THE PRACTICAL TURN IN PHILOSOPHY OF SCIENCE

Edited by
Evandro Agazzi
Gerhard Heinzmann

Epistemologia

FrancoAngeli

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Epistemologia, collana diretta da Evandro Agazzi

La collana intende venire incontro a quell'esigenza, ormai generalizzata, di conoscenza epistemologica che si riscontra a livello di cultura medio-alta e che corrisponde, in senso lato, alla diffusa aspirazione a prender coscienza critica della complessa varietà della nostra civiltà scientifico-tecnologica. Aspirazione che si accompagna, altresì, al desiderio di venire in chiaro circa lo statuto epistemologico di molte discipline le quali solo di recente hanno rivendicato l'impegnativa qualificazione di «scienza», pur riguardando ambiti di ricerca non inclusi nell'alveo delle discipline scientifiche tradizionali.
Rispetto ad analoghe collane già esistenti, questa si propone anche di allargare l'ambito delle scuole e tradizioni epistemologiche finora più correntemente conosciute in Italia, e che si ispirano in prevalenza al filone analitico anglosassone, portando l'attenzione su opere e autori afferenti ad altre aree culturali, come ad esempio quelle di lingua francese, tedesca, polacca.
Verranno quindi pubblicati, sia in traduzione che in opere originali, alcuni testi base di carattere istituzionale relativi all'epistemologia generale e alle diverse branche della filosofia della scienza. Per altro verso, verrà dato uno spazio più cospicuo del solito all'epistemologia delle scienze «umane», alla filosofia della logica, alle tematiche etiche che di recente si sono aperte nei riguardi della scienza. Pur senza rinunciare ad opere di carattere tecnico, l'accento generale verrà posto piuttosto su quei tipi di trattazione epistemologica nei quali è più presente un taglio specificamente filosofico.
La collana si propone di essere utilizzabile anche per corsi universitari: a tale scopo, oltre alle opere di carattere istituzionale cui si è fatto cenno, annovererà anche alcuni «readings» antologici, sia a carattere miscellaneo che monografico.

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Evandro Agazzi – Marco Buzzoni – Alberto Cordero –
Vincenzo Fano – Gerhard Heinzmann – Reinhard Kahle –
Hans Lenk – Giovanni Macchia –
Fabio Minazzi – Léna Soler – Paul Weingartner

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Introduction

by *Evandro Agazzi* and *Gerhard Heinzmann*

Philosophy of science can be considered, in a certain sense, as old as Western philosophy itself and, in another sense, as a recent specialized branch of philosophy. This has to do, in particular, with the fact that the elaboration of the very concept of science has been one of the central issues of Western philosophy during the whole of its history. Indeed the effort to determine in what consists *epistéme* (the Greek term that has been later translated as *scientia* and *science*) has been inaugurated by Plato and Aristotle, but by "science" they meant *knowledge* in general and wanted to distinguish it from *opinion* (even from "true opinion"). They proposed to consider science as a true opinion endowed with an "argument giving its reasons" (which is rather close to the contemporary characterization of knowledge as a true belief equipped with a justification). With the beginning of modernity, however, the concept of science was gradually restricted to a particular sector of knowledge, that of natural phenomena, along with the traditional domain of mathematics (a historical phenomenon usually called "scientific revolution"), and the rapidly growing success of this kind of investigation had as a consequence that the meaning of "science" was usually restricted to denote these "exact sciences". Philosophers were obviously paying due attention to this impressive intellectual construction and deep reflections on the sciences (understood in the modern sense) can be found in their works; they did not constitute, however, a special branch of philosophy like, for instance, logic, ethics, ontology, metaphysics, philosophy of history, philosophy of law, aesthetics, until the beginning of the twentieth century. Is there a reason for this fact? Yes there is, and consists in the fact that a profound *crisis* affected the "exact sciences" at the end of the nineteenth and the beginning of the twentieth century, a crisis that has been soon called "foundational" because it concerned precisely those "foundations" of mathematics and physics that (according to the millenarian tradition of Western civilization) were

indispensable requirements of science. New trends, ideas, starting points have often been produced in philosophy by the need of overcoming a certain crisis, and this also happened in connection with the crisis of the exact sciences that we are mentioning here, a crisis that was particularly deep because it challenged the pervasive positivist view that had attributed to science the monopole of secure knowledge and the role of being the ground of human progress. Among the philosophical reactions to that crisis some consisted in degrading science with respect to other spiritual activities, but others consisted in an effort of critical investigation of scientific knowledge with the aim of ascertaining its nature, scope, purport and limits after the loss of the security offered by the traditional confidence in intellectual intuitions and apparently unshakable concepts and principles. This enterprise concretely produced the creation of a new specialized branch of philosophy, that is, of philosophy of science in its contemporary sense, a philosophy, in particular, that implied not only an adequate technical acquaintance with the complex subject matter of the new scientific results, but also the command of certain sophisticated methods and tools that were required in order to carry on such a programme.

This historical situation explains why philosophy of science has been for rather a long while essentially an epistemology of science (up to the point that in certain languages where the expressions "gnoseology" or "theory of knowledge" are common, the term "epistemology" is considered as synonymous with "philosophy of science"). It was not sufficient, however, to consider philosophy of science to be an investigation of scientific *knowledge*, it was also necessary to rely upon some philosophical background or framework in order to proceed to such an investigation, and this was not particularly rich. The interest of the majority of philosophers was not oriented to science and, in addition, only very few of them had a sufficient scientific preparation to seriously enter the analysis of the foundational issues. Therefore philosophy of science was developed mainly by certain scientists (especially in the domain of mathematics) or by philosophers that had become familiar with certain specialized sectors of philosophy, such as logic and philosophy of language. Moreover, the leadership in this domain was spontaneously taken by the continuators of the philosophical movement that had strongly celebrated science, i.e., positivism; they were the members of the Vienna Circle whose common doctrine is usually labeled "neo-positivism", "logical positivism" or "logical empiricism". The last denomination points out the prevalence of a radical empiricism that superposed a particular feature to this philosophy of science.

How much did that philosophy of science concern the "working scientists"? Not very much indeed, because its declared aim was a logical

reconstruction of the result, of the output of such a "work", once it had been expressed in standardized artificial *languages* to which standardized formal logical tools could be applied. In other words, that philosophy of science was rather the philosophy of such an abstract, highly idealized and rarefied portrayal of science that had almost no contact with *doing science*, with the actual *practice* of scientific investigation. The shortcomings of such an approach clearly appeared in its inability to account for the *dynamics of science*, even when this is considered in its most elementary aspect, that is, theory change. Logical-linguistic criteria in conjunction with an alleged pure empirical evidence proved unable to account for theory change and theory comparison such as they *actually occur* in scientific practice, and other tools and criteria had to be looked for, taken from sociology, cognitive psychology, social philosophy, metaphysics, ontology. All these were more or less fruitful "approaches", but the question can be asked whether or not a recognized "philosophical school" can be indicated as the source of inspiration for a new trend in the philosophy of science. The answer to this question is affirmative: pragmatism is the school of thought that (though in a less explicit and rigid way in comparison with logical empiricism and analytic philosophy) has had a certain influence on that new trend in philosophy of science which is called "pragmatic", and this is, after all, rather obvious since this new trend takes more seriously into consideration scientific practice, and practice is for pragmatism the fundamental point of reference in several philosophical issues.

Pragmatists' ideas remained at variance with those of the dominant philosophical movements that shaped 20th century philosophy of science. Today, however, the core positions of pragmatism are present in the philosophy of science: they include a mild version of naturalism, anti-foundationalism, fallibilism, holism (in the sense that they avoid strict dichotomies) and empiricism. Indeed, during the last twenty years, there has been in philosophy of science a worldwide change whose starting point can already be found in the work of Henri Poincaré. The practical turn in philosophy of science postulates that scientific practice (such as the dynamic of laboratory work, the constitution of common knowledge or the consideration of tacit knowledge) must be the basis of external and internal studies of science. In order to appreciate the relevance of pragmatism for philosophy of science two chief issues should be examined: on the one side, what pragmatism can offer to the practical turn in philosophy of science which – considered in itself – is rather a consequence of the failure of the traditional foundational programs; on the other side, whether the practical turn in philosophy of science can produce some progress on problems belonging to foundational programs and inadequately solved within such programs. Those are the matters of central concern to the essays presented in this volume.

In the first introductory paper on "Truth between Semantics and Pragmatics", *Evandro Agazzi* points out that truth had been excluded from the requirements of science after the so-called "foundational crisis" of the exact sciences (mathematics and physics) occurred between the end of the 19th and the beginning of the 20th century. A formalistic outlook had imposed itself in the philosophy of science, from which meaning and truth were excluded. This approach, however, was seriously weakened after the discovery of the "internal limitations of formalisms" entailed by Goedel's theorems, and Tarski almost at the same time advocated the legitimacy of meaning and truth for the formalized languages, calling "semantics" this part of the metatheoretical investigations. This terminology has remained standard especially in mathematical logic. One must note, however, that semantics regards in a proper sense the level of *meaning*, whereas truth implies in addition the *reference* of the language to some extralinguistic domain of entities. This domain is not accessible by means of logical, linguistic or conceptual analysis, but can be attained through *operations* of some concrete kind, whose nature determines also the ontological status of the referents. Operations belong to *praxis*, and this is why the notion of truth is more properly attributed to "pragmatics", understood not in the original Morris' sense, but rather in a sense closer to pragmatism, in which the performance of actions is considered essential for providing criteria of truth.

According to *Alberto Cordero*, numerous ideas initiated by the classical pragmatists have homes in the main areas of contemporary philosophy of science; some of the ideas are "bad", some are merely "ugly", and some are "good". In his paper on "Pragmatism: The Good, the Bad, and the Ugly", he considers a few examples and elaborates on one particularly vibrant move in philosophy of science, namely the naturalist reform of empiricism and with it the rise of an "impure" and fallibilist but also arguably promising philosophy continuous with scientific inquiry.

In his paper on "Pragmatism and Objectivity", *Fabio Minazzi* takes up the old question whether, in the philosophy of science, the pragmatic turn has meant the defence of contextualism against the objective scope of knowledge (something comparable with the trend in the philosophy of language that has made of contextualism its workhorse for rejecting truth and advocating a new version of relativism). The image of science, however, is more complex because in scientific thinking are present different components, and their relations are not such as to destroy the objective purport of knowledge, although the objectivity of such knowledge is always built within precise "regional ontologies".

It is generally acknowledged that science studies, broadly understood as studies that take science as their object, underwent a change that began in the 1970s and was later often called a "practice turn". In her

contribution on "Shifts Introduced by the Practice Turn in Philosophy, History and Social Studies of Science", *Léna Soler* attempts a global characterization of this turn to practice. Her aim is to point to general and transversal trends, beyond the diversity of orientations and possible specificities depending on the fields. The corresponding trends will be framed in terms of shifts, so as to emphasize the contrast with anterior so-called 'traditional' ways of approaching science against which actors of the practice turn have motivated and defined their aims, methods and views.

According to *Marco Buzzoni*, Reichenbach's and Popper's discovery/justification dichotomy affects (in different ways) both the exponents of the sociological turn and the new experimentalists, despite the fact that these theorists are keenly aware that this dichotomy prevents a full recognition both of the social character of science and of the role of experiments in the natural sciences. In his paper on "The Practice Turn in Philosophy of Science: The Discovery/Justification distinction, and the social dimension of scientific objectivity", he proposes to distinguish between two main senses of the discovery/justification dichotomy, namely a transcendental or pre-operational sense, connected with the validity claims of any meaningful discourse, and a methodological sense. While the distinction should be accepted in the former sense, it should be rejected in the latter sense. This allows us to put forth a coherent argument for the essentially social character of science, including the intersubjective reproducibility of experimental practices.

In his contribution "Pragmatism and the Practical Turn in Philosophy of Mathematics: Explanatory Proofs", *Gerhard Heinzmann* points out the fact that the practical turn in philosophy of mathematics is by no means a uniform approach of anti-foundationalism but reflects different developments. He discusses some well-known difficulties of traditional positions such as Platonism and nominalism that pragmatism is trying to overcome by finding himself confronted with the remoteness of mathematical practice. Returning to this practice, pragmatism offers some symptoms to better illuminate the Cartesian distinction between certainty and evidence of proofs. So, a proof seems to be more evident if it gives an "intuitive insight", i.e., if "parts" of it can be interpreted as exemplifications of a general idea (schema). The insight increases in proportion to the intuitive proof stages.

The purpose of *Paul Weingartner*'s paper on "Pragmatic Aspects of Tarski's Truth Condition" is to show that Tarski's Truth Condition (TTC) has some important pragmatic aspects. He argues by quoting Tarski that he was aware of them. On the other hand, several people who formulated objections against TTC have neglected these pragmatic aspects. Moreover, Weingartner shows that by extending TTC through incorporating these aspects different versions of the Liar-paradox can be

solved. His contribution mentions some precursors of TTC in the history of philosophy, discusses some objections to TTC, which are concerned with two important pragmatic aspects of TTC and shows finally how to extend TTC with these pragmatic conditions in order to solve Liar-paradoxes.

In his contribution on "An Epistemological and Action-theoretical Approach to Pragmatic Realism" *Hans Lenk* argues for the thesis that not only philosophy of science but also general epistemology might profit from interfacing better with technology-oriented methodologies and an action-oriented reorientation of the concept of "knowledge" that can, in a wider sense, be called "grasping". The concept of "grasping" implies that the active dimension of acquiring knowledge is a genuinely constructive activity and not primarily a representational task of trying to represent external structures. Grasping should not only be interpreted in the literal sense of "gripping something"; it should also be understood in the figurative senses of "understanding", "knowing", and "getting inside". Knowledge in this sense is understood to be a kind of activity or even interactivity between partial systems: it relies upon agents, be they even, amongst others, "software agents".

Vincenzo Fano's and *Giovanni Macchia*'s paper on "Robustness and the Rejection of Wegener's Continental Drift in the thirties" offers some new epistemological reflections about the establishment of continental drift and plate tectonics as the current paradigm in geology. There is widespread agreement in the literature that the rejection of continental drift as a valid scientific hypothesis was rational. The paper challenges such standard account. It reviews many arguments in favor of the rationality of such a rejection and finds them all inconclusive. Finally it puts forward an independent argument to the point that the dismissal of continental drift not only was not rational, it was actually irrational.

Reinhard Kahle discusses in his paper on "After Hilbert and Brouwer: Bourbaki and Bishop" the mathematical "*Grundlagenkrise*" on a philosophical ground between Hilbert and Brouwer. It came, in some sense, to an end with Gödel's theorems. Searching for a lasting effect of this controversy in mathematics, he argues that Bourbaki (here considered as heir of Hilbert) and Bishop (considered as heir of Brouwer) turned the lessons of the discussion into practical consequences for the development of modern mathematics.

The papers collected in this volume were presented at an international conference on "Pragmatism and the Practical Turn in Philosophy of Sciences", promoted by the International Academy of the Philosophy of Science, the Archives Henri-Poincaré and the Elie Cartan Institut of the Université de Lorraine, at the Prémontrés Abbey, Pont-à-Mousson, which offered a perfect setting for a scientific exchange. It was attended by

fifty scholars from Austria, Belgium, Brazil, Canada, Denmark, France, Germany, Italy, Netherlands, Portugal, Spain, and the USA.

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Truth Between Semantics and Pragmatics

by *Evandro Agazzi*

Different meanings of truth

The *problem* of truth is complicated by the fact that the very *concept* of truth has received, and still receives, different meanings in ordinary language as well as in philosophy. According to certain ways of speaking, truth appears as something like a substance, that can be known, approached, even divided into parts (e.g., when we say "you do not tell the truth", "this is very far from truth", "the truths of faith are very different from the truths of mathematics"). This meaning is also implicit in such statements as "the aim of scientific investigation is the discovery of truth", or "nobody knows the truth about the death of Mr. Smith", or "after many efforts we have come closer to truth". What is unsatisfactory in this "substantival" meaning of truth is that it contains no indication about the nature of truth itself, about its characteristics: we may see that truth is not a material substance, but we cannot see "in what it consists". One could try to shift the difficulty by turning to an "adjectival" characterization of truth, saying that truth is the abstract name of a certain property, that is, of the property denoted by the *adjective* "true". In this way, however, ambiguities are still not avoided since it is not univocal in ordinary language what are the *subjects* to which the attribution of truth (or falsity) can be correctly applied. For example, are common in ordinary language expressions such as "a true Christian", "a true communist", "a true friend", "a true diamond", "the true Kant", "a true story", "a true sentence", "a true theory", and so on. We do not maintain that some of such expressions are wrong or improper (they could be justified through special considerations that are hardly made explicit and are rather complex), but for reasons of clarity we propose, in the present paper, to restrict the notion of truth to what is usually qualified as "propositional truth", according to which that of being true is a property that does or does not hold for

a proposition and, since a proposition must be formulated in a language in order to be considered and evaluated, we can also say that truth is the property of a sentence whose *sense* is the proposition. This is the meaning of truth that has been prevalent in Western philosophy since the time at least of Plato and, in particular, was systematically elaborated by Aristotle, a meaning that they expressed by saying that a discourse is true if "it says that something is the case, and this is the case". In other words, truth consists in a right relation between thought (or language) and reality, a relation that has been called of "correspondence" by several contemporary authors, but was by no means considered as something like a "mirroring" in classical philosophy, where it was expressed through the much more pregnant concept of *adequatio* (more precisely, as *adequatio intellectus et rei*). This notion, that in particular appears perfectly in keeping with common sense, was considered unproblematic even by those thinkers who advanced more sophisticated "theories of truth", but gave it for granted as a "nominal definition" of truth. For instance, Kant says that "the nominal clarification (*Namenerklärung*) of truth, namely that it is the accordance (Übereinstimmung) of knowledge with its object, is here given for granted and presupposed" (*Critique of Pure Reason*, B 82). Kant rightly remarked that the weakness of this spontaneous *notion* of truth was that it does not offer any *criterion* for truth, and the whole endeavour of his epistemology was precisely oriented to providing such a criterion which (as one can easily see) implies a satisfactory determination of the nature of the "accordance", as well as of the nature of the "object" (which in Kant's doctrine cannot be equated with the classical *res* understood as "reality" in a general sense).

The crisis of the notion of truth

It lies outside the scope of this paper to discuss the soundness of Kant's doctrine and of its developments especially within the "transcendental idealism", since it can be said that the "question of truth" seemed to remain a rather abstract and sophisticated debate going on in the ivory tower of professional philosophers, whereas normal people were satisfied with common sense and with the growing harvest of true knowledge produced by the sciences (Kant himself, after all, had considered mathematics and modern physics as paradigms of secure knowledge whose cognitive conditions should guide philosophy in the elaboration of a general model of knowledge). As a matter of fact this was the cultural atmosphere promoted by positivism that characterized especially the nineteenth century. It was, however, precisely the deep crisis occurred in the "exact sciences" at the end of that century and the beginning of the

twentieth that imposed a deep re-consideration of the problem of truth. The debates on the non-Euclidean geometries and the "foundations of mathematics" had led to the situation concisely expressed in the famous words of Russell, "mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true"[1]. Words that can be seen as the prelude of Hilbert's formalistic view of mathematics that dominated the first decades of the twentieth century. A similar situation (though for different reasons) occurred in physics around the same years as a consequence of the creation of relativity theory and quantum mechanics. If one reflects on both phenomena, one sees that they have a common root, that is, the fragility of the *criterion* proposed by Kant, that was *intuition* understood as *sensory* intuition (in his mature "critical" period he clearly excluded intellectual intuition). In modern mathematics and physics it had become clear that such an intuition was neither necessary nor sufficient for affirming the truth or falsity of statements and theories, and this easily induced people to maintain that truth is not a relevant condition for the admission of scientific theories, that can be (and are) accepted for other reasons (such as internal consistency or compatibility with observations) so that even rival theories should be accepted if they satisfy these other requirements. Taken seriously, the claim that scientific theories *are* neither true nor false amounts to saying that they have no *objects* about which they speak, and this is precisely the conclusion expressed in the quoted words of Russell.

Following the last analysis, the only condition that remained imperative for scientific theories – and systems of sentences in general – was non-contradiction or *consistency*, which was understood as the impossibility of deducing both a sentence and its negation from a given set of sentences equipped with a certain logical calculus (whose combination was called a "formal system"). If intuition had been considered a fragile ground for justifying a theory, however, consistency as well risked to appear a problematic requirement if it could not be shown to hold for a formal system without resorting to some external intuition. The hope to attain such a goal represented the celebrated Hilbert's Program whose failure was entailed by Gödel's proof that the consistency of a formal system (satisfying certain minimal conditions) cannot be proved "within" the system itself[2]. This famous result is usually considered in its more immediate significance, that is, as a demonstration of the failure of the original Hilbert's Program regarding the foundations of mathematics (that could be taken up again, in a more relaxed form by admitting

1. This often cited statement appeared first in (Russell, 1901) and was taken up literally in (Russell, 1917, chap. 4).

2. See (Gödel, 1931).

the use of "constructive" methods in metamathematics). Also its more philosophical significance, however, was soon pointed out, and consisted in the overcoming of that "syntacticist" prejudice according to which exact sciences must arrive at a stage in which their contents can be expressed by means of strictly formal systems "devoid of meaning" and open to a pure logical analysis, for which only internal consistency must be required. This overcoming is rightly identified with Tarski's famous paper "The concept of truth in formalized languages" that appeared in Polish in 1933 (Tarski, 1933) and found broader circulation in its German translation of 1935 (Tarski, 1935). This paper is considered the starting point of *semantics,* and it actually contained the approach and the basic tools of what was later designated with this term in mathematical logic, but it also had more general impacts, the most significant of which is probably the "turn" in the thought of Carnap, who had been the champion of syntacticism and gradually devoted attention to the "meaning" of scientific sentences and finally published in 1942 his *Introduction to Semantics* (Carnap, 1942), that became a standard reference for the inclusion of semantics in the treatments of the methodology of the sciences. It must be noted, however, that the term "semantics" had been explicitly used and rigorously treated by the same Tarski in a lecture held at a congress in Paris and published in its proceedings in 1936 in German, with the significant title "Foundation of the scientific semantics" (Tarski, 1936). This happened before the publication of the very influential work by Charles Morris*, Foundations of the Theory of Signs* (1938), in which the general theory of signs (i.e., semiotics) is divided into the three well-known domains, syntax, semantics and pragmatics.

The semantic conception of truth

What is of interest in this short historical reconstruction is that the path to semantics was opened by an effort to clarify the notion of *truth*, and this is explicitly confirmed in the very title of Tarski's article in which he gave a less technical and philosophically more articulated presentation of his theory of truth, *The Semantic Conception of Truth and the Foundations of Semantics* (1944). The reason for calling "semantic" his approach is the intention to oppose the syntactic-conventionalist approach of Carnap and logical empiricism, as it indirectly appears in the lines of Tarski himself, and very explicitly in a paper of 1936 by a disciple of him, M. Kokoszynska (1936), who presents Tarski's theory as at variance with the "coherence theory of truth" advocated by logical empiricists which intends to eliminate truth by means of a "syntactic concept" in which the "accordance" (*Übereinstimmung*) with other sentences replaces the genuine

requirement of an "accordance with reality". Now, the common-sense and traditional notion of the truth of a sentence (explicitly accepted by Tarski) makes it to consist in a relation of the sentence with some "reality" different from the sentence itself, a reality that Kant had called "object" and we should better call *referent* to remain in keeping with a more refined contemporary terminology. Therefore, the one proposed by Tarski is typically a "referential semantics" in which referents are abstractly thought of as unqualified individuals, sets of individuals, ordered n-tuples of individuals, etc., that is, the semantics that has become standard in mathematical logic and which we can call *extensional semantics* because the *interpretation* of linguistic signs is not understood as attributing them a *sense or intension*. Note that this was also the case with Morris' semiotics, in which the task of semantics was indicated as that of establishing "the relation of signs to their *designata* and so to the objects which they might or do denote" (Morris, 1938, p. 35). But this was not strange, since Morris was speaking of a *meaningful* language and not of a formalized language whose signs are supposed to be meaningless, and the "interpretation" has to provide them with a meaning in a full sense.

The treatment of truth within this extensional semantics has attained conspicuous results that are displayed in "model theory" of mathematical logic, and at the same time has brought to light several limitations, especially evident in meta-theorems such as those regarding semantic incompleteness of theories and logics, isomorphisms, lack of categoricity, whose philosophical core might be identified with the impossibility of picking up, of grasping the *intended* res, object, referent mentioned in the nominal definition of truth.

As a consequence, it became clear that a full-fledged semantics has to recover certain fundamental distinctions already present in the Scholastic tradition and elaborated in modern form, for example, by Frege with his distinction between *sense (Sinn)* and *reference (Bedeutung)* so that both of them must join in order to constitute the *meaning* of a linguistic expression or *sign*. In such a way the approaches and tools of philosophy of language entered massively into semantics, besides those (mostly of set-theoretical nature) used by the extensional semantics, but one cannot say that this broadening of the horizon and confluence of different approaches actually contributed to the solution of the "problem of truth", especially because even these expanded semantic tools did not provide the means for grasping the intended object of a linguistic expression. It is certainly not necessary to recall here the well-known developments of the so-called "post empiricist" philosophy of science (with its salient theses of the theory-ladeness of every concept, the social determination of all kinds of knowledge, the social-political contrivances that steer scientific practice and affect the reliability of the alleged results of scientific investigation) in