is different.

*Phone number

01 66 66 66 66

Discount code

*Payment method

☒ PayPal ☐ Pay with the invoice

CHECK OUT

Fill in your details. Choose a method of payment:

- Paypal,
- Pay with the invoice (for some professionals only).

Click on « Check out ».

Ship/Bill

Payment

Confirmation

Please choose your preferred shipping method

☒ **\$8.28 QUICK DELIVERY**
Delivery with tracking
Delivery time:2/3 days.
You will receive your order **between July 6, 2011 and July 7, 2011.**

☐ **\$19.32 EXPRESS SHIPPING**
Express shipping with UPS
Delivery time:2 days.
You will receive your order **on July 6, 2011.**

CHECK OUT

You can choose your shipping method.

Click on « Check out ».

Ship/Bill

Payment

Confirmation

Customer
 Marie BASSET
 marie.basset@adresse.com
 01 66 66 66 66




Billing Information

Shipping Address

Marie BASSET
 20 rue de Paris
 75001 Paris
 FRANCE

Marie BASSET
 20 rue de Paris
 75001 Paris
 FRANCE

Order

	Souris à brushing insupportable (Material: Multicolor)	
	\$100.66 * 1	\$100.66
	Petit Boudha (Material: White plastic)	
	\$35.41 * 1	\$35.41
	Nœud borroméen (Material: Black plastic)	
	\$16.12 * 1	\$16.12
Subtotal		\$152.19
Delivery with tracking		\$8.28
Basket Total		\$160.45
		Tax (included): \$26.30

PAYMENT
 Your payment will be processed through PayPal.

PURCHASE

Your order summary now displays. All that's left to do is pay - so click "Purchase". You will be redirected to our secure payment partner's site. When your payment is completed, you will be redirected back to Sculpteo. Save and/or print your invoice, which will also be automatically emailed to you.

Voila! You're done.

c. Formats supported

If you're lucky enough to be a skilled 3D designer, you can upload your own model to Sculpteo and order a 3D print of it. In order to do this, you need to export your model into a 3D file format Sculpteo can handle.

Sculpteo supports the following formats:

- * OBJ (Wavefront)
- * PLY (Stanford)
- * STL
- * OFF
- * SKP (SketchUp)
- * KMZ (Google Earth)
- * 3DS (3D Studio)
- * AC3D
- * ASE (3D Studio)
- * DAE (Collada)
- * MD2/MD3 (Quake)
- * Q3O (Quick3D)
- * COB (TrueSpace)
- * DXF (AutoCAD)
- * LWO (LightWave)
- * ZIP: a zip archive containing the 3D file, textures and colours if any (to make sure colours and textures are properly imported to the site)

Important!

- The STL format does not support colour.
- For this particular format, you must attach, along with the .obj model, the indexation file for colours and textures (.mtl), the texture files (image formats .jpg, .png, .gif or others) and include them together in a zip archive. It's this .zip that you have to upload to the website.

2. 3D-printing constraints: points to consider when modelling

a) Think object

Not all 3D designs are suitable for 3D printing. You must always bear in mind the final object as it will be produced.

Volume

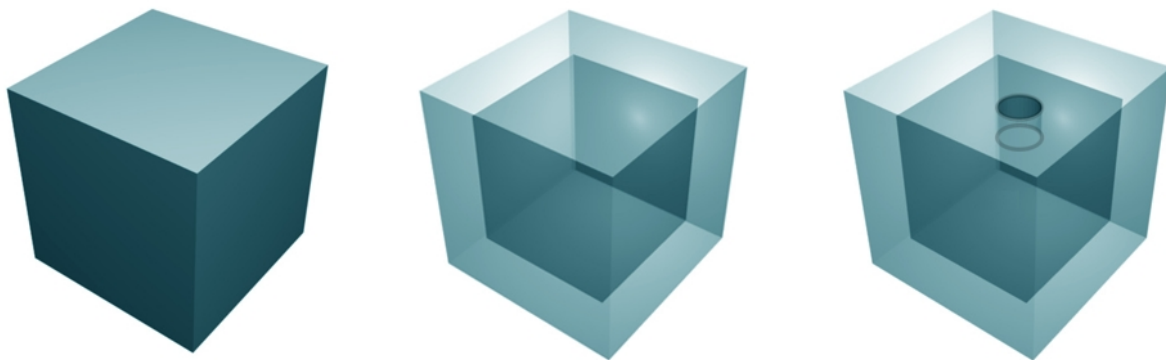
The object must have volumes. In gaming, some models are designed to obtain the most effective rendering, even if this means “cheating” a little with geometry. Hair, for instance, is sometimes modelled in simple textured faces with no volume. Such elements cannot be printed. Try to figure a flat surface as an object: if it exists in real life, it necessarily has at least some thickness. To prepare a model for 3D printing, you must first give volume to your surfaces, for example by extruding them.

Balance

Will the object be stable? If your model is a running character, it may have one foot in the air and the other on the ground. Are you sure it will stand? It might be a good idea to add a base.

Hollow object

If want some parts of your object to be hollow, remember to create a hole in the model so that the loose plastic powder can be evacuated:



a. Levels of detail

Printing accuracy is 0.1 millimetre, i.e. the thickness of a single layer. Bear in mind that in order to be visible, any details should be printed in at least 5 layers. We strongly recommend that you anticipate a printing size with details at least 1 mm thick for best results. Smaller details will be almost invisible or excessively brittle.

It is best to exaggerate details. For reliefs and patterns, don't hesitate to push out the relief quite thick. Marked contrasts between peaks and valleys yield better results.

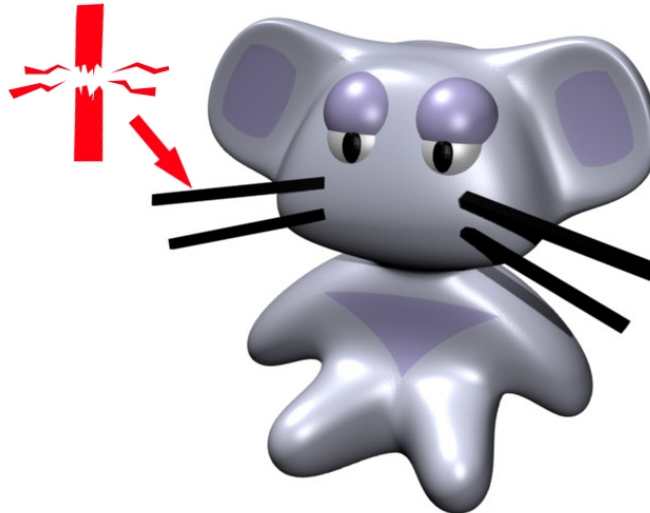
b. Avoid “soft spots”

Tiny details

Smaller details such as animal whiskers, wires or cables can be very fragile, or even impossible to print, if they are not thick enough.

This is mainly true with our coloured material. Our white material is flexible when very fine, within reasonable limits (e.g. at least 1 mm for whiskers).

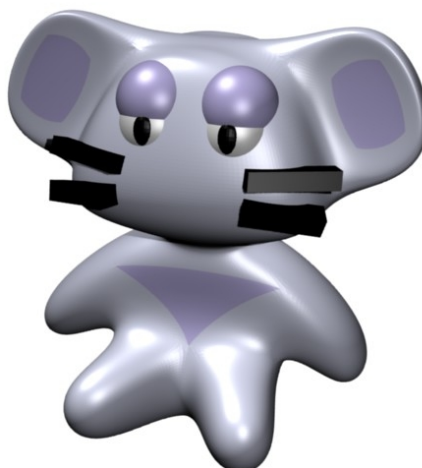
The little character below has long, fine whiskers. If this object is produced in colour, you can expect them to snap off pretty fast:



There are several ways of mitigating detail fragility:

- By increasing their thickness. This can work for cartoon-like figures, where exaggeration of detail is not a problem.
- By sticking the detail to a solid part of the model, as if it was resting on the model. For instance, a cat's whiskers stuck to its cheek.
- By removing them altogether. You can design spaces on the model to place a wire, string or small chain, and add them after printing. It's very easy to stick all sorts of details onto the printed material with regular glue.

Here, we have changed the design of our character's whiskers in a way that will make them more sturdy once printed:

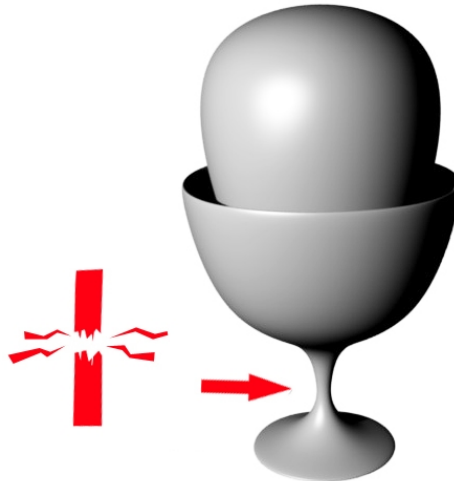


In any case, a minimum thickness of 3-4 mm is recommended for details that “stick out” of a colour object, and 2 mm for the white material. For reliefs, 1 mm accuracy is enough as the details are stuck to the model background and therefore much more solid.

Awkwardly-balanced objects

Large objects with thin bases are best avoided, unless supported by other elements.

If you choose to produce an object such as this one:



The base will probably be very brittle.

What we recommend:

- Reduce the size difference between the base and the object.
- Print the object large enough to make the base solid.
- In any case, printing in white plastic yields better results in terms of strength: the base is flexible/bendable (from a certain thickness - 4 mm at least for the object above). In colour, we would discourage printing this object as is.

c. Differences between rendering and object: anticipating errors

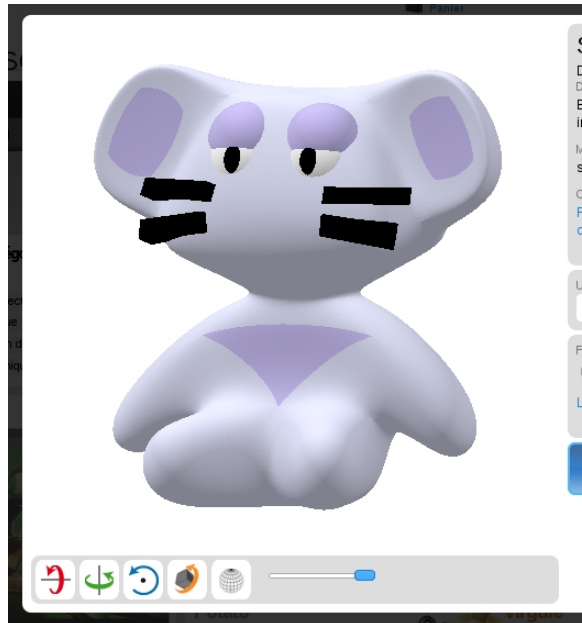
Colour rendering of an object produced by 3D software is often very different from reality, because software makes use of artificial lighting that can dull, lighten or transform the object's actual colours.

For example, below is a Blender rendering of our little character. The lighting makes its skin look yellowish.



To get an idea of the finished object's actual colours, you should check out the rendering on Sculpteo's online 3D viewer, which most faithfully reflects the object's appearance.

When exporting the model to Sculpteo and examining it in the 3D viewer, we can see that our character's skin is actually grey lightly tinged with purple.



Note that Sculpteo does not print transparent parts of the object in clear material. If you design a protective glass screen on a mobile handset, it will appear opaque, and will conceal the texture of the menu placed below it.

You should therefore remove any transparent part if you want to see what's behind it. One option is to change the object's texture to simulate a transparent effect.

Say we put a fishbowl over our little guy's head:



The printer will produce this:



d. Joints

Our machines produce your design's parts layer by layer, and can therefore produce parts with complex enclosed assemblies.

If you choose to produce articulated parts, remember to leave sufficient clearance to allow the joint to move freely. You can make hinges, pivots, cylindrical joints...

We recommend using our white plastic to produce moving parts.

With this material, a 0.5 mm clearance is recommended to ensure the joint can move freely.

e. Preparing a usable file

File size

It's best not to overdo model smoothing beyond what's necessary to render. Files that are too big are difficult to process. If they feature geometric errors, mesh complexity becomes problematic to perform repairs before printing. Sculpteo accepts file uploads up to 50 megabytes. Try to remain well below that - not only are big files more difficult to upload, but they may also be unsuitable for processing before printing.

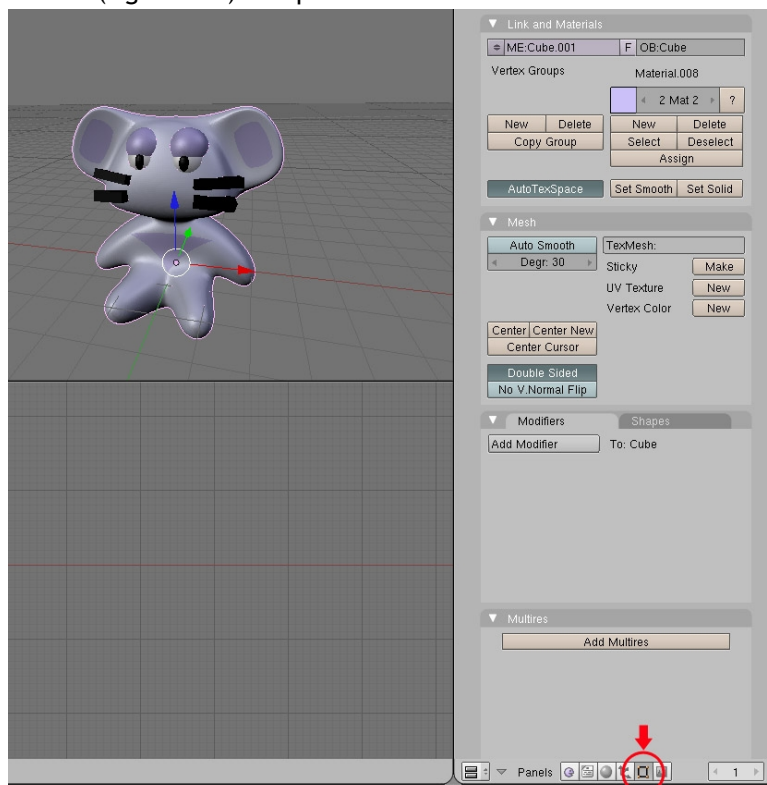
Reducing the file size

One way to reduce the file size is to cut down on the number of faces with a decimator. Most 3D applications feature one.

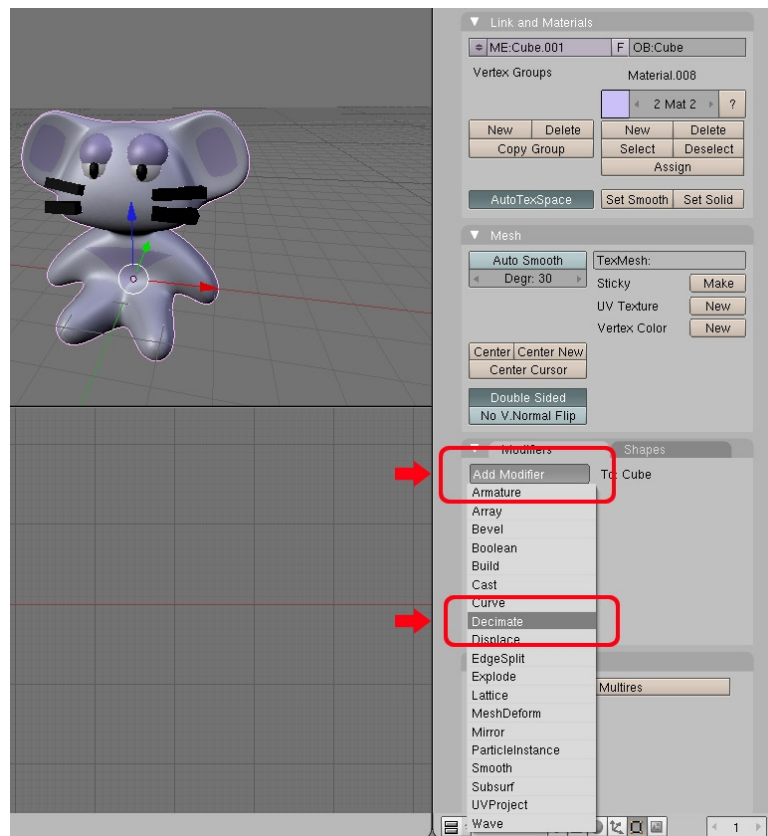
If you can't find one, you can always use Blender's freeware solution ([download here](#)) and use the "Decimate Modifier" on your model (Edit Menu: F9).

Proceed like this:

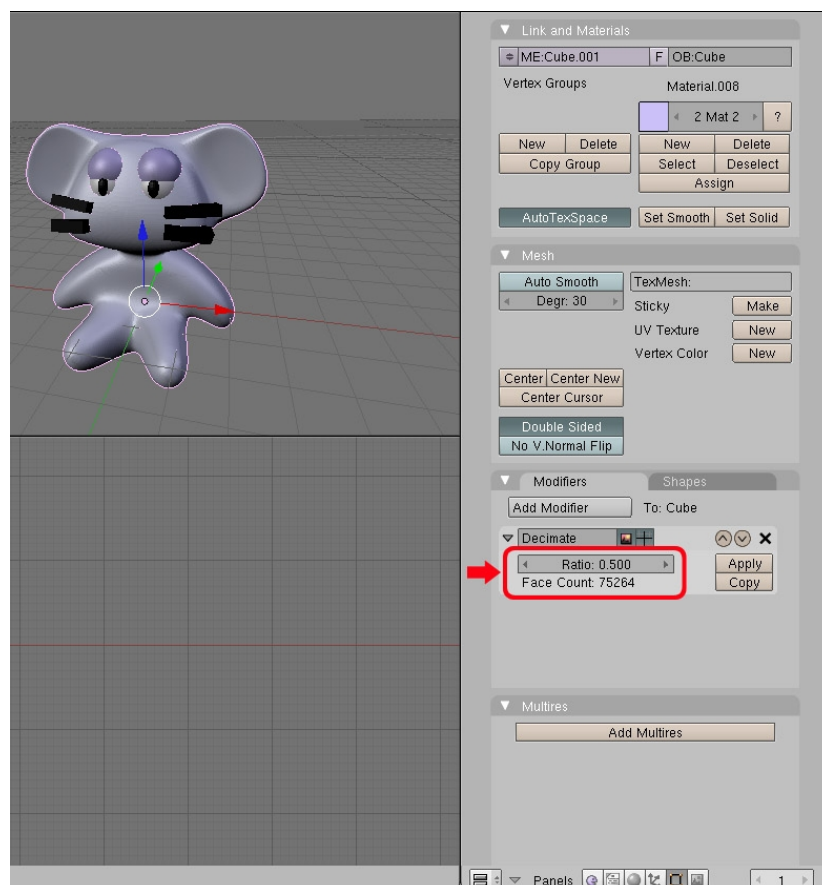
Import your model, select it (right click) and press F9 or click the Edit menu:



In the Edit tab, click "Add Edit" and select Decimate:



Set the decimation ratio (1 = original number of polygons; 0.5 = polygon count halved etc.):



Warning: The decimator will not always work when the model features geometric inconsistencies. If this is the case, you must fix the model first. You will find tutorials for this in the third section of this document.

Colours and textures

If your model features colours and textures, you will need to combine textures, colours and 3D model in a .zip archive. When uploading your 3D model to the site, remember to select the zip archive on your drive.

With a .3ds file, for instance, you must put the .3ds file and texture files (format: .bmp) together in a directory and zip it.

Warning: .obj files require a .mlt file (generated when exporting to obj with your modelling software) in addition to the textures. This file contains colour-indexing and texture data.

Because of its lack of limitations and relative compatibility with most 3D tools, the .obj format is recommended for coloured objects in general, although other formats are supported by Sculpteo.

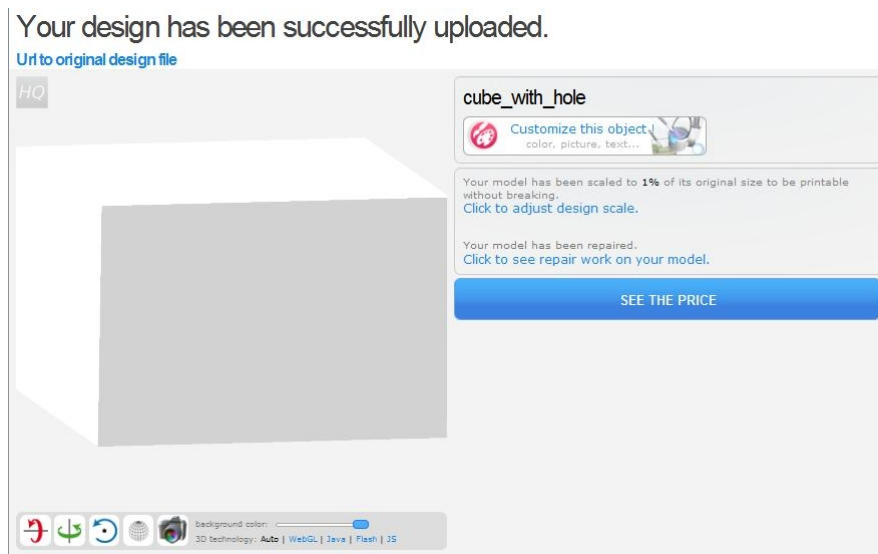
3. Geometrical errors: prevention and repair

a) Introduction

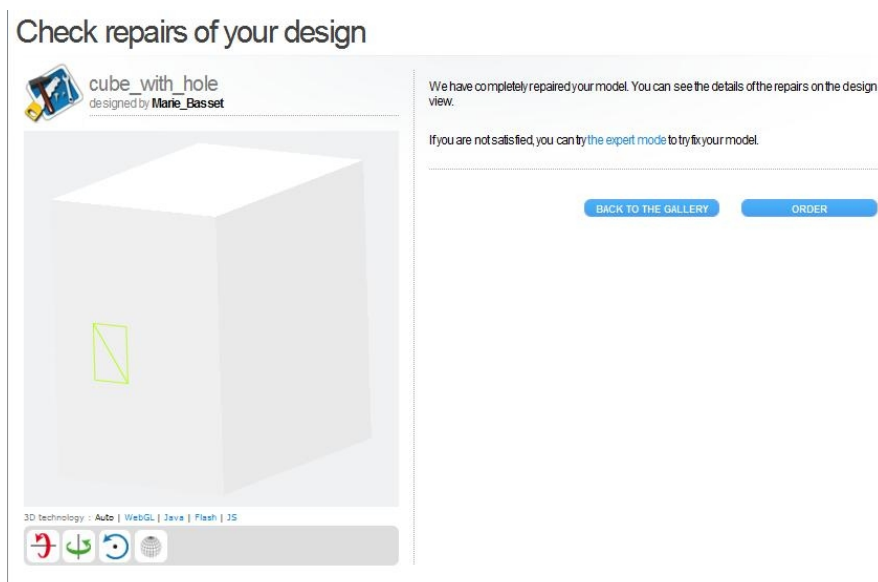
In order to be printed, 3D models must be geometrically correct. Many modelling applications generate errors in geometry without letting the user know this. The fact is that most rendering applications (3ds max, maya, blender...) are designed for video rendering, not 3D printing. A rendered object may look fine although it is actually not geometrically correct.

Sculpteo provides an online error-visualization system: simply upload your design to see if it contains errors.

Here, we have uploaded a cube featuring a small hole on one of its sides. This screen displays:



Click on « Click to see repair work on your model » to see the repairs. This screen displays:

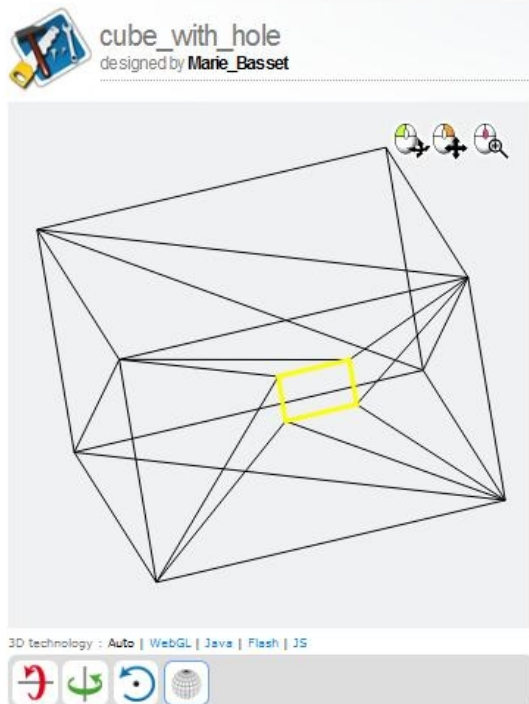


In the right frame, we read that our model has been repaired by the website, and we can click on « The expert mode » to see the problems.

This button allows you to view the problem with the hole:

Your design is not printable.

Your design geometry is broken. Try our manual method to repair your design!



We offer several methods to repair designs. These methods work more or less depending on the case. Try and choose the most suitable for your design.

SHOW ERRORS

SHOW BAD ORIENTATION

AUTOMATIC REPAIR

or

TRY THE PLUGGING

TRY THE RECONSTRUCTION

DIAGNOSTIC

- Design has 2 singular points
- Design has 4 border edges
- Design is not orientable

CANCEL

SAVE

You can choose different views:

- « Show errors »
- « Show bad orientation »

And the repair mode you want to try:

- « Automatic Repair »
- « Try the plugging »
- « Try the reconstruction »

The holes are highlighted in yellow, singular points in orange and singular edges in red. Later in this chapter, we will examine different types of problems, their causes and how to avoid them.

In any case, when working on a model, feel free to upload it to Sculpteo several times and use this tool to spot any issues.

Sometimes, the error is the result of a complex function, such as Boolean operations between two spherical forms in Blender which can destroy the model's topology. Other times, the cause is improper use of modelling methods. To avoid generating errors and prepare a printable model, the following points should be observed.

a. Elements with no volume

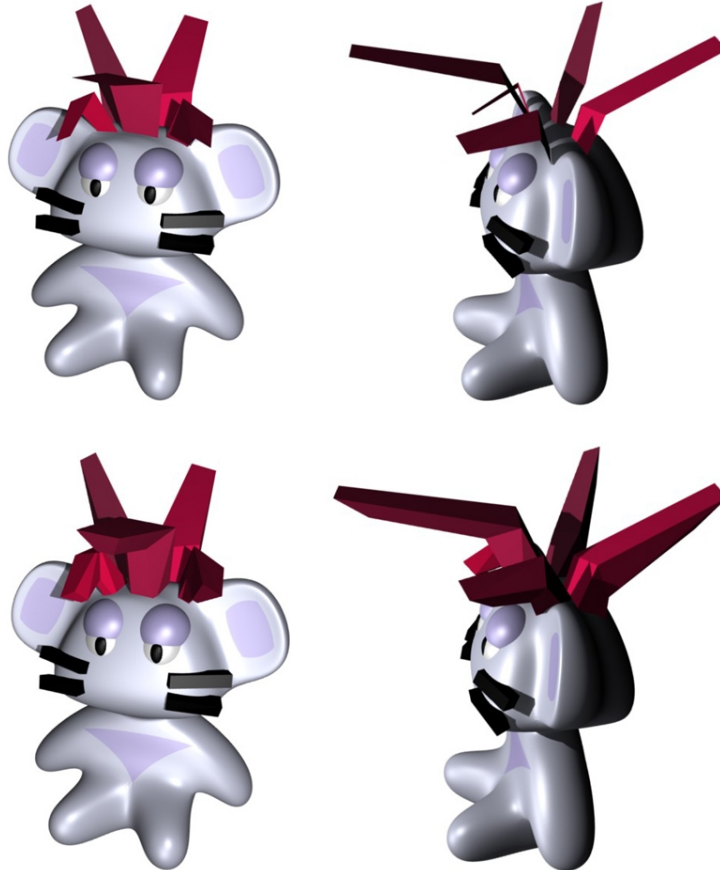
Models require some thickness to be printable. For some video game characters, for instance, hair is modelled with just a textured surface, which is fine for video rendering, but not printable. Before printing such models, they must be revised so that each element has a thickness.

We have placed hair on our creature's head, modelled in simple surfaces. As it stands, the model cannot be usefully uploaded to the site as some parts of the object have no volume.

How to fix this

All faces with no thickness must be extruded. It is best to add a fair amount of thickness to make the element solid.

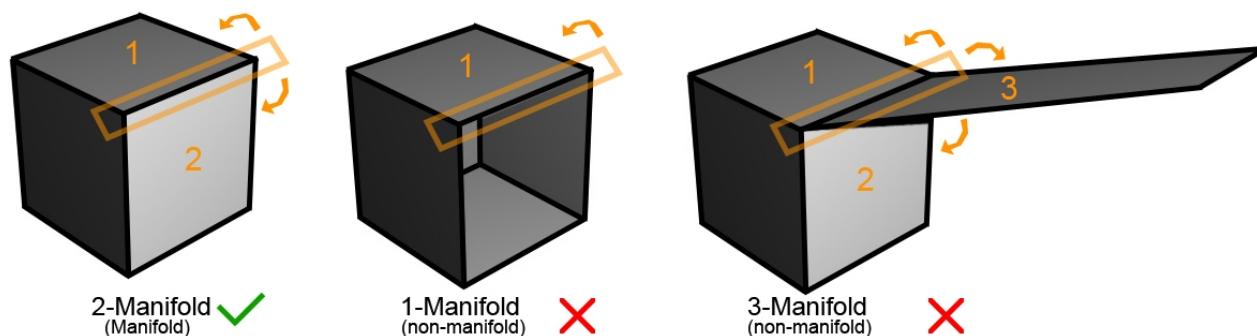
Here, we have strengthened our character's hair:



b. Non-manifold models

Non-manifold edge (singular)

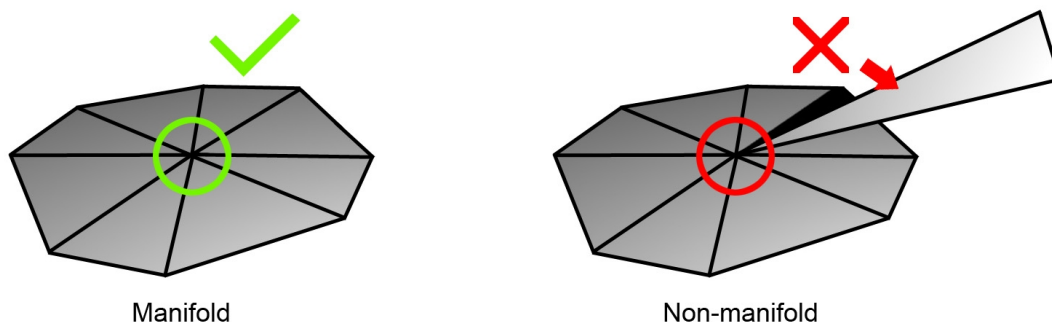
For a 3D model to be correct, every edge needs two adjacent faces - no more, no less. Otherwise, the edge is non-manifold, and the object volume cannot be correctly calculated.



Non-manifold point (singular)

Another requirement is that any point must belong to just one face. When two faces share a point without sharing a common edge, the point is known as non-manifold.

Example :



Such errors may occur for multiple reasons. Some are fairly common, and our algorithms can handle them:

- Faces trapped in a volume
- Double points
- Border edges
- Separate volumes connected by an edge or point.

How to fix this

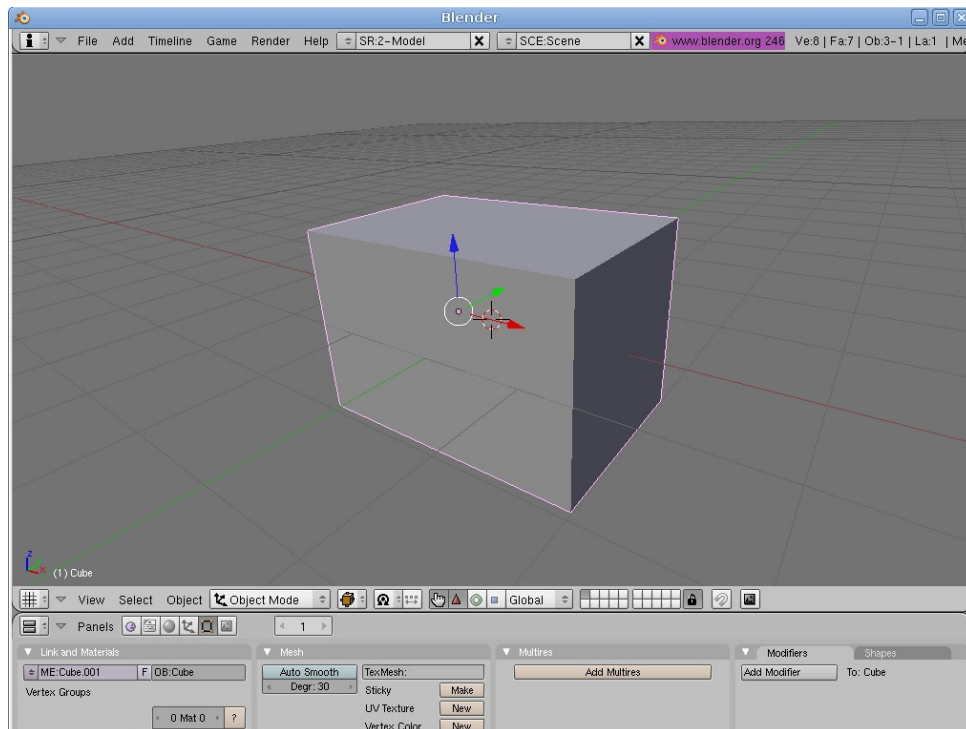
You must start by identifying non-manifold edges and vertices. Most 3D modelling applications offer this kind of detection. We'll examine how, with Blender ([download here](#)), we can detect these errors and correct them.

After importing the 3D model, you must select it (right-click) and go into edit mode: tab key. When switching to edit mode, all points are selected by default. Deselect all with the 'a' key. Click on the select -> non-manifold menu or use keyboard shortcut "Ctrl-Shift-Alt-M".

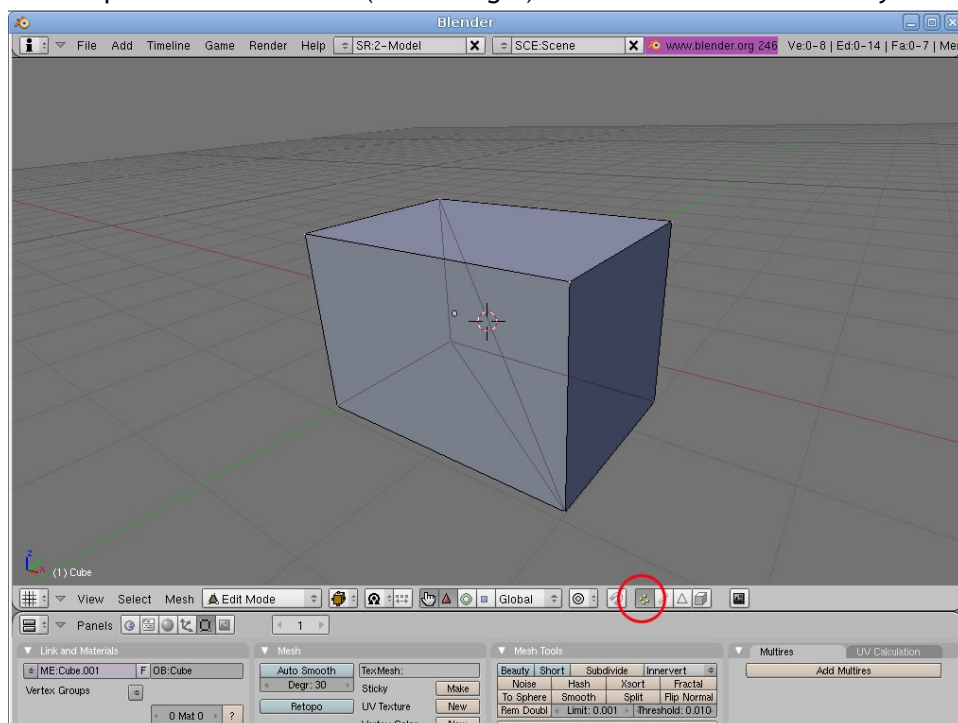
This displays all non-manifold points requiring work. Here, we will discuss simple examples.

Faces trapped in a volume

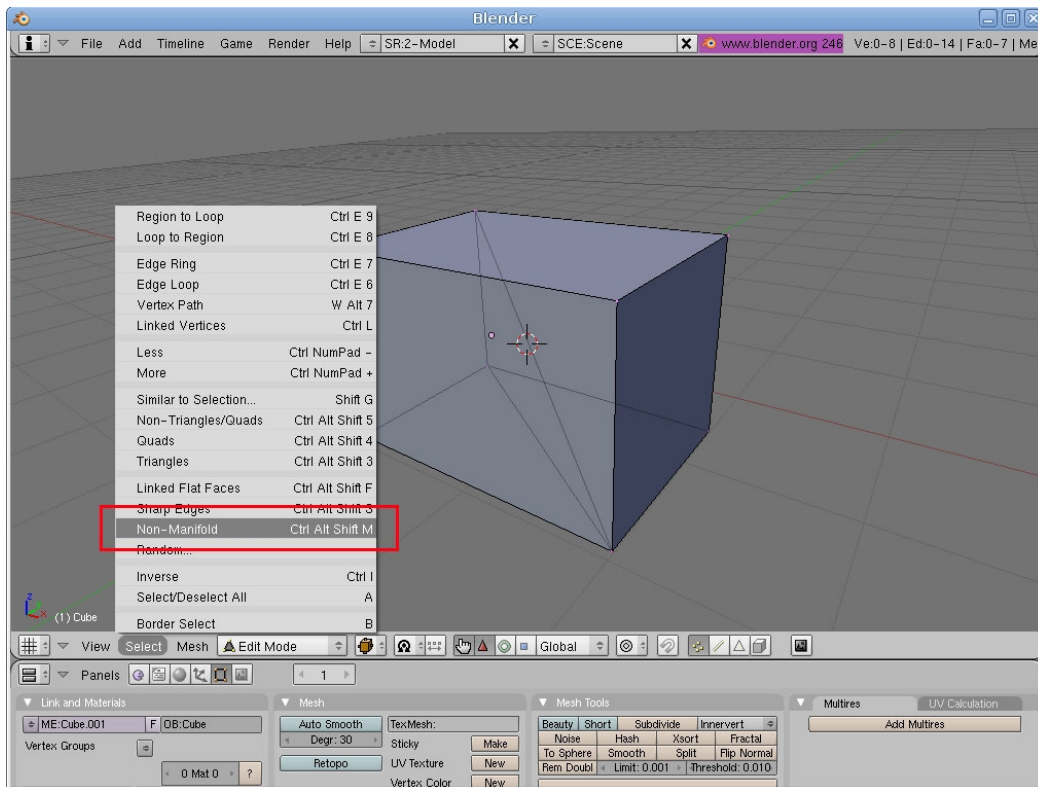
We have imported a simple model: a cube. Start by deselecting all ('a' key = select all/deselect all). Select the model with a right click:



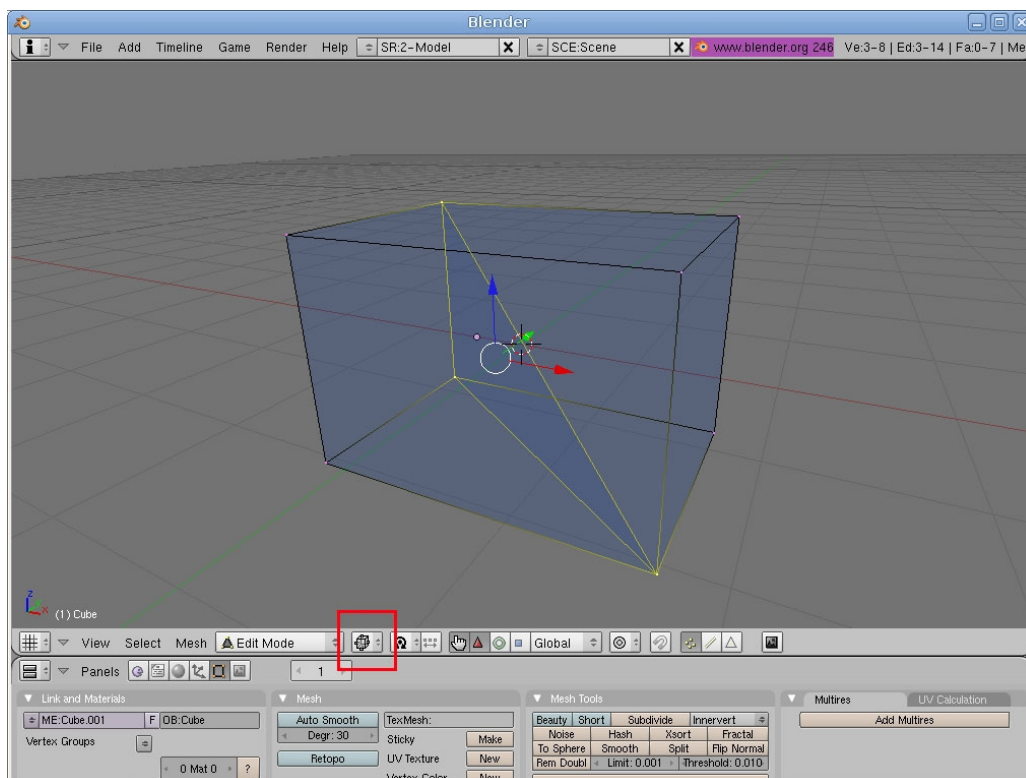
Then to edit mode (Tab key), the model structure displays. Make sure you are in point selection mode (bottom right). Deselect all with the 'a' key:



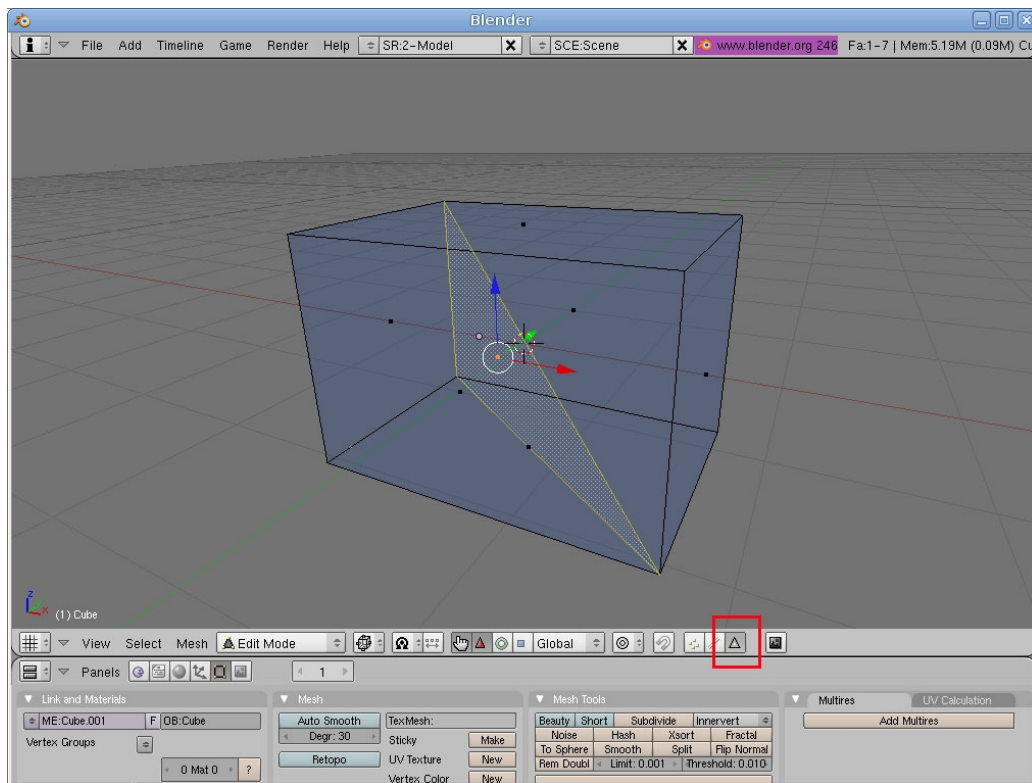
Click the "Select" menu then "Non-manifold" or use keyboard shortcut "Ctrl-Shift-Alt-M".



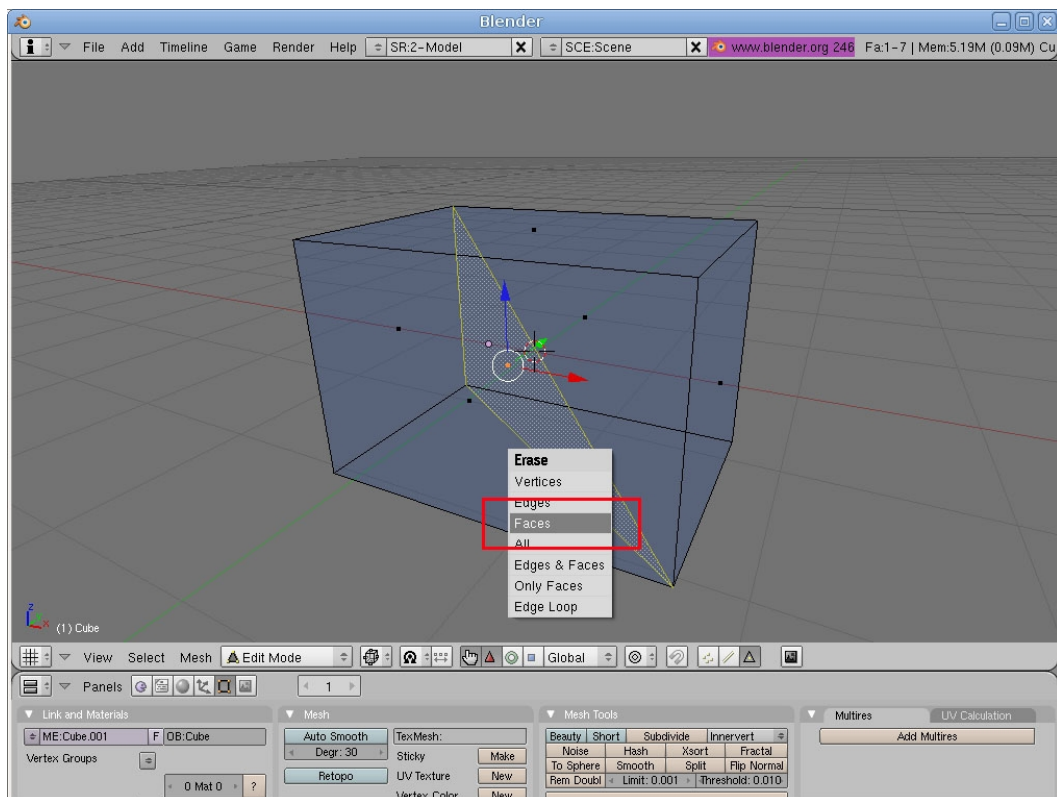
Switch to wireframe mode - "Z" key or Wireframe button:



Problematic vertices appear. You can see there is a face inside the model.
This is a geometrical error. Switch to face selection mode (bottom right) and select the relevant face:



Press the “Delete” key and select “Faces” to delete the problematic face.

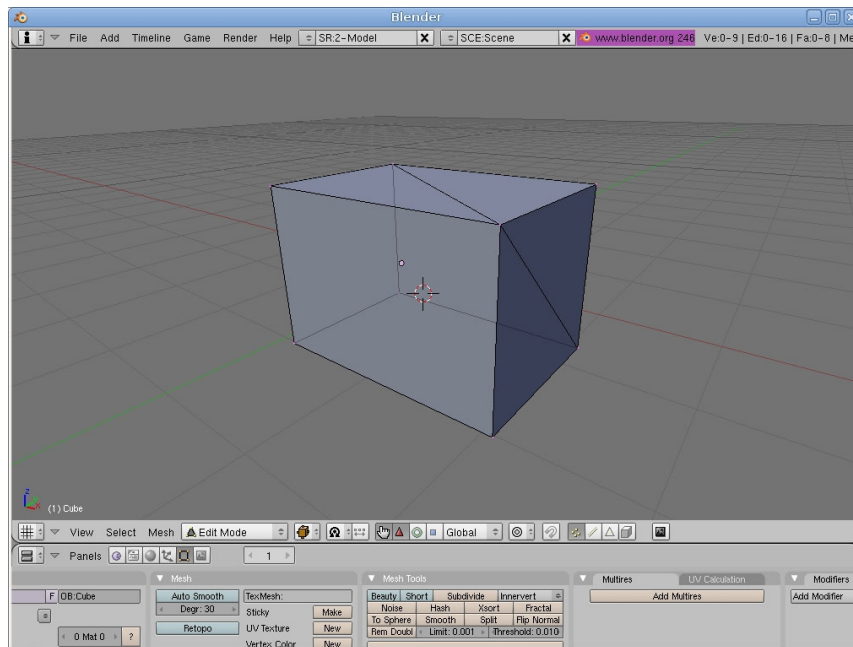


You can then deselect all, switch back to point selection and reselect non-manifold points with “Ctrl-Shift-Alt-M”. You will notice that nothing has been selected this time, meaning that the model is manifold, i.e. correct.

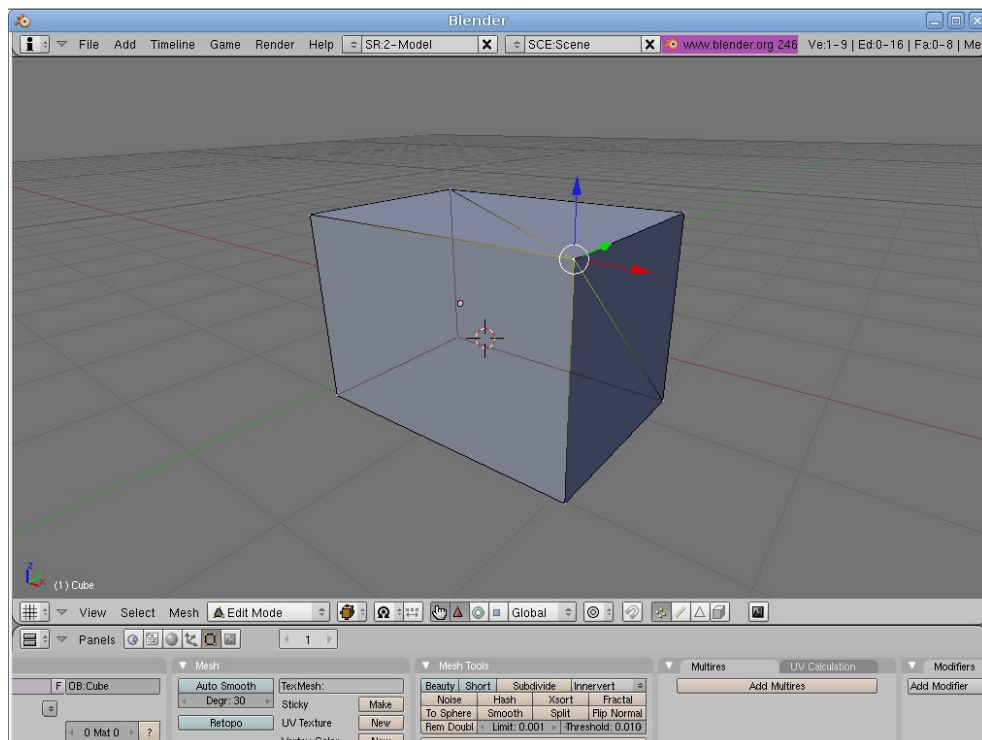
Note: The issue could have been a single edge trapped in the model. In this case, delete the edge as you would a face (edge selection mode).

Double points

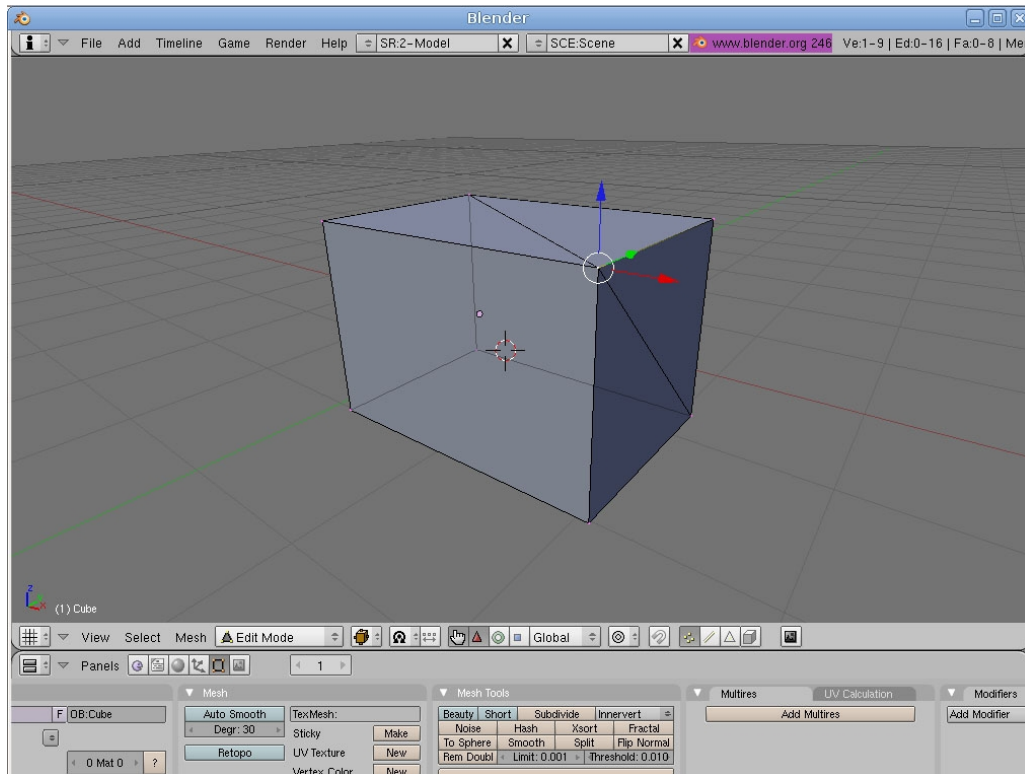
We have imported another cube. Switch to edit mode (Tab key) and point selection mode:



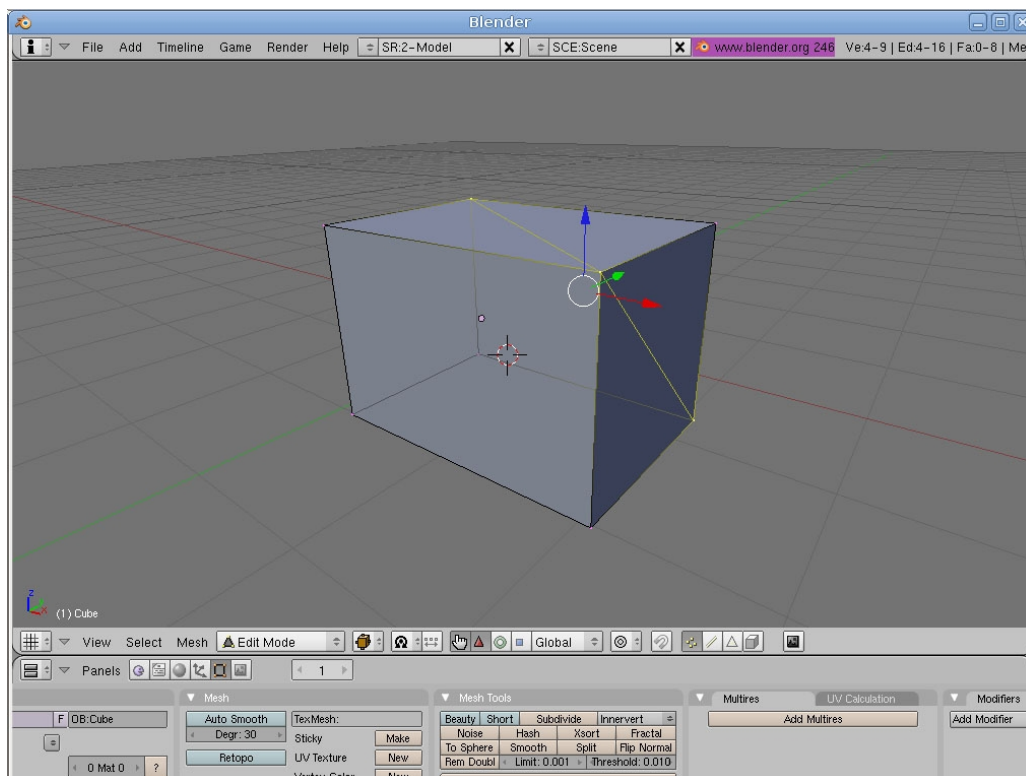
Apply the selection test for non-manifold points ("Ctrl-Shift-Alt-M"):



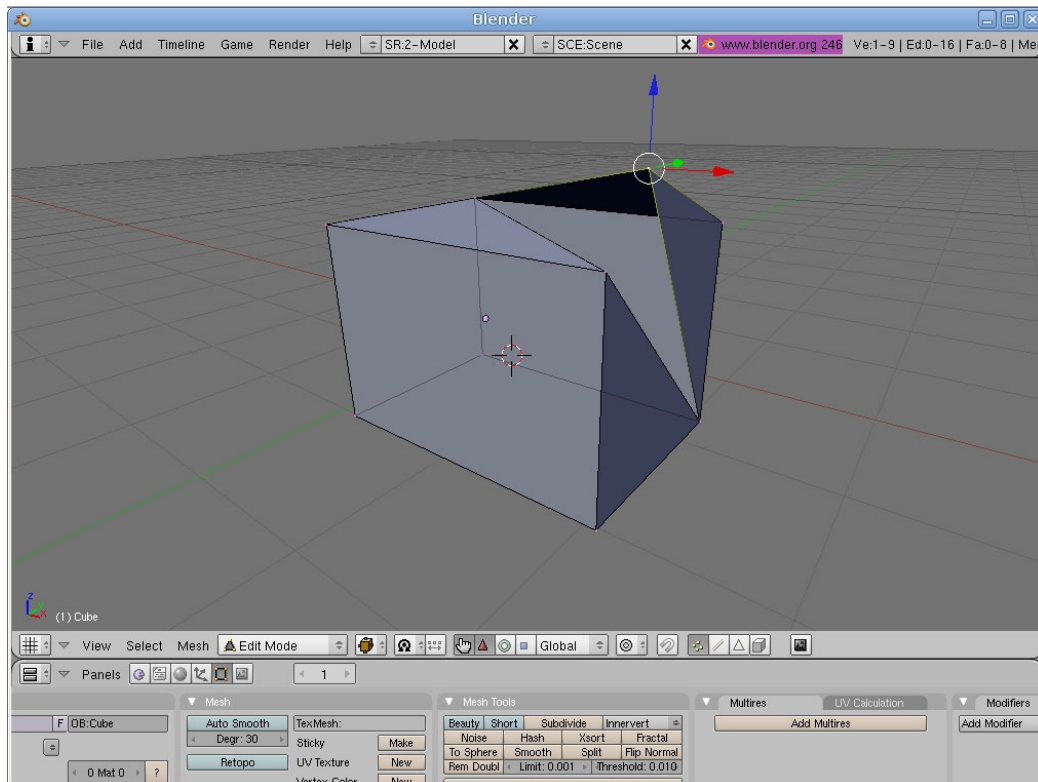
You will note that there are three non-manifold points, but clearly no face inside the model. Let's now turn to the central point, which is likely to be causing the problem. Right-click to select it.



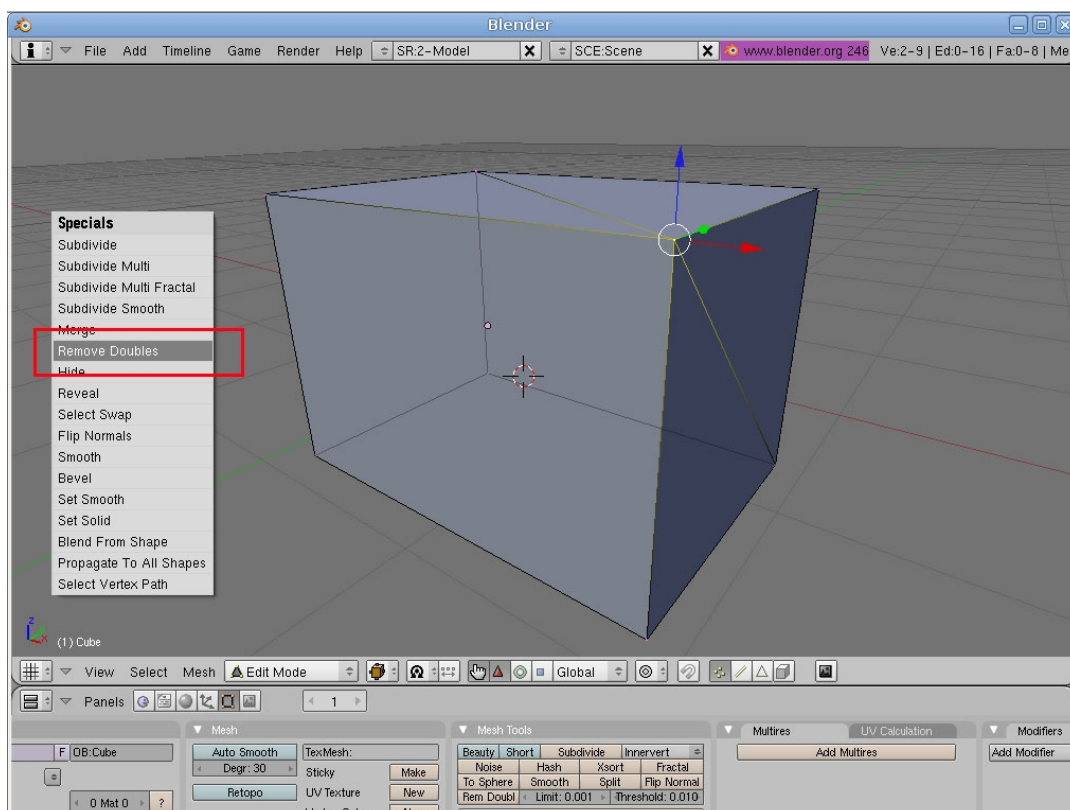
You will note that if you reselect it (right-click the same spot again), you select another point, apparently confused with the first one:



Make sure the points are distinct by trying to move the selection with the "g" key. When you move it around a little, you will see that there are two points on the vertex. Right-click to undo the movement:



We now select both points together: hit the "B" key and draw a selection square around the top. Both points are selected. Now, we hit "W" and choose "Remove Doubles".

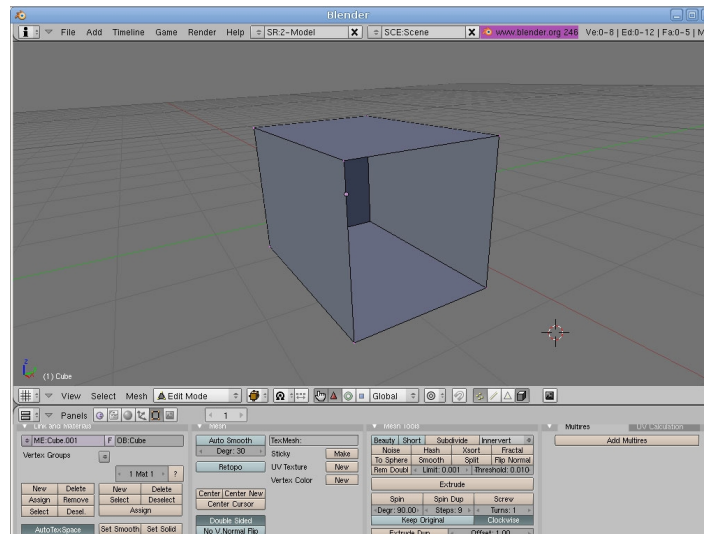


This merges the two points. Now, if you unselect all ("a" key) and select non-manifold points ("Ctrl-Shift-Alt-M"), we see no point is selected. The model is now correct.

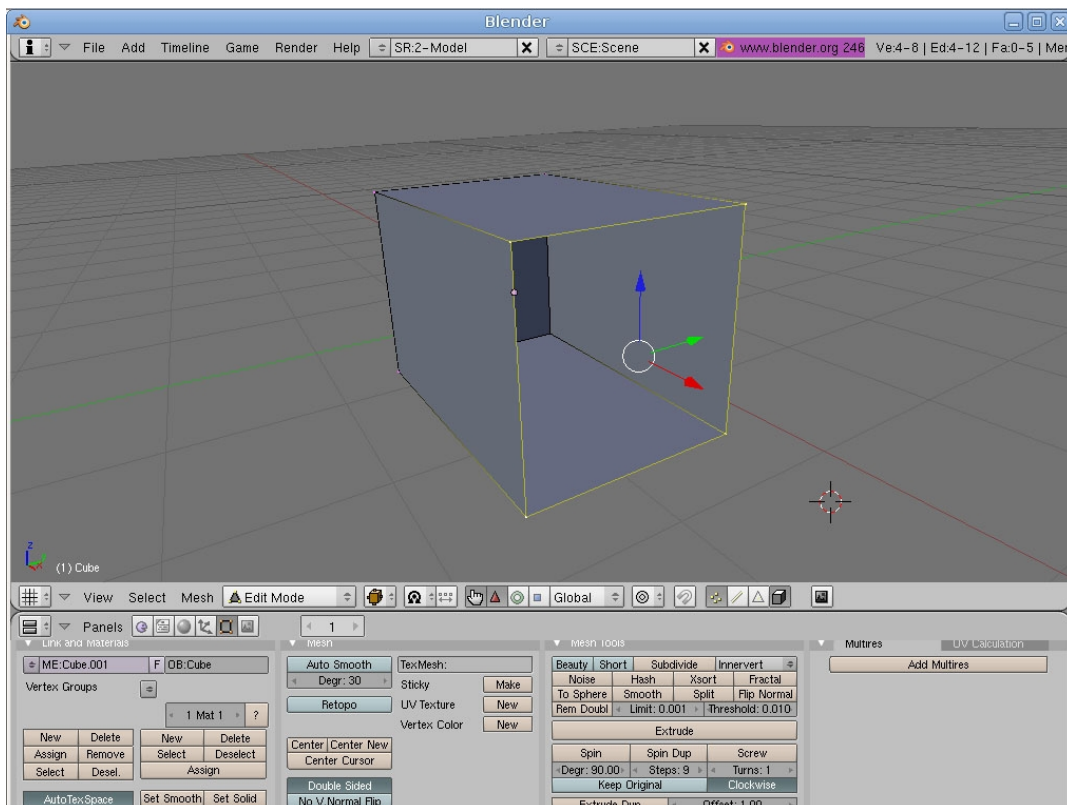
Note: with STL files, when you apply the non-manifold point selection test, the entire model is selected. This is because STL files save only positions of facets in space and not their connections. The points appear as often as they are present in a facet, without taking account of connections between facets. In this case, you must select every point in the model: in editing mode (Tab key), select all the points if required ("A") and press "W". Select Remove Doubles.

Border edges

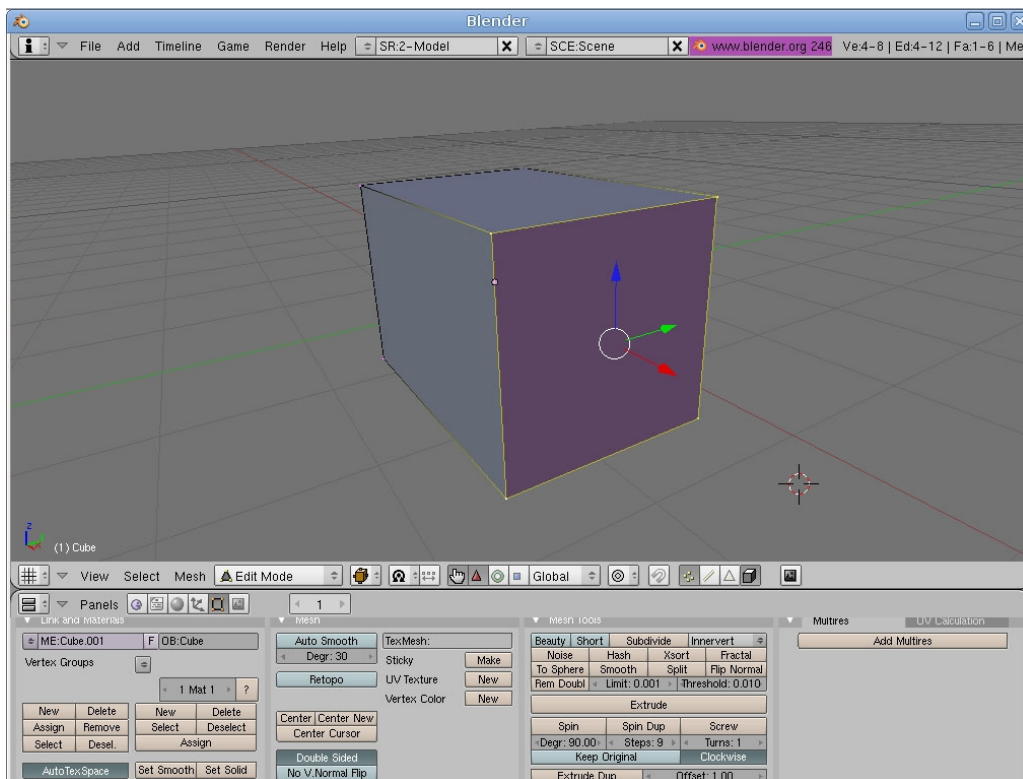
We have now imported a new cube. Switch to Edit Mode (Tab key) and point selection:



You will notice a hole in the cube, meaning it has no volume. The edges along the hole border are known as border edges. You must close the hole to repair this model. Select all points around the hole:



Press the "F" key. A face has been created within the points:

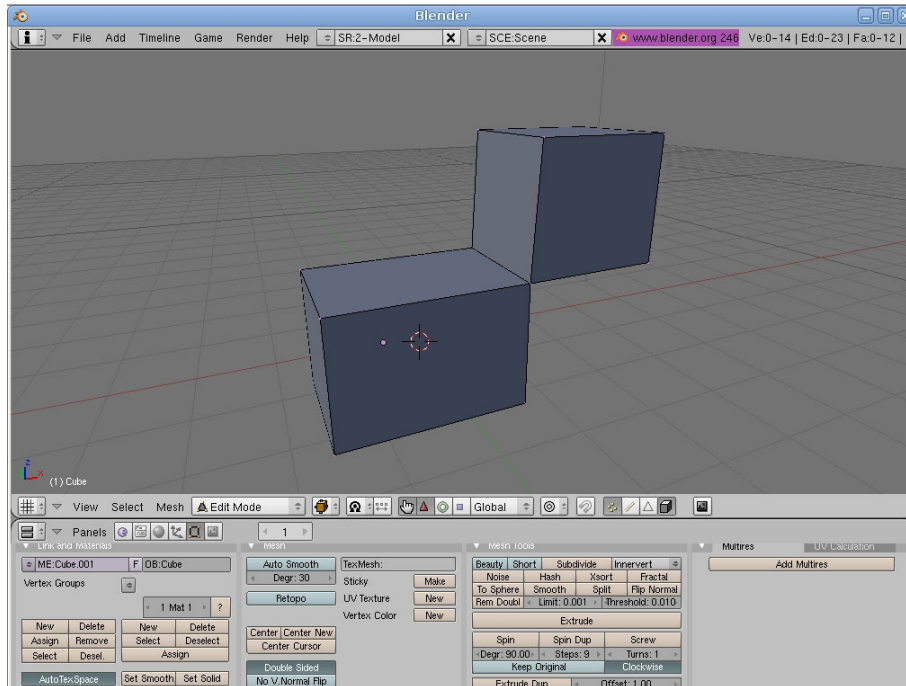


The model is now geometrically correct.

Note: The "F" key can also be used to connect 2 points and create an edge.

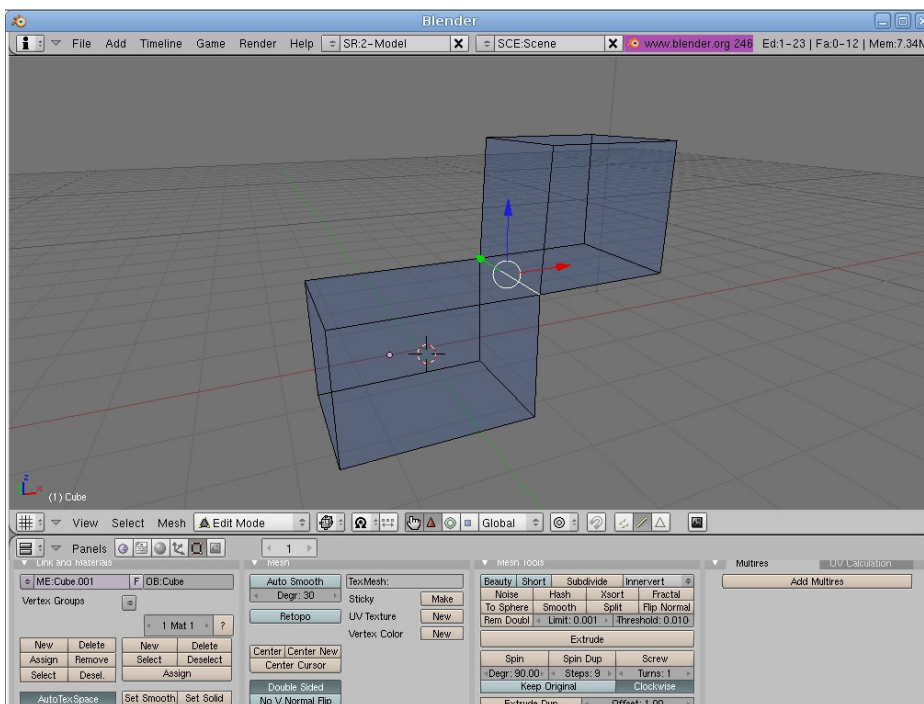
Separate volumes connected by an edge or point

We have imported a new model. Switch to Edit Mode (Tab key) and point selection:

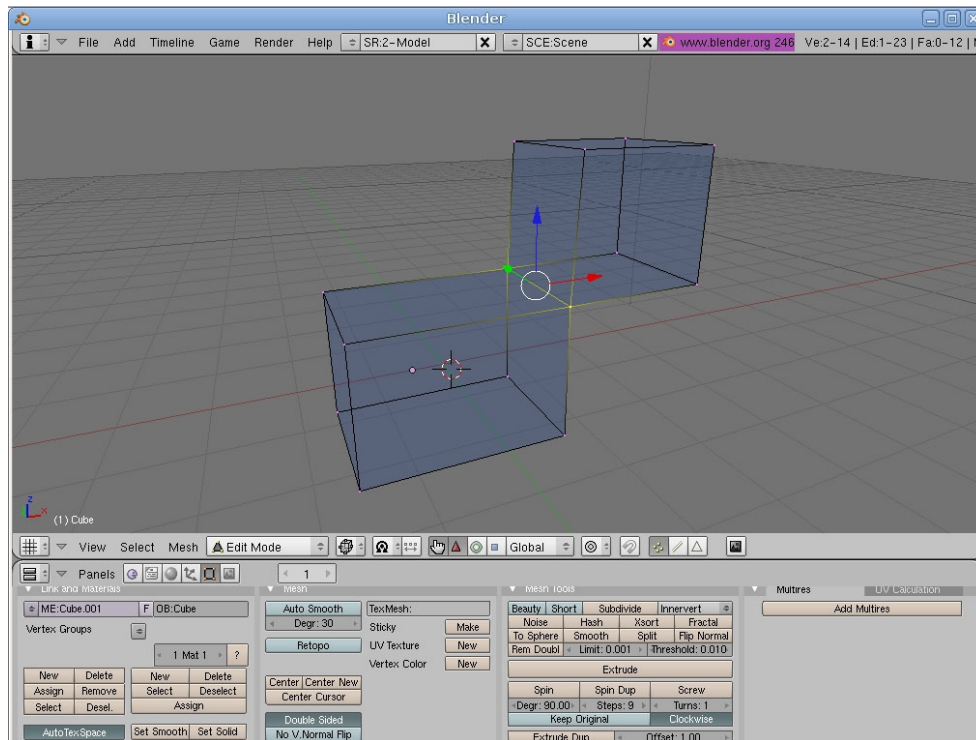


This model is not valid, as the connection between the two cubes is flawed and cannot be printed - the connexion has no volume. Let's remove the connection to create two separate cubes.

In face selection mode, if you test for non-manifold edges ("Ctrl-Shift-Alt-M"):

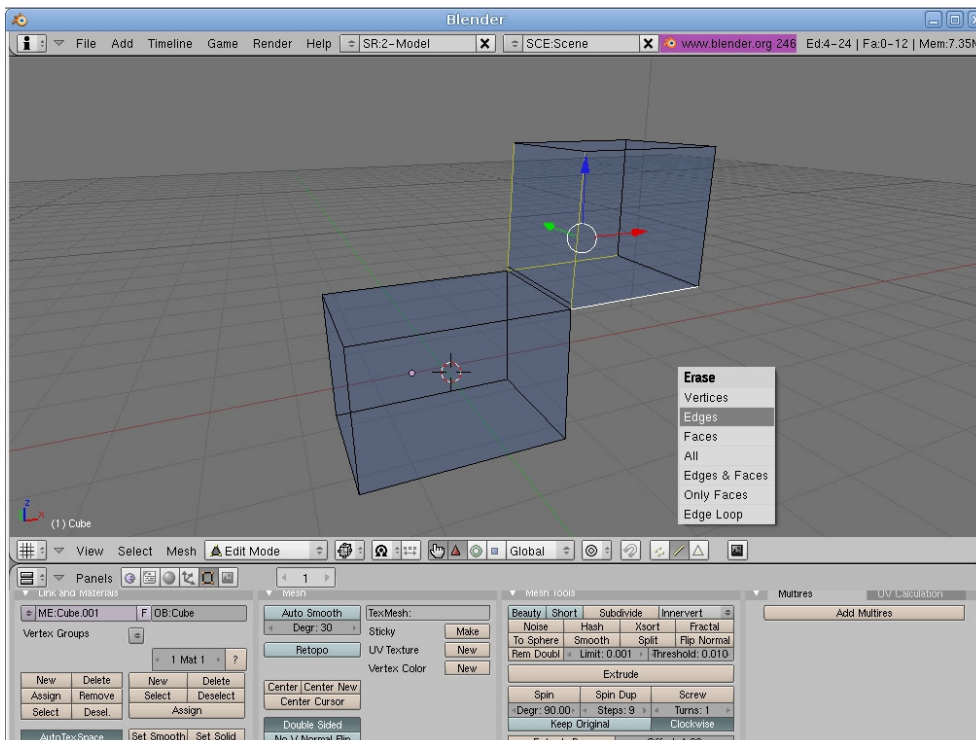


You will see that the non-manifold edge is indeed at the connection. Switch back to point selection mode and select the two points at either end of the edge:

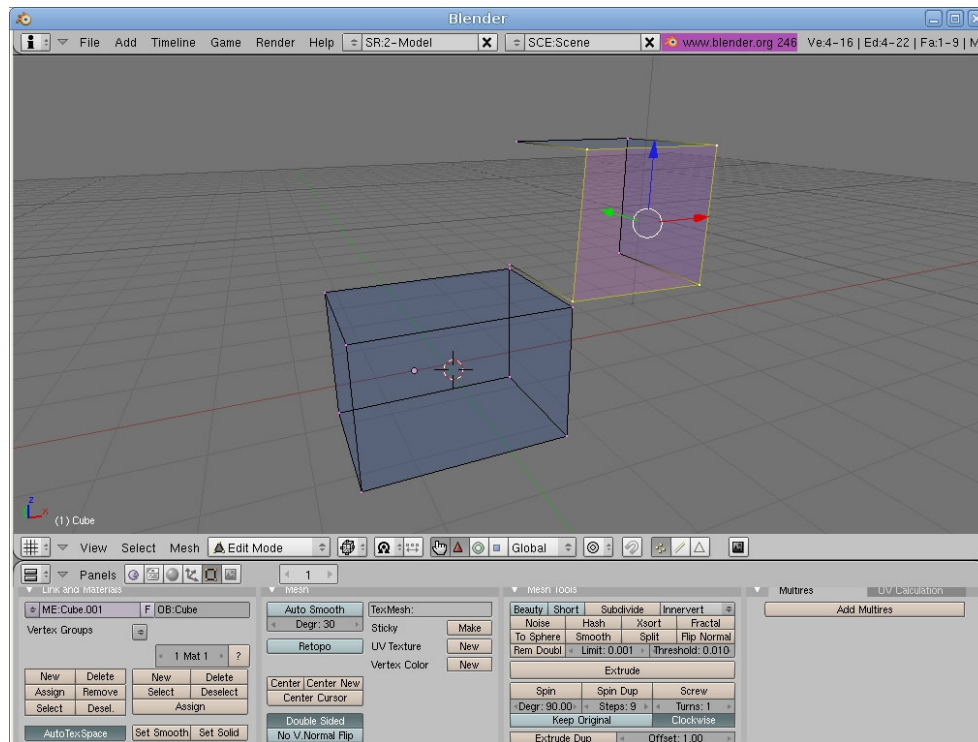


You must now duplicate the two points. Press Shift + D (duplicate). Then press "Z" (to act on the Z axis) and move the points up a little with the mouse.

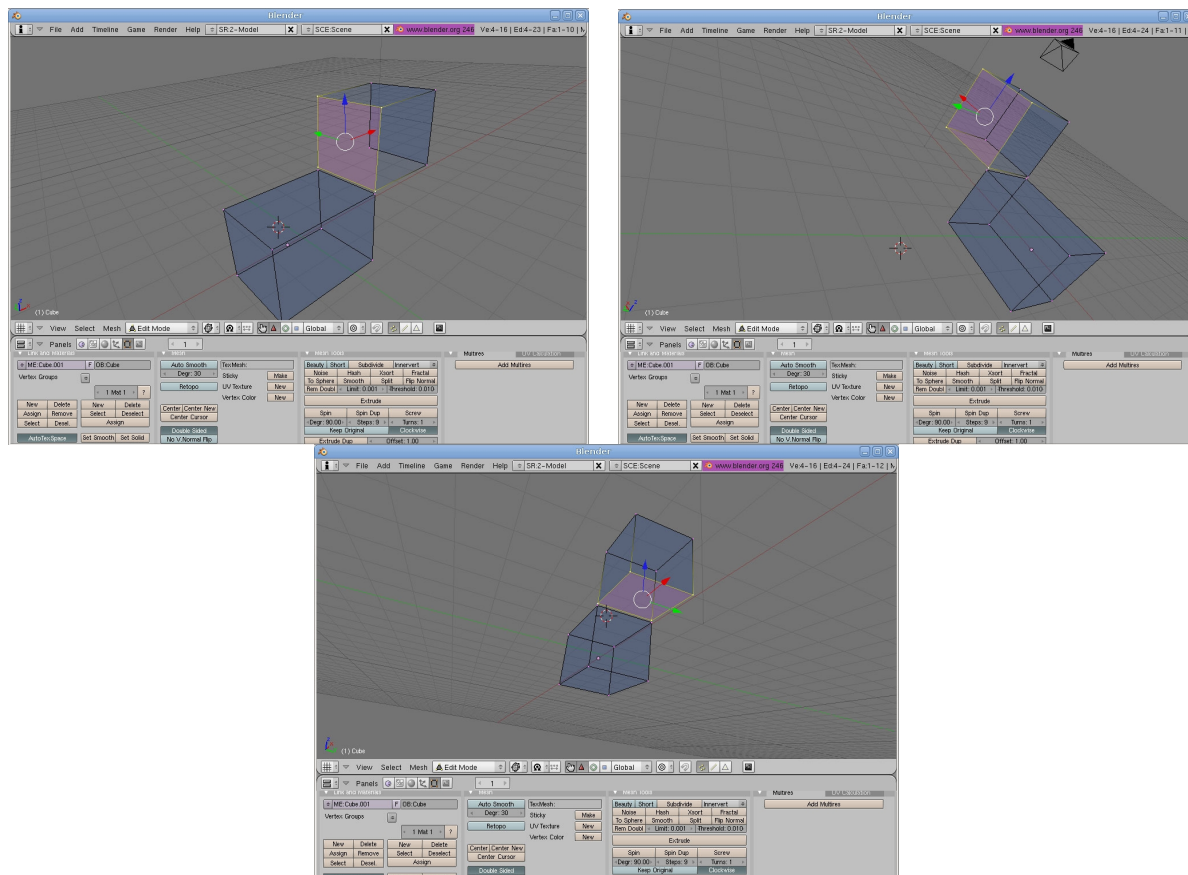
Hit the "F" key to connect the two points. We have a new edge just above the first one. Let's now destroy what connects the top cube to the bottom one, then rebuild the top cube. Select the following edges:



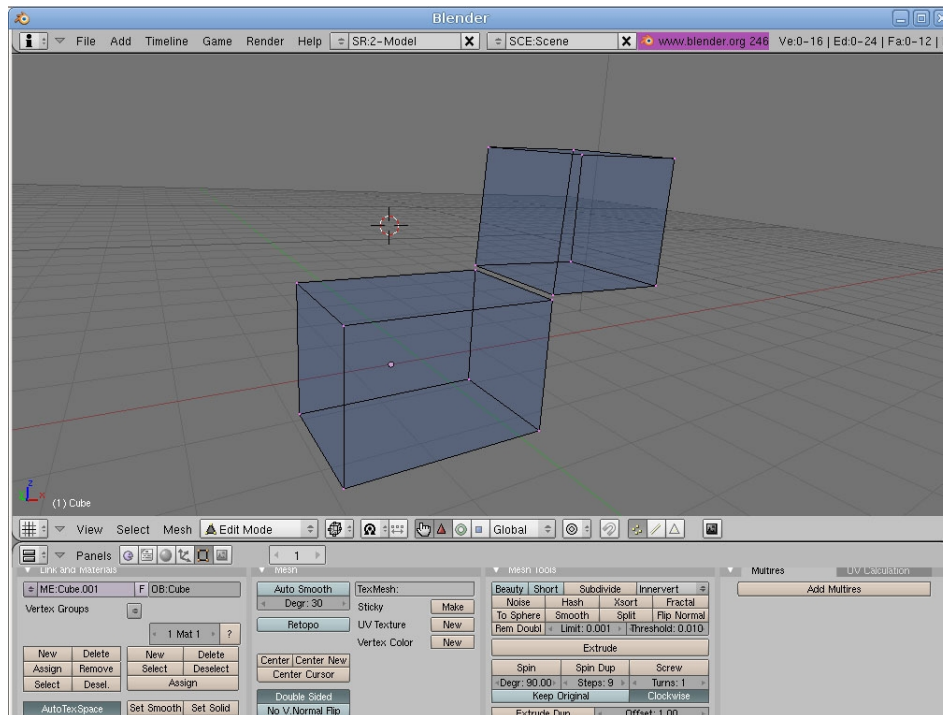
Hit the "Delete" key -> select "Edge". Once the edges have been deleted, you must now rebuild the cube. Select the points as follows, using the edge duplicated earlier as a new border for the cube. Press the "F" key to create the new face.



Proceed likewise to re-create all the cube faces:

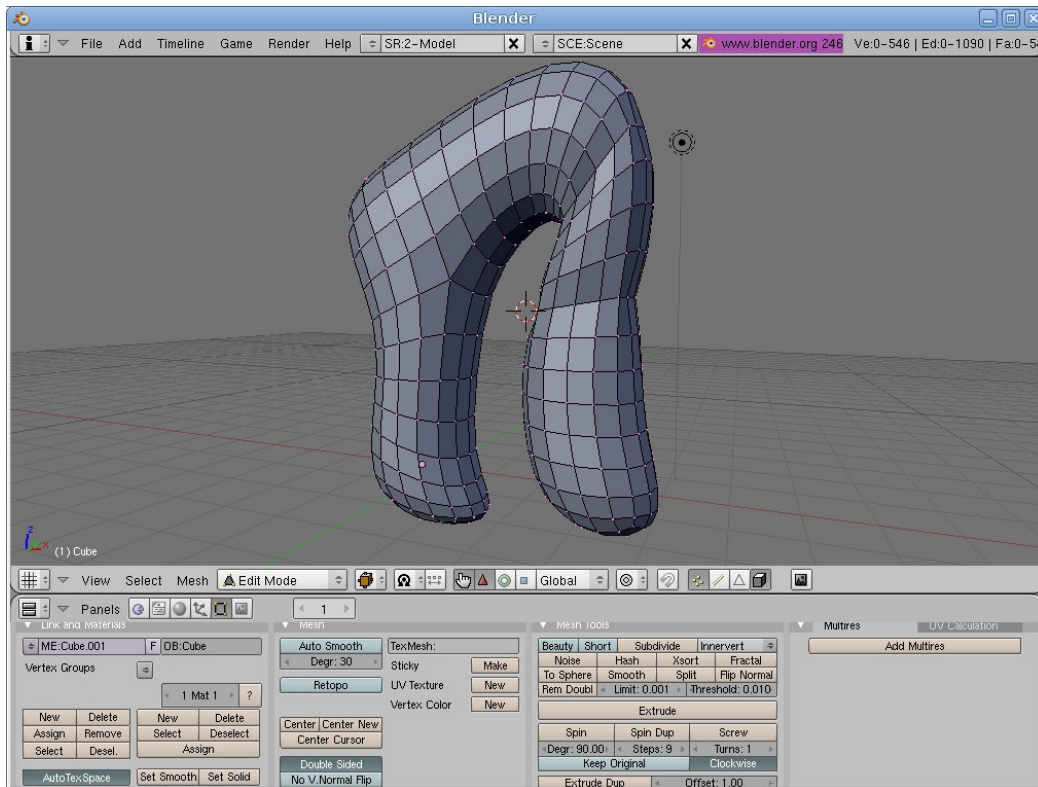


We have two fully separate cubes - the problem connection is gone. The model is now correct:

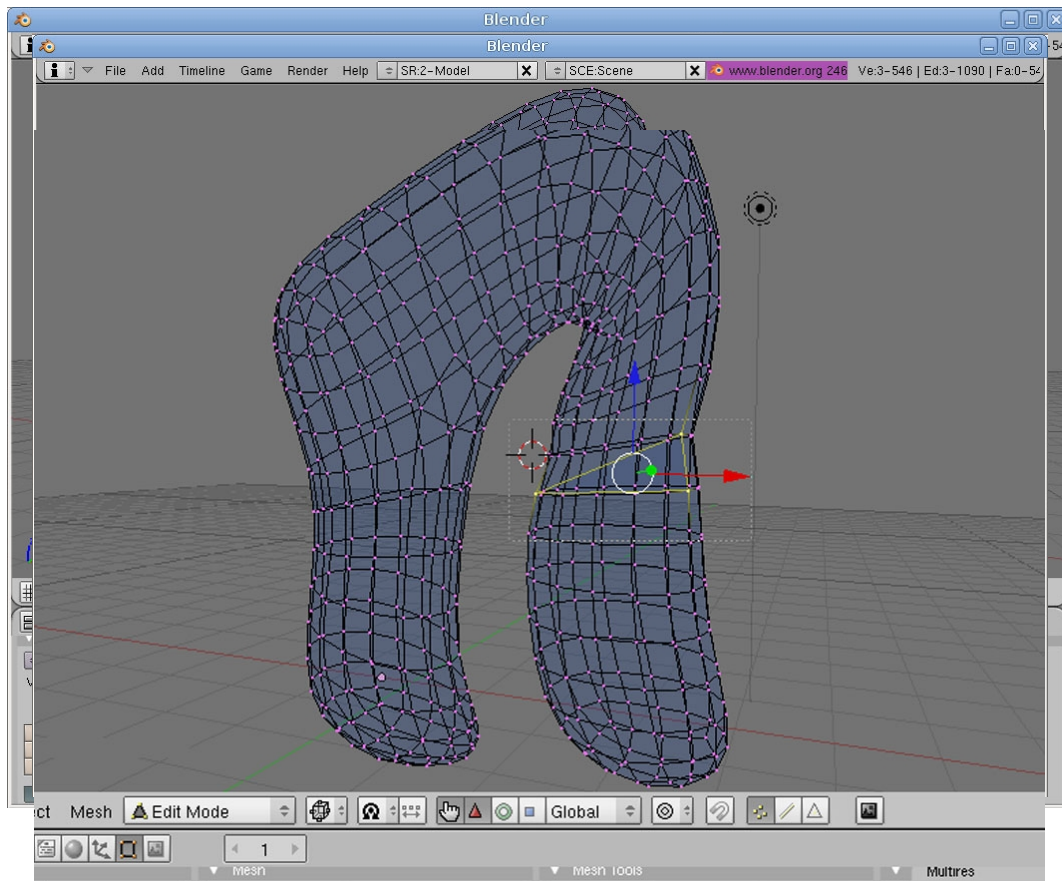


Complex models

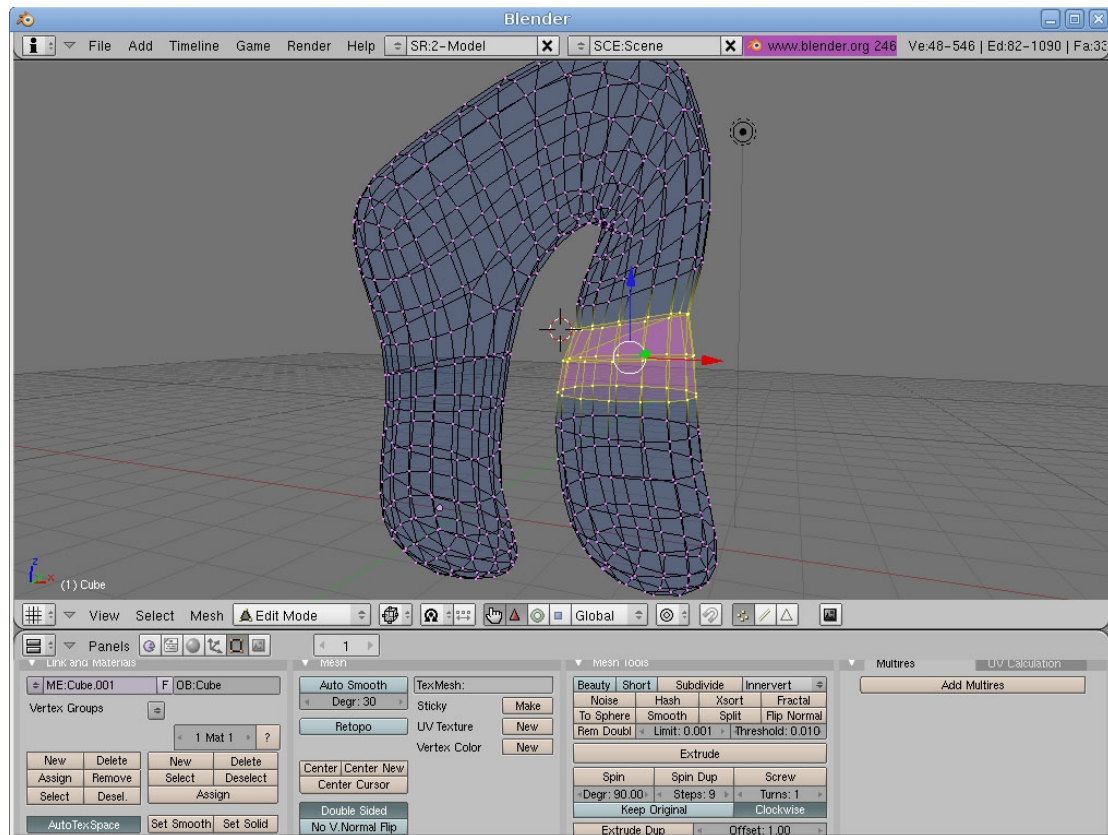
We have imported a new model. Switch to Edit Mode (Tab key) and point selection:



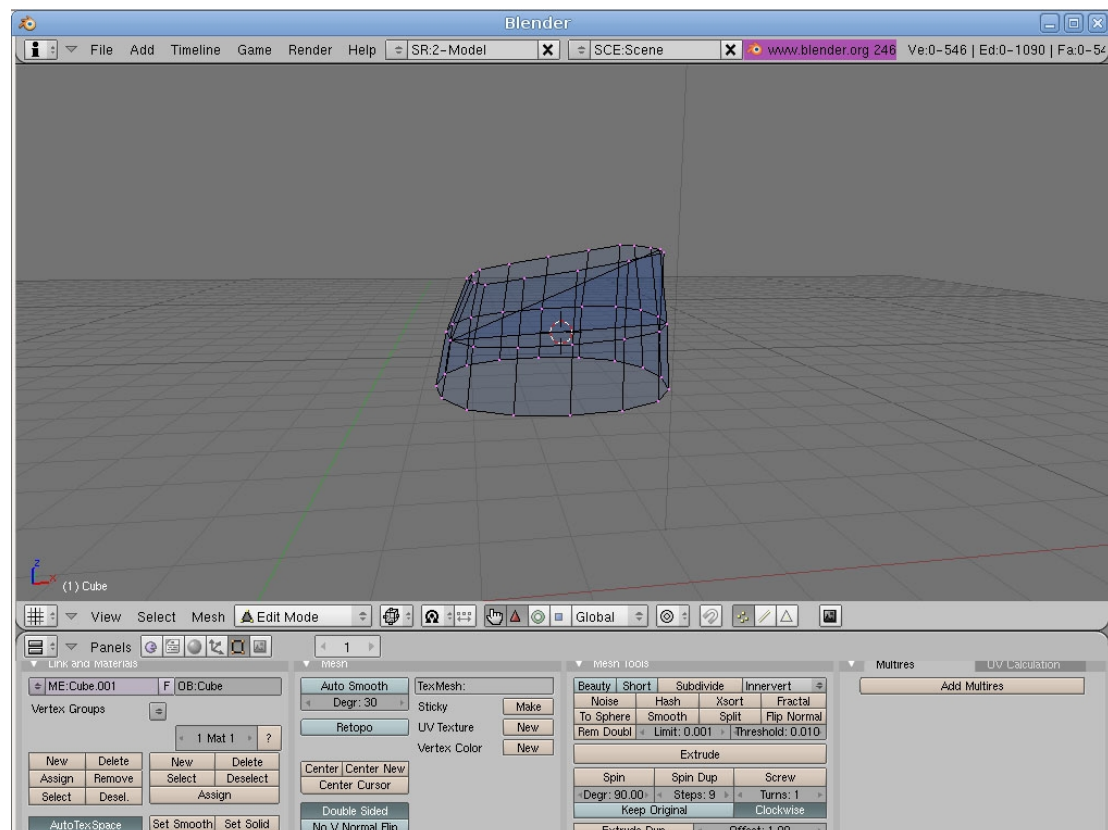
Then to wireframe mode (press "Z"):

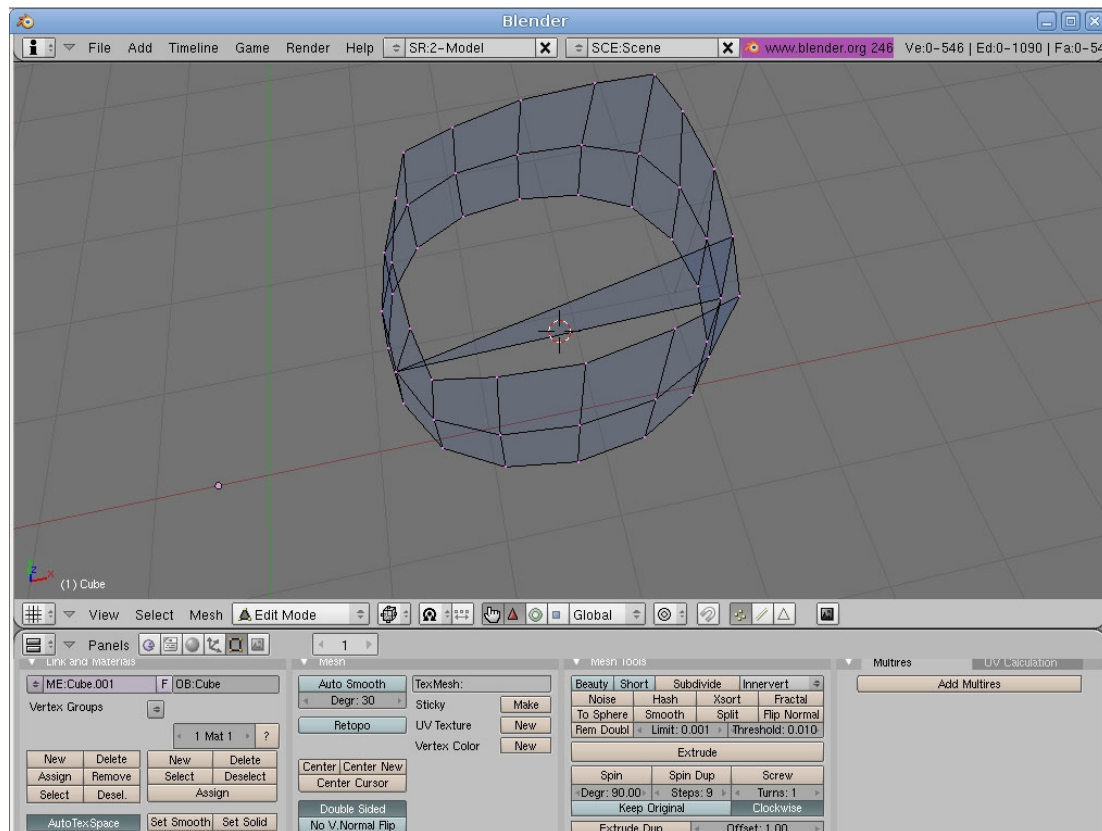


Note: You can also, after selecting the non-manifold points, use board shortcut “Ctrl-Numpad” to select all points around points already selected.



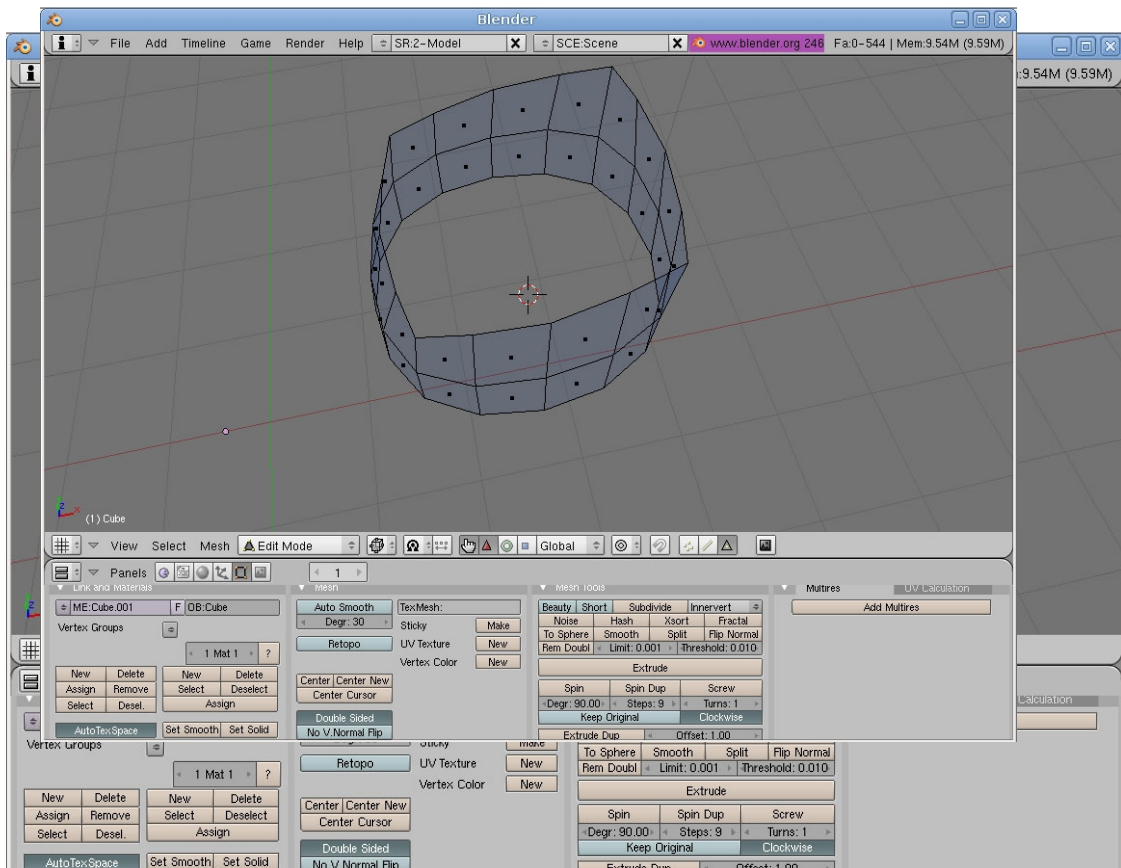
Next, hide everything not selected with “Shift-H”:



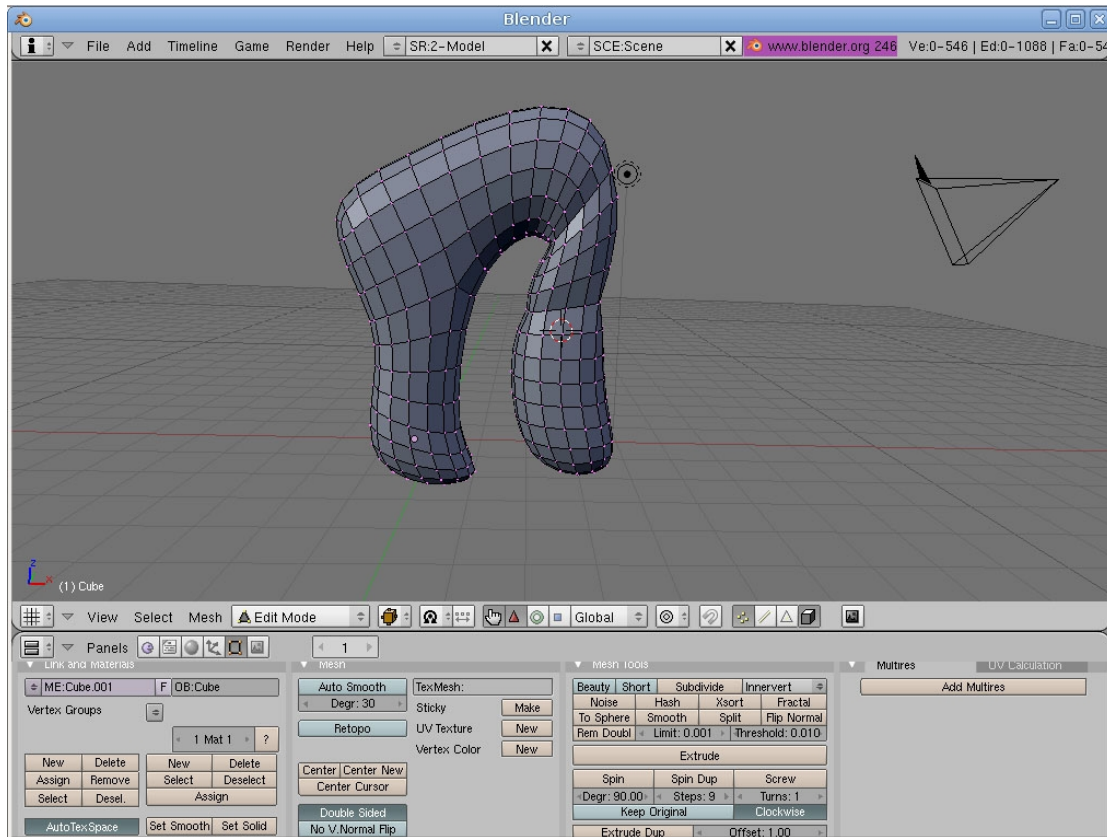


This makes it easier to handle the error. We can now see that its origin is an undesirable face inside the mesh. Select (right-click in face selection mode) and delete (Delete key, then Faces)

The problematic facet disappears:



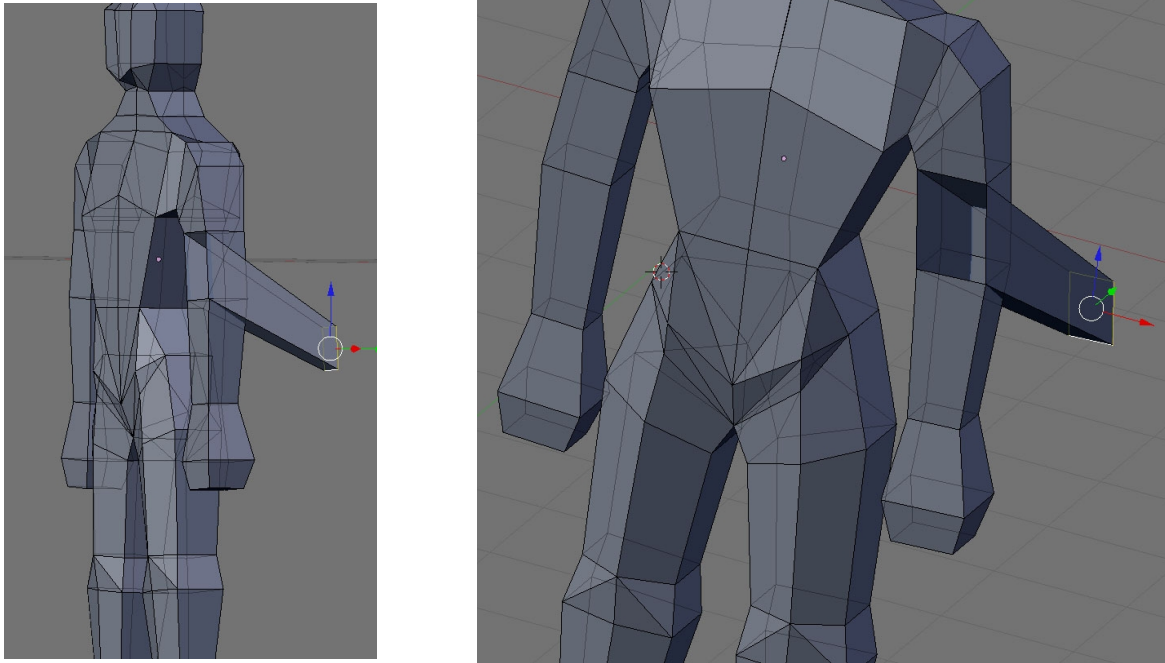
The rest of the model reappears when you hit “Alt + H”. The non-manifold point selection test (with “Ctrl-Shift-Alt-M”) now shows no points. The model is correct.



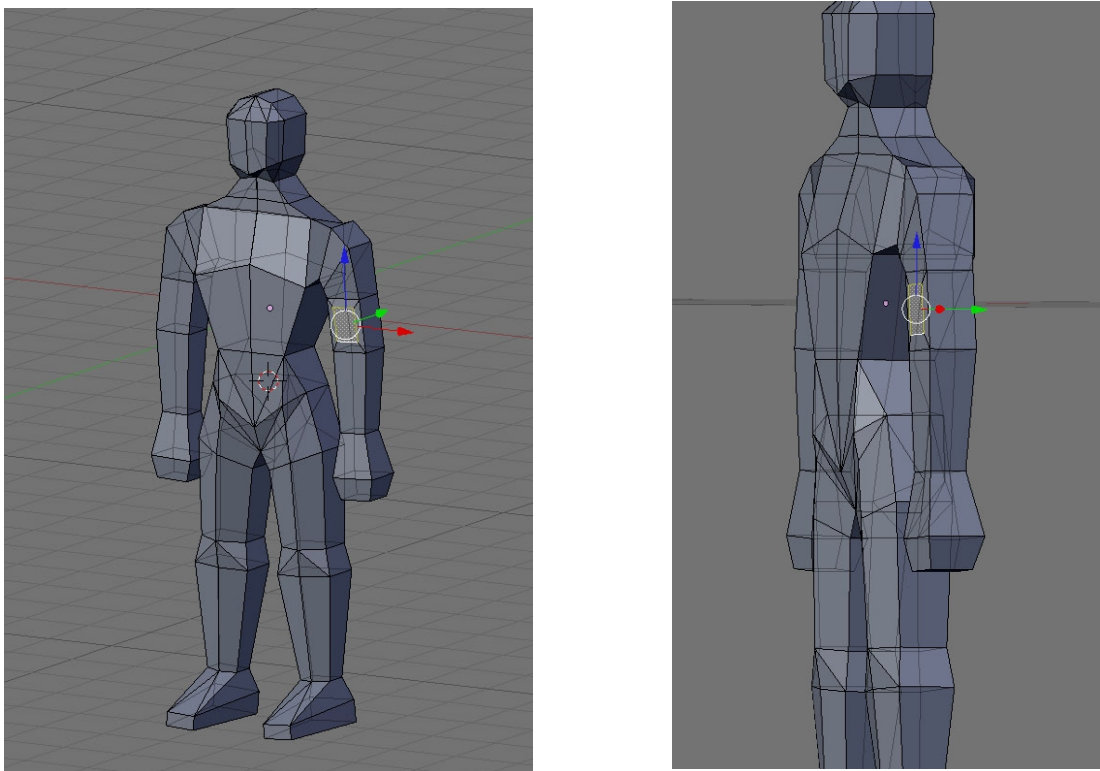
c. Overlapping surfaces (self-intersecting)

In 3D modelling, some errors such as overlapping surfaces make the model incorrect, as separation between inside and outside the object is unclear.

Here's an example:



You should check the model before uploading it to Sculpteo and reposition the facets correctly:



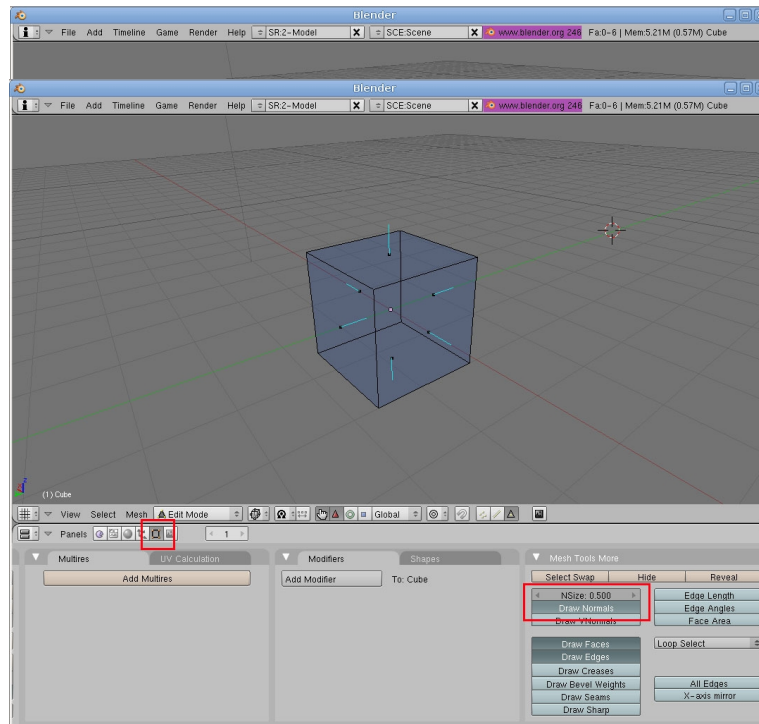
d. Volume orientation

The volume defined by a 3D model must be correctly oriented, i.e. the normals of the model's "skin" faces must all be facing outwards.

The model's volume is not properly defined when two adjacent faces have reversed normals. Problematic faces should be turned over to make the model printable.

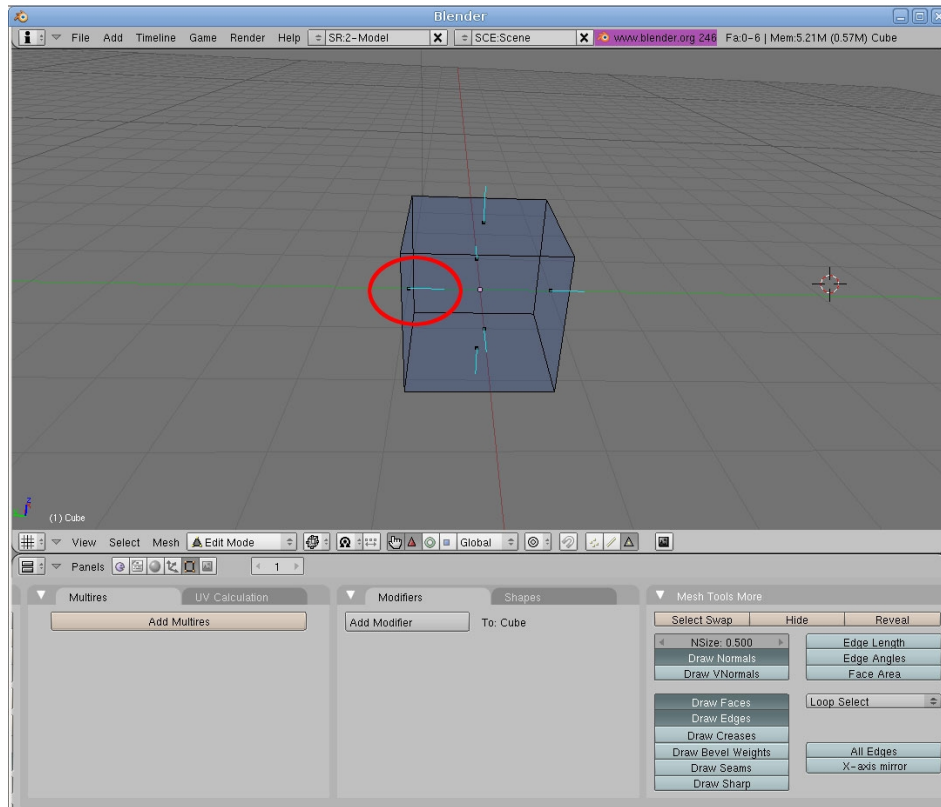
You can check the orientation of normals with Blender.

Here, for example, we have imported a simple cube with normals that are oriented inconsistently. Switch to edit mode (Tab key) and face selection. Deselect everything ("a" key) then switch to wireframe mode ("Z" key):

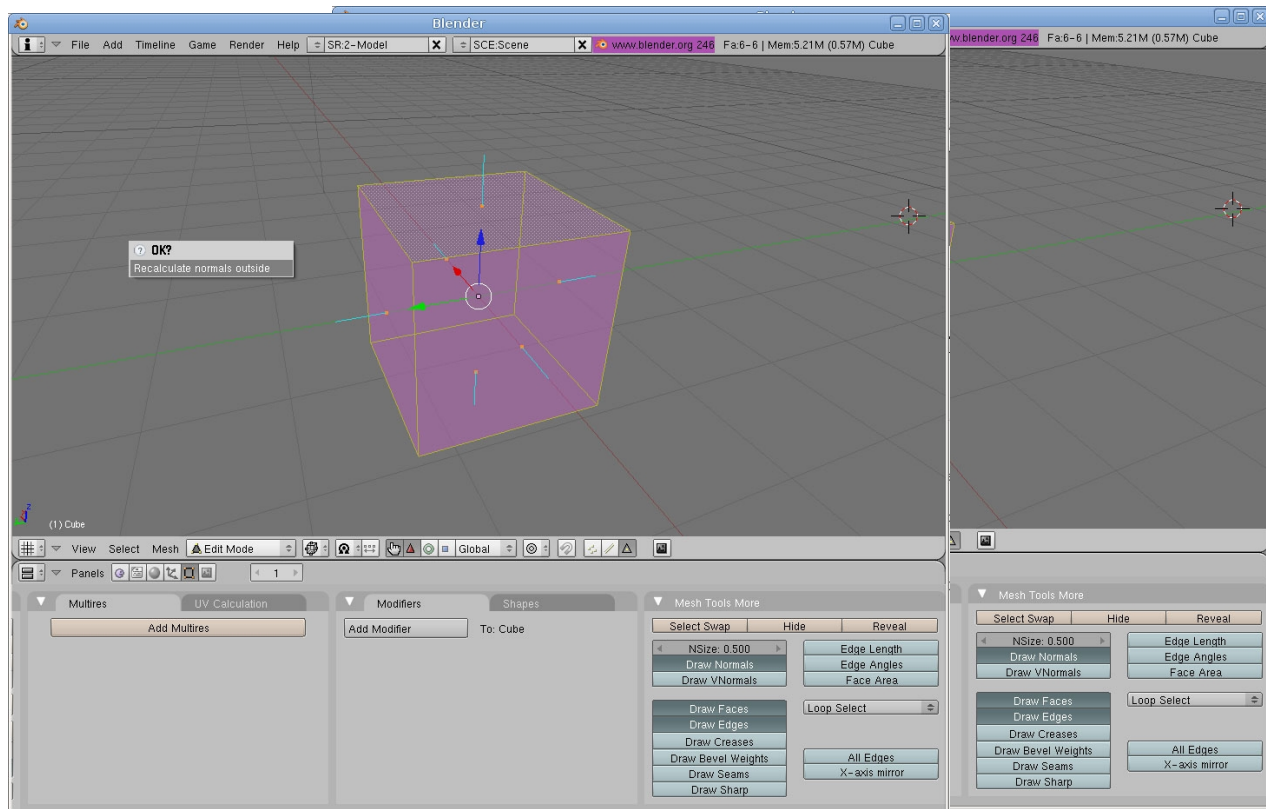


From the Edit menu (F9), select Draw Normals and adjust the normals height (nSize) to make them visible enough:

We can see that one normal is facing towards the inside of the model:

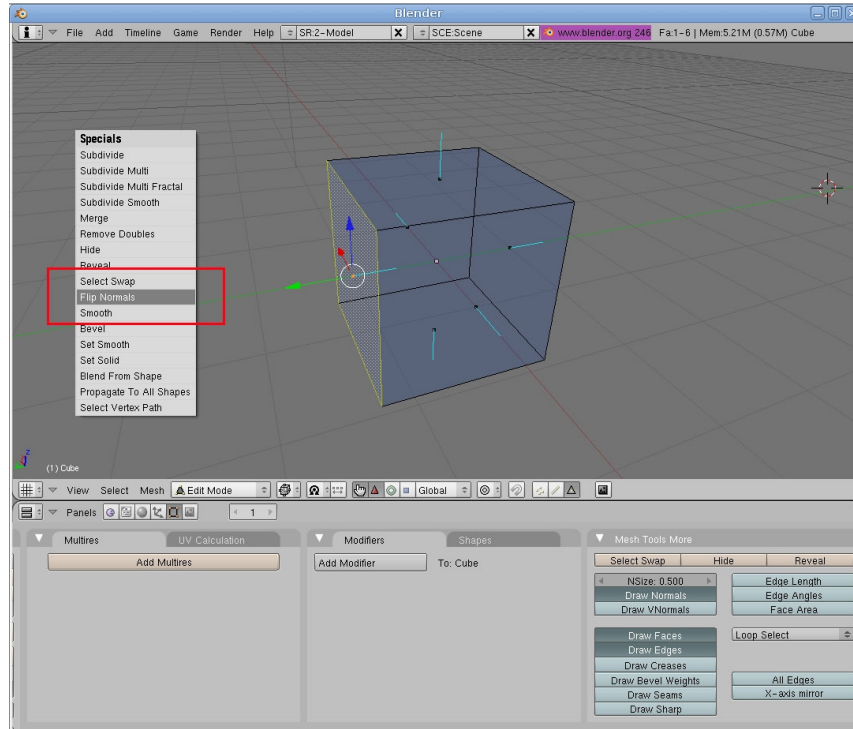


Select all the faces ("a" key) and press "Ctrl-N". Confirm. Blender will try to recalculate all normals outwards.



The normals are now all outward-facing. The model is properly oriented and therefore correct. This method does not always work, in which case you will need to finish the job by hand and check any remaining reversed faces. Suppose that Blender fails to flip an incorrectly-oriented face.

Select the face facing the wrong way (right-click) and hit "W". Choose Flip Normals.



All normals now face outwards. The model can be oriented properly and is therefore correct.

