2x2 Tutorial: Intermediate

Introduction

This tutorial will explain how to solve the 2x2 cube using the Ortega/Varasano method (the best name is a matter of debate). If you are new to solving cubes, you may want to look at my 2x2 Beginner Tutorial first.

This method has three steps:

1. Solve one side
2. Solve the opposite side
3. Permute both layers (i.e., fix everything!)

The Ortega/Varasano method solves the 2x2 in 20 moves on average using 12 algorithms. This is most effective when you can solve it "color neutral" - able to begin with any of the six colors. For the purposes of this tutorial, the first side will be white, so the opposite side will be yellow.

If needed, review cube notation before diving into the first step.

Solve One Side

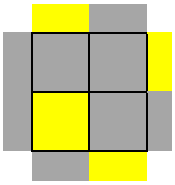
The first step is to solve a side (not necessarily a layer), just as in the basic 2x2 tutorial. This is an intuitive process that usually takes 4 moves, never more than 5 moves if you are color neutral. It is usually best to begin with a side that already has two adjacent matching corners.

Be sure to look at the three example solves at the end of this tutorial. These will illustrate some ways to use matching corners as the basis for your first side.

Solve the Opposite Side

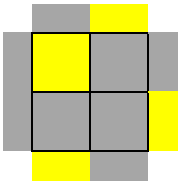
Next, we orient the top layer. The algorithms for these seven cases are generally shorter than their 3x3 counterparts since we have fewer pieces involved.

Sune



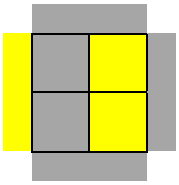
(RUR'U) (RU2R)

Anti-Sune



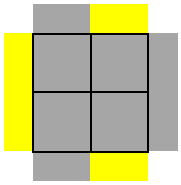
(R'U'RU2) (R'U2R)

Headlights



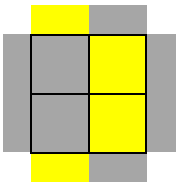
F (RUR'U') F'

Pi



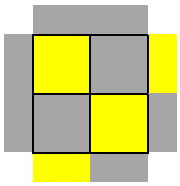
F (RUR'U')*2 F'

Blinkers



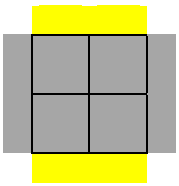
(RUR'U') (R'FRF')

Bowtie



(FR'F'R) (URU'R')
Alt: F (RU'R'U') (RUR'F')

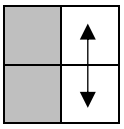
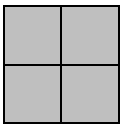
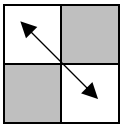
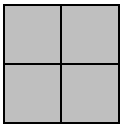
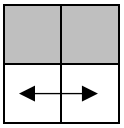
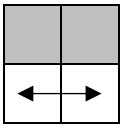
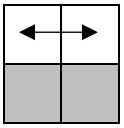
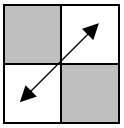
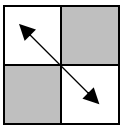
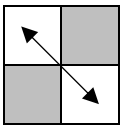
Double Headlights



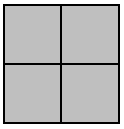
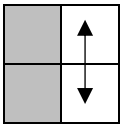
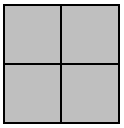
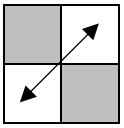
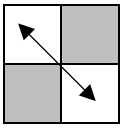
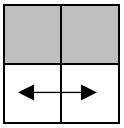
(R2U2) (R'U2R2)
Alt: F (RUR'U')*3 F'

Permute Both Layers

Finally, we permute both layers (PBL). This may sound intimidating, but there are only five cases, shown below. The top and bottom layers are shown from the perspective above the cube. You may need to use a U move to match one of the cases before using an algorithm.

Top	Bottom	
		(RU2R'U') (RU2L'U) (R'U'R) Alt: x U2 (R'U'RU2) (L'UR'U'R2) *T-Perm and J-Perm are also possible
		(RU'R'U') F2 (U'RUR'D) R2 *Y-Perm is also possible
		(R2U'R2'U2) (F2U'R2)
		(RU'L) U2 (R'UL') Alt: y2 (R'UR'F2) (RF'R) Alt: y2 (R'UL') (U2) (RU'L)
		R2' F2 R2

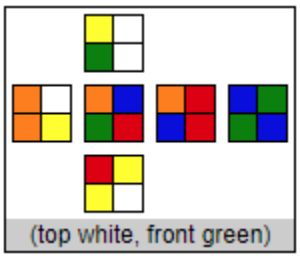
Three other cases correspond to one of the above cases after rotating the cube with x2:

Top	Bottom	
		x2 (RU2R'U') (RU2L'U) (R'U'R)
		x2 (RU'R'U') F2 (U'RUR'D) R2
		x2 (RU'L) U2 (R'UL')

A final U move may be necessary to solve the cube after using these algorithms.

Example Solves

Solve 1



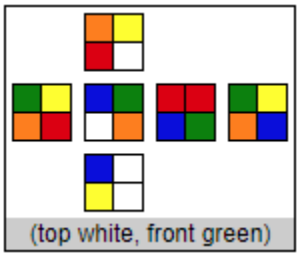
Scramble: (R' U F2 R' U2 F' R F' U' F)

One possible solution is to face the cube as shown (adjacent white stickers on the upper front), and use (R2DR'U'R). R2 the puts 3rd orange in place on the bottom. D prepares to receive the last orange piece. (R'U'R) inserts the final orange piece normally.

The full solve would be 26 moves:

- First Side: (R2DR'U'R)
- Opposite Side: U2 (RUR'U') (R'FRF')
- PBL: x2 (RU'R'U') F2 (U'RUR'D) R2 U'

Solve 2



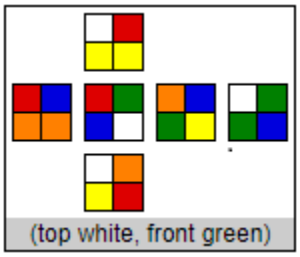
Scramble: (R U' F2 U' R2 F2 U2 R' U2 R2)

One possible solution is to face the cube as shown (adjacent whites on the lower right side) and use (RUR) to complete the red side on the bottom.

The full solve would be 22 moves:

- First Side: (RUR)
- Opposite Side: (RUR'U) (RU2R')
- PBL: x2 U2 (RU2R'U') (RU2L'U) (R'U'R)

Solve 3



Scramble: (F2 R2 U F' U' F R2 F2 U2 F2)

One possible solution is to face the cube as shown (orange pair on bottom, face the side with no red) and use (RUR). This completes the red side on the bottom.

The full solve would be 19 moves:

- First Side: (RUR)
- Opposite Side: U2 (RUR'U) (RU2R)
- PBL: U' (R'UR'F2) (RF'R) U2

Advanced 2x2 Methods

Waterman Method

Solve one layer, then use one of 42 CLL algorithms to orient and permute the last layer simultaneously. Two of these 42 algorithms are PLLs.

Erik-Gunnar (EG) Method

Solve one side, then use one of 128 algorithms to orient the opposite side and permute the entire cube. Roughly one third of these algorithms are the 42 CLL algorithms. The others do CLL on the last layer while swapping two pieces (either adjacent or opposite) on the bottom layer.