



3D printing tips

3D PRINTERS

# Prepare artwork for physical modelling

Get your designs off the screen and into your hands with **Rob Redman's** guide to printing 3D models

**E**ach day we spend hours creating designs, yet it's rare for us as 3D artists to make anything tangible. However, things are changing rapidly. With the advent of 3D printing you can now model an object, send it digitally over the internet, and within a short space of time a physical version can be delivered to your house or studio.

There are a number of machines available to enable you to do this yourself, so all you have to do is walk across the room to pick up the model. This is great for medium-sized studios, or artists who produce custom toys or who need to create rapid physical prototypes.

The costs involved are decreasing, but it's still hard for the majority of artists to justify the expense of even a 'hobbyist' machine such as the MakerBot. This is where online services come into their

own. There are a few of them around, all offering similar results, but with varying levels of cost and services. I've used Sculpteo ([www.sculpteo.com](http://www.sculpteo.com)) for the model opposite: it offers a broad range of services and a great quality of print, in many different materials. It also offers apps that enable you to order products directly from your iPhone or iPad.

You can choose to upload a model, buy a ready-made design or even upload a photo of yourself or your friends to have printed onto avatars. Another added bonus is that you can create a storefront for your models in much the same way as TurboSquid or other marketplace sites enable you to sell digital content – only here you can sell physical products.

There's a huge variety of objects already available, from mugs and iPhone covers through to designer lamps and

jewellery. Which brings me on to another aspect of 3D printing: materials.

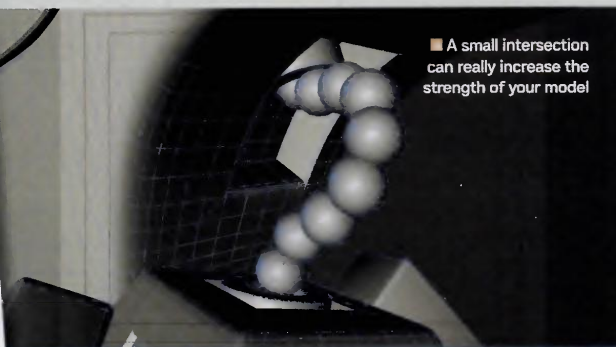
Although resin prints have been around for some time, you now have the option of printing in full colour, or in precious metals. There are many designers out there using sculpting applications such as ZBrush to create bespoke jewellery designs as mock-ups.

Now it's possible to upload that design directly to a storefront and start selling. No overheads are involved, and physical stock isn't necessary. Customers simply choose their design and materials, check out, and in a few days a silver ring drops through the letter box.

While this all sounds great – and it is – there are a few things to consider when preparing your first model for print. Over the page are a collection of tips to help you get the best out of your designs.



■ We first made a clay render of our model to show the fine details



■ A small intersection can really increase the strength of your model

## 01 The strength of the pose

If you're planning to have a character design printed, it's vital to make sure that it's self-supporting. If you look at my Bot you can see that his neck is made of small, connected spheres, which is fine for animations and still renders, but a printed version would be a different matter.

The weight of the head would make it far too easy for the neck to snap under the smallest pressure. You can see I very slightly intersected the head with the body. This might not always be desirable, but it's a good way to add strength and support. You could plan ahead further and print your model in multiple parts and then 'pin' the pieces with sturdy wire, something a lot of model makers do.

A base or stand is worth thinking about too, because uneven weight distribution can cause your model to fall.



▼ The finished Bot complete with a stand to prevent it from falling over

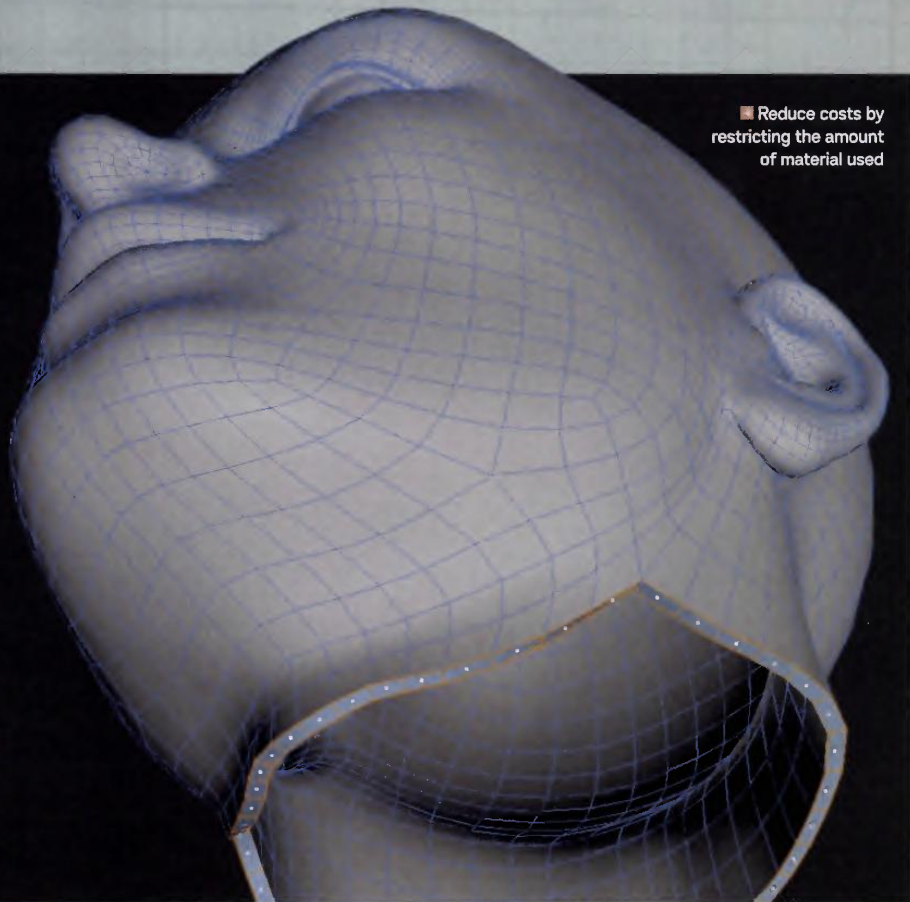


3D printing tips

**02** Hollow out your models

The costs involved in 3D printing can put some people off making the initial leap, but there are ways of drastically reducing them. A large part of the cost is the material used for the print, so finding ways to cut down on this can be hugely beneficial to both the wallet and the strength of the model.

Objects such as cups and phone cases are pretty optimised already by their nature, and use the minimum amount of material already, but if you want to have a print of a solid object, you could be looking at spending up to 20 times the amount needed. Instead of supplying your model solid, make it hollow. You need to leave an aperture somewhere, probably the bottom, but let's look at an example. Take a head model. Select the bottom faces of the neck and extrude them back up into the head, shaping the polygons so they leave around a centimetre of thickness. This will remove the need for a huge amount of materials, and will also make your object lighter in the process. If you feel you need that extra weight, then just fill it with another material, such as plaster, after it has been printed.



Reduce costs by restricting the amount of material used



Choose the right material for the intended use

**03** Choose your materials

A big decision you'll need to make when 3D printing is what material to have your object finished in. You can choose from a broad range with a variety of attributes. Sculpteo offers plastic, in either plain white or numerous colours, resins of various sorts and even metal compounds, which are great for trophies and jewellery.

The problem here is knowing which material will be most suitable for your intended use. If you're printing a custom mug or a bowl, for example, then glossy ceramic is the obvious choice, but if you want the object to have some flexibility then you might be better opting for one of the plastics or alumide (a mix of aluminium and polyester).

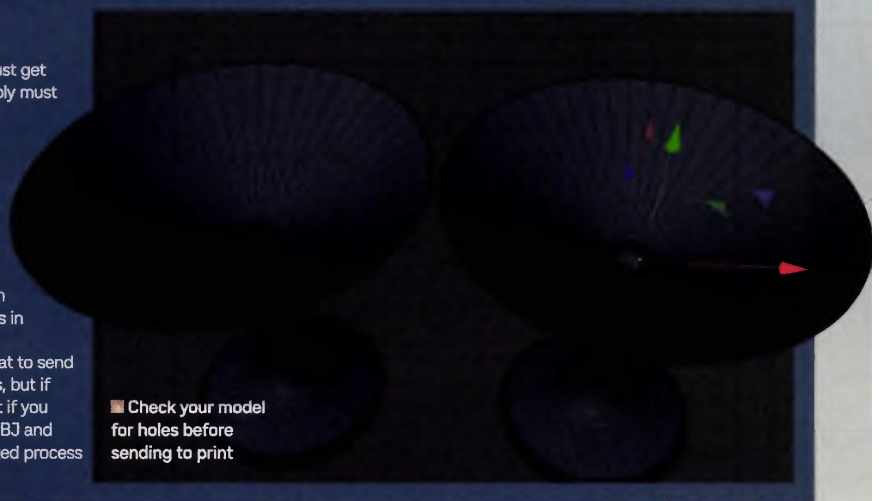
In some cases, you might want to keep this in mind while modelling. Ceramics and metals are stronger but less flexible and with lower surface details, whereas plastic is a great all-rounder, but doesn't excel in any one area.

**04** Keep it watertight

There's one aspect of the process that you must get right, and that's your base mesh. The geometry you supply must fit the needs of the printer, so make sure you check the maximum size available (although some suppliers will be able to resize). Also, all parts of the model need to be fully enclosed volumes. If you have a hole in the mesh it either won't be printable or the supplier may charge a fee to fix it, so make sure you don't have any missing polygons (flipped normals can cause problems too).

If you're printing a toy, extrude the inner shoulder joints and other joins inwards so there's a good, solid join and no gap in the mesh (intersections are fine – it's holes in geometry that cause problems).

It's also worth noting that an STL file is the best format to send to the printer. Many apps these days can export STL files, but if yours doesn't an OBJ might be okay. Just remember that if you want textures printed, you need to zip the UV-mapped OBJ and accompanying texture files into a zip file, so the automated process understands where to find everything.



Check your model for holes before sending to print

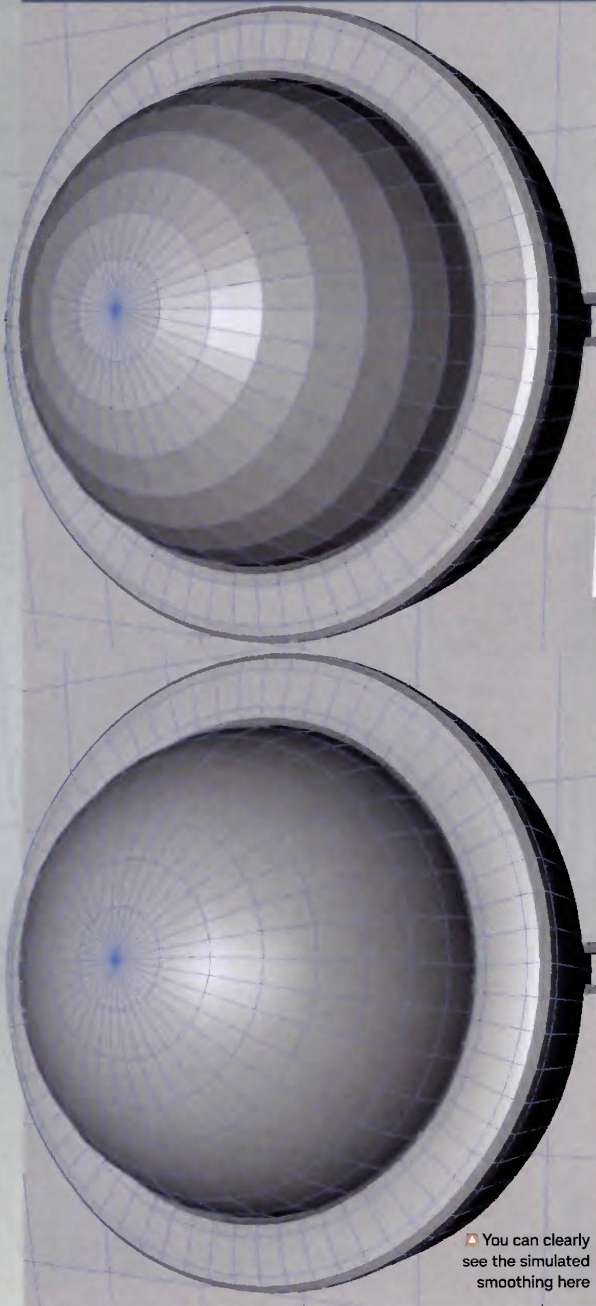


3D printing tips

**05 Smooth the model**

If you're used to using Phong angles or subdivision surfaces to smooth your models, there isn't a problem with using these tools when preparing your model for print. However, they won't transfer to the object that comes out of the printer itself.

Phong angles are used to present the surfaces of a model without the harshness of flat polygons, and are very useful, but you'll need to find a better way if you want gentle curves. The best bet is to place the model in a HyperNURBS or subdivision object, which brings me to the next point. Subdivision surfaces should be frozen or baked or made editable so that you are working with raw geometry, otherwise you could get less defined prints than you're expecting.



You can clearly see the simulated smoothing here

■ STL files will only hold triangulated polygon information



**06 Modifiers and deformers**

In a similar way to the Phong tag issue, you need to make it easy for the printer to understand what you're trying to achieve with your model. If you have deformers in your object or any kind of bone or skin rig setup, you need to pose the model and bake it into that pose. Different applications enable you to do this in various ways, but it's usually a simple process.

If you want to go a step further you could merge all the geometry into a single mesh and then triangulate it. The STL file format will triangulate as it saves, but if you do it yourself you'll gain more understanding of what's happening, and you can also check for any anomalies.

**Shopping around for 3D printers**

There are a growing number of places where you can get your models printed as well as find out more about this new industry, with many companies offering lots of help and guidance, as well as the actual prints themselves.

- [www.sculpteo.com](http://www.sculpteo.com)
- [www.3dartopart.com](http://www.3dartopart.com)
- [www.objet.com](http://www.objet.com)
- [www.shapeways.com](http://www.shapeways.com)

And if you really get the bug and want to start printing yourself, you should check out MakerBot: [www.makerbot.com](http://www.makerbot.com)



■ 3D printing has a variety of useful applications