

A novel mechanism for the construction of an 8x8x8 Rubik's cube type puzzle.

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Abstract: For this mathematical project, I am attempting to design an 8x8x8 Rubik's cube-type puzzle. People around the world are waiting for a more challenging puzzle higher than the V-Cube 7x7x7. Erno Rubik believed that a Rubik's cube higher than the 5x5x5 would be impossible to build because the corners would not be able to connect to the internal structure. Therefore, the Verdes family has come to construct the V-Cube 6x6x6 and 7x7x7. They plan on constructing all cubes up to the 12x12x12. However, their latest product was the V-Cube 7x7x7 and I am attempting to design an 8x8x8 Rubik's cube-type puzzle without using the structures featured in the V-Cubes. Though the design may be complex and much more difficult to build, I feel that the project can be successfully done and add a new addition to the Rubik's Cube group. I went about designing this by researching the flaws with the old mechanisms of previous Rubik's Cubes. For example, if you take the structure of a standard 3x3x3 Rubik's Cube and attempt to use it for the construction of a 8x8x8 cube, it will not work, because the center pieces would have no way of connecting to the inner mechanism. This is why cubes higher than the standard 3x3x3 Rubik's cube need to have significant inner mechanism. For the design of the 8x8x8 cube I used the inner structure of the Rubik's 4x4x4 along with minor adjustments. This solves the center piece problem along with the corner problem by preventing the corners from interfering with the center pieces and it holds the center pieces together while allowing them to move. While creating this project I found a very useful formula that helps to determine how many grooves are necessary for the internal structure. This allows the centers to glide with ease and not interfere with any other part of the cube. To solve the corner problem I put magnets in the pieces closest to the corner pieces and what this does is it holds the corner in place without the corner having to connect within the cube.

Keywords: Rubik's Cube, V-Cube, inner mechanism, structure or Rubik's cube

INTRODUCTION

This is a design for the construction of an 8x8x8 Rubik's cube puzzle. The furthest development in Rubik's cube type puzzles is the brand new 7x7x7 which was created in the summer of 2007 by Panagiotis Verdes and his company; Verdes Innovations SA. I intend on designing a mechanism to create a structurally sound 8x8x8 cube. I'm highly doubt that this will be the first time someone has designed one. However, Erno Rubik believed that it would be physically impossible for a cube higher than the 5x5x5 to be constructed but within the last decade, Verdes Innovations has proved that theory to be incorrect. And even though Verdes Innovations has proved Erno Rubik wrong, they have yet to construct an 8x8x8 due to its difficulties and intense core problems.

METHODS

The construction of an 8x8x8 Rubik's cube-type puzzle is a very challenging one because it needs solutions for problems that other cubes don't have. For example, the standard 3x3x3 has the simplest internal structure and as the cubes ascend the inner mechanisms become more and more complex. The inner structure of the Rubik's 3x3x3 does not have the corner problem that the 5x5x5 through the rest of the cubes have. This is because the corner of a 3x3x3 does not have to stretch across any center pieces, but the 5x5x5 the 6x6x6 the 7x7x7 and the 8x8x8 do. This is where the complexity of the mechanisms comes into play. First if you examine a Rubik's 4x4x4, the corner problem was solved by using a ball mechanism and this was also used in the 6x6x6 and 7x7x7. This solved the problem because it had grooves to allow the center pieces to move. I used this structure in the designing of an 8x8x8 because with it you can easily have a sturdy cube that can function correctly. However, there is still a flaw in this mechanism which is the corner piece problem that I spoke of earlier. This is the main problem because if the corner

interferes with the inner mechanism, the cube cannot function at all. So as a solution, the outer edge pieces would contain a magnet to hold the corner in place which does not allow the corner to interfere with the center pieces.

RESULTS

I found out that the inner center pieces will intervene with the core. Therefore, there must be a certain structure where a ball with grooves is used to allow the center pieces to move around freely. The equation needed to find out how many grooves needed is

$$(n-2)/2$$

where n is the order of the cube.



Notice in the picture above, how this core of the Rubik's 4x4x4 (Rubik's Revenge) has one groove. If we use the formula, we would substitute in 4 for n and then the math would simply be done: $(4-2)/2=1$; therefore, the core only needs one groove.

All cubes higher than 5x5x5 *should* be somewhat round in order to bypass the problem with the center pieces and the corners. For example, notice that in the picture below the original 3x3x3 Rubik's cube is a perfect cube while the V-Cube 7 (7x7x7) has a round/pillow shape.



Source: Wikipedia Commons
Author: Watfald

However, with this formula, I believe that this 8x8x8 can be structurally sound without having to be round at all.

CONCLUSION

Therefore, the structure needed for constructing an 8x8x8 Rubik's cube-type puzzle is similar to that of the Rubik's 4x4x4. This is needed because it solves all the problems of constructing an 8x8x8 such as the center and the corner piece problems. The special grooves will allow the center pieces to move freely and twist and turn like a regular Rubik's cube. With this internal structure, the 8x8x8 should be a fully functional cube with very few flaws such as various pops and misalignments.

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