Measuring and Comparing Human Response Rates
CLASS SET – PLEASE RETURN!

Background information:
Are quick responses important for survival? Are they needed for humans to survive in an urban environment? How quickly do humans react to sensory stimuli? What differences are there among individuals? Do males have quicker reactions times than females? Will your reaction rate be quicker if the initial stimulus is by sight, touch, or hearing? You will be testing your reaction rates using 3 major sensory pathways to the brain – visual, auditory, and touch, you can estimate reaction time by measuring on a falling ruler the distance it drops before you catch it.

Purpose: *What is the purpose of this activity?*

Hypothesis: *Write a proposal as to which of the three stimuli you will respond to the quickest and slowest. WHY?*

Materials: *List items to be used.*

Procedure: *See some helpful hints below in order to design your testing procedure.* ***DO NOT COPY!***

1. Watch the teacher demonstration for how to hold and release the meter stick. Note that the partner being tested should align her/his thumb and index finger with a region of the meter stick.
2. Construct a hypothesis that predicts which of the three stimuli will allow you to grab the stick most and least quickly.
   - **Visual:** being able to see when the stick is dropped.
   - **Tactile:** being touched exactly when the stick is dropped, but being unable to see.
   - **Auditory:** hearing a sound exactly when the stick is dropped but without seeing.
3. You will want to preserve the condition of your meter stick. Place a book on the floor directly under where the meter stick would drop if not caught. The meter stick's edge can chip if they hit a hard surface.
4. **Test the visual Stimulus variable:**
   Your partner will hold the meter stick while you stand with your hand extended at shoulder height. The top of your thumb and index finger should be aligned with a region of the meter stick. When you see your partner release the meter stick, grab it with your thumb and index finger. Read the centimeter value immediately above your thumb. Record this value in the data table. Repeat 4 more times for a total of **5 trials**. Record each number in your data table. Switch roles and repeat the trials.
5. **Test the Auditory Stimulus variable:**
   Stand as before, but this time put on a blindfold, safety goggles, or simply close your eyes. When your partner releases the stick, he/she will say something like "Go". Your job is to grab for the stick as quickly as possible. Repeat 4 more times and record the centimeter values in the data table. Now switch roles and repeat the trials.
6. **Test the Tactile Stimulus variable:**
   Using a blindfold, goggles, or closed eyes so that you cannot see. Instead of saying "Go" as above, your partner will touch or pinch your opposite hand or finger as the stick is released. Perhaps you let go of your partner's arm at the same time you release the stick. Try to grab the stick as soon as you feel this sensation. Repeat 4 more times and record the centimeter values in the data table. Now switch roles and repeat the trials.
7. Distance on the meter stick is not a direct measure of reaction time. The relationship is actually not linear. You now need to convert your average distance on the meter stick to actual reaction times in **centimeters per second** using the formula below.
8. Record the class average distance on your data table when they are calculated. Find the corresponding **reaction times in centimeters per second** for these values.

The equation for the curve, which converts distance on the meter stick to seconds of reaction time is based upon the acceleration due to gravity. This formula is: **$d = .5\ at^2$**. Where **d** is the distance traveled in centimeter, **a** is the acceleration due to gravity (a constant which equals **980. centimeters** per second squared) and **t** is the time in seconds. The equation solved for **t** (reaction time in seconds) is given below.

$$t = \sqrt{\frac{d}{.5a}}$$

Data: *Construct a table showing all data to be collected. Make sure you show units and all trials to be collected. Also, show calculations of distance converted to time for credit.*

Analysis: *Prepare a bar graph (on a separate sheet of paper) of the data, showing your own, your partner's, and the class average reaction times. Make sure to include labeled axis with units, a legend and a title.*

***** Look at the graph on the back showing the curve for distance converted to reaction time. Indicate by putting a **labeled point on the curve** to represent you, and the class average reaction times for each of the three stimuli.

Conclusion Questions:

1. To which sensory stimulus were you able to react most quickly?

2. To which stimulus did you react most slowly?

3. How do your findings support your hypothesis? Respond by discussing your hypothesis and how it was supported or not by the data you collected.

4. Compare your average times and your partner's average times to the class averages. What differences did you find?

5. After studying your bar graph, evaluate your hypothesis using the class data.

6. Propose an explanation based on the class data that explains the differences in reaction time among the three stimuli. Discuss the neural pathways involved.

7. For the tactile stimulus. What is there in the procedure that might affect reaction time differently than in the other 2 stimuli trials?

Application Questions:

1. Think of some ways in which the body prepares itself for action (sometimes called *fight-or-flight responses*). Which of these responses did you feel during the testing phase? (see your text book for help)

2. Design an experiment to test whether female reaction rates are faster then male reaction rates. How many subjects would you need? What would your testing procedure be? What are your controls? How many trials would you need? What is your hypothesis?

Curve for Converting Distance to Reaction Time