

correct answer, the answer that completely expresses reality in the matter. Whatever difficulty we may find in discerning or stating the truth is beside the point.<sup>16</sup>

Being a critical thinker means having a curious and questioning attitude about reality and examining the reality assumptions you hold and that others present to you in arguments. Critical thinkers realize that their knowledge and perceptions are limited, and they look for solid evidence before accepting or advocating a viewpoint. When new information becomes available, they revisit and reexamine their reality assumptions about an issue, always striving to discern the truth.

In many of our routine daily decisions, we don't spend a lot of time questioning our thinking. However, as we face the important decisions of our life as people in relationships, and as students, professionals, citizens, and consumers, we do need to question why we believe what we believe, and whether our beliefs are true.

How can we examine how we think and question our own reasoning or the reasoning of others? How can we overcome our own subjective perceptions? What tools are available to help us look critically at information, make reasonable decisions, and know that we are being "logical" in our thinking?

Those who study reasoning have come up with two general frameworks for testing the logic of our reasoning and for discovering truth; these frameworks are inductive and deductive reasoning. Inductive reasoning involves finding truth by making observations. The observations might be made through statistical polling, controlled experiments, or relevant examples and analogies. Our observations, when made carefully, can lead us closer to the truth of a matter. Good inductive reasoning tells us what will *probably* occur in a given situation based on what observation tells us *usually* occurs. We will look at inductive reasoning in Chapters 4 and 5.

While inductive reasoning gives us *probabilities* of what is true in a given situation, deductive reasoning is structured in such a way as to give us *certainty* about what is true in a given situation. The conclusion's certainty is established when deductive arguments contain true premises (reasons) stated in the correct form.

#### inductive reasoning

The process of finding truth by making observations; these observations may be from statistical polling, controlled experiments, or relevant examples and analogies.

#### deductive reasoning

The process of inferring a conclusion by putting forth true premises in a valid format.

## Deductive Reasoning

If we lose a sense of the value of truth, we will certainly lose something, and we may very well lose everything.

Bernard Williams, philosopher

In the first part of this chapter, we examined reality assumptions. We saw that sometimes our assumptions about reality, about what is true and what is false, contrast with those of others. How can we discover whether our assumptions are true and whether they are able to provide good evidence for our conclusions?

Philosophers, theologians, scholars, and critically thinking people are all concerned with truth, and many have tried to define truth over the centuries. Vincent Ryan Ruggiero, author of *Beyond Feelings*, gives this definition:

The truth about something is what is so about it, the facts about it in their exact arrangement and proportions. . . to look for the truth is to look for the

Fallacious and misleading arguments are most easily detected if set out in correct syllogistic form.

Immanuel Kant

The syllogism is one of the most valuable tools we have in trying to determine the truth.

Robert J. Gula

#### deductive argument

An argument that follows formal patterns of reasoning and is aimed at establishing the certainty of a conclusion through presenting true premises in valid form.

**valid argument** An argument structured in a correct deductive format; an argument structured in such a way that if its premises are true, then its conclusion must be true.

### Validity in Deductive Arguments

In a deductive argument, formal patterns are used to reveal the logic of our reasoning. These patterns give us a tool for "quality control"; when the correct deductive form is followed, the reasoning is logical and the argument is called valid. The basic patterns of deductive reasoning, which will be discussed in this section, help us test whether our thinking is valid and therefore logical. The pattern of a deductive argument can be considered its form; the statements placed in the pattern can be

<sup>16</sup> Vincent Ryan Ruggiero, *Beyond Feelings: A Guide to Critical Thinking* (Mountain View, CA: Mayfield Publishing, 1990), p. 25.

**sound argument** A valid deductive argument whose premises are true.

**sylogism** A deductive argument usually consisting of two premises and a conclusion.

#### **major premise**

The statement in a syllogism that sets forth a general principle. (The major premise contains the term that is the predicate of the conclusion.)

#### **minor premise**

The statement in a syllogism that expresses an instance of the principle set out in the major premise. (The minor premise contains the term that is the subject of the conclusion.)

**conclusion** In deductive reasoning, the inference drawn from the major and minor premises of a syllogism.

#### **categorical statement**

A statement in which members of one class are said to be included in another class. This statement may be used as the major premise of a syllogism.

#### **conditional syllogism**

In deductive reasoning, a syllogism whose major premise asserts that if the condition cited in the first part of a statement is true, then the claim cited in the second part of the statement will follow.

#### **modus ponens**

A valid conditional/hypothetical syllogism in which the antecedent is affirmed.

considered its content. Correct form makes an argument valid, which is a formal term for “logical”; accurate content makes it true. When the form is valid and the content is true, the argument is called sound.

The formal patterns that create the framework for deductive reasoning are called syllogisms. A syllogism is a deductive argument (usually written in three steps) that moves logically from a major and a minor premise to a conclusion. The conclusion is inferred or derived from the premises. Let’s look at the classic example of a syllogism given by Aristotle more than 2,000 years ago:

All men are mortal. (This categorical statement is called the major premise.)

Socrates is a man. (The minor premise expresses an instance of the principle set out in the major premise.)

Therefore, Socrates is mortal. (Conclusion—the conclusion is inferred—follows from—the major and minor premises.)

This pattern of deductive reasoning can be coded in letters as follows:

All As are Bs.

m is A.

Therefore, m is B.

In this deductive argument, the first premise (all As are Bs) is a universal or categorical statement, a statement in which members of one class are said to be included in another class.

This categorical statement is the major premise. The second statement, called the minor premise, gives a particular instance of the principle set out in the major premise. The final statement is the conclusion that is logically inferred from the major and minor premises.

Let’s look at some other common examples of deductive reasoning, noting their specific patterns. A conditional syllogism contains at least one hypothetical (if–then) premise. In a conditional (hypothetical) premise, we are asserting that if the first part of the statement is true, then the second part is also true. We call the first part (represented by A) the antecedent, and the second part (represented by B) the consequent. Here are some common forms of conditional/hypothetical syllogisms.

**1. Modus ponens.** The term modus ponens means “the way of affirmation” or affirming the antecedent.

If A, then B. (major premise; we are stating that the antecedent (A) leads to the consequent(B)

A (minor premise; we are affirming that the antecedent is true)

Therefore, B. (conclusion; if the antecedent is true, the consequent is also true)

#### **Examples**

If our team wins the playoff game, it will be in the championship game.

Our team did win the playoff game.

Therefore, our team will be in the championship game.

If the weather report says that it will rain today, I will need my raincoat.  
 The weather report says that it will rain today.  
 Therefore, I will need my raincoat.

Keep in mind the difference between a statement or assertion and an argument. Remember that in a deductive argument, the conclusion is inferred (drawn or understood) from the premises that are given. A common error is to take one premise alone as constituting an argument. The first premise given earlier, "If our team wins the playoff game, it will be in the championship game" is only a statement. This statement, called a **hypothetical statement**, sets up a condition. The condition needs to be fulfilled (or not fulfilled) for the argument to be complete. Conditional (or hypothetical) statements are used commonly in our lives in the form of warranties, contracts, threats, or predictions.

Your instructor may have given you a contract at the beginning of the semester that states the following:

1. If you get 80 percent of the points required, you will receive a B.  
 This is a conditional or hypothetical statement. It doesn't assert that you have 80 percent of the points in the class or that you have a B. But if you add another statement:
2. You have 80 percent of the points required (and that is true), then we arrive at the conclusion that:
3. You will receive a B in the class.

Note that if the first two statements in this format are true, then the conclusion must be true. When the conclusion must be true, we have deductive certainty.

## Stop and Think

What are some examples of hypothetical statements you have heard?

Here is another valid conditional/hypothetical syllogism:

2. **Modus tollens.** The term *modus tollens* means denying the consequent.

If A, then B.

Not B. (Here the consequent is denied.)

Therefore, not A. (Since the consequent is denied, the antecedent must also be denied in the conclusion.)

### Examples

If I have strep throat, then the culture will be positive.

But the culture is not positive.

So, I don't have strep throat.

If I have to get up now, my alarm will go off again.

But my alarm hasn't gone off again.

Therefore, I don't have to get up now.

### hypothetical syllogism

See conditional syllogism. A syllogism in which the major premise presents a condition ("if A, then B") or a possibility ("either A or B") that is resolved in the minor premise so that a valid conclusion can follow. The condition or possibility is resolved in the minor premise in the form of affirmation or denial. Conditional and disjunctive syllogisms (defined on page 92) are forms of hypothetical syllogisms.

**modus tollens** A valid conditional/hypothetical syllogism in which the consequent is denied.



**chain argument** A form of argument that builds and depends on a series of conditions being met.

**3. Chain argument.** A third form of the conditional argument is often called a chain argument:

If A, then B.  
If B, then C.  
Therefore, if A, then C.

#### Examples

If you lower the fat in your diet, you will lower your cholesterol.  
If you lower your cholesterol, you will reduce the risk of heart disease.  
Therefore, if you lower the fat in your diet, you will reduce your risk of heart disease.

If evidence of the suspect's DNA is found at the crime scene, then we can connect him with the crime.

If we can connect him with the crime, then we can have him stand trial.  
Therefore, if the suspect's DNA is found at the crime scene, then we can have him stand trial.

If I want to get a good grade in this class, I need high quiz points.

If I need high quiz points, I need to study for the quizzes.

Therefore, if I want to get a good grade in this class, I need to study for the quizzes.

### Reminder

Deductive arguments must follow the correct pattern in order to be considered valid. If our reasoning follows the steps outlined in these forms, our arguments are considered valid. If they do not follow the correct form, we have not provided adequate support for the conclusion, even if the conclusion happens to be true.

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#### disjunctive syllogism

A hypothetical syllogism in which two possibilities are given in the major premise and one is assumed to be necessarily true. In the minor premise, one of the possible alternatives is negated, and the remaining alternative is then affirmed in the conclusion.

**4. Disjunctive syllogism.** Another common pattern of deduction is found in the disjunctive syllogism: A disjunction is an "or" statement. In a disjunctive syllogism, it is claimed that only one of two possibilities (disjuncts) is true; if one possibility is true, then the other possibility is not true. The two alternative possibilities are presented in the major premise; one of them is denied in the minor premise and the other is affirmed in the conclusion. The pattern for this syllogism is structured as follows:

Either A or B.  
Not B.  
Therefore, A.  
or  
Either A or B.  
Not A.  
Therefore, B.

Either Ramon took the car to work or he took the bus.

But Ramon didn't take the bus to work.

Therefore, Ramon took the car.

My phone is either at Brianna's house or at work.

It's not at Brianna's house.

Therefore, it's at work.

Closely related to the disjunctive syllogism is an argument by elimination. An argument by elimination seeks to logically rule out various possibilities until only a single possibility remains. The following valid patterns are arguments by elimination:

Either A, or B, or C.  
Not B or C.  
Therefore, A.

The car's problem is the alternator, the generator, or the battery.

It's not the alternator or the generator.

Therefore, it's the battery.

Either A, or B, or C.

If B or C, then D.

Not D.

Therefore, A.

Either Rachel bought dinner, Roy bought dinner, or Sammy bought dinner.

If Roy or Sammy bought dinner, then they skipped baseball practice.

But Roy and Sammy did not skip baseball practice.

Therefore, Rachel bought dinner.

### Using Toulmin's Method to Understand Deduction

We don't speak in syllogisms, but we can test the logic of our reasoning by placing it into a syllogism. In fact, many of our assertions are what philosophers call enthymemes; an enthymeme is a syllogism with a premise implied rather than directly stated. The missing parts—the assumptions of the speaker or writer—are expected to be supplied by the listener or reader. When we discover the missing part, the implied premise, we can place the argument in one of the standard deductive patterns.

As we discussed in previous sections, British philosopher Stephen Toulmin has developed a method of dissecting arguments that helps us isolate the implied premises. His method identifies claims (which are the same as conclusions), reasons, those supports for the claims that are directly stated, and warrants, those connections between reasons and claims that are taken for granted (the reality assumptions). The warrants are the implied premises; they are the "glue" that attaches the reasons to the claims.

When the warrant is clarified, the reasoning of the speaker or writer is more fully revealed, and we are able to see if the reasoning is valid.

For example, you may say, "You shouldn't take that class—the teacher gives too much homework." (This preceding statement is the enthymeme.)

#### argument by elimination

A valid syllogism that seeks to logically rule out various possibilities until only a single possibility remains.

**Enthymeme** A syllogism with a key part or parts implied rather than directly stated.

*Claim/conclusion:* You should not take that class.

*Reason:* The teacher gives too much homework.

*Warrant/reality assumption:* If too much homework is given, a class should not be taken.

Written as a conditional syllogism, the reasoning would be revealed:

If a teacher gives too much homework, a class should not be taken.

That teacher gives too much homework.

Therefore, that class should not be taken.

Someone might respond to this argument by saying, “I like having a lot of homework—it helps me learn the material.” This response challenges the warrant that if too much homework is given, a class should not be taken; the objection is not about the logic of the reasoning but about the assumption that too much homework is a negative factor.

For another example, let’s say that you and a friend are planning to drive to a movie. You may say, “We’re almost out of gas—we need to stop on the way to the movie.” This enthymeme could be dissected as follows:

*Claim/conclusion:* We need to stop for gas on the way to the movie.

*Reason:* We’re almost out of gas.

*Warrant/reality assumption:* If we’re out of gas, we need to stop and get some more or we won’t make it to the movie.

We can also see the reasoning pattern by putting the enthymeme into a conditional syllogism, as follows:

If we’re almost out of gas, we need to stop and get some more.

We’re almost out of gas.

Therefore, we need to stop and get some more.

Let’s say, though, that your friend responds to your comment, “We need to stop at a gas station on the way to the movie” by stating, “No, we don’t need to stop; we’re fine.” Using Toulmin’s model, your friend’s argument is as follows:

*Claim/conclusion:* We don’t need to stop.

*Reason:* We’re fine. (We have enough gas to get to the movie.)

*Reality assumption/warrant:* If we have enough gas to get to the movie, we don’t need to stop.

The enthymeme “No, we don’t need to stop; we’re fine,” could be expressed in a conditional syllogism as follows:

If we already have enough gas to get to the movie, we don’t need to stop for more.

We already have enough gas to get to the movie.

Therefore, we don’t need to stop for more.

This sample disagreement points out an important element of deductive reasoning; a deductive argument may be valid (i.e., follow the correct pattern), as are both

of the preceding arguments, without being true. The untrue premise can be seen as a faulty reality assumption. The conclusion may follow from the premises, but one or both of the premises may not be true, and the truth is what we are seeking.

Toulmin’s method emphasizes the need to pursue truth in argumentation. The claims and reasons of each person need evidence, or what Toulmin calls **grounds**. In this case, both you and your friend would have to provide evidence that you do or do not have enough gas to make it to the movie. He might give examples of how the gauge was close to empty before, but he was still able to travel the distance it would take to get to the movie. You may have kept track of how many miles you have gone since the last time the tank was filled and do the math to determine if you have enough gas left to get to the movie. Or you could take your chances and find out if you have enough gas by not filling up and seeing if you make it to the movie.

Both of you have reasoned logically, and the syllogisms outlining your reasoning are both valid. But only one of you has a sound argument in which both the major and the minor premises are true. When the premises of a valid syllogism are true, the truth of the conclusion is certain.

When we know that an argument is sound, we can accept the conclusion of that argument with confidence. We can make good decisions based on the information given in a sound argument because the argument is both logical and true, as conveyed by the following chart.

	True	False
Valid	Sound Argument: Correct Form True Premises	Unsound Argument: Correct Form, Untrue Premises
Invalid	Unsound Argument: Incorrect Form, True Premises	Unsound Argument: Incorrect Form, Untrue Premises

**grounds** Evidence offered to prove a claim. Grounds can consist of statistics, examples, research, physical evidence, logical reasoning, and expert opinion.

Reminder

- 1. Understanding the process of deductive reasoning helps you realize what you are assuming to be true when you state your position on issues.
- 2. When an argument is valid and the premises are true, the conclusion must be true, and the argument is called sound.

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The Uses of Deductive Reasoning

Why is it useful to learn the patterns of deductive reasoning? Using deductive reasoning can

- 1. Illuminate and clarify our beliefs (reality assumptions) and help us consider whether those beliefs are rational. If we find that our beliefs are rational and logical, we may act on them. If they are irrational, we can challenge and revise them.

2. Help us discover truth, particularly in situations in which there is a right and wrong answer.
3. Help us make decisions, particularly when there are established rules, laws, and guidelines to follow.
4. Help us recognize and challenge stereotypes and prejudicial statements.
5. Help us understand argument.