THE REVOLUTION WILL BE PRINTED

By Michael Ventura
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That headline has been digitally duplicated (plagiarized) from David Bjerklie's essay in *Time's* special edition: "100 New Scientific Discoveries." Bjerklie's headline says it all.

Three-dimensional manufacturing is the making of something out of practically nothing. This technology accelerates as we speak. Bjerklie reports that there is only one retail outlet that sells 3-D printers, MakerBot in New York City. Only one, but it sold 15,000 3-D printers by late 2012.

Every new article on the subject reports something you never dreamed of. A week ago I didn't know that 3-D printers could make food.

Bjerklie writes of "a pork chop … produced by a bioprinter equipped with pig-cell ink that had been grown in vitro." Scientists are working on "3-D printed meat" that "could lessen the environmental impact and ethical objections of raising meat the old-fashioned way." The 3-D process would be lots cheaper than herding cows. The Great American Cowboy, or what's left of him, may ride off into the sunset for keeps.

Like most writers on the subject, Bjerklie quotes a researcher's warning. In this case, it's Michael Idelchik, vice president for advanced technologies at GE Global Research. Idelchik cautions that 3-D printing "has to the potential to fundamentally disrupt" all that we take for granted.

The real eye-opener is Professor Neil Gershenfeld's lengthy essay in *Foreign Affairs* (Nov.-Dec., 2012). Professor Gershenfeld is not a journalist. He is a scientist, the leader of the Massachusetts Institute of Technology's Center for Bits and Atoms. "Cutting edge" is a clichéd usage, but not in Gershenfeld's case. His Center is the knife point of the cutting edge. He subtitles his essay, "The Digital Fabrication Revolution."

Here's long and the short of it, in Gershenfeld's words: "Digital fabrication will allow individuals to design and produce tangible objects on demand, wherever and whenever they need them."

Three-dimensional printers are already old hat to the professor. "The revolution," he writes, "is … the ability to turn data into things and things into data. … Scientists in a number of labs (including mine) are now working on the real thing, developing processes that can place individual atoms and molecules into any structure they want. Unlike 3-D printers today, these will be able to build complete functional systems at once, with no need for parts to be assembled. The aim is to not only to produce parts for a drone, for example, but build a complete vehicle that can fly straight out of the printer. … Similarly, although today's digital manufacturing machines are still in their infancy, they can already be used to make (almost) anything, anywhere. That changes everything."

The professor, an able writer, chooses his words with care. When he says everything, he means everything.

His work is "democratizing access to the modern means to make things. … The ability to send data across the world and then locally produce products on demand has revolutionary implications for industry."

When Gershenfeld's "three-dimensional assemblers" become practical, as he is certain they will, they shall be able, first and foremost, to replicate themselves. So there won't be

a 3-D assembler industry, as we understand the word. No central suppliers. When you have one assembler, you can make more assemblers. And they can make anything.

"A design created [anywhere] can be sent electronically anywhere in the world for on-demand production, which effectively eliminates the cost of shipping."

Hit pause. A major aspect of geopolitics is the securing of free-trade sea lanes. With 3-D assemblers, solid products don't need to be shipped. The use of transport vehicles – ships, trains, trucks, planes – will be cut to a fraction of present use. Eighteen-wheelers will be obsolete. So will large harbor and docking facilities. So will box stores like Walmart, Target, and Home Depot. Most stores, in fact. Online shopping, too, will be largely obsolete. "The means of production," writes the professor, "can be owned by anyone."

So, a friend of mine opined, the future of profits will be in the supply of materials for 3-D production.

No.

Gershenfeld: "A deeper meaning of 'digital fabrication' is manufacturing processes in which the materials themselves are digital. A number of labs (including mine) are developing digital materials for the future of fabrication."

It seems that digitalized matter does not wear out.

The professor again: "Even more important is what the assemblers don't create: trash. … [A] product assembled from digital materials need not be thrown out when it becomes obsolete. It can simply be disassembled and the parts reconstructed into something new."

Hit pause again. Two points:

First, a single product could be recycled into another product and then another, for a considerable time. You resupply yourself.

Second, the pollution of manufacturing and shipping can be cut to an astonishing extent when the need for heavy commercial transport virtually disappears. The 3-D manufacturing process creates no trash and scant carbon footprints. The polluting methane of livestock may be cut drastically as well. Pollution in the not-so-distant future – 30 years? 50 years? 20? – could be miniscule when compared with today's. Maybe the planet can breathe again.

Gershenfeld ends his essay with a benign-sounding question: "How will we live, learn, work, and play when anyone can make anything, anywhere?"

Moshe Vardi, a computer scientist at Houston's Rice University, puts the question differently: "Are we prepared for an economy in which 50 percent of people aren't working?" (Associated Press, Jan. 25).

That figure sounds light to me. Factor in robotics, and 80% could be unemployed. Yet everyone could have whatever supplies they need.

Gershenfeld writes of a project in Barcelona, Spain, a city of more than 1.6 million that suffers 50% youth unemployment: "Rather than purchasing products from far away, the city … is deploying [existing 3-D technology] in every district as part of the civil infrastructure. The goal is for the city to be globally connected to knowledge but self-sufficient for what it consumes."

That certainly does change everything.

For capitalism can't cope with this. Not only does digital fabrication outdistance the concept of profits, it outdistances the concept of a company and the concept of employment. In fact, when anyone can make anything anywhere, the very concept of

capital becomes largely unnecessary. There won't be a stock exchange because there won't be stocks.

Every high-profile commentator today assumes the longevity, even the finality, of some sort of capitalism, as though it's the "ism" that cannot die.

A law of history: There is no final "ism."

Everything, but everything, will change within the lifetimes of the students I taught in high school who are now in their twenties. Count on more surprising consequences than any generation has yet faced.

But don't worry.

Digital fabrication won't mean a boring utopia.

We are human beings; fucking up is what we're best at.

Correction: What we're best at is not giving up.

Then comes fucking up.

We're also pretty good at doing the utterly unexpected.