

**Historico-
Philosophical
Essays
vol. 1**

Historico- Philosophical Essays vol. 1

Jan Woleński



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Preface

The present volume collects together eight of my historical papers published in the years 2001–2004 and it supplements my earlier book *Essays in the History of Logic and Logical Philosophy* (Jagiellonian University Press, Kraków 1999). The order of particular essays included here is chronological. Four papers (those numbered 1, 2, 3 and 7) deal with the history of logic and philosophy in Poland, my favorite historical subject. The remainder of the essays (the items numbered 4, 5, 6 and 8) concern Rudolf Carnap (one of my philosophical heroes), Finland, the general history of epistemology (I have taught epistemology for many years) and Heinrich Scholz (a remarkable logician). The main task of all of the pieces in this volume consists of elaborating the various questions indicated by their titles. However, I also have another aim that I consider to be important. The philosophical world is divided into philosophical superpowers and philosophical provinces and Poland, my homeland, belongs to the second camp. Of course, philosophers from the superpowers (presently, mostly from the UK and USA) play a dominant role in world philosophy. On the other hand, they are frequently unconscious of the fact that something interesting has happened and, perhaps, is still happening in the provinces. I hope that this collection, and the subsequent volume of my systematic contributions which follows it, will convince the philosophical public that good philosophy is not exclusively restricted to the superpowers.

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Jan Woleński

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Rationalism and Irrationalism The Case of Poland

The pamphlet “Wissenschaftliche Weltauffassung. Der Wiener Kreis”, the famous manifesto of the Vienna circle, published in 1929, does not mention any Polish names. The first important contact between Viennese and Polish philosophers was established when Karl Menger visited Warsaw in the autumn of 1929, although Jan Łukasiewicz met Moritz Schlick in Vienna in 1928 and discussed some philosophical questions with him, in particular the influence of mathematical logic on philosophy.¹ Menger was very impressed by what he observed during his stay in the capital of Poland. Years later he noted:

As I observed during this and subsequent visits, Warsaw between the two wars had a marvellous scientific atmosphere. The interest of the mathematicians in their own as well as their colleagues’ and students’ work was of an intensity that I have rarely observed in other mathematical centres. I discovered the same spirit in the Warsaw School of Logic. But up to that time the Polish logicians had been somewhat isolated. [...]. So I decided to familiarize the Vienna Circle as well as the members of my Mathematical Colloquium with the logico-philosophical work of the Warsaw school and invited Tarski to deliver three lectures before the Colloquium, to two of which I planned to invite also the entire Circle.²

¹ J. Łukasiewicz, *O znaczeniu i potrzebach logiki matematycznej* (*On the Significance and Needs of Mathematical Logic*), “Nauka Polska” 1929, vol. 10, p. 614.

² K. Menger, *Reminiscences of the Vienna Circle and the Mathematical Colloquium*, Kluwer Academic Publishers, Dordrecht 1994, pp. 143–145.

Tarski appeared in Vienna at the beginning of 1930 and, except for the lectures mentioned above by Menger, he had discussions with Rudolf Carnap and Kurt Gödel, and he invited the former to Warsaw. Tarski's conception of metamathematics attracted Viennese logicians and Carnap delivered a special talk "Tarski und die Bedeutung der Metamathematik" to the Vienna Circle.³ Carnap went to Poland in the same year and gave three lectures in Warsaw. Like Menger, he was also greatly impressed by the level of Polish philosophy. In his intellectual autobiography, Carnap wrote:

I found that the Polish philosophers had done a great deal of thoroughgoing and fruitful work in the field of logic and its applications to foundation problem, in particular the foundations of mathematics and in the theory of knowledge and the general theory of language, the results of which were almost unknown to philosophers in other countries. I left Warsaw grateful for the many stimulating suggestions and the fruitful exchange of ideas which I had enjoyed.⁴

The contact initiated by the visits of Menger and Carnap in Warsaw, and Tarski in Vienna became fairly intensive in the thirties. On the occasion of the International Philosophical Conference in Prague (1934), the Vienna Circle organized a special meeting devoted to the unity of science (*Einheit der Wissenschaft*. *Prager Vorkonferenz der International Kongresse für Einheit der Wissenschaft*) with papers by Charles W. Morris (2), Otto Neurath, Kazimierz Ajdukiewicz (2), Carnap, Hans Reichenbach, Janina Hosiasson, Ernest Nagel, Moritz Schlick, Edgar Zilsel, Philipp Frank, Tarski, Louis Rougier, Jan Łukasiewicz and Jörgen Jörgensen. The considerable number of Polish speakers (4 among 14) confirms the high opinion about philosophy in Poland within the Vienna Circle; the proceedings of the

³ See Th. Bonk, J. Mosterin, *Einleitung*, [in:] R. Carnap, *Untersuchungen zur allgemeinen Axiomatik*, Wissenschaftliche Buchgesellschaft, Darmstadt 2000, pp. 26.

⁴ R. Carnap, *Intellectual Autobiography*, [in:] P. Schilpp, *The Philosophy of Rudolf Carnap*, Open Court, La Salle 1963, p. 31.

Prague meeting (published in the journal “Erkenntnis” in 1935) include special bibliographical information about works of Poles covering the writings of 22 persons. Additionally, Ajdukiewicz was asked to deliver a special talk about the development of Polish philosophy related to the ideas of logical empiricism; Morris did the same with respect to American philosophy. It was also the genesis of Ajdukiewicz’ paper “Der logistische Antiirationalismus in Polen”.⁵

The title of Ajdukiewicz’s paper was not accidental. It seems that he intended to stress the independence of Polish analytic philosophy (the Lvov-Warsaw school) from the Vienna Circle. Although Ajdukiewicz pointed out that Polish analytic philosophy was related and similar to logical empiricism in the basic methodological tenets,⁶ he also added:

There are in Poland no absolute adherents of the Vienna Circle. I do not know of any Polish philosopher who would have assimilated and accepted the material theses of the Vienna Circle. The affinity between some Polish philosophers and the Vienna Circle consists in the similarity of the fundamental methodological attitude and the affinity of the problems analysed.⁷

Ajdukiewicz characterized the main tendencies of the Lvov-Warsaw School in four points: (a) anti-irrationalism, that is, the postulate demanding that only such statements should be accepted which are justified by intersubjective means; in particular, anti-irrationalism rejects all forms of mystical intuition or *Wesenschau*; (b) the postulate of

⁵ K. Ajdukiewicz, *Der logistischer Antiirationalismus in Polen*, “Erkenntnis” 1935, vol. V, pp. 151–161; repr. in: *Logische Rationalismus. Philosophische Schriften der Lemberg-Warschauer Schule*, eds. D. Pearce, J. Woleński, Athenäum, Frankfurt am Main 1988, pp. 30–37.

⁶ See J. Woleński, *Logic and Philosophy in the Lvov-Warsaw School*, Kluwer Academic Publishers, Dordrecht 1989 for a more extensive treatment of the relation between both groups.

⁷ K. Ajdukiewicz, *Der logistischer Antiirationalismus in Polen*, *op. cit.*, p. 30 (page-references are to reprints if mentioned in the bibliographical references at the end of this chapter)

conceptual clarity and linguistic exactness; (a) and (b) together establish that the value of philosophical enterprise is subjected to the same methodological criteria as those applied to special sciences; (c) Polish philosophy accommodated logical conceptual apparatus and generally became strongly influenced by formal (symbolic, mathematical) logic; (d) these general points, that is, anti-rationalism, the postulate of conceptual clarity and linguistic exactness, and the influence of logic, determined to a great extent interests of Polish analytic philosophers who concentrated on scientific knowledge, metatheoretical and intertheoretical investigations, semantics and the foundations of deductive sciences.

Ajdukiewicz also pointed out the historical background of logical anti-irrationalism, mentioning a few earlier Polish philosophers who had anticipated the pattern developed by the Lvov-Warsaw school. It is an important matter, because the general and quite popular picture of Polish mentality suggests that it is far from rationalism. Thus, it is said that Poland, due to the lack of suitable political reforms, lost its status as one of the leading European powers in 17th century and finally lost its independence in 18th century. Although Poles are appreciated for their boldness and military skills, they are also blamed for excessive and unrealistic political romanticism manifested, for instance, by several unsuccessful national uprisings resulting in unnecessary losses, sometimes extremely tragic, as in the case of fighting against Germans in 1944 (the Warsaw uprising). This attitude was perhaps best expressed by Adam Mickiewicz, a Polish national poet, in his appeal to Poles: measure strength according to aims, not aims according to strength. I am very far from denying some more or less negative features of Polish spirit. However, please note that the history of every nation is a result of internal and external circumstances. It is, for example, true that Poland rejected Hitler's claims in 1939 on the basis of a somewhat exaggerated imagination about national power, pride and honour, but, on the other hand, Great Britain and France, official Polish allies (by valid international treaties), promised much more than they actually did in September 1939 (the so called paper war against Germany).

We can also highlight examples of perfect rationality in the behaviour of Poles in various extremely difficult moments in their national history. I will mention two such cases, both from the recent history. The first case concerns the years 1939–1944, probably the most dramatic period in the whole of Polish history. I will begin with an anecdote. In 1946, one library from Argentina asked their counterpart to send the Polish academic journals which were missing from the war years. This represents a quite general inability to understand what was going on under Nazi occupation in Poland. It is true that journals were not published in Poland. However, in extreme circumstances, Poles organized clandestine universities and high schools. Not only that, but Poles created an entire underground state with their own courts and administration. Another example concerns the “Solidarity” movement which defeated communism in Poland in a wholly peaceful manner. Clearly, both cases do not suggest that they were rooted in any irrationalism. On the contrary, the Polish underground state and the fight against communism should be interpreted as manifestations of rationalism of the highest order. I will not continue this theme which appeared in my paper only incidentally in order to avoid too rash generalizations. Independent of the fact that this paper is not an essay on the history of Poland and its national fate, if any, let me also note that philosophy very often does not display national spirit, if any. At first, I would like to show that the history of Polish philosophy does not confirm the opinion that Poles are irrational.

Philosophy appeared as an academic discipline in Poland in the 15th century; the University of Cracow became the centre of philosophical and scientific life in Poland. All important scholastic philosophical trends were represented in Cracow and logic was quite strong, although Poland at that time had no figures of the rank of Thomas Aquinas, Duns Scotus or William of Ockham. Yet, one aspect of Polish thought in the late Middle Ages is worth mentioning. It is the idea of Pawel Wlodkowic (Paulus Wladimirus) that pagans cannot be converted to Christianity by force, in particular by military violence. This view contributed considerably to the notion of just war and prepared

the principle of religious tolerance. Copernicus was the most important figure in the Polish Renaissance, although his influence as a philosopher was limited. The most glorious ideas stemming from Poland in this period belong to political philosophy and are closely related to the Reformation. Andrzej Frycz-Modrzewski proposed a general political reform of Polish state and a new solution of the status of the Church; he was a Calvinist and demanded democracy in religious institutions. The Socinians (Polish Brethren) were the most original product of Reformation in Poland. Their doctrines, based on the ideals of non-violence, common equality, justice and tolerance, became widely popular in Poland and outside, and influenced several thinkers, including Hugo Grotius and John Locke. Poland was also the first country in which the idea of religious tolerance found its practical realization. The second half of the 17th century was not a good time for philosophy in Poland. The Counterreformation triumphed, the Socinians had to leave the country and Catholic obscurantism became a normal standard, although some interesting logicians, like Marcin Śmiglecki (very popular in Oxford) were active. This period also brought a considerable crisis to Poland as a political organism. The Polish Enlightenment, above all, developed as a movement for political reforms in order to save Polish independence. Polish philosophy at that time was mainly influenced by ideas imported from France. Hugo Kołłątaj, Stanisław Staszic and Jan Śniadecki belonged to the main representatives of the Polish Enlightenment. Their ideas were closely related to French rationalism, consisting of a fusion of elements of Cartesianism with British empiricism; Jędrzej Śniadecki tried to combine Kantism with the Scottish philosophy of common sense.

The first half of the 19th century is the only period in which Polish philosophy was dominated by irrationalism associated with romanticism and German-style idealism. The so-called Polish national philosophy tried to answer why Poland had lost its independence and how to recover it. Messianism originated by Joseph Hoene-Wroński and developed by great Polish romantic poets (Mickiewicz, Słowacki and Krasiński) attributed a special role to the Polish nation (Poland is

the Messiah of Nations), which required its sacrifice for the salvation of humanity. This attitude, which justified national uprisings (1830–1831, 1846–1848, 1863–1864) was strongly criticized by the Warsaw positivists (Julian Ochorowicz, Waław Świętochowski, Adam Mahrburg) who were very strongly influenced by August Comte, John Stuart Mill and Herbert Spencer. The members of this group recommended organic work consisting in the education of lower groups of society, rational organization of economics, etc. The enterprise of organic work was considered as a necessary condition of any successful fight for independence. These ideas became quite popular in Poland, divided at that time between Russia, Germany and Austro-Hungary.

Thus, if we look back at the development of philosophy in Poland, it is very far from the truth to say that it was dominated by irrationalism. On the contrary: Polish philosophy was usually sober, pluralistic and concerned with national problems. This tradition certainly influenced Kazimierz Twardowski, the founding father of the Lvov-Warsaw School. However, Twardowski's main ideas came from Brentano, his teacher. In particular, Twardowski followed Brentano in the view that "*Vera philosophiae methodus alia nisi scientiae naturalis est*" and made it the fundamental claim of his understanding of philosophy. The claim expressed in this statement suggested to Twardowski that philosophers should resign from studying those problems, even traditional and respectable, which could not be treated by genuine scientific methods. He sharply distinguished philosophy as a science from world-views; the main metaphysical positions belong, according to him, rather to the latter than to the former. Twardowski insisted very strongly upon conceptual clarity and linguistic strictness. Here we have a very characteristic declaration of this attitude to language:

The question [...] arises as to whether the lack of clarity that characterizes the style of some philosophical works is something unavoidable. [...]. [...], the basis for the opinion that it is impossible to write clearly about certain philosophical matters and issues remains a mystery. It is difficult to imagine someone being able to demonstrate that all writings

which deal with particular philosophical topics are characterized by an unclear style. On the other hand, it is much easier to show that some philosophers are able to express themselves quite clearly even about subject-matter that is universally recognized as difficult and complicated. This leads to the conjecture that some philosophers' unclarity of style is not an inevitable consequence of factors inherited in the subject-matter of their expositions, but has its source in the muddled and vague character of their thinking. The situation would then appear to be as follows: clarity of thought goes hand in hand with clarity of style insofar as whoever thinks clearly also writes clearly and we would have to conclude that an author who writes unclearly does not know how to think clearly.⁸

Twardowski also had a special vision of the development of philosophy in Poland; he understood the term "Polish national philosophy" simply as denoting the sum of results achieved by Polish philosophy. According to him, there are philosophical superpowers, like England, France and Germany, as well as philosophical provinces, where Poland belongs. It is understandable that superpowers dominate the provinces and it is very dangerous if the philosophical thought of a small nation becomes overly dominated by a superpower because it loses its autonomy. Hence, philosophers working in a provincial country should try to keep a balance in their thought by bringing together ideas from various superpowers. Although Twardowski himself was mainly influenced by German-language philosophy, he recommended British and French philosophy to his students. Moreover, Twardowski postulated that philosophers of any nation should produce suitable textbooks in national languages. It particularly concerns the history of philosophy because historians from superpowers were inclined to exaggerate the achievements of their own compatriots, ne-

⁸ K. Twardowski, *O jasnym i niejasnym stylu filozoficznym (On Clear and Unclear Philosophical Style)*, "Ruch Filozoficzny" 1920, vol. V, pp. 23–25; Eng. trans. by A. Szylewicz, in: *idem, On Actions, Products and Other Topics in Philosophy*, Rodopi, Amsterdam 1999, pp. 257–258.

glecting the ideas of other circles and usually completely ignoring the ideas from the provinces. Hence, if a nation wants to make its philosophy known even to its own members and show how it was and is related to other philosophies, it must be able to create a history of philosophy suitably balanced with respect to superpowers and correctly indicating the philosophical products of provinces, particularly their own thought. Twardowski was a real teaching genius. He trained more than 30 university professors in philosophy and other fields of humanities. Ajdukiewicz, Tadeusz Czeżowski, Tadeusz Kotarbiński, Jan Łukasiewicz, Stanisław Leśniewski and Zygmunt Zawirski belonged to Twardowski's leading students and all became representatives of logical anti-irrationalism. His influence was well summarized by Alfred Tarski, the philosophical grandson of Twardowski (via Kotarbiński, Leśniewski and Łukasiewicz):

Almost all researchers, who pursue the philosophy of exact sciences in Poland, are indirectly or directly the disciples of Twardowski, although his own work could hardly be counted within this domain.⁹

If we compare Ajdukiewicz's characterization of logical anti-irrationalism with Twardowski's metaphilosophical program, we can easily find common points. Admitting only those judgements that are intersubjectively controllable is equivalent to the claim that the genuine method of philosophy is the same as the method of science. Some Polish philosophers were inclined to identify the rational with the scientific. This path we find in Tarski, for example:

I used the word "rational" (as opposed to "irrational") in that wide sense in which it covers deductive and inductive methods alike.¹⁰

⁹ A. Tarski, *Brief an Otto Neurath* (25.IV.30), "Grazer Philosophische Studien" 1992, vol. 43, p. 10; Eng. trans. by J. Tarski, in: "Grazer Philosophische Studien" 1992, vol. 43, p. 20.

¹⁰ *Idem*, *Contributions to the Discussion*, "Revue Internationale de Philosophie" 1954 no. 8, p. 51; repr. in: *idem*, *Collected Papers*, vol. IV: 1958–1979, Birkhäuser, Basel 1986, p. 716.

Perhaps the most impressive statement to this effect is to be found in Ajdukiewicz's emphatic characterization of anti-irrationalism:

Rationalism values cognition whose paradigm is scientific cognition or more precisely whose paradigms are the mathematical and natural sciences. It rejects cognition based on revelation, all divinations, forebodings, prophecies, crystalgazing, etc. [...] Perhaps scientific cognition can be characterized best by emphasising two requirements which it must satisfy. Scientific cognition is first such that only such content of thought as can be communicated to others in words understood literally, that is without metaphors, analogies and others half-measures for the transformation of thought. Secondly, only those assertions can pretend to the title of scientific cognition whose correctness can be decided in principle by anybody who finds himself in the appropriate external conditions. In a word, scientific cognition is that which is intersubjectively communicable and controllable.¹¹

Although Ajdukiewicz did not explicitly mention the distinction of philosophy as a science and world-views, it is rather obvious that he accepted Twardowski's related view. The same concerns Twardowski's characterization of philosophy as a national enterprise. In fact, Ajdukiewicz's interests in French conventionalism arose as a result of Twardowski's insistence that Polish philosophy should not be overly dominated by German language one.

The characteristic openness of the Lvov-Warsaw School for new ideas coming from other circles, related to Twardowski's vision of Polish national philosophy, is well evidenced by the reception of mathematical logic in Poland. Twardowski himself, as Tarski noted (see above) did not work in mathematical logic and logical analysis of the

¹¹ K. Ajdukiewicz, *Zagadnienia i kierunki filozofii (Problems and Theories of Philosophy)*, Czytelnik, Warsaw 1949; Eng. trans. by H. Skolimowski and A. Quinton: Cambridge University Press, Cambridge 1973, pp. 45–46.

foundations of science. On the other hand, Twardowski very strongly stressed the importance of logical culture. He wrote:

I will not speak about a specialized logical culture, but about a general one which every educated person should possess, similarly as he or she should possess a general historical, mathematical, grammatical, scientific, literary, etc culture. A general logical culture like, for example, a mathematical or logical culture consists in having some amount of knowledge and the cultivation of some skills. [...]. I mentioned examples which sufficiently demonstrate a drastic lack of general logical culture in our journalism, textbooks for elementary schools, scientific literature and literary works. [...] Pointing out these omissions can be viewed as a scholarly pedantry. However, I think that the problem concerns very important matters which have significant effects. It is because the lack of logical culture not only decreases intellectual level from the theoretical point of view, but also brings ignorance and obscurity into practical applications of our thoughts. Needless to say that the whole of our life is that practical application.¹²

Twardowski's metaphilosophical project and his insistence on logical culture contributed to the fact that his students were vitally interested in logic in a broad understanding, covering semiotics, formal logic and methodology of science. By no means was it a peculiarity of Polish philosophy, because several other circles were equally sensitive to general logic. The rise and development of mathematical logic in Poland deserves special attention. Since I have tried to analyse this phenomenon elsewhere,¹³ I will restrict myself here to some very general remarks about the rise of the Warsaw group of logicians

¹² K. Twardowski, *O wykształcenie logiczne (Towards Logical Education)*, "Ruch Filozoficzny" 1919–1920 vol. V, pp. 65–71; repr. in: *idem, Rozprawy i artykuły filozoficzne (Philosophical Papers and Essays)*, Nakładem Uczniów, Lwów 1927, pp. 185–193.

¹³ See J. Woleński, *Logic and Philosophy in the Lvov-Warsaw School*, *op. cit.*; *idem, Mathematical Logic in Poland 1900–1939: People, Institutions, Ideas*, "Modern Logic" 1995, no. 5, pp. 363–405; repr. in: *idem, Essays in the History of Logic and Logical Philosophy*, Kraków, Jagiellonian University Press 1999, pp. 59–84.

with merely incidental remarks about other places, of which Cracow was quite a strong centre of logic (Leon Chwistek, later in Lvov and Jan Śleszyński). In the academic in Lvov in 1899–1900, Twardowski delivered a course about new directions in logic. The course was mainly devoted to Brentano's reform of traditional logic, but also informed participants about the rudiments of algebra of logic. This course was attended by Łukasiewicz, who became interested in new logic and began to lecture in Lvov from 1906. In 1910, Leśniewski joined Twardowski's circle. After reopening Warsaw University in 1915, Łukasiewicz was appointed as professor of philosophy (since 1920 his position was at the Faculty of Mathematics and Science), but was mainly teaching logic. In 1919 Leśniewski was given the chair of philosophy of mathematics in Warsaw. The main impetus for the development of logic in Warsaw came from mathematicians. The years 1914–1918 were the period of looking for ways of possible scientific research by various academic communities of Polish scholars. Mathematicians decided (the Janiszewski program) to concentrate on set theory and topology and their applications in other fields of mathematics. This project located mathematical logic and the foundations of mathematics at the very heart of mathematics. The appointment of Leśniewski and Łukasiewicz as professors was a conscious decision of mathematicians who were not afraid to have two logicians with a philosophical background in their company. Łukasiewicz had the pedagogical and organizing abilities of Twardowski's rank and very soon succeeded (together with Leśniewski) in creating a group of mathematical logicians in Warsaw. Tarski, one of the greatest logicians in the history of logic, became the third pillar of this group. The first ten years (1920–1930) constituted a period of forming the Warsaw school of logic and achieving the first important results. The school became internationally famous in the thirties; the above mentioned contacts with Viennese logicians, mathematicians and philosophers were significant in introducing Poles into the international logical forum. Thus, Polish logic (to use this not very happy label since logic is neither Polish, nor German, etc.) started almost from nothing

at the end of 19th century and during the life of one generation (thirty years from 1900–1930) achieved the highest level in this field. Probably nobody could predict this development.

Several factors contributed to the glorious career of logic in Poland and Twardowski's tradition was one of them. It is not known whether Zygmunt Janiszewski, who elaborated the program of the development of Polish mathematics, was influenced by Twardowski's vision of national philosophy, but it is clear that Janiszewski's project was in the spirit of Twardowski, because it recommended taking what was new and promising from the international labour of scientific research. The protection of logic by mathematicians was the next important circumstance (see also further remark below). Many young mathematicians, notably Tarski, felt free in choosing logic as their main field; in fact, relations between logicians and mathematicians became worse in the thirties, but the Warsaw school of logic was too powerful at that time and did not need special protection from mathematicians. The above-mentioned skills of Łukasiewicz, and Leśniewski's fame as one of the most original minds in Poland also brought effects. The students of mathematics at Warsaw University could attend several courses in mathematical logic from elementary to very advanced. The students had to take one elementary course, but the rest was optional. The teaching of logic was so organized that students who wanted to specialize in logic or at least to widen their logical knowledge, could attend logical courses and seminars during the whole period of studies, that is, four years. The fact that "Principia Mathematica" served as a textbook for advanced students of mathematics gives an impression of how logic was taught in Warsaw (in the twenties, as later "Principia" was regarded as an obsolete work); the teaching of mathematical logic in Poland outside Warsaw was perhaps not so intensive, but still obligatory at other Polish universities. The Warsaw group of logicians was the largest circle of people working together in a single place (eleven persons in the thirties). It is also interesting to note that Poland in the interwar period had four positions in mathematical logic whilst the rest of the world had only one (Münster in Germany).

The Warsaw school of logic had its own scientific ideology. It was expressed by Łukasiewicz in the following way:

Mathematical logic in Poland, particularly in Warsaw, is today a very vital cell of Polish creative scientific work [compare Menger's opinion quoted above – J.W.]. [...] By a happy coincidence, philosophers and mathematicians co-operated in forming Polish mathematical logic. This fact augurs favourably for the future development of this field in Poland. Mathematicians will not allow logic to be changed into philosophical speculation, but philosophers will defend it against a slave like application of mathematical logic resulting in its restriction to an auxiliary mathematical discipline.

As a matter of fact, mathematical logic is considered in Warsaw as an autonomous science having own aims and problems. [...] In Germany things look differently. I have an impression that mathematicians of Hilbert's school working in logic treat it just as an auxiliary, but not independent science. [...] On the other hand, there is no danger, I think, that Polish mathematical logic will wend anytime wrongly into philosophical speculation. Polish mathematicians, who co-operate with us, think too soberly to be subjected to unscientific phantasies. This danger is much more actual in the case of German mathematicians. [...] Both mathematicians and those philosophers who began to work in mathematical logic brought with them a mature feeling of scientific precision. Almost all philosophers working in mathematical logic in Poland are students of Prof. Twardowski and belong to so called "Lvov philosophical school" where they learned how to think, clearly, responsibly and methodically. Due to this fact, Polish mathematical logic achieved much higher level of scientific precision.¹⁴

The main points of Łukasiewicz's characterization of mathematical logic in Poland are these. Firstly, Polish mathematical logic is a pro-

¹⁴ J. Łukasiewicz, *O znaczeniu i potrzebach logiki matematycznej (On the Significance and Needs of Mathematical Logic)*, "Nauka Polska" 1929, vol. X, pp. 604–620.

duct of the co-operation of mathematicians and philosophers. Secondly, it is autonomous and, despite using mathematical methods, it is independent of mathematics; however, its genetic identity is associated mainly with its philosophical origins. The claim that logic is independent of mathematics as well as of philosophy seems exaggerated today, but it was very productive in the thirties in Poland. Perhaps the most important fact in this respect was that most mathematicians in Warsaw shared this view about the autonomy of logic. Certainly, it was a peculiarity of the atmosphere concerning logic in Warsaw which became crucial for the growth of a powerful logical school. For instance, the situation in Cracow was completely different, because Cracow mathematicians regarded mathematical logic as something located on the margins of mathematics, not in its centre. It prevented the development of the school of mathematical logic in Cracow, although in 1918 this city still had more advanced mathematical logicians than Warsaw. Thirdly, mathematics protects logic against speculation, but philosophy protects it against a pure “mathematization”. Fourthly, mathematical logic in Poland achieved an incomparable level of precision. The last point is important for the philosophical significance of logic. According to Łukasiewicz, the level of precision required and pursued in Polish mathematical logic should serve as a paradigmatic pattern for philosophers. In this way, mathematical logic contributed to that factor of logical anti-irrationalism which consisted of conceptual clarity and linguistic factors. Of course, logic also contributed to Polish philosophy in another way. Many-valued logic, Leśniewski’s systems and the semantic conception of truth, perhaps the most glorious results of Polish logic, clearly have a double logico-philosophical character, in particular, an obvious philosophical motivation and far-reaching philosophical consequences. Also several philosophical constructions such as Ajdukiewicz’s radical conventionalism, his semantic epistemology and Kotarbiński’s reism were invented under a very strong influence of logical ideas. Polish philosophers, at least those who were logically oriented, considered logic as a source of insights collectively forming logical anti-irrationalism.

Perhaps here is a proper place to indicate that Polish anti-irrationalism was much wider in the interwar period than only its logical manifestation. Many (even most) of Twardowski's students did not work in mathematical logic, but all accepted his anti-irrationalistic metaphilosophy. A particularly impressive sign of anti-irrationalism (in this case influenced by Polish logic) was the rise of the Cracow Circle, a group of Catholic philosophers (Józef M. Bocheński was among them) who were ready to introduce considerable modifications into Thomism and theology, in order to keep the rational standards propagated by Twardowski's school. Chwistek, a logician who did not belong to the Lvov-Warsaw School, was another example of an anti-irrationalistic philosopher who was influenced by logic and social ideals.

Like Twardowski, Polish logicians were convinced about the social importance of logic. Tarski touched this question in his popular textbook of logic:

I shall be very happy if this book contributes to a wider diffusion of logical knowledge. [...] For logic, by perfecting and by sharpening the tools of thought, makes men and women more critical – and thus makes less likely their being misled by all the pseudo-reasonings to which they are incessantly exposed in various parts of the world today.¹⁵

For Tarski (in Henry Hiż's personal communication), "Religion divides people, logic brings them together". Łukasiewicz considered logic as moral of speech and thought. Since insistence on logical culture was a typical feature of Polish anti-irrationalism, I will quote other similar declarations:

The most important point is this. Logical culture increases the level of demands, required by society, with respect to clarity and the proper

¹⁵ A. Tarski, *Introduction to Logic and to the Methodology of Deductive Sciences*, Oxford University Press, Oxford 1941, pp. XIII–XIV.

justification of statements. Due to that, declarations appealing only or mostly to emotional reactions lose their hearing in people. Journalism, political games and every public activity, if it is undertaken in order to influence society, has to satisfy these higher demands of logical correctness. It favours the seriousness of discussions, demagogues lose their footing, agreements become easier because it finds the base for solving controversies in logic. Societies having a high logical culture are more undivided and compact, due not to coercion but owing to the beacon coming from logic and protecting people against entering in erroneous paths of passions and destruction.¹⁶

People who are not competent in logic are inclined to chaotic thought and speech. They reason about many things at once, do not preserve a planned succession of articulated problems, have no orientation and are not able to distinguish close but different matters.¹⁷

The ability of logically correct thinking protects not only against errors with their all painful practical consequences, but also against being suggested by slogans with the empty content, although full of emotional furniture, that are neither true nor false. Due to their emotional character, they can execute prevailing but uncontrolled by deliberation influence on human conduct.¹⁸

And one more quotation which can be regarded as a generalization of expectations concerning logic in relation to anti-irrationalism in general:

¹⁶ T. Czeżowski, *O kulturze logicznej (On Logical Culture)*, [in:] *idem, Odczyty filozoficzne (Philosophical Essays)*, Towarzystwo Naukowe w Toruniu, Toruń 1969, pp. 185–190.

¹⁷ T. Kotarbiński, *Zadania swoiste logiki szkolnej (Special Tasks of Logic in Schools)*, “Nowa Szkoła” 1951, vol. 5, pp. 327–339; repr. in: *idem, Wybór pism (Selected Writings)*, vol. 2, PWN, Warsaw 1958, pp. 544.

¹⁸ K. Ajdukiewicz, *Co może zrobić szkoła dla podniesienia kultury logicznej uczniów? (What Can the School Do for Increasing the Logical Culture of Students?)*, “Nowa Szkoła” 1959, vol. 2, pp. 2–8; repr. in: *idem, Język i poznanie (Language and Knowledge)*, vol. 2, PWN, Warsaw 1964, pp. 322.

[...], the voice of the rationalist [that is, anti-irrationalist – J.W.] is a sound social reaction, it is an act of the self-defence of society against the dangers of being dominated by uncontrollable forces among which may be both a saint proclaiming a revelation as well as a madman affirming the products of his sick imagination and finally a fraud who wants to convert others to his views for the sake of his egoistic and unworthy purposes. It is better to rely on the safe but modest nourishment of reason than, in fear of missing the voice of ‘Truth’, to let oneself be fed with all sorts of uncontrollable nourishment which may more often be poisonous than healthy and beneficial.¹⁹

These quotations explain why the teaching of logic was considered as very important in Poland; of course, general anti-irrationalism in the Ajdukiewicz sense was closely related to logic. I have already mentioned how the teaching of logic was organized for students of mathematics. Principally, the same concerned students of philosophy in Warsaw. In fact, logical courses and seminars conducted in mathematical studies were also directed to students of philosophy; in other Polish universities, mathematical (or formal) logic was at least obligatory for philosophers. However, the teaching of logic in Poland was not restricted only to mathematicians and philosophers. Logic was taught in all secondary schools as a part of propaedeutic of philosophy and covered at least one semester. Further, logical courses were given at all pedagogical colleges. Also, all students of universities had a “Main Problems of Philosophy” course and of which logic was a considerable part. The level of teaching was very high. Let me briefly describe the logical content of Ajdukiewicz’s textbook:²⁰ I. On concepts and propositions; 1. Psychological meaning and linguistic meaning; 2. Sentence and proposition; 3. Name

¹⁹ K. Ajdukiewicz, *Zagadnienia i kierunki filozofii (Problems and Theories of Philosophy)*, *op. cit.*, p. 49.

²⁰ See K. Ajdukiewicz, *Propedeutyka filozofii (Propedeutics of Philosophy)*, Książnica-Atlas, Lwów 1938.

and concept; 4. The scope of name and concept; 5. The content of name and content; 6. Relations between scopes of concepts; 7. Logical division; 8. Inaccuracies of speech; 9. Definition; II. Information about formal logic; 10. The principle of contradiction and the principle of excluded middle; 11. Conditional sentence and the relation of entailment; 12. The logical square and principles of conversion; 13. About classical syllogism; III. Kinds of inference. Argumentation; 14. Deductive inference; 16. Reductive inference; 17. Inductive inference; 18. Argumentation and its kinds; 19. Errors in argumentation; IV. On science; 19. The classification of science; 20. A priori sciences; 21. Natural sciences; 22. Historical science. 23. The value of science. The whole book has 214 pages and consists of three parts: A. Psychology of cognitive processes (52 pages); B. Logic (102 pages); C. Human conduct (60 pages). The proportions of particular parts clearly show how logic prevailed in the program of teaching philosophy in secondary schools. Tarski²¹ was based on a booklet published in Polish in the thirties and served as the textbook in pedagogical colleges; it covers propositional calculus, predicate calculus and elements of metamathematics. Kotarbiński's "Elements"²² was the textbook for a general course in the "Main Problems of Philosophy"; it covers semantics, propositional calculus, the Leśniewski ontology and a lot of philosophy of science.

The power of Polish logic and the extensive teaching of logic at all levels of education (except elementary) resulted in the great prestige of this field in Poland. This is evidenced by a number of factors. One is the mentioned number of positions in logic at Polish universities. It was almost unconceivable that logic could be not taught in secondary schools and universities. It was taught during the war in the clandestine education system. Polish military forces fighting in North Africa,

²¹ See A. Tarski, *Introduction to Logic and to the Methodology of Deductive Sciences*, *op. cit.*

²² See T. Kotarbiński, *Elementy teorii poznania, logiki formalnej i metodologii nauk*, Ossolineum, Lwów 1929, Eng. trans. by O. Wojasiewicz: *Gnosiology. The Scientific Approach to the Theory of Knowledge*, Pergamon Press, Oxford 1966.

Italy and other Western fronts organized special schools for the children of officers and soldiers. We have an almost incredible document, namely the rotaprinted edition of “Propaedeutic of Philosophy”²³ (a textbook for secondary schools) published by the Publishing Section of the Second Polish Corp (some of the Polish troops fighting in Western Europe); it was printed in Bari in 1945. Łukasiewicz spent the last months of the war in Westphalia. Just after this region was taken by the Allies, he was moved to a camp for Poles liberated from Germany and demobilized soldiers. A Polish secondary school was immediately organized in this place and Łukasiewicz taught logic there. The teaching of logic continued in Poland after 1945. After a few years, the propaedeutic of philosophy was cancelled (it did not conform with the communist plan of education), but logic itself was preserved. After some interruptions in the early fifties, it was reintroduced to universities as an optional subject. It transpired that over ninety percent of students chose courses in logic. The last illustrative fact is that, at the peak of the Stalin era, Ajdukiewicz was able to convince Marxists that Poland, due to its tradition in logic, should have its own professional logical journal; the first volume of “Studia Logica” appeared in 1953.

The above mentioned facts clearly show that Polish logicians succeeded in making logic a prestigious and popular subject in Poland. Several generations of the Polish intelligentsia were subjected to intensive logical training. However, it is a separate problem whether it fulfilled the expectations of Twardowski and his followers concerning an increase of logical culture and the social effects of that. The answer is difficult, if at all possible, because human conduct is governed by many factors and nobody knows how much logic participates in causing human actions. Even if we qualify views of the Lvov-Warsaw School concerning the social role of logic and its teaching as too naive (personally, I think that they were such, at least too exaggerated), it is perhaps interesting to try to give an answer. It is relatively sim-

²³ See K. Ajdukiewicz, *Propedeutyka filozofii (Propedeutics of Philosophy)*, *op. cit.*

ple to assess the role of logical culture in particular fields, especially mathematics and philosophy. I will leave mathematics aside and concentrate on philosophy. It is doubtless that logic influenced Polish philosophy very much. The case of the Lvov-Warsaw School itself is obvious – it produced a sort of logical philosophy; the same concerns Leon Chwistek. I mentioned earlier the interesting case of Catholic philosophy in Poland. The influence of logic on Polish Catholic philosophy was not restricted to the Cracow Circle and is still alive today. Roman Ingarden was a great opponent and critic of the Lvov-Warsaw School and of applying formal logical methods in philosophy. However, his writings are much clearer than many other phenomenologists and I think that it was at least partly created by the fact that he lived in a logical environment and understood that he should preserve defined methodological standards. Perhaps Polish postwar philosophy is a sort of *experimentum crucis* here. Simply speaking, the level of Polish academic philosophy, due to its professional, and above all, logical culture was sufficiently strong in order to defend it against corruption by Marxism.²⁴ Even more, Polish Marxism adopted professional standards and became a normal philosophy (in most cases) very long before the end of communism as a political system in Poland in 1989. The fact that postmodernism and similar currents are not very popular in Poland, at least among philosophers, is due to the strength of logical culture. Briefly, logic contributed essentially to logical anti-irrationalism, the latter to general anti-irrationalism, and the last essentially determined the general climate of Polish philosophy. Although I am personally pleased by this fact, I must add that I fully recognize that not everybody needs to be happy with this situation. And if I say that postmodernism is not popular in Poland, I do not mean that it is completely absent in Polish philosophical life. The Polish philosophical scene was always pluralistic and anti-irrationalism did not change this fact. It is probably its further rational feature.

²⁴ See J. Woleński, *Philosophy Inside Communism: the Case of Poland*, “Studies in Soviet Thought” 1992, no. 43, pp. 93–100.

It is much more difficult to measure the effects of anti-irrationalism culture in such social areas as political life, journalism, literature, etc. However, I think that we can point out some possible effects of the relatively high logical culture of Polish intelligentsia, particularly in the pre-war period. By this I mean the quality of Polish legal statutes or the language of humanities. It is also possible that a very rational organization of Polish underground state in 1939–1945 was also caused (partly, of course) by anti-irrationalism, because people involved in those activities were educated in the anti-irrationalistic tradition. Another example is “Solidarity”. Although workers initiated this movement, its organizational framework, in particular the principle of self-limiting revolution, was elaborated by intellectuals, also sensitive to anti-irrationalism. These explanations are very tempting, but I advance them with considerable caution and many reservations (I will not enter into details here). It is also possible that we can measure some results of decreasing logical education. Poland is also an example in this respect, because logical and philosophical teaching has become limited in recent years; in secondary schools, it is absent (not only recently, but since the sixties) and reduced at universities. Accordingly, we can observe a radical decrease in the quality of statutes, public debates and an increase in irrational, for example, religious motivations. Once more, I do not insist that these facts are only caused by limitations of logical and philosophical teaching, but this factor should also be taken into account.

The case of anti-irrationalism is also interesting for purely philosophical issues, especially for the concept of rationalism. We have two oppositions: (a) rationalism versus empiricism, and (b) rationalism versus irrationalism. The immediate question is whether the word “rationalism” has the same meaning in (a) and (b). This is clearly not the case because irrationalism is different from empiricism. On the other hand, rationalism as anti-irrationalism appeared in the Enlightenment and consisted in a fusion of Cartesian themes (knowledge should be clear and well justified) with empiricism claiming that knowledge should be based on experience. It could be taken as

evidence that the rationalism of French philosophers of the 18th century was a successful overcoming of a sharp contrast between rational knowledge and empirical knowledge, an opposition which goes back to ancient philosophy with its distinction between certain episteme and probable doxa; the enlightened reason inherits in this picture virtues attributed to knowledge by rationalists as well as empiricists. However, the matter is much more complicated and requires a closer analysis of irrationalism and its place in the history of philosophy. It was done in Poland by Izydora Dąmbska²⁵ and Tadeusz Czeżowski.²⁶ Dąmbska distinguished the following kinds of irrationalism in philosophy: methodological (Dąmbska used the label “logical” in this case, but I changed it for “methodological”, in order to avoid a confusion with logical anti-irrationalism in the Ajdukiewicz understanding), epistemological, metaphysical and psychological. Logical irrationalism is a property of sentences. A sentence is irrational if and only if it is contradictory or essentially undecidable (this last property is related to the views of the Vienna Circle). However, Dąmbska adds that sentences are not irrational per se, but only if they are used with assertion. Epistemological irrationalism is a view, which legitimizes irrational sentences by pointing out various cognitive activities that are (a) different from rational (Dąmbska understood rationalism as Ajdukiewicz did, that is, as anti-irrationalism) ones, and (b) infallible. Metaphysical irrationalism (Heraclitus, Bergson) regards reality as irrational, that is, having a residuum, which cannot be caught by conceptual resources. Finally, a person who is inclined to use of irrational devices in the justification of his or her judgments is a psychological irrationalist. Dąmbska’s main concern was the relation of logical irrationalism and epistemological irrationalism to scientific knowledge. According to her, both logical irrationalism and epistemological irrationalism are inconsistent with science. This verdict concerns

²⁵ See I. Dąmbska, *Irracjonalizm a poznanie naukowe (Irrationalism and Scientific Knowledge)*, “Kwartalnik Filozoficzny” 1937, no. 14, pp. 83–118.

²⁶ See T. Czeżowski, *Kilka uwag o racjonalizmie i empiryzmie (Remarks on Rationalism and Empiricism)*, [in:] *idem, Odczyty filozoficzne, op. cit.*, pp. 18–22.

“*questio raris*”. On the other hand, it happens that science is (“*quaestio facti*”) irrational but (usually) only temporarily, because irrational elements are eliminated by further scientific discoveries. Czeżowski characterized traditional (he said “ancient”) rationalism by the following points: (1) genuine knowledge is certain and necessary; (2) certain knowledge (episteme) directly refers to the world, more precisely to its general and necessary features; (3) apodictic evidence is the criterion of knowledge; (4) deduction is the only method of constructing science. I think that this picture must be supplemented in (2) and (4). It is certainly not enough to say that, according to rationalism, episteme directly refers to the world. We should add that episteme was always conceived as having its own special objects, Platonic Forms, Aristotelian essences, God of the schoolmen, Husserlian eidos, etc. It is also not enough to say that deduction is the only method of constructing science. We should add that, according to rationalism, system of knowledge constitutes deductive-assertoric theory,²⁷ that is, theory which is based on axioms unconditionally asserted. Historically speaking, this type of rationalism far exceeds antiquity and can be found in every period of the development of philosophy. Modern empiricism (the qualification “modern” is important, because this form of empiricism did not appear before Hume, at least in its mature form) rejects all points (1)–(4). It is not surprising and characterization of empirical knowledge by statements being negations of (1), (2), (3) and (4) is almost standard. A further analysis of rationalism leads to perhaps unexpected conclusions. Let us start with (2) as it was supplemented. If the claim that episteme has its own object different from empirical phenomena is seriously taken, a special faculty has to be defined in order to directly catch Forms, essences, etc. Rationalists since Plato to Husserl proposed various solutions under the same heading: intuition. Usually rational intuition was contrasted with mystical fac-

²⁷ See K. Ajdukiewicz, *Axiomatic Systems from the Methodological Point of View*, “*Studia Logica*” 1960, pp. 205–218; repr. in: *idem, The Scientific World-Perspective and Other Essays 1931–1963*, D. Reidel, Dordrecht 1978, pp. 282–294.

ulties. Yet rationalists always had difficulties with the intersubjectivity of their intuitive knowledge (compare Husserl's dramatic attempts to prove that phenomenological intuition is intersubjective). It suggests that classical rationalism is irrationalism in spite of declarations of its leading proponents; it is epistemological irrationalism in Dąmbska's sense. A remarkable fact is that Ajdukiewicz excluded *Wesensschau* (certainly having in his mind Husserlian intuition) from the scope of rational knowledge. By the way, it is now clear why Husserl so strongly insisted that the traditional concept of experience is too narrow. Ajdukiewicz himself²⁸ limited irrationalism only too its classical forms, that is, mainly mysticism. However, a closer analysis of classical rationalism from the point of view of the definition of rational knowledge as intersubjective, inevitably leads to the conclusion that it was a form of irrationalism. The word "rationalism" is ambiguous and rationalism as opposed to empiricism should be differently labelled, for instance, by the word "apriorism", used in fact by Ajdukiewicz. Thus, it is not surprising that typical apriorism falls under epistemological irrationalism, because it proposes special kinds of knowledge that lacks intersubjective character in all historically available descriptions of aprioristic epistemology. However, a surprising thing is that some philosophers, like Plato or Hegel, regarded reality as perfectly ordered by a special logic of being (metaphysical rationalism) and yet they proposed epistemological irrationalism. I claim that this curiosity is always present when logical analysis in the proper sense is neglected. Polish logical anti-irrationalism can be regarded as an attempt to tame epistemological irrationalism by pointing out why devices proposed by irrationalism destroy reliable knowledge.

²⁸ See *idem*, *Zagadnienia i kierunki filozofii (Problems and Theories of Philosophy)*, *op. cit.*, pp. 48–49.

The Rise of Many-Valued Logic in Poland

Nicolas Rescher¹ distinguishes the following stages in the development of many-valued logic: (I) prehistory (Aristotle, Duns Scotus, William of Ockham), (II) early history 1875–1916 (Charles S. Peirce, Hugh MacColl, Nicolay Vasil'iev, Jan Łukasiewicz), (III) the pioneering era 1916–1932 (Jan Łukasiewicz, Emil Post), and (IV) the recent period (after 1932). This paper concerns the second period and the beginning of the third one, in particular the early development of many-valued logic in Poland. I will not worry about who the “real” ideological father of many-valued logic was. However, the great role of Jan Łukasiewicz and his school in the rise of many-valued logic as a mature logical field is beyond question. Early Polish contributions are interesting in themselves, regardless of the question of “absolute” priority in the invention of the idea of many-valueness. As a matter of fact, it was Łukasiewicz who first formulated the formal details of many-valued logic. It happened about 1917, but he published his results in 1920.² Two years later, Łukasiewicz explained the philosophical background of his understanding of many-valued logic;³ and this fact ends the period reported in this paper. The development of

¹ N. Rescher, *Many-Valued Logic*, McGraw Hill, New York 1967. pp. 1–16.

² In two short abstracts J. Łukasiewicz, *O pojęciu możliwości* (*On the Concept of Possibility*), “Ruch Filozoficzny” 1919–1920, no. 5, pp. 69–70; Eng. trans. by H. Hiż, in: *Polish Logic 1920–1939*, ed. S. MacCall, Clarendon Press, Oxford 1967, pp. 15–16 and *idem*, *O logice trójwartościowej* (*On Three-Valued Logic*), “Ruch Filozoficzny” 1919–1920, no. 5, pp. 170–171; Eng. trans. by O. Wojtasiewicz, in: *idem*, *Selected Works*, ed. L. Borkowski, North-Holland, Amsterdam 1970, pp. 88–89.

³ In paper *idem*, *O determinizmie* (*On Determinism*) (The Rectoral Address at the University of Warsaw in 1922); Eng. trans. by Z. Jordan, in: Łukasiewicz, *Selected Papers*, *op. cit.*, pp. 110–128.

many-valued logic in Poland was relatively autonomous. It means that although Łukasiewicz followed a general pattern of mathematical logic as it was done by Boole, Schroder, Peirce, Frege, Russell and Whitehead, he was not conscious that the idea of many-valuedness appeared earlier.⁴ Of course, Łukasiewicz knew well about Aristotle and his problems with future contingents, but, at least until 1920–1922, he did not attribute the idea of unorthodox logic to the Stagirite. Firm evidence for this interpretation is provided by the fact that Łukasiewicz regarded the new logic as non-Aristotelian in his early works. Thus, we can look at the rise of many-valued logic in Poland as a result of the process related to internal circumstances present in Polish philosophy.⁵

The Polish chapter in many-valued logic began when Kazimierz Twardowski published his very influential paper on the problem of relative truths.⁶ Twardowski very strongly defended the view that truth is absolute. Roughly speaking, Twardowski's thesis is

- (1) if a proposition A is true at the moment t , it is also true at any other (past or future) moment t_n .

Now, the thesis (1) can be divided into two subtheses depending on whether we are interested in the past or future. Thus, we have

⁴ For general information about the development of mathematical logic in Poland and its philosophical context, see J. Woleński, *Logic and Philosophy in the Lvov-Warsaw School*, Kluwer, Dordrecht 1989, chapters I and IV and *idem*, *Mathematical Logic in Poland 1900–1939: People, Circles, Institutions, Ideas*, “Modern Logic” 1995, no. 5, pp. 363–405; repr. in: *idem*, *Essays in the History of Logic and Logical Philosophy*, Jagiellonian University Press, Kraków 1999, pp. 59–84.

⁵ I would like to stress the word „philosophy”. It is perhaps the most important observation that the beginnings of many-valued logic in Poland were caused by philosophical, not mathematical or formal, factors.

⁶ K. Twardowski, *Über die sogenannten relativen Wahrheiten*, “Archiv für systematische Philosophie” 1900, no. 8, pp. 415–447; repr. in: *idem*, *Logischer Rationalismus. Ausgewählte Schriften der Lemberg-Warschauer Schule*, eds. D. Pearce, J. Wolenski, Athenäum, Frankfurt am Main 1988, pp. 38–58; Eng. trans. by A. Szylewicz, in: *idem*, *On Actions, Products and Other Philosophical Problems*, eds. J. Brandl, J. Wolenski, Rodopi, Amsterdam 1999.

(2) if a proposition A is true at the moment t , it is also true at any earlier moment t_e .

The content of (2) gives that truth is sempiternal: if something is true, it was true forever. The second subthesis is captured by

(3) if a proposition A is true at the moment t , it is also true at any other future moment t_f .

This last sentence expresses the principle of truth-eternality: if something is true, it will be true forever (*facta infecta fieri non possunt*).

Twardowski's view about truth was commonly accepted in Poland until 1910. In this year, Łukasiewicz published a book on the principle of contradiction (PC, for brevity) in Aristotle and a short abstract reporting on his lecture about the principle of the excluded middle (EM, for brevity). In the book, Łukasiewicz investigated the status of contradiction.⁷ He argued that it was not an obvious logical rule, even for Aristotle. Then, Łukasiewicz outlined the idea of non-Aristotelian logic, that is, logic in which PC does not hold. According to Łukasiewicz, nothing excludes this kind of logic as a basis for correct inferences.⁸ Finally, Łukasiewicz argued that we accept PC not, however, on theoretical grounds, but relative to our moral needs in order to maintain the difference between lying and truth-telling. Łukasiewicz did not propose in his book any formal system of non-Aristotelian logic, but clearly maintained that a revision of logic would be possible.

⁷ See V. Raspa, *Łukasiewicz on the Principle of Contradiction*, "Journal of Philosophical Research" 1999, vol. XXIV, pp. 57–112.

⁸ However, it is not quite clear, on Łukasiewicz's plan, whether non-Aristotelian logic only excludes PC from the stock of logical laws or perhaps validates its negation. It was later when Łukasiewicz clearly distinguished two things: A is rejected, that is, not- A is asserted, and A is neither asserted nor rejected.

For our story, Łukasiewicz's paper on EM is perhaps more relevant. The final passage of this one-page paper is as follows:

It is doubtful whether the principle of excluded middle holds for general objects, such as triangle in general or man in general. These objects seem to be defined only with respect to *essential* properties of subordinate objects but not with respect to *accidental* properties of them [...] With regard to real objects, the principle of the excluded middle seems to be closely connected with the postulate of universal *determination* of phenomena, not only present and past but also future ones. Were someone to deny that all future phenomena are today already predetermined in all respects, if it is correct, will perhaps explain those practical motives which lead us to acceptance of the principle of excluded middle.⁹

The last fragment formulates the view usually called 'logical determinism', that is, the view asserting a logical connection between EM and determinism. Although Łukasiewicz, at first, speaks loosely about a close connection, the subsequent sentences suggest that EM implies determinism because we read that denying the latter forces ("probably" looks like a rhetorical figure) the rejection of the former. The limitation of the applicability of EM in the case of general objects (I do not discuss whether Łukasiewicz's related view is correct or not) was another reason to think about a revision of classical logic. At this point, Łukasiewicz was influenced by Alexius Meinong.¹⁰

⁹ J. Łukasiewicz, *O zasadzie wyłączonego środka (On the Principle of the Excluded Middle)*, "Przegląd Filozoficzny" 1910, no. 13, pp. 372–373; Eng. trans. by J. Woleński and P. Simons, in: "History and Philosophy of Logic" 1987, no. 8, p. 69.; all page-references in this paper are to Eng. trans. if they exist.

¹⁰ See translator's introduction to Eng. trans. of *ibidem*, and P. Simons, *Łukasiewicz, Meinong, and Many-Valued Logic*, [in:] *The Lvov-Warsaw School and the Vienna Circle*, ed. K. Szaniawski, Kluwer, Dordrecht 1989, pp. 249–292; repr. in: *idem, Philosophy and Logic in Central Europe Selected Essays*, Kluwer, Dordrecht 1992, pp. 193–225. Meinong was probably the only foreign philosopher who exerted some influence in the Elary development of many-valued logic in Poland.

In 1911, Łukasiewicz delivered a lecture devoted to the concept of logical values. Since the abstract consists only of 3 sentences, I will quote the full text:

The speaker counts truth, falsehood and probability as logical values. Logical values are quantities and can be calculated. The speaker presented his view concerning the essence of probable sentences and formulated a rule of logical values, discovered by him: The logical value of the antecedent cannot be greater than the logical value of the consequent.¹¹

In order to avoid any historical misunderstandings, views expressed in this abstract are related to Łukasiewicz's studies on the concept of probability, not to many-valued logic.¹² The alluded view about the essence of probable sentences consisted in regarding them as indefinite. However, Łukasiewicz interpreted indefinite sentences as open formulas, not as genuine sentences, although he clearly looked for a way out of two-valueness. The rule of logical values discovered by Łukasiewicz is perhaps closer to many-valued logic than the idea of probability as the third value. Let us consider properties of implication in many-valued logic. Assume that 1 (truth) is the designated value and consider when the formula $A \Rightarrow B$ takes the designated value. The answer is: $v(A \Rightarrow B) = 1$ if and only if $v(A) \leq v(B)$. The formulation occurring in the quoted abstract is not precise, because Łukasiewicz should add that; "provided that implication is true" or "consequent logically follows from antecedent". On the other hand, it is probable that this connection played an important role in Łukasiewicz's further investigations about many-valued logic.

¹¹ J. Łukasiewicz, *O wartościach logicznych (On Logical Values)*. [in:] "Ruch Filozoficzny" 1911, vol. I, no. 3, p. 52.

¹² See *idem, Die logischen Grundlagen der Wahrscheinlichkeitsrechnung*, Polska Akademia Umiejętności, Kraków 1913; Eng. trans. (partial) by O. Wojtasiewicz in: J. Łukasiewicz, *Selected Works, op. cit.*, pp. 16–63.; see also *idem, W sprawie odwracalności stosunku racji i następstwa (On the Reversibility of the Antecedent-Consequent Relation)*, "Przegląd Filozoficzny" 1913, no. 16, pp. 98–110.

Tadeusz Kotarbiński was the next Polish author who entered the scene.¹³ He accepted (3), but rejected (2), because he argued that sempiternality of truth was at odds with human freedom.¹⁴ Assume that A is assertion about a human creative action a . Until a begins to exist, A cannot be true, because truth, following Franz Brentano, consists in asserting objects. What about falsity of A ? If A were false, its negation would be eternally false (by (3)). However, contrary to our assumption, a could not be a creative action. This means that A is indefinite, that is, neither true nor false. This fact raises the problem of the validity of EM. It holds in the following form:

(4) for any A , A is definite or indefinite,

but not with respect to the situation in which bivalence (every sentence is either true or false) has no exception. It is very likely that Kotarbiński was inspired by Łukasiewicz's talk about the excluded middle in 1910, because he considered the problem of logical determinism. On the other hand, Kotarbiński introduced into Poland the idea that there are sentences which are indefinite, that is, neither true nor false.¹⁵

Kotarbiński's paper was extensively criticized by Stanisław Leśniewski.¹⁶ Leśniewski accepted (1) in its unrestricted version, that

¹³ See T. Kotarbiński, *Zagadnienie istnienia przyszłości (The Problem of the Existence of the Future)*, "Przegląd Filozoficzny" 1913, no. 16, pp. 74–92; Eng. trans. "Polish Review" 1968, vol. 13, no. 3, pp. 7–22, and J. Woleński, *Kotarbiński, Many-Valued Logic and Truth*, [in:] *Kotarbiński: Logic, Semantics and Ontology*, ed. J. Wolenski, Kluwer, Dordrecht 1990 for a more extensive comments about Kotarbiński's related views.

¹⁴ Kotarbiński limited (2) only to natural facts, and excluded sentences about human creative actions from the scope of validity of (2).

¹⁵ Some authors, like H. Greniewski in: *2n+1 wartości logicznych (2n+1 Logical Values)*, "Studia Filozoficzne" 1957, no. 1, pp. 82–115 argue that this idea was so important that Kotarbiński should be regarded as the father of many-valued logic.

¹⁶ S. Leśniewski, *Krytyka logicznej zasady wyłączonego środka (The Critique of the Logical Principle of the Excluded Middle)*, "Przegląd Filozoficzny" 1913, no. 16, pp. 315–352; Eng. trans. by S.J. Surma and J. Wójcik, in: S. Leśniewski, *Collected*

is, comprising (2) and (3). According to Leśniewski, PC is provable, EM is limited because it is not applicable to inconsistent objects although this fact does not force any revision of classical logic for its existential assumption, and there are no indefinite propositions. Leśniewski's main task was to prove that (2) and (3) are logically equivalent.¹⁷ Leśniewski was never attracted to many-valued logic. It is known that he lectured on this subject in the thirties, but he regarded many-valued logic as a purely formal construction without any intuitive interpretation. Philosophically, he radically defended the view that truth is fully absolute and argued that many-valuedness opened the door for relativism and pragmatism. Also Twardowski took Leśniewski's side in this controversy.¹⁸ Kotarbiński became convinced by his opponents and, later, he never defended many-valued logic. The Kotarbiński-Leśniewski debate finished the first period of the Polish story.

Łukasiewicz was silent about the topic until 1917. In 1918, he left the university for the position of the Minister of Education in the Polish government under Ignacy Paderewski as the Prime Minister. On March 7, 1918, Łukasiewicz delivered a talk, usually referred to as "Farewell Lecture". It begins with the following words:

Papers, eds. S.J. Surma, J.T. Szrednicki, D.I. Barnett, V.F. Rickey, Kluwer, Dordrecht 1992, pp. 47–85; S. Leśniewski, *Czy prawda jest tylko wieczna czy też i wieczna i odwieczna? (Is Truth Only Eternal or Both Eternal and Preeternal?)*, "Nowe Tory" 1813, no. 18, pp. 493–528; Eng. trans. (with the title: *Is All Truth Only True Eternally or Is It Also True Without a Beginning?*) by S.J. Surma and J. Wojcik, in: S. Leśniewski, *Collected Papers*, *op. cit.*, pp. 86–114.

¹⁷ Unfortunately, I cannot reproduce here Lesniewski's proof which still waits for a detailed analysis. I guess that Lesniewski is right, although his proof requires *reductio ad absurdum*. Anyway, even with this proviso which points out, that classical, i.e., two-valued logic is essentially involved here, Lesniewski's result is extremely interesting, because it shows that if one is bothered by sempiternality, it also concerns eternity. On the other had, eternity was never questioned even in the context of classical logic.

¹⁸ K. Twardowski, *Wykłady z teorii poznania w r. a. 1924–25 (Theory of Knowledge. A Lecture Course 1924–25)*, "Archiwum Historii Filozofii i Myśli Społecznej" 1975, vol. 21; trans. into English in K. Twardowski, *On Actions, Products and Other Topics in Philosophy*.

In this farewell lecture I wish to offer a synthesis of my research, based on autobiographical confessions. I wish to describe the emotional background against which my views were developed.¹⁹

Then, we find a very passionate attack on any coercion which could limit human creative freedom. However, Łukasiewicz remarks that we must tolerate logical coercion consisting in following principles of logic and mathematics. However, as Łukasiewicz notes, Aristotelian logic forces determinism, that is, the view that necessity governs all events, including human actions. What can a scientist do in order to overcome determinism? Łukasiewicz answers:

He has two paths to choose from: either to submerge himself in scepticism and abandon research, or *to come to grips with the concept of science based on Aristotelian logic*. I have chosen the second path.²⁰

After providing an outline of natural science as a creative product of human mind, Łukasiewicz comes to logical matters:

Logical coercion is most strongly manifested *in a priori sciences*. Here the contest was the strongest. In 1910 I published a book on the principle of contradiction in Aristotle's work, in which I strove to demonstrate that that principle is not so self-evident as it is believed to be. Even then I strove to construct non-Aristotelian logic but, in vain.

Now I believe to have succeeded in this. My path was indicated to me by *antinomies*, which prove that there is a gap in Aristotle's logic. Filling this gap led me to a transformation of the traditional principles of logic.

Examination of this issue was the subject-matter of my last lectures. I have proved that in addition to true and false propositions there

¹⁹ J. Łukasiewicz, *Wykład pożegnalny, 7 III 1918 (Farewell Lecture, March 7, 1918)*, Warsaw 1918; Eng. trans. by O. Wojtasiewicz, in *idem, Selected Works, op. cit.*, p. 84.

²⁰ *Ibidem*, p. 85.

are *possible* propositions, to which objective possibility corresponds as a third in addition to being and nonbeing.

This gave rise to a system of *three-valued logic*, which I worked out in detail last summer. That system is as coherent and self-consistent as Aristotle's logic, and is much richer in laws and formulae.²¹

The end of the text returns to general ethical problems. As expected, Łukasiewicz claims that he solved the problem of human freedom.

Unfortunately, no record of Łukasiewicz's course in 1917–1918 was preserved.²² Thus, we cannot say with any certainty what his 1917 three-valued logic looked like. There is one mysterious point connected with Łukasiewicz's statement that his three-valued logic "is much richer in laws and formulas", although it is well-known that it is poorer. In order to answer this question we must turn to Łukasiewicz's papers published in 1920, namely two abstracts and an essay on two-valued logic. I will start with the latter.²³ It was conceived as an introduction to an extensive work on three-valued logic. Just at the beginning, Łukasiewicz says that two-valued logic is constructed in his paper in such a way that three-valued logic becomes a natural extension of it. However, Łukasiewicz never completed his announced (in 1920) work on three-valued logic. Why? We can only speculate that he was probably disappointed by something. What? Perhaps by the concept of extension of a logical system, not defined in his paper on two-valued logic. Leaving speculations aside, let us go onto firmer ground. The way of doing logic presented in the reported essay consists of using quite a rich language: connectives, quantifiers binding propositional variables, and propositional constants 1 (truth) and 0 (falsity). Theorems are mostly formulated as equations. In sum, the system links the tradition of algebra of logic with the way of building

²¹ *Ibidem*, p. 86.

²² Łukasiewicz mentions this course in his letter to Czesław Lejewski (December 27, 1951), but it does not include any information about its content.

²³ It seems that Łukasiewicz invented the name „two-valued logic”.

logic offered by Frege and *Principia Mathematica*. I assume that, according to the logical ideals shared by Łukasiewicz since the twenties, this system was very far from perfection. Since the Warsaw school of logic worked out its own very high logical standards very early (at the beginnings of the twenties, in fact), Łukasiewicz was dissatisfied with the “hybrid” system of 1920. When formal matters became clearer, the concept of the extension of logic presented itself as more complicated than Łukasiewicz had earlier assumed. In particular, it was obvious that many-valued logic could not be regarded as a simple extension of a two-valued system. However, it is certain that Łukasiewicz used the old method in constructing three-valued logic in 1917–1920, and he could think that the extension of language leads to an extension of logic. In fact, since we have no constants in three-valued logic, we have also new formulas, not expressible in the language of two-valued system. Apparently, we also have new theorems, that is, new equations, but since Łukasiewicz was not conscious of the problem of mutual interpretation of different logics, he came to an erroneous conclusion that he had obtained a richer system than two-valued logic. These matters were clarified later, mainly due to the works of Łukasiewicz and his students.

Łukasiewicz’s abstracts (*On the Concept of Possibility, On Three-Valued Logic*) published in 1920, reported his talks delivered in Lvov in the same year.²⁴ In his talk about possibility, Łukasiewicz proved that there is no matrix characterization of possibility, understood as an extensional oneplaced sentential functor, in two-valued logic. The pro-

²⁴ It seems that both talks (June 5, 1920, June 19, 1920) were sensational. Evidence is provided by the fact that Kazimierz Ajdukiewicz wrote two reports which were published in a newspaper in Lvov; see Ajdukiewicz’s items listed in bibliography. In fact, both abstracts, especially the second one, decide that the priority of inventing formal many-valued systems should be attributed to Łukasiewicz. Although Stanisław Jaśkowski, Adolf Lindenbaum, Bolesław Sobociński, Jerzy Słupecki, Alfred Tarski and Mordechaj Wajsberg (all students of Łukasiewicz and Lesniewski) essentially contributed to the development of many-valued logic, Łukasiewicz was the first father. In particular, it is unfair to refer to many-valued logic as „Łukasiewicz-Tarski logic”. Since this label was quite frequently used, Łukasiewicz protested against this custom. He was right, but this historical mistake still occurs in logical works.

viso that the extensional understanding of possibility be assumed is of the utmost importance.²⁵ One can wonder why Łukasiewicz did not try to use the Lewis-style extension of propositional logic to modal logic. He did not because extensionality was, for him, a dogma. Thus, Łukasiewicz always looked for an extensional interpretation of possibility, and he adopted many-valued logic as the basis for his modal logic, just because the two-valued system failed modulo extensionality.

Łukasiewicz's lecture on three-valued logic must be considered as fairly revolutionary, because it offered the first formal outline of three-valued logic.²⁶ In particular, Łukasiewicz formulated identities which lead to matrix characterization of logical constants in three-valued logic, for example $v(A) = 1/2 \Leftrightarrow v(\neg A) = 1/2$. Łukasiewicz also observed that some twovalued theorems failed in three-valued logic. This concerns, in particular, PC and EM which are only possible, that is, take the third value, if $v(A) = 1/2$. The formula (in the symbolism used by Łukasiewicz in 1920) $(A = \neg A) = 0$ is false, if $v(A) = 1/2$, and Łukasiewicz concludes from this fact that three-valued logic, for him, is free of antinomies. It explains the fragment of the "Farewell Lecture" in which Łukasiewicz notes that he was also guided by the problem of logical antinomies in constructing three-valued system of logic.²⁷ The abstract ends with the following words:

The present author is of the opinion that the three-valued logic has above all theoretical importance as an endeavour to construct a system

²⁵ The „extensional interpretation” means here that sentential functors are truth-functional: the value of compound sentences depends solely on the values of subsentences.

²⁶ Remember, however, that we do not know what Łukasiewicz said in his course in 1917–1918.

²⁷ This question was also investigated by Franciszek Smolka, doubtless, under Łukasiewicz's influence. Smolka, in his talk delivered in Lvov in 1920 (shortly after Łukasiewicz's presentations) opposed to the view that many-valued logic could solve the problem of antinomies. Instead, Smolka proposed an application of three-valued logic to the interpretation of temporally indefinite propositions. See F. Smolka, *Paradoksy logiczne a logika wielowartościowa (Logical Paradoxes and Many-Valued Logic)*, "Ruch Filozoficzny" 1919–1920, no. 5, p. 171. This is only a brief summary of Smolka's conclusions. The full text was never published.

of non-Aristotelian logic. Whether a new system of logic has any practical importance will be seen only when logical phenomena, especially those in deductive science, are thoroughly examined, and when the consequences of the indeterministic philosophy, which is the metaphysical substratum of the new logic, can be compared with empirical data.²⁸

Łukasiewicz's Rectorial Address finishes, as I already noted, the pioneering era in Poland. Łukasiewicz once more notes a connection between determinism, indeterminism and many-valued logic, but he considers logic now as ontologically free. It means that logic is not dependent on ontological assumptions. Łukasiewicz further defends indeterminism. He gives a famous interpretation of future contingents as referring to indeterminate future. His account of causal chains and the ontological status of future events explains how and why future contingents gave the third logical value until their realization. However, according to Łukasiewicz, logic is dictated not by ontology, but by metalogical assumptions. Further, Łukasiewicz notes that the problem of future contingents was investigated by Aristotle who suggested that they could be interpreted as indefinite propositions. Łukasiewicz concludes:

Aristotle's reasoning does not undermine so much the principle of the excluded middle as one of the basic principles of our entire logic, which he himself was the first to state, namely, that *every proposition is either true or false*. That is, it can assume one and only one of two truth-values: truth or falsity. I call this principle *the principle of bivalence*. In ancient times this principle was emphatically defended by the Stoics²⁹ and opposed by the Epicureans, both parties being fully aware of the issues involved. Because it lies at the very foundations of logic, the

²⁸ J. Łukasiewicz, *O logice trójwartościowej (On Three-Valued Logic)*, *op. cit.*, p. 88.

²⁹ This is why Łukasiewicz, in his later works, proposed to call many-valued logic „non-Chrysippean”, not „non-Aristotelian”.

principle under discussions cannot be proved. One can only believe it, and he alone who considers it self-evident believes it. To me, personally, the principle of bivalence does not appear to be self-evident. Therefore I am entitled not to recognize it, and to accept that besides truth and falsehood there exist other truth-values, including at least one more, the third truth-value.³⁰

What Łukasiewicz argues for is that ontology is involved as far as the matter concerns metalogic. Hence, many-valued logic does not consist in rejecting this or that logical principle, for instance, PC or EM, but it depends on a metalogical decision concerning the law of bivalence. This view leads to a completely new account of many-valued (or more generally: non-classical) logic which radically separates formal logical constructions from their philosophical background. This new philosophy of logic allowed formal tools to develop independently of philosophical views associated with particular logics. It was the environment for a very successful development of many-valued logic in Poland in 1920–1939. On the other hand, it also allowed discussions about the plausible intuitive interpretation of many-valued logic, if someone was interested in this business; Łukasiewicz was, but his students to a lesser extent.

Summing up, four factors caused the rise and further development of many-valued logic in Poland,³¹ Firstly, the development of mathematical logic in general which provided formal tools.³² Secondly, various philosophical speculations suggesting a revision of classical logic.³³ Thirdly, reflection about the history of logic showed that related

³⁰ *Idem*, *O zasadzie sprzeczności u Arystotelesa (On the Principle of Contradiction in Aristotle)*, Polska Akademia Umiejętności, Kraków 1910; Ger. trans. by J. Barski, *Über den Satz des Widerspruchs bei Aristoteles*, Hildesheim 1993.

³¹ See *idem*, *Geneza logiki trójwartościowej (The Genesis of Three-Valued Logic)*, “Nauka Polska” 1939, no. XXIV, pp. 215–223.

³² Łukasiewicz regarded the birth of mathematical logic as the very revolution, and he maintained that many-valued logic as a logic would be impossible without mathematical tools.

³³ Due to Łukasiewicz’s attitude mentioned in the previous note, he later underestimated informal philosophical arguments for many-valueness, although he always

problems bothered great masters of the past, especially Aristotle and the Stoics. Fourthly, relatively early awareness that the key problem lies in metalogic, and not in particular logical laws. The lucky combination of these ingredients caused that Polish logicians gave, very early, formal and philosophical works related to many-valued logic. Even if Łukasiewicz exaggerated (in fact, he did) the significance of his discovery, the Polish connection in the history of non-classical logic provides a quite fascinating case.

believed into indeterminism. In particular, Łukasiewicz was disappointed by his early book on Aristotle as too philosophical. He even said (in a letter to J. M. Bochenski) that, according to his impressions, someone else was the author. On the other hand, however, Łukasiewicz began to translate this book into English after 1945.