Stanisław Leśniewski: bibliography in English (A - Ind)

Contents of this Section

Studies on Leśniewski in English

1. Ajdukiewicz, Kazimierz. 1978. "Syntactic Connexion (1936)." In *The Scientific World Perspective and Other Essays, 1931-1963*, 118-139. Dordrecht: Reidel.
First published in German as: Die syntaktische Konnexität, *Studia Philosophica,* 1, 1935, pp. 1-27.
"The discovery of the antinomies, and the method of their resolution, have made problems of linguistic syntax the most important problems of logic (provided this word is understood in a sense that also includes metatheoretical considerations). Among these problems that of syntactic connexion is of the greatest importance for logic. It is concerned with the specification of the conditions under which a word pattern, constituted of meaningful words, forms an expression which itself has a unified meaning (constituted, to be sure, by the meaning of the single words belonging to it). A word pattern of this kind is syntactically connected.
The word pattern 'John loves Ann', for instance, is composed of words of the English language in syntactic connexion, and is a significant expression in English. However, the expressiun 'perhaps horse if will however shine' is constructed of meaningful English words, but lacks syntactic connexion, and does not belong to the meaningful expressions of the English language.
There are several solutions to this problem of syntactic connexion. Russell's theory of types, for example, offers a solution. But a particularly elegant and simple way of grasping the concept of syntactic connexion is offered by the theory of semantic categories developed by Professor Stanisław Leśniewski.
We shall base our work here on the relevant results of Leśniewski,(1) adding on our part a symbolism, in principle applicable to almost all languages, which makes it possible to formally define and examine the syntactic connexion of a word pattern.
Both the concept and the term 'semantic category' (*Bedeutungskategorie*) were first introduced by Husserl.(2)" (p. 118)
(...)
(1) Stanisław Leśniewski, *Grundziige eines neuen Systems der Grundlagen der Mathematik*. (Reprinted from *Fundamenta Mathematicae* 14 (Warsaw, 1929), pp. 13 ff., 67 ff.) We borrow from Leśniewski only the basic idea of semantic categories and their type.
Lesśniewski cannot be held responsible for the wording of the definitions and explanations we offer, nor for the details of the content we assign to this term, since his definitions are not general, but apply only to his special symbolism, in a quite distinct, highly precise, and purely structural sense.
(2) 2 Edmund Husserl, L*ogische Untersuchungen*, vol. ii, part I (2nd. rev. ed. Halle/S., 1913), pp. 294, 295, 305-12, 316-21, 326-42.

2. ———. 1978. "On the Notion of Existence. Some Remarks Connected with the Problem of Idealism (1949)." In *The Scientific World Perspective and Other Essays, 1931-1963*, 209-221. Dordrecht: Reidel.
First published in *Studia Philosophica* IV (1949/50).
"I wish to discuss in the present article two notions of existence, namely, the notion of real existence and that of intentional existence. The results obtained I propose to apply to the interpretation of the idealistic thesis which denies real existence to things we encounter in nature according them only an intentional existence, and to base on this interpretation a criticism of this thesis.
The term 'exists' occurs in logical systems in which it is precisely defined.
Such a definition has been given by Russell and Whitehead and also by Leśniewski. Russell's definition is formulated in a manner which allows to apply the term 'exists' only to symbols of classes, relations and descriptions, but its application to proper names is not admissible. This means that an expression consisting of the term 'exists' and a proper name has, in Russell's system, no meaning at all. Leśniewski in whose calculus of names, called Ontology(1) , proper names belong to the same syntactical category as common names, defines the term 'exists' in such a way that every sentence in which the term 'exists' is conjoined with an arbitrary name,

irrespective of whether this is a proper name, a class name, or a description, has a definite meaning.
For this reason, as well as because Leśniewski's definition seems closer to everyday language and is better known in Poland, we shall base our considerations on his definition of 'existence'. (p. 209)
(1) Stanisław Leśniewski, *Uber die Grundlagen der Ontologie*, Comptes rendus des séances de la Soc. Sci. Lett. Varsovie, Classe III, 23, 111 ~ 132.

3. Apostel, Leo. 1960. "Logic and Ontology." *Logique et Analyse* no. 3:202-225.
"Let us finally examine the fact that for certain logicians, logic was ontology. This was the case for Leśniewski and for Heinrich Scholz (deeply influenced by Leśniewski in this respect). Here the science of logic has quite explicitly as its object the study of certain very general laws of being. In the not well known work of Heinrich Scholz *Die Metaphysik als Strenge Wissenschaft* and in a famous paper by Leśniewski *Über die Grundlagen der Ontologie* (Comptes rendus des Séances de la Société des Sciences et des Lettres de Varsovie, classe III, 1930), these opinions have been expressed. Recently they have been clearly explained and analysed by Czesław Lejewski in *Logic and Existence* (*British Journal for the Philosophy of Science*, 1954-1955, p. 104-119) and in *On Leśniewskt's ontology* (December 1958, *Ratio*). It will perhaps astonish the reader that we examine such a very divergent view in this context. The reason however is that the definition of existence we meet in Leśniewski's Ontology (we regret not to have been able to consult Prof. Scholz'book) is extremely close to the definitions we have been studying." (pp. 213-214)

4. Asenjo, F. G. 1977. "Leśniewski's Work and Nonclassical Set Theories." *Studia Logica* no. 36:249-255.
"I. The heuristic value of Leśniewski's mereology
This is the thesis to be upheld. Leśniewski's conception of collective class and of the relationships between parts and wholes is not an idiosyncratic aberration that leads away from sound classical ideas but is, rather, an open door to a world of fresh, alternative ways of looking at the notion of aggregate. Since axiomatic set theory is by no means a closed book and is still today under intensive examination particularly stimulated by Cohen's results on the continuum problem every approach to the idea of aggregate that helps free the mind from traveling well-worn grooves should be welcome indeed. From this point of view, it is a disservice to Leśniewski's originality of outlook to interpret mereology as a Boolean algebra without a zero. Although legitimate from other viewpoints, here such an interpretation would hide more than it reveals. Further, in attempting to pursue the ramifications of Leśniewski's mereology it does not help to add individual atoms to his theory in order to force it into line with current set-theoretic conceptions. The fact that Leśniewski was not trapped by prevailing atomistic prejudices is very much to his credit; this was definitely an intended position on his part at the time of mereology's inception, not an omission, even if later on his feelings about the proper role of individuals may have been less assertive if that is really so." (p. 249)

5. Badejo, O. O. 2011. "Bivalence, Classical Logic and the Problem of Contingent Statements." *Lagos Notes and Records* no. 17:27-46.
Abstract: "The main objective of this paper is to argue that the principle of bivalence is right, contrary to the view of some philosophers. To fulfil this objective, the paper examined some arguments raised in Philosophy of Logic about the principle of bivalence starting from Aristotle‟s challenge to the principle of bivalence based on the idea that the principle cannot accommodate contingent statements. The paper examined Lukasiewicz's challenge of the principle of bivalence and Leśniewski's response to him. The paper evaluated these debates, in Philosophy of Logic, to determine if the principle of bivalence should be rejected. The paper employed the methods of logic. The study showed that the principle of bivalence had been misunderstood by some of the most influential proponents of many-valued logic, for example, Łukasiewicz. It was established that the terms true

(or false), in the arguments against bivalence, was used in an epistemic sense and not a logical sense. It was established that contrary to Aristotle's and Lukasiewicz's assumption, contingent statements were necessarily either true or false; hence, the principle of bivalence could accommodate contingent statements. The paper concluded that the principle of bivalence is not in any way limited; it is the core of logic; Furthermore, there may be no conflict between the principle of bivalence and other systems of logic that are not strictly bivalent, if their justification does not rely on a rejection of the principle of bivalence."

6. Bar-Hillel, Yehoshua. 1960. "On categorical and phase structure grammars." *The Bulletin of the Research Council of Israel* no. 9F:1-16.
Reprinted as Chapter 8 in Y. Bar-Hillel, *Language and Information: Selected Essays on their Theory and Application*, Chichester: Addison-Wesley 1964, pp. 99-115.
"The present chapter is dedicated to a study of certain more complex types of grammars discussed by Chomsky, which we call *simple phrase structure grammars* (SPGs), and their relation to what we propose to call *categorial grammars* (CGs), certain types of which were discussed by Leśniewski [88], Ajdukiewicz [1] and in Chapters 5 and 6.
The plan of this chapter is as follows. In Section 1, the historical background of these grammar types is sketched. In Section 2, the basic concepts to be discussed in this chapter are introduced. Section 3 contains the proof of the main result of the chapter, viz. the equivalence between SPGs and various kinds of CGs. As a corollary, these kinds of CGs are shown to be equivalent to each other. Section 4 contains a short remark on the adequacy of SPGs for representations of natural languages.
In the next chapter, we shall study the behavior of SPGs under Boolean operations and the relation between SPGs and finite automata; there we shall also deal with various decision problems connected with SPGs.
1. Historical survey
The Polish logician St. Leśniewski [88] introduced his theory of semantical categories for certain logico-philosophical reasons, under the impact of Husserl's *Bedeutungskategorien* on the one hand and Bertrand Russell's logical types on the other. However, this theory remained almost unnoticed outside of Poland until, in 1935, K. Ajdukiewicz [1] presented a more generally accessible version of it. In its full rigor, it was meant to apply not so much to natural languages as to artificial language systems and among these more specifically to those written in the so-called Polish (parenthesis-free) notation, i.e., the notation in which the operators (or functors) are always written to the immediate left of their arguments.
This notation allows us, for instance, to distinguish without the use of parentheses between arithmetical expressions which in the ordinary notation are distinguishable only by the use of parentheses. Instead of (a + b)-c and a +(b-c), for instance, the Polish notation has - + abc and +a:be, respectively." (pp. 99-100)
References
[1] K. Ajdukiewicz. Die syntaktische Konnexität. *Studia philosophica*, vol. 1 (1935), pp. 1-27.
[88] S. Leśniewski. Grundziige eines neuen Systems der Grundlagen der Mathematik, *Fundamenta mathematicae*, vol. 14 (1929), pp. 1-81.

7. Belnap, Nuel. 1993. "On Rigorous Definitions." *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition* no. 72:115-146.
"Definitions are crucial for every serious discipline.(1) Here I consider them only in the sense of explanations of the meanings of words or other bits of language. (I use "explanation" as a word from common speech, with no philosophical encumbrances.) As a further limitation I consider definitions only in terms of well-understood forms of rigor. Prominent on the agenda will be the two standard "criteria" - eliminability and conservativeness - and the standard "rules". There is, alas, hardly any literature on this topic. The discussion will therefore be preliminary, all too elementary, and imperfectly plain." (p. 115)
(...)

"*History*. The standard theory of definitions seems to be due to Leśniewski, who modeled his "directives" on the work of Frege, but I cannot tell you where to find a history of its development. The standard citation seems to be Leśniewski 1931; see also Leśniewski 1981 (*Collected works*). I learned most of the theory first from Suppes 1957, who credits Leśniewski (p. 153, note). There should have been mini-histories in either Church 1956 or Curry 1963, but I couldn't find what I was looking for. The matter was well understood by Frege (e.g. in Frege 1964), Couturat (see Couturat 1905), Carnap (e.g. in Carnap 1937) and Tarski (see e.g. Tarski 1941 for some well-chosen elementary words). Tarski himself contributed heavily to the theory, as evidenced in the material translated and reprinted in Tarski 1956. There Tarski gives the dates and circumstances of his own early contributions in the 20s and 30s. But no one of these lays out an account of the history of the matter in its beginnings. The standard histories of logic (Bochenski 1956, Kneale and Kneale 1962) do not discuss modem theories of definition. Neither does Kneebone 1963. Neither does Church's article on "definition" in Runes 1962. The 207-page book Robinson 1950 neither discusses the technical theory nor refers to its history (though there is some reference to the history of nontechnical discussions). The definition article in *The Encyclopedia of Philosophy* (1967) [*] does not even mention Leśniewski. The only useful general references I happen to know are the definition article in the *Dictionary of Logic,* Marciszewski 1981, and some penetrating paragraphs and authoritative citations in Luschei 1962 (see especially pp. 36-37 and nn. 34 and 78)." (pp. 117-118)
(1 Thank to A. Gupta and J. Tappenden for many-sided help.
[*] Raziel Abelson, “Definition,” pp. 314–324 in volume 2.
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Tarski, A. (1956) Logic, Semantics, Metamathematics, London and Oxford, The Clarendon Press.
[For a recent study see: Urbaniak, Rafal & Severi Hämäri, K. "Busting a Myth about Leśniewski and Definitions", *History and Philosophy of Logic,* 33, 2012, pp. 159.189.]

8. Betti, Arianna. 1998. "*De veritate*: Another Chapter. The Bolzano-Leśniewski Connection." In *The Lvov-Warsaw School and Contemporary Philosophy*, edited by Kijania-Placek, Katarzyna and Wolenski, Jan, 115-137. Dordrecht: Kluwer.
"In '*De Veritate: Austro-Polish contributions to the theory of truth from Brentano to Tarski*' Jan Wolenski and Peter M. Simons related an intriguing story of the "Austro-Polish obsession with truth".(1) Woleński and Simons mention the Bohemian philosopher Bernard Bolzano several times, with particular reference to absoluteness and sempiternity of truth in Twardowski and Leśniewski.
(...)
In the following I wish to point out three issues. First, in the so-called prelogistic writings the early Leśniewski defines truth of sentences in such a way that truth conditions are the same - *mutatis mutandis* - as Bolzano's.
Secondly, from this point of view the links between the early and the late Leśniewski, in this case between some parts of his early writings and some aspects of Ontology, are closer than they are commonly believed to be. Thirdly, in this perspective it can be shown that some of Bolzano's views come near to Leśniewski's Ontology. In discussing Bolzano's views I shall mostly follow Casari's reading of Bolzano's *Wissenschaftslehre*. The works of Leśniewski with which I am concerned are essentially 'An Attempt at a Proof of the Ontological Principle of Contradiction' (1912) and its Russian version published in *Logical Studies* (1913), the translation-revision by Leśniewski himself of the 'Attempt' and of his first article, 'A Contribution to the Analysis of Existential Propositions' (1911).(4)" (p. 115)
(1) Woleński-Simons (1989), ['De Veritate: Austro-Polish Contributions to the Theory of Truth from Brentano to Tarski', in K. Szaniawski (ed.), *The Vienna Circle and the Lvov-Warsaw School*, Kluwer Academic Publishers, Dordrecht, pp. 391-443] p. 391.
(4) *Logical Studies* are not included in Leśniewski's Collected Works and not available in any West European language.

9. ———. 2004. "Leśniewski's Early Liar, Tarski and Natural Language." *Annals of Pure and Applied Logic* no. 127:267-287.
Abstract: "This paper is a contribution to the reconstruction of Tarski's semantic background in the light of the ideas of his master, Stanisław Leśniewski. Although in his 1933 monograph Tarski credits Leśniewski with crucial negative results on the semantics of natural language, the conceptual relationship between the two logicians has never been investigated in a thorough manner. This paper shows that it was not Tarski, but Leśniewski who first avowed the impossibility of giving a satisfactory theory of truth for ordinary language, and the necessity of sanitation of the latter for scientific purposes. In an early article (1913) Leśniewski gave an interesting solution to the Liar Paradox, which, although different from Tarski's in detail, is nevertheless important to Tarski's semantic background. To illustrate this I give an analysis of Leśniewski's solution and of some related aspects of Leśniewski's later thought."

10. ———. 2004. "Łukasiewicz and Leśniewski on Contradiction." *Reports on Philosophy* no. 22:247-271.
"It was in 1911 that Łukasiewicz and Leśniewski met. Leśniewski himself reported that at that time he had read Lukasiewicz's masterpiece *On the Principle of Contradiction in Aristotle* (1910),(1) and, as Lejewski knew from Łukasiewicz, he

said he had come to criticize the author.(2) In the same year Leśniewski wrote "An Attempt at a Proof of the Principle of Contradiction", which was published in 1912 on *Przegląd Filozoficzny* and was addressed on the whole against Lukasiewicz's book.(3)

Whereas the role played by the principle of contradiction in the development of Lukasiewicz's ideas is generally speaking correctly underlined.s it is not so in Leśniewski's case. Surely the oblivion which covered Leśniewski's early writings prevented the scholars from regarding the issue worthy of inquiry in his philosophy. Yet the controversy between Leśniewski and Łukasiewicz on the principle. of contradiction may be considered quite rightly a touchstone between their very distant philosophical attitudes, which remained that way also later.

It is hard to exaggerate the great weight Lukasiewicz's monograph had in the Polish logico-philosophical scene. Although polemically inspired, Leśniewski did acknowledge the importance of Lukasiewicz's work:

<My> results [...] on the whole oppose the theoretical theses supported by Łukasiewicz [...] But the polemical character <of some passages> should not arouse in the reader the erroneous conviction that I turn
a blind eye to the theoretical value of Łukasiewicz' s work, which I regard as one of the most interesting and original of the entire 'philosophical' literature known to me." (p. 247)

• Added in proof. This paper was written in 1996. Until the publication in this issue it has circulated in various versions and fonns. Although the bibliography has been updated for the occasion, the paper has not been revised as regards content.

(1) Cf. Leśniewski [1927/31], p. 169 (Eng!. trans!. p. 181).
(2) Cf. Lejewski [1995], p. 28.
(3) Cf. Leśniewski [1912].
(4) Cf. for instance Wolenski [1990], p. 191; [1989], p. 119; [1987], p. XXXIV
(5) Leśniewski [1912], p. 202. Translations are mine, unless otherwise indicated.

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11. ———. 2006. "Sempiternal Truth: The Bolzano-Twardowski-Leśniewski Axis." In *The Lvov-Warsaw School: The New Generation*, edited by Jadacki, Jacek Jusliuz and Pasniczek, Jacek, 371-399. Amsterdam: Rodopi.

In 1913 Stanisław Leśniewski published his article on the sempiternity of truth, “Is Truth Only Eternal or Is It both Eternal and Sempiternal?” (Leśniewski 1913a).1 The paper, directed against Kotarbinki’s “The
Problem of the Existence of the Future” (Kotarbiński 1913), made an important contribution to the debate on the excluded middle current in the Lvov circle in those years.(2) The discussion involved at the same time absoluteness, eternity and sempiternity of truth, i.e. truth for ever and truth since ever, and had as ideal reference point Twardowski’s “On the So-Called Relative Truths” (1900),(3) where the founder of the Lvov-Warsaw School had attacked the relativity of truth. Contrasting Kotarbinski’s positions, Leśniewski defended “absolutism,” consequently taking sides with Twardowski.(4) Twardowski had revived Bernard Bolzano’s ideas on the subject, and, mainly thanks to him, these became known in the Lvov-Warsaw School (see, for instance, Jadacki 1993, p. 191). " (p. 371)

(2) To the discussion belonged also Leśniewski (1913b).
(3) See Twardowski (1900), labeled henceforth in the text *Relative Truths*. I should warn the reader that the German translation of the latter omits some parts of the text. See infra, nn. 39, 45. This paper and Twardowski (1911) have finally a good translation by Arthur Szylewicz in Kazimierz Twardowski – On Actions, Products and other Topics in Philosophy, J. Brandl and J. Wolenski (eds.), Rodopi, Atlanta/Amsterdam, 1999, resp. pp. 147-168 and 103-132.

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415-447; reprinted in: D. Pearce and J. Wole?ski (eds.), Lo*gische Rationalismus: Ausgewählte Schriften der Lemberg-Warschauer Schule (*Frankfurt: Athenäum, 1988), pp. 38-58.
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12. ———. 2006. "The Strange Case of Savonarola and the Painted Fish. On the Bolzanization of Polish Thought." In *Actions, Products, and Things. Brentano and Polish Philosophy*, edited by Chrudzimski, Arkadiusz, 55-81. Frankfurt: Ontos Verlag.

"I have previously discussed in several papers specific Bolzanian elements present in the Polish tradition. This paper will not, for the most part, add anything in particular to that. The new - and rather blunt hypothesis to be put forward here is that, despite appearances, Twardowski also contributed *de facto* to slowing down the reception of Bolzano's most modem logical discoveries. For in Poland Bolzano was to remain one logician among many for rather long. It was chiefly thanks to two factors that Bolzano's star could, slowly, begin to rise in Poland, or, at least, that the fundamental achievements of his logic could be known. One factor is antipsychologistic (more precisely Platonistic) influence coming from Husserl and from Twardowski's student Łukasiewicz. The other factor is the change in the conception of logic which took Polish logic from, say, Sigwart, to Tarski through Leśniewski and Łukasiewicz," (p. 55)

13. ———. 2008. "Polish Axiomatics and its Truth: On Tarski's Lesniewskian Background and the Ajdukiewicz Connection." In *New Essays on Tarski and*

Philosophy, edited by Patterson, Douglas, 44-71. New York: Oxford Univerrsity Press.
"In the first chapter of his monograph Tarski credits Leśniewski with crucial results on the semantics of natural language. As I showed in a previous chapter (Betti 2004), Lesniewski's early solution to the Liar reveals that it was indeed he who first avowed the impossibility of giving a satisfactory theory of truth for ordinary language, as well as the necessity of sanitation of the latter for scientific purposes. Of Lesniewskian origin were also Tarski's analysis of quotation marks, the idea that truth is language-relative, the notion of a closed language, and the finding that natural language is such a language.
But these are all negative results concerning the semantics of natural language, a diagnosis, if you will. How about the positive results, the medicine? Tarski's own solution to the Liar and the cure he proposes for the illnesses of natural language apparently did not coincide with his master's ultimate remedy—at least, nothing similar to the very idea of Tarski's enterprise can be found in Leśniewski. As Tarski wrote in 1944,
Leśniewski did not anticipate the possibility of a rigorous development of the theory of truth, and still less of a definition of this notion. (1944, 695 note 7)
The reason for this is probably that a Tarski-like theory of truth must have appeared to Leśniewski to offer an insufficiently intuitive solution to the malady of semantic antinomy. But in what sense exactly? A proper answer is still missing. Lack of textual evidence is one reason, but another, equally important reason is that, from a broader point of view, we also do not yet know enough about the specific cultural context in
which the answer must be sought. It is the aim of this chapter to address some aspects of this context." (pp. 44-45)
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Tarski, Alfred 1944) ''The Semantic Conception of Truth and the Foundations of Semantics.'' *Philosophy and Phenomenological Research* 4: 341–76. Page numbers refer to the reprint in Tarski (1986b): 661–99.
___ (1986b) *Collected Papers*, S. Givant and R. Mackenzie (eds.), 4 vols. Birkhäuser, Basel.

14. ———. 2009. "Leśniewski's Systems and the Aristotelian Model of Science." In *The Golden Age of Polish Philosophy: Kazimierz Twardowski's Philosophical Legacy*, 93-111. Dordrecht: Springer.
"The systems of Lessniewski, like Frege's, have an unmistakably old-fashioned flavour.
They stand to, say, post-Tarskian, post-Gödelian, post-Hilbertian logic like traditional peasant Tuscan bread soup stands to molecular fusion kitchen. Why is that?
According to suggestions recently put forward, which rely on van Heijenoort's opposition "Logic as Language vs. Logic as Calculus", or similar dichotomies, Lesniewski's attitude to logic was similar to Frege's insofar as it matched Frege's "Logic as Language" rather than Boole's and Schröder's "Logic as Calculus".(1)
What grounds the old-fashioned aura of Lesniewski's systems, so goes the suggestion, is Lesniewski's adherence to the "Logic as Language" paradigm.
Is this correct? In introducing his opposition, van Heijenoort builds on a remark by Frege on the *Begriffsschrift* as a system embodying two Leibnizian ideals that are in fact not opposed: *lingua characteristica* and *calculus ratiocinator* (van Heijenoort 1967: 233). But van Heijenoort's dichotomy remains very sketchy, so sketchy that one does not seem to get very far by applying it. Two things can be done to save its gist. One is beefin it up. This was done by Jaakko Hintikka in his refurbished *Language as Universal Medium vs. Language as Calculus.* The other option is tracing the source of van Heijenoort's opposition in the history of

philosophy, and go back, if at all possible, where it all started. In this paper I shall go for the latter. I shall leave for another occasion an account of why I think this is a much more fruitful option than Hintikka's. For my purposes here it will suffice to show that there is another way to account for Lesniewski's conservatism, a way that makes appeal to a millennia-old recipe for building proper deductive systems: a venerable model of scientific rationality to which I will refer in what follows as *The Aristotelian Model of Science.* The main purpose of this paper is to illustrate, then, that Lesniewski's systems follow this model closely." (p. 93)
(1) Cf. Sundholm (2003: 113), whom I follow in my (2004).
References
Betti, Arianna (2004) 'Lesniewski's Early Liar, Tarski and Natural Language', *Annals of Pure and Applied Logic*, 127, 267–287.
van Heijenoort, Jean (1967) 'Logic as Language and Logic as Calculus', *Synthese* 17, 324–30.
Sundholm, Göran (2003) 'Tarski and Leśniewski on languages with meaning versus languages without use – A 60th Birthday Provocation for Jan Wolenski', in: J. Hintikka, T. Czarnecki, K.Kijania-Placek, T. Placek, A. Rojszczak† (eds.) *Philosophy and Logic – In Search of the Polish Tradition, Essays in honour of Jan Wolenski on the Occasion of his 60th Birthday,* Dordrecht, Kluwer, 109–128.

15. ———. 2010. "Leśniewski's *characteristica universalis*." *Synthese* no. 174:295-314.
Abstract: "Leśniewsk's systems deviate greatly from standard logic in some basic features. The deviant aspects are rather well known, and often cited among the reasons why Leśniewski's work enjoys little recognition. This paper is an attempt to explain why those aspects should be there at all. Leśniewski built his systems inspired by a dream close to Leibniz'*s characteristica universalis*: a perfect system of deductive theories encoding our knowledge of the world, based on a perfect language. My main claim is that Leśniewski built his *characteristica universalis* following the conditions of de Jong and Betti's Classical Model of Science (2008) to an astounding degree.
While showing this I give an overview of the architecture of Leśniewski's systems and of their fundamental characteristics. I suggest among others that the aesthetic constraints Leśniewski put on axioms and primitive terms have epistemological relevance."
References
de Jong, W. R., & Betti, A. (2008). The classical model of science: A millennia-old model of scientific rationality. *Synthese* [Synthese (2010) 174:185–203]

16. ———. 2014. "Leśniewski, Tarski and the Axioms of Mereology." In *The History and Philosophy of Polish Logic: Essays in Honour of Jan Woleński*, edited by Mulligan, Kevin, Kijania-Placek, Katarzyna and Placek, Tomasz, 242-258. New York: Palgrave Macmillan.
"Alongside a respect for philosophically informed formal work and an interest in all things Polish, Jan Woleński and I share a profound admiration for Leśniewski's oeuvre. As Jan once told me, you can work on Leśniewski for your whole life. Indeed so. Eighteen years after I first met him, on a morning in late March at a bus stop in Sucha Bezkidzka, Southern Poland, here's a story about the axioms of Leśniewski's mereology, and Tarski's complicated role in it.
This story is for Jan." (p. 242)

17. Blass, Andreas. 1994. "A faithful modal interpretation of propositional ontology." *Mathematica Japonica* no. 40:217-223.
"Inoué [2] gave an interpretation of Ishimoto' propositional ontology [3] in the modal logic **K**. (The terminology used here will be defined below). He showed that his interpretation is not faithful in general although it is for a restricted class of formulas. In this note we present another interpretation of propositional ontology in **K** and we show that it is faithful.

In Section 1, we provide some known background information about Leśniewski's ontology and certain fragments of it. We include more in this section than is strictly needed in what follows in order to place propositional ontology in its proper context. Section 2 contains the definitions of propositional ontology and **K**, and a discussion of their models. In Section 3,
we describe our interpretation, compare it with Inoué's and prove its correctness. Finally, Section 4 contains the proof that this interpretation is faithful." (p. 217)
References
[2} T. Inouè, Partial interpretations of Leśniewski's epsilon in modal and intentional logics. *Lecture at Logic Colloquium '93* Keele. England. July 1993.

18. Bocheński, Jósef. 1949. "On the syntactical categories." *The New Scholasticism* no. 23:257-280.
Reprinted in Albert Menne (ed.), *Logic-Philosophical Studies*, Dordrecht: Reidel 1962, pp. 67-87.
"The theory of the syntactical categories (abridged here as 'SCs') has, since the twelfth century, been a traditional part of Scholastic logic. As a matter of fact we owe the idea to Aristotle.(1) After the barbarous period which for logic constitutes the modem centuries (sixteenth century-1847), the first new logicians showed hardly any interest in it. Husserl was the first to outline at the beginning of our century a sketch of a theory of SCS.(2)
Nearly thirty years later, St. Leśniewski elaborated a rigorous system of it(3) - but the present author knows only of one general study on that subject in existence, a paper by Professor K. Ajdukiewicz.(4) It would
seem that in spite of the brilliant development of other parts pertaining to the logical syntax, recent logicians are apt to neglect somewhat the problems of the SC.(5)" (p. 67)
(1) *On Interpretation* 1-5. 16a1-17a24. This is the first known attempt to classify the SCs; some remarks contained in that part of the works of Aristotle are still unsurpassed, e.g., the definition of a symbol, involved in 16a 2aif., the definition of a sentence, 17a 3ff. etc. There is no doubt that the Scholastics have greatly developed the Aristotelian syntax. But - as is generally the case in the entire domain of Scholastic logic - we
have no information about it, since there does not exist a single satisfactory study on it.
(2) *Logische Untersuchungen* (Halle an der Salle, 1913) II, 294, pp. 305f; pp. 316f. pp. 326f. Husserl calls them 'Bedeutungskategorien' i.e., categories of meaning.
(3) Grundzüge eines neuen Systems der Grundlagen der Mathematik, *Fundamenta Mathematicae*, 11 (1929), 13f., 67f. It is unfortunate that St. Leśniewski (1885-1939) who was considered the most eminent Polish logician, died without having published more than a small part of the results of his research. Moreover, even those papers which have been published are seldom read or used.
(4) Die syntaktische Konnexität, *Studia Philosophica, Commentarii Societatis Philosophicae Polonorum* 1 (1935), pp. 1-28.
(5) The matter has been, of course, often mentioned and several definitions concerning it have been stated. Cf. e.g. A. Tarski, Der Wahrheitsbegriff in den formalisierten Sprachen, *Studia Philosophica*, 1, 261-406; R. Carnap, *Introduction to Semantics* (3rd ed., Cambridge, Mass., 1948), p. 43. Also the Grammarians have studied the subject, e.g. o. Petersen, *The Philosophy of Grammar (*London, 1924), pp. 96lf.
(...)
"The object of the present paper is to develop further the main ideas proposed by Professor Ajdukiewicz(2) by drawing a sketch of such a theory and applying it to some logical and ontological problems. The
method will be a rather informal one; the reader is presumed to know the symbolism and the technique of elementary mathematical logic(3); more complex notions will be shortly explained." (p. 68)

(2) The main ideas explained in I, 1-3 and I, 1 are derived from this important paper, (quoted in footnote 4 on page 67). However, Professor Ajdukiewicz also speaks of semantical, not of syntactical categories; and for the formulation of the definitions and laws the author of the present paper is alone responsible.
(3) A. N. Whitehead and B. Russell: *Principia Mathematica*. I (2nd ed., Cambridge, 1935); W. Quine, *Mathematical Logic* (2nd ed., New York, 1947).

19. Bochman, Alexander. 1990. "Mereology as a theory of part-whole." *Logique et Analyse* no. 129-130:76-101.
"Mereology is now a widely known general name for various theories concerning part-whole relationships (see Simons [13]). The notions of part and whole are highly placed among philosophical concepts and they have been regarded as an important area of philosophical investigation from the time of Aristotle, who gave us the first systematic attempt to explore and employ these notions. Despite much attention given to this area since then, the first formal theory of the part-whole relation, called mereology, was developed only at the beginning of our century by the Polish logician and philosopher Stanisław Leśniewski.." (p. 75)
(...)
"Contemporaneously with Leśniewski, Alfred North Whitehead was developing a philosophical theory, which used some means similar to that ofmereology (see Whitehead [15,16,17]). One of his aims was to build a
theory of space and time which would not be based on the notion of point (resp., instant) as a primitive. In order to define points in terms of extended regions, Whitehead proposed his 'method of extensive abstraction', according to which points are defined roughly as chains of infinitely converging regions, ordered by the relation of being part." (p. 76)
(...)
"As will be clear, the theory proposed below has much in common with Aristotle's views described above and hence could be regarded in some respects as their restoration(1). However, the proposed theory is intended to cover not only continuous structures, but discrete 'wholes' as well." (p. 78)
References
[13] Simons, P.,1987, *Parts. A Study in Ontology*, Clarendon Press.
[15] Whitehead, A.N., *An Enquiry Concerning the Principles of Natural Knowledge,* Cambr., 1919.
[16] Whitehead, A.N., *The Concept of Nature*, Cambr., 1920.
[17] Whitehead, A.N., *Process and Reality*, N.Y., 1929.

20. Borowski, Leslaw. 2010. "Some corrections to R. Urbaniak's paper on ontological functors of Leśniewski's elementary ontology." *Reports on Mathematical Logic* no. 10:249-255.
"In the abstract of his recent article (4) Rafa l Urbaniak announces:
We present an algorithm which allows to define any possible sentence-formative functor of Lesniewski's Elementary Ontology (LEO), arguments of which belong to the category of names.
Other results are: a recursive method of listing possible functors, a method of indicating the number of possible n-place ontological functors, and a sketch of a proof that Lesniewski's Elementary Ontology is functionally complete with respect to {∧,¬, ∀, "}.
Our claim is the author presented neither a correct algorithm, nor a correct method for intended tasks the sketch being just sketchy and therefore hard to judge. Still, if we were to base the proof on the faulty results
we could obtain wrong conclusions." (p 249)

21. Canty, John Thomas. 1968. "On symbolizing singularity S5 functions." *Notre Dame Journal of Formal Logic* no. 9:340-342.
"In what follows Leśniewski's symbols for binary truth functions will be employed for singulary S5 functions and Lukasiewicz's symbols for truth functions will be

retained in their usual role. In particular, C, E, and N are used for conditionals, biconditionals and negations (see [5]).
References
[5] Scharle, T. W., "A diagram for functors of two-valued propositional calculus," *Notre Dame Journal of Formal Logic,* v. 3 (1962), pp. 243-255.

22. ———. 1969. "Leśniewski's terminological explanations as recursive concepts." *Notre Dame Journal of Formal Logic* no. 10:337-369.
"In 1929 Leśniewski published terminological explanations for his system of logic [5] where he used certain concepts from his system of mereology along with others such as equiformity. In [1] Peano's axioms
for arithmetic are shown to be derivable in Leśniewski's system of ontology extended by an axiom of infinity. In that exposition use is made of a numerical epsilon, first defined in [2], in order to provide a characteristically ontological model for the natural numbers. It is shown there that analogues for the axiom, rule of extensionality, and rule of definition for the primitive epsilon (ε) of ontology are derivable for the numerical epsilon (ε_{∞}). Thus, one has available for the numerical epsilon analogues of every thesis of ontology involving the primitive epsilon.
The numerical epsilon serves in this paper to reduce Leśniewski's terminological explanations to numerical concepts. That is, each terminological concept is shown to be definable as a numerical concept within
ontology extended by an axiom of infinity. Since the definitions to be given are recursive, the incompleteness of this extension of ontology is readily established." (p. 337)

23. ———. 1969. "Ontology: Leśniewski's Logical Language." *Foundations of Language* no. 5:455-469.
Reprinted in Jan T. J. Srzednicki, V, F, Rickey (eds.), *Leśniewski's Systems: Ontology and Mereology*, The Hague: Martinus Nijhoff 1984, pp. 158-163.
"Leśniewski's system of ontology developed out of his investigations of the logical paradoxes which were of concern to logicians at the beginning of this century. In discussing Russell's paradox, he distinguished collective and distributive uses of nouns in a manner not unlike that of the medieval theory of supposition. Roughly speaking, he attributed the existence of the syntactic paradoxes, at least in part, to the failure to treat separately the uses he distinguished. His objection can be paraphrased by maintaining that the existence of paradoxes in Frege, for instance, can be traced to his axioms about classes which assert some of the properties of classes where 'class' is taken by Frege in a distributive sense and some of the properties of classes where 'class' is taken in a collective sense.(1) After his investigation of the paradoxes, Leśniewski developed a theory of collective classes which he eventually called mereology. In his expositions of this system, certain nouns and nominal phrases were clearly indicated as collective, but their logic was couched in a language which employed nouns in a distributive sense. That is, in formally presenting the logic of collective classes, Leśniewski relied on a theory of distributive predication which for a time lacked any formal exposition of its own. In the interest of making his investigations precise, Leśniewski then developed his theory of distributive predication which he called ontology. If, following Leśniewski's analysis of propositions about individuals, one maintains that such propositions are composed of a subject, copula and predicate, then his theory is captured by asserting that any proposition about an individual subject is true only if the subject of the proposition is unique and unempty, while the copula of the proposition is transitive." (p. 158 of the reprint)
(1) Sobocinski [1949-1950].
(...)
"Leśniewski's ontology remains an early source of a language whose terminology is thoroughly explained; whose coherence is contextually deter minate and unambiguous; whose type theory adheres closely to categories which must be recognized in ordinary language; and whose directives for development mirror the

contextually determinate development that is to be expected of a vehicle for communication." (p. 163 of the reprint)
References
Sobocinski [1949-1950]. L'analyse de l'antinomie Russellienne par Leśniewski, *Methodos*, Vol. I, (1949), 94-107, 220-228, 308-316; Vol. II (1950), 237-257.

24. ———. 1969. "The numerical epsilon." *Notre Dame Journal of Formal Logic* no. 10:47-63.
"In this paper* Leśniewski's system of ontology extended by an axiom of infinity is used to derive Peano's arithmetic. Section 1 gives the main theses of this derivation which parallels the work of [6]. Using the
numerical epsilon, defined in section 2, Peano's arithmetic is given a characteristically ontological model in section 3. Thus, the paper provides, for Peano's arithmetic, the two ways of treating logical concepts in
ontology, the one, protothetical (section 1), the other, ontological (section 3)." (p. 47, a note omitted)
(...)
"Finally, having supplied an ontological model for Peano's arithmetic in ontology (extended by an axiom of infinity), the incompleteness of this system will follow, if its directives are recursive. In this respect, the
numerical epsilon proves very useful. The directives for ontology were given by Leśniewski [3] in a list of terminological explanations which are developed by employing his mereological concepts. Now, the numerical epsilon provides an efficient means of modeling Leśniewski's original terminological explanations in Peano's arithmetic as given in section 3, thus showing the applicability of Gödel's incompleteness result to ontology.
The details of this work are left for another paper." (p. 62)
References
[3] [3] Leśniewski, Stanisiaw, "Grundzϋge eines neuen Systems der Grundlagen der Mathematik," *Fundamenta Mathematicae*, v. 14 (1929), pp. 1-81. "Uber die Grundlagen der Ontologie," *Comptes rendus des seances de la Sociέtέ des sciences et des lettres de Varsovie*, Classe III, v. 23 (1930), pp. 111-132.
[6] Whitehead, Alfred N., and Bertrand Russell, *Principia mathematica*, Vol. I-III, (second edition), The University Press, Cambridge, 1963.

25. Chikawa, Kazuo. 1967. "On Equivalences of Laws in Elementary Protothetics. I." *Procedings of Japan Academy* no. 43:743-747.
"In his paper [1], J. Stupecki has given some generalizations of the six laws that have described the properties of functions of one argument in elementary protothetics.
In this paper, by using the well known rules of inference and substitution we shall show that each laws on functions of one argument is equivalent to its corresponding laws of functions of two arguments. J. Supecki has not given the proofs of the equivalences
given below in his parper 1. The rules of inference and of substitution used in the systems of elementary protothetics has given in J. Stupecki [1] in detail." (p. 743)
References
[1] J. Siupecki: St. Leniewski's protothetics. *Studia Logica,* 1, 44-112 (1953).

26. ———. 1968. "On Equivalences of Laws in Elementary Protothetics. II." *Procedings of Japan Academy* no. 44:56-59.
"In our previous paper [1], we have proved the equivalences of the two laws (i.e., the law of development and the law on the limit of a function).
In this paper, we shall prove the equivalence of the theorems (a) and (a') which have been called the generalized law on the limit of a function. The rules of inference, substitution and replacement used in the systems of elementary protothetics has in detail given in J. Stupecki [2], and our paper [1].
References

[1] K. Chikawa." On equivalences of laws in elementary protothetics. I. *Proc. Japan Acad.,* 43, 74-747 (1967).
[2] J. Siupecki: St. Leniewski's protothetics. *Studia Logica,* 1, 44-112 (1953).

27. Chrudzimski, Arkadiusz. 2006. "The Young Leśniewski on Existentials Propositions." In *Actions, Products, and Things. Brentano and Polish Philosophy*, edited by Chrudzimski, Arkadiusz and Łukasiewicz, Dariusz, 107-120. Frankfurt: Ontos Verlag.
"It was one of Brentano's central ideas that all judgements are at bottom existential. In his *Psychology from an Empirical Standpoint* he tried to show how all traditionally acknowledged judgement forms could be reinterpreted as existential statements. Existential propositions, therefore, were a central concern for the whole Brentano School. Kazimierz Twardowski, who also accepted this program (Twardowski 1894, 15f., 25), introduced the problem of the existential reduction to his Polish students, but not all of them found this idea plausible. In 1911 Stanisław Leśniewski published a paper under the title "A Contribution to the Analysis of Existential Propositions" where he criticised Brentano's translation. According to Leśniewski the consequences of Brentano's program would be absurd because according to Leśniewski all positive existential propositions are analytically true and all negative ones are contradictory. In his later works Leśniewski repudiated all his early writings (1911–1914) as philosophically immature and formally imprecise. "[…] I regret that they have appeared in print," he writes, "and formally 'repudiate' them herewith […]". (Leśniewski 1927–31, 198) But in spite of this severe assessment, these early papers are worth considering not only from a historical standpoint. As we will see, Leśniewski's critique of Brentano is unsound, but it casts an interesting light on his understanding of certain basic metaphysical concepts." (p. 107)
References
Leśniewski, Stanisław, 1927–31. "On the Foundations of Mathematics", in: Leśniewski 1992, vol. I, 174–382.
Leśniewski, Stanisław 1992. *Collected Works*, vols. I/II, edited by S. J. Surma, J. T. Srzednicki, D. I. Barnett, V. F. Rickey, Warszawa/Dordrecht/Boston/London: PWN / Kluwer Academic Publishers.
Twardowski, Kazimierz 1894. *Zur Lehre vom Inhalt und Gegenstand der Vorstellungen*, Wien: Hölder.

28. Clarke, Bowman L. 1981. "A Calculus of Individuals Based on 'Connection'." *Notre Dame Journal of Formal Logic* no. 22:204-218.
"Although Aristotle (*Metaphysics,* Book IV, Chapter 2) was perhaps the first person to consider the part-whole relationship to be a proper subject matter for philosophic inquiry, the Polish logician Stanisław Leśniewski [15] is generally given credit for the first formal treatment of the subject matter in his Mereology.(1) Woodger [30] and Tarski [24] made use of a specific adaptation of Leśniewski's work as a basis for a formal theory of physical things and their parts. The term 'calculus of individuals' was introduced by
Leonard and Goodman [14] in their presentation of a system very similar to Tarski's adaptation of Leśniewski's Mereology. Contemporaneously with Leśniewski's development of his Mereology, Whitehead [27] and [28] was developing a theory of extensive abstraction based on the two-place predicate, 'x extends over y' which is the converse of 'x is a part of y'. This system, according to Russell [22], was to have been the fourth volume of their *Principia Mathematica*, the never-published volume on geometry. Both Leśniewski [15] and Tarski [25] have recognized the similarities between Whitehead's early work and Leśniewski's Mereology. Between the publication of Whitehead's early work and the publication of *Process and Reality* [29], Theodore de Laguna [7] published a suggestive alternative basis for Whitehead's theory. This led Whitehead, in *Process and Reality*, to publish a revised form of his theory based on the two-place predicate, 'x is extensionally connected with y'. It is the purpose of this paper to present a calculus of
individuals based on this new Whiteheadian primitive predicate." (p. 204)

(1) For an exposition of Leśniewski's system, see [16] and [23].
References
[7] de Laguna, T., "Point, line and surface, as sets of solids," *The Journal of Philosophy*, vol. 19(1922), pp. 449-461.
[14] Leonard, H. S. and N. Goodman, "The calculus of individuals and its uses," *The Journal of Symbolic Logic*, vol. 5 (1940), pp. 45-55.
[15] Leśniewski, S., " 0 podstawack matematyki," *Prezeglad Filosoficzny*, vols. 30-34 (1927-1931).
[16] Luschei, E. C, The Logical Systems of Leśniewski, North-Holland, Amsterdam, 1962.
[24] Tarski, A., "Appendix E" in *The Axiomatic Method in Biology*, J. H. Woodger, Cambridge University Press, Cambridge, 1937.
[25] Tarski, A., "Foundations of the geometry of solids," in *Logic, Semantics, Metamathematics*, transl. J. H. Woodger, Oxford University Press, Oxford, 1956.
[27] Whitehead, A. N., *An Enquiry Concerning the Principles of Natural Knowledge*, Cambridge University Press, Cambridge, 1919.
[28] Whitehead, A. R, *The Concept of Nature,* Cambridge University Press, Cambridge, 1920.
[29] Whitehead, A. N., *Process and Reality,* The MacMillan Company, New York, 1929.
[30] Woodger, J. H., *The Axiomatic Method in Biology*, Cambridge University Press, Cambridge, 1937.

29. Clay, Robert F. 1965. "The relation of weakly discrete to set and equinumerosity in mereology." *Notre Dame Journal of Formal Logic* no. 5:325-340.
"This paper deals with a formal system introduced by Leśniewski called mereology, in which, as the name implies, the concept of "party of the whole" is primitive. This system studies the properties of the collective class. Mereology is based on ontology, a formal system in which " is " is the primitive term. Ontology in turn is based on protothetic or on propositional calculus and quantification theory.
The collective class differs greatly from the distributive class. However, under the condition, "the *a*'s are weakly discrete", which we introduce, the collective class of the *a*'s and the distributive class of the *a*'s become alike with respect to equinumerosity. We are thus able to prove the analogs of three important set-theoretic theorems under this condition.
Two of these were previously known for the condition, "the *a*'s are discrete", but the third is an entirely new theorem.
We then prove that for a certain class of statements dealing primarily with equinumerosity, discrete and weakly discrete are inferentially equivalent." (p. 325)

30. ———. 1966. "On the definition of mereological class." *Notre Dame Journal of Formal Logic* no. 7:359-360.
Reprinted in Jan T. J. Srzednicki, V, F, Rickey (eds.), *Leśniewski's Systems: Ontology and Mereology*, The Hague: Martinus Nijhoff 1984, pp. 229-230,
"Consider mereology axiomatized as in [1]. Sobocinski has posed the question, "If the usual definition of class, DMI, is replaced by

[*A*a]∵. *A*ε**KI**(a).=: *A*ε*A*:[*B*]:*a* ⊂ **e**l(B). = . Aε**el(**B),

is the resulting system equivalent to the original?". This note gives a negative answer. Theses A12 and A13, together with the two trivial models which follow them, show where the resulting system is weaker than
mereology." (p. 229 of the reprint)
References
[1] R. E. Clay: The relation of weakly discrete to set and equinumerosity in mereology, *Notre Dame Journal of Formal Logic*, Vol. VI, 1965, pp. 325-340

31. ———. 1968. "The consistency of Leśniewski's Mereology relative to the Real Number System." *Journal of Symbolic Logic* no. 33:251-257.
"It is known that Leśniewski constructed an interpretation of mereology in the real number system using binary expansions.(2) Unfortunately, this construction is no

longer extant. The following paper, except for a slight variation, is an attempt to reconstruct this interpretation. Leśniewski probably considered sequences of *0*'s and *1*'s (except for the sequence of all *0*'s) and defined a first sequence as an element of the second if every place in which the first has a *1*, so also does the second. Since some real numbers have two binary expansions, one must then construct a one-to-one function from the sequence of *0*'s and *1*'s onto the real numbers. Then the definition of element must be carried over to the real numbers by means of the function constructed. We shall eliminate the necessity for the function by considering decimal expansions of *0*'s and *1*'s (except for the expansion consisting only of *0*'s). We thus rule out expansions with all but a finite number of *9*'s and so no two expansions of the type we use give rise to the same real number. Our interpretation is thus constructed from a proper subset of the real numbers as opposed to Leśniewski's which used the whole set. This distinction is irrelevant to the matter of consistency. We shall consider the real number system as introduced by an axiom system within the framework of ontology. The real numbers are thus objects in ontology. Now if this system composed of the axioms and rules of ontology together with the axioms for the real numbers is consistent, then mereology is consistent. Note that this model does not restrict the rules of procedure to the basic semantical category so that the interpretation we are about to construct is an interpretation in the full sense of the word." (p. 251)
(2) B. Sobocin'ski recollected this fact.

32. ———. 1970. "The Dependence of a Mereological Axiom." *Notre Dame Journal of Formal Logic* no. 11:471-472.
Reprinted in Jan T. J. Srzednicki, V, F, Rickey (eds.), *Leśniewski's Systems: Ontology and Mereology*, The Hague: Martinus Nijhoff 1984, pp. 239-240.
"l;n this note we show that in the standard axiom system for mereology which follows, the reflexive axiom, *M2*, is dependent on *M3, DM, M4* and *M5.*" (p. 239)

33. ———. 1971. "A model for Leśniewski's mereology in functions." *Notre Dame Journal of Formal Logic* no. 12:467-478.
"Introduction.
Mereology, it may be recalled, is Leśniewski's system consisting of:
(1) A system of propositional logic, upon which is based
(2) A system for characterizing the meaning of 'is', upon which is based
(3) A system for characterizing the relation of 'part' to the 'whole'.
The partial system of mereology consisting of just (1) is called protothetic. The partial system consisting of (1) and (2) is called ontology.
Up to now, the models of mereology that have been constructed have given an interpretation for the terms 'part' and 'whole' of (3) but have left the term 'is' of (2) uninterpreted (see [3]). In this paper we give the first model for mereology in which 'is* is interpreted as well. In other words, based on ontology, we have a model of mereology that includes a model of ontology." (p. 467)
References
[3] Clay, R. E., "The consistency of Leśniewski*s mereology relative to the real number system," *The Journal of Symbolic Logic*, vol. 33 (1968), pp. 251-257.

34. ———. 1973. "Two results in Leśniewski's mereology." *Notre Dame Journal of Formal Logic* no. 14:559-564.
"In section 1 we prove that a certain characterization of class can be proved without the aid of auxiliary definitions. In section 2 we show that the main results in [l] still hold in the weakened system constructed by
replacing the original definition of class by the characterization given in section 1.1 In what follows we assume that the reader is acquainted with the Ontological Preliminaries in [1]."
References
[1] Clay, R. E., "The relation of weakly discrete to set and equinumerosity in mereology," *Notre Dame Journal of Formal Logic,* vol. VI (1965), pp. 325-340.

35. ———. 1974. "Some mereological models." *Notre Dame Journal of Formal Logic* no. 15:141-146.
"In this paper we show that the non-empty regular sets of any topological space form a Boolean algebra with zero deleted." (p. 141)

36. ———. 1974. "Relation of Leśniewski's Mereology to Boolean Algebra." *Journal of Symbolic Logic* no. 39:638-648.
Reprinted in Jan T. J. Srzednicki, V, F, Rickey (eds.), *Leśniewski's Systems: Ontology and Mereology*, The Hague: Martinus Nijhoff 1984, pp. 241-252.
"It has been stated in Tarski [1956] and 'proved' in Grzegorczyk [1955] that:
(A) The models of mereology and the models of complete Boolean algebra with zero deleted(1) are identical.
Proved has been put in quotes, not because Grzegorczyk's proof is faulty but because the system he describes as mereology is in fact not Leśniewski's mereology." (p. 241 of the reprint)
(...)
"Since cardinality is primarily a distributive notion, one's intuition should not be violated if the collective class cannot describe it.
Since Leśniewski's mereology includes protothetic and ontology and Boolean algebra is usually given some other logical base, statement (A) needs to be put inio a precise context. There is also need for a formal
definition of complete Boolean algebra with zero deleted. Since statement (A) is in some sense not completely true, we break it up into the following two statements:
(1) Mereology is a complete Boolean algebra with zero deleted.
(2) Complete Boolean algebra with zero deleted is a mereology.
'We shall present two alternative ways of introducing partial ordering into Leśniewski's logic and show that in order for (2) to hold we must be unreasonably restrictive in our definition of complete Boolean algebra with zero deleted." (p. 242 of the reprint)
(1) Deleting zero from a Boolean algebra results in a systcm without a zero except in the case when the Boolean algebra has exactly two elements.

37. ———. 1975. "Corrections for my paper 'A model for Leśniewski's mereology in functions'." *Notre Dame Journal of Formal Logic* no. 16:269-270.
I!n my paper, [1], an error was made. The analog for the category of names, denoted by *N*(σ), is too restrictive. It fails to have an analog for Λ, the empty name." (p. 269)
References
[1] Clay, R. E., "A model for Leśniewski's mereology in functions" *Notre Dame Journal of Formal Logic*, vol. XII (1971), pp. 467-478.

38. ———. 1975. "Single axioms for atomistic and atomless mereology." *Notre Dame Journal of Formal Logic* no. 16:345-351.
"It is part of the folklore of the subject, that Leśniewski's mereology is neutral with respect to the existence of atoms."
(...)
"Using Rickey's functor " **at** " Sobocinski axiomatized atomistic mereology in [4]. Lejewski gave the first single axioms for atomistic and atomless mereology in [2]. In this paper we shall give shorter single axioms for both systems." (p. 345)
References
[2] Lejewski, C, "A contribution to the study of extended mereologies," *Notre Dame Journal of Formal Logic*, vol. XIV (1973), pp. 55-67.
[4] Sobociήski, B., "Atomistic mereology I , " *Notre Dame Journal of Formal Logic*, vol. XΠ (1971), pp. 89-103.

39. ———. 1980. "Introduction to Leśniewski's logical systems." *Annali dell'Istituto di Discipline Filosofiche dell'Università di Bologna*:5-31.

40. Cocchiarella, Nino. 2001. "A Conceptualist Interpretation of Leśniewski's Ontology." *History and Philosophy of Logic* no. 22:29-43.
"A first-order formulation of Leśniewski"s Ontology is formulated and shown to be interpretable within a free first-order logic of identity extended to include nominal

quantification over proper and common-name concepts. The latter theory is then shown to be interpretable in monadic second-order predicate logic, which shows that the first-order part of Leśniewski"s Ontology is decidable."

41. Davis, Charles C. 1976. "A note on the axiom of choice in Leśniewski's Ontology." *Notre Dame Journal of Formal Logic* no. 17:35-43.
"This paper generalizes the results of [1] and hence a familiarity with [1] is presupposed."
(...)
"The paper divides naturally into four parts. Section 1 (2) introduces the general form of the definition of the generalized epsilon for nominal (propositional) categories and shows that a thesis having the same
structural form as the primitive axiom for Ontology is derivable. Section 3 (4) presents the demonstration of the equivalence of AC^{ε} « and ACH«, where a is a nominal (propositional) category." (p. 35)
References
[1] Davis, C. C , "An investigation concerning the Hilbert-Sierpiήski logical form of the axiom of choice," *Notre Dame Journal of Formal Logic*, vol. XVI (1975), pp. 145-184.

42. Fleming, Christopher. 1996. *Nominalistic Elements in the Work of Stanisław Leśniewski*.
Open Access Master's Theses Paper 1547.
"Stanisław Leśniewski (1886-1939) is called a nominalist, even though his published works contain no developed philosophical doctrine. Yet, in order to understand and interpret his logical systems, we must understand his nominalism. This thesis will investigate, in detail, the philosophical origins of the "nominalistic" elements of Leśniewski's logical systems and will offer a characterization of his nominalism.
This thesis will provide a brief historical sketch of Leśniewski's career as a logician and of the times in which his logical systems were developed. A definition of nominalism will be developed within the context of the realist/nominalist debate over the existence of universals and a realists notion of universals will be given as a background against which Leśniewski's philosophical beliefs can be measured. The philosophical origins of Leśniewski's nominalism will be explored and will provide the basis for an
examination of the nominalistic elements of his logical systems and the basis for a characterization of his nominalism.
Leśniewski's nominalism avoids traditional classification and can only be examined indirectly through an analysis of his logical systems and through his attitude towards Russellian classes. In the final analysis, it is best to say that Leśniewski was a philosopher who created consistent logical systems in which to "talk" about objects."

43. Gessler, Nadine. 2007. "Abstraction and Nominalization in Leśniewski's Ontology." In *Contemporary Perspectives on Logicism and the Foundation of Mathematics*, edited by Joray, Pierre, 63-82. Neuchâtel: Centre de Recherches Semiologiques.
"In this paper I intend to examine certain features that characterize the logicist construction that can be performed within the categorial and expansive framework provided by Leśniewski's Ontology, by putting these features in relation with the question of procedures of abstraction and nominalization. The latter will be placed in the problematic framework of classical logicism, relative to which the treatment of this question acquires all its relevance, given the fully effective resolution that Ontology makes possible." (p. 63)

44. Grzegorczyk, Andrzej. 1955. "The Systems of Leśniewski in Relation to Contemporary Logical Research." *Studia Logica* no. 3:77-95.
"The logical symbolism used by Stanisław Leśniewski (1886-1939), his specific metalogical terminology and the philosophical introductions. to his formal works evoke in his readers the feeling of the peculiarity of the problems with which he

deals. The question thus arises : in what relation are Leśniewski's investigations to the whole trend of logical research in the first half of the 20th century ? In the present paper I wish to give a brief answer to this question. Although I do not feel competent to give a proper historical account of Leśniewski's role in the development of logic, I believe that it might be useful to precede a formal logical discussion of his systems by some general histori? cal remarks." (p. 77)
(...)
"To sum up, Leśniewski's investigations in the years 1917 -1927 dealt with problems which interested all logicians; they were of the nature of discoveries and they were not published. In later years they gradually lost their actuality. Leśniewski's main conceptions, as to which his priority is unquestionable, date back to the first period. These are: the construction of a system of the simple theory of types (called by Leśniewski the system of semantic categories) simultaneously with Chwistek(6) and a philosophical explanation of that system on the basis of an analogy with everyday language; the establishing of the theory of classes (ontology) on the basis of a semantic analysis of the word "is" and thus giving a specific philosophical interpretation to the theory of classes; the construction of a theory grasping the intuitions connected with the word. "part" (mereology); the development of numerous syn.tactical concepts and the construction of many rules of inference which have henceforth become a part of the logical achievements of 20th century, above all the formulation of a rule of definition, the only one that was sufficiently exact; a contribution to the elucidation of severnl problems which were obscure at the time, such as the differentiation betwern. language and metalanguage, with Leśniewski's own solutions of all known logical antinomies;(7) and finally numerous critical remarks with regard to contemporary systems of logic. It is a well know fact that Leśniewski obtained all his results starting from his own specific philofcphical intuitions. Hence the philosophical foundations of his systems and their philosophical interpretations seem particularly interesting.
We shall not deal here with this aspect of his work and we shall concentrate on comparing Leśniewski's systems with other known systems. As we shall see his systems greatly resemble other systems created independently about the same time or somewhat later." (pp. 79-80)
(6) L. Chwistek, *Zasady czystej teorii typów* (Principles of the pure theory of types). "Przegl. Filoz." (Philosophical Review) Vol. 25 (1922), pp. 359-391.
(7) B. Sobocinski, *L'analyse de, l'antinomie russellienne*. „Methodos" Vol. I (1923) pp. 94-107, 220-228, 308-316.

45. Halina, Święczkowska. 2015. "On the Formal Approach to Describing Natural Language. Notes on the Margin of Leśniewski's Ontology." *Studies in logic, grammar and rhetoric* no. 42:67-78.
Abstract: "This article is an attempt to recreate the intuitions which accompanied Leśniewski when he was creating his calculus of names called Ontology. Although every reconstruction is to some extent an interpretation, and as such may be defective, still, there are reasons justifying such reconstruction. The most important justification is the fact that both Leśniewski and his commentators stressed that ontology originated from reflections about ordinary language, in which sentences such as A is B appear in one of the meanings associated with them in Ontology, and that the users of the Polish language use such sentences accordingly and properly identify them. Assumed it is so, let us try, based on Leśniewski's guidelines as well as comments and elaborations on Ontology (Leśniewski 1992: 364-382, 608-609; Kotarbiński 1929: 227-229; Rickey 1977: 414-229; Simons 1992: 244; Lejewski 1960: 14-29), to evaluate the accuracy of this approach, referring also to certain knowledge of the Polish language. To make it clear, this article is not about Ontology as a formal theory of language. It is solely an attempt to assess whether some syntactical constructs of the Polish language and this language's properties are significant conditions of a proper understanding of Ontology, and whether Ontology is, in fact, in a relationship with the ethnic language of its author."

46. Henry, Desmond Paul. 1964. "Ockham, *suppositio*, and modern logic." *Notre Dame Journal of Formal Logic* no. 5:290-292.

In a discussion (*Philosophical Review*, Jan. 1964) of the alleged difficulties of rendering the *descensus* of Ockham's *suppositio*-doctrine in terms of modern logic, G. B. Matthews is concerned with the inferences corresponding to the following theses:

. 1 If some man is animal, then this man is animal or that man is animal or ...

.2 If all men are animal then each man is either this animal or that animal or ...

.3 If some man is animal then some man is this animal or some man is that animal or ...

A If all men are animal then this man is animal and that man is animal and ...

5 $(3x)(F_x \cdot G_x) \supset (F_{x1} \cdot G_{x1} \cdot v\ F_{x2} . G_{x2} \cdot v\ ...)$

"The complaint that modern logic cannot analyse certain theses or forms of expression which occur in medieval logic has become a constantly recurring commonplace in the recent histories of logic; the offending items are dismissed as idiosyncratic (e.g. "homo est species"), or even as "nonsense" (as in the case of "All men exist"). The discussion just summarised attempts to diagnose exactly what the reason for this kind of failure amounts to in the cases described. I want to suggest that such complaints and diagnoses are based on an excessively narrow view of what "modern logic" is. After all, if it fails to accommodate itself to innocent little truths like "All men exist", small wonder that the slightly more complex truths of medieval logic should elude it. I shall now demonstrate the narrowness of the view presupposed by showing the perfectly straightforward analyses of .1, .2, .3, and .4 which are furnished by the Ontology of S. Leśniewski, and which do full justice to Ockham's position. May account is, for the most part, based on C. Lejewski's "On Leśniewski's Ontology" (*Ratio*, Vol. I, No. 2 [1958]), and on conversation with him. This system of course by no means abrogates the perfectly reputable predicate calculus in terms of which the discussion was originally based."

References

Gareth B. Matthews, "Ockham's Supposition Theory and Modern Logic", *The Philosophical Review*, vol. LXXIII, pp. 91-99.

47. ———. 1969. "Leśniewski's Ontology and some medieval logicians." *Notre Dame Journal of Formal Logic* no. 10:324-326.

"In the issue of this journal dated October 1966 (Vol. VII, No. 4, pp. 361-364) Professor John Trentman suggested limitations on my claim that Leśniewski's Ontology is of use in furnishing formal analyses of medieval logical theories, his grounds being that certain medieval theories deny what is called the "two-name theory of predication" allegedly common to Ockham and Ontology. Hence while the work of Ockhamists would be analysable with reference to Ontology, that of those "Thomists" who deny the two-name theory would not. Professor Trentman then goes on to suggest that for such "Thomist" analyses to take place, "something like Frege's functional analysis of predication", is needed to show the "disparity of semantic category that holds between the subject and the predicate", thereby implying that no such form is available in Ontology, and that the allegations about the inadequacy of the two-name theory could have escaped my notice.

Neither of these implications is tenable. Ignoring the second of them, I can deal with the first by exemplifying the manner in which the Ontology in question deals with the relations between names and verbs (i.e. functors which when completed with nominal arguments form propositions)." (p. 324)

48. ———. 1972. *Medieval Logic and Metaphysics: A Modern Introduction*. London: Hutchinson.

"Fortunately it happens that there exists a system of modern formal logic, unfamiliar to many logicians and philosophers, and sometimes misunderstood by others, which allows the investigator to overcome all of the difficulties stated above, and from the standpoint of which many of the further difficulties which may still be raised can be satisfactorily resolved. This

logic is that of the Polish logician S. Leśniewski (1886-1939), a partial account of which may be found in Part II below. This logic is anti-formalist, in that its theorems are interpreted truths, and not mere syntactically-permissible combinations of uninterpreted marks (cf. II §0.00). It has the capacity for the introduction of indefinitely many new parts of speech (semantical categories) and hence can adapt itself to the required degree of exactitude for the purpose of analysing medieval logic, as Part III will demonstrate. It employs an interpretation of the quantifiers which allows dissociation of the latter from its usually necessary entanglement with the notion of existence (II §2.23, II §2.25), and so is in a position to come to more exact terms with medieval discourse on this topic.
It follows that the purpose of the present work is three-fold. After the preliminary consideration of the field which is contained in this introduction, a practical account of one of the central theories of Leśniewski, namely his Ontology, will be presented in Part II. Thus armed, we will be in a position to expose in detail in Part III some examples of the way in which Ontology may be used in the analysis of medieval themes." (pp. 3-4)

49. Hintze, Henning. 1995. "Merits of Leśniewski type nominalism." *Logic amd Logical Philosophy*:101-114.
"For the sake of explaining the merits of a Leśniewski type nominalism, it should be made clear what is meant by „nominalism" and what the characteristics of this special type of nominalism are. To the first question we can find quite a lot of mutually inconsistent answers. Therefore I will just explain the distinction between two different nominalistic traditions which I hold to be fundamental. I think we should not just focus on the question which so-called abstract entities are rejected but as well look for basic entities nominalists rely on." (p. 102)

50. Hiż, Henry. 1984. "Frege, Leśniewski, and Information Semantics on the Resolution of Antinomies." In *Foundations: Logic, Language, and Mathematics*, edited by Leblanc, Hugues, Elliott, Mendelson. and Orenstein, Alex, 51-72. Dordrecht: Reidel.
"Frege sharply distinguished functions from objects. The interplay between the two domains led to serious complications to which many logicians of our century have addressed themselves. Perhaps the time has come to bridge this gap and to this end information semantics is a contribution.
Frege supposed that every function uniquely determines an object which is the value range of the function. He assumed also that functions with the same value range apply to the same objects. As is well known, Frege's postulates led to a contradiction. In order to analyze the problems involved in the antinomial character of Frege's theory, it is advisable to abstract from the intuitive sense of such wordings as 'is the value range of' (or 'is a class of'), and to note the relation by using the arbitrary letter 'a' and to see in it only what is stated in the postulates." (p. 51)
(...)
"In Section 3 and 4, I will report the details of Leśniewski's work. I will abstract from the less popular features of Leśniewski's theories. I will place these formulations entirely in the second-order predicate logic.
Leśniewski wrote a book about antinomies. It was never published and, so far as I know, the only handwritten copy of it vanished in Warsaw in 1944. Sobocinski published an extensive paper reconstructing in detail some of the main ideas and proofs.(5) Sobocinski's paper is my main source." (pp. 51-52)
(5) Bolestaw Sobocinski. 'L'analyse de l'antinomie Russellienne par Leśniewski'. *Methodos*, vol. I (1949), pp. 94-107; pp. 220-28; pp. 308-16; vol. II (1950), pp. 237-57.
Sections 2, 3, and 4 of the present paper constitute a restatement of what is in Sobocinski's paper. (Errata to Sobocinski's paper: p. 226, line 2 from the bottom, put a left-hand parenthesis before 'D'; p. 238, line 18, instead of'=' put'='; p. 238, line 24, instead of 'et' put 'est'.)

51. Hodges, Wilfrid. 2008. "Tarski's Theory of Definition." In *New Essays on Tarski and Philosophy*, edited by Patterson, Douglas, 94-132. New York: Oxford University Press.

"This chapter reviews what Alfred Tarski said about the theory of definitions during the years 1926–38. It is not the chapter I was expecting to write. I had believed that Tarski had his own well-formed views on definitions, and that I would be able to collect them together from his papers. Not so: his statements about central questions in the theory of definitions are often indirect and sometimes frankly careless. By contrast he was extremely careful about any questions to do with the relationship between object theory and metatheory. So his true interests reveal themselves.

For the theory of definitions, the effect is a little like playing the violin with gloves on—if you can really play well with them on, you must be terrific with them off. And so the work of Tarski that revolves around definitions, whatever its motives, did have a fundamental effect on our understanding of definitions. One measure of this is that these papers of Tarski are prominent in Robert Vaught's masterly summary [73] of Tarski's contributions to model theory—a part of mathematical logic with definitions close to its heart. Another discipline linked with the theory of definitions is formal semantics; when eventually the history of this discipline is written, Tarski should be named as one of its founders." (p. 94)

References

[73] Robert Vaught, 'Alfred Tarski's work in model theory', *Journal of Symbolic Logic* 51 (1986) 869–82.

52. Indrzejczak, Andrzej. 2022. "Leśniewski's Ontology – Proof-Theoretic Characterization." In *Automated Reasoning: 11th International Joint Conference, IJCAR 2022 Haifa, Israel, August 8–10, 2022 Proceedings*, edited by Blanchette, Jasmin, Kovács, Laura and Pattinson, Dirk, 541-558. Cham, Switzerland: Springer.

Abstract: "The ontology of Leśniewski is commonly regarded as the most comprehensive calculus of names and the theoretical basis of mereology. However, ontology was not examined by means of proof-theoretic methods so far. In the paper we provide a characterization of elementary ontology as a sequent calculus satisfying desiderata usually formulated for rules in well-behaved systems in modern structural proof theory. In particular, the cut elimination theorem is proved and the version of subformula property holds for the cut-free version."

53. ———. 2024. When Epsilon meets Lambda: Extended Leśniewski's Ontology. In *Applications of Logic in Philosophy and the Foundations of Mathematics XXVII, Szklarska Poręba, Poland*.

Abstract: "Leśniewski's ontology LO is an expressive calculus of names. It provides a basis for mereology but allows also for direct formalisation of reasoning in natural languages. Recently its elementary part was characterised by means of the cut-free sequent calculus GO. In this paper we investigate its extended version ELO which introduces lambda terms to represent complex descriptive names. The hierarchy of three systems is formalised in terms of sequent calculi which satisfy cut elimination and the subformula property."