JUSTIFICATION AND REASONS

People often give reasons for their beliefs. They may wish to confirm their beliefs, to convince others, or to develop new beliefs on the basis of beliefs already held. Sometimes the reasons given will justify the beliefs and sometimes they will not. Each of the following examples might illustrate an attempt to justify a belief.

1. The Democrats do not have an adequate solution to the deficit problem, so we should not vote for their candidates.

2. I know from a class survey that none of my students last semester were studying engineering, and Carol was among my students. Thus I can be sure that Carol was not studying engineering last semester.

3. If John were to fail chemistry, he would not graduate. John will not fail chemistry. Therefore, he will graduate.

In each case, reasons are given for accepting some claim.

Logic is the systematic investigation of standards for reasoning. In particular, when a belief is justified on the basis of other beliefs given as reasons for it, the logician would like to be able to identify the principles connecting the reasons with the conclusion they justify. The study of logic will provide analytical tools that will enable us to understand and evaluate people's attempts to give justifying reasons.

You might or might not feel pretty confident about your ability to distinguish good reasoning from bad; we will strengthen it through this study. But we will also develop something deeper—an understanding of what makes some reasoning good and an ability to show that a claim follows from the reasons offered for it. We can develop a systematic formulation of the fundamental elements of a large body of reasoning. Knowledge of this system of fundamental elements can serve as a firm basis for an understanding of good reasoning, for the ability to show that a conclusion follows, and for the ability to make evaluations of the reasoning of others.
ARGUMENTS

When reasons are given to justify a belief, an argument is being presented; so logic, the study of the standards of reasoning, can also be described as the study of characteristics that distinguish acceptable arguments from those that are not acceptable.

The word argument is often used to refer to a dispute. But in the logician's sense, an argument need not involve any dispute. For example, an argument could consist of new reasons for an old, uncontroverted belief.

4. Jennifer advised me to invest in this company. I followed her advice, and now I am rich because of it. As I have always done, I should trust her financial advice.

Or an argument could consist of reasons leading to a completely new belief that no one disagrees with because previously no one had any opinion about it.

5. The blue feathers and the particular kind of nest found here clearly show that blue jays lived here last summer.

The study of logic involves learning standards for the appraisal of completed pieces of reasoning, arguments. The process and attitudes involved in the production of the reasoning are not a part of this study.

An argument has two components. The reasons presented as justifications are the premises of the argument, and the claim that they are intended to justify is the conclusion.

6. Since almost everyone is disappointed with Democratic policies (premise), the Republicans will score significant gains in the next election (conclusion).

7. The cost of transporting needed raw materials to our manufacturing plant has become high (premise). There are other regions nearer the source of supply, where transportation costs are low (premise). In addition, construction costs are low there (premise), and labor costs will be lower than at our present location (premise). Thus we should consider moving (conclusion).

8. The new drug RXQ should not be sold to the public (conclusion), because it contains three known carcinogens and has not been sufficiently tested (premise).

9. Someone is knocking at the back door (premise). The meter man must be here (conclusion).

Logic can be characterized as the discipline that systematically describes the relationship between these two components, telling us when the premises could justify the conclusion.

Of course, people are not always presenting arguments when they speak or write. We tell stories, present facts without argument, ask questions, make exclamations, express admiration, and much more. But whenever reasons are presented for accepting some claim, we have an argument, and giving and evaluating reasons are key elements of intelligent belief formation. When we are using arguments to convince others of a conclusion, the premises and conclusion will be sentences we assert to convince others. When we are confirming our own beliefs or developing new beliefs on our own, the premises and conclusion might be beliefs that are never stated out loud. (Consider examples 4 and 9 above. Most often, a person would draw such a conclusion without saying or writing anything.)

Our goal in studying logic is to identify and examine systematic standards for appraising arguments. In doing so, we focus on how language is used in formulating arguments, because sentences that could be used in expressing beliefs are more visible and more easily studied than beliefs themselves (especially unexpressed beliefs). We study the relationships among sentences that can make them suitable to be the premises and conclusions of good arguments, and we formulate systematic standards for evaluating the relationship between premises and conclusion.

Recognizing Arguments in Ordinary Language

In principle we can take any set of sentences as premises, and any single sentence as a conclusion, and apply our evaluative standards, asking whether the argument with those premises and that conclusion is valid. But most often we are interested in particular arguments because someone has presented the argument as a reason for accepting the conclusion. In doing so, the speaker must state the premises and conclusion and, to be understood, must indicate which sentence is the conclusion. For us to consider a paragraph or series of paragraphs presenting an argument and to evaluate whether the argument presented is valid, we must be able to identify the premises and conclusion of the argument. Several indicator words aid us in doing this. If we see one of these, we can suspect that a conclusion is about to follow.

So
Hence
Thus
Therefore
It must be that
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"The president is very unpopular, so the opposition party will make significant electoral gains." The word 'so' helps to make it clear what is premise and what is conclusion.

We also have words indicating that a premise is about to follow.

For

Since

Because

Due to the fact that

"Since the president is very unpopular, the opposition will make significant electoral gains." These indicator words aid in identifying premises and conclusion.

But all of these aids must be used with care. Many of these words, especially 'since', 'because', and 'so', have other uses, to indicate temporal, causal, or other types of connections.

Since Tuesday he has not studied.

It broke because it dropped.

He shouted 'Help!' so that everyone would look at him.

These statements of temporal relationship and causal sequence are not arguments. Nothing is presented as a reason (a premise) for thinking that some other thing (a conclusion) is true.

It is important to note as well that an argument can be presented without any of these indicator words.

The president is very unpopular, and his party has not used its Senate majority effectively. The opposition will make significant gains in the next election.

As long as we find some sentence or sentences asserted as reasons for believing a further claim, we know that we have an argument. Here what is said in the first sentence might be given as a reason for accepting the second.

However, the absence of indicator words makes it harder to know whether an argument is being given, and it is generally better style to use indicator words to let your audience see clearly when premises are offered in support of a conclusion.

Even when it is clear that an argument is being presented and clear what the conclusion is, it is not always clear just what the entire argument is. Sometimes critical premises are left unstated because they are taken to be general knowledge or taken to be assumptions indicated in an obvious way by the rest of what is said.

Whales must have lungs, because all mammals have lungs.

It is clear that the conclusion is that whales have lungs. But that conclusion is connected with the explicitly stated premise, "all mammals have lungs," only if we assume that whales are mammals. The speaker can take that for granted because it is generally known and because context clearly indicates that the speaker is making this assumption.

EXERCISE 1a

For each passage below, determine whether it presents an argument. If it does, indicate what the conclusion is.

1. Hyenas must live in large groups, because all scavengers live in large groups, and hyenas are scavengers.

2. After a day in the Land Rover, John loves to see the huge congregation of animals at the water hole.

3. Since last summer, when he took his safari vacation, he carries his binoculars everywhere.

4. Since hyenas are not felines, they must be canines.

5. Bob will be angry unless someone brings the binoculars. But if John doesn't bring them, no one will. So if John doesn't bring the binoculars, Bob will be angry.

6. Bob was angry because he had no binoculars.

7. You have no respect for my opinions, I wouldn't discuss that with a jerk like you, and I'm sure that I'm right anyway.

8. If Bob is opposed to killing animals, he shouldn't eat meat.

9. Bob is opposed to killing animals, so he should not eat meat.

10. Bob is opposed to killing animals. Because of this, he didn't join the safari.

MAINTAINING COHERENT BELIEF

Logical connections are important in another context besides that of justifying a conclusion (giving an argument). Logical evaluation can lead us to revise or withdraw beliefs when we see that they stand in logical conflict. Thus I might believe these two things:

AI is trustworthy.

No one trustworthy would take the books from my room without asking.

But later I may find evidence leading me to believe the following:
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AI took the books from my room without asking.

I now have a problem. At least one of these three beliefs is false: the three sentences are logically connected in a way that makes it impossible for all of them to be true. Perhaps AI is not worthy of continued trust; perhaps there is some special reason that could lead someone trustworthy to take the books without asking (maybe the room was flooding); or perhaps the evidence is misleading — AI didn’t really take them. This conflict may lead me to look for further information to help me to decide which of the three claims is false; for further information, logic is sufficient to establish that they cannot all be true.

The principles at work in arguments are also at work here. Some sets of beliefs are logically acceptable, but others are not. All of the analytical techniques that help us to distinguish acceptable arguments from unacceptable sets of arguments will also help in distinguishing logically unacceptable sets of beliefs from logically acceptable sets. A set of sentences or beliefs like those in our example is an inconsistent set because there is no possible way for all of them to be true; at least one is false. Thus it is not fully acceptable to believe all three; you are sure to be wrong about at least one of them if you do.

Although our main focus will be the study of arguments, we will sometimes apply our analytical skills to showing the inconsistency of sets of sentences. In addition, it will be very useful later to discuss some of the relationships that exist between inconsistent sets of sentences and arguments.

VALIDITY AND SOUNDNESS

We need additional precise terminology to help us to focus on justification. Consider the following two arguments. (Here we will follow the useful practice in logic of writing premises separately and marking the conclusion with a special symbol, ‘::’. Ordinarily, when we present arguments in English, we use such words as ‘therefore’, ‘thus’, and ‘so’ to indicate the conclusion. But the special symbol makes the conclusion stand out more visibly.)

1. If Socrates was human, then he was warm-blooded.
   Socrates was human.
   :: Socrates was warm-blooded.

2. If Socrates was a plumber, then he used a plunger.
   Socrates was a plumber.
   :: Socrates used a plunger.

We can all readily recognize 1 to be a good argument. But is 2 a good argument? That question should not be quite so easy to answer, because the question itself is too crude. There are two important distinct factors that go into making an argument good:

Argument 1 has a bad feature and a good feature. On the bad side, it has a false premise, so it cannot be a convincing argument among those of us who recognize the premise’s falsity. But on the good side, the premises have the right sort of connection with the conclusion. If the premises were true, the conclusion would have to be true as well. In this book we are concerned primarily with the study of this connection between premises and conclusion; that is, we are concerned with what it would be for premises to support or justify a conclusion if they were true. This key concept of logic is the concept of valid argument, and this concept can be explained in either of two ways:

1. In a valid argument, if the premises were all true, the conclusion would also be true.

2. In a valid argument, it is not possible for the conclusion to be false when all the premises are true.

The study of logic is the systematic characterization of the validating relationships that can exist between premises and conclusion. These characterizations enable us to understand what makes some arguments valid and provide us with resources for showing that arguments are valid.

When it is possible for an argument to have true premises with a false conclusion, the argument is invalid. No special relationship guarantees that if the premises are true, the conclusion must also be true. In other words, there is no guarantee that truth will be preserved when the step is taken from the premises to the conclusion in an invalid argument.

Both of the preceding examples, 1 and 2, are valid arguments. The premises and conclusion are connected in the right sort of way; it is not possible for the conclusion to be false when the premises are true. In any possible situation in which the premises are true, the conclusion is also true. But 1 cannot be seen to be a much better argument than 2 when we consider the other evaluative factor, the facts about Socrates. Every premise of 1 is true, but that does not apply to 2. So let us introduce another important term of evaluation.

A sound argument is an argument with both of the following features:

1. It is valid.

2. All of its premises are true.

In seeking to establish new truths on the basis of things already known, we are seeking sound arguments. Because they are valid and have true premises, they must also have true conclusions. (Valid argument preserves truth, so that if we start with all true premises in a valid argument, we are certain to have a true conclusion.) An unsound argument, on the other hand, is one that fails one or
both of the conditions for soundness; either it is invalid or it has one or more false premises.

Logic alone cannot usually certify that an argument is sound. The
principles of valid argument are logic's domain of study and analysis, and the
question of soundness generally depends on nonlogical facts, for example, on
the historical fact that Socrates was not a plumber. Logic is concerned with
more general features of argument, features that can characterize an argument
no matter what its subject matter. The principles of reasoning and justification
studied here apply to reasoning about every subject matter.

Notice that validity is a concept that involves the full range of truth-value
possibilities. In a valid argument, it is impossible to have the premises true
with the conclusion false; that is, in every possible situation, if the premises
are true, the conclusion is true. In trying to show that an argument is valid, do
not try to determine whether the conclusion is actually true or false (in other
words, do not try to determine the actual truth-value of the conclusion), and
do not try to determine the actual truth-values of the premises. Validity has to
do with the full range of truth-value possibilities, and the actual truth-values
represent just one truth-value possibility. In a valid argument, the premises
and conclusion constitute a unit such that in every possible situation, if the
premises were true, the conclusion would have to be true. In showing that an
argument is valid, one must consider the full range of possibilities, checking
to see whether connections exist that rule out the possibility of true premises
with a false conclusion.

Some examples may make clearer how we are concerned with truth-value
possibilities, not with actual truth-values.

1. If John were to fail chemistry, he would not graduate. John will not
fail chemistry. Therefore, he will graduate.

2. All primates have some broad teeth. All mammals that eat vegetables
have some broad teeth. So all primates are mammals that eat vegetables.

3. Some dogs won't dance unless they get birthday cake. Anything that
won't dance will be painted blue. So some dogs will be painted blue
unless they get birthday cake.

We can determine that only example 3 is valid, even though 2 consists of true
sentences, 3 consists of false sentences, and 1 consists of sentences
concerning which we have no idea what the truth-value is. (The actual truth-
values are of no significance here.) In both examples 1 and 2 we can think of
possible situations in which the premises would be true and the conclusion
false. In example 1, John might pass chemistry but fail some other course he
needed for graduation. In example 2, it might have been that many creatures
that did not eat vegetables, including some primates that did not eat
vegetables, had broad teeth. Nothing in the premises rules this out, so the

CONSIDERING THE POSSIBILITIES

The definition of validity in terms of possible situations gives us an especially
useful way to think of validity. To establish that an argument is valid, it seems
that we must somehow show that no possible situation exists in which the
premises are true with the conclusion false. We will develop techniques for
doing that throughout this book. But this definition tells us immediately how
we could show someone that an argument is invalid: an example of just one
possible situation in which the premises are true with the conclusion false will
guarantee invalidity.

Suppose that someone were to argue in the following way:

Since some lawyers are senators (premise), and some senators are
old (premise), it must be that some lawyers are old (conclusion).

One way to see that this is invalid is to see clearly that there could be a
possible situation in which the premises were true with the conclusion false.
For example, if things became so bad with the law profession that we decided
to kill off all the lawyers and start over again, allowing no one over 30 to
become a lawyer, then after a short while we might have a situation in which
the premises were true with the conclusion false. If a few of the new, young
lawyers were elected to the senate (joining some of the old nonlawyers
already there), there could be a situation in which these were true:

Some lawyers are senators.
Some senators are old.
But the following would be false.
Some lawyers are old.
Thus the argument cannot be valid because it is possible for the premises to be
ture with the conclusion false.
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Note how we need just one possible situation to show invalidity. This situation can be very farfetched as long as it is clearly a possible situation. If we try to describe a situation in which some simple valid argument has true premises with a false conclusion, we will not succeed. For example, imagine a situation in which these sentences are true:

If Socrates was human, then he was warm-blooded.
Socrates was human.
Now try to add to the situation that the following sentence is false (while the others are still true):
Socrates was warm-blooded.
There is no such possible situation. To make the conclusion false, one must also falsify at least one of the premises. Attempts to show invalidity fail.
With more complex arguments, it is not so obvious when the attempt to describe a possible situation succeeds and when it fails. We will develop techniques of argument evaluation that can be applied to both simple and complex arguments.

RECOGNITION, UNDERSTANDING, AND PRACTICE

Many people (though not all) can distinguish good violinists from bad ones. A much smaller number understand some of the things that make someone a good violinist. A few people can even explain what makes one performance of a violin piece better than another. Understanding and explaining what makes good violin playing are of course very different from playing the violin well.

Often, people do pretty well at distinguishing simple valid arguments from invalid arguments. Our studies, though, will take us beyond that to an understanding of some of the logical connections that make for valid reasoning, and we will begin to develop the ability to explain why some arguments are better than others. We can develop the ability to show (prove) conclusively that something is correctly reasoned.

Understanding what constitutes good reasoning is different from reasoning well, just as understanding what constitutes good violin playing is different from playing the violin well. But in the case of reasoning there is, I think, a closer connection between knowledge and practice. For one thing, everyone observes and practices reasoning daily. Students will see reasoning and be forced to give reasons in almost all of their work, so that the practice that connects understanding with the exercise of the ability is much more common in the case of argument than it is in the case of violin playing. In addition, there is a systematically organized body of information about valid argument, whereas good violin playing involves a great variety of skills and

has no single systematic core of the sort that exists for the practice of giving valid arguments.

DEDUCTIVE VALIDITY AND INDUCTIVE STRENGTH

When we ask whether an argument is valid, we set a very high standard of appraisal. In a valid argument a false conclusion with true premises must be impossible. But premises sometimes support a conclusion even when they do not meet that high standard.

The weather report says that a low-pressure storm system is moving over us and that is will soon rain.
This weather report is usually right.
The sky is completely overcast.

It will soon rain.

These three premises support this conclusion even though the argument is not valid. It is possible for the premises to be true and the conclusion false, but not very likely. The support is strong but not absolute.

When we evaluate arguments we do not always want to look only for the cases in which it is impossible for the premises to be true with conclusion false. Sometimes that evaluative standard is inappropriate because it was never intended that the argument would meet that standard. Instead, we should apply a different standard, asking whether the premises support the conclusion in some other way: for example, by making the conclusion plausible or by making it more plausible than it otherwise would be.

So we need to distinguish at least two different standards for evaluating arguments. The notion of validity introduced earlier is also known as the deductive standard of evaluation for arguments. Arguments meeting that standard are deductively valid: it is impossible for the premises to be true with the conclusion false. This contrasts with inductive standards for appraising arguments. An argument is inductively strong when the premises provide strong support for the conclusion, and additional study of justification would try to formulate standards for determining when there is an inductively strong connection between premises and conclusion.

Inductive strength comes in degrees in a way that deductive validity does not. Further premises can make an argument stronger or weaker. If we add the following to the premises:

It is raining just west of here and the front is moving east.
then our argument becomes even stronger. If we had instead added:
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But clearing is reported just west of here and it has not yet rained within miles of here.

the argument would have become weaker. Adding further premises cannot make a deductively valid argument more or less valid. If an argument is deductively valid, the premises already contain enough information to guarantee that the conclusion is true (if the premises are true). Deductive validity does not come in degrees in the way that inductive strength does.

In many cases we can reconstruct slightly different arguments from a single paragraph. The arguments may even differ in whether inductive or deductive standards should apply. Consider the following example (presented at the beginning of this chapter).

I know from a class survey that none of my students last semester were studying engineering, and Carol was among my students. Thus I can be sure that Carol was not studying engineering last semester.

If we take it for granted that the class survey provided accurate information about all the students, the following deductively valid argument might be the appropriate one to consider:

None of my students last semester were studying engineering last semester.

So Carol was not studying engineering last semester.

But if we wanted to be more cautious in what we concluded from our survey, we might wish to make its role explicit.

Each of my students answering last semester's class survey said that he or she was not studying engineering.

So Carol was not studying engineering last semester.

These premises may provide support (even strong support) for the conclusion, but the argument is not deductively valid, nor is it intended to be. There are ways in which the premises might be true and the conclusion false—if Carol did not answer the survey, or if she lied, for example.

In this book we are concerned solely with deductive validity. There is a systematic and well-understood body of theory that we will master. No similar body of systematic theory exists for the understanding of inductive strength.

EXERCISE 1b

For each example, answer the applicable questions. (Note that questions b and c are not applicable if the answer to question a is 'no', and questions c is not applicable if the answer to question b is 'no'.)

a. Does this passage present an argument?

b. Is the argument valid?

c. Is the argument sound? (You might not be able to answer this question, even in the case of some of the valid arguments.)

1. All doctors have degrees, and all lawyers have degrees. So at least some doctors must be lawyers.

2. Since all doctors have degrees, and anyone who has a degree has attended school, every doctor must have attended school.

3. Every doctor is a lawyer. Every lawyer has a degree. Thus every doctor must have a degree.

4. Some surgeons are lawyers, but no lawyers have studied medicine. So some surgeons haven't studied medicine.

5. Every surgeon in New York is licensed to do surgery. Some doctors are surgeons in New York. Thus some doctors are licensed to do surgery.

6. Doctors and lawyers have clients, and they are also similar in other ways.

7. At least some doctors perform surgery, so, since no lawyers perform surgery, not all doctors are lawyers.


A TERMINOLOGICAL NOTE

Ordinary language has several ways of talking about the connection between premises and conclusion. If an argument is deductively valid we may say that:

The premises imply the conclusion.

The premises entail the conclusion.

The premises support the conclusion.

The conclusion follows from the premises.

The conclusion can be deduced from the premises.

The conclusion is a consequence of the premises.

The conclusion can be validly inferred (from the premises).

The argument is valid.

The reasoning is conclusive.

The inference is valid.
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KEY TERMS AND CONCEPTS

ARGUMENT: A belief or sentence together with some reasons for accepting it.

CONCLUSION OF AN ARGUMENT: The belief or sentence for which reasons are given in the argument.

PREMISES OF AN ARGUMENT: The beliefs or sentences that are the reasons given for accepting the conclusion.

VALID ARGUMENT: An argument in which it is impossible that the premises are true and the conclusion false; that is, in any possible situation, if the premises are true, the conclusion is also true (also called a deductively valid argument).

SOUND ARGUMENT: A valid argument with true premises.

INDUCTIVELY STRONG ARGUMENT: Argument in which adequate reasons for accepting the conclusion are provided.

CONSISTENT SET OF SENTENCES OR BELIEFS: A set of sentences or beliefs that could (in some possible, although perhaps nonactual situation) all be true.

INCONSISTENT SET OF SENTENCES OR BELIEFS: Not consistent. There is no possible situation in which every member of the set is true.

INDICATOR WORDS: Preceding a conclusion: so, hence, therefore, it must be that, thus; preceding a premises: for, since, because.

TRUTH-FUNCTIONAL REPRESENTATION: CONJUNCTION, DISJUNCTION, NEGATION

All of us have some ability to recognize simple valid arguments and pick out inconsistencies. In studying logic we will also develop an understanding of what makes some arguments valid and an ability to show arguments to be valid. In developing this understanding, we will also refine and extend the skills of recognition that already exist. The refinement of these skills and the development of this understanding require isolation of the elements of sentences that make recognition of valid arguments possible, and we will see how those elements of sentences are involved in connecting sentences together in a way that can make an argument valid. Once we have this understanding, we can use it as a foundation for the further skill of showing arguments to be valid.

COMPOUND SENTENCES

Suppose that we overhear this conversation:

Ali: John will study hard tonight or he will fail his exam tomorrow.

Bill: But John will not study hard tonight.

We know that if both of these claims are true, then this is also true:

John will fail his exam tomorrow.

We are recognizing the valid argument (A):

(A) 1. John will study hard tonight or he will fail his exam tomorrow.

2. John will not study hard tonight.