

## THE RELATIONSHIP BETWEEN LOGIC AND PSYCHOLOGY

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Logic as a formal discipline arose in the domain of philosophy and there it remains. In ancient Greece learning was the pursuit of gentlemen of wealth and leisure who, in spite of their privileged status, faced the practical problem of preserving their fortunes and privileges from the hoi polloi. Since there were no lawyers in those days each citizen had to be his own counsel. Disputation was a practical as well as a fine art. It was taught to the youth for a consideration by experts called sophists. Socrates developed the art of cross-examination. Logic was on the way.

The Greek philosophers professed to be in search of ultimate Reality. Some looked for it in permanence, others in change. Plato, preferring permanence, exalted concepts into something immutable and eternal and endowed them with privileged status in his theory of Ideas. Aristotle developed a formal analysis of discourse, as Euclid had done for geometry. This, it was said, yielded something certain, necessary, and universal. This was logic.

As different metaphysical systems developed each interpreted logic in terms of its own assumptions, called self-evident truths. Knowledge was defined in terms of these assumptions. Such formal knowledge, characterized by certainty and necessity in contrast to the uncertainty and contingency of opinion concerning practical affairs, was said to be the only true knowledge. Theory was glorified while practice was scorned. After the rise of empiricism the forms of Aristotle were spoken of as deductive logic while the procedures of experimental science were called inductive logic, as if there were two logics. In recent times logicians have defined logic as the study of types of order, denying any concern with application. They have insisted upon the autonomy of logic as an absolutely independent discipline. Psychological considerations have been contemptuously rejected as irrelevant or prejudicial to this autonomy.

Psychology also began in philosophy. In 1879 Wundt set up a laboratory for experimental psychology in Leipzig, Germany, and psychology set itself up as a science. It employed the technical machinery and methodology of physics and physiology with ostentation. Measurement as a mark of science became a fetish. The preliminary work of generations of research was overlooked. Psychology insisted upon being born grown-up.

From the outset psychology was afflicted with that metaphysical monstrosity called the mind-body problem. Psychology purported to be a study of the mind of states of consciousness as such, all the while noisily proclaiming its emancipation from metaphysics. The violent revolt of behaviorism only avoided spiritualism by embracing materialism which was the other horn of the same dilemma. It developed an obsession for the "objective." Small wonder that logic and psychology never got together. Yet, a casual look at their enterprises, apart from the technical lingo, shows that they have much in common.

Let me now sketch briefly some postulates for psychological exploration that shall make no metaphysical claims, permit no metaphysical interpretations and support no metaphysical conclusions. They must justify themselves as tools of organization. The basis of psychological operations is discrimination. It is the differentiation of a field of observation into two thought-units sometimes called figure and ground, which are at once distinct and correlative. A set of one or more aspects of things set up as specifications for purposes of organization is called an abstraction or concept. When such sets are seen in relation to each other the relation is called formal, in distinction from the relation between the things which exemplify them, which it called material. Conceptual systems express such formal relationships. Such a characterizing set is neither exclusive nor exhaustive, since things may be organized in many ways for many purposes. The establishment of the range of applicability of such a set is called generalization. In the language of sampling, it is the determination of the domain for which a given sample is adequately representative.

We do our thinking in terms of these thought-units. Simplicity and complexity are relative to the unit taken as base. Such units are functionally defined. No limit is postulated to the number, scope, or relationships of these units. Different units may exhibit different properties, all of which are relative to the frame of observation, which includes the observer. Complex units may be analyzed into simple ones and simple ones organized into complex ones. The properties of any such unit do not proscribe the properties of another.

Organizational properties are sought in the interrelationships among things, as systematic organization develops, rather than in the surface appearance of things. The individuality and interrelatedness of things are correlatives. Experimentation is the procedure by which such organizational properties are made observable and by which their sign value is tested. It is a search for determinate dependable signs for determinate consequences. The formal organization of concepts is called theory, the formal manipulation of which requires rigorous discipline which is called logic.

An observation is relative to a frame of reference including the observer. It is the base unit with reference to which other units are oriented. Such a frame provides the criteria of a field of relevance. The terms, reality and truth, are relative to such a frame, the terms being applicable when the criteria of the domain are satisfied. In this designative usage they are devoid of ontological claim.

Two kinds of analysis are distinguished. If the variables are separable in the frame of reference in question, we speak of separable-variable analysis; if the variables be distinguishable but inseparable, we speak of inseparable-variable analysis. Variables held constant are not thereby eliminated. Abstractive analysis is of the second kind. The analysis of consciousness into ideas, images, and feelings, as elements, confused these two kinds of analysis by treating abstractions as independent, separable, constitutive entities after the pattern of chemical analysis. Language is full of paired correlatives improperly treated as separable or contradictory.

The person and his surroundings shall be regarded as a pair of inseparable distinctions or variables, within the matrix

called the world. Psychological operations are within and not external to this matrix, and if the mathematicians will forgive my impudence, are functions of these variables but not functions of either exclusively. This may be followed by the further distinction between symbolic and overt behavior within the field of the behavior of the person.

A slight scrutiny of the mentalistic terms with which we are familiar betrays a systematic confusion of metaphysical and behavior meanings. The one set is derived from a metaphysical theory of mind; the other set from the observation of behavior. In dispensing with this useless theory behavior is left intact. Nothing is lost but the spurious explanations the theory yielded and the confusions it engendered.

In the light of these considerations what may be said relative to the claims of logic? Logic and psychology appear as divisions of labor rather than unique and separable subject-matters. Logical operations are at the same time psychological. The formal operations of logic are, at best, a set of specialized operations within a psychological matrix. This recognizes the full significance of formal symbolic procedures **without cutting them off** from the matrix in which they originate and function. Questions of relevance, importance, and significance are conceded to be psychological. The human being is the architect and operator of symbolic systems. Logic systematizes the principles for operating with symbolic machinery for human purposes.

The difference between induction and deduction is the difference between establishing an adequate sample and using one that is regarded as established. Any completed induction may, if it be required, be expressed syllogistically. In any particular research something is treated as established; something is to be established. The formal manipulation of the first is deduction, that of the second is induction. But there are not two logics.

The three laws of Aristotle, namely, identity, contradiction, and excluded middle have been given all sorts of interpretation reflecting the metaphysical postulates of the system in terms of which logic is interpreted. On the view

here presented they may be seen as the simplest conditions which must be met to keep account of marks and their referents in any unit of discourse. Any mark shall signify the same thing in any of its occurrences. It may not be substituted for another of different significance. Given two distinct referents to be symbolized, any given mark may be assigned to one but not to both.

Science on its formal side has been described as applied logic. It might better be said that logic should be formalized scientific procedure. Recall that Aristotle formalized the science of his day. Modern objections to the old logic assert that it does not adequately formalize science as it is carried on today, for formalized science becomes a system of symbolic functions constantly tested in action, revised and justified by its results, not something finished. Such symbolic organization, although relatively stable, does not permit development. At any period of its development it expresses the conditions of successful research. Formal and technical developments go hand in hand. In this sense systematic structure is regulative but not rigid nor dictatorial; not given once for all but a growing achievement; legislative, but subject to amendment.

In the emphasis upon the psychological matrix of logical operations we do not infringe upon the methodological autonomy of logic by our rejection of its metaphysical claims. We seek only to preserve the relationship between divisions of labor which the logicians have dogmatically disavowed.

In recent times logic has been defined as the study of types of order by those who have emphasized the kinship if not the identity of logic and mathematics—as some have done. There is no challenge to the autonomy of mathematics in recognizing that in origin and development and use, it operates in a psychological matrix. The recognition that in origin and application it is intimately related to practical affairs does not detract from its dignity nor prestige as an autonomous and abstract discipline. Without such contact with the world it probably would not have been sustained and nourished by the social order in which it developed. The

choice of domain to explore, the selection of postulates to employ, the evaluation of what shall be of interest and importance lie in the psychological matrix of such formalized research.

A mark together with some referent assigned by some person constitutes a unit called a symbol. It is a functional unit since neither marks nor things signify anything apart from such a human context. Let the mark or sign be torn from the referent and its symbolic function is destroyed. But, of course, such a signifying mark may be considered as a unit on its own account and may be put in relation to other such units as when various sets of specifications are considered in relation to each other simply as specifications. When the referent is thus disregarded for the time we say the context is abstract. But such disregard for a referent in the abstract context must not be taken as a denial of the referent.

The view that formal logic developed in the domain of human activity and derives its sanctions from its usefulness in human enterprises replaces any view which considers logic as imposed from without, as coming with credentials from some alien, transcendental domain to exercise dominion over human thought.

When the conception of postulate systems replaced the discarded doctrine of self-evident truths as the basis of human reasoning, the term, validity, instead of truth, was used to express the formal correctness of reasoned conclusions. The terms, certainty and necessity, however, continue to be used to characterize correct formal reasoning in contrast to the contingency and uncertainty which attach to material reasoning, with the implication that the latter is of an inferior sort. It is plain that these terms are employed eulogistically rather than technically when it is noted that the contrast is spurious. The certainty of the one is of a different kind from the uncertainty of the other. The certainty and necessity of formal logic are definitional and conventional, whereas the probability of science pertains to the range over which material conclusions hold. The validity of formal

reasoning is simply formal correctness. In no sense does logic supply that certainty which science is said to lack. Definitional certainty is no substitute for practical security.

When the formality of logic is cut off from its psychological matrix and is set up in absolute independence it becomes formalism. For logic treated formalistically the problem of internal consistency is paramount. How can one prove a system of postulates to be internally consistent? A beautiful demonstration has been offered. A set of postulates is proved consistent by pointing out some exemplification of the set. This appears to be a demonstration which depends upon an equivocal use of the term, proof, for it is clear that proof by exemplification is not proof in the sense of being derivable from postulates according to specified rules. Such proof by exemplification would not be allowed in demonstrating a theorem within the system. Reliance upon exemplification may be a sensible procedure based upon broad psychological grounds of interpretation but I hold it fatal on formalistic grounds since it makes a crucial appeal to the matrix which formalism explicitly repudiates. Moreover, the assertion that the postulates are in fact exemplified is infected with the same contingency that adheres to all applications of abstract concepts. The sharp contrast between the formal and the material, between theory and practice, was set up to get rid of the troublesome problems of application so that they might not arise to disturb the serene pursuit of pure form as an enterprise of pure thought uncontaminated by any worldly touch. Yet we find an appeal to exemplification at the most critical step in the argument by way of a devious use of the term, proof. A further amazing justification has been offered, namely, that what occurs in nature cannot be inconsistent, thus ascribing formal logical properties to material phenomena. I regard such antics as support for the view that form and matter, although distinct, should not be treated as separable and that logical operations should not be divorced from their psychological matrix. What may be put asunder only by such feeble subterfuge may reasonably be treated as belonging together.