# Unit 2: Does science tell the truth?

**Lesson 2 of 4: Lesson Plan: Is Science always right?**

### Objective of the lesson

##### To examine the Martian canals theory and explore an example of the fallibility of scientists and of scientific theories.

**Lesson Outcomes**

By the end of this lesson most pupils will:

* Describe the planet Mars
* Empathise with people who find that scientific evidence can be misinterpreted
* Explain why the Martian canals theory was mistaken
* Write a report using the words *theory*, *evidence* and *proof*

Some will only:

* Say what Mars looks like using a website image
* Listen to an account of the Martian canals theory and give a reason why it was mistaken
* Describe a Martian in an imaginative way
* Write a short report, giving an example of incorrect interpretation of evidence

Others will also:

* Through explanation, demonstrate understanding of the terms *evidence* and *conclusive proof*
* Link scientific theories to worldviews
* Relate the term *Theory Modification* to improved evidence
* Demonstrate in a report that often evidence may be drawn from mistaken interpretations of what has been observed

## Key words for this unit

## Observatory evidence conclusions

(conclusive) proof theory theory modification (for some)

## Lesson Outcomes (Pupil friendly)

### By the end of this lesson I will be able to ….describe how people can be swept along by scientific ‘evidence’ which later turns out to be mistaken.

### Resources

### The Hubble website for images of Mars: <http://hubblesite.org/newscenter/archive/2001/24/>

* Pupil resource Sheets 1, 2 and 3

### Introduction / Starter activity / first thoughts

What do we know about the planet Mars (its place in solar system, size, colour, climate etc)? Use primary textbooks, prior knowledge, posters of solar system etc.

What does Mars look like? Go to <http://hubblesite.org/newscenter/archive/2001/24/> for an image of Mars and description. Display on interactive whiteboard where available.

### Main Activity

We are going to read a story about two scientists who thought they had made some very exciting discoveries about Mars.

*Read* ***Pupil Resource 1 The Canals of Mars*** *with pupils. This should be followed by a short discussion of information in the boxed text.*

*Pupils then complete either* ***Pupil Resource 2 Percy’s Folly*** *(higher and mid-ability) or* ***Pupil Resource 3 Can you describe a Martian?***

Resources

###### Pupil Resource 1 - The Canals of Mars

**Pupil Resource 2** – Percy’s Folly

**Pupil Resource 3** – Can you describe a Martian?

Sometimes scientists think they have CONCLUSIVE PROOF about a new ‘discovery’ only for it to be overturned later by new ideas backed by stronger EVIDENCE.

We can only say that our THEORIES fit the facts as we see them – but they may change in future when better instruments are invented and more knowledge comes along.

Scientists will sometimes *want* something to be true and will let this cloud their judgement.

### Plenary / last thoughts

Discuss your answers, especially the answer to ‘What effect did his theory have on the people of the time? Did it change the way they thought about the world?

If NASA photographs came back with new evidence that a Martian civilization was living in cities below the surface of Mars, how would you feel? Would it change the way you thought about any of these: Earth? Mars? Humans and their place in the universe? Science? God?

Compose a newspaper headline or short report. The media likes to use the words ‘proof’ and ‘breakthrough’ when reporting about science. Why might this be?

If 2 years later more pictures came back in improved detail, showing the earlier ‘evidence’ to be mistaken, how would you feel?

### Differentiation / Extension

More able/ G + T may be introduced to the term THEORY MODIFICATION to describe the way theories are altered in the light of new evidence. Another suitable example of theory modification is that of dinosaur extinction.

Distinctions could be drawn between the terms ‘evidence’ and ‘proof’.

For the less able: an alternative to answering questions on *Pupil Resource 2* could be to draw out learning imaginatively using *Pupil Resource 3.This activity could be led by a Teaching Assistant. Pupils could discuss their responses in a separate plenary led by the Teaching Assistant.*

Possible pupil internet activity:

Visit <http://mars.jpl.nasa.gov.science> which is the NASA website.

Click on ‘Mars – Extreme Planet’ for Quick Facts, Mars in the solar system, Martian seasons and Martian atlas. Click on ‘Mars for Kids’ for an empathic story, ‘A little rock on Mars’. There is also a crossword and word search only suitable for the more able.

### Assessment

#### The following task will assess pupils’ understanding of the fact that scientific ‘evidence’ and ‘proof’ sometimes lead to inaccurate/wrong judgements. Emphasise to pupils that in the report, the Great Wall of China is seen by Martians as something else – for instance a huge snake, or a deep ravine.

**Assessment Task**

*Imagine you are one of Percy’s Martians looking through a telescope at Earth.*

*You see a long curvy line on the Earth’s surface (it is in fact the great Wall of China).*

*You give an interview to a Martian television reporter describing what you have seen.*

*The report comes on Martian TV. Write down the script – what has been seen (the observation), what you think it is (the interpretation), and how exciting it is.*

*Remember, you are writing down the words the reporter is going to say. That means you will exaggerate and sensationalise what you have been told! You may even tell people not to panic!*

*Use at least one of these words: theory, evidence, proof.*

### Notes to teacher

In this lesson pupils learn that some scientific ‘facts’ – especially how they are presented in the media, and often in textbooks – are in fact theories, and that theories are constantly being changed, modified or even totally abandoned in the light of better evidence. What about theories of sea monsters in ancient times, backed by eye-witness accounts and strange disappearances of whole ships? Today the currently accepted cosmological theory is that the universe began with a big bang and will one day end: not long ago there were many supporters of a rival steady state theory which proposed that the universe had no beginning or end.

In the **Introduction** pupils use the web and/or paper-based materials to find out about Mars, including how it looks.

The **Main Activity** contains a shared reading text entitled **Pupil Resource 1** ‘The Canals of Mars’ which tells of two astronomers who believed they had made some amazing discoveries about Mars. This should be followed by a short discussion of information in the boxed text. The learning points here are that a) theories change in the light of new evidence and b) scientists can be influenced by their own beliefs and desires.

Pupils then complete either **Pupil Resource 2** (higher and mid ability) or **Pupil Resource 3** (lower ability).

In the **Plenary** pupils compose a newspaper headline and reflect on how they would feel if they were suddenly presented with evidence of an underground Martian civilisation, and whether it would change their world view in any way.

There are some today who would argue that science is much more reliable than any other mode of enquiry because it offers not just evidence but conclusive proof about how the world is. They believe that only scientific ‘facts’ are worth pursuing in the human endeavour. This is a form of Scientism. It can lead to modes of thought such as ‘*science* *proves things are correct. Religion can’t prove anything, so why believe in it?’* These ideas are taken up in greater depth in the KS3 SRSP unit, ‘What is science?’

**Duration** 1 hour

**Year Group** Y5 / Y6 (ages 10-11)

**Prev. Know. [teacher]** For in depth information on Mars, visit <http://mars.jpl.nasa.gov/science>

**Prev. Know. [students]** basic knowledge of solar system

**Background Reading** ‘Scientism; Science, Ethics and Religion’ (Ashgate) by Mikael Stenmark. This recommended book addresses such questions as, ‘Can science tell us everything there is to know about reality?’

[www.daviddarling.info/encyclopedia/L/LowellP.html](http://www.daviddarling.info/encyclopedia/L/LowellP.html) gives a short biography of Percival Lowell and shows him at his telescope.

**Cross Curricular Links** Speaking and listening

Critical thinking

Creativity