Terrific Reactions

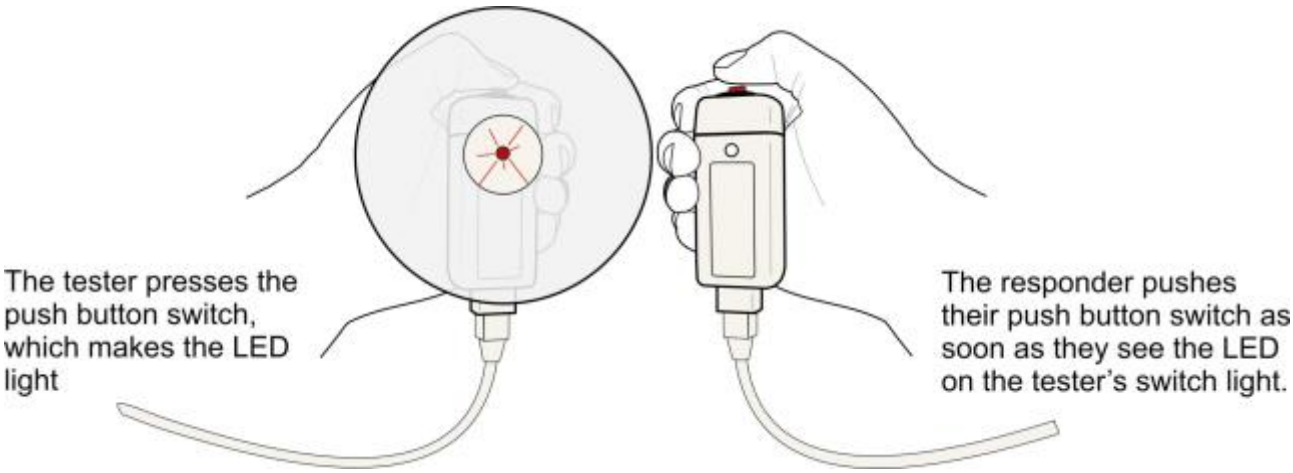
A reaction time is the quickest time an individual can respond to a stimulus. A reaction time is the total time for a message travel up to the Central Nervous System [CNS] and come back again and produce a response.

Reflex reactions are different from reaction times; they by-pass the brain to give a very quick response. You may be familiar with the eye blink response, knee jerk (as seen in many cartoons) and ankle twitch.

This activity involves quite a lot of brain power and has a conscious response to a stimulus. For example, saying OUCH!! to something that hurts is not a reflex, it has a bit of brain power involved. If you were hiding and hurt yourself, you could stop the OUCH! But, you can't stop an eye blink.

Because of the way the body works you would be unlikely to see a reaction time below 0.02 seconds (unless there was a bit of cheating!).

In this activity your student investigators will be able to see how reaction times vary to different stimuli, and perhaps any other factors that you and they may think might be important. For example, is it true that sporty people have better reactions?



Learning outcomes.

- Scientific method.
- Observation.
- Creating and testing a hypothesis.
- The fair test.
- Observation.

You will need.

1. A data logger with a pair of external push button switch sensors *(attached to the computer linked to your interactive whiteboard, projector or other large display)*
2. Software showing the product of the logger as a Time from A to B.

3. A CD or something to hide the testers finger movements but allow the subject to see the light.
4. Things and ideas to test that may alter reaction times, e.g. music, phones, flashing lights or any other distractor
5. A long tape measure (e.g. a field tape).
6. Some calculators (for extension work)

Suggested teaching method.

You will want to establish a base reaction time, use the period of demonstration of the practical activity to collect some average data.

The activity works best, initially, as a PC and whiteboard demonstration so the students can see the reaction times appearing as they happen.

The activity can then quickly progress to learning groups. The activity is also a simple enough for children to do as trios (one to set the stimulus, one to respond and one to control the computer software.

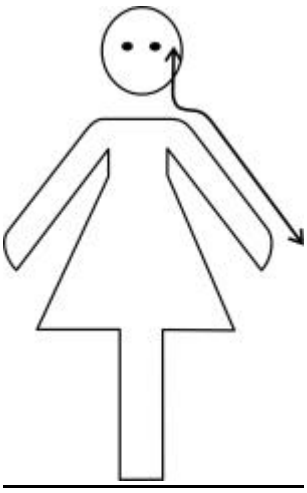
Results can, in addition to science work, link into mathematics, arithmetic and discussion work.

Setting the software.

It is important before starting to ensure that the push button switch connected to A is for the TESTER and the pushbutton switch connected to B is the RESPONDER. The tester has to hide any movement of their hand or fingers behind a shield that only lets the light on their switch shine through.

Use Timing.

1. Set the logging to Time From A to B.
2. Either use:
    a. The default distance between A and B (simple set up and gives comparative values).
    b. The true distance, which is the distance of the responders finger tips to end of nose when they are looking away from the fingers. A bit like the Egyptian temple carvings, flat against the wall!



Start with the simple,

1. Start the software.
2. Press the button to make the light shine.
3. Press the button as soon as you see the light.

You should get values that are quite consistent. If they vary ask why?

With a reliable base line average start to ask for ideas that can be tested for changing the reaction time e.g. have someone talking to the subject, have TV turned on that the subject can see,

Questions

Any questions should be free running and reactive to the activity as it progresses. As we are all made from the same basic design there should not be any real differences until distractions are involved.

- What is the journey of the message to press the switch? How does the stimulus get in?
- Why would distractions slow things down?
- Do you understand why talking to the driver of a car could be a problem?
- Is everyone the same? Are any differences really that important
- If you mix, two solutions together and you see a temperature change taking place what is happening?

Teachers notes.

We should use a common description of what's doing what and who is doing what.

- The person pressing the switch to show light is the TESTER.
- The person reacting to the light coming on is the RESPONDER
- The light is the STIMULUS.
- The action of pressing the button as soon as you see the light is the RESPONSE.
- The spinal cord and the brain together make up the Central Nervous System.
- Nerves (Neurones) carry the signals around

Some extensions

If you are lucky enough to have a timing mat, modify the activity to have the push button switch start the clock and the stamp on the mat stop the switch. This is perhaps a bit closer to seeing something and then stamping on a brake pedal. Does it make a difference? What is this a model of?

Do some mathematics (or pre gather the information from the internet) to find out how fast a car at 30mph, 40mph and 50mph is going in metres per second.

- Then get the children to measure out the distance travelled at each speed in a second. Challenge them to run the length in a second!
- Then use the reaction speed to find out how far a car would travel at each speed before the driver started to do something.

You could now find out how long a car is and mark along your travel line, start to think about "if I stepped out from behind that car, how could anyone stop for me?"

Social context of science

There is an opportunity to consider the reasons why,

1. Using phone when driving is a bad idea.
2. Drinking alcohol is bad idea (data is available for how much it slows you down).
3. Speed limits are 30 mph and often 20mph by schools.
4. You also have a responsibility as a pedestrian to drivers.
5. Misbehaving in the back seat of the car is more than just annoying!

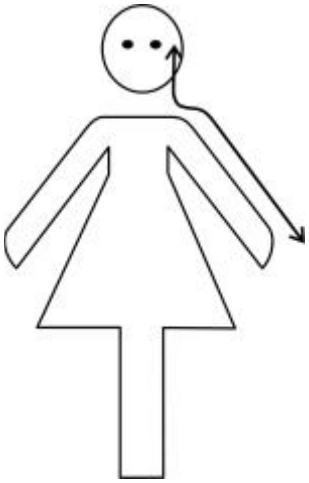
A full method.

This was written for a logger connected to a PC and using the PC Easysense software. If you are using iPad or Android data logging you will need to modify the instructions.

Note: Velocity is speed with a vector included. Speed is simply how long to get from A to B by any direction and distance travelled. Velocity is how long to get from A to B by the shortest most direct travel. In science we should really use velocity as the preferred short hand.

What you need to do

1. Connect the two Push Button Reaction switches to the inputs labelled A and B on the logger.
2. Use the tape to measure the distance from the responder's eye to the thumb tip in metres.
3. Select Timing in the software.
4. As the wizard starts select Time from A to B then Next until you reach the page that asks for "**Enter Parameters for Velocity from A to B**" and enter the distance measurement from the eye to the thumb tip.
5. The tester should hold the Push button Reaction switch that is connected to input A. Hide the push button part of the switch from the view of the responder so they will not see any movement of the tester's hand or fingers but will still see the LED.
6. The responder should hold the Push Button Reaction switch connected to Input B. Try few test runs to get used to the experiment.



7. Click on the **Start** icon to begin logging.
8. The tester should press their switch and the responder should press their switch as soon as they see the LED on the tester's switch light.
9. Repeat for at least ten readings and select Stop.

On many of the Data harvest loggers there is a timing section, use time from A to B and get the children to record results as a chart, number line, block graph or whatever is appropriate.
