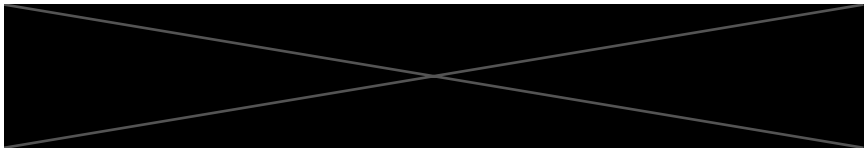
Science and Engineering Fair



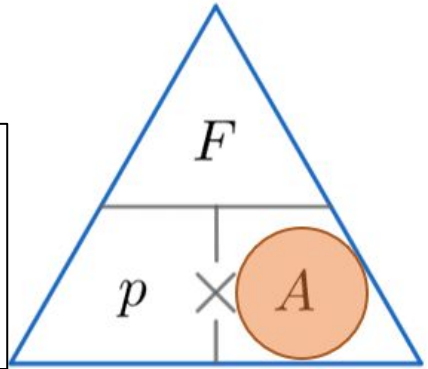
Grocery Glove

A Better Grocery Holder

Introduction

Holding a lot of grocery bags is too heavy for my mom's hands. So, I want to make something to make it feel lighter. I talked to my Uncle Max about how pressure works. He is an engineer. He explained to me that the smaller the area that the weight is applied, the heavier it feels. We watched a video (cited in my resources) that gave a great analogy for this. It asked "would you rather have a woman wearing a stiletto heel step on your foot, or an elephant's foot?" I would rather have an elephant's foot walk on me, because the weight is more spread out. I want to use this information to make something I call a Grocery Glove.

If we know the force (weight pulled down), and we know the area, we can calculate the pressure. This is what I want to decrease or reduce.



Question/Problem and Predictions

How can I make the weight of heavy grocery bags feel lighter and more comfortable to carry?

My hypothesis is that if we spread out the weight across a bigger surface area, the bags will feel less heavy and be more comfortable to carry.

Variables

The **independent variable** is the area where the force is applied. We will be gradually increasing the area.

We are looking for the pressure to be changed each time as we increase the area. This is my **dependent variable**.

The weight of the bags measured in Newtons will remain the same, as well as the distance traveled while carrying the bags, and the same person (me) carrying the bags each time. These are are my **controlled variables**.

*Note: a limitation is that my spring scale can only measure up to 5 Newtons. So we had to keep the force at a maximum of 5 N. Ideally we would make the bags heavier, but I do believe my hypothesis could still be applied to a test with heavier weight.

Investigation Methods and Procedures

1. Measurement Collection

First we collected some data points by doing some measurements.

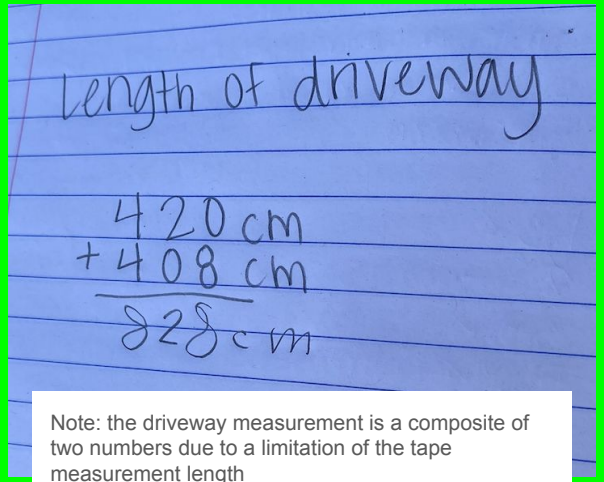
The area of wood A was only 96 sq. cm. The area of wood B was bigger, 336 sq. cm. My hypothesis again is that wood B with the bigger area will be/feel like less pressure. The area of the space on my hand that just the bag handle itself covers (our control) is 21 sq cm.

Next, we measured the length of our driveway, also in cms. The driveway is 828 cm long. This is the distance we will walk with the bags.

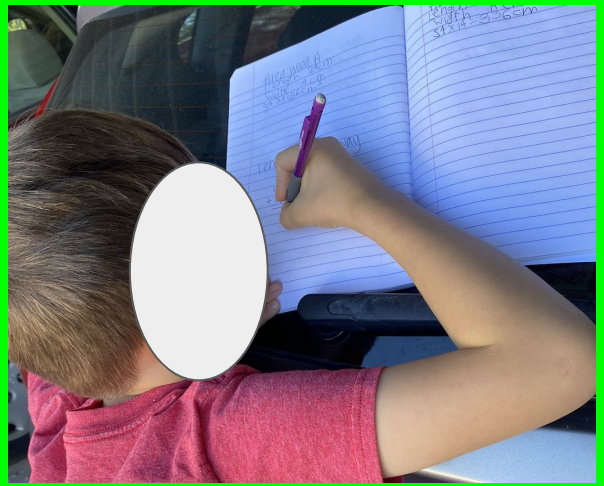
Finally, we measured the force of the 3 grocery bags with a few items in there. Again, a limitation here was that my spring scale could only measure up to 5 Newtons. So that had to be the maximum weight for this experiment to quantify the data. I do believe my hypothesis would be supported with heavier weight as well. The force of the 3 grocery bags was 5 Ns.

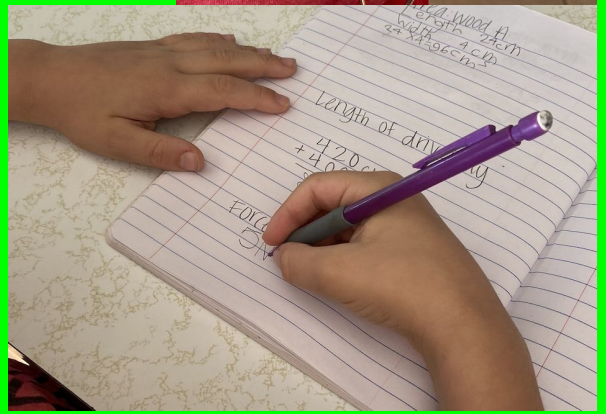
Area: Wood A
Length 24cm
Width 4 cm
24 X 4 = 96 cm²

Area: Wood B
Length 24 cm.
Width 14 cm
24 X 14 = 336 cm²



Note: the driveway measurement is a composite of two numbers due to a limitation of the tape measurement length





Investigation Methods & Procedures

We then ran 3 tests. I first went up the length of the driveway with no wood on my hand.

Next, I went up the same length of the driveway with Wood A (smaller area) on my hand and the bags spread across that area.

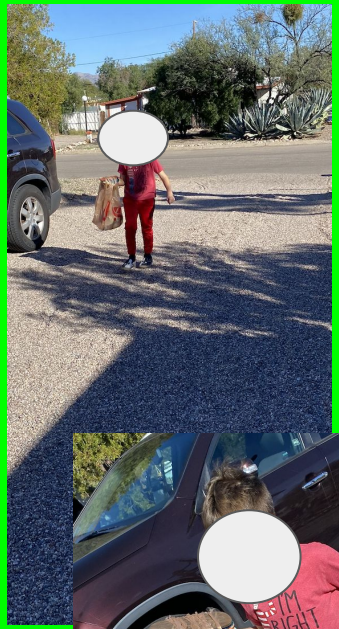
Then, I went up the driveway with Wood B (larger area) on my hand.

For each I told my mom my comfort rating on a scale of 1-5 where 1 is the least comfortable and 5 is the most comfortable.

I then added this data to my data collection table.

Finally, with my mom's calculator, I divided the force (5 Newtons) by the area (in square centimeters) to find the pressure. These calculations are shown in my data table.

I'M
RIGHT
HERE
BRO



I'M
RIGHT
HERE
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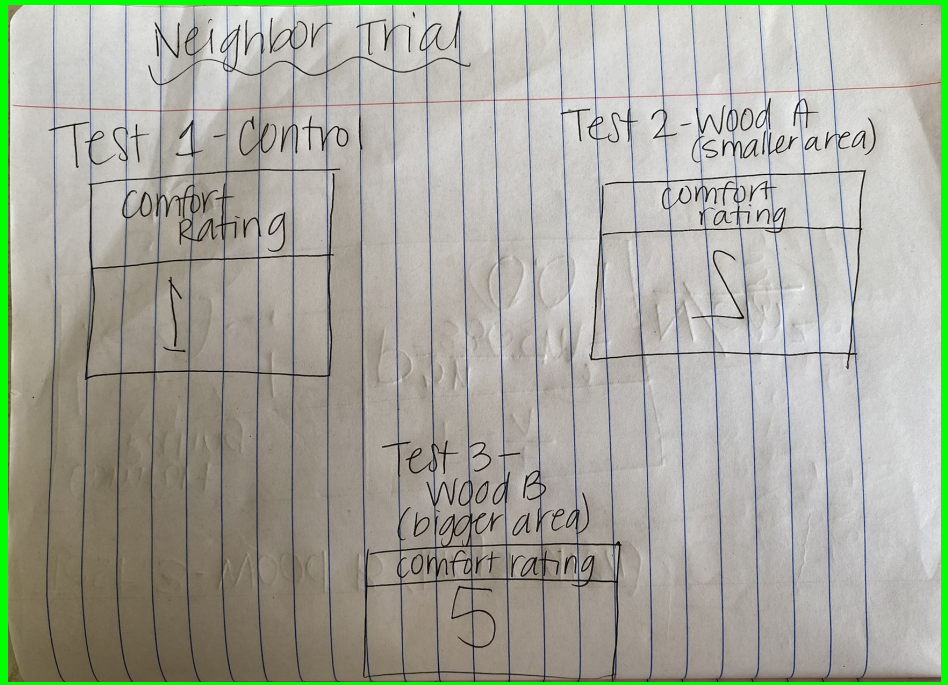
Investigation

To eliminate observer bias, I asked my neighbor to complete the 3 tests without knowing anything about my experiment. His comfort ratings are shown in the table below.

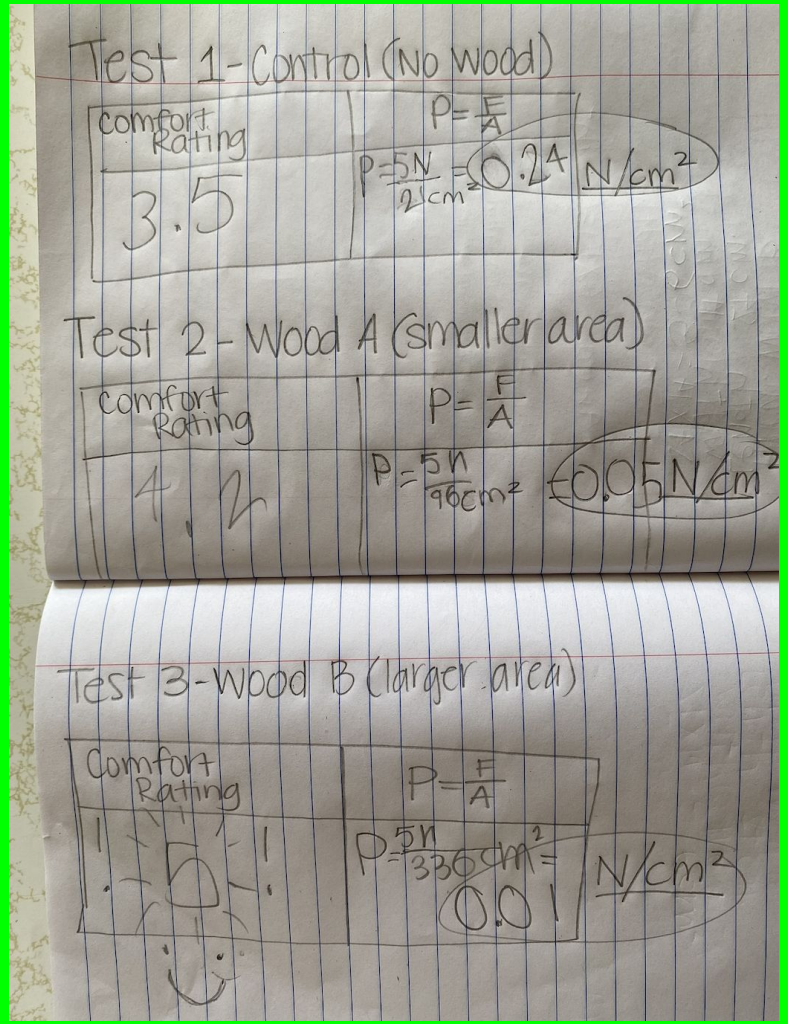


Results and Data

The control had a pressure of 0.24 N/sq cm and a comfort rating of 3.5 (1 from my neighbor)

Wood A (smaller area) had a pressure of 0.05 N/sq cm and a comfort rating of 4.2 (2 from my neighbor)

Wood B (larger area) had a pressure of 0.01 N/sq cm and a comfort rating of 5 (also a 5 from my neighbor).



Discussion and Interpretation

My conclusions from these tests and these data points is that the more that you spread out the weight (force), the more light it feels. I got a 3.5 in the first test because it was only on my hand. Then, when I was wearing Wood A, it was a little bit better. It was a 4.2 comfort rating. But then, once I did Wood B on my Grocery Glove, I finally got a comfort rating of a 5. It was so light that I couldn't feel the bags at all. The pressure number (N/sq cm) got smaller each test, that means there was less pressure each time as we increased the area. It looks like my hypothesis was correct.

Implications and Ideas for Future Research

I think the Grocery Glove is important because you can hold more weight, and it will be easier to hold your groceries. So it will be more peaceful to bring your groceries home if you are walking. Also this doesn't have to be used for just groceries, it can be used for anything. For example, clothes shopping. You just put the hangers on the Grocery Glove, and then, TADA! …You won't feel a thing and can hold more as you shop.

For future investigations, I might try to explore carrying the weight on other parts of my body. For example, holding the weight on my back instead of my hand. I might also try spreading the weight out even farther across a stick, or working with material that is more flexible than wood, such as foam. I would also want to run the experiment with more weight beyond 5Ns.

References

Shaelene Stranges. “Calculating Pressure, Force and Area.” YouTube, 10 June 2020, www.youtube.com/watch?v=UajHQ1iz1fQ. Accessed 29 Nov. 2025.

Uncle Max Atkinson, engineer