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- Seeing the world from a logical point of view
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Chapter 1 Taking a Logical Perspective

You and I live in an illogical world. If you doubt this fact, just watch a few YouTube videos. Or really listen to the person sitting at the next barstool. Or, better yet, spend the weekend with your in-laws.

With so many people thinking and acting illogically, why should you be any different? Wouldn't it be more sensible just to be as illogical as the rest of the human race?

Well, okay, being illogical *on purpose* is probably not the best idea. For one thing, how can trying to be illogical possibly be sensible? For another, if you've picked up this book in the first place, you probably aren't built to be illogical. Let's face it — some folks thrive on chaos (or claim to), and others don't.

In this chapter, I introduce you to the basics of logic and how it applies to life. I tell you about a few words and ideas that are key to logic. And I touch briefly on the connections between logic and math.

Getting an Overview of Practical Logic

Whether you know it or not, you already understand a lot about logic. In fact, you already have a built-in logic detector. Don't believe me? Take this quick test to see whether you're logical:

> **Q:** How many pancakes does it take to shingle a doghouse?
>
> **A:** 23, because bananas don't have bones.

If the answer seems illogical to you, that's a good sign that you're at least on your way to being logical. Why? Simply put, if you can spot something that's illogical, you must have a decent sense of what's actually logical.

In this section, I start with what you *already* understand about logic (though you may not be aware of that knowledge) and build toward a foundation that can help you in your study of logic.

Bridging the gap from here to there

Most children are naturally curious. They constantly want to know *why* everything is the way it is. And for every *because* answer they receive, they have one more *why* question. For example, consider these common kid questions:

> Why does the sun rise in the morning?
>
> Why do I have to go to school?
>
> Why does the car start when you turn the key?
>
> Why do people break the law when they know they could go to jail?

When you think about it, every great mystery seeks a solution via these types of questions: Even when the world doesn't make sense on its own, why does it feel like it should?

Kids sense from an early age that even though they don't understand something — like why the sun rises in the morning — the answer must be somewhere. And they think, "If I'm *here* and the answer is somewhere else, what do I have to do to get *there*?" (Often, their determination to get there leads them to bug their parents with more questions.)

REMEMBER

Human desire to get from here to there — from ignorance to understanding — is one of the main reasons logic came into existence as philosophy and science. Logic grew out of an essential human need to make sense of the world and, as much as possible, gain some control over it.

Understanding cause and effect

One way to understand the world is to notice the connection between cause and effect.

As you grow from a child to an adult, you begin to piece together how one event causes another. Typically, you can express the connections between cause and effect by using an *if-statement* (which is a basic conditional structure in logic). For example, consider these if-statements:

> *If* I let my favorite ball roll under the couch, *then* I can't reach it.
>
> *If* I do all my homework before Dad comes home, *then* he'll play catch with me before dinner.
>
> *If* I practice on my own this summer, *then* the coach will pick me for the team in the fall.
>
> *If* I keep showing up at job interviews prepared and with confidence, *then* I'll eventually get a job.

TIP

Understanding how if-statements work is an important aspect of logic.

Breaking down if-statements

Every if-statement is made up of two smaller statements called *sub-statements*: The *antecedent*, which follows the word *if*, and the *consequent*, which follows the word *then*. For example, consider this if-statement:

> *If* it is 5 p.m., *then* it's time to go home.

In this if-statement, the antecedent is the sub-statement *it is 5 p.m.* The consequent is the sub-statement *it's time to go home*.

REMEMBER

Every sub-statement can stand as a complete statement in its own right.

Stringing if-statements together

In many cases, the consequent of one if-statement becomes the antecedent of another. When this happens, you get a string of consequences, which the Greeks called a *sorites* (suh-*rye*-tease). For example:

If it's 5 p.m., then it's time to go home.

If it's time to go home, then it's almost time for dinner.

If it's almost time for dinner, then I need to call my husband to make reservations at the restaurant.

In this case, you can link these if-statements together to form a new if-statement:

> If it's 5 p.m., then I need to call my husband to make reservations at the restaurant.

Thickening the plot

As you gain more life experience, you may find that the connections between cause and effect become more and more sophisticated:

> *If* I let my favorite ball roll under the couch, *then* I can't reach it, *unless* I scream so loud that Grandma gets it for me, *though if* I do that more than once, *then* she gets annoyed and puts me back in my highchair.

> *If* I practice on my own this summer *but* not so hard that I blow my knees out, *then* the coach will pick me for the team in the fall *only if* there's a position open, *but if* I do *not* practice, *then* the coach will *not* pick me.

Knowing everything and more

As you begin to understand the world and what you find in it, you begin to make more general statements about it. For example:

> All horses are friendly.
>
> All 5-year-olds are silly.
>
> Every teacher at that school is out to get me.
>
> Every time I hear a phone ring in our house, it's my sister's phone.

REMEMBER

Words like *all* and *every* allow you to categorize things into *sets* (groups of objects) and *subsets* (groups within groups). For example, when you say, "All horses are friendly," you mean that the set of all horses is *contained within* the set of all friendly things — that is, horses are a *subset* of friendly things.

Explaining existence itself

You also discover connections within the world by figuring out what *exists* and *doesn't exist.* For example:

Some of my teachers are nice.

There is at least one student in school who likes me.

No one in the chess club can beat me.

There is no such thing as a Martian.

REMEMBER

Existence statements like these generally use wording that points to connections (or not):

- **An intersection of sets:** Words like *some*, *there is*, and *there exists* show an overlapping of sets called an *intersection.* For example, when you say, "Some of my teachers are nice," you mean that there's an intersection between the set of your teachers and the set of nice things.
- **No intersection between sets:** Words like *no*, *there is no*, and *none* show that there's no intersection between sets. For example, when you say, "No one in the chess club can beat me," you mean that there's no intersection between the set of all the chess club members and the set of all the chess players who can beat you.

Identifying a few logical words

As you can see, certain words show up a lot as you begin to make logical connections. Some of these common words are:

if . . . then	and	but	or
not	unless	though	every
all	only if	each	there is
there exists	some	there is no	none

Taking a closer look at words like these is an important step in the development of logic. When you do, you begin to see how these words enable you to divide and categorize the world in different ways (and therefore understand it better).

Building and Evaluating Logical Arguments

When people say "Let's be logical" about a given situation or problem, they often mean "Let's follow steps like these":

1. **Figure out what we know to be true.**
2. **Spend some time thinking about it.**
3. **Find the best course of action.**

REMEMBER

In logical terms, this three-step process involves building a *logical argument* — an explanation or rationale that contains a set of premises at the beginning and a conclusion at the end. In many cases, the premises and the conclusion will be linked by a series of intermediate steps. In the following sections, I discuss the steps in the order you're likely to encounter them.

Generating premises

The *premises* are the facts of the matter: the statements that you know or believe to be true. In many situations, writing down a set of premises is a great first step to problem-solving.

For example, suppose you're a school board member trying to decide whether to support the construction of a new school that would open for the school term that begins in September. Everyone is excited about the project, but you make some phone calls and piece together your facts to construct the following premises:

> The funds for the project won't be available until March.
>
> The construction company won't begin work until they receive payment.
>
> The entire project will take at least eight months to complete.

So far, you have only a set of three premises. But when you put these premises together, you get closer to the conclusion, which will complete your logical argument. In the next section, I show you how to combine the premises.

Bridging the gap with intermediate steps

Sometimes a logical argument is just a set of premises followed by a conclusion. In many cases, however, an argument also includes *intermediate steps* that show how the premises gradually lead to that conclusion.

Using the school construction example from the previous section, you may want to spell things out like this:

> According to the information we have, we won't be able to pay the construction company until March, so they won't be done until at least eight months later, which is November. But the school term begins in September. Therefore . . .

The word *therefore* indicates a conclusion and is the beginning of the final step, which I discuss in the next section.

Forming a conclusion

The *conclusion* is the outcome of your logical argument. If you've worked through the intermediate steps in a clear progression, the conclusion should be fairly obvious. For the school construction example I've been using, here it is:

> The building won't be complete before the school term begins in September.

If the conclusion doesn't make sense, something may be wrong with your argument. In some cases, an argument may not be valid. In others, you may have missing premises that you'll need to add.

Deciding whether the argument is valid

After you've built a logical argument, you need to be able to decide whether it's *valid,* which means that it's a good argument.

REMEMBER

To test a logical argument's validity, you assume that all the premises are true and then see whether the conclusion follows automatically from them. If the conclusion follows automatically, you know it's a valid argument. If not, the argument is *invalid*.

Understanding enthymemes (assumptions)

The school construction argument (from the example in the previous sections) may seem valid, but you also may have a few doubts. For example, if another source of funding became available, the construction company could start earlier than March and perhaps finish by the September deadline. And so, the argument has a hidden premise, or assumption, called an *enthymeme* (*en*-thi-meem), as follows:

> There is no other source of funds for the project.

TIP

Logical arguments about real-world situations (in contrast to mathematical or scientific arguments) almost always have enthymemes — that is, hidden assumptions that may go unacknowledged. So, the clearer you understand the enthymemes hidden in an argument, the better chance you have of making sure your argument is valid.

Uncovering hidden premises in real-world arguments is more closely related to *rhetoric* — the study of how to make clear and convincing arguments — than it is to logic. I touch upon rhetoric, logical fallacies, and other details about the structure of logical arguments in Chapter 3.

Making Logical Conclusions Simple with the Laws of Thought

As a basis for understanding logic, philosopher Bertrand Russell set down three laws of thought. These laws are all grounded in ideas dating back to Aristotle, who founded classical logic more than 2,300 years ago. (See Chapter 2 for more on the history of logic.)

All three laws of thought are basic and easy to understand. The important thing to note is that these laws enable you to draw logical conclusions about statements even if you aren't familiar with the real-world circumstances they're discussing.

The law of identity

REMEMBER

The *law of identity* states that every individual thing is identical to itself.

For example:

> Jason Sudeikis is Jason Sudeikis.
>
> My cat, Ian, is my cat, Ian.
>
> The Washington Monument is the Washington Monument.

Without any information about the world, you can see from logic alone that all these statements are true. The law of identity tells you that any statement in the form of *X is X* must be true. In other words, any individual thing in the universe is the same as itself.

The law of the excluded middle

REMEMBER

The *law of the excluded middle* states that every statement is either true or false.

For example, consider these two statements:

> My first name is Mark.
>
> My first name is Algernon.

Again, without any information about the world, you know logically that each of these statements is either true or false. According to the law of the excluded middle, no third option is possible — in other words, statements can't be partially true or false. Rather, in logic, every statement is either completely true or completely false.

As it happens, I'm content that the first statement is true and relieved that the second is false.

The law of non-contradiction

REMEMBER

The *law of non-contradiction* states that given a statement and its opposite, one is true, and the other is false.

For example:

> My first name is Algernon.
>
> My first name is not Algernon.

Even if you don't know my name, you can be sure from logic alone that one of these statements is true and the other is false. In other words, because of the law of non-contradiction, my first name can't both be and not be Algernon.

Combining Logic and Math

Throughout this book, I often prove my points with examples that use math. (Don't worry — none of my examples is more complicated than what you learned in fifth grade or before.) Math and logic go great together for two reasons, which I explain in the following sections.

Math is good for understanding logic

Throughout this book, as I explain logic to you, I sometimes need examples that are clearly true or false to prove my points. As it turns out, math examples are great for this purpose because, in math, a statement is always either true or false, with no gray area between.

On the other hand, sometimes random facts about the world may be more subjective, or up for debate. For example, consider these two statements:

> Rihanna is an amazing singer.
>
> *Romeo and Juliet* is a lousy play.

Many people may well agree in this case that the first statement is true and the second is false, but both statements are up for debate. Now look at these two statements:

> The number 7 is less than the number 8.
>
> Five is an even number.

Clearly, there's no disputing that the first statement is true and the second is false.

Logic is good for understanding math

As I discuss in the section "Making Logical Conclusions Simple with the Laws of Thought" earlier in this chapter, the laws of thought on which logic is based — such as the law of the excluded middle — depend on black-and-white thinking. And, well, not many subjects are more black-and-white than math. Even though you may find studying history, literature, politics, or the arts to be more fun, they contain many more shades of gray.

Math is built on logic like a house is built on a foundation. If you're interested in the connection between math and logic, check out Chapter 22, which focuses on how math starts with obvious facts called *axioms* and then uses logic to form interesting and complex conclusions called *theorems.*