

Overview

- | | |
|--|---|
| 1.1 TRUTH CONTENT AND LOGICAL COMPONENT | 1.4 REASONING, JUDGMENT, AND DEDUCTIVE ANALYSIS |
| 1.2 LOGIC AND RELATIONSHIPS | 1.5 DEDUCTIVE AND INDUCTIVE INFERENCES |
| 1.3 TRUTH CONTENT ERRORS, LOGICAL COMPONENT ERRORS, AND THE ANALYSIS OF INFERENCES | 1.6 UNCERTAINTY AND INDUCTIVE ANALYSIS |

We live in the Information Age. Cable television stations provide local and world news 24 hours a day. The Internet provides access to millions of books, articles, and thousands of newspapers from around the world. Personal Web sites, Web logs (blogs), and chat rooms contain instant commentary about events around the world. We often find that, along with information, various claims are presented. For example, suppose we read the following:

Some film studios and independent movie directors are releasing their films on DVD rather than placing them in theaters. Soon you will be able to view first-run movie releases in your home for a fraction of the cost of going to a theater, buying, or renting a movie. In fact, ticket sales for U.S. theaters have been steadily declining for the past ten years. Therefore, we can expect movie theaters to become obsolete.

This passage contains an **inference**. An inference, or argument, is a network of **statements** (sentences that are either true or false). The first three sentences of the passage are **premises**; they contain information that is intended to provide good reasons to believe the **conclusion**, the claim that movie theaters will become obsolete. In this passage there are two things to consider: Is the information that is given true? If the information is true, does it offer good reasons to accept the conclusion? These questions offer a glimpse of the role of logic, which is the study of reasoning. Logical analysis reveals the extent of the correctness of the reasoning found in inferences. Logic

Inference: A set of statements whereby the premises are offered as support for a conclusion.

Statement: A sentence that is either true or false.

Premise: A statement (or set of statements) offered as support for a conclusion.

Conclusion: The end point of an inference; the statement that is meant to follow from premises.

Truth content: The actual truth or falsity of a statement and the methods of its determination.

Logical component: The logical relationship between premises and a conclusion.

provides the skills needed to identify other peoples' inferences, putting you in a position to offer coherent and precise analysis of those inferences. Learning logical skills enables you to subject your own inferences to that same analysis, thereby anticipating challenges and criticisms. This book introduces the tools of logical analysis and presents practical applications of logic.

1.1 TRUTH CONTENT AND LOGICAL COMPONENT

Our initial concern in the study of logic is with two important ways in which we evaluate the information we receive in our conscious interaction with the world. First is the **truth content**—*Is the information true or false?* Second is the **logical component**—*If the information is true, then what follows?* For example, if someone enters a room and appears to be soaking wet, we might conclude that it is raining outside. This very natural and nearly instantaneous thought is actually the result of two processes. The first is the evaluation of the visual information—the person “appears to be wet.” The second process, although complex, happens so quickly that it can escape notice. Its complexity lies in the remarkable process of extending a piece of information beyond its boundaries. From “a wet person” we conclude that “it is raining.” From one piece of information we have developed, or *inferred*, a consequence. The complexity is realized only when we become aware of the process. We are then confronted with the further process of *evaluating* and *justifying* our inference. If we remark to someone that it is raining outside, we might be asked to explain why we think so. Only then do we become conscious of the need to analyze and justify our conclusion. Pointing to the wet person might help to justify our conclusion, but further analysis raises the possibility that we were wrong, that it is not raining. There are certainly other reasons for people being wet—they could have been hit by water balloons, they could have splashed water on themselves because they were hot, they could have run through lawn sprinklers, or the wetness could be from excessive sweating, etc. In fact, as explanations for the wetness begin to pile up, the less confident we may become that it is really raining. This example illustrates that we must consider our interaction with the world in two different ways: (1) Is the information we have received accurate, correct, or true? (2) If it is true, then what can we infer from it; what conclusions follow?

1.2 LOGIC AND RELATIONSHIPS

Evaluating the truth content and logical component of an inference is a complex process, so it is quite easy to make mistakes. There are two potential sources of error—*incorrect truth content* and *incorrect logical component*. Although not likely, it is nevertheless possible that in our previous example we could have been wrong about the person actually being wet (remember, we said that the person “appeared” to be wet). If so, this would be an instance of incorrect truth content. On the other hand, our inference might be faulty; it might not be raining. If so, this would be an instance of incorrect logical component. (It is also possible that we were wrong in both ways—incorrect truth content *and* incorrect logical component.) The first source of error, incorrect truth content, is the most familiar. Much of our formal education is devoted to the truth content of information. However, the second

source of error, incorrect logical component, is more difficult to recognize because it is about the *relationship* between statements, and not the statements themselves. To fully understand this it is necessary to look at examples that will clarify the distinctions we are making. Suppose you were given these two pieces of information:


1. Vincent van Gogh was born sometime in the 1800s.
2. Marie Curie was born sometime in the 1800s.

First, we can investigate the truth of the statements. Notice that the truth or falsity of each statement is independent of the other—that is, they may both be true, they may both be false, or one may be true and the other false. We could easily find evidence concerning the truth or falsity of each statement (consulting an encyclopedia, a history of science book, searching the Internet, etc.). The result of this line of analysis would be our knowledge of the truth content; we would have determined the actual truth or falsity of each statement. However, prior to investigating the truth content we might consider the two statements as potential premises. Our focus then would be on what could be inferred from the pair—*What follows from them if they are true?* This line of analysis takes us into the area of logical component, which focuses on the relationship between the pair of statements above, and a new statement, a conclusion, which we could derive from the pair. The following is one possible conclusion:

3. Vincent van Gogh was born before Marie Curie.

Our attention is now focused on different questions, such as, “*What if the first two statements are true?*” “How is the truth or falsity of the first two statements related to the truth or falsity of the third statement?” “Do the first two statements support the third statement?” “Do the first two statements provide good reasons for accepting the third statement?” These considerations are radically different from our concerns with the truth content of the first two statements. Since we are now concentrating on the relationship between the three statements, our analysis has a completely different form. An analogy might help you to grasp this point. When we talk about the relationship between two people, we might consider whether it is “good,” “strong,” “supportive,” “shaky,” “very weak,” etc. This is similar to what we are now doing. If we display the statements in a different way, we can see this more clearly.

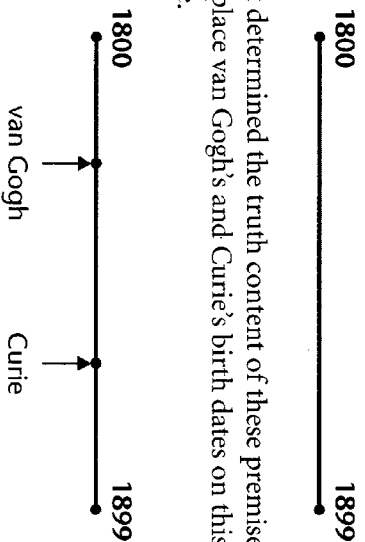
Example 1.1

- 
1. Vincent van Gogh was born sometime in the 1800s.
 2. Marie Curie was born sometime in the 1800s.
 3. Vincent van Gogh was born before Marie Curie.

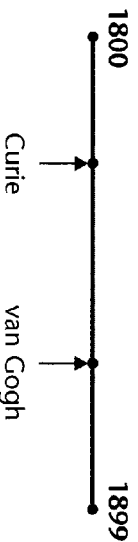
This way of displaying the information reveals that the first two statements are meant to be premises while the statement under the line is the conclusion of an inference. We want to analyze the **logical relationship** $\{R\}$ between the premises and the conclusion. Specifically, we want to see whether the premises, *if both are true*, guarantee anything about the conclusion. If we accept the information in the first premise as true, then we would be informed that Vincent van Gogh was born

Logical relationship:
The logical connection between premises and conclusions.

somewhere between the years 1800 and 1899. If we accept the information in the second premise as true, then we would be informed that Marie Curie was also born somewhere between the years 1800 and 1899. At this point, it is important to separate the truth content of the conclusion from the logical consideration of whether or not it follows from the premises, which is a relationship question. This is crucial because we are not always in a position to assess the truth content of statements. However, we can draw a time line to represent the 1800s.



Of course, it is also logically possible to place van Gogh's and Curie's birth dates on this line such that the conclusion is false.



Analysis of Example 1.1 has revealed that even if the information in the premises is true, it is nevertheless logically possible for the conclusion to be either true or false. This example shows that we can determine the logical relationship between statements *without knowing the actual truth or falsity of the statements involved*.

Now let's consider a slightly different pair of statements.

1. Marie Curie was born sometime in the 1800s.
2. Nelson Mandela was born sometime in the 1900s.

We are now interested in the relationship that exists between this pair of statements and a new statement, one that we could derive as a consequence of this pair. One candidate would be this statement:

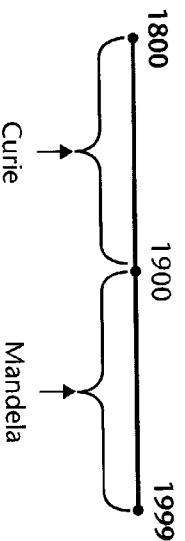
3. Marie Curie was born before Nelson Mandela.

This provides us with a new example for logical analysis.

Example 1.2

- $\{R\}$
1. Marie Curie was born sometime in the 1800s.
 2. Nelson Mandela was born sometime in the 1900s.
 3. Marie Curie was born before Nelson Mandela.

As before, for purposes of logical analysis we start by accepting the premises as true. If so, the information given is this: Premise 1—Marie Curie was born somewhere between 1800 and 1899. Premise 2—Nelson Mandela was born somewhere between 1900 and 1999. We can again draw a time line to help us with our analysis.



Marie Curie's birth date can be placed anywhere between 1800 and 1899, and Nelson Mandela's birth date can be placed anywhere between 1900 and 1999. Now, if the information in the premises is true, then the relationship $\{R\}$ between these three statements is such that the conclusion in Example 1.2 must be true, too. Remember that this is a logical analysis only—we are not claiming that any of the statements are really true. Rather, we are considering only the logical component contained in the inference (*what if the premises are true*). Our analysis has revealed something completely different from Example 1.1. Specifically, Example 1.2 shows that it is possible for a relationship in an inference to exist whereby the premises, if true, *guarantee* the conclusion to be true. Logical analysis is thus completely different from truth content analysis, which considers only *what is* the case (whether the statements are true or false).

One final example will be considered here.

Example 1.3

- $\{R\}$ {
1. Marie Curie was born sometime in the 1800s.
 2. Nelson Mandela was born sometime in the 1900s.
 3. Nelson Mandela was born before Marie Curie.

As before, for purposes of logical analysis we start by accepting the premises as true. If so, the information given is the same as before: Premise 1—Marie Curie was born somewhere between 1800 and 1899. Premise 2—Nelson Mandela was born somewhere between 1900 and 1999. If the premises are accepted as true, then the relationship $\{R\}$ between these three statements is such that *the conclusion must be false*.

The discussion so far has revealed that, as far as the relationship question is concerned, the results can differ. In Example 1.1, the relationship was such that even if the premises were both true, the conclusion *could be either true or false*. In Example 1.3, the relationship was such that if the premises were both true, the conclusion *had to be false*. Most importantly, in Example 1.2, the relationship was such that if the premises were both true, the conclusion was *guaranteed to be true*.

Mastering logical analysis requires the active separation of the two types of information evaluation we have been considering. Since our minds naturally

process information in the two ways we have been discussing, it is often confusing when we first try to consciously keep the two distinct. First, is the information I am receiving accurate, correct, or true? Second, if it is true, then what can I infer from it—that is, what conclusions follow? In fact, for most people the first type of evaluation (the truth content) takes priority. If you are not aware of the difference between truth content and logical component, then confusion arises. We can illustrate this by performing a little experiment in which you read a statement, understand what it means, but *do not judge it to be true or false*. Try to understand the meaning of the statement without deciding its actual truth or falsity. The statement will refer to the book you are now reading. Here is the statement:

The book you are now reading weighs 2000 pounds.

Most people, if not all, upon finishing the statement immediately know it to be false. Their “deciding” it was false happened so fast they could not stop it. This shows that one part of our mind is constantly analyzing information for truth and falsity. This is important for our discussion precisely because we must recognize that our minds are constantly working on two different levels, and we must learn to keep those levels separate. In order to evaluate the relationship (the logical component) that exists *between* statements we must disregard the truth content. We must temporarily ignore the actual truth/falsity results—not because they are unimportant, but simply because we are doing something entirely different.

It is possible to get a clear understanding of how the two functions differ by considering how we process other kinds of information. The sense of sight and the sense of smell are two distinct functions. We don’t expect our eyes to detect the fragrance of a flower, or our noses to tell us what color the flower is. In fact, people sometimes close their eyes when smelling something in order to give their sense of smell the highest priority. We quite often close our eyes when we want to concentrate on hearing something. Similarly, when we are concentrating on the logical component, we must learn to “close” our truth content faculty for a while.