10 THINGS YOU NEED TO KNOW BEFORE YOU BUY A 3D PRINTER

BRUCE JACKSON
**Table of Contents**

1. Introduction
2. Pick your technology
3. What type of materials do you want to print with?
4. Long term cost of owning a 3D Printer
5. Spares & local support
6. Speed trap
7. Layers
8. Product reviews
9. Awards
10. Easy to use and reliable
11. Kickstarter
12. Summary
Now before you head out scouring the internet, here is some advice on what every shopper should know before flicking out their plastic to buy a 3D printer. Having a 3D printer at home, in the classroom or at work, is like having a mini factory on your desk. They can be great fun, but they can also make you go grey and the one thing they can't print is hair!

With so many different makes and models of printers being released each week, it can be frustrating and knowing what to look for is a confusing task. This guide will help you make sense of all the jargon and have you printing in no time at all!!

1. PICK YOUR TECHNOLOGY

It is important when choosing the type of technology that will best suit your requirements. There are three main 3D Printing technologies available today and you’ll need to choose one of the following:

- **Fused Filament Fabrication (FFF) aka (FDM)** - this is the most common 3D printing technology and it works like a robotic hot glue gun. Printed parts are strong with good quality. Parts are often printed in PLA or ABS plastic (more on this later).
- **Selective Laser Sintering (SLS)** - the best printing technology in the world, but comes with a huge price tag! Part quality is exceptional and extremely strong. The most common material used is nylon or variants of.
- **Stereolithography (SLA)** - Uses a messy liquid resin that is cured by UV light or laser. The part quality is spectacular but parts cannot be used for end-use. They lack the strength and durability required for real-world use.

There are a few other technologies available, like printing in full colour with either powders or papers, but these don't offer strong or durable parts, just nice to look at and prices start around $40,000

Are you confused yet?

Well unless you are looking at spending over $5,000, SLS and SLA printing systems are out of the question. Only if you are serious about starting a business in offering print services or have a business requirement for high end production parts. That leaves the most common technology, Fused Filament Fabrication (FFF). Prices of these desktop 3D printers start from a few hundred dollars, so are the best choice for getting started in 3D printing. It is the most common technology that you are likely to see when people talk about of 3D printers.
2 WHAT TYPE OF MATERIALS DO YOU WANT TO PRINT WITH?

The two most common thermoplastics that are commonly used in 3D printing are ABS (the same plastic as Lego) and PLA (derived from corn starch).

- **ABS** offers high strength with a slight amount flexibility. It has a much higher temperature resistance compared to PLA. The smell can be a deterrent, as the plastic has a petroleum origin. ABS is superb for parts with snap lock fittings, can be freely sanded, glued and painted too. The printed parts will last! One thing to watch out for is that ABS can warp so it does require a heated print bed. The larger the printer then you'll require an active heated enclosure.

- **PLA** has a delightful popcorn smell during printing, but has a low temperature resistance. Parts will start breaking down over time, as the material is biodegradable. Excellent in for use in the classroom. PLA can also warp slightly (but far less than ABS).

There are several other types of filaments available including but not limited to: wood, nylon, polycarbonate and PET with new materials being released regularly. Each of these have their own challenges when it comes to printing and I recommend avoiding them until you are a confident maker.

3 LONG TERM COST OF OWNING A 3D PRINTER

Purchasing a 3D printer is one thing, but knowing how much will it cost to run in the long run, is just as important. How much is it going to cost each time you want to print a model.

This is an important question that should be asked. Most 3D printers have a roll or spool of material, however some vendors use proprietary spools or lock these into micro chipped cartridges as they don’t want you to know how much material is on the spool. This hides the true cost of printing a model. Make sure you can use cheaper filaments such as available from places like EBay and Amazon on open spools. Making it easier on your wallet and keeping your material options open. For example being able to print in “wood” is pretty awesome!
4

SPARES & LOCAL SUPPORT

Your new 3D printer will have a lot of moving parts and along with it being a fairly new technology, it is likely to break down from time to time.

Much like a car, you wouldn’t generally purchase one from overseas in case it breaks down. You want to be able to get it serviced and maintained in Australia or New Zealand (wherever you call home)

3D printers are precision devices and shipping them internationally can result in lowered print quality. Ensure that the 3D printer store carries a range of spare parts locally and at an affordable price. Also it is a good idea to check if they have a local service centre. Ask the question how much a replacement nozzle and print head is and if it can be changed by the user. These are the two most common parts that need replacement.

5

SPEED TRAP

Don’t get caught up in the speeds of 3D printing. Let’s be honest most 3D printers are slow and if you want fast 3D printing with great quality, best wait another few years before investing in your own system. As it stands now, the slower you print the better the print quality. This is a commonly accepted fact in the 3D printing community.

Don’t be fooled by claims of fast print speeds with top quality results, it can only be done with a very limited number of prints and designs. All printers must print slowly for mechanically strong, accurate and high quality prints. The practical upper speed limit for reliable prints is 50mm/s and about half that is more practical without obsessive tuning. It’s a matter of physics, how fast can melt, lay down, let the material set and then be ready for the next layer on top.
Some manufacturers are offering insane Z layer resolution (thickness of each printed layer). As the part is printed layer upon layer, the finer the layers typically result with a smoother finish and improve the print quality (presumably). I must warn you that the finer each layer is, the longer it will take to print. For instance most 3d printer owners print at around 0.25mm per layer, the part quality at this setting is very good and doesn't take too long to print.

Take an example of a computer mouse sized object printed hollow:

a. At 0.25mm per layer would take 52 mins with 158 layers
b. At 0.15mm per layer would take 2 hrs with 259 layers
c. At 0.05mm per layer would take 7 hrs with 730 layers

As you can see in the above example, 3d prints can take a long time and that is only for a small object! Can you imagine what a basketball sized object would take at 0.05mm per layer? Something of that magnitude would take several days at least and is at risk, hoping the print doesn't fail. The other downside to very fine layers is that removing support material becomes incredibly difficult, as they are likely to fuse to the model itself.

What really does make these fine resolutions impractical from day to day use is how level and flat the bed must be. Just like laying a foundation for a building, it is required to be level before construction starts. The accuracy of the base must be proportional to the layer height. So if you want to print at 50micron your levelling must be within 100micron at worst. Else you will cause the nozzle to jam and surge into the base which will screw up the print for quite some distance and possibly block your nozzle. So look for a printer that offers auto-levelling as this reduces potential headaches.

Speed vs. Quality
7. **PRODUCT REVIEWS**

Reviews and testimonials are an essential part of choosing the best 3D printer. Some online shops use the trusted Yotpo reviews where only customers who have actually purchased the product from that store can place a "Verified Buyer" review. Look for comments that quote easy to use, fast delivery, excellent service and friendly support. It shows that the printer has been used by real people and not just for a short period of time. It is natural to have some people with complaints, but the warning bells should start ringing when every review is negative or doesn't have the "Verified Buyer" review stamp.

8. **AWARDS**

Make Magazine puts together the annual 3D Printing Buyers Guide every year. Within this they review the leading 3D printers on the market. This is an excellent and trusted eBook to use and can be purchased here:


The UP 3D Printers have won several awards in the last two years. Nowhere else do people have access to such a wide range of different 3D printers for the pure purpose of comparing them. Your friend might love his [generic 3D printer] but unless you have compared it to another one, how do you really know if it is the best 3D printer for you?

9. **EASY TO USE AND RELIABLE**

Building a 3D printer with open source hardware, like the RepRap project, is a great way of learning how a 3D printer works.

However, this will take you or your students several months just to get average quality prints, not to mention the amount of time spent on constant printer maintenance tuning and tweaking.

Choosing a ready built printer that works out of the box is probably the easiest way to get started. First read product reviews to see what customers say, as you can't always believe what the sales catalogues say.
There are numerous 3D printers being launched weekly on popular crowd sourcing websites. Once funded, many of these projects double their promised delivery times. While you are waiting to receive your printer, a newer and better product is released the following week with improved features at a lower cost.

None of these projects have any history or customer reviews so it is always a gamble at what and when the product will be delivered. Will the printer meet your expectations? Will there be after sales support? Am I happy to wait up to a year for the printer to reach my door? Who will pay to send it back if it has a fault? Important questions like these should be considered before backing the next 'greatest' printer.

The greatest thing that 3D printing brings us is the ability to design and print complex shapes without limitations. Any 3D printer can print an owl, a whistle, vase or an iPhone case, but these are not complex shapes. To explain in better detail, in the real world when building a bridge you require scaffolding aka support material. This is used to hold the bridge in place during construction.

With a great 3D printer, it will automatically create the support structures for you and these are printed in a lower density so they are easy to remove. Only a very small handful of 3D printers can do this trick very well.

Watch this extreme example of printing working parts in one go with breakaway support and see if the 3D printer you are looking at can do that. https://www.youtube.com/watch?v=Ak03wmi-3FE

If you can’t find any videos of the printer you are researching, showing how to break away supports, then maybe keep on looking.

I highly recommend to you that when researching for a 3D printer, your number one criteria should be how easy it is to remove support material!
There is a lot to know about 3D printers and 3D printing and Bruce is passionate about the technology and he is eager to share his knowledge with you.

Bruce has been involved in the 3D printing industry for over four years and has been featured in several TV & radio interviews as well as leading print and online news sites. An upcoming author about the advancements of 3D printing and is one of the leading experts in Australia and New Zealand on 3D printing.

So if you have any questions about 3D printers or 3D printing in general drop Bruce (or the team at 3D Printing Systems) a line on 03 9099 0225 (Australia), 09 281 4206 (New Zealand) or fire an email to sales@3dprintingsystems.com (both sides of the Tasman).