Roman Suszko – logician and philosopher

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Abstract. The paper presents basic information about life and main scientific achievements of Roman Suszko (1919-1979). He is known as one of the first logicians who applied the model theory to non-mathematical problems, particularly to study development of knowledge. The article is divided into five sections: 1. Life, 2. Main papers, 3. Views, 4. Influences, 5. Summary.

1. Life

Roman Suszko was born on 9 th of November 1919 in Podobora near Cieszyn in Poland (at present – Czech Republic).

Roman Suszko started his studies at Poznań University in 1937. In 1939, with outbreak of Second World War, he was displaced to Cracow, where he spent the whole of the occupation period; he worked as a night guard, telephonist and – at the same time – he attended the clandestine study classes of physics, mathematics and philosophy under the guidance of professors of Jagiellonian University. In 1945 he obtained a title of Master of Arts in Philosophy for the work *The achievements of polish logic* promoted by Professor Zygmunt Zawirski.

In 1946-1953 he worked at the Chair of the Theory and Methodology of Science, Faculty of Mathematical-Natural Sciences, University of Poznań. In 1948 he was awarded a title doctor for the thesis *On Normal Systems and Few Questions of Basic Logic* written under the supervision of Professor Kazimierz Ajdukiewicz. The thesis was published in the form of two articles *On Analytical Axioms and Logical Rules* and *From the Theory of Definitions*. In 1951 he was awarded a postdoctoral degree in logic also on the Faculty of Mathematical-Natural Sciences, University of Poznań for the dissertation *Canonic Axiomatic systems*, Studia Philosophica IV, Poznań 1951. In 1953 he moved to Warsaw and started to work at the Faculty of Philosophy at the University of Warsaw. From the very beginning of his work

in Warsaw he had close contact with the Polish Academy of Sciences, at the beginning only with the Group of Algebra headed by Jerzy Łoś at the Institute of Mathematics, and then with the Group of Logic headed by Kazimierz Ajdukiewicz at the Institute of Philosophy and Sociology PAN.

In 1959 he was awarded a title of associate professor. In 1960 he was elected to the position of a Dean of the Faculty of Philosophy at the Warsaw University. In 1960 he moved to the Institute of Philosophy and Sociology of PAN, where in 1966-1969 he was a head of the Group of Logic Institute of Philosophy and Sociology Polish Academy of Sciences. In 1967-1969, 1970-1973 he worked as a professor at the Stevens Institute of Technology in Hoboken, New Jersey, USA. After returning from the USA in 1973 till his death he worked at the Group of Logic Institute Philosophy and Sociology Polish Academy of Sciences. Besides scientific and teaching activity Suszko played also important role as a publisher: he was one of the founders of Studia Logica – journal on logic with international coverage – and till the end he was a member of its Programming Board.

He died on cancer on 3 June 1978 in Warsaw.

2. Main papers

Roman Suszko's works were published in prestigious international journals of mathematics, logic and philosophy, such as: "Fundamenta Mathematicae", "Journal Symbolic Logic", "Colloquium Mathematicum", "Synthese", "Theoria", "Logique et Analyse", "Archiv für anathematise Logik und Grundlagen-Forschung ", "Studia Logica" and others.

From the scientific achievement of Suszko we select those publications, which influenced greatly the choice scientific interest and investigation of many logicians, philosophers and mathematicians, both in Poland and abroad.

[1] *Canonic axiomatic systems*, Studia Philosophica, **IV**, 301-330 (1951)

[2] *On the extending of models.* II. *Common extensions* (together with J. Łoś), Fundamenta Mathematicae, **XLII**, 343-347 (1955)

[3] *Formalna teoria wartości logicznych.* I [A formal theory of logical values I], Studia Logica, **VI**, 145-237 (1957)

[4] *On the extending of models* (IV). *Infinite sums of models* (with J. Łoś), Fundamenta Mathematicae, **XLIV/1**, 52-60 (1957)

[5] *Remarks on sentential logics* (with J. Łoś), Indagationes Mathematicae, **20**, 177-183 (1958)

[6] *Syntactic structure and semantical reference II*, Studia Logica, **IX**, 63-91 (1960)

[7] *Wykłady z logiki formalnej. Część I* [Lectures on formal logic], ed. B. Stanosz, Warsaw, PWN (1965)

[8] *Formal logic and the development of knowledge* [in:] Problems in the Philosophy of Sciences, International Colloquium London, Amsterdam: North-Holland, 210-222 (1965)

[9] *Ontology in the Tractatus of L. Wittgenstein*, Notre Dame Journal of Formal Logic, **9**, 7-33 (1968)

[10] *Non-Fregean logic and theories*, Analele Universitatii Bucuresti, Acta Logica, **11**, 105-125. (Russian translation of that work is in the collection of articles Neklassičeskaja logika, Moscov 1970)

[11] *Identity connective and modality*, Studia Logica, **XXVII**, 7-39 (1971)

[12] *Abstracts Logics* (with D. J. Brown), Dissertationes Mathematicae, CII, PWN, Warsaw (1973)

[13] *Abolition of the Fregean Axiom*, Lecture Notes in Mathematics, **453**, 169-239 (1975)

[14] *The Fregean axiom and Polish mathematical logic in the 1920s*, Studia Logica, **36**, 376-380 (1977)

[15] *The reification of situations*, [in:] Philosophical Logic in Poland, ed. J. Woleński, Kluwer Academic Publishers (translation from Polish by T. Stazeski), 247-270 (1994)

Suszko's scientific work is very diverse and strictly connected with his philosophical views, and above all - with his views on philosophy of language and of logic.

In his doctoral thesis Suszko considered with so called "problem of logic without axioms". He refers – from one side – to the theory of language presented by K. Ajdukiewicz in *O znaczeniu wyrażeń* [On the meaning expressions], according to which one can among the semantic rules of a language distinguish: axiomatic, deductive and empirical rules, and – from other side – he refers to works written by Jaśkowski and Gentzen, which dealt with replacing logical axioms with sets of inference rule.

According to Suszko the rules offered by them are not "proper inference rules", because they let to infer infinitely many logical theorems without any assumptions. According to Ajdukiewicz they are at the same time axiomatic inference rules.

Another important thread in Suszko's work was the problem of connections between logical matrixes and sentential calculi. This subject appear again in many Suszko's works written at different age, devoted to both abstract and specific logics. In the work *Remarks on sentential logics* Łoś and Suszko formulated the general notion of strong adequacy of a matrix with respect to abstract sentential calculi and formulated general conditions of existence of such a matrix for any calculus. The work is still quoted in almost all publications on sentential calculus. Suszko in cooperation with J. Łoś wrote certain number of works on models for first-order predicate languages. The results obtained in those works Suszko used later in his research on formal aspects of development of knowledge. According to Suszko certain epistemological problems, which were investigated traditionally in an intuitive way, contemporary logic can search in a strict and formal way. It is possible thanks to the fact that logical semantics – and especially the model theory – is a branch of logic. In Suszko's opinion logic is strictly connected with epistemology, and he considered the mathematical model theory as a formal part of the theory of knowledge. Application of logic to the research on development of knowledge was called

by Suszko "diachronic logic". He devoted to the diachronic logic certain number of publications.

Introducing non-Fregean logic was considered by Suszko as his most important achievement. The name "non-Fregean logic" is derived from the fact that Suszko rejected Frege's assumption, according to which all true sentences have one common semantic correlate, just as all false sentences have one common semantic correlate. Those assumption Suszko called "Frege's axiom" and more strictly – "semantic version of Frege's axiom". The common correlate of true sentences is usually interpreted as: truth, being or universe of a model, which means: all objects that satisfy any true sentence. Analogically the common correlate of all false sentences is usually interpreted as: false, non-being, all objects that belong to the universe of model and that satisfy any false sentence. The term non-Fregean logic was introduced by Suszko in [10].

The "non-Fregean period" (1966-1979) was the most creative period of Suszko's life. He wrote 36 scientific works and promoted seven doctors. However for him it was also the time of tragedy, because during this period his 15-years-old son was killed in an accident and his 24-years-old stepson died in tragic circumstances.

3. Views

In Roman Suszko's logical writings there are many remarks and reflections on the idea of logic which is closely related to his work In formal logic.

According to Suszko the subject of logical investigations are any conceptual constructions that came into being as the result of the cognition of the world. The totality of those constructions is called by Suszko *logical material*. The state of logical studies at any time is determined by the logical material available as well as the research tools at the hand. Among various research tools used for studying logical material Suszko – in agreement with the trends of contemporary logic – gives priority to mathematical instruments, especially he prefers the set-theoretical, algebraic and topological methods.

According to Suszko logic – and especially semantics – is not the science devoid of assumptions but, on the contrary, logic has at its fundament certain general and schematic knowledge of reality, such as: there are objects, which has properties and which are related one with another; there are certain states of affairs and some of them occur, while other do not occur etc. In Suszko's opinion logic gains those knowledge from the set theory. Since the set theory contains certain ontological presumptions of logic, Suszko used to call this theory "formal ontology". What is essential in this view, is that there are certain general, structural, and – at the same time – formal properties of the world to be investigated by ontology.

Suszko took the view, that formal languages being designed and studied by logic are not free creations, but abstracts derived from common languages and languages of particular sciences. They may also constitute hypothetical presumptions of those languages. We investigate the consequences of those presumptions within

logic. "Science, cognitive process and natural language, which play essential role in this process, are frame of reference for formal logical research." wrote Suszko in his *Formal theory of logical values I.* According to Suszko logic investigates language by means of all formal tools, i.e. by means of any mathematical method available.

Suszko distinguished two basic categories of expressions: sentences and names. All other categories have no any independent meaning but are designed for construction of more complex expressions. Those auxiliary expressions were called by Suszko "formators"; there are formators that do not bind variables (e.g. connectives, predicates) and fornators that bind variables (such as quantifiers and description operators). Suszko was convinced that there is certain logico-philosophical parallelism, and namely: names correspond to objects; sentences correspond to situations; and formators correspond to functions. That is why Suszko used to quote J. Bocheński: "Syntax mirrors ontology".

Suszko believed that there are certain semantical principles which connect the syntactical construction rules with theirs object references. Those principles allows us to introduce the notion of a model for any language which is formalized in a standard way. The philosophical views that inspired his logical work are here presented.

4. Influences

Roman Suszko had great influence over the choice of investigation problems and over the way of scientific investigations carried out by many philosophers, logicians and mathematicians, both in Poland and abroad.

Joint work Suszko's and Łoś's [5] was continued by R. Wójcicki and his school. Also the works [2], [4], [8] served as a source of inspiration for the logicians who applied the model theory to the methodology of empirical sciences.

Suszko's reflections on the connections between natural languages and formal languages were continued among others by: B. Stanosz, A. Nowaczyk, U. Wybraniec-Skardowska, J. Pogonowski. Those reflections were continued in such works as:

Stanosz, B., Nowaczyk, A.: Logiczne podstawy języka (in Polish) [Logical Foundations of language]. Ossolineum (1976)

Wybraniec-Skardowska, U.: On language adequacy. Studies in Logic, Grammar and Rhetoric, **40**(**53**). In: Cognitive Systems. M. Hensel, R. Poczobut (eds.), 257-292 (2015)

Wybraniec-Skardowska, U.: On the Denotation of Quantifiers. In: Idee logiczne Romana Suszki (in Polish) [Logical ideas of Roman Suszko]. ed. M. Omyła, Warsaw, 89-119 (2001)

In turn work [6] devoted to the paralleism between language and work [3] in which Suszko ascribes to sentences logical values different than true and false, serve as a reference base for G. Malinowski , M. Omyła, B. Wolniewicz i A. Wójtowicz. Suszko inspired with non-Fregean logic and abstract logic logicians in USA working

at the Stevens Institute of Technology: S. L. Bloom, D. J. Brown, J. D. Kagan, A. Michaels, R. Quackenbush and others, and in Poland: W. Dzik, G. Malinowski, M. Omyła, J. Pogonowski, J. Zygmunt. Non-Fregean logic is also subject of study for younger generation logicians: T. Huuskonen, J. Golińska-Pilarek, P. Łukowski, A. Wójtowicz, i J. Wesserling. With the course of years it was turned out that the abstract logic which was grown out from the considerations on characteristics of non–Fregean logic and on its place in the spectrum of logical calculi found its application in universal algebra. J. Czelakowski, W. Dzik, W. Dziobiak, A. Wroński and others – in Poland – and W. Blok , D. Pigozzi i J. M. Font - abroad - are working on abstract logics inspired by non-Fregean logic.

After Suszko's death three monographs at least were published which related meaningfully to his ideas and which – one can say – fulfill his program:

Omyła, M.: Zarys logiki niefregowskiej (in Polish) [Outline Non-Fregean Logic]. Warsaw (1986)

Wójtowicz, A.: Znaczenie nazw a znaczenie zdań, w obronie ontologii sytuacji (in Polish) [Meaning name and meaning sentences]. Semper, Warsaw (2007)

Dzik, W.: Unification Types in Logic. Silesian University, Katowice (2007)

Very good discussion of the work [13] constitutes the review:

Malinowski, G., Zygmunt, J.: R. Suszko "Abolition of the Fregean Axiom". Erkenntnis, **12**, 369-380 (1978)

Full bibliography of Suszko and its description can be found in:

Omyła, M., Zygmunt, J.: Roman Suszko (1919-1979): Bibliography of the Published Work with an Outline of His Logical Investigations. Studia Logica, **43**, 421-441 (1984)

Comparison between diachronic logic and non-Fregean logic can be found in the work:

Omyła, M.: Roman Suszko - from diachronic logic to non-Fregan logic. In: Polish Philosophers of Science and Nature in the 20th Century. ed. W. Krajewski, Amsterdam – New York, 153-161 (2001)

5. Summary

Suszko's logical ideas were a source of inspiration in the choice of problems and in the ways of carrying out logical investigations in the second half of XX century and in first decades of XXI century, both in Poland and in the world.

The majority of polish logicians of the second half of XX century remained under his scientific influence and his irresistible personal charm. Almost on all scientific conferences devoted to logic taking place in Poland, beginning from Suszko's death till today, both speakers and commentators refer to Suszko's ideas as great inspiration for other logicians.

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