

OBJECTIVE FOUNDATIONS OF THE SCIENTIFIC METHOD

1. THE BASIC PROBLEMS

Contemporary scientific research has reached such fundamental layers of laws to be discovered that questions of scientific methodology, of means and procedures of analysis, of creating (or of perfecting) a method of research can no longer be answered “along the line” in the course of a strictly scientific progression. It is necessary to consider them as a particular branch of research, to separate them as independent stages, although absolutely indispensable within the structure of contemporary science.

The problems of methodology of the sciences as they are discussed at the present time cover a very large field. Different points of view are brought to bear, and are sometimes mutually exclusive. Yet no one would contest the assertion that methodology today, as a particular branch of science, offers a series of

Translated by Paul Grigorieff.

specific problems which are sufficiently precise and the solution of which has a fundamental influence upon the general development of science.

That these problems arise is objectively dependent upon the fact that the progress of science must inevitably continue. At the same time, and as has often happened in the history of science, these questions incite critical appraisal of notions and terms already existent; they force the adoption of a richer conception of the usual categories and, as the elementary condition of scientific analysis, they bring out the need for a univocal definition of concepts which correspond to the present level of scientific knowledge.

It seems to us to be indispensable here to give the working definitions of certain fundamental notions used in this article: not to precise them often leads to missing the true solution of the problems, and at times even to misunderstandings. By “scientific theory” we are referring to a logically defined consistent system of knowledge adequately reflecting the essential and objective legality of the progression, of the development of an area of reality—of nature, of society or of human thought. Every theory is not scientific. The specific mark of a scientific theory is its objective foundation which makes it possible to verify the truth or the falsity of the concepts and judgments of which it is composed.

The notion “objectivity” signifies the existence outside of and independent of the human consciousness (but not outside of human activity). A “scientific method” will represent for us a group of procedures and methods of research used in scientific theories. What is often meant by “scientific method” is a group of rules strictly definable for the construction of a system of scientific knowledge (for example, of an axiomatical system). The term designates here, in a very legitimate way of course, a particular area of the logic and methodology of scientific research. We are only concerned with its most general aspect, and only in a partial way. Nevertheless, the value of its results depends on at least two elements: 1. on the sound basis of the principles, rules, and logical calculations applied; 2. on the objective sound basis of the scientific viewpoints as a whole which are basically interpreted as formal-logical means. It is precisely the means

Objective Foundations of the Scientific Method

and the procedures used for studying the phenomena of objective reality and the methods of its theoretical reproduction which will be treated in this article.

From this beginning we will use the term "methodology" to designate the study of that which is essentially general and invariant in the partial methods of particular scientific theories which determine the very process of the study of reality. Each scientific theory has its specific method of research. The method of one theory can be entirely unacceptable for another theory. A given theory and the method which corresponds to it constitutes an indivisible organic unity. This unity is determined by a single objective foundation of the theory and of the method.

We will define the objective foundation of the theory as a system of material facts conforming to a law, independent of the human conscience, of which the adequate reflection in the consciousness of man (in the corresponding systems of scientific knowledge) determines the exactitude of a given theory; and the inadequate reflection of which determines in a like manner the falsity of a given theory as a whole, or the particular false judgments that this theory contains. Thus it is first a question of recognizing the objectivity of the object of a particular theory; secondly of the manner in which this object itself is conceived; thirdly, of the method used for studying this object. It follows that a determined conception of the method of research is set down from the very beginning, as an organically indispensable constituent part, in the notion of scientific theory. The objective foundation of a scientific method may be defined as a group of procedures and of methods of research prescribed by the demands of the objective foundation of the theory.

Just as the judgments concerning a theory have their origins in the competence of this theory, and their destination in the sphere of a meta-theory, the judgments concerning a method constitute the domain of methodology, in the sense previously defined.

2. SOME PROBLEMS OF METHODOLOGY

The principal task insofar as scientific methodology is concerned is to give a critical explanation of the research progression itself,

of the process of reproducing the means and the forms in the reflective thought of man, of the relationships and dependencies which determine the development of scientific thought, and of the subordination of this thought to the object of the research; to study certain typical means of acquiring knowledge in a determined area of research; of studying the relationships which allow thought to act most effectively on the object and on the transformation of the objective relationships.

The study of the objective foundation of the scientific method may be divided into the following steps: *First*, the analysis of the relationships of the material reality existing objectively and of the forms which take its image in scientific concepts. Theoretically, the exact response to this question is the following: matter is first in relationship to the human consciousness, which is nothing more than its image in thought (even though this image be extremely complicated, contradictory and indirect). The logical principles of thought can only give the illusion of the independence of their significance by this hypostasis. That which is called “autonomous movement of thought” can not be submitted to scientific proof. Finally, strictly scientific thought depends always on the objective laws of the object of the research. It has always, on principle, a corresponding experimental foundation. Consequently, the laws of science must be *discovered*, and not *invented*.

Secondly, the study of the internal and objective contradiction of the object of research, and the various aspects of the relationships determined by this immanent contradiction. The thesis which asserts that it is necessary to know reality as it really is probably can not be questioned. Yet this thesis supposes a knowledge of reality in all its complexity and with all of its contradiction. The characteristics belonging to reality can not help but have a decisive influence on the method used in its study.

Thirdly, the analysis of the concrete forms of the *determination* of the scientific method by the dynamic state of the object under study. Scientific thought, as opposed to what is called “common sense,” identifies in no way the object, and the object of research. The delimitation of the object of research consists of calculating certain groups of relatively constant dynamic elements—connections, properties, relationships—which might not

Objective Foundations of the Scientific Method

appear at the surface of phenomena, yet which in fact form completed quantities, original and opposed unities which, as such, are characterized by relationships of essences. If the essences of the objects and the phenomena were to be found at the surface of the latter, there would be no need for science. Scientific knowledge assumes just that penetration of the essences of phenomena and of the processes studied.

The fact that *determinism* and *dynamics* are emphasized calls for further explanation. We are in no way neglecting what the natural sciences call “non-determined” systems. It is a question of being completely aware of the variations of the environment and of not protecting the objective dynamism of the systems being studied artificially from “exterieur” necessities which were not foreseen in the preliminary calculations. The subordination must be reversed; it is not the systems which must be arbitrarily adjusted to the calculations, but the calculations which must be modified to conform to the objective determination of the systems.

Let us proceed. The principle of determinism does not exclude “backing up”; for example, when we start with forms of fixed and sedimentary thoughts in the language and bring out their objective content—their connections and their reciprocal actions. The lack of distinction between the objective content of the knowledge and the stereotyped forms, often symbolic in its expression, alone can prevent the discovery along the way of a fertile possibility of methodological analysis.

Finally, dynamics not only does not exclude, but even assumes a relative invariance of the objects being studied. The dynamics of a given object is precisely *its* dynamism. In other words, one considers the invariance of an object as the expression of the relative dynamic balance of its forces, and of its internal opposed tendencies.

*

One of the characteristic properties of contemporary science is the study of its objects as *systems*. This is also what determines the character of the system of contemporary scientific methods. It is on the basis of the intensive *differentiation* and *integration* of scientific knowledge which occur today, starting from the mo-

ment of the birth of the *new* branches of science, and from where this process takes place, which is, as a general rule, at the *meeting point* of sciences already known, that the intervention of tumultuous processes of interpenetration and of interaction of the methods occurs. Mathematical methods penetrate the social sciences more and more, while methods of logical analysis penetrate the natural sciences. It is important to stress that new branches of learning and the corresponding methods do not appear arbitrarily as a result of the whim of some scientist, but because of the force of an objective necessity, and it is often stimulated by the very research which applies to the objective foundation of the scientific method.

Bionics may be cited here as an example. The creation of this science which studies and puts into practice possibilities offered by the application of biological laws to technics, is one of the necessities arising from research on the *objective determination of theoretical constructions* and the extension of the actual possibility of scientific prevision which is only possible on the basis of the study of objective laws by methods which are also objective.

This involves the necessity of a complex approach, formulating the synthesis of a whole series of theories and of scientific methods. It is thus not by chance that the need arose for a structural-systematic approach. Such an approach creates, nevertheless, a multitude of new problems beginning with the definition of such notions as "system," "structure," "organization," "connection," "interaction," and winding up with the clarification of the relationships between the "whole" and the "part" (the "system" and the "element of the system").

An analysis of these problems, and others, calls for a concrete manner of approach. The interaction of the whole and of the part differs considerably depending upon the sphere in which it occurs, that of nature, of society, or of thought. In a living organism, for example, an element of the system can modify itself, or modify another one, without any resulting change in the fundamental character of the whole. The study of principles which assure biological systems of considerable security, undertaken by cybernetics and bionics for the purpose of reproducing the biological principles of the reserve compensatory functions of organisms (in

Objective Foundations of the Scientific Method

order to give to machines in particular the versatility and the security of brain activity), prompted radical opposition, from one sphere to another, in the interaction of the whole and of the part.

The ability of the brain to resolve problems presented to it even though an important area is not functioning is well known (the part which is intact then compensates for the lost functions). On the other hand, the slightest modification of the normal working order of the elements of an electronic machine leads to a breakdown.

There is no question that the role of the whole (of the system), as compared to the part, is preponderant. Nevertheless, concrete analysis of the hierarchy of the various systems and sub-systems demands that sufficient attention be given to the parts of the whole which carry out the centralized functions. From there stems the necessity of revealing the objective structure of the object of research, the study of the particular connections, and the definition of the means and of the thought processes to formulate an adequate theoretical description, and particularly the necessity of considering the systems and the structures as dialectical unities: a system always has a structure, and a structure is systematic.

Using the problem thus formulated as a point of departure, we intend to study here the question of the objectivity of the systems studied. We are of the same opinion as W. Ross Ashby, who notes that "a system *must* be objective."¹ The objective study of objective systems assumes an examination of the structural levels; a clarification of problems related to these levels: integration and organization, spatial-temporal characteristics, type of causality; a study of the problem of one-way, probabilistic or multiple-way determination of the phenomena, of the levels of organization, of the types of laws and of the qualitative precisions, of the totality of the specific connections of the whole and of its parts within different organized material systems. Let us add that objectivity in no way signifies the absolute. It only signifies the negation of the subjective arbitrariness, unacceptable in a truly scientific demonstration.

To conclude the remarks we have just made, we may point out that the objective foundation of the scientific method in the

¹ Ross Ashby, *Design for a Brain*, London 1962, Chapman and Hall.

domain of knowledge will be assured under the following conditions: 1) the various types of structures studied are concretely analyzed and generalized; 2) the logical structure of procedures and means of research is understood; 3) if the relationship of the subordination of the different types and levels of material-objective and logical structures is defined.

In this triple methodological task, recognition of the objective determination of the scientific research by the very object of the analysis occupies an essential place. This circumstance not only gives a strictly scientific direction to theoretical analysis, but also stimulates scientific thought, favoring creativity by giving it an heuristic signification and by reducing the probability of seeing the analysis fall into unproductive or dead-end paths to a minimum.

That the elaboration of an objective foundation of the scientific method is demanding is one of the fundamental principles of the materialistic-dialectic method which is synonymous with the scientific and philosophical method in general, and with the scientific methodology, and which was born and developed in the struggle against metaphysics² and positivism.

3. FORMATION OF THE SCIENTIFIC METHOD

The study of the history of philosophy from antiquity up until today reveals that although the *complexity* of phenomena submitted to the knowledge process, and that of this process itself, has almost never left, and does not leave, doubts in the minds of thinkers, the contradictory character of phenomena and of the process of knowledge has often been judged uncertain.

This circumstance is particularly clear in the philosophical teachings of the adherents of the Elea school, particularly of Zenon. The arguments presented in his remarkable antinomies and aphorisms ("The Dichotomy," "Achilles and the Turtle," "The Arrow," "The Stadium") were directed against the possibility of movement and of diversity. Zenon, insofar as the level of development of knowledge at his time allowed, brought to light the ob-

² The term "metaphysics" has multiple meanings. It is used to designate theories including empirically verifiable propositions, and theories deducing the universal essence of the being from theological principles. We will use the term as a synonym of "anti-dialectical".

jective opposition of quantity and quality, of knowledge of the senses, and of rational knowledge,³ of the finite and the infinite of space, of its discontinuity and its continuity, of its unity and its multiplicity, the contradiction of movement.⁴

Of course it would be naive to think that Zenon denies movement in general, the existence of objects in movement. The difficulty that he ran up against and tried to overcome was this: can the exterior world, in constant movement, changing, filled with internal objective contradictions, be reflected in human concepts which are, according to him, *immobile* and *uncontradictory*?

V.I. Lenin made the following remark on this subject: "Zenon had no intention of denying movement as a 'certainty of the senses;' the only question he asked was that of 'its truth'—the truth of movement."⁵ And this was not an imaginary difficulty, but a perfectly real one, that philosophy could not resolve before Marxism, because it did not know how to apply dialectic materialistic principles to the theory of reflection.

Later, certain philosophers encountered an analogous difficulty, although it was not always defined in a sufficiently strict manner. It appeared in a grotesque form in the antinomies of Kant, which in fact reflected the objective character of the contradictions of thought. But Kant was unable to go beyond the simple statement of this contradiction. Hegel, who tried to overcome it on the basis of the position of idealism, built the imposing structure of idealistic dialectic which, in its original form, was too mysterious to be used as a scientific method; Hegel, indeed, leaning on the idealistic principle of the identity of thought and

³ This is how, for example, Zenon formulated the antinomy of the "Grain of Wheat": if we throw a grain of wheat on the ground we are not conscious of the noise of its fall; if we throw a sac of grains on the ground, we hear a noise. Reason tells us, however, that either the fall of one grain makes a noise, or else that of a sac of grains does not make any. If it were otherwise, the sum of several zeros would be equal to a positive quantity.

⁴ Let us cite, for example, the aphorism of the "Dichotomy": no one can move from the spot he occupies, that is to say, begin and end a movement, nor change from rest to movement, because an object, to move towards a goal, must first cover half of the distance which separates him from it. To do this he must cover half of this half, etc; Finally, it is by virtue of this "principle" that Achilles can not overtake the turtle, and "the arrow stops in its flight."

⁵ V. I. Lenin, *Philosophical Notebooks*.

being, represented on the one hand the objective contradictions of reality as simple contradictions of thought, and on the other hand, also attributed to reality the contradictions which only characterized thought.

Materialistic dialectics, contrary to metaphysics, in fact recognizes on one hand the *contradictory character of objective reality*, and on the other hand, *the contradictory character of the process of knowledge; it recognizes the truth of objective contradiction*; it studies the process of knowledge as a process of the reflection of reality by thought, as a unity of contradictory moments, as an identity of opposites. It must be pointed out at the same time that materialistic dialectics recognizes the necessity of the reflection of objective contradictions in specifically contradictory forms characterizing thought.

History is witness to the fact that metaphysics replaced the naively dialectic viewpoint of ancient times, and was in turn replaced by dialectics, this time scientific, by the materialistic dialectics. In fact, the history of philosophy, when viewed from a particular angle, represents the history of the struggle between dialectics and metaphysics, the history of the incoercible perfecting of the dialectic comprehension of phenomena and processes of objective reality.

The early dialectic point of view was naive and elementary as a result of the inferior level of scientific expression and a lack of maturity in social relationships. Yet as long ago as the ancient Greeks, for example, there were remarkable conjectures being made on the unity of opposites as a motive force behind evolution. According to the ideas of one of the founders of dialectics, Heraclitus of Ephesus, who was, by the way, before Zenon, all exists and at the same time does not exist because everything *flows*, everything is in a constant state of change, undergoing an eternal process of upheaval and disappearance. "The world, of uniform constitution for all, was not created by any god, nor by any man. But it has always existed, it exists, and will forever exist, a fire eternally alive, alighting and extinguishing with moderation," said Heraclitus, and again, "All is one." This formula not only did not exclude, it even assumed multiplicity and contradiction. "All is one, divisible indivisible, created un-

created, mortal immortal.”⁶ The struggle of opposites is according to Heraclitus the origin of the growth of all that is: “Everything arises out of combat and necessity.”⁷ In spite of the elementary dialectics of his viewpoint, Heraclitus formulated the problem of the division of the whole and the knowledge of its contradictory parts. The materialistic dialectical solution of this problem has now entered the gold reserve of scientific philosophy. The elementary dialectical attitude when faced with the study of nature and of human knowledge underwent, in the course of history, the most diversified transformations from refusal (shown by Zeno) or unilateral development in an idealistic spirit (Kant, Fichte, Hegel), up until the explanation of its various aspects beginning with materialistic positions (Aristotle, I. Kuzanski, J. Toland, F. Bacon, V. Belinski, L. Feuerbach, A. Herten, N. Tchernychevski, etc.). Yet through the highly complex evolution of philosophical doctrines, where now one aspect of methodology, now another, came to the forefront—interpretation of general and particular categories (struggle of nominalism, of realism and of conceptualism), problem of the truth of rational knowledge and of knowledge of the senses (struggle of rationalism and empiricism), etc.;—through the tangle of chance, the materialistic dialectical vision of the world blazed irreprehensibly its trail; the dialectic and scientific method of research developed.

Each period of development of philosophical ideas has been closely connected to the following three elements upon which they may be said to depend: *the general formation of theoretical thought, the level of development of the natural and social sciences, and the maturity of social relationships*. A certain level in the development of all of these elements was necessary for the creation of a dialectic method of scientific research. These conditions were united in the mid-19th century. *Great discoveries in the natural sciences* were made at that time—discovery of the cell, Darwin’s theory of evolution, law of conservation and transformation of energy, etc.; Biology, Geology, Chemistry, and Physics of that time were undergoing their own revolution,

⁶ Hippolytus, *Refut.*, IX, 9.

⁷ Origen, *Contra Celsum*, VI, 2.

demanding dialectic generalizations. The stage was set for dialectics.

The metaphysical method of thought and research which dominated up until that time in the natural sciences and which was justified by history, acted as a brake on the progress of science.⁸ It was even less possible to make use of it for penetrating the essence of social processes. The idealistic dialectics of Hegel, as we have already mentioned, could not be used by science. What science needed was the *materialistic dialectic method* of research and thought founded on a *materialistic scientific theory*.

The dialectic method is not limited to the generalization of new procedures and to giving them a philosophical interpretation by *absorbing* the most recent data, by enriching itself and becoming concrete, by modifying its appearance. The opposite process occurs simultaneously: the action of the dialectic method upon comprehension, the true interpretation, reveal its heuristic importance in research and in the discoveries which concern the profound objective legality which governs natural processes.

This fact shows up clearly in the contemporary natural sciences. For example, a category of physics today as important as *probability* can not be understood in depth and in all of its aspects without a materialistic dialectic interpretation. Of course it can always be described, exposed, even created, used as grounds for an entire "theory." But to understand its *heuristic* significance, it is necessary to examine probability in close connection with the categories of *possibility* and *reality*, *necessity* and *chance*, *cause* and *effect*. It is only in terms of this dialectic comprehension that probability as a category may be actually considered "operative."

Thus, in order to draw some sort of a conclusion from these statements, it may be said that the metaphysical method, although legitimate in certain areas, more or less spread out depending upon the nature of the object, sooner or later reaches the limits

⁸ Dialectic materialism demands a dialectic attitude in view of the dialectic method itself, as much as in view of metaphysics. It is thus, to give an example, that dialectic materialism, contrary to Hegelian idealism, never ridicules the metaphysical method. Likewise, it does not absolutely refuse the dialectics of Hegel which was entirely rejected by the metaphysical philosophers.

Objective Foundations of the Scientific Method

beyond which it becomes one-sided, narrow, abstract, beyond which it loses itself among insurmountable contradictions: behind certain objects it does not grasp their relationships, nor their upheaval and their disappearance behind their being; it forgets their movement because of their immobility. In this sense, the dialectical method surpasses the metaphysical method. It is apparent that at the present time to return to the latter would signify a backwards step.

In the mid-19th century, social relationships reached such a level of maturity as compared to the fixed progress in the theories of natural and social sciences, and the clarification of determinism in the historical process was simplified to such an extent that the discovery of the objective legality of social evolution proved to be possible. Mature social relationships excluded *spontaneity* and demanded *scientifically conscious* activity. This was one of the conditions necessary for the elaboration of a dialectical scientific method.

Thus in the mid-19th century the problems created by the scientific development, theoretical and social, were very apparent and in need of an answer. Marx and Engels brought this answer. This proved to be an authentic revolution in theoretical thought, in the building of a scientific method of research. The materialistic dialectic, as well as the philosophy of dialectic materialism as a whole as far as the most important areas are concerned, made further progress and took on a concrete form in the hands of Lenin whose works constitute a step forward in the development of the Marxist philosophy.

Materialistic dialectics, as a method of research and thought, is thus in no way the invention of the mind of a genius. It is a method discovered in a most objective reality, a method which springs from scientific data and appears as the result of the critical comprehension of the entire history of man. Its force is in its truth, in its adequate reflection of the objective legality of material reality, in its systematic improvement through contact with important discoveries in the field of the natural and social sciences, and in social practice.

In order to be sure that the scientific method had an objective foundation in sociology, fundamental discoveries had to be made, and they were. It suffices here to cite only one of them: the

materialistic conception of history. Chaos and arbitrariness dominated the various pre-Marxists theories of sociology and history until they were replaced by the harmonious and searching image of an objective progression, and they became subject to laws of social processes.

At the present time, dialectics as a scientific theory and scientific method of research offers a strict, harmonious and finished unity of a theory of knowledge, of logic, of principles, of laws and categories which engage creative thought and research at the contemporary level of scientific development. Its conscious application could be of substantial aid in the solution of a great number of philosophical and logical problems.

Let us give an example. A great number of the adherents of logical positivism stress heavily the originality of their viewpoints,⁹ and often refer to the most recent findings of the natural sciences. However, the fundamental and stimulating ideas of this philosophical movement are borrowed from a fairly distant period, and their roots reach into the antinomies, contradictions and logical paradoxes that the philosophers of ancient times sought to resolve. We approve here Tarski, the author of the *semantic conception of truth*, which is one of the most recent results of logical positivism. In his analysis of the significance of logical paradoxes formulated by the Megara school (in the 4th century before our era),¹⁰ and the antinomy of the “Liar” in particular, Tarski makes the following statement: “The fact that antinomies play an essential role in the founding of contemporary deductive sciences must be emphasized... It is thus that the antinomy of the “Liar” and other semantic antinomies stimulated the building of theoretical semantics”.¹¹ The problem of overcoming the contradictions we have set forth above on the subject of the example of Zenon was not posed by dialectic materialism alone, but also by logical positivism. Dialectic materialism resolved scien-

⁹ Wittgenstein wrote, for example, in the preface of his *Tractatus logico-philosophicus*: “... it makes no difference to me to know whether or not someone before me has thought the same things as I.” (Paris, Gallimard, 1961, p. 27).

¹⁰ These sophisms-paradoxes represented the most absurd formulation, and perhaps the most unjust also, of the antinomies of which Zenon had spoken.

¹¹ A. Tarski, “The Semantic Conception of Truth,” *Readings in Philosophical Analysis*, 1949, p. 59.

Objective Foundations of the Scientific Method

tifically the problem of contradiction by creating the method of materialistic dialectics. As for the logical positivist, they recognized the problem, but did not go beyond stating it. Strictly speaking, the problem itself as it was formulated was not absolutely exact; for this reason its solution was carried over into the domain of language and of logic, which were significant independently. Logical positivism proved unable to resolve the problem of contradiction in simply giving a verbal "solution," which only served to veil and dissimulate it. This stems from its misunderstanding of the materialistic dialectic method. Instead of the scientific dialectic method, various other procedures and research methods appeared which were not based upon materialistic-dialectic principles, but on metaphysical conceptions according to which the various linguistic and logical forms of thought were either pseudo-problems or intellectual data independent of the evolution of these forms and of the laws of objective reality. It is therefore not surprising that numerous adherents of logical positivism progressively renounced the research methods which they had originally accepted, and that they doubted such fundamental principles of their theory as that of "verification," of "physicalism," etc. It is thus, in particular, that in his speech before the 13th International Congress of Philosophy (México, 1963) one of the most eminent representatives of logical positivism, L. Fengel, was obliged to make the following statement: "It is universally accepted today that early logical positivists, in their eagerness to purify philosophy of its pseudo problems, went too far. Their criterion for the comprehension of facts was expressed in the form of a too narrow viewpoint of verification."¹² As soon as the adherent of a particular theory ceases to believe in the objective value of its fundamental positions, the situation is grave.

To give another example, for several centuries the history of philosophy consisted of a struggle between rationalism and empiricism. If the defenders of rationalism exaggerated the role of logical, rational thought, and studied the latter while at the same time isolating it from the data of the senses, underestimat-

¹² Cf. *Memórias del XIII Congreso Internacional de Filosofía*, México, 1963, vol. IV, p. 103.

ing its role in the process of knowledge, the supporters of empiricism in their struggle against rationalism, stressed all the more unilaterally and metaphysically the *sole* importance of the human senses in comprehension. It is well known that in answer to the famous turn of phrase of the empiricist sensualist, John Locke, "There is nothing in the understanding that has not its origin in the senses," rationalist Leibnitz added with a certain sarcasm, "if it is not understanding itself." Here we find ourselves faced with a truly difficult problem: how are concepts formed in the human understanding whereas they do not exist in nature? How are sciences such as mathematics, for example, possible whereas they concern abstract objects and logical operations without direct counterparts in nature? How are notions having unity formed from sense data which are disparate? In short, the problem lay in understanding exactly the dialectic relationships of the elements of the senses and of reason contributing to knowledge.

Dialectic materialism offered a scientific solution to this problem. On the basis of the analysis of data concerning different sciences—history of doctrines dealing with theoretical knowledge, physiology of the higher nervous centers, and particularly the thorough study of the physiology of the organs of the senses, psychology and the study of reflexive activity of the brain—gave final proof of organic unity and the interdependence of the elements of the senses and of reason in knowledge. The solution to the problem of the scientific-natural foundation for research offered by the dialectic method is founded upon a wealth of data concerning the historical development of scientific knowledge itself, and of the means and methods of thought and research known in the entire history of science.

Along with this scientific solution to the problem there also exist today some pseudo solutions. It is thus that the same logical empiricism managed, if only in its name, to relate *logic* and *empiricism*. In fact, this tie appeared as mechanical, artificial and metaphysical owing to the absence of a dialectic approach to the problem, and that of a materialistic scientific explanation of the cognitive process.

The problem is even more complicated where contemporary occidental sociology is concerned. Here the need for finding a

Objective Foundations of the Scientific Method

single scientific method is of the utmost importance, not only for its value in the study of social processes, but also for its possible contribution to the building of a better society. J. Lundberg, professor at the university of Washington, so states quite clearly: "A scientific method applicable to all social problems represents our highest hope (the hope of Americans) for attaining a better society."¹³

A careful study of sociological thought in the United States leads us to the conclusion that the opposition between a logical-theoretical conception and an empirical conception of research has not as yet been overcome. Eminent American sociologists themselves are obliged to admit that not only do the two approaches exist, but that there also exist different orientations within American sociology. Either one abides by the theoretical conception, or by the empirical, as they are considered to be mutually exclusive. On this subject we may cite the declarations of certain extremely competent representatives of American sociology. Thus, for example, T. Parsons distinguishes two orientations of the bourgeoisie sociology of the United States, and defines them as "pragmatic-empiricism" or "anti-theoretical empiricism," citing R. Merton as principal representative; and "general theory," or "systematic theory," which he himself has worked out.¹⁴ R. Merton has this to say: "We see on one side the sociologists who look above all to the generalization," who scorn "the small-scale details and aim at the grandiose over-all generalizations." Their "device" is the following: "We don't know if what we say is true, but at any rate it is important." This is the "theoretical" orientation. The opposed doctrine is "radical empiricism." "The opposite position is upheld by a detachment of opinionated sociologists who do not worry as to whether or not their findings are applicable, but who are absolutely convinced that they are right." The "device of radical empiricism" is the following: "The truth of our findings can be demonstrated, but we can not show the significance."¹⁵ Approximately the same

¹³ J. Lundberg, *Can Science Save Us?*, New York, 1961, p. 134.

¹⁴ T. Parsons, "The Prospects of Sociological Theory," *Essays in Sociological Theory*, Glencoe, 1954, p. 305.

¹⁵ R. Merton, "Sociological Theory," *The American Journal of Sociology*, 1945, Vol. 50, No. 6, p. 462.

thing is to be learned from P. Lazarsfeld who, in his statement on "Methodological Problems in Empirical Sociological Research," presented before the 4th World Congress of Sociology, distinguishes "microsociology," the study of human behavior in everyday situations using quantitative methods... from "macrosociology" of a "more philosophical orientation," which centers its analysis upon "the structure of society."¹⁶

Finally, we come to the opinion of F. Znaniecki, expressed in several of his works. Znaniecki was not satisfied by the mere statement of the existence of opposed orientations of American sociology; he declared it to be a serious drawback and attempted himself to correct it. According to him, these orientations are the following: 1) Radical empiricism, and mathematical dogmatism;" 2) "Metaphysics."¹⁷ Radical empiricism and mathematical dogmatism prevent the combined use of the qualitative and quantitative methods," while metaphysics "prevents a natural conception of social problems."¹⁸ What solution does Znaniecki propose? He proposes an eclectic combination of the two viewpoints. He declares at one point that "All sociological research must be undertaken with a clear, firm awareness of the fact that sociology is an independent empirical science," and that "its sole and permanent foundation" must be "pure empiricism."¹⁹ Yet on the other hand he believed that in sociological research the true result can only be achieved through "intuitive proof:" "Truths are arrived at intuitively, from the very fact of their evidence, and they need no other confirmation."²⁰

Recognition of the objective foundation of the scientific method does not at all imply passive contemplation, mirror reproduction and imitation of natural processes. Man is not simply a thinking being; he is also an active reacting being who all but transforms the world to assure social progress. It is true that the social

¹⁶ P. Lazarsfeld, "Methodological Problems in Empirical Social Research", *Transcription of the 4th World Congress of Sociology*, Vol. 2, London, 1959, pp. 225-243.

¹⁷ F. Znaniecki, "The Proximate Future of Sociology", *The American Journal of Sociology*, 1945, vol. 50, No. 6, p. 514.

¹⁸ *Ibid.*

¹⁹ F. Znaniecki, *The Method of Sociology*, New York, 1934, p. 217.

²⁰ *Ibid.*, p. 220.

Objective Foundations of the Scientific Method

environment does not always allow him to appear in the role of master of social facts, to accomplish the work to be done, to develop harmoniously his talents and aptitudes. Nevertheless, when he cooperates with nature, he strives to do his best to transform it and harness it to serve mankind.

Man also appears as the creator of certain defined structures of social organization. The use of scientific methods to direct social processes plays a fundamental role in the realization of scientific, technical, cultural, economic and political progress of society.