

## Good Reasoning

*Logic*, the second subject of the classical *trivium*, deals with the theory of deductive and inductive arguments. It aims to distinguish good reasoning from bad reasoning by studying the laws of *inference*.

*Inference* is the act or process of deriving a conclusion from premises known or assumed to be true or from observations with a certain probability of being correct. "We can *infer* from his face that he lied."

### Deductive reasoning and syllogisms

The first of the two broad methods of reasoning is called *deductive reasoning*; its arguments are called *deductive arguments*. In this type of inference, the argument starts from a general principle and reasons to the specific instance.

*Logical argument* is not simply making statements, engaging in dispute, or stating old prejudices in a new form. A deductive logical argument attempts to support the truth of a proposition called a *conclusion*, based on the truth of a set of propositions called *premises*.

A *syllogism*<sup>1</sup> (Greek, συλλογισμός) is a kind of logical argument in which one proposition (the *conclusion*) is inferred from at least two others (the *premises*). A syllogism consists of at least three parts: a *major premise*, a *minor premise*, and a *conclusion*. Each of the premises has one term in common with the conclusion: the major premise has a *major term* (the predicate of the conclusion); the minor premise has a *minor term* (the subject of the conclusion). A *middle term* connects them. In traditional logic, the form of the syllogism is:

<i>Major premise:</i>	All B are A	"A" is the <i>major term</i>
<i>Minor premise:</i>	All C are B	"C" is the <i>minor term</i>
<i>Conclusion:</i>	All C are A	"B" is the <i>middle term</i>
<i>Major premise:</i>	All men are mortal.	
<i>Minor premise:</i>	Socrates is a man.	
<i>Conclusion:</i>	Socrates is mortal.	

In this famous syllogism "being mortal" is the major term; "Socrates" is the minor term; "being a man" is the middle term.

In everyday arguments a premise is often unstated.<sup>2</sup>

<i>Minor premise:</i>	Because Socrates is a man,
<i>Conclusion:</i>	he will die.

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<sup>1</sup> A syllogism is more correctly a *categorical syllogism*. Aristotle defines *syllogism* as: "a discourse in which, certain things being stated [premises], something other than what is stated [a conclusion] follows of necessity from their being so." (*Prior Analytics*, 24b18-20)

<sup>2</sup> The term *enthymeme* is used to identify a syllogism with an unstated premise.

Logical arguments viewed in their entirety are either *valid* or *invalid*; the propositions that make up the argument are either *true* or *false*. Arguments are never true or false; propositions are never valid or invalid. When an argument is valid and its premises are true, the conclusion is *necessarily true* and the argument is said to be *sound*. Though all its propositions are true, the following is an invalid argument:

*Major premise:* All men are mortal.  
*Minor premise:* Socrates is a man.  
*Conclusion:* Socrates is a Greek.

The form alone makes this argument invalid: *If* all B are A; and *if* all C are B; *then* all C are D. The truth of the premises and conclusion has nothing to do with determining whether the argument is valid or invalid.

We use the words *if... then* to make a valid or logically correct inference. We are asserting the validity of an argument, not the truth of its propositions: "If all swans are white, then some swans are white." We use the words *since ... therefore* to make an actual inference about the truth of the conclusion, the soundness of our reasoning. We are asserting both the validity of the argument and the truth of all its propositions: "Since all swans are [in fact] white, therefore [it follows that] some swans are [indeed] white."

### Inductive reasoning

The second of the two broad methods of reasoning is called *inductive reasoning*; its arguments are called *inductive arguments*. In this type of inference, a more general conclusion is reached based on one or a number of specific observations or experiences. Specific propositions are used to infer general propositions:

*Observation:* This person has died after touching the water.  
*Conclusion 1:* All people who touched the water will [probably] die.  
*Conclusion 2:* The water [probably] contains a toxic agent.  
*Conclusion 3:* The thing that killed him [probably] entered his body through his skin.

With deductive reasoning, in a valid argument with true propositions, the conclusion was necessarily true. With inductive reasoning the conclusion has *a probability* of being correct. If the conclusion can be tested by additional observations, it can be disproved by a single observation to the contrary. If a general observation contains or implies the word "all" it can be contradicted by a single contrary observation. As Mortimer Adler says, "The search for negative instances is unending; scientific generalization can never be finally or completely verified."<sup>3</sup>

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<sup>3</sup> For this quote and other discussion, see *Aristotle for Everybody*, ch. 17, "Logic's Little Words" (Mortimer J. Adler).