

Scaffolded Explorations with a Modified Rubik's Cube

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Happy 50th
Anniversary,
Rubik's
Cube!



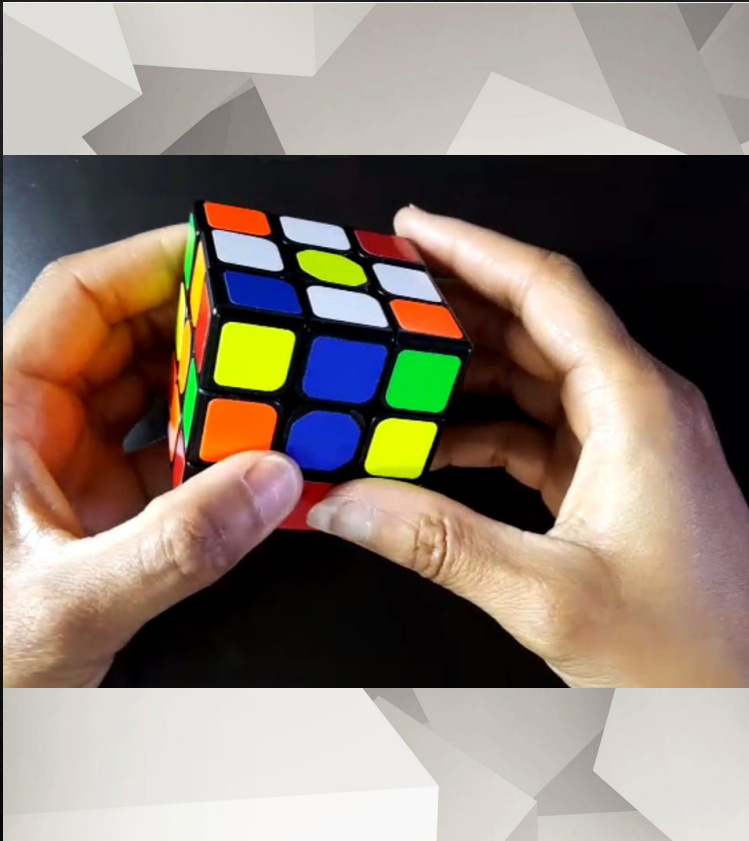
50 YEARS OF RUBIK'S CUBE

If one Rubik's Cube has more than 43 quintillion possibilities and millions of Rubik's Cubes are sold and solved every year, multiply that by 50 years and you have...so many possibilities!

Discover some of the milestones and iconic moments that have helped cement Rubik's Cube as one of the best-selling puzzles of all time.

Ernő Rubik, Inventor of the Rubik's Cube





How many of you know how to solve a Rubik's cube?

How many of you have taught someone how to solve a Rubik's cube?

How did it go?

Our Experience

- ◆ Teaching virtually is difficult: 2D vs. 3D, mirror image in Zoom, etc.
- ◆ Teaching more than one person at a time is difficult: people learn at very different rates (kind of like teaching math)
- ◆ The cube is complicated – 43 quintillion configurations!
- ◆ Some learners are still working on “left” vs. “right”
- ◆ Younger students may not know what “clockwise” means!
- ◆ What’s the challenge implied throughout this slide deck?

Standard Way to Teach the Cube

- ◆ Here's a scrambled cube.

- ◆ Make a daisy

- ◆ Now make a white cross

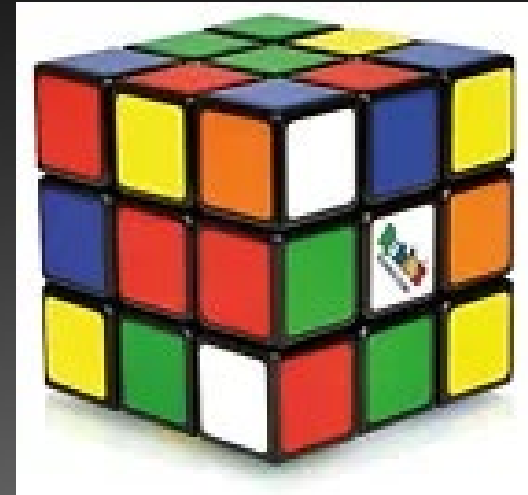
- ◆ Now solve the first layer

- ◆ Etc.

- ◆ Some are up for the challenge and will follow a presentation or a manual

- ◆ Some will go online and figure it out

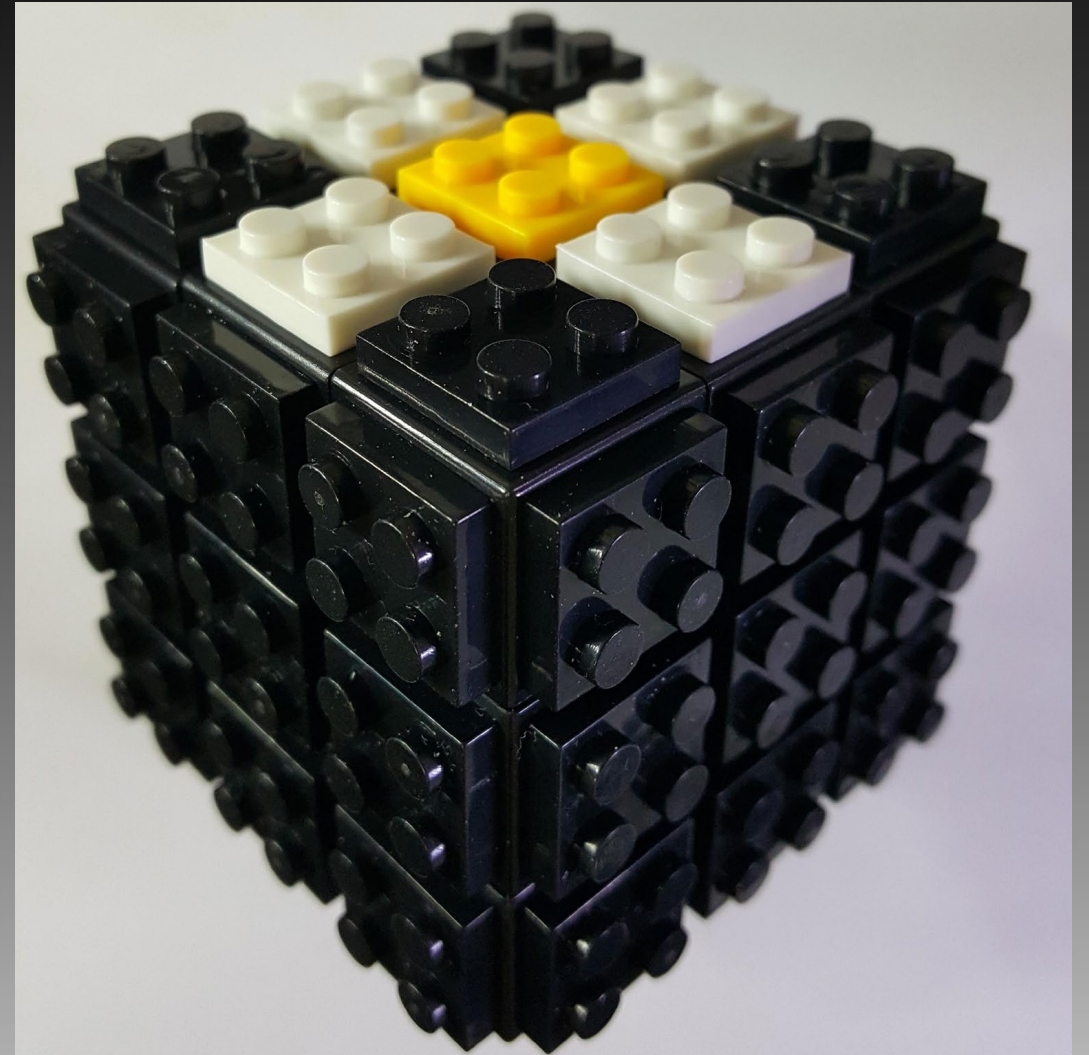
- ◆ Some will give up and decide that it's out of their reach



How can we teach EVERYONE?

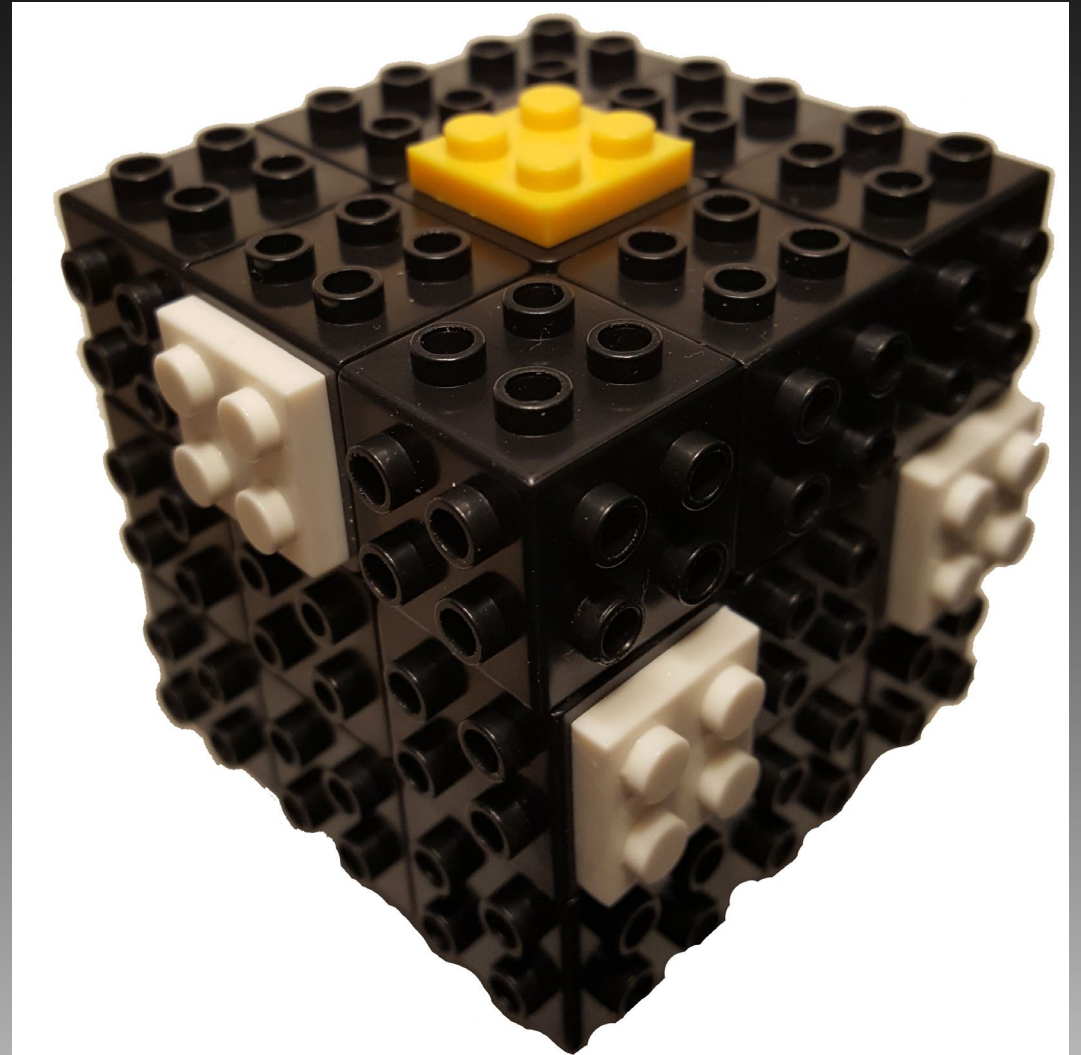
Enter the Brick Cube!

- ◆ Here is a daisy, ONLY.
- ◆ Scramble this and put the white tiles on top with the yellow center.



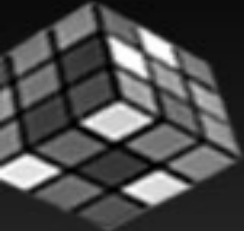


Scaffolded Brick Cube Method

- ◆ No distractions from the other tiles
- ◆ Only 5 tiles matter
- ◆ Easy to demonstrate
- ◆ Easy to follow





Lauren's Brick Cube Experience

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- ◆ Taught the cube on Zoom to seven instructors in the Thrive Scholars Summer Academy
 - ◆ Used a regular cube and modified brick cubes
 - ◆ Three knew how to solve up to the 1st or 2nd layer, four had no experience
 - ◆ Demonstrated each step with a regular cube and modified brick cubes
- 
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Results

- ◆ They all found the brick cube demonstrations more helpful, even though they were using regular cubes
- ◆ Note: this was a two-hour long workshop!





Try the Brick Cubes!

Join us for *Floor to Ceiling Adventures with Rubik's Cubes*, part of the Math Circles in

Motion Hands-on Poster Session

Friday, August 9

4-7 pm ET

White River Ballroom F

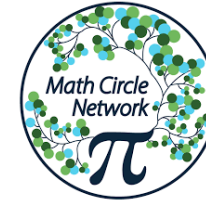
Thank you for joining us!

Floor to Ceiling Adventures with Rubik's Cubes

A. Gwinn Royal, Lauren Rose, Daniel Rose-Levine

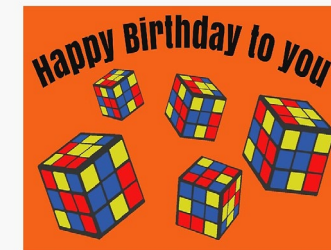
Learn it! Twist it!

Singmaster Notation

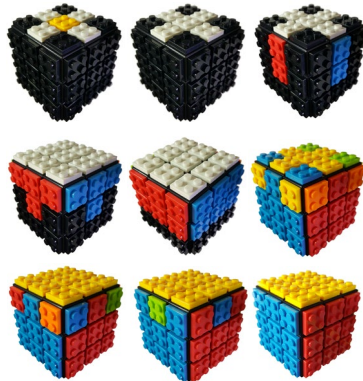


Celebrate it!

Happy 50th Birthday,
Rubik's Cube!



Build it! Solve it!



Teach it!

Combinatorics: How many configurations are there?

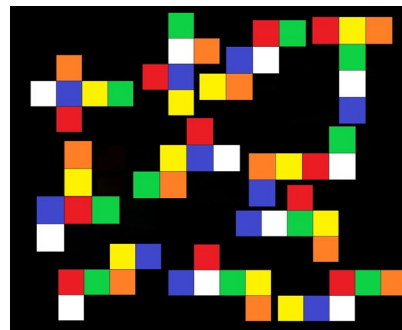
Probability: How likely is a given configuration?

Group Theory: Study the cube group!

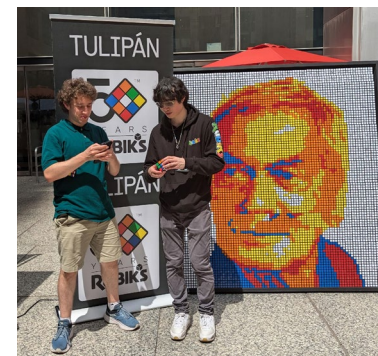
Geometry: How does symmetry play a role in solving?

Happy 80th Birthday,
Ernő Rubik!

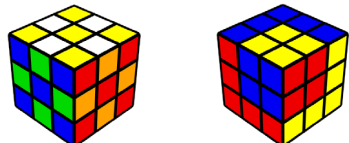
Flatten it!



Make a Mosaic!



Make patterns!

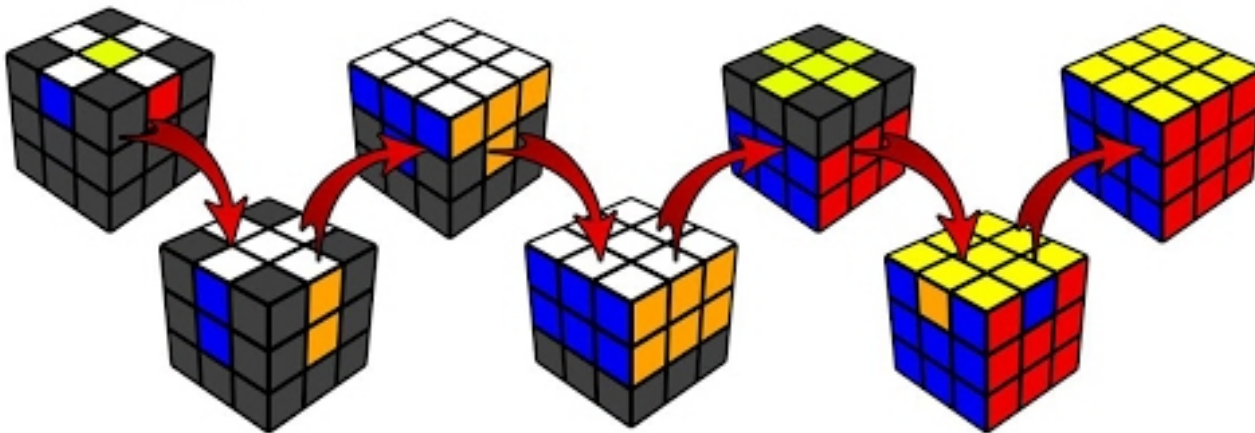




Welcome to the
After Party:
Solving Basics

Beginner's Method Steps

Rubik's Cube Beginner's Tutorial



- ◇ Daisy
- ◇ White Cross
- ◇ First Layer
- ◇ Second Layer
- ◇ Yellow Cross
- ◇ Yellow Top
- ◇ Yellow Edges (ta-da!)

Beginner's Method Moves



U



D



R



L



F



B



U'



D'



R'



L'



F'



B'



U2



D2



R2



L2

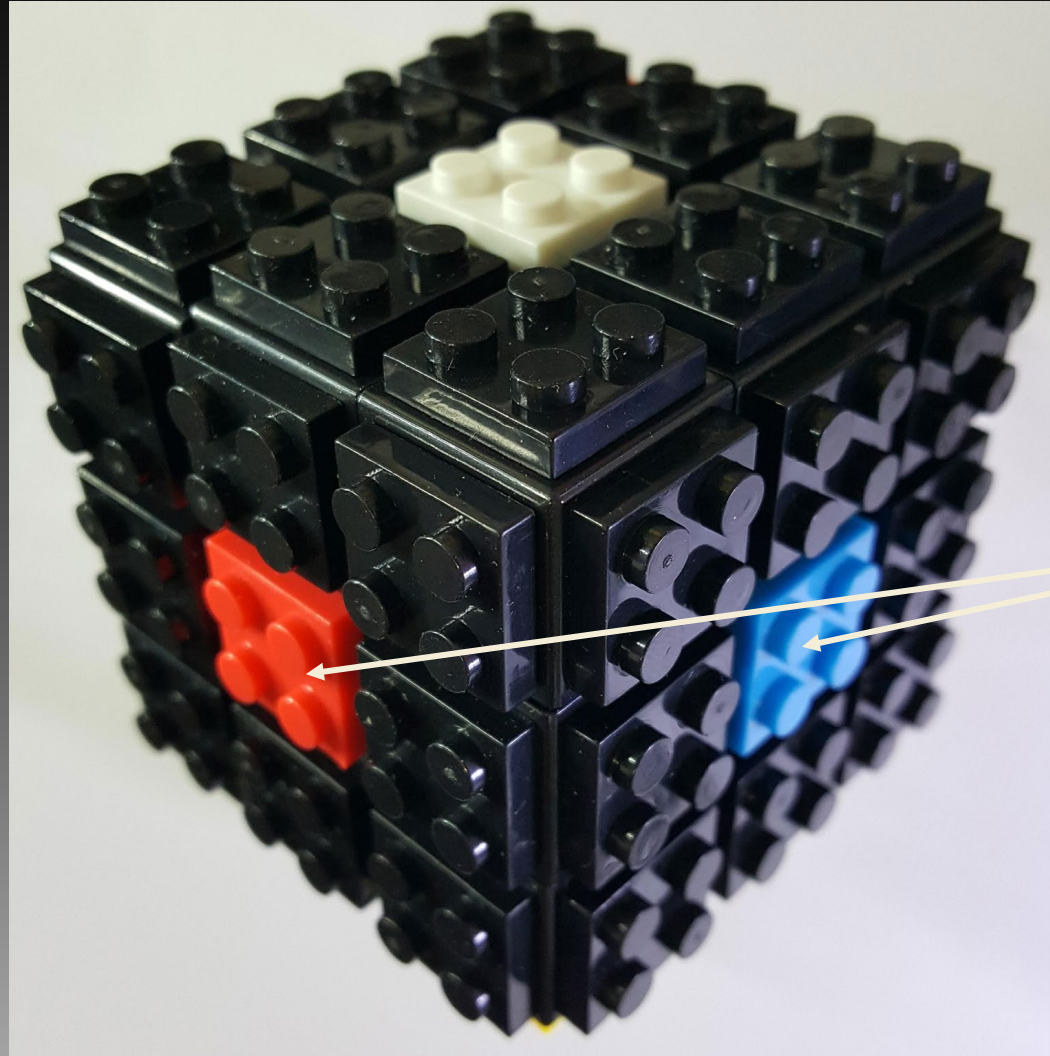


F2



B2

Get to Know the Cube

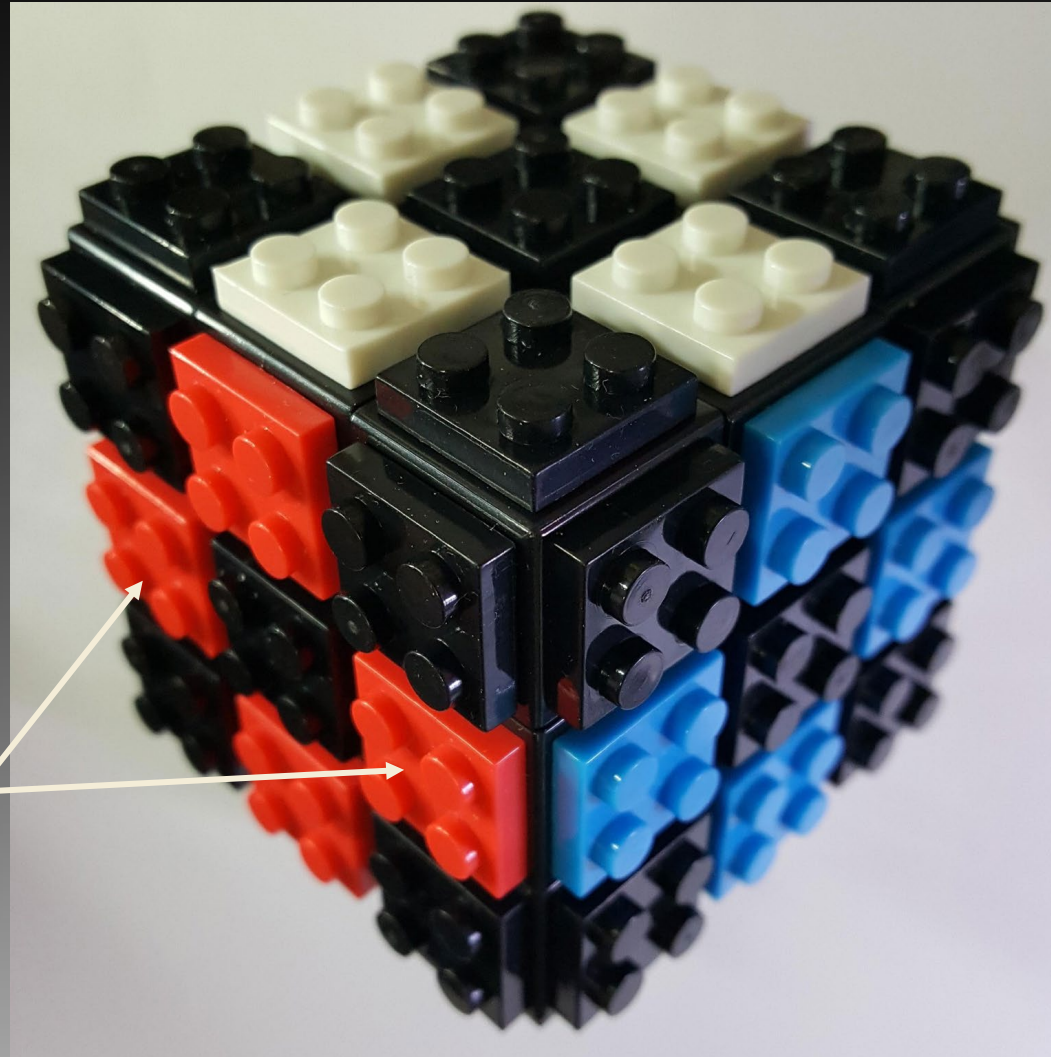


Center
"cube"
(has 1 color)

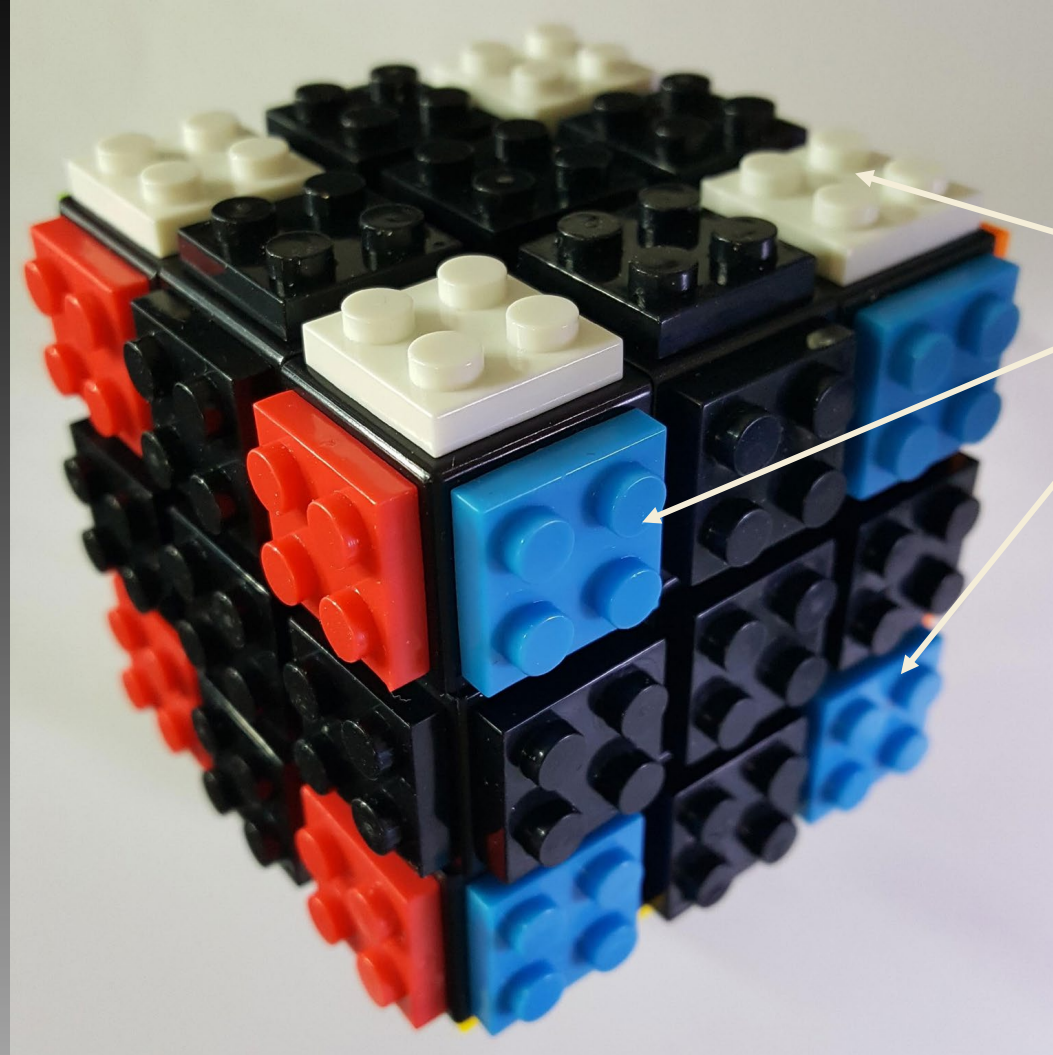
Get to Know the Cube



Edge “cubie”
(has 2 colors)

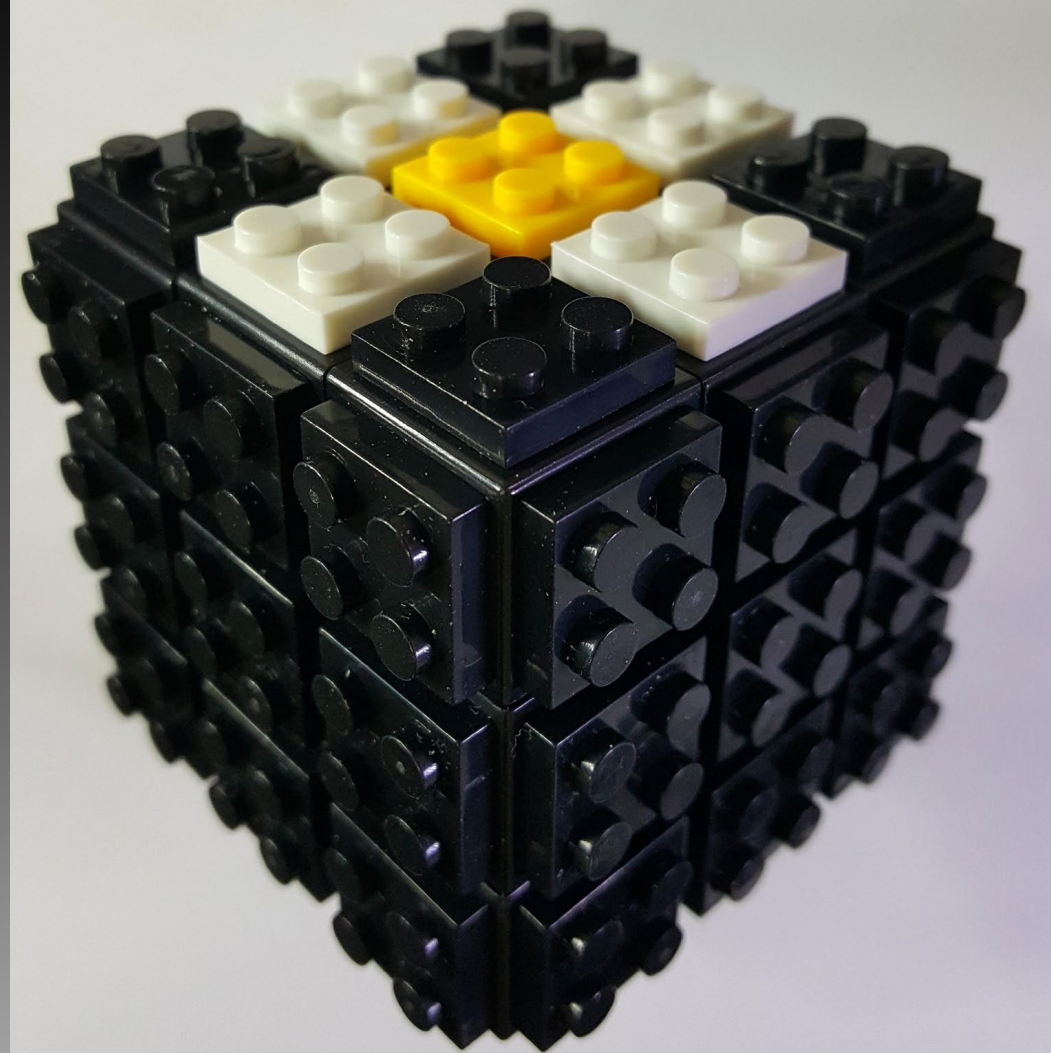


Get to Know the Cube

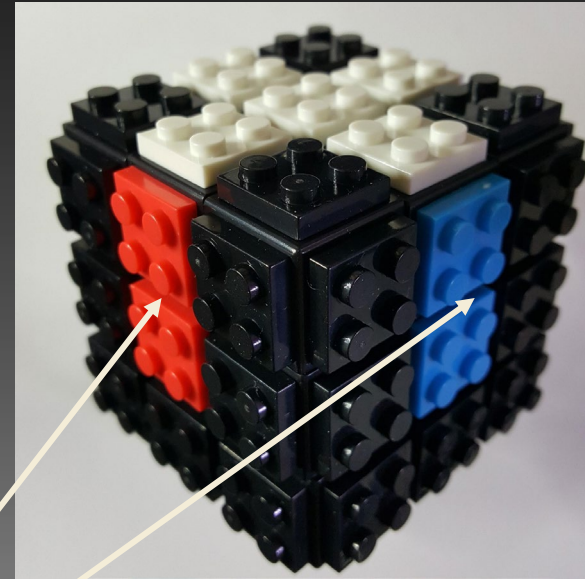
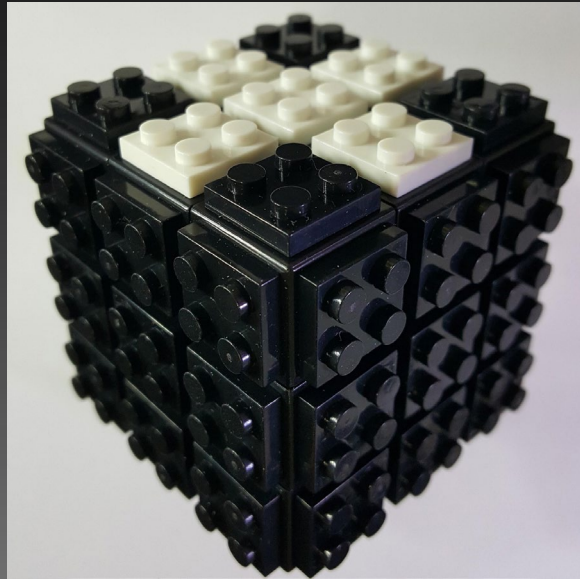


Corner
“cubie”
(has 3 colors)

Make a “daisy”



Make a White Cross, Matching the Centers



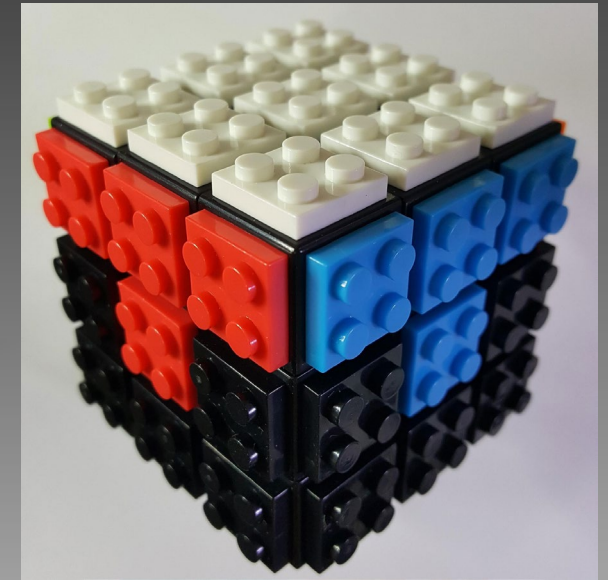
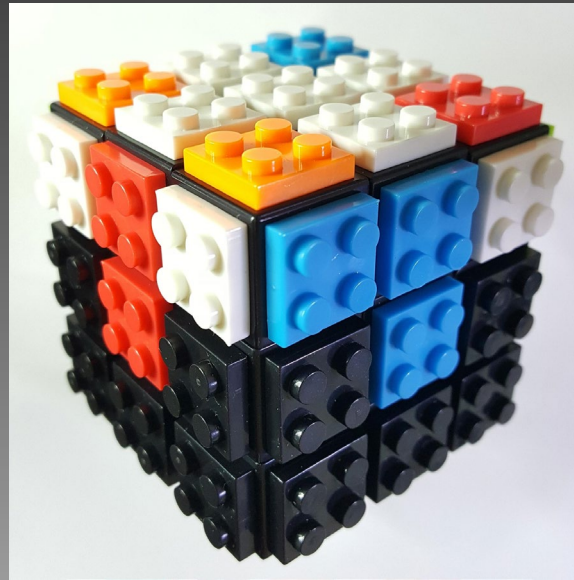
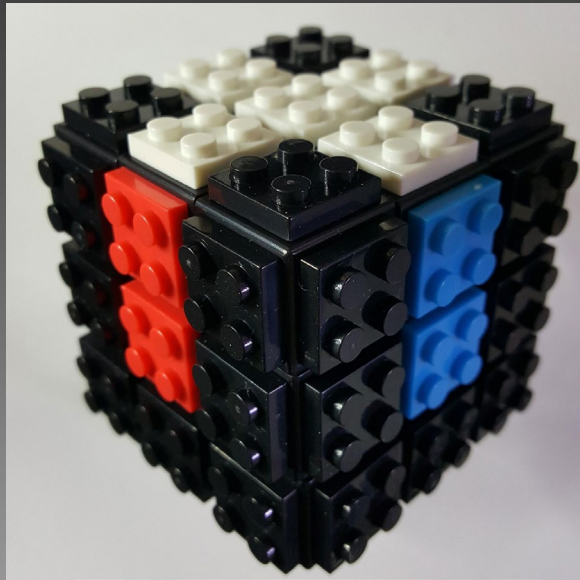
The color on the side of the white petal matches the center color on that side

Put in the White Corners

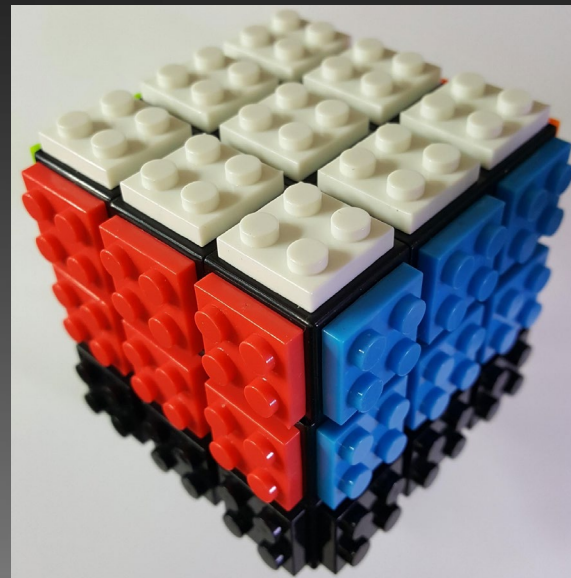
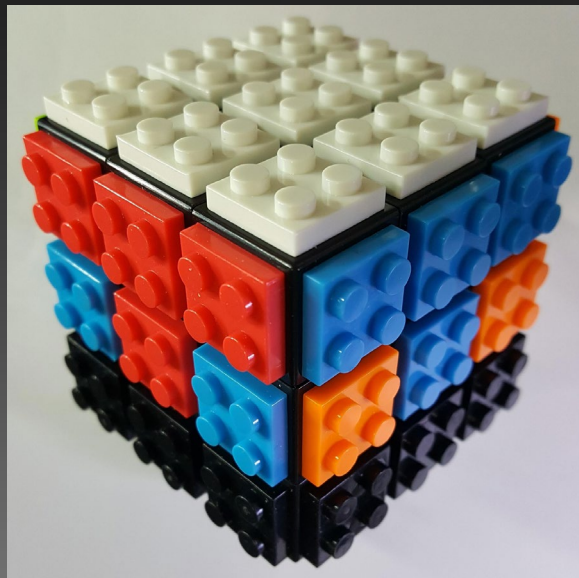
The entire top should be white and there should be a short T on each side

It doesn't matter what's on the bottom layer

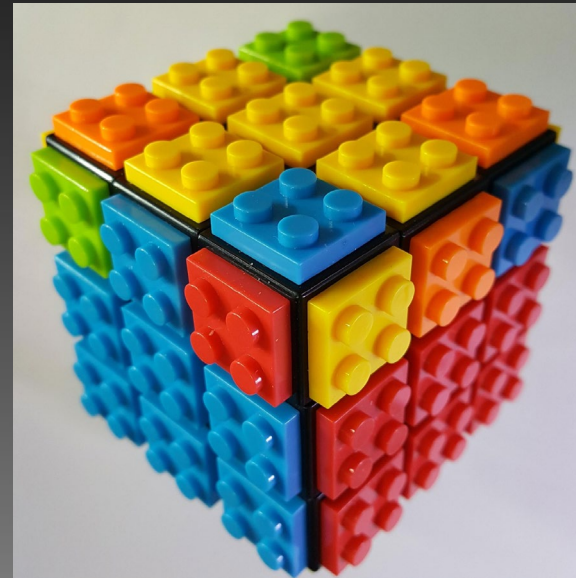
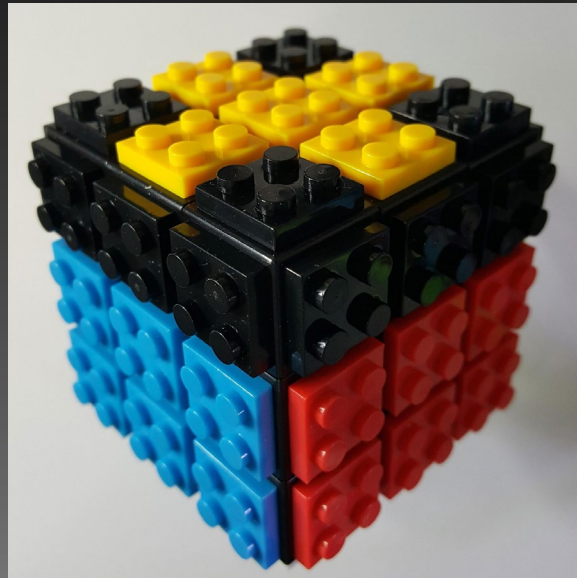
Try putting in a corner on your own using your own spatial intuition!



Complete the second layer



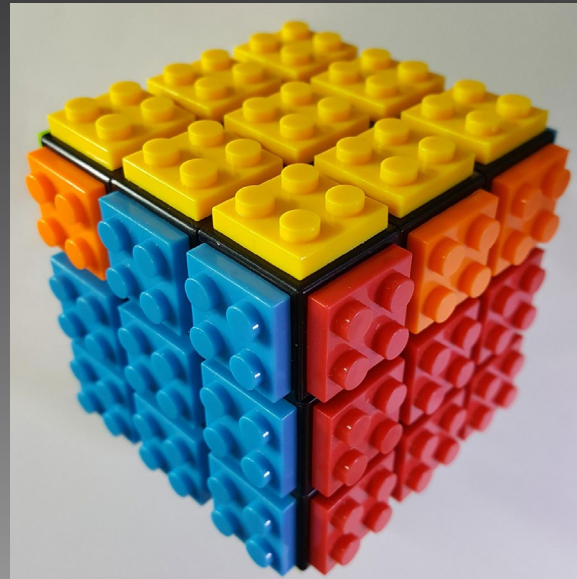
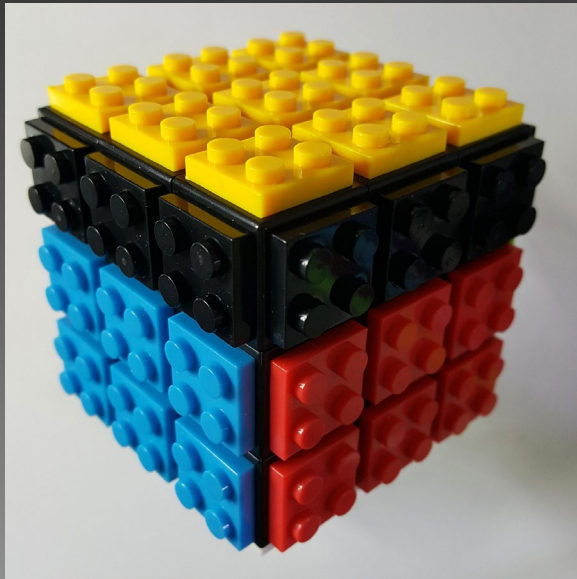
Make a Yellow Cross



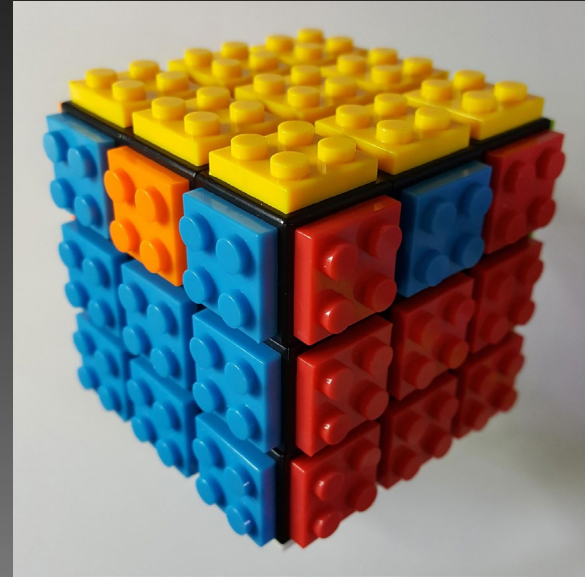
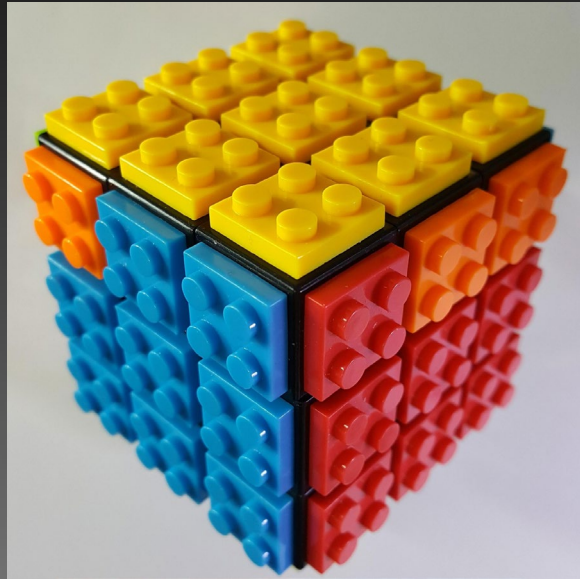
Put in the Yellow Corners

Make the entire top yellow

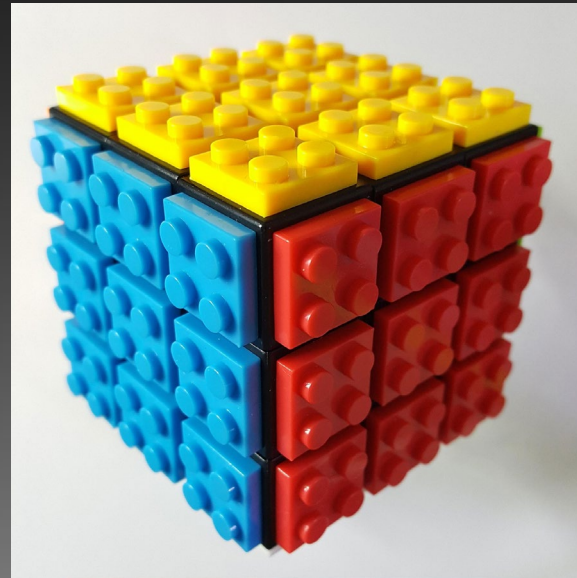
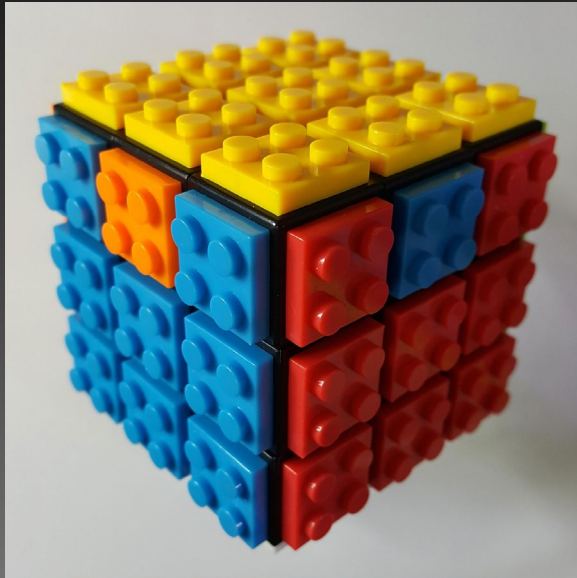
Neither the edge pieces nor the corners need to be in the correct position at the end of this step



Position the Yellow Corners



Position the Yellow Edges



Questions?

Feel free to contact us:

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Happy cubing!

