ROAD TO ZERO

POST-VISIT ACTIVITY: SEE, THINK, REACT

This investigation will explore the *first* part of the stopping distance equation:

Distance travelled while reacting + *Braking distance* = *Stopping distance*

Students will devise and conduct a serious of tests, and consider which test is the best analogue for a car driver reacting to a braking stimulus. They will also examine the neurological and biomechanical steps involved, and compare their findings to their *Road to Zero* virtual reality (VR) test track data.

Learning context

Science classes

Victorian curriculum learning areas and level

Science	**Level 9–10**
Capabilities	**Level 9–10**

- Critical and Creative Thinking

Victorian curriculum strands and sub-strands

Science	**Science Understanding** ***Physical sciences*** • The description and explanation of the motion of objects involves the interaction of forces and the exchange of energy and can be described and predicted using the laws of physics (VCSSU133) ***Biological sciences*** • An animal's response to a stimulus is coordinated by its central nervous system (brain and spinal cord); neurons transmit electrical impulses and are connected by synapses (VCSSU118) ***Science as a human endeavour*** • The values and needs of contemporary society can influence the focus of scientific research (VCSSU116)
Capabilities	**Critical and Creative Thinking** ***Questions and Possibilities*** • Challenge previously held assumptions and create new links, proposals and artefacts by investigating ideas that provoke shifts in perspectives and cross boundaries to generate ideas and solutions (VCCCTQ045)

Learning intention

Understand the role of reaction time in determining car stopping distances, and the neurological and biomechanical processes involved

Success criteria

- Conduct an experiment exploring the factors affecting reaction time and analyse the results
- Understand the processes involved in a driver reacting to a braking stimulus
- Consider the implication of delayed reaction time to the motion of a vehicle and its ability to stop
- Identify safety implications of investigation findings and suggest solutions

Learning activity description

1. Reaction time investigation

Students will design an experiment to test their ability to react to a stimulus. The goal is to determine a fair test that best mimics the action of a driver braking in an emergency situation.

Students can research methods to test reaction times and/or use an online or app-based reaction timer, such as https://www.humanbenchmark.com/tests/reactiontime/

It's recommended that students test the reaction times of different parts of their body. Remind them to factor in any movement that needs to occur (e.g. having their finger resting on the trigger (e.g. mouse) will result in a faster reaction time compared to having their hand flat on the table next to the mouse.) Suggested tests are listed below, although students should be encouraged to be creative!

- Hand resting on trigger
- Foot resting on trigger
- Hand moving onto trigger
- Foot moving onto trigger

Students should aim to find an average reaction time for each test type by conducting multiple trials with different test subjects.

2. Analysis

Students should consider the results of their investigation and answer the question:

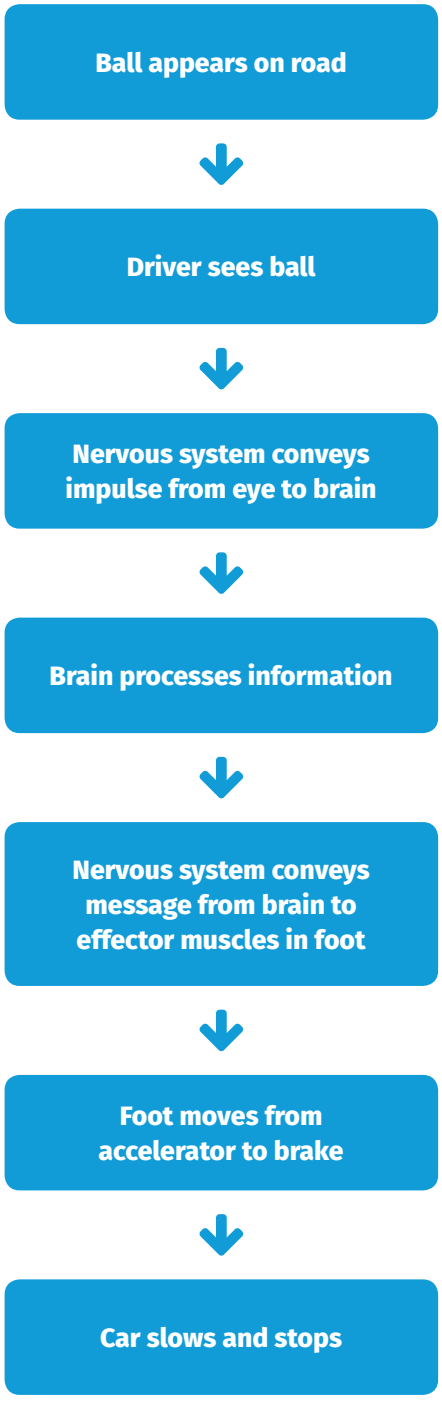
Of the reaction tests devised, which one most closely models the response of a driver braking?

3. Stimulus and reaction – the reaction pathway

Next, students should consider all the steps that occur for a driver to react to a braking stimulus, e.g. a ball bouncing across the road. Students should consider what is happening on the road environment, in the car as well as the biological steps required for the driver to move their foot to the brake pedal.

Creating a flow chart, similar to the example on the right, will help students consider each of the steps.

Flow chart example



4. Share and brainstorm

Ask the students to share their flow charts with the class, discussing any potential differences.

Next, students should consider all factors that could potentially affect an individual's ability to react. This can be done collectively, with the responses written on the board or collected electronically. Example responses include:

- Being tired
- Age
- Distractions
- Mental or physical impairments

5. Data comparison

Students should now consider the results from their *Road to Zero* stopping experiment and respond to the following questions.

Comparing the reaction times in the VR environment to the results of the tests conducted today:

- Which test type explored today best modelled the response in the VR environment (finger on controller button)?
- On average, what was the difference in reaction time between the *Road to Zero* results and the test that your group identified as most closely modelling a driver reaction?
- Do you think that pushing the VR controller button during your *Road to Zero* experiment was a good way of modelling a driver in an emergency braking situation? How could it be changed to make it more realistic?
- Optional: Devise a mathematical formula to apply to your *Road to Zero* reaction time results to make them more realistic (e.g. add 1 second, double the reaction time)
  - HINT: Research shows that the average time it takes for a driver to react to a hazard by braking is about 1.2 seconds – longer for drivers who are tired, distracted or impaired by alcohol/drugs.