OCR

Friday 6 June 2014 – Afternoon

LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE

R072/02/I How scientific ideas have developed

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Duration: 1 hour

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- This Insert contains the article required to answer Question 1.

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Reaction times

Reaction time has been a favourite subject of scientists since the middle of the nineteenth century.

Reflex Reactions

Figure 1

Some of our reactions are reflexes. These are usually very fast. The patellar reflex (knee-jerk) is well known. Tapping on a tendon with a small hammer stretches the tendon. The reflex produces a movement of the lower leg. This allows us to keep our balance when standing up (Figure 1).

A **reflex** is an unconscious reaction to an external stimulus. It can happen extremely quickly – often less than 100 ms. Other reactions take longer as the subject (the person who is being tested) has to think about how to respond to the stimulus.

Measuring simple reaction times

Figure 2

In a **simple reaction time** experiment, there is only one stimulus and one response. The subject might be required to click a mouse button when a computer display changes colour. If the subject clicks the mouse button too soon, an error is recorded (Figure 2).

A ruler can be used to measure how fast a person reacts. The person doing the investigation drops the ruler without warning. The subject catches the ruler. A long reaction time means that the ruler drops a long way before it is caught. As the ruler is accelerating, the distance dropped is not exactly proportional to the reaction time (Figure 3).

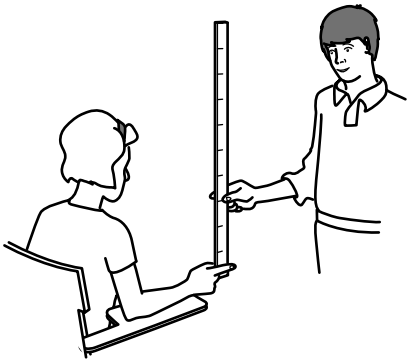


Figure 3

Three students each measured their reactions using a ruler.

These are their results.

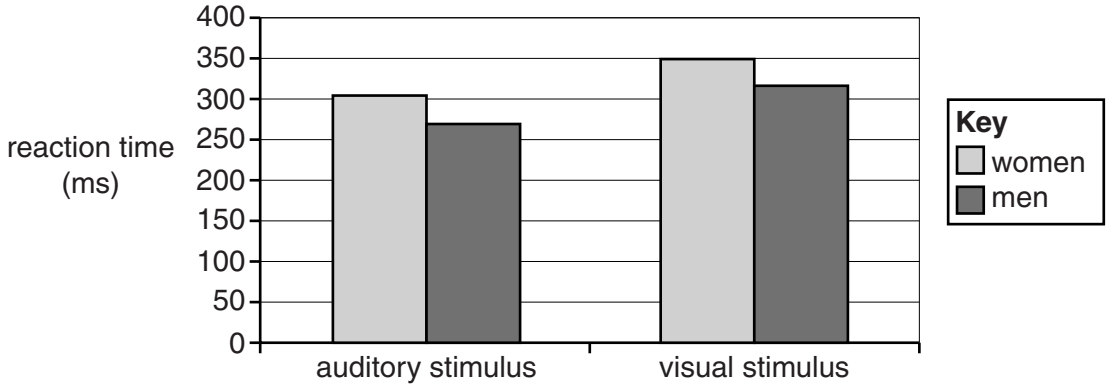
	Distance before the ruler was caught in cm				
Ali	25	30	30	25	25
Charlie	45	40	40	35	40
Phil	92.1	81.3	44.5	43.2	36.4

Table 1

Some investigators measured simple reaction times using different stimuli.
They used a computer to measure the time their subjects took to react to an auditory stimulus (the sound of a buzzer) and a visual stimulus (a colour change).
They also recorded whether their subjects were men or women.

This is what they found.

Mean simple reaction times



Graph 1

Measuring more complex reaction times

In a **recognition reaction time** experiment, there is a stimulus that should be responded to and at least one other that should get no response (distractor). There is still only one correct way to respond. An example of this would be for the subject to click the mouse button when the computer display shows a capital "X" but not if a letter "K" is shown. If the subject clicks when shown the wrong letter this counts as an error. The reaction time measured this way is usually longer than the time taken for a simple reaction test.

In **choice reaction time** experiments, the subject must give a response that matches the stimulus. This might mean pressing a key that matches the number appearing on the screen. The correct response is different for each possible stimulus, so this is usually the slowest reaction time.

Figure 4 shows the equipment used for choice reaction timing. The digits 0, 1, 2, 3 or 4 may appear on the screen in a random order and the subject presses the matching button.

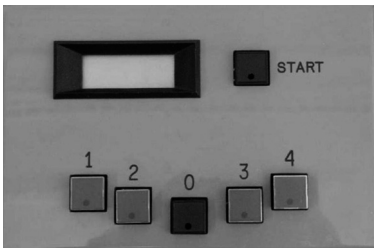


Figure 4

Factors that can change reaction times

Someone suggested that reaction times are longer as people get older. To test this idea, people were divided into groups according to their age. They were each given a choice reaction time test.

Age range in years	6–9	10–14	15–19	20–29	30–39	40–49	50–59	60–69	70–87
Mean reaction time in ms	487	380	265	266	292	321	367	449	560

Table 2

Another investigator looked at the effect of two different drugs on reaction times.
The drugs were alcohol and temazepam. Alcohol is commonly sold in the UK and temazepam is prescribed by doctors to help people sleep.

The subjects were divided into five groups.

Group	Amount of alcohol in blood in mg/100 ml	Amount of temazepam in mg
A	0	0
B	40	0
C	80	0
D	0	15
E	0	20

Table 3

Each group did the same choice reaction time test measuring both the speed of the responses and the number of errors. The results are shown below.

Graph 2