trialism, with a scientific technique very different from traditional culture. A third cause was popular education, which conferred the power to read and write, but did not confer culture; this enabled a new type of demagogue to practise a new type of propaganda, as seen in the dictatorships.

Both for good and evil, therefore, the day of the cultured gentleman is past.

CHAPTER XXII

Aristotle's Logic

ARISTOTLE'S influence, which was very great in many different fields, was greatest of all in logic. In late antiquity, when Plato was still supreme in metaphysics, Aristotle was the recognized authority in logic, and he retained this position throughout the Middle Ages. It was not till the thirteenth century that Christian philosophers accorded him supremacy in the field of metaphysics. This supremacy was largely lost after the Renaissance, but his supremacy in logic survived. Even at the present day, all Catholic teachers of philosophy and many others still obstinately reject the discoveries of modern logic, and adhere with a strange tenacity to a system which is as definitely antiquated as Ptolemaic astronomy. This makes it difficult to do historical justice to Aristotle. His present-day influence is so inimical to clear thinking that it is hard to remember how great an advance he made upon all his predecessors (including Plato), or how admirable his logical work would still seem if it had been a stage in a continual progress, instead of being (as in fact it was) a dead end, followed by over two thousand years of stagnation. In dealing with the predecessors of Aristotle, it is not necessary to remind the reader that they are not verbally inspired; one can therefore praise them for their ability without being supposed to subscribe to all their doctrines. Aristotle, on the contrary, is still, especially in logic, a battle-ground, and cannot be treated in a purely historical spirit.

Aristotle's most important work in logic is the doctrine of the syllogism. A syllogism is an argument consisting of three parts, a major premiss, a minor premiss, and a conclusion. Syllogisms are of a number of different kinds, each of which has a name, given by the scholastics. The most familiar is the kind called "Barbara":

All men are mortal (Major premiss).
Socrates is a man (Minor premiss).
Therefore: Socrates is mortal (Conclusion).
Or: All men are mortal.
All Greeks are men.
Therefore: All Greeks are mortal.

(Aristotle does not distinguish between these two forms; this, as we shall see later, is a mistake.)
Other forms are: No fishes are rational, all sharks are fishes, therefore no sharks are rational. (This is called "Celarent.")

All men are rational, some animals are men, therefore some animals are rational. (This is called "Darii.")

No Greeks are black, some men are Greeks, therefore some men are not black. (This is called "Ferio.")

These four make up the "first figure"; Aristotle adds a second and third figure, and the schoolmen added a fourth. It is shown that the three later figures can be reduced to the first by various devices.

There are some inferences that can be made from a single premiss. From "some men are mortal" we can infer that "some mortals are men." According to Aristotle, this can also be inferred from "all men are mortal." From "no gods are mortal" we can infer "no mortals are gods," but from "some men are not Greeks" it does not follow that "some Greeks are not men."

Apart from such inferences as the above, Aristotle and his followers thought that all deductive inference, when strictly stated, is syllogistic. By setting forth all the valid kinds of syllogism, and setting out any suggested argument in syllogistic form, it should therefore be possible to avoid all fallacies.

This system was the beginning of formal logic, and, as such, was both important and admirable. But considered as the end, not the beginning, of formal logic, it is open to three kinds of criticism:

(1) Formal defects within the system itself.

(2) Over-estimation of the syllogism, as compared to other forms of deductive argument.

(3) Over-estimation of deduction as a form of argument.

On each of these three, something must be said.

(1) *Formal defects.* Let us begin with the two statements "Socrates is a man" and "all Greeks are men." It is necessary to make a sharp distinction between these two, which is not done in Aristotelian logic. The statement "all Greeks are men" is commonly interpreted as implying that there are Greeks; without this implication, some of Aristotle's syllogisms are not valid. Take for instance:

"All Greeks are men, all Greeks are white, therefore some men are white." This is valid if there are Greeks, but not otherwise. If I were to say:

"All golden mountains are mountains, all golden mountains are golden, therefore some mountains are golden," my conclusion would be false, though in some sense my premisses would be true. If we are to be explicit, we must therefore divide the one statement "all Greeks are men" into two, one saying "there are Greeks," and the other saying "if anything is a Greek, it is a man." The latter statement is purely hypothetical, and does not imply that there are Greeks.

The statement "all Greeks are men" is thus much more complex in form than the statement "Socrates is a man." "Socrates is a man" has "Socrates" for its subject, but "all Greeks are men" does not have "all Greeks" for its subject, for there is nothing about "all Greeks" either in the statement "there are Greeks" or in the statement "if anything is a Greek it is a man."

This purely formal error was a source of errors in metaphysics and theory of knowledge. Consider the state of our knowledge in regard to the two propositions "Socrates is mortal" and "all men are mortal." In order to know the truth of "Socrates is mortal," most of us are content to rely upon testimony; but if testimony is to be reliable, it must lead us back to some one who knew Socrates and saw him dead. The one perceived fact—the dead body of Socrates—together with the knowledge that this was called "Socrates," was enough to assure us of the mortality of Socrates. But when it comes to "all men are mortal," the matter is different. The question of our knowledge of such general propositions is a very difficult one. Sometimes

they are merely verbal: "all Greeks are men" is known because nothing is called "a Greek" unless it is a man. Such general statements can be ascertained from the dictionary; they tell us nothing about the world except how words are used. But "all men are mortal" is not of this sort; there is nothing logically self-contradictory about an immortal man. We believe the proposition on the basis of induction, because there is no well-authenticated case of a man living more than (say) 150 years; but this only makes the proposition probable, not certain. It cannot be certain so long as living men exist.

Metaphysical errors arose through supposing that "all men" is the subject of "all men are mortal" in the same sense as that in which "Socrates" is the subject of "Socrates is mortal." It made it possible to hold that, in some sense, "all men" denotes an entity of the same sort as that denoted by "Socrates." This led Aristotle to say that in a sense a species is a substance. He is careful to qualify this statement, but his followers, especially Porphyry, showed less caution.

Another error into which Aristotle falls through this mistake is to think that a predicate of a predicate can be a predicate of the original subject. If I say "Socrates is Greek, all Greeks are human," Aristotle thinks that "human" is a predicate of "Greek," while "Greek" is a predicate of "Socrates," and obviously "human" is a predicate of "Socrates." But in fact "human" is not a predicate of "Greek." The distinction between names and predicates, or, in metaphysical language, between particulars and universals, is thus blurred, with disastrous consequences to philosophy. One of the resulting confusions was to suppose that a class with only one member is identical with that one member. This made it impossible to have a correct theory of the number *one*, and led to endless bad metaphysics about unity.

(2) *Over-estimation of the syllogism.* The syllogism is only one kind of deductive argument. In mathematics, which is wholly deductive, syllogisms hardly ever occur. Of course it would be possible to re-write mathematical arguments in syllogistic form, but this would be very artificial and would not make them any more cogent. Take arithmetic, for example. If I buy goods worth $4.63, and tender a $5 bill in payment, how much change is due to me? To put this simple sum in the form of a syllogism would be absurd, and would tend to conceal the real nature of the argument. Again, within logic there are non-syllogistic inferences, such as: "A horse is an animal, there-

fore a horse's head is an animal's head." Valid syllogisms, in fact, are only some among valid deductions, and have no logical priority over others. The attempt to give pre-eminence to the syllogism in deduction misled philosophers as to the nature of mathematical reasoning. Kant, who perceived that mathematics is not syllogistic, inferred that it uses extra-logical principles, which, however, he supposed to be as certain as those of logic. He, like his predecessors, though in a different way, was misled by respect for Aristotle.

(3) *Over-estimation of deduction.* The Greeks in general attached more importance to deduction as a source of knowledge than modern philosophers do. In this respect, Aristotle was less at fault than Plato; he repeatedly admitted the importance of induction, and he devoted considerable attention to the question: how do we know the first premisses from which deduction must start? Nevertheless, he, like other Greeks, gave undue prominence to deduction in his theory of knowledge. We shall agree that Mr. Smith (say) is mortal, and we may, loosely, say that we know this because we know that all men are mortal. But what we really know is not "all men are mortal"; we know rather something like "all men born more than one hundred and fifty years ago are mortal, and so are almost all men born more than one hundred years ago." This is our reason for thinking that Mr. Smith will die. But this argument is an induction, not a deduction. It has less cogency than a deduction, and yields only a probability, not a certainty; but on the other hand it gives *new* knowledge, which deduction does not. All the important inferences outside logic and pure mathematics are inductive, not deductive; the only exceptions are law and theology, each of which derives its first principles from an unquestionable text, viz. the statute books or the scriptures.

Apart from *The Prior Analytics*, which deals with the syllogism, there are other writings of Aristotle which have considerable importance in the history of philosophy. One of these is the short work on *The Categories*. Porphyry the Neoplatonist wrote a commentary on this book, which had a very notable influence on medieval philosophy; but for the present let us ignore Porphyry and confine ourselves to Aristotle.

What, exactly, is meant by the word "category," whether in Aristotle or in Kant and Hegel, I must confess that I have never been able

to understand. I do not myself believe that the term "category" is in any way useful in philosophy, as representing any clear idea. There are, in Aristotle, ten categories: substance, quantity, quality, relation, place, time, position, state, action, and affection. The only definition offered of the term "category" is: "expressions which are in no way composite signify"—and then follows the above list. This seems to mean that every word of which the meaning is not compounded of the meanings of other words signifies a substance or a quantity or etc. There is no suggestion of any principle on which the list of ten categories has been compiled.

"Substance" is primarily what is not predicable of a subject nor present in a subject. A thing is said to be "present in a subject" when, though not a part of the subject, it cannot exist without the subject. The instances given are a piece of grammatical knowledge which is present in a mind, and a certain whiteness which may be present in a body. A substance in the above primary sense is an individual thing or person or animal. But in a secondary sense a species or a genus—e.g., "man" or "animal"—may be called a substance. This secondary sense seems indefensible, and opened the door, in later writers, to much bad metaphysics.

The Posterior Analytics is a work largely concerned with a question which must trouble any deductive theory, namely: How are first premisses obtained? Since deduction must start from somewhere, we must begin with something unproved, which must be known otherwise than by demonstration. I shall not give Aristotle's theory in detail, since it depends upon the notion of *essence*. A definition, he says, is a statement of a thing's essential nature. The notion of essence is an intimate part of every philosophy subsequent to Aristotle, until we come to modern times. It is, in my opinion, a hopelessly muddle-headed notion, but its historical importance requires us to say something about it.

The "essence" of a thing appears to have meant "those of its properties which it cannot change without losing its identity." Socrates may be sometimes happy, sometimes sad; sometimes well, sometimes ill. Since he can change these properties without ceasing to be Socrates, they are no part of his essence. But it is supposed to be of the essence of Socrates that he is a man, though a Pythagorean, who believes in transmigration, will not admit this. In fact, the question of

"essence" is one as to the use of words. We apply the same name, on different occasions, to somewhat different occurrences, which we regard as manifestations of a single "thing" or "person." In fact, however, this is only a verbal convenience. The "essence" of Socrates thus consists of those properties in the absence of which we should not use the name "Socrates." The question is purely linguistic: a *word* may have an essence, but a *thing* cannot.

The conception of "substance," like that of "essence," is a transference to metaphysics of what is only a linguistic convenience. We find it convenient, in describing the world, to describe a certain number of occurrences as events in the life of "Socrates," and a certain number of others as events in the life of "Mr. Smith." This leads us to think of "Socrates" or "Mr. Smith" as denoting something that persists through a certain number of years, and as in some way more "solid" and "real" than the events that happen to him. If Socrates is ill, we think that Socrates, at other times, is well, and therefore the being of Socrates is independent of his illness; illness, on the other hand, requires somebody to be ill. But although Socrates need not be ill, *something* must be occurring to him if he is to be considered to exist. He is not, therefore, really any more "solid" than the things that happen to him.

"Substance," when taken seriously, is a concept impossible to free from difficulties. A substance is supposed to be the subject of properties, and to be something distinct from all its properties. But when we take away the properties, and try to imagine the substance by itself, we find that there is nothing left. To put the matter in another way: What distinguishes one substance from another? Not difference of properties, for, according to the logic of substance, difference of properties presupposes numerical diversity between the substances concerned. Two substances, therefore, must be *just* two, without being, in themselves, in any way distinguishable. How, then, are we ever to find out that they *are* two?

"Substance," in fact, is merely a convenient way of collecting events into bundles. What can we know about Mr. Smith? When we look at him, we see a pattern of colours; when we listen to him talking, we hear a series of sounds. We believe that, like us, he has thoughts and feelings. But what is Mr. Smith apart from all these occurrences? A mere imaginary hook, from which the occurrences

are supposed to hang. They have in fact no need of a hook, any more than the earth needs an elephant to rest upon. Any one can see, in the analogous case of a geographical region, that such a word as "France" (say) is only a linguistic convenience, and that there is not a *thing* called "France" over and above its various parts. The same holds of "Mr. Smith"; it is a collective name for a number of occurrences. If we take it as anything more, it denotes something completely unknowable, and therefore not needed for the expression of what we know.

"Substance," in a word, is a metaphysical mistake, due to transference to the world-structure of the structure of sentences composed of a subject and a predicate.

I conclude that the Aristotelian doctrines with which we have been concerned in this chapter are wholly false, with the exception of the formal theory of the syllogism, which is unimportant. Any person in the present day who wishes to learn logic will be wasting his time if he reads Aristotle or any of his disciples. None the less, Aristotle's logical writings show great ability, and would have been useful to mankind if they had appeared at a time when intellectual originality was still active. Unfortunately, they appeared at the very end of the creative period of Greek thought, and therefore came to be accepted as authoritative. By the time that logical orginality revived, a reign of two thousand years had made Aristotle very difficult to dethrone. Throughout modern times, practically every advance in science, in logic, or in philosophy has had to be made in the teeth of the opposition from Aristotle's disciples.

CHAPTER XXIII

Aristotle's Physics

IN this chapter I propose to consider two of Aristotle's books, the one called *Physics* and the one called *On the Heavens*. These two books are closely connected; the second takes up the argument at the point at which the first has left it. Both were extremely influential, and dominated science until the time of Galileo. Words such as "quintessence" and "sublunary" are derived from the theories expressed in these books. The historian of philosophy, accordingly, must study them, in spite of the fact that hardly a sentence in either can be accepted in the light of modern science.

To understand the views of Aristotle, as of most Greeks, on physics, it is necessary to apprehend their imaginative background. Every philosopher, in addition to the formal system which he offers to the world, has another, much simpler, of which he may be quite unaware. If he is aware of it, he probably realizes that it won't quite do; he therefore conceals it, and sets forth something more sophisticated, which he believes because it is like his crude system, but which he asks others to accept because he thinks he has made it such as cannot be disproved. The sophistication comes in by way of refutation of refutations, but this alone will never give a positive result: it shows, at best, that a theory *may* be true, not that it *must* be. The positive result, however little the philosopher may realize it, is due to his imaginative preconceptions, or to what Santayana calls "animal faith."

In relation to physics, Aristotle's imaginative background was very different from that of a modern student. Now-a-days, a boy begins with mechanics, which, by its very name, suggests machines. He is accustomed to motor-cars and aeroplanes; he does not, even in the dimmest recesses of his subconscious imagination, think that a motor-car contains some sort of horse in its inside, or that an aeroplane flies