Logic, Epistemology, and the Unity of Science

Volume 45

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Semantics and Truth

Springer

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ISSN 2214-9775 ISSN 2214-9783 (electronic)
Logic, Epistemology, and the Unity of Science
ISBN 978-3-030-24535-1 ISBN 978-3-030-24536-8 (eBook)
https://doi.org/10.1007/978-3-030-24536-8

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To my Family

Preface

This book has a long history. I began to work on it in 2001, on the occasion of investigations supported by the Committee of Scientific Research in Poland at the end of the last century, realizing a grant. I continued the research on the concept of truth during my stay at the Netherlands Institute of Advanced Study in Waassenaar from September 2003 to June 2004. I would like to express my deep thanks to these institutions. Unfortunately, teaching and other professional duties caused me to interrupt writing this book, although I published several papers on truth (historical as well as substantial) in the interim. I summarized many of these results in Woleński 2005 (a book on epistemology and its problem—in Polish). I use a substantial portion of the material already published in the present monograph as well as the mentioned papers on truth; details will be provided at appropriate places, but I wish to give a special mention to my monograph Woleński 1989 on the Lvov–Warsaw School which provides a description of the general philosophical environment relevant for the topic of the present book.

Technical remarks. This book has no endnotes or footnotes. I belong to that group of readers who dislike the latter and can barely tolerate the former. Instead, I have introduced digressions, indicated by (**DG**); they end with the sign ►. Every chapter has its own numbered set of digressions with indications of the type (**DGn**), where the digit refers to the number of a given digression. References to digressions are indicated by the sequence of the type **DGnX**, where the indication to following the digit refers to the number of the chapter in which the given digression occurs; if the reference concerns digression in the same chapter, the sequence **DGn** is employed. For example, the sequence **DG1VII** refers to the first digression in Chap. 7 and the sequence **DG3**—to the third digression in a given chapter. The same convention applies to references made to numbered formulas and definitions, where they occur. References to sections (§), formulas, digressions, and definitions within the same chapter omit its number. I freely use devices to indicate distinctive phrases (mainly formulas and lists of questions), namely, numerals, letters, or special signs, like # or (*). In general, such references apply to particular paragraphs, but I hope that specific contexts preclude possible misunderstanding. Here is an example of a digression:

(**DG1**) One may wonder how I use the word 'theory' with respect to a set of philosophical statements. Philosophy does not offer collections of sentences as being either logical or mathematical theories—that is, sets of sentences closed by the consequence operation or as empirical theories, namely, collections of hypotheses formulated in order to explain or predict some empirical data. As I shall show in Chap. 1, aletheiology (this word is derived from the German neologism *Alethiologie*, introduced by Johannes Lambert in the eighteenth century; 'aletheiology' can be regarded as a substitute for 'philosophy of truth') has to fulfill some tasks stemming from its history. Such an enterprise always leads to a definite class of statements that answer traditional questions. Such answers are traditionally called truth-theories or theories of truth, and there is no reason to abandon this terminology. In general, philosophical theories are bodies (classes, complexes, sets, etc.) of interconnected statements, which are subjected to philosophical and metaphilosophical constraints—for example, that we work *via* claims, like that every philosophical problem is legitimate, provided that it can be naturalized.►

Bibliographical references consist of the author's name, the publication date, and/or page-number(s) (note that the sequence M, N 2000 refers to names of co-authors or co-editors of a joint piece published in 2000)—except for classical sources up to and including Kant. The latter are quoted or mentioned in full (first time), with information about English translation, if any, or by abbreviated (in further cases) title. If a translator's name is not given, translation is mine. These sources are not included in the bibliography at the end of the book. This way of treating the classical sources is motivated by my feeling that brief references to them such as Kant 1787 are odd. Moreover, the exact dates of some of the older sources are unknown. Pre-Socratics are mainly quoted after H. Diels, *Fragmente der Vorsokratiker*, 3 vls., 17th ed. Berlin: Weidmannsche Verlagsbuchhandlung 1954 (I use the standard notation: Diels I 4B 35 refers to fragment 35 in the section B of chapter 4 of volume 1) or G. S. Kirk, J. E. Raven, M. Schofield, *The Presocratic Philosophers*, 2nd ed., Cambridge: Cambridge University Press 1983 (references: Kirk, Raven, Schofield plus page-number); otherwise, a special information is provided. In other cases (until the nineteenth century), I usually mention the title and chapter (section, etc.). For historical reasons, references (to writings included in the bibliography) are almost always to originals and first editions (very few exceptions are justified by the lack of historical relevance or proximity of particular editions). Consequently, the titles of the books and papers listed in the bibliography at the end are always given in the language of the original. If an English translation or a later edition is also mentioned in the bibliography, page-references are to it. Names of translators are provided only in the case of quoting from a given book (paper). If several writings are cited together, they are chronologically ordered.

One more remark about bibliographical data is in order. There are thousands (that is no exaggeration) of writings about truth and problems related to this concept. Also Tarski's truth-theory, which is the main focus of my considerations, was presented, commented on, and criticized so many times that it is difficult to assess their number. So I had to make a selection of quoted books and papers, but I

decided to include into the Bibliography rather a long list of my own contributions related to the concept of truth. The reason is not that I try to promote myself, but to give a credit to the already published material used in this book. In general, I frequently omit references in the case of marginal questions, illustrative examples, or commonly known facts from the history of logic and philosophy. Clearly, my decisions are to some (or even a great) extent subjective. I apologize in advance for all bibliographical inaccuracies.

One omission should be especially mentioned. I resigned from quoting many Polish books and papers. On the other hand, I am greatly indebted to many of my Polish friends and colleagues for stimulating discussions and/or benefit that stemmed from reading their writings. The list of these persons is included in alphabetical order: Anna Brożek, Wojciech Buszkowski, Bogdan Chwedeńczuk, Roman Duda, Katarzyna Gan–Krzywoszyńska, Adam Grobler, Michał Heller, Jacek J. Jadacki, Elżbieta Kałuszyńska, Anna Kanik, Katarzyna Kijania–Placek, Sebastian Kołodziejczyk, Stanisław Krajewski, Piotr Łukowski, Grzegorz Malinowski, Witold Marciszewski, Wiktor Marek, Roman Murawski (particularly for his consultations about formal matters), Jan Mycielski, Adam Nowaczyk, Adam Olszewski, Leszek Pacholski, Jacek Paśniczek, Tomasz Placek, Jerzy Pogonowski, Michael Schudrich, Andrew Schumann, Marcin Selinger, Stanisław J. Surma, Jerzy Szymura, Marek Tokarz, Kazimierz Trzęsicki, Urszula Wybraniec–Skardowska, Ryszard Wójcicki, Andrzej Wroński, and Jan Zygmunt. Although I credited my debts in quotations, some persons from the abroad deserve to be especially mentioned for their remarks and discussions with them, namely, Joseph Agassi, Evandro Agazzi, David Armstrong, Nuel Belnap, Arianna Betti, Natan Berber, Jean-Yves Béziau, Johannes Brandl, Maria Luisa Dalla Chiara, Franco Conglione, John Corcoran, Marian David, Michael Devitt, Pascal Engel, Susan Haack, Hartry Field, Keith Fine, Juliet Floyd, Dagfinn Føllesdal, Paul Horwich, David Kashtan, Wolfang Künne, Eckerhardt Köhler, Saul Kripke, Kevin Mulligan, Ilkka Niiniluoto, David Pearce, Volker Peckhaus, Roberto Poli, Carl Posy, Michael Potter, Gabriel Sandu, Denis Savieliev, Dana Scott, Krister Segerberg, Valentin Shehtman, Gila Sher, Peter Simons (we co-authored together the paper important for this book), Barry Smith, Göran Sundholm, Matti Sintonen, Jan Tarski, Christian Thiel, Max Urchs, Jean-Yves Beziau, Jan von Plato, and Paul Weingartner. I also cannot omit to mention colleagues and friends who passed away, in particular, Józef M. Bocheński, Donald Davidson, Burton Dreben, Solomon Feferman, Andrzej Grzegorczyk, Rudolf Haller, Jaakko Hintikka, Henryk Hiż, Jerzy Kalinowski, Stig Kanger, Alexander Karpenko, Czesław Lejewski, Jerzy Łoś, Leszek Nowak, Jerzy Pelc, Jerzy Perzanowski, Ingmar Pörn, Marian Przełęcki, Hilary Putnam, Willard v. O. Quine, Barbara Stanosz, Roman Suszko, Klemens Szaniawski, Aleksander Szulc, Georg Henrik von Wright, and Józef Życiński. All lists included above are surely incomplete and please forgive me for omissions.

Springer Verlag agreed to publish the present book in the series “Trends in Logic” (Heinrich Wansing, the editor) at first, and finally—“Logic, Epistemology, and the Philosophy of Science” (Shahid Rahman, the editor). I am very indebted to the publisher, and both mentioned editors for patience allowing me to complete this

book. Adam Tuboly kindly provided English translations of Otto Neurath's letters to Rudolf Carnap quoted in Chap. 9, and permitted me to quote them. Romina Padro sends me Kripke's forthcoming paper (see Bibliography). Last but not least, I am very indebted to Arthur Szylewicz for thorough job of emending my English, to Jacqueline Duong Nguyen for processing those changes electronically, and to the anonymous referee for his/her valuable remarks. Although I did not follow all suggestions of the referee, the final version of the text is certainly better than the earlier one.

All non-English single words or nominal phrases are printed in italics, and usually occur without quotation marks—except for those that occur in cited passages; the same applies to Greek or Latin philosophical maxims, for example, the famous sentence *ens et bonum convertuntur*. Quotations are normally inserted as separate fragments printed in smaller letters (non-English fragments are printed in italic in such cases), others occur in double quotes ("…"); such quotes are also used to mark a metaphorical meaning of a given phrase. Single quotes ('…') indicate that an expression is mentioned, but not used (see **DGIII3** for an explanation of this distinction). In order to avoid using quotes too frequently, I adopt the standard convention that such phrases as 'the expression …', 'the letter …', 'the variable …', 'the formula …', etc. indicate that their completion stands in the material mode, that is, are mentioned, not used. Thus, the phrase 'the variable *x*' abbreviates 'the variable '*x*'. However, this convention (following the style employed by Polish logicians) applies only to the fully symbolic contexts. If a phrase contains solely words, or words and symbols, we write, for example, 'the sentence 'snow is white', but not 'the sentence snow is white' and 'the formula '*x* is white', but not 'the formula *x* is white'. All citations preserve the original, also its way of employing quotation marks, with the exception that double-spaced print, sometimes occurring in older German writings, is replaced by italics (for instance, 'N a m e' by '*Name*'). The African, Chinese, Greek, Hebrew, and Sanskrit words occur in simplified Latin transcriptions. I am fully aware that technical rules prescribed in this book are conventional, and that their use sometimes looks artificial, but I hope these circumstances do not lead to misunderstandings.

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Reference

Woleński, J. (1989). *Logic and Philosophy in the Lvov–Warsaw School*. Dordrecht: Kluwer.

Introduction

Abstract Presenting Tarski's semantic theory of truth (**STT**) as a formal logical construction and as a philosophical theory is the task of the book. Although **STT** as a formal theory is commonly recognized, its philosophical significance is debated. Several opinions of logicians and philosophers are quoted in order to show the state of art of the discussions around **STT**. My own attitude considers **STT** as philosophically important. Moreover, I explain my analytical methodology consisting of so-called interpretative consequences.

This book offers a systematic exposition of the semantic theory of truth (**STT** henceforth) in frameworks of semantics and logic. This theory, formulated by Alfred Tarski in 1930s, has two separate, though closely interconnected, aspects. First, **STT** is a formal logical (or even mathematical) theory and functions as the central conceptual foundation of model theory, next to proof theory and recursion theory, of the most important branches of modern mathematical logic. Second, **STT** is also a significant philosophical doctrine (see Woleński 1999a), which tries to elaborate the notion of truth as investigated by philosophers from antiquity to contemporary times. The assessment of **STT** as a mathematical theory on the one hand, and as a philosophical doctrine on the other, is however different to some extent. Consider the following prophecy (Hodges 1985–1986, p. 135):

> But before you dismiss him as a mere theorem prover, you should ask yourself what your grandsons and granddaughters are likely to study when they settle down to their 'Logic for computing class' at 9.30 after school assembly. Will it be syllogisms? Just possibly it could be the difference between saturated objects and unsaturated concepts, though I doubt it. I put my money on Tarski's definition of truth for formalized languages. It has already reached the universal textbooks of logic programming, and another ten years should see it safely into the sixth forms. This is a measure of how far Tarski has influenced the whole framework of logic

Clearly, in the quoted fragment, Hodges talks about **STT** as a well-established mathematical theory. Independently of whether Hodges' prophecy is right, or perhaps too optimistic with respect to the education of our grandsons and granddaughters, Tarski's truth-definition is permanently in vogue among mathematical

logicians and specialists in the foundations of mathematics, and almost nobody denies its importance as an idea within mathematical logic. If the reader wonders why I say "almost nobody", I would like to recall what Turing said once about **STT**, namely, that "Triviality can go no further" (see Wang 1986, p. 144). Turing's words elicited the following view from Hao Wang (p. 144):

> There is a great difference of opinion on the importance of [Tarski's] contribution to this area [that is, the theory of truth—J. W.].

It is not quite clear whether this evaluation concerns the formal aspect of **STT** or its philosophical content or even both. Nevertheless, it is fair to say that the importance of Tarski's work as a mathematical enterprise is much closer to Hodges' view than to Turing's and Wang's opinion.

That Tarski himself considered **STT** as a philosophical doctrine can be clearly documented by two passages taken from his main work (Tarski 1933, p. 152, pp. 266–267; the first opens the book, the second almost closes it):

> The present article is almost wholly devoted to a single problem—*the definition of truth*. Its task is to construct—with reference to a given language—*a materially adequate and formally correct definition of the term 'true sentence'*. This problem […] belongs to the classical questions of philosophy […].
> […] in its essential parts the present work deviates from the mainstream of methodological study [that is, metalogical or metamathematical; the scope of the methodological study should be seen here in a wider sense than in the Hilbert school, that is, as not restricted to finitary proof theory—JW]. Its central problem—the construction of the definition of true sentence and establishing the scientific foundations of the theory of truth—belongs to the theory of knowledge and forms one of the chief problems of philosophy. I therefore hope that this work will interest the student of the theory of knowledge [in the Polish original "zainteresują się przede wszystkim teoretycy poznania", which literally means "will interest above all epistemologists"—JW] that he will be able to analyse the results contained in it critically and to judge their value for further research in this field, without allowing himself to be discouraged by the apparatus of concepts and methods used here, which in places have been difficult and have not been used in the field in which he works."

However, **STT** as a philosophical doctrine is far more complex and there certainly is—to repeat Wang's evaluation—for the most part proper in this context, "a great difference of opinion on the importance of [Tarski's] contribution." To start with positive responses, Tarski's ideas became immediately welcomed by philosophers using logical tools in philosophical investigations ('logical philosophers' is a label that has recently gained popularity). Alfred Ayer wrote (Ayer 1967, p. 116):

> Philosophically the highlight of the Congress [in Paris in 1935—J. W.] was the presentation by Tarski of a paper which summarized his theory of truth.

Three important contemporary philosophers, namely, Kazimierz Ajdukiewicz, Rudolf Carnap, and Karl Popper radically changed or at least modified their earlier views under Tarski's direct influence. Ajdukiewicz abandoned radical conventionalism, which was, among other things, a theory of language and meaning (Ajdukiewicz 1964, p. 315):

> The objection […] communicated to me by Tarski in a conversation […] seems to show that the concept of meaning is not definable in purely syntactical terms without the use of semantic terms in the narrower sense.

Carnap made a similar point (Carnap 1942, p. X):

> Tarski, both through his book, and in conversation, first called my attention to the fact that the formal method of syntax and semantics must be supplemented by semantic concepts, showing at the same time that these concepts can be defined by means not less exact than those of syntax. Thus the present book owes very much to Tarski, more indeed than to any other single influence.

Briefly, Carnap passed, under Tarski's influence, from philosophy as logical syntax to philosophy as exact semantic analysis. It is no exaggeration to say that Tarski made an essential contribution to the semantic revolution in philosophy (see Woleński 1999b and Chap. 6).

Finally, Popper recalls (Popper 1972, p. 322; see also Hazohen 2000, passim):

> […] I met Tarski in July 1934 in Prague. It was early in 1935 that I met him again in Vienna in Karl Menger's Colloquium […] It was in those days that I asked Tarski to explain me his theory of truth, and he did so in a lecture of perhaps twenty minutes on a bench (un unforgotten bench) in the *Volksgarten* in Vienna. He also allowed me to see the sequence of proofs sheets of the German translation of his great paper on the concept of truth, which was than just sent to him from […] *Studia Philosophica*. No words can describe how much I learned from all this, and no words can express my gratitude for it. Although Tarski was only a little older than I, and although we were, in those days, on terms of considerable intimacy, I looked upon him as the one man whom I could truly regard as my teacher in philosophy, I have never learn so much from anybody else.

How did Tarski's ideas influence Popper? Generally speaking, Popper abandoned his earlier doubts about the concept of truth and adopted realism in his approach to science. In particular, he came to the conclusion that **STT** rehabilitated the idea that truth consists in conformity of propositions to objective reality.

These three examples of the acceptance of Tarski's ideas together along with Ayer's general assessment are perhaps the most spectacular traces of Tarski's influence on philosophy. However, the philosophical role of **STT** is by no means limited to these specific works. Almost every book (introductory or advanced) in semantics, philosophy of language, or the history of analytic philosophy gives a summary of or, at least, mentions it. Similarly, almost every discussion of how to define meaning, semantic realism, or scientific realism employs Tarski's results, or at least alludes to them. Several important views in contemporary philosophy make use **STT**, for example, Donald Davidson's theory of meaning as based on truth-conditions (see Chap. 9, Sect. 9.4) or various semantic theories of induction (Carnap and his followers). Tarski's theory was more or less modified, like in Kripke 1975 or Gupta, Belnap 1993, or replaced by other constructions, as in Hintikka 1996. Since both modifications and replacements refer to **STT** as the solid starting point, it can be generally said that Tarski's ideas attracted many leading philosophers, contributed to the semantic revolution, gave the rise to several

modifications and constructions regarded as alternatives to the semantic theory of truth, stimulated investigations on a variety of philosophical problems and, last but not least, found a lasting place in textbooks, monographs and anthologies. It is no exaggeration that every post-Tarskian theory of truth (at least in analytic philosophy), even if critical to some extent, is propter-Tarskian. Saul Kripke expressed this dependence by saying (Kripke 1975, p. 97) that the ghost of the Tarski hierarchy (of languages; see Chaps. 7–8) "is still with us." (see Kripke 2019a, for a more sophisticated, than in Kripke 1975, treatment of the issue of language-hierarchies).

The above focuses on the positive influence of Tarski's ideas as something accepted, or at least stimulating, in philosophical investigations. However, **STT** is also strongly criticized. Of course, it is not surprising that most non-analytic philosophers, of the post-modernist camp, for example, simply ignore this theory, or even regard it as a typical degeneration of the logical mind. I will not comment on such criticisms, although I would like to explain why. A discussion between philosophers belonging to various philosophical camps is a delicate matter. The main problem is that metaphilosophical options contribute substantially to resolving issues. Thus if someone says as Martin Heidegger does, that truth is entirely outside logic or semantics and must be located in philosophical anthropology, there is very little chance of a fruitful discussion between such a philosopher and one who believes philosophy to be based on logical analysis. As a dedicated logical philosopher, I do not say that other philosophies are wrong and have no value. I only indicate that, except to register fundamental metaphilosophical contrasts and their effects, I do not have very much to discuss with non-analytical or post-analytical philosophers; their attitude will be similar, of course. A consequence of this view, which I regard as rational, leads to the claim that I will focus on criticisms of **STT** that arose inside the analytical camp or its vicinities. Since various arguments advanced for by analytic philosophers against will be discussed in many places of this book (particularly in Chap. 9), at this point I note only a handful of examples. Max Black (see Black 1948) tried to show that **STT**, although correct from a purely logical point of view, is neutral in fact with respect to old philosophical controversies about the concept of truth. Perhaps the most radical criticism of **STT** is that of Hilary Putnam (see Putnam 1975a, Putnam 1983, Putnam 1985–1986). He argues that **STT** theory, although proper for mathematical logic, is incorrect as a philosophical proposal and deceives philosophers. Yet objections against **STT** strongly suggest that Tarski was effectively achieving his goal to interest philosophers in his ideas. When we browse the Internet, we find virtually tens of thousands to Tarski and his theory truth. Admittedly, this is considerably fewer than when we search 'Heidegger and truth' (almost sixty thousands), but this last topic is much broader and accessible to everyone with philosophical ambitions, whereas discussing **STT** requires some specialized knowledge and logical competence.

In spite of the fact that **STT** is located at the heart of (analytical) philosophy, there is as yet no comprehensive systematic stud on it. Of course, there are various treatments. Some are long, other shorter, some are more technical, other less technical, some are simplified other advanced, but none, at least as far as I know, try

to deal with all or the main philosophical problems related to **STT**. The present monograph tries to fill this gap. It is intended as a multifaceted philosophical study of **STT**. I previously noted that the formal mathematical aspects of **STT** and its philosophical features are interconnected. However, their mutual interplay is not symmetrical. If one sketches or even fully elaborates **STT** as a part of model theory in mathematical logic, one does not need to allude to the philosophical content of the theory. Such a practice has become the norm in contemporary textbooks and monographs on logic and model theory (see, for example, Enderton 1972, Chang, Keisler 1973, Doets 1996, Manzano 1999, Hinman 2005). This situation is not surprising, as the content of mathematical theories is usually independent (and it should be) of their philosophical background.

However, the reverse, that is, the direction from philosophy to logic, is different, according to metaphilosophical principles I share. Formal (logical) philosophical analysis cannot be independent of the technical results of logic. Let me use an analogy to explain the point. We can debate about determinism, indeterminism, and related topics without any appeal to physics. Nevertheless, it seems pointless to discuss these issues while ignoring quantum mechanics and the physical theory of chaotic phenomena. Similarly, it is perfectly possible to discuss the concept of truth without any appeal to logic, metamathematics, and formal semantics. This analogy goes further. Suppose that we want to speak about the philosophical consequences of Heisenberg's uncertainty principle. In particular, we want to investigate whether the formula $\Delta p_1 \bullet \Delta p_2 \geq h$ (the product of indeterminacies of momentum and position of an elementary particle is greater than the Planck constant; this formulation is simplified with respect to h) entails indeterministic consequences, or not.

If we take the word 'entails' in its strict logical sense, a discussion pertaining to deterministic or indeterministic consequences of Heisenberg's principle is simply not possible. The reason is that the terms 'determinism' and 'indeterminism' (or related adjectives) do not occur in the formulation of the principle. In order to derive an ontological statement about the nature of the world, we need to embed the uncertainty principle into the philosophical vocabulary. Heisenberg himself did this by using the frequently held view of determinism which claims that the future can be predicted if we have an exact knowledge of the present state of reality. Since the uncertainty principle essentially precludes an exact knowledge of the present state of reality, deterministic predictions are impossible. Ergo, indeterminism is correct. However, other philosophical embeddings are also possible, for instance, weakened determinism and indeterminism. If we see determinism as consistent with statistical or probabilistic predictions, the relation between the uncertainty principle and the deterministic structure of reality becomes more complicated than under Heisenberg's view. Hence, we can conclude that the physical sense of the uncertainty principle is completely independent of the philosophical embeddings imposed on it. Thus, the philosophical consequences of the Heisenberg principle do not derive directly from it, but from its reformulations, relative to adopted philosophical interpretations. I qualify such conclusions derived from scientific results as interpretative consequences. In particular, indeterminism is an interpretative consequence of the Heisenberg principle when the mentioned interpretation of

determinism is accepted, that is, when the uncertainty principle is seen modulo the idea that the future can accurately be predicted from information about the past. In order to obtain interpretative consequences of scientific statements, the Heisenberg principle, for example, one should embed the latter into a philosophical language. Note that such embeddings should not be considered as exact translations.

The idea of interpretative consequences accords very well with a vision of philosophy in its (chosen) analytic setting in particular. I agree in principle with the following view (Waismann 1956, p. 1):

> […] philosophy, as it is practised today, is very unlike today, is very unlike science; and this in three respects: in philosophy there are no proofs; there are not theorems; and there are no questions which can be decided, Yes or Not. In saying that there are no proofs I do not mean to say that there are no arguments. Arguments certainly there are, and first-rate philosophers are recognized by the originality of their arguments; only these do not work in the sort of way they do in mathematics or in the sciences.

Observe that there is a contradiction between Waismann's view and the idea of interpretative consequences because the latter does not preclude that philosophical problems have the answers: Yes or No. But the point is that interpretative consequences do not work as scientific arguments. On the other hand, the suggested method of analysis *via* philosophical embeddings of various scientific—in particular, mathematical and physical results—and deriving interpretative consequences from them shows how the philosophical arguments proceed and provide means for their evaluation. For example, I am inclined to regard the arguments for teleology derived from Aristotle's physics as obsolete and wrong, whereas I see criticism of these arguments based on the theory of evolution or the theory of chaotic phenomena as sound. However, I have no tools to demonstrate that relevant philosophical embeddings are absolutely incorrect, because, for example, no empirical investigation can justify the view that Aristotle's theory of substance is wrong. Thus, a Thomistic philosopher can always say that he or she intuitively sees substances as composed of form and matter and there is no way to convince them that this idea is wrong. All we can do is argue that Aristotle's vision of substance is at odds with physics, but the Aristotelians can always defend their position by pointing out that philosophy is more fundamental than natural science. The gap between various (meta)philosophical camps is indeed very wide (or deep, if you prefer this way of speaking about philosophical issues).

I will consider **STT** not only as a piece of philosophy (it is out of the question) but also as good philosophical theory (it is problematic). I will argue, as Tarski himself did, that **STT** not only remains inside the definite Aristotelian tradition but also illuminates it in a very interesting way. My argumentation will proceed *via* the interpretative consequences derived from the philosophical embeddings imposed on the logical machinery employed in **STT**. Hence, this monograph takes **STT** seriously as a formal theory. One can now ask for the source of philosophical embeddings (interpretations) that generate interpretative consequences. Although it is not an easy process, the best place to look for insights in this respect is the history of philosophy. We need to look to history for the investigation of any truth-theory,

because the problem of truth certainly has been one of the philosophical invariants, since Aristotle at least. In the philosophy of truth, as in other branches of philosophy, the basic collection of problems originated from the ancient Greeks. Generations of philosophers have worked on the concept of truth, often producing entirely new insights. As is customary in philosophy, some questions disappear and some reappear while new ones emerge. One can ask why logic is an important source of philosophical ideas. My answer follows Stanisław Leśniewski's view (Henry Hiż's personal communication) that logic is a formal exposition of intuition.

The context described above determines the structure of the present book, which has substantive as well as historical ambitions. I begin with three chapters on the history of the concept of truth from antiquity up to the nineteenth and twentieth centuries. It is astonishing that truth, one of the most important concepts in all philosophy, still awaits a full historical exposition (see Enders 1999, Szaif 2006 and Pritzl 2010 for a partial realization of this task). The temptation to redress this imbalance and write a complete history of the truth-concept was great. However, I decided to limit the historical side of my study to an investigation of the classical or correspondence theory of truth, although, as I will show later, we need to distinguish between the classical theory of truth and the correspondence theory of truth. Other theories are mentioned only in passing. A special section (in Chap. 3) is devoted to Polish works on truth, because Tarski grew up in a specific philosophical environment determined by the ideas of Kazimierz Twardowski and his followers (the Lvov–Warsaw School) and because this intellectual climate essentially influenced the content of **STT**. Two issues arose in connection with the subject matter of the historical chapters. First, although it is true that in philosophy (at least) everything can be compared with something else—and therefore we could compare **STT** with the pragmatic theory of truth or the consensus theory—such a procedure would be pointless, because the related sets of ideas are fundamentally different. Second, I decided to include a review of many historical points in order to show that **STT** belongs to the trajectory of arguments which regard truth as consisting in saying that something is so and so and something is just such and such. I hope that the historical part of my study, in spite of its shortcomings and incompleteness, possesses some autonomous value as an introduction to a more ambitious history of aletheiology. Anyway, if history is considered as the teacher, this role of it is as important in philosophy as in elsewhere. Chapter 4 outlines the tasks that form the basis for any philosophical theory of truth. This fragment is quite straightforward, as I first wanted to focus on some basic concepts for explaining some preliminary issues, and to introduce the most important currents of thinking within the past and present philosophy of truth.

Chapter 5 presents the logical basis of my further analysis (some logical problems are also considered in Chap. 4, but in a semi-formal manner). I touch on various logical and metalogical topics in order to provide formal tools for a more advanced analysis of **STT**. I decided to present the rudiments of logic and metalogic for three reasons. First, I want to make this book self-contained. Second, I wanted to set uniform terminological usages employed in further parts of the book. Third, formal concepts and results provide the instruments to facilitate a discussion

of (some) philosophical aspects and the uses of **STT**. Matters of semantics are discussed in Chap. 6. Two next chapters contain informal (Chap. 7) and formal (Chap. 8) presentation of **STT**. In particular, an explicit picture of the relation between syntax and semantics is an outcome of limitative theorems presented and discussed in Chap. 8. That semantics is not reducible to syntax, I consider perhaps as the most important moral coming from the analysis of **STT**. Chapter 9 discusses some interpretative, comparative, and philosophical issues related to the semantic theory of truth. A more detailed survey of the content of the last chapter is provided in introduction to it. The book ends with a short conclusion concerning the status of **STT** as a piece of philosophical analysis.

I intend to follow Tarski's way of formulating **STT** rather closely. In particular, I propose to take his arguments seriously and I defend most of his views. On the other hand, Tarski is not sacrosanct and some of his views must (or should be) be corrected. I mention two departures from the original version of **STT**. The first concerns the assumed formalism (I will repeat these remarks in other places of the book). Tarski formulated his truth-theory for a version of the simple theory of types. Contemporary textbooks and monographs employ the first-order logic and its metalogic. Since this change agrees with Tarski's suggestions implicit in his later works, it can be regarded as of a secondary importance. A more essential departure concerns the philosophical content and consequences of **STT**. Tarski was very careful in expressing his philosophical views (see Mostowski 1967, Suppes 1988) and usually abstained from articulating them, particularly, in his writings. On the other hand, he was more ready to speak about philosophical issues in oral discussions, but not very much information preserved (see Feferman, Feferman 2004 for perhaps the most extensive documentation). Tarski's attitude toward philosophical declarations does not allow to reconstruct his views about many interesting philosophical issues provoked by **STT**. I decided to say much more about these questions, because I believe that the philosophical content of Tarski's theory is more comprehensive than he admitted.

References

Black, M. (1948). The Semantic Definition of Truth. Analysis, 8, 49–63; repr. (with additions), in Black (1949), 89–107, 251.

Black, M. (1949). *Language and Philosophy.* Ithaca: Cornell University Press

Cauman, L. S., Levi, I., Parsons, Ch., Schwartz, R. (Eds.) (1983). *How Many Questions? Essays in Honour of Sidney Morgenbesser*. Indianapolis: Hackett Publishing Company.

Doets, K. (1996). *Basic Model Theory*. Stanford: Center for the Study of Language and Information.

Edwards, P. (Ed.) (1967). *The Encyclopedia of Philosophy*, v. 1–8. New York: Macmillan.

Enderton, H. B. (1972). *A Mathematical Introduction to Logic*. New York: Academic Press.

Enders, M. (1999). *Wahrheit und Notwendigkeit. Die Theorie der Wahrheit bei Anselm of Canterbury im Gesamtzusammenhang seines Denkens und unter besonderer Berücksichtigung seiner antiken Quellen (Aristoteles, Cicero, Augustinus, Boethius)*. Leiden: Brill.

Enders, M., Szaif, J. (2006). *Die Geschichte des philosophischen Begriffs der Wahrheit*. Berlin de Gruyter.
Feferman, A., Feferman, S. (2004). *Alfred Tarski. Life and Logic*. Cambridge: Cambridge University Press.
Gupta, A., Belnap, N. (1993). *The Revision Theory of Truth*. Cambridge, Mass.: The MIT Press.
Hazohen, M. H. (2000). *Karl Popper. The Formative Years 1902–1945*. Politics and Philosophy in Interwar Vienna. Cambridge University Press: Cambridge.
Hinman, P. G. (2005). *Fundamentals of Mathematical Logic*. Wellesday, Mass.: A. K. Peters.
Hintikka, J. (1996). *The Principles of Mathematics Revisited*. Cambridge: Cambridge University Press.
Kripke, S. (1975). An outline of a theory of truth. The Journal of Philosophy, 72, 690–716; repr. in Kripke (2011), 75–98.
Kripke, S. (2011). *Philosophical troubles. Collected Papers*, v. 1, New York: Oxford University Press.
Kripke, S. (2019). *Philosophical Troubles. Collected Papers*, v. 2. New York: Oxford University Press (forthcoming).
Kripke, S. (2019a). Ungroundedness in Tarskian languages. In Kripke (2019).
Lewis, D. (Ed.) (1956). *British Philosophy*, *III*. London: George Allen and Unwin.
Manzano, M. (1999). *Model Theory*. Oxford: Clarendon Press.
Mostowski, A. (1967). Alfred Tarski. In Edwards (1967), v. 8, 77–81.
Peregrin, J. (Ed.) (1999). *The Nature of Truth (If Any)*. Dordrecht: Kluwer.
Pritzl, K. (Ed.) (2010). *Truth. Studies in a Robust Presence*. Washington, D. C.: The Catholic University of America Press.
Putnam, H. (1975). *Mind, Language and Reality. Philosophical Papers*, v. 2. Cambridge: Camrbidge University Press.
Putnam, H. (1975a). Do true assertions correspond to reality? In Putnam (1975), 70–84.
Putnam, H. (1983). On truth. In Cauman, Levi, Parsons, Schwartz 1(983), 35–56; repr. in Putnam, H. (1994), 315–329.
Putnam, H. (1985–1986). On comparison of something with something else. *New Literary History*, 17, 61–79; repr. in Putnam (1994), 330–350.
Putnam, H. (1994) *World and Life*. Cambridge, Mass: Harvard University Press.
Suppes, P. (1988). Philosophical implications of Tarski's work. *The Journal of Symbolic Logic*, 53, 80–91.
Waismann, F. (1956). How I see philosophy? In Lewis (1956), 447–490; repr., in Waismann (1968), 1–38.
Waismann, F. (1968). *How I see Phiolosophy.* London: Macmillan.
Woleński, J. (1989). *Logic and Philosophy in the Lvov–Warsaw School*. Dordrecht: Kluwer.
Woleński, J. (1999a). Semantic conception of truth as a philosophical theory. In Peregrin, (1999), 51–66.
Woleński, J. (1999b). The semantic revolution—Rudolf Carnap, Kurt Gödel, Alfred Tarski. In Woleński, Köhler (1998), 1–15.
Woleński, J. (2005). *Epistemologia. Poznanie, prawda, wiedza, realizm* (Epistemology. Cognition, Truth, Knowledge and Realism). Warszawa: Wydawnictwo Naukowe PWN.
Woleński, J., Köhler, E. (Eds.) (1999). *Alfred Tarski and the Vienna Circle. Austro-Polish Connection in Logical Empiricism*. Dordrecht: Kluwer.

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