

# The Incredible World Of 3-D Printing

| Yakov M. Wagschal

## Could You Please Print Me A... Tuna Sandwich?

*Once upon a time, printing shops were places where books, newspapers and flyers were printed. Now, though, we are on the verge of a revolution in printing, in which every sort of product, from big to small, will be manufactured with printers. Get ready for the advent of the latest technology that is taking the industrial world by storm!*





When most people hear about printing, the first thing that comes to mind is a printing press where *sefarim*, books, newspapers or magazines are printed. This article, though, is not about printing reading material, but about printing items such as jewelry, cars, food and even homes!

In the near future, a large percentage of products will be produced in a print shop using a technique called 3-D (three-dimensional) printing. Just as in the early days of the old-fashioned 2-D printers, few individuals will be able to afford their own 3-D printer at first. But the day may not be too far off when anyone will be able to afford a personal 3-D printer.

## How Does 3-D Printing Work?

In some ways 3-D printing mimics the more traditional forms of printing. The information is entered into a computer, which then passes this information to a printer. The difference is that here the information is not a flat electronic image, but an electronic diagram.

Suppose you are printing a shoe. You enter the information for a full three-dimensional model of the shoe into the computer. The computer sends this information on to a printer that uses the specific materials—such as metal or plastic—and colors necessary to reproduce that shoe.

Just like in a regular printer, you must insert cartridges that need to be replaced when they are emptied, except that in the case of the 3-D printer, the cartridge will contain not only the right color but also the particular materials necessary for that job. Plastic and metal are just the beginning. In the future 3-D printing will involve cement for printing buildings, nutrients to print food and cells to help people grow new organs for transplants.

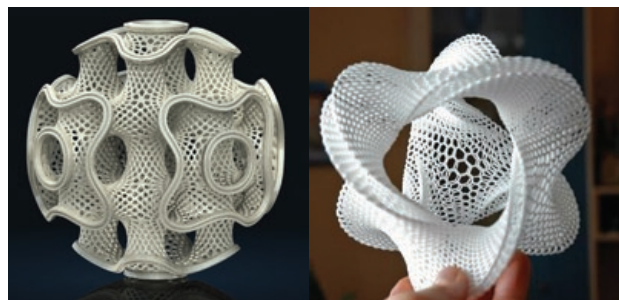
Just as books are printed by laying successive lines of ink on paper, 3-D printers produce their products by laying down on a



Model of a building created using a 3-D printer.



A large format 3-D printer for creating bigger products.



3-D printers can produce extremely complex products easily.

base the appropriate materials in the exact form necessary, regardless of what that form is. In 3-D printing, however, the material is “printed” in layers, one above the other, until a complex object is completed. This allows for creating finished products that have been very difficult to produce using traditional manufacturing methods. Using this method, printers can speedily churn out

items that used to take hours or even days to finish.

To better understand what we are talking about, take an apple and study it closely. Now we challenge you to figure out how to reproduce it. We’ll go easy on you this time and allow you to use plastic instead of edible material. What do you know about manufacturing? Don’t worry; we’ll help you out:

Cut the apple horizontally into thin slices. Starting from the bottom, pile the layers one on top of another in the correct order until you reach the top. That is how a 3-D printer does the job. It produces an article one layer at a time until the product is completed. Using this method it can speedily churn out items that used to take hours or even days to finish.

Not only that, but the 3-D printer produces fully assembled products. Think of a watch, with its many gears that interlock and turn each other. Until now each part was produced separately and then the entire watch had to be painstakingly assembled. Using 3-D printing the same watch can be produced with assembly completed. The parts are produced right where they need to be, ready to spin and interlock with the other parts.

If you are not astounded, think of it this way: When you pour a model bicycle from plastic, the wheels will not turn, of course. They are formed as a single continuous piece of the remainder of the bicycle. Using 3-D printing, however, the same model will have fully functional parts the moment it leaves the printer. The wheels will all spin normally.

## Who Invented 3-D Printing?

3-D printing is a relatively new technology—so new that for most of us it still sounds like a wild fantasy. Yet the basic technique was invented nearly 30 years ago, in 1986. The inventor was Chuck Hall, founder of 3-D Systems Corp.

Hall was looking for a new and simpler method of producing complex products and parts. In the past, the manufacturing process

began with raw parts that were shaped, stamped and drilled until they reached the necessary form. This method was called the “subtractive process” because it involved whittling away at the material to produce the final form.

Hall came up with the idea of reversing the process. Instead of cutting, hammering and drilling away at a piece of metal until it reaches the final shape, the product would be built from the ground up in the first place using the correct form. This is done by adding material layer by layer in a method Hall calls “additive manufacturing.” Today it is more commonly known as 3-D printing.

Hall’s invention aroused excitement in the manufacturing world. It cut a tremendous amount of waste, both in terms of the material and in terms of the time spent to change its form. For many years Hall’s invention remained little more than an idea. Computers could not generate 3-D models with the ease they can today. The few 3-D printers that were built cost millions to develop and few companies could afford them.



A 3-D-printed bicycle is fully functional by the time it emerges from the printer.



Transform your children’s drawings easily into a live model!