3-D printing: The next big thing?

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March 12, 2008 (Computerworld) Heading a start-up after leaving his position as head of Microsoft Game Studios, Ed Fries thought that he might be able to sell 10,000 units of his product -- personalized online game figurines -- the first year.

After two months, about 100,000 people had signed up, and Fries had to institute a lottery to determine which customers would actually be served.

Fries and his his start-up, FigurePrints LLC in Kirkland, Wash., are using a process called 3-D printing that uses printer-like machines to build small models, parts and prototypes. The technology has been around for a while but is moving closer to the small shop and perhaps even the consumer space, some observers say.

FigurePrints.com makes one-eighteenth-scale figurines of action characters developed (through lengthy game play, during which they acquire armor and attributes) by players of the World of Warcraft multiplayer online game.

Full-color World of Warcraft game figurine created by FigurePrints.com with a 3-D printer.

The buyer chooses a pose and a pedestal, and the figurine (averaging 4 in. high) is shipped with a bell-jar dust cover for $99.95, plus $14.95 for shipping and handling. With four machines built by Z Corp. running around the clock, Fries can make 48 figurines per day. The initial 100,000 prospects, meanwhile, amount to about 1% of the 10 million World of Warcraft subscribers.

How does it work?

3-D printing is the low end of a market variously called rapid prototyping (RP) or additive manufacturing. 3-D computer-aided design (CAD) files are converted into thin slices that are then built one upon the next using various processes, including heated powders, extruded plastic filaments and resins precisely cured with lasers, explained Terry Wohlers, head of Wohlers Associates Inc., an RP consulting firm in Fort Collins, Colo.

It's almost the reverse of taking a small model and slicing it into a multitude of layers. A 3-D printer is able to "print" the first layer of the model using, for example, a plastic-like substance. It then "prints" the next layer on top of that one, and so on. In the process, all the slices are bonded together, and you end up with a solid, 3-D representation of the model described by the CAD file.

Fries' experience might be a foreshadowing of a technological development that could sweep away economic pillars such as manufacturing and distribution.

The idea goes like this: Today, information is readily available online and can be faithfully reproduced locally with laser or ink-jet printers. But tomorrow, many more descriptions of 3-D objects may be available online, and consumers will be able to faithfully reproduce them using 3-D printing, circumventing most stages of commerce.

A 3-D printer from Z Corp. for the commercial market.

Most of the resulting models are basically plastic prototypes suitable for form, fit and function testing, or for casting molds. But some high-end processes produce metal parts suitable for immediate use, Wohlers said. Prices for commercially available 3-D printers currently start at about $20,000. At the high end, you need several hundred-thousand dollars to get started, he said.

What about accuracy?

As for the accuracy of the printed models, RP tolerances aren't as good as what's available with plastic injection molding, explained RP consultant Todd Grimm, president of T. A. Grimm & Associates Inc. in Edgewood, Ky. But they can be better than investment casting, which is used to make items such as golf clubs and other metal items that will be subjected to further finishing, he added.

Tolerances for high-end RP machine are usually 0.1% or 0.2%, said John Kawola, vice president at Z Corp. in Burlington, Mass.

With low-end 3-D printers, tolerances are rarely less than 0.5%. "But with, say, an engine block, you don't care about the tolerances except for the holes, and you machine-finish those anyway," Kawola said. "3-D printing probably satisfies 70% to 90% of what people want to do with a prototype." Consequently, sales of 3-D printers have been growing by 30% to 40% yearly for several years and now amount to 80% of the whole RP market, Kawola said.

"It speeds up the design process by at least a factor of four," estimated 3-D printing user William Effrece, lab manager at The Stanley Works tool factory in New Britain, Conn. "Previously, making a prototype was something done only at the end of the design process, it cost $3,000, and you had to wait two or three weeks. Now it can be done in a day, and the only expense is the cost of the materials. Our machine paid for itself in three months." He uses a 3-D printer from Z Corp., whose powder-deposition model-building technology allows for photorealistic models.