When Chuck Hull patented the first stereolithographic machine in 1986 he knew that his technology was not going to be available commercially for quite some time (Hickey, 2014) but that did not deter him. What stemmed from a frustration over the lack of production speed became something much, much greater than just a way to replicate small parts for new technologies (Hickey, 2014). Today stereolithographic machines, more commonly known as 3D Printers, are being used to make everything from nuts and bolts for shelving (Griffey, 2014, p. 7), to replacement parts (Lau, Mitani, & Igarashi, 2012, p. 77) to surgical models of children's noses (Moorefield-Lang, 2014, p. 590), to houses (Hickey, 2014). 3D printing serves many different purposes to many different individuals and across multiple industries. Above all it is another medium in which the creative functionality of the brain can thrive. This is why it is a technology that is needed in libraries; libraries breed, foster, and inspire creativity across all lines (gender, age, income, etc…).

Throughout history libraries have been the place where mainstream America can go to inspect and/or use the latest pieces of technology (Griffey, 2014), and to learn any number of things. Libraries have provided low to no cost options for machinery usage for decades. Long before they became widely available and affordable patrons headed to the library to use computers, the internet, laser printers, and typewriters, to name a few (Griffey, 2014). It is only logical that patrons would head into their nearest branch to try out this enticing "new" technology. Putting 3D technology inside of libraries is simply another way that libraries have evolved to stay relevant in the 21st century. Steve Teeri of the Detroit Public Library said it best, "libraries aren't just about books; they're about learning and literacies of all sorts" (as cited in Moorefield-Lang 2014, p. 588).

There are four main types of 3D printing available today. They are Fused Deposition Modeling (FDM) printing, Stereolithography printing, Selective Laser Sintering, and Laminated Object Manufacturing (Griffey, 2014; Moorefield-Lang, 2014; Wapner, 2015). Griffey talks a great deal about the characteristics of and the differences between these four types of printers in chapter 2 of his publication, *3-D Printers for Libraries* (2014). Stereolithography uses a liquid

resin as its source material. The resin is light sensitive and hardens or dries when exposed to a specific UV frequency. Selective Laser Sintering is characterized by using special powders that are augmented with the use of lasers that then deposit layer upon layer on top of one another on a print bed. Laminated Object Manufacturing is possibly the most interesting type of 3D printing as it involves layering thin sheets of paper or plastic on top of one another and simply gluing them together. Unfortunately even though the raw materials that are used are relatively inexpensive, the overall cost of the system (around $35,000) prices it out of range for most libraries. Fused Deposition Modeling printers are the most affordable, and as such, are the most common. This is due in part to the patent for FDM expiring in 2009, allowing for the market to be flooded with many new 3D printing machines running off of this technology (Newman, 2014). FDM machines use different types of plastics, typically acrylonitrile butadiene styrene (ABS) and/or polylactic acid (PLA). These plastics are melted and deposited onto the base layer of the object and the process is repeated until the item is completed. Upon deciding to include 3D printers in their collection libraries must do the research and determine which type of machinery is right for them.

Having 3D printers on hand can be incredibly rewarding and incredibly difficult at the same time. On the one hand the printers offer libraries and their patrons the ability to connect not only with themselves and their own inner creativity but also on a greater scale for the greater good. Andy Plemmons, an elementary school librarian in Georgia, and Shannon Miller, a librarian at the Van Meter Community School in Van Meter, Iowa, are working together on a 3D printing project that has their students creating charms and bracelet looms to send to children in other countries (Moorefield-Lang, 2014). The negative aspect of this project is not something unique to these schools, it is a common 3D printing issue; "3D technology is amazing...but it is time consuming" (Plemmons, as cited in Moorefield-Lang 2014, p. 586). This problem is ongoing and related to many factors. The primary reason for the time consumption being that the printer is creating multiple layers, and within each layer a number of tedious steps must be performed to create the object (Lavine, 2015). On the other hand there are the individuals who could potentially use this technology to create items that are dangerous. One of the most common

questions that librarians are asked when discussing 3D printers is "So can you print a gun with it?" (Griffey, 2014, p. 6). The short answer is yes, however "it's really not any more dangerous than having chemistry textbooks on the shelves." (Griffey 2014). That being said libraries that entertain this technology within their walls are having to stay on top of the ongoing debates that surround 3D printing. For example the city of Philadelphia banned 3D printing of firearms two years ago, and there is an ongoing debate about whether or not to extend the Undetectable Firearms Act to include those that are printed (Wapner, 2015, p. 6).

For every unsavory patron who is interested in printing a firearm there is one who is interested in printing items three dimensionally for the positive benefit of others. This is most certainly the case of the Kansas high-school student who printed a working prosthetic hand for his nine-year-old family friend (Wapner, 2015), Williams 2014) at the local public library. Libraries do not limit their book collections based upon the negative actions of their patrons, why should they limit their technology collections for that reason? At this time there is no policy set forth by the American Library Association related to 3D printing of firearms or any other "questionable" items. It is not the role of the library or the librarian to police technology, however libraries have the freedom to set broad policies regarding usage and safety for their own protection as well as that of their community (Wapner, 2015).

Chuck Hull told *Industry Week* "I'm not a futurist. I don't have a crystal ball that tells me what things are going to happen, but I know this: when you get enough smart people working on something, it always gets better"("Spotlight | National Inventors Hall of Fame," n.d.). By instilling these once futuristic machines into libraries we are allowing for an exponential amount of opportunity and growth both within and for the community. This technology is not limited to those more financially stable than others, as patrons from all tax brackets can benefit from 3D printers in public spaces. Children are given the opportunity to scour their minds and can produce most anything they can imagine from robot wheels to prosthetic limbs (Wapner, 2015). Engineers and architects can create buildings and design spaces (Moorefield-Lang, 2014); anyone can create replicas of the Taj Mahal, the Empire State Building, and a whole slew of

other famous landmarks with the plugin for SketchUp, a free piece of software once owned by Google (Griffey, 2014, p. 17). The possibilities are endless and when the possibilities are endless the imagination, the patron, and the community all win.

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