

Future of 3D Printing

From: ASME SmartBrief [asme@smartbrief.com]
To: Dennis Horwitz
Cc:
Subject: May 28, 2013 - Opinion: Celebrated 3-D printing has its limitations

ASME SmartBrief



Essential news for the global engineering community

Search past news ▶

Today's Tech Buzz

Sponsored by: OPEN forum

Opinion: Celebrated 3-D printing has its limitations

The possibilities of 3-D printing continue to be explored, but the limitations are less known, writes Carl Bass. It will not replace traditional manufacturing on a significant scale and its unique qualities require a different business model that takes into account 3-D's considerable costs, he writes. [Wired.com](#) (5/28) Share: [in](#) [f](#) [t](#) [E-MAIL](#)

Presented by Dennis Horwitz
Micronor Inc.

Based on WIRED.Com Article by Carl Bass, President/CEO-Autodesk



SUBSCRIBE TO WIRED
Print and Digital Access
Renew | Give a Gift | International

OPINION

provocative primers

business & enterprise

science

cars, gadgets, apps

FOLLOW WIRED OPINION



An Insider's View of the Myths and Truths of the 3-D Printing 'Phenomenon'

BY CARL BASS 05.28.13 6:30 AM

Share
 Tweet 911
 +1 148
 227



A 3-D printed table ... with holes and all. Photo: [rosemarybeetle](#) / Flickr

MOST RECENT WIRED POSTS



Why Book Publishers Are Still Dragging Their Heels on Selling You E-Books



Wired Space Photo of the Day: ISS and Aurora Over Crater Lake

Two Legends Dish on How to Design A Typeface

\$30M VC Investment in Shapeways

Announced April 23, 2013

Venture capital firm Andreessen Horowitz has invested \$30 million, on Shapeways and 3-D printing.

Shapeways is doing for manufacturing, what the internet did for self-publishing, making it accessible to everyone, [says Chris Dixon](#), the Andreessen Horowitz general partner who led the firm's investment in the New York City-based company.



For a fee, Shapeways offers anyone access to very expensive industrial-grade 3-D printers that can crank out objects ranging from jewelry to figurines and other original inventions in stainless steel, ceramic and plastic among other materials. Unlike much cheaper desktop 3-D printers, [Shapeways offers](#) professional designers and hobbyists a more refined end product. In other words, something you might sell.

Staples becomes first major US retailer to sell 3D printers with \$1,299 Cube

Announced May 3, 2013



3D Printing Won't Replace Other Manufacturing Technology

3-D printing will not replace other manufacturing technologies let alone industrial-scale ones [for a variety of reasons](#). It will complement them.

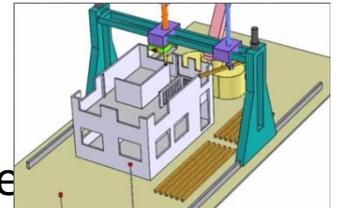
Responses to criticisms of 3D printing

Slow for production? Yes, but it speeds up the design process

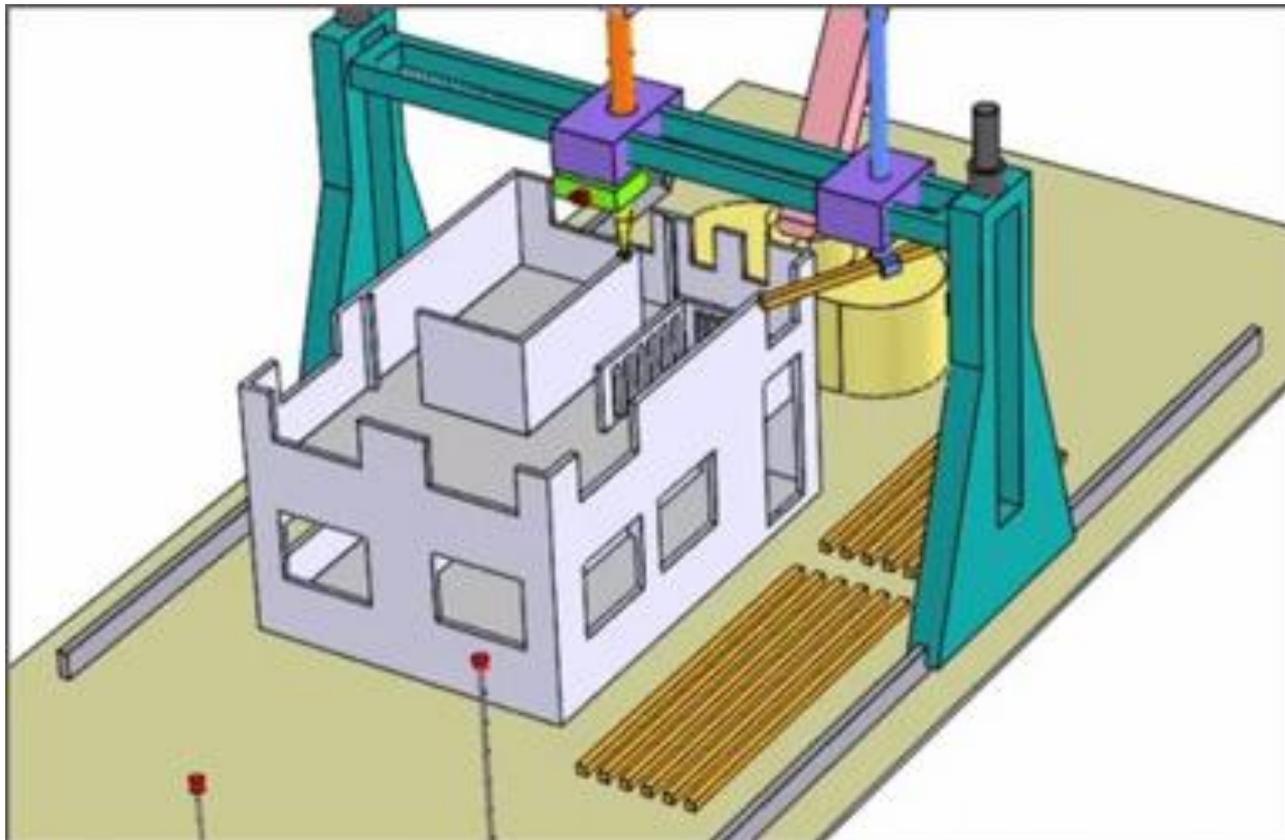
Does speed always matter? Not if the thing being printed is actually impossible (or too expensive) to make or obtain by other means

Niche only? Yes, but maybe the future is more niche than the present: mass production itself may become niche

Mostly small items only? You can actually [build houses using 3D printing](#): also, creating giant 3D printers can be orders of magnitude cheaper than equipping any other fabrication process to produce big parts

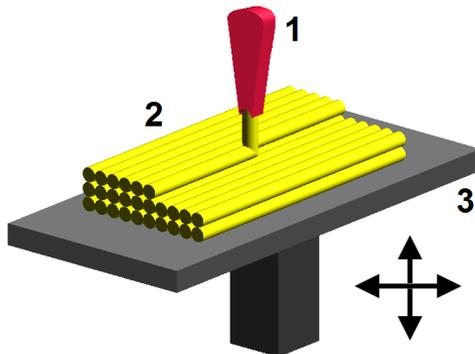


Building A House Using 3D Printing



3D Printing Technologies (i.e. Additive Manufacturing)

| Type | Technologies | Materials |
|-------------------|--|---|
| Extrusion | Fused deposition modeling (FDM) | Thermoplastics (e.g. PLA, ABS), HDPE, eutectic metals, edible materials |
| Wire | Electron Beam Freeform Fabrication (EBF ³) | Almost any metal alloy |
| Granular | Direct metal laser sintering (DMLS) | Almost any metal alloy |
| | Electron beam melting (EBM) | Titanium alloys |
| | Selective heat sintering (SHS) ^[citation needed] | Thermoplastic powder |
| | Selective laser sintering (SLS) | Thermoplastics, metal powders, ceramic powders |
| | Powder bed and inkjet head 3d printing, Plaster-based 3D printing (PP) | Plaster |
| Laminated | Laminated object manufacturing (LOM) | Paper, metal foil, plastic film |
| Light polymerised | Stereolithography (SLA) | photopolymer |
| | Digital Light Processing (DLP) | photopolymer |



Extrusion
Deposition
Process

Typical 3D Printers

Commercial



ZPrinter 250
\$24,900

Home



Cubify 3D Systems
Cube \$1299
CubeX \$2499

We Need A Different Kind of Moore's-like Law For 3D Printing

While the hype paints visions of limitless replication — lost components, shoes, body parts, musical instruments, even [guns](#) — here's a key fact: Where 3-D printing may be unfettered by complexity, it is constrained by volume.

Everything from cost and time to amount of material increases exponentially: specifically, to the third power.

So if we want something twice as big, it will cost 8 times as much and take 8 times as long to print. If we want something three times as big, it will cost about 27 times more and takes 27 times longer to print. And so on.

3D Printing Ecosystem Is Changing

The limitations introduced by “the 3rd power law of 3-D printing” — as well as the freedom of scale introduced by the unfettered complexity — should bookend any discussion of where 3-D printing is going.

But everything else in between these two immutable facts is constantly changing. That includes the quality and speed of 3-D printing as well as the vibrant collection of people and companies working to overcome the current limitations and broaden use of the technology.

The ecosystem [isn't just about](#) the printers, however. 3-D printing is part of the accelerating software-controlled manufacturing trend which is making not just 3-D printers — but laser cutters, mills, lathes, routers, and industrial robots — increasingly powerful, affordable, approachable ... and therefore *accessible* to lay users. Software is democratizing this space just as the PC democratized computing.

3D Research Directions

The 3rd power law of 3-D printing:

Everything from cost and time to the amount of material increases to the 3rd power.

- Printing objects
- Printing electronics
 - Bioprinting
 - Printing DNA
- Architectural scale 3D printing

The Next Shift is from **Prototyping** to *Limited Production*

3-D printing and other technologies in the software-controlled manufacturing trend fundamentally rewrite the rules of mass production.

No longer do we need to produce things in very large quantities to enjoy low cost and high quality; we can get very high quality products in small lots at a reasonable cost.

There is a shift looming where 3-D printing can be useful for more than just rapid prototyping of small plastic parts and for small-batch production. However, don't expect to see 3-D printing replace very inexpensive production methods.

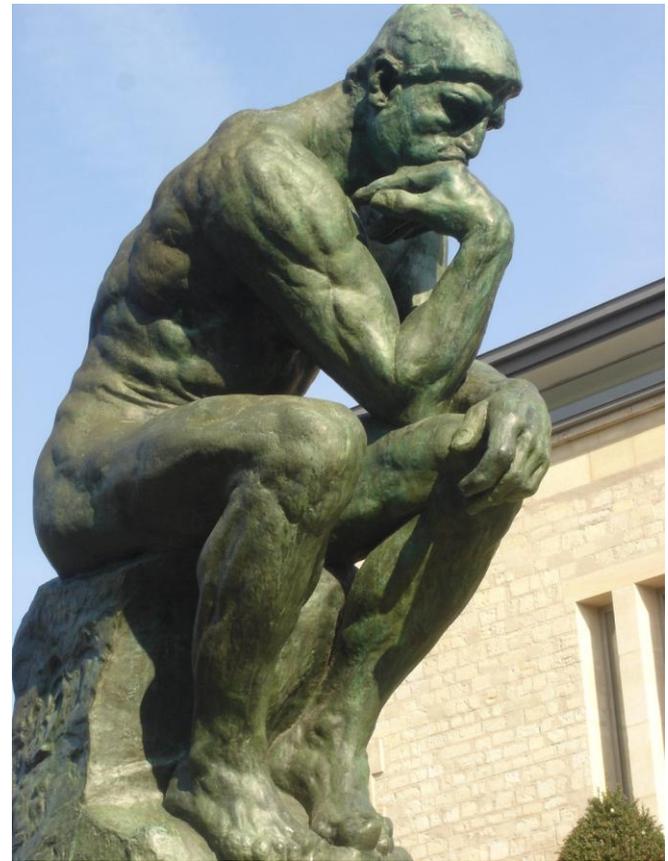
Most 3D Printing will be Personal and Custom

Instead of a mass-manufacturing marketplace where everything is made the same way, expect the “production” trajectory for 3-D printing to start with low-volume, high-value objects like prosthetic devices or bespoke items like [jewelry](#).

Most 3-D printing will be personal and custom, similar to the way we use our inkjet printers today.

Just as rip-mix-burn became the anthem for digital music, we are starting to do the same thing for the physical world with capture-modify-print (or download-modify-print) using only the cameras on our cellphones to inform computer vision algorithms.

What Do You Think?



Get your daily thought feed from ASME SmartBrief!
Sign up today at [ASME.ORG](https://www.asme.org)!

Pick an engineering topic of personal interest and lead a discussion at a future ASME Channel Islands meeting!