Chris Hardwick's Rubik's Cube Page

This page is for people who are interested in the Rubik's Cube, and other Rubik's puzzles. I've been interested in the Cube and other puzzles since June of 1998 and I still love doing them. I enjoy speed solving for all my puzzles, especially the Rubik's Cube. If you enjoy the cube or other Rubik-like puzzles then I invite you to browse my site. I hope you enjoy it.

Me after successfully completing the 6x6 while blindfolded at the 2007 Rubik's Cube World Championships in Budapest, Hungary.

Rubik's Cube World Competition 2003
25th Anniversary of the cube
Read about the 2003 Rubik's Games World Championships

United States Rubik's Cube Championships 2004
Read about the 2004 United States Rubik's Games Championships

November 2005: Cubing with Dan Knights
Read about it

My officially recognized world records in Speedcubing
You can see all my competition results at WCA sanctioned tournaments.

See the speedcubing.com main site

Videos:

NEW! [Sport stacking video](#) Me performing the cycle in 10.23 seconds.

[3x3x3 solved blindfolded in 18.50 seconds](#) I took approximately 1 hour and 54 minutes to memorize the cube and plan through my entire solution. I was then able to solve it in 18.50 seconds while blindfolded. I did not do any moves on the cube during the planning phase.

[One-handed 3x3x3 solve](#) Click here to see my 44.98s one handed 3x3x3 solve from the 2003 World Championships
Many thanks to Keith Sauer for the video

[Speed Solving Video (One Handed)](#): watch me solve a rubik's cube in 29.09 seconds using only one hand (.wmv)

[Speed Solving Video](#): watch me solve a rubik's cube in 17.88 seconds. (.mpeg video)
For people who use the Fridrich speed solve method here are the situations I ran into during the video. I timed each part and here is what I came up with
First two layers: solved in 13.48 seconds
Last Layer: solved in 4.40 seconds
Orientation Case: Do **R B L' B L B2 R'** on a solved cube to see
Permuation Case: Do **R2 U F B' R2 F' B U R2** on a solved cube to see
To see the third layer exactly as I saw it do **L2 U B F' L2 F B' U L2 R B L' B L B2 R'** on a solved cube

Sport stacking:
Sport stacking is another dexterity thing that I've gotten into that is a lot of fun. Basically you stack specially designed cups into pyramids through a specific sequence, and then unstack them. Sound easy? Give it a shot, it's harder to get fast than you'd think! To get an idea of what sport stacking is, check out Emily Fox's world record video on [superhandz.com](#). I've been sport stacking since 2003, and below are my records for the 3-6-3 stack and the cycle (the same sequence that Emily does in her video).

My records

3-6-3 :	3.61 seconds
Cycle :	9.47 seconds
Cycle (average of 10 trials) :	11.04 seconds

- See my [personal records page](#) for the times in my average and also my cube records.
- Official sport stacking site : [www.speedstacks.com](#)

Click on the colored nodules below to navigate my site.

More

[Speed Solving Video](#) A video of me solving the rubik's cube in 17.88 seconds, with music!

[Speed memorization](#) How to memorize various sized Rubik's cubes quickly for use in blindfolded cubing.

[My competition tutorial](#) If you have never been to a competition, and would like to know what to do when, etc.. then this is the tutorial for you.

[ZB method](#)Information and algorithms for learning the ZB method.

[Fridrich two look last layer 3x3x3 solution](#) 2 look 3rd layer algs I used to average sub-18. Includes finger trick notation. PLL page to be updated soon.

[One-handed speedsolving](#) Tips page for one-handed speedsolving written jointly by Michael Atkinson and myself

[Solution page to my extended cross F2L method](#) Description of my new approach to the first two layers. Includes interactive cubes with samples and tips.

[Beginner/Intermediate solution to the Rubik's Revenge](#) Tired of seeing your 4x4x4 scrambled? Well click here to **Solve It!**

[Advanced solution to the Rubik's Revenge](#) Learn how to really speed solve on the Revenge and got some very fast times.

[Number of possible combinations to the n x n x n cube](#) An explicit formula for the number of combinations to the n x n x n cube.

[How to convert algorithms in your head](#) Tutorials on how to reflect/invert and reflect/etc. algorithms in your head without writing anything down.

[Watch me SOLVE a 20x20x20 cube](#) See some screen captures from when I solved a 20x20x20 cube

[All about BIG Cubes](#) Learn all about BIG cubes (6x6x6 and larger) Basic info, where to play with a BIG cube and best of all ***still in the works*** how to solve a BIG cube of absolutely **any** size!

[Unofficial World Records Page](#) Compare your fastest time with people all of the world for any rubik puzzle!

[Play with the Cube](#)

[Speed Solving Rubik's Cube](#) Yahoo! Group all about speed solving. Trade tips and hints with others or learn how.

[How to get faster](#) So you're stuck at that 30-60 second barrier, well here's some info on how to get faster.

[Links](#)

[Various methods of solving the cube](#)

NEW! [Developing speedcubing methods](#) These methods have all been published around 2003 and represent the lastest developments in speedcubing. Most of them are still being learned by speedcubers and are still undergoing changes or developing variations.

[Online cube applets](#)

See [my fastest cube times](#)

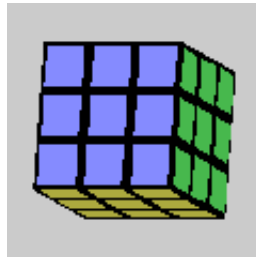[Cube High](#) Read about an interesting experience I had while cubing

[NCSSM Rubik's Cube competition](#) The results from a speed solving competition I held at my school (May 2001).

More to Come

Play with the Cube

Want to try out your cubing skills? Click in the window below to play with the cube.

S - Scrambles the cube
R - Restores the cube

Set a new record? Then [Post it on the Unofficial World Records Page](#)

Go back to the [top](#)

All newly posted records will be highlighted

Links to other cube sites

Favorite Links

- [Macky's cube page](#) Macky is one of the best in the world for speedsolving and blindfolded solving. This page is a great resource if you're looking to learn more about the cube.

- [Dan's Cube Station](#) Dan hosts the Saturday contest (fewest moves competition) as well as a detailed look at the 2 look last layer, worth a look

- [Lars Vandenbergh's CubeZone](#) Lots of information about advanced speedcubing methods. Lars is also the current European 3x3 champion and square-1 world champion.

- [Jess Bonde's Cube Page](#) Cool graphics and some funny cube pictures. Also a very nice timer for taking your averages. Worth a look.

- [Dan Knights - Rubik's Cube](#) The webpage of the former 2003 3x3x3 World Champion. His page has a lot of information for anyone who wants to learn about the cube, and speed solving as well

- [Speed Solving Rubik's Cube](#) Yahoo! Group about the cube. Meet some great people, talk about the cube, all kinds of stuff.

Speedsolve methods

- [Jessica Fridrich's site](#) A great site for anyone looking at setting their own record times

- [Lars Petrus' Cube Page](#) A speed solve solution that breaks from the usual layer-by-layer method. Definately worth a look.

Cube Resources

- [Jaap's Puzzle Page](#) A huge collection of information on <u>many</u> Rubik's puzzles with solutions to almost all of them. A great site for puzzle fans

- [Matt Monroe's Rubik's Cube Links](#) Links to other cube pages including solutions to various rubik puzzles

- [Georges Helm's Rubik's Cube Page](#) This page has an excellent links resource (HUGE) and tons of rubik's cube info

- [Domain of the Cube](#) All kinds of cube-related information

- [Denny's Puzzle Pages](#) ***LINK UPDATED*** An extensive puzzle museum with info on many Rubik-like puzzles. Also solutions to the 2x2x2, 3x3x3, and 4x4x4 cubes

Other cool cube sites

- [Gliding Cube](#) A very nice cube program, supports any cuboid up to 10x10x10 cube. It also allows you some very cool move capabilities which creates a very different type of puzzle! Worth a try!

- [Blake O'Hare's Puzzles Site (and other puzzles)](#) **(LINK UPDATED 10-15-03)** An extensive Rubik

site including <u>several</u> solutions to various Rubik puzzles

- [Rubik's Cube Art](#) A very cool page with some awesome looking art made entirely out of rubik's cubes. A must see for any cube freak

- [Cube Explorer and Cube Optimizer](#) This is an awesome program for finding the shortest way to solve the cube from any position. I scrambled my cube over 250 moves and this program solved it in 19 moves! It also runs extremely fast so you don't have to wait to see the move. I really recommend downloading this program.

- [Rubix Repair](#) This is a cool applet that solves your cube for you and shows you how to do it

- [Marie's Rubik's Cube](#) See what the inside of your cube looks like without taking it apart

- [Meffert's Puzzles](#) A great site for anyone who likes puzzles. Meffert's also lets you order puzzles online

- [Rubik Online](#) The Official Rubik Page created by Erno Rubik. Lots of online Java puzzles and an online cube.

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Solutions to the Rubik's Cube 3x3x3

Here are some various methods for solving the Rubik's Cube.

<u>For Beginners</u>

- [Joël van Noort's solution](#) This method is what we math people like to call a commutater based method. Even if you don't know anything about commutaters, all you need to know is that this method is the easiest type of method to learn if you have never tried to solve a cube before. This method will be a bit slower in practice than Jasmine's beginner method (below), but will be, in my opinion, easier to learn. His method for the last layer uses one simple process that is easy to learn (commutaters), rather than a number of different move sequences that you will be required to memorize. If you are interested in speedcubing I highly recommend starting off with Jasmine Lee's method, and later moving on to either [Fridrich](#) or [Petrus](#) (both are extremely fast speedcubing methods). If you just want to know how to solve the cube, and are not too fond of memorizing move sequences, then I highly recommend learning Joël's method.

- [Jasmine Lee's solution](#) Excellent solution page with diagrams for each step. If you are intersted in learning a simple beginner's solution that solves the cube quickly, and is expandable to a complete speedcubing solution, then I highly recommend this site. This solution is an excellent start if you know you will later want to be able to solve the cube in under a minute or faster on a consistent basis. As a follow-up to this method I highly recommend either [Fridrich](#) or [Petrus](#) (both are extremely fast speedcubing methods).

- [How to Solve the Rubik's Cube 2.3](#) A great site, the one I used to first learn how to solve the cube. I would recommend learning both methods, it helps you learn how to understand the cube better.

- [Blake O'Hare's simple solution](#) This method tackles the cube in layers with minimal moves for memorization. With dedication this method can be memorized in a day, but a few days would be realistic for most.

For intermediate/advanced cubists

These two methods assume that you solve the first two layers first. Both of these will decrease your times for the third layer.

- [Dan Knights Intermediate speed solve method](#) Great for decreasing your third layer times, but won't make your head explode to learn it.

- [Dan Knights Advanced speed solve method](#) A faster and more in depth third layer solution

For Experts

- [Jessica Fridrich's Page](#) Jessica can solve the cube in 17 seconds, and many of the fastest cubists in the world use her method. Using this method I can solve the cube in 16.75 seconds on average. This is also the method I used in my [speed cubing video](#)

- [www.speedcubing.com](#) See Ron van Bruchem's extensive lists of algorithms for all steps of the Fridrich method.

- [Lars Petrus' Solution](#) Unconventional speed solve method, does not use a layer by layer approach yet is still very fast.

Current developing methods

The links below are to methods that are currently or have recently been developed in the speedcubing community. These represent the latest developments in strategy since 2003. Worth a look if you are interested in the developments of speedcubing techniques.

- [Gilles Roux's method](#) This method is a recent development that is proven to be very fast. Gilles averages 15.08 seconds using this method. The strategy is to build a 3x2x1 block on one side of the cube, as well as on the opposite side. This leaves only the top and middle layer unsolved. You then solve the orientation and position of the corners, and finally you solve the last 6 edges and the centers. There are a number of people learning this method, and it has already been proven to be very, very fast.

- [Ryan Heise's method](#) This is a variation on the [Lars Petrus speedsolving approach](#). In this method you start by solving the first two layers minus one corner edge pair. Then you solve the middle layer edge, a 3x2x1 block in the last layer and its opposite edge. You finish off with the last three corners. The first step allows for a surprising amount of freedom during the solve, allowing many opportunities for efficient speedsolves. The third step is explained in terms of commutators and conjugates, rather than requiring the memorization of many different sequences. These types of sequences are already proven to be efficient and more importantly fast during speedsolving. [Andy Camann](#) is currently studying a

variation on this method if you have any questions relating to this style of solving.

- [Duncan Dicks' L2L(1-4) methods](#) This method is an extension and variation on the keyhole method. There are 4 substeps to be learned, each can be learned individually without knowledge of the others and provide a fast method, or all of them can be learned for the most advanced version of the method. The goal is to learn the 4th substep, but knowledge of all the substeps would allow for the choice of the best startegy based on the given scramble. The strategy changes for each substep, but the overall strategy is to break up the F2L solve into various steps making sure to always perform useful affects on the last layer at each F2L step. This makes the F2L solve longer than a Fridrich style solve, but it drastically shortens the LL solve by building it and the F2L at the same time. The average number of moves for the L2L4 strategy is 53-55, which is about the same as Fridrich. 53 algorithms are required for the most advanced L2L4 version. This method also includes useful variations for the ZB method (see below).

- [Zborowski-Bruchem (ZB) method](#) This is the method I am learning and works to affect the last layer while finishing the F2L. In this method you solve the cross and 3 corner/edge pairs. While solving the last corner edge pair you also orient the edges of the last layer. The final step solves the rest, or orients corners and permutes all pieces in one algoritm. This method averages less than 50 moves in speedsolving, however the minimum number of algs required for the whole method is 158 (306 with reflections and inverses) for the F2L step and 270 (493 with reflections and inverses) for a total of 428 (799 with reflections and inverses). This may seem staggering, but a few people have already started learning it. [Ron van Bruchem](#), [Zbigniew Zborowski](#), [Lars Vandenbergh](#), [Dan Harris](#), and [myself](#) are all learning this method if you have any questions about it.
- [Vandenbergh-Harris method](#) This method is a variation on ZB, and is a useful stepping stone for learning the whole method. In this method you solve the F2L minus one corner/edge pair. You then pair up and insert the final pair such that the last layer edges are oriented correctly. You finish with a COLL alg (orient and solve corners of last layer while preserving edge orientation) and an edge permutation. The advantages of this method are that it starts getting you used to ZBF2L (ZB first two layers) techniques and for the last layer you have a 1/12 chance of skipping the edge permutation after COLL.
- [Vandenbergh-Harris variation 1](#) In this variation you learn the first two layers approach of ZB (ZBF2L) instead of first pairing up the corner edge pair and then inserting it such as to correctly orient the last layer edges. I currently average 22-23 seconds with this method, and have averaged sub-20 with it a few times. The disadvantage of this method is that you have to learn 158 algorithms (306 counting reflections), however the advantage is that it is a significant step towards learning the entire ZB method. [Lars Vandenbergh](#) and [Zbigniew Zborowski](#) also have extensive pages on the ZBF2L.
- [Vandenbergh-Harris variation 2](#) In this variation you continue to pair up and insert the final corner edge pair such that all last layer edges are oriented correctly, however instead of using COLL/PLL to finish, you use the ZB last layer technique. [Dan Harris](#) is currently learning this method as a means to learn ZB. The disadvantages to this method are that you have to learn 270 (493 with reflections) algorithms, but the major advantage is that this method requires learning a huge chunk of the ZB method algorithms. Learning this variation is a significant step towards learning all of ZB. In addition to Dan's site you can also view my site on the [ZBLL algs](#).

Speed Cubing Vidoes :

[Dan Knights' video](#) Solved in 18 seconds
[Ron van Bruchem's video](#) Solved in 16.48 seconds

[Ton Dennenbroek's video](#) Solved in 38 seconds
[Chris Brown's video](#) Solved in 1 minute 48.1 seconds, [smaller version](#) of this video
[Chris Hardwick's video](#) Solved in 17.88 seconds
[Suehiro Kondo's video](#) Solved in 22.38 seconds

Cube solving programs

- [Cube Explorer and Cube Optimizer](#) This program will help you find the shortest possible algorithm for any effect on the cube, including solving. This program can routinely solve your cube in under 20 moves. *Note* you have to download and install this program.
- [Rubix Repair](#) This online cube solver allows you to enter the colors on your cube and see a 3D representation so you can double check. This program solve the cube in 100 moves or less depending on how you set it.
- [Dan Knights' Java Applet](#) This solve your cube in 50-60 if you choose the short solution or around 70-80 for the long solution. It also shows you the moves being done, and does them one at a time so you can follow along at any pace.

Other useful/interesting programs

- [Gliding Cube](#) This applet is very smooth and has excellent graphics. Supports any cuboid up to 10x10x10. It also adds some VERY interesting move capabilities. A very cool new puzzle can be formed! Give it a try!
- [Ron's Cube Solver](#) Version 0.93 of Ron's applet. This applet helps you to find the shortest algorithm (up to 20 moves) for an effect on the cube. Longer algorithms may take a while. You can also ignore parts of the cube to specialize the moves you want to find. New feature lets you play with the cube, includes 3D graphics
- [Ron's Online Timer](#) Very useful. Counts down examination time before you start and times you as you go. You can also vary the examination time beforehand from 1 sec to 15 seconds. Simply hit spacebar to start and stop. If you speed cube then this timer is very helpful.

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Some Java Cubes on the net

- [Dan Knights' Java Applet](#) created by [Dan Knights](#) : Play with a scrambled cube, enter you own type of cube with any color combination to play with. Enter your own cube to play with or have solved for you, or to be shown how to solve. A very nice applet, definately worth a visit!
- [oinkleburger.com's applet](#) : Java Applet for all cube sizes, also higher order cubes (6x6x6 and larger)
- [Rubik's Online - Online Cube](#): Java Cube applet from the Official Rubik's site.
- [Rubik's Cube Java Applet](#) created by [Michael Schubart](#): Really nice 3x3x3 cube applet. It's easy to use and has a hall of fame if you can solve it.
- [Virtual Reality Magic Cube](#) created by [Michael Chang](#): Very nice graphics. Has 2x2x2, 3x3x3, 4x4x4, 5x5x5, and 6x6x6!
- [Enchanted Mind - Creative Java Puzzles](#) created by [J. L. Read](#): Lots of challenging puzzles including

the Rubik's Cube
- [Virtual Cube](#) created by [Song Li](#): 3x3x3 Rubik's Cube applet.
- [kibuR's Clock](#) created by [Raymond Penners](#): While not exactly a cube Rubik's Clock is still cool

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Last Updated: 5/12/2006

Website created by [Chris Hardwick](#). If you have any questions, move suggestions for different cubes, record times that you'd like to share, suggestions, criticisms, questions about where to get Rubik's and other puzzle products, or any other thing you'd like to address then [e-mail me](#). I'll be glad to answer any questions that you might have.