Is Additive Manufacturing a Real Revolution?

Hod Lipson[1]

So much is happening in the 3D printing space, it's hard to keep track. Every day a new device is launched, a new 3D printing material is created, and a new application is demonstrated. Yet many analysts seem to ponder: Is 3D printing merely hype, or is it here to stay? Will it fade away, or is it a real industrial revolution? These questions are not without merit; technologies come and go, some of them change our lives forever, and some disappear without a trace. And while the market size of 3D printing is nearing $3B, that market is dwarfed by conventional manufacturing that is at least three orders of magnitude larger. Is 3D printing just another manufacturing technology, or is it a game changer?

Here's why I think 3D printing is a real revolution. If you look back at previous industrial revolutions, you'll see a common thread—in all industrial revolutions, a major industrial cost driver vanished. A substantial industrial cost factor dropped by orders of magnitude, essentially disappearing from the equation. That dramatic change led to a cascade of new industries and new innovation. In the first industrial revolution, it was the cost of power. Before steam engines, every watt was precious. Power came from animals, water wheels, and wind mills, but after the steam engine was invented, power became readily accessible, paving the way to entirely new industries such as transportation.

In the second industrial revolution, the cost of calculation dropped. Before electronic computers, even the best people with the best equipment could add but a few hundred numbers per hour. After electronic computers, anyone could add thousands of numbers a second—leading to a cascade of new industries. In the third industrial revolution, the cost of communication dropped significantly. Just a few decades ago sending large amounts of information long distance was slow and unreliable. Today we send terabytes across the planet, and we don't worry whether it will reach its destination. The ability to communicate led to a cascade of new industries, such as e-commerce and social networking.

3D printing has the same hallmark. A major drop in the cost of manufacturing complex things. Before 3D printing, fabricating complex shapes required substantially more skill, time, effort, and budget. But a 3D printer can make a complex shape as easily as it can print a rectangular paperweight. The marginal cost of complexity is tending to zero. While designing complexity is still challenging, manufacturing complexity is becoming easier by the day, and this is leading to a cascade of new innovation across many fields. There is no doubt that the steam engine, the computer, and the internet were not a fad or hype; they wormed their way into every discipline, every field, every industry. And so will 3D printing.

Which fields will be affected most? Fields that involve making complex shapes and optimized products in relatively small quantities. It is not surprising, therefore, that the first industries to embrace 3D printing are aerospace and medicine.

In this issue, we look at some of these aspects in depth. We take a look at industrial adoption trends, and we take a deep dive into use of 3D printing in biology.

As the editor-in-chief, I hope that you enjoy this issue and join us as an active participant in this new resource. Look out for our next issue of the Journal, publishing in the fall of 2014.

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