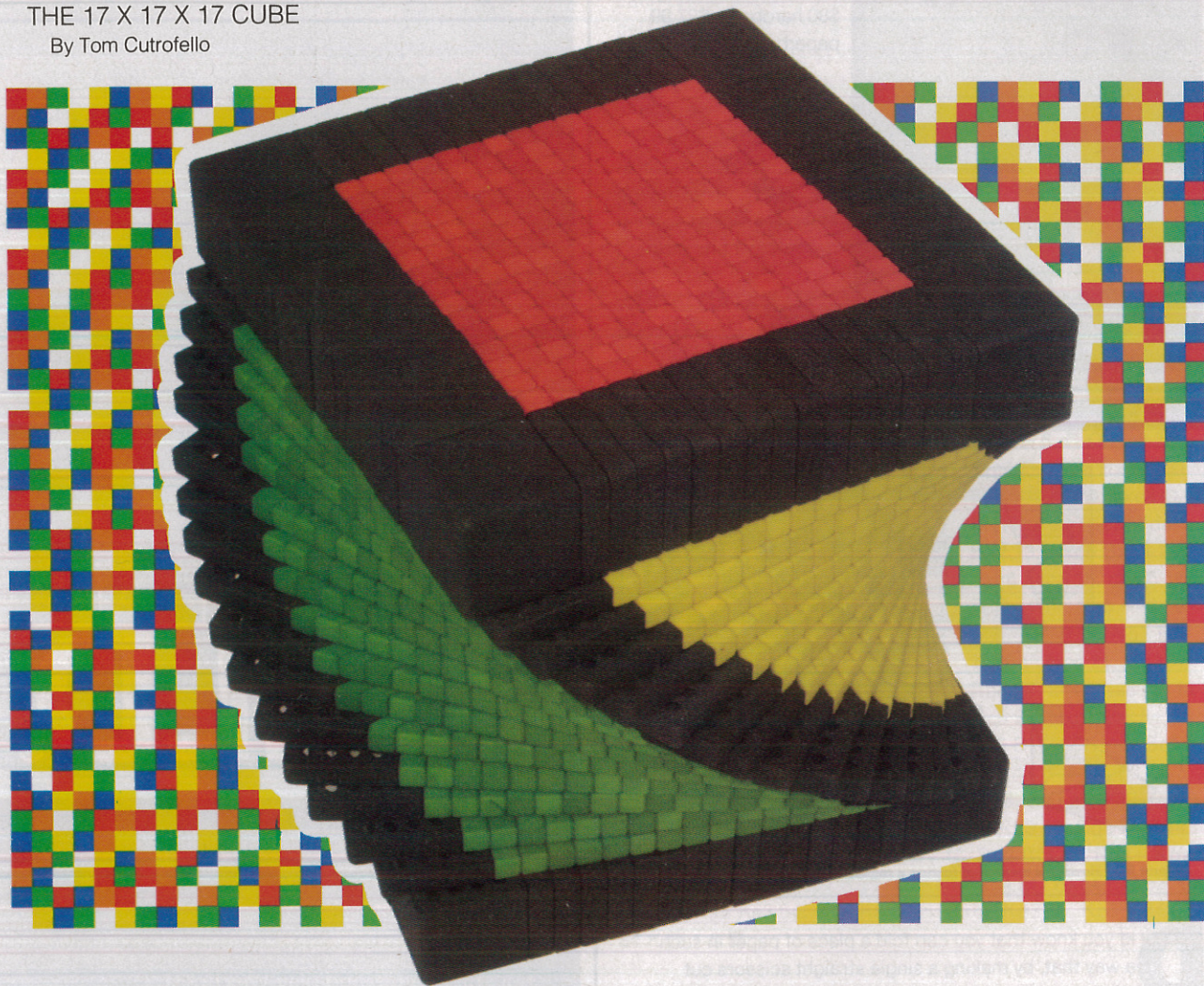


# OVER THE TOP

THE 17 X 17 X 17 CUBE

By Tom Cutrofello



**Q** In February 12, 2011, in New York City, puzzle history was made at the New York Puzzle Party Symposium. Oskar van Deventer, an electrical engineer from the Netherlands, presented a version of Rubik's Cube with an order of  $17 \times 17 \times 17$ .

## QUICK HISTORY

Thirty-five years ago, Ernő Rubik invented the  $3 \times 3 \times 3$  puzzle cube, which took the world by storm. That was followed by the  $4 \times 4 \times 4$  invented by Peter Sebesteny in 1983. It had two names: Rubik's Revenge and The Master Cube. Udo Krell created the  $5 \times 5 \times 5$ , known as The Professor's Cube, in 1986.

For many years it was considered a mechanical impossibility for a puzzle to exceed the order of  $5 \times 5 \times 5$ . Puzzle fanatics could only dream of ever toying with a  $6 \times 6 \times 6$ .

Fortunately, Panagiotis Verdes from Greece was not aware that higher order puzzle cubes could not be designed. In 2004, at the International Puzzle Party in Helsinki, he presented the  $6 \times 6 \times 6$  and  $7 \times 7 \times 7$  cubes. In addition, he presented his patented designs for all levels up to and including the  $11 \times 11 \times 11$ . (Verdes's patent has been used as a blueprint by Chinese manufacturers to make the  $11 \times 11 \times 11$  cubes. They have not paid royalties to Verdes.)

On November 20, 2009, Leslie Le from China presented a successful design and prototype of a  $12 \times 12 \times 12$ , breaking through the "Verdes limit."

## 3D PRINTERS

Oskar van Deventer, from the Netherlands, is one of the world's most prolific puzzle inventors. In 2004, his good friend George Miller, of California, bought a 3D printer. Almost immediately, Oskar started creating mechanical puzzles that could only be realized with 3D printing, such as a maze on a Möbius strip. He emailed files for dozens of puzzles to George. 3D printers build objects layer by layer, using extrusion



or laser sintering (a method for making objects from powder). Printing a small object can take several hours because it is composed of many very thin layers.

In 2009 Oskar started working with a 3D printing company called Shapeways. During that time, he started to make strange mutant modifications of "twisty puzzles." In just two years, Oskar has produced more than 100 novel puzzles. Describing their form and function is not easy. Puzzles have a tactile feel. Many of his twisty puzzles incorporate gears. His puzzle titles include Crazy Comet, Gear Skewb, Meteor Madness, Anisotropic Cube, Big Boulder, and Fairly Twisted. Oskar's Caution Cube was mass-produced by Mefferts.com and is now known as the Gear Cube. I have over 30 years of experience with mechanical puzzles and yet am often baffled and amazed at the creativity and genius of these puzzles.

**THE GIFT CUBE**

Matthew Farnsworth had an idea for a cube that, once solved, would open up to reveal something. He commissioned Oskar to design and build it. Matthew then put a diamond engagement ring inside. He scrambled the cube. His girlfriend Mindy solved the cube, opened it, and said yes!

Many of Oskar's twisty puzzles cost hundreds of dollars, which can be an obstacle for serious puzzle collectors who try to collect all types of puzzles. This is because the 3D printing is expensive due to the cost of materials.

On the subject of cost, Oskar says, "I am relentlessly pursuing new puzzle concepts. Making prototypes is essential. Many think that I have made a fortune. In fact, even though my Shapeways Shop (<http://www.shapeways.com/shops/oskarpuzzles>) is doing quite well, I have spent more on prototypes than I've made in sales. I do this because this is my hobby."

**OSKAR'S PROTÉGÉS**

Among collectors of twisty puzzles, Oskar van Deventer has become a demigod. He has inspired at least 20 new puzzle designers to create their own twisty puzzles and open their own shops on Shapeways. Eric Vergo is an engineering student at Rochester Institute of Technology and has designed several novel twisty puzzles, including The Master Pentultimate. "Oskar's body of work can be viewed as a collection of seemingly simple, yet deceptively complex ideas that open up entire new worlds to explore. His ideas have forced me to think in new



CAUTION CUBE



GEAR SNAKE

The February 2006 issue of GAMES contained our first in-depth story about Oskar and his incredible puzzles. By that time Oskar had designed and prototyped some 200 puzzles. We featured 18 of his mazes, his specialty.

At that time, Oskar mentioned that he had started designing puzzles with gears. Here are some of his new masterpieces in puzzle sophistication and art.

The Caution Cube appears as a regular 3x3x3 cube, but the 12 normal edges are replaced with gears. This is not a difficult puzzle because only half turns can be made. This was mass produced by Mefferts.com and renamed The Gear Cube. The Anisotropic Cube is almost identical. Some of the gears have been replaced with solid edge pieces to allow quarter turns, making the puzzle significantly harder.

Gear Snake is a contraption that holds four normal 2x2x2 cubes. One turn of the gears scrambles all the cubes simultaneously.

Gear Skewb uses 24 gears, a remarkable total. The diagonal turns add to the complexity. The price of \$250 seems reasonable.





and innovative ways, and he is constantly pushing the boundaries of what is possible. Oskar's 17x17x17 is a truly defining moment for the world of puzzling, 3D printing, and mechanical design. It has shown the world that we can create whatever we like, and the only thing limiting us is our imaginations."

At the Dutch Cube Day in October 2009, Ernő Rubik made a surprise public appearance. According to Oskar: "Rubik was at my table for half an hour playing with my puzzles. He was impressed."

### DESIGNING THE 17X17X17

The 3x3x3, 4x4x4, and 5x5x5 puzzles have an internal spindle. The center pieces act as anchors for the edge and corners.

The 6x6x6 through 11x11x11 cubes build on this core design. The center sits on its surrounding pieces, keeping them in place. Those neighbors keep the edges and corners from popping out. These puzzles have a puffed-out shape instead of flat surfaces. This enables the individual squares to have the same size.

Leslie Le's 12x12x12 cube has the corners anchored to the internal core, with the other pieces hanging off them. This technique provides additional stability.

Oskar chose to design the 17x17x17 "because I can!" He adds: "Besides, nobody would pay attention to a 13x13x13 cube." Oskar's 17x17x17 puzzle uses a combination of techniques. The centers are attached to the spindle. But the corners and edges are extra large and keep the inner pieces in place.

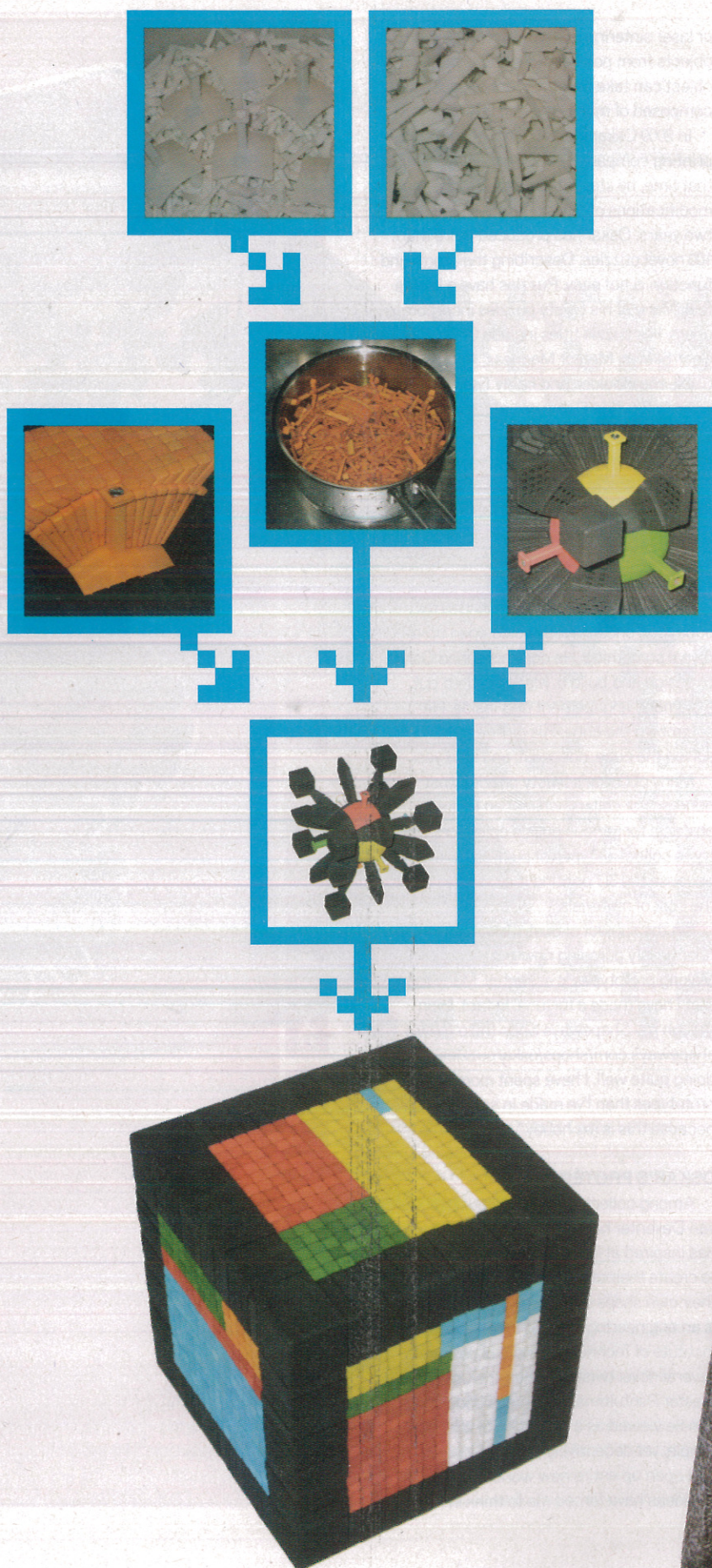
The real challenge in designing the 17x17x17 was keeping the pieces from popping out. For the smaller puzzles, the edges and corners are dovetailed and hang off the center pieces, which are anchored to the internal spindle. In Oskar's 17x17x17 puzzle, the corners and centers are anchored to the interior sphere. The edges and interior pieces are interwoven and hang off those centers and corners.

Oskar spent about 100 hours designing the pieces. Then, he hollowed out the pieces as much as possible in order to reduce the weight.

### THE PATRONS

Claus Wenicker ordered the first 17x17x17 puzzle from Shapeways and assembled the pieces himself. It failed. Some of the pieces were too small and popped out. There was also too much friction.

Oskar made improvements, and Claus ordered the second version. It was much





better, but the core was too loose. Total cost to Claus: 1500 euros, times two!

Shapeways sponsored version number three—this time it was a success.

#### THE FINAL PRODUCT

Once the pieces were designed, Shapeways printed them. Oskar and his wife José washed and dried them. On their stovetop, they dyed the pieces. Next, sorting. To truly appreciate the final product, one must see the puzzle in various stages of assembly.

Will somebody else design a higher level cube puzzle one day? Maybe. But it's going to be very costly. In the meantime, you can order your own 17×17×17 puzzle and enjoy assembling the 1,539 pieces yourself! **G**

#### LINKS

[www.shapeways.com/shops/oskarpuzzles](http://www.shapeways.com/shops/oskarpuzzles)  
[www.youtube.com/user/OskarPuzzle](http://www.youtube.com/user/OskarPuzzle)  
[www.mefferts.com](http://www.mefferts.com) (Uwe Meffert has mass-produced some of Oskar's puzzles.)

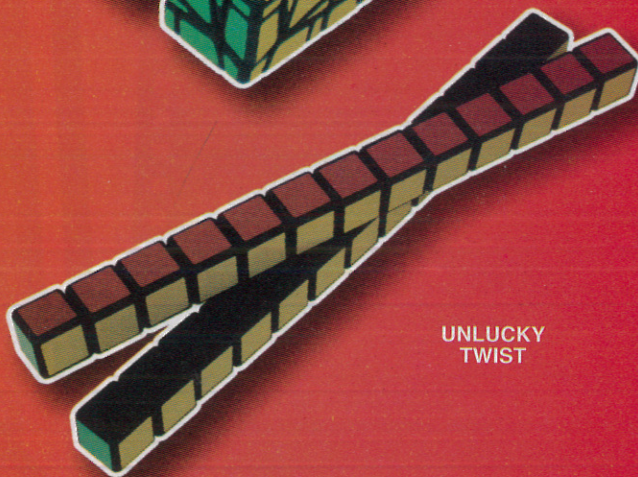
*Tom Cutrofello organizes the annual New York Puzzle Party Symposium. If you would like to attend, contact him: [Cutrofello@hotmail.com](mailto:Cutrofello@hotmail.com)*



## OSKAR'S MUTANT TWISTS



MIXUP CUBE



UNLUCKY TWIST

Since Rubik's Cube became a worldwide phenomenon in 1981, a handful of designers, led by Tony Fisher, have created their own custom modification puzzles. 3D printing changed everything in the last five years. New designers use computers and email their files to Shapeways for customers to order. Oskar already had much experience with 3D printers. He is constantly creating strange, novel, twisty mutations. (Shapeways is making a small fortune just from Oskar's prototypes.) These puzzles typically cost from \$100 to \$300.

Unlucky Twist is the tallest twisty puzzle, having an order of  $1 \times 2 \times 13$ . It's easy to solve. As the two halves separate, the pieces do not fall out. The pieces on the extreme ends are attached to the center via a clever telescopic mechanism originally conceived by Ola Jansson.

Overlap Cube ( $2 \times 2 \times 23$ ) functions like a normal  $2 \times 2 \times 2$  and is not difficult to solve. But the extra 84 pieces will take more time. This is the highest order of any twisty puzzle—another world record.

Meteor Madness is unusual because each face has seven pieces, with the center piece being an isosceles triangle. Oskar confessed to this author that he has no idea how to solve it!

Mixup Cube ( $5 \times 5 \times 5$ ) has 262 pieces and functions like a normal  $5 \times 5 \times 5$ —i.e., it has 90-degree turns. It also functions with 30-degree turns. So, an interior piece can migrate to the perimeter.

Oh Cube is not functional yet. It turns like a normal  $3 \times 3 \times 3$ , but a single corner can also rotate in place with the three surrounding edge pieces swapping locations.

YouCube is unique not only because of its shape, but because the two halves are connected with dovetails.

