

3D Printing More Than Impressive

Most people know how computers and printers work together to produce a two-dimensional printed impression of an image created on a computer screen.

Once a computer-created image is completed—whether it is a drawing, design, or text—the computer sends data to the printer, which deposits ink in a pattern that duplicates the visual image on the computer screen. The result is a flat, two-dimensional image. It has the dimensions of length and width.

But now, increasingly complex printers are creating three-dimensional, or 3D, objects that have length, width, and depth. These printers allow designs on a computer to be produced in a solid form. Instead of a flat picture of a ball, for example, a 3D printer can create a round ball that can be tossed and caught.

3D printers build objects with layers

Often, 3D printing is done using an additive process. That means the 3D shape of the object is produced as the 3D printer lays down thin, stacked layers of a material until the entire object is built up. Each single layer is much like the ink layer a typical printer would apply to a page. Instead of ink, the 3D printer adds layer upon layer of a material, typically a plastic-like liquid resin, that quickly hardens as each layer is applied. Each of these layers represents a precise, thin horizontal cross-section of the finished 3D object.

Materials used can vary greatly

Various other materials can also be used in 3D printing, including metal, ceramic, or glass powders. Lasers fuse them into solid form by following a pattern created by computer software.

The possibilities of using other materials seem almost unlimited. At the University of Exeter in England, for example, researchers developed a 3D chocolate printer. It can create a chocolate candy, layer by layer, in almost any configuration desired.

Three-dimensional printing is also being applied in many other fields where it might reduce costs, save the planet, or even save lives.

For instance, 3D printers and electricity-conducting inks are being used to make circuit boards for tiny electronic devices. A 3D printer using a sand mixture has created artificial reefs to restore real reefs off the coast of Monaco that have been damaged by pollution. Three-dimensional printing also is increasingly being used to make custom medical devices to assist both doctors and patients.

Automakers helped pioneer the process

Some of the earliest uses of 3D printing go back to the 1980s when manufacturing companies began using “rapid prototyping,” a way of quickly making a sample product or part.

The automotive industry was among the early leaders in 3D printing. The manufacturers used it to make sample car bodies or parts to see how well they fit together or how the final product would look.

The technology behind 3D printing was patented in 1986, but the term 3D printing was not used widely until 1996.

Automobile manufacturers and parts makers have come a long way since then. Today, some auto companies are using 3D printing to make working parts of engines or auto interiors.

Many other kinds of industries have embraced rapid prototyping using 3D printing, including some major shoe companies. As the speed of 3D printing has risen and the cost has dropped, manufacturers are finding that they can save much time and money creating sample products.

For example, one major shoemaker has used 3D printers to create various samples of multicolored shoes. Creating a sample was once a process that cost thousands of dollars and took weeks to finish. Now the cost is far less, and any changes desired from the first prototype can be incorporated into a new design and printed the same day.

3D leads to rapid manufacturing

Continuing advances in 3D printing technology have led to a process called "rapid manufacturing." It means companies are using 3D printers to make final products rather than only samples of the product.

This technique is particularly useful for companies that offer limited quantities of custom-made products for customers.

Three-dimensional printing has many advantages in manufacturing. It can be done quickly. It can save money and energy. It reduces material waste and allows for highly customized products.

These are some of the reasons the 3D printing industry is expected to grow worldwide.

Will 3D change production methods?

As it has continued to advance, 3D printing technology is likely to change many aspects of our lives well into the future.

For example, some predict that widespread use of 3D printing might change product manufacturing. It might mean far smaller manufacturing plants located much closer to customers.

Having smaller plants might enable the companies to make made-to-order products much less expensively than in the past as well as cut shipping costs. If products are made to order, companies will not have to stock large amounts of products that might not sell or need to be stored in warehouses.

Although the advantages are clear, some contend a disadvantage might be that smaller plants would employ fewer workers or mean that workplaces would be more scattered than they have been in the past.

Others worry that if 3D printers become smaller, more affordable, and easier to use, people eventually might be able to make some of the products they want right from personal computers, reducing the need for factories.

Others argue that the reverse might be true. They say a new world of manufacturing fueled by 3D printers could create demands for workers skilled in 3D design, troubleshooting, and numerous other aspects of this expanding technology. This shift in demand might regenerate a manufacturing job base that has been eroded by other technology in recent years.

Regardless, as 3D printing technology continues to evolve, it seems clear it will continue to make a major imprint on daily life around the world.

9. Which paragraph is the **best** summary of the passage?

- (A) Unlike traditional printers, 3D printers make objects that have length, width, and depth. Automobile manufacturers and shoemakers have used 3D printers to create products. The technology existed for many years before the term “3D printing” became widely used.
- (B) Some people believe 3D printers will have a positive effect, but others are not so sure. Automobile manufacturers believe that the technology is helpful and are already using it to make some automobile parts. The 3D printers have made working parts of engines and parts for auto interiors.
- (C) In 3D printing, a printer stacks layers of material on top of each other to form an object. Three-dimensional printing can use various material to make many types of products. One early use of 3D printing was making sample parts for automobiles. In the future, 3D printing may lead to smaller manufacturing plants offering custom-made goods.
- (D) Three-dimensional printing is a new technology that some industries have already started to use. One shoemaking company has used 3D printers to create samples of multicolored shoes. This task used to require weeks to complete and thousands of dollars. Some people worry that 3D printing could reduce the number of factories and the number of jobs.

10. Read the sentence from the passage.

“Three-dimensional printing also is increasingly being used to make custom medical devices to assist both doctors and patients.”

What is being suggested by the use of the word custom?

- (A) acceptance
- (B) luxury
- (C) personalization
- (D) equality

11. Read the sentence from the passage.

“Some of the earliest uses of 3D printing go back to the 1980s when manufacturing companies began using ‘rapid prototyping,’ a way of quickly making a sample product or part.”

Which statement **best** describes how the author’s use of the phrase “rapid prototyping” influences the reader?

- (A) It emphasizes the speed at which companies are able to produce a product.
- (B) It suggests that 3D printing has not changed since it was first developed.
- (C) It emphasizes the problems encountered when using 3D printing for anything other than a sample.
- (D) It suggests that companies that once ignored 3D printing have now become interested.

12. Based on information in the passage, how could 3D printers have a negative effect on workers?

- (A) They may only offer benefits to people working in the automobile and shoe industries.
- (B) They may have to be serviced by people who understand computer technology and design.
- (C) They may affect the amount of manufacturing time a company needs to produce a product.
- (D) They may cause large factories that employ many people to become obsolete.

13. What is the author’s purpose in writing the passage?

- (A) to explain a technology that some people may not be familiar with
- (B) to persuade people to use a new type of printing device
- (C) to encourage people to learn how to use a technology to their advantage
- (D) to prove that new printing devices may not last as long as older ones