HOW TO ANALYZE AN ARGUMENT

What does it mean to provide an argument for a statement?

“To provide an argument for a statement is an activity we carry out both in our everyday lives and within the sciences. We provide arguments for statements if we want to convince someone of their truth. We provide arguments in order to justify a belief that we take to be true; and we provide arguments in order to get to know the consequences of actions and events, i.e. in order to examine the consequences following from certain basic assumptions. We use arguments in many different contexts we find ourselves in, for instance if we want to show how general laws apply to singular cases, if we want to explain the phenomena of nature, or if we want to give a mathematical proof.”[1]

Providing arguments for statements is an activity that is undertaken for a rhetorical purpose, namely for the purpose of finding out whether the statement is true or for the purpose of convincing another person of the truth of this statement. We come across arguments both in spoken and written language, in what people say and in what they have written.

When we provide arguments for the truth of a statement, we make use of a language (spoken or written). If we want to convince a person of the truth of a statement by argument, then we better use a language that both we and the person we address speak and understand.

What is an argument?

An argument is a sequence of propositions. However, not every sequence of propositions is an argument. A sequence of propositions is an argument if and only if the last proposition of the sequence, the **conclusion** of the argument, is related to the preceding propositions, the **premises** of the argument, in a certain way.

Deductive and inductive arguments

We distinguish between deductive arguments on the one hand and inductive arguments on the other. The distinction concerns the way in which the premises of an argument are related to its conclusion.

[1] Quoted after Axel Bühler, *Einführung in die Logik*. Argumentation und Folgerung. Freiburg/München 1992, p. 11/2.

Deductive arguments

An argument is deductive if and only if its conclusion **is logically deducible** from the conjunction of its **premises**. The **conjunction** of the premises is the connection of these premises by "and". (There are arguments with only one premise. The logic of such arguments does not differ from the logic of more complex arguments, i.e. those that have more than one premise.)

What does it mean to say that a conclusion is logically deducible from a conjunction of premises? A conclusion **is logically deducible** from a conjunction of premises if and only if the truth of all premises (i.e. the truth of the conjunction of premises) guarantees the truth of the conclusion.

A deductive *argument* consists of a conjunction of premises and a conclusion, such that if the premises are all true, then the conclusion is necessarily true.

Here is an example of a deductive argument:

All humans are mortal.	(1. premise)
Socrates is human.	(2. premise)
Socrates is mortal.	(Conclusion)

We have to distinguish between the **logical correctness** or **validity** of a deductive argument on the one hand and the **truth** of its premises and its conclusion on the other. **Logical correctness** or **validity** is a property of a deductive argument and concerns the inferential relationship between a conjunction of premises and a conclusion: the inference from the premises to the conclusion is valid.
Truth on the other hand is a property of a proposition. The example given above is an example of a valid argument of which all premises are true.

Examples of logical forms of deductive arguments:

(Pn = Premise number, C = Conclusion)

Syllogism "Barbara"

P1: All humans are mortal.
P2: Socrates is human.
C: Socrates is mortal.

Transitivity of Implication

P1: All cats are mammals.
P2: All mammals are animals.
P3: All animals are creatures of God.
C: All cats are creatures of God.

Modus Ponens

P1: If it rains, then the ground is wet.
P2: It rains.
C: The ground is wet.

Modus Tollens

P1: If it rains, then the ground is wet.
P2: The ground is not wet.
C: It does not rain.

This is just a small selection of examples of logical forms of deductive arguments. As the premises of these arguments are true, these are all valid arguments.

Inductive Arguments

"Inductive arguments, unlike deductive arguments, provide conclusions whose content exceeds that of their premises. … To do this, inductive arguments must sacrifice the necessity of deductive arguments. … even though we cannot guarantee that the conclusion of an inductive argument is true if the premises are true, still, the premises of a correct inductive argument do support or lend weight to the conclusion. … among correct inductive arguments there are degrees of strength or support. … The premises of a correct inductive argument may render the conclusion extremely probable, moderately probable, or probable to some extent. Consequently, the premises of a correct inductive argument, if true, constitute reasons, of some degree of strength, for accepting the conclusion. … The degree of support of the conclusion by the premises of an inductive argument can be increased or decreased by additional evidence in the form of additional premises. … it is a general characteristic of inductive arguments, that additional evidence may be relevant to the degree to which the conclusion is supported."[2]

An example of an inductive argument:

"By far the simplest type of an inductive argument is **induction by enumeration**. In arguments of this type, a conclusion about **all** of the members of the class is drawn from premises that refer to **observed** members of that class.

> Suppose we have a barrel of coffee beans. After mixing them up, we remove a sample of beans, taking parts of the sample from different parts of the barrel. Upon examination, the beans in the sample are all found to be grade A. We then conclude that all of the beans in the barrel are grade A."[3]

P: All beans in the observed sample from the barrel B are grade A.
K: All beans in the barrel B are grade A.

[2] Quoted from Wesley C. Salmon, *Logic.* 3rd ed. Englewood Cliffs, New Jersey 1984 (Prentice-Hall), p. 88.

[3] Quoted from Wesley C. Salmon, *Logic.* 3rd ed. Englewood Cliffs, New Jersey 1984 (Prentice-Hall), p. 89.

Fallacies

Deductive Fallacies

Some sequences of propositions rhetorically pretend to provide a deductive argument for the truth of a certain proposition (by using conjunctions like “therefore”, “because”, “as”, “if ... then” for example) but fail to do so because the proposition that is supposed to be the conclusion is not logically deducible from the propositions that are supposed to function as premises. Such sequences of propositions are **deductive fallacies**.

Here are a few examples of logical forms of deductive fallacies:

Affirming the Consequent

P1: If it rains, then the ground is wet.
P2: The ground is wet.
K: It rains.

Denying the Antecedent

P1: If I am in Oslo, then I am in Norway.
P2: I am not in Oslo.
K: I am not in Norway.

None of these sequences of sentences provides an argument as the conjunction of the so-called premises can be true even though the so-called conclusion is false. Both “If it rains, then the ground is wet” and “The ground is wet” can be true even though it does not rain (there can be another reason for the ground being wet). And even if “If I am in Oslo, then I am in Norway”, and “I am not in Oslo” are both true, it is fully possible that I am in Norway; I can be in Bergen for example. These sequences of sentences are pseudo-arguments or fallacies; their rhetoric somehow tries to imitate the rhetoric of real arguments.

Inductive Fallacies

“There are certain premises that can render inductive arguments either absolutely or practically worthless. We shall refer to these errors as **inductive fallacies**. If an inductive argument is fallacious, its premises do not support its conclusion.”[4]

Here is an example for an inductive fallacy:

Insufficient statistics

P1: All swans observed in Europe are white.
K: All swans are white.

What makes the argument fallacious is the fact that there are black swans in Australia. The observational basis for the conclusion is insufficient. The inductive generalization has been made before enough data had been accumulated.

[4] Quoted from Wesley C. Salmon, *Logic.* 3rd ed. Englewood Cliffs, New Jersey 1984 (Prentice-Hall), p. 88.

How to Justify a Proposition by way of Deduction

How do we have to proceed in order to justify a proposition *p* deductively*,* that is in order to show that *p* is true? We have to provide a deductive argument for the truth of *p.*

In order to do so we have to proceed in two steps:
First, we have to indicate a sequence of propositions from which the proposition *p is logically deducible*. *Second*, we have to show that **all** the propositions of this sequence are *true*.

How to Test Sequences of Propositions that Claim to Provide a Deductive Argument

What do we have to do in order to test whether a sequence of propositions actually provides a *valid deductive argument* for a certain proposition, i.e. in order to find out whether the sequence of propositions convinces us of the truth of a certain proposition?

The ***first* step** is to test whether the sequence of propositions provides an argument or whether it is no more than a fallacy. If it provides a valid inference from the premises to the conclusion, if it is logically correct, then it does indeed provide an argument, then the proposition which is meant to be the conclusion follows logically from the propositions that are meant to function as premises. In order to go for this first step, we have to analyze the *logical form* of the sequence of sentences.
Often, it is not easy to recognize the logical form of a deductive argument brought forth in a text spoken or written in a natural language. The art of analyzing arguments presented in a natural language is above all the art of recognizing a certain logical form in a sequence of sentences.

The ***second* step** is to test whether the premises of the deductive argument actually are true. If these premises are true, the conjunction of these premises is true, and then the conclusion is true as well. In most cases we cannot decide whether a proposition that functions as a premise in an argument is true or false by a simple analysis of its logical form; we must instead check whether the proposition corresponds to the facts in the real world or not.

First step
The *first step* of an analysis of the logical form of a sequence of sentences claiming to provide a deductive argument leads to one of two possible results:
Either the sequence of sentences does indeed provide a deductive argument, the inference from the premises to the conclusion is logically correct or valid;
or the sequence of sentences does not provide a deductive argument, it is a pseudo-argument.
In the first case we can go right from the first to the *second step* of the analysis of the argument. In the second case there are two possibilities of how to proceed: Either we leave it there and stay with the diagnosis of a fallacy. We simply conclude that the sequence of sentences claiming to provide an argument does not provide any valid

inference to the proposition that was meant to be its conclusion. Or we try (bearing in mind the principle of charity) to transform the fallacy into a valid deductive argument, for example by adding further propositions as premises. If we succeed to provide a valid inference from the premises to the conclusion, we must continue with the *second step*.

Second Step

The test of the truth value of the premises of an argument again leads to one of two possible results: *Either* all the premises actually are true and therefore the conjunction of these premises is true as well. *Or* not all of the premises are true (at least one of these premises is false); in this case the conjunction of the premises is false. In the first case we can infer the truth of the conclusion. In the second case we have to admit that the argument (despite its logical correctness!) is not suited to convince us of the truth of its conclusion.

Please note:

A logically correct or valid deductive argument of which some premises are false does _not_ allow for any inference concerning the truth value of its conclusion.

The following three arguments are examples of *logically correct* arguments (syllogismes of the form “Barbara”: All A are B, this C is an A. Thus this C is a B.)

(1)	All humans are immortal. Socrates is human. Socrates is immortal.	Here the first premise is false, the other true, but the conclusion is false.
(2)	All humans are wise. Alle primates are human. Alle primates are wise.	Here both the premises as well as the conclusion are false.
(3)	All senators are old. All over 80 are senators. Alle over 80 are old.	Here both premises are false, while the conclusion is true.

Always keep in mind the distinction between the logical correctness or validity of a deductive argument on the one hand and the truth of the propositions which function as its premises on the other.
Common language does not always make this distinction.
Make the distinction a part of your own use of language! [5]

[5] Further reading: Wesley C. Salmon, *Logic*. 3rd ed. Englewood Cliffs, New Jersey 1984. The logic of induction is a complicated matter. Those interested in the debate may start with Nelson Goodman’s “Riddle of Induction”; see Nelson Goodman, Fact, Fiction, and Forecast. Cambridge/mass. And London/England, 1st edition 1979 (Harvard University Press), chapter III.