Identifiers: Sam Choi and Daniel Kuntz Thursday Cumming Session 11/9//17

Title: Bungee Jump #2 Force

Experiment Summary

This experiment was designed to test how changing the unstretched length of the cord would affect the force put on the object experiencing a bungee jump. We kept the mass constant in all trials and only changed one variable, the unstretched length. We were able to measure the force by attaching a force sensor at the top of the jump and stimulating a bungee jump by dropping a mass from the top. The force sensor program showed the force throughout the whole jump and we recorded the maximum force put on it. By having the force values, we were able to solve for the acceleration of the object using F=ma. This is of interest to us because in the actual bungee jump, the acceleration cannot exceed three times the mass of the object. However, our acceleration values are around 55 m/s^2 and therefore caused the falling object harm by halting it too suddenly. The uncertainty was 1.21 and was derived from Excel regression analysis. Our mass used was greatly smaller than the mass of the egg which we will be using for the actual bungee jump so that could affect the acceleration. Based on our findings, the unstretched length doesn’t seem to affect acceleration. When we ran this same experiment with a mass close to the eggs, the acceleration was below 3g. So we can disregard that when trying to make our egg bungee jump safely.

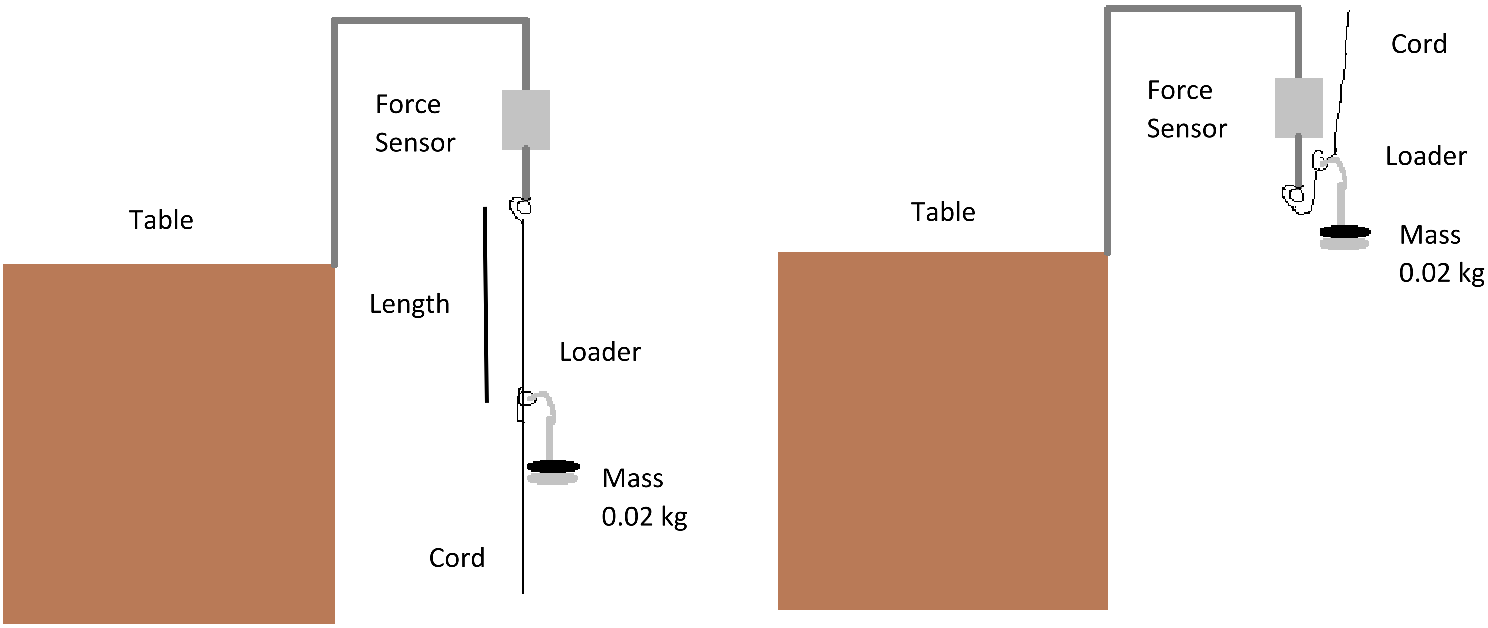

Figure 1 - Diagrams of Bungee Jump: We were able to attach a force sensor facing down at the top of the pole. Once we dropped the mass at the top of the cord, the force sensor program would track the force put on it during the jump and we recorded the maximum force.

Mass (kg)	Unstretched Length (m)	Maximum Force (N) ($\pm$0.027 N)	Acceleration (m/s^2) ($\pm$1.30 m/s^2)
0.02	0.20	1.05	52.33
0.02	0.40	1.11	55.50
0.02	0.53	1.09	54.33
0.02	0.69	1.11	55.67
0.02	0.95	1.10	55.00

Figure 2 – Trials of Bungee Jump: The force shown is the average of the forces we recorded from our trials. Then, we divided the force by the constant mass of 0.02 kg to find acceleration.

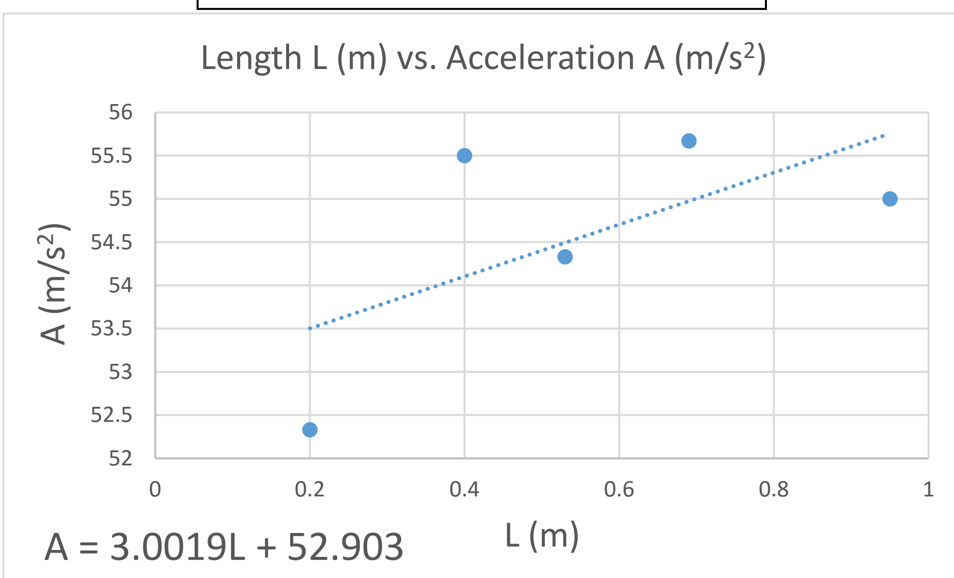

Figure 3 – Length (m) vs. Acceleration (m/s^2): The acceleration is very similar and the reason for the positive linear relationship could be due to error.

Experimental Value of Interest

The value of interest in this bungee jump experiment is the acceleration of the object falling. We solved for acceleration by dividing the force we recorded by the mass. A=F/m. Our accelerations had a range from 52.33 m/s^2 to 55.67 m/s^2 ($\pm$1.30 m/s^2) but the minimum is an outlier and most of them were very close to 55 m/s^2. As stated in the summary, our acceleration cannot be over 3g or 29.4 m/s^2. Our uncertainty value from Excel regression analysis is 1.21.

Evaluating Results

According to our acceleration results, our object experiences too harsh of a stop at the bottom of the bungee jump. Our experiment differs from the actual egg test because the mass is much smaller. Our uncertainty could've occurred from not completely accurate measurements of force by the sensor. We could test for our accuracy in acceleration by taking a slow motion video and using a program to find acceleration by tracking the movement frame by frame. Then we could calculate error percentage by doing $(Actual - Accepted)$/Accepted x100. A percent error of less than -5 or 5% would mean our experiment was fairly accurate.

On my honor, I have neither given nor received any unacknowledged aid on this assignment. Pledged:

Sam Choi