



# CSCI DEPARTMENTAL PROJECT

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# EXECUTIVE

Students from CSCI 1010 laboratory one by one participated in an experiment to understand the human senses when interacting with machines and mechanisms. The experiment had students individually interact with a mechanism under the watch of the researcher. Within the scenario, the students were all blindfolded and given earmuffs to suppress hearing. Not only this, but almost half of the students were additionally given gloves to wear when exploring the structure. The experiment was recorded at several stages of the mechanism being opened. Each student recorded the time of each stage and anything that pertained about completing the task to open and work the mechanism



# BACKGROUND

This experiment was created in order to comprehend the importance the sense of touch has on humans' ability to identify objects and analyze their environments. Researcher Roxana Leontie implemented this experiment with the hopes of applying the information gained through it to the rapidly growing field of robotics.

# INSTRUMENTATION

The mechanism explored had several configurations for it to reach completion and of maximum use. In other words, the configurations can be seen as stages and parts of the structure's function. The object initially just has a tube upright. Unscrewing, aligning the grooves and pulling it respectively reveals a segment with a hinge. Pushing the mechanism to be 90 degrees unlocks another segment of the mechanism to reveal the ball and socket joint. Pulling the tube once more would reveal the joint and its articulation when prompted to move. The only tools that the students 3 were able to use in the tangible interactions were their hand movements.

The data analysis was done in the programming language R. First, the data was manually preprocessed. Elements with missing values was excluded from the final, analyzed data set. This excluded only a single element. Many elements had a value of zero listed for stages. These were not removed or hidden from the analysis in any way. The rationale behind this is the possibility that some stages may have been solved together, in a single action, with a time of zero.



# METHODS

To analyze the data, we first manually performed preprocessing. We deleted the first row containing labels, and then deleted the one row containing a null value. We then used the R statistical programming language to analyze the data. Using R, first we delete the values in the columns 6-17 into a new dataframe to allow for analysis of the other data. We then calculate the breakdown of students by gender and whether they wore gloves or not. We create bar graphs of the visualization score and total exploration time. Finally we calculate the correlations among the major variables, and then we print them in a visual matrix.

# RESULTS

According to our data, haptic senses are extremely important throughout touch exploration. The minimum, mean, and maximum exploration time was longer for people who were randomly selected for the gloved experimental group. The average exploration time with gloves is much greater than the average time without gloves. In general, all of the categorical times that we utilized (minimum, average, and maximum exploration times) tended to be higher with gloves. This supports the notion that the sense of touch is vital for exploration. In terms of gender, there was no significant difference observed between the male and female. Our conclusion based on this data is that gender has no effect on haptic senses- they are more based on an individual's characteristics.





# SUMMARY

We have concluded that a tactile sense is important in exploring new objects to define their behavior. Specifically, the articulated object was solved much more quickly by subject who did not wear gloves than those who did. We have not found a strong correlation gender and performance on this test. We did not even find a large correlation between visualization score the time it took to explore the articulated object. We found that gloves were by far the greatest indicator of performance on the articulated object test.