CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
S0319

Project Title
The Effects of Varying Lever Arm Length and Fulcrum on a Catapult's Efficiency

Abstract

Objectives/Goals
The longest lever arm will deliver the farthest launch.

Methods/Materials
Trebuchet kit, Sanding Sponge, Wood Glue, Elmer's Glue, Drill, Weights (1, 5, & 8 oz.), Metric Tape Measure, Pencil, Paper, Notebook, Poster Board, Computer, Printer, Scissors, Border, Construction Paper

Results
The results from my experiment showed that hole 1, which was -4 cm from the control, had an average of 424.8 centimeters per launch, hole 2, which was -2 cm from the control, had an average of 366 centimeters, hole 3, which was the control, had an average of 308.8 centimeters, hole 4, which was 2 cm from the control, had an average of 224.55 centimeters, and hole 5, which was 4 cm from the control, had an average of 117.2 centimeters. As a result of my tests, hole 1 appeared to be the most successful and hole 5 the least successful in affecting distance and accuracy. This conclusion was supported by my ANOVA test. From this test I determined that there was less than a 3% chance of another factor affecting the distance, such as, wind, friction, or user error. Statistical analysis also supported the idea that a negative change in arm length improved distance and accuracy by increasing the influence of the counter balance.

Conclusions/Discussion
My results didn't support my hypothesis. I had hypothesized that the longest lever arm would yield the farthest launch, but actually the shortest lever arm yielded the farthest launch. I think my hypothesis was wrong because when I went farther down the arm, less force was created by the falling counterweight, decreasing the distance of the launch.

The data that I recorded shows that changing the length of the lever arm directly affects the distance of the projectile. This is proven by the one way ANOVA test that I conducted, which stated that there was a 3% chance that another factor could have affected the distance of each launch.

I learned from this project that little things make a big difference. For example, I changed the fulcrum of the arm by 2 cm, added a few more ounces to the original counterweight, and allowed the sling to swing freely which made a big difference on the experiment. This experiment relates to medieval weapons used to seize castles and hobbies such as Punkin Chunkin where contestants build trebuchets and other machines to launch pumpkins.

Summary Statement
I changed the length of the lever arm in order to discover which yielded the farthest launch.

Help Received
Dad helped me measure the distance of the launch; Mom helped me prepare my board; Advisor helped me revise my work; Neighbor helped me drill holes in catapult's arm