

Logic, theory of science, and metaphysics according to Stanisław Leśniewski

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1. Introduction

The current availability in English of almost all of Leśniewski's works allows even those scholars unfortunate enough not to read Polish to gain a clearer picture of his ideas. The publication of two volumes of his works has been an arduous editorial undertaking

that has occupied Jan Srzednicki for more than eighteen years.¹ To him we owe our gratitude for the tenacity and the strength of will that enabled him to surmount the many and difficult obstacles that stood in his way. And it should also be said that the importance of the outcome overrides some shortcomings in the editorial work: unfortunately, the English translation is not always crystal clear and certain works contain some irritating mistakes that further revision of the proofs might have eliminated.² The publication in English of Leśniewski's works finally gives the entire community of scholars direct access to his writings.

All those who have had occasion to read Leśniewski's works know that he justified his basic philosophical choices by brief references in which he confined himself to laconic comments without entering into thorough discussion. In these cases the reader must often rely on cursory citations of the works of other authors. The problem is, however, that some of these secondary sources cited by Leśniewski, and which are indispensable to complete understanding of his thought, have only very recently become available, or else are not yet satisfactorily so.

Even a brief reading of Leśniewski's works reveals that his main references are to:

J. Stuart Mill,

Austrian philosophy (Brentano, Marty, Husserl),

J. Lukasiewicz, and

L. Petrazycki.

As for the first two references (Mill and Austrian philosophy), the following quotation more than suffices: "Steeped in the influence of John Stuart Mill in which I mainly grew up, and 'conditioned' by the problems of 'universal-grammar' and of logico-semantics in the style of Edward [sic] Husserl and by the exponents of the so-called Austrian School, I

¹ Surma et al. 1992. The following abbreviations are used in the notes: EP: "A contribution to the analysis of existential propositions", 1-19; PC: "An attempt at a proof of the ontological principle of contradiction", 20-46; EM: "The critique of the logical principle of the excluded middle", 47-85; EB: "Is all truth true eternally or is it also true without a beginning?", 86-114; FM: "On the foundations of mathematics", 174-382; FF: "Fundamentals of a new system of the foundations of mathematics", 410-605; FO: "On the foundations of ontology", 606-628; IR: "Introductory remarks to the continuation of my article: 'Grundzüge eines neuen Systems der Grundlagen der Mathematik'", 649-710.

ineffectually attacked the foundations of ‘logistic’ from this point of view” [FM, 181]. Or again: “It appears to me that the above argumentation makes it possible to state in a proper way the theory of propositions which is constructed on the premises defended by some exponents of Franz Brentano’s so-called ‘Austrian school’” [EP, 14].

Lukasiewicz’s influence on Leśniewski is obvious. His monograph of 1910 on the principle of non-contradiction in Aristotle is one of the points of departure for Leśniewski’s entire philosophical endeavour, and references to Lukasiewicz are scattered through various of his writings. Further evidence of Lukasiewicz’s enduring influence is provided, for example, by the following quotation from Leśniewski’s work on the foundations of ontology: “One can consider the meaning I have adopted for the expressions ‘ontology’ and ‘ontological’ to have originated as the result of the generalization of the relevant terminology of Jan Lukasiewicz” [FO, 626].

Lukasiewicz’s essay on the principle of non-contradiction has yet to be published in English; fortunately, however, a German translation has recently become available,³ which does not ensure its general legibility but at least enables a wider circle of scholars to examine his thought in detail.

The Russian-Polish thinker Leon Petrazycki,⁴ author of the 1905 book, *Introduction to the study of law and morality: the bases of emotional psychology*,⁵ was quoted by Leś

² For general assessments see the critical notice by Libardi 1993 and the review by Simons 1994.

³ Lukasiewicz 1993.

⁴ Leon ‘Petrazycki’ (Polish version) or ‘Petrazhitsky’ (Russian version) [1867-1931] is one of the many thinkers who has lapsed into undeserved obscurity. He studied medicine (2 years) and law at university, where he translated into Russian (from the German) J. Baron, *The system of Roman law*. He graduated in 1890 and immediately obtained a scholarship to attend H. Dernburg’s seminar in Berlin. In 1892 he published his first works, in which he resolved intricate questions of Roman law by applying Mill’s rules on inductive reasoning. He became an associate professor in 1898 and a full professor in 1901, at St Petersburg.

“Meditating on the empirical nature of law, he came to the conclusion that its reality was psychological. This idea had been anticipated by Bierling and Jellinek, Kavelin and Korkunoff, but it had never received adequate development. Petrazhitsky turned for assistance to psychology, but the psychology of his days was inadequate for the construction of the theory he needed” (N.S. Timasheff, “Introduction” to Petrazycki 1955, xxiii). Consequently he elaborated his own psychology. Moreover, he “saw that the teachings of contemporary logicians as to the formation and definition of concepts were insufficient, and he thereupon decided, also, to construct a new logic, at least with regard to concepts”. Petrazycki

niewski in some crucial passages. Unfortunately, the 1955 translation of Petrazycki's book into English does not include some of the sections of greatest interest to us,⁶ and it is the logical part of Petrazycki's work, in particular, which is most brutally summarized. Indeed, we read in the preface that "the theory of logic (107 pages in the *Introduction*) has been condensed in a short section of four pages".⁷

In the course of this lecture, we propose to present a reconstruction of Leśniewski's position, gathering together and analysing his general theories and – as far as possible – his explicit references to other authors.

Before proceeding with our presentation, however, we would draw attention to the fact that Leśniewski set forth his general position mainly in his early works. It is well known that Leśniewski formally 'repudiated' the early stage of his research: "Living intellectually beyond the sphere of the valuable achievements of the exponents of 'Mathematical logic', and yielding to many destructive habits resulting from the one-sided, 'philosophical'–grammatical culture, I struggled in the works mentioned with a number of problems which were beyond my powers at that time, discovering already-discovered Americas on the way... I formally 'repudiate' them... affirming the bankruptcy of the 'philosophical'–grammatical work of the initial period of my work" [FM, 197-198].

However, we should not be misled, since Leśniewski actually declared that "the change to a symbolic way of writing, which constituted a far-reaching revolution in my scientific life in the field of symbolic technique, was not accompanied by any far-reaching parallel events in the domain of my 'logical' views" [FM, 366]. The change, then, was restricted to his decision to move from a presentation of his ideas in natural language to a presentation

constructed his new psychology and his new logic on the basis of a conception of science which was also endowed with innovative features. He declared, for example, that it is better to talk of 'tendencies' rather than 'laws' of nature, and he developed an original theory of the classification and of the adequacy of a theory with respect to the sphere of reality described by it. For certain (minimal) aspects of Petrazycki's logic and theory of science see *infra* §§ 9-10.

After leaving Russia and after a period spent in Finland – where he wrote a 'positional logic', subsequently lost – in 1918 he obtained a professorship in the department of sociology at Warsaw. He further developed his 'positional logic' and worked on the philosophical thought of the eighteenth and nineteenth century. On 5 May 1931 he committed suicide.

⁵ 1st ed, 1905, 2nd 1907, 3rd 1908.

⁶ Petrazycki 1955.

⁷ Petrazycki 1955, xli.

in symbolic language, following which shift Leśniewski began to utilize “formulas constructed by ‘mathematical logicians’ in place of the colloquial language which I had used up to that time with obstinate determination” [FM, 364]. This change of language apart, the basic ideas remained the same.

Since it is our intention in this essay to reconstruct the reasons and the basic conceptual choices adopted by Leśniewski, and since he himself stated that “the change to a ‘symbolic’ way of writing ... was not accompanied by any far-reaching parallel events in the domain of my ‘logical’ views”, we believe it entirely legitimate to accept the thesis of the continuity of his thought. Accordingly, we deem ourselves wholly entitled to use also his early writings in order to reconstruct his logico-philosophical position.

It will now be clear that adequate reconstruction of Leśniewski’s logical thought requires precise specification of his philosophical position. The matter may appear banal if we remain within the options acknowledged and permitted by the contemporary logical community; in reality, however, Leśniewski’s philosophical doctrines were very distant from those envisaged by the logical paradigms current today. In undertaking a sound reconstruction of Leśniewski’s logical thought⁸ it is important to bear in mind that he based

⁸ Leśniewski defined ontology, one of his three foundational systems, as “a certain kind of modernized ‘traditional logic’” [FM, 176]. In this respect it is worth bearing in mind that in the 1937-38 academic year Leśniewski taught a course called “Traditional ‘formal logic’ and traditional ‘set theory’ on the ground of ontology”; cf. Srzednicki and Stachniak 1988, 180. On this see Kotarbiński 1966, 253-54 [the Polish original was published in 1929], which Leśniewski praised in [FM]: see in particular pp. 373 ff. Kotarbiński noted that Leśniewski “calls his system ‘ontology’ in harmony with certain terms used earlier (as in the ‘ontological principle of contradiction’)", and in strict relation to the Greek root of ‘ontology’ as the participle of the verb ‘to be’. Leśniewski’s ‘ontology’ is therefore “closely connected with traditional Aristotelian formal logic, of which it is an extension and an improvement, while on the other hand it is a terminal point in the attempt to construct a calculus of names in the area of logistic... If in spite of these reasons we do not use the word ‘ontology’ here as a name for the calculus of names, this is only because of the fear of a misunderstanding. Misunderstanding could arise from the fact that this name has its roots already in another role, i.e., it has been long agreed to call ‘ontology’ the enquiry ‘on the general principles of existence’ conducted in the spirit of certain parts of Aristotelian ‘metaphysical’ books. It has to be admitted however, that if the Aristotelian definition of the main theory (*prote filosofia*) discussed in those books is interpreted in the spirit of a ‘general theory of objects’, then both the word and its meaning, can be applied to the calculus of names of Leśniewski”, Kotarbiński 1966, 373-374. Leśniewski commented on Kotarbiński’s remarks thus: “I used the name ‘ontology’ to characterize the theory I was developing,

his proposals on a different logical paradigm, that of traditional logic;⁹ which is a statement that asserts something both significant and difficult. Every paradigm, in fact, brings with it a baggage of thoughts and mental habits. Paradigms work because they save us the effort of constantly having to rethink those key concepts that are accepted as a common heritage. Changing a paradigm entails rethinking the initial moves – the basic concepts on which the

without offence to my ‘linguistic instincts’ because I was formulating in that theory a certain kind of ‘general principles of existence’” [FM, 374].

Given these premises, we gain clearer understanding of his interest in the principles of non-contradiction [PC] and excluded middle [EM], as well as his references to the theory of conversion (p. 68 ff), of the *suppositio* (p. 18) and of the validity of the syllogism (p. 71 ff). This inquiry was encouraged by his interest in the history of logic and in the formal treatment of the problems of classical philosophy by the Lvov-Warsaw school. Jan Łukasiewicz’s (1886-1939) research into the history of propositional calculus, the Aristotelian syllogistic and the principle of non-contradiction are well known. Also significant is Ajdukiewicz’s 1985, also cited by Leśniewski [FF, 487]. Twardowski, the founder of the school, was also interested in traditional logic. As a lecturer at the University of Lvov, for many years he taught a course on *Attempts to reform traditional logic*, in which he outlined the theories of Bolzano, Brentano, Boole and Schröder; cf. Dąbmska 1978, 123.

As confirmation of the fact that “the borderline between modern and traditional logics can hardly be drawn in the case of the Lvov-Warsaw Philosophical School” [Vasyukov 1993, 59], one may cite the influence of Kotarbiński, Łukasiewicz and Leśniewski on the work of the scholars who belonged to the ‘Cracow Circle’ in the 1930s. This small group of Catholic philosophers, whose most outstanding member was Innocenty M. Bocheński (1902-1994), set out to apply the new methods of formal logic to some traditional logico-philosophical problems of Thomism and the scholastics. Its principal members besides Bocheński were Jan Salamucha (1903-1944), Jan Drewnowski (1896-1978) and Bolesław Sobociński (who was the main link between the two schools). On the Cracow Circle see the monograph section of *Axiomathes* 1993, 169-226, consisting of the introductory essay Puciato 1993, and the English translations of the following essays: J.M. Bocheński, ‘On logical relativism’, J. Salamucha, ‘Comparisons between scholastic logical tools and modern formal logic’, and J.F. Drewnowski, ‘Neoscholasticism and the demands of modern science’.

⁹ The concept of traditional logic has not yet been defined in conceptually acceptable terms. For a minimalist perspective, see the *Dictionary of philosophy* edited by D. Runes, according to which traditional logic can be defined as those parts and that method of the treatment of logic which come down to us essentially unchanged from the classical and mediaeval ages. In this sense, traditional logic highlights the distribution of propositions into subject and predicate and the related classification in the four forms A, E, I, O (Item written by A. Church). For further remarks see Poli 1993, Poli and Libardi (*submitted-a*) and Poli and Libardi (*submitted-b*).

paradigm is constructed and which have become common sense – such as, for example, the concepts of formalization, proposition, variable, etc. If one fails to take account of intervention by a different paradigm, one risks committing categorial errors which invalidate the interpretation proposed.

In effect, much of the ‘difficulty’ and ‘incomprehension’ concerning Leśniewski’s ‘technical’ choices – for example his theory of quantification, certain peculiar characteristics of the protothetics, the meaning of the copula, etc. – stems in fact from a desire to understand them using current logical orthodoxy, without fully exploring the different presuppositions of his logic.

Put otherwise, Leśniewski proposed a theory of logic based on an original theory of signs and therefore of the relationships among language, logic and the world. And it is rather unlikely that its details will be understood unless preliminary clarification is given to Leśniewski’s conceptual dictionary and consequently to the meanings that he attached to ‘symbol’, ‘name’, ‘proposition’, ‘denotation’, ‘connotation’, ‘symbolic function’, ‘symbolic disposition’, etc.

2. The system of the foundations of mathematics

In various passages Leśniewski declared that he was working towards a system of the foundations of mathematics, even if it is not wholly clear what he meant by ‘foundations’ and ‘mathematics’. He once wrote that his desire was “to contribute as much as possible to the justification of modern mathematics” [TS, 129]. But what does ‘justification’ mean? Considering the authors that influenced Leśniewski’s intellectual development, the term ‘justification’ correlates with a quasi-phenomenological attitude which seems at odds with debate on the foundations of mathematics.

Apart from the presence of phenomenological elements, what did Leśniewski mean by ‘mathematics’? The most explicit passage is perhaps the following: “mathematical sciences... serve to capture the various realities of the world in the most exact laws possible” [FM, 176]. In other words, mathematics is a theory of reality or, better, of aspects of reality. This is an interpretation that the formalistic frenzy of the last sixty years has considered of little importance. In actual fact, however, realization is growing – from a historical point of view as well – that mathematics has never been a purely formal theory

and that it has always sought to solve concrete problems. At bottom, the distinction between pure and applied mathematics is a relatively recent one.¹⁰ Hence Leśniewski's interpretative key seems considerably more modern than the neopositivist approach contemporary to him, and it may even gain credit that was not always accorded it at the time of its formulation.

The most striking consequence of this attitude concerns the criteria by which axioms were fixed, and it was precisely for this reason that Leśniewski believed his axioms to be true and founded on intuition, an aspect which is fundamental to understanding of his analysis of antinomies.

Leśniewski proceeds by analysing Russell's antinomy on the basis of two principles:

(1) Natural language is the depository of structures which should not be ignored by formal logic, lest contradictions arise. Thus a limit is set on the freedom of formalization by aspects of natural language.

(2) From this attitude derives a particular conception of the relationship between ontology and formal sciences. The latter, according to Leśniewski, cannot correctly assert the existence of ontologically unfounded objects. Leśniewski frequently polemicizes, in fact, against 'invented objects', a category which comprises, amongst others, the concept of empty class [FM, 211-215], which he claims is a "'mythological' conception" [FM, 202], or the Fregean idea that classes should be treated as extensions of concepts [FM, 218 sgg.]. On the latter, Leśniewski writes: "Scenting in the 'classes' of Whitehead and Russell and in the 'extensions of concepts' of Frege, the aroma of mythical specimens from a rich gallery of 'invented' objects, I am unable to rid myself of an inclination to sympathize 'on credit' with the authors' doubts as to whether objects which are such 'classes', do exist in the world" [FM, 224].

These quotations evidence that Leśniewski's intention was to construct his logic on the basis of an ontology understood as a theory of objects and developed from a principle of existence. Hence it follows that his theory of objects which must inevitably reject

¹⁰ "Far from mathematical structures being created for their own sake, and *then* being applied to areas of scientific inquiry, the weight of evidence is for exactly the reverse". In effect, "over most of its history, mathematics has been positively driven by the requirements and difficulties posed by the problems of practical, everyday living, as well as by those appearing in the world of physical sciences as we know it today". See Gould 1986, 2.

contradictory objects¹¹ – whose non-existence Leśniewski seeks to demonstrate in “An attempt at a proof of the ontological principle of contradiction” – and general objects, that is, universals.¹²

Worth noting is the fact that Leśniewski did not alter his views about the theory of objects, classes, contradictory objects, general objects and abstract objects, as he passed from the preformal to the formal phase of his thought. It should be stressed, indeed, that the theory of objects is the effective background against which to set his analysis. More specifically, this is the theoretical element that highlights the particular ‘Aristotelian’ colouring assumed by his ontology. We shall return to this topic later.

If mathematics – as Leśniewski thought and as Brentano firmly believed – is the formal theory of reality or of aspects of reality, then it makes no sense to speak of structures based on a so-called meaningless syntax. On this point Leśniewski is penetratingly ironic. In several passages he reiterates that “an unintuitive mathematics contains no effective remedy for any malady of the intuition” [FF, 413] Or: “Having no predilection for various ‘mathematical games’ that consist in writing out according to one or another conventional rule various more or less picturesque formulae which need not be meaningful, or even – as some of the ‘mathematical gamers’ might prefer – which should necessarily be meaningless, I would not have taken the trouble to systematize and to often check quite scrupulously the directives of my system, had I not imputed to its theses a certain specific and completely determined sense, in virtue of which its axioms, definitions, and final directives ... have for me an irresistible intuitive validity. I see no contradiction, therefore, in saying that I advocate a rather radical ‘formalism’ in the construction of my system even though I am an obdurate ‘intuitionist’” [FF, 487]. And again: “I cannot deny myself the pleasure of stating the fact that I tried to write my work so that it would not concern exclusively some kind of ‘free creations’ of various more or less Dedekindian creative souls” [FM, 228].

¹¹ Consider the following statement: “Some modern scholars, e.g., Husserl, Łukasiewicz, Meinong, claim that certain objects are ‘contradictory’ and contend that it is possible to investigate the properties of those objects. In my article “An attempt at a proof of the ontological principle of contradiction” I tried to demonstrate that no object is contradictory” [EM, 62].

¹² For Leśniewski, general objects are those objects which possess “only those features which are common to all the ‘individual’ objects corresponding to them” [FM, 198]. On their rejection see [EM, 50

Leśniewski viewed the problem of the antinomies as lying at the root of the cleavage between formal theories built on an underlying intuition and formal theories as pure syntactic games. “[The antinomies] encouraged the disappearance of the feeling for the distinction between the mathematical sciences, conceived as deductive theories, which serve to capture various realities of the world in the most exact laws possible, and such non-contradictory deductive systems, which indeed ensure the possibility of obtaining, on their basis, an abundance of ever new theorems, but which simultaneously distinguish themselves by the lack of any connection with reality of any intuitive, scientific value” [FM, 177-178].

In short, Leśniewski proposed a system of the foundations of a theory of reality possessing, as a system, considerable intuitive force. This system is made up of the three theories that Leśniewski developed during his research – protothetic, ontology and mereology – as he himself reminds us in several passages: “the system of foundations of mathematics whose outline I wish to present in this work... embraces three deductive theories, whose union I consider to be one of the possible foundations for the whole of the system of the mathematical science” [FM, 176]; and again: “This system consists of three deductive theories, which union forms one of the possible bases of the whole structure of mathematics” [IR, 650].

In other passages, he seems to restrict the system to only the first two of the above theories: “From the single axioms of protothetics and ontology it is possible, using their directives, to derive the whole formalized system of the foundations of mathematics” [FO, 608]; or when he refers to them as the fundamental mathematical theories: “Fundamental mathematical theories (in particular ... protothetic and ontology)” [FF, 421].

This view of the foundations of mathematics raises several issues. First, it is not at all clear that the complex of the three theories that Leśniewski proposes as a system of foundations is in fact a system of the foundations of mathematics. In his published essays, the fundamental mathematical concepts are neither defined nor justified. The only mathematical concepts to be defined (in mereology) are ‘equinumerous’ and ‘less numerous than’. We find an interesting reference in “On the foundations of mathematics”, when, apropos a course taught in Warsaw in the academic year 1922-23, Leśniewski states

sgg.] e [FM, 181 sgg.]). An example of a general object is the ‘triangle in general’ used for example in mathematical proofs.

that “in that course I dealt with a set of theses, which I called arithmetic, as a part of ontology” [FM, 370]. From this point of view, arithmetic would be part of the ontology.

Lejewski has written: “we do not know exactly what his conception of arithmetic was. For Sobociński arithmetic is an example of a deductive theory which presupposes an ontology, but once again we do not know whether in saying this he is expressing his own opinion or that of his master. In any case, presupposing an ontology is not the same thing as being a proper part of that ontology.”¹³ During a course on inductive definitions taught in the academic year 1933-1934,¹⁴ Leśniewski set out the axioms of Peano’s arithmetic in the language of the ontology. However, he does no more than show that Peano’s axioms can be formulated in the ontology; a quite different matter, obviously, would be showing that they are derivable from it. This result was obtained by John Canty, who derived the axioms of the arithmetic in a version of ontology to which was added the *axiom of the infinite*.¹⁵ All things considered, therefore, the information available to us is too scanty to draw acceptable conclusions.

Second, Leśniewski does not appear to have ever concerned himself with real and proper mathematical problems, except for two short pieces from 1929, “On functions whose fields, with respect to these functions, are groups” and “On functions whose fields, with respect to these functions, are abelian groups”. The problem is therefore understanding why he decided to address these topics in particular. His writings contain only one brief passage in which he declares that they are profound aspects of every deductive theory. To understand them, therefore, we must gain a more precise idea of what a deductive theory is. But for the time being, we shall continue with our work of general reconstruction.

3. Modernized traditional logic

It is well known that Leśniewski defined his proposal as a system of modernized traditional logic [IR, 650]. But why did he say that he was obliged to turn to traditional

¹³ Lejewski 1989, 32.

¹⁴ Szrednicki and Stachniak 1988, 153-170; see also ‘Primitive terms of arithmetic – Lectures from 1928/29’, in Szrednicki and Stachniak 1988, 129-152.

¹⁵ For derivation of Peano’s axioms in the Ontology see FM; Lejewski 1989, 32; Słupecki 1984, 71-72; Szrednicki and Stachniak 1988, 129-171; Canty 1967; Welsh 1978, 25-62.

forms of logic? Why did he never seriously consider some modern form of logic, even though he had studied it in depth? We are confronted by a scholar with good knowledge of the modern mathematical form of logic who nonetheless decided to use the old form of two names plus the copula. Obviously there must have been aspects of the modern form of logic which were radically unacceptable to him. The problem then is to specify these problematic aspects of the modern method of studying logic. Unfortunately, in this respect, Leśniewski is not very explicit. Nevertheless, some indications can be found, at least indirectly.

We know for example that Leśniewski devoted several years to meticulous study of *Principia Mathematica* ([FM, 175 ff, 195]).¹⁶ We also know that he was extremely critical of both the *Principia*'s approach and the decidedly more rigorous approach of Hilbert and his school. Let us briefly consider Leśniewski's main criticisms.

First, Leśniewski found "shocking defects" in the formal setting of the *Principia* and stated that the fundamental questions were "presented disastrously" [FM, 179], so much so that he was "unable to understand the terminology of Whitehead and Russell" [FM, 224]. It is widely acknowledged that the presentation of the expressive and deductive apparatus of the *Principia* is considerably lacking in precision. The issue is well known and not worth dwelling upon here. Indeed, the limitations of the *Principia Mathematica* were highlighted by numerous scholars and within a decade it had become a widely shared view. What is special about Leśniewski's criticism is perhaps its extreme, even excessive, radical nature [FM, 181].

This did not prevent Leśniewski from using a formal language which adopts a symbolism in which the influence of Whitehead and Russell, as well as of Peano, are blatantly obvious. From the former he took the form of the principal functorial constants of their propositional logic, and the convention of using groups of dots instead of brackets. From Peano he borrowed the idea of symbolizing the copula with the Greek letter epsilon, which enabled him to formalize singular expressions of the type 'A is b' in the expression ' $\epsilon(Ab)$ ' or, in more discursive form, as ' $(A \epsilon b)$ '.

Leśniewski's second criticism was levelled at the formalistic approach which was emerging at the time. In other words he was attacking the distinction between the syntactic aspect, reduced to the calculistic and manipulatory dimension, and the moment of interpretation. To quote Lejewski, "Leśniewski meant his logic to be a true, though very general, description of reality, a kind of *prote filosofia*... Contrary to the fashion prevailing

among mathematicians, Leśniewski insisted that only *true* propositions should be allowed as axioms of a deductive theory and that only those rules of transformation should be admitted which embodied intuitively *valid* rules of inference. He did not reject formalization as a method of presenting deductive theories. Far from it. But he maintained that a theory which was intuitively sound did not lose its meaning through being subject to a process of formalization. He consequently described himself as a confirmed intuitionist who at the same time was a radical formalist, and a better characterization of his standpoint could hardly be given.”¹⁷ For Leśniewski, then, formalization was an instrument with which to make precise and clear assertions which were already true and significant. We will return to this point later.

From this perspective the distinction between formalization and interpretation obviously makes no sense, and there is therefore no point in considering the formal systems as a manipulation of arbitrary formulae. Here one of the fundamental characteristics of contemporary logic collapses – the distinction between syntax and semantics, and therefore the distinction between the level of correctness and the level of validity.

But how does Leśniewski proceed? In the first of his works devoted to the problem of the foundations, “Foundations of the general theory of sets. I”, subsequently considered imperfect in various respects, he states: “The psychic ‘sources’ of my axioms are my intuitions, which simply means that I believe in the truth of my axioms, but I am unable to say why I believe, since I am not acquainted with the theory of causality. My axioms do not have a logical ‘source’, which simply means that these axioms do not have proofs within my system, just as in general no axioms... have proofs in that system for which they are axioms [TS, 130-131]. Therefore the axioms of his deductive systems are true with respect to a pre-established interpretation; logic is not an empty game of symbols to which an interpretation is added a posteriori, but an outlining of the rules for the use of terms which have been meaningful from the very start.

This appeal to intuition leaves a fundamental problem unresolved, and it is a problem that criticism has not addressed with the necessary rigour: what is the meaning of the concept of ‘intuition’ to which Leśniewski appeals? Given the diversity of the forms of ‘intuition’ – we may for example distinguish between the intuition of the empiricists, the eidetic intuition of the phenomenologists and the rational or metaphysical intuition to

¹⁶ Cf. also Lejewski 1989.

¹⁷ Lejewski 1984, 123-24.

which Brouwer appeals and which gives intuitionism its name – how can we specify what Leśniewski is referring to?

The issue becomes formally more strict if we trace it back to its origins. One of its first sources is relatively easy to identify, and we have already mentioned it: the problem of the antinomies.

The early development of modern logic was stunted by the antinomies, but traditional logic does not seem to have been so dramatically affected by them. Which raises the question as to why the beginnings of modern logic were so vulnerable.

Before attempting an answer, it is worth noting that, among those seeking to deal with the problem of the antinomies during the early development of modern mathematical logic, it was those who chose to *accentuate* the distance between the level of intuition, and, say, the level of common sense, that prevailed. In other words, the popular option was the exact opposite of that chosen by Leśniewski. The “obdurate ‘intuitionist’” found no fellow-travellers.

To return to the main point, however, one possible answer to the question why modern logic is so vulnerable to antinomies may be the following.

The reason may lie in modern logic’s practice of starting with terms (individual variables and constants) that are solely denotative, with no connotative value, and constructing therefrom terms (predicative variables and constants) which perform a vicarious connotative role.

Leśniewski did not accept such a position, for various reasons; some of which we now set out in an order that does not imply any priority:

(i) a theory of this kind must adopt two different types of term (one for individuals and one for properties);

(ii) such a theory ends up by treating propositional and predicative calculuses as distinct layers (thereby distinguishing a further type of variable, the propositional one), and it is therefore difficult, if not impossible, to develop a *general* theory of linguistic signs;

(iii) a credible general theory of terms must recognize all possible combinatory cases.

With regard to terms which both denote and connote, for Leśniewski the predominance of the denoting function over the connoting function does not depend on the terms themselves but on the *position* that terms occupy in the proposition. Hence it follows that for terms in the subject position the predominant function is denotative, while the predominant function of terms in the predicative position is connotative.

Leśniewski formalizes the proposition

(*) “Socrates is a philosopher”

in the standard form: $(A \varepsilon b)$. This expression states that the object *denoted* by ‘A’ is (one of) the objects *connoted* by ‘b’. In clarification of the meaning of the expression ‘A is b’ the term ‘object’ is used in the generic sense; that is, it may stand in a denotative sense for a single object, for more than one object, or for no object.¹⁸

From this preliminary outline it becomes clearer that Leśniewski’s diversity was not so much or not only of the technical kind; rather, it was of paradigmatic nature. Before considering what this means more closely, we must eliminate a false problem.

It is usually thought that the difference between traditional logic (in its various forms) and modern formal logic depends on the fact that the latter – unlike the former – is a *mathematical* logic. In fact, it is perfectly possible to give a mathematical structure to (at least some of the versions of) traditional logic, as has already been done in several significant cases. If this is true – and there is ample evidence that it is – it points that the matter does not hinge on mathematization.

Yet if it is not mathematization that explains the difference, what else could it be? At this point it is advisable to recall that our view of a mathematical logic results from certain choices which generally – and quite independently of our present concern with Leśniewski – warrant more thorough exploration. Consider, for example, the concept of function, whose application to linguistic objects was Frege’s great intuition. We know that a function is a many-one or one-one connection, where the fundamental point is the unicity of the

¹⁸ In ordinary logic, (*) is formalized by $F(s)$, where F is the predicate ‘be a philosopher’ whose semantic category is $s:n$, while s is an individual constant. In the ontology, (*) becomes $A \text{ is } A \wedge A \text{ is } b$ and is thus differently formalized; omitting the first adjunct we may say that A is an individual name which corresponds to ‘Socrates’, b is a general name which corresponds to ‘philosopher’, both belonging to category n , and ε is the primitive functor of the ontology whose category is $s:nn$. The formal translation of the expression (*) is therefore $s:n(n)$ in the former case, and $s:nn(n)(n)$ in the latter. The two signs F and s designate two ontologically different expressions, of which ‘be a philosopher’ is an unsaturated expression while ‘Socrates’ is a saturated one. The former is a predicate and designates a concept, the second is a name and designates an object. In Leśniewski’s system, instead, the signs are three in number: two names, ‘philosopher’ (general name) and ‘Socrates’ (singular name), which nevertheless belong to the same semantic category, and a nominal functor which forms propositions out of names.

value. In effect, however, it would be perfectly acceptable to weaken the requirement of the unicity of the value without leaving the sphere of mathematical rigour. Instead of functions, we could for instance use mappings, that is, a many-many or one-many kind of connection. Who is to say that in this case we are no longer dealing with logics? And we can consider other possibilities – which, moreover, in certain cases have already been tested – such as admitting operations which are not defined for all the objects of the domain. The point, therefore, once again, is not one of mathematical structuring. Even under the hypothesis sometimes suggested that traditional logic was weaker, less ‘mechanical’, than contemporary formal logic, the distinction does not inhere in the forms of mathematization employed.

The problem can be framed more clearly if we check the mathematization of traditional logic from the point of view of modern formal logic. It is evident that, in many cases, there is something that fails to work properly. The issue has been raised many times but apparently without a conclusive answer. We believe that the difficulties depend on the fact that different forms of logic may use different semiotic frameworks. In other words, the semiotics expressed in conventional mathematical tools does not correspond to the semiotics presupposed by the traditional forms of logic. Since mathematic tools are formal, they exhibit elements extraneous to the semioses that they express and which cannot be imputed to them. Analysis should instead address the semiotic setting, which is too often taken for granted and acritically presupposed by the mathematical tools used. If the initial semiotics is to be correctly used in logics characterized by diverse paradigms, it must be ‘adjusted’. What does this mean?.

Two of the essential components of every semiosis are the choice between the types of variable admissible and the expression of the distinction between reference (denotation) and meaning (connotation). The most obvious distinction regarding the choice of types of variable is between systems which accept solely nominal variables and those which accept both nominal and predicative variables. It should be stressed that in the two cases the organization of the logical levels assumes distinct features.

The other aspect is what, in Mill’s terminology, concerns the role and the distinction between connotation and denotation. This gives rise to four possible cases: terms which have denotation but no connotation; terms which have connotation but no denotation; terms which have connotation and denotation; terms which have neither.

Let us dwell for a moment on this situation. If we look at the ‘standard’ extensional viewpoint, we see at once the drastic nature of its point of departure: it admits only denoting expressions which have no connotation (names of individuals), and thence a different class of terms (the predicates) which are supposed to have a connotation (for example the class of bearers of the property) is constructed.

However, the situation is very different if we start with natural language. For which reason Leśniewski moved on to development of a more general framework, which we will now examine.

4. Forms of expressions

His starting point is development of a general theory of expressions. From Mill and traditional logic Leśniewski took the idea that all expressions can be divided between connoting and non-connoting expressions and between denoting and non-denoting ones. According to Leśniewski, the expression ‘connoting expression’ denotes expressions that can be defined, whereas the expression ‘non-connoting expression’ denotes expressions that cannot be defined. The examples that follow are taken from Mill’s *Logic* and are quite clear: the expressions ‘man’, ‘green’, ‘square circle’ and ‘centaur’ are examples of connoting expressions; the expressions ‘to a man’, ‘well’, ‘at’, ‘abracadabra’, ‘object’, ‘every man is mortal’, etc. are examples of non-connoting expressions [PC, 31]. In other words, all nominal expressions with a superordinate genus are definable. The other kinds of expression are not definable: non-nominal expressions (every man is mortal), nominal expressions without a superordinate genus (object), adverbs and prepositions (well, at), exclamations and interjections (abracadabra) and incomplete expressions (to a man).

Moving to the other classification, we may say that “an expression which denotes something can be exemplified by the following: ‘man’, ‘green’, ‘object’, ‘the possessing by every man of the property of mortality’, ‘every man is mortal’, etc. The expressions which do not denote anything can be exemplified by the following ones: ‘abracadabra’, ‘square circle’, ‘centaur’, ‘the possessing by every man of the property of immortality’, ‘every man is immortal’, etc.” [PC, 31].

To understand how this second classification operates, it is essential to look at the world itself. We may thus check whether there are things which are men, things which are green,

things which are objects, and whether the things which are men are also mortal things. Continuing in this vein, we may check whether it is impossible to find things which are abracadabras or things which are square circles or things which are centaurs, just as we can check whether the things which are men are not immortal things.

At this point there are two fundamental observations to be made. First the distinction between nominal expressions and propositional expressions is not given *ab origine* but is constructed within the system.

Secondly it should also be acknowledged that checking how things stand in the world is not the task of logic but of science. We will return to this later, when we address the problem of Leśniewski's theory of science and the relationship between scientific propositions and logical propositions. For the moment we shall leave this aspect of the theory aside.

We have already said that for Leśniewski "there exist expressions which connote something ... but denote ... nothing; such expressions are, e.g. 'square circle', 'centaur'. On the other hand, there exist expressions which connote nothing and yet denote something, e.g. 'object', 'every man is mortal'. Besides, there also exist expressions which neither denote nor connote anything; example: 'abracadabra'" [PC, 32]. The expressions which denote everything and which connote nothing cannot, of their very nature, be defined [EP, 4-5; PC, 27]. To sum up, for Leśniewski some terms are denoting and connoting (man), some are denoting and non-connoting (object), some are non-denoting and connoting (centaur) and some are neither denoting nor connoting (abracadabra).

The distinction between expressions which denote and expressions which do not denote is the same distinction that we have when we distinguish those expressions which are symbols from those which are not. In other words Leśniewski thought that the distinction between expressions which denote something and expressions which denote nothing can also be formulated by resorting to the distinction between symbolizing something and symbolizing nothing, or expressions which are symbols and those which are not. To say that an expression denotes something or that an expression symbolizes something or that an expression is a symbol are different ways of formulating the same content.

For this reason we may say that "the expression 'square circle' does not perform a symbolic function because no object is a square circle; in other words there is no object that could be symbolized by the expression 'square circle'; thus the expression 'square circle' symbolizes no object, in other words it symbolizes nothing" [PC, 31-32].

If logic, at least in some of its components, is the discipline that renders natural language more exact, it is necessary to introduce at least one further distinction: between symbolic *disposition* and symbolic *function*. If we are not clear on this point, we run the risk of “treating expressions which are not symbols as expressions possessing a symbolic function” [PC, 33].

According to Leśniewski, an expression’s property of being used *as if* it were a symbol, or *as if* it had a symbolic function, is called ‘symbolic disposition’. Thus “not all of the expressions possessing a symbolic disposition possess also a symbolic function”. The difference between a symbolic disposition and a symbolic function does not alter the opposition between connotation and non-connotation: just as the expressions possessing a symbolic function are or are not connoting, so the “expressions that possess a symbolic disposition can be connoting or non-connoting” [PC, 33].

At this point it is possible to use the distinctions just introduced to define new classes of expressions. Consider for example the class of expressions which are propositions. By ‘proposition’ Leśniewski meant those expressions “possessing the *disposition* to symbolize relations of inherence” [PC, 34, emphasis added], whereas the relation of inherence is “the relation between an object and a property which consists in this object possessing that property” [EB, 89].

The connection with the distinctions between the ‘connoting expression/non-connoting’ opposition and the ‘denoting expression/non-denoting expression’ opposition (or: symbolic function/non-symbolic function’) proceeds as follows: “All connoting expressions possessing a symbolic function can be divided into two groups: expressions which correspond with any non-connoting expression symbolizing the same object, and expressions which correspond with no non-connoting expression symbolizing the same object. Thus, e.g., the connoting expression ‘the possessing by every man of the property of mortality’ corresponds with a non-connoting expression symbolizing the same object, namely the expression ‘every man is mortal’. The latter also symbolizes the possessing by every man of the property of mortality, and also the expression ‘the possessing by every man of the property of mortality’. Whereas the connoting expression ‘man’ corresponds with no non-connoting expression which would symbolize the same objects as those symbolized by the word ‘man’.”

Although Leśniewski’s manner of setting out his position is somewhat laborious, his position is clear. Corresponding to certain connoting expressions endowed with symbolic

function (that is, which denote something) are non-connoting expressions which symbolize (denote) the same object. These latter are propositions. The crucial point is that propositions are non-connoting expressions to which correspond connoting expressions endowed with a referent.

An analogous structure holds in the case of expression which possess a symbolic *disposition*, of which Leśniewski's definition is as follows: "All connoting expressions possessing a symbolic disposition can be divided into two groups: expressions which correspond with any non-connoting expression possessing the same symbolic disposition, and expressions which correspond with no such non-connoting expression".

Once the initial framework has been outlined, the next step is to check whether a certain content is or is not adequately represented in a proposition. To do this, we must establish the criteria of adequacy (or of inadequacy); criteria which belong to the general theory of propositions [EP, 16] and concern "certain general conventional-normative schemas for embodying the dependence of symbolic functions of propositions on the symbolic functions of their elements, and on the mutual relationship between these elements" [EP, 17] (translation slightly modified).

As Leśniewski never tired of repeating "it is I who decide what rules to choose for constructing the system of linguistic symbols to be used" [PC, 38]. In the specific case, Leśniewski states: "To express this dependence I have adopted the following normative schema: every proposition is to represent the possessing, by the object represented by the subject, of the properties connoted by the predicate" [EP, 17]. This initial formulation is followed by others which give more precise specification to its context but do not alter its essential content. A case in point being CONVENTION 1 of "An attempt at a proof of the ontological principle of contradiction": "Any proposition possessing a symbolic function symbolizes the possessing by the object, symbolized by the subject of the proposition, of properties connoted by its predicate. This convention implies that propositions can symbolize only the relations of inherence" [PC, 36].

In other words, Leśniewski started from the assumption that his theories concerned that type of proposition whose predicate connotes properties possessed by the object to which the subject of the proposition refers.

From these preliminary postulates it follows that Leśniewski's initial semiotic is broader than that used by contemporary logic.

Indeed, we have seen that Leśniewski believed that the field of expressions comprises signs which belong to the various combinations which derive from the two oppositions of denoting term/non-denoting term and connoting term/non-connoting term. Operating on this basis is CONVENTION 1 mentioned above: the propositions that interest Leśniewski are those in which the properties connoted by the predicate belong to the object denoted by the subject of the proposition.

In general, it seems natural to argue that an adequately sophisticated logical theory must be able to recognize and handle possible cases and not just certain particular situations. “Out of the infinite domain of logical propositions, different scholars constructing ‘general’ systems of logic or logical monographs choose certain propositions – in accordance with their ‘theoretical’ or ‘practical’ predilections. These predilections can be very different” [EM, 55].

Leśniewski then developed – he declares – a method for handling different types of proposition: “While relying on ‘linguistic instinct’ and the often non-uniform tradition of ‘traditional logic’, I attempted to devise a consistent method of working with propositions which were ‘singular’, ‘particular’, ‘general’, ‘existential’, etc.” [FM, 366].

Leśniewski’s logical studies stem in fact “from his inquiry into the meaning and logical power of the various types of proposition already distinguished by Aristotle and usually discussed in the logical textbooks by the 19th century traditional logicians”,¹⁹ and which are extraneous to logic developed after Frege. His analysis of traditional logic is based on a principle whereby elementary propositions are *classified* into certain fundamental categories to which correspond *schemes of propositions* which do not exhaust all possible cases but are philosophically and linguistically meaningful. By contrast, modern symbolic logic uses a principle of the recursive generation of all possible forms of propositions from a set of simple symbols by means of the reiterated application of a finite set of operations.

In the light of the foregoing discussion, many things change. Among the aspects that deserve at least brief discussion are the theory of proper names, the problem of synonymy, the difference between analytic and synthetic propositions, and the problem of existential propositions. We now turn to these.

5. Proper names

¹⁹ Lejewski 1989, 21.

We begin with the classical point of departure, J.S. Mill's theory which has been widely discussed in recent years. Leśniewski set out Mill's position thus: "[Mill] says that not all names have connotations; to those which have no connotations belong, according to Mill, proper names such as, e.g., Paul, Caesar... Yet even the names which I have mentioned, and which according to Mill have no connotation, in my opinion, have connotation; proper names connote the property of possessing a name which sounds like the given proper name... In fact the word 'Socrates', while denoting different objects, connotes always one property, that is the property of bearing the name 'Socrates'" [EP, 5-6].

Unlike Mill, therefore, Leśniewski asserts that proper names have a connotation: to be precise they connote the denoted object's property of having the name that they have. This position is an extremely interesting one, although it seems to have gone completely unnoticed for at least eighty years. Set alongside a suitable definition of synonymy, it enables us to eliminate a number of problems. Accordingly, let us see how Leśniewski defined synonymy.

6. Synonymous propositions

A preliminary condition for the possibility of checking whether two expressions are synonymous is that they should be reducible to a canonical form which, according to Leśniewski, is that of "categorical propositions with positive copulas and predicates in the nominative". Once this reduction has been made, it is possible to proceed. Leśniewski writes: "I employ the expression 'synonymous propositions' to denote such propositions as... possess adequate subjects and synonymous predicates. I employ the expressions 'adequate subjects' to denote such subjects as do not denote different (if only numerically) objects and do not connote different properties... I employ the expressions 'synonymous predicates' to denote such predicates as connote identical properties" [EP, 21]. Let us look at an effective application of these instructions. Leśniewski states the following: "Łukasiewicz claims that the propositions 'Aristotle was the founder of logic' and 'The Stagirite was the founder of logic' are synonymous; I think this claim is false. These two propositions are not synonymous because they do not have adequate subjects; their subjects – 'Aristotle' and 'the Stagirite' – are not adequate because they connote different

properties: the word ‘Aristotle’, e.g. connotes the property of possessing the name ‘Aristotle’ while the word ‘Stagirite’ does not connote that property”. It is obvious that if this argument is adopted, some if not most of the difficulties related to the problem of opaque contexts are eliminated.

7. Analytic and synthetic propositions

Moving to the distinction between the analytic and the synthetic, we begin with some much-needed definitions. A proposition in canonical form is analytic if it contains no predicates which connote properties that are not connoted by the subject. A proposition in canonical form is synthetic if it contains predicates which also connote properties that are not connoted by the subject [EP, 3]. Examples of analytic propositions are the following: ‘Paul bears the name ‘Paul’’; ‘Napoleon bears the name ‘Napoleon’’ [EP, 7-8]. On the other hand, a proposition such as ‘The victor of Jena bears the name ‘Napoleon’’ is synthetic.

It is usually thought that analytic propositions are true a priori. In reality, given the definition adopted by Leśniewski, the distinction between analytic and synthetic does not coincide with the distinction between a priori and a posteriori.

Leśniewski stated that “only the following two types of propositions can be true a priori: (1) propositions whose subject is the word ‘object’, and (2) propositions which... are based on propositions whose subject is the word ‘object’” [PC, 42].

Moreover, “true propositions whose subject is the word ‘object’ are always synthetic since their subject does not connote anything” and therefore the predicate always connotes properties which are not connoted by the subject. In brief, “only (the) following two types of propositions can be true a priori: (1) synthetic propositions and (2) propositions which are based only on synthetic propositions. Hence it follows that all a priori analytic true propositions are based on the validity of synthetic propositions” [PC, 42].

Even if “in modern logic there is a widespread conviction that all analytic propositions are true... the discussion [above] indicates that some analytic propositions might be true, while others might be false” [EM, 61]. Put otherwise, Leśniewski’s proposal radically alters a picture that seemed to have achieved a certain stability at the cost of much effort, and it obliges us to rethink the whole issue once again.

A further interesting case of analytic and synthetic propositions is that of existential propositions, which are discussed in the next section.

8. Existential propositions

Just as all propositions are analytic or synthetic, so existential propositions are either analytic or synthetic [EP, 2; §2]. From his degree thesis onwards, Leśniewski argued as follows:

- All positive existential propositions are analytic;
- Negative existential propositions, except for propositions whose subjects connote the property of non-existence, are synthetic;
- All negative existential propositions are contradictory.

We will proceed by giving some definitions and briefly commenting on them.

We begin with the definition of ‘positive existential propositions’. We may say that a positive proposition is existential iff it takes the form of a proposition with a positive copula, contains a predicate in the positive form of the verbs ‘be’ and ‘exist’, or in forms which synonymous with them.

“The predicate of every positive existential proposition which has been formulated as a proposition with a positive copula does not connote anything (except for the eventual property of number – being greater than one – if the predicate is plural)” [EP, 4]. Furthermore: “Any positive existential proposition is thus analytic because, having the form of a proposition with a positive copula, it contains a predicate that does not connote properties which are not connoted by the subject” [EP, 4].

A not dissimilar argument holds for negative existential propositions. Let us first examine the concept of synthetic proposition. For Leśniewski, “Negative existential propositions which contain subjects that do not connote the property of non-existence, are synthetic propositions”. To which he adds: “The remaining negative existential propositions are analytic”. This is due to the fact that “the predicate of every negative existential proposition which has been brought to the form of a proposition with a positive copula, connotes the property of non-existence” [EP, 11].

It follows that all negative existential propositions are contradictory “because their subjects contain a contradiction” [EP, 13]. As a further consequence, Leśniewski notes that “negative existential propositions cannot be true because... they are all contradictory. Thus, e.g., the proposition ‘a square circle does not exist’ is not true” [EP, 14].

At the end of his analysis, Leśniewski states: “It appears to me that the above argumentation makes it possible to state in a proper way the theory of propositions which is constructed on the premises defended by some exponents of Franz Brentano’s so-called ‘Austrian school’” [EP, 14]. His doubts on the reform of logic proposed by Brentano are summarized thus: “If any sentence could indeed be reduced to an existential proposition, we would have to draw – in view of what I have said at the beginning of this section – the absurd conclusion that no proposition containing a negative copula can be true”. To verify the untenability of this position, it is sufficient to note the following. “Paris... is indeed not situated in China; therefore the proposition ‘Paris is not situated in China’ must be true. The latter proposition, being true, cannot be equivalent to the false proposition ‘a Paris situated in China does not exist’ and consequently the theory which says that all propositions can be reduced to existential propositions, is refuted” [EP, 15].

9. The concept of logic

We have sought to reconstruct Leśniewski’s position in some detail in order to present some of his general theories with greater effect. In the light of the analyses summarized above, it is clear that at their basis lies a particular idea of what should be understood by logic. Leśniewski’s answer was as follows: “I use the word ‘logic’ to denote the discipline which investigates the question which propositions are true and which are false” [EM, 53]. And a little earlier he had written: “I employed the expression ‘logical proposition’ in accordance with the sense in which I use the word ‘logic’: I use the latter word to refer to the discipline which investigate which propositions are true and which are false” [EM, 49]. It follows that “a logical proposition is not every proposition but only such a proposition about a proposition or propositions which asserts that the latter proposition (or propositions) is true or false. To every true proposition of the type ‘A is b’ correspondes a true logical proposition of the type ‘the proposition ‘A is b’ is true’” [EM, 54]. Therefore a

logical proposition is a proposition like: ‘the thesis that- p is true’. We say that it is true because it is about proposition p .

In other words, propositions of the kind ‘A is b’ are not always logical propositions. From Leśniewski’s point of view, a proposition such as ‘all bodies are heavy’ is a proposition of physics, not of logic, while the proposition ‘the thesis that all bodies are heavy is true’ is a logical proposition.

Secondly, Leśniewski explicitly stated: “I call all propositions which possess a symbolic function, true propositions; I call all propositions which do not possess a symbolic function, false propositions” [PC, 35]. It follows that the correspondence between a ‘true proposition’ and a ‘proposition possessing a symbolic function’ is the point of contact between the theory of logic and the theory of signs.

We may summarize Leśniewski’s position in the following thesis: “(1) a true proposition always possesses a subject which denotes something; (2) a true proposition always possesses a predicate that connotes something” [EM, 57].

The concept of logic developed by Leśniewski owes a great deal to Petrazycki, as is made clear by the following quotation, which is of considerable interest. It is a long quotation, but nevertheless worth following with care:

Assume that a student of logic (or grammar) is given the problem of making a logical (or grammatical) analysis of the following three judgements or propositions: (1) the servant is in the anteroom, (2) Zeus is the king of the Olympian gods, and (3) the treasury has extensive property; and that our supposed student solves this problem as follows: to find the logical subject of the first judgement (or the grammatical subject of the first proposition) he sets out for the anteroom, is happy to find the servant there, brings him to the person awaiting the conclusion, and declares triumphally, “Here is the subject of the first judgement (the subject of the first proposition)! Nor does he encounter any difficulty as to the subject of the second judgement (or the subject of the second proposition): he is no pagan, and has too good an education to believe in the existence of Zeus, wherefore he spends neither time nor money on a trip to Greece in order to inspect the clouds on Olympus, but asserts confidently that there is no subject in this case and that there can be no judgement (or proposition) without a subject.

However, the subject of the third judgement seems to him to present a highly complicated and subtle problem: he proceeds to construct extremely profound hypotheses as to what exactly is the subject here, and advances some such belief as that there is here some special and enormous organism – something supra-animal, with a whole system of organs. All these

conclusions, manifestly, are based on a misunderstanding as to where subjects are found and how they should be sought out: they are, of course, found in the judgement themselves (in the consciousness of those who experience these judgements) as constituents part thereof, and nowhere at all in space outside the judgements – either in the anteroom, or in the clouds of Olympus, or anything of that sort.

This fundamental and general misunderstanding is responsible for three types of mistaken solutions: (1) The first consists in mistakenly accepting an actually existing object (the servant) found in an improper sphere (the anteroom) as the object which is being sought for, whereas in fact what is sought has an entirely different nature, and is to be found in an entirely different sphere, that is to say, in the judgement itself... (2) The second consists in mistakenly denying the existence of a subject (which undoubtedly exists and can be readily found in the subject's very judgement) and therefore the existence of the judgement itself, because of disbelief in the existence of the irrelevant object in an improper sphere (the living Zeus in the clouds of Olympus)... (3) Finally, the third consists in conjectures as to the existence and nature of irrelevant objects in an improper sphere of investigation, followed by speculation more or less profound or fantastic.²⁰

This long quotation prompts a number of observations. First, we obtain an original interpretation of semantics, according to which the semantic relationship is not a relationship between a term and its denotation in some universe of discourse. We should say instead that the relationship is between the terms which occur in logical propositions and the terms which occur in the corresponding propositions with which the logical propositions are concerned.

This position is reflected in the theory of definition. Leśniewski notes that mistakes are commonly made on account of 'typical' symbolic inadequacies [EP, 18]. The most common mistakes are those which in mediaeval terminology stem from an erroneous use of the *suppositio materialis*. These are mistakes in which "instead of formulating a proposition about the expression we are going to define, we formulate a proposition about the object of which the expression in question can only be a symbol" [EP, 18]. The definitions must proceed in such a way that their "subjects are symbols of the symbols of objects, that is symbols of words and not symbols of the objects themselves or their so-called concepts" [EP, 19].

²⁰ Petrazycki 1955, 9-10.

10. Theory of science

According to Leśniewski, a science is “a systematized aggregate of propositions which possess a symbolic function” [PC, 35]. We know that possessing a symbolic function means that the corresponding propositions are true. A science then is a systematized aggregate of true propositions. “The aim of any scientific criticism of a proposition or of a system of propositions consists in answering the question whether these propositions possess a symbolic function, i.e. whether they are true. The purpose of a consistent scientific criticism is the exclusion of all propositions which do not possess a symbolic function” [PC, 35].

A science will prove useful if it is able to classify all the propositions that are relevant to its purposes. The problem is therefore that of being able to handle all the objects that correspond to the root of the classification adopted. In Leśniewski’s words: “I consider, as the touchstone of theoretical usefulness of a classification, the possibility of constructing propositions or scientific theories concerning all the objects (and only these objects) which are included under the respective headings of the classification” [EP, 10]. This latter point is of especial importance because in its regard Leśniewski refers to the previously cited work by Petrazycki.

The problem of classification is one of the cornerstones of Petrazycki’s theory. Instead of using a traditional form of classification, based on the subject of sciences, Petrazycki’s classification is based on the division of propositions into definite types. A science is created up by a bound field of homogeneous propositions. The distinction therefore proceeds not by arguments but by types of proposition. We shall briefly discuss some aspects of this distinction.

A first distinction is between theoretical and practical propositions. Theoretical propositions can be general or individual. General propositions are propositions whose subjects are concepts or collections of objects (perhaps, infinite); individual propositions are propositions whose subjects are individual or collective concepts designing a definite collection.²¹

We have said that a science proves useful if it manages to classify all the propositions that are relevant to its purposes. A somewhat more detailed exemplification may be useful

²¹ Opalek 1961, 136.

in explaining what this means. Let us assume that the fundamental distinction in logic is between analytic and synthetic propositions. This hypothesis is scientifically useful not only if one is able to distinguish analytic and synthetic propositions from other types of proposition but also if one finds a way to handle all and only analytic propositions and all and only synthetic ones. Leśniewski provides such a method and the classification of propositions into analytic and synthetic is scientifically useful.

This latter observation allows us to introduce a further aspect where Petraycki's influence is obvious. Scientific theories must not only be correct; they must also be adequate. And the idea of adequacy is clearly taken from Petrazycki. We cite:

Scientific theories are those having a sound methodological and systematic basis, while adequate scientific theories are those which satisfy this very definite prerequisite: what is predicated must be precisely true of the class of objects with respect to which it is predicated.

Many theories, comprising no fallacy, are yet inadequate: one may form the concept of 'a cigar weighing five ounces', predicate about that class everything known about material things in general (about solid bodies in general, the chemical properties of the ingredients of these cigars, the influence of smoking them on health, and so on); these 'theories' – while perfectly correct – are manifestly inadequate since what is predicated with respect to 'cigars weighing five ounces' is also true of innumerable objects which do not belong to that class, such as cigars in general.

A theory may be inadequate either (1) because the predicates are related to classes which are too narrow... or (2) because the predicate is related to a class which is too broad (such as various sociological theories which attribute 'everything' to the influence of one factor which in fact plays a much more modest part).

If a genus consists of n species relative to the class corresponding to the generic concept, $n+1$ adequate theories can be constructed: one concerning each of the species, and in addition one concerning the genus.²²

11. Metaphysics

To understand the concept of metaphysics adopted by Leśniewski and to distinguish it from the concept of logic, one must first understand which propositions are metaphysical

²² Petrazycki 1955, 19.

propositions and which are logical propositions. An early declaration by Leśniewski states: “I employed the word ‘metaphysics’ to represent the system of true propositions concerning all objects in general” [EM, 48]. To which we may add: “propositions ... which refer to all objects in general are metaphysical propositions (I also call them ‘ontological’). The propositions [which refer only to a certain group of objects] are logical propositions” [EM, 48].

Two elements emerge. First, it is said the metaphysics is a science (because it is a system of true propositions); second, it is said that logic concerns only certain types of object while metaphysics concerns all objects in general.

Third, the reference to ontology makes it possible to clarify a further aspect of the theory. Quote: “I used the name ‘ontology’ to characterize the theory I was developing, without offence to my ‘linguistic instincts’ because I was formulating in that theory a certain kind of ‘general principles of existence’” [FM, 374]. To which one may add the above-cited note: “One can consider the meaning I have adopted for the expressions ‘ontology’ and ‘ontological’ to have originated as the result of the generalization of the relevant terminology of Jan Łukasiewicz” [FO, 626].

Given that “propositions concerning all objects in general cannot be formulated as conditionals” [PC, 30], it follows that “if we apply the word ‘metaphysics’ to denote the system of true propositions concerning all objects in general, we shall thus obtain the following thesis: metaphysics can be constructed only as a system of categorical propositions” [PC, 30].

Since we are dealing with categorical propositions, we may understand why in the “system of true propositions concerning all objects in general” Leśniewski only uses the universal quantifier and prohibits use of the particular quantifier.

The statement that metaphysics deals with all objects in general should be taken in a very precise sense. For example, “the propositions about ‘general’ objects which are allegedly opposed to ‘individual’ objects cannot be metaphysical propositions because they do not refer to ‘individual objects’ and, thus, are not propositions concerning all objects” [EM, 50].

Also the second statement to the effect that metaphysics is “the system of true propositions concerning all objects in general” can be traced directly to Petrazycki. Leśniewski states, in fact, that “Metaphysics conceived as a system of true propositions concerning all objects has obviously nothing to do with the system of propositions about

allegedly existing ‘objects in general’ or ‘general objects’. The proposition ‘every object possesses the properties $c_1, c_2, c_3 \dots c_n$ ’ is a typical metaphysical proposition... Metaphysical propositions can be contrasted with such propositions which do not refer to all objects but only to some of them and which are exemplified by the following types of propositions – ‘some objects possess the properties $c_1, c_2, c_3, \dots, c_n$ ’, ‘every object possessing the properties $c_1, c_2, c_3, \dots, c_n$ possesses the properties $c_1, c_2, c_3, \dots, c_n$ ’, ‘some objects possessing the properties $c_1, c_2, c_3, \dots, c_n$ possesses the properties $c_1, c_2, c_3, \dots, c_n$ ’, etc.” And here he concludes with an explicit reference to pages 81-83 of the already cited work by Petrazycki [EM, 49].

12. An interpretation

Our description of the general features of Leśniewski’s system is now complete. We can therefore now attempt to draw some conclusions.

First, the influential role of Łukasiewicz’s monograph on the Aristotelian principle of non-contradiction emerges with unexpected salience, but also and especially that of Petrazycki’s monograph on the psychological foundation of law.

Łukasiewicz’s monograph had important repercussions on Leśniewski’s concepts of ontology and of synonymy. From Petrazycki he derived his theories of science, logic and (again) metaphysics/ontology.

An extreme hypothesis, one which is not supported by Leśniewski’s writings but which emerges with a certain force from examination of his intellectual career, is the following: it seems that the fundamental purpose of his entire inquiry was to progress towards a formalization and a ‘modernization’ of Aristotle’s *Metaphysics*. Indeed, Leśniewski’s early works are perfectly in keeping with the Aristotelian revival of the period. One need only consider his papers on the ontological principle of contradiction [PC] and on the principle of the excluded middle [EM], as well as those on the existential propositions [EP] and on truth [EB]. But the most telling evidence is provided by a possible and, in the end quite reasonable, interpretation of the structure of his system of the foundations of mathematics.

It is not difficult to see mereology as a system which proposes a formalization of the theory of substance (matter). If we continue in this fashion, we realize that the so-called

implausibility of mereology immediately disappears. The results of mereology as a theory of substance correspond perfectly to the expectations of our intuition. The move towards ontology is even less problematic. For example, Leśniewski states: “I used the name ‘ontology’ to characterize the theory I was developing, without offence to my ‘linguistic instincts’ because I was formulating in that theory a certain kind of ‘general principles of existence’” [FM, 374], from which one naturally draws the conclusion that ontology is a formalization of the theory of being. Finally, with protothetics, we have – and this is something we have already seen – a formalization of the theory of *verum*.

To these internal observations we can add some notes concerning his intellectual context. In those years, first at Lvov and later at Warsaw, Aristotle was studied in depth. In addition to the widely known works of Łukasiewicz, we should also mention Twardowski, the founder of the Lvov-Warsaw school and one of Brentano’s most outstanding pupils. Kotarbiński is certainly no less important: mention should at least be made of his analysis of Aristotle’s categories in *Elementy teorii poznania, logiki formalnej i metodologii nauk*, an analysis carried out along lines very similar to Leśniewski’s approach.²³

We would conclude by noting that, however surprising it may seem, the hypothesis that Leśniewski’s fundamental intention was to seek to formalize the *Metaphysics* is perhaps the deepest and clearest explanation of his unshakeable faith in the superiority of the traditional theory of logic.

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²³ With reference to expressions of the kind ‘A is b’, Kotarbiński’s analysis of Aristotle’s theory of categories distinguishes purely nominal categories of the ‘b’ kind (the first six) from categories of the ‘is-b’ kind (the last four). Cf. Kotarbiński 1966, 49-50.

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