Newton's Third

Purpose: To investigate Newton's third law and the effects of action/reaction pairs.

Set-up:
Attach the Airlinks to two force sensors link them to the computer using Capstone. Set-up a force vs. time graph using Graph. Add a second y-axis to the graph by clicking on "*Add a new y-axis to active plot area*". Select the measurement for one y-axis to correspond to one of the force sensors, i. e. "*Force Sensor, Ch A*" and the select measurement for the other y-axis to correspond to the second force sensor, i. e. "*Force Sensor, Ch B*". This set up makes the data for both force sensors to show up on the same graph. Make sure one force sensor is set to detect a pulling force as positive and the other sensor records a pull as negative. To do this, go to "*Data Summary*", and click on the icon to the right of "*Force Sensor, Ch. A*" and click the box for "*Change Sign*" then "*OK*". Click on "*Data Summary*" again to exit this window. Set the sampling rate to 200 hz.

READ THROUGH THIS FIRST AND THEN BEGIN WORKING!!!

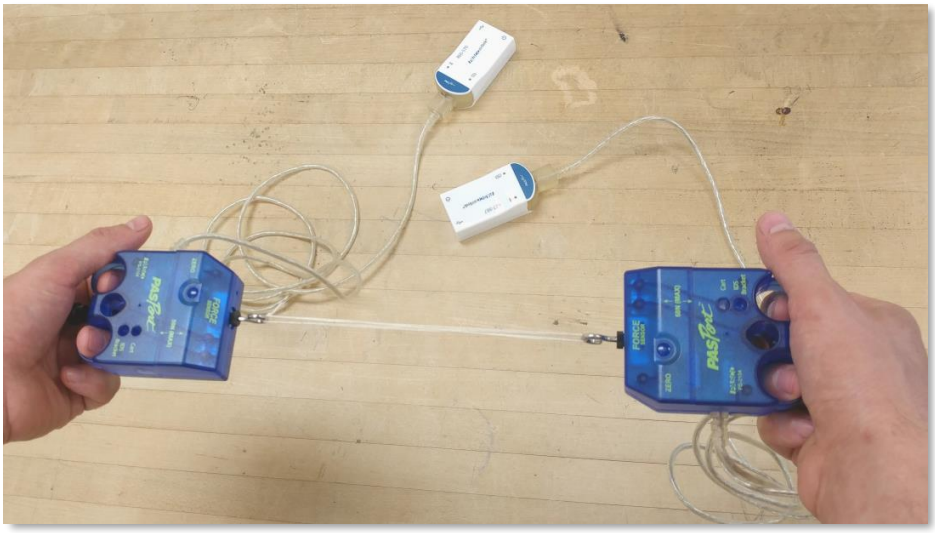

Fig. 1 - Set up to investigate Newton's Third Law

Activity:
Use a piece of string make a loop then connect the hooks of the two force sensors, as shown in Fig. 1. Have two group members each hold one of the force sensors horizontally. Start the record button while the string between the two sensors is still slack (no pulling yet) and "Zero" the force sensors by pressing its "zero" button, then have the two group members pull against one another while keeping the string tight. **These two members should hold the Airlinks connected to their sensor with their other hand.** Generate a force vs. time graph for this effort. Observe what happens when the force sensors do not move, and also when they move between the two group members (always keeping the string tight!).

On your graph, use a multi-coordinates tool  to identify a point in the region when the force sensors do not move. Use another one of this to identify a point when the sensors were being moved. Print the graph obtained from this effort.

Discussion/Questions:

1. Describe the meaning of your graph. Draw a system schema for the system made up of the two force probes, and draw free-body-diagrams for each force probe. Discuss whether you can tell if the force probes were moving or not; include evidence for how you know.

Now have one group member sit in a chair and another stand, each with his/her own force sensor. Set the chair in motion by pulling with the force probes; try it two different ways so that a different force probe remains stationary each time.

2. How does the force measured by one probe compare to the force measured by the other? Explain what you have observed.

Develop a novel situation as a group for which you can collect force data using both force sensors. Collect your force data and print the graph.

3. Describe the novel situation that you came up with in detail (much like the problems we have been working on during the past few class meetings). Does the obtained graph for this novel situation show and illustrate Newton's Third Law? Provide free-body diagrams for each force sensor and explain why they are correct.

Put you names on the printouts. ***Remember that lab reports are to be completed individually. Graphs will obviously be the same for each group member, however all questions/descriptions must reflect your own work (a group discussion will help to clarify your ideas, and help you put them into words). Any duplicate lab reports from within a group will receive NO CREDIT.

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