3D Printing: New Technology

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Introduction

While 3D printing seems like a relatively new concept, the idea has been around since 1981. Since then, technology has advanced a great deal, which has helped 3D printing improve since its first design. When the first 3D printers started appearing, they were limited and not very accessible to home inventors, however in recent years 3D printers have become more accessible to the public. This has caused communities to grow online and create new markets for 3D printers. While the potential benefits of 3D printing are enormous, the legal issues and security concerns can become an issue for this technological advancement.

What is 3D Printing

3D printing is a process for making a physical object form a three-dimensional digital model, typically by laying down many successive thin layers of a material. 3D printers use different types of materials to form these physical objects. According to Hornick and Roland (2013), "Most 3D printed products are made of either ABS or PLA thermoplastic, but some companies are making 3D printers that print with medal". They go on to say "other materials can be printed with more advanced machines, such as ceramics, sand glass, and even human tissue". With technology like this you have the ability to create whatever you want, though 3D printers are expensive. Hornick and Roland (2013) go on to talk about the how 3D printers work. They state "unlike traditional manufacturing, which uses subtractive processes, such as grinding, forging, drilling, and cutting, 3D printing is an additive process. There are many 3D printing processes, but they all fuse materials, layer on layer, with heat, chemicals, light, electron beams, or glue". Post production work is generally required with 3D printing. Hornick and Roland (2013) state, "post production work often is required after printing, such as sintering or heat

treating to achieve a desired strength or hardness, sanding or polishing to achieve a desired

surface or texture, or cleaning excess powder". The process of 3D printing can be quite complex,

but it is actively being improved. The ability to 3D print using a large assortment of materials has

been helpful to 3D print more designs.

Potential Benefits / Current Use

3D printing is currently making huge strides in the aerospace, automotive, defense, and

healthcare industries. According to Hornick and Roland (2013), "the aerospace industry is using

3D printing to to improve performance, shorten manufacturing runs, and save costs". One of the

biggest factors contributing to the increase of 3D printing comes from the reduction of cost.

Hornick and Roland (2013) go on to say, "KOR EcoLogic has created the Urbee-the world's first

car with a 3D printed body". This has led other companies to invest into 3D printing cars as well.

The US Government has also used 3D printing to great success. Hornick and Roland (2013)

stated, "In the defense industry, the US government has used 3D printing in combination with

traditional manufacturing to save millions of dollars and provide improved and timely training in

areas such as avionics, weapons, telecommunication, and medical readiness". The healthcare

industry has benefitted from the use of 3D printing more than any others. Hornick and Roland

(2013) talk about a young girl, "born with arthrogryposis, who wears 3D printed "magic arms"

that give her the strength to life her real arms". With 3D printers becoming more available to the

public, online communities have been created to share projects and designs in the form of CAD

files. Some of these files are free to download, while others must be payed for. Ebrahim T. Y.

(2016) states, "3D printing enables do it yourself communities and small, innovative companies

to rapidly and electronically share their electronic designs with others around the world".

Ebrahim T. Y. (2016) goes on to say, "physical products are already being designed, sold, and distributed over the Internet, with end consumers only printing the physical manifestations of the product". The use of 3D printers has grown tremendously with 3D printers becoming more accessible, allowing people to share designs online for anyone to use.

Legal and Ethical Issues

With the increasing use of 3D printers there questions regarding intellectual property rights. Ebrahim T. Y. (2016) states, "the legal regimes that made sense in the traditional manufacturing world are being challenged in their attempted application to the digital manufacturing world. There are newfound challenges to the law that govern utility patents, copyrights, design patents, trademarks, and trade dress as it applies to 3D printing". We could start to see more design patents being applied for with the increased use of 3D printers. Hornick and Roland (2013) say, "manufacturers might be motivated to follow suit and obtain design patents to prevent third parties from entering the replacement-parts market". One of the major problems with patents is that a lot of designs are not patentable. Hornick and Roland (2013) go on to say, "products that are copyrightable, such as dolls, action figures and figurines, and toys, are especially vulnerable to 3D printing at home, where infringement is essentially undetectable". The best way to protect against this would be to try and keep the CAD files for all of these designs secure, however it is still possible for someone to create a similar design from scratch. 3D printers have become more accessible in recent years, which is why this seems like a problem. Copyright and patent laws are being improved in response to the technological change. Ebrahim T. Y. (2016) goes on to say, "the complexity regarding applicability of either copyright or patent law to a particular technology arises either when the technology is difficult to

define, when there are multiple subcomponents, or when there are multiple actors". There are

two ways you can consider infringement in 3D printing. Ebrahim T. Y. (2013) states "direct

infringement by making a device without authorization from the patent owner for example, when

somebody uses a 3D printer to print an object covered by a patent; and direct infringement based

on the CAD file itself, as infringing patent claims directed to the physical object". The biggest

concern is protecting the items people could 3D print from being mass produced and sold.

Ebrahim T. Y. (2013) explains "one suggested amendment to the Patent Statute has been to

include an exemption to infringement for personal 3D printing. This reform would create

immunity for DIY-ers who are consumers and not large-scale manufacturing commercial

companies". A technology like 3D printing pushes the boundaries with current patent and

copyright laws, however they are actively trying to figure out a way to protect everyone's rights.

Security Concerns

There are rising security concerns about the capability of 3D printing and firearms. One

of the largest security risks right now is the ability to 3D print a working gun. The 'Liberator' is

a working handgun that is made up of 3D printed parts, which has the ability to fire one bullet at

a time. Walther G. (2015) Walther G. (2015) explains, "since the introduction of the Liberator,

the 3D gun community has produced other weapons as well". All of these guns were still made

out of plastic and required other unprintable pieces. The gun files that were posted online were

quickly removed. Walther G. (2015) went on to say: "On 6 November 2013, US Company Solid

Concepts released a video that showed the first metal-printed gun. The company claims this gun

successfully fired more than 600 rounds without any malfunctions. At the presentation of the the

printed gun, there were hardly any concern as metal printers are extremely expensive". The

printing of a 3D gun also had law enforcement agencies interested. Walther G. (2015) goes on to say, "the fear comprises two elements: first, 3D guns make it easier for everyone to acquire a gun and thus increases the danger to police officers as well as civilians; and second, 3D guns are difficult to detect so they might be ideal for assassination of terrorist attacks". The idea that you can 3D print a gun can be scary at first. One thing to keep in mind is that 3D printers are still very expensive. Walther G. (2015) explains, "given that it is yet very expensive to obtain a 3D printed guns will most likely be printed in rich countries, which already have more guns available than poorer countries". With this in mind, the security concern for 3D printed weapons is low. Anyone with access to a 3D printer that could print a metal gun would either have no actual use for it or have enough money to buy more dangerous weapons.

Conclusion

Since its first concept in 1981, 3D printing has quickly grown. In 30 years it has become cheaper and more accessible. 3D printing has helped progress so many different types of industries. The practice of 3D printing has been extremely beneficial, however there are some issues that have risen. Concerns with patents and safety are a growing concern. The ability to 3D print anything is a great tool that benefits many people, as long as people do not go out and break the law with what they create. Moving forward with new patent laws and safety regulations regarding items 3D printing, 3D printing should create a more productive future.

References

Bartel, J. (2015). 3D can transform business, not just production. Manufacturing Engineering,

155(6), 14. Retrieved from

http://search.proquest.com.mutex.gmu.edu/docview/1750977950?accountid=14541.

Retrieved on September 24, 2016.

This article was found on Proquest and is part of a scholarly journal. I intend to use it for

general information on 3D printing, and the current uses of the technology. The article

can also be used to discuss 3D printing benefits. It mainly talks about how 3D printing

can be used in the business and manufacturing world, not just for engineers. The author

is Jim Bartel. Bartel is the senior vice president of Strategy, Marketing & Business

Development Stratasys Direct Manufacturing.

Ebrahim, T. Y. (2016). 3D printing: Digital infringement & digital regulation. *Northwestern*

Journal of Technology and Intellectual Property, 14(1), 37-74. Retrieved from

http://search.proquest.com.mutex.gmu.edu/docview/1763734055?accountid=14541

Retrieved on September 24, 2016.

This is a journal piece discussing copyright infringements that 3D printing poses. It has

been hard to regulate the patent laws because 3D printing is a newer technology. This

journal piece discusses many questions that have arisen about patent laws and how they

are going to be changed for the future. The author is Tabrez Y Ebrahim, from the

Northwestern University, and was published in the Northwestern University Journal of

Technology and Intellectual Property. I will use this source for the social implications of this technology.

Gao, K., Tao, Y., Zhang, K., & Song, L. X. (2015). Research on common problems based on a desktop 3D printer. *Applied Mechanics and Materials, 757*, 175-178. doi: http://dx.doi.org.mutex.gmu.edu/10.4028/www.scientific.net/AMM.757.175 Retrieved on October 2, 2016

This a scholarly journal discussing 3D printing, particularly the problems the technology may face during the actual process of printing something. This was written by a couple different authors, in a journal about mechanical engineering. This journal will help me provide more information on my topic as well as some problems the technology has.

Hall, E. (2015). 3D printing to transform everything about the way we live, says specialist steve sammartino; A digital and disruptive technologies specialist says 3D printing will transform everything about the way we live within a matter of years. steve sammartino says 3D printing will have an even bigger impact on economies and society than the internet. Sydney: Australian Broadcasting Corporation. Retrieved from http://search.proquest.com.mutex.gmu.edu/docview/1667787467?accountid=14541 Retrieved on September 24, 2016.

This is an Australian broadcast with a technology specialist, Steve Sammartino. This broadcast highlights different aspects of 3D printing that will be of use to my paper. He goes over the potential problems, benefits, and the different industries that 3D printing can aid. I also think it will be important to note the public reaction to 3D printing, as

Sammartino has discussed. Reading this broadcast has given me more ideas on subjects in my paper.

Hornick, J., & Roland, D. (2013, 08). 3D printing and intellectual property: Initial thoughts. *The Licensing Journal, 33*, 12-16. Retrieved from

http://search.proquest.com.mutex.gmu.edu/docview/1429625955?accountid=14541

Retrieved on September 28, 2016.

This is a PDF of a magazine all about 3D printing. It begins by giving an overview of 3D printing, it's uses, as well as information about corporations that are beginning to use 3D printing. This magazine will be very useful to many parts of my paper. The authors are John Hornick and Daniel Roland. It is published in The Licensing Journal.

Walther, G. (2015). Printing insecurity? The security implications of 3D-printing of weapons. Science and Engineering Ethics, 21(6), 1435-1445. doi: Retrieved from

http://search.proquest.com.mutex.gmu.edu/docview/1735607075/74313EF7743F42B1PQ/6?accountid=14541 Retrieved on September 24, 2016.

This is a piece written about the security concerns of 3D printing. Using the technologies of 3D printing, one is able to print and fire a working firearm. This article is written by Gerald Walter, and printed in "Science and Engineering Ethics" scholarly journal. This article will help me address the security concerns that 3D printing may pose. It also discusses how future laws will help control what a person can print and use.