3D Printers

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3D printers are moving into the mainstream. Over the past few months, Office Depot and Staples have started stocking the devices. While the products sold by these retailers are priced at over $1000, others are selling 3D printers for as little as $300. This all sounds cool, but how should we think about 3D printing from a Christian perspective?

What is 3D Printing?

While the most common 3D printers use a mechanism very similar to ink jet printers, 3D printers aren't really printers at all. Like a printer, a 3D printer takes a digital file on the computer and creates output that you can hold and take with you, away from the computer. Unlike a printer, a 3D printer isn't very good at reproducing words and precise images. Its output isn't a sheet of paper. Instead, what it produces is a physical object – a reproduction of something real or imagined.

Today, consumer grade 3D printers cost anywhere from a few hundred dollars up to a couple thousand dollars. These printers produce plastic objects. Industrial grade 3D printers can cost up to half a million dollars and can produce objects made of metal, ceramic, or even glass. Knowing the budgets of most ministries (and those in ministry), I'm only going to focus on the consumer grade products in this article.

In very basic terms, a 3D printer works by laying down layer upon layer of melted plastic. There are two elements of the printer actively involved in this process – the extruder (like the traditional print head) and the platform. This isn't so different from "2D" printers, where the "platform" was a piece of paper.

In the 2D printers that we're used to, the "platform" (paper) may move in the y-axis direction (top to bottom of the page), while the print head moves in the x-axis direction (left to right across the page) lay-

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standard across printers there's a competitive market keeping prices down. A few models, including those sold at Office Depot and Staples, require proprietary plastic cartridges (like printers) which are more expensive for the same plastic volume than spools. Most consumer 3D printers only support a single spool with a single color of plastic, so the objects you produce will be in one color (similar to black and white printers). More expensive printers can have multiple colors of plastic that are being laid down by the extruder to create a multi-color object.

If you haven't seen it, the process of producing a 3D object is fascinating. There are many clips on YouTube that you can watch. However, it is not a fast process. 2D printers today are rated in pages per minute, while it can take hours to produce even relatively simple 3D objects.

Once you have a printer, the real question is – what are you going to print? The printer requires a set of instructions that it can follow to lay down layer upon layer of melted plastic. Printers generally come with the software for your computer to produce those instructions. There are generally two steps in the process. The first is the creation of a 3D representation of the object to be created (this is an STL file). The second is the slicing up of that creation into the layers and producing the instructions for the printer. Since different printers have different resolutions, the slicing will be unique to your printer model.

I quickly skipped over the step of creating a 3D representation of an object. Obviously, this is a major undertaking requiring something like 3D CAD software, lots of skill, perhaps some creativity, and often significant experience before pleasing results can be produced. Thankfully, there's a growing collection of available 3D designs available for free or a reasonable price from sites like 3DLT.com and thingiverse.com. These designs can be downloaded to your computer in STL file format, ready for slicing.

How can ministries use 3D printing?

My greatest reservation with writing this article was that, at least at this point, the applicability of 3D

ing down ink where appropriate to create the desired output. In a 3D printer, between the two of them the platform and the extruder will move in three dimensions (x, y, and z – up and down in height). Different printer models work differently in terms of which directions the platform and extruder move. As they move, the extruder is laying down melted plastic where appropriate to create the desired output.

Different printers have different "resolutions" – the thickness of each layer of plastic. Just as in 2D printing, higher resolution (thinner layers) creates a more realistic end product and printers with higher resolution generally cost more.

Consumer 3D printers generally use either ABS or PLA plastic. ABS melts at a higher temperature (464 degrees F) than PLA (365 degrees F), so ABS is more appropriate for creating objects that will be used in high temperature environments, but ABS printing requires very good ventilation and the end product will smell more like melted plastic. In general, any given 3D printer model will either work with PLA or ABS, not both, so you'll need to consider your applications before buying the printer.

In most cases, the plastic comes as a spool of a long thin strand of plastic. Since these spools are

printing to ministry is likely limited – or perhaps it's my vision that is limited! When I mentioned this concern to my wife, who teaches children's Sunday school, she immediately started thinking of all the cool props she could create to help teach her lessons. I'm sure as 3D printing becomes mainstream, we will find many more uses, just as we have managed to create reams of printed pages to support our ministries.

What is dangerous about 3D printing?

The physical characteristics of 3D printing can produce some dangers – very hot components, noxious odors, noise in the printing process – but all of these are manageable. There has also been a fair amount of press about 3D printing used to produce dangerous items (e.g. "printed" functioning guns). We must also guard ourselves against sinning in the use of 3D printers – such as reproducing items with patent, trademark, or copyright protection without the intellectual property owner's permission. But in general, 3D printing is simply a new extension on our computing capabilities. Perhaps the greatest risk right now is in being good stewards of our funds and time. These devices aren't cheap and will require constantly buying plastic. However, the material costs are less expensive than I expected for moderately sized objects (often less than a dollar), so the hours spent producing 3D printed items may be your greatest ongoing cost.

Remember Paul's warning: "Look carefully then how you walk, not as unwise but as wise, making the best use of the time, because the days are evil. Therefore do not be foolish, but understand what the will of the Lord is." (Ephesians 5:15-17)

It is my hope and prayer that these articles on the power and danger of technology will encourage you in your daily walk with Christ. Whether it is the printing press, radio, television, personal computers, the Internet, the Cloud, smartphones, or 3D printers, new technologies continue to advance our ability to know God and to serve Him, wherever we go.

*Russ McGuire is an executive for a Fortune 100 company and the founder/co-founder of three technology start-ups. His latest entrepreneurial venture is CXfriends (*https://cxfriends.com*), a social network for Christian families which is being built and run by four homeschooled students under Russ' direction.*