Solving the Rubik's Cube

New Mexico
Supercomputing Challenge
Final Report
March 29 2015

Team Number 10
Aspen Elementary School

Team Members:

Andy Corliss

Max Corliss

Phillip Ionkov

Ming Lo

Teacher(s):

Suzy Koehn

Project Mentor(s):

Latchesar Ionkov

Li-ta Lo

Executive Summary

Our objective was to create a 3D Rubik's Cube simulation in NetLogo that can scramble and solve itself autonomously or manually by a human. We have managed to create a Rubik's Cube that can scramble itself and can be solved manually. We thought the project was interesting because it was about Rubik's Cubes which are very fun puzzles and would be nice for other people to solve them.

Statement of Problem

A Rubik's Cube is a three dimensional shape that has sides that are turnable and can be scrambled so that you will be able to solve it. If you made a single turn every second on a 3x3x3 Cube it would take 14 trillion years to go through all the combinations [1]. There are approximately 43 quintillion combinations. The most expensive Rubik's Cube was the Masterpiece cube which is valued at approximately 1.5 million U.S. dollars. You can solve the 3x3x3 Rubik's Cube in at most 20 moves from any position. The people who proved that are Tomas Rokicki, Herbert Kociemba, Morley Davidson, and John Dethridge. The world record for the 3x3x3 is 5.55 seconds. There are many methods for solving the 3x3x3. There are a lot of Rubik's Cube competitions where people try to set new records for solving the fastest. Computers can solve it by finding the colors and seeing where they have to go to make the Rubik's Cube solved. The reason people think that the Rubik's Cube is hard to solve is because sometimes they don't know what to move to not destroy the work they have already done.

We wanted to make a program on NetLogo 3-D that generated a 3x3x3 Rubik's Cube that could be scrambled manually and autonomously, and solved manually and autonomously. We managed to accomplish 4 of these tasks. We made the program able to generate the Cube, scramble itself manually and autonomously, and able to be solved manually.

Description of Method

NetLogo 3-D is the programming language that we used. It allows users to create and use 3-D objects. We chose this language because some of us had experience in Netlogo.

We had each square on the Rubik's Cube be a single turtle (turtles are the agents) because NetLogo doesn't allow turtles to be more than one color.

Validating the Model

We made sure that the things we did were right by testing the Cube. At first, when we scrambled the Cube, there would be impossible situations. For example, sometimes the corners would have white on all three sides. Our mentors helped us fix the problem. The other buttons worked fine.

Results

We had awesome results. We could turn and scramble the Cube both manually and autonomously, without any bugs. We used the NetLogo 3-D interface to control how the Rubik's cube turned and scrambled. We wrote 1423 lines of code. We made it able to scramble by making it make between 30 and 98 random turns.We made it able to turn by finding the neighboring turtles' color and shifting the color to the correct position: to turn the Front side, we asked the bordering sides (Up, Down, Left, Right) turtles' color and found which way the Front side was supposed to turn.
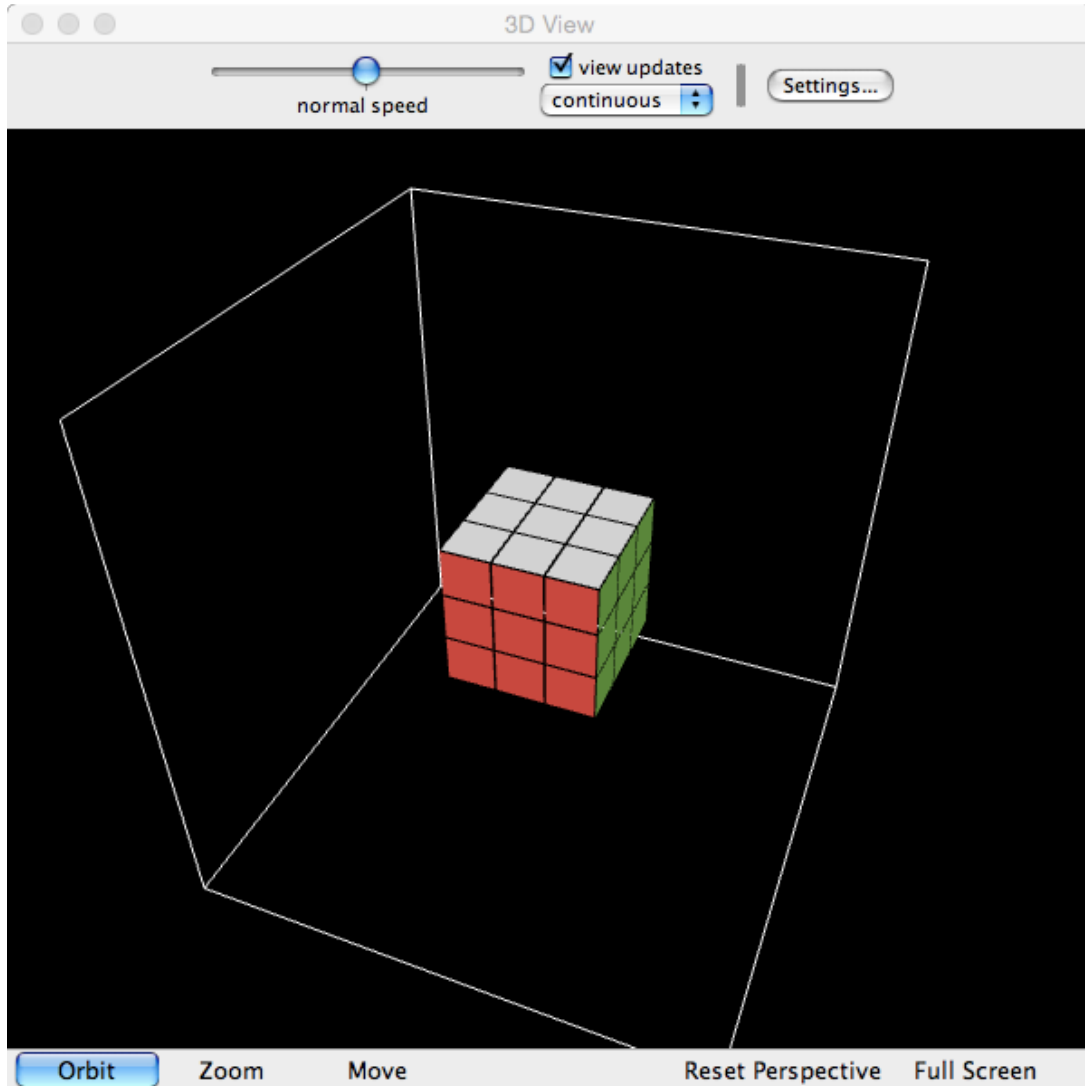
Conclusion

Doing this project was very fun. We enjoyed working, playing, and eating together. We are very proud of our program.

Significant Achievement

Acknowledgements

We would like to acknowledge our mentors, Latchesar Ionkov and Li-ta Lo.

Reference

[1] You CAN Do the Rubik's Cube! Community