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Research Summary: 3D Printing

 10 years ago, nobody would have believed 3D printing was possible as the idea was totally unheard of. Today 3D printers are able to do more than anyone could have imagined on such a large, unprecedented scale. These printers are capable of forming virtually any geometric shape from 3D molds or electronic blueprints. Since 2010, the cost of these printers has dramatically declined since 2010 and so have the costs of materials they use. With that being said, more middle-class households have begun to integrate them into their lifestyles. As costs have declined, these printers are being used in a wider variety of environments that include hospitals, households, classrooms, construction sites, and businesses. As this technology continues to increase both the quality and the quantity of production, we are left to wonder if a third industrial revolution may be a reality.

Chuck Hull is credited for inventing the first 3D printer. He patented his idea in 1983, the same year he co-founded his company 3D Systems. Today, 3D Systems is the largest manufacturer of 3D printers in the world. The company is credited for creating prototypes for several private investors. They’re also credited for their major contribution in the aerospace industry.

3D printing has made huge impacts in healthcare where they are sometimes referred to as “bioprinters.” Bhaskar Chakravoti wrote, “Much like familiar desktop inkjet printers, specialized 3D printers can be used to jet living cells, along with support material, called scaffolding. Such “bioprinters” are being used for [printing skin, bones, and joints.](http://3dprintingindustry.com/2015/01/22/japaneseresearchersbio3dprinter) Recently, a surgeon used the technology to [create a new pelvis for a man](http://www.telegraph.co.uk/news/health/10627556/Surgeon-creates-pelvis-using-3D-printer.html), while [soldiers could have their bones scanned](http://www.telegraph.co.uk/news/science/11413503/Soldiers-could-have-their-bones-copied-and-3D-printed-in-case-of-injury.html) prior to going into combat so that 3D replicas could be created in case they are injured.” The printers use raw materials such as calcium phosphate and TCP composite. Biological materials don’t always have to be used as lightweight metals such as titanium are also used.

With these materials, bioprinters can create artificial skin, bones, joints, and organs. Chakravoti reported, “Reliable organ-printing systems would be nothing short of revolutionary. Over 121,000 people are on the waiting list for an organ transplant, with a new person added to the list every 12 minutes, with 21 who die each day waiting for a transplant.” If more of these printers are integrated into healthcare environments so many lives will be saved and there would be little to no need for organ donors.

3D printers are also being used to print pharmaceutical products such as nutritional supplements, vitamins, and medical pills. This allows for complete personalization of products that will reach all of the patient’s medical requirements. However, as Inside Counsel reporters Maya Eckstein and Kyle Sampson noted, that even though the FDA has already approved 3D printed products, they may begin enforcing stricter regulations to ensure that these practices are safe. They wrote, “FDA’s existing regulatory framework is based on mass production of one-size-fits-all products. 3D printing technology, however, holds the promise of production of customized drugs and devices for specific patients. Are new regulatory approval pathways needed for FDA review of 3D-printed drugs and devices? Should FDA issue guidance explaining how this new can fit into the existing framework? At a minimum, FDA guidance regarding the application of existing FDA regulation to 3D-printed drugs and devices would be useful. Despite the increased usage of 3D printing in drug and device manufacturing, many manufacturers are holding back due to regulatory uncertainty.”

Their article suggests that the manufacturers and the FDA cannot reach an agreement in which both parties are satisfied. Due to the situation, the manufacturers cannot be aggressive in making products that meet a patient's specific needs in fear of stricter regulations. Instead, they must continue making generalized products that won’t be able to treat all of their patients. Hopefully, the power struggle between both parties will come to an end when they are able to reach an amicable agreement. Chakravoti described how 3D printers could revolutionize personalized treatments when he wrote, “More generally, 3D printing, through alteration of a pill’s surface area and printing of complex shapes, can allow more reliable and customized control over dosing, size, flavors, and colors, which can be especially useful for the elderly, young children or the physically impaired — usually the largest medicine consumers.”

Because computers control these printers they can print materials in almost any color and in different shades. There are over 250 materials that can be used and as a result 3D printers are being used in several different industries. These printers will only become more advanced in their tasks and they will continue to make their way into different industries. This raises major concern about employment. These machines are essentially robots that can make almost anything that the human hands can. This will replace the need for labor industries such as those of fashion and textiles, where most of the products are handmade. Manufacturers will more than likely resort to 3D printing because it will be faster and each product will have the same quality as the last. Also, as long as the materials are made available these printers can run 24 hours a day whereas breaks are required when using human labor.

Another concern is there are now printers that can print entire products on a large scale. Huffington Post reporter, Peter Diamandis and industry insider, Avi Reichental reported, “There have been tremendous improvements in speed. The prediction now is that speed is not just going to double every couple of years, but speed is probably going to go 10x, 50x, 100x in the next 5 years. There are quite a few successful companies out there that are demonstrating today that they can get to convincing scale with 3D printing that will be at least a hundred times faster than it is today.”

In conclusion, I believe that 3D printing will ultimately lead to the third industrial revolution, as these printers will only improve in their performance. Over time, the types of tasks these printers can perform and the materials they can use will only increase in number. My fear is that so many people will be left without employment, especially in the textile, fashion, and furniture industries. However, these printers are perfect for those who love to express themselves in a creative manner. Artists will have the chance to start their businesses and make their mark in the world. 3D printers will be integrated into their environments more and I believe we will all be able to adapt. Perhaps we’ll even 3D printers create complete products rather than just the components in the near future.

Works Cited

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