

Preface

The Lvov-Warsaw School of Logic and Analytic Philosophy was one of the most important schools of philosophical thought in twentieth century. In early 1910s its members already discussed the validity of the principles of excluded middle and contradiction. Among ideas developed in this school, one might count Łukasiewicz's view that one can believe a contradiction and that certain sentences can be neither true nor false. This led to the construction of his three-valued logic. Another example is Ajdukiewicz's conventionalism about meaning and his formal work on definitions (it seems that it was Ajdukiewicz and Łukasiewicz who first focused on the consistency, translatability, and non-creativity conditions on definitions, at least on the Polish ground). Other examples include Jaśkowski's approach to natural deduction and his work on discussive logics, Lindenbaum's lemma on maximally consistent sets of formulas, Presburger's work on arithmetic, Kotarbiński's semantical reism, and Tarski's work on formal semantics and truth.

One of the representatives of this school was Stanisław Leśniewski (1886–1939) (Alfred Tarski, whose importance in twentieth century logic it is hard to overestimate, was his only Ph.D. student). Leśniewski developed his system of foundations of mathematics as an alternative to the system of *Principia Mathematica*. He constructed three systems: Protothetic, which is his version of a generalized propositional calculus, his own (higher-order) logic of predication called Ontology, and a theory of parthood called Mereology.

Leśniewski's work is interesting for a few reasons.

- If one is interested in history of logic in general, it is hard to deny that Leśniewski was one of the key figures in one of the most important schools of logic in twentieth century. He devoted his research to developing an alternative to the system of *Principia Mathematica* and this attempt is worth studying in his own right.
- If one is interested in the development of Tarski's thought it might be useful to learn what his Ph.D. supervisor's views were and how Leśniewski's work and Tarski's ideas are (or are not) related.
- Philosophical discussions in which Leśniewski participated pertained to issues which are discussed quite lively even today. His approach to semantical and set-theoretic paradoxes and his views on the validity of the principle of excluded middle and of the principle of contradiction are philosophically interesting.

- Leśniewski was a nominalist and his systems were a nominalistic attempt to provide a system of foundations of mathematics. It is a major attempt of this sort and as such it is worth an examination.
- His metalogic is quite specific. Nominalist as he was, he wanted to develop a purely inscriptional syntactic description of his systems in a way that did not make any reference to expression types. It is interesting to see how he proceeded.
- His systems have some interesting properties. For instance, in all of them definitions can be creative (and this is not considered to be a problem). The generality of Prothetic admits interesting extensions (intuitionistic (see López-Escobar and Miraglia 2002) or modal (see the works of Suszko and in general, see [Sect. 3.7](#) for references). The language of Ontology (which, in a way, can be viewed as one of the first free formal logics) is, arguably, more suitable for capturing certain aspects of predication and abstract noun phrases as they work in natural language.

This book is devoted to a presentation of Leśniewski's achievements and their critical evaluation. I discuss his philosophical views, describe his systems, and evaluate the role they can play in the foundations of mathematics. It was my purpose to focus on primary sources and present Leśniewski's own views and results rather than those present in secondary literature. For this reason, later developments are not treated in detail but rather either mentioned in passing, or described in sections devoted to secondary literature included in some chapters. The intended audience of this book includes philosophy majors, graduate students, and professional philosophers interested in logic, mathematics, and their philosophy and history.

Parts of this book started as my Ph.D. dissertation written under the supervision of Richard Zach and defended in 2008 at the University of Calgary. Other parts report on research which went beyond the dissertation (in particular, [Chap. 6](#) was written together with Severi K. Hämäri). Ultimately, in 2011 my wife took me to India, where she pursued her research in Indian philosophy and forced me to use those few months to write the whole book anew.

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References

- López-Escobar, E. & Miraglia, F. (2002). Definitions: The primitive concept of logics or the Leśniewski-Tarski legacy. *Dissertationes Mathematicae* 401, Polska Akademia Nauk, Instytut Matematyczny, Warszawa.

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