



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Andrew V. Kelleghan	Project Number J1613
Project Title Why Knot? Experiments in Knot Formation	
Abstract Objectives/Goals The purpose of my project is to find out the variation of knot formation depending on several factors including string length, material, and thickness. I used different lengths of thin and thick strings, and varying times on the rotator to see if knots form. I then monitored the complexity of the resulting knots. Methods/Materials To do my project, I built a rotator to simulate everyday movement and jostling of strings. For my experiments, I used a total of 90 inches of cotton string and 90 inches of shoelace as sample materials. For each experiment, I started by putting the sample material into my empty tissue box. Then I spun the rotator for 5, 15, or 30 seconds. After I had finished spinning the rotator, I dismantled the tissue box from the rotator. I took the material out of the box carefully so that it did not lose shape. Then I counted the crossings and recorded the results in my lab notebook. Lastly, I took a picture of the knot and recorded the picture number. Results After finishing my experiments, I found that the 54 inch cotton string spun on the rotator for 30 seconds yielded the highest crossing number. The 36 inch shoelace spun for 5 seconds had the lowest crossing number of all the tests. The highest crossing number of all the tests was 83 (cotton string, 54 inches, spun for 30 seconds) and the lowest was 7 (shoelace, 36 inches, spun for 5 seconds). Conclusions/Discussion In my experiments, I used the crossing number to indicate how many knots would form as the materials were spun in the rotator. The crossing number is the number of times the length of material crosses over itself. If a crossing number is low, then it is a smaller knot, however, if the crossing number is high, then the knot is larger. By doing this project, I hope to learn more about knots and how they form. My hypothesis was confirmed; the longest, thinnest sample material, the 54 inch cotton string spun for the longest time, 30 seconds, had the highest crossing number. I found that the longer the material is, the more crossings it will have. Also the crossing number is affected by the thickness of the material and the amount of time it is spun. The shoelace was thicker, and, therefore had a lower crossing number than the thinner cotton string.	
Summary Statement My project measures how tangled strings become based on three factors: thickness of the string, length of the string, and time spun on the rotator.	
Help Received None	