

3D Printing Worksheet

Research It

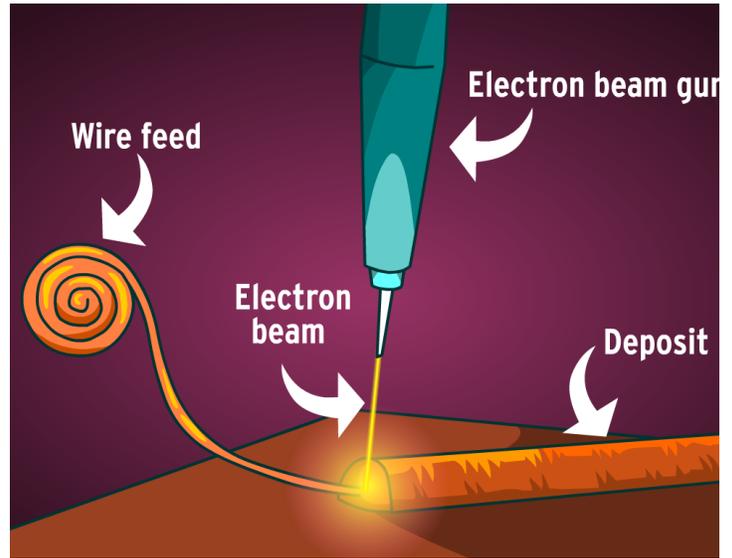
Research examples of how 3D printing has advanced society in the following categories.

<p>Conservation</p>	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Art preservation</p>	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Construction</p>	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Space exploration</p>	<hr/> <hr/> <hr/> <hr/> <hr/>
<p>Medicine</p>	<hr/> <hr/> <hr/> <hr/> <hr/>

3D Printing

Tim and Moby touch on a few 3D printing methods in the movie, but there are many ways to print three-dimensional objects. Here's a closer look at some of them.

Stereolithography: The first form of 3D printing developed, stereolithography was created in the mid-1980s by American computer scientist Chuck Hull. A tank is filled with gallons of a special liquid plastic that hardens when exposed to ultraviolet light. An ultraviolet laser "paints" the surface of the liquid in the shape of the object to be made. The surface hardens, creating the first "slice" of the object. After each "slice" is made, a platform below the surface moves lower, submerging the newly created layer in more liquid. The process repeats until the object is built from the bottom up.



Electron Beam Freeform Fabrication: Developed by NASA, this technology uses a superhot beam of electrons (see image) to melt a metal wire. The wire moves at a constant rate toward a rotating surface, where the beam molds it into thin slices. As in other forms of 3D printing, the slices are then built, layer by layer, into a 3-D object.

Laminated object manufacturing: A sheet of plastic is rolled over a platform. There, a laser cuts the sheet into the shape of the object to be made. A new sheet of plastic is rolled over the platform by a heated roller, bonding it to the shaped slice below. The laser cuts this sheet into the shape of the next layer, and so on, until a 3-D object is made.

· 3D Printing

If you have a 3D printer, you can build some pretty cool stuff. Here are some of the coolest items that computer scientists and designers have come up with. Some of these products are available for purchase, so if you're interested in buying one, do an Internet search and see what you can find!

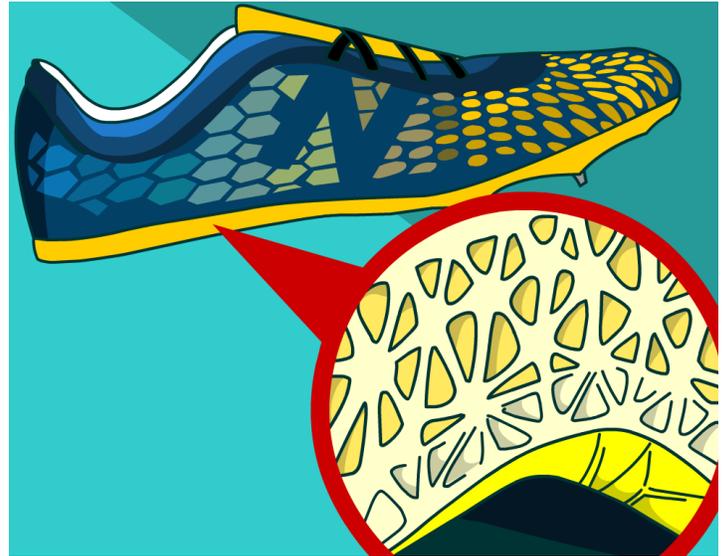
Keys: Computer science students at MIT have created a software tool that allows users to copy almost any key in the world.

Musical Instruments: In 2012, a company called Bespoke Innovations created the first 3D printed acoustic guitar. For those with limited musical talent, 3D-printable kazoos are also available.

Clothing: A company called Continuum makes 3D-printed swimsuits based on the exact physical measurements of their customers. Meanwhile, architect Francis Bitonti and fashion designer Michael Schmidt made a 3D-printed dress consisting of 2,500 pieces that were joined together by hand.

Sneakers: In March 2013, Nike announced that its new football shoes would contain 3D-printed components. Around the same time, New Balance revealed that it had created a 3D printed shoe custom-designed around individual runners' feet. To create the model, the company uses sensors and motion-capture technology to measure how a runner's feet moves inside his shoes.

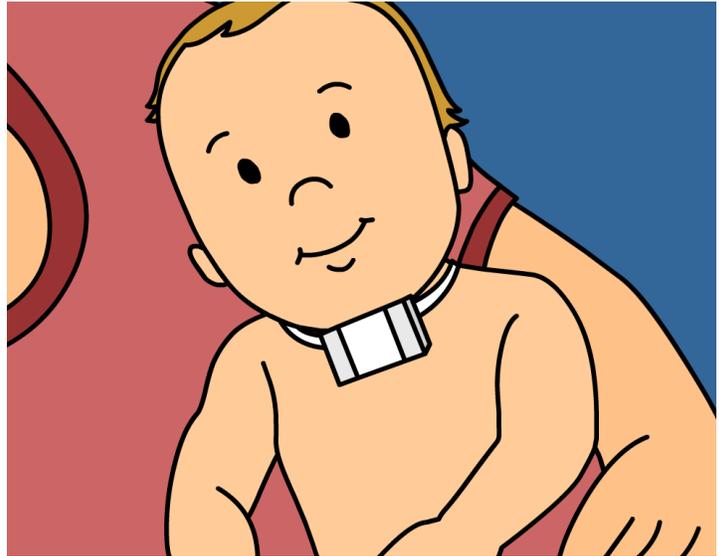
Electric Skateboards: In 2011, engineers in Los Angeles rolled out the ZBoard, an electric-powered skateboard. A 3D-printed weight sensor on the front of the board tells the ZBoard's motor to speed up when you lean forward. A similar sensor on the rear of the deck slows the motor down when you lean back. The board's creators also used their 3D printers to test different designs. The cost of fabricating these designs professionally might have prevented them from bringing their product to market.



3D Printing

If you want to know how 3D printing might revolutionize the medical industry, look no further than the case of Kaiba Gionfriddo.

In 2011, Kaiba was born with severe respiratory problems. Part of his trachea (the tube that connects the lungs to the mouth) had collapsed, and he'd stop breathing for a brief time each day. According to his mother, a number of Kaiba's doctors didn't believe he'd leave the hospital alive.



Fortunately, the Gionfriddos contacted Dr. Glenn Green, who got emergency clearance from the U.S. Food and Drug Administration to create a device that would allow Kaiba to breathe.

First, Green and his team took a CT scan of Kaiba's trachea, creating a 3-D computer model of it. Using this model, they printed a device that would provide structural support to his trachea.

The **tracheal splint** perfectly matched the dimensions of Kaiba's airway, and was sewn around it in March 2012. It expanded the trachea and gave it an artificial "skeleton" to help it grow properly. Since the splint was printed out of a biodegradable substance, it will be absorbed by Kaiba's body in a few years. In other words, he'll never need surgery to remove it!

Twenty-one days after the splint was implanted, Kaiba was breathing without the help of a ventilator. Since then, he has had no breathing problems.

"Kaiba's case is definitely the highlight of my career so far," said Scott Hollister, an engineer on Green's team. "To actually build something that a surgeon can use to save a person's life? It's a tremendous feeling."

3D Printing

As 3D printing grows in popularity, the legal issues surrounding it have become more complicated. At the heart of the matter is the issue of **copyright infringement**.

Just about any object you can buy in a store has been trademarked or copyrighted. That means it can't be sold or distributed without its creator's permission. For example, Moby is a copyrighted character, and his likeness is owned by BrainPOP. If you started producing and selling Moby action figures without BrainPOP's permission, it'd be illegal. You'd be ordered to stop, and if you didn't, you might face legal action.

Now, let's say someone creates a 3D image of Moby that can be printed as a 3D action figure, and makes it available for free on the Internet. People who download it, print it out, and create their own Moby Army might think that the file has been authorized.

And if they share the file with their friends, they might be breaking the law without realizing it!

That's why systems have been put in place to catch folks who illegally distribute copyrighted material. Websites allowing users to share copyrighted music and video files have been shut down. Crafty users have found ways to get around these laws and continue distributing stuff for free, but if they're caught, they still face fines and possible jail time.

So, if you have a 3D printer, be careful how you use it. Don't create 3D files of copyrighted objects. And if someone offers you a free 3D file that'll allow you to print the likeness of a copyrighted object, don't take it!

