#### **Evaluating Arguments**

#### **Validity, Truth, Soundness, Strength and Cogency**

Every argument contains two kinds of claim: a claim that certain things are the case (***a factual claim***), and a claim that those things are evidence or reasons for something that follows from their being true (***an inferential claim***).

The evaluation of an argument entails the evaluation of the factual claims and the inferential claim contained within that argument. However, it is the inferential claim that can be thought of as the most important of the two. This is because if the inferential claim is false, then it does not matter whether the factual claims are true or false. Determining that the inferential claim is false is sufficient to determine that one is dealing with a bad argument. In such cases the argument is of no use, and it is therefore unnecessary to continue any further by trying to establish whether the factual claims made in the premises are true.

For this reason, it makes sense to test the inferential claim first, and only if the premises do support the conclusion will it then be necessary to test the factual claims of the premises.

Deductive arguments will be considered first, and then inductive arguments.

**Deductive arguments**

A deductive argument is an argument where it is claimed that the conclusion necessarily follows from the truth of the premises. If the conclusion does necessarily follow from the truth of the premises, then the argument is said to be **valid**. Therefore, a **valid deductive argument** is an argument in which the conclusion cannot be false if the premises are true. An **invalid deductive argument** is an argument that is *claimed* to be deductive, but where the conclusion does not *necessarily* follow from the truth of the premises.

These definitions of ‘valid’ and ‘invalid’ are such that there can be no degrees of validity and invalidity. A deductive argument must be either valid (if the conclusion follows of necessity from the truth of the premises), or invalid (if the argument is claimed to be deductive but the conclusion does not follow of necessity from the truth of the premises); no deductive argument can be ‘almost’ valid or ‘almost’ invalid.

The first step in testing the validity of an argument is to assume that all the premises are true. Having made that assumption, we then determine whether it is possible for the conclusion to be false. Hurley (2003: 41-2) discusses the following example:

All television networks are media companies.

NBC is a television network.

Therefore, NBC is a media company.

In this example both of the premises are actually true, but that does not matter as the first step is to assume that they are true. The next step is to determine whether, assuming that those premises are true, it is possible for the conclusion to be false. Clearly, in this case it is not possible for the premises to be true and the conclusion to be false, so this is a valid deductive argument.

If we assumed the premises to be true and then claimed that the conclusion could be false, then we would have asserted a *contradiction* because if NBC is a television network (premise two), and all television networks are media companies (premise one), then it cannot be the case that NBC is not a media company.

Notice that the actual truth of the premises makes no difference to determining whether the argument is valid or not. In the example above the premises were actually true, but in the following example (modified from Hurley, 2003: 42) both premises are false but the argument is valid:

All car manufacturers are computer manufacturers.

United Airlines is a car manufacturer.

Therefore, United Airlines is a computer manufacturer.

In determining whether this is a valid argument it is not necessary for someone to know whether it is true that all car manufacturers are indeed computer manufacturers, or whether it is true that United Airlines is a car manufacturer. All that is necessary is that we determine whether the conclusion could be false *if* the premises are true. That can be done irrespective of knowledge of the truth or falsity of the premises.

The following is an example (taken from Hurley, 2003: 42) of an invalid argument:

All banks are financial institutions.

Wells Fargo is a financial institution.

Therefore, Wells Fargo is a bank.

Both of the premises in this argument are true, but the conclusion does not follow of necessity from the truth of the premises (while it may be the case that all banks are financial institutions, it is not the case that all financial institutions are banks).

Notice that this argument is invalid despite the fact that the conclusion is actually true, Wells Fargo is a bank. This is because there is no contradiction in assuming the premises true and the conclusion false. Given the information in the premises, they could have been true and yet the conclusion could still have been false (despite the fact that in reality it isn’t).

These examples illustrate the fact that:

In general, validity is not something that is uniformly determined by the actual truth or falsity of the premises and conclusion. … Rather, validity is something that is determined by the *relationship* between premises and conclusion. The question is not whether premises and conclusion are true or false, but whether the premises *support* the conclusion. (Hurley (2003: 42)

Notice that the claim in the quotation above contains the qualification ‘in general’. This is because there is *one* arrangement of truth and falsity in premises and the conclusion that does determine the validity of an argument. Any deductive argument in which the premises are actually true and the conclusion is actually false will be an invalid argument.

The reason for this is that the definition of an invalid argument is one in which the premises can be true and the conclusion false, and that is precisely the situation that obtains in such cases.

The idea that any deductive argument having actually true premises and a false conclusion is invalid may be the most important point in all of deductive logic. The entire system of deductive logic would be quite useless if it accepted as valid any inferential process by which a person could start with the truth in the premises and arrive at falsity in the conclusion. Hurley (2003: 43)

The relationship between the validity of a deductive argument and the truth or falsity of its premises and conclusion can be summarised as follows:

|  |  |  |
| --- | --- | --- |
| **Premises** | **Conclusion** | **Validity** |
| T | T | ? |
| T | F | Invalid |
| F | T | ? |
| F | F | ? |

A **sound argument** is a *deductive* argument that is *valid* and where *all the premises are true*. For an argument to be sound it is necessary for all three conditions (being a deductive argument, being valid and all the premises being true) to be met. If the argument is a deductive argument and one or both of the other two conditions is not met, then the argument is *unsound*.

An **unsound argument** is a deductive argument that is invalid, has at least one false premise, or is both invalid and has at least one false premise.

A sound argument and a ‘good’ deductive argument amount to the same thing because a sound argument is a valid argument where all the premises are true, and a valid argument that has true premises must also have a true conclusion (which means that it must be a good argument).

**Sound argument = Valid argument + All true premises**

One qualification is necessary in relation to this definition of a sound argument. For an argument to be unsound any premises that are untrue must be required to validly support the conclusion. If a deductive argument contains a false premise, but that premise is superfluous, then the argument would still be sound.

Equally, if an argument is sound, then no addition of false premises will render it unsound. This is because any such premise would be superfluous, and therefore not part of the argument.

**Inductive arguments**

Inductive arguments can be divided into two types:

**Strong inductive argument**: an inductive argument in which it is improbable that the conclusion be false if the premises are true. In Strong inductive arguments the conclusion does follow *probably* from the truth of the premises.

**Weak inductive argument**: an inductive argument in which the conclusion does not follow probably from the truth of the premises, despite the fact that it is claimed to.

The procedure for determining the strength of inductive arguments is similar to the procedure for determining the validity of deductive arguments. Like the procedure for determining the validity of deductive arguments, the procedure for determining the strength of inductive arguments begins by assuming that the premises are true. Having done so, we determine whether, on the basis of the assumption that the premises are true, the conclusion is *probably* true.

Hurley (2003: 44) gives the following example:

All dinosaur bones discovered to this day have been at least 50 million years old.

Therefore, probably the next dinosaur bone to be found will be at least 50 million years old.

In this case the premise is true, but that fact is irrelevant to the procedure of determining the strength of this inductive argument because the first step in that procedure is to assume that the premise is true. On the assumption that the premise here is true, the conclusion is also probably true, so the argument is strong.

Hurley (2003: 44) also gives this example:

All meteorites found to this day have contained gold.

Therefore, probably the next meteorite to be found will contain gold.

In this case the premise is false, but that makes no difference to the procedure of determining the strength of this inductive argument because the first step in that procedure is to assume that the premise is true. On the assumption that the premise is true here, the conclusion is also probably true, so the argument is strong.

Another example from Hurley (2003: 45):

When a lighted match is slowly dumped into water, the flame is snuffed out.

But gasoline is a liquid, just like water.

Therefore, when a lighted match is slowly dumped into gasoline, the flame will be snuffed out.

This is an argument from analogy (based on the fact that both water and gasoline are liquids).

In this example the premises are true, but the conclusion is probably false. Following the procedure for determining the strength of an inductive argument requires us to assume the truth of the premises, and if we do so in this case it does not seem likely that the conclusion could be true. Therefore, the argument is weak.

Another example (Hurley, 2003: 45):

During the past 50 years, inflation has consistently reduced the value of the American dollar.

Therefore, industrial productivity will probably increase in the years ahead.

In this example the premise is actually true, and in reality the conclusion is also probably true, but the probability of the conclusion does not follow from the assumption of the truth of the premise. There is no direct connection between inflation and increased industrial productivity, so the premise is irrelevant to the conclusion and therefore provides no probabilistic support for that conclusion. The premise is, therefore, probably true independently of the premise. This means that the argument is weak.

The examples above show that the strength or weakness of an inductive argument is the result of the probabilistic support the premises give to the conclusion, rather than the result of the actual truth or falsity of the premises and conclusion.

As with the analysis of deductive arguments, there is only one arrangement of truth and falsity that always produces the same result. True premises and a probably false conclusion (as in the lighted match argument above) always produce an inductive argument that is weak.

The relationship between the strength of an inductive argument and the truth or falsity of its premises and conclusion can be summarised as follows:

|  |  |  |
| --- | --- | --- |
| **Premises** | **Conclusion** | **Strength** |
| T | Probably T | ? |
| T | Probably F | Weak |
| F | Probably T | ? |
| F | Probably F | ? |

A major difference between the validity and invalidity of deductive arguments and the strength and weakness of inductive arguments, is that the strength and weakness of inductive arguments admits of degrees.

Inductive arguments that are judged to be strong must have a conclusion that seems to be more probable than improbable. One way of putting that is to say that the likelihood of the conclusion being true must seem to be more than 50%. The strength of an argument increases as the probability of the conclusion being true increases.

Hurley (2003: 46-7) gives the following two arguments as examples:

This barrel contains 100 apples.

Three apples selected at random were found to be ripe.

Therefore, probably all 100 apples are ripe.

This barrel contains 100 apples.

Eighty apples selected at random were found to be ripe.

Therefore, probably all 100 apples are ripe.

The first argument is weak and the second argument is strong. However, in each case the weakness and strength of the arguments is a matter of degree. Each could be made stronger by increasing the size of the sample, and each could be made weaker by decreasing the size of the sample. The addition of premises to an inductive argument can also strengthen or weaken it. For example, if the premise ‘one unripe apple that had been found earlier was removed’ was added to either argument, it would weaken that argument.

A **cogent argument** is an *inductive argument* that is *strong* and where *all the premises are true*. The absence of either of those two conditions renders an inductive argument uncogent.

An **uncogent argument** is an inductive argument that is weak, has one or more false premises, or is both weak and has one or more false premises.

A cogent argument is the inductive analogue of a sound deductive argument and is what is meant by a “good” inductive argument without qualification. Because the conclusion of a cogent argument is genuinely supported by true premises, it follows that the conclusion of every cogent argument is probably true. (Hurley, 2003: 47)

**Cogent argument = Strong argument + All true premises**

Inductive arguments are vulnerable to new evidence, whereas deductive arguments remain deductive regardless of the addition of new premises. Inductive arguments can either be strengthened or weakened by the addition of new premises.

**References**

Hurley, P. J. (2003) *A Concise Introduction to Logic*, eighth edition, Belmont, CA: Wadsworth/Thomson Learning.

**Further Reading**

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