

The Nature of Science

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Institute

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Equipped with five senses,
humanity explores the universe
and calls the adventure
Science.

So, what is **science**?

On an index card, take a moment and
write down your definition of
science.

sci·ence noun (Google)

- The **intellectual and practical activity** encompassing the **systematic study** of the structure and behavior of the **physical and natural world** through **observation and experiment**
- A particular area of this - *veterinary science*
- A **systematically organized body of knowledge** on a particular subject - the *science* of criminology
- **Knowledge** of any kind

sci·ence noun (dictionary.com)

- a branch of **knowledge** or **study** dealing with a body of **facts** or truths **systematically** arranged and showing the operation of general **laws**
- **systematic knowledge** of the **physical** or material **world** gained through **observation and experimentation**
- any of the branches of **natural** or **physical** science
- **systematized knowledge** in general
- **knowledge**, as of **facts** or principles; **knowledge** gained by **systematic study**

Science in 3 domains

1. A body of knowledge

- facts
- definitions
- concepts
- theories
- laws
- etc.

Science in 3 domains

2. A set of methods and processes

- observing
- measuring
- estimating
- inferring
- predicting
- classifying
- hypothesizing
- experimenting
- concluding
- etc.

Science in 3 domains

3. A way of knowing about nature

- Scientific knowledge is based on evidence.
- Scientific knowledge can last over time.
- Creativity plays an important role in science.
- Background knowledge influences how scientists view data.
- etc.

So, what is the **nature of science?**

NOS seeks to describe the nature of the scientific enterprise and the characteristics of the knowledge it generates.

Why teach the nature of science?

Research shows:

- it helps us better define the boundaries of science and non-science
- increased student interest
- developing awareness of the impacts of science in society

Why teach the nature of science?

To help students develop a better understanding of:

- what science is
- the types of questions science can answer
- how science differs from other disciplines
- the strengths and limitations of scientific knowledge (Bell, 2008)

Key NOS tenets

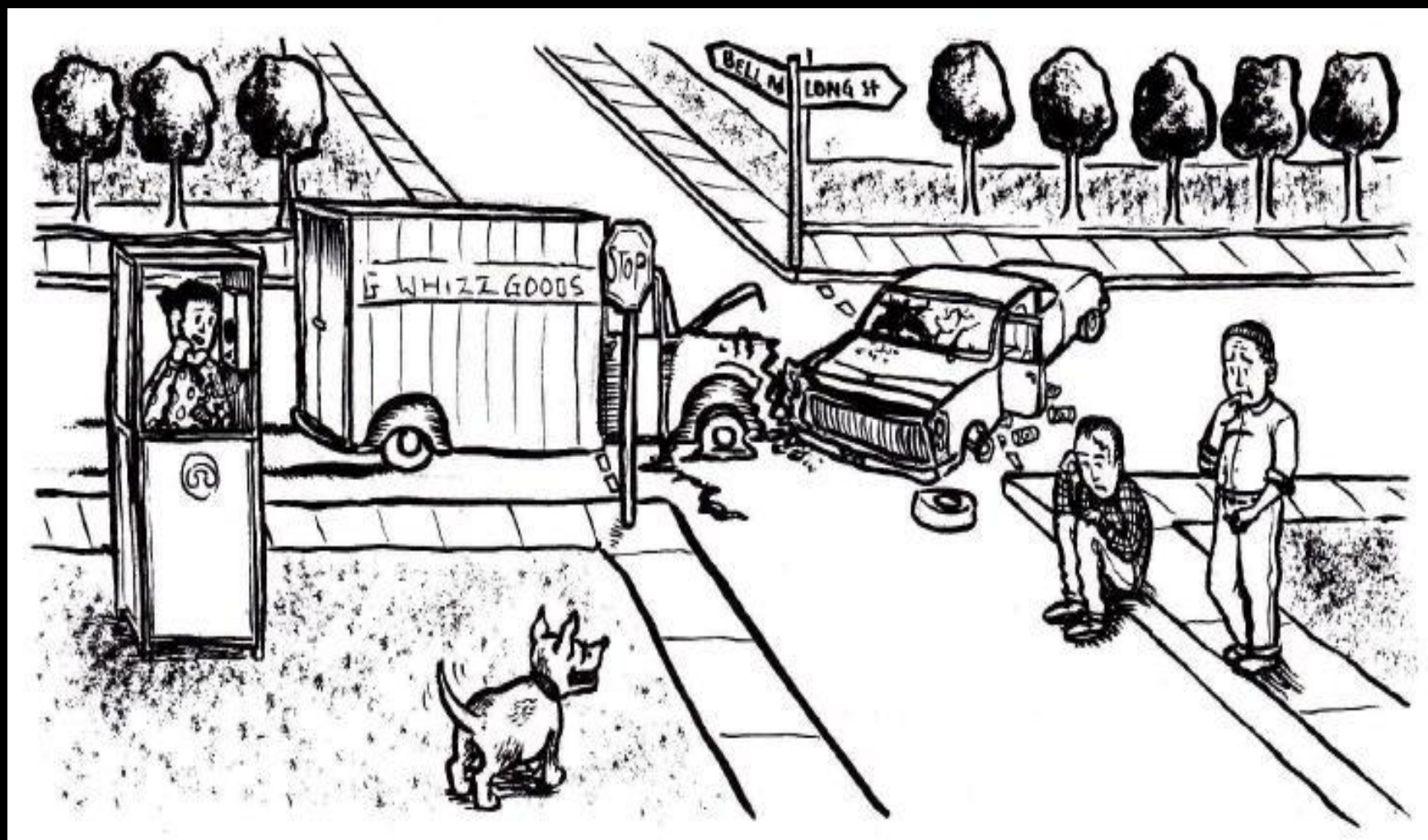
Tentativeness

All scientific knowledge is subject to change in light of new evidence and new ways of thinking. That does not mean that we shouldn't have confidence in scientific knowledge, rather that it may change in the future.

Key NOS tenets

Observation and inference

Observation involves gathering information using the five senses while **inferences** are explanations based on observation and prior knowledge.



Key NOS tenets

Empirical evidence

Scientific knowledge is derived from data and evidence gathered by observation or experimentation.

Key NOS tenets

Scientific laws and theories

A **law** is a succinct description of relationships or patterns in nature based on observation and is often expressed mathematically. Scientific **theories** are broadly based concepts that make sense of a large body of observations and experimentation.

Examples of scientific laws

- Hubble's Law of Cosmic Expansion
- Universal Law of Gravity
- Newton's Laws of Motion
- Law of Superposition
- The Ideal Gas Law
- Archimedes Law of Buoyancy
- Bernoulli's Law

Examples of scientific theories

- Big Bang Theory
- Theory of Evolution
- Heliocentric Theory
- Cell Theory
- Atomic Theory
- Theory of Plate Tectonics
- Germ Theory

Key NOS concepts

Objectivity and subjectivity

Scientists strive to be objective and employ self-correcting mechanisms such as peer review. But intuition, personal beliefs, and social values all play a role in the scientific enterprise.

Key NOS tenets

Scientific methods

scientists employ a wide variety of approaches to generate scientific knowledge. There is no single universal method.

<http://undsci.berkeley.edu/>

Key NOS tenets

Creativity

is a source of innovation and inspiration in science. Scientists use creativity and imagination throughout their investigations.

Effective NOS instruction in the classroom

Kindergarten, first, and second grade students can begin to understand what science is, who does science, and how scientists work through classroom activities, stories about scientists, and class discussions.

Third grade students' knowledge base and observational abilities are increasing; asking scientific questions and constructing reasonable explanations based on evidence; and, communicating their own ideas and investigations.













Dr. Richard Hoffman
1928-2012



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