

Stanisław Leśniewski: Original and Uncompromising Logical Genius



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Leśniewski was notable for the degree of prolixity which he was willing to admit in the interest of complete rigor and precision.

W.V. Quine, *The Journal of Symbolic Logic* 5, (1940), p. 83

Abstract Stanisław Leśniewski was one of the two originators and drivers of the Warsaw School of logic. This article describes his work chronologically, from his early philosophical work in Lvov to his highly original logical systems of protothetic, ontology and mereology. His struggles to overcome logical antinomies, his absolute commitment to logical clarity and precision, and his antipathy towards set theory made his nominalistic approach to logic among the most original of the twentieth century, while his early death and the loss of his papers meant his work was only gradually discovered and appreciated outside Poland.

Keywords Stanisław Leśniewski · Lvov-Warsaw School · Protothetic · Ontology · Mereology · Antinomies

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1 Life

Stanisław Kazimierz Leśniewski was born in Serpukhov, near Moscow in Russia, on 28 March 1886. His father, Izydor Leśniewski, was an engineer who worked on the construction of the Trans-Siberian Railway. His mother was Helena, née Palczewska. Stanisław was baptised at St. Stanislav's church in St. Petersburg. His mother died when he was young and his father remarried, so Stanisław had several younger step-siblings. He attended classical *Gymnasium* in Irkutsk in Siberia from 1899 to 1903. Between 1904 and 1910 he studied Philosophy and Mathematics at several universities: Leipzig, Zurich, Heidelberg, St. Petersburg, and Munich. In Leipzig, he heard lectures by Wilhelm Wundt, and in Munich by Hans Cornelius, Moritz Geiger and Alexander Pfänder. In 1910, already with a solid philosophical education behind him, he went as a doctoral

student to Lvov University, then in Austria-Hungary, completing his doctorate under Kazimierz Twardowski in 1912 with a dissertation entitled *Przyczynek do analizy zdań egzystencjalnych* [Contributions to the Analysis of Existential Propositions] [1]. This was also published as an article the previous year in the leading Polish-language philosophy journal *Przegląd Filozoficzny*.

In 1913 he married Zofia Prewysz-Kwintów (1893–1958), from a Lithuanian landowning family. They had no children. Four further publications on the philosophy of logic followed until the outbreak of war, which Leśniewski spent largely in Moscow teaching mathematics at Polish schools. During this period, he developed what he called his theory of collections, which later became known as mereology. After the Bolshevik Revolution in Russia, Leśniewski left Russia for Poland. During the 1919–1921 Polish-Bolshevik War he worked as a codebreaker for the Polish General Staff's Cipher Bureau. He tried unsuccessfully to obtain his habilitation in Lvov, but got it instead in 1918 in the University of Warsaw, where in 1919 he became Extraordinary Professor of the Foundations of Mathematics, a position especially created for him. From then until his final illness Leśniewski lectured regularly on logical and mathematical topics, and built up his logical systems. Leśniewski published nothing between 1916 and 1927. Between 1927 and 1931 he published two major pieces, one a series in Polish on mereology, the other a long article in German on protothetic, his extended propositional logic. Leśniewski was made a full professor in 1936. He contracted thyroid cancer and died on 13 May 1939 at the age of 53 after an unsuccessful operation. He was buried in the historic Old Powązki Cemetery in Warsaw. His papers, entrusted to his student Bolesław Sobociński, included unfinished works on logical antinomies and on many-valued logic. All of these papers were destroyed in Sobociński's apartment during the Warsaw Rising of 1944.

2 Phases of Activity

It is common to divide Leśniewski's work into two phases: an early one (up to 1916) in which he worked informally on questions of the philosophy of logic, and a mature phase (from roughly 1919 to his death) in which he formulated and perfected his formal logical systems. Leśniewski himself gave his imprimatur to the idea that his early work should be clearly separated from his later, since in 1927 he wrote that he formally repudiated all his work before 1914, which he regarded as bankrupt: "philosophical"-grammatical, in his words, with the exception of an argument against Twardowski's conception of general objects, which he still regarded as acceptable.

However, while from the point of view of content there is a clear difference between the work before 1914 and that after, it is something of an oversimplification to divide his activity into just two periods. True, the early papers between 1911 and 1913 are written from the "philosophical"-grammatical point of view that Leśniewski came to despise. Between 1914 and 1916 however, while Leśniewski continued to write in regimented prose, his interests centred around finding a solution to the problem of Russell's Paradox, and mark a transition to his later interests and style. The long period without publication is when Leśniewski was formulating and perfecting his systems. Between 1927 and 1931 there was a burst of publication. Then there was another pause in publishing, when

Leśniewski probably concentrated on writing a large systematic work on antinomies, and on criticising many-valued logics. The year before Leśniewski died, a continuation of the German paper appeared.

So it would be more accurate to say there were five phases: an initial, “philosophical” phase, a transitional phase where Leśniewski was working out how to deal with Russell’s Paradox, an intensive developmental phase where his mature systems were formulated and results proved without publication, a concerted publishing phase, with this leading into a second phase of consolidation without publication, the final paper being really an artificially delayed postscript to the earlier burst of publishing. Had Leśniewski survived longer there would doubtless have been another period of publication.

Continuity from 1919 to 1939 was provided both by Leśniewski’s efforts to formulate and perfect his systems, and by his unbroken teaching in the University of Warsaw, which centred firmly around the foundations of mathematics and how to approach them properly, being the place where he could try out his ideas and perfect them with the collaboration of students.

3 Early Writings

During his studies in Germany, Leśniewski encountered the philosophy of language of Anton Marty, whose major work *Untersuchungen zur Grundlegung der allgemeinen Grammatik und Sprachphilosophie* (1908), he contemplated translating into Polish. Legend has it that the project foundered after he was unable to find an adequate translation for the second word of the title. It is likely he also encountered Husserl’s *Logische Untersuchungen* (1900/1901), and again thought of translating this (somewhat later: 1915/1916), again without outcome. What he later called this “Austrian” approach influenced his early work. This concentrated not on grammar or philosophy of language *per se* but on aspects of the philosophy of logic. The dissertation [1] is dedicated to showing, using notions of denotation and connotation derived from Mill, that existential statements of the form *S exists* are tautological—and false. This barely believable thesis is slightly softened by his claim that the seemingly equivalent sentence *Some object is S* is both non-tautological and may be true. This kind of fine linguistic differentiation was to become the hallmark of his work.

Other writings of this kind from this period were in good part reactions to work by others, but always with an original slant. The paper ‘Próba dowodu ontologicznej zasady sprzeczności’ [Attempt at a Proof of the Ontological Principle of Contradiction] (1913) [2] is a reaction to aspects of Jan Łukasiewicz’s 1910 monograph *O zasadzie sprzeczności u Arystotelesa* [On the Principle of Contradiction in Aristotle], a work that was to have far-reaching consequences for Leśniewski’s own career. The article ‘Czy prawda jest tylko wieczna czy też wieczna i odwieczna?’ [Is truth only eternal or both eternal and from eternity?] (1913) [3] criticises an argument by Leśniewski’s friend and fellow-student Tadeusz Kotarbiński that statements about future contingents are not true in advance of the outcome, a view later taken up by Łukasiewicz as the motivation for his invention of many-valued logic. Leśniewski upholds the view that statements about future contingents are true or false in advance of the event, and his argument persuaded Kotarbiński to change

his mind. The most substantial of Leśniewski's pre-war pieces was 'Krytyka logicznej zasady wyłączonego środka[a]' [Critique of the Logical Principle of Excluded Middle] (1913) [4], again taking on ideas of Łukasiewicz and Twardowski. It contains, among other things, an argument against Twardowski's conception of a general object. Suppose a general object—say the general tomato—is defined as the object having all and only the properties common to all tomatoes. Suppose one tomato weighs 150 g and another tomato weighs 100 g. Then the general tomato has neither the property of weighing 150 g nor the property of not weighing 150 g. Thus, the only way a general object can be non-contradictory is if it is the sole object of its kind, which renders the notion useless. This is the only argument of Leśniewski's early work that he did not "repudiate" in 1927. Another part of the paper discusses the Liar Paradox or Epimenides, the first indication of Leśniewski's long battle against antinomies.

In general, Leśniewski's pre-war papers are characterized by extreme attention to language and how he intends certain words and sentences to be understood, which is not always in the same way as others, and a steely resolve to follow the argument wherever it leads, even if the resulting theses are sometimes counterintuitive. At the same time, his verbal commentary is often colourful and he makes abundant use of scare-quotes. These characteristics were to remain with him throughout his writing career.

4 Antinomies, Classes, Parts

In Łukasiewicz's 1910 monograph on the principle of contradiction in Aristotle, there is an appendix discussing the treatment of contradiction in symbolic logic, employing the notation of Louis Couturat. There is also a discussion of Russell's Paradox of the class of classes which are not members of themselves. Leśniewski read the book in 1911 and was so struck by trying to solve the paradox, which he initially thought was just a trivial puzzle that could be solved in a couple of hours, that he is said to have missed a railway connection from Poland to Russia and endured a long wait. In fact he worked on the problem for 11 years, and never lost his fascination with antinomies. His first published foray into the field was his 1914 paper 'Czy klasa klas, nie podporządkowanych sobie, jest podporządkowana sobie?' [Is the class of classes not subordinate to themselves subordinate to itself?] [5]. The idiosyncratic formulation 'subordinate to itself' rather than 'member of itself' is taken from Łukasiewicz's discussion. While it makes some relatively unimportant assumptions that Leśniewski would later have criticised, the main thrust of the article is that there is no antinomy, because every class (every collection having at least one member) is a member of itself. The reason for this is that Leśniewski understands 'member of A ' in effect to mean 'part (or whole) of A '.

This "solution" was expounded in much greater detail in a forty-page monograph, *Podstawy ogólnej teorii mnogości I* [Foundations of the General Theory of Collections I] (1916: no further parts appeared) [6] dedicated by Leśniewski to his wife. Consider a line segment AB , and suppose it is composed of subsegments AC , CD , DE , EB , and that the several segments AC , CD , DE and EB are the objects m . Then the class of (all the) m just is the whole object AB , an object that we would now call the mereological sum of the objects m . As is clear from Leśniewski's explanations of his terminology, he considered this to be the only sensible way to understand the notions of 'class of m ' (the sum of all

the m), ‘set of m ’ (a sum of some but not necessarily all the m), and ‘element of m ’ and ‘subset of m ’ (a proper or improper part of the class of the m). The monograph declares this to give the true understanding of ‘set’ (*Menge*) in Cantor, and it is in effect a bid to take over the terminology of the then exploding discipline of set theory and turn it in Leśniewski’s direction. That his understanding is clearly *not* that of Cantor and other set theorists is shown by the fact that there are four objects m but many more (including AB and all its parts) that are elements of m , and that a single object such as AB can be the class of many distinct groups of objects n , even such as have none in common with the m , all of which runs counter to Cantor, and standard set theory.

The basic notion of the monograph is that of ‘part’ (*część*), meaning a proper part, not identical with the whole—Leśniewski’s term for a proper-or-improper part is here ‘ingredient’ (*ingredyens*), but he later preferred the term ‘element’ for this notion (they are defined differently but are equivalent in the monograph). The development is based on four axioms and three definitions, those for ingredient, set and class. The axioms say that parthood is asymmetric and transitive, and that if there is at least object m then there is exactly one class of m . Leśniewski later criticised this theory for including definitions at the basic level, and would afterwards always attempt to base his theories on a single notion governed by axioms, before introducing definitions and theorems. On the other hand, the development in the monograph is extremely clearly done and there is very little to criticise from Leśniewski’s later formal point of view. The theorems are stated and proved in ordinary Polish augmented with variables, and employing a very restricted vocabulary. They were thus very easy to formalize later.

Leśniewski’s concretistic, mereological understanding of the ideas of set theory was destined not to catch on, and led in the 1920s and 1930s to increasingly critical and ultimately personally bitter disagreements with the proponents of what Leśniewski ironically called “official” set theory. To distinguish his views from theirs, in 1927 he renamed his theory ‘mereology’ [*mereologia*], from the Greek *meros*, part. That is the name that has become standard for formal part-whole theory ever since, and the 1916 monograph was the first formal theory of part and whole to appear in print.

5 Formalization

Upon his appointment to the professorship in Warsaw in 1919, Leśniewski embarked on a 20-year teaching career, the bulk of which was concerned with various aspects of the foundations of mathematics. It was Leśniewski’s aim and ambition to provide a rigorous and antinomy-free foundation for mathematics, avoiding the inconsistency of Frege’s logical foundation in *Grundgesetze der Mathematik* (1893/1903), the inexactness of Whitehead and Russell’s foundation in *Principia Mathematica* (1910–1913), as well as the—to Leśniewski—absurd and counterintuitive set theory developed by Zermelo and others. This was now his life’s project.

The initial hurdle to this was the example of Whitehead and Russell, who were notoriously careless about use and mention in the prose passages of *Principia*, a fact which prevented the extremely literal and unsympathetic reader Leśniewski from even understanding their work, and made him shy away from symbolic logic for several years, on the assumption that symbolization itself was problematic. Two factors changed

his mind. One was his admiration for the metalogical care and clarity of Frege, notwithstanding the inconsistency of his system, and the other was personal persuasion by Leon Chwistek in 1920.

Leśniewski then set about putting his system into a formal and symbolic guise, starting with the mereology from 1916, which he had continued augmenting and improving in the intervening years, without publication. The way in which Leśniewski came to formalization from already precisely formulated vernacular formulations was somewhat unusual, and explains his attitude to formal logic. It is nowadays generally assumed, in the vein of Hilbert and formalism, that a symbolic system consists of a collection of symbols assembled into formulas by syntactic rules and conventions, given a proof theory by inferences rules and axioms, and endowed with meaning by a formal semantics, often though not always drawing on set theory. In the early twentieth century, several prominent logicians, notable Frege, Whitehead, Russell and Brouwer, took a different view, assuming that the symbols they employed in their logic had a determinate, intuitive meaning, and that axioms and rules were teasing out the logical effects of these intuitive meanings. Leśniewski's sympathies lay with the latter group, since the symbols he started employing from 1920 already inherited their meaning from his prior vernacular formulations and did not need to have it conferred from outside. The point of the axioms and rules was to capture as adequately as possible for logical purposes what these meanings were. This is why, in later writing, Leśniewski ironically describes himself as both a formalist and an intuitionist.

Having dealt with mereology, Leśniewski next turned to the logical apparatus underlying it, in the first place, the logic of names and predicates. Unlike Frege and Russell, Leśniewski was quite happy to allow names to denote more than one individual, following in this regard rather Aristotle, the tradition, and the algebraic logic of Ernst Schröder. He also accepted that a name could be empty, that is, fail to denote anything. The basic notion that he identified as requiring axiomatic determination was that of singular inclusion, in the form 'A is (a) b', for example, 'Socrates is a man'. In Polish, which lacks articles, this is *Sokrates jest człowiekiem*, so logical attention focusses on the single word 'jest'. He then collected some logical truths he considered it to govern, for example 'If A is b, then A is A', and 'If A is B, and B is c, then A is c'. The use of lower and upper case variables is not logically significant, but was merely an informal convention he adopted, taken over from his early writings, that in a subformula which could only be true if the subject was singular, he would use a capital letter for the subject term. For a symbol, Leśniewski took over the Greek lower-case epsilon, 'ε', used by Peano and taken from the Greek *esti*, [is]. In 1920 he managed to come up with a single axiom governing 'is' or 'ε'. Following ideas from Russell's theory of descriptions, according to which '(The) A is a b' means 'There is at least one A, and there is not more than one A, and every A is a b', this was the axiom

For all A and a: $A\epsilon a$ if and only if: for some B, $B\epsilon A$, and for all B and C, if $B\epsilon A$ and $C\epsilon A$, then $B\epsilon C$, and for all B, if $B\epsilon A$ then $B\epsilon a$.

Because this primitive enabled Leśniewski to define several other expressions involving uses of the verb *to be*, such as those expressing existence, singular identity, inclusion, and general identity, he came to call the resulting logical system *ontology*. The 1920 axiom was subsequently replaced by shorter ones, and so came to be called the 'long' axiom of ontology, but it remains the most intuitively evident, and embodies a kind of self-definition of 'ε'.

It remained for Leśniewski to formalize the logic of propositional connectives and quantifiers presupposed in ontology and thus in mereology. This proved a little tougher. Leśniewski's view on definitions was that they should be expressed as equivalences, using the connective \leftrightarrow of equivalence, rather than as metalogical abbreviations. He thus wished to base his logic of propositions on material equivalence and universal quantification alone, but could not see how to define conjunction. It was his genial young PhD student Alfred Tarski who found the solution, defining conjunction by quantifying propositional functors, as

$$p \wedge q \leftrightarrow \forall f(p \leftrightarrow (f(p) \leftrightarrow f(q)))$$

so that, by 1923, Leśniewski had a formal system of propositions, propositional functors and quantifiers, which he dubbed *protothetic*. The full system of foundations now comprised protothetic, ontology and mereology, in that order of logical precedence.

6 Consolidation and Publication

Through the early and mid-1920s, Leśniewski did not publish his results, preferring to work on improving them and aspiring to publish a systematic treatise in the style of *Principia Mathematica*. But while he worked on this and discussed his results with others, he increasingly found that results obtained by himself or one or other of his interlocutors were being held back for fear of disputes about priority and responsibility for advances—both Leśniewski and several of his colleagues were notoriously sensitive about attributions of priority. To relieve the difficulty, he decided on a different way of getting his ideas into print, which was a quasi-autobiographical sequence of results in the order he and others had found them. The first result of this was in effect a treatise in eleven sections, ‘O podstawach matematyki’ [On the foundations of mathematics], published in five parts in *Przegląd Filozoficzny* between 1927 and 1931 [7]. It was affectionately dedicated to “My esteemed and beloved Professor of Philosophy, Dr. Kazimierz Twardowski”, from “a philosophical apostate, but a grateful pupil.” The paper was a biography of mereology, from 1916 onwards. Like the original, it was expressed in regimented Polish, with a somewhat revised vocabulary, and contained detailed comparisons between the various systems and proofs of over 250 theorems. It also contained a comparison with and criticism of Whitehead's theory of events, to which Tarski had drawn Leśniewski's attention. While Whitehead also used part-whole theory, and had probably developed his ideas at about the same time as Leśniewski, his published formulation was flawed, and Leśniewski mercilessly pointed out the defects.

The other major publication of this time was a long 1929 article, ‘Grundzüge eines neuen Systems der Grundlagen der Mathematik’ [Fundamentals of a New System of the Foundations of Mathematics] [8], published in *Fundamenta Mathematicae*, also in eleven sections. After a further “autobiographical” account of the development of protothetic, this continued with detailed metalogical specifications, but the development was incomplete at the end of Sect. 11 and it was another 9 years before the series was continued.

In this period Leśniewski also published four short articles, two on single-axiom axiomatizations of group theory and Abelian group theory [9, 10], a short sketch of the metalogic of ontology [11], and an account of principles of definition in propositional logic [12].

7 Final Years

From 1931, Leśniewski's publications faltered again, this time in part because he had fallen out with the other editors of *Fundamenta Mathematicae* over their continued practice of promoting set theory through the journal. A chance to continue the 'Grundzüge' article only came towards the end of the decade, when a new journal, *Collectanea Logica*, was founded, and Leśniewski wrote a long introduction to the continuation noting developments in the intervening years [13], and following it with the completely formal twelfth section, comprising no fewer than 422 theses. But the outbreak of war meant that the journal never appeared. A preprint of the article survived in Harvard, perhaps sent to Quine who then wrote a review for the *Journal of Symbolic Logic* in 1940. Leśniewski was somewhat belatedly promoted to full professor in 1936. At the time of his death he was working on a refutation of many-valued logic, as well as a treatise on antinomies. Neither survived the Warsaw Rising, being lost with his papers and correspondence.

8 Metalogic

Because of his antipathy to set theory, which became the medium of choice for logical semantics, Leśniewski never ventured into semantics, believing it unnecessary for systems whose constants are already meaningful. It was also probably in good part because his former student Tarski employed set theory in his famous paper on truth of 1933 that Leśniewski did not accept Tarski's results, though in the early part of the truth paper Tarski paid generous tribute to Leśniewski for the analysis of the Liar Paradox and the way quotation mark names are used. In his ontological views, Leśniewski was anti-platonistic, and only declined to call himself a nominalist because he thought that some mental phenomena such as after-images defied physicalistic explanation. On the other hand, in his practice of logic, Leśniewski was uncompromisingly nominalistic. In his view, a logical system is a concrete, spatiotemporal collection of marks or inscriptions which can be added to over time by new marks constituting definitions and proofs of theorems. This is in complete contrast to platonistic views, according to which a logic is a system of eternal propositions standing in timeless logical relationships.

Because of this very down-to-earth view of logic, Leśniewski was unable to formulate metalogical principles in what has become the standard way, by a recursive specification, but gave detailed schematic directives on how to extend an existing logical system with new theses. Because the theses are not set out in Plato's heaven, the descriptions of what may count as an acceptable continuation need to be self-adjusting, referring back to expressions already introduced in previous theses. The directives for protothetic

include those for substitution, detachment, quantifier distribution, and very importantly, for definitions. Definitions, being concocted like the rest of the system as one went along, were regarded by Leśniewski as object-language equivalences introducing new symbols, effectively new axioms, and they could be creative and non-conservative. Formulating the principles governing what could count as a good definition gave Leśniewski much trouble, and he regarded his directives for adding definitions to protothetic and ontology as his finest work. In protothetic there was only one kind of definition, for sentences and functors, while for ontology there were two kinds, one for adding new sentence-forming functors (predicates of first and higher order), and one for adding names and nominal functors of first and higher order. The directives were expressed in a highly precise way employing a complex regimented vocabulary specified by a series of what Leśniewski called terminological explanations, but which were in effect precise stipulations for the meanings of his metalogical terms.

In the early 1920s, Leśniewski employed a version of Whitehead and Russell's type theory, but he was wary of its apparently inflated ontology and soon reformulated his logical grammar as what was subsequently known as a categorial grammar, according to which any expression is either a sentence or a name or a functor, with precise argument input kinds and output kind, each such kind being what Leśniewski somewhat misleadingly called a *semantic category*. His inspiration for this was Husserl's theory of *Bedeutungskategorien*, though unlike Husserl he understood the categories to be meaningful expressions rather than meanings, and the constraints to be syntactical. The combinatory principles for such a grammar were first set out not by Leśniewski but by Kazimierz Ajdukiewicz. Ajdukiewicz was unable to give satisfactory principles for quantifiers or other variable-binding operators. This mirrored a difficulty faced by Leśniewski, who treated the universal quantifier, binding any finite number of variables from any available categories, as itself syncategorematic, and found himself unable to give directives for adding new binding operators, despite offering students any degree they needed if they could come up with a solution. Leśniewski found his theory of semantic categories to be so natural that he considered a logical system should use it even if there were no threatening antinomies. Tarski initially followed Leśniewski's theory of semantic categories but his later readiness to go beyond the system and allow transfinite types or categories was no doubt another contributory factor to their disagreement.

When Quine met Leśniewski in Warsaw in 1933 they disagreed about whether Leśniewski's liberal practice of allowing quantifiers to bind variables of any category committed him to a correspondingly complex ontology of abstract entities: Quine thought it did; Leśniewski maintained it did not.

9 Teaching and Students

Leśniewski taught in Warsaw from 1919 to 1939, mainly on his own theories, occasionally on work by others, such as Cantor, Zermelo, Peano and Łukasiewicz. Some of his courses extended over 2 academic years, and he used them to trial his own ideas. Lejewski reported that his advanced seminars on directives lasted for three semesters. His style was to work from copious notes, writing theses on the board and asking students for assistance in formulating examples and counterexamples. Quine found it easy to follow

despite knowing no Polish. By their nature, his classes did not attract a wide following, and Leśniewski would quietly send away unknowing students, who were just making up their hours, with a positive mark in their student book. Once when unexpectedly many students turned up at the beginning of the class he expressed surprise at their numbers and asked whether they had confused him with Bergson. Those who stayed were dedicated. Leśniewski only ever supervised one doctoral student, Alfred Tarski, who obtained his doctorate in 1923 at the age of 22. Leśniewski would proudly say he had 100% geniuses as doctoral students.

In teaching, as in some of his publications, Leśniewski conducted proofs by a system of natural deduction, which was much easier to follow than full axiomatic proofs. Although one of the first logicians to carry out proofs in this way, he regarded such derivations as mere sketches for “proper” proofs, comparing them with a lounge suit worn in preference to formal evening dress with a stiff shirt and collar. He therefore never formulated exact principles for these derivations, and the impetus for doing so, work pioneered by Stanisław Jaśkowski, came not from Leśniewski but from Łukasiewicz.

10 Colleagues and Personality

Leśniewski remained in various forms of contact with his teacher Twardowski and study colleagues from pre-war Lvov, including Jan Łukasiewicz, Kazimierz Ajdukiewicz and Tadeusz Kotarbiński. Obviously Łukasiewicz was a close colleague in Warsaw, while Tarski soon joined his two teachers as the third major logician of the Warsaw School. There were also his mathematical colleagues in Warsaw, notably Waław Sierpiński and Kazimierz Kuratowski. His relationships with most of them eventually deteriorated, for a variety of reasons. As the obverse of his obsession with exactness, Leśniewski was a fierce and unsympathetic critic of sloppy thinking and his interventions at seminars in Warsaw put people off from going to speak there. His written criticisms of the ideas of gifted mathematicians such as Hausdorff and von Neumann were often blunt to the point of rudeness, and gained him few friends. His political views shifted rightwards over the years: he supported the authoritarian *Sanacja* regime inspired by Józef Piłsudski, and became increasingly anti-semitic in his sentiments. At the time of his death his only remaining close friend was the patient and forgiving Kotarbiński, who visited him in hospital in his final days and was with him when he died. On the other hand, he inspired fierce loyalty and admiration among the small group of his closest students, and even his critics had to admit he was one of the most gifted and original of the brilliant interwar generation.

11 Legacy

From the 1930s onwards, a number of factors conspired to keep Leśniewski’s work out of the logical mainstream. In part it was his own meticulous but often inconvenient logical practices. In part it was his ideological disagreement over set theory and other platonistic mathematical theories, which meant that he did not participate in the semantic revolution

in logic initiated by Tarski. Finally, his tragically early death and the wartime destruction of his papers meant that what passed down was a torso of his work. After the Second World War, his students, particularly Ślupecki, Sobociński and Lejewski, made efforts to reconstruct his ideas, recalled from lectures and papers, but most logicians, not least the now famous and influential Tarski, regarded his work as old-fashioned and superseded. Isolated aspects of his work were taken up more widely, in particular mereology, rendered in more conventional logical guise by Henry Leonard and Nelson Goodman, but for the most part his work was regarded as a quaint and ultimately unfruitful branch of modern logic, and largely forgotten. It did not help that most of his work was in Polish, and difficult to access.

From the 1980s things improved somewhat. Translations of rescued lecture notes [14] and English [15] and French [16] translations of his articles brought his primary work to a wider audience. Mereology was instated as a crucial tool of metaphysics. A Polish collected edition, *Pisma Zebrane* [17], a biography by Jacek Jadacki and a commentary monograph by Rafał Urbaniak rounded out the published picture. As the historiography of the Lvov-Warsaw School was written, Leśniewski re-emerged not only as one of the chief drivers of that remarkable school, but more widely as one of the most original and inspirational logicians of the twentieth century.

Stanisław Leśniewski's Works Mentioned in the Paper

1. Przyczynek do analizy zdań egzystencjalnych. *Przegląd Filozoficzny* **14**, 329–345 (1911) (Cf. [Jadacki, J.J. (ed.): *Pisma Zebrane*. [Collected Writings], 2 vols, pp. 15–31. Semper, Warsaw (2015)]; English translation: A contribution to the analysis of existential propositions. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): *Collected Works*, 2 vols, pp. 1–19. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
2. Próba dowodu ontologicznej zasady sprzeczności. *Przegląd Filozoficzny* **15**, 202–226 (1912) (Cf. [Jadacki, J.J. (ed.): *Pisma Zebrane*. [Collected Writings], 2 vols, pp. 32–56. Semper, Warsaw (2015)]; English translation: An attempt at a proof of the ontological principle of contradiction. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): *Collected Works*, 2 vols, pp. 20–46. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
3. Czy prawda jest wieczna, czy też wieczna i odwieczna? *Nowe Tory* **18**, 493–528 (1913) (Cf. [Jadacki, J.J. (ed.): *Pisma Zebrane*. [Collected Writings], 2 vols, pp. 147–182. Semper, Warsaw (2015)]; English translation: Is all truth only true eternally, or is it also true without a beginning? In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): *Collected Works*, 2 vols, pp. 86–114. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
4. Krytyka logicznej zasady wyłączonego środka. *Przegląd Filozoficzny* **16**, 315–352 (1913) (Cf. [Jadacki, J.J. (ed.): *Pisma Zebrane*. [Collected Writings], 2 vols, pp. 183–222. Semper, Warsaw (2015)]; English translation: The critique of the logical principle of the excluded middle. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): *Collected Works*, 2 vols, pp. 47–85. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
5. Czy klasa klas nie podporządkowanych sobie jest podporządkowana sobie? *Przegląd Filozoficzny* **17**, 63–75 (1914) (Cf. [Jadacki, J.J. (ed.): *Pisma Zebrane*. [Collected Writings], 2 vols, pp. 223–235. Semper, Warsaw (2015)]; English translation: Is the classes of classes not subordinated to themselves, subordinated to itself? In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): *Collected*

- Works, 2 vols, pp. 115–128. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey)
6. Podstawy ogólnej teorii mnogości I. Prace Polskiego Koła Naukowego w Moskwie. Sekcja matematyczno-przyrodnicza, No.2. Poplawski, Moscow (1916). No further parts appeared (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 256–294. Semper, Warsaw (2015)]; English translation: Foundations of the general theory of sets. I. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 129–173. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
 7. O podstawach matematyki, I–V. Przegląd Filozoficzny **30**, 164–206 (1927); **31**, 261–291 (1928); **32**, 60–101 (1929); **33**, 77–105 (1930); **34**, 142–170 (1931) (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 295–468. Semper, Warsaw (2015)]; English translation: On the foundations of mathematics. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 174–382. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey]; French translation: [Sur les fondements de la mathématique. Hermès, Paris (1989)]
 8. Grundzüge eines neuen System der Grundlagen der Mathematik. *Fundamenta Mathematicae* **14**, 1–81 (1929) (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 489–569. Semper, Warsaw (2015)]; English translation: Fundamentals of a new system of the foundations of mathematics. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 410–488. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
 9. Über Funktionen, deren Felder Gruppen mit Rücksicht auf diese Funktionen sind. *Fundamenta Mathematicae* **13**, 319–332 (1929) (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 475–488. Semper, Warsaw (2015)]; English translation: On functions whose fields, with respect to these functions are groups. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 383–398. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
 10. Über Funktionen, deren Felder Abelsche Gruppen in bezug auf diese Funktionen sind. *Fundamenta Mathematicae* **14**, 242–251 (1929) (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 714–723. Semper, Warsaw (2015)]; English translation: On functions whose fields, with respect to these functions are abelian groups. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 399–409. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
 11. Über die Grundlagen der Ontologie. Sprawozdania z posiedzeń Towarzystwa Naukowego Warszawskiego, Wydział III [Comptes rendus des séances de la Société des Sciences et des Lettres de Varsovie, Classe III] **22**, 111–132 (1930) (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 724–745. Semper, Warsaw (2015)]; English translation: On the foundations of ontology. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 606–628. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
 12. Über Definitionen in der sogenannten Theorie der Deduktion. Sprawozdania z posiedzeń Towarzystwa Naukowego Warszawskiego **23**, 289–309 (1930) (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 746–766. Semper, Warsaw (2015)]; English translation: On definitions in the so-called theory of deduction. In: McCall, S. (ed.) *Polish Logic, 1920–1939*, pp. 170–187. Clarendon, Oxford (1967). Cf. [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 629–648. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
 13. Einleitende Bemerkungen zur Fortsetzung meiner Mitteilung u. d. T. ‘Grundzüge eines neuen System der Grundlagen der Mathematik’ [Introductory remarks to the continuation of my article ‘Grundzüge eines neuen Systems der Grundlagen der Mathematik’]. *Collectanea Logica* **1**, 1–60 (1938) (Cf. [Jadacki, J.J. (ed.): Pisma Zebrane. [Collected Writings], 2 vols, pp. 570–629. Semper, Warsaw (2015)]; English translation: Introductory remarks to the continuation of my article ‘Grundzüge eines neuen Systems der Grundlagen der Mathematik’. In: McCall, S. (ed.) *Polish Logic, 1920–1939*, pp. 116–169. Clarendon, Oxford (1967). Cf. [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): Collected Works, 2 vols, pp. 649–710. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])

14. Grundzüge eines neuen System der Grundlagen der Mathematik (Fortsetzung). *Collectanea Logica* **1**, 61–144 (Cf. [Jadacki, J.J. (ed.): *Pisma Zebrane*. [Collected Writings], 2 vols, pp. 630–713. Semper, Warsaw (2015)]; English translation: *Fundamentals of a new system of the foundations of mathematics*. In: [Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): *Collected Works*, 2 vols, pp. 489–605. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey])
15. Srzednicki, J.T.J., Stachniak, Z. (eds.): *S. Lesniewski's Lecture Notes in Logic*. Kluwer, Dordrecht (1988)
16. Surma, S.J., Srzednicki, J.T.J., Barnett, J.D., Rickey, V.F. (eds.): *Collected Works*, 2 vols. Kluwer/Polish Scientific Publishers, Dordrecht/Warsaw (1992), with an annotated bibliography to 1978 by V.F. Rickey
17. *Sur les fondements de la mathématique*. Hermès, Paris (1989). Translation of [O podstawach matematyki, I–V. *Przegląd Filozoficzny* **30**, 164–206 (1927); **31**, 261–291 (1928); **32**, 60–101 (1929); **33**, 77–105 (1930); **34**, 142–170 (1931)] by G. Kalinowski
18. Jadacki, J.J. (ed.): *Pisma Zebrane*. [Collected Writings], 2 vols. Semper, Warsaw (2015)

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