Chapter 7

THINKING STRAIGHT: EVIDENCE, REASON, AND CRITICAL EVALUATION

The number of persons who have a rational basis for their belief is probably infinitesimal; for illegitimate influences not only determine the convictions of those who do not examine, but usually give a dominating bias to the reasonings of those who do.

(William E. H. Lecky)

Crime is common. Logic is rare.

(Sherlock Holmes)

A WELL-CONSTRUCTED scientific argument, defending a scientific conclusion, generally rests upon two foundations: reliable empirical evidence and sound logical reasoning. Of course, there have been scientific arguments that weren’t based on good evidence and reasoning, but these shoddy arguments (and the conclusions based on them) generally don’t withstand the test of time. The point isn’t that we always have proper evidence and reasoning in the sciences, the point is that we always should have these things. This point is not trivial. In some areas of human thought, conclusions may quite properly not be based on logic and evidence. In some political discourse, for example, we might legitimately based our conclusions on a shared set of values and traditions instead of rational analysis (elected government versus divine right of kings, for instance). Although such considerations sometimes enter into scientific thinking (see chapter 11), science still provides an excellent example of reasoned discourse. As such, we can at least use science as a starting point for a discussion of valid argumentation across the board.

The subject matter of this chapter, as you see, extends far outside the boundaries of science. We are concerned here with methods of clear thinking and critical analysis that are relevant to any issues. Where the methods and thought processes typical of the sciences are applicable, these methods are invaluable. When issues turn on differences in values, faith, cultural background, and so on, then we are obligated to isolate these differ-
ences and identify them clearly. Differing values are no excuse for bad logic and lack of evidence. Valid argumentation in the murky and ambiguous issues of human affairs is not essentially different from valid argumentation in the esoteric realms of science; it’s just more difficult.

§1. Good Arguments

*Deductive Reasoning*

The purpose of deductive logic is to find relationships between statements (called premises and conclusions) that guarantee the truth of the conclusions if the premises are true. On the one hand, this means that we must be very careful to scrutinize the premises carefully. False premises can lead to false conclusions even when the logic of the argument is valid. (Logicians use the word “argument” to mean a set of premises leading to a conclusion.) On the other hand, the ability to spot bad logic ensures that we don’t get fooled into accepting false conclusions based on obviously true premises. In fact, if we can spot bad logic, then we don’t even need to look very carefully at the premises; we already know the conclusions are suspect at best. A valid logical argument, based on well-supported premises, leads to a trustworthy conclusion. A few years ago, when I was exhorting one of my classes to look for logical flaws (along with undocumented assertions, errors of fact, internal contradictions, and so on), one of my students said “It’s all a matter of opinion.” But not everything is simply a matter of opinion. There are clear and well-defined rules worked out by logicians that can be used to analyze arguments. Recent work in logic is all symbolic, essentially reducing arguments to formulas and examining the conditions under which the formulas are valid. Although this work is interesting, I’ll focus here on the older verbal tradition in logic, which goes back to Aristotle.

A central element of this tradition is the syllogism. A syllogism is a form of logical argument that consists of two premises and a conclusion. The premises might be general propositions, taken to be always universally true; particular propositions about a single object, person, event, and so on; or conditional propositions concerning the circumstances under which a statement is true. In a valid syllogism, the truth of the two premises ensures without fail that the conclusion is true. Logicians customarily illustrate the use of the syllogism with simple examples like this:

1. All cats are cute. {major premise}
2. Smokey is a cat. {minor premise}
3. Therefore, Smokey is cute. {conclusion}
Figure 5. If all cats are cute, then this individual cat must, by the inescapable logic of the syllogism, be cute.

(see Figure 5) It’s quite obvious here that statements (1) and (2) cannot be true and yet have statement (3) false. People may have differing opinions about statement (1), and statement (2) is a simple matter of fact, either right or wrong. But if we accept both of these statements, the truth of statement (3) inevitably follows. Syllogisms like this one, which contain no conditional propositions, are called categorical syllogisms. The syllogism is a useful tool in constructing an argument. Once you have established a valid syllogism, you can then concentrate on establishing the validity of your premises. Perhaps more importantly, in analyzing someone else’s argument, you can disentangle the logic from the premises. After you isolate the syllogistic form of the logic, you may see clearly that the reasoning is invalid. In that case, you don’t have to worry about analyzing the premises (often a difficult and problematic task, leading to no unambiguous result). The veracity of the premises doesn’t matter if the logic is invalid; the argument is no good anyway.

Another useful point concerning syllogisms is that the logic can be reversed. Once a valid syllogism has been established, one of the rules of logic tells us the following: If the conclusion is known to be false, then at least one of the premises must be false. Apply this reasoning to our example. If Smokey is not cute, then either Smokey isn’t a cat or else not all cats are cute. I should also mention that there are some conclusions which cannot be drawn from syllogisms. For example, the truth of the conclusion doesn’t tell us anything about the truth or falseness of the premises. Similarly, the falseness of the premises tells us nothing about the truth or
falseness of the conclusion. We’ll explore these rules further in our discussion of bad logic in §3. Finally, let’s look briefly at another important part of deductive logic, the conditional proposition. One type of conditional proposition tells us something about the truth of statements that are paired together (example: either $1+1=2$ or my understanding of arithmetic is wrong). A second important type is the hypothetical proposition, which takes the form of an “if . . . then” assertion (example: if the Orioles win one more game, then they will be in the playoffs). These conditional propositions can also be used as premises in a syllogism.

**Inductive Reasoning**

In deductive logic, our conclusions are based on a set of premises, and the truth of the premises implies the truth of the conclusions. The advantage of deductive logic is that we have the certainty of truth in those cases where the method can be used. The disadvantage of deductive logic is that we seldom have any well-defined general premises that we know are true. Instead, we can use a different form of reasoning, called inductive logic. The method of inductive logic is to use the truth of many particular statements to make a generalization, which is our conclusion. If every cat I’ve ever seen is cute, then I conclude based on this experience that all cats are cute. Obviously, the disadvantage of reasoning by induction (as opposed to deduction) is that my conclusions are less certain. I might run into an ugly cat tomorrow.

The use of inductive reasoning at some point is almost unavoidable. The difficulty is how to assess the validity of an inductive argument. Since a proof by induction can never be absolutely certain, how can we judge the quality of any conclusions drawn? Philosophers have put a lot of effort into deciding how to make such judgments; but for analyzing typical arguments, we can get a lot of use just from common sense. If a generalization is based on only one or two examples, then the conclusion is basically worthless. If the generalization is based on thousands of well-controlled and highly documented cases, then we can (at least provisionally) accept a conclusion in this case. In between these extremes, we’ll accord conclusions the respect they deserve based on the amount of inductive evidence presented.

**Evidence**

As we’ve seen, a valid deductive argument only results in a genuinely valid conclusion if the premises are true. An inductive argument is likewise only meaningful if reliable particular cases are presented. In both of these methods, the quality of the argument rests as much on the evidence of-
fered in support of the argument as it does on the logic. Accordingly, we must be able to evaluate the quality of this evidence in order to analyze the validity of the argument. How can we evaluate evidence? One of the first questions to ask is whether any documentation has been presented to back up the contentions being made. Why should we believe a claimed statement? What source, reference, or authority has warranted this claim? Where does a particular fact come from? Is the source of this fact reliable or not? Politicians and editorialists often feel no need to provide any documentation at all for claimed facts. When a source is given, it’s often of doubtful credibility. Beyond asking for documentation, we can also make our own evaluations of how plausible a claim is. This involves looking for internal contradictions, violations of intuition and common sense, contradictions of other facts we know to be true, numerical estimates that don’t make sense, and so on. Some of these methods are typically used in the sciences (§2), but critical evaluation of evidence is always a necessary part of a proper analysis (§3).

§2. The Contributions of Science

What does critical analysis of argumentation have to do with science? One simple answer to this question is that science routinely employs this very kind of critical analysis all the time. Science is one of the few human endeavors in which we sometimes have the luxury of starting with a general premise, deductively working out the results of this premise, and comparing these results to evidence of extremely high quality. Examining this process at work in the relatively tidy and uncomplicated problems of science gives us a sense of how to proceed in the more difficult realms of politics, economics, social issues, and so on. The skeptical attitude characteristic of the sciences also fosters a spirit of critical analysis across a wide range of issues. Beyond these general considerations, however, science offers several techniques and modes of thinking that are not commonly found in other fields. In the rest of this section, we’ll survey some of these scientific thinking practices.

Using Basic Knowledge

Although science continues to progress as new results are discovered and old theories are modified, we have a certain amount of core knowledge and experience in science that is not likely to change radically or quickly. Unlike the trends and fads of political ideologies and public opinion, we can count on this basic scientific knowledge to be correct. When such knowledge is relevant to the premises of an argument, then we can evalu-
ate these premises without knowing every factual detail. An example is the conservation of energy law (see chapter 17). There are no known exceptions to this principle, and none are expected. If the success of some public policy initiative depends on the creation of energy from nothing, then we can reject this policy without further consideration. You don’t need an extensive stock of scientific knowledge to apply this kind of reasoning. For example, it’s clear on very fundamental grounds that the earth is finite. Anyone who argues that the earth’s resources are limitless must then be wrong. Any argument that depends on limitless resources as a premise is likewise wrong. Another example of basic knowledge is the form and properties of exponential growth (chapter 20). Whether the subject of debate is population growth, economics, resource use, finance, or energy policy, any exponentially changing quantity shares the same properties and characteristics; and these properties are not subject to contrary opinion, they are simply matters of arithmetic. If the premise of an argument demands a contradiction of these known properties, then you may safely conclude that this premise is wrong. Notice that both of these examples provide us with constraints on truth, giving information about what must be wrong instead of telling us that something is right.

Probabilistic Thinking

At one end of the spectrum, these few rock-hard certainties are useful when we can apply them, but unfortunately this is seldom. In other words, we often find ourselves trying to arrive at conclusions in the absence of the information we need. So at the other end of the spectrum, we can employ a completely different way of thinking that scientists also find useful, namely, thinking in terms of the probability that a statement is correct. If we don’t (perhaps can’t) know for sure whether a premise is right or wrong, we need to make our best guess as to how likely the premise is to be right or wrong. This style of thinking is alien to many people. “A statement is either right or it’s wrong. How can there be anything in between?” Some people feel a need to choose sides, even in the absence of information, and become wedded to their position. More sophisticated people might still choose sides, but they will remain aware that their choice could well be incorrect and keep an open mind. In both cases, though, a position is staked out.

In the course of scientific work, we are often faced with situations we don’t understand because of insufficient information. Suppose there are three alternative explanations for an experimental result. We don’t want to choose one of them without good evidence. The ideal procedure might be to design further experimental tests to weed out the inferior ideas. But this procedure costs time and effort, so we rank the ideas based on the
probability of correctness for each one and test the best idea first. Our probability estimates may not be very accurate, but at least they are better than choosing at random. This approach is a very natural way to think about a scientific problem. Since all scientific results are in some sense provisional, thinking in terms of probabilities gives us a way to make distinctions between ideas that are speculative, those that are well founded, and those that are quite certain. The rock-hard certainties I mentioned before are the concepts with such a high probability of being correct that we can, for pragmatic purposes, assume they are true. A few things in everyday life fall into this category, like the inevitability of death and taxes. Most real-life issues, however, are much more complex and ambiguous than scientific questions. Does it make sense to attempt estimates for probabilities of correctness in these murkier cases? I believe that it does make sense to try, even if we don’t have (and can’t get) the additional information we need to verify and improve our estimates. The benefit I see in such probabilistic thinking is that we don’t get tied to a position; we maintain a more fluid and flexible receptivity to new information and different viewpoints. On the other hand, probabilistic thinking allows us to make judgments rather than just give up because we don’t have certainty on an issue; an application of this outlook to real-life public policy issues is discussed in chapter 10.

Hidden Assumptions

The conclusion of an argument is based on the premises of the argument. In verbal rhetoric, however, the premises are not always stated clearly. Sometimes the premises are implied or taken for granted. A syllogism containing an unstated but clearly implied premise is called an enthymeme (“Sacco is evil because he is an anarchist” implies the unstated major premise “all anarchists are evil” and also states the conclusion first rather than last). But even when the premises appear to be stated fully, there might be some further hidden premises assumed, either in addition to those that are stated or else underlying those that are stated. In the analysis of an argument, either scientific or nonscientific, it’s always important to look for hidden assumptions and to evaluate the validity of those assumptions. Let’s look at a few scientific examples. If a chemical reaction needs to be done in the absence of oxygen, a chemist might do the experiment in a container with the air pumped out. The unstated underlying assumption here is that the tiny amount of oxygen left over (about 0.01 percent of the amount found in air) is not enough to affect the experiment—probably a good assumption, but not necessarily. A famous example of an unstated assumption (in physics) was that the measured velocity of light would depend on the velocity of the person making the measure-
ment. This “fact” was taken for granted until Albert Einstein stated explicitly that it was really just an assumption, and an incorrect assumption too. In biology, the classification of organisms into animals and plants carries with it the underlying assumption that all organisms must fit into one category or the other (this assumption has also been challenged by more recently discovered organisms). For a long time, an unstated assumption of medical research was that studies having only adult males for subjects produce results applicable without modification to the rest of the population.

Now let’s apply the technique to some political issues. In the debate over gun control legislation, both proponents and opponents make unstated assumptions about the relationship between the incidence of violent crime and the easy legal availability of guns. In debates over the desirability of environmental regulations, there is often a hidden assumption embedded in the arguments, namely that such regulations are a drain on the economy leading to loss of jobs, and so forth. Politicians proposing large tax cuts often employ the underlying assumption that no relationship exists between the tax revenues collected by the government and the desired services provided by the government. A hidden assumption may or may not be correct, but until we bring it out into the open by making an explicit statement of the assumption, we can’t engage in an analysis of its correctness.

Evaluating Causality

Although philosophers differ over some of the finer points concerning causality, we do have some pragmatic criteria for establishing causality in both science and logic. These criteria are just as applicable in everyday life and public affairs as in the sciences. Many people find the subject confusing, and invalid claims of cause/effect relationships are pretty common. One mistake is so common that it even has a Latin name: post hoc, ergo propter hoc. A literal translation is “after this, therefore because of this.” When one event follows another, you might assume that the first was the cause of the second. After Jimmy Carter was elected President, the country suffered a period of high inflation. Can we conclude that Carter’s policies caused the inflation? (His political enemies certainly made this claim.) But his term had been preceded by many years of high military and domestic spending; during his term, oil cartels had artificially driven up the price of energy. Both of these conditions, having little to do with Carter’s policies, are more plausible reasons for the cause of inflation at that time (actually, of course, a complicated detailed analysis is needed here). On a less grand scale, consider your car; suppose it needs some repairs to the engine, then a new muffler, then a new battery, and finally
some new tires. Does each of these problems cause the problem that follows? I doubt it. This example, in fact, illustrates an alternative explanation that makes more sense than “A causes B.” A more likely situation is that the car is old, and the old age of the car is responsible for all of the other problems. “C causes both A and B” instead of “A causes B” is often a possibility worth considering.

Fallacious reasoning about causality is ubiquitous in our political and economic discussions. Any time people see correlations between events, trends, or quantitative measures, they have a strong desire to assume a causal link. But there may be many different causes contributing to a single effect. Or the two correlated things may both be caused by something else that you haven’t identified yet. Or you may not have a cause/effect relationship at all in some cases; for example, two events might be related by a feedback loop (see chapter 21). And of course, the correlation you see may be nothing more than a coincidence. The welfare state has caused an increase in poverty; guns on the streets have caused an increase in violent crime; environmental regulations have caused a decrease in productivity; sexual immorality has caused the AIDS epidemic; television has caused a declining attention span in our youth; and so on. Claims like these, which vary greatly in plausibility, are made all the time. Very few, if any, are actually valid claims.

How can we rigorously demonstrate a causal link? Doing so turns out to be very difficult. We would first need to demonstrate that the cause must have been present for the effect to occur. In addition, we would need to demonstrate that the effect will always occur when the cause is present. In the language of logic, we say that the cause must be both a necessary and a sufficient condition for the effect. In science, this can sometimes be accomplished by a detailed series of carefully controlled experiments. Much of the controversy and confusion arising from biomedical studies results from the ability of such studies to draw conclusions that are highly suggestive of causal links, and their inability (due to monetary and/or ethical constraints) to rigorously prove causality. Since the majority of complicated situations have multiple partial causes, we still customarily use the word “cause” even when the cause is neither necessary nor sufficient. In these cases, we must settle for a statistical inference of causality, requiring a large random sample. For a one-time historical event, a rigorous demonstration of causality is virtually impossible. The best we can do is to make a detailed analysis that accounts for as many known possible causal factors as we can think of and assess the role of each one in bringing about the effect. We will undoubtedly not be able to prove causality, but we may well be able to make a convincing case (probability again).
Models

Another important ingredient in establishing causality is having a causal model. In other words, we should have some reasonable way to understand how and why $A$ causes $B$. A good model by which to understand the claimed causal link contributes to making the claim more believable. The causal link between tobacco smoking and lung cancer, for example, is based in part on statistical evidence and in part on physiological models of the carcinogenic activity of the tars. Establishing causality is only one of the many important uses of models in thinking, both inside and outside the sciences. The topic of models, modeling, and successive approximation is so important that I have given it an entire chapter (6) of its own. One worthwhile point concerning models and the evaluation of arguments is this: Arguments are often based on analogies, and the validity of the argument then turns on how good the analogy is. An analogy is a comparison between dissimilar ideas, events, processes, and so forth; the comparison might be very apt, but it might also be wildly inappropriate. How can we judge whether an analogy is good or not? Since models are also basically a kind of analogy, familiarity with models (and how to assess them) can help us to evaluate critically a claim based on analogy.

Quantitative Thinking

Many of the arguments that we must evaluate are totally verbal, but sometimes an argument rests at least partly on some numerical claims. These numerical arguments require their own special techniques of critical analysis. How accurate and how precise are the claimed numbers? Do the numbers make any sense in terms of other things you know? Can you make an order-of-magnitude estimate of your own against which to check the claims? Are the numbers as large or as small as claimed when you compare them to something relevant (e.g., a percent change)? Once again, science offers us a variety of useful ways to think about these quantitative issues, and the importance of the material warrants a separate chapter (8).

§3. Bad Arguments

An argument can be bad in a variety of different ways. A bad argument simply means an argument that has an untrustworthy conclusion, as opposed to being invalid in a formal sense. Logicians call this “material” validity. A materially invalid (bad) argument might be defective on several different grounds. For example, the argument might simply be logically
flawed as we discussed in §1. But, the argument might instead be logically valid and have a false conclusion because some premises are false. For example:

(1) All cows are reptiles.
(2) All reptiles can fly.
(3) Therefore, all cows can fly.

This ridiculous example is a logically valid syllogism, in a formal sense, even though not a single statement in it is true. Another type of invalid argument is one in which the statements are not necessarily false, but the statements are so ambiguous that they don’t have any well-defined meaning. Many rhetorical devices are also used by writers and speakers to convince without valid logic or evidence. A number of these fallacious arguments have been categorized and named. The typical political speech, newspaper editorial, or magazine opinion piece is far more likely to contain fallacious rhetorical tricks than any actual attempt at valid argumentation. We’ll examine a few of the more common types of fallacy (straw man, false dilemma, ad hominem, begging the question, and slippery slope) later. Next, though, we’ll examine some of the mistakes that are often made in the logical form of arguments, and then take a critical look at the validity of evidence used in arguments.

Invalid Logic

Let’s start with a look at arguments that do attempt some logical structure, but that have a logical flaw. After starting with a true (or at least plausible) argument, one mistake commonly made is to assume the truth of its converse (i.e., reversing the conclusion and premise). For example, you might read a well-documented and convincing essay arguing that overly high taxation rates impair the productivity of an economy. At the end, the writer demonstrates that our economic productivity is low, and from this concludes that we have an overly high taxation rate. Note the form of the logic: “If taxes are too high, then productivity is low; productivity is in fact low, therefore taxes are too high.” Even if you accept the first statement, the second statement need not be true. A valid argument doesn’t imply its converse (after all, productivity may be low for a different reason). If the flaw in the logic is not apparent, consider a more obvious example: “If I am a corporate executive, then I make a good salary; I do make a good salary, therefore I must be a corporate executive.” But of course it’s not so. Maybe I’m an M.D. or a basketball star.

The inverse of an argument is another example of invalid logic. Once again we start with a valid argument, so that some premise really does
imply a conclusion. We then show that the premise is wrong. Because the premise is false, we decide that the conclusion has also been proven false. For example, consider this fallacious bit of logic that was used often a few decades ago: “Citizens who support the country’s war effort are patriotic citizens. Therefore, those who don’t support the war are not patriotic.” The truth of the first statement in no way implies the truth of the second. (After all, very patriotic people may well believe a war is not in the best interests of their country.) If emotions are running high over an issue like this, the illogic of the argument may well be overlooked. The incorrect logic becomes more obvious in this example: “All dimes are coins. This is not a dime, so it can’t be a coin.” But it may be a nickel.

Our last example of commonly used invalid logic concerns the incorrect use of what logicians refer to technically as distribution. Distribution means making a statement about all members of a class. When we say that all cats are cute, the term “cats” is distributed because we have made an assertion about every single cat. The term “cute” is not distributed in our statement because we have not made any assertions about all possible cute creatures (or any other cute things, for that matter). You can see the possibilities for foggy thinking here.

For example, we can make a simple invalid syllogism:

(1) All cats are cute.
(2) All dogs are cute.
(3) Therefore, all cats are dogs.

This example illustrates the fallacy of the undistributed middle term. The middle term of a syllogism is the term that appears in both of the premises, the term that relates them to each other in some way (e.g., “cat” is the middle term of our original syllogism example back in §1). A rule of logic states that the middle term must be distributed in at least one of the premises in order for any valid conclusion to be drawn. Our example makes the mistake seem silly and trivial, but people’s lives have been destroyed on the basis of this logical fallacy. “Mr. Jones has admitted that he is member of the Free Oppressed Peoples League (FOPL). The FOPL has been proven to be a Communist front organization. Jones is obviously a Communist and should be fired from his government job.” This kind of reasoning was all too common a half century ago. The middle term of this syllogism is the FOPL. FOPL is undistributed in the first premise because it’s the predicate of the sentence. The tricky reasoning is in the second premise, the logic of which should be restated as “some members of the FOPL are Communists.” (No more than that can be validly inferred from the FOPL’s status as a Communist front.) Restated in this way, we see more clearly that the middle term is undistributed (“some” not “all”)
and that no valid conclusions can be made concerning Mr. Jones. There are a number of other ways in which invalid arguments can be made by using distribution incorrectly. Without going into a lot of technical details, we can summarize the basic gist of the rules fairly simply: You can’t draw a conclusion that is stronger than the premises on which the conclusion is based.

Invalid Evidence

In typical disputes over everyday matters and public affairs, inadequate evidence is at least as big a problem as flawed logic. There are several different varieties of invalid argument based on evidence; most of them can be found in virtually any edition of any newspaper. The simplest example of invalid evidence is the old-fashioned unadorned lie. People who are opportunists or extreme ideologues will say virtually anything, with little regard for whether it’s false or true. In some cases, we have no trouble discerning lies; few people pay any attention to the claims made by spokespersons for the tobacco industry. In other cases, though, we would need some kind of independent reliable information in order to detect lies. A plausible statement from an apparently reputable source is usually taken at face value. Our only recourse in these situations is to have as many different information sources as possible, and to accept statements only on a tentative basis (in the spirit of probabilistic thinking discussed in §2). We do have a few strategies with which to defend ourselves against lies. A claim which sounds plausible might become more dubious upon further critical evaluation (an example is given in chapter 8). We can also look for internal contradictions in a set of statements made by the same person. The reliability of the source is another place to check carefully and critically; many highly biased organizations give themselves neutral-sounding names and paid operatives now mount phony grassroots campaigns on various issues.

But people don’t need to lie in order to mislead us. There is also the problem of suppressed evidence, also sometimes called an error of omission. We are told the truth, but only a part of the truth. A politician might say that she only has five thousand dollars in her bank account, a perfectly accurate statement, but one that fails to mention the two million dollars she has in stocks. A commercial advertisement might boast (truthfully) about the virtues of the ingredients in a product, but leave out the fact that all of the product’s competitors contain the same ingredients. A variation of the suppressed evidence technique is the selective quotation, often called quoting out of context. As we all know, a person’s actual thinking can be completely misrepresented by quoting a single sentence fragment from an hour-long speech. The quoted words are accurate (and the
speaker can’t deny saying them), but the position attributed to the speaker is totally distorted. Once again, we are faced with a difficulty. How do we know what we’re not being told? We may be lucky enough to have the facts from another source, but we can’t always depend on this. Our only alternative is to consider all claims critically and skeptically. Although we can’t always know what evidence has been suppressed, it’s often easy to hypothesize the kind of evidence that may well have been suppressed. In the end, we must make judgments and evaluations based on a variety of considerations (the consistency of a claim with other things we know; the reliability of the source; the plausibility of the claim; the plausibility of the hypothetical suppressed information). Some of the techniques outlined in §2 are helpful in this process. Obviously, the more information we have from a variety of different (and reasonably reliable) sources, the better able we are to spot cases of suppressed evidence.

At least two other criteria are useful in evaluating evidence. One is the source of the evidence. Often, no source at all is given; a fact seems to come from nowhere, or else a vague and undocumented source is given (“Many scientists agree that ———” or “Senior officials in the administration say that ———”). A variation of this problem is when a specific source is cited, but the worth of the source is questionable. I recently read a diatribe against vaccination that contained many quotations, facts, and statistics, each one carefully documented by citing a source; but the source was the same book in every single instance, a book written by somebody with no known qualifications and published by a publisher I’ve never heard of. Despite the copious documentation, I was less than impressed by the reliability of the evidence. The second criterion we can use is the likelihood that a writer (or source cited) really knows (or even could know) the fact being stated. Political parties, candidates, ideologues, and governments often tell you the intentions and motivations of their opponents; if you think about it, there’s no one less likely to really know these things. You-are-there style journalism often tells you what someone was thinking or saying at a certain time, information not known by anyone with certainty. In cases like these, a little thought reveals that something stated as a fact is probably nothing more than a supposition. The factual-sounding form of the statement is there for rhetorical effect.

Statistics

Most of these points concerning evidence in general apply equally well to statistical evidence, but the use of statistics presents some extra opportunities to mislead. Statistical facts may be cited selectively, for example, which is another version of suppressed evidence. But statistical facts might be unreliable or misleading for more technical reasons, which we will now
explore. The reliability of statistical results depends (among other things) on the size and quality of the sample used. Conclusions based on small samples tend to be quite unreliable. Some biomedical studies, which received a good deal of publicity, have actually been based on samples too small to tell us anything reliable. Even a large sample might yield misleading results. To tell us something unambiguously, a statistical sample must be chosen randomly. If you do a survey of people chosen from the membership of the Sierra Club, you probably won’t get an accurate picture of American opinion on environmental issues. On a more subtle and realistic note, statistical studies may also be biased by a nonrandom response rate; in other words, the people who choose to send back a completed survey may hold opinions that don’t accurately reflect those of the entire initial sample. Similarly, people who volunteer to take an experimental heart disease drug may well be people who already take extra measures (such as proper diet and exercise) to prevent heart disease.

Public opinion surveys are especially prone to biased results because the way in which the questions are worded has a large effect on the answers given. For this reason, you should view with suspicion any statistical claims about people’s opinions. Many people will be in favor of helping prevent children from starving, while few people will support wasting more money on welfare cheats, despite the fact that both statements may refer to the identical policy change. Without knowing how the question was phrased, statistics concerning public opinion are as worthless as they are exact-sounding. Governmental statistical reports also suffer from various flaws. Crime rate statistics, for example, are based on crimes reported rather than crimes committed, which may not always be the same (rapes and crimes against poor ethnic minorities have often been underreported). Economic statistics are also dependent on the quality of the data reported to the government, which is quite possibly less than accurate in some cases.

Perhaps the major intentional use of statistics to mislead people employs accurate numbers that are then incorrectly interpreted, usually by leaving out some important point (suppressed evidence again). For example, a political party might claim that its budget proposal contains a 1.2 percent increase in money for some popular program. But if the inflation rate is 4.5 percent, this “increase” represents a substantial cut. If I want to know whether defense spending is increasing or decreasing, should I look at the dollars spent on defense or at the percent of the budget spent on defense? For a statistical comparison to mean anything, the quantities we compare must be appropriate. Unfortunately, we are rarely provided with all of the information we need in order to make such appropriate comparisons. Our only recourse is to question the information we are given and ask ourselves what we really want to know.
There are many rhetorical devices that are intended to deceive a reader or listener with fallacious arguments. A variety of these techniques have been catalogued and named. Let’s look at a few of the more common types.

A “straw man” argument is directed not at someone’s actual position, but rather at a distorted version that was fabricated by the perpetrator of the straw man fallacy. This distorted version (the straw man) might be a weaker argument, with irrelevant evidence and poor logic substituted for the valid arguments that support the conclusion under attack. Alternatively, the straw man position might be a more radical version than the real position held by a person or group, and this radical distortion is more easily attacked (extreme positions rarely have much support in the general public). The straw man fallacy is a popular rhetorical trick used by ideologues, editorialists, and (almost universally) political campaigners.

Another often-used technique is the “ad hominem” argument. A literal translation of this Latin phrase is “to the man.” In other words, instead of actually addressing the evidence and logic of a person’s argument, those who commit the ad hominem fallacy attack the person herself. For example, suppose Senator Krupt has proposed campaign finance reform legislation. Opponents of this legislation, instead of saying why it will be ineffective or undesirable, merely attack the legislation by pointing out that Senator Krupt has often engaged in the sleazy campaign financing practices that this legislation will prevent. Possibly true, but definitely irrelevant. The effectiveness of the ad hominem argument in popular discourse is remarkable when so little thought is needed to reveal its fallaciousness; the validity of a position certainly doesn’t depend on the virtues (or vices) of the person proposing that position.

The “false dilemma” is another piece of effective rhetoric that is logically invalid. In the false dilemma, two alternatives are proposed as the only possible positions that can be adopted. One of these is inherently weak and easily attacked. After demonstrating how poor this weaker position is, the argument concludes that the other alternative is correct. The logical flaw, of course, is that there may well be other alternatives besides those two, perhaps even a broad spectrum of possibilities that haven’t been included for consideration. An oversimplified example of the false dilemma is the following: “We must engage in a massive military buildup because unilateral disarmament will surely lead to the destruction of our country.” Other false dilemmas are “either good jobs or a livable environment” and “either traditional health care delivery or socialized medicine.” These examples may sound silly when written out so starkly, but the same
basic arguments might be quite plausible sounding (to the unwary) if they are dressed in enough rhetorical embellishment.

When an argument assumes the truth of the conclusion as part of the premises, this is known as begging the question (sometimes called circular reasoning). For example, suppose we argue as follows: “The government spends too much of our hard-earned money. Therefore, we need to cut back on government spending.” We might be able to make a pretty good case for this conclusion, but we haven’t made any kind of case at all here; we could just as easily have reversed the conclusion and the premise. We have merely begged the question.

Although there are many other categories of fallacious argument, we’ll just consider one more, namely the “slippery slope.” In this case, the position argued against is assumed to lead inevitably to some terrible result. This terrible result is then argued against, instead of the actual proposed position. Examples: “Banning the sale of machine guns is a bad idea because if we do that today, then tomorrow we’ll be confiscating every gun from every citizen.” “If we allow any logging in this old growth forest, then we’ll soon be clearcutting the entire area.” Unless some good evidence or convincing reasons are given to support the claim that one action really will lead to another, the slippery slope argument is a fallacy. A famous historical example of a slippery slope argument is the domino theory used during the controversy over the Vietnam war. Fallacious arguments can be difficult to spot because the stylistic form of an essay (or a speech) often disguises the logical structure. Conclusions and premises might be mixed together in any order, and some premises might simply be left out (unstated, either implied or hidden). Arguments can be based on analogy or appeals to emotion instead of logic, and the rhetorical use of loaded words (or images) can easily sway our opinions. Suppressed and/or fabricated evidence isn’t always easy to detect, and our own prejudices can mislead us as much as clever rhetoric. But all these difficulties can be overcome to some extent by critically evaluating the arguments we encounter.

For Further Reading


