ON POLISH LOGIC
from a historical perspective

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In this talk, we will look at the development of Polish logic in the 20th century, and its main phases. There is no attempt at giving a complete history of this rich subject. This is a light introduction, from my personal perspective as a Polish student and professional logician over the last 40 years. But for a start, to understand Polish logic, you also need to understand a bit of Polish history.

1 Poland in the 20th century[2]

Polish logic and the logic of Poland's history are tied together by a force that lifted the country from "decline" and "truncation" at times when national independence and freedom of thought and speech were inseparable.

Take a glance at the maps that you see here: medieval Poland under the Jagiellonian dynasty in the 17th century, and 20th century Poland with its borders after the First World War (1918) and the Second World War (1945):

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[1] I would like to thank Johan van Benthem for his crucial help in preparing this text.

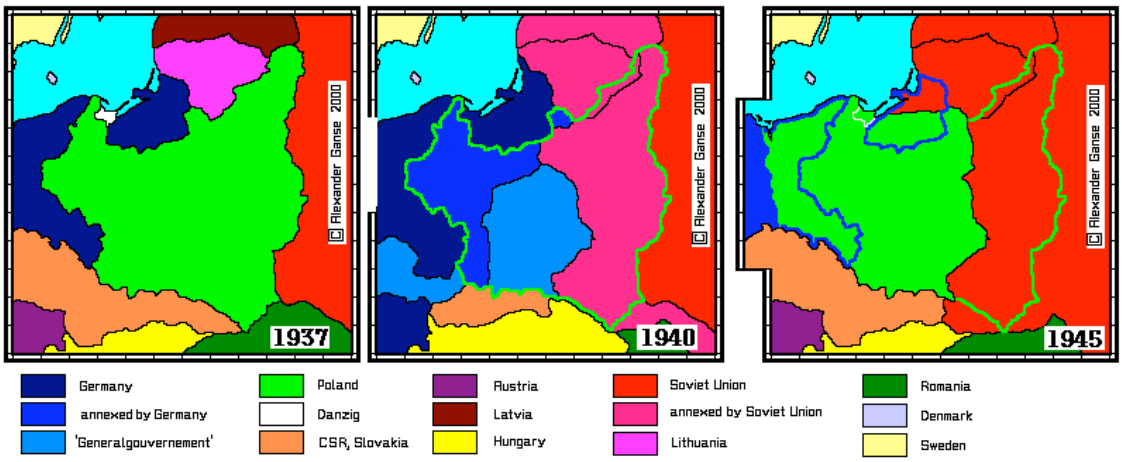
[2] We rely heavily on Roman Marcinek, 2005. *Poland. A Guide Book*, Kluszczynski, Krakow.

Under the Wettin dynasty in the 18th c., Poland was a pawn in the hands of foreign rulers. The attempt to abolish Russian domination ended in the First Partition of Poland, among Russia, Austria and Prussia (1772). Attempts at reform (Constitution of 3 May 1791) were blocked by Poland's neighbours, and internal opposition (Targowica, 1792). The Second and Third Partitions (1793, 1795) and the Kosciuszko Insurrection (1794) sealed Poland's fate.

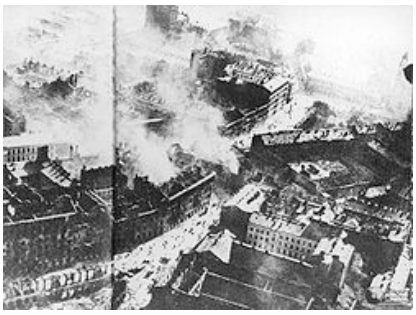
Hopes of independence were revived by heroic attempts of many. During the First World War (1914-1918) Polish volunteers fought both on the side of Prussia and Austria (Piłsudski's Legion) and Russia (Puławy Legion). Following revolutions in Russia and Germany, the Poles were in a position to claim independence. On November 11, 1918, Józef Piłsudski took control of Poland as Head of State. Since that date, Poland has been independent.

Many Poles dreamt of reestablishing the borders of 1772, which included Lithuania and Belarus and most of the Ukraine (with Lvov). While efforts were under way to rebuild the newly independent state and win international recognition, heavy fighting went on at its borders (Polish-Soviet War, 1919-20; Silesian Uprisings, 1919-21). On March 17th 1921 Poland ratified its final constitution. On May 1926, Piłsudski acted to restore law and order. The economy rebounded. Polish culture, arts and science could develop freely. Poland seemed to be safe.

But history intervened. The invasion by Germany on 1 September 1939 and the Soviet Union on 17 September 1939 begins the Second World War. Poland was again divided, under the Nazi-Soviet pact of 23 August 1939:



A period of unprecedented persecution and extermination of Polish citizens (especially Polish Jews) began, as well as massive scale pillage. A Polish Government-in-Exile was constituted. Likewise, the Polish Armed Forces were established, fighting hand in hand with the Allies (Narvik, Batle of Britain, Tobruk, Monte Casino). On the home front in Poland itself, the resistance movement gradually evolved into an Underground State. Teaching was conducted in secret. Still, scientific and cultural activity was broken.



Warsaw after a bombing

The reconstructed royal palace

At Teheran (1943) and Yalta (1945), the "Big Three" decided to include Poland in the post-word Soviet zone of influence. The new rulers used terror (the notorious UB secret police) and the assistance of Soviet troops, while also rigging elections. The new political system was modified after Stalin's death in 1956, but after that, liberal policies were gradually abandoned. Student riots in 1968 were brutally suppressed, and two years later army and police massacred workers on strike in several towns on the Baltic coast. In August 1980, strikes at the Gdansk Shipyard and other enterprises led to an independent trade union "Solidarity" (under the leadership of Lech Walesa). The period of relative political freedom was cut short by the declaration of martial law, introduced on December 1981. The last years of communist rule in Poland were marked by a stagnant economy and social apathy.

Round table talks between the government and the opposition in Spring 1989 led to a partly democratic election in June 1989, that was a sweeping victory for the opposition. Poland was finally on the way towards economic recovery

and consolidation of its sovereignty (also through memberships in NATO). Today, the Republic of Poland is a member state of the European Union.

2 How the Polish logic tradition started around 1900

Now that we have seen the historical background, here is the scientific story. We cannot talk about Polish Logic without noting the achievements of The Lvov-Warsaw School and The Warsaw Logical School, that grew out of the former. How did these arise?

The Lvov-Warsaw School

The Lvov-Warsaw School was founded at the end of the 19th century and carried out its activity until the Second World War. Its founder was Kazimierz Twardowski – an associate of Franz Brentano – who, at the age of 29 (in 1895) was appointed professor of philosophy in Lvov, then an Austrian town.

Kazimierz Twardowski

Professor Twardowski was a man with a special charisma as a teacher and tutor, uniquely tied to ordinary friendliness, which built the community of the School. He promoted more than 30 Ph.D. students, who earned their professorships. During the inter-war period, his former students held chairs in philosophy departments at all of the Polish universities, with the exception of the Catholic University of Lublin. Among the characteristic features of the

School were its serious approach to philosophical studies and teaching of philosophy, dealing with philosophy and propagation of it as an intellectual and moral mission, passion for clarity and precision, as well as exchange of thoughts, cooperation with representatives of other disciplines at home and abroad, and also fruitful collaboration with mathematicians. The School found its own scientific style of 'philosophizing' and drew Polish philosophers closer to the world stream of modernization in philosophy. It met international standards of training, rigor, professionalism and specialization.

The Lvov-Warsaw School was the first philosophical school in Poland. At the same time, it was a community that managed to establish contacts between its philosophers and the world philosophy.

3 The Warsaw School: its main figures and ideas

The cooperation of the Lvov-Warsaw philosophers with mathematicians evolved to a great logical school based in Warsaw. The Warsaw Logical School functioned during the interbellum, with double roots: philosophical and mathematical. The School maintained a close contact between its logicians and philosophers, in particular Tadeusz Kotarbinski, by joint seminars run by the individual scholars.

Stanislaw Lesniewski (1886–1939) and Jan Lukasiewicz (1878–1956), the School's founders, were logicians, philosophers, mathematicians, graduated at Lvov. They continued the philosophical thoughts, teaching methods and of scientific research organization of Kazimierz Twardowski, and protagonists of formal techniques in science, similar to those applied in mathematics.

Lukasiewicz, who lectured at Warsaw University from 1915, Lesniewski, a professor of the philosophy of mathematics at Warsaw since 1919, and their student, Alfred Tarski, who obtained his doctor's degree in 1924 with an impressive scientific output already at that time, are the three outstanding representatives of the Warsaw School of Logic:



Lukasiewicz *Lesniewski* *Tarski*

Other well-known members were: Adolf Lindenbaum, Stanislaw Jaskowski, Mordechaj Wajsberg, Mojzesz Presburger, Andrzej Mostowski, Wanda Szmielew, Jerzy Slupecki (my teacher), and Boleslaw Sobocinski. All were mathematicians, with the exception of the last who graduated in philosophy. (I omit other famous Polish philosophers such as Tadeusz Kotarbinski, Kazimierz Ajdukiewicz, Tadeusz Czezowski, Wladysław Tatarkiewicz – as their interests were concerned with the Lvov center rather than the Warsaw School.)

In the Warsaw Logical School, unprecedented results were achieved, sometimes even in Master's theses. As Heinrich Scholz from Münster stated:

> "*Warsaw became the main centre of logical studies*".

Thus, in the lifetime of one generation, 'Polish' logic grew from ground level to the acme of international acclaim. In the book of A. Fraenkel, Y. Bar-Hillel, *Foundations of Set Theory* (Amsterdam 1958, p. 200), it is stated that:

> "*Probably no other country, taking into account the size of its population, has contributed so greatly to the development of mathematical logic and foundations of mathematics as Poland*"
>
> *and that: "this curious fact should be explained sociologically."*

The masters – Lesniewski, Łukasiewicz and Tarski – were individualists with different personalities, so they 'shaped' their students in many ways. It is said that the first – Lesniewski – invested the School with the need for synthesis, the second – Łukasiewicz – gave it its dynamics, and the third – Tarski – the contact with mathematics. As Jan Wolenski writes, there were no divisions in the School into 'old' and 'young', 'beginner' and 'advanced'.

The School had a strong accent on cooperation, irrespective of social position, viewpoints, or character of members. Thus, it combined scientists active in public and academic life (Łukasiewicz was a Minister of Religious Denominations and Public Enlightenment, as well as Deputy President of Warsaw University and twice President of this University) with modest secondary school teachers (Mordechaj Wajsberg, Jerzy Słupecki) – and from the well-off (like Adolf Lindenbaum) to the rather poor, like Alfred Tarski.

Members also differed in socio-political and religious views, or personality traits: Łukasiewicz and Sobocinski adhered to a conservative ideology, whereas Lindenbaum and Presburger were inclined towards communism, some were devout Catholics, others followers of Judaism, or atheists. With the exception of the bitter Lesniewski, most were persons of tender heart. Whatever their differences, they were united around one common scientific idea, the charisma of their teachers, awareness of their exceptionality, and also the role they played in the development of logic in their world.

Now, I would like to present some main characteristics and achievements of the Warsaw School (following Słupecki 1972).

Characteristics of the Warsaw School

The problems the School dealt with mostly belong to mathematical logic. Still, it all started in philosophy. Both Łukasiewicz and Lesniewski earned their doctor's degrees in philosophy at the University of Lvov: the first – in 1902, and the other – in 1912, both under the supervision of Kazimierz Twardowski.

Lukasiewicz started with methodology of empirical sciences. However, in 1910, in his monograph *About the Principle of Contradiction in Aristotle*, he added a short lecture on 'algebraic logic'. The works by Lukasiewicz, beside those by Jan Sleszynski, are the first Polish works in mathematical logic. Lukasiewicz never resumed his research into the methodology of science.

On the other hand, Lesniewski's studies in the time before the First World War concerned – primarily – problems of semantics of colloquial language and antinomies. Some ten years afterwards, Lesniewski commented:

> *"I greatly worry about the fact that [these works] were published at all. I would like to disown them […] and acknowledge their bankruptcy […].*

The philosophical education of the founders of the Warsaw School had a strong influence on their output in mathematical logic, and on their disciples. A feature of the School that made it different from other contemporary and later schools of mathematical logic is the great care for the intuitive values of their studies. Thus, according to Lesniewski, the intuitive difficulties that stem from early work in mathematical logic:

> *"can discourage a great number of scientists from dealing with 'logistic', those who are not content with the very delight of putting down signs and transforming formulas and who – contrary to advocates of nonsensical nature of mathematics (there happen to be some of those) – wish to realize the significance of the formulae being transformed, respectively – make themselves aware of 'about what' and 'what' one tries to conclude with the help of the formulae".*

The representatives of the Warsaw School of Logic tied philosophical questions to those of formal logic, solving classical problems of philosophy by its means. For instance, Lukasiewicz was convinced that the three-valued logic he had created indeed cast new light on the problem of determinism.

In the famous work *The Concept of Truth in Languages of Deductive Sciences* (published in Polish in 1933 and translated into several languages), Tarski solved one of the fundamental questions of the theory of knowledge in such an undisputable manner that probably no other account could claim.

Lesniewski called himself a 'philosopher-apostate', while Lukasiewicz always considered himself a philosopher. Still, Lukasiewicz did some purely formal work, while to Lesniewski, logic was always a tool for philosophical questions.

Another characteristic feature of the Warsaw School of Logic was a drive towards full, precise and, if possible, easy solutions of problems. Lukasiewicz called this 'perfectionism' and it caused the Warsaw logicians to frequently release their results with a delay, at the risk of losing priority. They took delight in formally perfecting the systems they built, simplifying their axioms several times. The peak achievement was reduction of a system of axioms to only one, and that as short as possible, written by means of possibly a small number of symbols. The most surprising results in this area were achieved by Łukasiewicz and Sobocinski, and it is worth recalling that Łukasiewicz and Lesniewski created two types of original and inventive logical symbolism.

Methodology of the sentential calculus and Tarski's influence

A core subject in the Warsaw Logical School was methodology of the propositional calculus. Studies in this area were conducted on the initiative and under the guidance of Łukasiewicz. Tarski's results are among the most outstanding. Famous other contributions were made by Lindenbaum, or by Wajsberg on intuitionism, or Jaskowski's system of natural deduction.

Tarski's subsequent accomplishments extended to the methodology of all deductive systems. Starting from 1930, he initiated the abstract study of axiomatic systems, but also the by now standard semantic viewpoint of his paper *The Concept of Truth in Languages of Deductive Sciences* (1933).

Tarski led a very busy didactic activity at the University of Warsaw and his pupils, who obtained outstanding results already before the War, were Andrzej Mostowski and Wanda Szmielew. But you probably know as much about this as I do from the Tarski biography of Anita and Solomon Feferman!

A counterpoint: the work of Lesniewski

Another highly original strand in the Warsaw School was the work of Lesniewski. His greatest creation were the three systems that he called '*prototetics*', '*ontology*' and '*mereology*', trying to improve on the mathematical foundations of Russell and Whitehead. Especially, Lesniewski's ontology has continued to attract interest, for instance from Andrzej Grzegorczyk and Bar-Hillel, and in the early 1970s by Boguslaw Iwanus. But perhaps his most famous system is the mereology, studied by Tarski and many others, that still finds applications in geometry, biology, and linguistics today.

After Lesniewski's death, Stefan Mazurkiewicz expressed what many thought:

> *"His [Lesniewski's] lectures, both written and spoken – were successive floors of one magnificent and uniform building that he was erecting for over 20 years. The same features that give his studies such a high value, unlimited correctness and solidity, the unbounded will to reach the very foundations of investigated problems, power of dialectics, and acute sense of criticism – were introduced by him in all walks of life".*

The Warsaw school: characteristics and influence

The notion of a scientific school is a complex one. Members should address a common problem with common methods of investigation. The Warsaw School satisfied this to a high degree. Also, to call a center a *school*, it must enrich science with results that create a valuable whole. What was the contribution of the Warsaw School to world logic?

In 1967, a 400-page volume entitled *Polish Logic 1920-1939* (ed. S. McCall, Clarendon Press, Oxford 1967) was published. It contained translations of 17 articles by Polish logicians presented between 1920 and 1939. Except for two, all came from the Warsaw School. In 1970, the *Selected Works* of Łukasiewicz appeared (edited by J. Słupecki). Half were papers from the interwar period. In 1962, a several-hundred-page monograph by E.C. Luschei appeared under the title *The Logical Systems of Lesniewski.* A wide selection of Tarski's articles of the time before the War was the book *Logic, Semantics, Mathematics* in 1956 (translated by J.H. Woodger, Oxford 1956; second edition by John Corcoran, Hackett Publishing Company, Indianapolis, 1983).

A school can also be characterized by personal contacts of its members, an atmosphere of constant discussion and exchange of thoughts. The following excerpt from the introduction to *Elements of Mathematical Logic* by Łukasiewicz (1929) illustrates what the cooperation of logicians and mathematicians connected with Warsaw University looked like:

> *"I owe the most to the scientific atmosphere created at Warsaw University in the field of mathematical logic. It is in discussions with my colleagues, mainly Professor Lesniewski and Assistant Professor Tarski, and often also with students of theirs and mine that I had a chance to comprehend many a notion, absorb new ways of expressing myself, and learning many a new result whatever their authors were like."*

4 Polish Logic after the Second World War

1939 was the last year in the activity of the Warsaw School. Just before the War, Lesniewski died and Tarski left for the United States. During the War Lindenbaum, Wajsberg and Presburger were killed. After the War, Łukasiewicz, Sobocinski and Lejewski worked outside of Poland, and Jaskowski, Sadowski and Słupecki outside of Warsaw.

Polish logic never regained the international renown of the Warsaw School, not so much by losses in human resources as by a loss of rhythm in scientific and didactic activity. The irreparable losses to libraries, loss of manuscripts (including a monograph on Aristotle's syllogistics by Lukasiewicz, a work on the same topic by Slupecki, important manuscripts of Lesniewski) added to this. The reorganization of academic life, and lack of freedom in expressing thoughts, did not favour logic in the destroyed Poland and in the new Polish reality, either. Lvov found itself outside Poland (it has belonged to the Ukraine since the end of the War), Warsaw was completely destroyed.

In the context of these bitter facts, Alfred Tarski in exile shone all the more. As a Professor at Berkeley, he founded the great Californian School of Logic, that exerted a dominant influence on logic after the War. We may agree with Jan Wolenski, an expert in the history of world logic, who claimed that

> *"The most outstanding school of logic in the world after the Second World War was founded in California […]. The Californian School of Logic – because of Tarski – was in many ways similar to its Warsaw ancestor."*

Present-day Poland

The new Warsaw centre

After the War, a new center of logical studies in Warsaw was started by Andrzej Mostowski. Mostowski (1913-1975) – stayed in Warsaw at the time when the situation of logic was very difficult. Not much was left of the former center. Mostowski, on his own as a logician, kept close contacts with mathematicians like Kazimierz Kuratowski and Waclaw Sierpinski.

Mostowski's center in Warsaw, continuing Tarski's work in the foundations of mathematics, worked on set theory and issues in logic such as: decidability, algebraic and topological methods in logic, or model theory. Famous names around the center are Helena Rasiowa (she died in 1994) and Andrzej Grzegorczyk, who has continued the traditions of the Lvov-Warsaw and

Warsaw Schools until today as a logician, mathematician, philosopher and ethicist. To a new generation belong logicians like Zofia Adamowicz, Henryk Kotlarski, Michal Krynicki, and Marcin Mostowski. One persistent topic has been the logic of generalized quantifiers, started by Mostowski in 1957.

Other logicians from the Warsaw School went elsewhere in Poland. For instance, Jaskowski (1906-1965) – known as the inventor of natural deduction (1934), independently of Gentzen, in 1945 found himself in Torun (the city of Nicholas Copernicus), where he developed his scientific and didactic activity not only in the field of logic, but also in that of mathematics.

5 My teacher Jerzy Słupecki, his career and influence

My teacher Jerzy Słupecki (1904-1986) was a typical illustration of how the Warsaw School spread out in new ways. He was an ardent propagator of the work of Łukasiewicz, Lesniewski and Tarski. After the War, he found himself in Lublin and then in Wroclaw (1948). As his main scientific goal he chose to continue, popularize and extend the studies of the Warsaw Logical School. In particular, it is Słupecki's making Lesniewski's output more systematic and general, that made it accessible to a much wider audience.

Słupecki's interests during his studies concentrated on mathematical logic. He graduated in 1935 and his M.A., thesis, supervised by Łukasiewicz, won the award of the Department Council. At the start he pursued many-valued sentential logic. Let us call a many-valued calculus 'functionally complete' (or 'full' in the terminology of the time) if the truth-tables for its primitive connectives can define every possible truth-value function. Słupecki's first discovery was that 1) Łukasiewicz's three-valued system Ł is not functionally complete, and 2) extending the primitives of Ł with a suitable new functor *T* yields a system that is both functionally complete (1936; English version: *The full three-valued propositional calculus*, in: *Polish logic 1920-1939*, Oxford 1967, 335-337) and Post-complete (when adding two new axioms to Wajsberg's axiom system for Ł). In 1939 Słupecki formulated a famous criterion of fullness (*A criterion of fullness of many-valued systems of propositional logic*, Studia Logica 30 (1972), 153-157). He also proved that a broad class of functionally complete logics is finitely axiomatizable. These results are in his PhD. thesis *Dowód aksjomatyzowalności pełnych systemów wielowartościowego rachunku zdań* ["A proof of the axiomatizability of full systems of many-valued propositional calculus", 1938]. It was supervised by Łukasiewicz, and reviewed by the mathematician Waclaw Sierpinski. The thesis was translated into French and English (in *Studia Logica* (1971), 29,155-168). It established his scientific position, not only among the Warsaw logicians.

Significant meaning for logic and philosophy attaches to Słupecki's papers on the intuitive basis of many-valued logics. His papers (in Polish 1964; in English 1967) *Some remarks on the three-valued logic of J. Łukasiewicz*, Studia Logica 21 (1967), 45-70; co-authors: G. Bryll, T. Prucnal; in Russian 1974, "Nauka", Moskwa) see the issue differently from Łukasiewicz. He believed that it is possible to interpret the system L in a deterministic light, and he also considered some dialectic interpretations of Łukasiewicz's logics.

In another line, Słupecki's results on Aristotle's Syllogistic, first presented in a Warsaw seminar, 1938, are well-known, too (Lublin 1946, Wroclaw 1948, 1951 in English). His supervisor Jan Łukasiewicz described them as follows:

> "*the most historical discovery which has been made in the field of syllogistics since Aristotle,*" [and therefore:] "*systematic studies into Aristotle's syllogistics can be considered completed in a sense.*"

Logic in Wrocław

Słupecki defended his dissertation "On studies in Aristotle's Syllogistics" at the Jagiellonian University of Cracow (1947) and became a Full Professor in Wroclaw (1948). Wroclaw became the home of Słupecki, as for many displaced people from all over Poland, and expatriates from Lvov.

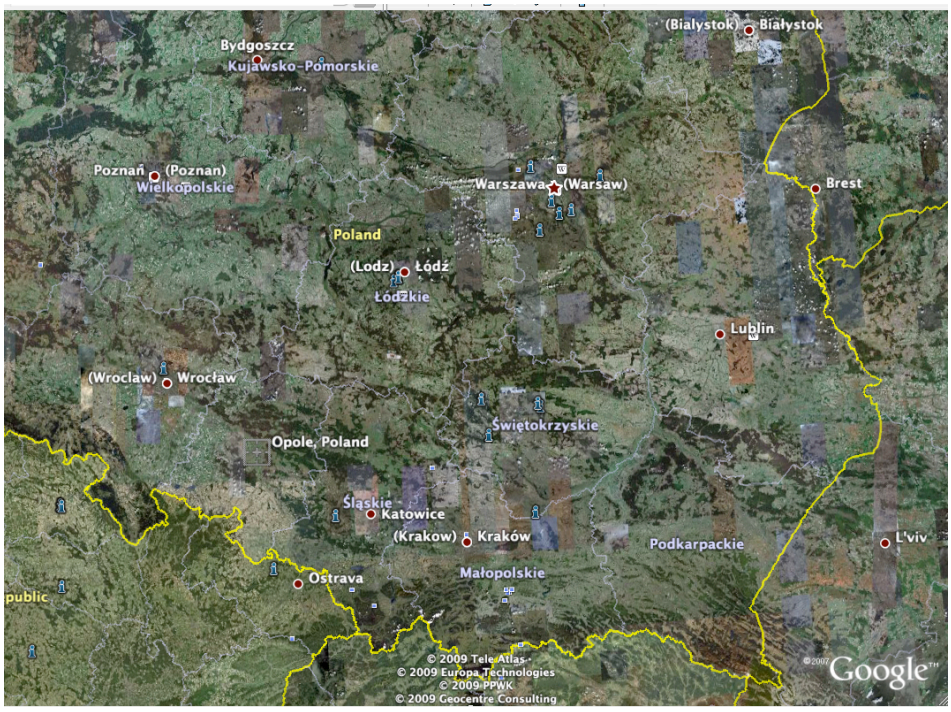
A strong group of logicians and philosophers gathered around Słupecki: Maria Lutmanowa-Kokoszynska, Bogusaw Iwanus, Tadeusz Kubinski, Ryszard Wójcicki and Słupecki's students and then co-workers: Ludwik Borkowski and Witold A. Pogorzelski. One striking feature were mutual cyclic seminars.

After the War, Wrocław gained the reputation of the leading logical center in Poland. In this context two names should be mentioned – Czesław Ryll-Nardzewski and Jerzy Łos - prominent logicians and mathematicians.

The Opole Centre

In 1950, Słupecki started working for the Opole Teacher Training College, 80 km to the east of Wrocław, where he founded his own center of logic. (It is also why I was asked by Słupecki to move from Wroclaw to Opole.) Here, he held the post of the President of the Teachers' Training College for many years. Here, too, he ran all-Polish logical seminars. Opole was also the venue of the All-Polish Conference of Logicians in 1965. Słupecki chaired the Conference of Logicians in 1973 as well, as part of celebrating the Year of

Polish Science. Many prominent Polish logicians and mathematicians taught in Opole: Roman Suszko, Stan Surma, and Jan Mycielski, to mention just a few.



Sentential calculi

The Opole center investigated many-valued sentential calculi, resulting in new three-valued calculi close to that of Bochvar & Finn (Krystyna Piróg-Rzepecka 1977), and to mathematical theories with conditional definitions (K. Hałkowska 1979), close to Halldén's logic. These relate to expressions that lack denotation, and led to the construction of new algebras.

My teacher also actively propagated Tarski's ideas and work, mainly in the formalization of the methodology of deductive sciences – building with Witold Pogorzelski, and others, theories of deductive systems based on non-classical logics. Enriching Tarski's theory of deductive systems with a 'rejection function', Słupecki inspired my constructing a general theory of rejected propositions, on top of Tarski's classical consequence theory (1930), the basis of my dissertation. This also threw new light on the methodology of the empirical sciences: cf. the dissertation by my colleague Grzegorz Bryll.

Building on the preceding work, Słupecki introduced a new notion of '$\mathcal{L}$-decidability' of deductive systems (1971). The Opole community still pursues $\mathcal{L}$-decidability of different propositional calculi. Here I just note that all significant propositional calculi have been tested for $\mathcal{L}$-decidability.

I cannot mention all people associated with the Opole Centre, but I make one exception: for Tadeusz Prucnal, a creative, wise, and kind colleague.

Logic, natural language, and computation

At the instigation of my teacher I prepared my Habilitation on the theory of language syntax (1985; English version with Kluwer in 1991). My theory refers to Tarski's concatenation theory, Markov's theory of concrete and abstract words, the Lesniewski-Ajdukiewicz theory of syntactic categories, and the categorial grammar originating with Ajdukiewicz (1935) and Bar-Hillel (1950, 1953, 1964). In the 1980s, these topics enjoyed great popularity. In 1988, the book *Categorial Grammar*, edited by J. van Benthem, W. Buszkowski and W. Marciszewski (John Benjamins, Amsterdam-Philadelphia) appeared. These studies were continued in Poland by W. Buszkowski and his students in Poznan.

Talking about the Wroclaw - and Opole-based community of logicians, with which I am connected myself, it is also worth noting that the systems of natural deduction by Jaskowski and Gentzen had not come to full light until Słupecki and his former student and later colleague at Wroclaw – Ludwik Borkowski – published their works. They also expanded the theory to practice by mathematicians and colloquial intuitions. The English translation of the Polish book of 1963 by the two authors was published in Oxford in 1967; the book had been translated into Russian prior to that in 1965.

The method in this book was used in computer-based testing of correctness of proofs of theorems, and by me and the group of my Opole colleagues to teaching logic, by means of the computer program MIZAR, elaborated at the University center in Białystok by Andrzej Trybulec and his colleagues. The

research in this direction was coordinated by their supervisor – Professor Witold Marciszewski – himself known as an author of encyclopedias of logic, published also in the English language (*Dictionary of Logic as Applied to the Study of Language: Concepts, Methods, Theories*, Martinus Nijhoff, Den Haag 1981; *Encyclopedic Dictionary of Semiotics* (ed. T. Sebeok).

The center created by Słupecki ceased to exist after the death of its founder (1987) and the subsequent elimination of logic from the curricula of many studies, including mathematics. This happened in other places, too. Still, the three universities in Silesia, Opole, Wroclaw and Katowice, organize annual all-Polish conferences on Applied Logic and Foundations of Mathematics. [3] [4]

6 Further trends in Polish logic today

Polish logic and philosophy do function today, though with a different impact than before the War. The influence of the Lvov-Warsaw School is still clear, as described by Professor Jacek Jadacki in an article "The Lvov-Warsaw School – The New Generation", published in a volume under the same title by Professor Jacek Pasniczek and himself in 2006 (*Poznan Studies in Philosophy of The Sciences and The Humanities*, Rodopi, Amsterdam-New-York).

Besides influences from the Warsaw School, Polish logic after World War Two owed much to Kazimierz Ajdukiewicz who still taught actively in post-war Poland. His early ideas and scientific results opened a way to develop (a) the

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[3] Janusz Czelakowski should be mentioned here, who moved to Opole in 1992. He is one of the founders of Abstract Algebraic Logic, which studies the interaction of algebra and logic. His *Protoalgebraic Logics* is still a key monograph. He conducts a seminar in Opole on algebraic methods in meta-logic and foundations of mathematics. It gathers young logicians from south-west Poland, especially Silesia.

[4] In addition to Opole, I also should mention my current university of Chorzów as a place where applied logic and argumentation theory are lively activities today.

study of questions and answers in terms of contemporary logic (since the 20s), (b) the earlier mentioned notion of a categorial grammar (1935) and (c) the notion of meaning (*O znaczeniu* wyrazen, published in Lvov, 1931[*On meaning of expressions*] and *Sprache und Sinn*, Erkenntnis IV, 1934, 100-138).

The interest of Polish logicians in questions is due Tadeusz Kubinski who contributed most to the field. His monograph *Wstep do logicznej teorii pytan* [*An Introduction to the Logical Theory of Questions*] appeared in 1971, well ahead of the famous *The Logic of Questions and Answers* by Belnap and Steel in 1976; an English version, *An Outline of the Logical Theory of Questions*, was published only in 1980 in (East) Berlin. A student of Kubinski, Andrzej Wisniewski, developed his ideas into an '*Inferential Erotetic Logic*'. Wisniewski's theory is in his book *The Posing of Questions: Logical Foundations of Erotetic Inferences,* Kluwer 1995, and in papers in international journals.

We have already mentioned the tradition of logic and categorial grammar, that spread from Poland to many countries. In particualr, Ajdukiewicz' ideas on meaning have been taken up again recently by myself (*Meaning and Interpretation*, Studia Logica (2007), 85 and 86) and are also a subject of study in a current research program conducted by Ryszard Wójcicki.

Indeed, Professor Ryszard Wójcicki occupies an important place in Polish logic. He was – for many years – the head of the Section of Logic in the Polish Academy of Sciences. Being a talented organizer, with Roman Suszko he created, at the end of the 60s, an active logical center in the Academy. Wójcicki's pupils (Janusz Czelakowski, Wieslaw Dziobiak, Jacek Malinowski) are still very active in logic and algebra. Wójcicki has published extensively in algebraic logic, and since the 1960s, he has also been a pioneer in logical methods in philosophy of science. He has recently organized international conferences under the title "Trends in Logic", with publications under the same title. For many years Wójcicki was Editor-in-chief of the journal *Studia Logica* founded by Ajdukiewicz in 1955. Thanks to him *Studia Logica* is now a

significant international journal; Jerzy Słupecki used to be a member of the Editorial Board from the very beginning and its Editor-in-chief for many years. He started a special column devoted to the didactics of logic.

Polish traditions in logic of language are continued mainly due to Professor Jerzy Pelc who for about 40 years conducted all-Poland semiotic seminars in Warsaw, and is the author and editor many papers and books on semiotics.

Finally, Kraków – the former capital of Poland in post-war times, is also a capital of annual Conferences of History of Logic (in November of this year, the 55th of these will be held: a long and illustrious tradition).

Wawel Royal Castle, Kraków

Logic and computer science [5]

My survey has been mainly directed toward mathematical and philosophical logic, with some excursions into natural language. But I must finally mention another important line that did not exist at all in the pre-War period.

Over the last decades, many Polish logicians found new scope for their talents, namely, in the field of computer science. Names like Rasiowa,

[5] For this section, I relied mainly on information from Johan van Benthem.

Rauszer, Orlowska, Skowron, Niwinski, Apt, Krynicki, Pawlak, Trybulec, Salwicki, Prymuszscinski, Walukiewicz, and many others are internationally famous.

A whole further story can be told of the contributions of these fellow logicians of mine at the interface with computer science, to topics like the foundations of computation in 'algorithmic logic' and recently the modal mu-calculus, to data base theory in 'rough sets', to generalized quantifiers and complexity theory, relational algebraic methods in computation, or to default logics. In the 1980s, the joke was that the most efficient conference language for international meetings on non-monotonic logic would be Polish. But that is a story for another occasion, and maybe another speaker.

SCIENTIFIC PROGRAMME and CALL FOR PARTICIPATION

Annual Conference of the European Association for Computer Science Logic

CSL 2004

Organized by
Institute of Computer Science, Wroclaw University
in Karpacz, Karkonoski National Park, Poland

September 20-24, 2004

http://csl04.ii.uni.wroc.pl/

The deadline for early registration for CSL 2004 is August 5, 2004.

Scientific Programme

MONDAY, SEPTEMBER 20

Session 1: 9.00 am - 10.15 am
Invited talk: Ken McMillan, "Applications of Craig Interpolation to Model Checking"
Session 2: 10.45 am - 12.15 pm
Krishnendu Chatterjee, Rupak Majumdar, and Marcin Jurdzinski, "On Nash Equilibria in Stochastic Games"
Mikolaj Bojanczyk, "A Bounding Quantifier"
Hugo Gimbert, "Parity and Exploration Games on Infinite Graphs"
Session 3: 1.30 pm - 3.00 pm
Harald Ganzinger and Konstantin Korovin, "Integrating Equational Reasoning into Instantiation-based Theorem Proving"
George Metcalfe, Nicola Olivetti, and Dov Gabbay, "Goal-Directed Methods for Lukasiewicz Logic"
Jeremy E. Dawson and Rajeev Gor=E9, "A General Theorem on Termination of Rewriting"
Session 4: 3.30 pm - 5.00 pm
Pierre Hyvernat, "Predicate Transformers and Linear Logic: yet another Denotational Model"
Pietro Di Gianantonio, "Structures for Multiplicative Cyclic Linear Logic: Deepness vs Cyclicity"
Lutz Stra=DFburger and Fran=E7ois Lamarche, "On Proof Nets for Multiplicative Linear Logic with Units"

I end my survey with a somewhat more sad social or political note.

The state of logic in Poland today

The subject does not flourish in contemporary Poland: the authorities responsible for curricula keep eliminating the subject from study courses. Financing scientific research in the field is restricted to a minimum, which also affects the possibility of exchanging scientific thoughts.

Hence, after its enthusiastic and influential start, Polish logic now depends on international assistance and support, especially in the current world crisis that is affecting Poland in many aspects of our social and scientific life.

We in Poland still believe in the famous motto of the Solidarity movement:

"There's no liberty without solidarity".