

This is good too, if not so good as our last example. It could, I suppose, convey some insight to a sheltered three-year-old. Its virtues, according to hoary tradition, are these:

1. Its premises are true.
2. Its reasoning is valid.

Now obviously, these virtues don't by themselves add up to a prize-winning argument. There are other things we'd like—such as significance, substance, relevance to some larger context—but the two listed above *are* virtues. Arguments that lack them are not likely to convey insight into true conclusions. So they are as good a place as any to start if we want to understand what makes an argument good.

Virtue 1, however, is the business of just about everybody but the logician. To tell whether or not a given premise is true (except for logically true or logically false propositions, cases to which we will later return), we must turn to science, conscience, or common sense—not to logic.

1.2 VALIDITY AND COUNTEREXAMPLES

That leaves us with virtue 2, the one that generally interests logicians. Most logicians have belonged to a school of thought known as the **classical tradition**. In the first four parts of this book we will consider logic from the classical perspective, though in the fifth we shall step outside of it. To say that an argument is **valid** is, according to the classical tradition, to say that there is no way for the conclusion not to be true while the premises are true. We'll sometimes put this in terms of "possible situations": There is no possible situation in which the premises are true but the conclusion isn't.

The Socrates argument is valid, for there is no possible situation in which all men are mortal, Socrates is a man, and Socrates is not mortal; we can't even coherently think such a thing.

The end-in-itself argument is **invalid** (i.e., not valid), for there is a possible situation in which the premises are true and the conclusion isn't. That is, it is possible that humans are the only rational beings and that rationality alone enables a being to make moral judgments but that humans are not the only ends-in-themselves. One way this is possible is if being an end-in-itself has nothing to do with the ability to make moral judgments, but rather is linked to some more general capacity, such as sentience or the ability to live and flourish. Thus perhaps other critters are also ends-in-themselves even if the argument's premises are true.

A possible situation in which an argument's premises are true and its conclusion is not true is called a **counterexample** to the argument. We may define validity more briefly simply by saying that a valid argument is one without a counterexample.

When we speak of possible situations, the term 'possible' is to be understood in a very broad sense. To be possible, a situation need not be something we can

bring about; it doesn't even have to obey the laws of physics. It just has to be something we can **coherently conceive**—that is, it has to be thinkable and describable without self-contradiction.

Thus, intuitively,³ to tell whether or not an argument is valid, we try to conceive or imagine a possible situation in which its premises are true and conclusion is untrue. If we succeed (i.e., if we can describe a counterexample), the argument is invalid. If we fail, then either we have not been imaginative enough or the argument is valid. This makes logicians nervous; they'd like to have a test that doesn't rely on human ingenuity; much of this book will be devoted to explaining what they do about this anxiety and how their efforts fare.

But most people are not so skittish. We appeal to counterexamples almost unconsciously in everyday life. Consider this mundane argument:

They said on the radio that it's going to be a beautiful day today.
∴ It is going to be beautiful today.

One natural (albeit cynical) reply is, "They could be wrong." This reply demonstrates the invalidity of the argument by describing a counterexample—that is, a possible situation in which the conclusion ('It's going to be a beautiful day today') is untrue even though the premise ('They said so on the radio') is true: namely, the situation in which the forecasters are wrong.

A counterexample need not be an actual situation, though it might; it is enough that the situation be conceptually possible. Thus it need not be *true* that the forecasters are wrong; to see the invalidity of the argument, we need only realize that it is *possible* they are wrong.

To give a counterexample, then, is merely to tell a kind of story. The story needn't be true, but it must be conceptually coherent. The cynical respondent to our argument above hints at such a story with the remark "They could be wrong."

That's enough for casual conversation. But for logical analysis it's useful to be more explicit. A well-stated description of a counterexample should contain three elements:

1. Affirmations of all the argument's premises.
2. A denial of the argument's conclusion.
3. An explanation of how this can be—that is, how the conclusion can still be untrue while the premises are all true.

If we flesh out the cynic's counterexample to make all of these elements explicit, the result might be something like this:

They said on the radio that it's going to be a beautiful day today. But they are wrong. A cold front is moving in unexpectedly and will bring rain instead of a beautiful day.

³ When I say 'intuitively', I mean from an informal point of view. We are still talking about thoughts here, not symbols. This is typical of informal logic. The formal, symbolic approach begins with the next chapter.

All three elements are now present. The first sentence of this “story” affirms the premise. The second denies the conclusion. The third explains how the conclusion could be untrue even though the premise is true.

This is not, of course, the only possible situation that would make the premises but not the conclusion true. I made up the idea of an unexpected cold front more or less arbitrarily. There are other counterexamples as well. Maybe an unexpected *warm* front will bring rain. Or maybe there will be an unexpected dust storm. Or maybe the radio announcer knew it was going to be an awful day and flat out lied. Each of these scenarios is a counterexample. This is typical; invalid arguments usually have indefinitely many counterexamples, each of which is by itself sufficient to show that the argument is invalid.

Let’s consider another example. Is the following argument valid or invalid?

All philosophers are freethinkers.

Al is not a philosopher.

∴ Al is not a freethinker.

To answer, we try to imagine a counterexample. Is there a way for the conclusion not to be true while the premises are true? (To say that the conclusion is not true, of course, is to say that Al *is* a freethinker.) A moment’s thought should reveal that this is quite possible. Here’s one counterexample:

All philosophers are freethinkers and Al is not a philosopher, but Al is nevertheless a freethinker, because there are some freethinking bricklayers who are not philosophers, and Al is one of these.

Again all three elements of a well-described counterexample are present. The statement ‘All philosophers are freethinkers and Al is not a philosopher’ affirms both of the premises. The statement ‘Al is nevertheless a freethinker’ denies the conclusion, and the remainder of the story explains how this can be so. The story is perfectly coherent, and thus it shows us how the conclusion could be untrue even if the premises were true.

Notice again that the counterexample need not be an actual situation. It’s just a story, a scenario, a fiction. In fact, it isn’t true that all philosophers are freethinkers, and maybe it isn’t true that Al (whoever Al is) is a freethinker, either. That doesn’t matter; our story still provides a counterexample, and it shows that the argument is invalid, by showing how it *could be* that the conclusion is untrue while the premises are true.

Notice, further, that we needn’t have said that Al is a bricklayer; for purposes of the example, he could have been an anarcho-communist or some other species of freethinker—or an unspecified kind of freethinker. The details are flexible; what counts, however we formulate the details, is that our “story” is coherent and that it makes the premises true and the conclusion untrue.

Let’s consider another argument:

All philosophers are freethinkers.

Al is a philosopher.

∴ Al is a freethinker.

This has no counterexample. If we affirm the premises, then we cannot without lapsing into incoherence deny the conclusion. If all philosophers are freethinkers and Al is one of the philosophers, then he must be a freethinker. This argument is valid.

That, of course, doesn't mean it's a good argument in all respects. On the contrary, some philosophers are dogmatically religious, so the first premise is false, which makes the argument unconvincing. But still the reasoning is valid.

Sometimes what appears to be a counterexample turns out on closer examination not to be. Unless the mistake is trivial (e.g., the story fails to make all the premises true or fails to make the conclusion untrue), the problem is often that the alleged counterexample is subtly incoherent and hence impossible. To return to the argument about Socrates, suppose someone said

The argument is invalid because we can envision a situation in which all men are mortal and Socrates is a man, but Socrates is nevertheless immortal because he has an immortal soul.

This story does seem to make the premises of the argument true and the conclusion false. But is it really intelligible? If having an immortal soul makes one immortal and the man Socrates has an immortal soul, then not all men are mortal. The story is incoherent; it contradicts itself. It is therefore not a genuine counterexample, since a counterexample is a *possible* situation; that is, its description must be conceptually coherent.

Some additional invalid arguments with accompanying counterexamples are listed below. Keep in mind that invalid arguments generally have many counterexamples so that the counterexamples presented here are not the only ones. Note also that each counterexample contains all three elements (though sometimes more than one element may be expressed by the same sentence). The three elements, once again, are

1. Affirmations of all the argument's premises.
2. A denial of the argument's conclusion.
3. An explanation of how this can be—that is, how the conclusion can be untrue while the premises are all true.

In each case, the counterexample is a logically coherent story (not an argument) that shows how the conclusion could be untrue while the premises are true, thus proving that the argument is invalid. Notice how each of the counterexamples below performs this function:

Invalid Argument

Sandy is not a man.
∴ Sandy is a woman.

Counterexample

Sandy is neither a man nor a woman but a hamster.

Invalid Argument

If the TV is unplugged, it doesn't work.
 The TV is not working.
 \therefore It's unplugged.

Counterexample

If the TV is unplugged it doesn't work, and it's not working. However, it is plugged in. The reason it's not working is that there's a short in the circuitry.

Invalid Argument

All charged particles have mass.
 Neutrons are particles that have mass.
 \therefore Neutrons are charged particles.

Counterexample

All charged particles have mass, but so do some uncharged particles, including neutrons.

Invalid Argument

The winning ticket is number 540.
 Beth holds ticket number 539.
 \therefore Beth does not hold the winning ticket.

Counterexample

The winning ticket is number 540; Beth is holding both ticket 539 and ticket 540.

Invalid Argument

There is nobody in this room taller than Amy.
 Bill is in this room.
 \therefore Bill is shorter than Amy.

Counterexample

Bill and Amy are the only ones in this room, and they are the same height.

Invalid Argument

- Sally does not believe that Eve ate the apple.
 ∴ Sally believes that Eve did not eat the apple.

Counterexample

Sally has no opinion about the story of Eve. She doesn't believe that Eve ate the apple, but she doesn't disbelieve it either.

Invalid Argument

- Some people smoke cigars.
 Some people smoke pipes.
 ∴ Some people smoke both cigars and pipes.

Counterexample

There are pipe-smokers and cigar-smokers, but nobody smokes both pipes and cigars, so the two groups don't have any members in common.

Invalid Argument

- Some people smoke cigars.
 ∴ Some people do not smoke cigars.

Counterexample

There are people, and all of them smoke cigars. (If everybody does, then some people do and so the premise is true!)

Invalid Argument

- We need to raise some money for our club.
 Having a bake sale would raise money.
 ∴ We should have a bake sale.

Counterexample

We need to raise money for the club, and having a bake sale would raise money, but so would other kinds of events, like holding a car wash or a telethon. Some of these alternative fund-raising ideas better suit the needs of the club and the abilities of its members, and so they are what should be done instead of a bake sale.

Invalid Argument

Kate hit me first.
 \therefore I had to hit her back.

Counterexample

Kate hit the (obviously immature) arguer first. But the arguer could have turned the other cheek or simply walked away; there was no need to hit back.

Let's take stock. What launched our discussion of counterexamples was talk of validity, and what led us to validity was a look at the two virtues of a good argument, namely:

1. The premises are true.
2. The reasoning is valid.

Logicians sometimes suggest that these two virtues are sufficient for a good argument. I have already expressed doubts about this. But we can see why someone might believe it if we consider the two virtues together. To say that the reasoning is valid is to say that there is no counterexample—that is, there is no way for the conclusion not to be true while the premises are true. Now, if we add virtue 1—namely, that the premises *are* true—we see that the two virtues together add up to a guarantee of the truth of the conclusion. An argument that has both virtues—true premises and valid reasoning—is said to be **sound**. Sound reasoning certifies that its conclusion is true.

If that's all we want from reasoning, then virtues 1 and 2 are all we need. In the classical logical tradition, it has been customary to ask for no more. But I think we generally want more. We want insight, significance, cogency . . . well, at least we want **relevance**. Virtues 1 and 2 don't even give us that—as we shall see in the next section.

Exercise 1.2

Classify the following arguments as valid or invalid. For those that are invalid, describe a counterexample, making sure that your description includes all three elements of a well-described counterexample. Take each argument as it stands; that is, don't alter the problem by, for example, adding premises.

1. No plants are sentient.
 All morally considerable things are sentient.
 \therefore No plants are morally considerable.
2. All mathematical truths are knowable.
 All mathematical truths are eternal.
 \therefore All that is knowable is eternal.
3. Most geniuses have been close to madness.
 Blake was a genius.
 \therefore Blake was close to madness.

4. Most of the sentences in this book are true.
Most of the sentences in this book are about logic.
∴ There are true sentences about logic in this book.
5. A high gasoline tax is the most effective way to reduce the trade deficit.
We need to reduce the trade deficit.
∴ We need a high gasoline tax.
6. Some angels are fallen.
∴ Some angels are not fallen.
7. To know something is to be certain of it.
We cannot be certain of anything.
∴ We cannot know anything.
8. The surface area of China is smaller than the surface area of Russia.
∴ The surface area of Russia is larger than the surface area of China.
9. Some men are mortal.
∴ Some mortals are men.
10. The witnesses said that either one or two shots were fired at the victim.
Two bullets were found in the victim's body.
∴ Two shots were fired at the victim.
11. People do climb Mount Everest without oxygen tanks.
∴ It is possible to climb Mount Everest without oxygen tanks.
12. Some fools are greedy.
Some fools are lecherous.
∴ There are some fools who are both lecherous and greedy.
13. No one has ever lived for 200 years.
∴ No one ever will.
14. DNA contains the code of life.
Life is sacred.
∴ It is wrong to manipulate DNA.
15. There are fewer than a billion people in the whole United States.
New York is only a part of the United States.
∴ There aren't a billion people in New York.

1.3 RELEVANCE

Consider the following rather lyrical argument:

- I've heard of Wartburg, Tennessee.
∴ There's no tree that's not a tree.

Pretty bad—but it has both of the virtues discussed in the previous section: The premise is true, and the reasoning is valid. Of course the conclusion doesn't *follow* from the premise. But that wasn't how we defined validity—following from the premises. We defined it as the absence of a counterexample. And there is no counterexample here.