The Value of Regular Mind Exercise

Improve Memory Retention using a Rubik's Cube

Solving the Rubik's Cube puzzle can be a game as well as a mental challenge.

This document will explain the WHY and HOW the regular use of the Rubik's Cube may:

1. Help older workers demonstrate capability and help find a job.
2. Help seniors keep their mind active and contribute to dementia treatment.
3. Help disabled people lead a more inclusive and collaborative life.
4. Act as a form of social engagement if they wish to be competitive.

To learn the Rubik's Cube is not hard but it helps to have personal mentoring tuition and group engagement and best delivered through a formal mentor network structure. The intention is to deliver the opportunity with the involvement of volunteers.

Tuition method needs to be sufficiently personal to allow people to learn at their own pace, but recognising that if left to individuals to discipline themselves to learn, it will not happen.

The solution is the creation of the not-for-profit **Rubeit Foundation** to help teach the Rubeit technique.

1. Help Older Workers Prove their Worth to Employers

There is a definite prejudice against older workers. The perception is their mind is not as sharp as their younger colleagues. The problem is "how does an older worker establish their credentials in an objective test?" For those who saw the movie, The Pursuit of Happiness, you will remember the scene where Will Smith is looking for a job and impresses his potential manager (Brian Howe) by solving the Rubik's Cube puzzle during a shared taxi drive (watch the YouTube).

I cannot promise that every older worker will get the job they want by taking their Rubik's Cube along to the interview but if the selection process takes out the age factor you will stand a better chance. The best way to cancel the age concerns is an objective test and solving the Rubik's Cube puzzle is about as objective as it can be: You either solve it or you don't. The more you practice, the faster you get.

Solving the Rubik's Cube is certainly not impossible. It is only a matter of following some basic steps to set up the first two layers and then memorising four algorithms to finish the job. You can make it look

impressive by putting on a blind fold when you get towards the finish because you don't have to see what you are doing: Just follow the algorithm steps in your mind and let your fingers respond.

Speed is not important, but if you practice regularly, you will complete the job in under 5 minutes most of the time. Luck does play a part in fastest speed because the solution involves repeat rotation cycles and you don't know at what point in the cycle you are coming in at.

2. Help Seniors Keep their Mind Active

Many seniors already solve cross-word puzzles, play cards or engage in some form of games to keep their mind active. The Rubik's Cube game is just another challenge and it can be practiced individually or in a group.

Successfully completing the game offers group recognition and is bound to impress others.

By participating in a mentoring network seniors may become instructors/mentors to others or just enjoy the social interaction.
From a medical science perspective, the purpose of the Rubik's Cube "game" is to create muscle memory through repetition. There are cognitive advantages through continuous use of the cube.

The network concept is designed for social interaction and for all those who have been frustrated by the mystique of the wretched little cube.

To solve the Rubik's Cube puzzle does not require superior intelligence, only the memorisation of steps defined as algorithms. In reality, there are only four algorithms to memorise and the rest is procedural steps leading into the algorithm stage of the exercise. Anyone can do it with a little perseverance: A later section explains how

Enabled by modern technology, tuition from mentors may be delivered face-to-face or via Zoom style online video connection. Sessions may be individual or group. Zoom breakout rooms allow further separation to allow participants to be more comfortable and able to learn at their own pace.

3. Disabled Involvement in Rubeit

There is no reason why disabled people cannot play an active part in Rubeit activities. Depending on the extent of a person's disability they can participate via Zoom or remote video connection.

The exciting part about disabled participation is the opportunity to develop interactive participation using the latest technology.

Communication Technology

If any good has come out of the coronavirus pandemic it has been the rapid improvement in remote communication and products like Zoom has evolved alongside products from Google and Microsoft.

Edge Computing using IoT (Internet of Things) devices has enabled near real time connection for gaming anywhere in the world. Satellite network communication lays a platform for interaction with others in any part of the world.

Rubik's Cube Solution is Programable

Every step in the lead up to the algorithm stage (described further on) is programable. Voice activation can invoke the necessary steps.

Rubik's Cube Algorithms are an Artificial Intelligence Application

Via a simple voice activated command competitors can invoke an algorithm to execute a step in the solution. The challenge is knowing when to invoke the command.

There is already a lot of work being done to develop the right technology using object recognition and other methods. Here are a few:

GoCubes OpenAI

Many robotic researchers have focused on enabling robots to solve the Rubik's cube quickly on computers. A little more than a year ago, OpenAI managed to use artificial intelligence to help a neural network learn how to solve the Rubik's cube, and demonstrated it through a robotic appendage resembling the human hand. While the results are humble, and the robotic technology cannot solve the cube quickly, it is still a landmark achievement in robotic sciences.

https://getgocube.com/play/best-rubik-cube-robot-solver/

Ruwix: Rubik's Cube Robots

The goal is to create an algorithm which finds the optimal solution (as few steps as possible), and to build robotic arms which can handle the Rubik's Cube with the required precision and speed. An accurate scanning system is required so the robot can recognize the colors of the scrambled cube.

https://ruwix.com/the-rubiks-cube/lego-rubiks-cube-robots-rubot2/

Skyfi Labs

Rubik's cube is a puzzle which everybody cannot solve easily, a person needs to calculate and then twist the cube to match the colors of each side. How exciting would it be if a robot can solve a Rubik's cube? If a person is solving a Rubik's cube, then he checks the pattern of all the sides in the cube and calculates what should be the movement of the cube to match the colors of each side. This Rubik's cube solver robot does the same.

The Rubik's cube when shuffled has many possible patterns, the robot should be able to take any pattern as input and solve the cube. The

robot should be able to hold the cube in a position and twist it to change the pattern and also turn the cube's side. The pattern of the cube will be input for the robot.

https://www.skyfilabs.com/project-ideas/rubiks-cube-solver-robot

4. Rubik's Cube Competition: Demonstrate Talent

Successful completion of the Rubik's Cube could lead to a sense of achievement, improved self-esteem and bragging rights amongst friends, as well as impress children and grandchildren.

There can be enjoyment through club membership and inter-club meetings, and competitions if you wish to take your talent to the next level.

If there is sufficient interest, local club branches could be established as part of the Rubeit NFP (not for profit) organisation with volunteer participation. A possible competition format could be as follows:

Local Competitions

Inter-club competition can be run as Rubeit Relays: That is, one player does the first layer, another does the second layer, another the third and the fourth person brings it home (all that explained further on).

Clubs could be formal or informal and run as part of the Rubeit non-profit organisation supported by commercial organisations and government services bodies.

International Competition

There is a World Cube Association (WCA) that conducts international competitions. It is not planned to teach members of the Rubeit Mentor Network to graduate to that level, but it may be possible to influence similar associations to expand their competitions to include senior events and special needs categories.

There is a YouTube video that demonstrates how organised the WCA is and how seriously they take their competitions.

Solving the Rubik's Cube Puzzle Instructions

Introduction

Completing the Rubik's Cube is like building a house. You start with the foundation and then build the floor level and finally the roof.

Use the cube's white face as the foundation and the yellow as the roof.

The house is built in stages: The first layer (foundation) must be complete before you build the second layer and then the third (the roof). Whilst doing that, it is just a matter of remembering a "general maintenance" process to restore the layers while putting on the roof.

The algorithms only come into play after you have built the first and second layer and don't want to disturb what you have done. That is, after moving the blocks around to build the roof you want to restore the lower layers to their original position as you go.

The algorithms simply record a sequence for rotation. That is the part of the building process that must be memorised. The earlier build stages are just following rules to position blocks and the blocks are always visible as you go.

There are only FOUR algorithms to memorise and are explained further on.

Terms Used in the Rubeit Technique

For reference purposes, consider each side colour of the Rubik's Cube as a "family". When the "family" block is facing you consider the colours on the adjacent sides as "cousins". This simple approach will help describe the rotation direction of the cube.

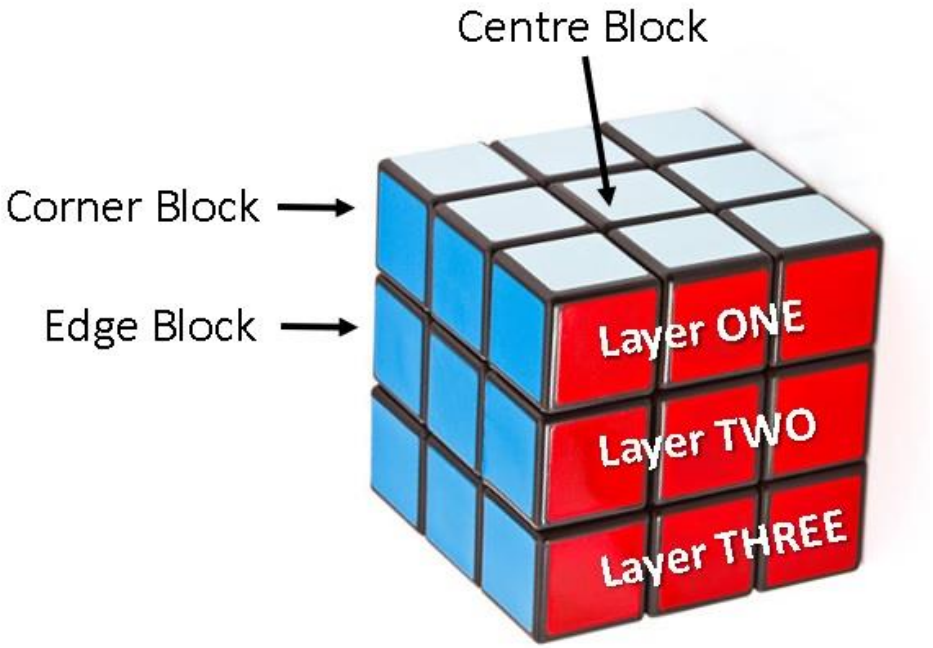
About the Cube

Only the sides rotate: The centre blocks remain constant. That is white will always be opposite yellow, green opposite blue, etc.

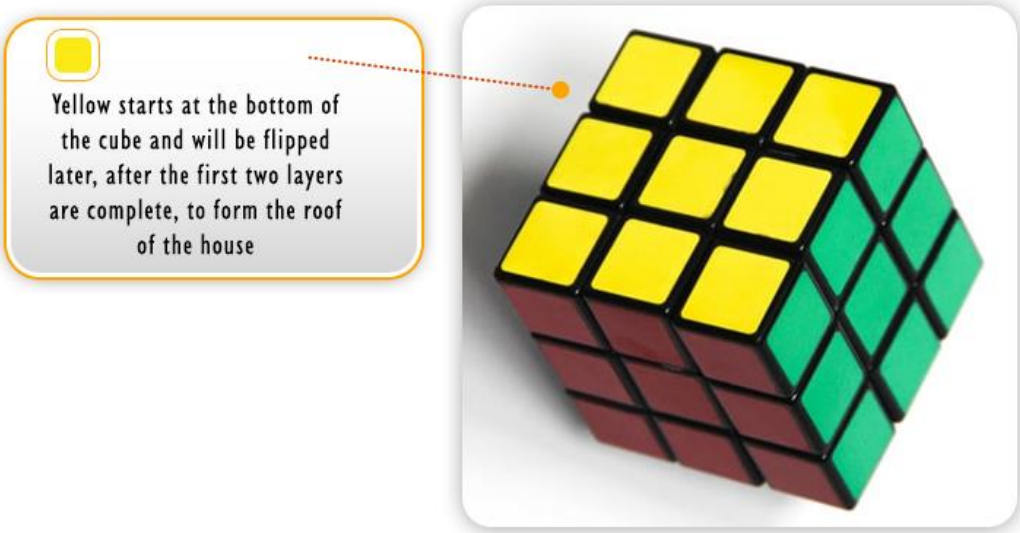
Always hold the cube in a consistent position. Don't keep changing it unnecessarily during the construction stage.

Rubik's Cube Layers

The white layer will ultimately become the foundation layer and move to the bottom later but, to start, hold the cube with the white Centre Block at the top. There will be edges and corners around the white centre piece to be put in place, as shown in the diagram below.



The cube will be flipped later to have the white face (representing the foundation layer) at the bottom and the yellow face (representing the roof of the house) at the top, as shown in the diagram below.



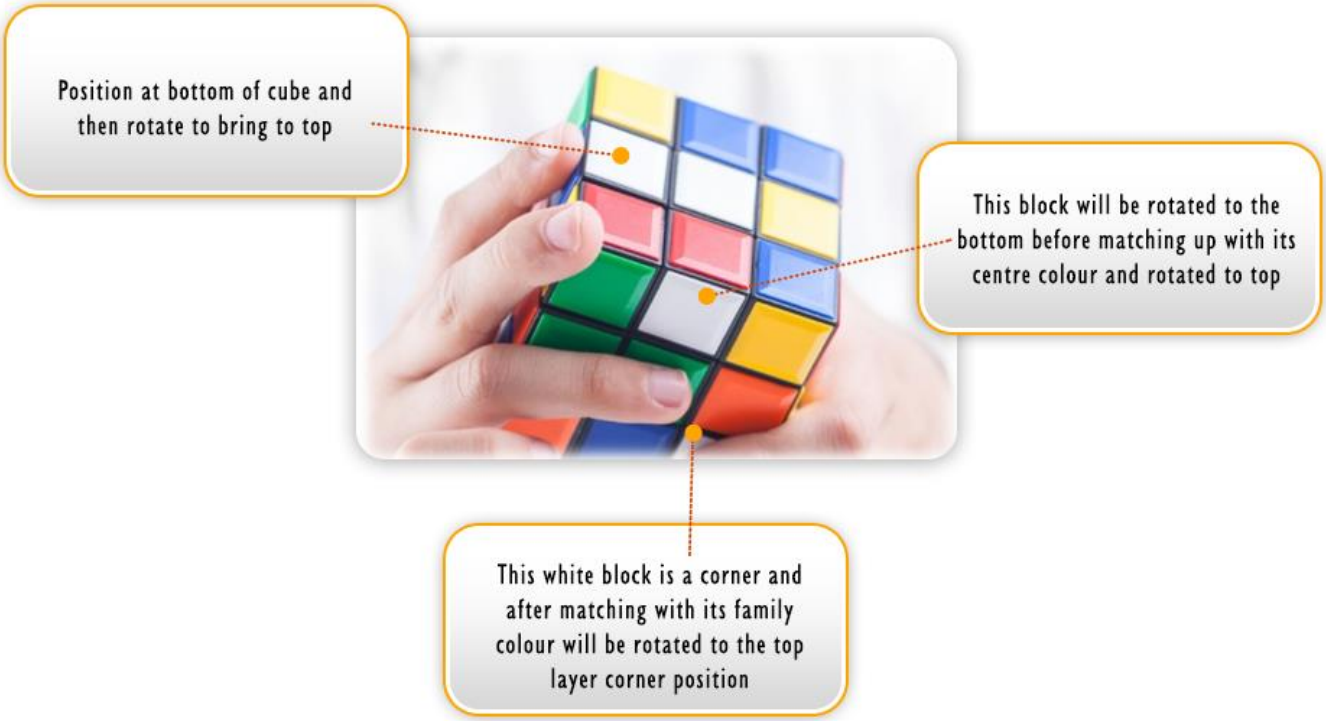
TIER ONE - THE WHITE LAYER

Time to start solving the puzzle:

POSITION EDGES

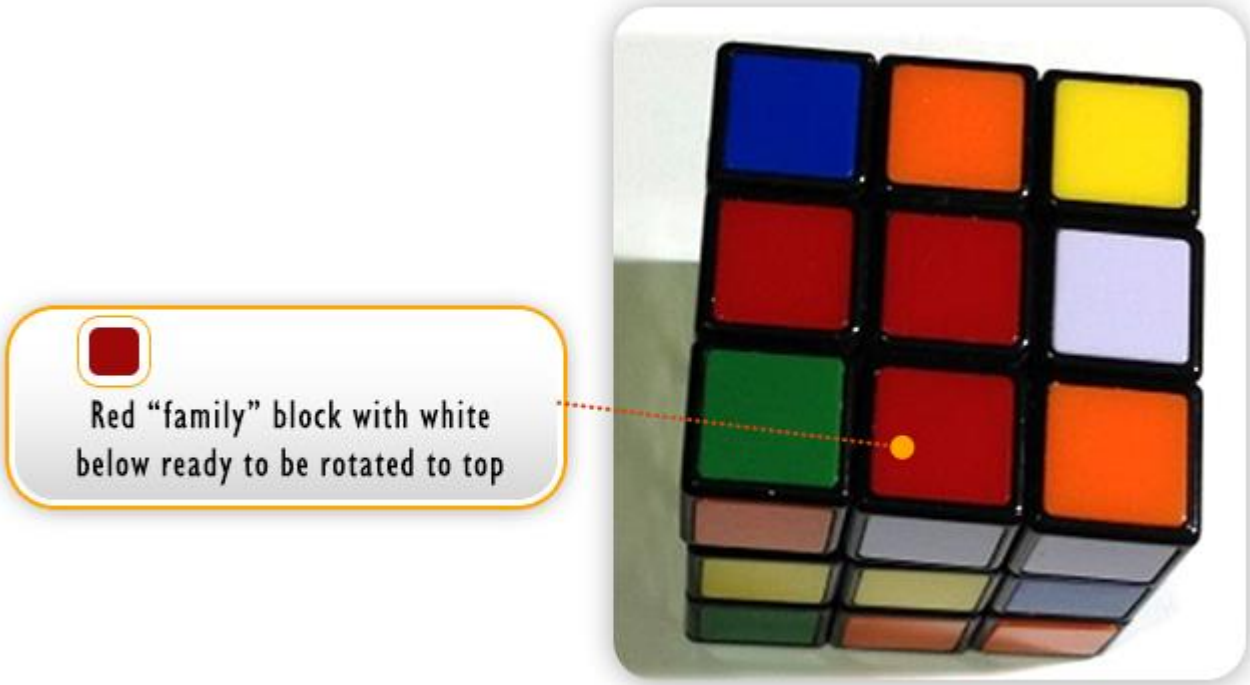
Set up **EDGES** to form a cross at the top, in white.

To do this position a white edge at the **BOTTOM** of the cube ready to rotate to the top.



Then line the edge up with the “family” colour in the level above (level two).

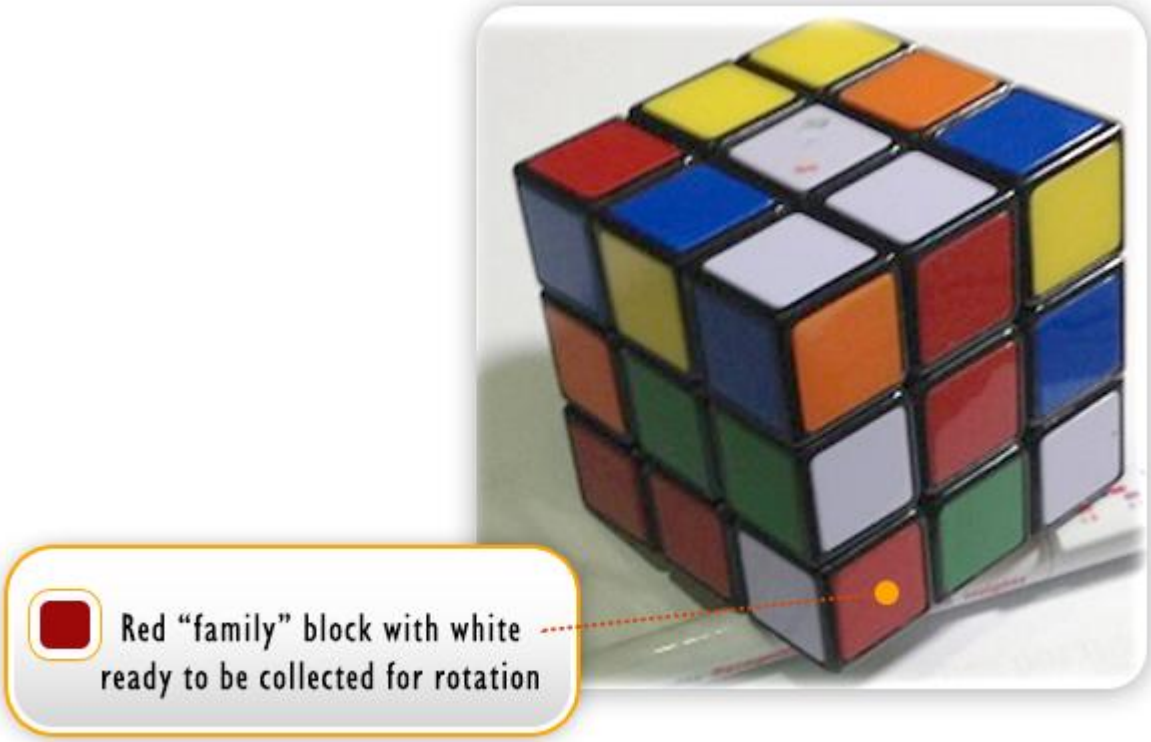
Rotate the side face containing the “family” aligned edges to bring the white edge to the top (shown in the diagram below). Do that for the four white edges.



This process is used to RESTORE the top layer as we move through the construction process.

POSITION CORNERS

Now for the **CORNERS:** Position the white corners facing you on the **SIDE** and in the third or bottom layer. If the corners are underneath or in the top layer twist the cube until they appear on the **SIDE** of the third layer (shown in the diagram below).



Match the non-white side of the corner block with their "family" by rotating the layer until it matches. Hold the cube with the "family" colour facing you. It is now ready to go up to the top layer.

Here is how:

- Rotate the block **away** from the “family” but keep the cube facing you.
- Now rotate the “family” face of the cube clockwise, or anti-clockwise depending on the position, down to collect the corner block we just moved away from the “family”.
- We can now move the third layer containing the white block back to where it came from to be collected and uploaded as the corner piece.
- Rotate the “family” side of the cube facing you up to the top again.

It is easy to remember if you keep in mind the white edges should start at the very bottom of the cube and the white corner blocks start at the third layer facing you. It is simply a matter of rotation to get them in the right place.

The corner piece should now take its rightful place in the top layer. Repeat this process for all four corners, each time positioning the corner in the third or lower layer before rotating it to the top.

The process to remember is away, down, back to collect and RESTORE.

We should now have the white blocks of the cube in position at the top of the cube with all sides matching the centre piece in Layer Two.

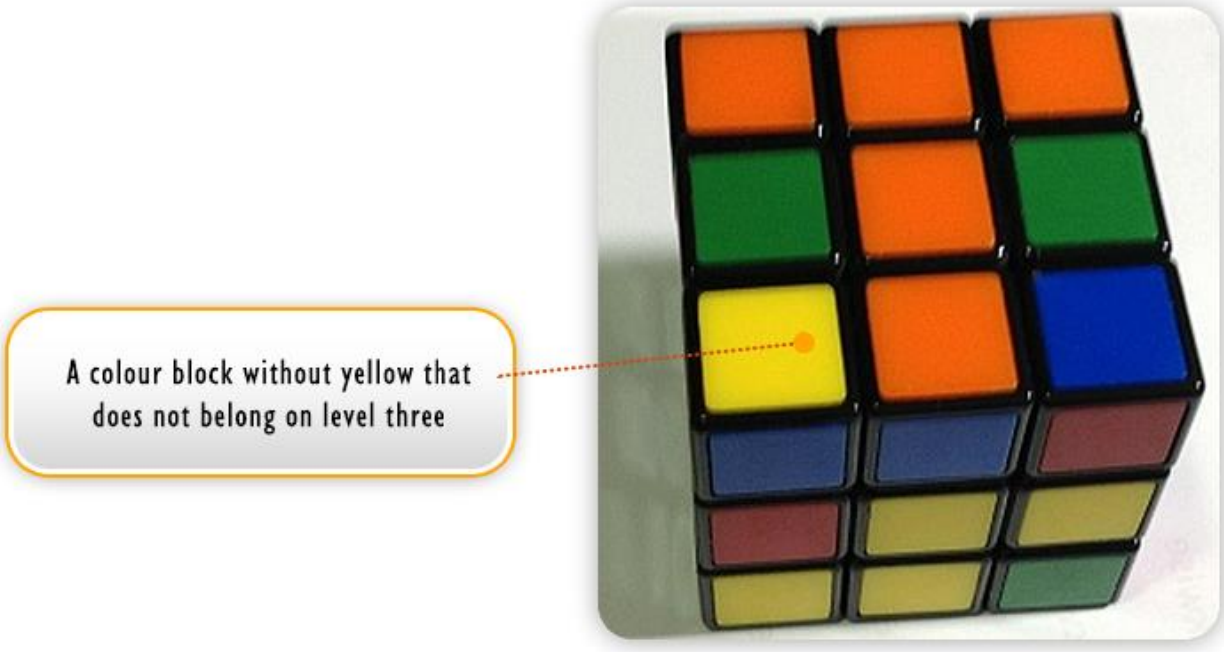
This process is going to be repeated in the next step to RESTORE the top layer, after we disturb it.

REMOVE YELLOW BLOCKS FROM THE MIDDLE LAYER

You will notice the edges for the top Layer are now aligned with the **centre** "family" colour on the second layer, but some of the edges on the side of the **second layer** are probably in the wrong place. They need to be fixed by rotation.

Note: There are no corners in the second layer.

Any edges with yellow in them do not belong in the second layer and similarly any edges on the third layer without yellow are in the wrong place.



If you turn the cube upside down you will see if any of the blocks on the third layer do not belong there (see the diagram above). They are our targets for completing this stage of the puzzle.

To fix this we are going to disturb the corners in the top layer that we already completed in an earlier stage. Unfortunate, but that is the way it works. Just remember how we got the corners into position by rotation before, because that is how we are going to get them back into position this time and RESTORE the situation. Let's call that RESTORE process "general maintenance" and it will be repeated from time to time.

Here we go to fix the second layer:

- Find the **edge blocks** without yellow on the third or bottom layer and rotate the layer around until they join up with their "family's" **centre block** colour in layer two.
- Keep the cube with the matched up "family" colour facing you now as you do this next step.
- Under the block in the third layer that you just rotated to line up with its "family" member, will be another colour. Let's call that its "cousin". The cube will have a block the same colour as its "cousin" on one of its sides.
- Now, rotate the bottom layer (keeping the cube with the "family" colour facing you) **AWAY** from its "cousin".
- Now, the side of the cube that contains the "cousin" block will be rotated down to collect the block. This will disturb the top layer.
- Now, rotate the bottom layer back to where it came from so the edge piece we started with joins up with the "family" colour.

- Now, RESTORE the side of the cube we brought down, back up to the top from where it came using the RESTORE method we used earlier.

Repeat the process until all the blocks in the middle layer are in place.

It is very simple if you consider we are just doing an away, down and back process. We are just using the “family” and “cousin” analogy to illustrate what direction the away and back should take.

We now have levels one and two in place. If there is an edge of the cube without yellow on level two, but in the wrong place, rotate the cube until it is on the bottom layer and then apply the process just described.

ALGORITHMS - SECOND & FINAL STAGE

Time to memorise algorithms to bring it home and complete the puzzle

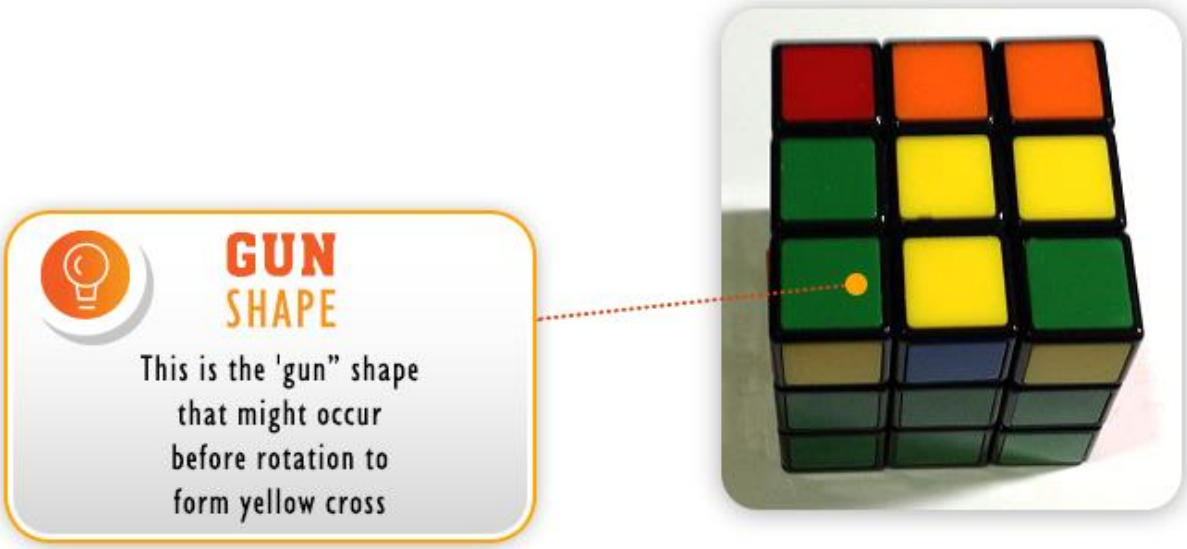
Turn the block upside down with the white layer (the foundation layer) at the bottom of the cube and the yellow at the top.

Here is where the algorithms come into play because we are going to rotate the blocks but want to do so without ruining what we have already done.

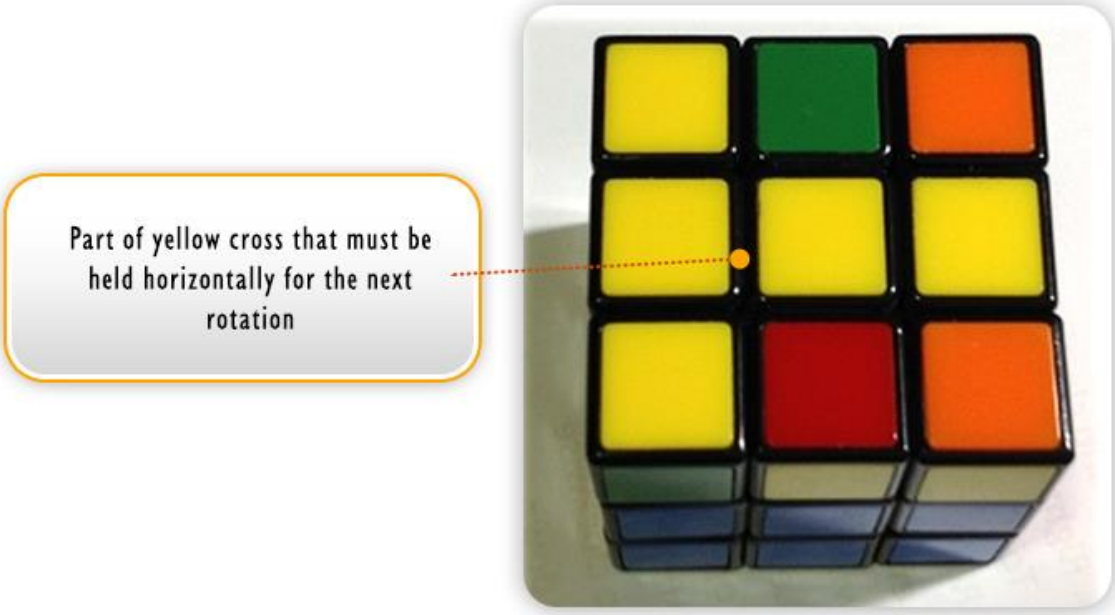
The same principle we used before to set up the white layer applies again to the new yellow top layer. That is, we create a yellow cross first and then fill in the edges and corners but using algorithms this time.

How to hold the Cube

Now we are ready to start, but there may be only one yellow centre block or there may be a partially made cross with three blocks forming a “gun” shape or a cross bar (see the diagram below). If there is only the one block on top (no gun or cross bar) it doesn’t matter which side is facing you to start.



If there is a cross bar (see the following diagram), hold the block so the cross bar is horizontal to you. If it is a “gun” have one block facing vertically towards you and the other in a horizontal position to the right of the vertical block.



Now run Algorithm ONE. You may have to repeat this several times before the cross emerges and you may need to change how you hold the cube (mentioned earlier) as the positions of the colours change.

Algorithm ONE (to get a CROSS)

1. Front Clockwise
2. Right Up
3. Top Clockwise
4. Right Down
5. Top Anti Clockwise
6. Front Anti Clockwise

You may now have a cross, but the edges may not line up with the colours on the centre layer.

Align the Edges of the Cross on the Yellow Layer

We now want to line up the Edges of the yellow layer with the colours in the middle layer. To do this we will run Algorithm TWO. Before we

do that, rotate the top yellow layer to see if the edges can line up by manually rotating the layer. You may have to repeat this several times before the alignment occurs. Do that each time before running Algorithm TWO.

Algorithm TWO (to get the EDGES of the cross to line up with the centre colour pieces)

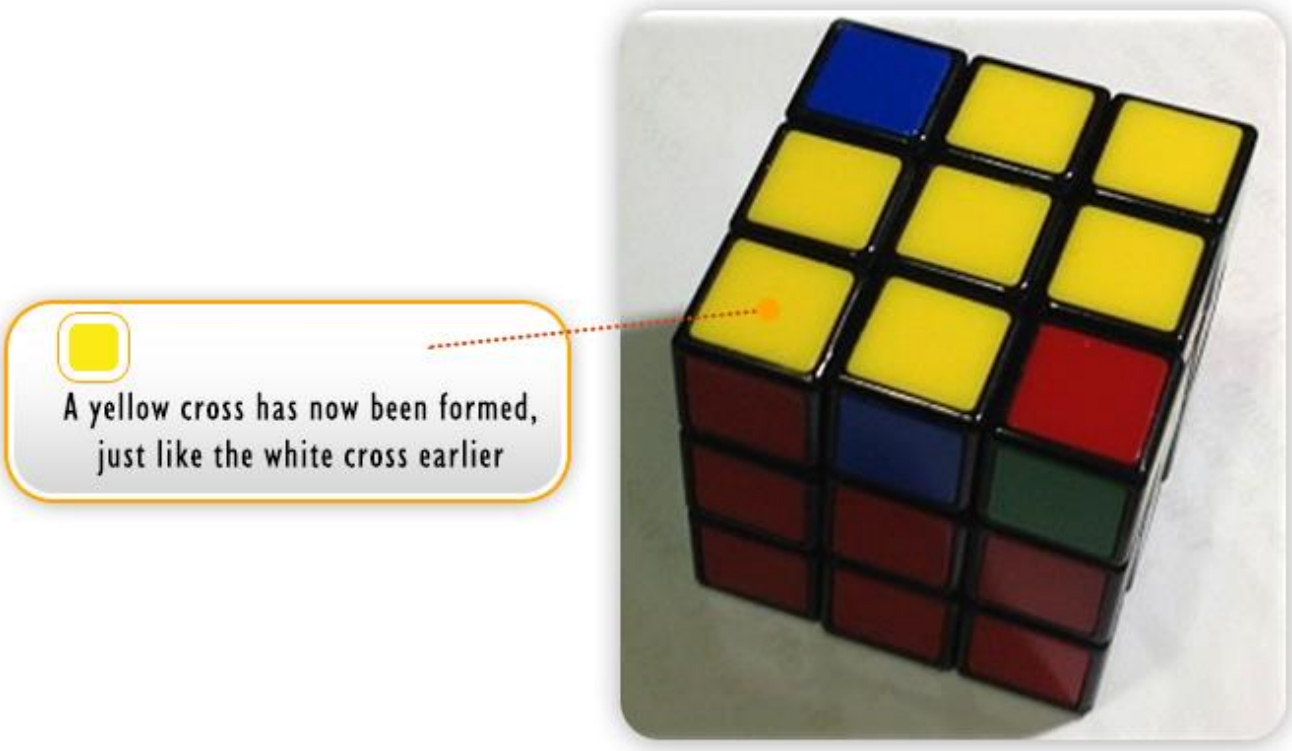
How to hold the cube

If one edge already lines up with the cube centre piece with the same colour then move that to be at the back or the left hand side of the cube facing you. If front and back blocks line up then hold one of the blocks to face you before running the following algorithm:

1. Right side Clockwise (away from you) up
2. Rotate top layer clockwise twice
3. Right side Anti Clockwise (towards you) Down
4. Top side Anti Clockwise
5. Right side Anti Clockwise Up
6. Top Anti Clockwise
7. Right side Anti Clockwise down

The cube will continuously be rotating. It depends where you come in on the rotation cycle as to how many times you may need to repeat this process before all the edges line up with the centre colours.

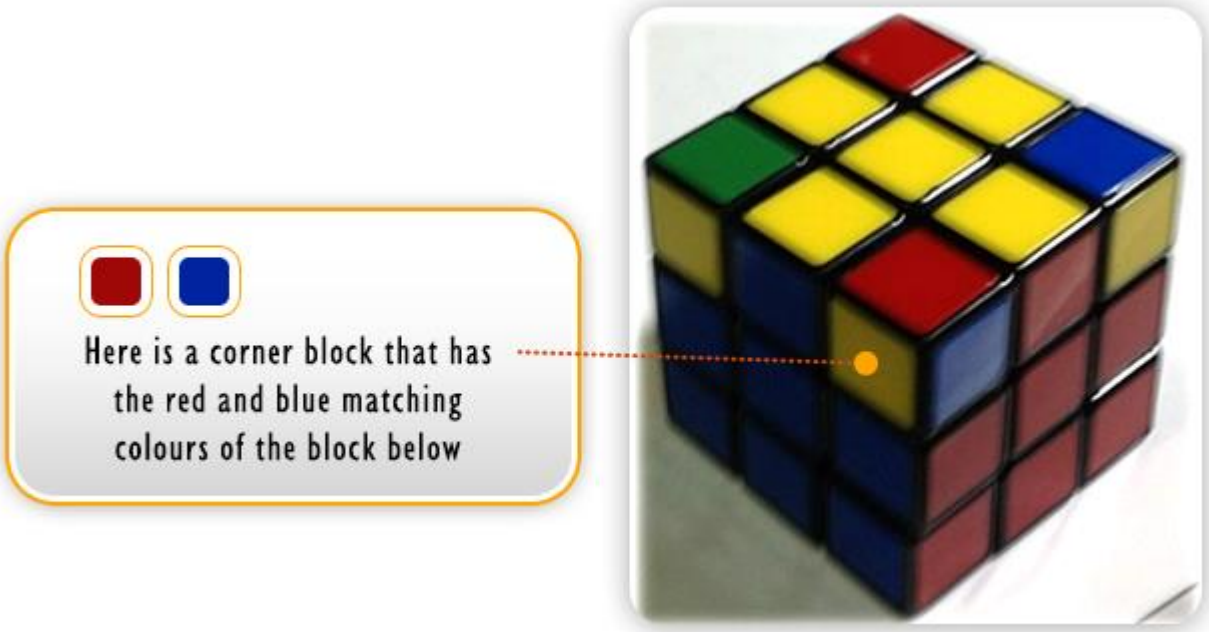
Now the cross is set up correctly (see the diagram below) for the next stage, with the EDGES in the right, but CORNERS need to be fixed.



Position the Corners in the Yellow Cross

Algorithm Three will bring the corners into position. They may not be facing the right direction initially, after completing algorithm three, but they will have the right colour combinations for the corner position they occupy.

There will either be one block in the right position, or no blocks in the right position, or all of the blocks in the right position. See the following diagram.



How to hold the cube

Hold the cube with the block that is now in the right place (see the diagram above) on your righthand side.

Algorithm THREE (to get the CORNERS of the cross to line up)

1. Left up
2. Top clockwise
3. Right up
4. Top anti clockwise
5. Left down
6. Top clockwise
7. Right down
8. Top anti clockwise

All the corners should now be in the right place, but not necessarily facing the right way: If not you may need to repeat the algorithm again until all the corners are ready.

The Final Step

It is now time to bring it home with Algorithm FOUR. You know when you are close to solving the puzzle because you will have one side of the layer with all three blocks lined up. When that happens hold the three lined up blocks on the left hand side of the cube. You will either have the two outside corners on the opposite side with yellow facing outwards or straight ahead like headlights in a car. That will make you one or two runs of the Algorithm from home.

Algorithm FOUR (The final step)

How to hold the cube

If you don't have one side lined up, as mentioned above, hold the cube with any yellow blocks facing outwards on the right hand side to use as your start point. Then run Algorithm four doing the right side first and then the left.

1. **Right up**
2. Top twice clockwise
3. Right down
4. Top anti clockwise
5. Right up
6. Top anti clockwise
7. Right down
8. **Left up**
9. Twice clockwise on top
10. Left down
11. Top clockwise
12. Left up
13. Top clockwise
14. Left down

This may need to be repeated several times but that's it. The Rubik's Cube should then be complete.