“Over The Top”

Developing the Shapeways 17x17x17

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This talk and puzzle were sponsored by
Outline

- Oskar, puzzle designer
- To ever higher NxNxN “Rubik’s Cubes”
  - Rubik, Sebestini, Krell, Verdes, Le, …
- Designing these twisty puzzles
- The Shapeways 17x17x17
Oskar, puzzle designer

- Started in 1978 at age 12
- Designed 100’s of mechanical puzzles
- Hanayama, Smart Games, Recent Toys, Mefferts, …
- Day-time: making internet TV standards
- World records: 1x2x13, 2x2x23, 3D-print Shapeways
To ever higher NxNxNxN “Rubik’s Cubes”

- 3x3x3: Erno Rubik, Budapest, 1974
- 4x4x4: Péter Sebestény, Hamburg, 1980
- 5x5x5: Udo Krell, Hamburg, 1986

To ever higher NxNxN “Rubik’s Cubes”

- 6x6x6 – 11x11x11: Panagiotes Verdes, 2003

To ever higher \(N \times N \times N\) “Rubik’s Cubes”

- 12\(\times\)12\(\times\)12: Leslie Le, 2009

Designing these twisty puzzles

- **Recipe:**
  - Design cut curves → the creative part!
  - Revolve, boolean intersections
  - Offsets, rounding, hollowing, meshing → work

- **Example:** Rubik’s Cube
Designing these twisty puzzles

- Verdes brilliance:
  - Curved outside \(\rightarrow\) 7x7x7 corner stays attached
  - Spherical shells \(\rightarrow\) stable turning
  - Conical cuts \(\rightarrow\) robust pieces
Designing these twisty puzzles

- Leslie Le brilliance:
  - Corner hanging → additional stability
  - Extremely clever curve design

Leslie Le, Chinese patent 2009.08.1
CN200920134647.8
The Shapeways 17x17x17

- Oskar attempt 1, January 2010
  - Pagoda style: center-corner-edge hanging
  - Binary recursion
The Shapeways 17x17x17

- **Oskar attempt 1, January 2010**
- **Failure: too much friction, pieces falling out**

Sponsored and built by Claus Wenicker, 3D-printed by Shapeways
The Shapeways 17x17x17

- Oskar attempt 2, November 2010
  - Floating anchors: long pieces for stability
  - Hanging from centers-edges-corners
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- Oskar attempt 2, November 2010
- Success at last! Bit loose …

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The Shapeways 17x17x17

- Today, shown live for the first time!
- Perfect prototype no. 3, printed by Shapeways
The Shapeways 17x17x17
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- I dedicate this puzzle to the tender memory of my beloved father, who taught me to live life to the fullest
Thank you!