



# CALIFORNIA STATE SCIENCE FAIR

## 2005 PROJECT SUMMARY

Name(s) <b>Jonathan R. Glicksberg</b>	Project Number <b>S0210</b>
Project Title <b>Creating Binocular Vision with Only One Eye</b>	
<b>Objectives/Goals</b> The purpose of this project is to create a noninvasive Depth-Displaying Device (DDD) that would help people with only one functioning eye perform tasks, such as threading a needle, which are much more difficult to accomplish without binocular vision and depth perception.	<b>Abstract</b> I designed and built a DDD using a series of mirror pieces arranged at 45-degree or variable angles. I also constructed a wooden test box, for use in a depth-perception test, containing a 1-inch pegboard grid that holds dowels vertically and non-permanently at different depths. Subjects chose when 2 dowels appeared to be at the same distance. The test was repeated 15 times (5 depths x 3 repetitions, in a predetermined random order). Subjects were tested using two eyes (if both functioned), with one eye, and with one eye using the DDD. I also created a safe threading task, testing subjects with a dowel "needle" at 5 different distances, with and without the DDD.
<b>Methods/Materials</b> Four individuals with two functioning eyes achieved perfect scores on the depth-perception test when both eyes were used. When these subjects used only one eye, they correctly identified the depths only 15% of the time, with a range of -4 to +7 inches relative to the actual dowel positions. With the DDD these subjects matched the exact depths 98% of the time. The two subjects with only one functioning eye exhibited a coping mechanism, as evidenced by the proximity of their incorrect answers to the actual dowel positions; although only 20% of their answers without using the DDD were exactly correct, 97% were within one inch of the correct locations. Significantly, when the one-eyed subjects used the DDD, their scores were boosted to 97% exact depth answers. One-eyed subjects improved their ability to perform the practical application (threading) task, threading the loop with fewer attempts when using the DDD.	<b>Results</b> One-eyed subjects improved their ability to perform the practical application (threading) task, threading the loop with fewer attempts when using the DDD.
<b>Conclusions/Discussion</b> Although the monocular test subjects had developed some methods of compensation, their accuracy in the depth-perception test and their performance in the practical application test were both greatly improved by using the DDD. My Depth-Displaying Device enabled individuals with one eye to distinguish relative depths nearly as accurately as their two-eyed counterparts achieved using both eyes.	
<b>Summary Statement</b> I created a Depth-Displaying Device that enables monocular subjects (with one usable eye) to detect relative depths, a feat that normally requires binocular vision.	
<b>Help Received</b> Parents helped shop for supplies, supervised me while I used power tools, and had useful discussions with me.	