

A Critique of 3D Printing as a Critical Technology

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Republished from **Johan Söderberg**:

“The third industrial revolution might come with personal or digital manufacturing, when what used to be bought in a shop could be made at home with such tools as laser cutters, 3D printers and computer numerical control (CNC) milling machines. They are all based on the same principle, using software to help guide the movements of a machine tool, and the one that has attracted the most media attention is a printer that prints three-dimensional objects, with a nozzle that lays down a plastic material layer by layer. Designs for the printer of such objects as doorknobs or bicycles can be downloaded from the net.

The media articles featured one of the many commercial 3D printers, but the technology was developed by a loose network of hobbyists or “makers,” whose homemade 3D printer is called RepRap. They are rooted in the world of free software and strive to apply the same values and practices to manufacturing; some aspire to democratise the means of production and abolish consumer society. It is often predicted that 3D printing will reduce labour costs and lessen the incentive of firms to outsource production to low-cost-labour countries. This idea, which is closer to a respectable business outlook, is endorsed by the publisher of Make magazine, which also organises annual Maker Faires in major US cities.

At the New York 2011 Faire, I noticed a certain dissonance with the revolutionary ideals. A corner of it was dedicated to “the Print-Village,” with 20 booths devoted to the RepRap and its many derivatives. Nearby was a much larger pavilion with many exhibitions of sophisticated CNC machines, and one booth that stood out — it was for the “Alliance for American Manufacturing,” between American steel manufacturers and United Steelworkers (USW), and had red, white and blue banners with the message “Keep it made in America.” A hostess handed out badges with the same message; she confessed to me she found it ironic to be doing that here, next to the machines descended from a technology that contributed so much to the destruction of factory jobs in the United States and elsewhere.

The historian David Noble has shown that CNC machinery came out of numerical control (N/C) machinery — automated machine tools — which originated in the context of the cold war, its development largely funded by military contracts. The technology was thought to be crucial to the arms race against the Communist enemy, and the fight against unions; a major source of union strength was the workers’ knowledge monopoly over the production process.

This had been identified by Frederick W Taylor, in his principles of scientific management: “The managers assume ... the burden of gathering together all of the traditional knowledge which in the past has been possessed by the workmen and then of classifying, tabulating, and reducing this knowledge to rules, laws and formulae which are immensely helpful to the workmen in doing their daily work.” The pages preceding this quote describe the ways that workers can pretend that they are

working at full speed to fool their employers. A benchmark of average performance had to be established so that lazy, dishonest workers could be detected, but when engineers were sent in to measure worker productivity, the workers learned how to fool them too.

Compliance could be enforced through the design of the machinery. In the early 19th century, the British mathematician Charles Babbage travelled to observe different branches of industry, and then produced a catalogue of ingenious mechanisms by which the honesty of servants and workers could be ensured in the absence of their master. He declared: “One great advantage which we may derive from machinery is from the check which it affords against the inattention, the idleness, or the dishonesty of human agents.” Babbage is chiefly remembered as the “father of computers,” due to his pioneering experiments with calculating machines; his Analytical Engine was programmed with punched cards, “software” that was used a century later in N/C machines.

Noble explained how software realised the dreams of control of Babbage and Taylor: “Essentially, this was a problem of programmable automation, of temporarily transforming a universal machine into a special-purpose machine through the use of variable ‘programs’, sets of instructions stored on a permanent medium and used to control the machine. With programmable automation, a change in product required only a switch in programs rather than reliance upon machinists to retool or readjust the configuration of the machine itself.”

The aim of reducing managers' dependency on skilled machine operators was an incentive behind the development of N/C technology, as were the need to manufacture parts that could not easily be constructed manually, the imperative of increasing productivity and, as far as the researchers at the Massachusetts Institute of Technology (MIT) were concerned, the joy of solving mathematical problems. Noble argues there were alternatives that would have had less adverse consequences for workers, but these were deliberately not pursued.

This puts the enthusiastic claims for 3D printers into perspective. One claim is that laid-off American workers can find a new source of income by selling printed goods over the Internet, which will be an improvement, as degraded factory jobs are replaced with more creative employment opportunities. But factory jobs were not always monotonous. They were deliberately made so, in no small part through the introduction of the same technology that is expected to restore craftsmanship. "Makers" should be seen as the historical result of the negation of the workers' movement. Many high-profile makers are students and teachers at MIT, which played such a decisive role in the creation of N/C and CNC technology. This history returns as a repressed memory for makers, in their obsession with abandoned factories and scrapyards. Detroit, the global symbol of deindustrialisation, is repeatedly featured in Make magazine and associated blogs.

Catherine Fisk, a lawyer, has gone through old trials in the United States in which employers and employees confronted each other over the ownership of ideas. In the early 19th century, courts tended to uphold the customary right of workers to freely

make use of knowledge gained at the workplace, and attempts by employers to claim the mental faculties of trained white workers were rejected by courts because this resembled slavery too closely. As the knowhow of workers became codified and the balance of power shifted, courts began to vindicate the property claims of employers. This lends a different aspect to the makers' ideas about alternatives to copyright, such as free software licenses and Creative Commons. Some researchers have warned that these might end with workers exploiting themselves. There is a crowdsourcing platform owned by Amazon, where net users are invited to solve simple tasks, such as identifying people in photographs. The average income of an "employee" is \$1.25 an hour.

Plans are already being worked out for integrating home 3D printers into a flexible production line; and it is easy to see how this could lead to downward pressure on wages in the industry. When I suggested this to Adrian Bowyer, the instigator of the RepRap project, he agreed, but said: "It might not be such a bad thing for workers, because they would not have to buy as many things in stores." So the struggle is to be fought out at the point of consumption, involving intellectual property legislation and the design of the tools made available to the general public.

While some hobbyists strive to develop a machine that corresponds to their ideals about distributed production, entrepreneurs, investors and intellectual property lawyers back a very different idea of what the 3D printer might become. The stakes were spelled out in the Technology Bill of Rights, proposed in 1981 by the International Association of Machinists (IAM), when CNC machines were making inroads into

manufacturing industry. The manifesto declared: “The new automation technologies and the sciences that underlie them are the product of a world-wide, centuries-long accumulation of knowledge. Accordingly, working people and their communities have a right to share in the decisions about, and the gains from, new technology.”

Source: Le Monde diplomatique, March 2013

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