

The puzzle masters: How 3D printing is enabling the most complex puzzles ever created

by [Signe Brewster](#) JUL. 29, 2013 - 5:00 AM PDT

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SUMMARY: *Oskar van Deventer and George Miller make puzzles. After George bought a 3D printer in 2003, they started producing puzzles that they could previously only dream of.*



photo: Oskar van Deventer

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[Oskar van Deventer](#) and [George Miller](#) make puzzles.

Not the flat, jigsaw kind, but the complex, 3D variety that most of us associate with the Rubik's Cube. Both have mathematical minds that allow them to dream up wild interlocking pieces that can take weeks to put together. For Oskar, some of his earlier designs were so complex that they were ahead of the manufacturing capabilities of the time, caging the most exotic shapes in his mind.

In 2003, they visited the Chicago Museum of Science and Industry and discovered something amazing: a 3D printer. They watched, mesmerized, as it printed tiny UFO toys. George bought one immediately when he got home.

"This was a super stupid thing to do because I didn't know how to make things, how to run the machine, what language it used or anything like that," George said. "I just said, 'This is something that I have to have.'"

Oskar began sending him puzzle designs. The first, called "Tube Maze," involved slipping a red ring off of a scrambled tube of plastic. Many were unprintable on a machine other than a 3D printer. Oskar's puzzles were free.



Oskar's "Tube Maze" puzzle, which was made with George's 3D printer. Photo by George Miller.

Two puzzle masters are born

Oskar has been making puzzles for most of his life. A 1982 article in a Dutch paper describes 16-year-old Oskar as a "brainiac" and a "prodigy."

DE GOOI- EN EEMLANDER VAN WOENSDAG 7 APRIL 1982

Oskar van Deventer heeft 180 puzzels

Naardense scholier is een Gooise professor Rubik

(Van onze verslaggeefster Jetty Claus)

NAARDEN — De 16-jarige Oskar van Deventer is eigenlijk een Gooise professor Ernő Rubik, de uitvinder van de draaikubus. De Naardense

scholier heeft een verzameling van 180, grotendeels zelf gefabriceerde puzzels. Hij is in wetenschap, natuur- en scheikunde een echte bolleboos. Vaak prijkt er een 10 op zijn rapport.

Oskar heeft geen interesse in legpuzzels, maar wel in ruimtelijk en technisch spelgoed. Het is allemaal begonnen met 'n kubus van een doosje uit de „Donske Dook“. Later kreeg hij een boek om zijn puzzels te maken. De jongen ontwerpt ze nu ook zelf.

Oskar heeft zijn uitvindingen nog eens aan de man te kunnen brengen. Hij is al heel wat spelgoedfabrikanten als Jumbo en Jumbo-burger afgebaas. Hij heeft echter trillen met op reikt



"In the beginning, I used paper, wood, metal wire and, at a later time, I got access through a friend to a very good plastic material that I could cut and glue to make high quality prototypes," Oskar said. "I've made a lot of cube puzzles out of staples. You would not recognize staples as a construction material, but I do. The resulting shape, you can make very nice cube puzzles and they are more rugged than when you are just gluing dice together."



Oskar van Deventer poses with his array of puzzles 3D printed via Shapeways.

George entered the puzzle scene later in life. At the age of 52, he retired from a career as a mathematician and decided he wanted to do three things: go back to school for industrial design, become a ski instructor and publish puzzles. He went back to school. Then he took the classes to become a ski instructor, but the first place that hired him said he would have to shave his beard. So that was out, and he started a puzzle workshop in his backyard.



George Miller poses in his home in San Francisco with his favorite puzzle. It is very tactile, making it ideal for children with autism. Photo by Signe Brewster

One year he visited London and began talking with a shop owner about a small snake puzzle. He let George in on a secret: There's a puzzle fraternity that meets once a year for an event called the International Puzzle Party. It's invite-only and held in a secret location to keep people who steal puzzle designs away.

George joined a few years later. Suddenly, he had hundreds of people to relate to over what had been a personal obsession. It was hard not to notice Oskar, a celebrity in the puzzle community. George admired from a distance for several years. Eventually, they became friends.

3D printing evolves

Oskar's ideas came in rapidly. George slowly figured out the secrets of his Stratasys Dimension printer and began producing the unique multicolored puzzles. Stratasys machines are professional grade, so in 2003 George was printing objects of a higher quality than consumer printers can make today.

"I went nuts over it because you could put different colors in and they're vivid colors and the plastic that it makes is strong. You can't crush it in your hand," George said. "You could manufacture usable things without any post processing. You pull it out of the machine and bam! You can use it right away. That just couldn't be beat."

George limited sales of each puzzle to 100 units and printed each one as he received orders. They required expensive materials and sometimes more than 10 hours to print, and as a result could cost several hundred dollars.

Today, there are more cheaper and more practical options. Oskar [sells his puzzles on Shapeways](#), an enormous online marketplace for 3D printed objects. There are knot, cube, ring, pyramid and tree-shaped puzzles all available for purchase. You can also buy his 17x17x17 "Over the Top" Rubik's Cube, which [set a world record](#) in 2011. It has 1,539 parts and took more than 100 hours to design.



The "Jumble Pebble" puzzle, sold by Oskar van Deventer on Shapeways.



“With Shapeways, I can 3D print puzzles for a price that would be still twice or three times the price of a mass produced puzzle, but the difference is very small and the difference will be shrinking,” Oskar said. “I hope there will be a 3D printer for home use that has the same quality, but it’s not there yet.”

A few of his designs are [available on Layer by Layer](#) now too, but you need a home printer to make them.

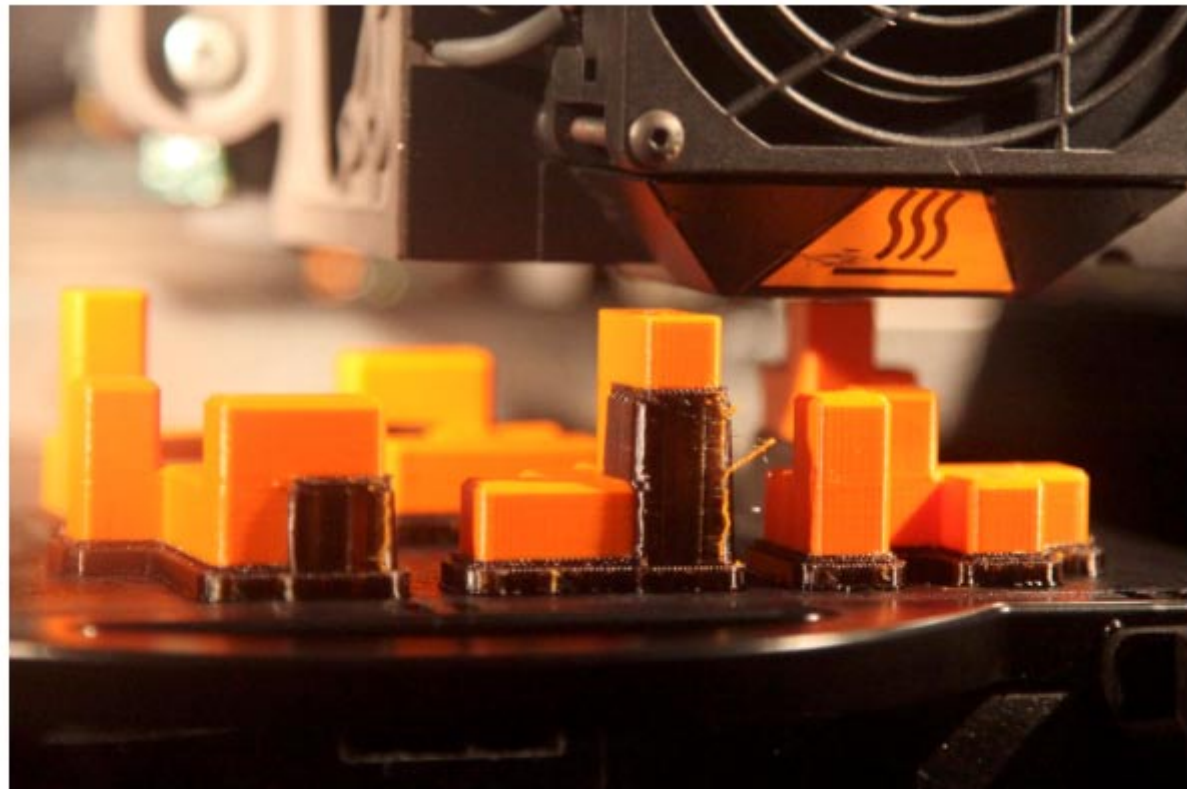
George and Oskar also develop puzzles for mass production. Like the rest of the world, 3D printing has totally changed how they make prototypes. It used to be that puzzle makers relied on drawings or laborious wood carvings. Now they can use a 3D printer, whether they want an object to take to a manufacturer or to just be able to hold their creation in their hands.

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George Miller has brought lots of puzzles to market. In his San Francisco home, he displays many of the original prototypes and the finished, packaged version. Photo by Signe Brewster

During a visit to his home in San Francisco, George showed me how he prints a puzzle. He has since upgraded from his original Stratasys Dimension to a newer model. Unlike most consumer printers, George's professional printer builds with two materials: ABS plastic and a support material that holds up the overhanging parts of puzzle pieces. The nozzle darts between pieces to lay down layers of molten plastic.



George Miller's Stratasys Dimension 3D printer prints pieces for a cube puzzle. Photo by Signe Brewster

George had started the print job early in the morning. It was ready by late afternoon. The print platform lowered and George pulled it out to reveal eight orange Tetris-like puzzle pieces that fit together to form a cube. It joined seven pre-printed, multicolored clones laid out on a table.



George Miller scrapes support structures off of a puzzle he recently pulled from his 3D printer. Photo by Signe Brewster

George scraped off the support material and began a laborious process few people think about: If you make the puzzle, you have to put it together before you can show it off.



George Miller puts together a cube puzzle he 3D printed. Photo by Signe Brewster

“They used to have operators for telephones, and now everyone is their own operator. The same thing is going to happen with 3D printing, but it’s going to take a lot longer because that’s another step up in intellectual endeavor,” George said. “Someday I think this will be natural. I don’t think everyone will do this. I think it’s like music. Not everyone plays the piano. But they can take lessons if they want to.”



George Miller portrait

George Miller poses in his home in San Francisco with a 3D printed prototype puzzle and the commercial version. Photo by Signe Brewster