

Solving the Rubik's Cube Last Layer

2026-10-20 · Brian Rosenthal

With the first two layers done, eight short lessons take you from a scrambled top to a solved cube. Each move is written two ways: the standard notation, and how to say it.

Lesson 1 — The vowel system

Every move is one syllable. The consonant is the face you turn; the vowel is how you turn it.

Vowel	Means	Notation
-a	a quarter turn clockwise	R
-ee	a quarter turn counter-clockwise (prime)	R'
-ay	two layers together, clockwise (wide)	r
-oo	two layers together, counter-clockwise	r'
-oe	a half turn	R2

Face	How to say it
R (right)	Ra, Ree, Ray, Roo, Roe
L (left)	La, Lee, Lay, Loo, Loe
U (top)	Ta, Tee, Tay, Too, Toe
D (bottom)	Da, Dee, Day, Doo, Doe
F (front)	Fa, Fee, Fay, Foo, Foe
B (back)	Ba, Bee, Bay, Boo, Boe
M (middle slice, turns like L)	Ma, Mee, Moe
x (tilt the whole cube up, the way R turns)	Xa, Xee, Xoe
y (spin the whole cube, the way U turns)	Ya, Yee, Yoe

The top face is T rather than U so that every syllable starts with a consonant. Clockwise always means clockwise as you look straight at that face. The last two rows turn the whole cube in your hands rather than a layer; after Xa the old front is on top, so every syllable that follows is read from the new position.

Practice: say the five vowels for each face in order while turning (Ra Ree Ray Roo Roe, La Lee Lay Loo Loe, Ta Tee Tay Too Toe...). Then write ten random moves on a card and read them aloud as fast as you can. When a card of twenty takes under fifteen seconds with no mistakes, move on.

Shorthand words

The move syllables all end in a vowel, so any word that ends in a consonant is a shorthand word, never a move. Each one stands for a short sequence your hands will learn as a single motion.

Word	Moves	How to say it in full	Notes
Rand	R U R' U'	Ra Ta Ree Tee	the right-hand trigger; six Rands in a row return a solved cube to solved
Land	L' U' L U	Lee Tee La Ta	the same motion with the left hand
Taratiri	U R U' R'	Ta Ra Tee Ree	Rand backwards; Rand then Taratiri cancels
Tilitala	U' L' U L	Tee Lee Ta La	Land backwards
Reef-Rafi	R' F R F'	Ree Fa Ra Fee	right hand, with the front face
Lafeeleef	L F' L' F	La Fee Lee Fa	the left-hand Reef-Rafi: Lafee then Leef
Farifira	F R' F' R	Fa Ree Fee Ra	Reef-Rafi backwards; opens the bowtie
Filafali	F' L F L'	Fee La Fa Lee	Lafeeleef backwards; the left-hand Farifira
Reef	R' F	Ree Fa	the T move's "reefing" (the -ing is a rest beat); written "reefa" inside the J, F and N sentences
Reefy	R' F'	Ree Fee	ends the T move ("rata reefee") and opens the J move

Word	Moves	How to say it in full	Notes
Laughing	L F'	La Fee	the left-hand Reef; the second word of the left T move (the -ing is a rest beat)
Leef	L' F	Lee Fa	Reef spelt with the left hand's letters; note it is not Reef's mirror image, which is Laughing
Leefy	L' F'	Lee Fee	Reefy spelt with the left hand's letters
Ritari	R' U R'	Ree Ta Ree	the right hand's closing flourish; ends the U move
Latila	L U' L	La Tee La	the left-hand Ritari
Ratiri	R U' R'	Ra Tee Ree	Ritari with the vowels swapped; the middle of the A perm
Litala	L' U L	Lee Ta La	the left-hand Ratiri
Ratari	R U R'	Ra Ta Ree	Rand without its last turn; opens the Y and N moves
Litila	L' U' L	Lee Tee La	the left-hand Ratari

Two rules cover all fourteen: a word starting with R is the right hand and L the left hand (the four longer words that start with T or F begin with a top or front turn, and their second consonant tells you the hand); and a word is spelt the way it is said, so Taratiri is Ta Ra Tee Ree, which is Rand run backwards.

One more piece of grammar you will meet later: a word whose last syllable is **-ray** or **-roo** (or **-lay**, **-loo**) has its last move gone wide, two layers at once. *Farifiray* is Farifira ending in Ray instead of Ra; *Taratiroo* is Taratiri ending in Roo instead of Ree.

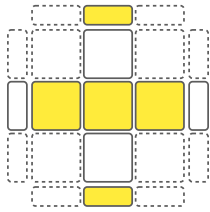
From here on, long algorithms are written as sentences: a shorthand word where one fits, and sound-alike syllables for the rest. **Rand reefing, rotee reetee, rata reefee** is easier to keep than fourteen separate moves, and it says the same thing.

Lesson 2 — The cross

First get the four top edges showing yellow. Ignore the corners for now. Looking down at the top, the edges are in one of three states, and one short word handles each.

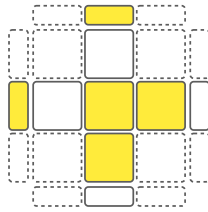
Three ways the top edges can start

Front at the bottom. Filled = yellow. Only the edges matter here; the corners (dashed) can be anything.



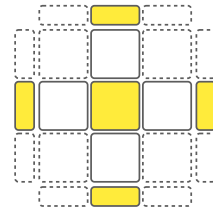
Line

Fa-Rand-Fee



Nine o'clock

Fay-Rand-Foo



Dot

Fa-Rand-Fee, then Fay-Rand-Foo

You see	Say	Notes
Line (two opposite edges yellow)	Fa-Rand-Fee F R U R' U' F'	Hold it so the line runs left to right. Say the wrapper (Fa), say Rand, close the wrapper (Fee).
Nine o'clock (two neighbouring edges yellow)	Fay-Rand-Foo f R U R' U' f'	Hold it so the two edges still missing yellow point to 12 and 9 (back and left); the yellows are at the right and the front. The same word as the line with the wrapper gone wide: Fay and Foo turn two layers.
Dot (no edges yellow)	Fa-Rand-Fee, then Fay-Rand-Foo F R U R' U' F', then f R U R' U' f'	Any hold. After the first word you are looking at the nine o'clock; turn it into place and say the second.

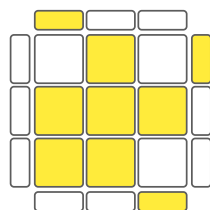
Practice: do Fa-Rand-Fee on a solved cube and look at the top: that is the line it fixes. Do it again and it is gone. Then the same with Fay-Rand-Foo.

Lesson 3 — Sune

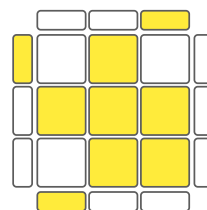
With the cross done, Sune turns the corners yellow. It is the only corner algorithm you need: every corner case gives way to Sune repeated at most twice, as long as you can do it with either hand.

Sune, right hand and left hand

Front at the bottom. Filled = yellow sticker; the bars are the side stickers of the top layer.



Right-hand Sune
Rata reeta, ratoree



Left-hand Sune
Leetee latee, leetola

Say	Notes
Rata reeta, ratoree R U R' U R U2 R'	Four beats and three: RA-ta-REE-ta, ra-to-REE. Hold: one corner yellow and a yellow sticker facing you at the front-right. Put the yellow corner at the front-left.
Leetee latee, leetola L' U' L U' L' U2 L	The same sentence with every syllable mirrored (R→L, a→ee, ee→a); only the Toe stays put. Hold: one corner yellow and a yellow sticker facing you at the front-left. Put the yellow corner at the front-right.

- No corner yellow, or two: do either Sune from any angle, look again, and you will have one of the two holds in the table.

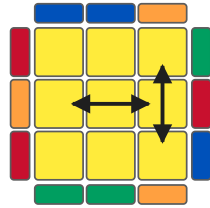
Practice: on a solved cube do the right-hand Sune and look at the top. That is the case it fixes; the left-hand Sune is its mirror image. Then scramble only the corners (a few Sunes from random angles) and solve them back, saying every syllable.

Lesson 4 — The T move

The top is all yellow now; what is left is sliding pieces around the top layer. The T move swaps two corners next to each other and the two edges on either side of them. It is the first one everybody learns, and it is built from words you already have. You only need one of the two versions below: pick the hand you prefer and learn that one. The other is there for left-handers and for the curious.

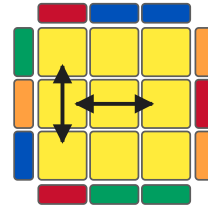
The T move, either hand

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right hand

Rand reefing, rotee reetee, rata reefee



Left hand

Land laughing, lota lata, leef

Say	Notes
Rand reefing, rotee reetee, rata reefee $R\ U\ R'\ U'\ R'\ F\ R^2\ U'\ R'\ U'\ R\ U\ R'\ F'$	In full: Rand, then Ree Fa Roe Tee Ree, then Tee Ra Ta Ree Fee. The two tails rhyme: REE-fa-ROE-tee-ree, TEE-ra-TA-ree-fee. Hold: headlights (the matching pair of corner stickers) on the left. The two corners that swap are under the right hand.
Land laughing, lota lata, leef $L'\ U'\ L\ U\ L'\ F'\ L^2\ U\ L\ U\ L'\ U'\ L\ F$	A looser fit: "leef" covers the last four moves, which is fine once the hands know the ending. Hold: headlights on the right. The T move is its own mirror image, so either hand solves the same case; one version is enough.

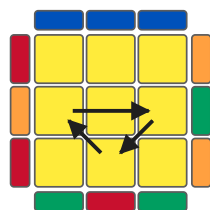
Practice: T move twice brings a solved cube back to solved. Chant it through twice at a steady beat, one syllable per turn.

Lesson 5 — The U move

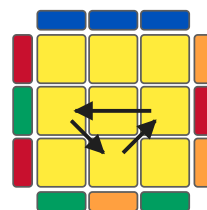
The U move cycles three edges and leaves every corner alone. With the T move, it finishes any cube: T move until the corners are right, U move until the edges are.

The U move: the working hand pulls its side edge to the front

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right-hand U move
Rota Rand Reetee Ritari



Left-hand U move
Lotee Land Lata Latila

Say	Notes
Rota Rand Reetee Ritari R2 U R U R' U' R' U' R' U R'	Rota is the half turn and a top turn (R2 U), then a whole Rand, then Reetee (R' U'), then Ritari to finish (R' U R'). Lean on the rhythm: RO-ta, RAND, REE-tee, ri-TA-ri. Hold: solved edge at the back. Use the right hand when the right-hand side edge is the one that belongs at the front: the working hand pulls its own side edge round to the front.
Lotee Land Lata Latila L2 U' L' U' L U L U L U' L	The same sentence mirrored: LO-tee, LAND, LA-ta, la-TI-la. Hold: solved edge at the back. Use the left hand when the left-hand side edge belongs at the front.

If no edge is solved yet, the cube needs the H perm (next lesson) or a U move from any angle followed by a second one.

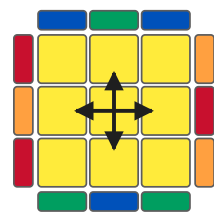
Practice: right-hand U move, then left-hand U move, cancels out. Alternate them and watch the right edge come to the front, then go back.

Lesson 6 — The H perm

When every corner is right and all four edges are wrong, with each edge opposite the place it belongs, that is the H perm. It is the easiest algorithm in the book: the right hand barely moves.

The H perm: opposite edges swap

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



H perm

Mo' tomato, mo' tamo

Say	Notes
Mo' tomato, mo' tamo M2 U M2 U2 M2 U M2	M is the middle slice between L and R; Moe is a half turn of it, pushed with the ring finger. Almost a palindrome, Moe Ta Moe Toe Moe Ta Moe, so if you start it you can finish it. Left hand: the same with the top turns reversed (M2 U' M2 U2 M2 U' M2). Hold it any way you like; the case looks the same from every side.

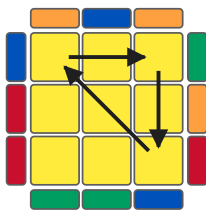
Practice: Moe alone, ten times, until the slice moves cleanly without the outer layers coming along. Then the whole sentence; it brings a solved cube back to solved on its own.

Lesson 7 — The A perm

The A perm cycles three corners and leaves the edges alone. It is short, and it introduces two things the earlier moves did not use: a half turn of the bottom face, and tilting the whole cube before you start.

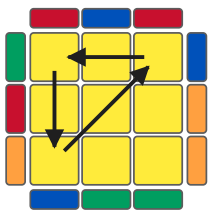
The A perm: three corners cycle under the working hand

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right-hand A perm

Xa, Ritari Doe, Ratiri Doe, Roe



Left-hand A perm

Xa, Latila Doe, Litala Doe, Loe

Say	Notes
Xa, Ritari Doe, Ratiri Doe, Roe x R' U R' D2 R U' R' D2 R2	Start with your right thumb on the front face. Xa tilts the front up to the top and the thumb comes with it, so it is resting on top, ready for the first Ree. Read everything after that from the new position: two matching phrases, each ending in Doe (a half turn of what is now the bottom), then Roe to close. Ritari and Ratiri are the same three fingers with the vowels swapped. Hold: find the corner already in place (its two side stickers match their neighbours) and put it at the front-left. The three corners that cycle are under the right hand. When you finish the cube is still tilted; Xee brings it back, or carry on from where it is.
Xa, Latila Doe, Litala Doe, Loe x L U' L D2 L' U L D2 L2	Left thumb on the front face, same tilt. Hold: the corner already in place at the front-right; the cycling corners are under the left hand.

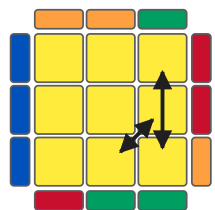
Practice: say and do "Ree Doe Ra" on its own twenty times to get the grip. Then the whole sentence. Right-hand A perm followed by left-hand A perm does not cancel (they are not inverses), so check your work by doing the same one three times, which does return to solved.

Lesson 8 — The J move

The J move swaps two corners next to each other and two edges next to each other. It is half a T move, which is why it comes easily once the T move is solid.

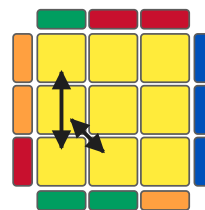
The J move: the bar sits away from the working hand

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right-hand J move

Rata Reelee, Rand, Reefa Rotee Ree



Left-hand J move

Leetee Lafa, Land, Lafee Lota La

Say	Notes
Rata reefee, Rand, reefa rotee ree R U R' F' R U R' U' R' F R2 U' R'	The T move rearranged: rata reefee is its last phrase, then Rand, then reefa rotee ree is its middle phrase cut short. Hold: the solid bar of three matching stickers on the left, away from the working hand; the two corners that swap are under the right hand. The four pieces that stay put make a J.
Leetee lafa, Land, lafee lota la L' U' L F L' U' L U L F' L2 U L	Hold: bar on the right; swapping corners under the left hand. The pieces that stay put make a backwards J.

Practice: J move twice returns a solved cube to solved. Then alternate hands on a scrambled top: whichever side the bar is on tells you which hand to use.

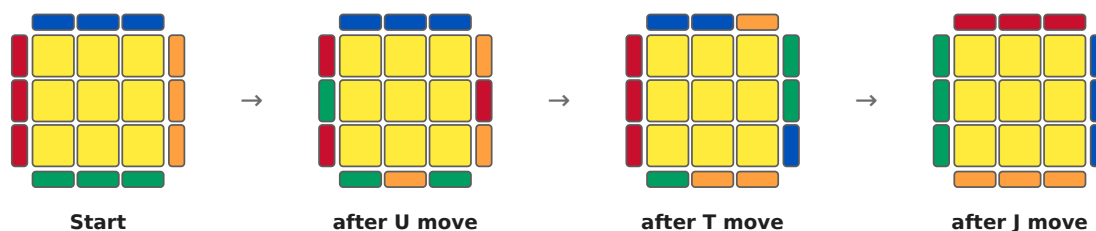
Lesson 9 — Practice loops

Every loop here starts on a solved cube and ends on one, so you can drill without scrambling. Keep the cube in your hands the whole way: no re-gripping between moves, no looking for the case. The pictures show the top layer after each move, so if you lose the thread you can see exactly where.

Loop 1: U move, T move, J move. Three in a row, then a Tee to line the top up. This is the one to learn first. It also tells you something: a J move is a U move and a T move done backwards.

Loop 1: U move, T move, J move (then a Tee to line up)

Front at the bottom. The top layer after each move; the cube stays in your hands the whole time, never re-gripped.

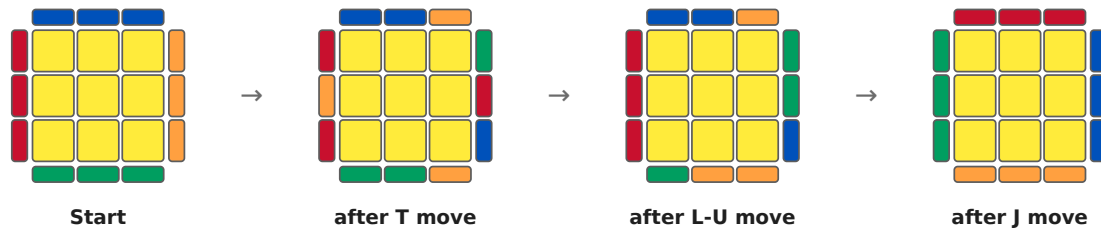


After the U move you are looking at the left-hand U move's case; after the T move, the T case exactly as Lesson 4 draws it.

Loop 2: T move, left U move, J move. Same shape, with the U done by the other hand; a Tee at the end.

Loop 2: T move, left U move, J move (then a Tee)

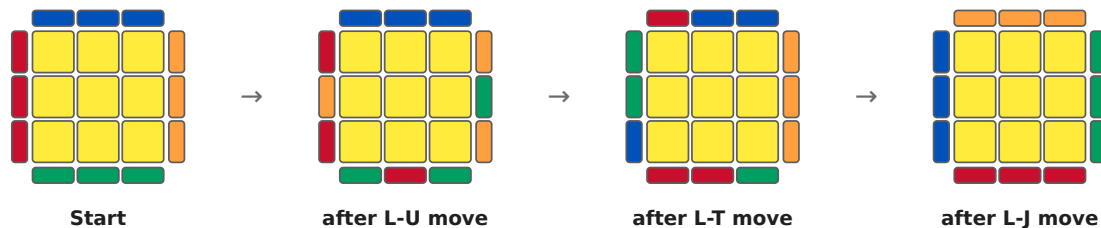
Front at the bottom. The top layer after each move; the cube stays in your hands the whole time, never re-gripped.



Loop 3: left U, left T, left J. Loop 1 in the mirror, finishing with a Ta instead of a Tee.

Loop 3: left U, left T, left J (then a Ta)

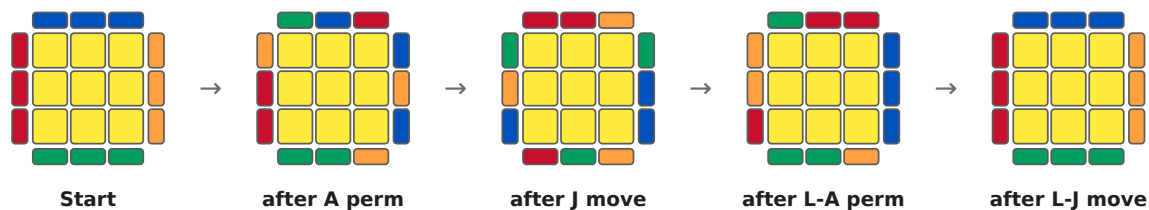
Front at the bottom. The top layer after each move; the cube stays in your hands the whole time, never re-gripped.



Loop 4: A perm, J move, left A perm, left J move. Four moves, no turns, lands exactly solved. The A perm leaves the cube tilted; say Xee before the J move, or the rest will not follow the pictures.

Loop 4: A perm, J move, left A perm, left J move

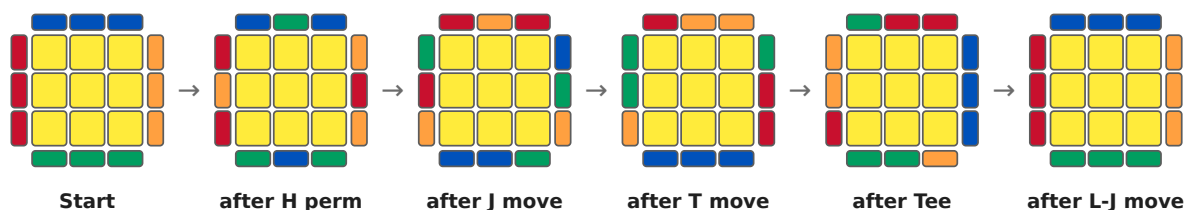
Front at the bottom. The top layer after each move; the cube stays in your hands the whole time, never re-gripped.



Loop 5: H perm, J move, T move, Tee, left J move. Also lands exactly solved.

Loop 5: H perm, J move, T move, Tee, left J move

Front at the bottom. The top layer after each move; the cube stays in your hands the whole time, never re-gripped.



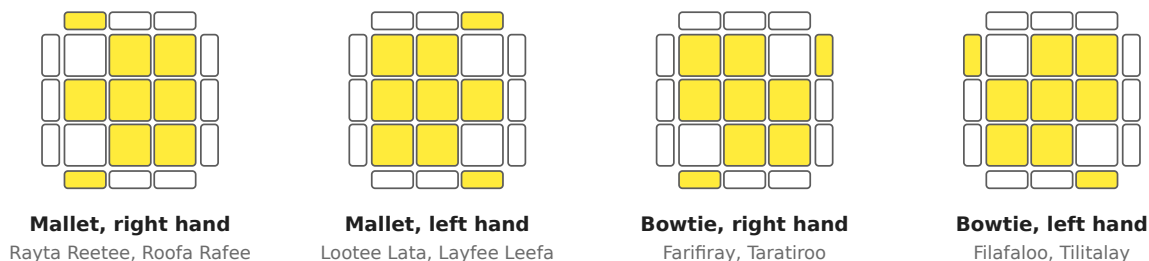
Optimisation 1 — Mallet and bowtie

Lessons 1 to 8 are enough to solve the cube. From here on, each optimisation trades a little more memory for fewer moves. The corners come first: Sune handles every case, but often in two goes, and a dedicated algorithm per case makes it one. Learn them in pairs.

The mallet (a yellow T lying on its side, head to the right) and the bowtie are the two cases with two corners already yellow, and their algorithms are exact inverses: do one on a solved cube and you are looking at the other. It is called a mallet rather than a T so that the T move in Lesson 4 keeps the letter to itself.

Mallet and bowtie, both hands

Front at the bottom. Filled = yellow sticker; the bars are the side stickers of the top layer. Left-hand cases are the mirror image.



Case	Say	Notes
Mallet	Rayta Reetee, Roofa Rafee <code>r U R' U' r' F R F'</code>	Rand and Reef-Rafi with the first move of each gone wide: Ray for Ra, Roo for Ree. Hold as in the picture: the T's head is the right-hand column, the handle points left.

Case	Say	Notes
Mallet, left hand	Lootee Lata, Layfee Leefa l' U' L U l F' L' F	Land and Lafeeleef with the first move of each gone wide. Use it when theallet comes up mirrored. Hold: the mirror of the picture. The T's head is the left-hand column and the handle points right; one yellow faces you at front-right, one faces back at back-right.
Bowtie	Farifray, Taratiroo F R' F' r U R U' r'	Farifira and Taratiri with the last move of each gone wide: the final Ra becomes Ray and the final Ree becomes Roo. Exact inverse of theallet: do one on a solved cube and you are looking at the other.
Bowtie, left hand	Filafaloo, Tilitalay F' L F l' U' L' U l	Filafali (Lafeeleef backwards) and Tilitala with the last move of each gone wide: the final Lee becomes Loo and the final La becomes Lay. Exact inverse of the left-handallet. Hold: the mirror of the picture. Yellow corners at back-right and front-left; a yellow faces you at front-right, one on the left side at the back.

Practice: Mallet then bowtie, with nothing between, returns a solved cube to solved. So does either one three times in a row.

Practice with theallet and bowtie

Loops in the style of Lesson 9, now with the two new corner cases mixed in. Because theallet and bowtie change which stickers face up, the pictures show the whole top layer, not just the sides. Keep the cube in your hands throughout.

Loop 6: Bowtie, left U move, Mallet, U move. Four moves, no turns, lands exactly solved. The bowtie breaks the yellow face, the left U move is done with the top still broken, theallet restores the yellow, and the right U move puts the edges back. It is the simplest example of doing a permutation move while the orientation is still wrong, which is something the two-look method never asks of you.

Loop 6: Bowtie, left U move, Mallet, U move

Front at the bottom. The whole top layer after each move, yellow and otherwise; the cube is never re-gripped.



Loop 7: Bowtie, Sune, left Sune, left A perm. No turns, lands exactly solved. Three corner moves in a row, then one permutation to tidy up.

Loop 7: Bowtie, Sune, left Sune, left A perm

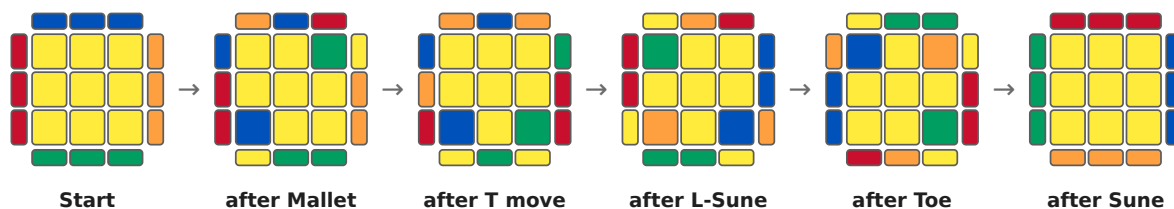
Front at the bottom. The whole top layer after each move, yellow and otherwise; the cube is never re-gripped.



Loop 8: Mallet, T move, left Sune, Toe, Sune. Then a Tee to line up. The mallet on its own, with the Sunes undoing what it did.

Loop 8: Mallet, T move, left Sune, Toe, Sune (then a Tee)

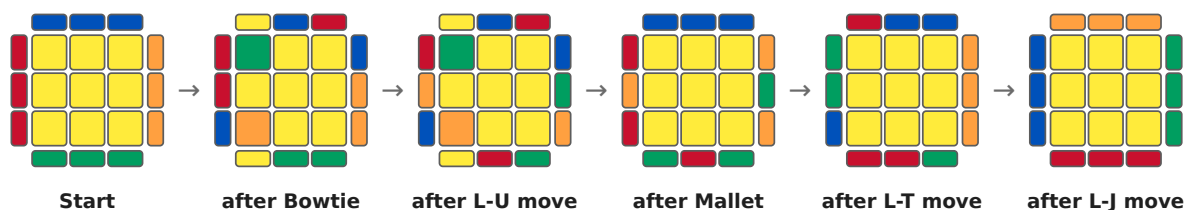
Front at the bottom. The whole top layer after each move, yellow and otherwise; the cube is never re-gripped.



Loop 9: Bowtie, left U move, Mallet, left T move, left J move. Five moves, no turns, then a Ta to line up. Loop 6 with the right U move replaced by the all-left ending from Loop 3.

Loop 9: Bowtie, left U, Mallet, left T, left J (then a Ta)

Front at the bottom. The whole top layer after each move, yellow and otherwise; the cube is never re-gripped.

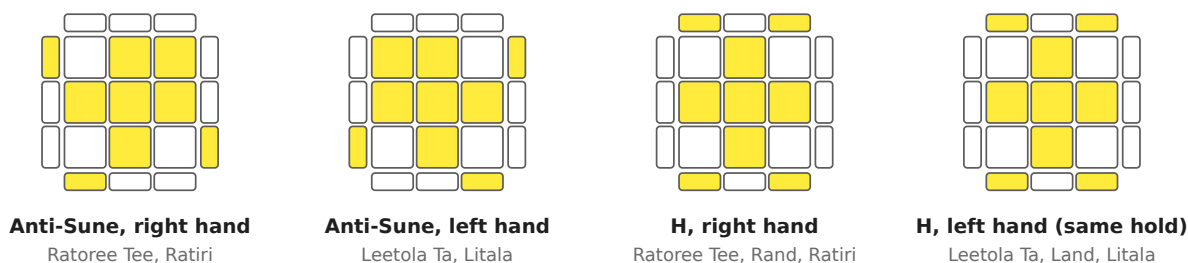


Optimisation 2 — Anti-Sune and H

These two are fingered almost identically. Anti-Sune is *Ratoree Tee, Ratiri*; H is the same thing with a Rand dropped into the middle. Learn Anti-Sune first, then H is one extra word.

Anti-Sune and H, both hands

Front at the bottom. Filled = yellow sticker; the bars are the side stickers of the top layer. Left-hand cases are the mirror image.



Case	Say	Notes
Anti-Sune	Ratoree Tee, Ratiri R U2 R' U' R U' R'	Sune's exact inverse, and the case a left-hand Sune solves; if the left Sune is already in your hands you can skip this one. Hold as in the picture: the yellow corner at the back-right, a yellow sticker facing you at the front-left.
Anti-Sune, left hand	Leetola Ta, Litala L' U2 L U L' U L	The left Sune's exact inverse; it solves the case a right-hand Sune solves, so it is the one to learn if your Sune is right-handed. Hold: the mirror of the picture. The yellow corner at the back-left, a yellow sticker facing you at the front-right.

Case	Say	Notes
H	Ratoree Tee, Rand, Ratiri R U2 R' U' R U R' U' R U' R'	Anti-Sune with a Rand dropped into the middle; fingered the same. Hold: a yellow pair on the front and another on the back.
H, left hand	Leetola Ta, Land, Litala L' U2 L U L' U' L U L' U L	Left Anti-Sune with a Land dropped into the middle. Hold: the same as the right hand; the H case is its own mirror image.

Practice: Sune then Anti-Sune returns a solved cube to solved. H three times in a row does too.

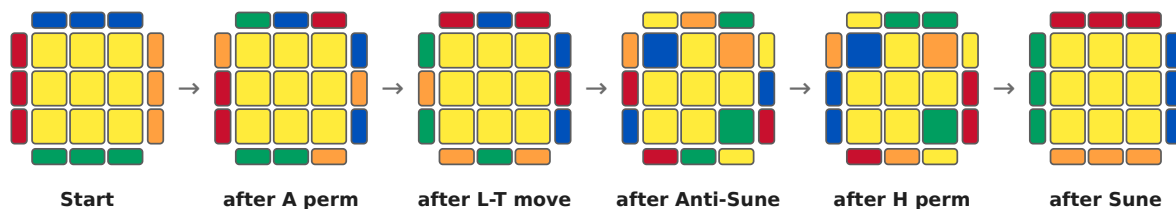
Practice with Anti-Sune and H

Loops that start and end solved, using the two new corner cases with moves from the lessons. Pictures show the whole top layer after each move.

Loop 10: A perm, left T move, Anti-Sune, H perm, Sune. 5 moves, no turns between, then a Tee to line up.

Loop 10: A perm, left T move, Anti-Sune, H perm, Sune (then a Tee to line up)

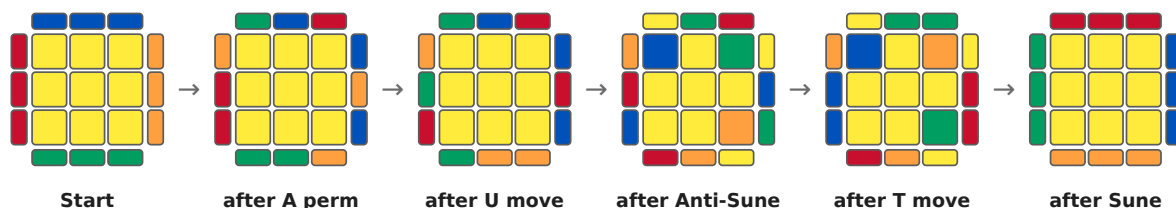
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 11: A perm, U move, Anti-Sune, T move, Sune. 5 moves, no turns between, then a Tee to line up.

Loop 11: A perm, U move, Anti-Sune, T move, Sune (then a Tee to line up)

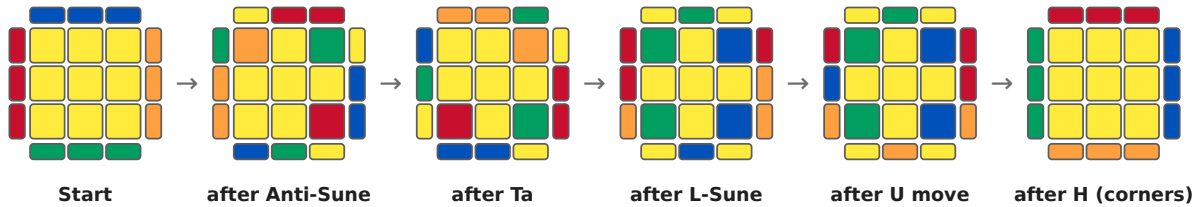
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 12: Anti-Sune, Ta, left Sune, U move, H (corners). 4 moves, one turn between, then a Tee to line up.

Loop 12: Anti-Sune, Ta, left Sune, U move, H (corners) (then a Tee to line up)

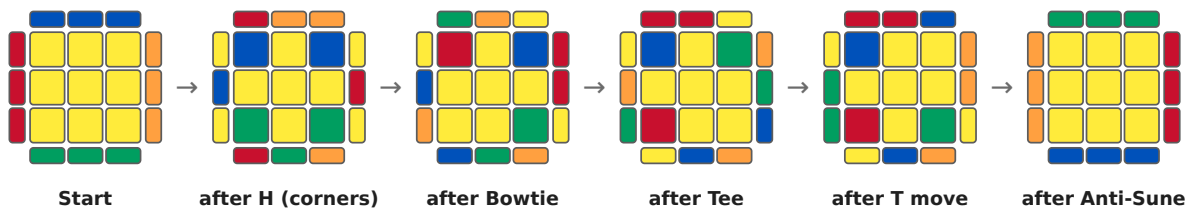
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 13: H (corners), Bowtie, Tee, T move, Anti-Sune. 4 moves, one turn between, then a Toe to line up.

Loop 13: H (corners), Bowtie, Tee, T move, Anti-Sune (then a Toe to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.

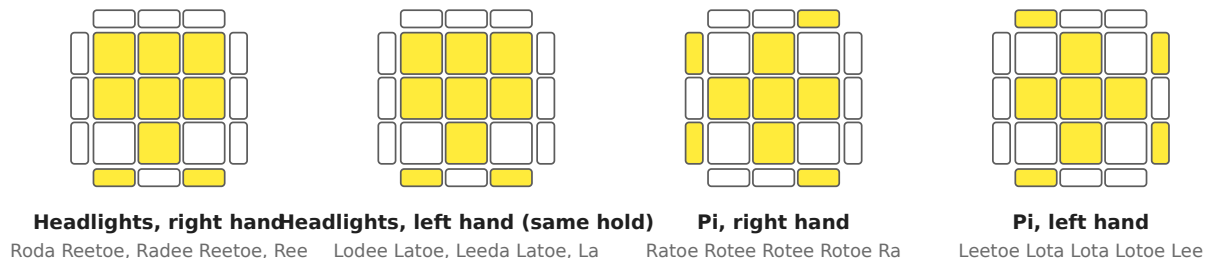


Optimisation 3 — Headlights and Pi

The last two corner cases. Each has a short dedicated algorithm and a longer one made of Sunes you already know, so there is a choice to make.

Headlights and Pi, both hands

Front at the bottom. Filled = yellow sticker; the bars are the side stickers of the top layer. Left-hand cases are the mirror image.



Case	Say	Notes
Headlights	Roda Reetoe, Radee Reetoe, Ree R2 D R' U2 R D' R' U2 R'	The only corner case that touches the bottom face; the grip is the whole difficulty. Start with your right thumb on the bottom face, so Doe is a thumb push rather than a regrip. Say "Roda Reetoe" on its own twenty times until it is comfortable. Hold: the two yellow corners at the back, the yellow pair facing you.
Headlights, left hand	Lodee Latoe, Leeda Latoe, La L2 D' L U2 L' D L U2 L	Start with your left thumb on the bottom face, so Dee is a thumb push. Hold: the same as the right hand; the Headlights case is its own mirror image. The long way is left Sune, Tee, left Anti-Sune.
Headlights, the long way	Sune, Ta, Anti-Sune R U R' U R U2 R' U R U2 R' U' R U' R'	Same hold, fourteen moves, no bottom turn. Use it until the Headlights grip feels natural.
Pi	Ratoe Rotee Rotee Rotoe Ra R U2 R2 U' R2 U' R2 U2 R	Nine moves, nothing but R2 and top turns, with a rhythm that sticks: RA-toe, RO-tee, RO-tee, RO-toe, ra. Start with your right thumb on the front face; every R2 is a wrist flick and the thumb never has to move. Hold: the yellow pair on the left; one yellow each on front and back at the right.
Pi, left hand	Leetoe Lota Lota Lotoe Lee L' U2 L2 U L2 U L2 U2 L'	Left thumb on the front face; every L2 is a wrist flick. Hold: the mirror of the picture. The yellow pair on the right; one yellow each on front and back at the left. The long way is left Sune, Ta, left Sune.
Pi, the long way	Sune, Tee, Sune R U R' U R U2 R' U' R U R' U R U2 R'	Same hold.

Practice: Headlights three times in a row returns a solved cube to solved. Pi needs six, or three with a Toe between each.

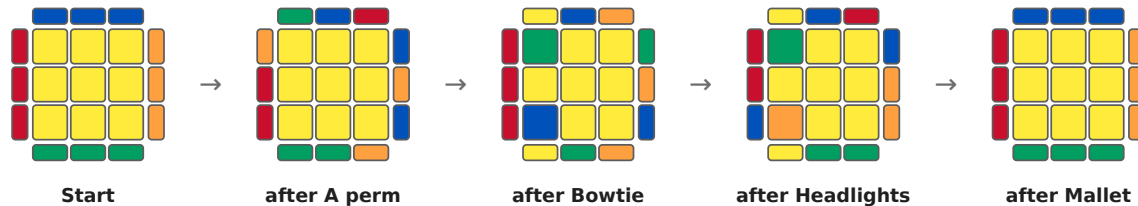
Practice with Headlights and Pi

Same idea: start solved, end solved, with Headlights and Pi inside. Loop 15 is a nice one for Pi, since the two cross words clean up after it.

Loop 14: A perm, Bowtie, Headlights, Mallet. 4 moves, no turns between, lands exactly solved.

Loop 14: A perm, Bowtie, Headlights, Mallet

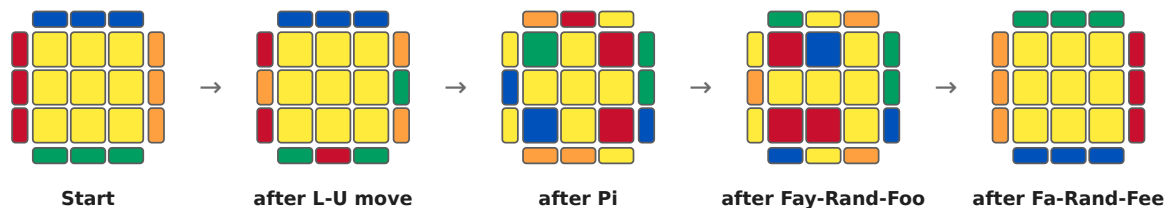
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 15: left U move, Pi, Fay-Rand-Foo, Fa-Rand-Fee. 4 moves, no turns between, then a Toe to line up.

Loop 15: left U move, Pi, Fay-Rand-Foo, Fa-Rand-Fee (then a Toe to line up)

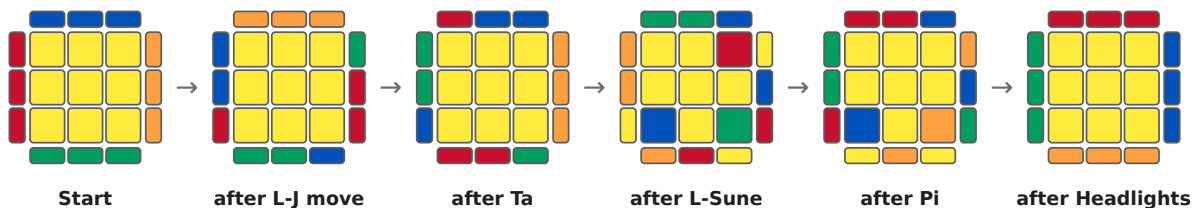
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 16: left J move, Ta, left Sune, Pi, Headlights. 4 moves, one turn between, then a Tee to line up.

Loop 16: left J move, Ta, left Sune, Pi, Headlights (then a Tee to line up)

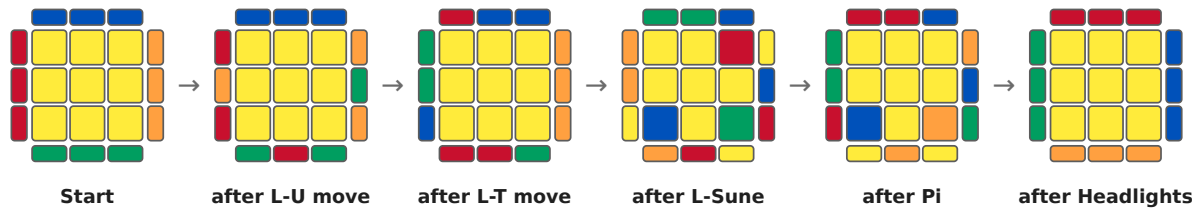
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 17: left U move, left T move, left Sune, Pi, Headlights. 5 moves, no turns between, then a Tee to line up.

Loop 17: left U move, left T move, left Sune, Pi, Headlights (then a Tee to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



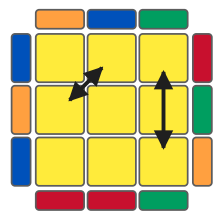
Optimisation 4 — The R move

With the corners sorted, the rest of the optimisations are last-layer permutations you would otherwise solve with two of the moves you already have. In order of how much they save: the R move comes up on one solve in nine, and it uses nothing but right-hand triggers and a bottom turn you met in the A perm.

It swaps two corners next to each other and two edges next to each other, like the J move, but with the edges on the far side.

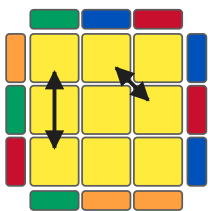
The R move: the two corners under the working hand swap

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right-hand R move

Ratiri Tee, Rata Rada, Reetee Radee, Reeto Ree



Left-hand R move

Litala Ta, Leetee Leedee, Lata Leeda, Lato La

Say	Notes
Ratiri Tee, Rata Rada, Reetee Radee, Reeto Ree R U' R' U' R U R D R' U' R D' R' U2 R'	The middle phrases are a pair: Rata Rada goes down, Reetee Radee brings it back. It opens with Ritari from the A perm and closes with Ratoree from the Sune, vowels swapped. Hold: headlights on the left. Then turn the top until the front-right corner's sticker facing you matches the front centre. That one matching sticker is the tell; the headlights themselves will not match their centre, and that is correct. The swapping corners are under the right hand.

Say	Notes
Litala Ta, Leetee Leedee, Lata Leeda, Lato La $L' U L U L' U' L' D' L U L' D L U^2 L$	Hold: headlights on the right; turn the top until the front-left corner's sticker facing you matches the front centre.

Practice: three R moves in a row return a solved cube to solved. So does R move, Tee, R move, Tee.

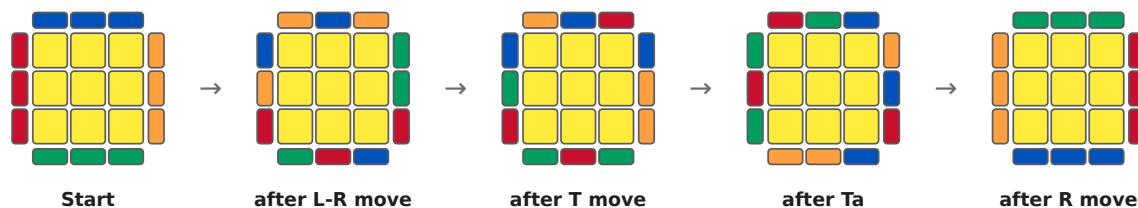
Practice with the R move

Loops that put the R move to work, both hands. Loop 18 is the one to start with: a left R, a T, a turn, a right R.

Loop 18: left R move, T move, Ta, R move. 3 moves, one turn between, then a Toe to line up.

Loop 18: left R move, T move, Ta, R move (then a Toe to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 19: A perm, left A perm, R move, left R move. 4 moves, no turns between, lands exactly solved.

Loop 19: A perm, left A perm, R move, left R move

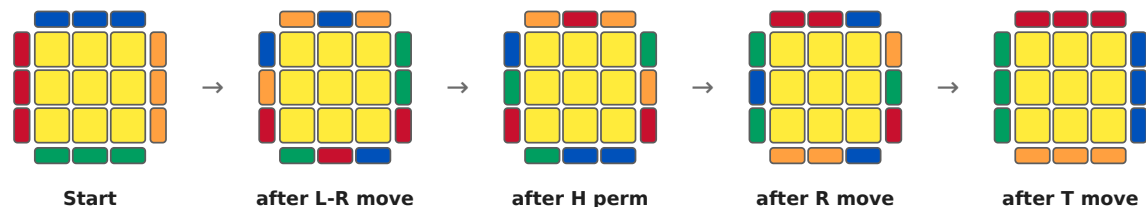
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 20: left R move, H perm, R move, T move. 4 moves, no turns between, then a Tee to line up.

Loop 20: left R move, H perm, R move, T move (then a Tee to line up)

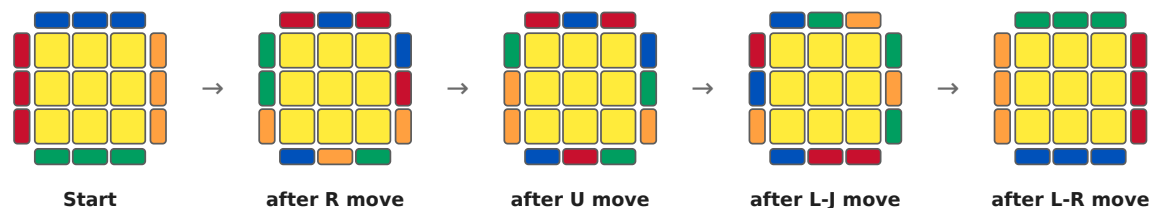
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 21: R move, U move, left J move, left R move. 4 moves, no turns between, then a Tee to line up.

Loop 21: R move, U move, left J move, left R move (then a Tee to line up)

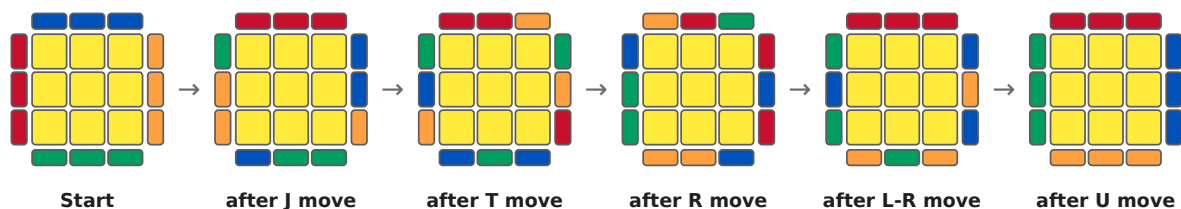
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 22: J move, T move, R move, left R move, U move. 5 moves, no turns between, then a Tee to line up.

Loop 22: J move, T move, R move, left R move, U move (then a Tee to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.

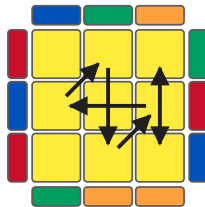


Optimisation 5 — The G moves

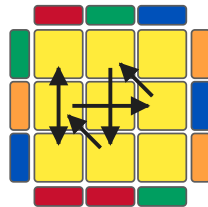
The G cases are the biggest prize left: between them they appear on more than one solve in five. There are four, but with both hands you need only two sentences: a front-block G and a back-block G, each done with whichever hand the picture asks for.

The G moves: headlights away from the working hand

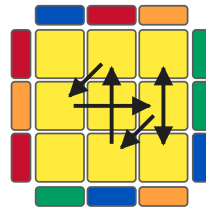
Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



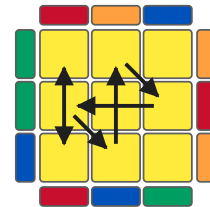
Right G, front block
Ga



Left G, front block
Gc



Right G, back block
Gb



Left G, back block
Gd

Case	Say	Notes
Front block (Ga)	Rota Reeta, Reetee Ratee, Rotee, Da Reeta Radee (R2 U R' U) (R' U' R U') (R2) (U' D) (R' U R) (D') Thumb: start with the right thumb on the front face and never regrip; it rides round with the right layer. Rota flips it to the back, Reeta brings it up, Reetee back to the front, Ra up again, and Rotee leaves it underneath the cube. So Tee Da is one beat of the right hand: index finger pulls the top, thumb pushes the bottom (the Headlights push). Reeta Ra brings the thumb back underneath, and the closing Dee is the same thumb push the other way. Both bottom turns are the thumb.	Ends with a bottom-face bracket: Da opens it, Radee closes it. Hold: headlights on the left. The 2-by-1 block (an edge and a corner that match) is on the front face, under the right hand.
Front block (Gc)	Lotee Latee, Lata Leeta, Lota, Dee Latee Leeda (L2 U' L U') (L U L' U) (L2) (U D') (L U' L') (D) Thumb: the mirror. Start with the left thumb on the front face and never regrip; by Lota it is underneath the cube, so Ta Dee is the left index on top and the left thumb pushing the bottom, and the closing Da is the same thumb push the other way.	Hold: headlights on the right; the block is on the front face, under the left hand.
Back block (Gb)	Reetee Rata, Dee, Rota Reeta, Ratee Ratee, Roda (R' U' R) (U D') (R2 U R' U) (R U' R U') (R2) (D) Thumb: start with the right thumb on the front face and never regrip. Reetee Ra takes it down and back to the front, so for Ta Dee the right hand just holds while the left hand does both: index on top, ring finger reaching under the back for Dee. Through the middle the thumb goes back, up, back, down, and Roda leaves it on top; the closing Da is the right ring finger reaching under from the back.	Shares Rota Reeta with the front block, but the bottom turn comes early (Dee) and Roda closes at the end. Exact inverse of the right front-block G. Hold: headlights on the left. The block is on the right side face, at the back.

Case	Say	Notes
Back block (Gd)	Lata Leetee, Da, Lotee Latee, Leeta Leeta, Lodee (L U L') (U' D) (L2 U' L U') (L' U L' U) (L2) (D') Thumb: the mirror. Left thumb starts on the front face and never regrips; Tee Da is the right hand alone, index on top and ring finger under the back; after Lodee the left thumb is on top and the closing Dee is the left ring finger from under the back.	Exact inverse of the left front-block G. Hold: headlights on the right; the block is on the left side face, at the back.

Practice: a front-block G followed by the back-block G with the same hand returns a solved cube to solved (they are inverses). The same G four times in a row does too. The loops below do the rest.

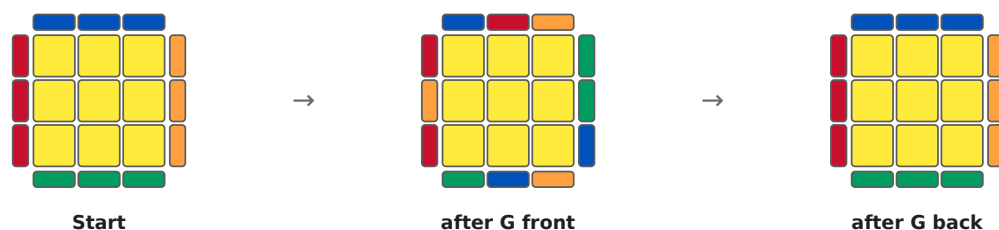
Practice with the G moves

First, the fact that makes the G moves practisable: **the front-block G and the back-block G are exact inverses of each other, hand for hand.** Do the right front-block G and you are looking at the right back-block case; do the back-block G and you are solved again. Loops 23 and 24 are just that. Loops 25 to 28 put one move between a G and its partner, which is where recognition gets exercised; the rest mix the G moves with the lessons.

Loop 23: front-block G, back-block G. 2 moves, no turns between, lands exactly solved.

Loop 23: front-block G, back-block G

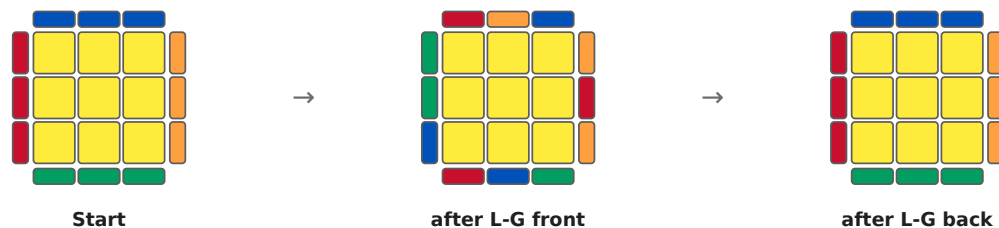
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 24: left front-block G, left back-block G. 2 moves, no turns between, lands exactly solved.

Loop 24: left front-block G, left back-block G

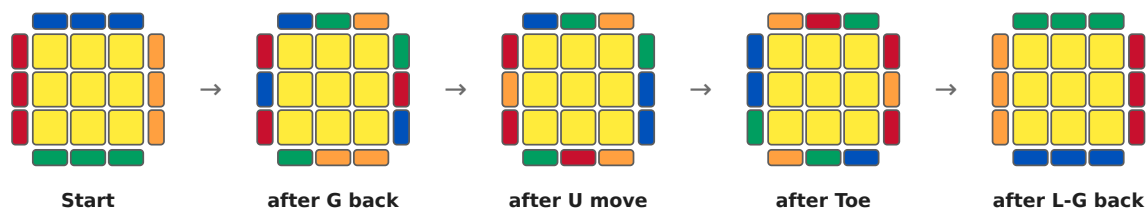
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 25: back-block G, U move, Toe, left back-block G. 3 moves, one turn between, then a Toe to line up.

Loop 25: back-block G, U move, Toe, left back-block G (then a Toe to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 26: left J move, back-block G, Ta, front-block G. 3 moves, one turn between, then a Tee to line up.

Loop 26: left J move, back-block G, Ta, front-block G (then a Tee to line up)

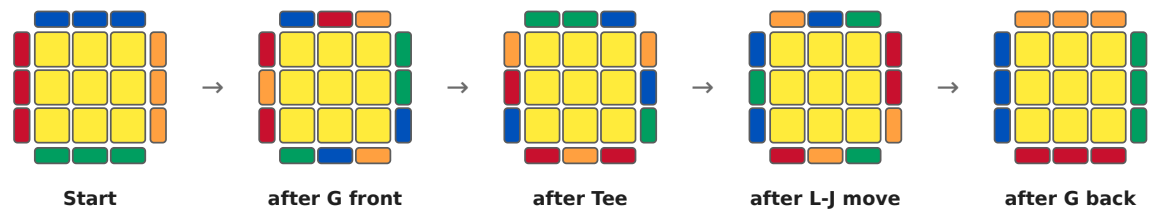
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 27: front-block G, Tee, left J move, back-block G. 3 moves, one turn between, then a Ta to line up.

Loop 27: front-block G, Tee, left J move, back-block G (then a Ta to line up)

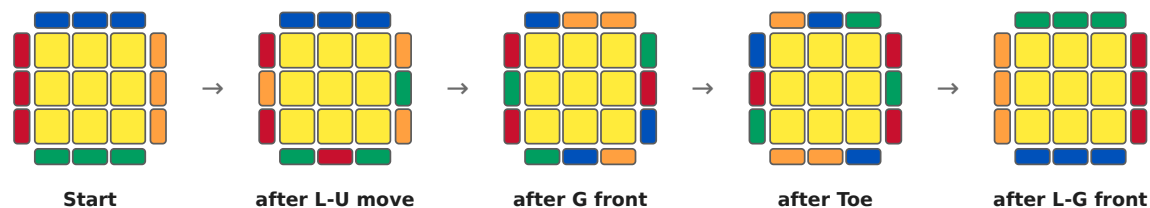
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 28: left U move, front-block G, Toe, left front-block G. 3 moves, one turn between, then a Toe to line up.

Loop 28: left U move, front-block G, Toe, left front-block G (then a Toe to line up)

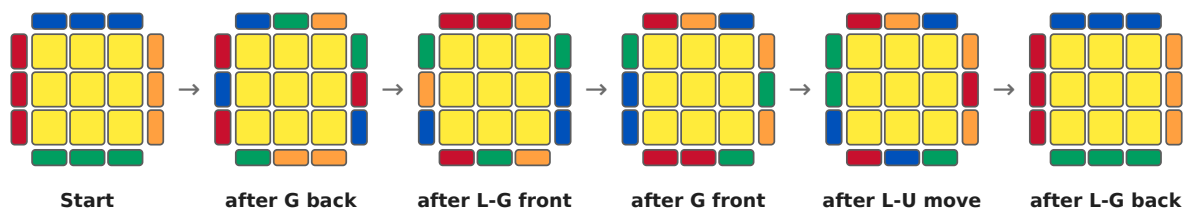
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 29: back-block G, left front-block G, front-block G, left U move, left back-block G. 5 moves, no turns between, lands exactly solved.

Loop 29: back-block G, left front-block G, front-block G, left U move, left back-block G

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 30: A perm, back-block G, left back-block G, front-block G. 4 moves, no turns between, then a Tee to line up.

Loop 30: A perm, back-block G, left back-block G, front-block G (then a Tee to line up)

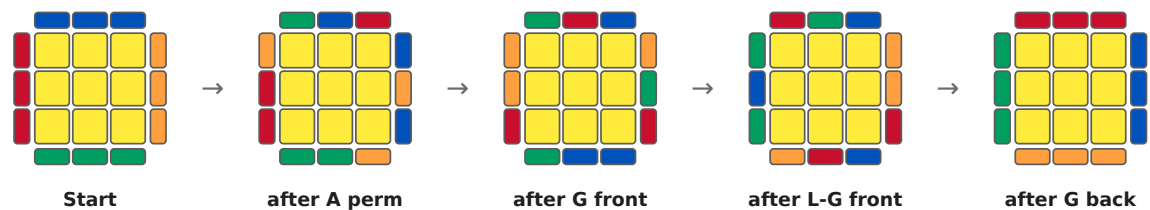
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 31: A perm, front-block G, left front-block G, back-block G. 4 moves, no turns between, then a Tee to line up.

Loop 31: A perm, front-block G, left front-block G, back-block G (then a Tee to line up)

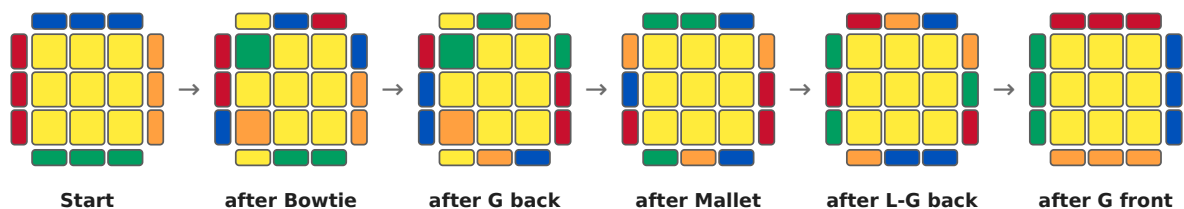
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 32: Bowtie, back-block G, Mallet, left back-block G, front-block G. 5 moves, no turns between, then a Tee to line up.

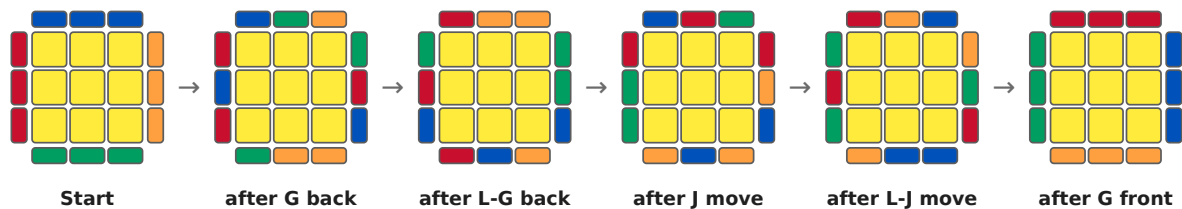
Loop 32: Bowtie, back-block G, Mallet, left back-block G, front-block G (then a Tee to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 33: back-block G, left back-block G, J move, left J move, front-block G. 5 moves, no turns between, then a Tee to line up.

Loop 33: back-block G, left back-block G, J move, left J move, front-block G (then a Tee)
 Front at the bottom. The whole top layer after each move; the cube is never re-gripped.

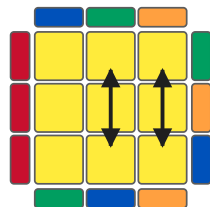


Optimisation 6 — The F move

The F move swaps two corners next to each other and the two edges in front of and behind them. It is the T move with three moves added at the front and three at the back, so it costs almost nothing to learn once the T move is automatic.

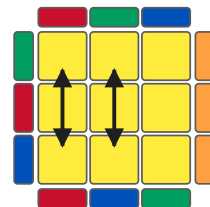
The F move: a T move with a prefix and a suffix

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right-hand F move

Reetee Fee, Rand, Reefa Rotee Ree, Tee Ratari, Tara



Left-hand F move

Lata Fa, Land, Lafee Lota La, Ta Litila, Tee Lee

Say	Notes
Reetee Fee, Rand, Reefa Rotee Ree, Tee Ratari, Tara <code>R' U' F' R U R' U' R' F R2 U' R' U' R U R' U R</code>	The T move in a bracket: Reetee Fee opens, then Rand, Reefa Rotee Ree, Tee Ratari is the T move with its last Fee dropped, and Tara closes. Hold: the solid bar of three on the left, like the J move. The corners that swap are under the right hand; the edges that swap are front and back.
Lata Fa, Land, Lafee Lota La, Ta Litila, Tee Lee <code>L U F L' U' L U L F' L2 U L U L' U' L U' L'</code>	Hold: bar on the right; swapping corners under the left hand.

Practice: the F move is its own inverse. Do it twice and the cube is solved.

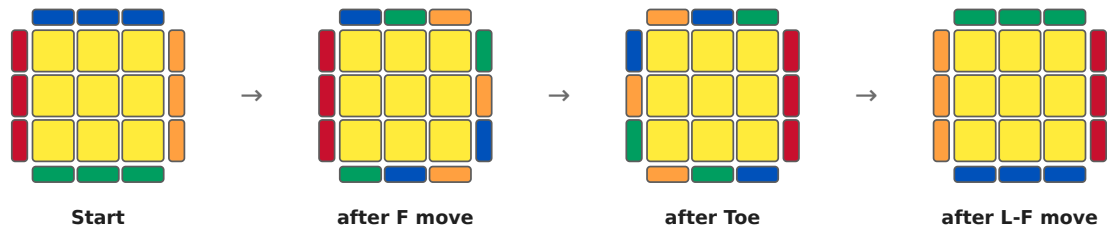
Practice with the F move

The F move is its own inverse, so the simplest loop is F, Toe, left F. The others pair it with the A perm and the J move.

Loop 34: F move, Toe, left F move. 2 moves, one turn between, then a Toe to line up.

Loop 34: F move, Toe, left F move (then a Toe to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 35: A perm, left F move, left A perm, F move. 4 moves, no turns between, lands exactly solved.

Loop 35: A perm, left F move, left A perm, F move

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 36: F move, left F move, left T move, T move. 4 moves, no turns between, lands exactly solved.

Loop 36: F move, left F move, left T move, T move

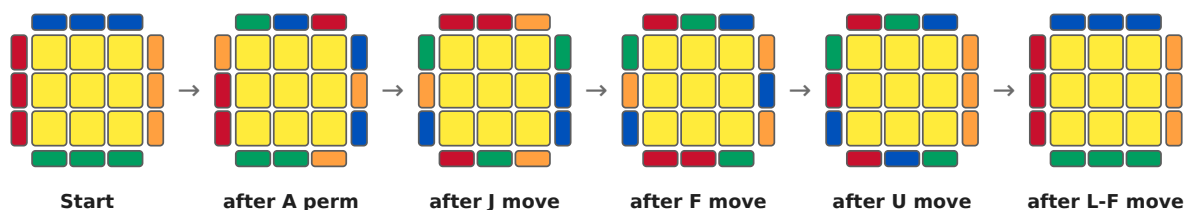
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 37: A perm, J move, F move, U move, left F move. 5 moves, no turns between, lands exactly solved.

Loop 37: A perm, J move, F move, U move, left F move

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.

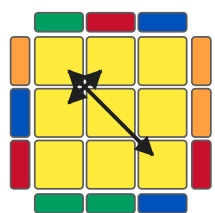


Optimisation 7 — The Y move

The Y move swaps two corners across the diagonal and two edges next to each other. Without it, a diagonal corner swap costs two T moves.

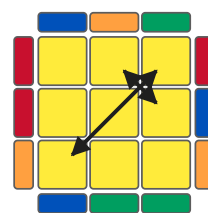
The Y move: diagonal corners swap

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right-hand Y move

Fa, Ratiri, Tee, Ratari, Fee, Rand, Raft



Left-hand Y move

Fee, Litala, Ta, Litila, Fa, Land, Laft

Say	Notes
Fa, Ratiri, Tee, Ratari, Fee, Rand, Reef-Rafi F R U' R' U' R U R' F' R U R' U' R' F R F'	Almost entirely dictionary words: Fa ... Fee wraps Ratiri and Ratari, then Rand and Reef-Rafi finish, which is the mallet without the wide turns. Hold: there are no headlights; the one 2-by-1 block (an edge and a corner that match) is the landmark. Put it at the front-left. The Y move is its own mirror image, so either hand will do once the block is placed.
Fee, Litala, Ta, Litila, Fa, Land, Lafeeleef F' L' U L U L' U' L F L' U' L U L F' L' F	Hold: the block at the front-right.

Practice: the Y move is its own inverse; twice through returns to solved.

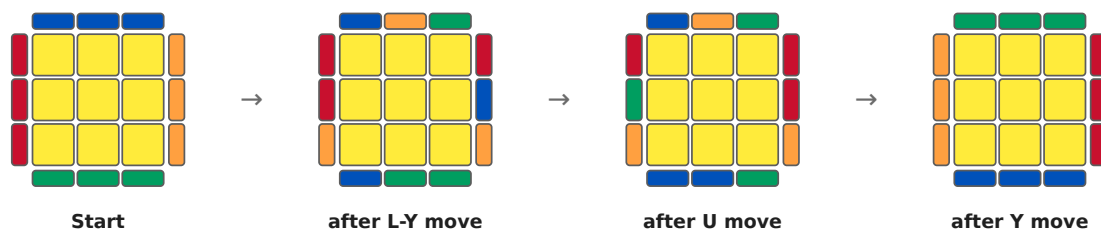
Practice with the Y move

The Y move and the left Y move are the same case held two ways, so a U move between them makes a loop. Loop 41 wraps that in the two cross words.

Loop 38: left Y move, U move, Y move. 3 moves, no turns between, then a Toe to line up.

Loop 38: left Y move, U move, Y move (then a Toe to line up)

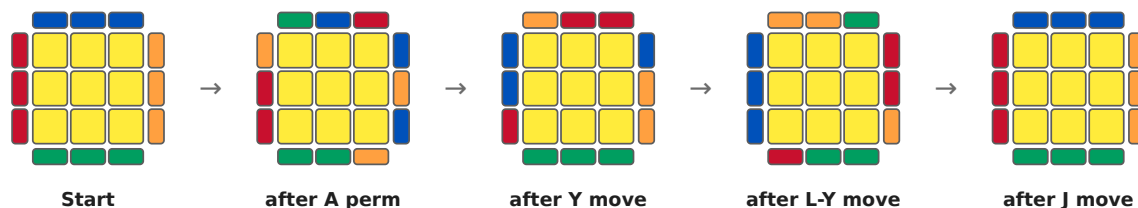
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 39: A perm, Y move, left Y move, J move. 4 moves, no turns between, lands exactly solved.

Loop 39: A perm, Y move, left Y move, J move

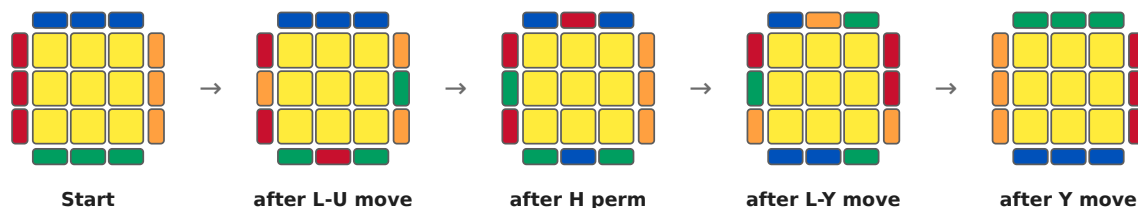
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 40: left U move, H perm, left Y move, Y move. 4 moves, no turns between, then a Toe to line up.

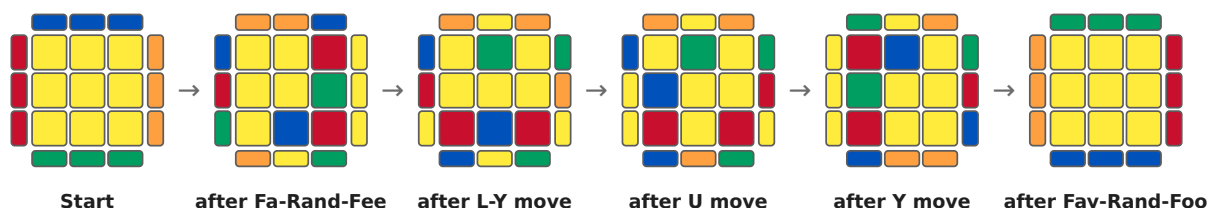
Loop 40: left U move, H perm, left Y move, Y move (then a Toe to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 41: Fa-Rand-Fee, left Y move, U move, Y move, Fay-Rand-Foo. 5 moves, no turns between, then a Toe to line up.

Loop 41: Fa-Rand-Fee, left Y move, U move, Y move, Fay-Rand-Foo (then a Toe to line u
 Front at the bottom. The whole top layer after each move; the cube is never re-gripped.

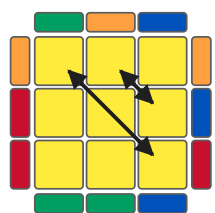


Optimisation 8 — The V move

The V move also swaps two corners across the diagonal, but with the other pair of edges, so it looks like the Y move with a bigger solved block.

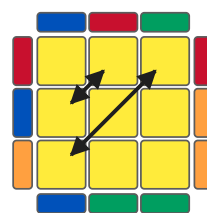
The V move: diagonal corners swap, with a three-piece block

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Right-hand V move

Ree Rend, Foo Tee, Ratoree, Tee, Ratiri, Fay Ra



Left-hand V move

La Lend, Fay Ta, Leetola, Ta, Litala, Foo Lee

Say	Notes
Ree Taratiri, Foo Tee, Ratoree, Tee, Ratiri, Fay Ra <code>R' U R U' R' f' U' R U2 R' U' R U' R' f R</code>	Opens with Ree and Taratiri, then a wide front turn (Foo) takes you into Sune's tail, Ratoree and Ratiri; the closing Fay Ra undoes the wide turn. Everything is a dictionary word except the Foo Tee ... Fay Ra bracket. Hold: the three-piece block (a corner and both edges beside it) at the front-left. Telling V from Y: same hold; a two-piece block is the Y move, a three-piece block is the V move.
La Tilitala, Fay Ta, Leetola, Ta, Litala, Foo Lee <code>L U' L' U L f U L' U2 L U L' U L f' L'</code>	Hold: the three-piece block at the front-right.

Practice: the V move is its own inverse; twice through returns to solved.

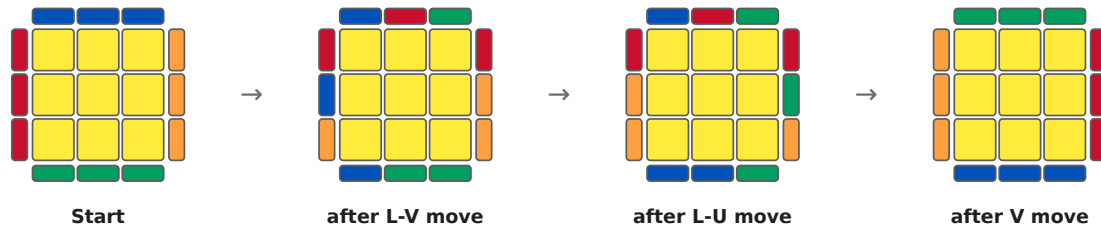
Practice with the V move

The V move loops mirror the Y move loops exactly: swap Y for V and the left U for the right, or the other way round.

Loop 42: left V move, left U move, V move. 3 moves, no turns between, then a Toe to line up.

Loop 42: left V move, left U move, V move (then a Toe to line up)

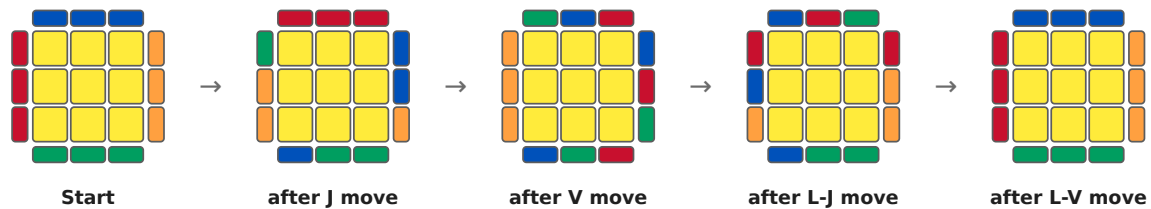
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 43: J move, V move, left J move, left V move. 4 moves, no turns between, lands exactly solved.

Loop 43: J move, V move, left J move, left V move

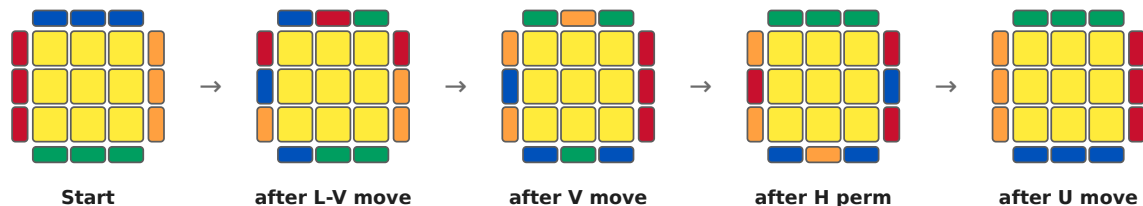
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 44: left V move, V move, H perm, U move. 4 moves, no turns between, then a Toe to line up.

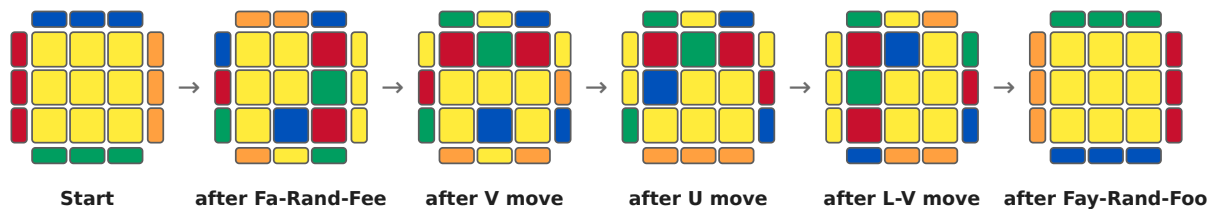
Loop 44: left V move, V move, H perm, U move (then a Toe to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 45: Fa-Rand-Fee, V move, U move, left V move, Fay-Rand-Foo. 5 moves, no turns between, then a Toe to line up.

Loop 45: Fa-Rand-Fee, V move, U move, left V move, Fay-Rand-Foo (then a Toe to line u
 Front at the bottom. The whole top layer after each move; the cube is never re-gripped.

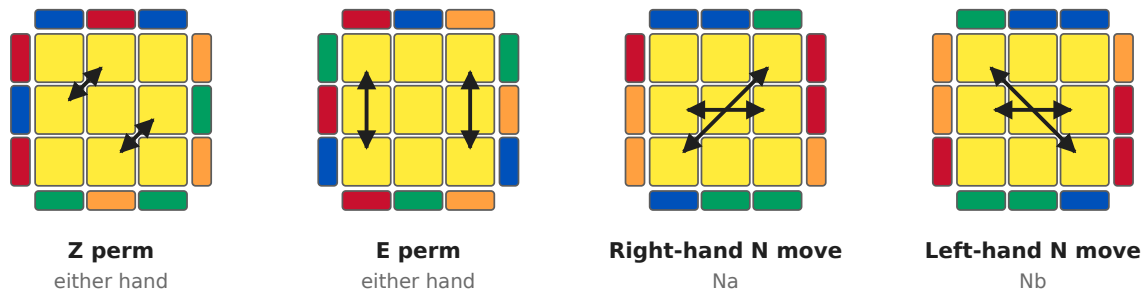


Optimisation 9 — The rare three: Z, E and N

Between them these three turn up on about one solve in twelve, and each already has a two-move answer (Z and E: two of the moves you know; N: a T move and a J move). Learn them last, or not at all.

The rare three: Z, E and N

Front at the bottom. Match the pattern, not the colours; arrows show which pieces trade places. A last top turn lines everything



Case	Say	Notes
Z	Mota Mota, Meetoe Motoe, Meetoe M2 U M2 U M' U2 M2 U2 M' U2	Swaps two pairs of neighbouring edges; the corners are all solved. The H perm's cousin, all middle slice. Hold it any way; it looks the same from every side.

Case	Say	Notes
E	Xee, Ratiri Da, Ratari Dee, Ratari Da, Ratiri Dee, Xa <code>x' R U' R' D R U R' D' R U R' D R U' R' D' x</code>	Swaps both pairs of diagonal corners and leaves the edges alone. The same three-finger phrase four times, alternating Da and Dee. Grip: as the A perm, tilt first (here Xee) with the thumb ending on top.
N	Ratari Ta, Ratari Fee, Rand, Reefa Rotee Ree, Toe, Ratiri <code>R U R' U R U R' F' R U R' U' R' F R2 U' R' U2 R U' R'</code>	The J move with Ratari Ta, Ratari Fee in front of it and Toe, Ratiri behind. Hold: two 2-by-1 blocks on opposite sides, running from back-left to front-right.
N	Litila Tee, Litila Fa, Land, Lafee Lota La, Toe, Litala <code>L' U' L U' L' U' L F L' U' L U L F' L2 U L U2 L' U L</code>	Hold: the blocks run from back-right to front-left.

Practice: all three are their own inverses; twice through returns to solved.

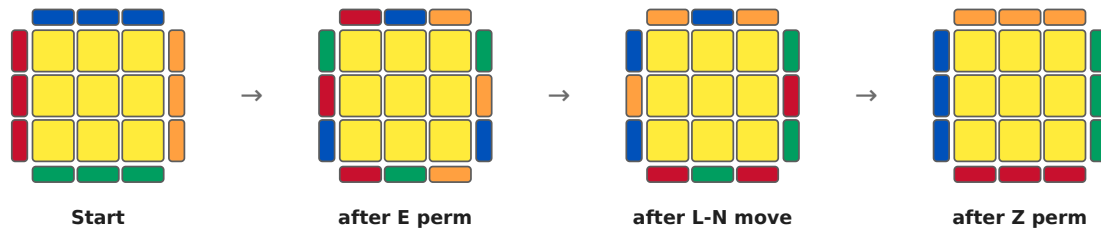
Practice with Z, E and N

The rare three in loops with each other and with the earlier moves. Loop 46 is only three moves and uses the E perm's tilt, the N move and the Z perm's slice in a row.

Loop 46: E perm, left N move, Z perm. 3 moves, no turns between, then a Ta to line up.

Loop 46: E perm, left N move, Z perm (then a Ta to line up)

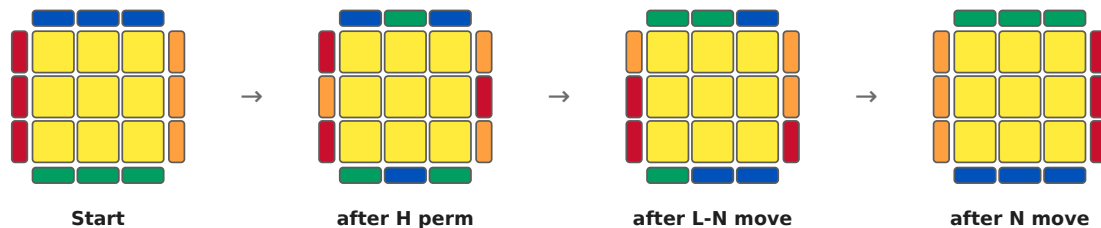
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 47: H perm, left N move, N move. 3 moves, no turns between, then a Toe to line up.

Loop 47: H perm, left N move, N move (then a Toe to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 48: E perm, H perm, N move, Z perm. 4 moves, no turns between, then a Tee to line up.

Loop 48: E perm, H perm, N move, Z perm (then a Tee to line up)

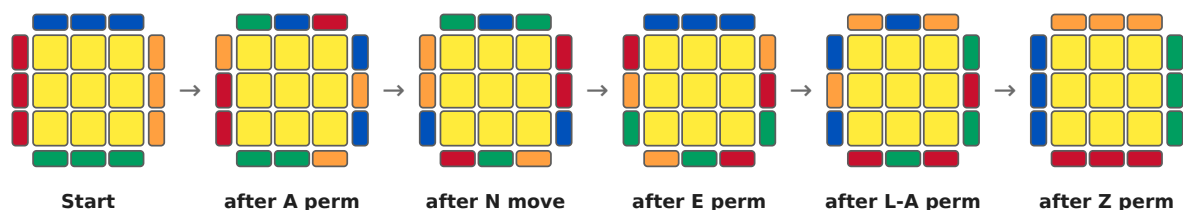
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 49: A perm, N move, E perm, left A perm, Z perm. 5 moves, no turns between, then a Ta to line up.

Loop 49: A perm, N move, E perm, left A perm, Z perm (then a Ta to line up)

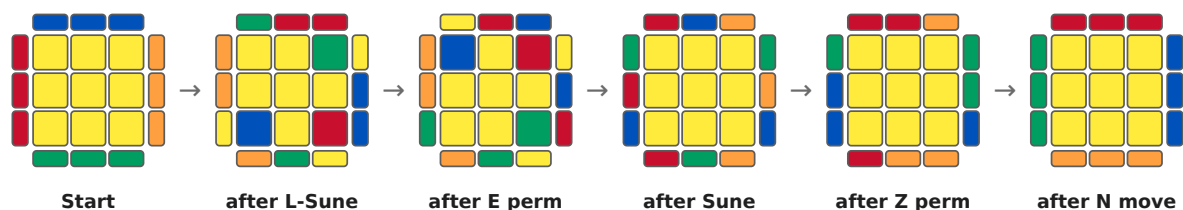
Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Loop 50: left Sune, E perm, Sune, Z perm, N move. 5 moves, no turns between, then a Tee to line up.

Loop 50: left Sune, E perm, Sune, Z perm, N move (then a Tee to line up)

Front at the bottom. The whole top layer after each move; the cube is never re-gripped.



Reference

Everything on one page: the eight lessons, then the optimisations in order. Right hand first, left hand under it.

Lesson	Case	Hand	Say	Moves
2	Cross, line	either	Fa-Rand-Fee	F R U R' U' F'
2	Cross, nine o'clock	either	Fay-Rand-Foo	f R U R' U' f'
2	Cross, dot	either	Fa-Rand-Fee, then Fay-Rand-Foo	F R U R' U' F' f R U R' U' f'
3	Sune	right	Rata reeta, ratoree	R U R' U R U2 R'
3	Sune	left	Leetee latee, leetola	L' U' L U' L' U2 L
4	T move	right	Rand reefing, rotee reetee, rata reefee	R U R' U' R' F R2 U' R' U' R U R' F'
4	T move	left	Land laughing, lota lata, leef	L' U' L U L F' L2 U L U L' U' L F

Lesson	Case	Hand	Say	Moves
5	U move	right	Rota Rand Reetee Ritari	R2 U R U R' U' R' U' R' U R'
5	U move	left	Lotee Land Lata Latila	L2 U' L' U' L U L U L U' L
6	H perm	either	Mo' tomato, mo' tamo	M2 U M2 U2 M2 U M2
7	A perm	right	Xa, Ritari Doe, Ratiri Doe, Roe	x R' U R' D2 R U' R' D2 R2
7	A perm	left	Xa, Latila Doe, Litala Doe, Loe	x L U' L D2 L' U L D2 L2
8	J move	right	Rata reefee, Rand, reefa rotee ree	R U R' F' R U R' U' R' F R2 U' R'
8	J move	left	Leetee lafa, Land, lafee lota la	L' U' L F L' U' L U L F' L2 U L
Opt 1	Mallet	right	Rayta Reetee, Roofa Rafee	r U R' U' r' F R F'
Opt 1	Mallet	left	Lootee Lata, Layfee Leefa	l' U' L U l F' L' F
Opt 1	Bowtie	right	Farifiray, Taratiroo	F R' F' r U R U' r'
Opt 1	Bowtie	left	Filafaloo, Tilitalay	F' L F l' U' L' U l
Opt 2	Anti-Sune	right	Ratoree Tee, Ratiri	R U2 R' U' R U' R'
Opt 2	Anti-Sune	left	Leetola Ta, Litala	L' U2 L U L' U L
Opt 2	H (corners)	right	Ratoree Tee, Rand, Ratiri	R U2 R' U' R U R' U' R U' R'
Opt 2	H (corners)	left	Leetola Ta, Land, Litala	L' U2 L U L' U' L U L' U L
Opt 3	Headlights	right	Roda Reetoe, Radee Reetoe, Ree	R2 D R' U2 R D' R' U2 R'
Opt 3	Headlights	left	Lodee Latoe, Leeda Latoe, La	L2 D' L U2 L' D L U2 L
Opt 3	Pi	right	Ratoe Rotee Rotee Rotoe Ra	R U2 R2 U' R2 U' R2 U2 R

Lesson	Case	Hand	Say	Moves
Opt 3	Pi	left	Leetoe Lota Lota Lotoe Lee	L' U2 L2 U L2 U L2 U2 L'
Opt 4	R move	right	Ratiri Tee, Rata Rada, Reetee Radee, Reeto Ree	R U' R' U' R U R D R' U' R D' R' U2 R'
Opt 4	R move	left	Litala Ta, Leetee Leedee, Lata Leeda, Lato La	L' U L U L' U' L' D' L U L' D L U2 L
Opt 5	G, front block	right	Rota Reeta, Reetee Ratee, Rotee, Da Reeta Radee	R2 U R' U R' U' R U' R2 U' D R' U R D'
Opt 5	G, front block	left	Lotee Latee, Lata Leeta, Lota, Dee Latee Leeda	L2 U' L U' L U L' U L2 U D' L U' L' D
Opt 5	G, back block	right	Reetee Rata, Dee, Rota Reeta, Ratee Ratee, Roda	R' U' R U D' R2 U R' U R U' R U' R2 D
Opt 5	G, back block	left	Lata Leetee, Da, Lotee Latee, Leeta Leeta, Lodee	L U L' U' D L2 U' L U' L' U L' U L2 D'
Opt 6	F move	right	Reetee Fee, Rand, Reefa Rotee Ree, Tee Ratari, Tara	R' U' F' R U R' U' R' F R2 U' R' U' R U R' U R
Opt 6	F move	left	Lata Fa, Land, Lafee Lota La, Ta Litila, Tee Lee	L U F L' U' L U L F' L2 U L U L' U' L U' L'
Opt 7	Y move	right	Fa, Ratiri, Tee, Ratari, Fee, Rand, Reef-Rafi	F R U' R' U' R U R' F' R U R' U' R' F R F'
Opt 7	Y move	left	Fee, Litala, Ta, Litila, Fa, Land, Lafeeleef	F' L' U L U L' U' L F L' U' L U L F' L' F
Opt 8	V move	right	Ree Taratiri, Foo Tee, Ratoree, Tee, Ratiri, Fay Ra	R' U R U' R' f U' R U2 R' U' R U' R' f R

Lesson	Case	Hand	Say	Moves
Opt 8	V move	left	La Tilitala, Fay Ta, Leetola, Ta, Litala, Foo Lee	L U' L' U L f U L' U2 L U L' U L f' L'
Opt 9	Z perm	either	Mota Mota, Meetoe Motoe, Meetoe	M2 U M2 U M' U2 M2 U2 M' U2
Opt 9	E perm	either	Xee, Ratiri Da, Ratari Dee, Ratari Da, Ratiri Dee, Xa	x' R U' R' D R U R' D' R U R' D R U' R' D' x
Opt 9	N move	right	Ratari Ta, Ratari Fee, Rand, Reefa Rotee Ree, Toe, Ratiri	R U R' U R U R' F' R U R' U' R' F R2 U' R' U2 R U' R'
Opt 9	N move	left	Litila Tee, Litila Fa, Land, Lafee Lota La, Toe, Litala	L' U' L U' L' U' L F L' U' L U L F' L2 U L U2 L' U L

The hand rule, in one line: the pieces that move are under the hand that does the work. The working hand pulls its side edge to the front for the U move; swapping corners under it for the J; cycling corners under it for the A. The T move and the H perm are their own mirror images, so either hand will do.

Mirroring, if you ever need a left-hand version of something new: swap R and L, and swap the a and ee vowels. Ra becomes Lee, Ree becomes La, Ta becomes Tee, Fa becomes Fee; Toe, Roe-to-Loe and Moe keep their vowel.