

Name: _____

Date: _____

Guided Learning: Science and Testability (Part 3)

Indirect testing... a closer look

The fact that Samoa changed her behavior after marching band season ended refuted explanation IV— that she learned the behavior as a pup. If that were true, you would expect her to continue to greet you more frequently on Mondays and Thursdays. However, the results are otherwise inconclusive because all three other explanations are still possible.

This illustrates a fundamental idea in scientific reasoning:

The most useful scientific tests are those whose results refute almost all plausible explanations for the original observation.

Tests whose results are compatible with multiple explanations are still useful. Often, scientists test explanations in different ways to refute separate competing accounts for a phenomenon.

Reinforcement Check: According to the National Association of Science, what is science and why can some explanations not be evaluated using science?

(After completing this question, check your answer with your teacher and correct it if necessary.)

Thinking about... controlled experiments

Your observation compared Samoa's behavior when you came home right after school with her behavior when you returned at 5:00. Even though it looked like only one thing changed—the time you came home—in actuality, several things changed. During band season, you frequently returned with treats for Samoa; afterward, this stopped. During band season, you came home at a time when she was thirsty; afterward, you didn't. During band season, you were away from Samoa for longer periods of time on Mondays and Thursdays.

Because so many things changed after marching band season ended, there were many explanations compatible with the results. One way that scientists narrow down the number of plausible explanations is by using **controlled experiments**. In a controlled experiment, some factors are purposefully kept the same throughout the investigation. The more things that change from one scenario to another, the more potential there is for multiple explanations.



You begin using a different route on Wednesdays that takes you by the pet food boutique. You still get home from school around 3:30 P.M., but you bring treats home on Wednesdays. After five weeks, you notice Samoa greets you at the door more often on Wednesdays.

1. Which of the original explanations does this support? _____.

2. Does this experiment rule out the other explanations for Samoa's earlier behavior? Explain.

3. Consider the last two observations you have made:

- i. When you came home from school at the same time by the same route, there was no difference from one day to another in Samoa's behavior.
- ii. When you began coming home by a different route on Wednesdays, Samoa began to greet you more often.

Based on i you can assume the day of week is not a relevant factor. Below is a list of the other factors you have identified as possibly affecting how likely Samoa is to greet you at the door. Circle all the factors that remained the same between observation i and ii.

Time you got home

Length of time you were away from Samoa

Whether you went by pet food boutique

4. If you think of these two observations as an experiment, the factors you circled, the factors that did not change from one observation to the next, are called **controlled variables**.

A. Why is it important for scientists to try to determine the factors that might be affecting a given situation when designing a useful experiment?

B. Do you think a scientist can ever be certain he or she knows all the factors that affect a system? Explain.
