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## **Logic (1937)**

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WHEN we reflect upon the behavior of men, whether of individuals or of groups, we see that they are dominated more by their passions than by their reason. Especially when surveying contemporary society, one could almost despair of the role of logic as a factor determining human behavior. Nevertheless, to see clearly on the matter, it is essential that we obtain an adequate conception of the province of logic. By doing so we will be able to distinguish between thinking which is irrational or illogical and thinking which is reasonable or logical, and thus win a richer understanding of the ways in which logical and illogical thought may influence the activities of men.

The cardinal point about which we must become clear is that logic is not concerned with human behavior in the same sense that physiology, psychology, and social sciences are concerned with it. These sciences formulate laws or universal statements which have as their subject matter human activities as processes in time. Logic, on the contrary, is concerned with *relations* between factual sentences (or thoughts). If logic ever discusses the truth of factual sentences it does so only *conditionally*, somewhat as follows: *if* such-and-such a sentence is true, *then* such-and- such another sentence is true. Logic itself does not decide whether the first sentence *is* true, but surrenders that question to one or the other of the empirical sciences. Consequently,

since the rules of logic refer simply to various *relations* between sentences (or thoughts), we can distinguish between thinking which is in accordance with these rules and thinking which violates them. The former we shall call *logical thinking*, the latter *illogical*. On the other hand, although logic itself is not concerned with facts, a process of thought, whether it be logical or illogical, is an actual fact. And it is a question of greatest importance, both for the individual and for society, whether our thinking is logical or not.

Contemporary logical theory is too vast and technical to be summarized here. It is, however, possible to view at least a part of this theory as defining the conditions of logical thought. And in what follows, I wish to consider the requirements which thinking must satisfy in order to be logical or reasonable. These requirements can be summarized briefly under the following three heads: clarity, consistency, and adequacy of evidence.

1. The *condition of clarity* may be formulated as follows. We must become clear as to what is the subject of our talking and thinking. Although this requirement may seem trivial, in practice it is often not observed. The most serious and frequent breaches of this rule occur whenever sentences are uttered which are taken to assert something, although in fact nothing is asserted, whether truly or falsely. Such self-deceptions have their source, for the most part, in the structure of our common-day language. For our common language is well adapted for obtaining the gross agreements necessary in practical affairs; but when employed in theoretical pursuits to formulate and communicate knowledge, it is very often not merely inadequate but even seriously misleading.

A little reflection will therefore show that we must distinguish between

two main functions which expressions may have. Certain expressions in our language assert something, and are therefore either true or false. Such expressions exercise a *cognitive function* and have a cognitive meaning. On the other hand, certain expressions express the emotions, fancies, images, or wishes of the speaker, and under proper conditions evoke emotions, wishes, or resolutions in the hearer. Such expressions will be said to exercise an *expressive function*, and it is possible to subdivide them further into expressions with pictorial, emotional, and volitional functions. An expression may exercise these different expressive functions simultaneously; and it often is the case that a sentence with cognitive meaning may also possess one or more of the expressive functions. It is of prime importance to note that not all expressions of our language possess a cognitive meaning, so that we must distinguish between those which do and those whose function is solely expressive.

This distinction is frequently concealed by the fact that sentences with solely expressive functions sometimes have the grammatical form of statements which are either true or false. Hence we are led to believe, quite mistakenly, that such sentences do have cognitive meaning. When a lyric poet sings of the melancholy forest or the friendly gleam of moonlight, his utterances take the form of factual statements. However, everyone realizes that the poem is not to be taken as a factual description of the forest or the moon; for it is tacitly understood that the lyric poem is simply expressive of a mood, exactly as music is. But what is so evident in poetry is often far from clear in philosophy. Careful logical analysis has shown that many sentences uttered by trans-empirical metaphysicians appear to have cognitive

meaning simply because their grammatical form is that of genuine assertions, although in fact these utterances exercise a solely expressive function. For example, a metaphysician may say, "The fact that all objects in nature, down to the smallest particles of matter, attract and repel one another, is to be explained by the love and hate which these objects bear toward one another." If such a metaphysician supposes that his explanation adds anything to our knowledge of the empirical facts of attraction and repulsion, he is grossly in error, misled by his language. For his statement (or better, pseudo-statement) asserts nothing whatsoever, and simply associates certain images and sentiments with our knowledge of the attraction and repulsion of bodies. His statement has, therefore, no cognitive meaning, although it has a pictorial and emotional function. It is neither true nor false, and belongs to poetry, not to science. Without question, many metaphysical utterances of this type influence our lives by stimulating our emotions and springs of action. Nevertheless, when such utterances are taken to be assertions and arguments are offered for them either *pro* or *con*, the partners to the controversy are deceiving themselves.

Unfortunately, this type of illogical thinking occurs also in fields other than philosophy. Philosophers constitute only a small proportion of mankind; and their doctrines and the confusions arising from their failure to distinguish between the cognitive and expressive function of sentences produce relatively little harmful effects upon human destiny. In any case, their influence is considerably less than is often alleged by many philosophers and philosophical historians. The consequences of the indicated confusion are much more serious when it occurs in discussions concerning individual or political conduct.

When I say to some one “Come here!” it is evident that my words exercise a volitional function, and express my desire in order to evoke a certain response in my hearer. My utterance is not an assertion, and any debate about its truth or falsity would clearly be irrelevant. If a theoretical discussion were to arise concerning it, the debate would be significant only if it were to deal with such questions as whether the person addressed will obey me or what the consequences of his decision will be.

But although the matter is obvious for this simple case, the situation is not so readily apprehended when sentences expressing a command have the grammatical form of assertions. Frequent illustrations of this are found in politics, with serious practical consequences. For example, suppose that the following creed is promulgated in a certain country: “There is only one race of superior men, say the race of Hottentots, and this race alone is worthy of ruling other races. Members of these other races are inferior, so that all civil rights are to be denied them so long as they inhabit the country.” This pronouncement certainly has the appearance of an assertion. Some of those who dissent from it, taking the grammatical form at face value, may regard it as a genuine assertion and may therefore propound a doctrine in opposition to it. In fact, however, the pronouncement has no cognitive meaning and exercises merely a volitional function. The true nature of the doctrine (or better, pseudo-doctrine) is made clear if we state the pronouncement in the imperative form, to reveal its exclusively volitional function. It then reads as follows: “Members of the race of Hottentots! Unite and battle to dominate the other races! And you, members of other races! Submit to the yoke or fly from this land!” It is now obvious that the political creed is a command,

concerning which it is not significant to raise questions of truth or falsity. It is, of course, true that it is possible to raise cognitively significant issues in connection with such a command. But these will involve questions such as whether and to what degree the command will be executed, and what the consequences will be of obeying it or not. It is also possible to debate the factual statements about races, which are usually connected with the command; these are clearly scientific issues belonging to anthropology, and must be critically investigated by specialists in this field. It is, however, of great practical importance for understanding the effective appeal of political war-cries like the above to note that they take the form of misleading pseudo-assertions. This is to be explained by the fact that many men respond less readily to what are obviously commands than to such assertions or pseudo-assertions, especially when the latter are accompanied by powerful emotional appeals.

2. The *condition of consistency*, that our ideas agree with one another, is the second requirement for logical thinking. Logic is not competent to decide whether a judgment of ours having factual content is either true or false. However, logic is competent to determine whether our assertions or suppositions are consistent with one another. The task of logic may also be viewed as making evident the consequences of a given assumption, irrespective of its truth or falsity. For logic as the study of valid consequences is identical with logic as the inquiry into conditions of consistency, and the insight that one sentence follows from another is the same as the insight that the contradictory of the first is incompatible with the other. If, for example, I assume that iron does not float on water and that my latch-key is made

of iron, the supposition that my latch-key will float on water is incompatible with my original assumptions. In order to avoid contradicting my own premises, I must therefore assume that my key will sink. Logic itself does not affirm this last assumption; it simply renders explicit what is implicitly contained in the two premises previously assumed.

It will be clear, therefore, that the requirements of logic are much weaker than those of the empirical sciences. The latter demand of us that we accept certain assertions and reject others. Logic, however, does not prescribe what factual assertions we are to accept or reject; it simply demands that we do not at the same time accept and also reject an assertion. This demand is made in our own name, so to speak, by recalling to us our own intent and pointing out that to accept a given assertion would contravene some resolutions previously made.

This task of logic here indicated is far from being as trivial as it may appear at first glance. During the past one hundred years what is known as symbolic logic has been developed by Boole, Peirce, Frege, Whitehead, Russell, and many others. A vast treasure of validating forms, conditioning valid inferences, but unknown to traditional logic, has thus been discovered. It will here suffice to mention as an example the theory of relations worked out in detail by Peirce. The precise study of structures and order-types exemplified in different subject matters has become possible only on the basis of this theory. For example, geometry as the theory of a certain type of order applicable to space is simply a special instance of the general theory of relations. Moreover, one of the triumphs of modern logical research has been to demonstrate the fact that all of mathematics has the same status as

logic itself. That is to say, mathematics has been shown to make no factual assertions of any kind, and is revealed as the instrument for exhibiting the relations of consistency and deducibility between assumptions concerning any subject matter whatsoever.

Philosophers have sometimes maintained that mathematics differs from the natural sciences in that the latter take actually existing objects as their subject matter, while the former studies ideal objects. The truth is, however, that mathematics no more than logic is concerned with any type of objects. Both mathematics and logic simply teach how we may make explicit the conclusions implicitly contained in given assumptions so that both are concerned with possible linguistic or conceptual forms, and not with objects of any description. In particular, what are usually designated in our disastrously misleading language by the substantive “numbers,” are not entities of any sort; they are conceptual forms, forms of thought and statement, applicable to any empirical subject matter. The same conclusion is reached for mathematical functions, and even more obviously for the aggregates, groups, and fields of the more abstract branches of modern mathematics.

These points may become clearer in the context of a more concrete illustration. In order to build a bridge, the engineer must take into account certain laws of nature, partly formulated as general laws of mechanics and partly as specific laws of the materials to be employed. With the help of these laws he can calculate that a bridge with a specified structure is capable of carrying such-and-such a load. Now these laws are supplied to the engineer by the empirical sciences, in particular by physics. Mathematics and logic, on the other hand, enable him to deduce the strength of the bridge from the



physical laws and the initial data concerning the details of its structure. The logico-mathematical instrument is thus essential for every type of rational, planned activity. This is true not only in constructing machines but also in organizing human associations and activities, for instance, in the field of economics for planning both individual enterprises and large-scale social undertakings. Without this instrument, it is clear that civilization as we know it today would not be possible.

3. *Adequacy of evidence* is the third requirement for logical thinking; this is the condition that there be a sufficiently secure empirical foundation both for the universal laws we formulate and for the predictions we make with their aid. The point of this requirement will be clear from the following illustration. The prediction is made that three years hence at 3 P.M. there will be a heavy rainfall at Cambridge. This assertion is unexceptionable with respect to its form. It is also consistent with the rest of our knowledge, since it contradicts no known facts or recognized laws. Nevertheless, the prediction violates the third kind of logical rules, namely, the methodological rules for factual thinking. The fundamental rule of scientific method requires that every assertion about anything not observed (for instance future events) must be securely connected with our knowledge concerning facts already observed. And it will be clear that this is not the case for the above prediction. However, in the present case, just as in matters of consistency, logic has only conditional judgments to offer: *if* such-and-such observation sentences are given, *then* a law of a specified kind has an adequate (or inadequate) empirical foundation. Such judgments constitute the *logic of empirical confirmation*. This branch of logic asserts, for example, that a law (that is, a

universal sentence) is confirmed to a higher degree, the greater is the number of its instances which are confirmed by observation, provided that none of its instances are in disagreement with observation.

The progress that has been made in the theory of scientific method is due not only to professional philosophers, but even to a greater degree to natural scientists themselves. Some of the eminent workers in this branch of logic have been Ernst Mach, Poincaré, Duhem, Peirce, and Russell, and in recent years modern symbolic methods have made it possible to formulate their results more exactly and to extend them. The interest in methodological problems is increasing; and I think that it is one of the hopeful signs of the times that various groups, in America as well as Europe, which concern themselves with these issues, are beginning to co-operate actively with one another.

It is not surprising that consequences disastrous for human behavior frequently follow, when, in situations of practical importance, the requirement of an adequate empirical basis for factual thinking is violated. Far-reaching conclusions concerning the conduct of a whole people are sometimes asserted on the basis of relatively meager and inadequate data obtained in psychological laboratories. For example, the statistics of intelligence tests upon men drafted for army service have been used to bolster up the view that most men are slaves by nature, and to support the prediction that the run of mankind is incapable of higher forms of civilization. Indeed, it is not necessary to press the point that in daily life this important third condition for logical thinking is fulfilled more often in the breach than in observance. Men expect a future which will satisfy their hopes and desires, even when such expectations are

inadequately based on observed facts. A naïve chess-player expects that his opponent will make just those moves which will fall in with his own plan; he does not stop to think that it would be more reasonable to await a move which could favor his opponent's game. In the same way, deceived by their desires, men count on just that behavior in others which would coincide with their own needs. It is in this way that we must explain the conduct of different nations, races, and social classes, since, unfortunately, their conduct is controlled more often by passions than by reflection upon the facts of psychology and the social sciences. Their expectations, inadequately founded, are usually followed by disappointments in the behavior of other parties; but the failures of their hopes, instead of leading to the correction of erroneous assumptions, frequently become the occasions for a childish reproval of opposing groups in the name of morality.

The conditions which logic sets for rational thinking and which we have now surveyed, are not to be understood as possessing some absolute metaphysical validity or as resting on the will of God. The requirements made by logic are based on the simple fact that unless they are satisfied, thought and knowledge cannot perform their function as instruments for arriving at successful decisions in practical matters. Now since our actual thinking frequently violates the requirements of logic, it follows that illogical thought is an important factor in determining human behavior. Indeed, certain anti-rationalistic tendencies of our day preach the view that reason should be esteemed less, and that men ought to assign a smaller role to rational thought in practical life. Furthermore, the confusions in practice and doctrine which

are to be found in society, science, and art are asserted to be consequences of overvaluing the intellect. In fact, however, it is not of much importance whether men think much or little; it is of far greater consequence, *if* they think at all, whether their thinking is logical or not. And advocates of irrationalism are most successful in strengthening men in their biases and prejudices, confirming mankind in its errors instead of disciplining men's thoughts to aim at objectivity.

Logic must often play the role of the critic, especially in our own day. Its task is to serve as a spiritual hygiene, cautioning men against the disease of intellectual confusion. It has the ungrateful duty, whenever it finds symptoms of this disease, to pronounce the unwelcome diagnosis. But in what manner, it maybe asked, shall we conduct the therapeutic treatment? The logician by himself has no remedy to offer, and must turn to psychologists and social scientists for aid; for it is obvious that the mere discovery and acknowledgment of errors have no significant influence upon the thoughts and actions of men. Logic can point out the anomalies, but it is psychology which must find curative methods for them.

Logicians sometimes imagine that they can effect practical changes by their critical analyses. Such an expectation, however, itself violates the requirement of adequate empirical foundation. It is based simply on our desires, in utter disregard of facts clear to every observer of individual and social behavior. The laws of human conduct in observing and violating the requirements of logical thinking must be discovered by psychology and the social sciences. These are the disciplines which must locate the irrational sources of both rational and illogical thought. This theoretical problem once solved,

it then becomes the practical task of education, conceived in the broadest sense, to apply suitable methods for healing the indicated anomalous behavior. Indeed, a far better aim of education and a more effective program for it is the establishment of prophylactic methods for eliminating the source of illogical types of thought. Logic itself, however, must remain content with the more modest task of pointing them out.