

Soundness and Validity

Consider this argument:

P1. All humans are mortal.

P2. Socrates was a human.

C. Therefore, Socrates was mortal.

This argument is **sound** because it is both (i) **deductively valid** and (ii) all of its **premises are true**. Validity has to do with the *form* of an argument whereby the conclusion is *entailed* by or *follows from* the premises. The premises need not be true for an argument to be valid:

P1. The sun is a ball of wax.

P2. All balls of wax have no mass.

C. The sun has no mass.

This is obviously a terrible argument (since both of its premises are clearly false in addition to the conclusion), but it is still a valid argument. If we *assume* the truth of the premises, the conclusion follows.

Here's a famously invalid form of argument called "affirming the consequent":

P1. Whenever it rains, John takes out his umbrella.

P2. John took out his umbrella.

C. It rained.

Why is this invalid? Because John taking out his umbrella is only a **necessary condition** of it raining, not a **sufficient condition**. If the **antecedent** (the first part) of premise 1 is true, then the **consequent** (the second part) of premise 1 is *always* true. But the consequent can be true without the antecedent being true. It could have been particularly sunny and John wanted some shade, so he took out his umbrella and used it as a parasol. It didn't need to be the case that it rained in order for John to have taken out his umbrella. It might have rained, but it needn't have, so we can't deductively infer that it rained. But according to premise 1, it must be the case that John takes out his umbrella if it rains.

Notice that there is another argument here that looks similar but *is* deductively valid:

P1. Whenever it rains, John takes out his umbrella.

P2. John didn't take out his umbrella.

C. It didn't rain.

This argument is called ***modus tollens*** or “the way of denying” or “denying the consequent.” It is a common form of deductive inference. It works because the consequent is always the necessary condition of the antecedent. So if you remove the necessary condition (if you say John didn’t take out his umbrella), then there’s no way it could have rained. That because if it rained, it *had to* have been the case that John took out his umbrella.

It is also possible to have an *unsound* argument that is valid and has a true conclusion:

P1. The sun is made of cheese.
P2. Any star made of cheese has a mass of 1.989×10^{30} kg.

C. The sun has a mass of 1.989×10^{30} kg.

The first two premises are clearly false. In fact, premise 2 may even be conceptually incoherent (is a star still a star if it is made of cheese?), but the conclusion is true. Moreover, the form is valid: *if* the sun were made of cheese, and *if* any star made of cheese has a mass of 1.989×10^{30} kg, then the sun would have to have a mass of 1.989×10^{30} kg. But the fact that the sun actually does have a mass of 1.989×10^{30} kg is a complete coincidence and has nothing to do with the soundness of this argument.

There are very many different forms of valid argumentation that are not mentioned here. There are also many formal fallacies. But the most important thing to remember is that **a *valid* argument with all *true* premises can never lead you to a false conclusion**. If the form is good and the premises true, it’s sound. But just because the conclusion is true does not mean that it is either sound or valid.

Further reading: <http://www.jimpryor.net/teaching/vocab/validity.html>