1.1.2. Inference and arguments

The norms studied in logic can concern many different features of reasoning and we will consider several of these. But the most important one and the one that will receive most of our attention is ***inference***, the process of drawing a ***conclusion*** from certain ***premises*** or ***assumptions***.

Inferences are to be found in science when generalizations are based on data or when a hypothesis is offered as the best explanation of some phenomenon. They are also to be found when theorems are proved in mathematics. But the most common case of inference calls less attention to itself. Much of the process of understanding what we hear or read can be seen to involve inference. We may simply extract information that is provided by the spoken or written text and formulate it as an answer to a question we find of interest, or we may go beyond what has been said or written in a way that clarifies its significance for us. In either case, as in the cases of inference in mathematics and the experimental sciences, we can be understood to formulate a statement that we base on certain other statements. Of course, a reasoner may not formulate an explicit statement of a conclusion or of the data it is based on; but, to the extent that reasoning is articulated sufficiently to apply norms, such statements must be seen to be implicit in it.

The terminology we will use to speak of inference deserves some comment. The terms *premise* and *assumption* both to refer to the starting points of inference—whether these be observational data, mathematical axioms, or the statements making up something heard or read. The term *premise* is most appropriate when the claim or claims from which we draw a conclusion are ones that we accept. The term *assumption* need not carry this suggestion, and we may speak of something being "assumed for the sake of argument." But, in general, we will be far more interested in judging the transition from the starting point of an inference to its conclusion than in judging the soundness of its starting point, so the distinction between premises and assumptions will not have a crucial role for us; and, for the most part, we will use the two terms interchangeably. (If it should seem strange to suppose that you might draw conclusions from claims you do not accept, imagine going over a body of data to check for inconsistencies either within the data or with information from other sources. In this sort of case, you may well extract information from data that you do not accept and, indeed, extract this information as a way of showing that the data is unacceptable.)

It is convenient to have a term for a conclusion taken together with the premises or assumptions on which it is based. We will follow tradition and label such a combination of premises and conclusion an ***argument***. A particularly graphic way of writing an argument is to list the premises (in any order) with the conclusion following and separated off by a horizontal line (as shown in Figure 1.1.2-1). The sample argument shown here is a version of a widely used traditional example and has often served as a paradigm of the sort of reasoning studied by deductive logic.

premises	*All humans are mortal*
	Socrates is human
conclusion	*Socrates is mortal*

Fig. 1.1.2-1. The components of an argument.

This example serves to emphasize again that the concepts of inference and argument can be applied not only to reasoning from experimental data or mathematical axioms, but to any reasoning where a conclusion is drawn from certain statements. It also shows that the extraction of information need not be limited to the collection and summary of data. The information expressed in the conclusion is the result of an interaction between the two premises. In its broadest sense, the traditional term ***syllogism*** (whose etymology might be rendered as 'reckoning together') applies in the first instance to this sort of inference, and the argument above is a traditional example of a syllogism.

It is also useful to have some abstract notation so that we can speak of arguments and their components generally without displaying specific examples. We will use the lower case Greek letters φ, ψ, and χ to stand for the individual sentences that may appear as the conclusion of an argument or as its premises. And we will use upper case Greek Γ, Σ, and Δ to stand for sets of sentences, such as the full set of premises of an argument. We will use / (***solidus*** or slash) to divide the premises from the conclusion when an argument is represented horizontally, so the argument above might be written horizontally as *All humans are mortal*, *Socrates is human* / *Socrates is mortal*. The general form shared by all arguments can then be expressed as Γ / φ, where Γ is the set of premises and φ is the conclusion.

Although we speak of the premises of an argument as forming a set, in practice what appears to the left of the sign / will often be a list of sentences, and a symbol like Γ can often best be thought of as standing for such a list. The reason for speaking of sets at all is that while the items in a list appear in a particular order and can appear more than once, we have no concern to distinguish arguments on the basis of the order of their premises or the number of times a premise appears; and this means that we regard two arguments that share a conclusion as the same if their premises form the same set. There are other features of sets, however, which are of little use to us. In particular, we have no need to distinguish between a sentence φ and the set {φ} that has φ as its only member, and we will not attempt to preserve this distinction in our notation for arguments.

If we regard the capital Greek letters as standing for lists of sentences, it makes sense to write Γ, φ / ψ to speak of an argument whose premises consist of the members of Γ together with φ—that is, the set of whose premises is the union of Γ and {φ}. Since this idea does not exclude the possibility that φ is itself a member of Γ, it provides convenient way to refer to any argument whose premises include φ.

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