



CALIFORNIA STATE SCIENCE FAIR 2015 PROJECT SUMMARY

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Project Title See the Force: Can Vision Help Tactile Memory?	
Abstract Objectives/Goals The objective is to see how accurately people can remember and reproduce a specific force level when they push on a deformable object where they can see the indentation, or on a hard object that has no indentation. Methods/Materials Informed consent was obtained from 36 subjects. Each subject (randomly assigned to moderate or heavy force) grips a hand exercise device that requires a particular force. The subject then tries to remember and reproduce that force five times on a hard object (table) and five times on a deformable object (squeeze ball). The order is randomized. A fingertip pressure sensor records the force exerted by the index finger. The average force for each push is calculated, and the variance of the five values for each object is used as a measure of repeatability. A one-tailed paired t-test was used to compare the squeeze ball data and table data, and an unpaired t-test was used to compare the moderate and heavy force data. Results I found that forces are repeated more reliably for the deformable object ($p < 0.01$). The comparison of moderate vs. heavy force provided some evidence that people are more consistent when trying to repeat a moderate force than when they try to repeat a heavy force ($p=.051$ for squeeze ball). Conclusions/Discussion When a person pushes on a hard object such as a table, there is the tactile sensation of pressure on the fingertip. When pushing on a deformable object such as squeeze ball, there is additionally a visual sensation (seeing the indentation) and a proprioceptive sensation (feeling the finger moving into the ball). People are more accurate in a statistically significant way at repeating force levels on deformable objects, perhaps due to this additional feedback. This may be useful for designing user interfaces and remote controls, or for providing guidance to physical therapy patients and surgical trainees.	
Summary Statement People can more accurately repeat forces when pushing on deformable objects than on hard objects.	
Help Received Brother taught me statistical tests and how to use sensors; Mom helped design posterboard	