## Chapter 1: Arguments, Premises, and Conclusions

### What is logic? And why we study logic?

Logic may be defined as the science that evaluates arguments. All of us encounter arguments in our day-to-day experience. We read them in books and newspapers, hear them on television, and formulate them when communicating with friends and associates. The aim of logic is to develop a system of methods and principles that we may use as criteria for evaluating the arguments of others and as guides in constructing arguments of our own. Among the benefits to be expected from the study of logic is an increase in confidence that we are making sense when we criticize the arguments of others and when we advance arguments of our own.

An argument, as it occurs in logic, is a group of statements, one or more of which (the premises) are claimed to provide support for, or reasons to believe, one of the others (the conclusion). All arguments may be placed in one of two basic groups: those in which the premises really do support the conclusion and those in which they do not, even though they are claimed to. The former are said to be good arguments (at least to that extent), the latter bad arguments. The purpose of logic, as the science that evaluates arguments, is thus to develop methods and techniques that allow us to distinguish good arguments from bad.

As is apparent from the above definition, the term ‘‘argument’’ has a very specific meaning in logic. It does not mean, for example, a mere verbal fight, as one might have with one’s parent, spouse, or friend. Let us examine the features of this definition in greater detail. First of all, an argument is a group of statements. A statement is a sentence that is either true or false—in other words, typically a declarative sentence or a sentence component that could stand as a declarative sentence. The following sentences are statements:

Aluminum is attacked by hydrochloric acid.
Broccoli is a good source of vitamin A.
Argentina is located in North America.
Napoleon prevailed at Waterloo.
Rembrandt was a painter and Shelley was a poet.

The first two statements are true, the second two false. The last one expresses two statements, both of which are true. Truth and falsity are called the two possible truth Values of a statement. Thus, the truth value of the first two statements is true, the truth value of the second two is false, and the truth value of the last statement, as well as that of its components, is true.

Unlike statements, many sentences cannot be said to be either true or false. Questions, proposals, suggestions, commands, and exclamations usually cannot, and so are not usually classified as statements. The following sentences are not statements:

| | |
|---|---|
| What is the atomic weight of carbon? | (question) |
| Let's go to the park today. | (proposal) |
| We suggest that you travel by bus. | (suggestion) |
| Turn to the left at the next corner. | (command) |
| All right! | (exclamation) |

The statements that make up an argument are divided into one or more premises and one and only one conclusion. The premises are the statements that set forth the reasons or evidence, and the conclusion is the statement that the evidence is claimed to support or imply. In other words, the conclusion is the statement that is claimed to follow from the premises. Here is an example of an argument:

All crimes are violations of the law.
Theft is a crime.
Therefore, theft is a violation of the law.

The first two statements are the premises; the third is the conclusion. (The claim that the premises support or imply the conclusion is indicated by the word ''therefore.'')In this argument the premises really do support the conclusion, and so the argument is a good one. But consider this argument:

Some crimes are misdemeanors.
Murder is a crime.
Therefore, murder is a misdemeanor.

In this argument the premises do not support the conclusion, even though they are claimed to, and so the argument is not a good one.

One of the most important tasks in the analysis of arguments is being able to distinguish premises from conclusion. If what is thought to be a conclusion is really a premise, and vice versa, the subsequent analysis cannot possibly be correct. Frequently, arguments contain certain indicator words that provide clues in identifying premises and conclusion. Some typical **conclusion indicators** are:

Therefore thus it must be that it follows that

| | | | |
|---|---|---|---|
| Wherefore | consequently | whence | implies that |
| accordingly | we may infer | so | as a result |

Whenever a statement follows one of these indicators, it can usually be identified as the conclusion. By process of elimination the other statements in the argument are the premises. Example:

> Corporate raiders leave their target corporation with a heavy debt burden and no increase in productive capacity. Consequently, corporate raiders are bad for the business community.

The conclusion of this argument is ‘‘Corporate raiders are bad for the business community,’’ and the premise is ‘‘Corporate raiders leave their target corporation with a heavy debt burden and no increase in productive capacity.’’

Premises are claimed evidence whereas Conclusion is what is claimed to follow from the evidence.

If an argument does not contain a conclusion indicator, it may contain a **premise indicator**. Some typical **premise indicators** are:

| | | |
|---|---|---|
| Since | in that | seeing that |
| as indicated by | may be inferred from | for the reason that |
| because | as | inasmuch as |
| for | given that | owing to |

Any statement following one of these indicators can usually be identified as a premise.

Example:

> Expectant mothers should never use recreational drugs, since the use of these drugs can jeopardize the development of the fetus.

The premise of this argument is ‘‘the use of these drugs can jeopardize the development of the fetus,’’ and the conclusion is ‘‘Expectant mothers should never use recreational drugs.’’

One premise indicator not included in the above list is ‘‘for this reason.’’ This indicator is special in that it comes immediately after the premise that it indicates. ‘‘For this reason’’ (except when followed by a colon) means for the reason (premise) that was just given. In other words, the premise is the statement that occurs immediately before ‘‘for this reason.’’ One should be careful not to confuse ‘‘for this reason’’ with ‘‘for the reason that.’’

Sometimes a single indicator can be used to identify more than one premise. Consider the following argument:

> The development of high-temperature superconducting materials is technologically justified, for such materials will allow electricity to be transmitted without loss over great distances, and they will pave the way for trains that levitate magnetically.

The premise indicator ‘‘for’’ goes with both ‘‘such materials will allow electricity to be transmitted without loss over great distances’’ and ‘‘they will pave the way for trains that levitate magnetically.’’ These are the premises. By process of elimination, ‘‘the development of high-temperature superconducting materials is technologically justified’’ is the conclusion.

Sometimes an argument contains no indicators. When this occurs, the reader/ listener must ask himself or herself such questions as: What single statement is claimed (implicitly) to follow from the others? What is the arguer trying to prove? What is the main point in the passage? The answers to these questions should point to the conclusion. Example:

> The space program deserves increased expenditures in the years ahead. Not only does the national defense depend upon it, but the program will more than pay for itself in terms of technological spinoffs. Furthermore, at current funding levels the program cannot fulfill its anticipated potential.

The conclusion of this argument is the first statement, and all of the other statements are premises. The argument illustrates the pattern found in most arguments that lack indicator words: the intended conclusion is stated first, and the remaining statements are then offered in support of this first statement. When the argument is restructured according to logical principles, however, the conclusion is always listed after the premises:

P1: The national defense is dependent upon the space program.
P2: The space program will more than pay for itself in terms of technological spinoffs.
P3: At current funding levels the space program cannot fulfill its anticipated potential.
C: The space program deserves increased expenditures in the years ahead.

When restructuring arguments such as this, one should remain as close as possible to the original version, while at the same time attending to the requirement that premises and conclusion be complete sentences that are meaningful in the order in which they are listed.

Note that the first two premises are included within the scope of a single sentence in the original argument. For the purposes of this chapter, compound arrangements of statements in

which the various components are all claimed to be true will be considered as separate statements.

Passages that contain arguments sometimes contain statements that are neither premises nor conclusion. Only statements that are actually intended to support the conclusion should be included in the list of premises. If a statement has nothing to do with the conclusion or, for example, simply makes a passing comment, it should not be included within the context of the argument. Example:

> Socialized medicine is not recommended because it would result in a reduction in the overall quality of medical care available to the average citizen. In addition, it might very well bankrupt the federal treasury. This is the whole case against socialized medicine in a nutshell.

The conclusion of this argument is ‘‘Socialized medicine is not recommended,’’ and the two statements following the word ‘‘because’’ are the premises. The last statement makes only a passing comment about the argument itself and is therefore neither a premise nor a conclusion.

Closely related to the concepts of argument and statement are those of inference and proposition. An inference, in the technical sense of the term, is the reasoning process expressed by an argument. As we will see in the next section, inferences may be expressed not only through arguments but through conditional statements as well. In the loose sense of the term, **‘‘inference’’** is used interchangeably with‘‘argument.’’

Analogously, **a proposition,** in the technical sense, is the meaning or information content of a statement. For the purposes of this book, however, ‘‘proposition’’ and ‘‘statement’’ are used interchangeably.

## Note on the History of Logic

The person who is generally credited as being the father of logic is the ancient Greek philosopher Aristotle (384–322B.C.). Aristotle’s predecessors had been interested in the art of constructing persuasive arguments and in techniques for refuting the arguments of others, but it was Aristotle who first devised systematic criteria for analyzing and evaluating arguments. Aristotle’s logic is called syllogistic logic and includes much of what is treated in Chapters 4 and 5 of this text. The fundamental elements in this logic are terms, and arguments are evaluated as good or bad depending on how the terms are arranged in the argument.

After Aristotle’s death, another Greek philosopher, Chrysippus (279–206B.C.), one of the founders of the Stoic school, developed a logic in which the fundamental elements were whole

propositions. Chrysippus treated every proposition as either true or false and developed rules for determining the truth or falsity of compound propositions from the truth or falsity of their components.

For thirteen hundred years after the death of Chrysippus, relatively little creative work was done in logic. The physician Galen (A.D.129–ca. 199) developed the theory of the compound categorical syllogism, but for the most part philosophers confined themselves to writing commentaries on the works of Aristotle and Chrysippus. Boethius (ca. 480–524) is a noteworthy example.

The first major logician of the Middle Ages was Peter Abelard (1079–1142). Abelard reconstructed and refined the logic of Aristotle and Chrysippus as communicated by Boethius, and he originated a theory of universals that traced the universal character of general terms to concepts in the mind rather than to ‘‘natures’’ existing outside the mind, as Aristotle had held. In addition, Abelard distinguished arguments that are valid because of their form from those that are valid because of their content, but he held that only formal validity is the ‘‘perfect’’ or conclusive variety. The present text follows Abelard on this point.

After Abelard, the study of logic during the Middle Ages blossomed and flourished through the work of numerous philosophers. It attained its final expression in the writings of the Oxford philosopher William of Occam (ca. 1285–1349). Occam devoted much of his attention to modal logic, a kind of logic that involves such notions as possibility, necessity, belief, and doubt. He also conducted an exhaustive study of forms of valid and invalid syllogisms and contributed to the development of the concept of a meta language—that is, a higher-level language used to discuss linguistic entities such as words, terms, propositions, and so on.

Toward the middle of the fifteenth century, a reaction set in against the logic of the Middle Ages. Rhetoric largely displaced logic as the primary focus of attention; the logic of Chrysippus, which had already begun to lose its unique identity in the Middle Ages, was ignored altogether, and the logic of Aristotle was studied only in highly simplistic presentations. A reawakening did not occur until two hundred years later through the work of Gottfried Wilhelm Leibniz (1646–1716).

Leibniz, a genius in numerous fields, attempted to develop a symbolic language or ‘‘calculus’’ that could be used to settle all forms of disputes, whether in theology, philosophy, or international relations. As a result of this work, Leibniz is sometimes credited with being the

father of symbolic logic. Leibniz's efforts to symbolize logic were carried into the nineteenth century by Bernard Bolzano (1781–1848).

With the arrival of the middle of the nineteenth century, logic commenced an extremely rapid period of development that has continued to this day. Work in symbolic logic was done by a number of philosophers and mathematicians, including Augustus DeMorgan (1806–1871), George Boole (1815–1864), William Stanley Jevons (1835–1882), and John Venn (1834–1923), some of whom are popularly known today by the logical theorems and techniques that bear their names. At the same time, a revival in inductive logic was initiated by the British philosopher John Stuart Mill (1806–1873), whose methods of induction are presented in Chapter 9 of this text.

Toward the end of the nineteenth century, the foundations of modern mathematical logic were laid by Gottlob Frege (1848–1925).. Frege's work was continued into the twentieth century by Alfred North Whitehead (1861–1947) and Bertrand Russell (1872–1970), who's monumental Principia Mathematica attempted to reduce the whole of pure mathematics to logic.

During the twentieth century, much of the work in logic has focused on the formalization of logical systems and on questions dealing with the completeness and consistency of such systems. A now-famous theorem proved by Kurt Goedel (1906–1978) states that in any formal system adequate for number theory there exists an un decidable formula—that is, a formula such that neither it nor its negation is derivable from the axioms of the system. Other developments include multi valued logics and the formalization of modal logic. Most recently, logic has made a major contribution to technology by providing the conceptual foundation for the electronic circuitry of digital computers.

## 2. Recognizing Argument

Not all passages contain arguments. Because logic deals with arguments, it is important to be able to distinguish passages that contain arguments from those that do not. In general, a passage contains an argument if it purports to prove something; if it does not do so, it does not contain an argument. Two conditions must be fulfilled for a passage to purport to prove something: (1) At least one of the statements must claim to present evidence or reasons. (2) There must be a claim that the alleged evidence or reasons supports or implies something—that is, a claim that something follows from the alleged evidence. As we have seen, the statements that claim to present the evidence or reasons are the premises, and the statement that the

evidence is claimed to support or imply is the conclusion. It is not necessary that the premises present actual evidence or true reasons nor that the premises actually support the conclusion. But at least the premises must claim to present evidence or reasons, and there must be a claim that the evidence or reasons support or imply something.

The first condition expresses a factual claim, and deciding whether it is fulfilled usually presents few problems. Thus, most of our attention will be concentrated on whether the second condition is fulfilled. This second condition expresses what is called an inferential claim. The inferential claim is simply the claim that the passage expresses a certain kind of reasoning process—that something supports or implies something or that something follows from something. Such a claim can be either explicit or implicit. An explicit inferential claim is usually asserted by premise or conclusion indicator words (‘‘thus,’’ ‘‘since,’’ ‘‘because,’’ ‘‘hence,’’ ‘‘therefore,’’ and so on). Example:

> The human eye can see a source of light that is as faint as an ordinary candle from a distance of 27 kilometers, through a non absorbing atmosphere. Thus, a powerful searchlight directed from a new moon should be visible on earth with the naked eye.

The word ‘‘thus’’ expresses the claim that something is being inferred, so the passage is an argument. An implicit inferential claim exists if there is an inferential relationship between the statements in a passage. Example:

> The price reduction [seen with the electronic calculator] is the result of a technological revolution. The calculator of the 1960s used integrated electronic circuits that contained about a dozen transistors or similar components on a single chip. Today, mass-produced chips, only a few millimeters square, contain several thousand such components.

The inferential relationship between the first statement and the other two constitutes an implicit claim that evidence supports something, so we are justified in calling the passage an argument. The first statement is the conclusion, and the other two are the premises.

In deciding whether there is a claim that evidence supports or implies something, keep an eye out for (1) indicator words and (2) the presence of an inferential relationship between the statements. In connection with these points, however, a word of caution is in order. First, the

mere occurrence of an indicator word by no means guarantees the presence of an argument. For example, consider the following passages:

> Since Edison invented the phonograph, there have been many technological developments.
> Since Edison invented the phonograph, he deserves credit for a major technological development.

In the first passage the word ‘‘since’’ is used in a temporal sense. It means ‘‘from the time that.’’ Thus, the first passage is not an argument. In the second passage ‘‘since’’ is used in a logical sense, and so the passage is an argument.

The second cautionary point is that it is not always easy to detect the occurrence of an inferential relationship between the statements in a passage, and the reader may have to review a passage several times before making a decision. In reaching such a decision, it sometimes helps to mentally insert the word ‘‘therefore’’ before the various statements to see whether it makes sense to interpret one of them as following from the others. Even with this mental aid, however, the decision whether a passage contains an inferential relationship (as well as the decision about indicator words) often involves a heavy dose of interpretation. As a result, not everyone will agree about every passage. Sometimes the only answer possible is a conditional one: ‘‘If this passage contains an argument, then these are the premises and that is the conclusion.’’

To assist in distinguishing passages that contain arguments from those that do not, let us now investigate some typical kinds of non arguments. These include simple non inferential passages, expository passages, illustrations, explanations, and conditional statements.

## Simple Non inferential Passages

Simple non inferential passages are unproblematic passages that lack a claim that anything is being proved. Such passages contain statements that could be premises or conclusions (or both), but what is missing is a claim that any potential premise supports a conclusion or that any potential conclusion is supported by premises. Passages of this sort include warnings, pieces of advice, statements of belief or opinion, loosely associated statements, and reports.

A **warning** is a form of expression that is intended to put someone on guard against a dangerous or detrimental situation. Examples:

Watch out that you don't slip on the ice.
Whatever you do, never confide personal secrets to Blabbermouth Bob.

If no evidence is given to prove that such statements are true, then there is no argument.

A **piece of advice** is a form of expression that makes a recommendation about some future decision or course of conduct. Examples:

> You should keep a few things in mind before buying a used car. Test drive the car at varying speeds and conditions, examine the oil in the crankcase, ask to see service records, and, if possible, have the engine and power train checked by a mechanic.
>
> Before accepting a job after class hours, I would suggest that you give careful consideration to your course load. Will you have sufficient time to prepare for classes and tests, and will the job produce an excessive drain on your energies?

As with warnings, if there is no evidence that is intended to prove anything, then there is no argument.

A **statement of belief** or **opinion** is an expression about what someone happens to believe or think at a certain time. Examples:

> We believe that our company must develop and produce outstanding products that will perform a great service or fulfill a need for our customers. We believe that our business must be run at an adequate profit and that the services and products we offer must be better than those offered by competitors.
>
> I think a nation such as ours, with its high moral traditions and commitments, has a further responsibility to know how we became drawn into this conflict, and to learn the lessons it has to teach us for the future

Because neither of these authors makes any claim that his belief or opinion is supported by evidence, or that it supports some conclusion, there is no argument.

**Loosely associated statements** may be about the same general subject, but they lack a claim that one of them is proved by the others. Example:

> Not to honor men of worth will keep the people from contention; not to value goods that are hard to come by will keep them from theft; not to display what is desirable will keep them from being unsettled of mind.

Because there is no claim that any of these statements provides evidence or reasons for believing another, there is no argument.

A **report** consists of a group of statements that convey information about some topic or event. Example:

> Even though more of the world is immunized than ever before, many old diseases have proven quite resilient in the face of changing population and environmental conditions, especially in the developing world. New diseases, such as AIDS, have taken their toll in both the North and the South.

These statements could serve as the premises of an argument; but because the author makes no claim that they support or imply anything, there is no argument. Another type of report is the news report:

> A powerful car bomb blew up outside the regional telephone company headquarters in Medellin, injuring 25 people and causing millions of dollars of damage to nearby buildings, police said. A police statement said the 198-pound bomb was packed into a milk churn hidden in the back of a stolen car.

Again, because the reporter makes no claim that these statements imply anything, there is no argument.

One must be careful, though, with reports about arguments:

> ‘‘The Air Force faces a serious shortage of experienced pilots in the years ahead, because repeated overseas tours and the allure of high paying jobs with commercial airlines are winning out over lucrative bonuses to stay in the service,’’ says a prominent Air Force official.

Properly speaking, this passage is not an argument, because the author of the passage does not claim that anything is supported by evidence. Rather, the author reports the claim by the Air Force official that something is supported by evidence. If such passages are interpreted as ‘‘containing’’ arguments, it must be made clear that the argument is not the author’s but one made by someone about whom the author is reporting.

## Expository Passages

An expository passage is a kind of discourse that begins with a topic sentence followed by one or more sentences that develop the topic sentence. If the objective is not to prove the topic sentence but only to expand it or elaborate it, then there is no argument. Examples:

> There are three familiar states of matter: solid, liquid, and gas. Solid objects ordinarily maintain their shape and volume regardless of their location. A liquid occupies a definite volume, but assumes the shape of the occupied portion of its container. A gas maintains neither shape nor volume. It expands to fill completely whatever container it is in.
>
> There is a stylized relation of artist to mass audience in the sports, especially in baseball. Each player develops a style of his own—the swagger as he steps to the plate, the unique windup a pitcher has, the clean-swinging and hard-driving hits, the precision quickness and grace of infield and outfield, the sense of surplus power behind whatever is done.

In each passage the topic sentence is stated first, and the remaining sentences merely develop and flesh out this topic sentence. These passages are not arguments because they lack an inferential claim. However, expository passages differ from simple non inferential passages (such as warnings and pieces of advice) in that many of them can also be taken as arguments. If the purpose of the subsequent sentences in the passage is not only to flesh out the topic sentence but also to prove it, then the passage is an argument. Example:

> Skin and the mucous membrane lining the respiratory and digestive tracts serve as mechanical barriers to entry by microbes. Oil gland secretions contain chemicals that weaken or kill bacteria on skin. The respiratory tract is lined by cells that sweep mucus and trapped particles up into the throat, where they can be swallowed. The stomach has an acidic pH, which inhibits the growth of many types of bacteria.

In this passage the topic sentence is stated first, and the purpose of the remaining sentences is not only to show how the skin and mucous membranes serve as barriers to microbes but to prove that they do this. Thus, the passage can be taken as both an expository passage and an argument.

In deciding whether an expository passage should be interpreted as an argument, try to determine whether the purpose of the subsequent sentences in the passage is merely to develop

the topic sentence or also to prove it. In borderline cases, ask yourself whether the topic sentence makes a claim that everyone accepts or agrees with. If it does, the passage is probably not an argument. In real life situations authors rarely try to prove something that everyone already accepts. However, if the topic sentence makes a claim that many people do not accept or have never thought about, then the purpose of the remaining sentences may be both to prove the topic sentence as well as to develop it. If this be so, the passage is an argument.

Finally, if even this procedure yields no definite answer, the only alternative may be to say that if the passage is taken as an argument, then the first statement is the conclusion and the others are the premises.

**Illustrations**

An illustration consists of a statement about a certain subject combined with a reference to one or more specific instances intended to exemplify that statement. Illustrations are often confused with arguments because many of them contain indicator words such as ‘‘thus.’’ Examples:

> Chemical elements, as well as compounds, can be represented by molecular formulas. Thus, oxygen is represented by‘‘O2,’’ water by‘‘H2O,’’ and sodium chloride by ‘‘Na Cl.’’
>
> Whenever a force is exerted on an object, the shape of the object can change. For example, when you squeeze a rubber ball or strike a punching bag with your fist, the objects are deformed to some extent.

These selections are not arguments because they make no claim that anything is being proved. In the first selection, the word ‘‘thus’’ indicates how something is done—namely, how chemical elements and compounds can be represented by formulas. In the second selection, the example cited is intended to give concrete meaning to the notion of a force changing the shape of something. It is not intended primarily to prove that a force can change the shape of something.

However, as with expository passages, many illustrations can be taken as arguments. Such arguments are often called **arguments from example**. Here is an instance of one:

> Water is an excellent solvent. It can dissolve a wide range of materials that will not dissolve in other liquids. For example, salts do not dissolve in most

> common solvents, such as gasoline, kerosene, turpentine and cleaning fluids. But many salts dissolve readily in water. So do a variety of nonionic organic substances, such as sugars and alcohols of low molecular weight.

In this passage the examples that are cited can be interpreted as providing evidence that water can dissolve a wide range of materials that will not dissolve in other liquids. Thus, the passage can be taken as both an illustration and an argument, with the second sentence being the conclusion.

In deciding whether an illustration should be interpreted as an argument one must determine whether the passage merely shows how something is done or what something means, or whether it also purports to prove something. In borderline cases it helps to note whether the claim being illustrated is one that practically everyone accepts or agrees with. If it is, the passage is probably not an argument. As we have already noted, in real life situations authors rarely attempt to prove what everyone already accepts. But if the claim being illustrated is one that many people do not accept or have never thought about, then the passage may be interpreted as both an illustration and an argument.

Thus, in reference to the first two examples we considered, most people are aware that elements and compounds can be expressed by formulas—practically everyone knows that water is H2O—and most people know that forces distort things—that running into a tree can cause a dent in the car bumper. But people may not be aware of the fact that water dissolves many things that other solvents will not dissolve. This is one of the reasons for evaluating the first two examples as mere illustrations and the last one as an argument.

## Explanations

One of the most important kinds of non argument is the explanation. An explanation is a group of statements that purports to shed light on some event or phenomenon. The event or phenomenon in question is usually accepted as a matter of fact.

Examples:

> The Challenger spacecraft exploded after liftoff because an O-ring failed in one of the booster rockets.

> The sky appears blue from the earth's surface because light rays from the sun are scattered by particles in the atmosphere.
>
> Cows can digest grass, while humans cannot, because their digestive systems contain enzymes not found in humans.

Every explanation is composed of two distinct components: the **explanandum** and explanans. The explanandum is the statement that describes the event or phenomenon to be explained, and the **explanans** is the statement or group of statements that purports to do the explaining. In the first example above, the explanandum is the statement ''The Challenger spacecraft exploded after liftoff,'' and the explanans is ''An O-ring failed in one of the booster rockets.''

Explanations are sometimes mistaken for arguments because they often contain the indicator word ''because.'' Yet explanations are not arguments because in an explanation the purpose of the explanans is to shed light on, or to make sense of, the explanandum event—not to prove that it occurred. In other words, the purpose of the explanans is to show why something is the case, while in an argument, the purpose of the premises is to prove that something is the case.

In the first example above, the fact that the Challenger exploded is known to everyone. The statement that an O-ring failed in one of the booster rockets is not intended to prove that the spacecraft exploded but rather to show why it exploded. In the second example, the fact that the sky is blue is readily apparent. The intention of the passage is to explain why it appears blue—not to prove that it appears blue. Similarly, in the third example, virtually everyone knows that people cannot digest grass. The intention of the passage is to explain why this is true.

Thus, to distinguish explanations from arguments, identify the statement that is either the explanandum or the conclusion (usually this is the statement that precedes the word ''because''). If this statement describes an accepted matter of fact, and if the remaining statements purport to shed light on this statement, then the passage is an explanation.

This method works for practically all passages that are either explanations or arguments (but not both). However, as with expository passages and illustrations, there are some passages that can be interpreted as both explanations and arguments.

Example:

> Women become intoxicated by drinking a smaller amount of alcohol than men because men metabolize part of the alcohol before it reaches the bloodstream whereas women do not.

The purpose of this passage could be to prove the first statement to those people who do not accept it as fact, and to shed light on that fact to those people who do accept it. Alternately, the passage could be intended to prove the first statement to a single person who accepts its truth on blind faith or incomplete experience, and simultaneously to shed light on this truth. Thus, the passage can be correctly interpreted as both an explanation and an argument.

Perhaps the greatest problem confronting the effort to distinguish explanations from arguments lies in determining whether something is an accepted matter of fact. Obviously what is accepted by one person may not be accepted by another. Thus, the effort often involves determining which person or group of people the passage is directed to—the intended audience. Sometimes the source of the passage (textbook, newspaper, technical journal, etc.) will decide the issue. But when the passage is taken totally out of context, this may prove impossible. In those circumstances the only possible answer may be to say that if the passage is an argument, then such-and-such is the conclusion and such-and-such are the premises.

## Conditional Statements

A **conditional statement** is an ‘‘if... then...’’statement; for example:

If air is removed from a solid closed container, then the container will weigh less than it did.

Every conditional statement is made up of two component statements. The component statement immediately following the ‘‘if’’ is called the antecedent, and the one following the ‘‘then’’ is called the consequent.(Occasionally, the word ‘‘then’’ is left out, and occasionally the order of antecedent and consequent is reversed.) In the above example the antecedent is ‘‘Air is removed from a solid closed container,’’ and the consequent is ‘‘The container will weigh less than it did.’’ This example asserts a causal connection between the air being removed and the container weighing less.

However, not all conditional statements express causal connections. The statement ‘‘If yellow fever is an infectious disease, then the Dallas Cowboys are a football team’’ is just as much a conditional statement as the one about the closed container.

Conditional statements are not arguments, because they fail to meet the criteria given earlier. In an argument, at least one statement must claim to present evidence, and there must be a claim that this evidence implies something. In a conditional statement, there is no claim that either the antecedent or the consequent presents evidence. In other words, there is no assertion that either the antecedent or the consequent is true. Rather, there is only the assertion that if the antecedent is true, then so is the consequent. Of course, a conditional statement as a whole may present evidence because it asserts a relationship between statements. Yet when conditional statements are taken in this sense, there is still no argument, because there is then no separate claim that this evidence implies anything.

Some conditional statements are similar to arguments, however, in that they express the outcome of a reasoning process. As such, they may be said to have a certain inferential content. Consider the following:

If both Saturn and Uranus have rings, then Saturn has rings.
If iron is less dense than mercury, then it will float in mercury.

The link between the antecedent and consequent of these conditional statements resembles the inferential link between the premises and conclusion of an argument. Yet there is a difference because the premises of an argument are claimed to be true, whereas no such claim is made for the antecedent of a conditional statement. Accordingly, these conditional statements are not arguments. Yet their inferential content may be re expressed to form arguments:

Both Saturn and Uranus have rings.
Therefore, Saturn has rings.
Iron is less dense than mercury.
Therefore, iron will float in mercury.

Finally, while no single conditional statement is an argument, a conditional statement may serve as either the premise or the conclusion (or both) of an argument, as the following examples illustrate:

> If cigarette companies publish warning labels, then smokers assume the risk of smoking.
> Cigarette companies do publish warning labels.
> Therefore, smokers assume the risk of smoking.
> If banks make bad loans, then they will be threatened with collapse.
> If banks are threatened with collapse, then the taxpayer will come to the rescue.
> Therefore, if banks make bad loans, then the taxpayer will come to the rescue.

The relation between conditional statements and arguments may now be summarized as follows:

1) A single conditional statement is not an argument.

2) A conditional statement may serve as either the premise or the conclusion (or both) of an argument.

3) The inferential content of a conditional statement may be re expressed to form an argument.

The first two rules are especially pertinent to the recognition of arguments. According to the first rule, if a passage consists of a single conditional statement, it is not an argument. But if it consists of a conditional statement together with some other statement, then, by the second rule, It may be an argument, depending on such factors as the presence of indicator words and an inferential relationship between the statements.

Conditional statements are especially important in logic because they express the relationship between necessary and sufficient conditions. A is said to be a sufficient condition for B whenever the occurrence of A is all that is needed for the occurrence of B. For example, being a dog is a sufficient condition for being an animal. On the other hand, B is said to be a necessary condition for A whenever A cannot occur without the occurrence of B. Thus, being an animal is a necessary condition for being a dog. These relationships are expressed in the following conditional statements:

> If X is a dog, then X is an animal.
>
> If X is not an animal, then X is not a dog.

The first statement says that being a dog is a sufficient condition for being an animal and the second that being an animal is a necessary condition for being a dog. However, a little reflection reveals that these two statements say exactly the same thing. Thus each expresses in one way a necessary condition and in another way a sufficient condition. The terminology of sufficient and necessary conditions will be used in later chapters to express definitions and causal connections.

## Deduction and Induction

Arguments can be divided into two groups: deductive and inductive. A deductive argument is an argument in which the premises are claimed to support the conclusion in such a way that it is impossible for the premises to be true and the conclusion false. In such arguments the conclusion is claimed to follow necessarily from the premises. On the other hand, an inductive argument is an argument in which the premises are claimed to support the conclusion in such a way that it is improbable that the premises be true and the conclusion false. In these arguments the conclusion is claimed to follow only probably from the premises. Thus, deductive arguments are those that involve necessary reasoning, and inductive arguments are those that involve probabilistic reasoning. Examples:

The meerkat is closely related to the suricat.
The suricat thrives on beetle larvae.
Therefore, probably the meerkat thrives on beetle larvae.

The meerkat is a member of the mongoose family.
All members of the mongoose family are carnivores.
Therefore, it necessarily follows that the meerkat is a carnivore.

The first of these arguments is inductive, the second deductive.

The distinction between inductive and deductive arguments lies in the strength of an argument's inferential claim. In other words, the distinction lies in how strongly the conclusion is claimed to follow from the premises. Unfortunately, however, in most arguments the strength of this claim is not explicitly stated, so we must use our interpretive abilities to evaluate it. Three factors that influence our decision about this claim are (1) the occurrence of special indicator words, (2) the actual strength of the inferential link between premises and conclusion, and (3) the character or form of argumentation the arguer uses.

The occurrence of special indicator words is illustrated in the examples we just considered. The word ‘‘probably’’ in the conclusion of the first argument suggests that the argument should be taken as inductive, and the word ‘‘necessarily’’ in the conclusion of the second suggests that the second argument be taken as deductive. Additional inductive indicators are ‘‘improbable,’’ ‘‘plausible,’’ ‘‘implausible,’’ ‘‘likely,’’ ‘‘unlikely,’’ and ‘‘reasonable to conclude.’’ Additional deductive indicators are ‘‘certainly,’’ ‘‘absolutely,’’ and ‘‘definitely.’’ (Note that the phrase ‘‘it must be the case that’’ is ambiguous; ‘‘must’’ can indicate either probability or necessity).

Inductive and deductive indicator words often suggest the correct interpretation. However, if they conflict with one of the other criteria (discussed shortly), we should probably ignore them. Arguers often use phrases such as ‘‘it certainly follows that’’ for rhetorical purposes to add impact to their conclusion and not to suggest that the argument be taken as deductive. Similarly, some arguers, not knowing the distinction between inductive and deductive, will claim to ‘‘deduce’’ a conclusion when their argument is more correctly interpreted as inductive.

The second factor that bears upon our interpretation of an argument as inductive or deductive is the actual strength of the inferential link between premises and conclusion. If the conclusion actually does follow with strict necessity from the premises, the argument is clearly deductive. In such an argument it is impossible for the premises to be true and the conclusion false. On the other hand, if the conclusion does not follow with strict necessity but does follow probably, it is usually best to consider the argument inductive. Examples:

All saleswomen are extroverts.
Elizabeth Taylor is a saleswoman.
Therefore, Elizabeth Taylor is an extrovert.

The vast majority of saleswomen are extroverts.
Elizabeth Taylor is a saleswoman.
Therefore, Elizabeth Taylor is an extrovert.

In the first example, the conclusion follows with strict necessity from the premises. If we assume that all saleswomen are extroverts and that Elizabeth Taylor is a saleswoman, then it is impossible that Elizabeth Taylor not be an extrovert. Thus, we should interpret this argument as deductive. In the second example, the conclusion does not follow from the premises with strict

necessity, but it does follow with some degree of probability. If we assume that the premises are true, then based on that assumption it is improbable that the conclusion is false. Thus, it is best to interpret the second argument as inductive.

Occasionally, an argument contains no indicator words, and the conclusion does not follow either necessarily or probably from the premises; in other words, it does not follow at all. This situation points up the need for the third factor to be taken into account, which is the character or form of argumentation the arguer uses. Five examples of argumentation that are typically deductive are arguments based on mathematics, arguments from definition, and categorical, hypothetical, and disjunctive syllogisms. Additional ones will be addressed in later chapters.

An **argument based on mathematics** is an argument in which the conclusion depends on some purely arithmetic or geometric computation or measurement. For example, a shopper might place two apples and three oranges into a paper bag and then conclude that the bag contains five pieces of fruit. Or a surveyor might measure a square piece of land and, after determining that it is 100 feet on each side, conclude that it contains 10,000 square feet. Since all arguments in pure mathematics are deductive, we can usually consider arguments that depend on mathematics to be deductive as well. A noteworthy exception, however, is arguments that depend on statistics. As we will see shortly, such arguments are usually best interpreted as inductive.

An **argument from definition** is an argument in which the conclusion is claimed to depend merely upon the definition of some word or phrase used in the premise or conclusion. For example, someone might argue that because Claudia is mendacious, it follows that she tells lies, or that because a certain paragraph is prolix, it follows that it is excessively wordy. These arguments are deductive because their conclusions follow with necessity from the definitions of ‘‘mendacious’’ and ‘‘prolix.’’

A syllogism, in general, is an argument consisting of exactly two premises and one conclusion. Categorical syllogisms will be treated in greater depth in Chapter 5, but for now we will say that a **categorical syllogism** is a syllogism in which each statement begins with one of the words ‘‘all,’’ ‘‘no,’’ or ‘‘some.’’ Example:

All lasers are optical devices.
Some lasers are surgical instruments.

Therefore, some optical devices are surgical instruments.

Arguments such as these are nearly always best treated as deductive.

A **hypothetical syllogism** is a syllogism having a conditional statement for one or both of its premises. Examples:

If electricity flows through a conductor, then a magnetic field is produced.
If a magnetic field is produced, then a nearby compass will be deflected.
Therefore, if electricity flows through a conductor, then a nearby compass will be deflected.

If quartz scratches glass, then quartz is harder than glass.
Quartz scratches glass.
Therefore, quartz is harder than glass.

Although certain forms of such arguments can sometimes be interpreted inductively, the deductive interpretation is usually the most appropriate.

A **disjunctive syllogism** is a syllogism having a disjunctive statement (i.e., an ‘‘either...or...’’statement) for one of its premises. Example:

Either breach of contract is a crime or it is not punishable by the state.
Breach of contract is not a crime.
Therefore, it is not punishable by the state.

As with hypothetical syllogisms, such arguments are usually best taken as deductive.

Now let us consider some typically inductive forms of argumentation. In general, inductive arguments are such that the content of the conclusion is in some way intended to ‘‘go beyond’’ the content of the premises. The premises of such an argument typically deal with some subject that is relatively familiar, and the conclusion then moves beyond this to a subject that is less familiar or that little is known about. Such an argument may take any of several forms: predictions about the future, arguments from analogy, inductive generalizations, arguments from authority, arguments based on signs, and causal inferences, to name just a few.

In a **prediction,** the premises deal with some known event in the present or past, and the conclusion moves beyond this event to some event in the relative future. For example, someone might argue that because certain meteorological phenomena have been observed to develop over a certain region of central Missouri, a storm will occur there in six hours. Or again, one might argue that because certain fluctuations occurred in the prime interest rate on Friday, the value of the dollar will decrease against foreign currencies on Monday. Nearly everyone realizes that the

future cannot be known with certainty; thus, whenever an argument makes a prediction about the future, one is usually justified in considering the argument inductive.

An **argument from analogy** is an argument that depends on the existence of an analogy, or similarity, between two things or states of affairs. Because of the existence of this analogy, a certain condition that affects the better-known thing or situation is concluded to affect the similar, lesser-known thing or situation. For example, someone might argue that because Christina's Porsche is a great handling car, it follows that Angela's Porsche must also be a great handling car. The argument depends on the existence of a similarity, or analogy, between the two cars. The certitude attending such an inference is obviously probabilistic at best.

An **inductive generalization** is an argument that proceeds from the knowledge of a selected sample to some claim about the whole group. Because the members of the sample have a certain characteristic, it is argued that all the members of the group have that same characteristic. For example, one might argue that because three oranges selected from a certain crate were especially tasty and juicy, all the oranges from that crate are especially tasty and juicy. Or again, one might argue that because six out of a total of nine members sampled from a certain labor union intend to vote for Johnson for union president, two-thirds of the entire membership intends to vote for Johnson. These examples illustrate the use of statistics in inductive argumentation.

An **argument from authority** is an argument in which the conclusion rests upon a statement made by some presumed authority or witness. For example, a person might argue that earnings for Hewlett-Packard Corporation will be up in the coming quarter because of a statement to that effect by an investment counselor. Or a lawyer might argue that Mack the Knife committed the murder because an eyewitness testified to that effect under oath. Because the investment counselor and the eyewitness could be either mistaken or lying, such arguments are essentially probabilistic.

An **argument based on signs** is an argument that proceeds from the knowledge of a certain sign to knowledge of the thing or situation that the sign symbolizes. For example, when driving on an unfamiliar highway one might see a sign indicating that the road makes several sharp turns one mile ahead. Based on this information, one might argue that the road does indeed make

several sharp turns one mile ahead. Because the sign might be misplaced or in error about the turns, the conclusion is only probable.

A **causal inference** underlies arguments that proceed from knowledge of a cause to knowledge of the effect, or, conversely, from knowledge of an effect to knowledge of a cause. For example, from the knowledge that a bottle of wine had been accidentally left in the freezer overnight, someone might conclude that it had frozen (cause to effect). Conversely, after tasting a piece of chicken and finding it dry and crunchy, one might conclude that it had been overcooked (effect to cause). Because specific instances of cause and effect can never be known with absolute certainty, one may usually interpret such arguments as inductive.

It should be noted that the various subspecies of inductive arguments listed here are not intended to be mutually exclusive. Overlaps can and do occur. For example, many causal inferences that proceed from cause to effect also qualify as predictions. The purpose of this survey is not to demarcate in precise terms the various forms of induction but rather to provide guidelines for distinguishing induction from deduction.

Keeping this in mind, we should take care not to confuse arguments in geometry, which are always deductive, with arguments from analogy or inductive generalizations. For example, an argument concluding that a triangle has a certain attribute (such as a right angle) because another triangle, with which it is congruent, also has that attribute might be mistaken for an argument from analogy. Similarly, an argument that concludes that all triangles have a certain attribute (such as angles totaling two right angles) because any particular triangle has that attribute might be mistaken for an inductive generalization. Arguments such as these, however, are always deductive, because the conclusion follows necessarily and with complete certainty from the premises.

One broad classification of arguments not listed in this survey is scientific arguments. Arguments that occur in science can be either inductive or deductive, depending on the circumstances. In general, arguments aimed at the discovery of a law of nature are usually considered inductive. Suppose, for example, that we want to discover a law that governs the time required for a falling body to strike the earth. We drop bodies of various weights from various heights and measure the time it takes them to fall. Comparing our measurements, we notice that

the time is approximately proportional to the square root of the distance. From this we conclude that the time required for anybody to fall is proportional to the square root of the distance through which it falls. Such an argument is best interpreted as an inductive generalization.

Another type of argument that occurs in science has to do with the application of known laws to specific circumstances. Arguments of this sort are often considered to be deductive—but only with certain reservations. Suppose, for example, that we want to apply Boyle's law for ideal gases to a container of gas in our laboratory. Boyle's law states that the pressure exerted by a gas on the walls of its container is inversely proportional to the volume. Applying this law, we conclude that when we reduce the volume of our laboratory sample by half, we will double the pressure. Considered purely as a mathematical computation, this argument is deductive. But if we acknowledge the fact that the conclusion pertains to the future and the possibility that Boyle's law may not work in the future, then the argument is best considered inductive.

A final point needs to be made about the distinction between inductive and deductive arguments. There is a tradition extending back to the time of Aristotle which holds that inductive arguments are those that proceed from the particular to the general, while deductive arguments are those that proceed from the general to the particular. (A **particular statement** is one that makes a claim about one or more particular members of a class, while a **general statement** makes a claim about all the members of a class.) It is true, of course, that many inductive and deductive arguments do work in this way; but this fact should not be used as a criterion for distinguishing induction from deduction. As a matter of fact, there are deductive arguments that proceed from the general to the general, from the particular to the particular, and from the particular to the general, as well as from the general to the particular; and there are inductive arguments that do the same. For example, here is a deductive argument that proceeds from the particular to the general:

> Three is a prime number.
> Five is a prime number.
> Seven is a prime number.
> Therefore, all odd numbers between two and eight are prime numbers.

And here is one that proceeds from the particular to the particular:

Gabriel is a wolf.
Gabriel has a tail.
Therefore, Gabriel's tail is the tail of a wolf.

Here is an inductive argument that proceeds from the general to the particular:

All emeralds previously found have been green.
Therefore, the next emerald to be found will be green.

The other varieties are easy to construct. Thus, the progression from particular to general, and vice versa, cannot be used as a criterion for distinguishing induction from deduction.

In summary, to distinguish deductive arguments from inductive, we look for special indicator words, the actual strength of the inferential link between premises and conclusion, and the character or form of argumentation. If the conclusion follows with strict necessity from the premises, the argument is always deductive; if not, it could be either deductive or inductive depending on the other factors. The deductive and inductive arguments that we have surveyed in this section are as follows: **Deductive arguments:** arguments based on mathematics**,** arguments from definition**,** categorical syllogisms**,** hypothetical syllogisms, and disjunctive syllogisms. On the other hand **inductive** arguments are: predictions**,** arguments from analogy**,** inductive generalizations**,** arguments from authority**,** arguments based on signs**,** and causal inferences.

### 1.4 Validity, Truth, Soundness, Strength, Cogency

This section introduces the central ideas and terminology required to evaluate arguments. We have seen that every argument makes two basic claims: a claim that evidence or reasons exist and a claim that the alleged evidence or reasons support something (or that something follows from the alleged evidence or reasons). The first is a factual claim, the second an inferential claim. The evaluation of every argument centers on the evaluation of these two claims. The most important of the two is the inferential claim, because if the premises fail to support the conclusion (that is, if the reasoning is bad), an argument is worthless. Thus we will always test the inferential claim first, and only if the premises do support the conclusion will we test the factual claim (that is, the claim that the premises present genuine evidence, or are true). The material that follows considers first deductive arguments and then inductive.

## Deductive Arguments

The previous section defined a deductive argument as one in which the premises are claimed to support the conclusion in such a way that it is impossible for the premises to be true and the conclusion false. If the premises do in fact support the conclusion in this way, the argument is said to be valid. Thus, a **valid deductive argument** is an argument such that it is impossible for the premises to be true and the conclusion false. In these arguments the conclusion follows with strict necessity from the premises. Conversely, an **invalid deductive argument** is a deductive argument such that it is possible for the premises to be true and the conclusion false. In invalid arguments the conclusion does not follow with strict necessity from the premises, even though it is claimed to.

An immediate consequence of these definitions is that there is no middle ground between valid and invalid. There are no arguments that are‘‘almost’’ valid and ‘‘almost’’ invalid. If the conclusion follows with strict necessity from the premises, the argument is valid; if not, it is invalid.

To test an argument for validity we begin by assuming that all premises are true, and then we determine if it is possible, in light of that assumption, for the conclusion to be false. Here is an example:

All television networks are media companies.
NBC is a television network.
Therefore, NBC is a media company.

In this argument both premises are actually true, so it is easy to assume that they are true. Next we determine, in light of this assumption, if it is possible for the conclusion to be false. Clearly this is not possible. If NBC is included in the group of television networks (second premise) and if the group of television networks is included in the group of media companies (first premise), it necessarily follows that NBC is included in the group of media companies (conclusion). In other words, assuming the premises true and the conclusion false entails a strict contradiction. Thus the argument is valid.

Here is another example:

All automakers are computer manufacturers.

United Airlines is an automaker.

Therefore, United Airlines is a computer manufacturer

In this argument, both premises are actually false, but it is easy to assume that they are true. Every automaker could have a corporate division that manufactures computers. Also, in addition to flying airplanes, United Airlines could make cars. Next, in light of these assumptions, we determine if it is possible for the conclusion to be false. Again, we see that this is not possible, by the same reasoning as the previous example. Assuming the premises true and the conclusion false entails a contradiction. Thus, the argument is valid. Another example:

All banks are financial institutions.

Wells Fargo is a financial institution.

Therefore, Wells Fargo is a bank.

As in the first example, both premises of this argument are true, so it is easy to assume they are true. Next we determine, in light of this assumption, if it is possible for the conclusion to be false. In this case it is possible. If banks were included in one part of the group of financial institutions and Wells Fargo were included in another part, then Wells Fargo would not be a bank. In other words, assuming the premises true and the conclusion false does not involve any contradiction, and so the argument is invalid.

In addition to illustrating the basic idea of validity, these examples suggest an important point about validity and truth. In general, validity is not something that is determined by the actual truth or falsity of the premises and conclusion. Both the NBC example and the Wells Fargo example have actually true premises and an actually true conclusion, yet one is valid and the other invalid. The United Airlines example has actually false premises and an actually false conclusion, yet the argument is valid. Rather, validity is something that is determined by the relationship between premises and conclusion. The question is not whether premises and conclusion are true or false, but whether the premises support the conclusion. In the examples of valid arguments the premises do support the conclusion, and in the invalid case they do not.

Nevertheless, there is one arrangement of truth and falsity in the premises and conclusion that does determine the issue of validity. Any deductive argument having actually true premises and an actually false conclusion is invalid. The reasoning behind this fact is fairly obvious. If the premises are actually true and the conclusion is actually false, then it certainly is possible for the

premises to be true and the conclusion false. Thus, by the definition of invalidity, the argument is invalid.

The idea that any deductive argument having actually true premises and a false conclusion is invalid may be the most important point in all of deductive logic. The entire system of deductive logic would be quite useless if it accepted as valid any inferential process by which a person could start with truth in the premises and arrive at falsity in the conclusion.

Table 1.1 presents examples of deductive arguments that illustrate the various combinations of truth and falsity in the premises and conclusion. In the examples having false premises, both premises are false, but it is easy to construct other examples having only one false premise. When examining this table, note that the only combination of truth and falsity that does not allow for both valid and invalid arguments is true premises and false conclusion. As we have just seen, any argument having this combination is necessarily invalid.

**Table 1.1 Deductive Arguments**

| | Valid | Invalid |
|---|---|---|
| True premises<br>True conclusion | All wines are beverages.<br>Chardonnay is a wine.<br>Therefore, chardonnay is a beverage.[sound] | All wines are beverages.<br>Chardonnay is a beverage.<br>Therefore, chardonnay is a wine.(unsound) |
| True premises<br>False conclusion | None exist | All wines are beverages.<br>Ginger ale is a beverage.<br>Therefore, ginger ale is a wine.[unsound] |
| False premises<br>True conclusion | All wines are soft drinks.<br>Ginger ale is a wine.<br>Therefore, ginger ale is a soft drink. [unsound] | All wines are whiskeys.<br>Chardonnay is a whiskey.<br>Therefore, chardonnay is a wine.[unsound] |
| False premises<br>False Conclusion | All wines are whiskeys.<br>Ginger ale is a wine.<br>Therefore, ginger ale is a whiskey.[unsound] | All wines are whiskeys.<br>Ginger ale is a whiskey.<br>Therefore, ginger ale is a wine.[unsound] |

The relationship between the validity of a deductive argument and the truth or falsity of its premises and conclusion, as illustrated in Table 1.1, is summarized as follows:

| Premises | Conclusion | Validity |
|---|---|---|
| T | T | ? |
| T | F | invalid |
| F | T | ? |
| F | F | ? |

A **sound argument** is a deductive argument that is valid and has all true premises. Both conditions must be met for an argument to be sound, and if either is missing the argument is unsound. Thus, an unsound argument is a deductive argument that is invalid, has one or more false premises, or both. Because a valid argument is one such that it is impossible for the premises to be true and the conclusion false, and because a sound argument does in fact have true premises, it follows that every sound argument, by definition, will have a true conclusion as well. A sound argument, therefore, is what is meant by a ‘‘good’’ deductive argument in the fullest sense of the term. Therefore, sound argument= valid argument + all true premises.

In connection with this definition of soundness, a single proviso is required: For an argument to be unsound, the false premise or premises must actually be needed to support the conclusion. An argument with a conclusion that is validly supported by true premises but with a superfluous false premise would still be sound. Analogous remarks, incidentally, extend to induction.

## Inductive Arguments

Section 1.3 defined an inductive argument as one in which the premises are claimed to support the conclusion in such a way that it is improbable that the premises be true and the conclusion false. If the premises do in fact support the conclusion in this way, the argument is said to be strong. Thus, a **strong inductive argument** is an inductive argument such that it is improbable that the premises be true and the conclusion false. In such arguments, the conclusion follows probably from the premises. Conversely, a **weak inductive argument** is an inductive argument such that the conclusion does not follow probably from the premises, even though it is claimed to.

The procedure for testing the strength of inductive arguments runs parallel to the procedure for deduction. First we assume the premises are true, and then we determine whether, based on that assumption, the conclusion is probably true. Example:

> All dinosaur bones discovered to this day have been at least 50 million years old.
>
> Therefore, probably the next dinosaur bone to be found will be at least 50 million years old.

In this argument the premise is actually true, so it is easy to assume that it is true. Based on that assumption, the conclusion is probably true, so the argument is strong. Here is another example:

> All meteorites found to this day have contained gold. Therefore, probably the next meteorite to be found will contain gold.

The premise of this argument is actually false. Few, if any, meteorites contain any gold. But if we assume the premise is true, then based on that assumption, the conclusion would probably be true. Thus, the argument is strong. The next example is an argument from analogy:

> When a lighted match is slowly dunked into water, the flame is snuffed out.
>
> But gasoline is a liquid, just like water. Therefore, when a lighted match is slowly dunked into gasoline, the flame will be snuffed out.

In this argument the premises are actually true and the conclusion is probably false. Thus, if we assume the premises are true, then, based on that assumption, it is not probable that the conclusion is true. Thus, the argument is weak.

Another example:

> During the past fifty years, inflation has consistently reduced the value of the American dollar. Therefore, industrial productivity will probably increase in the years ahead.

In this argument, the premise is actually true and the conclusion is probably true in the actual world, but the probability of the conclusion is in no way based on the assumption that the premise is true. Because there is no direct connection between inflation and increased industrial productivity, the premise is irrelevant to the conclusion and it provides no probabilistic support for it. The conclusion is probably true independently of the premise. As a result, the argument is weak.

This last example illustrates an important distinction between strong inductive arguments and valid deductive arguments. As we will see in later chapters, if the conclusion of a deductive argument is necessarily true independently of the premises, the argument will still be considered

valid. But if the conclusion of an inductive argument is probably true independently of the premises, the argument will be weak.

These four examples show that in general the strength or weakness of an inductive argument results not from the actual truth or falsity of the premises and conclusion, but from the probabilistic support the premises give to the conclusion. The dinosaur argument has a true premise and probably true conclusion, and the meteorite argument has a false premise and a probably false conclusion; yet, both are strong because the premise of each provides probabilistic support for the conclusion. The industrial productivity argument has a true premise and a probably true conclusion, but the argument is weak because the premise provides no probabilistic support for the conclusion. Analogously to the evaluation of deductive arguments, the only arrangement of truth and falsity that establishes anything is true premises and probably false conclusion (as in the lighted match argument). Any inductive argument having true premises and a probably false conclusion is weak.

Table 1.2 presents the various possibilities of truth and falsity in the premises and conclusion of inductive arguments. Note that the only arrangement of truth and falsity that is missing for strong arguments is true premises and probably false conclusion. The relationship between the strength of an inductive argument and the truth or falsity of its premises and conclusion, as illustrated in Table 1.2, is summarized as follows:

| Premises | Conclusion | Strength |
|---|---|---|
| T | prob. T | ? |
| T | prob. F | weak |
| F | prob. T | ? |
| F | prob. F | ? |

**Table 1.2 Inductive Arguments**

| | Strong | Weak |
|---|---|---|
| True premises<br>Probably true conclusion | All previous American presidents were men. Therefore, probably the next American president will be a man. [cogent | A few American presidents were Federalists. Therefore, probably the next American president will be a man. |

| | | |
|---|---|---|
| | | [uncogent] |
| True premises<br>Probably false conclusion | None exist | A few American presidents were Federalists. Therefore, probably the next American president will be a Federalist. [uncogent] |
| False premises<br>Probably true conclusion | All previous American presidents were television debaters. Therefore, probably the next American president will be a television debater. [uncogent] | A few American presidents were Libertarians. Therefore, probably the next American president will be a television debater. [uncogent] |
| False<br>premises<br>Probably false<br>Conclusion | All previous American presidents were women. Therefore, probably the next American president will be a woman. [uncogent] | A few American presidents were Libertarians. Therefore, probably the next American president will be a Libertarian. [uncogent] |

Unlike the validity and invalidity of deductive arguments, the strength and weakness of inductive arguments admit of degrees. To be considered strong, an inductive argument must have a conclusion that is more probable than improbable. In other words, the likelihood that the conclusion is true must be more than 50 percent, and as the probability increases, the argument becomes stronger. For this purpose, consider the following pair of arguments:

This barrel contains 100 apples.
Three apples selected at random were found to be ripe.
Therefore, probably all 100 apples are ripe.

This barrel contains 100 apples.
Eighty apples selected at random were found to be ripe.
Therefore, probably all 100 apples are ripe.

The first argument is weak and the second is strong. However, the first is not absolutely weak nor the second absolutely strong. Both arguments would be strengthened or weakened by the random selection of a larger or smaller sample. For example, if the size of the sample in the second argument were reduced to 70 apples, the argument would be weakened. The incorporation of additional premises into an inductive argument will also generally tend to

strengthen or weaken it. For example, if the premise ‘‘One unripe apple that had been found earlier was removed’’ were added to either argument, the argument would be weakened.

A **cogent argument** is an inductive argument that is strong and has all true premises; if either condition is missing, the argument is uncogent. Thus, an uncogent argument is an inductive argument that is weak, has one or more false premises, or both. A cogent argument is the inductive analogue of a sound deductive argument and is what is meant by a ‘‘good’’ inductive argument without qualification. Because the conclusion of a cogent argument is genuinely supported by true premises, it follows that the conclusion of every cogent argument is probably true.

* Cogent argument= Strong argument + All true premises

There is a difference, however, between sound and cogent arguments in regard to the true-premise requirement. In a sound argument it is only necessary that the premises be true and nothing more. Given such premises and good reasoning, a true conclusion is guaranteed. In a cogent argument, on the other hand, the premises must not only be true, they must also not ignore some important piece of evidence that outweighs the given evidence and entails a quite different conclusion. As an illustration of this point, consider the following argument:

> Swimming in the Caribbean is usually lots of fun. Today the water is warm, the surf is gentle, and on this beach there are no dangerous currents. Therefore, it would be fun to go swimming here now.

If the premises reflect all the important factors, then the argument is cogent. But if they ignore the fact that several large dorsal fins are cutting through the water, then obviously the argument is not cogent. Thus, for cogency the premises must not only be true but also not overlook some important factor that outweighs the given evidence and requires a different conclusion.

In summary, for both deductive and inductive arguments, two separate questions need to be answered: (1) Do the premises support the conclusion? (2) Are all the premises true?

To answer the first question we begin by assuming the premises to be true. Then, for deductive arguments we determine whether, in light of this assumption, it necessarily follows that the conclusion is true. If it does, the argument is valid; if not, it is invalid. For inductive arguments we determine whether it probably follows that the conclusion is true. If it does, the

argument is strong; if not, it is weak. For inductive arguments we keep in mind the requirements that the premises actually support the conclusion and that they not ignore important evidence.

Finally, if the argument is either valid or strong, we turn to the second question and determine whether the premises are actually true. If all the premises are true, the argument is sound (in the case of deduction) or cogent (in the case of induction). All invalid deductive arguments are unsound, and all weak inductive arguments are uncogent.

☞ The various alternatives open to statements and arguments may be diagrammed as follows. Note that in logic one never speaks of an argument as being ‘‘true’’ or ‘‘false,’’ and one never speaks of a statement as being ‘‘valid,’’ ‘‘invalid,’’ ‘‘strong,’’ or ‘‘weak.’’

- Statements = True or False
- Arguments =Deductive arguments or Inductive arguments
- Deductive arguments =Valid or Invalid (all are unsound)
- Inductive arguments =Strong or Weak (all are uncogent)
- Valid = Sound or Unsound
- Strong = Cogent or Uncogent

***To Summarize:*** Logic is the study of the evaluation of arguments, which are lists of statements consisting of one or more premises and one conclusion. Premises can be distinguished from conclusion by the occurrence of indicator words (‘‘hence,’’ ‘‘therefore,’’ ‘‘since,’’ and so on) or an inferential relation among the statements. Because not all groups of statements are arguments, it is important to be able to distinguish arguments from Non arguments. This is done by attending to indicator words, the presence of an inferential relation among the statements, and typical kinds of non arguments. Typical non- arguments include warnings, loosely associated statements, reports, expository passages, illustrations, conditional statements, and explanations.

Arguments are customarily divided into deductive and inductive. Deductive arguments are those in which the conclusion is claimed to follow necessarily from the premises, while inductive arguments are those in which the conclusion is claimed to follow only probably from the premises. The two can be distinguished by attending to special indicator words (‘‘it necessarily follows that,’’ ‘‘it probably follows that,’’ and so on), the actual strength of the inferential relation, and typical forms or styles of deductive and inductive argumentation. Typical deductive arguments include arguments based on mathematics, arguments from definition, and categorical, hypothetical, and disjunctive syllogisms. Typical inductive arguments include

predictions, arguments from analogy, generalizations, arguments from authority, arguments based on signs, and causal inferences.

The evaluation of arguments involves two steps: evaluating the link between premises and conclusion, and evaluating the truth of the premises. Deductive arguments in which the conclusion actually follows from the premises are said to be valid, and those that also have true premise are said to be sound. Inductive arguments in which the conclusion actually follows from the premises are said to be strong, and those that also have true premises are said to be cogent. The terms ‘‘true’’ and ‘‘false’’ apply not to arguments, but to statements. The truth and falsity of premises and conclusion is only indirectly related to validity, but any deductive argument having true premises and false conclusion is invalid.

The validity of a deductive argument is determined by the form of the argument. An argument form that allows for a substitution instance having true premises and a false conclusion is an invalid form, and any argument having that form is an invalid argument. This fact leads to the counterexample method for proving invalidity. The method consists in identifying the form of a given invalid argument and then constructing a counterexample having premises that are indisputably true and a conclusion that is indisputably false.

The structure of longer arguments may be disclosed by the application of a method consisting of arrows and braces that show how the various premises support intermediate conclusions, and how the latter in turn support the main conclusion. Four basic argument patterns are the vertical pattern, horizontal pattern, conjoint premises, and multiple conclusions.

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# Chapter 2: Language: Meaning and Definition

## 2.1 Varieties of Meaning

Ordinary language, as most of us are at least vaguely aware, serves various functions in our day-to-day lives. The twentieth-century philosopher Ludwig Wittgenstein thought the number of these functions to be virtually unlimited. Thus, among other things, language is used to ask questions, tell stories, tell lies, guess at answers, form hypotheses, launch verbal assaults, tell jokes, flirt with someone, give directions, sing songs, issue commands, greet someone, and so on.

For our purpose, two linguistic functions are particularly important: (1) to convey information and (2) to express or evoke feelings. Consider, for example, the following statements:

> The death penalty, which is legal in thirty-six states, has been carried out most often in Georgia; however, since 1977 Texas holds the record for the greatest number of executions.
>
> The death penalty is a cruel and inhuman form of punishment in which hapless prisoners are dragged from their cells and summarily slaughtered only to satiate the bloodlust of a vengeful public.

The first statement is intended primarily to convey information; the second is intended, at least in part, to express or evoke feelings. These statements accomplish their respective functions through the distinct kinds of terminology in which they are phrased. Terminology that conveys information is said to have **cognitive meaning**, and terminology that expresses or evokes feelings is said to have **emotive meaning**. Thus, in the first statement the words ‘‘legal,’’ ‘‘thirty-six,’’ ‘‘most often,’’ ‘‘Georgia,’’ ‘‘record, ’’and soon have primarily a cognitive meaning, while in the second statement the words ‘‘cruel,’’ ‘‘inhuman,’’ ‘‘hapless,’’ ‘‘dragged,’’ ‘‘slaughtered,’’ ‘‘bloodlust, ’’and ‘‘vengeful’’ have a strong emotive meaning. Of course, these latter words have cognitive meaning as well. ‘‘Cruel’’ means tending to hurt others, ‘‘inhuman’’ means inappropriate for humans, ‘‘hapless’’ means unfortunate, and so on.

The emotively charged statement about the death penalty illustrates two important points. The first is that statements of this sort usually have both cognitive meaning and emotive meaning. Therefore, since logic is concerned chiefly with cognitive meaning, it is important that we be able to distinguish and disengage the cognitive meaning of such statements from the emotive

meaning. The second point is that part of the cognitive meaning of such statements is a value claim. A value claim is a claim that something is good, bad, right, wrong, or better, worse, more important or less important than some other thing. For example, the statement about the death penalty asserts the value claim that the death penalty is wrong or immoral. Such value claims are often the most important part of the cognitive meaning of emotive statements. Thus, for the purposes of logic, it is important that we be able to disengage the value claims of emotively charged statements from the emotive meaning and treat these claims as separate statements.

These observations suggest the reason that people use emotive terminology as often as they do: Value claims as such normally require evidence to support them. For example, the claim that the death penalty is immoral cannot simply stand by itself. It cries out for reasons to support it. But when value claims are couched in emotive terminology, the emotive ‘‘clothing’’ tends to obscure the fact that a value claim is being made, and it simultaneously gives psychological momentum to that claim. As a result, readers and listeners are inclined to swallow the value claim whole without any evidence. Furthermore, the intellectual laziness of many speakers and writers, combined with their inability to supply supporting reasons for their value claims, reinforces the desirability of couching such claims in emotive terminology.

Many people, for example, will refer to someone as ‘‘crazy,’’ ‘‘stupid,’’ or ‘‘weird’’ when they want to express the claim that what that person is doing is bad or wrong and when they are unable or unwilling to give reasons for this claim. Also, many people will refer to things or situations as ‘‘awesome’’ or ‘‘gross’’ for the same reasons. Those who happen to be listening, especially if they are friendly with the speaker, will often accept these claims without hesitation.

For a subtler example of emotive terminology, consider the word ‘‘harvest.’’ This word evokes feelings associated with honest, hardworking farmers being rewarded for their labor in planting and tending their crops. To capitalize on this positive feeling, wood products companies speak of harvesting the trees in 200-year-old forests, even though they had nothing to do with planting them, and surgeons speak of harvesting the organs from the bodies of donors and the tissue from aborted fetuses. In all of these cases, the use of the word ‘‘harvest’’ is specifically calculated to elicit a favorable or agreeable response from the listener.

Let us now consider emotive terminology as it occurs in arguments. In arguments, emotive terminology accomplishes basically the same function as emotive terminology in statements. It allows the arguer to make value claims about the subject matter of the argument without providing evidence, and it gives the argument a kind of steamroller quality by which it tends to crush potential counterarguments before the reader or listener has a chance to think of them. This steamroller quality also tends to paralyze the logical thought processes of readers or listeners so that they are not able to see illogical arguments in their true light. These effects of emotive terminology can be avoided if the reader or listener will disengage the value claims and other cognitive meanings from the emotive meaning of the language and re express them as distinct premises.

Consider, for example, the following emotively charged argument taken from the letters to the editor section of a newspaper:

> Now that we know that the rocks on the moon are similar to those in our backyard and that tadpoles can exist in a weightless environment, and now that we have put the rest of the world in order, can we concentrate on the problems here at home? Like what makes people hungry and why is unemployment so elusive?

The conclusion of this argument is that our government should take money that has been spent on the space program and on international police actions and redirect it to solving domestic problems. The author minimizes the importance of the space program by covertly suggesting that it amounts to nothing more than work on ordinary rocks and tadpoles (which, by themselves are relatively insignificant), and he exaggerates the scope of the international effort by covertly suggesting that it has solved every problem on earth but our own. Also, the phrase ‘‘put...in order’’ suggests that the international effort has been no more important than restoring order to a room in one’s house. We might rephrase the argument in emotively neutral language, making the implicit suggestions and value claims explicit, as follows:

> The space program has been confined to work on ordinary rocks and tadpoles. Ordinary rocks and tadpoles are less important than domestic hunger and unemployment.

> Our international efforts have restored order to every nation on earth but our own.
> These efforts have been directed to problems that are less important than our own domestic problems.
> Therefore, our government should redirect funds that have been spent on these projects to solving our own domestic problems.

By restructuring the argument in this way, we can more easily evaluate the degree to which the premises support the conclusion. Inspection of the premises reveals that the first, third, and possibly fourth premises are false. Thus, the actual support provided by the premises is less than what we might have first expected. If the argument were to be rephrased a second time so that the premises turned out true (for example, the first premise might read ‘‘Part of the space program has been devoted to research on ordinary rocks and tadpoles’’), the support given to the conclusion would still be weaker than the author intended.

Now that we have distinguished emotive meaning from cognitive meaning, let us explore some of the ways that cognitive meanings can be defective. Two of them are vagueness and ambiguity. A linguistic expression is said to be vague if there are borderline cases in which it is impossible to tell if the expression applies or does not apply. Vague expressions often allow for a continuous range of interpretations. The meaning is hazy, obscure, and imprecise. For example, words such as ‘‘love,’’ ‘‘happiness,’’ ‘‘peace,’’ ‘‘excessive,’’ ‘‘fresh,’’ ‘‘rich,’’ ‘‘poor,’’ ‘‘normal,’’ ‘‘conservative,’’ and ‘‘polluted’’ are vague. We can rarely tell with any precision whether they apply to a given situation or not. How fresh does something have to be in order to be called fresh?

Vagueness can also affect entire statements. Such vagueness may arise not so much from the individual words as from the way in which the words are combined. For example, suppose someone were to say, ‘‘Today our job situation is more transparent.’’ First, what is the meaning of ‘‘job situation’’? Does it refer to finding a job, keeping a job, filling a job, completing a job, or bidding on a job? And what exactly does it mean for a job situation to be ‘‘transparent’’? Does it mean that the job is more easily perceived or comprehended? That the job is more easily completed? That we can anticipate our future job needs more clearly? Or what else?

Not all cases of vagueness, however, are problematic. To describe an acquaintance as ‘‘tall’’ or ‘‘thin’’ often causes no trouble in ordinary conversation. Indeed, it may be overly burdensome to describe this person in more precise language. Trouble arises only when the language is not sufficiently precise for what the situation demands.

The other way in which cognitive meanings can be defective is ambiguity. An expression is said to be ambiguous when it can be interpreted as having more than one clearly distinct meaning in a given context. For example, words such as ‘‘light,’’ ‘‘proper,’’ ‘‘critical,’’ ‘‘stress,’’ ‘‘mad,’’ ‘‘inflate,’’ ‘‘chest,’’ ‘‘bank,’’ ‘‘sound,’’ and ‘‘race’’ can be used ambiguously. Thus, if one were to describe a beer as a light pilsner, does this mean that the beer is light in color, light in calories, or light in taste? If one were to describe an action as proper, does this mean proper in a moral sense or proper in the sense of being socially acceptable? Or if one were to describe a person as critical, does this mean that the person is essential for a certain task or that the person tends to criticize others?

As is the case with vagueness, ambiguity can also affect entire statements. Such ambiguity often results from the way in which certain words are combined. For example, there was a newspaper headline that read, ‘‘Tuna are biting off the Washington coast.’’ Does this mean that the tuna are nibbling away at the coastline or that fishermen are catching them off the coast? Presumably it means the latter. And another headline read, ‘‘College students are turning to vegetables.’’ Does this mean that the students are metamorphosing into vegetables or that they are incorporating more vegetables into their diet? Again, the intended meaning is probably the latter.

The difference between ambiguity and vagueness is that vague terminology allows for a relatively continuous range of interpretations, whereas ambiguous terminology allows for multiple discrete interpretations. In a vague expression there is a blur of meaning, whereas in an ambiguous expression there is a mix-up of otherwise clear meanings. However, there are many forms of expression that are ambiguous in one context and vague in another. For example, the word ‘‘slow’’ in one context could mean either mentally retarded or physically slow, but when the word refers to physical slowness, it could be vague. How slow is slow? Similar remarks apply to ‘‘light,’’ ‘‘fast,’’ and ‘‘rich.’’

Ambiguity and vagueness are important in logic because there are countless occasions in which the evaluation of an argument leads to the observation, ‘‘Well, that depends on what you mean by...’’ Certain phraseology in the argument is vague or ambiguous, and its meaning must be clarified before any evaluation can proceed. For example, Scientologists argue that their organization should be exempt from paying taxes because, they claim, Scientology is a religion. Evaluating their argument requires that we clarify the meaning of ‘‘religion.’’ Pro-life advocates argue that abortion is wrong because it results in the killing of human beings. But what is the meaning of ‘‘human being’’? And feminists argue that leering glances constitute sexual harassment.

## 2.2The Intension and Extension of Terms

The main task of logic is the evaluation of arguments. However, as we saw in the previous section, there are countless arguments in which this task leads to the observation, ‘‘Well, that depends on what you mean by...’’ Such an observation usually indicates that the meaning of certain words in the argument is vague or ambiguous. Clearing up the problem often involves supplying a definition. Thus, the study of meaning and definition is closely related to the main task of logic. In this section we continue our inquiry into aspects of linguistic meaning, and the results of this inquiry provide the basis for the theory of definition in the next section.

The basic units of any ordinary language are words. Our main concern in this chapter, however, is not with words in general but with terms. A term is any word or arrangement of words that may serve as the subject of a statement. Terms consist of proper names, common names, and descriptive phrases. Here are some examples:

| Proper names | Common names | Descriptive phrases |
|---|---|---|
| Napoleon | animal | first president of the United |
| North Dakota | restitution | author of Hamlet |
| The United States | house | books in my library |
| Senate | activity | States |
| Gore Vidal | person | officers in the Swiss Navy |
| Robinson Crusoe | | those who study hard |

Words that are not terms include verbs, non substantive adjectives, adverbs, prepositions, conjunctions, and all non syntactic arrangements of words. The following words or phrases are not terms; none can serve as the subject of a statement:

| | |
|---|---|
| Dictatorial | moreover |
| runs quickly | craves |
| above and beyond | cabbages into again the forest |

The last example is a non syntactic arrangement.

At this point it is important to distinguish the use of a word from the mention of a word. Without this distinction any word can be imagined to serve as the subject of a statement and, therefore, to count as a term. The word ‘‘wherever,’’ for example, is not a term, but ‘‘wherever’’ (in quotes) can serve as the subject of a statement, such as ‘‘‘Wherever’ is an eight-letter word.’’ But in this statement, it is not the word itself that is the subject but rather the quoted word. The word is said to be mentioned—not used. On the other hand, ‘‘wherever’’ is used in this statement: ‘‘I will follow you wherever you go.’’ In distinguishing terms from non terms one must be sure that the word or group of words can be used as the subject of a statement.

Words are usually considered to be symbols, and the entities they symbolize are usually called meanings. Terms, being made up of words, are also symbols, but the meanings they symbolize are of two kinds: intensional and extensional. The intensional meaning consists of the qualities or attributes that the term connotes, and the extensional meaning consists of the members of the class that the term denotes. For example, the intensional meaning of the term ‘‘cat’’ consists of the attributes of being furry, of having four legs, of moving in a certain way, of emitting certain sounds, and so on, while the extensional meaning consists of cats themselves—all the cats in the universe. The term connotes the attributes and denotes the cats.

The intensional meaning of a term is otherwise known as the intension, or connotation, and the extensional meaning is known as the extension, or denotation. ‘‘Intension ’’and ‘‘extension’’ are roughly equivalent to the more modern terms ‘‘sense’’ and ‘‘reference,’’ respectively. Also, it should be noted that logic uses the terms ‘‘connotation’’ and ‘‘denotation’’ differently from the way they are used in grammar. In grammar, ‘‘connotation’’ refers to the subtle nuances of a word, whereas ‘‘denotation’’ refers to the word’s direct and specific meaning.

Exactly how a term connotes a set of attributes allows for at least two different interpretations. Some philosophers take an objective approach and hold that a term connotes whatever attributes something must have in order to be denoted by the term. Others take what might be called a subjective approach and hold that a term connotes the attributes that occur in the minds of the people who use that term. This book takes the latter approach.

In connection with this approach, however, we encounter the problem of terms connoting different things to different people. Thus, to a cat lover the term ‘‘cat’’ might connote the attributes of being cuddly and adorable, while to someone who hates cats it might connote the attributes of being obnoxious and disgusting. To avoid this problem, we restrict the meaning of connotation to what is usually called the conventional connotation. The conventional connotation of a term includes the attributes that the term commonly calls forth in the minds of competent speakers of the language. Under this interpretation, the connotation of a term remains more or less the same from person to person and from time to time.

The denotation of a term also typically remains the same from person to person, but it may change with the passage of time. The denotation of ‘‘currently living cat,’’ for example, is constantly fluctuating as some cats die and others are born. The denotation of the term ‘‘cat,’’ on the other hand, is presumably constant because it denotes all cats, past, present, and future.

Sometimes the denotation of a term can change radically with the passage of time. The terms ‘‘currently living dodo bird’’ and ‘‘current king of France,’’ for example, at one time denoted actually existing entities, but today all such entities have perished. Accordingly, these terms now have what is called **empty extension.** They are said to denote the empty (or ‘‘null’’) class, the class that has no members. Other terms with empty extension include ‘‘unicorn,’’ ‘‘leprechaun,’’ ‘‘gnome,’’ ‘‘elf, ’’and‘‘griffin.’’ While these terms have empty extension, however, they do not have empty intension. ‘‘Currently living dodo bird’’ and ‘‘current king of France,’’ as well as ‘‘unicorn,’’ ‘‘elf,’’ and ‘‘griffin, ’’connote a variety of intelligible attributes.

The fact that some terms have empty extension leads us to an important connection between extension and intension—namely, that intension determines extension. The intensional meaning of a term serves as the criterion for deciding what the extension consists of. Because we know the attributes connoted by the term ‘‘unicorn,’’ for example, we know that the term has empty

extension. That is, we know that there are no four-legged mammals having a single straight horn projecting from their forehead. Similarly, the intension of the word ‘‘cat’’ serves as the criterion for determining what is and what is not a member of the class of cats.

One kind of term that raises problems for the intension-determines-extension rule is proper names. For example, the name ‘‘David’’ might not appear to have any intension, but it denotes the person who has this name. Although philosophers have disagreed about this, it would seem that proper names must have some kind of intension or we would not know what persons, if any, they denote. One possible solution to this problem is that names are shorthand symbols for descriptions or bundles of descriptions. For example, ‘‘David’’ could be shorthand for ‘‘the person who lives next door’’ or ‘‘the person who works at the corner store and who drives a green Chevy.’’

Another possible solution to the problem of proper names is that the intension of proper names consists of the causal chain of events leading from the point at which the name is first assigned to the point at which a certain person learns about the name. Thus, the first link in such a chain might be the baptismal event at which the name ‘‘David’’ is given to a certain infant, the second link would be the event in which a certain third party is informed of the first event, and so on. This entire chain of events extending through the linguistic community would then constitute the intension of ‘‘David.’’ Thus, we conclude that for all terms, including proper names, intension determines extension.

The distinction between intension and extension may be further illustrated by comparing the way in which these concepts can be used to give order to random sequences of terms. Terms may be put in the order of increasing intension, increasing extension, decreasing intension, and decreasing extension. A series of terms is in the order of increasing intension when each term in the series (except the first) connotes more attributes than the one preceding it. In other words, each term in the series (except the first) is more specific than the one preceding it. (A term is specific to the degree that it connotes more attributes.) The order of decreasing intension is the reverse of that of increasing intension.

A series of terms is in the order of increasing extension when each term in the series (except the first) denotes a class having more members than the class denoted by the term preceding it. In

other words, the class size gets larger with each successive term. Decreasing extension is, of course, the reverse of this order. Examples:

| | |
|---|---|
| increasing intension: | animal, mammal, feline, tiger |
| increasing extension: | tiger, feline, mammal, animal |
| decreasing intension: | tiger, feline, mammal, animal |
| decreasing extension: | animal, mammal, feline, tiger |

These examples illustrate a fact pertaining to most such series: The order of increasing intension is usually the same as that of decreasing extension. Conversely, the order of decreasing intension is usually the same as that of increasing extension. There are some exceptions, however. Consider the following series:

> unicorn; unicorn with blue eyes; unicorn with blue eyes and green horn; unicorn with blue eyes, green horn, and a weight of over 400 pounds.

Each term in this series has empty extension; so, while the series exhibits the order of increasing intension, it does not exhibit the order of decreasing extension. Here is another, slightly different, example:

> living human being; living human being with a genetic code; living human being with a genetic code and a brain; living human being with a genetic code, a brain, and a height of less than 100 feet

In this series none of the terms has empty extension, but each term has exactly the same extension as the others. Thus, while the intension increases with each successive term, once again the extension does not decrease.

### 2.3 Definitions and Their Purposes

Over the years philosophers have held various conflicting views about the purpose of definitions. For Plato, to mention just one, definitions were intended to explicate the meaning of certain eternal essences or forms, such as justice, piety, and virtue. For most logicians today, however, definitions are intended exclusively to explicate the meaning of words. In conformity with this latter position, we may define definition as a group of words that assigns a meaning to some word or group of words. Accordingly, every definition consists of two parts: the

**definiendum** and the **definiens**. The definiendum is the word or group of words that is supposed to be defined, and the definiens is the word or group of words that does the defining. For example, in the Definition ‘‘‘Tiger’ means a large, striped, ferocious feline indigenous to the jungles of India and Asia,’’ the word ‘‘tiger’’ is the definiendum, and everything after the word ‘‘means’’ is the definiens. The definiens is not itself the meaning of the definiendum; rather, it is the group of words that symbolizes (or that is supposed to symbolize) the Definiendum samemeaning as the definiendum. Because we presumably know in advance what the definiens symbolizes, we are led, via the definition, to understand what the definiendum symbolizes. It is in this way that the definition ‘‘assigns’’ a meaning to its definiendum.

* Definition = Definiendum (Word to be defined) + Definiens (Words that do the defining)

Once it has been decided that definitions explicate the meaning of words, other disagreements emerge among the philosophers. Some argue that since a definition is merely a rule that allows one set of words (the definiens) to be used in place of another set (the definiendum), definitions communicate no information at all about the subject matter of the definiendum. Others take the opposite tack and argue that since definitions result in a clarification of language, they provide a means for the discovery of deeper philosophical truths. It seems, however, that neither of these approaches is able to make good sense of all the various kinds of definitions that are actually employed in ordinary usage. As a result, instead of beginning their analysis of definitions with a set of a priori criteria, many logicians take a pragmatic approach and begin with a survey of the various kinds of definitions that are actually used and of the functions that they actually serve. This is the approach taken here.

## Stipulative Definitions

A **stipulative definition** assigns a meaning to a word for the first time. This may involve either coining a new word or giving a new meaning to an old word. The purpose of a stipulative definition is usually to replace a more complex expression with a simpler one.

The need for a stipulative definition is often occasioned by some new phenomenon or development. For example, a few years ago the attempt was made at a certain zoo to crossbreed tigers and lions. Because of the genetic similarity of the two species, the attempt succeeded. Offspring were produced from a male tiger and a female lion and from a male lion and a female

tiger. When the offspring were born, it became appropriate to give them names. Of course, the names ‘‘offspring of male tiger and female lion’’ and ‘‘offspring of male lion and female tiger’’ could have been used, but these names were hardly convenient. Instead, the names ‘‘tigon’’ and ‘‘liger’’ were selected.

Any two new words would have sufficed equally well for naming the offspring— ‘‘topar’’ and ‘‘largine’’ for example—but ‘‘tigon’’ and ‘‘liger’’ were considered more appropriate, for obvious reasons. ‘‘Tigon’’ was taken to mean the offspring of a male tiger and a female lion, and ‘‘liger’’ the offspring of a male lion and a female tiger. These assignments of meanings were accomplished through stipulative definitions.

Another use for stipulative definitions is to set up secret codes. For example, during World War II, ‘‘Tora, Tora, Tora’’ was the code name Admiral Yamamoto transmitted to the war office in Tokyo signaling that the Japanese fleet had not been spotted in the hours preceding the bombing of Pearl Harbor; ‘‘Operation Barbarosa’’ was the name the Germans gave to the invasion of Russia; and ‘‘Operation Overlord’’ was the name the allied forces gave to the planned invasion of Normandy. More recently, ‘‘Operation Desert Storm’’ was the code name given to the military invasion of Iraq. Law enforcement organizations have adopted similar code names for sting operations against organized crime.

Because people are continually coming up with new creations, whether it be new food concoctions, new inventions, new modes of behavior, new kinds of apparel, new dances, or whatever, stipulative definitions are continually being used to introduce names for these things. Sometimes these definitions are only implicit and amount to little more than the spontaneous association of the word with some action—as was probably the case when the words ‘‘bop,’’ ‘‘twist,’’ ‘‘jerk,’’ and ‘‘chicken’’ came to be known as names of dances a few decades ago. At other times, they are definitely explicit, as when the word ‘‘penicillin’’ was selected as the name for an antibacterial substance produced by certain Penicillium molds, or when the symbol‘‘$10^5$ ’’ was chosen as a simple substitute for‘‘$10\times10\times10\times10\times10$.’’

Because a stipulative definition is a completely arbitrary assignment of a meaning to a word for the first time, there can be no such thing as a ‘‘true’’ or ‘‘false’’ stipulative definition. Furthermore, for the same reason, a stipulative definition cannot provide any new information

about the subject matter of the definiendum. The fact that the word ‘‘tigon’’ was selected to replace ‘‘offspring of a male tiger and a female lion’’ tells us nothing new about the nature of the animal in question. One stipulative definition may, however, be more or less convenient or more or less appropriate than another.

Stipulative definitions are misused in verbal disputes when one person covertly uses a word in a peculiar way and then proceeds to assume that everyone else uses that word in the same way. Under these circumstances that person is said to be using the word ‘‘stipulatively.’’ In such cases the assumption that other persons use the word in the same way is rarely justified.

## Lexical Definitions

A lexical definition is used to report the meaning that a word already has in a language. Dictionary definitions are all instances of lexical definitions. Thus, in contrast with a stipulative definition, which assigns a meaning to a word for the first time, a lexical definition may be true or false depending on whether it does or does not report the way a word is actually used. Because words are frequently used in more than one way, lexical definitions have the further purpose of eliminating the ambiguity that would otherwise arise if one of these meanings were to be confused with another.

As we saw in the first section of this chapter, an expression is ambiguous when it can be interpreted as having two or more clearly distinct meanings in a given context. Words such as ‘‘light,’’ ‘‘mad,’’ and ‘‘bank’’ can be used ambiguously. Because a lexical definition lists the various meanings that a word can have, a person who consults such a definition is better prepared to avoid ambiguous constructions of his or her own and to detect those of others. Undetected ambiguity causes the most trouble. In many cases the problem lies not with the obvious differences in meaning that words such as ‘‘light’’ and ‘‘bank’’ may have but with the subtle shadings of meaning that are more likely to be confused with one another. For example, if a woman is described as ‘‘nice,’’ any number of things could be intended. She could be fastidious, refined, modest, pleasant, attractive, or even lewd. A good lexical definition will distinguish these various shadings and thereby guard against the possibility that two such meanings will be unconsciously jumbled together into one.

## Precising Definitions

The purpose of a precising definition is to reduce the vagueness of a word. As we saw in the first section of this chapter, an expression is vague if there are borderline cases in which it is impossible to tell if the word applies or does not apply. Words such as ‘‘fresh,’’ ‘‘rich, ’’and ‘‘poor’’ are vague. Once the vagueness of such words is reduced by a precising definition, one can reach a decision as to the applicability of the word to a specific situation. For example, if legislation were ever introduced to give direct financial assistance to the poor, a precising definition would have to be supplied specifying exactly who is poor and who is not. The definition ‘‘‘Poor’ means having an annual income of less than $4,000 and a net worth of less than $20,000’’ is an example of a precising definition.

Whenever words are taken from ordinary usage and used in a highly systematic context such as science, mathematics, medicine, or law, they must always be clarified by means of a precising definition. The terms ‘‘force,’’ ‘‘energy,’’ ‘‘acid,’’ ‘‘element,’’ ‘‘number,’’ ‘‘equality,’’ ‘‘contract, ’’and‘‘agent’’ have all been given precising definitions by specific disciplines.

Sometimes the substance of a court trial may revolve around the precise usage of a term. A trial in California addressed the question of whether a man who had driven a bicycle while intoxicated violated the motor vehicle code. The question concerned whether, for these purposes, a bicycle could be considered a ‘‘vehicle.’’ The court decided in the affirmative, and the decision amounted to an incremental extension of an already existent precising definition of the word ‘‘vehicle.’’

Another example involves the practice of surgical transplantation of vital organs. Before a heart transplant can be conducted, the donor must be dead; otherwise the surgeon will be accused of murder. If the donor is dead for too long, however, the success of the transplant will be imperiled. But exactly when is a person considered to be dead? Is it when the heart stops beating, when the person stops breathing, when rigor mortis sets in, or some other time? The question involves the meaning of the term ‘‘moment of death.’’ The courts have decided that ‘‘moment of death’’ should be taken to mean the moment the brain stops functioning, as measured by an

electroencephalograph. This decision amounts to the acceptance of a precising definition for ‘‘moment of death.’’

A precising definition differs from a stipulative definition in that the latter involves a purely arbitrary assignment of meaning, whereas the assignment of meaning in a precising definition is not at all arbitrary. A great deal of care must be taken to ensure that the assignment of meaning in a precising definition is appropriate and legitimate for the context within which the term is to be employed.

**Theoretical Definitions**

A theoretical definition assigns a meaning to a word by suggesting a theory that gives a certain characterization to the entities that the term denotes. Such a definition provides a way of viewing or conceiving these entities that suggests deductive consequences, further investigation (experimental or otherwise), and whatever else would be entailed by the acceptance of a theory governing these entities. The definition of the term ‘‘heat’’ found in texts dealing with the kinetic theory of heat provides a good example: ‘‘‘heat’ means the energy associated with the random motion of the molecules of a substance.’’ This definition does more than merely assign a meaning to a word; it provides a way of conceiving the physical phenomenon that is heat. In so doing, it suggests the deductive consequence that as the molecules of a substance speed up, the temperature of the substance increases. In addition, it suggests a number of experiments—experiments investigating the relationship between molecular velocity and the phenomena of radiation, gas pressure, molecular elasticity, and molecular configuration. In short, this definition of ‘‘heat’’ provides the impetus for an entire theory about heat.

Other examples of theoretical definitions are the definition of ‘‘light’’ as a form of electromagnetic radiation and the definition of ‘‘force,’’ ‘‘mass,’’ and ‘‘acceleration’’ in Newton’s second law of motion as expressed in the equation ‘‘F=MA.’’ The latter is a kind of contextual definition in which each term is defined in terms of the other two. Both definitions entail numerous deductive consequences about the phenomena involved and suggest numerous avenues of experimental investigation.

Not all theoretical definitions are associated with science. Many terms in philosophy, such as ‘‘substance,’’ ‘‘form,’’ ‘‘cause,’’ ‘‘change,’’ ‘‘idea,’’ ‘‘good,’’ ‘‘mind,’’ and ‘‘God, ’’have been given theoretical definitions. In fact, most of the major philosophers in history have given these terms their own peculiar theoretical definitions, and this fact accounts in part for the unique character of their respective philosophies. For example, Gottfried Wilhelm Leibniz’s definition of ‘‘substance’’ in terms of what he called ‘‘monads’’ laid the foundation for his metaphysical theory, and John Stuart Mill’s definition of ‘‘good’’ as the greatest happiness of the greatest number provided the underpinnings for his utilitarian theory of ethics.

Like stipulative definitions, theoretical definitions are neither true nor false, strictly speaking. The reason is that theoretical definitions function as proposals to see or interpret some phenomenon in a certain way. Since proposals have no truth value, neither do theoretical definitions. They may, however, be more or less interesting or more or less fruitful, depending on the deductive consequences they entail and on the outcome of the experiments they suggest.

**Persuasive Definitions**

The purpose of a persuasive definition is to engender a favorable or unfavorable attitude toward what is denoted by the definiendum. This purpose is accomplished by assigning an emotionally charged or value-laden meaning to a word while making it appear that the word really has (or ought to have) that meaning in the language in which it is used. Thus, persuasive definitions amount to a certain synthesis of stipulative, lexical, and, possibly, theoretical definitions backed by the rhetorical motive to engender a certain attitude. As a result of this synthesis, a persuasive definition masquerades as an honest assignment of meaning to a term while condemning or blessing with approval the subject matter of the definiendum. Here are some examples of opposing pairs of persuasive definitions:

> ‘‘Abortion’’ means the ruthless murdering of innocent human beings.
> ‘‘Abortion’’ means a safe and established surgical procedure whereby a woman is relieved of an unwanted burden.
> ‘‘Liberal’’ means a drippy-eyed do-gooder obsessed with giving away other people’s money.
> ‘‘Liberal’’ means a genuine humanitarian committed to the goals of adequate housing and health care and of equal opportunity for all of our citizens.

> ‘‘Capitalism’’ means the economic system in which individuals are afforded the God-given freedom to own property and conduct business as they choose.
> ‘‘Capitalism’’ means the economic system in which humanity is sacrificed to the wanton quest for money, and mutual understanding and respect are replaced by alienation, greed, and selfishness.
> ‘‘Taxation’’ means the procedure by means of which our commonwealth is preserved and sustained.
> ‘‘Taxation’’ means the procedure used by bureaucrats to rip off the people who elected them.

The objective of a persuasive definition is to influence the attitudes of the reader or listener; thus, such definitions may be used with considerable effectiveness in political speeches and editorial columns. While persuasive definitions may, like lexical definitions, be evaluated as either true or false, the primary issue is neither truth nor falsity but the effectiveness of such definitions as instruments of persuasion.

## 2.4 Definitional Techniques

In the last section we presented a survey of some of the kinds of definitions actually in use and the functions they are intended to serve. In this section we will investigate some of the techniques used to produce these definitions. These techniques may be classified in terms of the two kinds of meaning, intensional and extensional, discussed in Section 2.2.

### Extensional (Denotative) Definitions

An **extensional definition** is one that assigns a meaning to a term by indicating the members of the class that the definiendum denotes. There are at least three ways of indicating the members of a class: pointing to them, naming them individually, and naming them in groups. The three kinds of definitions that result are called, respectively, demonstrative or ostensive definitions, enumerative definitions, and definitions by subclass.

**Demonstrative (ostensive) definitions** are probably the most primitive form of definition. All one need know to understand such a definition is the meaning of pointing. As the following examples illustrate, such definitions may be either partial or complete, depending on whether all or only some of the members of the class denoted by the definiendum are pointed to:

> ‘‘Chair’’ means this and this and this—as you point to a number of chairs, one after the other. ‘‘Washington Monument’’ means that—as you point to it.

If you were attempting to teach a foreigner your own native language, and neither of you understood a word of each other’s language, demonstrative definition would almost certainly be one of the methods you would use.

Because demonstrative definitions are the most primitive, they are also the most limited. In addition to the limitations affecting all extensional definitions (which will be discussed shortly), there is the obvious limitation that the required objects be available for being pointed at. For example, if one wishes to define the word ‘‘sun’’ and it happens to be nighttime, or the word ‘‘dog’’ and none happens to be in the vicinity, a demonstrative definition cannot be used.

Demonstrative definitions differ from the other kinds of definitions in that the definiens is constituted at least in part by a gesture—the gesture of pointing. Since the definiens in any definition is a group of words, however, a gesture, such as pointing, must count as a word. While this conclusion may appear strange at first, it is supported by the fact that the ‘‘words’’ in many sign languages consist exclusively of gestures.

**Enumerative definitions** assign a meaning to a term by naming the members of the class the term denotes. Like demonstrative definitions, they may also be either partial or complete. Examples:

> ‘‘Actor’’ means a person such as Nick Nolte, Al Pacino, or Richard Gere.
>
> ‘‘Baltic state’’ means Estonia, Latvia, or Lithuania.

Complete enumerative definitions are usually more satisfying than partial ones because they identify the definiendum with greater assurance. Relatively few classes, however, can be completely enumerated. Many classes, such as the class of real numbers greater than 1 but less than 2, have an infinite number of members. Others, such as the class of stars and the class of persons, while not infinite, have still too many members to enumerate. Therefore, anything approximating a complete enumerative definition of terms denoting these classes is clearly impossible. Then there are others— the class of insects and the class of trees, for example—the vast majority of whose members have no names. For terms that denote these classes, either a demonstrative definition or a definition by subclass is the more appropriate choice.

A **definition by sub class** assigns a meaning to a term by naming subclasses of the class denoted by the term. Such a definition, too, may be either partial or complete, depending on whether the subclasses named, when taken together, include all the members of the class or only some of them. Examples:

> ‘‘Tree’’ means an oak, pine, elm, spruce, maple, and the like.
> ‘‘Flower’’ means a rose, lily, daisy, geranium, zinnia, and the like.
> ‘‘Cetacean’’ means either a whale, a dolphin, or a porpoise.
> ‘‘Fictional work’’ means either a poem, a play, a novel, or a short story.

The first two are partial, the second two complete. As with definitions by enumeration, complete definitions by subclass are more satisfying than partial ones; but because relatively few terms denote classes that admit of a conveniently small number of subclasses, complete definitions by subclass are often difficult, if not impossible, to provide.

Extensional definitions are chiefly used as techniques for producing lexical and stipulative definitions. Lexical definitions are aimed at communicating how a word is actually used, and one of the ways of doing so is by identifying the members of the class that the word denotes. Dictionaries frequently include references to the individual members (or to the subclasses) of the class denoted by the word being defined. Sometimes they even include a kind of demonstrative definition when they provide a picture of the object that the word denotes. Not all lexical definitions have to occur in dictionaries, however. A lexical definition can just as well be spoken, as when one person attempts to explain orally to another how a word is used in a language. Such attempts, incidentally, often have recourse to all three kinds of extensional definition.

Stipulative definitions are used to assign a meaning to a word for the first time. This task may be accomplished by all three kinds of extensional definition. For example, a biologist engaged in naming and classifying types offish might assign names to the specific varieties by pointing to their respective tanks (demonstrative definition), and then she might assign a class name to the whole group by referring to the names of the specific varieties (definition by subclass). An astronomer might point via his telescope to a newly discovered comet and announce, ‘‘That comet will henceforth be known as ‘Henderson’s Comet’’’(demonstrative definition). The organizer of a children’s game might make the stipulation: ‘‘John, Mary, and

Billy will be called 'Buccaneers,' and Judy, George, and Nancy will be 'Pirates'''(enumerative definition).

Although it is conceivable that extensional definitions could also serve as techniques for theoretical and persuasive definitions (though this would be highly unusual), extensional definitions by themselves cannot properly serve as précising definitions for the following reason. The function of a precising definition is to clarify a vague word, and vagueness is a problem affecting intensional meaning. Because the intension is imprecise, the extension is indefinite. To attempt to render the intension precise by exactly specifying the extension (as with an extensional definition) would be tantamount to having extension determine intension—which cannot be done.

The principle that intension determines extension, whereas the converse is not true, underlies the fact that all extensional definitions suffer serious deficiencies. For example, in the case of the demonstrative definition of the word ''chair,'' if all the chairs pointed to are made of wood, observers might get the idea that ''chair'' means ''wood'' instead of something to sit on. Similarly, they might get the idea that ''Washington Monument'' means ''tall'' or ''pointed'' or any of a number of other things. From the definition of ''actor,'' readers or listeners might think that ''actor'' means ''famous person''—which would include Albert Einstein and Winston Churchill. From the definition of ''tree'' they might get the idea that ''tree'' means ''firmly planted in the ground,'' which would also include the pilings of a building. And they might think that ''cetacean'' means ''fast swimmer'' instead of ''aquatic mammal.'' In other words, it makes no difference how many individuals or subclasses are named in an extensional definition, there is no assurance that listeners or readers will get the intensional meaning. Extensions can suggest intensions, but they cannot determine them.

## Intensional (Connotative) Definitions

An **intensional definition** is one that assigns a meaning to a word by indicating the qualities or attributes that the word connotes. Because at least four strategies may be used to indicate the attributes a word connotes, there are at least four kinds of intensional definitions: synonymous definition, etymological definition, operational definition, and definition by genus and difference.

A **synonymous definition** is one in which the definiens is a single word that connotes the same attributes as the definiendum. In other words, the definiens is a synonym of the word being defined. Examples:

‘‘Physician’’ means doctor.
‘‘Intentional’’ means willful.
‘‘Voracious’’ means ravenous.
‘‘Observe’’ means see.

When a single word can be found that has the same intensional meaning as the word being defined, a synonymous definition is a highly concise way of assigning a meaning. Many words, however, have subtle shades of meaning that are not connoted by any other single word. For example, the word ‘‘wisdom’’ is not exactly synonymous with either ‘‘knowledge,’’ ‘‘understanding,’’ or ‘‘sense’’; and ‘‘envious’’ is not exactly synonymous with either ‘‘jealous’’ or ‘‘covetous.’’

An **etymological definition** assigns a meaning to a word by disclosing the word’s ancestry in both its own language and other languages. Most ordinary English words have ancestors either in old or middle English or in some other language such as Greek, Latin, or French, and the current English meaning (as well as spelling and pronunciation) is often closely tied to the meaning (and spelling and pronunciation) of these ancestor words. For example, the English word ‘‘license’’ is derived from the Latin verblicere, which means to be permitted, and the English word ‘‘captain’’ derives from the Latin noun caput which means head.

Etymological definitions have special importance for at least two reasons. The first is that the etymological definition of a word often conveys the word’s root meaning or seminal meaning from which all other associated meanings are derived. Unless one is familiar with this root meaning, one often fails to place other meanings in their proper light or to grasp the meaning of the word when it is used in its most proper sense. For example, the word ‘‘principle’’ derives from the Latin word principium, which means beginning or source. Accordingly, the ‘‘principles of physics’’ are those fundamental laws that provide the ‘‘source’’ of the science of physics. The English word ‘‘efficient’’ derives from the Latin verb efficere, which means to bring about. Thus, the ‘‘efficient cause’’ of something (such as the motion of a car) is the agent that actually brings that thing about (the engine).

The second reason for the importance of etymological definitions is that if one is familiar with the etymology of one English word, one often has access to the meaning of an entire constellation of related words. For example, the word ‘‘orthodox’’derives from the two Greek words ortho, meaning right or straight, and doxa, meaning belief or opinion. From this, one might grasp that ‘‘orthopedic’’ has to do with straight bones (originally in children—paisin Greek means child), and that ‘‘orthodontic’’ has to do with straight teeth (odonin Greek means tooth). Similarly, if one is familiar with the etymological definition of‘‘polygon’’ (from the Greek words poly,meaning many, and ganosmeaning angle), one might grasp the meanings of‘‘polygamy’’ (fromgamos, meaning marriage) and ‘‘polygraph’’ (from graphein, meaning to write). A polygraph is a lie detector that simultaneously records pulse rate, blood pressure, respiration, and so on.

An **operational definition** assigns a meaning to a word by specifying certain experimental procedures that determine whether or not the word applies to a certain thing. Examples:

One substance is ‘‘harder than’’ another if and only if one scratches the other when the two are rubbed together.

> A subject has ‘‘brain activity’’ if and only if an electroencephalograph shows oscillations when attached to the subject’s head.
> A ‘‘potential difference’’ exists between two conductors if and only if a voltmeter shows a reading when connected to the two conductors.
> A solution is an ‘‘acid’’ if and only if litmus paper turns red when dipped into it.

Each of these definitions prescribes an operation to be performed. The first prescribes that the two substances in question be rubbed together, the second that the electro- encephalograph be connected to the patient’s head and observed for oscillations, the third that the voltmeter be connected to the two conductors and observed for deflection, and the fourth that the litmus paper be placed in the solution and observed for color change. Unless it specifies such an operation, a definition cannot be an operational definition. For example, the definition‘‘A solution is an ‘acid’ if and only if it has a pH of less than 7,’’ while good in other respects, is not an operational definition because it prescribes no operation.

Operational definitions were invented for the purpose of tying down relatively abstract concepts to the solid ground of empirical reality. In this they succeed fairly well; yet, from the standpoint of ordinary language usage, they involve certain deficiencies. One of these deficiencies concerns the fact that operational definitions usually convey only part of the intensional meaning of a term. Certainly ‘‘brain activity’’ means more than oscillations on an electroencephalograph, just as ‘‘acid’’ means more than blue litmus paper turning red. This deficiency becomes more acute when one attempts to apply operational definitions to terms outside the framework of science. For example, no adequate operational definition could be given for such words as ‘‘love,’’ ‘‘respect,’’ ‘‘freedom,’’ and‘‘dignity.’’ Within their proper sphere, however, operational definitions are quite useful and important. It is interesting to note that Einstein developed his special theory of relativity in partial response to the need for an operational definition of simultaneity.

A definition by **genus and difference** assigns a meaning to a term by identifying a genus term and one or more difference words that, when combined, convey the meaning of the term being defined. Definition by genus and difference is more generally applicable and achieves more adequate results than any of the other kinds of intensional definition. To explain how it works, we must first explain the meanings of the terms ‘‘genus,’’ ‘‘species,’’ and ‘‘specific difference.’’

In logic, ‘‘genus’’ and ‘‘species’’ have a somewhat different meaning than they have in biology. In logic, ‘‘genus’’ simply means a relatively larger class, and ‘‘species’’ means a relatively smaller subclass of the genus. For example, we may speak of the genus animal and the species mammal, or of the genus mammal and the species feline, or of the genus feline and the species tiger, or the genus tiger and the species Bengal tiger. In other words, genus and species are merely relative classifications.

The ‘‘specific difference,’’ or ‘‘difference,’’ for short, is the attribute or attributes that distinguish the various species within a genus. For example, the specific difference that distinguishes tigers from other species in the genus feline would include the attributes of being large, striped, ferocious, and so on. Because the specific difference is what distinguishes the species, when a genus is qualified by a specific difference, a species is identified. Definition by

genus and difference is based on this fact. It consists of combining a term denoting a genus with a word or group of words connoting a specific difference so that the combination identifies the meaning of the term denoting the species.

Let us construct a definition by genus and difference for the word ‘‘ice.’’ The first step is to identify a genus of which ice is the species. The required genus is water.

Next we must identify a specific difference (attribute) that makes ice a special form of water. The required difference is frozen. The completed definition may now be written out:

| **Species** | | **Difference** | **Genus** |
|---|---|---|---|
| ‘‘Ice’’ | means | frozen | water. |

A definition by genus and difference is easy to construct. Simply select a term that is more general than the term to be defined, then narrow it down so that it means the same thing as the term being defined. Examples:

| **Species** | **Difference** | **Genus** |
|---|---|---|
| ‘‘Daughter’’ means | female | offspring. |
| ‘‘Husband’’ means | married | man. |
| ‘‘Doe’’ means | female | deer |
| ‘‘Fawn’’ means | very young | deer |
| ‘‘Skyscraper’’ means | very tall | building |

Other examples are more sophisticated:

> ‘‘Tent’’ means a collapsible shelter made of canvas or other material that is stretched and sustained by poles.

‘‘Tent’’ is the species, ‘‘shelter’’ is the genus, and ‘‘collapsible’’ and ‘‘made of canvas...’’ the difference.

Definition by genus and difference is the most effective of the intensional definitions for producing the five kinds of definition discussed in Section 2.3. Stipulative, lexical, precising, theoretical, and persuasive definitions can all be constructed according to the method of genus and difference. Lexical definitions are typically definitions by genus and difference, but they also often include etymological definitions. Operational definition can serve as the method for

constructing stipulative, lexical, precising, and persuasive definitions, but because of the limitations we have noted, it typically could not be used to produce a complete lexical definition. Other techniques would have to be used in addition. Synonymous definition may be used to produce only lexical definitions. Since, in a synonymous definition, the definiendum must have a meaning before a synonym can be found, this technique cannot be used to produce stipulative definitions, and the fact that the definiens of such a definition contains no more information than the definiendum prohibits its use in constructing precising, theoretical, and persuasive definitions.

This account of definitions is inevitably incomplete. At the beginning of the chapter we mentioned that all words—not just terms—stand in need of definitions, but the account given here is based on the intension and extension of terms. Nevertheless, many of the techniques developed here can be applied to words in general, and even to symbols. For example, in Chapters 6 and 8 we will present definitions of various symbols that are used in modern logic to connect one statement with another and to translate ordinary language statements into symbolic form. When these symbols were introduced many years ago, it was accomplished through stipulative definitions. Also, as we will see in Chapter 6, some of these symbols are defined by certain tables, called ‘‘truth tables, ’’which establish each symbol’s meaning under all possible arrangements of truth values. These definitions are probably best described as extensional, and they are similar in some ways to demonstrative definitions and enumerative definitions.

## 2.5 Criteria for Lexical Definitions

Because the function of a lexical definition is to report the way a word is actually used in a language, lexical definitions are the ones we most frequently encounter and are what most people mean when they speak of the ‘‘definition’’ of a word. Accordingly, it is appropriate that we have a set of rules that we may use in constructing lexical definitions of our own and in evaluating the lexical definitions of others. While some of these rules apply to the other kinds of definitions as well, the unique functions that are served by stipulative, precising, theoretical, and persuasive definitions prescribe different sets of criteria.

### Rule 1: A Lexical Definition Should Conform to the Standards of Proper Grammar

A definition, like any other form of expression, should be grammatically correct. Examples of definitions that are grammatically incorrect are as follows:

Vacation is when you don't have to go to work or school.
Furious means if you're angry at someone.
Cardiac is like something to do with the heart.

The corrected versions are:

''Vacation'' means a period during which activity is suspended from work or school.
''Furious'' means a condition of being angry.
''Cardiac'' means pertaining to, situated near, or acting on the heart.

Technically the definiendum should be put in quotation marks or italics, but this convention is not always followed.

**Rule 2: A Lexical Definition Should Convey the Essential Meaning of the Word Being Defined**

The word ''human'' is occasionally defined as featherless biped. Such a definition fails to convey the essential meaning of ''human'' as the word is used in ordinary English. It says nothing about the important attributes that distinguish humans from the other animals, namely, the capacity to reason and to use language on a sophisticated level. A more adequate definition would be '''human' means the animal that has the capacity to reason and to speak.''

If a lexical definition is to be given in terms of an operational definition or in terms of any of the forms of extensional definition, it should usually be supplemented by one of the other forms of intensional definition, preferably definition by genus and difference. As we have noted, from the standpoint of ordinary language usage an operational definition often conveys only part of the intensional meaning of a word, and this part frequently misses the essential meaning altogether. As for extensional definitions, at best they can only suggest the essential meaning of a word; they cannot determine it precisely. As a result, no adequate lexical definition can consist exclusively of extensional definitions.

**Rule 3: A Lexical Definition Should Be Neither Too Broad nor Too Narrow**

If adefinition is too broad, the definiens includes too much; if it is too narrow, the definiens includes too little. If, for example, ''bird'' were defined as any warm-blooded animal having wings, the definition would be too broad because it would include bats, and bats are not

birds. If, on the other hand, ‘‘bird’’ were defined as any warm-blooded, feathered animal that can fly, the definition would be too narrow because it would exclude ostriches, which cannot fly.

The only types of lexical definitions that tend to be susceptible to either of these deficiencies are synonymous definitions and definitions by genus and difference. With synonymous definitions, one must be careful that the definiens really is a synonym of the definiendum. For example, the definition ‘‘‘king’ means ruler’’ is too broad because many rulers are not kings. ‘‘Ruler’’ is not genuinely synonymous with ‘‘king.’’ As for definitions by genus and difference, one must ensure that the specific difference narrows the genus in exactly the right way. Both of the above definitions of ‘‘bird’’ are definitions by genus and difference in which the specific difference fails to restrict the genus in exactly the right manner.

**Rule 4: A Lexical Definition Should Avoid Circularity**

Sometimes the problem of circularity appears in connection with pairs of definitions. The following pair is circular:

‘‘Science’’ means the activity engaged in by scientists.
‘‘Scientist’’ means anyone who engages in science.

At other times a definition may be intrinsically circular. Of the following, the first is a synonymous definition, the second a definition by genus and difference:

‘‘Quiet’’ means quietude.
‘‘Silence’’ means the state of being silent.

Certain operational definitions also run the risk of circularity:

‘‘Time’’ means whatever is measured by a clock.

Surely a person would have to know what ‘‘time’’ means before he or she could understand the purpose of a clock.

**Rule 5: A Lexical Definition Should Not Be Negative When It Can Be Affirmative**

Of the following two definitions, the first is affirmative, the second negative:

‘‘Concord’’ means harmony.
‘‘Concord’’ means the absence of discord.

Some words, however, are intrinsically negative. For them, a negative definition is quite appropriate. Examples:

> ‘‘Bald’’ means lacking hair.
> ‘‘Darkness’’ means the absence of light.

**Rule 6: A Lexical Definition Should Avoid Figurative, Obscure, Vague, or Ambiguous Language**

A definition is *figurative* if it involves metaphors or tends to paint a picture instead of exposing the essential meaning of a term. Examples:

> ‘‘Architecture’’ means frozen music.
> ‘‘Camel’’ means a ship of the desert.

A definition is *obscure* if its meaning is hidden as a result of defective or inappropriate language. One source of obscurity is overly technical language. Compare these two definitions:

> ‘‘Bunny’’ means a mammalian of the family Leporidae of the order Lagomorpha whose young are born furless and blind.
> ‘‘Bunny’’ means a rabbit.

The problem lies not with technical language as such but with needlessly technical language. Because ‘‘bunny’’ is very much a nontechnical term, no technical definition is needed. On the other hand, some words are intrinsically technical, and for them only a technical definition will suffice. Example:

> ‘‘Neutrino’’ means a quasi-massless lepton obeying Fermi-Dirac statistics and having one-half quantum unit of spin.

A definition is vague if it lacks precision or if its meaning is blurred—that is, if there is no way of telling exactly what class of things the definiens refers to. Example:

> ‘‘Democracy’’ means a kind of government where the people are in control.

This definition fails to identify the people who are in control, how they exercise their control, and what they are in control of.

A definition is ambiguous if it lends itself to more than one distinct interpretation. Example:

> ‘‘Triangle’’ means a figure composed of three straight lines in which all the angles are equal to 180°.

Does this mean that each angle separately is equal to 180° or that the angles taken together are equal to 180°? Either interpretation is possible given the ambiguous meaning of‘‘all the angles are equal to 180°’’

**Rule 7: A Lexical Definition Should Avoid Affective Terminology**

Affective terminology is any kind of word usage that plays upon the emotions of the reader or listener. It includes sarcastic and facetious language and any other kind of language that is liable to influence attitudes. Examples:

> ‘‘Communism’’ means that ‘‘brilliant’’ invention of Karl Marx and other foolish political visionaries in which the national wealth is supposed to be held in common by the people.
> ‘‘Theism’’ means belief in that great Santa Claus in the sky.

The second example also violates Rule 5 because it contains a metaphor.

**Rule 8: A Lexical Definition Should Indicate the Context to Which the Definiens Pertains**

This rule applies to any definition in which the context of the definiens is important to the meaning of the definiendum. For example, the definition‘‘‘Deuce’ means a tie in points toward a game or in games toward a set’’ is practically meaningless without any reference to tennis. Whenever the definiendum is a word that means different things in different contexts, a reference to the context is important. Examples:

> ‘‘Strike’’ means (in baseball) a pitch at which a batter swings and misses.
> ‘‘Strike’’ means (in bowling) the act of knocking down all the pins with the first ball of a frame.
> ‘‘Strike’’ means (infishing) a pull on a line made by a fish in taking the bait.

It is not always necessary to make explicit reference to the context, but at least the phraseology of the definiens should indicate the context.

**To summarize**: Terminology that conveys information is said to have cognitive meaning, and terminology that expresses or evokes feelings is said to have emotive meaning. Statements

expressed in emotive terminology often make value claims; when these statements occur in arguments, it is appropriate to disengage the value claims from the emotive language and express them as separate premises. Two ways in which cognitive meanings can be defective are vagueness and ambiguity. Vagueness involves a blur of meaning, whereas ambiguity involves a mix-up of otherwise clear meanings.

A term is a word or group of words that can serve as the subject of a statement. All terms have intensional meaning (intension or connotation), and those terms that refer to actually existing things also have extensional meaning (extension or denotation). The intensional meaning of a term consists of the attributes that the term connotes, and the extensional meaning consists of the members of the class that the term denotes. Terms that refer to nonexistent things are said to have empty extension.

A definition is a group of words that assigns a meaning to a word or group of words. The definiendum is the word or group of words being defined, and the definiens is the word or group of words that does the defining. Because definitions can serve different purposes, there are different kinds of definitions. Stipulative definitions assign a meaning to a word when itfirst comes into use, lexical definitions report the meaning that a word already has within a given linguistic community, precising definitions reduce the vagueness of a word, theoretical definitions suggest a theory that gives a certain characterization to the entities that the term denotes, and persuasive definitions are used to influence the attitude of people in the community toward the things the word denotes.

The two kinds of meaning that words have, intensional and extensional, can be used as the basis for producing definitions. Extensional definitions assign a meaning to a word by identifying the things that the word denotes, and intensional definitions accomplish the same purpose by identifying the attributes that the word connotes.

Among the extensional definitions, demonstrative definitions ‘‘point’’ to the things in question, enumerative definitions name various individuals in the class, and definitions by subclass identify subclasses of those things. Among the intensional definitions, synonymous definitions equate the word being defined with another word that connotes the same attributes, etymological definitions disclose the word’s ancestry, operational definitions specify experimental procedures for determining whether the word applies to a certain thing, and

definitions by genus and difference identify a larger class of things and then narrow it down so that it matches the class that the word refers to.

There are rules that govern the construction of lexical definitions. Such definitions should conform to grammatical standards, convey the essential meaning of the word being defined, be neither too broad nor too narrow, avoid circularity, avoid negative, figurative, obscure, vague, ambiguous, and affective language, and indicate the context to which the defininiens pertains.

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## Chapter 3: Informal Fallacies

### 3.1 Fallacies in General

A fallacy is a defect in an argument that consists in something other than merely false premises. As we will see, fallacies can be committed in many ways, but usually they involve either a mistake in reasoning or the creation of some illusion that makes a bad argument appear good (or both). Both deductive and inductive arguments may contain fallacies; if they do, they are either unsound or uncogent, depending on the kind of argument. Conversely, if an argument is unsound or uncogent, it has one or more false premises or it contains a fallacy (or both).

Fallacies are usually divided into two groups: **formal** and **informal**. A **formal fallacy** is one that may be identified through mere inspection of the form or structure of an argument. Fallacies of this kind are found only in deductive arguments that have identifiable forms. Chapter 1 presented some of these forms: categorical syllogisms, disjunctive syllogisms, and hypothetical syllogisms. The following categorical syllogism contains a formal fallacy:

All bullfights are grotesque rituals.
All executions are grotesque rituals.
Therefore, all bullfights are executions.

This argument has the following form:

All A are B.

All Care B.

All A are C

Through mere inspection of this form, one can see that the argument is invalid. The fact that A, B, and C stand respectively for ‘‘bullfights,’’ ‘‘grotesque rituals,’’ and ‘‘executions’’ is irrelevant in detecting the fallacy. The problem may be traced to the second premise. If the letters C and B are interchanged, the form becomes valid, and the original argument, with the same

change introduced, also becomes valid (but unsound). Here is an example of a formal fallacy that occurs in a hypothetical syllogism:

If apes are intelligent, then apes can solve puzzles.
Apes can solve puzzles.
Therefore, apes are intelligent.

This argument has the following form:

If A then B.

B.

---

A.

In this case, if A and B are interchanged in the first premise, the form becomes valid, and the original argument, with the same change, also becomes valid. This fallacy and the one that precedes it will be discussed in later chapters.

In distinguishing formal from informal fallacies, remember that formal fallacies occur only in deductive arguments. Thus, if a given argument is inductive, it cannot contain a formal fallacy. Also, keep an eye out for standard deductive argument forms such as categorical syllogisms and hypothetical syllogisms. If such an argument is invalid because of an improper arrangement of terms or statements, it commits a formal fallacy. Section 1.5 investigated some of these forms and gave instruction on distinguishing the form from the content of an argument. All of the exercises at the end of that section commit formal fallacies.

**Informal fallacies** are those that can be detected only through analysis of the content of the argument. Consider the following example:

All factories are plants.
All plants are things that contain chlorophyll.
Therefore, all factories are things that contain chlorophyll.

A cursory inspection of this argument might lead one to think that it has the following form:

All A are B.
All B are C.
All A are C.

Since this form is valid, one might conclude that the argument itself is valid. Yet the argument is clearly invalid because it has true premises and a false conclusion. An analysis of the

content—that is, the meaning of the words—reveals the source of the trouble. The word ‘‘plants’’ is used in two different senses. In the first premise it means a building where something is manufactured, and in the second it means a life form.

Thus, the argument really has the following invalid form:

All A are B.
All C are D.
All A are D.

The various informal fallacies accomplish their purpose in so many different ways that no single umbrella theory covers them all. Some fallacies work by getting the reader or listener to feel various emotions, such as fear, pity, or camaraderie, and then attaching a certain conclusion to those emotions. Others attempt to discredit an opposing argument by associating it with certain pejorative features of its author. And then there are those that appeal to various dispositions on the part of the reader or listener, such as superstition or mental laziness, to get him or her to accept a conclusion. By studying the typical ways in which arguers apply these techniques, one is less likely to be fooled by the fallacious arguments posed by others and is less likely to stumble blindly into fallacies when constructing arguments for one’s own use.

Since the time of Aristotle, logicians have attempted to classify the various informal fallacies. Aristotle himself identified thirteen and separated them into two groups. The work of subsequent logicians has produced dozens more, rendering the task of classifying them even more difficult. The presentation that follows divides twenty-two informal fallacies into five groups: fallacies of relevance, fallacies of weak induction, fallacies of presumption, fallacies of ambiguity, and fallacies of grammatical analogy. The final section of the chapter considers the related topics of detecting and avoiding fallacies in the context of ordinary language.

### 3.2 Fallacies of Relevance

The **fallacies of relevance** share the common characteristic that the arguments in which they occur has premises that are logically irrelevant to the conclusion. Yet the premises are relevant psychologically, so the conclusion may seem to follow from the premises, even though

it does not follow logically. In a good argument the premises provide genuine evidence in support of the conclusion. In an argument that commits a fallacy of relevance, on the other hand, the connection between premises and conclusion is emotional. To identify a fallacy of relevance, therefore, one must be able to distinguish genuine evidence from various forms of emotional appeal.

### 1. Appeal to Force (*Argumentum ad Baculum*: Appeal to the ‘‘Stick’’)

The fallacy of **appeal to force** occurs whenever an arguer poses a conclusion to another person and tells that person either implicitly or explicitly that some harm will come to him or her if he or she does not accept the conclusion. The fallacy always involves a threat by the arguer to the physical or psychological well-being of the listener or reader, who may be either a single person or a group of persons. Obviously, such a threat is logically irrelevant to the subject matter of the conclusion, so any argument based on such a procedure is fallacious. The ad baculum fallacy often occurs when children argue with one another:

> Child to playmate: ‘‘Teletubbies’’ is the best show on TV; and if you don’t believe it,
> I’m going to call my big brother over here and he’s going to beat you up

But it occurs among adults as well:

> Secretary to boss: I deserve a raise in salary for the coming year. After all, you know how friendly I am with your wife, and I’m sure you wouldn’t want her to find out what’s been going on between you and that sexpot client of yours.

The first example involves a physical threat, the second a psychological threat. While neither threat provides any genuine evidence that the conclusion is true, both provide evidence that someone might be injured. If the two types of evidence are confused with each other, both arguer and listener may be deluded into thinking that the conclusion is supported by evidence, when in fact it is not.

The appeal to force fallacy usually accomplishes its purpose by psychologically impeding the reader or listener from acknowledging a missing premise that, if acknowledged, would be seen to be false or at least questionable. The two examples just given can be interpreted as concealing the following premises, both of which are most likely false:

> If my brother forces you to admit that ‘‘Teletubbies’’ is the best show on TV, then ‘‘Teletubbies’’ is in fact the best show.
>
> If I succeed in threatening you, then I deserve a raise in salary.

The conclusion of the first argument is that ‘‘Teletubbies’’ is the best show on TV. But just because someone is forced into saying that it is does not mean that such is the case. Similarly, the conclusion of the second argument is that the secretary deserves a raise in salary. But if the boss is threatened into raising the secretary's salary, this does not mean that the secretary deserves a raise. Many of the other informal fallacies can be interpreted as accomplishing their purpose in this way.

### 2. Appeal to Pity *(Argumentum ad Misericordiam)*

The **appeal to pity** fallacy occurs when an arguer attempts to support a conclusion by merely evoking pity from the reader or listener. This pity may be directed toward the arguer or toward some third party. Example:

> Taxpayer to judge: Your Honor, I admit that I declared thirteen children as dependents on my tax return, even though I have only two. But if you find me guilty of tax evasion, my reputation will be ruined. I'll probably lose my job, my poor wife will not be able to have the operation that she desperately needs, and my kids will starve. Surely I am not guilty.

The conclusion of this argument is ‘‘Surely I am not guilty.’’ Obviously, the conclusion is not logically relevant to the arguer's set of pathetic circumstances, although it is psychologically relevant. If the arguer succeeds in evoking pity from the listener or reader, the latter is likely to exercise his or her desire to help the arguer by accepting the argument. In this way the reader or listener may be fooled into accepting a conclusion that is not supported by any evidence. The appeal to pity is quite common and is often used by students on their instructors at exam time and by lawyers on behalf of their clients before judges and juries.

Of course, some arguments that attempt to evoke sympathetic feelings from the reader or listener are not fallacious. We might call them arguments from compassion. Such arguments differ from the fallacious appeal to pity in that, in addition to evoking compassion on behalf of some person, they supply information about why that person is genuinely deserving of help or special consideration. Whenever possible these non fallacious arguments should show that the person in question is a victim of circumstances and not responsible for the dire straights he finds himself in, that the recommended help or special consideration is not illegal or inappropriate, and that it will genuinely help the person in question. In contrast to such arguments, the appeal to pity proceeds by ignoring all of these considerations and attempts to support a conclusion by merely evoking pity from the reader or listener.

### 3. Appeal to the People *(Argumentum ad Populum)*

Nearly everyone wants to be loved, esteemed, admired, valued, recognized, and accepted by others. The appeal to the people uses these desires to get the reader or listener to accept a conclusion. Two approaches are involved, one of them direct, the other indirect.

The direct approach occurs when an arguer, addressing a large group of people, excites the emotions and enthusiasm of the crowd to win acceptance for his or her conclusion. The objective is to arouse a kind of mob mentality. This is the strategy used by nearly every propagandist and demagogue. Adolf Hitler was a master of the technique, but it is also used with some measure of success by speechmakers at Democratic and Republican national conventions. Waving flags and blaring music add to the overall effect. Because the individuals in the audience want to share in the camaraderie, the euphoria, and the excitement, they find themselves accepting any number of conclusions with ever-increasing fervor.

The direct approach is not limited to oral argumentation, of course; a similar effect can be accomplished in writing. By using such emotionally charged phraseology as ‘‘fighter of communism,’’ ‘‘champion of the free enterprise system,’’ and ‘‘defender of the working man,’’ polemicists can awaken the same kind of mob mentality as they would if they were speaking.

In the indirect approach the arguer aims his or her appeal not at the crowd as a whole but at one or more individuals separately, focusing on some aspect of their relationship to the crowd.

The indirect approach includes such specific forms as the bandwagon argument, the appeal to vanity, and the appeal to snobbery. All are standard techniques of the advertising industry.

Here is an example of the **bandwagon argument:**

> Of course you want to buy Zest toothpaste. Why, 90 percent of America brushes with Zest.

The idea is that you will be left behind or left out of the group if you do not use the product.

**The appeal to vanity** often associates the product with someone who is admired, pursued, or imitated, the idea being that you, too, will be admired and pursued if you use it. The current television and billboard ads for the U.S. Marine Corps provide an example. The ads show a strong, handsome man in uniform holding a gleaming sword, and the caption reads:

> The Few, the Proud, the Marines.

The message is that if you join the Marines, then you, too, will be admired and respected, just like the handsome man in the uniform.

The **appeal to snobbery** depends on a similar kind of association.

> A Rolls Royce is not for everyone. If you qualify as one of the select few, this distinguished classic may be seen and driven at British Motor Cars, Ltd. (By appointment only, please.)

Needless to say, the indirect approach is used by others besides advertisers:

> Mother to child: You want to grow up and be just like Wonder Woman, don't you? Then eat your liver and carrots.

These examples illustrate how the indirect version of the appeal to the people can overlap the false cause fallacy, which is presented in Section 3.3. Thus, the previous example might be interpreted to suggest that eating liver and carrots will cause one to become just like Wonder Woman. If so, the fallacy could be identified as false cause.

Both the direct and indirect approaches of the ad populum fallacy have the same basic structure:

> You want to be accepted/included-in-the-group/loved/ esteemed....Therefore, you should accept XYZ as true.

In the direct approach the arousal of a mob mentality produces an immediate feeling of belonging for each person in the crowd. Each person feels united with the crowd, which evokes a sense of strength and security. When the crowd roars its approval of the conclusions that are then offered, anyone who does not accept them automatically cuts himself or herself off from the crowd and risks the loss of his or her security, strength, and acceptance. The same thing happens in the indirect approach, but the context and technique are somewhat subtler.

### 4. Argument Against the Person *(Argumentum ad Hominem)*

This fallacy always involves two arguers. One of them advances (either directly or implicitly) a certain argument, and the other then responds by directing his or her attention not to the first person's argument but to the first person himself. When this occurs, the second person is said to commit an argument against the person.

The **argument against the person** occurs in three forms: the **ad hominem abusive**, The ad hominem circumstantial, and the tu quoque. In the ad hominem abusive, the second person responds to the first person's argument by verbally abusing the first person. Example:

> Before he died, poet Allen Ginsberg argued in favor of legalizing pornography. But Ginsberg's arguments are nothing but trash. Ginsberg was a marijuana-smoking homosexual and a thoroughgoing advocate of the drug culture.

Because Ginsberg's being a marijuana-smoking homosexual and advocate of the drug culture is irrelevant to whether the premises of his argument support the conclusion, this argument is fallacious.

Not all cases of the ad hominem abusive are as blunt as this one, but they are just as fallacious. Example:

> William Buckley has argued in favor of legalizing drugs such as cocaine and heroin. But Buckley is just another one of those upper-crust intellectuals who is out of touch with real America. No sensible person should listen to his pseudo solutions.

Again, whether Buckley is an upper-crust intellectual has nothing to do with whether his premises support his conclusion.

**The ad hominem circumstantial** begins the same way as the ad hominem abusive, but instead of heaping verbal abuse on his or her opponent, the respondent attempts to discredit the opponent's argument by alluding to certain circumstances that affect the opponent. By doing so the respondent hopes to show that the opponent is predisposed to argue the way he or she does and should therefore not be taken seriously. Here is an example:

> The Dalai Lama argues that China has no business in Tibet and that the West should do something about it. But the Dalai Lama just wants the Chinese to leave so he can return as leader. Naturally he argues this way. Therefore, we should reject his arguments.

The author of this argument ignores the substance of the Dalai Lama's argument and attempts to discredit it by calling attention to certain circumstances that affect the Dalai Lama—namely, that he wants to return to Tibet as its leader. But the fact that the Dalai Lama happens to be affected by these circumstances is irrelevant to whether his premises support a conclusion. The ad hominem circumstantial is easy to recognize because it always takes this form: ''Of course Mr. X argues this way; just look at the circumstances that affect him.''

The **tu quoque (''you too'')** fallacy begins the same way as the other two varieties of the ad hominem argument, except that the second arguer attempts to make the first appear to be hypocritical or arguing in bad faith. The second arguer usually accomplishes this by citing features in the life or behavior of the first arguer that conflict with the latter's conclusion. In effect, the second arguer says, ''How dare you argue that I should stop doing X; why, you do (or have done)X yourself.'' Example:

> Child to parent: Your argument that I should stop stealing candy from the corner store is no good. You told me yourself just a week ago that you, too, stole candy when you were a kid.

Obviously, whether the parent stole candy is irrelevant to whether the parent's premises support the conclusion that the child should not steal candy.

It is important to keep in mind that the purpose of an ad hominem argument is to discredit another person's argument by placing its author in a bad light. Thus, for the fallacy to be committed, there must always be two arguers (at least implicitly). If it should turn out that the person being attacked is not an arguer, then the personal comments made by the attacker may well be relevant to the conclusion that is drawn. In general, personal observations are relevant to conclusions about what kind of person someone is (good, bad, stingy, trustworthy, and so forth) and whether a person has done something. Example:

> International terrorist Osama bin Laden planned the bombing of the U.S. embassies in Kenya and Tanzania, killing over two hundred innocent people, and he supports terrorist causes all over the world. Bin Laden is therefore a wicked and irresponsible person.

The conclusion is not that Bin Laden's argument is bad but that Bin Laden himself is bad. Because the premises give relevant support to this conclusion, the argument commits no fallacy. Another example:

> Shakespeare cannot possibly have written the thirty-six plays attributed to him, because the real Shakespeare was a two-bit country businessman who barely finished the fourth grade in school and who never left the confines of his native England.

The conclusion is not that some argument of Shakespeare's is bad but that Shakespeare did not write certain plays. Again, since the premises are relevant to this conclusion, the argument commits no ad hominem fallacy.

Determining what kind of person someone is includes determining whether that person is trustworthy. Thus personal comments are often relevant in evaluating whether a person's proclamations or statements, unsupported by evidence, warrant our belief. Examples of such statements include promises to do something, testimony given by a witness, and testimonials in support of a product or service. Here is an example of an argument that discredits a witness:

> Mickey has testified that he saw Freddy set fire to the building. But Mickey was recently convicted on ten counts of perjury, and he hates Freddy with a passion and would love to see him sent to jail. Therefore, you should not believe Mickey's testimony.

This argument commits no fallacy. The conclusion is not that you should reject Mickey's argument but rather that you should reject his testimony. Testimony is not argument, and the fact that the witness is a known liar and has a motive to lie now is relevant to whether we should believe him. Furthermore, note that the conclusion is not that Mickey's statement is literally false but rather that we should not believe the statement. It is quite possible that Mickey really did see Freddy set fire to the building and that Mickey's statement to that effect is true. But if our only reason for believing this statement is the mere fact that Mickey has made it, then given the circumstances, we are not justified in that belief. Personal factors are never relevant to truth and falsity as such, but they are relevant to believability.

Yet there is often a close connection between truth and believability, and this provides one of the reasons why ad hominem arguments are often effective. In evaluating any argument there are always two issues to be considered: the quality of the reasoning and the truth of the premises. As we have noted, both are irrelevant to the personal characteristics of the arguer. But whether we accept the premises as true may depend on the credibility of the arguer. Knowing that the arguer is biased or has a motive to lie may provide good grounds for distrusting the premises. Another reason why ad hominem arguments are effective is that they engage the emotions of readers and listeners and thereby motivate them to transfer their negative feelings about the arguer onto the argument.

### 5. Accident

The fallacy of **accident** is committed when a general rule is applied to a specific case it was not intended to cover. Typically, the general rule is cited (either directly or implicitly) in the premises and then wrongly applied to the specific case mentioned in the conclusion. Two examples:

> Freedom of speech is a constitutionally guaranteed right. Therefore, John Q. Radical should not be arrested for his speech that incited the riot last week.
>
> Property should be returned to its rightful owner. That drunken sailor who is starting a fight with his opponents at the pool table lent you his .45-caliber pistol, and now he wants it back. Therefore, you should return it to him now.

In the first example, the general rule is that freedom of speech is normally guaranteed, and the specific case is the speech made by John Q. Radical. Because the speech incited a riot, the rule does not apply. In the second example, the general rule is that property should be returned to its rightful owner, and the specific case is the sailor who wants his gun returned. The rule does not apply because the return of the property might result in serious injury or death.

The fallacy of accident gets its name from the fact that the specific case exhibits some attribute, or ‘‘accident,’’ that prevents the general rule from applying. In the first example the accident is that the speech incited a riot; in the second example, the accidents are that the sailor is drunk, that he is starting a fight, and that the property in question is dangerous.

### 6. Straw Man

The straw man fallacy is committed when an arguer distorts an opponent’s argument for the purpose of more easily attacking it, demolishes the distorted argument, and then concludes that the opponent’s real argument has been demolished. By so doing, the arguer is said to have set up a straw man and knocked it down, only to conclude that the real man (opposing argument) has been knocked down as well. Example:

> Mr. Goldberg has argued against prayer in the public schools. Obviously Mr. Goldberg advocates atheism. But atheism is what they used to have in Russia. Atheism leads to the suppression of all religions and the replacement of God by an omnipotent state. Is that what we want for this country? I hardly think so. Clearly Mr. Goldberg’s argument is nonsense.

Like the argument against the person fallacy, the straw man fallacy involves two arguers. Mr. Goldberg, who is the first arguer, has presented an argument against prayer in the public schools. The second arguer then attacks Goldberg’s argument by equating it with an argument for atheism. He then attacks atheism and concludes that Goldberg’s argument is nonsense. Since Goldberg’s argument had nothing to do with atheism, the second argument commits the straw man fallacy.

As this example illustrates, the kind of distortion the second arguer resorts to is often an attempt to exaggerate the first person’s argument or make it look more extreme than it really is. Here are two more examples:

> The garment workers have signed a petition arguing for better ventilation on the work premises. Unfortunately, air conditioning is expensive. Air ducts would have to be run throughout the factory, and a massive heat exchange unit installed on the roof. Also, the cost of operating such a system during the summer would be astronomical. In view of these considerations the petition must be rejected.
>
> The student status committee has presented us with an argument favoring alcohol privileges on campus. What do the students want? Is it their intention to stay boozed up from the day they enter as freshmen till the day they graduate? Do they expect us to open a bar for them? Or maybe a chain of bars all over campus? Such a proposal is ridiculous!

In the first argument, the petition is merely for better ventilation in the factory—maybe a fan in the window during the summer. The arguer exaggerates this request to mean an elaborate air conditioning system installed throughout the building. He then points out that this is too expensive and concludes by rejecting the petition. A similar strategy is used in the second argument. The arguer distorts the request for alcohol privileges to mean a chain of bars all over campus. Such an idea is so patently outlandish that no further argument is necessary.

### 7. Missing the Point *(Ignoratio Elenchi)*

All the fallacies we have discussed thus far have been instances of cases where the premises of an argument are irrelevant to the conclusion. Missing the point illustrates a special form of irrelevance. This fallacy occurs when the premises of an argument support one particular conclusion, but then a different conclusion, often vaguely related to the correct conclusion, is drawn. Whenever one suspects that such a fallacy is being committed, he or she should be able to identify the correct conclusion, the conclusion that the premises logically imply. This conclusion must be significantly different from the conclusion that is actually drawn. Examples:

> Crimes of theft and robbery have been increasing at an alarming rate lately. The conclusion is obvious: we must reinstate the death penalty immediately.
>
> Abuse of the welfare system is rampant nowadays. Our only alternative is to abolish the system altogether.

At least two correct conclusions are implied by the premise of the first argument: either ‘‘We should provide increased police protection in vulnerable neighborhoods’’ or ‘‘We should initiate

programs to eliminate the causes of the crimes.'' Reinstating the death penalty is not a logical conclusion at all. Among other things, theft and robbery are not capital crimes. In the second argument the premises logically suggest some systematic effort to eliminate the cheaters rather than eliminating the system altogether.

*Ignoratio elenchi* means ''ignorance of the proof.'' The arguer is ignorant of the logical implications of his or her own premises and, as a result, draws a conclusion that misses the point entirely. The fallacy has a distinct structure all its own, but in some ways it serves as a catchall for arguments that are not clear instances of one or more of the other fallacies. An argument should not be identified as a case of missing the point, however, if one of the other fallacies fits.

### 8. Red Herring

This fallacy is closely associated with missing the point *(ignoratio elenchi).* The red Herring fallacy is committed when the arguer diverts the attention of the reader or listener by changing the subject to a different but sometimes subtly related one. He or she then finishes by either drawing a conclusion about this different issue or by merely presuming that some conclusion has been established. By so doing, the arguer purports to have won the argument. The fallacy gets its name from a procedure used to train hunting dogs to follow a scent. A red herring (or bag of them) is dragged across the trail with the aim of leading the dogs astray. Since red herrings have an especially potent scent (caused in part by the smoking process used to preserve them), only the best dogs will follow the original scent.

To use the red herring fallacy effectively, the arguer must change the original subject of the argument without the reader or listener noticing it. One way of doing this is to change the subject to one that is subtly related to the original subject. Here are two examples of this technique:

> Environmentalists are continually harping about the dangers of nuclear power. Unfortunately, electricity is dangerous no matter where it comes from. Every year hundreds of people are electrocuted by accident. Since most of these accidents are caused by carelessness, they could be avoided if people would just exercise greater caution.
>
> There is a good deal of talk these days about the need to eliminate pesticides from our fruits and vegetables. But many of these foods are essential to our

> health. Carrots are an excellent source of vitamin A, broccoli is rich in iron, and oranges and grapefruits have lots of vitamin C.

Both arguments commit the red herring fallacy. In the first, the original issue is whether nuclear power is dangerous. The arguer changes this subject to the danger of electrocution and proceeds to draw a conclusion about that. The new subject is clearly different from the possibility of nuclear explosion or meltdown, but the fact that both are related to electricity facilitates the arguer's goal of leading someone off the track. In the second argument, the original issue is pesticides, and the arguer changes it to the value of fruits and vegetables in one's diet. Again, the fact that the second topic is related to the first assists the arguer in committing the fallacy. In neither case does the arguer draw a conclusion about the original topic, but by merely diverting the attention of the reader or listener, the arguer creates the presumption of having won the argument.

A second way of using the red herring effectively is to change the subject to some flashy, eye-catching topic that is virtually guaranteed to distract the listener's attention. Topics of this sort include sex, crime, scandal, immorality, death, and any other topic that might serve as the subject of gossip. Here is an example of this technique:

> Professor Conway complains of inadequate parking on our campus. But did you know that last year Conway carried on a torrid love affair with a member of the English Department? The two used to meet every day for clandestine sex in the copier room. Apparently they didn't realize how much you can see through that fogged glass window. Even the students got an eyeful. Enough said about Conway.

The red herring fallacy can be confused with the straw man fallacy because both have the effect of drawing the reader/listener off the track. This confusion can usually be avoided by remembering the unique ways in which they accomplish this purpose. In the straw man, the arguer begins by distorting an opponent's argument and concludes by knocking down the distorted argument. In the red herring, on the other hand, the arguer ignores the opponent's argument (if there is one) and subtly changes the subject. Thus, to distinguish the two fallacies, one should attempt to determine whether the arguer has knocked down a distorted argument or simply changed the subject. Also keep in mind that straw man always involves two arguers, at least implicitly, whereas a red herring often does not.

Both the red herring and straw man fallacies are susceptible of being confused with missing the point, because all three involve a similar kind of irrelevancy. To avoid this confusion, one should note that both red herring and straw man proceed by generating a new set of premises, whereas missing the point does not. Straw man draws a conclusion from new premises that are obtained by distorting an earlier argument, and red herring, if it draws any conclusion at all, draws one from new premises obtained by changing the subject. Missing the point, however, draws a conclusion from the original premises. Also, in the red herring and straw man, the conclusion, if there is one, is relevant to the premises from which it is drawn; but in missing the point, the conclusion is irrelevant to the premises from which it is drawn. Finally, remember that missing the point serves in part as a kind of catchall fallacy, and a fallacious argument should not be identified as a case of missing the point if one of the other fallacies clearly fits.

### 3.3 Fallacies of Weak Induction

The fallacies of weak induction occur not because the premises are logically irrelevant to the conclusion, as is the case with the eight fallacies of relevance, but because the connection between premises and conclusion is not strong enough to support the conclusion. In each of the following fallacies, the premises provide at least a shred of evidence in support of the conclusion, but the evidence is not nearly good enough to cause a reasonable person to believe the conclusion. Like the fallacies of relevance, however, the fallacies of weak induction often involve emotional grounds for believing the conclusion.

#### 9. Appeal to Unqualified Authority *(Argumentum ad Verecundiam)*

We saw in Chapter 1 that an argument from authority is an inductive argument in which an arguer cites the authority or testimony of another person in support of some conclusion. The appeal to unqualified authority fallacy is a variety of the argument from authority and occurs when the cited authority or witness is not trustworthy. There are several reasons why an authority or witness might not be trustworthy. The person might lack the requisite expertise, might be biased or prejudiced, might have a motive to lie or disseminate ‘‘misinformation,’’ or might lack the requisite ability to perceive or recall. The following examples illustrate these reasons:

> Dr. Bradshaw, our family physician, has stated that the creation of muonic atoms of deuterium and tritium hold the key to producing a sustained

> nuclear fusion reaction at room temperature. In view of Dr. Bradshaw's expertise as a physician, we must conclude that this is indeed true.

This conclusion deals with nuclear physics, and the authority is a family physician. Because it is unlikely that a physician would be an expert in nuclear physics, the argument commits an appeal to unqualified authority.

> David Duke, former Grand Wizard of the Ku Klux Klan, has stated, ''Jews are not good Americans. They have no understanding of what America is.'' On the basis of Duke's authority, we must therefore conclude that the Jews in this country are un-American.

As an authority, David Duke is clearly biased, so his statements cannot be trusted.

> James W. Johnston, Chairman of R. J. Reynolds Tobacco Company, testified before Congress that tobacco is not an addictive substance and that smoking cigarettes does not produce any addiction. Therefore, we should believe him and conclude that smoking does not in fact lead to any addiction.

If Mr. Johnston had admitted that tobacco is addictive, it would have opened the door to government regulation, which could put his company out of business. Thus, because Johnston had a clear motive to lie, we should not believe his statements.

> Old Mrs. Furguson (who is practically blind) has testified that she saw the defendant stab the victim with a bayonet while she was standing in the twilight shadows 100 yards from the incident. Therefore, members of the jury, you must find the defendant guilty.

Here the witness lacks the ability to perceive what she has testified to, so her testimony is untrustworthy.

In deciding whether a person is a qualified authority, one should keep two important points in mind. First, the person might be an authority in more than one field. For example, a chemist might also be an authority in biology, or an economist might also be an authority in law. The second point is that there are some areas in which practically no one can be considered an authority. Such areas include politics, morals, and religion. For example, if someone were to argue that abortion is immoral because a certain philosopher or religious leader has said so, the argument would be weak regardless of the authority's qualifications. Many questions in these areas are so hotly contested that there is no conventional wisdom an authority can depend on.

### 10. Appeal to Ignorance *(Argumentum ad Ignorantiam)*

When the premises of an argument state that nothing has been proved one way or the other about something, and the conclusion then makes a definite assertion about that thing, the argument commits an appeal to ignorance. The issue usually involves something that is incapable of being proved or something that has not yet been proved. Example:

> People have been trying for centuries to provide conclusive evidence for the claims of astrology, and no one has ever succeeded. Therefore, we must conclude that astrology is a lot of nonsense.

Conversely, the following argument commits the same fallacy.

> People have been trying for centuries to disprove the claims of astrology, and no one has ever succeeded. Therefore, we must conclude that the claims of astrology are true.

The premises of an argument are supposed to provide positive evidence for the conclusion. The premises of these arguments, however, tell us nothing about astrology; rather, they tell us about what certain unnamed and unidentified people have tried unsuccessfully to do. This evidence may provide some slight reason for believing the conclusion, but certainly not sufficient reason.

These examples do, however, lead us to the first of two important exceptions to the appeal to ignorance. The first stems from the fact that if qualified researchers investigate a certain phenomenon within their range of expertise and fail to turn up any evidence that the phenomenon exists, this fruitless search by itself constitutes positive evidence about the question. Consider, for example, the following argument:

> Teams of scientists attempted over a number of decades to detect the existence of the luminiferous aether, and all failed to do so. Therefore, the luminiferous aether does not exist.

The premises of this argument are true. Given the circumstances, it is likely that the scientists in question would have detected the aether if in fact it did exist. Since they did not detect it, it probably does not exist. Thus, we can say that the above argument is inductively strong (but not deductively valid).

As for the two arguments about astrology, if the attempts to prove or disprove the astrological claims had been done in a systematic way by qualified experts, it is more likely that the arguments would be good. Exactly what is required to qualify someone to investigate astrological claims is, of course, difficult to say. But as these arguments stand, the premises state nothing about the qualifications of the investigators, and so the arguments remain fallacious.

It is not always necessary, however, that the investigators have special qualifications. The kinds of qualifications needed depend on the situation. Sometimes the mere ability to see and report what one sees is sufficient. Example:

> No one has ever seen Mr. Andrews drink a glass of wine, beer, or any other alcoholic beverage. Probably Mr. Andrews is a nondrinker.

Because it is highly probable that if Mr. Andrews were a drinker, somebody would have seen him drinking, this argument is inductively strong. No special qualifications are needed to be able to see someone take a drink.

The second exception to the appeal to ignorance relates to courtroom procedure. In the United States and Canada, among other countries, a person is presumed innocent until proven guilty. If the prosecutor in a criminal trial fails to prove the guilt of the defendant beyond reasonable doubt, counsel for the defense may justifiably argue that his or her client is not guilty. Example:

> Members of the jury, you have heard the prosecution present its case against the defendant. Nothing, however, has been proved beyond a reasonable doubt. Therefore, under the law, the defendant is not guilty.

This argument commits no fallacy because ‘‘not guilty’’ means, in the legal sense, that guilt beyond a reasonable doubt has not been proved. The defendant may indeed have committed the crime of which he or she is accused, but if the prosecutor fails to prove guilt beyond a reasonable doubt, the defendant is considered ‘‘not guilty.’’

### 11. Hasty Generalization (Converse Accident)

**Hasty generalization** is a fallacy that affects inductive generalizations. In Chapter 1 we saw that an inductive generalization is an argument that draws a conclusion about all members of a group from evidence that pertains to a selected sample. The fallacy occurs when there is a

reasonable likelihood that the sample is not representative of the group. Such a likelihood may arise if the sample is either too small or not randomly selected. Here are two examples:

> After only one year the alternator went out in Mr. O'Grady's new Chevrolet. Mrs. Dodson's Oldsmobile developed a transmission problem after six months. The obvious conclusion is that cars made by General Motors are just a pile of junk these days.
>
> Six Arab fundamentalists were convicted of bombing the World Trade Center in New York City. The message is clear: Arabs are nothing but a pack of religious fanatics prone to violence.

In these arguments a conclusion about a whole group is drawn from premises that mention only two instances. Because such small, atypical samples are not sufficient to support a general conclusion, each argument commits a hasty generalization. The second example indicates how hasty generalization plays a role in racial (and religious) prejudice.

The mere fact that a sample may be small, however, does not necessarily mean that it is atypical. On the other hand, the mere fact that a sample may be large does not guarantee that it is typical. In the case of small samples, various factors may intervene that render such a sample typical of the larger group. Examples:

> Ten milligrams of substance Z was fed to four mice, and within two minutes all four went into shock and died. Probably substance Z, in this amount, is fatal to the average mouse.
>
> On three separate occasions I drank a bottle of Figowitz beer and found it flat and bitter. Probably I would find every bottle of Figowitz beer flat and bitter.

Neither of these arguments commits the fallacy of hasty generalization because in neither case is there any likelihood that the sample is atypical of the group. In the first argument the fact that the mice died in only two minutes suggests the existence of a causal connection between eating substance Z and death. If there is such a connection, it would hold for other mice as well. In the second example the fact that the taste of beer typically remains constant from bottle to bottle causes the argument to be strong, even though only three bottles were sampled.

In the case of large samples, if the sample is not random, it may not be typical of the larger group. Example:

> One hundred thousand voters from Orange County, California, were surveyed on their choice for governor, and 68 percent said they intend to vote for the Republican candidate. Clearly the Republican candidate will be elected.

Even though the sample cited in this argument is large, the argument commits a hasty generalization. The problem is that Orange County is overwhelmingly Republican, so the mere fact that 68 percent intend to vote for the Republican candidate is no indication of how others in the state intend to vote. In other words, the survey was not conducted randomly, and for this reason the argument is fatally flawed. The need for randomness in samples is discussed further in Section 9.4 of this book.

Hasty generalization is otherwise called ‘‘converse accident ’’because it proceeds in a direction opposite to that of accident. Whereas accident proceeds from the general to the particular, converse accident moves from the particular to the general. The premises cite some characteristic affecting one or more atypical instances of a certain class, and the conclusion then applies that characteristic to all members of the class.

### 12. False Cause

The fallacy of false cause occurs whenever the link between premises and conclusion depends on some imagined causal connection that probably does not exist. Whenever an argument is suspected of committing the false cause fallacy, the reader or listener should be able to say that the conclusion depends on the supposition that X causes Y, whereas X probably does not cause Y at all. Examples:

> During the past two months, every time that the cheerleaders have worn blue ribbons in their hair, the basketball team has been defeated. Therefore, to prevent defeats in the future, the cheerleaders should get rid of those blue ribbons.

> Successful business executives are paid salaries in excess of $50,000. Therefore, the best way to ensure that Ferguson will become a successful executive is to raise his salary to at least $50,000.

> There are more laws on the books today than ever before, and more crimes are being committed than ever before. Therefore, to reduce crime we must eliminate the laws.

The first argument depends on the supposition that the blue ribbons caused the defeats, the second on the supposition that a high salary causes success, and the third on the supposition that laws cause crime. In no case is it likely that any causal connection exists.

The first argument illustrates a variety of the false cause fallacy called ***post hoc ergo propter hoc*** (‘‘after this, therefore on account of this’’). This variety of the fallacy presupposes that just because one event precedes another event the first event causes the second. Obviously, mere temporal succession is not sufficient to establish a causal connection. Nevertheless, this kind of reasoning is quite common and lies behind most forms of superstition. (Example: ‘‘A black cat crossed my path and later I tripped and sprained my ankle. It must be that black cats really are bad luck.’’)

The second and third arguments illustrate a variety of the false cause fallacy called ***non causa pro causa***(‘‘not the cause for the cause’’). This variety is committed when what is taken to be the cause of something is not really the cause at all and the mistake is based on something other than mere temporal succession. In reference to the second argument, success as an executive causes increases in salary—not the other way around—so the argument mistakes the cause for the effect. In reference to the third argument, the increase in crime is, for the most part, only coincidental with the increase in the number of laws. Obviously, the mere fact that one event is coincidental with another is not sufficient reason to think that one caused the other.

A third variety of the false cause fallacy, and one that is probably committed more often than either of the others in their pure form, is **oversimplified cause**. This variety occurs when a multitude of causes is responsible for a certain effect but the arguer selects just one of these causes and represents it as if it were the sole cause. Here are some examples:

> The quality of education in our grade schools and high schools has been declining for years. Clearly, our teachers just aren’t doing their job these days.

> Today, all of us can look forward to a longer life span than our parents and grandparents. Obviously, we owe our thanks to the millions of dedicated doctors who expend every effort to ensure our health.

In the first argument, the decline in the quality of education is caused by many factors, including lack of discipline in the home, parental uninvolvement, too much television, and drug use by students. Poor teacher performance is only one of these factors and probably a minor one at that. In the second argument, the efforts of doctors are only one among many factors

responsible for our longer life span. Other, more important factors include a better diet, more exercise, reduced smoking, safer highways, and more stringent occupational safety standards.

The oversimplified cause fallacy is usually motivated by self-serving interests. Sometimes the arguer wants to take undeserved credit for himself or give undeserved credit to some movement with which he or she is affiliated. At other times, the arguer wants to heap blame on an opponent or shift blame from himself or herself onto some convenient occurrence. Instances of the fallacy can resemble either the post hocor the non causa pro causavarieties in that the alleged cause can occur either prior to or concurrently with the effect. It differs from the other varieties of false cause fallacy in that the single factor selected for credit or blame is often partly responsible for the effect, but responsible to only a minor degree.

The false cause fallacy is often convincing because it is often difficult to determine whether two phenomena are causally related. A lengthy time lapse between the operation of the cause and the occurrence of the effect can exacerbate the problem. For example, the thirty-year interval between exposure to asbestos and the onset of asbestosis impeded the recognition of a causal connection. Also, when two events are causally related, it may be hard to determine the degree of relatedness. Thus, there may be some connection between the electromagnetic field produced by high voltage transmission lines and leukemia, but the connection may be extremely slight. Finally, when a causal connection is recognized, it may be difficult to determine which is the cause and which is the effect. For example, an allergic reaction may be connected with an episode of anxiety, but it may be hard to tell if the allergy causes the anxiety or if the anxiety causes the allergy.

The realm of human action constitutes another area in which causal connections are notoriously difficult to establish. For example, the attorneys for accused murderer Dan White argued that Twinkies, Coke, and potato chips caused him to kill San Francisco Mayor George Moscone. Other attorneys have blamed their clients' crimes on PMS, rap music, childhood abuse, mental retardation, and hallucinations. The complex nature of human motivation renders all such causal claims difficult to evaluate. The situation may become even worse when whole nations of people are involved. Thus, the recent drop in crime rates has been attributed to ''three strikes'' laws, but it is difficult to say whether this or some other factor is really responsible.

One point that should be kept in mind when establishing causal connections is that statistical correlations by themselves often reveal little about what is actually going on. For example, if all that we knew about smoking and lung cancer was that the two frequently occur together, we might conclude any number of things. We might conclude that both have a common cause, such as a genetic predisposition, or we might conclude that lung cancer is a disease contracted early in life and that it manifests itself in its early stages by a strong desire for tobacco. Fortunately, in the case of smoking and lung cancer there is more evidence than a mere statistical correlation. This additional evidence inclines us to believe that the smoking is a cause of the cancer.

## 13. Slippery Slope

The fallacy of slippery slope is a variety of the false cause fallacy. It occurs when the conclusion of an argument rests upon an alleged chain reaction and there is not sufficient reason to think that the chain reaction will actually take place. Here is an example:

> Immediate steps should be taken to outlaw pornography once and for all. The continued manufacture and sale of pornographic material will almost certainly lead to an increase in sex-related crimes such as rape and incest. This in turn will gradually erode the moral fabric of society and result in an increase in crimes of all sorts. Eventually a complete disintegration of law and order will occur, leading in the end to the total collapse of civilization.

Because there is no good reason to think that the mere failure to outlaw pornography will result in all these dire consequences, this argument is fallacious. An equally fallacious counterargument is as follows:

> Attempts to outlaw pornography threaten basic civil rights and should be summarily abandoned. If pornography is outlawed, censorship of newspapers and news magazines is only a short step away. After that there will be censorship of textbooks, political speeches, and the content of lectures delivered by university professors. Complete mind control by the central government will be the inevitable result.

Both arguments attempt to persuade the reader or listener that the welfare of society rests on a ‘‘slippery slope’’ and that a single step in the wrong direction will result in an inevitable slide all the way to the bottom.

Deciding whether a slippery slope fallacy has been committed can be difficult when there is uncertainty whether the alleged chain reaction will or will not occur. This question is discussed in Section 3.5. But many slippery slopes rest on a mere emotional conviction on the part of the arguer that a certain action or policy is bad, and the arguer attempts to trump up support for his or her position by citing all sorts of dire consequences that will result if the action is taken or the policy followed. In such cases there is usually little problem in identifying the argument as a slippery slope.

### 14. Weak Analogy

This fallacy affects inductive arguments from analogy. As we saw in Chapter 1, an argument from analogy is an argument in which the conclusion depends on the existence of an analogy, or similarity, between two things or situations. The fallacy of weak analogy is committed when the analogy is not strong enough to support the conclusion that is drawn. Example:

> Harper's new car is bright blue, has leather upholstery, and gets excellent gas mileage. Crowley's new car is also bright blue and has leather upholstery. Therefore, it probably gets excellent gas mileage, too.

Because the color of a car and the choice of upholstery have nothing to do with gasoline consumption, this argument is fallacious.

The basic structure of an argument from analogy is as follows:

> Entity A has attributes a, b, c, and z.
> Entity B has attributes a, b, c.
> Therefore, entity B probably has attribute z also.

Evaluating an argument having this form requires a two-step procedure: (1) Identify the attributes a, b, c,. . . that the two entities A and B share in common, and (2) determine how the attribute z, mentioned in the conclusion, relates to the attributes a, b, c,... If some causal or systematic relation exists between z and a, b, or c, the argument is strong; otherwise it is weak. In the argument above, the two entities share the attributes of being cars; the attributes entailed by being a car, such as having four wheels; and the attributes of color and upholstery material.

Because none of these attributes is systematically or causally related to good gas mileage, the argument is fallacious.

As an illustration of when the requisite systematic or causal relation does and does not exist, consider the following arguments: The flow of electricity through a wire is similar to the flow of water through a pipe.

> Obviously a large-diameter pipe will carry a greater flow of water than a pipe of small diameter. Therefore, a large-diameter wire should carry a greater flow of electricity than a small-diameter wire.
>
> The flow of electricity through a wire is similar to the flow of water through a pipe. When water runs downhill through a pipe, the pressure at the bottom of the hill is greater than it is at the top. Thus, when electricity flows downhill through a wire, the voltage should be greater at the bottom of the hill than at the top.

The first argument is good and the second is fallacious. Both arguments depend on the similarity between water molecules flowing through a pipe and electrons flowing through a wire. In both cases there is a systematic relation between the diameter of the pipe/wire and the amount of flow. In the first argument this systematic relation provides a strong link between premises and conclusion, and so the argument is a good one. But in the second argument a causal connection exists between difference in elevation and increase in pressure that holds for water but not for electricity. Water molecules flowing through a pipe are affected by gravity, but electrons flowing through a wire are not. Thus, the second argument is fallacious.

The theory and evaluation of arguments from analogy is one of the most complex and elusive subjects in all of logic. Additional material on arguments from analogy appears in Sections 3.5 and 9.1 of this text.

### 3.4 Fallacies of Presumption, Ambiguity, and Grammatical Analogy

The **fallacies of presumption** include begging the question, complex question, false dichotomy, and suppressed evidence. These fallacies arise not because the premises are irrelevant to the conclusion or provide insufficient reason for believing the conclusion but because the premises presume what they purport to prove. Begging the question presumes that

the premises provide adequate support for the conclusion when in fact they do not, and complex question presumes that a question can be answered by a simple ‘‘yes,’’ ‘‘no,’’ or other brief answer when a more sophisticated answer is needed. False dichotomy presumes that an ‘‘either...or...’’statement presents mutually exhaustive alternatives when in fact it does not, and suppressed evidence presumes that no important evidence has been overlooked by the premises when in fact it has.

The **fallacies of ambiguity** include equivocation and amphiboly. These fallacies arise from the occurrence of some form of ambiguity in either the premises or the conclusion (or both). As we saw in Section 2.1, an expression is ambiguous if it is susceptible to different interpretations in a given context. The words ‘‘light’’ and ‘‘bank’’ are ambiguous, as is the statement‘‘ Tuna are biting off the Washington coast.’’ When the conclusion of an argument depends on a shift in meaning of an ambiguous word or phrase or on the wrong interpretation of an ambiguous statement, the argument commits a fallacy of ambiguity.

The **fallacies of grammatical analogy** include composition and division. Arguments that commit these fallacies are grammatically analogous to other arguments that are good in every respect. Because of this similarity in linguistic structure, such fallacious arguments may appear good yet be bad.

### 15. Begging the Question *(Petitio Principii)*

The fallacy of begging the question is committed whenever the arguer creates the illusion that inadequate premises provide adequate support for the conclusion by leaving out a key premise, by restating the conclusion as a premise, or by reasoning in a circle. The *Latin* name for this fallacy, *petitio principii*, means ‘‘request for the source.’’ The actual source of support for the conclusion is not apparent, and so the argument is said to beg the question. After reading or hearing the argument, the observer is inclined to ask, ‘‘But how do you know X?’’ where X is the needed support.

The first, and most common, way of committing this fallacy is by leaving a key premise out of the argument while creating the illusion that nothing more is needed to establish the conclusion. Examples:

> Murder is morally wrong. This being the case, it follows that abortion is morally wrong.

> Of course humans and apes evolved from common ancestors. Just look how similar they are.
> It's obvious that the poor in this country should be given handouts from the government. After all, these people earn less than the average citizen.
> Clearly, terminally ill patients have a right to doctor assisted suicide. After all, many of these people are unable to commit suicide by themselves.

The first of these arguments begs the question ''How do you know that abortion is a form of murder?'' The second begs the question ''Does the mere fact that humans and apes look similar imply that they evolved from common ancestors?''And the third and fourth beg the questions ''Just because the poor earn less than the average citizen, does this imply that the government should give them handouts?'' and ''Just because terminally ill patients cannot commit suicide by themselves, why does it follow that they have a right to a doctor's assistance?''

These questions indicate that something has been left out of the original arguments. Thus, the first argument is missing the premise, ''Abortion is a form of murder''; the second is missing the premise, ''the fact that humans and apes look similar implies that they have common ancestors''; and so on. These premises are crucial for the soundness of the arguments. If the arguer is unable to establish the truth of these premises, then the arguments prove nothing. However, in most cases of begging the question, this is precisely the reason why such premises are left unstated. The arguer is notable to establish their truth, and by employing rhetorical phraseology such as ''of course,'' ''clearly,'' ''this being the case,'' and'' after all,'' the arguer hopes to create the illusion that the stated premise, by itself, provides adequate support for the conclusion when in fact it does not.

The same form of begging the question often appears in arguments concerning religious topics, to justify conclusions about the existence of God, the immortality of the soul, and so on. Example:

> The world in which we live displays an amazing degree of organization. Obviously this world was created by an intelligent God.

This argument begs the question, ''How do you know that the organization in the world could only have come from an intelligent creator?'' Of course the claim that it did come from an

intelligent creator may well be true, but the burden is on the arguer to prove it. Without supporting reasons or evidence, the argument proves nothing. Yet, most people who are predisposed to believe the conclusion are likely to accept the argument as a good one. The same can be said of most arguments that beg the question, and this fact suggests another reason why arguers resort to this fallacy: Such arguments tend to reinforce preexisting inclinations and beliefs.

The second form of petitio principia occurs when the premise of an argument merely restates the conclusion in slightly different language. Examples:

> Capital punishment is justified for the crimes of murder and kidnapping because it is quite legitimate and appropriate that someone be put to death for having committed such hateful and inhuman acts.
>
> Anyone who preaches revolution has a vision of the future for the simple reason that if a person has no vision of the future he could not possibly preach revolution.

In the first argument, saying that capital punishment is ‘‘justified’’ means the same thing as saying that it is ‘‘legitimate and appropriate,’’ and in the second argument the premise and the conclusion say exactly the same thing. However, by repeating the same thing in slightly different language, the arguer creates the illusion that independent evidence is being presented in support of the conclusion, when in fact it is not. Both arguments contain rhetorical phraseology (‘‘hateful and inhuman,’’ ‘‘simple reason,’’ and ‘‘could not possibly’’) that help effect the illusion. The first argument begs the question, ‘‘How do you know that capital punishment really is legitimate and appropriate?’’ and the second begs the question, ‘‘How do you know that people who preach revolution really do have a vision of the future?’’

The third form of petitio principia involves circular reasoning in a chain of inferences. Here is an example:

> Ford Motor Company clearly produces the finest cars in the United States. We know they produce the finest cars because they have the best design engineers. This is true because they can afford to pay them more than other manufacturers. Obviously they can afford to pay them more because they produce the finest cars in the United States.

Upon encountering this argument, the attentive reader is inclined to ask, ‘‘where does this reasoning begin? What is its source?’’ Since the argument goes in a circle, it has no beginning or source, and as a result it proves nothing. Of course, in this example the circularity is rather apparent, so the argument is not likely to convince anyone. Cases in which circular reasoning may convince involve long and complex arguments having premises that depend on one another in subtle ways and a key premise that depends on the conclusion.

In all cases of begging the question, the arguer uses some linguistic device to create the illusion that inadequate premises provide adequate support for a conclusion. Without such an illusion, the fallacy is not committed. Thus, the following arguments commit no fallacy:

No dogs are cats.
Therefore, no cats are dogs.

London is in England and Paris is in France.
Therefore, Paris is in France and London is in England.

In both of these examples, the premise amounts to little more than a restatement of the conclusion. Yet, both arguments are sound because they are valid and have true premises. No fallacy is committed because no illusion is created to make inadequate premises appear as adequate. We will study arguments of this sort in Chapters 4 and 7.
Here is another example:

Rome is in Germany or Rome is in Germany.
Therefore, Rome is in Germany.

This argument is valid, but it is unsound because it has a false premise. However, it commits no fallacy because, again, no illusion is created to cover anything up. Arguments having this form also appear in Chapter 7.

As with these examples, arguments that beg the question are normally valid. This is easy to see. Any argument that includes the conclusion as one of the premises is clearly valid, and those forms of the fallacy that leave a key premise out of the argument become valid when that key premise is introduced. The problem with arguments that beg the question is that they are usually unsound, or at least not clearly sound, because the premise needed to provide adequate

support for the conclusion is, at best, of uncertain truth value. Because such arguments presume the truth of this premise, begging the question is called a fallacy of presumption.

### 16. Complex Question

The fallacy of complex question is committed when a single question that is really two (or more) questions is asked and a single answer is then applied to both questions. Every complex question presumes the existence of a certain condition. When the respondent's answer is added to the complex question, an argument emerges that establishes the presumed condition. Thus, although not an argument as such, a complex question involves an implicit argument. This argument is usually intended to trap the respondent into acknowledging something that he or she might otherwise not want to acknowledge. Examples:

Have you stopped cheating on exams?
Where did you hide the cookies you stole?

Let us suppose the respondent answers ''yes'' to the first question and ''under the bed'' to the second. The following arguments emerge:

You were asked whether you have stopped cheating on exams. You answered ''yes.'' Therefore, it follows that you have cheated in the past.

You were asked where you hid the cookies you stole. You replied ''under the bed.'' It follows that you did in fact steal the cookies.

On the other hand, let us suppose that the respondent answers ''no'' to the first question and ''nowhere'' to the second. We then have the following arguments:

You were asked whether you have stopped cheating on exams. You answered ''no.'' Therefore, you continue to cheat.

You were asked where you hid the cookies you stole. You answered ''nowhere.''
It follows that you must have stolen them and eaten them.

Obviously, each of the questions is really two questions:

Did you cheat on exams in the past? If you did cheat in the past, have you stopped now?
Did you steal the cookies? If you did steal them, where did you hide them?

If respondents are not sophisticated enough to identify a complex question when one is put to them, they may answer quite innocently and be trapped by a conclusion that is supported by no evidence at all; or, they may be tricked into providing the evidence themselves. The correct response lies in resolving the complex question into its component questions and answering each separately.

The fallacy of complex question should be distinguished from another kind of question known in law as a leading question. A leading question is one in which the answer is in some way suggested in the question. Whether or not a question is a leading one is important in the direct examination of a witness by counsel. Example:

> Tell us, on April 9, did you see the defendant shoot the deceased? (leading question)
> Tell us, what did you see on April 9? (straight question)

Leading questions differ from complex questions in that they involve no logical fallacies; that is, they do not attempt to trick the respondent into admitting something he or she does not want to admit. To distinguish the two, however, it is sometimes necessary to know whether prior questions have been asked. Here are some additional examples of complex questions:

> Are you going to be a good little boy and eat your hamburger?
>
> Is George Hendrix still smoking marijuana?
>
> How long must I put up with your snotty behavior?
>
> When are you going to stop talking nonsense?

## 17. False Dichotomy

The fallacy of false dichotomy (otherwise called ‘‘false bifurcation’’ and the ‘‘either or fallacy’’) is committed when one premise of an argument is an ‘‘either...or...’’ (disjunctive) statement that presents two alternatives as if they were jointly exhaustive (as if no third alternative were possible). One of these alternatives is usually preferred by the arguer. When the arguer then proceeds to eliminate the undesirable alternative, the desirable one is left as the conclusion. Such an argument is clearly valid; but since the disjunctive premise is usually false, the argument is almost always unsound. Of course, not all unsound arguments are fallacious. The

fallacious nature of false dichotomy lies in the attempt by the arguer to delude the reader or listener into thinking that the disjunctive premise presents jointly exhaustive alternatives and is therefore true by necessity. The fallacy is commonly committed by children and adolescents when arguing with their parents, by advertisers, and by adults generally. Here are some examples:

> Either you let me attend the Garth Brooks concert or I'll be miserable for the rest of my life. I know you don't want me to be miserable for the rest of my life, so it follows that you'll let me attend the concert.
>
> Either you use Ultra Guard deodorant or you risk the chance of perspiration odor. Surely you don't want to risk the chance of perspiration odor. Therefore, you will want to use Ultra Guard deodorant.
>
> Either you buy only American-made products or you don't deserve to be called a loyal American. Yesterday you bought a new Toyota. It's therefore clear that you don't deserve to be called a loyal American.

None of the disjunctive premises in these arguments presents alternatives that are jointly exhaustive. Yet in each case the arguer wants to make it appear that it does. For example, in the first argument the arguer wants to convey the illusion that either he or she goes to the concert or faces a lifetime of misery, and no other alternatives are possible. Clearly, however, such is not the case.

False dichotomy is classified as a fallacy of presumption because the soundness of the argument depends on the presumption that the two alternatives presented are the only ones that exist. If they are not the only ones that exist, the ''either...or...''statement is false, and the argument is unsound.

Most instances of false dichotomy are not presented as complete arguments. Only the disjunctive premise is expressed, and the arguer leaves it to the reader or listener to supply the missing parts:

> Either you buy me a new mink coat, or I'll freeze to death when winter comes.
>
> Either I continue smoking, or I'll get fat and you'll hate to be seen with me.

The missing premise and conclusion are easily introduced.

## 18. Suppressed Evidence

Chapter 1 explained that a cogent argument is an inductive argument with good reasoning and true premises. The requirement of true premises includes the proviso that the premises not ignore some important piece of evidence that outweighs the presented evidence and entails a very different conclusion. If an inductive argument does indeed ignore such evidence, then the argument commits the fallacy of suppressed evidence. Consider, for example, the following argument:

> Most dogs are friendly and pose no threat to people who pet them. Therefore, it would be safe to pet the little dog that is approaching us now.

If the arguer ignores the fact that the little dog is excited and foaming at the mouth (which suggests rabies), then the argument commits a suppressed evidence fallacy. This fallacy is classified as a fallacy of presumption because it works by creating the presumption that the premises are both true and complete when in fact they are not.

Perhaps the most common occurrence of the suppressed evidence fallacy appears in inferences based on advertisements. Nearly every ad neglects to mention certain negative features of the product advertised. As a result, an observer who sees or hears an advertisement and then draws a conclusion from it may commit the fallacy of suppressed evidence. Example:

> The new RCA Digital Satellite System delivers sharp TV reception from an 18-inch dish antenna, and it costs only $199. Therefore, if we buy it, we can enjoy all the channels for a relatively small one-time investment.

The ads for the Digital Satellite System fail to mention that the user must also pay a substantial monthly fee to the satellite company and that none of the local channels are carried by the system. Thus, if the observer takes the ads at face value and uses them as the basis for such an argument, the argument will be fallacious.

Another way that an arguer can commit the suppressed evidence fallacy is by ignoring important events that have occurred with the passage of time that render an inductive conclusion improbable. Here is an example:

> During the past fifty years, Poland has enjoyed a rather low standard of living. Therefore, Poland will probably have a low standard of living for the next fifty years.

This argument ignores the fact that Poland was part of the Soviet bloc during most of the past fifty years, and this fact accounts for its rather low standard of living. However, following the collapse of the Soviet Union, Poland became an independent nation, and its economy is expected to improve steadily during the next fifty years.

Yet another form of suppressed evidence is committed by arguers who quote passages out of context from sources such as the Bible, the Constitution, and the Bill of

Rights to support a conclusion that the passage was not intended to support. Consider, for example, the following argument against gun control:

> The Second Amendment to the Constitution states that the right of the people to keep and bear arms shall not be infringed. But a law controlling handguns would infringe the right to keep and bear arms. Therefore, a law controlling handguns would be unconstitutional.

In fact, the Second Amendment reads, ‘‘A well regulated militia, being necessary to the security of a free state, the right of the people to keep and bear arms, shall not be infringed.’’ In other words, the amendment states that the right to bear arms shall not be infringed when the arms are necessary for the preservation of a well-regulated militia. Because a law controlling handguns (pistols) would have little effect on the preservation of a well-regulated militia, it is unlikely that such a law would be unconstitutional.

The suppressed evidence fallacy is similar to the form of begging the question in which the arguer leaves a key premise out of the argument. The difference is that suppressed evidence leaves out a premise that requires a different conclusion, while that form of begging the question leaves out a premise that is needed to support the stated conclusion. However, because both fallacies proceed by leaving a premise out of the argument, there are cases where the two fallacies overlap.

## 19. Equivocation

The fallacy of equivocation occurs when the conclusion of an argument depends on the fact that a word or phrase is used, either explicitly or implicitly, in two different senses in the argument. Such arguments are either invalid or have a false premise, and in either case they are unsound. Examples:

> Some triangles are obtuse. Whatever is obtuse is ignorant. Therefore, some triangles are ignorant.
>
> Any law can be repealed by the legislative authority. But the law of gravity is a law.
>
> Therefore, the law of gravity can be repealed by the legislative authority.
>
> We have a duty to do what is right. We have a right to speak out in defense of the innocent. Therefore, we have a duty to speak out in defense of the innocent.
>
> A mouse is an animal. Therefore, a large mouse is a large animal.

In the first argument ‘‘obtuse’’ is used in two different senses. In the first premise it describes a certain kind of angle, while in the second it means dull or stupid. The second argument equivocates on the word ‘‘law.’’ In the first premise it means statutory law, and in the second it means law of nature. The third argument uses ‘‘right’’ in two senses. In the first premise ‘‘right’’ means morally correct, but in the second it means a just claim or power. The fourth argument illustrates the ambiguous use of a relative term. The word ‘‘large’’ means different things depending on the context. Other relative terms that are susceptible to this same kind of ambiguity include ‘‘small,’’ ‘‘good,’’ ‘‘bad,’’ ‘‘light,’’ ‘‘heavy,’’ ‘‘difficult,’’ ‘‘easy,’’ ‘‘tall,’’ ‘‘short,’’ and so on.

To be convincing, an argument that commits an equivocation must use the equivocal word in ways that are subtly related. Of the three examples given above, only the third might fulfill this requirement. Since both uses of the word ‘‘right’’ are related to ethics, the unalert observer may not notice the shift in meaning. Another technique is to spread the shift in meaning out over the course of a lengthy argument. Political speechmakers often use phrases such as ‘‘equal opportunity,’’ ‘‘gun control,’’ ‘‘national security,’’ and ‘‘environmental protection’’ in one way at the beginning of a speech and in quite another way at the end. A third technique consists in using such phrases one way in a speech to one group and in a different way in a speech to an

opposing group. If the same people are not present at both speeches, the equivocation is not detected.

## 20. Amphiboly

The fallacy of amphiboly occurs when the arguer misinterprets a statement that is syntactically ambiguous and proceeds to draw a conclusion based on this faulty interpretation. The original statement is usually asserted by someone other than the arguer, and the syntactical ambiguity usually arises from a mistake in grammar or punctuation—a missing comma, a dangling modifier, an ambiguous antecedent of a pronoun, or some other careless arrangement of words. Because of this ambiguity, the statement may be understood in two clearly distinguishable ways. The arguer typically selects the unintended interpretation and proceeds to draw a conclusion based upon it. Here are some examples:

> The tour guide said that standing in Greenwich Village, the Empire State Building could easily be seen. It follows that the Empire State Building is in Greenwich Village.
>
> John told Henry that he had made a mistake. It follows that John has at least the courage to admit his own mistakes.
>
> Professor Johnson said that he will give a lecture about heart failure in the biology lecture hall. It must be the case that a number of heart failures have occurred there recently.

The premise of the first argument contains a dangling modifier. Is it the observer or the Empire State Building that is supposed to be standing in Greenwich Village? The correct interpretation is the former. In the second argument the pronoun ‘‘he’’ has an ambiguous antecedent; it can refer either to John or to Henry. Perhaps John told Henry that Henry had made a mistake. In the third argument the ambiguity concerns what takes place in the biology lecture hall; is it the lecture or the heart failures? The correct interpretation is probably the former. The ambiguity can be eliminated by inserting commas (‘‘Professor Johnson said that he will give a lecture, about heart failure, in the biology lecture hall’’) or by moving the ambiguous modifier (‘‘Professor Johnson said that he will give a lecture in the biology lecture hall about heart failure’’).

Two areas where cases of amphiboly cause serious problems involve contracts and wills. The drafters of these documents often express their intentions in terms of ambiguous statements, and alternate interpretations of these statements then lead to different conclusions. Examples:

> Mrs. Hart stated in her will, ‘‘I leave my 500-carat diamond necklace and my pet chinchilla to Alice and Theresa.’’ Therefore, we conclude that Alice gets the necklace and Theresa gets the chinchilla.
>
> Mr. James signed a contract that reads, ‘‘In exchange for painting my house, I promise to pay David $5000 and give him my new Cadillac only if he finishes the job by May 1.’’ Therefore, since David did not finish until May 10, it follows that he gets neither the $5000 nor the Cadillac.

In the first example, the conclusion obviously favors Alice. Theresa is almost certain to argue that the gift of the necklace and chinchilla should be shared equally by her and Alice. Mrs. Hart could have avoided the dispute by adding either ‘‘respectively’’ or ‘‘collectively’’ to the end of the sentence. In the second example, the conclusion favors Mr. James. David will argue that the condition that he finish by May 1 affected only the Cadillac and that he therefore is entitled to the $5000. The dispute could have been avoided by properly inserting a comma in the language of the promise.

Amphiboly differs from equivocation in two important ways. First, equivocation is always traced to an ambiguity in the meaning of a word or phrase, whereas amphiboly involves a syntactical ambiguity in a statement. The second difference is that amphiboly usually involves a mistake made by the arguer in interpreting an ambiguous statement made by someone else, whereas the ambiguity in equivocation is typically the arguer’s own creation. If these distinctions are kept in mind, it is usually easy to distinguish amphiboly from equivocation. Occasionally, however, the two fallacies occur together, as the following example illustrates:

> The Great Western *Cookbook* recommends that we serve the oysters when thoroughly stewed. Apparently the delicate flavor is enhanced by the intoxicated condition of the diners.

First, it is unclear whether ‘‘stewed’’ refers to the oysters or to the diners, and so the argument commits an amphiboly. But if ‘‘stewed’’ refers to the oysters it means ‘‘cooked,’’ and if it refers to the diners it means ‘‘intoxicated.’’ Thus, the argument also involves an equivocation.

## 21. Composition

The fallacy of composition is committed when the conclusion of an argument depends on the erroneous transference of an attribute from the parts of something onto the whole. In other words, the fallacy occurs when it is argued that because the parts have a certain attribute, it follows that the whole has that attribute too and the situation is such that the attribute in question cannot be legitimately transferred from parts to whole. Examples:

> Maria likes anchovies. She also likes chocolate ice cream. Therefore, it is certain that she would like a chocolate sundae topped with anchovies.
>
> Each player on this basketball team is an excellent athlete. Therefore, the team as a whole is excellent.
>
> Each atom in this piece of chalk is invisible. Therefore, the chalk is invisible.
>
> Sodium and chlorine, the atomic components of salt, are both deadly poisons.
>
> Therefore, salt is a deadly poison.

In these arguments the attributes that are transferred from the parts onto the whole are designated by the words ‘‘Maria likes,’’ ‘‘excellent,’’ ‘‘invisible, ’’and ‘‘deadly poison, ’’respectively. In each case the transference is illegitimate, and so the argument is fallacious.

Not every such transference is illegitimate, however. Consider the following arguments:

> Every atom in this piece of chalk has mass. Therefore, the piece of chalk has mass.
>
> Every component in this picket fence is white. Therefore, the whole fence is white

In each case an attribute (having mass, being white) is transferred from the parts onto the whole, but these transferences are quite legitimate. Indeed, the fact that the atoms have mass is the very reason why the chalk has mass. The same reasoning extends to the fence. Thus, the acceptability of these arguments is attributable, at least in part, to the legitimate transference of an attribute from parts onto the whole.

These examples illustrate the fact that the fallacy of composition is indeed an informal fallacy. It cannot be discovered by a mere inspection of the form of an argument— that is, by the

mere observation that an attribute is being transferred from parts onto the whole. In addition, detecting this fallacy requires a general knowledge of the situation and of the nature of the attribute being transferred. The critic must be certain that, given the situation, the transference of this particular attribute is not allowed.

Further caution is required by the fact that composition is sometimes confused with hasty generalization. The only time this confusion is possible is when the ‘‘whole’’ is a class (such as the class of people in a city or the class of trees in a forest), and the ‘‘parts’’ are the members of the class. In such a case composition proceeds from the members of the class to the class itself. Hasty generalization, on the other hand, proceeds from the specific to the general. Because it is sometimes easy to mistake a statement about a class for a general statement, composition can be mistaken for hasty generalization. Such a mistake can be avoided if one is careful to keep in mind the distinction between these two kinds of statements. This distinction falls back on the difference between the collective and the distributive predication of an attribute. Consider the following statements:

Fleas are small.
Fleas are numerous.

The first statement is a general statement. The attribute of being small is predicated distributively; that is, it is assigned (or distributed) to each and every flea in the class. Each and every flea in the class is said to be small. The second statement, on the other hand, is a statement about a class as a whole, or what we will call a ‘‘class statement.’’ The attribute of being numerous is predicated collectively; in other words, it is assigned not to the individual fleas but to the class of fleas. The meaning of the statement is not that each and every flea is numerous but that the class of fleas is large.

To distinguish composition from hasty generalization, therefore, the following procedure should be followed. Examine the conclusion of the argument. If the conclusion is a general statement—that is, a statement in which an attribute is predicated distributively to each and every member of a class—the fallacy committed is hasty generalization. But if the conclusion is a class statement—that is, a statement in which an attribute is predicated collectively to a class as a whole—the fallacy is composition. Example:

Less gasoline is consumed by a car than by a truck. Therefore, less gasoline is consumed in the United States by cars than by trucks.

At first sight this argument might appear to proceed from the specific to the general and, consequently, to commit a hasty generalization. But in fact the conclusion is not a general statement at all but a class statement. The conclusion states that the whole class of cars uses less gas than does the whole class of trucks (which is false, because there are many more cars than trucks). Since the attribute of using less gasoline is predicated collectively, the fallacy committed is composition.

## 22. Division

The **fallacy of division** is the exact reverse of composition. As composition goes from parts to whole, division goes from whole to parts. The fallacy is committed when the conclusion of an argument depends on the erroneous transference of an attribute from a whole (or a class) onto its parts (or members). Examples:

> Salt is a nonpoisonous compound. Therefore, its component elements, sodium and chlorine, are nonpoisonous.
>
> This jigsaw puzzle, when assembled, is circular in shape. Therefore, each piece is circular in shape.
>
> The Royal Society is over 300 years old. Professor Thompson is a member of the Royal Society. Therefore, Professor Thompson is over 300 years old.

In each case the attribute, designated respectively by the terms ‘‘nonpoisonous,’’ ‘‘circular in shape,’’ and‘‘over 300 years old,’’ is illegitimately transferred from the whole or class onto the parts or members. As with the fallacy of composition, however, this kind of transference is not always illegitimate. The following arguments contain no fallacy:

> This piece of chalk has mass. Therefore, the atoms that compose this piece of chalk have mass.
>
> This field of poppies is uniformly orange in color. Therefore, the individual poppies are orange in color.

Obviously, one must be acquainted with the situation and the nature of the attribute being transferred to decide whether the fallacy of division is actually committed.

Just as composition is sometimes prone to being confused with hasty generalization (converse accident), division is sometimes prone to being confused with accident. As with composition, this confusion can occur only when the ‘‘whole’’ is a class. In such a case, division proceeds from the class to the members, while accident proceeds from the general to the specific. Thus, if a class statement is mistaken for a general statement, division may be mistaken for accident. To avoid such a mistake, one should analyze the premises of the argument. If the premises contain a general statement, the fallacy committed is accident; but if they contain a class statement, the fallacy is division. Example:

Stanley Steamers have almost disappeared.
This car is a Stanley Steamer.
Therefore, this car has almost disappeared.

The first premise is not a general statement but a class statement. The attribute of having almost disappeared is predicated collectively. Accordingly, the fallacy committed is division, not accident.

This example also illustrates how cases of division that involve class statements can include a subtle form of equivocation. In the conclusion, the word ‘‘disappeared’’ means fading from vision, as when the lights are turned down; but in the first premise it means rarely seen. The equivocation is a kind of secondary fallacy that results from the primary fallacy, which is division.

The next example shows how division turns up in arguments dealing with averages.

The average American family has 2.5 children.
The Jones family is an average American family.
Therefore, the Jones family has 2.5 children.

The statement ‘‘The average American family has 2.5 children’’ is not a general statement, but rather a class statement. The sense of the statement is not that each and every family has 2.5 children, but that the class of families is reducible to 55 percent children and 45 percent adults. Thus, once again, the fallacy is division, and not accident.

In our account of composition and division, we have presented examples of arguments that commit these fallacies in conjunction with other, structurally similar arguments that do not. Because of the structural similarity between arguments that do and do not commit these fallacies, composition and division are classified as fallacies of grammatical analogy.

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# Chapter Four: Categorical Propositions

## 4.1 The Components of Categorical Propositions