



Astronaut reaction speed

Introduction

Human reaction speed is influenced by many factors in the environment, but also people's reactions get slower as they get older. Human reflexes such as moving a hand away from a hot object are very fast. Reactions are slightly slower when the brain is involved in processing information to make a conscious decision, such as when catching a ball. The speed of reaction is partly determined by the speed at which electrical impulses can travel along a nerve fibre (up to 100ms) and also by

the number of connections (synapses) there are between the nerve fibres involved. People operating complex machinery need to have fast reactions to enable them to respond to changes in the environment. Their reaction speed can be reduced by fatigue, distractions and by the effect of certain drugs. In this activity we will be using a Micro:bit device to measure reaction speeds, and investigate the effect of distraction on reaction speed.





Figure 1 UK Astronaut Tim Peake in training

Space context

Astronauts live in extreme conditions and their bodies experience many effects that could potentially slow down their reaction speeds. These include:

- restricted diet
- restricted opportunities for exercise
- altered sleep patterns
- breathing an artificial atmosphere
- being subjected to extreme pressure changes and to extreme accelerations
- operating complex devices with multiple displays

Many operations required on a space mission have become automated, or can be controlled from Earth. But it is essential that astronauts remain alert, and have normal reaction speeds if they are to function safely and effectively in space. Their health is therefore monitored regularly and information fed back to Earth on how they perform routine tasks.



Figure 2 Shuttle flight deck, including 11 different screen displays



Prior Knowledge

Rapid human responses to the environment are called reflexes. They involve nerve fibres that connect a sense organ to the spinal cord, and a separate nerve fibre connecting the spinal cord to a muscle, which brings about the response. Some reflexes may involve the brain making a decision, which will slow down the speed of response.

Reaction speeds can be improved to some extent by training. They can also be slowed down by distractions and by drugs such as alcohol.

Learning intentions

- How to measure reaction speed by taking a series of measurements and finding their mean value.
- Exploring the effect of distractions on reaction speed.
- By adjusting inputs in the code, students will be able to change the strength of the stimulus, and find out if this has any influence on reaction speed.

Resources

- Micro:bit and connecting lead to computer
- Battery pack
- Computer with access to Micro:bit web site to download code

Preparation

The code for this activity is available [here](#)

Once the code has been downloaded it needs to be compiled and flashed to the Micro:bit. Additional help is available [here](#)

To start the procedure, press the reset button on the rear of the device.



Lesson activity

Check that students understand that individuals have different reaction speeds, and show how this can be measured simply by catching a falling ruler.

Explain the components of a reflex arc, and the factors that influence reaction speed.



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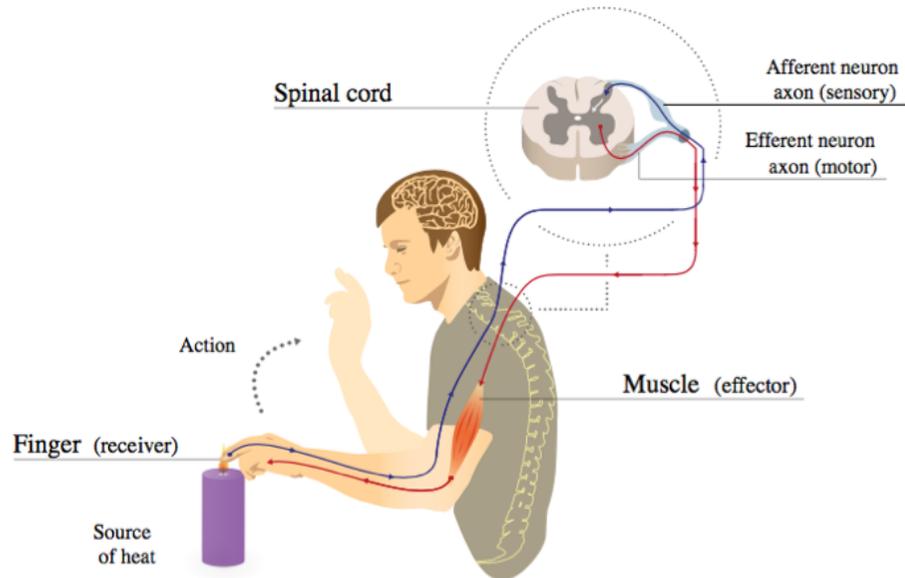


Diagram of a reflex arc – response to pain

Demonstrate how to download, install and run a procedure for measuring reaction speed on Micro:bit device.

The procedure measures the time taken for a button to be pressed once an LED is illuminated, and the number of seconds is presented as text on the LED display. Organise the class into small groups of three, each with a Micro:bit. Get each member of the group to record their own reaction speeds.

Each group should then devise an investigation into the effect of distraction on the reaction speed of one member of the group. You may want to restrict the types of distraction used if the groups are working in the same room to avoid too much noise.

Assessment opportunities

Assess student's working scientifically skills in the design of their investigation. Ensure they collect sufficient data and analyse it effectively to provide evidence for their conclusions.

Ask students to draw a flow chart to illustrate the steps in a typical reflex arc, using words such as stimulus, response, receptor and effector.

Discuss possible links between the outcomes of their investigations, and the ability of people to carry out complex tasks such as driving a car or controlling a space vehicle.

Taking it further

Plan investigations into the effects of training (repetition) and fatigue on response times.

Links

[Teacher support on Micro:bit site](#)

[NASA site describing results of investigations into astronaut response times](#)

[BBC Bitesize: human reflexes](#)





Image credit: Wiki Commons

Figure 3 Men's 100m final, Olympics 2012, London

