MODERN SCIENCE AND NON-ARISTOTELIAN LOGIC [1]

I. THE NEED FOR A NEW ORIENTATION

It is generally recognized that we are living in a period of profound reorganization in human culture. There is a demand not only for practical readjustment in the social order, but there is now developing the belief that we need also a fundamental reconstruction of the theoretical foundations of science. A searching investigation would probably reveal that these two developments are not isolated manifestations, but phases of the same unitary phenomenon—the demand for a new mode of orientation.

The statement that we need a new mode of orientation to deal with the practical and theroetical difficulties which confront us is more radical than some might suppose. We are here referring not merely to the *content* of our "thoughts," but to the very *forms* themselves. So thoroughgoing is this proposed reconstruction that it reaches down into a critical examination of the "logical" and linguistic tools we employ in all our orientations. In other words, one of the reformations which is now being advocated as an essential part of the new methodology is that we develop a theory of coherence to take the place of the traditional Aristotelian "logic," which the human race has employed for over two thousand years, and adopt a non-Aristotelian system, thereby rejecting the most fundamental "laws of thought" which have regulated our "rea-

[1] This essay is an expanded version of a paper presented before the Psychology Section of the A.A.A.S., Dec. 1934. Some of the changes which appear are the result of suggestions made by Count Alfred Korzybski. The liberal use of quotation marks is necessary in the non-Aristotelian system which is here being expounded.

soning" processes, inductive as well as deductive. If such a proposed reconstruction of our "thinking" technique should succeed in establishing its claims, we would be in for an intellectual revolution which would alter the entire character of our culture. In his recent book, *The Search for Truth,* E. T. Bell states that Euclid hog-tied mathematics and Aristotle hand-cuffed human thought. And just as Lobatchewsky in the nineteenth century emancipated mathematics from the idea of "truth" in geometry, so Bell holds that non-Aristotelian systems free man from slavery to traditional "laws of thought." In the one example of non-Aristotelian systems we shall examine, that of Count Alfred Korzybski, Aristotelian logic, Euclidian geometry, and Newtonian physics are regarded as forming one coherent system, with non-Euclidian geometry, non-Newtonian (relativity) physics, and non-Aristotelian system forming another coherent system.

The demand for a non-Aristotelian system is not an isolated phenomenon. The several independent sources of the revision are found in physics, organic phenomena, and mathematics.[2] We cannot here examine these several non-Aristotelian "logics," but will confine ourselves to the system of Alfred Korzybski, as presented in his treatise, *Science and Sanity, An Introduction to Non-Aristotelian Systems and General Semantics* (1933). We turn our attention to this system mainly because Korzybski has much to say about biological and psychological phenomena which is of interest to students of human nature. Before passing on, however, it may be pointed out that Kurt Lewin has contrasted what he designates as the Aristotelian and Gali-

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2 For a statement of the sources of Non-Aristotelian developments see the writer's paper, "Non-Aristotelian Logics," *Monist,* Vol. XLV (1935), pp. 100-117. See also the writer's book, *Philosophy and the Concepts of Modern Science,* (1935), Ch. III.

leian modes of thought. If Lewin had taken the additional step of establishing a necessary connection between the Aristotelian "mode of thought" and Aristotelian "logic," he might also have arrived at the conclusion that modern scientific findings require a non-Aristotelian system for their organization. That gestalt psychology will eventually have to adopt a non-Aristotelian approach is a point on which there can be little doubt.

Returning to Korzybski, the first observation to make is that the focal point of attack in his system is against "identity." The most fundamental of the three traditional "laws of thought," implicitly assumed in Aristotelian logic, is that a thing is what it is, or is identical with itself in all respects. On the basis of this "law" traditional thought has argued that the human "mind," observing these "identities" in nature, can generalize the observed uniformities and make statements about classes of objects, and these constitute the "laws of nature." Thus science was tied up with a logic developed by ancient Greek thought.

This view, as Korzybski points out, was elaborated long before the theory of relativity. Now the Minkowski-Einstein doctrine teaches us that *a physical thing is a space-time fact,* and that the temporal dimension cannot be separated from the spatial coördinates. For this reason the statement that an electron, or an apple, or any thing, is "identical" with itself is *false to facts,* since there is no such thing as an identical piece of matter at successive times. No object ever occupies the same ("identical") space-time twice. Human beings, by virtue of their power of abstraction, can isolate "things" from their "environments" and label these supposedly self-identical objects with names; but we must not let language mislead us into believing that because we use the same name for an object,

it is therefore the same object. Every object is unique, and should have a unique symbol. To avoid the fallacy of false identification, Korzybski states, we should label all our names with subscripts indicating dates, thus—apple$_1$, apple$_2$, etc. Any given object is a complex of sub-microscopic events in space-time, which can be treated as an "object" or "substance" when its behavior remains invariant in a given situation; but no two macroscopic objects are alike in "all" respects, and the "same" object is not identical with itself at some previous instant of time. Since it is language which misleads us into making these false identifications, it is necessary to consider in more detail the relation between language and thought.

II. LANGUAGE AND THOUGHT

It is quite generally known that in primitive thought word-magic is an essential part of the culture-pattern.[3] The conception of an occult connection between "words" and "things" leads to taboos against the use of certain sacred words and to such practices as giving evil names to dolls representing your enemies, on the assumption that the original of the manikin will thereby be injured. But that this verbal magic also crept into the culture of Western Europe, largely through the influence of Greek philosophy, is not so generally recognized. And yet this fact is not difficult to establish. The momentous consequences of this fact will appear as we proceed.

That some of the Greeks regarded words as the revelation of the nature of things is familiar to all students of ancient Greek philosophy. This is true, for example, of Heraclitus. As F. M. Cornford [4] states of his philosophy:

[3] On this point see *The Meaning of Meaning*, by C. K. Ogden and I. A. Richards, 1923, Ch. II.

[4] In *From Religion to Philosophy*, p. 45.

"The Logos is revealed in speech. The structure of man's speech reflects the structure of the world; more, it is an embodiment or representation of it." This Logos doctrine, interpreted in terms of the creative power of sound, entered into Christian theology through the *Gospel of St. John,* as everyone knows.

This fact itself is of great historical importance in the subsequent history of Western European culture, but when we take into consideration the interplay of thought and language in Aristotelian logic, and the tremendous influence of the Aristotelian tradition, the significance of word-magic in our own civilization becomes far more obvious and important. This is a strong statement, and it becomes all the more impressive if we grant the validity of the contention of Bertrand Russell, who on several occasions has declared that he doubted whether anyone trained in Aristotelian logic could ever free himself sufficiently from that tradition to think clearly. Russell's view that the civilization of Western Europe has been corrupted by its slavishness to Aristotelian habits of thought rests in part on his theory of the tyranny of language. In his book, *The Analysis of Mind* (p. 212), Russell argues that many philosophers have erred in assuming that the structure of sentences corresponds to the structure of facts. He here refers to the doctrine of Sayce, who maintained that all European philosophy since Aristotle had been dominated by the fact that all philosophers spoke Indo-European languages, and therefore supposed that the world, like the sentences they used, was necessarily divisible into subjects and predicates. This theory of the relation of thought to language is entirely consistent with the statement of Mauthner that "if Aristotle had spoken Chinese or Dacotan, he would have had to adopt an entirely different logic." The fact is, how-

ever, that Aristotle *did not* speak these languages, and so we find that, for better or for worse, Greek language and logic have formed the backbone of Western science and philosophy.

To see how this came about it is necessary to make a brief excursion into "theory of knowledge."

III. THE PROBLEM OF PERMANENCE AND CHANGE

One of the most obvious things about the universe is that it is constantly suffering change but that in the midst of change there are foci of permanence. To explain this problem of change it has been the natural tendency to postulate some underlying substratum as the seat of qualitative changes, which are therefore regarded as transformations of this primal stuff. One of the earliest problems of Greek philosophy was to describe the nature of this original "stuff." The formulation of the view that qualities inhere in a thing-like core, as pins stick in a pin cushion, is generally credited to Aristotle. In favor of this view it may be noted that the categories of "substance" and "quality" first appear explicitly in Aristotle's system, who is therefore held responsible for fixing in human thought the notion of the "thing" as the bearer of the qualities which inhere in this "substantial" substratum.

It is held by some that this metaphysics of matter is a consequence of the Aristotelian logic of classes. The foundation of Aristotelian logic is the doctrine that every proposition must affirm or deny a predicate of a subject. Since Aristotle's definition of a primary substance is that which can be a subject but never a predicate, propositions about subjects must predicate qualities of the substances. In other words, in propositions the subjects are represented by class names, and in a logic of classes the predicates are the

ascription to, or denial of, a quality or attribute to the subject terms. One aspect of this logic which is especially noteworthy is the way in which the verb "to be" functions in expressing the various relations between subjects and predicates. The relations of "class inclusion," "identity," and "class membership," are regarded in modern mathematical logic as distinct in nature, and therefore requiring distinct symbolization; but in Aristotelian logic they are lumped together under the common form of *"A is B."* According to Bertrand Russell, the use of "is" to express both predication and identity is a disgrace to the human race!

To be sure, there *is* room for difference of opinion on the matter of just what Aristotle meant by "substance." Among those who take the stand that the faulty Aristotelian conception of substance is intimately connected with the Aristotelian logic of classes is Professor A. N. Whitehead. As Professor Whitehead[5] says: "Aristotle asked the fundamental question, What do we mean by 'substance'? Here the reaction between his philosophy and his logic worked very unfortunately. In his logic, the fundamental type of affirmative proposition is the attribution of a predicate to a subject. Accordingly, amid the many current uses of the term 'substance' which he analyses, he emphasises its meaning as 'the ultimate substratum which is no longer predicated of anything else.'

"The unquestioned acceptance of the Aristotelian logic has led to an ingrained tendency to postulate a substratum for whatever is disclosed in sense-awareness, namely, to

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[5] *Cf. The Concept of Nature,* 1920, pp. 18-20. Professor Whitehead repeats his criticism of Aristotelian logic in his more recent book, *Adventures of Ideas,* 1933, p. 196. Probably it is due to the influence of Professor Whitehead's teaching that Charles Hartshorne describes Aristotle's notion of substance as "meaningless" (*cf.* "Metaphysics for Positivists," *Philosophy of Science,* 1935, Vol. II, p. 287).

look below what we are aware of for the substance in the sense of the 'concrete thing.' This is the origin of the modern scientific concept of matter and ether, namely they are the outcome of this insistent habit of postulation." This criticism of the Aristotelian notion of substance as a thing-like core was anticipated by E. G. Spaulding,[6] who also regards it as a consequence of Aristotle's logic. In justice to the situation, however, it needs to be kept in mind that there *are* those who hold that this is not an adequate interpretation of Aristotle. Thus, in connection with Professor Whitehead's views, J. D. Mabbott[7] argues that Whitehead has misunderstood Aristotle. Mr. Mabbott holds that while Professor Whitehead claims to be attacking the notion of substance as it comes down to us from Aristotle, he really accepts the Aristotelian conception of substance and is attacking the notion of a permanent independent physical object as it has come to us from the Greek atomists. Somewhat along the same lines, we find that Professor J. A. Leighton[8] has protested against the misinterpretation of Aristotle as embodied in Professor Spaulding's presentation.

Whatever its origin, this substance-quality view has influenced all subsequent philosophy and science. One needs only to note that it is the metaphysical basis of the religious doctrine of transubstantiation to see its importance in Western thought,—an importance which was not nullified until, as V. F. Lenzen[9] points out, relativity physics, through the electrodynamic conception of matter, eliminated the last vestige of Scholasticism from physics. Perhaps, also, the contempt for matter as a principle of evil (*e.g.*, as in Puritanism and Christian Science) is to be

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6 *Cf. The New Rationalism*, 1918, pp. 29-35.
7 In his article on "Substance," *Philosophy*, 1935, Vol. X, p. 188.
8 *Cf. Man and the Cosmos*, 1922, p. 187.
9 See his article on "World Geometry," *Monist*, Vol. XLI (1931) p. 501.

sought in the turn which the Greeks gave to the problem of "being" and "becoming." Both in Plato and in Aristotle a dualism appears between the purposive activity of the "idea" or "form" and the resistance of matter. In science this notion of matter as a "retarding" principle reappears in the concept of "inertia." Here the consequence of Aristotelian physics was definitely unfortunate. Aristotle's law of falling bodies, making velocity dependent upon mass, was false, and had to be corrected by Galileo. (It makes no difference to the argument whether Galileo established the new law by experiments from the leaning tower of Pisa, or whether this alleged historical event is only a myth, as Lane Cooper states.) This substantialistic view of matter as a substratum of inertial mass—identified with the "primary qualities" of space-occupancy, impenetrability, etc.—exercised its authority in determining the theory of "space" as the vessel or *container* in which the motions of "matter" occur; of "time" as the history of the transformations of matter in space; of "force" as the active cause of the motions of matter; and of the "ether" as the underlying continuum of the interactions of the "bodies" of nature. It is only recently that we have sufficiently disengaged ourselves from this attitude to permit ourselves to ask whether a *thing-like stuff* represents the foundational reality, or whether *events* and *relational structure* are more fundamental. The subsequent history of physics, guided by the Newtonian conception of "space," "matter," "force," etc., as *absolutes* of nature, and the transformation of Newtonian mechanics into the *additive-particle-picture* of Laplace is the story of the inevitable movement of thought toward the inescapable consequences of the materialistic theory. This story is so well known as to make its retelling here a work of supererogation.

This, in brief, is the story of the alliance between Aris-

totelian logic and classical physical science. Now modern science must undo the cumulative effects of two thousand years of tradition. Physics is the first of the contemporary sciences to demand a new orientation. Relativity (non-Newtonian) physics is moving toward a new system which requires a non-Aristotelian approach. The attack on the classical system was first directed against the traditional notion of "substance" as an absolute and self-identical underpinning of the phenomenal world. *Events* (space-time facts) are now conceived to be primary in nature. "Particles" must be regarded as nodes of permanence, invariant within their contexts of contemporaneous change. Complex "matter" is an aggregate, a relatively stable equilibrium, of such foci of electrical density. "Substance" is only a kind of resting-place for thought, expressing an unwillingness to analyse further. Einstein's thesis concerning the equivalence of "matter" and "energy" detroys the materialistic philosophy of Newton and Laplace. The old Aristotelian, subject-predicate (substance) logic is gone, never to return.

This is the present situation in physics. But what are the implications of this logical-physical revolution for science in general? Let us here return to Korzybski's views.

IV. NON-ADDITIVE RELATIONS AND ORGANISMIC PROCESSES

We have said that Korzybski has been the most thorough investigator thus far to trace out the consequences of these ideas in biology, psychology, etc. Indeed, one of the most interesting features of this writer's views is the manner in which they link up with other contemporary movements in science. Korzybski has much to say about organism-as-a-whole processes, and by this he seems to

mean what others express by *non-summative, gestalt,* or *emergent* properties and behavior. For Korzybski this type of process is an instance of phenomena represented mathematically by *non-linear equations.* Until Korzybski, no one—with the possible exception of W. Köhler—has stressed this connection between organismic processes and non-linearity.

In every instance where we are dealing with organism-as-a-whole processes we are face to face with a situation in which the function of the sum (whole) is not the sum of functions of the part processes. Thus we have two types of equations to represent the two types of processes: *linear* or *additive functions* and *non-linear* or *non-additive functions* (equations). Korzybski suggests (*ibid.,* p. 610) that the following equation, based on additivity, be taken as a definition of linearity: $f(x+y)=f(x)+f(y)$. In linear equations of this type a function of the sum is equal to the sum of functions, and has only one solution. Such a relation holds in vector analysis when the addition of vectors is defined by the familiar parallelogram of forces, and in calculus when we deal with linear equations where the "derivative of the sum is the sum of derivatives" and the "integral of the sum is the sum of integrals." But in all cases where the effect of two or more causes working together is *not* the *sum* of their effects working separately, linear equations are inadequate.

Count Korzybski points out (p. 188) that the notion of organism-as-a-whole is central in biology, psychiatry, etc., and terms this general principle *non-elementalism,* meaning by this that an organism is *not* a mere algebraic *sum* of its parts, but is more than that and must be treated as an integrated whole Bodily changes are frequently non-additive, as, for example (p. 116), when the heart, for any

reason, slows down the circulation, this may produce an accumulation of carbonic acid in the blood, which again increases the viscosity of the blood and so throws more work on the already weakened heart. In the same way (p. 356) the superposition of new neurological processes on old ones is non-additive, for this may fundamentally alter the whole character of the organism. "Thought" also represents the reaction of the organism-as-a-whole (p. 413), and like all associative connections may be a non-additive function. Similarly (p. 527), fears are not an additive or a linear function, but follow some more complex function of a higher degree. In general the typical functioning of the nervous system is connected with what Korzybski calls *time-binding,* which is represented mathematically by an exponential function of time. +

It is part of Korzybski's thesis that this same general situation appears in physics, and that the theory of relativity illustrates the principle of non-elementalism. He states (p. 265) that only since Einstein have we come to see that the simplest and easiest-to-solve linear equations are not structurally adequate. These non-linear equations are more complex and difficult to handle, and are often solved by approximations; but it is no one's fault that the world does not happen to be an additive affair.[10] In relativity theory this appears when the ordinary theorem concerning the addition of vectors (or compounding of velocities) is rejected. The corresponding parallel between gestalt theory and relativity was apparently first pointed

[10] In a review of Korzybski's book in the *American Mathematical Monthly,* Vol. XLI (1934), 570-573, Professor E. T. Bell makes this interesting comment: "There is nothing sacrosanct about the linearity of certain differential equations (and hence the additivity of their solutions) that makes most of mathematical physics as we know it a possibility; a more competent generation may find that linearity is a gratuitous concession to present mathematical disabilities. It has been conjectured (although possibly not in print) by Einstein that some of our failures to give a coherent (='semantic,' in Korzybski's sense) account of some physical phenomena may be rooted in the traditional demand for linearity."

Noting the fact that there is much false-to-facts "thinking," infantilism, and consequent maladjustment in the out by George Humphrey,[11] and the writer,[12] in commenting on the analogy, expressed doubts as to its value, but in the light of Korzybski's thesis this judgment may have to be reconsidered.

We have stated that Korzybski's claim to the development of a non-Aristotelian system rests upon the fact that his system rejects "identity." It is true that Korzybski also is committed to abandonment of the "law of excluded middle"; thus the *two*-valued "logic" which requires that a proposition be either "true" or "false" is replaced by a *multiple-valued* system. Since Korzybski's notion of what he terms *infinite-valued orientations* has points in common with this more general non-Aristotelian movement, it is unfortunate that lack of space compels us to pass over this phase of his system. Before leaving this matter, however, it needs to be pointed out that this system should *not* be described as a non-Aristotelian "logic." All existent "logics," Korzybski argues, are *elementalistic,* in the sense that they claim to study the activity of "reason," of "thought," independently of "emotion," whereas in reality the separation of "intellect" *and* "emotion" is just as objectionable as the separation of "space" *and* "time," or "mind" *and* "body." The science of the adjustment of man to his environment is a *psycho-logic,* and this is based on a non-Aristotelian *system* rather than a *logic.*

It is because of the broad scope of its principles and applications that the system of Korzybski is of interest to psychiatrists and educators. And this brings us to what might be called the pragmatic sanction of this system.

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11 In "The Theory of Einstein and the *Gestaltpsychologie*: A Parallel," *Am. J. Psychol.,* Vol. XXXV (1924), pp. 353-359.

12 In "Gestalt Psychology and the Philosophy of Nature," *Phil. Rev.,* Vol. XXXIX (1930), pp. 556-572.

world, and noting the fact that certain types of insanity are based upon false identifications, and that there are obvious analogies between the irrational "thinking" of schizophrenics and the magic of primitive peoples (as Dr. Alfred Storch has shown in his study, *The Primitive Archaic Forms of Inner Experience and Thought in Schizophrenia*), Korzybski concludes that if we abandon "identity" we will at one stroke render impossible, not only the type of disorientation we have in *in*sanity (delusion and false identifications), but also the *un*sanity of those who are functioning in accordance with Aristotelian habits of "thought." The practical need for a non-Aristotelian semantics rests upon the fact that human problems grow out of linguistic abuses. Our difficulties of adjustment are *neuro*-semantic and *neuro*-linguistic. Only by retraining in an *extensional* orientation can we undo the evil effects of false identifications. The infinite-valued adjustments of Korzybski's system require a new canalization of energy. This is a laborious process, but the end justifies the means. The results, Korzybski assures us, are automatic, far-reaching, and entirely beneficial.

Having thus presented in thumb-nail sketch some of the important features of Korzybski's system and suggested a few of its applications, it now remains to say something of the criticisms that are made of this interesting scheme.

V. A CRITIQUE OF NON-ARISTOTELIANISM

In looking over some of the reviews of the book, *Science and Sanity,* and talking with interested parties, I find that some of the main reasons critics give for regarding Korzybski's argument as not convincing are as follows:

(A) It will be argued by some that the very fact of

false identifications presupposes that there are also *true* identifications. Thus John Doe, a patient in a psychiatric institution, may be there because he suffers from the delusion that he is Napoleon; but this "false identification" would never have occurred had John Doe observed the "law of identity,"— that John Doe is John Doe. Moreover, in order to observe this principle of personal identity we need not be guilty of confusing the name of the man with the man himself.

(B) Again, it will be argued by some critics that Korzybski is forced to employ the very principle he claims to eliminate from his system. This, it may be held, is illustrated in a number of ways: (1) The law of identity is presupposed in observing the principle that in any given "universe of discourse" the meanings of our terms (defined and undefined) are to remain constant. (2) The notion of *isomorphic structures*, which Korzybski cannot get along without, and which is becoming increasingly useful in all natural science, is an instance of "identity" of logical structure. (3) Even though in nature we never discover true instances of "absolute identity in all respects," nevertheless, we need the notion of identity in our thinking. Emile Meyerson, for example, has argued at great length that the formulation of scientific laws and theories involves the process of "identification." For Meyerson the "irrational" is simply that which defies such "identification."

In connection with Meyerson's thesis concerning "identification," let us be careful to note that if we take a mathematical equation as an example of an "identity," as Meyerson proposes, it turns out that the "equality" asserted between what is on the left and the right sides of the equality sign is by no means an "identity," as has been pointed out by Professor A. N. Whitehead.[13] Moreover, certain non-

Aristotelian enthusiasts might argue, even in purely formal logic the meaning of, and necessity for, "identity" still remains to be established. The classical work in the field of mathematical logic is the *Principia Mathematica* of Whitehead and Russell. But no less an authority than F. P. Ramsey [14] argues that one serious defect of this monumental work is found in the treatment of "identity." Ramsey holds that the definition "does not define the meaning with which the symbol for identity is actually used." To escape the difficulties he suggests that we adopt the proposal of Wittgenstein [15] and eliminate the sign of identity, replacing it by the convention that different signs must have different meanings.

This argument might be put forth by some non-Aristotelians as final confirmation of the repeal of this famous "law" of traditional logic. But in reply the opposition will argue that this is only another example of fools rushing in where angels fear to tread. To avoid grave mistakes it is necessary to know precisely what is being done in the above instances. The real fact is that Wittgenstein and Ramsey have never criticised the Aristotelian *principle* of identity. They are concerned with the *concept* of identity, and find fault with the Leibniz-Russell *definition* of identity as derived from the principles of the identity of indiscernibles, when interpreted as a convention stipulating unrestricted mutual substitutibility.

It will be recalled that Leibniz's principle of the identity of indiscernibles appeared legitimate to him because of the atomism of his system: the perfect individuality of the monad made it a completely closed entity through all eternity. Without accepting Leibniz's monadology,

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13 In *The Principle of Relativity*, 1922, Ch. III.
14 In *The Foundations of Mathematics*, 1932, pp. 30-32.
15 *Cf. Tractatus Logico-Philosophicus*, by Ludwig Wittgenstein, 1922, p. 139.

the modernized version of this principle has found it very useful in the logic of analogies, etc. Thus the identity of an object may be defined in terms of its properties, and *a* and *b* are identical if all the properties of *a* are properties of *b*, and vice versa. In the *Principia Mathematica* a similar use is made of this principle when it is asserted that two classes are identical if the propositional functions from which they are derived are "equivalent." Unfortunately this definition of identity in terms of predicative functions makes it self-contradictory for two things to have all their elementary properties in common. As Max Black [16] points out, there is clearly some difficulty here, for, aside from the fact that to say two things are identical is merely a clumsy way of asserting that in reality there is only one thing, there is the additional difficulty due to the fact that it is not permissible in the logistic scheme to speak of *all* the properties which two things have in common. This last difficulty is met in *Principia Mathematica* by the use of the *axiom of reducibility* (*i.e.*, to any characteristics of a higher order there are equivalent characteristics of a lower order), but this axiom in turn has created more problems than it has solved. Thus, say the opponents of non-Aristotelianism, the difficulties in mathematical logic on this point are a result of treating "identity" as a propositional function of two arguments, and these difficulties are by no means insuperable.

And now what can those who advocate non-Aristotelian system say in reply to this? Since it happens that the foregoing argument represents the statement of one of the outstanding logical positivists, let us address ourselves to this viewpoint. It is recognized that logical positivism is pretty well committed to the "operational" theory of meaning. On this theory the meaning of a concept is found in its consequences, its implications, and how it

[16] In *The Nature of Mathematics*, 1934, pp. 70-71.

functions in its own system. Moreover this view subscribes to the *tautological* theory of implication: deductive reasoning in logic and mathematics consists in the elaboration of strings of tautologies. Since inference is the result of the manipulation of meaningless symbols according to *arbitrarily* selected rules of operation, we can grind out of the symbolic machine only what we put into it. *But on this view the Aristotelian "laws of thought" become mere conventions (or postulates) which validate certain forms of inference, and one could equally well substitute other postulates (rules of operation on symbols).* Either this, or we must deny that other rules are possible, in which case we return to the traditional view and assign the old unique status to the three traditional "laws of thought" of Aristotelian logic. *But this is to abandon the tautological theory!* How can we say that the laws of Aristotelian logic are *no more* and *no less* important than, *e.g.*, the commutative law, admit that this latter principle may be set aside (as in the non-commutative algebra of the new quantum theory), and then turn around and deny the possibility and utility of a non-Aristotelian logic? Professor Herbert Feigl has restated the Peirce-Wittgenstein criterion of meaning thus: *An unverifiable difference is no difference.* I wonder if we may in turn revise this formulation and say: *An unverifiable identity is no identity?* If so, where are we?

So far as the validity of Korzybski's system is concerned, it seems to me that one's views on the question of whether Korzybski has made good his case for the elimination of "identity" will be determined in some measure by one's reaction to his claim that the notion of "levels of abstraction" renders unnecessary Russell's theory of types. This theory, plus the very troublesome "axiom of reducibility," was supposed to provide an escape from the fallacy

of "illegitimate totalities" and the vicious circle paradoxes arising out of the use of "all." According to Korzybski, the vicious circle arises from identifying different orders of statements: statements about statements represent the results of new neurological processes, their content varies, so that multi-ordinal terms (like "class") have a unique meaning *only* in a given context, *where the order of abstraction is definitely indicated.* If, therefore, we observe the rule of non-confusion of orders of abstraction, abandon the term class and the "is of identity," and accept the four-dimensional language of abstractions of *different* orders, with a temporal coördinate, the axiom of reducibility becomes superfluous. Thus says Korzybski.

For my own part, I can only say that physical identity is really a limiting case of analogy, as two things become more and more alike, and this ideal limit is an asymptotic goal which no two things or situations ever attain. And so far as pure logic is concerned, it would be better to term the "law of identity" the *principle of symbolic univalence,* thus avoiding the ambiguity which has always resided in this "law." In justice to Korzybski it should always be remembered that he is little interested in "formal logic." His system is really a psycho-logic, *and is concerned with the harmful effects of identification as an orientation.* However else we may react to Count Korzybski's views, let us not make the mistake of judging the new *system* by the conventions of an alternative *logic.*

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