

Elementary Statistical Concepts and the
Logic of the Scientific Method
Module 2, Part 1
Logic and Reasoning

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Elementary Statistical Concepts and
the Logic of the Scientific Method
On-line Modules

- Module 1: Knowledge Generation
- **Module 2: The Scientific Method**
 - Part 1: Logic and Reasoning**
 - Part 2: The Scientific Method;
Marrying logic and empiricism
- Module 3: Elementary Statistics &
Research Design
- Module 4: Describing Your Data
- Module 5: Inferential Statistics & Research Design
- Module 6: Selecting Statistics by Design
- Module 7: Research Design and Statistics:
Examples and Practice

Just a suggestion....

- Please open and/or print the handout
associated with this presentation
- Following along with the handout allows you
to add notes as the presentation
goes along
- You can always pause the presentation, too...

Overview of Module 2:

- Building Natural Systems of Knowledge
Requires use of the Scientific Method
- The Scientific Method Marries the Essential
Elements of Logic and Empiricism
- We Need to Know a Bit About Logic

Module 2...

In this Module – Module 2, Part 1

- **Part 1: Introduction to the Essentials of
Logic**

In Part 2:

- Building Knowledge of Natural Systems: Theory
and Hypothesis Testing
- The Scientific Method and the
Elements of a Research Article

Module 2, Part 1 :
Introduction to Essentials of Logic

- Logic and Reasoning
- The Syllogism
- Induction and Deduction
- Preview of Part 2

Reasoning and Logic

- **Logic**

- The bricks and mortar of reasoning – three essential elements:
 - premise, inference, conclusion
- The rules of the game – rules for evaluating a chain of reasoning (i.e., determining soundness)

- **Reasoning**

A linked set of premises, inferences, and conclusions open to clarification and evaluation (i.e., evaluated for “soundness”)

The Bricks and Mortar of Logic

- **Premise** – a declarative sentence included in an argument as support for another declarative sentence, known as a conclusion
- **Inference** – the invisible link between one or more premises to a conclusion
- **Conclusion** – a declarative sentence whose truth value is dependent on one or more premises

Bricks and Mortar of Logic Used in Reasoning: The Syllogism

Example 1:

All cats are animals, Toby is a cat,
therefore, Toby is an animal.

Example 2:

Trees with needles and bearing cones are called
coniferous. This tree has cones and needles.
therefore, it is a coniferous tree.

The Rules of the Game: Evaluating Instances of Reasoning

- If...
 - All premises are true, and...
 - The inference is valid, then....
 - The conclusion must be true and...
- The reasoning is sound

Two Ends of the Spectrum: Deduction and Induction

- **Deduction:** To reach a conclusion by reasoning. To infer from a general principle to a particular instance; reason deductively.
- **Induction:** A principle of reasoning to a conclusion about all the members of a class from examination of only a few members of the class; to infer general principles from examination of a particular.

Bricks and Mortar of Logic Used in Reasoning: Deduction - Review

- Arguing from the general to the specific
- If premises are true and the inference is valid, then, the conclusion must be true.
- All squirrels eat peanuts; my pet is a squirrel.
Therefore.....

Next Up:
The Scientific Method
A Preview:

Theory

Premise

Deduction

Inference

Hypothesis

Conclusion

- We deduce hypotheses from theory. If the theoretical statements are true, and the inference is valid, the hypothesis (containing concrete concepts) must be true.
- Theory is related to hypothesis via deductive logic

In Part 2:
The Scientific Method

- Building Knowledge of Natural Systems: The Scientific Method as Building Theory and Testing Hypotheses
- The Scientific Method and the Elements of a Research Article