

Scientific Explanations and Interpretations

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CONCEPT **1**

Scientific Explanations and Interpretations

- Identify and define facts, explanations, and opinions.



"It used to be, everyone was entitled to their own opinion, but not their own facts. But that's not the case anymore." Stephen Colbert, AV Club Interview, January 2006

Can you tell a fact from an opinion? Can you tell when an idea follows logically from a fact? Basing ideas on facts is essential to good science. **Science** is a set of facts, and it is also a set of explanations that are based on those facts. Science relies on facts to explain the natural world.

Facts, Observations, Opinions

Scientists usually begin an investigation with facts. A **fact** is a bit of information that is true. Facts come from data collected from observations or from experiments that have already been run. **Data** is factual information that is not subject to opinion or bias.

What is a fact? Look at the following list and identify if the statement is a fact (from observation or prior experiments), an opinion, or a combination.



FIGURE 1.1

Can you be sure from the photo that Susan has a cold?

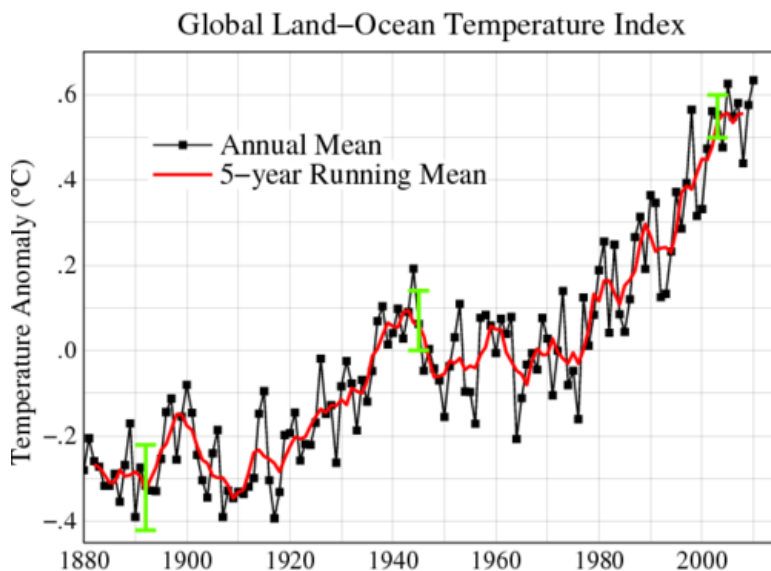
1. Susan has long hair.
2. Susan is sneezing and has itchy eyes. She is not well. She has a cold.
3. Colds are caused by viruses.
4. Echinacea is an herb that prevents colds.
5. Bill Gates is the smartest man in the United States.
6. People born under the astrological sign Leo are fiery, self-assured, and charming.
7. Average global temperature has been rising at least since 1960.

An Analysis

The following is an analysis of the statements above:

1. This is a fact made from observation.
2. The first part is from observations. The second is a fact drawn from the prior observations. The third is an opinion, since she might actually have allergies or the flu. Tests could be done to see what is causing her illness.

3. This is a fact. Many, many scientific experiments have shown that colds are caused by viruses.
4. While that sounds like a fact, the scientific evidence is mixed. One reputable study published in 2007 showed a decrease of 58%, but several other studies have shown no beneficial effect.
5. Bill Gates is the wealthiest man in the United States; that's a fact. But there's no evidence that he's also the smartest man, and chances are he's not. This is an opinion.
6. This sounds like a fact, but it is not. It is easy to test. Gather together a large number of subjects, each with a friend. Have the friends fill out a questionnaire describing the subject. Match the traits against the person's astrological sign to see if the astrological predictions fit. Are Leos actually more fiery, self assured, and charming? Tests like this have not supported the claims of astrologers, yet astrologers have not modified their opinions.
7. This is a fact. The graph below shows the temperature anomaly since 1880. There's no doubt that temperature has risen overall since 1880 and especially since the late 1970s.

**FIGURE 1.2**

Global Average Annual Temperatures are Rising. This graph shows temperature anomaly relative to the 1951-1980 average (the average is made to be 0). The green bars show uncertainty.

Vocabulary

- **data:** Facts that have been uncovered scientifically by systematic observations or experiments.
- **fact:** A bit of information that is true.
- **science:** Knowledge about the natural world gathered systematically.

Summary

- Facts are true. Data, gathered correctly, are facts.
- Some statements that appear to be facts are not.
- All scientific explanations and interpretations are based on facts.

Practice

Use this resource to answer the questions that follow.

<http://www.youtube.com/watch?v=zcavPAFiG14>



MEDIA

Click image to the left for more content.

1. What is science?
2. What is evidence?
3. List the steps of the scientific method (procedure).
4. What happens if a hypothesis is determined to be wrong?
5. Why is peer review important?
6. What is a theory?
7. Why might a theory be modified?
8. Explain the importance of the scientific method.

Review

1. Just because something appears in print doesn't mean it's true. Many stories circulate around the internet and appear to be true but are not. Take a look at <http://www.snopes.com> to see some interesting true and false tales. Think of something that you think is true, but may not be, and look it up. Here's one: a tooth placed in Coca-Cola will dissolve overnight.
2. Neuroscientists have shown that people are more likely to believe a statement if they have heard it before, whether it's true or not. Look in a newspaper or watch television news and find three statements that are not actually true but that the person saying them is hoping will be believed. Is this effective?
3. What is the relationship between observations and facts? What is the relationship between facts and opinions?