THE LOGIC OF NATURAL LANGUAGE

J. Anthony Blair and **Ralph H. Johnson**
Centre for Research in Reasoning, Argumentation and Rhetoric, University of Windsor, Windsor, ON, Canada

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Contents

Summary

This chapter discusses the logic of natural language. After an explanation in Section 1 of what that phrase may be taken to mean and of why this logic is so important, Section 2 provides an account of the key ideas: logic, reasoning and argument, and of the relationship between logic, rhetoric and dialectic. Section 3 is a discussion of the norms that apply to natural language arguments. There are two types of norms: those that apply to the premises, and those that pertain to the support relationships. Three types of connection that may occur in arguments are discussed: necessary connections, probable connections, and plausible ones. Section 4 is an account of two important developments that provide assistance in coming to grips with plausible connections—fallacies and argument(ation) schemes—and how they relate to each other.

1. Introduction

Human beings reason constantly. Whether or not the capacity to reason is innate, we teach our children to reason better by identifying and correcting their mistakes. Moreover, all of our reasoning relies on information, or ways of identifying and classifying information, that we acquire from the social worlds we inhabit. We also regularly reason with others, either thinking together with them to work out implications, or seeking to persuade or convince them that certain conclusions or courses of action are reasonable and others, unreasonable. So in these respects, although each person reasons separately, reasoning has an essential social dimension. Although we can and do reason privately, reasoning is in principle, and often in practice, public.

Reasoning can be done well or poorly. Good reasoning does not guarantee success in our enterprises, but it contributes to their success. Bad reasoning contributes to their failure and can result in disaster. The norms distinguishing good reasoning from bad are

called "logic." Insofar as reasoning is expressed or expressible in language, we can speak of the logic of reasoning in language, or the logic of language, for short. The topic of this essay is the logic of reasoning that is expressible in language. Why the title alludes to "natural" language will be explained below.

This essay contributes to the EOLSS Theme, "Philosophy and World Problems", from this logical standpoint. As a specific essay within the Topic, "Modes of Reason," it discusses modes of reasoning as they are represented in and subject to the logic of natural language.

The plan of the chapter is to begin at the narrow end of this assignment and work to the broad end. So Section 2 begins with an explanation of natural language, logic, and their connection. Section 3 contains a description and discussion of the logical norms that can be applied to reasoning in ordinary language. Section 4 discusses the relevance of this logic for world problems, and the relevance of such problems to it. Section 5 concludes with a summary of the chapter.

2. What Is "The Logic of Natural Language"?

A "natural" language is simply any language that children learn as they grow up in a culture. Arabic, Hindi, Swahili, Russian, Chinese, Japanese, Spanish, English, Italian, Dutch, Portuguese—these and thousands of others like them are "natural" languages. (There are 6,912 living [natural] languages, according to Gordon (2005), although the exact number will depend on the precise definition of 'language' and on how dialects are counted.) The term "natural language" was coined in the 20th century in order to distinguish the referent of the word 'language' as it is ordinarily understood from the purely formal "languages" that certain theorists were interested in, which they called "artificial" languages. Artificial languages are language-like symbol systems that are created for various technical purposes, or purely invented languages such as Esperanto. The codes used to create computer programs are examples of artificial languages. Thus a "natural" language is simply what all but a handful of specialists understand a "language" to be.

The phrase "the logic of language" stems from the philosophical work of the later Wittgenstein. In Section 89 of his *Philosophical Investigations* (1953), in a critique of the previous understanding of the relation between logic and language, Wittgenstein observed that "logic seems to have a peculiar depth—a universal significance. Logic lay, it seemed, at the bottom of all the sciences. For logical investigation explores the nature of all things. It seeks to see to the bottom of things, and is not meant to concern itself with whether what actually happen is this or that." Such an investigation is an *a priori* one rather than an empirical one, revealing how things had to be. Elsewhere (Section 437) he characterizes this feature as "the hardness of the logical must"—a hardness related to the developments in logic starting with Frege's *Begriffschrift* (1879) and continuing on to Whitehead and Russell's *Principia Mathematica* (1910-1913). Wittgenstein writes: "On the other hand, this together with a misunderstanding of the logic of language, seduces us into thinking that something extraordinary, something unique, must be achieved by propositions" (Section 93). This passage suggests that Wittgenstein believes there is a logic to our language, but that he and Russell had

misunderstood that logic by expecting natural language to conform to the precision and rigor of formal or mathematical logic. It seems clear that for the later Wittgenstein, the logic of natural language has nothing to do with the formal calculi that developed with the study of logistic systems and everything to do with what he calls "the grammar of our language"—how expressions, words, and sentences are used.

The logic of natural language, then, is the logic of the language(s) that anyone grew up speaking. So the next question is, what is the "logic" of such a language? Any answer to this question steps off the firm ground of established fact and onto the unsettled footing of contested theory, so the reader needs to be aware that other writers might well put matters differently. With that warning, here are some ways to understand what the logic of a natural language is.

2.1. Logic

In one sense of 'logic,' its subject matter is the norms for systems of *necessary connections*. A necessary connection is one that cannot be otherwise. Here is an example. If a flower is yellow, then it is colored. Indeed, if anything is yellow, then it is colored. Being yellow, it must be colored; it cannot be without color. There is, then, a necessary connection between being yellow and being colored. Other examples of necessary connections are between the propositions: "Sulja is a mother" and "(That same) Sulja is a woman who has a child"; between "Cairo is more populous than Sao Paul" and "Sao Paul is less populous than Cairo"; between "Leo is afraid" and "(That same) Leo believes he is somehow in danger." In these examples, if the first of the pair is true, then the second *must* be true. The second cannot be false if the first is true. That is what is meant by "necessary" in this context. Logic, in one sense, expresses in general terms the laws of such necessary relationships. And insofar as such necessary relationships as those illustrated above hold by virtue of the meanings of the words in a natural language, one way to define the logic of a natural language is as the norms or rules of necessary relationships that result from the meanings of the words and expressions of a natural language.

In this sense of the logic of natural language, it is not always very interesting, for just understanding a language entails already understanding its logic in this sense to a high degree. Logicians or linguists might want to identify the general features of these norms, but their results will not necessarily lend illumination to those who already speak the language, because for the most part they already understand and know how to abide by those norms, even if they are not able to articulate them. In this sense, knowing the logic of a natural language is like knowing its grammar. Just as one can speak and write a language grammatically correctly without being able to formulate its grammatical rules, so one can use and follow the logic of one's language without being able to formulate its logical rules or laws.

On the other hand, the implications of the meanings of words in natural language can be very important. For example, note the connection between an obligation and a right. If one person has a right to something, then some other person or some body has an obligation to that person. For instance, if you have a right to an education, or to gainful employment, or to affordable medical care, then someone else or some body has an

obligation to provide you with the means for an education, or gainful employment or affordable medical care. Conversely, if no person or body has an obligation to provide you with these things, then you have no such rights. These connections have obvious and important political, social and legal implications.

2.2. Reasoning and Argument

But 'logic' in reference to natural language has other senses. An explanation of a second of these senses requires introducing the notions of reasoning and argument as well.

First, reasoning. The word 'reasoning' names (among other things) a kind of mental activity, and also the expressions of such mental activity. You might reason that it is raining outside because you hear what sound like raindrops falling on the roof. And if someone asks you, "What is the weather like outside?" and you reply, "I think it is raining, because that sounds like raindrops on the roof," that sentence expresses your reasoning.

Reasoning includes the mental activity of drawing inferences, also known as coming to conclusions. This is something that everyone does many, many times in a day. On the basis of some information we have or certain assumptions we make, we judge that something else is the case as well. Someone sees the clouds covering the summer sky grow dark and infers that it might rain. Introduced to a person with the title of "Doctor," one may conclude that this person is likely a physician. Travelers assume that a man they encounter walking along a village lane is a native of the village and they infer that he can knowledgeably give them directions. There are any number of examples. Sometimes the inferences that we draw from the information we have or assumptions we make are warranted, and sometimes they are not. Either way, they constitute our reasoning.

Such inferences can be expressed in language. One can say, "Mrs. Yee is addressed as 'Dr. Yee,' so Mrs. Yee is a physician"; or "It is likely to rain because when a cloudy summer sky grows very dark, it is likely to rain, and the summer sky here has grown very dark (so take an umbrella with you when you go out)"; or "This man is a resident of the village (and people who live in a village usually know their way around it), so this man can give us reliable directions." Such sentences are expressions of reasoning, good or bad. For example, possibly Dr. Yee is a professor with a Ph.D., so while correctly addressed as "doctor," she is not a physician. We can judge such sentences to be true or false according to whether the information asserted in them is correct and the inferences expressed in them are warranted. One of several different uses of the word 'argument' is to refer to such expressions of reasoning. In this sense of 'argument,' an argument is a sequence of statements that expresses a mental sequence of reasoning. In the second sense of 'logic,' then, the term refers to the general norms of good (warranted or justified) reasoning or of good arguments of the kind just described. The logic of natural language, in this sense, tells us the general criteria for distinguishing good reasoning from bad as we carry it out or, the equivalent, as it is or can be expressed in arguments stated in some natural language or other.

2.3. Logic, Dialectic and Rhetoric

Furthermore, 'logic' in this second sense also refers to one of the kinds of norms that are used to evaluate a different kind of argument. There are in fact at least three kinds of norms that can be applied to this other kind of argument—logical, dialectical and rhetorical. So the logical perspective must be distinguished from the other two.

In our daily lives, all of us encounter situations in which we want to convince someone that some proposition is true or to persuade another person to do something. Sometimes we want to convince or persuade not just one person, but many others. We might want to persuade a prospective employer to hire us, and in the process of doing that we want to convince him or her that we are excellent candidates for the advertised job. We might want to persuade a customer to buy a product we are selling, or as a customer we might seek to persuade the seller to lower the asking price of a product we want to buy. We might want to convince our friends or family of the merits of a particular political party or candidate, and persuade them to vote a certain way. The occasion need not be momentous. Perhaps we want to persuade a friend or colleague to join us for a cup of tea or coffee, or a family member to take an umbrella with him when he goes outdoors. And we can equally well be on the receiving end—just as often someone else is trying to convince or persuade us. It is easy to multiply indefinitely examples of situations in which someone wants to convince or persuade someone else or others of something.

One way to try to convince or persuade another of something is to provide reasons why that person should agree. A name for such reasons is "an argument." In this sense of 'argument,' an argument is a set of reasons that one person offers to another as grounds for agreeing—for accepting what the "arguer" is trying to get the other person to agree to. This is a familiar sense of 'argument': it is arguments like this that lawyers make in court, or that scholars make in articles in learned journals, for example.

An argument in this sense is like, but slightly different from, the sense of argument described just above in Section 2.2. Both involve the drawing of inferences. In the current sense, the person offering the argument is suggesting that the other should drawn an inference from the information the arguer puts forward as reasons. And if the argument is successful, the other person does draw the inference that is invited or proposed. But there is also this difference: the arguer might not privately draw the inference he or she is publicly asking the other person to draw. For example, one person might try to persuade another that her religious beliefs commit her to a certain action (perhaps giving to a charity for which he is collecting), even if he holds different religious beliefs, and so would not accept that argument for himself. Another difference is that the arguments described in Section 2.2, while they are expressions of a person's reasoning, need not be communicated to others and so need not play any role in trying to convince or persuade others, whereas those described here are by definition communicated to others for the purpose of persuading or convincing them of something.

As mentioned above, arguments used to convince or persuade may be evaluated from different points of view. In using arguments to try to convince or persuade others, a person is trying to be reasonable—or, at the least, pretending to try to be reasonable. That is so because an argument consists of giving reasons for beliefs, attitudes or actions. The arguer is using reasons as opposed to using force, or appealing to irrelevant emotions to try to convince or persuade. (The qualification "irrelevant" is added because

by no means are all emotional appeals used in arguments irrelevant. For instance, sympathy and compassion are good reasons for helping others.) It follows that such arguments can be assessed as attempts at reasonable communication, and from three points of view.

One point of view emphasizes the communicative properties of such communications. That includes all the factors that go into being persuasive or convincing, and more. For instance, the argument needs to hold the attention of its audience. So besides appealing ultimately to grounds that the audience is willing to accept, it needs to be clear enough for the audience to follow it and it needs to avoid making the audience hostile and unreceptive. In addition, the language and tone of the argument need to serve the arguer's other goals in the communication, such as retaining the goodwill of the audience in order to be able to work with its members constructively on future occasions. The field that studies the norms of arguments as communications is called *rhetoric*

It should be emphasized that such communicative advice as "avoid making the audience hostile" and "retain the good will of the audience" does not mean that communication must be more concerned to swing the audience to one's view than to communicate the truth—that it encourages sophism. A hostile or indifferent audience will tend to be disinclined to consider the arguments, or to consider them with an open mind, no matter how cogent they might be. The truth of an argument's premises does not by itself guarantee that they ought to be accepted by the audience. Moreover, the "logic" of an argument, however sound, must be communicated somehow, well or poorly, effectively or obscurely. That involves rhetoric. To be sure, rhetoric can be used to manipulate, but it can also serve to help reveal the truth to the audience and to render the audience receptive to cogent arguments aimed at convincing them of the truth.

A second point of view from which to assess natural language arguments judges them for their degree of reasonableness as *communications*. If one is genuinely trying to communicate reasonably, one is committed to the norms of such an activity. For one example, if one is trying to persuade an audience that someone's views are mistaken, it is only reasonable to represent those views accurately, and not to critique a distortion of them that is easy to rebut. For another example, in such communication it is only reasonable to respond to objections that the other party makes to the view you are trying to persuade them of or to the arguments that you have presented so far. These are just two examples among many. The field that studies the norms of such arguments as reasonable communication is called *dialectic*.

But there is also a third perspective from which to assess arguments used to convince or persuade others. Because they are attempts to be cogent, or at least as pretending to try to be cogent—that is, to truly justify their conclusions—arguments used to convince or persuade can be assessed for the merits of the reasoning that they embody or express: they can be measured against the norms for good reasoning in arguments. In other words, their *logic* can be assessed (in the second sense of 'logic' noted above, the one that refers to the general norms of cogent reasoning.).

In sum, an argument can be evaluated using any or all of three distinct kinds of criteria.

The criteria of effective communication are those of rhetoric; the criteria of responsive argumentation are those of dialectic; and the criteria of cogent reasoning are those of logic. A "good" argument, all things considered, is one that scores well on all three.

The following section sets out in more detail and explains the different logical norms that can be applied to reasoning and to its expression in natural language in arguments used to persuade or justify.

3. Logical Norms for Natural Language Arguments

3.1. The Two Elements of Arguments

An argument starts from grounds (information, assumptions) and the reasoner or arguer draws inferences or tries to get another or others to accept other claims (conclusions, positions, standpoints) on the basis of those grounds. The reasoner or arguer is thinking or saying, "These grounds are cogent grounds, and they support that claim; it follows from them; and so that claim is cogent, too." Thus an argument has three elements: the grounds or starting points, and inference from those grounds to the outcome or conclusion, and the conclusion. A useful metaphor is to think of an argument like a house. If the conclusion is the roof, walls that support it must hold it up, and the walls must rest on a solid foundation. The foundation is the premises, the link is the supporting walls, and the roof is the conclusion. (The metaphor of the house was introduced by Missimer, 2005.)

In a logically good argument, the starting points are solid, and the support they provide for the claim in question is strong. The outcome is justified by the grounds offered. It is reasonable to accept the conclusion on the basis of the reasons given. And, correspondingly, a logically weak argument can fail for either or both of two reasons. Its grounds can be problematic (for various reasons, as we will see); or, even if the grounds are solid on their own, the link from them can fail to provide any, or enough, support for the particular conclusion adduced from them. In the following sections there is, first, a discussion of the norms that apply in judging how good the grounds are, and then a discussion of the norms that apply in judging how good is the support that grounds provide for the claims based on them.

3.2. The Norms for Premises (Also Known As: Grounds, Assumptions, Starting Points)

Whether you are reasoning for yourself or trying to persuade someone else, the grounds you start from—the beliefs, assumptions, alleged information—should ideally be true. Certainly, false starting points cannot produce good reasoning or sound arguments. Often, however, we are not in a position to know that our premises are true. (For example, suppose you are trying to decide what clothes to pack for a trip and you must rely, as the premise of your reasoning, on the weather forecast or on a guess about the activities you might be asked to take part in when you arrive.) If you cannot know that your premises are true, they should at least be reasonable for you to believe. Any likelihood that your premises are not true requires you to qualify whatever conclusion you draw from them accordingly. For example, if the weather forecast not very reliable,

then you can only conclude that "probably" you should pack this or that clothing. So starting points for reasoning should be true, or at least reasonable for you to believe.

If you are using arguments to try rationally to convince or persuade another person and that person can interact with you, you need to start from premises that you think it would be reasonable for the other person to accept (grant, or concede). If your interlocutor refuses to grant your premises, your argument cannot succeed. So if the other party is hesitant or unwilling to accept a premise you want to use and that you think is reasonable for him or her to accept, you can try to convince the person of it by appealing to other things you think the person reasonably accepts that show it to be true—that is, by making it the conclusion of another argument. (Using premises that are open to challenge by the interlocutor without defending them results in the fallacy of problematic premise, to be discussed later).

Some might think that appealing to what it is reasonable for the interlocutor to accept is being rhetorical rather than logical, or risks conflating rhetoric with logic. To be logical, they might contend, requires appeal to grounds that are justified, *simpliciter*, whether or not the interlocutor finds them reasonable to accept, or indeed, whether or not they are reasonable for the interlocutor to accept. But such a view risks misunderstanding the nature of argumentation in ordinary language. Such a view seems to assimilate arguments to the proofs of mathematics. A proof starts from true premises, and deduces a conclusion from them by means of formal entailments. But an argument typically is an attempt by one person to persuade, rationally, another person or group of people to accept some claim (as true or probable or plausible), to adopt some attitude, or to perform, or be disposed to perform, some action. If an arguer offers to an interlocutor, as the starting points of argument, premises that the interlocutor does not find it reasonable to accept, the argument cannot get off the ground. So the "logic" of arguments in natural language has to be different from the "logic" of proofs. The logical norms that apply to arguments have to take into account the necessity of obtaining the assent of the interlocutor(s) to the premises.

To be sure, it is always possible to argue from what you know or believe are prejudices or superstitions that the other party endorses. You can appeal to irrational fears or unrealistic hopes or expectations. But in that case, you would be in some sense inconsistent in doing so. For since you are using arguments, which are ostensibly a tool of reasonableness, there is a presumption that it will be reasonable of you to employ the arguments that you use. Normally, it will be reasonable for you to employ an argument only if (as far as you can judge) it is a reasonable argument. So, if you don't, then on the one hand you are purporting to be reasonable and on the other hand, by appealing to propositions that you do not believe are reasonable: you are being disingenuous. There is a kind of pragmatic inconsistency involved here. This is analogous to lying. The liar must purport to be telling the truth even as he deliberately does not tell the truth. The philosopher, Immanuel Kant, argued that this kind of deliberate inconsistency makes an action immoral. Readers can decide for themselves whether appealing to unreasonable beliefs that another party (nevertheless) holds, in order to convince or persuade him, is morally wrong as well as a violation of the norms of reasonable argument. (To be sure, there might be rare cases in which it would be reasonable to use premises you don't think are reasonable, for example to try to persuade someone who believes them to

refrain from committing some heinous act—just as, in rare cases, it can be morally right to lie.)

To sum up, the starting points, grounds, or premises of reasoning for oneself should ideally be true, and failing that, plausible or probable—that is, reasonable to believe or accept. If the person (or persons) you are trying to convince or persuade is not present or not otherwise able to communicate with you, you are faced with the task of trying to determine what grounds for your arguments they are likely to accept and that they would be justified in accepting.

The kinds of sources of the information that is available to use as premises in arguments are twofold: our own imagination and experience (including our observations) and the testimony of other people (what people tell us, what we read, and in general what is communicated—by conversations, newspapers, magazines, books, radio, television, the internet, and so on). In order to be a sound basis for reasoning or arguments, such information needs to be reliable.

We all know that our own observations and experiences can be unreliable in various ways. For instance, we might have poor eyesight or poor hearing, or be hurried or tired or stressed during our observations, or be observing in poor light or in a noisy place or with other distractions, or be influenced by expectations or biases or prejudices, or not have the experience properly to interpret what we observe, and so on. We can misidentify our experiences, for example, mistaking lust, or the excitement of a new relationship, for love, or mistaking embarrassment for shame. So to reason or argue well from our own experience, we need to make sure that none of these distorting or misleading factors has affected the "information" that we are relying upon.

The information that we get from others can unreliable too, in many and various ways. There might be miscommunication from our source to us. It might not be clear, or we might fail to understand it. Assuming we understand the information accurately, it can still be unreliable for a variety of reasons relating to its source. Its source, like we ourselves, might have been subject to one or more of the many distorting or misleading factors to which most are liable. It is also possible for others deliberately to lie or mislead us, given their particular interests—that is, they might be untrustworthy. If the source is someone who might be expected to be authoritative about the information, such as a physician about medical matters, and in general anyone who is supposed to be an expert in some area, there can still be problems. Perhaps the person's expertise is limited, or does not apply to the particular matter at hand. Perhaps, although the person is an expert in this matter in general, he or she has not examined the particular case in question. Perhaps this matter is very hard to determine and equally qualified experts will reasonably disagree about it, as happens sometimes with medical diagnoses. Or perhaps a mistake was made—an instrument wasn't properly calibrated, or it malfunctioned, or someone misread a number or innocently transposed a number in writing it down. In matters in which the outcome is particularly important but we must rely on the information that only experts or other kinds of authorities can provide, it is a prudent practice to get a second opinion or several other opinions, on the assumption that agreement among experts suggests reliable information and disagreement indicates the opposite.

The track record of a particular source of information can help us judge its reliability about a particular item of information. That is why tabloids can be properly held to be unreliable as news sources: their track record is spotty. The "established" media in many countries—radio, television, newspapers—tend to be more reliable than the tabloids, but they too are often misleading in their points of view (for example, blocking out the point of view of one side in an international or labor dispute), and slanting report of the evidence (i.e., reporting only the facts which support a favored side, even if the facts are as reported.)

McMurtry approaches this problem in a logically systematic way in his 1988 article in *Informal Logic,* "The Unspeakable: Understanding the System of Fallacy in the Media"). Relatedly, we need to keep in mind that in most countries the "media"—newspapers and television broadcasters—are controlled by large corporations which not only cut corners to maximize profits, but also have a financial interest in supporting the ideology of corporate capitalism. So the selection, completeness and balance of their information need to be treated with strong reservations.

It is in the interests of some kinds of sources to be meticulous about accuracy. Reference works like dictionaries and encyclopedias, if up-to-date, though not infallible, can be expected generally to be very reliable, because the costs of unreliability are great. Academic reputation, not to say sales, would be destroyed by a record of poor reliability. Similarly, scientific and other scholarly journals take pains to check the reliability of the articles they publish, and they tend to publicize and correct mistakes, because their value to the scientific and scholarly communities that they serve depends on their reliability. Even so, one must be on guard. In the early 2000s there were reports that accounts of pharmaceutical research reports had been ghost-written by the drug companies making the drugs in question and simply "fronted" by physicians who accepted payment for the use of their names. If those reports are true, this practice, by casting the reliability of medical journals into doubt, threatens to undermine the credibility of a major source of important information.

This has been a quick scan of the sorts of factors that can come into play in judging whether to accept the grounds or premises offered in an argument or to be used in reasoning. In general, anyone who is reasoning or making arguments needs to be, and can be, vigilant about the reliability of the information he or she takes as the starting point.

3.3. The Norms for Inferences (or Types of Support for Conclusions)

Assuming that the premises are true, or reasonable to believe or grant, the second critical question to be asked of any piece of reasoning or argument from a logical point of view is this: Is the conclusion supported by the offered premises to the extent alleged or to the extent that it needs to be?

3.3.1. Necessary Connections

The concept of necessary connections between statements has been explained above. In the case of some arguments, a necessary connection is claimed to exist between the

grounds or premises and the claim or conclusion that they are adduced to support. It is said of them that if the premises are true, the conclusion must be true—it cannot in that case possibly be false. Such a connection is termed, in logic, an "entailment," and the premises of such arguments are claimed to "entail" their conclusion. The logic of entailments is called "deductive" logic. Deductive logic is the most developed branch of logic, and many systems of deduction have been worked out.

Deductive connections or entailments can be found in the reasoning or arguments of ordinary language involved in daily life. If you reason that your misplaced keys must be somewhere in your apartment, because (you know that) you brought them into the apartment with you last night and there is no way they could have been taken out of it since then, you are alleging a necessary connection. If the two premises you reason from are indeed true, then your conclusion cannot be false. In other words, such an argument is "valid" in the sense of that term used in logic. Here validity refers to the situation that obtains when it is not possible that the premises of the argument be true and the conclusion false. To say that such an argument is valid is another way of saying that the premises of the argument entail the conclusion. (The term 'valid' is used differently in sampling, or survey research, where a "valid" measuring instrument is one that measures exactly what it is supposed to measure.)

Entailments are also found in arguments in certain kinds of specialized subjects, such as mathematics and philosophy. When Descartes reasoned, "I think, therefore I am," he was claiming that he had to exist (as a thinking being), given that he could question whether he really did exist.

A deductive logic can often be expressed in general terms and thus given a "formal" expression. An analogy is mathematics. We know that $2+2=4$, $9+9=18$, $130+130=260$, and so on. These truths can be generalized—any positive number added to itself equals a number that is twice its magnitude. And so this truth can be expressed formally. Let x represent any number; then $x + x = 2x$. Consider now the argument just seen: "My keys are either in my apartment or they are not in it; and they cannot be anywhere else; so they must be in it." That argument has the same form as, "You will certainly find Georges in the café, because he is always either in the café or in his office and he is not in his office"; or "You are either with us or you are against us, and you are not with us; so you must be against us"; and so on. (As these examples indicate, the subject matter can range from the innocuous to the politically explosive.) This "form" of reasoning or argument can be expressed in general or formal terms. Let p and q be symbols representing any two (declarative) sentences whatsoever; the form of the argument then is, "Either p or q, and not-q, so p." That is why deductive logic is often called "formal" logic. (If we add other symbols for the terms 'or,' 'and,' 'not,' and 'so,' we can express the whole argument in symbols. Thus formal logic is also known as "symbolic" logic.)

A deductive logic identifies the forms of reasoning or argument that have the property of expressing in general terms necessary or entailment connections among their component elements for different kinds of elements. Thus there is a deductive logic for simple declarative sentences joined by the constants "if …, then…," "and," "or" and the prefix 'not' (called "propositional" logic)—just exemplified in the preceding paragraph.

There is also a logic that studies the necessary connections among sentences expressing obligation, permission and prohibition joined by the above constants: e.g., if an act is permitted, then it is not obligatory and it is not prohibited. This logic is known as *deontic* logic. It applies to strict moral or legal reasoning. It is the logic of the reasoning about strict rules, as opposed to reasoning about rules that hold only for the most part, with room for unspecified exceptions. *Modal* logic is the logic that studies the connections among sentences expressing possibility and necessity joined by the above constants: e.g., if something is necessarily the case, then it is not possible for it not to be the case). Modal logic helps to clarify the concept of implication, which is crucial to reasoning and argument, by marking a distinction between different kinds of implication and their entailments.

Such logical systems have the property that for any form of expression in the system, it can be determined whether that form is an entailment. It can be worked out and proved which forms of expression in the system are entailments. If any argument in ordinary language has the form of an expression that has been proved to be an entailment in a formal logical system, then that argument's premises entail its conclusion, and that means that the conclusion must be true, provided that the premises are true. This kind of premise-conclusion supporting link is the strongest possible, and anyone is justified in accepting the conclusion on the basis of those premises if they are true.

Unfortunately, such deductive logic systems are of limited usefulness for ordinary language reasoning and arguments, for several reasons. For one thing it is impractical to require everyone who wishes to assess his or her own or another's reasoning or arguments to learn all the deductive systems, even if they had been worked out for every possibility (which they are not). For another thing, it is usually necessary to reformulate the reasoning or arguments as expressed in ordinary language in order to see whether they correspond to the forms proven to be entailments in a deductive system, and whether a reformulation is faithful to the original reasoning or argument is very often a controversial matter.

Most of the reasoning and arguments expressed in ordinary language in most contexts, especially for purposes of daily living and for reasoning and arguing about moral, aesthetic, legal, social and political issues, is not intended to consist of formal entailments in accordance with an external logical scheme not found in natural language

3.3.2. Non-Deductive Connections

For many kinds of reasoning and arguments where the grounds offered provided convincing, rationally compelling, reasons for accepting the conclusion, the conclusion does not follow necessarily. The premises do not entail the conclusion in the sense that it would be impossible for the conclusion to be false if the premises were true. That is because it is in principle possible, however unlikely, for new information to be found that weakens, or even removes, the support provided by the initial premises.

For example, all the swans that Europeans had ever seen over thousands of years were white, and so people there reasonably concluded from this huge body of evidence that any swan is white. But then Europeans began to explore the Southern Hemisphere, and

in Australia and South America they came across birds that were swan-like in every respect, except they were black or black and white. So although the thousands upon thousands of white swans that Europeans had seen provided them with very strong evidence that swans are white, yet it did not entail that swans are white, since it was always possible that some non-white swans could exist—as it turned out they did exist in Australia and South America.

Take another example. Suppose an only child as a young adult made a solemn promise to his father and mother to care for them in their old age. It follows that this son had a moral obligation to care for his elderly parents, based both on the promise he had made and, in most cultures, also on the duty a child has towards his parents. It follows that he ought, morally speaking, to care for them. But suppose this son and his wife later had a child of their own who was stricken with a debilitating illness that required all their resources to provide it with the care it needed, so that the son could not care for both his parents and his child. In that case it is no longer clear that the son has a moral obligation to care for his parents in their old age. So the conclusion that the son ought to care for his aging parents, while very strongly supported by his relation to them and by his solemn promise, was not entailed by those premises. The change in his situation caused by the illness of his own child is new information that makes that conclusion now open to question, even though the premises are still true.

The first example, about the color of swans, is an instance of what is often called inductive reasoning or an inductive argument. The second example, about the obligation to the son to his parents, is an instance of a type of reasoning that does not have a settled name. Some call it plausible reasoning or a plausible argument, and that convention will be followed here, even though it is not universal. Inductive reasoning and arguments concern the nature of the world as we observe it with our senses, both the human or social world and the non-human world of organic and inorganic nature, and their conclusions are about what is probably true about this world, given the physical and human evidence we can obtain in part by observation. It is the kind of reasoning and arguments that are predominantly employed in the sciences. Plausible reasoning and arguments have as their conclusions claims about what is consistent with our values or the norms we endorse, as well as with what count as facts; they are in general about what is consistent with our beliefs and other attitudes. While its conclusions can be about what to believe or what (other) attitude to take, plausible reasoning is prominently reasoning or arguments about what choices are best, what actions should be performed, and what rules (such as policies or laws) should be adopted. It is the typical kind of reasoning or argument used in evaluation.

The following two subsections describe the norms for conclusion support in samples of inductive reasoning and argument and of plausibilistic reasoning and argument. In both cases, the norms relate to typical patterns of reasoning and argument. These patterns are often termed reasoning or argument "schemes." Such a scheme is a recurring pattern of reasoning or argument with identifiable features. A defining characteristic of each scheme is a set of critical questions that need to be answered in assessing the merits of any particular instance of reasoning or arguing using that scheme. Such schemes will be illustrated in the course of a review of some of the more common patterns of inductive and plausibilistic reasoning and arguments.

3.3.2.1. Inductive Reasoning and Argument

Inference to the best explanation. A very common type of inductive reasoning and arguing uses the scheme of reasoning to the best explanation, one version of which has the following pattern:

Phenomena $A_1 \ldots A_n$ have properties $p_1 \ldots p_n$.
Those phenomena would probably not have had those properties unless E were the case.
So probably E is the best explanation of $A_1 \ldots A_n$ having properties $p_1 \ldots p_n$.

Here is an example of an argument that is an inference to the best explanation:

1. The crisis of the Pinochet *coup d'état* in Chile was followed by the imposition of "Chicago school" laissez-faire radical free-market economic policies (at a cost of terrible human rights abuses).
2. The post-Falklands War regime in Argentina was saddled with a debt crisis that was used as a reason to impose radical free-market economic policies there, at a cost of enormous economic hardship to the populace.
3. The post-Soviet economic crisis in Poland was used as a reason to impose radical free-market economic policies there, against the wishes of the democratically elected government.
4. Free-market economic policies were introduced in South Africa during the negotiations to end Apartheid that established the Mandela government, at a huge cost in unemployment, low wages, poor housing and evictions that black South Africans continue to suffer.
5. Similar introductions of laissez-faire economic policies have occurred following the U.S. invasion of Iraq, crises in Bolivia, and in Pacific rim countries following the 2004 tsunami catastrophe.
6. This series of crises immediately followed by the introduction of radical free market economic policies probably would not have occurred unless there was a deliberate policy to exploit these crises to introduce ideologically-driven economic policies.
7. Thus, there probably was, in the late 20th and early 21st century, a concerted effort by proponents of laissez-faire economic doctrines deliberately to exploit crises, be they political, economic, or environmental, to impose their economic ideology around the world, undemocratically and at great cost to the affected people. (This is an argument from Naomi Klein's book, *The Shock Doctrine: The Rise of Disaster Capitalism*, Toronto: Alfred A. Knopf Canada, 2007.)

Associated with the inference to the best explanation scheme are the following critical questions. What motivates these questions is that they point to the kinds of ways that this reasoning can be weaker or stronger.

1. How many entities is the inference based on? The more there are, the stronger the inference.
2. How similar were the circumstances in which these phenomena occurred.
3. How likely is it that these similarities occurred by chance?
4. Are there similar phenomena where these properties were not found?

5. Are there any other equally or more plausible explanations of the phenomena?

Sampling. Another typical kind of inductive reasoning and argument involves generalization. It is reasoning or arguing from the fact that certain properties are found in a sample of some group of things to the conclusion that the group (often called the "population") as a whole will share those properties, and to the same degree. This reasoning is used in product-testing in manufacturing to make sure the products being produced consistently meet the specifications that are supposed to have. For example, an auto-parts manufacturer cannot, economically, test every single door handle, rear-view mirror or seat back, and in principle a canner cannot open and check every can of peas, corn or tomatoes. Instead, a small randomly picked subset of the items in question are checked, and if they pass inspection the inference is made that the entire lot very probably does so too. This is in principle the same method used in polling for consumer attitudes or voting preferences. The polling company contacts (usually by telephone) a sample of the target population (e.g., diaper buyers, fast-food eaters, registered voters), asks for information about attitudes and preferences, and then generalizes the results by inferring that what is true of that sample of people will probably be (more or less) also true of the whole target population. Reasoning and arguments that involve generalizing from a random sample to a population have the following scheme:

Sample S of population P has property x_1 to degree d_1, property x_2 to degree d_2, etc.

Sample S is representative of population P with respect to properties x_1, x_2, etc.

So probably population P has, more or less, property x_1 to degree d_1, property x_2 to degree d_2, etc.

Here are some of the critical questions typically associated with generalizing from samples to populations:

1. Is sample S really representative of population P? Was the sample selected randomly, or by some other legitimate method? Is it large enough to include all the relevant variations within P? (A favorite trick is to use a sample of people invited to write in or call in their responses—this is called a "self-selected sample"—which is virtually always unrepresentative: only those with strong opinions, who are usually at one or both extremes of opinion on the question, will take the trouble to respond, so the views of the majority in between don't get recorded.)
2. Was the method of measurement "valid" in the (survey-research) sense that the reported property really was present in the sample? For instance, did the people polled express their true opinions or attitudes? Did the questions asked elicit the information sought? It is extremely difficult to formulate questions that are "neutral" in the sense that they don't prompt a particular response. Compare: "Do you favor increasing consumer spending by implementing a tax cut?" and "Are you opposed to increasing the deficit by implementing a tax cut?"
3. Were the differences noted in the sample too close to permit a trustworthy generalization? Was the difference in political party preference found in the sample so close that there can be no assurance that such precision can be projected onto the population of voters as a whole? If one party or candidate polls support of 36% of the sample and another has support of 31%, but the margin of error of the poll is +/-

4%, it could be that the first has actually only 32% support $(36 - 4)$ and the second has actually 35% support $(31 + 4)$. In other words, a headline such as "Obama holds 5% lead over Clinton" would have been unjustified. A proper headline in that case would be: "Race too close to call."

The answers to these and similar critical questions about a given case are what enable us to evaluate the reasoning or argument used in that case.

There are other kinds of inductive reasoning and argument, but these two examples will serve to illustrate it.

3.3.2.2. Plausible Connections

The above types of connection between premises and conclusion often can be quantified, but many believe that there are still other types of connection that aim at achieving a plausible or reasonable connection that cannot be assigned odds or a percentage of likelihood.

Inferences in legal reasoning are an example of this type of connection. For instance, suppose the defense offers an argument for the innocence of the accused by formulating an explanation of that innocence that is consistent with the pertinent law plus a set of the facts of the case, while the prosecution or crown offers an argument for the guilt of the accused by formulating an explanation of that guilt consistent with the pertinent law plus a set of the facts of the case. The judge or jury must decide which argument is better by deciding which explanation is more plausible. This judgment cannot be determined by a probability calculus, and the inference is not a deductive entailment.

In the literature, various terms have been proposed to refer to the type of connection that is neither deductive nor inductive—what was eventually referred to as "a third kind of evidentiary support" (Johnson and Blair, 2000: p. 97). Examples of the proposal of types of non-standard deductive or inductive support can be found in various places. Rescher (1976) discusses what he calls "plausible reasoning," which is a presumptive inference to the most plausible of rival alternatives, based on such things as the authoritativeness of sources. Govier (1987) introduces the idea of "conductive inference" (following Wellman 1971), which Wellman describes as the sort of reasoning in which a conclusion about some individual case is inferred non-conclusively from premises about the same case and without appeal to other cases. Scriven (1987) describes a number of examples of "probative reasoning" and calls for a "probative logic." This is, for him, the reasoning of the inferences and arguments that are of a kind that is neither deductive, nor quantitatively probabilistic, yet properly thought to be strongly persuasive to the rational faculty. Walton, citing Rescher, discusses what he calls "presumptive reasoning" (1996) which he describes as neither deductive nor inductive in nature, but represents a third, distinct kind, which is inherently tentative and subject to defeat by the special circumstances of a particular case. What these examples seem to have in common is that they describe types of connection between the premises and the conclusion are neither deductive (the premises do not entail the conclusion) nor inductive (in the sense that the premises confer some assignable degree probability on the conclusion), yet are rationally compelling. Whether there is just one "third kind" of

support, or whether the so-called "third way" is best thought of as just a label for a whole variety of non-deductive, non-inductive types of support is a question that remains to be answered by logical theorists exploring these issues.

Toulmin's "model." An important example of a different kind of approach was introduced by Toulmin (1958) (see also Toulmin, Rieke and Janik 1979) and has gained a wide following, especially among argumentation theorists in the field of speech communication. Toulmin's "model" for analyzing any unit of argument has three distinctive features. First, the support offered to conclusions of arguments is always taken to be qualified (by such terms as "certainly," or "probably," or "presumably"). Second, except in the rare cases in which the claim being argued for follows with certainty (in "analytic" arguments), its following from the support offered will be subject to possible conditions of rebuttal. In contemporary parlance, the conclusion is the "default" position, given the support, but it is always possible, in principle, for the conclusion to be overridden or undermined, for example if new, unexpected, information becomes known that tells against it. For most arguments, the types of conditions that would override or undermine the conclusion, given the support—should they happen to transpire—can be specified in advance. Third, in any argument, what justifies the move from the evidence or grounds to the claim being argued for is an inference license or "warrant," which takes the form of a generalization that can be expressed as, "given grounds of this sort (specified), one is entitled—with due qualification and allowing for conditions of rebuttal—to infer this claim." Toulmin thinks that each field of specialized knowledge will have its own particular warrants— that warrants for such fields are field-specific. So, for example, a warrant that might justify an inference in an argument within chemistry would not hold for an argument within history, and conversely. Furthermore, proposed or historically accepted warrants within a field may be challenged and defended. Toulmin's "model" accounts for arguments with deductive entailments and for probabilistic reasoning and arguments, while also accommodating arguments that are neither technically deductively "valid" nor scientifically "probabilistic."

Non-monotonic logic and defeasible reasoning. All of the above bear some relationship to the ideas of *non-monotonic logic* and *defeasible reasoning*, both terms that originate in research on argumentation that comes from the perspective of those interested in the study of artificial intelligence (AI). According to the entries in the on-line *Stanford Encyclopedia of Philosophy*:

The term "non-monotonic logic" covers a family of formal frameworks devised to capture and represent defeasible inference, i.e., that kind of inference of everyday life in which reasoners draw conclusions tentatively, reserving the right to retract them in the light of further information. Such inferences are called "non-monotonic" because the set of conclusions warranted on the basis of a given knowledge base does not increase (in fact, it can shrink) with the size of the knowledge base itself. This is in contrast to classical (first-order) logic, whose inferences, being deductively valid, can never be "undone" by new information.

Defeasible reasoning is the study of forms of reasoning that, while convincing, are not as formal and rigorous as deductive reasoning

There are fine-grained distinctions made between these two concepts, but both employ the idea of an inference that can be rationally compelling even if it is not deductively valid (see Walton and Reed (2002)). The truth of the premises of a good defeasible argument provides support for the conclusion, even though it is possible for the premises to be true and the conclusion false. In other words, the relationship of support between premises and conclusion is a tentative one, potentially defeated by additional information. This type of inference would seem also to include various kinds of practical reasoning Walton (1996, 2007), case-by-case reasoning (Govier 1987), balance of considerations arguments (Scriven 1976, Govier 1999). It also has a strong connection with the study of fallacies, to be discussed below.

Scriven's seven-step method. Another initiative in the ongoing attempts to render the logic of natural language is the so-called Seven-Step method, developed by Scriven (1976). In line with what might be called the standard view that the crucial issues for evaluation are the evaluation of the premises and evaluation of the connection (or inference), Scriven proposes a seven-step method of argument analysis: (1) clarification of meaning (of the argument and its components); (2) identification of conclusions (stated and unstated); (3) portrayal of structure; (4) formulation of assumptions (missing premises); (5) criticism of (a) the premises (stated and missing) and (b) of the inferences; (6) introduction of other relevant arguments; (7) overall evaluation of the argument in light of (1) through (6).

Scriven's method of evaluation focuses on the questions implied in steps (5)-(7). For criticism of the premises, Scriven adopted a criterion he called "reliability" (p. 43), which is like "acceptability"—that is, it must be possible to rely on the premises to be true or reasonable to believe. In criticizing the "inferences"—the premise-conclusion connection—he asks the critic to inquire whether, given the truth of the premise(s), the conclusion is true or likely to be true. The test of an inference (as well as of a generalization, a definition or an interpretation or analysis) is whether it withstands counterexamples. In addition, Scriven requires the arguer to look for other arguments that bear on the issue, both those pointing to a different conclusion and also other arguments favoring the stated conclusion. Thus, one must go outside the frame of the argument in order to evaluate it properly. Finally, the critic must make an overall judgment, taking into consideration both strengths and weaknesses. (See Hitchcock 1983, for one application of Scriven's approach.) An example would be the reasoning that goes into hiring someone, especially for a long-term position that carries considerable responsibilities—particularly when there are several well-qualified candidates, each with different, but overlapping, strengths and weaknesses. There will tend to be good arguments for selecting different candidates and good arguments against selecting different candidates. In the light of what can appear to be a standoff, there might be arguments for postponing the decision, or arguments for hiring more than one person. All these arguments will thus have to be analyzed critically, and a final overall judgment made on the basis of that critical analysis.

4. Fallacies and Argument(ation) Schemes

In the previous section alternatives to the deductive-inductive distinction were discussed. All of those approaches focus on the type of inferential relationship between

the premises and the conclusion. In this section the focus is on two approaches which focus on the overall pattern of the argument: the fallacy approach and argumentation schemes.

4.1. Logical Norms and Fallacies

Traditionally, one of the ways in which it is held that arguments in natural language go astray is through the commission of fallacies. In fact, it was natural in discussing arguments that had problems with plausibility to refer to those violations as fallacies.

4.1.1 What is a Fallacy?

Most generally, and traditionally, a fallacy is thought of as either a mistaken belief, or else a kind of bad reasoning. Since there are at least three different types of connection between premises and conclusion, it is not surprising to find that there are corresponding types of fallacy.

There are formal fallacies, which are really mistakes in deductive reasoning. The most cited example is called "affirming the consequent," of which the following is an example:

If Iraq had or were developing weapons of mass destruction, then the Saddam Hussein regime would try to impede the work of the United Nations teams searching for evidence of such weapons. And that regime did impede the work of the U.N. weapons inspection teams. Therefore Iraq had or was developing weapons of mass destruction.

The trouble with such reasoning is that there might be other reasons why the "consequent" (or "then…" clause) might have been true besides the "antecedent" (or "if…" clause) being true. As is now known, Iraq impeded the work of the U.N. weapons inspection teams, even though it did not have and was not (at the time) developing weapons of mass destruction. Even if the consequent is true, the antecedent can be false, so to reason from the affirmation of the consequent to the truth of the antecedent is fallacious.

There are inductive fallacies. An example of the former is the Gambler's Fallacy, the belief that because, for example, a die has come up 5 three times is a row, it is "due to change"—as if each toss of the die is influenced by the preceding tosses. Since each toss of the die is completely independent of the previous ones, the result of each toss will be independent of the results of previous tosses.

And there are what are called the informal fallacies An example of the latter is the fallacy call "*ad hominem*" which consists in attempting to discredit someone's argument by attacking that person personally (to be discussed below).

4.1.2 Origin of the Term

The term fallacy goes back to Aristotle (384-322 BCE), commonly acknowledged as the founder of Logic. In Aristotle's school in Athens, the Lyceum, a kind of stylized

structured debate took place to practice reasoning and arguing. This style of debate was governed by rules, one of which was that a proponent could not make use of a statement that was identical to the conclusion that was being argued for. This is the origin of the term "begging the question," which is a translation of the Latin phrase by which this kind of illicit debate move was later known (*petitio principi*) and that occurred when one of the disputants "asked for" his opponent to accept the very statement that was at issue. Aristotle identified altogether thirteen violations of the rules. He called such moves in debate 'sophisms' and undertook the first full-length study of these ways of going wrong in his work *De Sophisticis Elenchis*. That is the origin of the study of fallacy. The Latin translation of the Greek word for 'sophism' was *'fallax'* (hence 'fallacy') which in Latin also includes the idea of trickery or deception—a notion not present in the Greek term but that came to be part and parcel of the idea of fallacy as it developed.

4.1.3 Definitions of 'Fallacy'

Contemporary concepts of fallacy derive from Aristotle's use of the term to denote something that has gone wrong in someone's reasoning or argument. Perhaps the most important contemporary definition was given by Hamblin in his landmark work *Fallacies* (1970) when he said that "a fallacious argument … is one that seems to be valid but is not so" (12). But this definition seemed to many as too narrow, because it limits the term to argument in which the goal is validity, and that, as noted above, is only sometimes the case. Kahane broke important new ground in the teaching of logic with his text *Logic and Contemporary Rhetoric* by departing from the standard approach, in which there is a section on deductive logic, a section of inductive logic and then a section of language and fallacies—the paradigm exemplified in Copi's *Introduction to Logic* (1953). Kahane introduced instead an approach that used argumentation on current issues as the focus, and used the concept of fallacy as its chief normative tool. Kahane did not abandon the traditional logics, but they are relegated to a role secondary to that of fallacy, which he defined, "an argument that ought not persuade a rational person to accept its conclusion" (1971: p. 1).

Today there are many competing conceptions of and approaches to fallacy in the scholarly literature. Any attempt to review them and adjudicate among them would require a separate chapter. Instead, the authors will illustrate one approach to the analysis of fallacies in natural language arguments—the ARS approach.

4.1.4 The ARS Approach to the Study of Fallacies

According to the approach to fallacy illustrated here, an argument is logically good if and only if it meets the criteria of (A)acceptability, (R)relevance and (S)sufficiency. That is, first, its premises must be individually relevant to the conclusion. Second, taken together they must provide enough support for the conclusion. Third, the premises must be acceptable to (and worthy of acceptance by) the audience. These are labeled the ARS criteria, for short. (See Johnson and Blair (1977) for a more complete presentation of this approach. See Blair (2008) for a more recent discussion of these criteria.)

Relevance. By "relevance" is meant that the premise in question has some evidentiary

connection to the conclusion. (Some call this probative relevance.) Indeed relevance is such a basic feature of reasoning that it is hard to explicate or define in terms of any more fundamental concept. A few comments will help clarify this criterion.

Relevance does not inhere in an individual premise but rather in an individual premise taken in conjunction with certain other items of evidence or information. Sometimes these will be tacit or unexpressed. Think of the sort of thing that makes for dramatic TV fare. The prosecutor asks: "Is the defendant left-handed?" The defense lawyer objects: "May the Court please, Your Honor, that question is surely irrelevant." Now the prosecutor jumps us and says: "But, Your Honor, we shall establish that the murderer had to have been left-handed, so if the defendant is left-handed, that is relevant to the question of whether he could have been the murderer." With the addition of that information, the relevance of the premise is now clear. Sometimes, then, a charge of irrelevance may be caused by the arguer's failure to complete his or her reasoning. When that missing piece is provided, the logical focus will then shift from the question of the relevance of the original premise to the question of the acceptability of the newly added, relevance-supplying premise. But sometimes irrelevance occurs because the position has not been thought through carefully enough, and no additional premise with any plausibility at all can be found to supply relevance.

One way of testing for relevance is to use the method of counter-exampling. To illustrate that method, here is, first, an example. A Member of Parliament in Canada once charged in the House of Commons that the Federal Department of Health and Welfare had been cooperating with the Kellogg Company in permitting the sale of a breakfast cereal (Kellogg's Corn Flakes) which contained "little or no nutritional value." The Minister of Health, seeking to rebut that charge, stated: "As for the nutritional value of Corn Flakes, the milk you have with your corn flakes has great nutritional value." The *implication* of this claim in this context is "Kellogg's Corn Flakes does have significant nutritional value." One way to show the irrelevancy of the Minister's response is by constructing a counter-example: an argument that employs the same pattern of reasoning with a different subject matter, in which the reasoning is clearly bad. For the present case, here is a counter-example:

Salt possesses great nutritional value, because the steak you sprinkle it on has great nutritional value.

Or this one:

Water has great nutritional value, because the ingredients you add to make soup have great nutritional value.

In these constructed examples, the premise clearly fails to provide support for the conclusion, precisely because it is irrelevant to the conclusion. The minister's argument has the same pattern. So a case can be made that the argument commits the fallacy of irrelevant reason.

The charge of irrelevant reason, as indeed any other charge of fallacy, constitutes an initial criticism of the argument and may well solicit a response. The arguer (or someone who

shares his view) could reject the criticism by showing how the premise, in conjunction with some as yet unmentioned assumption(s), would provide support for the conclusion.

Global vs. local relevance. The relevance discussed thus far might be termed "local relevance," the relevance of an individual premise to a conclusion. But because conclusions themselves are located in a dialectical context where there are multiple issues and competing points of view, there is another kind of relevance sometimes called "global relevance". A claim may fail to be locally relevant (not relevant to the conclusion as formulated), but yet be globally relevant (relevant to the issue the conclusion addresses).

Sufficiency. By "sufficiency" is meant that the premises of the argument taken together provide all the grounds needed to support the conclusion—to make it reasonable to believe or adopt the conclusion on their basis. This is a property, not of any of the premises individually, but only of all taken together. It means that the arguer has provided enough of the right types of support and within any type enough of that type. Of course, just what that amounts to will vary from one situation to the next. Thus in a civil law case in many jurisdictions, the evidence is sufficient if the preponderance of evidence points to the conclusion. That would not suffice in a criminal trial in many jurisdictions, where the stakes are higher; there the grounds must be such that they support the conclusion beyond any reasonable doubt. Thus even if the motive and means had been established beyond any reasonable doubt, if a judge or juror has a reasonable doubt about the opportunity (for instance, if there is plausible reason to think that the defendant was not at the scene of the crime), then even though the preponderance of evidence points to a guilty verdict, the judge or juror must find that conclusion was not sufficiently supported.

Local vs. global sufficiency. The previous paragraph describes one very important kind of sufficiency, the sufficiency of the evidence embodied in the premises to support the conclusion directly. But, as was the case with relevance, there is another kind of sufficiency important in argumentation that stems from the dialectical nature of argument. This can be termed "global sufficiency". Arguments typically occur in a dialectical setting. That is, there are competing points of view on the issue and an argument is the attempt to show that one of them is correct or deserves allegiance. If your argument is to succeed in its attempt to persuade rationally, it is not enough merely to present the reasons or evidence that directly support its conclusion. You must also respond to the competing points of view on the issue, and to the reasons why others might resist your conclusion. You can identify alternative viewpoints and argue that they are defective, or inferior to yours. You need to identify standard objections to your position and showing how those objections fail. An argument that does not in some sense address these competing points of view fails to satisfy the requirement of global sufficiency. By the same token, to assess someone else's argument thoroughly, you must consider how well it meets the requirement of global sufficiency. Check to see whether some of its premises engage objections or attempt to refute alternative positions. Are there well-known competing points of view that are plausible and that have not been shown to be mistaken? If you can show that the arguer has failed to address such dialectical material, then you have shown that the arguer has not satisfied the global sufficiency requirement, and hence is guilty of hasty conclusion.

Acceptability. The basic idea governing the acceptability of premises derives from the purpose of arguments. Their point is to provide grounds (the premises) to convince a reasonable person to accept a claim that person originally questioned or did not accept (the conclusion). If the person questions any premise (as well as the conclusion), then either that premise will have to be discarded, or it in turn will have to be supported. For unless it is, it will not be a reason for this person to accept the conclusion. Since the hypothesis is that the argument is addressed to a reasonable person (one capable of being persuaded by good reasons), then it can be assumed that the arguer will be obliged to deal only with reasonable questions and challenges. The arguer, then, has an obligation to respond to any reasonable doubt or question about the argument. Should there be a reasonable question about whether any premise should be accepted, then the arguer has a duty to supply an answer; namely a reason why the premise should be accepted. Thus when an arguer uses as a premise of an argument a claim that he or she fails to defend and which should have been defended, the arguer has violated the acceptability criterion. As stated above, the starting points, grounds, or premises of arguments intended to convince or persuade another or others should be acceptable to that party and ideally true, or failing that, reasonable for them to accept.

To make this approach clearer, there follows an illustration of each ARS type of fallacy.

4.1.4.1. *Ad Hominem*—A Failure of Relevance

When someone has committed the *ad hominem* fallacy they have made use of a certain form of argumentative move: they engage in an irrelevant attack on the person of the arguer and thereby fail to engage properly with the argument. In saying that it is an irrelevant attack on the person, it is acknowledged that there can be relevant attacks on the person, that is, there can be occasions on which it is perfectly legitimate to direct attention to the person who presented an argument as a way of criticizing that argument

Example of *Ad Hominem*

In an interview in *Image* magazine conducted at her home in the hills of Mendicino, California, Alice Walker, author of *The Color Purple* and *Possessing the Secret of Joy*, complained about the spiritual emptiness of America. "America is a terrible place for spiritual growth because it is so full of material goodies that you can latch onto those things and think that is really what it's all about," said Walker. Responding to her statements, RWD wrote: "Why should we listen to a lecture by Ms. Walker about what a rotten country America has become, while she lives in splendor in her lush pad on a Mendocino hillside?"

This response constitutes an *ad hominem* attack. RWD responds to Alice Walker's position ("that America is a terrible place for spiritual growth because...") by launching a personal attack on Walker. That attack takes the form of referring to the circumstances in which she lives—that Walker "lives in splendor in [a] lush pad". The implication is that she can know nothing about spiritual growth. The further implication is that she is guilty of the very thing she is condemning. In this response, RWD totally ignores the argument Walker had given. The personal attack on Walker is irrelevant to the assessment of her argument. The fact that Walker lives comfortably, even if it were true,

does not detract from the value of her argument, nor make it hypocritical of her to live that way. The issue here concerns the spiritual condition of America at the time—and no argument about this depends for its cogency on the material conditions of its author. (By the way, the *ad hominem* fallacy might not be the only fallacy in RWD's reasoning in the quoted passage.)

4.1.4.2. Hasty Conclusion—A Failure of Sufficiency

Sydney Harris, who wrote a syndicated column for American newspapers in the 1970s and 1980s, once wrote an article titled "Jogging is an unnatural activity for human beings" (January 1982):

... while exercise [such as running] is beneficial for the lungs and heart and the whole circulatory systems, it is debilitating to the legs. That is why most physical fitness experts recommend swimming as the ideal all around exercise, not walking or running: because in swimming the legs move easily through the surface and do not pound a hard surface. While walking may do more good than harm, in terms of total bodily welfare, I cannot believe that jogging is anything but a bonanza for the podiatrist and the orthopedic surgeons. Some medical specialists indeed have already begun to warn the public of the probable perils in jogging as a daily routine.

Harris is guilty of a hasty conclusion in his argument that jogging is not a good method of exercising. His grounds are that it is debilitating to the legs and that specialists have begun to warn the public about jogging. These are surely relevant premises that provide some support. The problem here is that there is evidence his argument fails to take into account. This untapped evidence is of two sorts. First, while there is no doubt that jogging can lead to injury in some cases, answers to the following questions need to be considered: How many cases of injury? How many, in relation to the total number of joggers? Under what conditions do these injuries occur? Are those injured training intelligently, or perhaps overzealously? If only a relatively few joggers report injuries and most of those came about from either poor judgment or poor gear, then Harris's evidence, while relevant, doesn't add up to a good case for his claim. Second, while it might be true that there is a risk of injury to all joggers, that risk needs to be weighed against benefits, which would include better circulation, increased lung capacity, anaerobic fitness, weight control and better self-image. In that case, Harris's claim would fail to support his conclusion because it is partial in a different sense. (Hasty conclusion might not be Harris's only fallacy here.)

4.1.4.3. Problematic premise—a failure of acceptability

Consider this argument titled "The Case Against Abortion":

In 1988, more than 152,000 women had their children killed before they could be born. These numbers are on the increase every year. By the end of 1995, we will have reached the 200,000 level. The percentages are similar in Western Europe. They are greater in the Soviet Union. No one would be against abortion when the woman's life is at stake, but that situation is now exceedingly rare. The present mass feticide takes place almost always for convenience. The medical professionals tell us that 95% of abortions are now done to kill healthy offspring of healthy women. How has it happened that this quiet

medical slaughter has become part of modern societies everywhere?

Although the last sentence indicates that the writer's argument has broad scope, its reconstruction, below, is restricted to its application to Canada, where the letter appeared and to which the writer was referring. The implicit claim that is the target of the letter seems to be that under Canadian abortion laws, mass feticide was occurring in Canada. Here is a layout of the structure of that argument:

Premise 1. In 1988, more than 150,000 Canadian women had their children killed before they could be born.
Premise 2. These numbers are increasing steadily so that by the end of 1995 we may nearly have reached the 200,000 level.
Premise 3. The medical professionals tell us that 95% of abortions are now done to kill healthy offspring of healthy women.
Premise 4. The present mass feticide takes place almost always for convenience.
Conclusion (implied). Under present abortion laws, there is a situation of mass feticide (quiet medical slaughter) in Canada.

There are two kinds of difficulty with Premise 1: the numbers and the terminology. The figure of 150,000 abortions sounds like a lot (the population of Canada in 1988 was about 25 million), but the relevant figures are the ratio of abortions to pregnancies and how that ratio compares to the ratio of illegal abortions to pregnancies in countries similar to Canada but where abortion is illegal. In other words, is there a significant increase in the number of abortions in Canada caused by the legalization of abortion there? Also, is the figure accurate? The numbers are important, because otherwise the author cannot justify the conclusion that this is "mass" killing. The trouble is, the audience is made up of the newspaper-reading public, most of whom would not know the ratios or know if the number is accurate, so, besides different data, the arguer should have provided the source of his numbers so they could be checked.

But in addition, the author's description of abortions as "women [having] their children killed" is question-begging. Anyone who has followed the abortion debate knows that many who favor the right to have an abortion do not regard the fetus as a child and so would not agree that in having an abortion involves killing a "child." To use the term 'children' in this context without arguing for it is to unjustifiably bias the description in a way favorable to the conclusion. For the author's term 'feticide' in the conclusion, suggesting as it does an analogy to "homicide" or murder, gains plausibility if the description of abortion as the killing of one's "child" is granted. So Premise 1, using without support numbers and terminology that require defense, is a   problematic premise.

Premise 2 is problematic as well. This whole issue of legalizing abortion is highly controversial, with each side being dubious about the reasons offered by the other side. In that context, the sources of factual claims, such as numbers and trends, need to be provided so the other side can check and assure itself of their bona fides. Absent such support, the premise is problematic.

Premise 3 also needs defense, and for the same kinds of reasons that apply to Premise 1.

The 95% figure is surprisingly high, so its source should have been supplied. (The reference to "the medical profession" is much too vague to count as identifying a source here: the reader needs information that would make it possible to check the source.) And the judgment "healthy offspring" has two controversial elements. One needs to know what the author of this statistic counted as healthy, since this is a point of contention. For example, would a fetus identified as brain-damaged be counted as healthy if it were otherwise physically in good health? Also, the term "offspring" is argumentative, since it is normally used to refer to children after their birth, not to fetuses. The author thus has used a description that could be objected to with good reason, without the needed defense. The point is not that the author cannot have a right to use this terminology, but rather that its use must be defended if it is to be legitimately employed in making the case (and by the way, in this case defending the terminology is as difficult as making the case in the first place). Premise 3 is also a case of problematic premise.

Premise 4 is similarly flawed. "Convenience" is a weak reason to have an abortion, so if this term is accurate the criticism of the impact of the abortion legislation in Canada gains force. But is it accurate? What one side on this debate counts as reasons of convenience the other counts as reasons of great importance. At the least, the term needs to be defined and defended. In addition, the quantity asserted—"almost always"—is uselessly vague. To judge the premise it is necessary to know if significant numbers of abortions are undergone for frivolous reasons in Canada, and the author has supplied no justification for that controversial claim. Once more: a problematic premise.

The ARS concept of fallacy just illustrated diverges somewhat from standard conceptions in that, according to it an argument can contain a fallacy but not be destroyed by it: the occurrence of a fallacy is not necessarily fatal to the argument containing it. For instance, if an argument fails to provide good enough grounds to establish its conclusion, it contains a fallacy of sufficiency, but perhaps more evidence or additional or different kinds of reasons can be found. In that case, the argument should not be dismissed or abandoned, but repaired. Or again, if a premise as it stands is irrelevant, there is a fallacy. But perhaps there is an unexpressed assumption which, when made explicit and added to the challenged premise, makes the pair relevant and gives support to the conclusion. In that case, the argument had merit; its reasoning just needed to be made explicit. The more conventional view is that a fallacy is "a serious violation, as opposed to an incidental blunder, error or weakness of execution" as Walton puts it in his*, A Pragmatic Theory of Fallacy* (1995, 238).

The idea that a fallacy does not necessarily destroy its argument might seem counter-intuitive, but it has the following virtue. It requires the person who has identified a fallacy in an argument to go further and think whether the argument can be repaired, and if so, how. Thus construed, fallacy analysis is not a device for dismissing arguments. Instead, it is a way of leading the critic more deeply into the appreciation of arguments and placing on the critic a burden of proof. The critic must support the charge of fallacy with appropriate reasoning. Also, the person whose argument is charged may well have a rejoinder to the charge. She may admit the flaw, but claim that the argument can be repaired; or she may claim that the criticism has misunderstood the argument

4.2 Other Approaches to Fallacy

The approach to fallacy outlined above (ARS) belongs to the logical tradition. Here is a brief account of some prominent alternatives within that tradition, followed by mention of dialectical and rhetorical approaches to fallacy.

In his seminal work, *Fallacies*, Hamblin (1970) claimed that "the standard treatment" of fallacies in the textbooks is to be described as follows:

… what we find in most cases, I think it should be admitted, is as debased, worn out and dogmatic a treatment as could be imagined—incredibly tradition bound, yet lacking in logic and in historical sense alike, and almost without connection to anything else in modern Logic at all. (p. 12)

Hamblin called for a concerted effort to revitalize this impoverished corner of logic, and beginning in the early 1970s, Woods and Walton took up Hamblin's challenge, and over the course of the next ten years published together 19 papers, mostly on individual fallacies but some on fallacy theory in general (collected in Woods and Walton, 1989). Their approach was *ad hoc* in the sense that they worked from no global theory of fallacy, but it was very much in Hamblin's spirit in that they sought historical roots, provided thorough original analyses of the fallacies they studied, and made ample use of the tools of modern logic when and as those proved illuminating. Their approach to fallacy might be called the "analytical logical" approach.

Since the early 1980s, Walton has been working out a distinctive, theoretically unified theory of fallacy, publishing elements and successive iterations of it in a series of monographs, including: *Logical Dialogue Games and Fallacies* (1984); *Informal Fallacies* (1987); *Begging the Question: Circular Reasoning as a Tactic of Argumentation* (1991); *Slippery Slope Arguments* (1992); *A Pragmatic Theory of Fallacy* (1995); *Arguments from Ignorance* (1996); *Appeal to Pity* (1997a); *Appeal to Expert Opinion: Arguments from Authority* (1997b); *Ad Hominem Arguments (1998).* Walton departs from the traditional account of fallacy. For him, "a fallacious argument involves an error of reasoning but also a misuse of reasoning, in many cases, as a sophistical tactic to try unfairly to get the best of a speech partner in a dialogue by deception" (1998, 292). His theory shows the influence of both the dialogical (see below) and the Pragma-Dialectical approach (van Eemeren and Grootendorst 1984) in that he regards argumentation as modeled by dialogue, and he takes its norms to be importantly pragmatic as well as syntactic and semantical. A fallacy, in Walton's more specific account, is a fatal failing in the use of an argument scheme, either internally, by way of a failure to fulfill its particular conditions, or externally, by way of the use of an inappropriate scheme or an illicit dialogue shift, in which a scheme appropriate to one kind of dialogue is improperly deployed in a different type of dialogue. In his view, these features account for both the erroneousness and the deceptiveness of fallacy. Walton calls his approach a "pragmatic" theory of fallacy.

Woods's recent reflections, on the other hand, have taken a different tack, and most recently have led him to question whether there is such a thing as fallacy in the traditional sense. See his (2008) "Why is Fallacy Theory So Difficult?"

All the approaches discussed thus far might be called "logical." An entirely different and novel theory of fallacy was proposed by E.M Barth (1982), who, citing the influences of Ness, Crawshay-Williams, Hamblin, Lorenz and Lorenzen, suggested that a fallacious argument be understood as "an argument not generated (at that stage of the discussion) by the system of dialectical rules" governing it. Barth (referring to her work with Krabbe (1978, 1982)) suggested that:

the study of fallacies can then move from the stage of a catchword classification that we know today to an investigation of the relation of a given argument (i) to the dialogical situation at the given stage of the discussion and (ii) to the dialectical rules (of a given system) that pertain to exactly that dialogical situation. (160)

Such an approach might be called a "dialogical approach" to fallacy.

A different way of developing a dialogical approach is taken by van Eemeren and Grootendorst, who developed the Pragma-Dialectical theory (see 1984, 2004; on fallacies, see especially 1992). They conceive of fallacies as violations of the pragmatic rules for what they call a "Critical Discussion"—an idealized kind of structured dialogue between two parties aimed at resolving a difference of opinion between them in a reasonable way. A critical discussion has four stages: the opening stage—identifying the disagreement; the confrontation stage—agreeing to norms governing acceptable claims and sound inferences; the argumentation stage—engaging in argumentation designed to persuade, and the concluding stage—deciding what the upshot of the discussion has been. Given the goals of each stage, certain kinds of speech acts are obligatory, permitted or forbidden, and these prescriptions constitute the rules of reasonableness for such discussions. The historically standard fallacies are re-interpreted as violations of the rules of one or another element of the discussion. Thus, for example, the *ad hominem* fallacy is construed as a fallacy that occurs in the opening stage when one of the interlocutors engages in a personal attack on his opponent attempting " to eliminate him as a serious partner in the discussion by undermining his right to advance a standpoint, or cast doubt on standpoint" (1992: p. 11).

Finally, as one would expect, given the three perspectives of logic, dialectic and rhetoric (see Section 2.3, above), there is also what some would call a "rhetorical" approach to fallacies. Tindale (2007) provides an example of this approach in which fallacies are seen as rhetorical in character. In the rhetorical approach, emphasis is placed on the fact that an argument takes place in a specific context. Tindale explains:

In many instances this involves the details of a dialogue between participants in an argumentative exchange. In other cases we must sift through what is available of the background to a dispute, such as the history of the exchanges between participants or the beliefs of the audience. This brings into consideration dialectical and rhetorical features crucial to understanding and evaluating fallacies and shows that the study involves more than a traditional logical assessment. (2007, xiv)

Those who advocate a rhetorical approach do not wish to preclude either logical or dialectical approaches, but believe that a richer understanding of the fallacies requires reference to the rhetorical dimension in addition. As Tindale writes, "In many ways

fallacies are breakdowns of the norms of reasoning and through their study we gain a better understanding of ourselves as reasoner and as members of audiences in social setting" (xv).

4.3 Argument(ation) Schemes

The approach to the evaluation of argumentation using what are known as argumentation schemes (Walton 1996, Walton and Reed 2003)—sometimes also called "argument schemes"—emerged in the 1990s, spurred on by a number of developments. First, it can be seen as a modification of the fallacy approach in the following way. The fallacy approach is based on the recognition that there are patterns of argument (patterns, as distinguished from logical forms) that underlie the fallacies, and that sometimes what are called fallacies result from the inappropriate uses of argumentation schemes that can in other contexts have perfectly legitimate instances. The argument scheme approach to argument evaluation seeks first to identify the particular argument scheme being used, and second to formulate a series of questions ("critical questions") that make reference to the scheme and help the individual determine whether the scheme has been properly deployed. In many cases, improper deployment of an argument scheme results in what would be called a fallacious argument. Thus what comes to be known as the argument scheme approach allows for a more general and less negative approach to argument evaluation.

Consider the argumentation scheme for the *appeal to authority*. Many arguments from authority are perfectly cogent, and the pattern of a typical argument from authority can be described. According to Walton et al, (2003), the following is the scheme for the *ad verecundiam* (the appeal to authority) argument.

> Source E is an expert in domain, D .
> E asserts that A , a proposition, is known to be true.
> A is within D.
> Therefore, A may plausibly be taken to be true.

Walton has attached six main critical questions to this scheme. For example, "In this case is the person appealed to as an authority actually knowledgeable about the particular claims at issue?" In a particular argument in which an appeal to authority is used to settle a claim, if the answers to such questions are "no," the fallacy of "improper appeal to authority" can be said to have been committed.

A second feature of the "argumentation scheme" approach is that in many instances the type of connection between the premises or support and the conclusion of claim is neither deductively valid nor inductively strong, in any standard sense of "induction." That is, argumentation schemes appear to be yet another example of a "third way" in which those who study argumentation have sought to provide an alternative to the classical approach according to which the deductive-inductive distinction exhausts all possible types or standards of reasoning or argument (see Johnson and Blair, 1980, 22-23; 25).

4.4 Summary

In this section two approaches to argumentation that focus on the overall pattern of the argument were discussed: the fallacy approach and argumentation schemes.

5. Conclusion: Logic and World Problems

In our everyday activities and our more reflective undertakings, the norms that govern the proper uses of arguments, reasoning and argumentation are of fundamental importance. People invoke or make use of the logic of natural language all the time. We reason constantly in our personal and professional lives, and most people reason well enough to function more or less competently. Attention to what is called here the logic of natural language is particularly applicable to reasoning at points where it becomes problematic and difficult, when mistakes can be costly, or result in unhappiness (or disaster!), and where the uses of reasoning are complex and sophisticated beyond the competence of those without special training or experience. These norms affect what may be accepted as adequate justification and legitimate means of persuasion in law, medicine, engineering, business, politics, public policy and administration, scientific research in the physical and in the social sciences, scholarship in the humanities—in short, the logic of natural language is applicable to every area of life, public and private, theoretical and practical.

Bad argumentation by governments and the citizens who elect them, by business, and by professionals produces social, economic and political conduct and policies that are inefficient or harmful to civic and economic life, for present and future generations. Good argumentation matters. It doesn't guarantee good outcomes, but it contributes significantly to them; and bad reasoning almost always results in harm.

An example of questionable logic in natural language argument is the logic of the reasoning that was offered to the public to justify the American-led coalition's invasion of Iraq in 2003. (It is immaterial to the point that the policy makers might themselves have had different, undisclosed reason for the invasion.) In our analysis, we appeal only to well-known events and undisputed facts. One reason offered was that Iraq had and was developing weapons of mass destruction (including chemical warfare weapons and nuclear weapons) and that Iraq had harbored and supported the Al Qaeda attacks on the west. It was argued on that basis that the Saddam Hussein regime in Iraq had to be overthrown for the safety of Israel and of America and other western countries. Both premises were contested prior to the decision to invade, but the objecting arguments were not heeded. In other words, the premises were problematic. Anyone who accepted this argument without question thus overlooked the challengeable nature of the reasons offered. Also, the argument against invading Iraq without delay, based on the premise that the UN weapons inspectors ought to be given time (a matter of months) to determine whether Iraq really did have such weapons, was similarly widely dismissed. This argument put into doubt the sufficiency of the premises used in the original argument. Again, anyone who took the original argument to be adequate even in the face of this objection reasoned in a questionable way. In retrospect, the evidence of weapons of mass destruction and of Iraqi involvement with Al Qaeda could have been recognized at the time to be at best weak, and at worst, non-existent, and the arguments against the reliability of the findings of the UN weapons inspectors could have been seen to be specious. It was also argued that by replacing the Hussein autocracy by a

democratic government, other autocratic regimes in the Middle East would be influenced to become more democratic. The supporting evidence was speculative, and this claim was at the time contested by many experienced observers of Middle East history and politics. Those who accepted the argument as solid, in the face of the weakness of the evidence and the doubts of some experts, reasoned hastily. Finally, it was argued by many military experts that if an invasion were to be carried out, some 200,000 troops would be needed to keep the peace. Detailed plans for the post-war administration of Iraq and for involving the contending ethnic and religious factions in Iraq in processes aimed at developing democratic institutions and practices would have to be in place. These arguments were ignored or dismissed by many. Anyone who went along with that dismissal of these challenges to the argument without considering them closely was not reasoning carefully. In sum, sources whose authority was questioned, but ought to have much more been widely questioned, were accepted by many as reliable. Evidence that had little probative weight was taken by many to have great probative weight. Individuals and bodies such as the United Nations had their credibility undermined by personal attacks that were accepted by many, yet were open to question. Conclusions were drawn hastily by many. Contrary arguments were ignored by many. As a result, recognizably strong arguments against the invasion at that time were made and ignored or not give their due weight by many, and recognizably weak arguments in favor of the invasion were accepted by many as convincing. In giving credence to these poor arguments, many people reasoned badly, and as a result supported an invasion and war that they later grew to question.

It might be objected against this example that logic alone is not sufficient to prevent such episodes. That is undoubtedly true. However, if the norms of logic are heeded, there is some basis for thinking that some disasters of human creation can be avoided. In the case of the Iraq war begun in 2003, had there been a stronger a commitment to good reasoning, what is widely conceded to have been a grave series of mistakes, at the very least in the timing of the invasion and in the administration of Iraq following the downfall of the Hussein regime, might have been avoided.

Glossary

Argument:	Typically in the tradition, a certain type of cognitive (or rational) product in which reasons are offered in support of a claim or thesis. The reasons are said to be the premises of the argument; the conclusion is the thesis supported. It is further held that an argument provides or invites an inference from the premises to the conclusion. Arguments have many and differing uses; they may be used to provide justification, to persuade, to open up lines of inquiry, to test points of view, etc.
Argumentation:	The give and take of arguments in a dispute or the body of arguments used to try to support a controversial position. In this context (or practice), one side constructs and forwards arguments to an audience, which may then raise questions, doubts or objections. The arguer typically responds by producing arguments to answer those questions, doubts or

objects, or else revises the initial arguments in light of the response. The circumstances might permit the audience to respond to the new or revised arguments, and so for the back-and-forth interaction to continue for several turns.

Argumentation theory (or the theory of argumentation) :
The multidisciplinary inquiry that studies argument and argumentation with a view to dealing with normative, conceptual, and empirical issues. For example an important normative question is: What are the norms for argument, and how are they to be identified, justified? And important conceptual question is: What are the various types of argument? An important empirical question is: What role does or should the audience play in the shaping of the argument. What does research show about the qualities of persuasive arguments? There are many different approaches to argumentation theory, principal among which are the logical, dialectical, and rhetorical approaches. Accordingly, there are many different types of theories of argumentation. Logical approaches, such as is taken in this chapter, tend to focus on the normative issues that surround argumentation.

Argumentation (or Reasoning) Schemes:
Patterns of reasoning or argument—both very general ones, and also more detailed instances of those general ones. These schemes thus represent types of argument or reasoning. Accordingly, there are schemes in general, for example, for argument from analogy or argument from authority. (*General analogy:* " X is like Y , and Y has property P , so probably/presumably X has property P also." *General Authority:* " A says S ; A is an authority about things like S ; so probably/presumably S .") And there are also more specific schemes representing sub-types of these general patterns. (e.g., *Enumerative analogy:* "Instances of Aa -1, a - 2, a - 3 , etc. have property X , so instance of Aa -n will have property X "; *a priori analogy:* "Act A deserved treatment T ; act B is relevantly similar to A ; so act B deserves treatment T .") Associated with each scheme is a set of critical questions that have to be answered appropriately for any argument that is an instance of that scheme if it is to be a cogent argument. In addition, according to one current conception of fallacy, a fallacy an inappropriate use of an argumentation scheme (for an example an inappropriate appeal to authority, such as appealing to a physician—a medical authority—in support of a pro- or con- point of view about abortion, which is a moral, not a medical, issue).

Deduction:
In ordinary language, another word for reasoning, as in, "When he saw the smoke, he deduced (made the deduction that) the engine overheated." In the discipline of logic, deduction is used as a technical term typically to mean necessary consequence (entailment) (see "Deductive Logic, below).

Deductive Logic: The branch of logic that studies the principles of entailment— the situation that occurs when one proposition follows necessarily from another, or others. This happens when it is impossible for the premises of the argument to be true and the conclusion false. This relationship is sometimes also called implication. Entailment (implication) instantiates the property that has come to be known in logic as *validity*. An argument where it is impossible for the premises to be true and the conclusion false is said to be "valid," in the logician's restricted technical sense of 'validity.': Usually deductive logic is considered to be a formal inquiry/science. That is, whether an argument is valid depends on its logical form, not on its content. The following example has been used to illustrate: "All men are mortal; Socrates is a man; therefore Socrates is mortal." This argument is technically valid even if it should turn out to be the case that there was no such person as Socrates, because the conclusion follows necessarily from the premises. This also illustrates the point that validity is not sufficient for a good argument, "All men are rich; all who are rich are mortal, therefore all men are mortal." This argument is valid but most would reject it because the first premise is false. So in addition to being valid, the argument must have true premises. (See "Soundness" below.)

Defeasible Reasoning: The forms of reasoning that are not as formal and rigorous as deductive reasoning. The term was brought to prominence by Pollock (1995), reasoning is defeasible when the corresponding argument, though not valid, is yet rationally meritorious. Pollock developed the term to help work through issues in epistemology. Given the relationship between epistemology and logic, it is not surprising that the term has found employment in logic. In recent work, the term has typically been limited to inferences involving rough-and-ready, exception-permitting generalizations, that is, inferring what has or will happen on the basis of what normally happens (*Stanford Online Encyclopedia*).

Dialectical/Dialectics: In its simplest terms, dialectics is the study of the norms of reasonable interpersonal or interactive argumentation. It is the study of the argumentation in which the roles of proponent and of opponent of a point of view are assumed and various goals of their interactive communication are considered. Argumentation is dialectical by virtue of being an interaction between contending points of view.

Dialogical: In argumentation theory, the approaches that take the primary setting for argument as the dialogue or exchange between two or more parties and that seek to formulate rules that govern those exchanges. A completely different concept would be Paolo Friere's idea of dialogical pedagogy, which focuses on the importance of dialogue between teacher and student

Fallacy:	In ordinary language, a mistaken belief, e.g., the "Gambler's fallacy"—the belief that a certain combination of die can be "due to come up" in the next toss." In the study of argumentation (argumentation theory), a fallacy is a recurrent flaw of reasoning. Originally, Aristotle uses the Greek term translated as *sophism* to refer to an error in the kind of dialogue practiced in the Lyceum. Later comes the term "fallacy" that derives from "*fallax*"—the Latin translation of *sophismos*. There it took on the connotation of deception, which has persisted. In the 20th century, the best known definition is that of Hamblin (1970): a fallacious argument is one that appears to be valid but is not. Other conceptions (among many): Kahane (1971) takes a fallacy to be an argument that ought not to persuade anyone of its conclusion; Johnson and Blair (1977) take a fallacy to be a type of recurrent argument that violates one of the criteria for a logically good argument; van Eemeren and Grootendorst (1992) take a fallacy to be a violation of the rules of reasonable dialectical procedures
Induction/Inductive Logic:	Typically contrasted with deduction, inductive reasoning or induction is reasoning in which the conclusion follows from the premises, often with some assignable degree of probability or likelihood. One type of inductive inference is a generalization from the observed properties of a subset of a group to the conclusion that those properties will be found, and with approximately the same distribution, in the group as a whole (as in polling data). Another is reasoning by analogy, as when one reasons that since two things are groups share a certain number of properties in common, then some property that is found in the first will probably also be found in the second (as in inferring that unobserved hoofed animals are likely herbivores).
Informal Logic:	The logic concerned with natural language argumentation. According to the authors, informal logic is the branch of logic whose task is to develop non-rigid formal standards, criteria, procedures for the analysis, interpretation, evaluation, criticism and construction of argumentation in everyday discourse and in disciplined inquiry.
Logic:	The normative study of good reasoning. There are as many types of logic, as there are types of reasoning, but logic is most closely associated with inference and argument. Inference means the drawing of a conclusion from evidence (premises). Historically it had been widely believed that there are just two types of inference: deductive and inductive; and so traditionally logic was thought to divide into deductive and inductive logic. But in the late 20th century it became clear that that "inductive" and "deductive" do not exhaust the types of inferential connection. Prominent alternatives (well ensconced

	in the literature) are conductive inference (Govier, 1987), defeasible inference (Pollock, 1995) and nonmonotonic reasoning. In some circles, "inductive logic" is defined as any type of non-deductive logic, thus preserving the dualism of the two types of logic as deductive and inductive. However, so construed induction covers a wide variety of different modes of reasoning, from probabilistic reasoning to balance of considerations (where no quantification is attempted) and no common denominator is apparent.
Nonmonotonic Reasoning (Logic) :	The term "non-monotonic logic" covers a family of formal frameworks devised to capture and represent defeasible inference—that kind of everyday inference in which reasoners draw conclusions tentatively, reserving the right to retract them in the light of further information. Such inferences are called "non-monotonic" because the set of conclusions warranted on the basis of a given knowledge base does not increase (in fact, it can shrink) with the size of the knowledge-base itself. This is in contrast to classical (first-order) logic, whose inferences, being deductively valid, can never be "undone" by new information. (*Stanford Online Encyclopedia*)
Rhetoric:	Often taken to refer to flowery or bombastic prose, or to deceitful persuasion, 'rhetoric' is also the name of a serious academic discipline and an important subject matter. The discipline of rhetoric is the study of the norms of effective communication. Classically (starting with Aristotle), rhetoric referred to the art of effective speech-making to public bodies—the address to a jury, to a legislative assembly, or to a group of people at a celebratory ceremony. Contemporary rhetoric studies all manner of communication, both descriptively (what made Dr. Martin Luther King's "I Have a Dream" speech or Lincoln's "Gettysburg Address" so effective?) and prescriptively (what does a writer need to do in order to keep the attention, interest and receptivity of his or her readers?). In the latter sense, rhetoric and logic are not only compatible, but good rhetoric is needed to ensure that good logic gets a hearing.
Soundness:	As a technical term in logic, soundness refers that property which obtains when the premises of an argument are true and the argument is valid. Some consider soundness to be necessary and sufficient for an argument to be a good one. That is, an argument that lacks either property is not a good argument; and an argument that exhibits both is a good one. However, soundness is too narrow a criterion of good argument, since some invalid arguments (such as strong inductive ones) are logically good and some arguments whose premises cannot be known to be true (although it is more reasonable to believe them than not to) are still logically good arguments. Soundness is also too broad a criterion, for any

argument that begs the question and has true premises will be sound. Thus, the following argument would be sound: Canada is a parliamentary democracy, so parliamentary democracy is the form of government in Canada. But it is not a logically good argument.

Validity: As a technical term used in logic, validity is that property of an argument that obtains when it is not possible for its premises to be true and the conclusion false. Validity can be a property of logical form. Thus the following form is valid: "Either p or q ; not - p ; therefore q ." Any argument that has this form is valid, e.g., "Swans are either black or white; they are not black; therefore they are white." An argument is thus invalid if it is possible for the premises to be true and the conclusion false, e.g., "Swans are either black or white; they are white; therefore they are not black." This form (Either p or q ; q ; therefore not - p) is invalid.

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Biographical Sketches

J. Anthony Blair was born in Ottawa, Canada, educated in primary and high school there and at McGill University (Hons. Philosophy B.A.) and the University of Michigan (Philosophy M.A.). He is married to June Fulford with whom he has a son, Jay.

Blair taught in the University of Windsor Philosophy Department from 1967 to 2006, serving two terms as Department Head, and retiring with the title of University Professor. In 2006 he founded the Centre for Research in Reasoning, Argumentation and Rhetoric (CRRAR) at the University of Windsor. Together with Ralph Johnson: he wrote the influential textbook, *Logical Self-Defense* (1977, latest edition 2006); chaired the First International Symposium on Informal Logic (1978), the Second (1983) and the Third (1988); started the journal *Informal Logic* (1984), which he continues to co-edit; authored several survey-of-the-field articles; and directs CRRAR. With Robert Pinto he wrote the critical thinking textbook, *Reasoning, A Practical Guide* (1993). He has served on the board of the International Society for the Study of Argumentation (ISSA) based at the University of Amsterdam and on the organizing committee of the quadrennial ISSA conferences since 1986, and on the organizing committee for most of the Ontario Society for the Study of Argumentation (OSSA) conferences. He was a keynote speaker at the 2005 OSSA conference, and the J. Anthony Blair Prize for an outstanding student paper at the OSSA conferences was established in his honor.

Blair has published some 70 papers on theory and pedagogy of informal logic and critical thinking and on argumentation theory. His theoretical papers address the nature of arguments and argumentation, the logical norms of argument, the dialectical character of argument and argumentation, and the rhetorical character of argument and argumentation.

Ralph H. Johnson was born on September 14, 1940 in Detroit, Michigan. He received his B.A. from Xavier in 1958 , an M.A. in Philosophy from Notre Dame (1966) and his Ph.D. from Notre Dame in 1973. In 1967, he married Margaret Moran. They have three children: Mary, Sean and Matthew.

Johnson retired in Fall 2006 after 39 years with the Department of Philosophy, University of Windsor, during which he served two term as Head of Department. In 1971, he along with his colleague, J. Anthony Blair, developed a new approach to logic they called informal logic. In 1977, Johnson and Blair published their text, *Logical Self-Defense (*3rd edition, 1993; U.S. edition, 1994; IDEA, 2006). In 1979, Johnson and Blair founded the *Informal Logic Newsletter,* which became the journal, *Informal Logic,* in 1985. They have been its publishers and editors from the beginning. In 2006, he and Blair founded the Centre for Research in Reasoning, Argumentation and Rhetoric, for which they currently serve as Co-Directors.

Johnson has published more than 50 articles on various issues in argumentation theory and informal logic, for all the major journals and delivered keynote addresses at many conferences. His *Manifest Rationality* [Lawrence Erlbaum 2000] was well received.

In 1993, Johnson received a 3M Teaching Fellowship for outstanding university teachers, one of ten such awards conferred that year in Canada. In 1994, he was awarded the rank of University Professor by the University of Windsor. In 2000, he was awarded the Distinguished Research Award by the International Society for the Study of Argumentation. In 2003, he was elected a Fellow of the Royal Society of Canada. Johnson is listed in *Who's Who in Canada.*