The Lvov-Warsaw School: A True Mythology

Jean-Yves Beziau

Dedicated to Jan Zygmunt, my host during my first stay in Poland, Wrocław, 1992–93

Abstract I discuss various aspects of the Lvov-Warsaw School: its past, present and future; its location, evolution, mathematics; the variety of its members. I develop this analysis on the basis of my 25-year experience with Poland.

Keywords Lvov-Warsaw School · Twardowski · Leśniewski · Łukasiewicz · Tarski · Polish logic · Metalogic · Methodology of deductive sciences · Consequence · Universal logic

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This paper is a mix between personal recollections and logico-philosophical reflections about the glorious Lvov-Warsaw School. When supervising the edition and production of the present book in the series *Studies in Universal Logic* I started to think about my experience with Poland and I realized how much I had been connected to this tradition from the very start of my research up to the development of my present and future projects. So I decided to develop the topic, to look at all the archives I have, and to investigate more about the Lvov-Warsaw School.[1]

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[1] I have consulted many books and papers, among them: 4–6, 31, 43, 48, 49, 55, 57, 62, 65–67, 75, 77, 89, 92, 93, 95, 99, 102 and others also quoted in the list of references of this paper, which gathers the main works on the topic.

1   From Bahía Blanca to Wrocław

1.1   *Meeting with Stan Surma at the End of the World*

It is like a fair trail: in August 1992 I took a train from Bahía Blanca, Argentina to Wrocław, Poland. It was an all night train and by no chance I was seated next to Stan Surma and his son Charles (Fig. 1). We said good bye in Buenos Aires this August 1992 and we were to meet again only in August 2007, 15th years later, for the *2nd World Congress on Universal Logic* (UNILOG) I organized in Xi'an, China. In the mean time I developed the Universal Logic project, defending a PhD in Paris (July 1995), organizing the 1st UNILOG in Montreux (March 2005) and launching the journal *Logica Universalis* (January 2007), a project rooted in Poland, considering in particular that I coined the expression "Universal Logic" when in Wrocław in 1992–93.

Stan Surma was the head of the logic group at the Jagiellonian University in Kraków during the sixties, many of his students became later main logicians in Poland: in particular Grzegorz Malinowski, Jan Woleński, Jan Zygmunt, Andrzej Wroński, Jerzy Perzanowski. He founded there in 1965 the journal *Prace z Logiki* which in 1973 became *Reports on Mathematical Logic*. He then escaped communism going first to Black Africa where he was teaching mathematics in the jungle, then Australia, then New Zealand (In Xi'an, his son Charles told me this story and we also produced an interview/film with
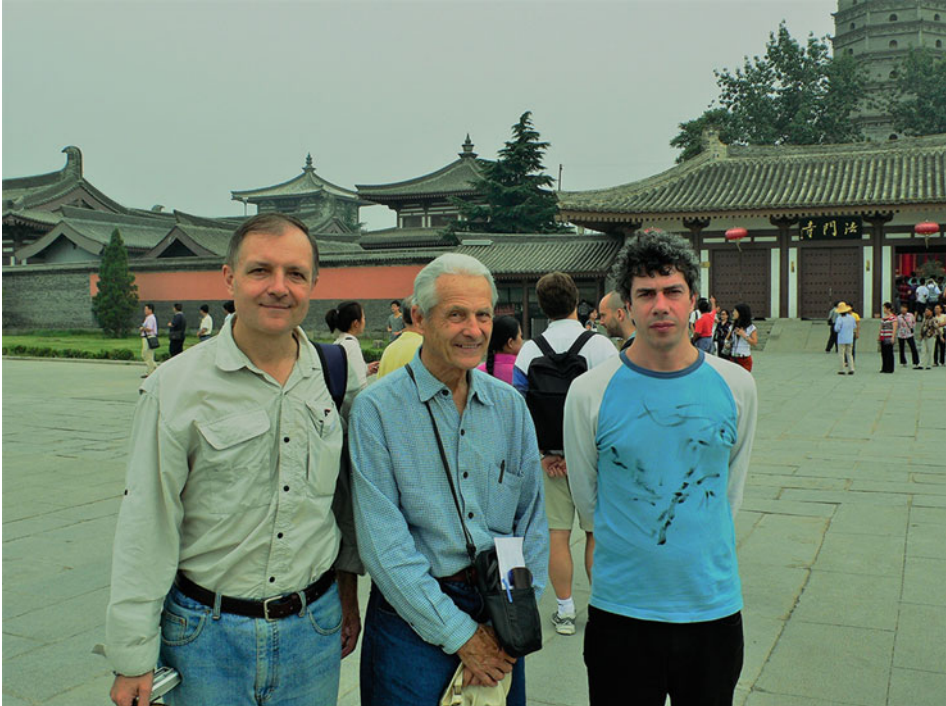
Fig. 1 JYB with Stan and Charles Surma at the 2nd UNILOG in Xi'an, 2007

Stan). When in New Zealand he edited *The Collected Works of Leśniewski* (cf. [50]). A very important book to maintain alive the Lvov-Warsaw tradition, since Leśniewski is one of the main figures of this school.

Still in Kraków, Surma "originated an ambitious program of reconstruction of various results obtained in past in logic but presented in an incomplete or inaccurate way. Surma's team was able to offer a complete and rigorous setting for some of Lindenbaum's, Post's, Wajsberg's and others' results." [84, p. 106]. April 27–29, 1973 he organized in Kraków the XIX edition of the conference of the history of logic with subject the scientific achievement of Mordchaj Wajsberg (published in the *Bulletin of the Section of Logic* the same year, see [69]). Surma also published the collected works of Wajsberg [81], and later on a paper entitled "The logical work of Mordachj Wajsberg" [71]. Surma wrote also several papers on Lindenbaum (see [70] and [68]).

But Surma's work did not restrict to this historical/editorial line of work, he pursued logical research in the very spirit of the Polish tradition. At the *9th Latin American Symposium on Mathematical Logic* which took place August 10–14, 1992 in Bahía Blanca he gave the talk "Alternatives to the consequence theoretic approach to metalogic" (the corresponding paper was published in the IX SLALM proceedings [72]). This work was much in the spirit of what I was working on for my PhD at this time. When I created the journal *Logica Universalis*, his paper "A Galois connection" was included in the first issue [73].

1.2 The Polish Brazilian Connection

I left Paris in August 1991, where I was doing a PhD in mathematical logic, to work 1 year with Newton da Costa in São Paulo, Brazil. I was first interested in the work of da Costa through paraconsistent logic, the topic of my Master in mathematical logic [8]. But when I came to Brazil we were working on what da Costa calls the *Theory of Valuation*, a general theory of logics based on bivaluations, that he started to develop after having provided non truth-functional bivalent semantics for his systems of paraconsistent logic and other non-classical logics. This is what I presented at the IXth SLAM in Bahía Blanca.[2]

In view of extending and generalizing this general theory of logic I started to use the expression "abstract logic". There were two reasons do to so: it fits the spirit of modern mathematics, a general theory of logical systems would be a theory of logical structures, and a good name for a logical structure would be "abstract logic" in the same way as "abstract algebra". The second point is more philosophical, emphasizing abstraction of the objects. From this perspective my project was at this time to have a PhD with title *From Formal Logic to Abstract Logic*.

Then, I discovered the work of Suszko at the library of the Department of Mathematics of the University of São Paulo. Suszko had himself used the expression "abstract logic".[3] I started to seriously think of going to Poland to know more about all this. I talked with da

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[2]A systematic paper on that was published in *Logique et Analyse* [32] and a more philosophical note [33], related to the talk I presented in Bahía Blanca was published in the same proceedings as Surma's paper; see also Loparic and da Costa's paper reprinted in the anthology of universal logic [21] with my comments.

[3]See about this, one of Suszko's papers reprinted in the anthology of universal logic [21], with comments by Ramon Jansana and my paper "La logique abstraite au sein de la mathématique moderne" [9].

Costa and he encouraged me to do so. He had himself developed strong links with Poland, having been there several times in the 1960s and 1970s and inviting Polish logicians to come to Brazil: Lech Dubikajtis, Jerzy Kotas, Grzegorz Malinowski, Jerzy Perzanowski. And Ryszard Wójcicki, who wrote his book *Lectures on propositional calculi* [82] there:

> Although the work on this book was concluded only after my return to Poland, the substantial part of it have been done during my stay in Brazil sponsored by FAPESP (Fundação de Amparo a Pesquisa do Estado de Sao Paulo, Brazil, grant no 80/1188–8). I benefited a great deal and in various ways from the opportunity to have scientific context with my Brazilian colleagues and friends. My greatest debt has been to Prof. Ayda I. Arruda, at that time the Director of Instituto de Matemática e Estatística e Ciência de Computacão, Universidade Estadual de Campinas both for the care she took for creating me excellent conditions for work and for her keen and penetrating interest in the ideas I discussed in my lectures. Also I own a special debt to Prof. Newton C. A. da Costa for his invitation to Instituto de Matemática e Estatística, Universidade de São Paulo and stimulating discussions we held, and to Prof. Elias Alves for his introducing me to people from the Logical Center of UNICAMP and his assisting me on many occasions.

This book is a overall presentation and synthesis of the general approach to logical systems mainly develop by Polish logicians, which is sometimes qualified as *Polish Logic*. Wójcicki later wrote a second version of this book [83], with more details, which can be considered as the Bible of Polish logic, internationally published and promoted by Kluwer (now Springer). I myself prefer the style of the first edition, published by Ossolineum in Poland, which is nowadays difficult to find.

Newton da Costa himself was born in Curitiba, South of Brazil, which is the second most important Polish city in the world outside of Poland, after Chicago. And Brazil also has the second largest community of Polish immigrants after the USA, nearly two millions. The Polish colony was started by Sebastian Woś (1844–1933) from the city of Siolkowice (region of Opole). Then, between the two world wars, there was an important second wave of Polish immigration to Brazil, in particular many Jews. Famous among them is Leopoldo Nachbin (1922–1993), considered as the most important Brazilian mathematician, funding member of the IMPA (Institute for Pure and Applied Mathematics) in Rio de Janeiro, whose PhD was directed by Laurent Schwartz.

1.3 Polish Surroundings

Besides the logical attraction to Poland I was also interested to go to Poland for various reasons. When I was a student in Paris in the 1980s, two Polish artists were very popular: Roman Polanski and Witold Gombrowicz. I saw many movies by Polanski in particular *Repulsion* (1965) with Catehrine Deneuve and *Le Locataire* (1976) with Isabelle Adjani. I also saw him in a theatre on a one man show, interpreting *The Metamorphosis* by Franz Kafka. From Gombrowicz I read in that order three books: *Cosmos* (1965), *Ferdydurke* (1937), *Possessed* (1939) and was quite impressed. I saw the movie adaptation of *Ferdydurke* directed by Jerzy Skolimowski, a quite good adaptation (never easy to make a good movie about a literature masterpiece). Skolimowski is a famous Polish filmaker who has collaborated with Polanski in the seminal *Knife in the water* (1962), both being from the famous Łódź's film school. I also saw Skolimowski's very good movie, *Torrents of Spring* (1989), adaptation of a novel by Turgenev, with Nastassia Kinski, the daughter of the legendary actor Klaus Kinksi, also of Polish origin. There are several connections between Polish logicians and movies. Lindenbaum's father was a film producer (see

[104]) and Roman Suszko appeared in a mythical post-war Polish movie *A trip down the river* (1970) directed by Marek Piwowski (original title in Polish: *Rejs*).

Gombrowicz was exiled in Argentina and became famous when the French publisher Maurice Nadeau (1911–2013) got interested in his work. René Goscinny (1926–1977) is another Polish guy connecting Poland, Argentina and France. Of Polish Jewish origin, born in France, he spent his youth in Buenos Aires, moved back to France after WWII and became a cultural icon through comic books: *Astérix* of course, but also *Lucky Luke* and *Iznoud* (my favorite one). With *Astérix*, Goscinny promoted the Gauls as a founding cultural myth of French identity. It became a symbol of French culture in the same way as Mickey Mouse is a symbol of American culture. This myth is a mix of many things in particular figures imported from Argentina (cf. *Patoruzú*). Goscinny was really good at puns, in particular multilinguistic puns, therefore *intraduisible*. . . The name of his main hero *Astérix* has a double or triple meaning, one of them being *king of the stars*. The French mathematical society created in 1973 a journal called *Astérisque* (Fig. 2), punny name referring to this symbolic figure in the continuity of the Bourbachic funny naming tradition, rich of meaning and quite spiritual in the French way ("avoir de l'esprit")— one of a few foreign members of Bourbaki was Samuel Eilenberg (co funder of category theory with MacLane), a Polish Jew.

At the Sorbonne I was a student of Sarah Kofman, also from Polish Jewish origin. Her father was a Rabbi who was deported during WWII and was beaten to death in Auschwitz, because he didn't want to work during the Sabbath, by a Jewish kapo, who later on became a successful merchant in Paris. She wrote a very nice book about Plato: *Comment s'en sortir*, literally: *How to get out?* This is a book about the notion of "aporia" (Greek etymology: without a path). She pointed out that in the dialogues, when facing an "aporia", a deadlock, by using rational thinking, dialectics, then Plato uses the myth to go out, telling some stories. She showed very well that at the heart of Plato's philosophy there is a constant mix between *logos* and *muthos*, a true mytho-logy. Unfortunately, she thought, the mythical dimension was washed away in Aristotle's philosophy. She was one of my favorite teachers and I did a Master thesis with her on Plato's cave [7].[4]

On my family side, one of my mother's uncles emigrated from Marocco to Argentina in the 1950s and his three daughters all married Polish emigrants there. Moreover the sister of my mother married a guy of Polish origin, Jean Dybowsky, descendant of the famous
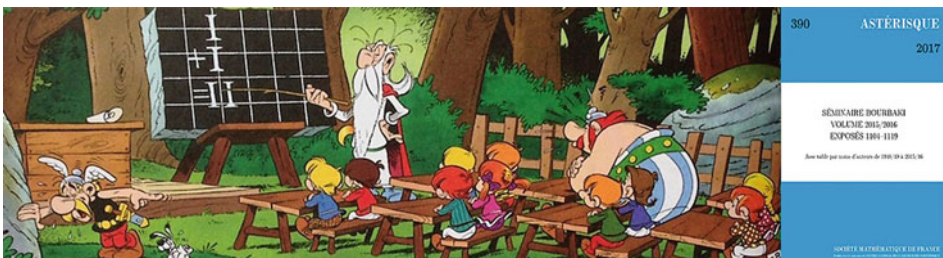

Fig. 2 Astérix and mathematics

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[4]She later on committed suicide and I dedicated to her a paper I wrote on suicide [11]. When in Poland I visited Auschwitz and this was a terrific experience.

African explorer bearing the same name, giving birth to three neo-Polish cousins. Finally, my father told me several times that my mother (of Swiss citizenship) had some Polish Jewish ascendancy. I don't know if it is true and I never inquired to check this information, because on the one hand if it is true, it is a logical truth, a tautology, since good logicians are all Polish Jews, on the other hand I don't feel the necessity to identify myself with a specific community, subculture, or abelian subgroup. To simply be a rational animal is already quite complicated!

Anyway, for all these reasons, I had some sympathy for Poland. And after going from the 1st World (France) to the 3rd World (Brazil), I was curious to discover the 2nd World, which was a mystery for me. I remember that during an exchange in high school in France I spent 2 weeks in Bayreuth in 1979 and one of the attractions was to go to watch the iron curtain (Czech border). On the other side it looked really like another world. I knew very few things about Poland. In the train from Bahía Blanca to Buenos Aires Stan Surma draw me a logic map of Poland. As the erudite reader may know it is not possible to go all the way by train from Argentina to Poland. I took a bus from Buenos Aires to São Paulo, then a plane to Paris and then again a train to Poland. I stopped a few days in Brazil to meet again Newton da Costa and in France to visit my family.

I was going to Poland within an exchange program between France and Poland. The French Ministry of Foreign Affairs sent me a train ticket and I took a train from Paris to Warsaw on October 1st, 1992 (Fig. 3). It was the train Paris-Moscow, a 48 h trip, Warsaw being at the middle of the way, a 24 h trip. I was in a compartment with a friendly Polish professor. Arriving in Warsaw there was nobody from the French Embassy waiting for me as promised (Fig. 4). I didn't know where to go. I had lots of baggages, few money and didn't speak Polish. Delikatnej sytuacji . . .

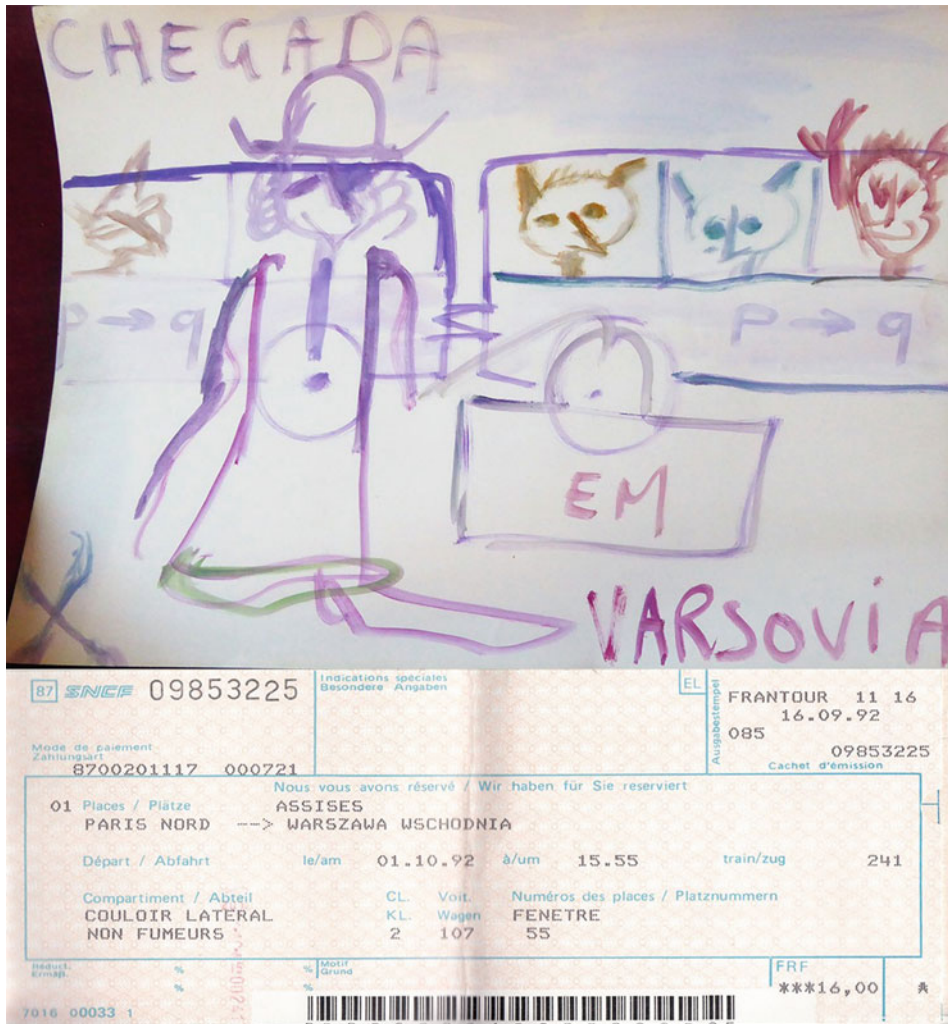**Fig. 3** JYB and grandma Alice, Oct 1 1992, France: departure to Poland

Fig. 4 Logical arrival in Warsaw

I met by chance on the platform a French girl who was in the same situation as me and the Polish professor helped us to call the French Embassy. It was a Friday, late afternoon. They told us they right now could not help us, but that we could use the diplomatic visitor flat at the Embassy and that we will talk on Monday. The flat was OK but with only one bed so we had to sleep on the same bed. And during the weekend I walked around Warsaw with this girl, I think her name was "Sylvie". Monday morning we had a meeting with the staff at the French embassy and they put us on a train to Wrocław. For this girl this was normal since she was supposed to study at the Art School there. In my case this was quite a surprise because I was prepared to go to Łódź. When in Brazil I had written to Wójcicki, he didn't reply to me, but after some months I received a letter from Grzegorz Malinowski inviting me to join his group in Łódź (Fig. 5).

Grzegorz Malinowski
Department of Logic
University of Łódź,
ul. Matejki 34 a
90-237 Łódź, Poland
Fax: 48 42 783958

Nantes, 15 june 1992.

Dear Mr. Beziau,

Your letter of 13 February, 92 reached Prof. R.Wójcicki with some delay (his current address is: UPT Warszawa 37, P.O. Box 61) and, finally, it was passed to me only recently.

As far as your possible visit to Poland is concerned I would like to inform you that R.Wójcicki already some time ago switched to the philosophy of science and he is now working with a small group of scholars interested in the field. So, I am afraid that your joining his group at the moment might be not as useful for you as you might expect - just for that reason Prof. Wójcicki passed your letter onto me. Since I am interested in the problems you are dealing with one might consider the possibility of your coming to Łódź and staying there some time. If you were interested in such a solution I, as the head of the Department, would be ready to sent you an invitation confirming the readiness of receiving you in case when you get a scholarship from France.
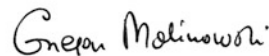
I passed through the article "Recherche sur la logique abstraite: Les logiques normales" which you sent us rather quickly. It seems to be of some interest but, taking into account the high degree of generality of the approach one may ask for justifying the need and usefulness of it. Thus, in particular: what kind of *non-structural* formal systems (*logics*) that have not available kind of semantics does have the semantics discussed by you, what are "reasonable" abstract logical systems, which may be treated using the framework. On the other hand, one can hardly find any remarks relating your construction to the similar well accomodated concepts in the literature such as e.g. the notions introduced some twenty years ago by S.Bloom and R.Suszko. As far as the conception of two-element valuations is concerned one should also receive at least an outline of the treatments by several authors among them D.Scott, R.Suszko et R.Wojcicki, which in several places provided justified forms of bivalent or referential semantics.

Since I have intension to discuss the problem of logical valuations of N.C. da Costa on my seminar, on that occasion I will pass through your article more thoroughly. Perhaps thereafter I will be able to say you something more: I think that it would be useful if you could sent me your unpublished paper "Les logiques paraconsistantes Ci and C1".

In Nantes I will stay until July 1, 92. After that date you can contact me using my constant address (as above).

With best regards,

Sincerely yours

Grzegorz Malinowski

Grzegorz Malinowski

PS. Please convey my best wishes and regards to Prof. Newton da Costa.

Fig. 5 Malinoswki's letter inviting me to join his logic group in Łódź

But for some reasons the French Ministry of Foreign Affairs organized my coming to Worcław. That's how I arrived in this town I knew nothing about. On the platform was waiting for me Jan Zygmunt who drove me in his little Fiat to a University House in Plac Grunwaldzki (cf.[39]).

2 The Atopicity of the Lvov-Warsaw School

The expression "Lvov-Warsaw School" has become canonical. It is rather a proper name than a definite description. But, like many proper names, it is also improper. It can reasonably serve as an identification device, we roughly know what we are talking about, like when we use names such as "Poland", "Truth" or "Alfred Tarski". But this does not mean we know exactly what it is. Identification does not confer identity. Maybe Poland and Truth do not have a proper identity. The identity of Alfred Tarski is more palpable, tangible, at least imaginable, paintable, photographical, not (yet!) completely mythical. The consistency of a phenomenon can be tested by trying to answer the five basic questions: when, where, what, why, how? Let's see if LWS passes the test...

I will use "LWS" as an acronym/abbreviation for the Lvov-Warsaw School. Sometimes people use "LWs" or "LW-s". I prefer to capitalize the School, as they do in Vienna with the Circle. Note also that in the canonical expression "Lvov-Warsaw School", "Lvov" has become a standard English spelling for the name of this city, but the tendency is nowadays to write "Lviv".

2.1 A School Without a Location

I progressively discovered that I arrived not only in Wrocław but also in Lvov and Breslau. Before WWII the city of Wrocław was named "Breslau" and was in Germany. The Friedriech Wilhelm University of Breslau was an important University frequented by famous people like the Nobel prizes Erwin Schrödinger, Max Bohr or Friedrich Bergius. The book by Frege *Die Grundlagen der Arithmetik, eine logisch-mathematische Untersuchung über den Begriff der Zahl* was published in Breslau in 1884 by W. Koebner.

After WWII "Breslau" became "Wrocław" and the surrounding region became part of Poland. On the other hand the city of Lvov and the surrounding region, which was part of Poland before WWII, became part of Soviet Union. Poland was displaced on the West (Fig. 6). This displacement was not purely physical, but also humanistical. Poland, like many countries, has a variable geometry...

Wrocław is a sort of transposition of Lvov. Polish people from Lvov moved to Wrocław. German people of Breslau fled or were expelled "home", i.e. in what would be called "DDR", *Deutsche Demokratische Republik*, now out of the map, like Prussia, Atlantis or Gaul.

Wrocław University became a major university of Poland after WWII, Wrocław a major student town, and also one of the most prosperous Polish towns, in particular due to his President (or Mayor) Rafał Dutkiewicz, who did study logic at Wrocław University and that I shortly met during my stay—he was not yet famous (Fig. 7).
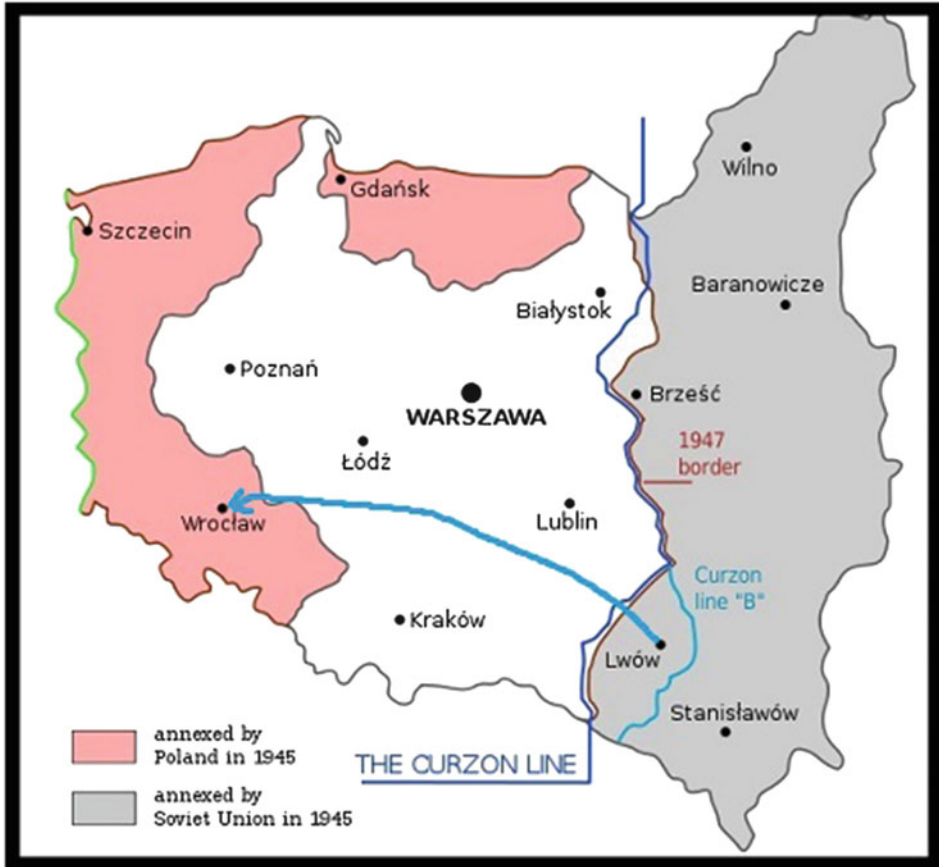
Fig. 6 After WWII Poland goes West—Lvov moves to Wrocław
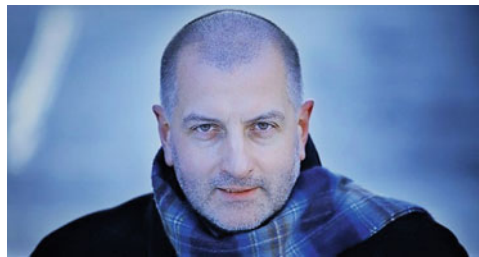
Fig. 7 Rafał Dutkiewicz logically successful mayor of Wrocław

A symbol of the transposition of Lvov to Wrocław is the Ossolineum foundation. This foundation was created by the Count Józef Maksymilian Ossoliński (1748–1826) in Lvov. I used to have lunch at the canteen of the Ossolineum foundation which was one block from the Department of Logic in the same street, Szewska street. Ossolineum was during the communist time the main publisher of the Polish Academy of Science, publishing

many books of logic and the journal *Studia Logica*. When I arrived there everything was changing. Wójcicki made a deal in 1992 with Kluwer (which later on was incorporated into Springer) and Jan Zygmunt was the editor-in-chief of *Studia Logica*. I went to the Ossolineum office in Wrocław asking if it was possible to buy old issues of the journal. I succeeded to buy a good number of issues which were in the cellar for a price as low as 2 or 3 cents each.

Wrocław became after WWII one of the most important logic centers in Poland. Wójcicki describes the situation as follows:

> Wrocław was another important center of postwar logic. The most prominent figure in foundations of mathematics has been Czeslaw Ryll-Nardzewski. He grouped around himself several very talented young peoples (L. Pacholski, B. Węglorz, A. Wojciechowska, and others) but that group was much more oriented towards foundational than purely logical problems. Also Jerzy Łoś, known for a number of outstanding theoretical results, notably his famous ultraproduct theorem, started his academic career in Wrocław. Another eminent Wrocław logician was Jerzy Słupecki. His most prominent collaborators were Ludwik Borkowski, Witold A. Pogorzelski and Boguslaw Iwanuś. . . . my own academic biography starts in Wrocław too. [84, pp. 503–504].

Considering all these aspects we can maybe talk about a Lvov-Warsaw-Wrocław school of logic. But on the one hand Wrocław has not been the only and main center of logic after WWII in Poland and on the other hand there was a serious break in the development of logic in Poland after WWII, in particular with the emigration of Alfred Tarski to the USA where he founded a center for logic in Berkeley (California) who became during 25 years the most important logic center in the world. Considering this move, one could also talk of a Lvov-Warsaw-Berkeley school of logic. But this also would be controversial because few people of the "original" school followed Tarski in California—one of them was the young Kalicki who tragically died there in a car accident (see [101]).

Słupecki tried without success to develop a logic school in Wrocław, as explained by Woleński and Zygmunt:

> Since the beginning of his activities in Wrocław, Slupecki supervised graduate students and doctors, evaluated doctoral and habilitation theses and influenced mature logicians. This circle was formed by Edward Baluka, Ludwik Borkowski, Edmund Glibowski, Boguslaw Iwanuś, Tadeusz Kubinski, Jerzy Nowak, Witold A. Pogorzelski, Juliusz Reichbach and others, but it was not a school as Slupecki would have envisaged it, and such a school that could not develop in Wrocław mathematical circles, of which he was fully aware. [98]

My host in Wrocław, Jan Zygmunt, was the director for the Department of Logic, which full and official name was *Katedra Logiki i Metodology Nauk*. It literally means *Chair of Logic and Methodology of Science*. It was part of the Institute of Philosophy located in a building which was very close to the main building of the university where there was the beautiful "Aula Leopolodina" and a nice cafeteria to which Jan Zygmunt used to frequently invite me to chat having a tea.

At the department I had a big office room. On the wall it was written: "Alfred Tarski and Dana Scott were there in 1955". I don't know the exact impact of this on my mind, but I spent lots of time reading all the papers of Dana Scott on rules and general logic and wrote in January 1993 the paper "Rules, derived rules, permissible rules and the various types of systems of deduction" [12]. Later on I decided to include one of these papers by Scott, "Compleneteess and axiomatizibility in many-valued logic", in the anthology of universal logic and asked Lloyd Humberstone, one of his former students to write the

presentation of it (see [21]). This room was the one of Tomasz Skura, who at this time was in an exchange program in Konstanz, Germany invited by Andre Fuhrmann (who later on moved to Brazil and became my friend). Other permanent members of the department were Tomasz Furmanowski and Jacek Hawranek. I also met at this time the East-German logician Max Urchs who was partially employed at the department. The present director of the department, Marek Magdziak, was at this time doing his PhD there. There was a regular seminar to which I presented two talks (as recalled by Zygmunt [39]) and to which was coming Juliusz Reichbach, a retired logician, who had done some important work on completeness in the 1950s (cf. [60, 61]) and after that emigrated to Israel but didn't succeed to adapt and came back to Poland.

Reichbach was living in the same building as me on Plac Grunwaldzki. It was a Stalinist building called "the house of science" at the corner of Plac Grunwaldzki and Curie-Skłolodowskiej street. I used to bump into him on the nearby supermarket where he was buying vodka. One day I invited him to have a tea in my flat but when he saw my paintings on the wall (Fig. 8) he was quite afraid and decided not to enter. I had made only few painting when I was a child in Corsica and then in high school. For some reasons I started to paint quite a lot when I was living in Wrocław. In some sense this was quite natural if we think of someone like Leon Chwistek who was both a famous logician and painter.

I remember that I bought some tubes of paint on the Russian market just below my flat. At this time the (ex) Soviet Army was leaving the country after many years of occupation selling all they had, from watches to planes. After some years the department of logic was

Fig. 8 One of the paintings I did when in Wrocław

Fig. 9 Back to Wrocław in 1998: JYB and Valdimir Vasyukov

moved from the town center to the ex-Soviet Military based. Visiting Wrocław again in 1998 I had the opportunity to see the place. At this time the Russian logician Vladimir Vasyukov was also there. He was a good friend of Jan Zygmunt and also became a good friend of mine (he invited me to Moscow in 2001 and I went again to Russia in 2003, 2009, 2012, 2016). The father of Vasyukov had been a military officer in activity in Wrocław and Vladimir spent some years of his life there when he was a child and spoke good Polish (Fig. 9).

1992–93 was a great time in Wrocław, it was a transition period. After the liberation of Poland people were optimistic, new bars and restaurants were opening every day. There were lots of foreigners: business men coming to invest, visitors at the university and tourists. At the same time the way of life and style of life of the communist time was still very present. Moreover communism, in particular due to isolation, had frozen things, so it was like a travel in time, back to the 1960s or 1950s and even the 1930s.

Plac Grunwaldzki was used by the Germans at the end of the war as an airfield: most of the buildings were demolished for that and furthermore the region was heavily bombarded by the Russians. After the war it was developed in a "modern" way—after my departure it was further modernized with a big shopping center (Fig. 10). The department of mathematics was located at the entrance of Plac Grunwaldzki, near the bridge. I used to go there at the library, where there was a mix of books from the University of Breslau and the University of Lvov. There were some logicians there, like Węglorz, but I hardly met/knew him. This was in fact symptomatic of the separation between logic and mathematics in Poland which, according to the legend, goes back to a dispute between Sierpiński and Leśniewski. Also, though the department of logic was in the institute of

Fig. 10 Evolution of Plac Grunwaldzki

philosophy, we nearly had no contact with the other parts of the institute, still under heavy influence of Marxism.

During my first stay in Poland I visited also some other towns, in particular Łódź and Kraków which were two other important logic centers in Poland at this time, with important departments of logic. This was not the case of Warsaw. I went there only a few times to solve some questions with the French Embassy.

2.2   A School Without a Topic

How can we characterize the topic of the Lvov-Warsaw School? The Vienna Circle (VC) is strongly associated with "Logical empiricism" and "Logical positivism". It would

be difficult to find an expression that could systematically be associated with the name "Lvov-Warsaw School".

There is a famous paper by Ajdukiewicz entitled "Logistic anti-irrationalism" [3]. So one may want to put the equation:

$$LWS = Logical\ Anti\text{-}Irrationalism$$

that would be parallel to the equation:

$$VC = Logical\ Positivism$$

But the expression "anti-irrationalism" is too much idiosyncratic and its meaning is not completely clear.[5] It is a bit confuse for a school wanting to promote conceptual clarification. And we may wonder why being so negative, with a double negation. Why not being purely positive? But then we would have something like "Logical Rationalism" which is rather pleonastic.

There is another expression, also used by Ajdukiewicz: "Methodology of deductive sciences". This expression is the title of his habilitation thesis defended in 1921 in Lvov [1], and was then systematically used and promoted by Alfred Tarski, in Polish, German, English and French, in one way or another:

- "Fundamentale Begriffe der Methodologie der deduktiven Wissenschaften. I." (paper published in 1930)
- *O Logice Matematycznej i Metodzie Dedukcyjnej* (book published in Lvov-Warsaw 1936 [76])
- Sur la méthode deductive (talk presented at the 9th International congress of philosophy in Paris in 1937, cf. [78])
- *Introduction to logic and the methodology of deductive sciences* (book published in Oxford in 1941. English version of [76])

The interesting thing about *Methodology of Deductive Sciences*, hereafter MDS, is that it keeps a philosophical perspective which disappears in the case of expressions like "Metalogic" or "Polish logic". The word *Metalogic* was mainly promoted in Poland, in particular it was used by Wajsberg. It is a very important word that rightly characterizes the Polish perspective: on the one hand the distinction between two levels, on the other hand the generally beyond it; it is not only the study of mathematical reasoning, but the deductive reasoning of any science. Tarski was also much interested in biology and physics. It is of course inspired by the *Metamathematics* of Hilbert and there is a direct connection since Ajdukiewicz visited Göttingen. However Polish logicians went much higher at the metalevel, because firstly, as it is well known, and contrarily to Hilbert, they were promoting no limitation at the metalevel, and secondly they had more imagination which led to the idea of arithmetization of syntax, crucial to Gödel's theorem. This was mainly promoted by Łukasiewicz in the early twenties as recalled by Tarski who explained that to Gödel during a visit in Vienna (cf. [80]).

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[5]See our recent paper "Is logical relativity irrational?" in a special issue of *Studia Metodologiczne* dedicated to Ajdukiewicz [25].

Before WWII were already created some Departments of Logic and Methodology of Science in Poland and this expanded after WWII. Nowadays there are many such departments in Poland, most of them in philosophy institutes, but not always. Can we consider that

$$LWS = MDS$$

is a key equation explaining everything? This would be the easiest solution, but a simplification. First it important to notice that between the two wars, LWS was not a tiny part of the university but the dominating part. Łukasiewicz was twice the rector of the University of Warsaw. Good also to remember that Twardowski was rector of the University of Lvov and that Ajdukiewicz, who married his daughter after WWII, became the rector of the university of Poznań (Jaśkowski was also a rector after WWII: rector of Nicolas Copernicus University in Toruń).

Few years ago the University of Warsaw created a symbolic monument with four statues: those of Twardowski, Łukasiewicz, Tarski and Leśniewski. This means that these four men are considered as the most important figures of the history of the University of Warsaw (Fig. 11).

On the one hand we could say that at some point MDS was dominating the University of Warsaw and that it is not anymore the case. Or on the other hand we could say that LWS was much broader than MDS, which is true in some sense if we consider that LWS was an nebulous group of philosophers, mathematicians, linguists and artists.

But looking at the Fig. 11 we see another paradox: if we put aside Twardowski, the bridge between Lvov and Warsaw and considered as the founding father of the LWS (the figure of a father is typically mythical, before and after Freud), the three other men are mainly known as logicians. So why not putting the following equation

$$LWS = Polish\ Logic?$$

Here is what Jan Zygmunt wrote about this expression:

> The term "Polish logic" was coined by McCall to signal the important contributions to modern logic by logicians from Poland between the wars. There were several centres of research, of which

Fig. 11 Monument at Warsaw University with statues of Twardowski, Łukasiewicz, Tarski and Leśniewski

the Warsaw school, which grew out of the earlier Lvov-Warsaw philosophical movement, was the most significant. Its development was closely connected with the Warsaw school of mathematics, which gave it its characteristic mathematical bent…

The main centres of logic research between these dates were Cracow, Lwów, Poznań, Wilno and, most importantly, Warsaw. The Warsaw school of logic, founded by Łukasiewicz and Leśniewski, began as an intellectual offshoot of the Lvov-Warsaw philosophical movement, but quickly eclipsed it in both quantity and quality of research. The development of the Warsaw school of logic was closely connected with that of the Warsaw school of mathematics. In 1918 one could already speak of Warsaw as a fairly strong centre of research in set theory and topology under the direction of Janiszewski, Mazurkiewicz and Sierpiński. The two schools shared organizational structures, swapped directors and collaborated on many academic initiatives. This accelerated the development of both schools and deepened their research in key areas. In later years Kuratowski, Lindenbaum, Tarski and finally Mostowski made significant contributions to both schools. [103, p. 6634]

But on the other side there were also philosophers, as described by Wójcicki;

One may also point out that an interwar (1920–1939) formation widely known as the "Polish School of Logic" overlapped in a very substantial way with another formation known as the "Lwow-Warsaw School of Philosophy". The members of the latter not only considered logic to be the main tool of philosophical analyses but they often contributed to logical investigations by themselves. [84, p. 498].

So at the end we can have the following picture: a group of three men—Leśniewski, Łukasiewicz and Tarski—mainly logicians with on one side some mathematicians, on the other side some philosophers. In the French version of Wikipedia, the following is said about Leśniewski : "With Jan Łukasiewicz and Alfred Tarski, who was his only doctor, he formed a troika which during the decades 1920 and 1930 made the University of Warsaw one of the most important research centers of mathematical logic in the world." This troika scheme is confirmed by the entry on Łukasiewicz in the English version of Wikipedia: "He remained a professor at the University of Warsaw from 1920 until 1939 when the family house was destroyed by German bombs and the university was closed under German occupation. He had been a rector of the university twice. In this period Łukasiewicz and Stanisław Leśniewski founded the Lvov-Warsaw school of logic which was later made internationally famous by Alfred Tarski who had been Leśniewski's student." And Woleński provided a general picture as follows:

Alfred Tarski (1901–1983), later recognized as one of the greatest logicians of all times, decided to specialize in logic (he graduated and obtained his PhD under Leśniewski) and became the third pillar of the Warsaw School of Logic (WSL for brevity). In the 1920s and early 1930s these Big Three were joined by (I list them in alphabetical order) Stanislaw Jaśkowski (1906–1965), Adolf Lindenbaum (1904–1941?) (the question marks in the dates indicate that exact data are uncertain or even unknown), Andrzej Mostowski (1913-1975), Mojżesz Presburger (1904–1943?), Jerzy Słupecki (1904–1987), Boleslaw Sobociński (1906–1980) and Mordechaj Wajsberg (1902–1943?). All of them except for Sobociński were mathematicians by training. …The WSL as a working group had eleven members at its peak, that is, around 1937. Is this large or small? Of course, everything depends on the point of reference. Evaluating from the contemporary point of view, about a dozen people working together in logic is perhaps not so many. However, if one looks at this group from a broader international perspective, one should remember that no other place in the world in which logic was actively done had even one third of this amount. Thus, at the time Warsaw was the place most populated by professional logicians in the world. …The Warsaw logical community was much larger than the WSL sensu stricto. Some mathematicians, already mentioned above, like Kuratowski, should be included. [94, p. 35]

Woleński also note that: "According to Łukasiewicz, logic is an autonomous subject which is subordinated neither to philosophy nor to mathematics. On this view, logic is no servant of any other science." [91, p. 377] So it makes sense to consider that logic is the heart of the LWS even if we don't use the expression "Lvov-Warsaw School of Logic" to make clear that LWS was not reduced to logic or to at least logic reducely considered.

Polish logic can be understood as literally logic made in Poland. But can we way that there is (or there was) a special way of doing logic in Poland? One may think of some peculiarity such as Polish notation, the search for the unique axiom or the focus on propositional logic. But, at the middle of all this, there is the theory of consequence developed by Tarski, as emphasized by Jan Zygmunt:

> A metamathematical theme was present in Polish logic from the early 1920s, beginning with Ajdukiewicz (1921). Tarski's efforts allowed investigations of the sentential calculi to be carried out within an explicitly metamathematical framework. Tarski generalized this framework to a mathematical theory of two primitive concepts (sentence and consequence) which he called 'the methodology of the deductive sciences'. Within this theory he was able to provide a conceptual apparatus for investigating deductive systems. (Lindenbaum contributed much to this work, including the widely known Lindenbaum maximality lemma.) [103, p. 6636]

and Ryszard Wójcicki:

> Note that already in the early thirties, Tarski, at that time a young docent at Warsaw University, formed his theory of deductive systems. It was intended to be the most general theory of logical reasoning. The central notion of Tarski's theory is a consequence operation, thus an operation which applied to any set of premises yields the set of all the conclusions derivable from (or, under semantic interpretation of the consequence operation entailed by) those premises. Since, depending on one's logical preferences, logical validity (and hence both derivability and entailment) can be understood in different ways, Tarski focused his attention on those characteristics of the consequence operation which are by and large independent of our logical preferences. Curiously enough the theory of deductive systems, known also as the theory of the consequence operation, has attracted little attention outside of Tarski's native country. In this way the theory of the consequence operation became a Polish specialty, not to say idiosyncrasy, often treated as some strange, not to say redundant, province of logical investigations. Only now, after nonmonotonic logic has been invented, the significance of Tarski's idea of studying the consequence operation in an abstract way, independent of any rules of inference derived from a specific system of logic, has become obvious. [84, p. 498].

This theory can be called *Polish logic* because it was developed mainly in Poland and it is not well-known outside of Poland. Tarski himself when he moved to California developed model theory because he had the idea that it was a more general framework and didn't work anymore directly or explicitly on the theory of consequence operator. Results about this theory can be found in the two books of Wójcicki [82, 83] and on the book *Completeness theory for propositional logics* by Pogorzelski and Wojtylak, originally published in 1982 by the Silesian University of Katowice, that we re-edited in 2008 in the book series *Studies in Universal Logic* [56]. A seminal work in this line is the monograph by Łoś, originally written in Polish [51], translated in English by Robert Purdy, but not yet published.

2.3   A School Which Is Not a School

The Aula Leopolidna of the University of Wrocław is nowadays considered as the baroque jewel of Poland. "Baroque" is a name of an artistic movement 1590–1725. The name was given only afterwards by the Swiss historian Jacob Burckardt (1897–1897) in his book *Der Cicerone Eine Anleitung zum Genu der Kunstwerke Italiens* published in 1855 (see [29]). The people who had developed the baroque style as a reaction to protestant's sobriety, didn't identify as a movement and didn't self-baptize them as "baroque".

Burckardt created the Baroque movement, he did not create the word. Jean-Jacques Rousseau notably used this word in his *Dictionary of Music*:

> Baroque : Une musique baroque est celle dont l'harmonie est confuse, chargée de modulations et dissonances, le chant dur et peu naturel, l'intonation difficile, et le mouvement contraint. Il y a bien de l'apparence que ce terme vient du baroco des logiciens. (A Baroque, or rough music, is that, whose harmony is confused, filled with modulations and dissonances, its notes hard and unnatural, the intonation difficult, and the movement constrained. It appears evidently that this term must be derived from the Baroco of the logicians, William Waring's translation). [63]

In syllogistic, Baroco is the name of the fourth mode of the second figure, an example of which would be:

All good logicians are Polish
Some humans are not Polish
Therefore some humans are not good logicians

Strange indeed! Maybe the Lvov-Warsaw School, by its heterogeneity and diversity, can be considered as baroque. Considering self-consciousness and self-baptism, the situation is not so baroque because LWS presented itself as such: at the event organized in 1935 in Paris by Louis Rougier, Ajdukiewicz, in his introductory speech used this expression:

> Presque tous les membres polonais de notre Congrès sont disciples de l'école connue sous le nom d'école de Lwôw et de Varsovie. (Most of the Polish members of our congress are disciples of a school known as school of Lwôw and Warsaw.) [2]

It was later on used again for example by Zbigniev Jordan [47], but the full canonization is certainly due to the works and activities of Jan Woleński (in particular: [86–88]).

With LWS we don't have something as explicit as with the Bourbaki's group, the Surrealist movement or the Vienne Circle. In the two last cases, besides the self-baptism, there were also manifestos. Chapman wrote the following about the Vienna circle:

> Philosophers are not generally known for being team players. Philosophical ideas may sometimes be attributed jointly to two or more thinkers, but it often turns out that these people disagreed on fundamental issues, or that they worked in separate countries or even separate centuries...The Vienna Circle was unusual. It consisted of a large but identifiable group of philosophers who met regularly, collaborated on work of mutual interest, and largely agreed on their conclusions. They even acknowledged their group identity by coining the term *The Vienna Circle*, or *Der Wiener Kreis*, in the title of a collaborative manifesto. [30, p. 7]

Let us compare this with what Surma wrote about LWS:

> A distinctive feature of the school and one of the secrets of its success was the spirit of teamwork. The mutual collaboration among the members was so close and intimate that it is often hard to decide who should be credited with which particular results. [71, p. 102]

But it is more connected with the school of Polish logic. There is a joke, pushing to the extreme this empathy, claiming that all important results proved by Tarski at this time are due to Lindenbaum. What is interesting is that this group of people were able to work together without sharing the same views. Lindenbaum was strongly communist (see [96, 104]), in a rather fanatic and irrational way, this was not the case of Tarski or Łukasiewicz.

Woleński wrote that: "Lindenbaum, Presburger, Tarski and Wajsberg were Jews, but Leśniewski and Sobociński (later also Łukasiewicz) were strongly antisemitic." [94, p. 38] As it is known Tarski changed his name and did as much as possible to hidden his Jewish identity to escape persecution but was inclined to consider Jews has a superior race (see [38]).

In Wikipedia, we find the following description:

> A school of thought (or intellectual tradition) is a collection or group of people who share common characteristics of opinion or outlook of a philosophy, discipline, belief, social movement, economics, cultural movement, or art movement...
> Schools are often named after their founders such as the "Rinzai school" of Zen named after Linji Yixuan and the Asharite school of early Muslim philosophy named after Abu l'Hasan al-Ashari. They are often also named after their places of origin, such as the Ionian School of philosophy that originated in Ionia and the Chicago school of architecture that originated in Chicago, Illinois and the Prague School of linguistics, named after a linguistic circle found in Prague, or Tartu-Moscow Semiotic School whose representatives lived in Tartu and Moscow. (Wikipedia, School of thought)

The name "Lvov-Warsaw School" is related to a name of a (bi)location, not a person. Although, according to the myth Twardowski is the father of LWS, nobody would use the expression "Twardowski School" instead of or as a synonym to LWS. When the name of a school is attached to a location, this means that some people gathered in a place, but shared something which is not limited to the place. In the case of LWS it is clear that a group of people gathered in Warsaw (Lvov in the shadow) and shared something which was part of a general rational movement but whose specific identity is connected to logic, however difficult to characterize.

On the other hand the situation of the group that Tarski developed in California is much simpler. It can be qualified in various ways: Tarski's school, Berkeley's school of model theory, etc. There is a main figure and a main topic. But funny enough, since 1957, it is called *Group in Logic and the Methodology of Science*...

3   The Future of the Lvov-Warsaw School

3.1   *No Future*

One may wonder what the future of the Lvov-Warsaw school is. A simple and direct reply would be: No Future. We can say that this school ended at the time of the second world war with:

- the death of Leśniewski (natural death few months before the war),
- the departure of Tarski to United States (just before the war),
- the destruction of Warsaw by the Nazi Germany,

- the invasion of Lvov by the Soviets,
- the departure of Łukasiewicz to Ireland (after the war).

These are five main central symbolic points with many corollaries and side-effects: The killing of Lindenbaum, Wajsberg and Presburger. The suicide of Witkiewicz. The departure of Bocheński, Sobociński, Kalicki, etc.

WWII officially started with the invasion of Poland by the Nazi Germany on September 1st 1939. On the other side Poland was invaded by the Soviets on September 17, 1939. During WWII Poland became a German Nazi death camp. Poland was chosen by the Nazis to develop the main extermination camps, the most famous being Auschwitz-Birkenau. The population of Poland before WWII was about 35 millions of people, after, less than 24. It is the country with the highest percentage of its citizens that died during WWII. It is difficult to imagine the survival of any school under such circumstances.

Moreover, after the war, Poland was dominated by the Soviet Union during about 40 years. Poland became free again only with the third republic in 1989, result of the Solidarność movement which played an important role in the final collapse of the Soviet Union in 1991. When I arrived in Wrocław in October 1992 the Soviet Army was still there. Things have been changing slowly: the 1st May of 2004 Poland entered the European Union. I was in Wrocław at this time, after taking part to a meeting of logic in Karpacz, and there was a great party on the main square. But 13 years after, for better or for worse, Poland is still not part of the eurozone.

The Soviet built the impressive tower dominating the city of Warsaw named *Joseph Stalin Palace of Culture and Science* (Fig. 12), nicknamed the *8th sister* because of its similarity with the seven sister Stalinist skyscrapers in Moscow, being the second highest one after the main building of Moscow State University. In this tower there was in

Fig. 12 Stalin power in Poland: the palace of culture and science

particular the department of mathematics of the University of Warsaw, where Andrzej Skowron, as he recently told me, attended a talk by Newton da Costa in the 1970s.

The result of the Soviet domination over the development of logic in Poland after WWII was on the one hand isolation from Western Europe and United States, on the other hand the domination of the Russian school. The best Polish students were sent to Moscow, this was the case of Surma who went to study with Kolgomorov. Philosophy in the Soviet sphere was strongly ideologically oriented towards Marxism. This certainly broke the interaction between logic and philosophy and in Poland logicians concentrated on more technical matters: algebraic methods applied to the study of non-classical logics (Rasiowa, see [59]), a general theory of logic (Suszko's abstract logic, see [45]), foundations of mathematics (in particular Mostowski, see [54]).[6]

The Lvov-Warsaw School is very much linked to the 2nd Republic of Poland which lasted from 1918 to 1939, a 20 year period, described as follows by Jan Zygmunt:

> In 1918, after 120 years of subjugation by foreign powers, Poland reappeared on the map of Europe as a free and independent nation-state. In 1939 the outbreak of the Second World War reversed these brief gains, bringing down the curtain on the Second Republic and inflicting massive damage on its economy, culture and learning. [103, p. 6634].

During this interwar period grew a milieu, a society, a world that was almost completely destroyed, didn't re-appear and never will. In this period logic developed, within a cocktail of philosophy, art and mathematics, an extraordinary situation which does not exist anymore anywhere in the world. This happened in Poland at the beginning of the twentieth century and also in Austria. Maybe it would make sense to speak about a Vienna-Lvov-Warsaw school, considering in particular that Twardowski studied in Vienna and that the interaction between logicians in Vienna and Warsaw was very important during the 1930s. As we already said Tarski went to Vienna and met Gödel (see [38] and [80]). The two schools met in Paris in 1935 at the congress organized by Louis Rougier (cf. [25]). Quine came to Europe and symbolically visited Vienna and Warsaw (see [36] and [58]).

Such atmosphere does not exist nowadays in other places in the world, in particular not in United States, where in some sense the center of civilization was displaced after WWII. Tarski created a school of logic in Berkeley, which became from the 1950s until his death the main school of logic in the world, but it turned out to be mainly a school of model theory centered on mathematics. At the start Tarski tried to develop applications of the axiomatic method to other sciences, in particular to physics. He organized, jointly with Leon Henkin and Patrick Suppes, an important event in December 1957 at Berkeley (cf. [44]). But there was no real follow up. Nowadays the main group of people working on the logic of physics, especially relativity theory, is in Hungary, a group formed by Istvan Németi.

Other Polish logicians were spread around the world: Sobociński in Notre Dame (USA), Bocheński in Fribourg (Switzerland), Łukasiewiz in Dublin (Ireland) [64], Surma in Auckland (New Zealand). Although these people were quite active, for example Sobociński created *Notre Dame Journal of Logic*, no one, excepted Tarski, created a group

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[6]Stan Surma recalls this time in a film we did with him in Xi'an. In Warsaw there were important seminars directed by Andrzej Mostowski, Helena Rasiowa and Zdisław Pawlak. To know more about that period, see [37], [85], [90].

Fig. 13 USA won the cold war: Warsaw becoming as beautiful as New York

or a school of logic. The relations between Polish logicians outside of Poland were not developed in a systematic way. Moreover the relation between these expatriate logicians with those inside Poland were severely restricted due to the cold war and the iron curtain. So we cannot talk of a Polish school of logic around the world after WWII.

One may think that the end of Soviet Union has led to a true liberation of Poland, but this is a fairly naive perspective symbolically illustrated by the statue of liberty at the entrance of New York (Fig. 13). People say that during the Soviet period in Poland, they had money but there was nothing to buy, after this period there are many things to buy but they don't have money to buy them. You can see a Ferrari in a shopping center but it is a pleasure only for the eyes. One can also say more generally that during the Soviet time there was no choice, in the post-Soviet time, there is the freedom to become a slave (Fig. 14).

It is interesting to remember the etymology of the word "school", *skhole* in Greek: "spare time, leisure, rest ease; idleness; that in which leisure is employed; learned discussion" (*Online Etymology Dictionary*.) In the open market society, a researcher has to become a business man, i.e. someone who is always *busy*, in particular fundraising is considered as a major quality and request for a researcher. There cannot therefore be schools in the original sense, like was the Lvov-Warsaw School.

Fig. 14 After 1991 Poland went further West

3.2   *Logic in Poland 1992–2017*

Since the end of the Soviet Union things are changing in Poland. I will describe the situation from the point of view of my own experience having visited Poland 11 times in 25 years, my first visit being a 14 month stay at the Department of Logic of the University of Wrocław in 1992–93 and my latest visit being a visit in Warsaw in June 2017 for the 2nd World Congress on Logic and Religion I was co-organizing.

From 1995 to 1999 I was working at the National Laboratory for Scientific Computing (LNCC) in Rio de Janeiro. During this period I came three times to Poland for three different conferences:

- April 1997, Karpacz, 2nd Conference Applications of Logic in Philosophy and the Foundations of Mathematics
- July 1998, Toruń, Stanislaw Jaśkowski Memorial Symposium
- August 1999, Kraków, 11th LMPS (Logic, Methodology and Philosophy of Science) congress.

The series of conferences "Applications of Logic in Philosophy and the Foundations of Mathematics" (ALPFM) was launched in 1996 and it happens every year since then. It generally takes place in a very nice village named Karpacz (now in Szklarska Poręba) in the South West of Poland. It has been organized by Jan Zgymunt, Piotr Wojtylak, Janusz

Fig. 15 JYB with Jan Zygmunt in 1997 in Karpacz

Czelakowski, Marcin Selinger, and Tomasz Połacik. I was invited to the first edition but was not able to take part to it. Two neo-Brazilian friends of mine went there: Marcelo Tsuji and David Miller. In 1997 I presented at the second edition the talk "Universal Logic in Perspective" (Fig. 15).

July 15–18, 1998 was organized in Toruń a conference commemorating 50 years of the publication of the paper by Jaśkowski on discussive logic (cf. [46]). It was a kind of follow up of the first world congress on paraconsistency organized in Ghent (Belgium) in 1997. Jaśkowski is considered as one of the two forerunners of paraconsistent logic (the other one is the Russian logician Vasiliev). Generally Łukasiewicz is not considered as a forerunner, although he wrote a seminal book on the principle of contradiction in Aristotle [52], severely criticizing arguments of Aristotle defending this principle. But Łukasiewicz didn't present a paraconsistent system of logic. He famously presented a three-valued system of logic [53] (later on criticized by Suszko [74]). Funny enough the matrices of this system were later used by Asenjo, da Costa and D'Ottaviano and Priest, to develop paraconsistent systems of logic.

The work of Jaśkowski on discussive logic has been promoted outside of Poland mainly by Newton da Costa and his pupils, in particular Lafayette de Moraes (see e.g. [34]). For this reason, at the occasion of this memorial conference was attributed to da Costa Nicholas Copernicus University's medal of merit. Da Costa was not able to come. He was represented by his colleague Itala D'Ottaviano, with whom he developed a logic called "J3"—the "J" referring to Jaśkowski, the "3" to three-valuedness. It is a paraconsistent logic trying to modelize Jaśkowski's ideas using three-valued logical

Fig. 16 Jaśkowski Memorial Symposium, Nicholas Copernicus University, Toruń, 1998. JYB, Arthur Buchsbaum, Lafayette de Moraes

matrices (see [35]). I myself presented at this meeting a talk entitled "The Paraconsistent Logic Z" [17], presenting yet another modelization, closer to Jaśkowski's ideas, based on modalities, inspired by a discussion I had with Arthur Buchsbaum [18] (another Brazilian logician, who also spent some times at the University of Wrocław through the connection I established with Jan Zygmunt) (Fig. 16).

In 1999 I went to Poland for the 11th LMPS congress which took place in Kraków August 20–26. It was my first participation to this series of events—after that I went to the 12th edition in Oviedo (Spain) in 2003, the 13th edition in Beijing (China) in 2007 and the 15th edition in 2015 in Helsinki (Finland). The edition in Kraków was by far the best. In particular because it was the more logical one. This series of event, mainly initiated and promoted by Tarski (cf. [38]), has become more and more oriented towards history and philosophy of science, most of the time without any serious logical basis. The event in Kraków was masterly organized by Jan Woleński. Stanislas Lem (1921–2006), the science fiction writer, author of *Solaris* (with was famously adapted in cinema by Tarkowsky in 1972) was invited to give a general audience talk. I met there the late Hartley Salter, with whom I had discussions which lead to my work on the square of opposition (many papers and a series of world events, see [22, 26]). I presented at this LMPS meeting a talk entitled "The Philosophical Import of Polish Logic" (cf. [13]) in which I emphasize the import of three logical notions which were clarified within the Polish school of logic: structurality, truth-functionality, extensionality.

In 2000 and 2001 I was at Stanford University working with Patrick Suppes and didn't come to Poland. From 2002 to 2008 I was working in Switzerland and during this time I also came three times to Poland for three conferences:

- May 2003, Karpacz, 8th ALPFM conference
- April 2004, Karpacz, 9th ALPFM conference
- March 2006, Zakopane, Applications of Algebra to Logic and Informatics X.

I was invited to work at the Institute of Logic of the University of Neuchâtel in Switzerland by Denis Miéville. Neuchâtel is where Jean Piaget was born and his father

was the first rector of the university. Piaget taught in Paris and then built a school and research center in Geneva. One of his students, Jean-Blaise Grize, was from the region of Neuchâtel and developed logic and semiology there. He became rector of the University of Neuchâtel and created an institute of logic and a semiological research center. Miéville was his main student and he became head of the institute of logic and later on also rector of the university. Grize had interest for many things but Miéville main interest was about Leśniewski. He published many papers and book on Leśniewski and became one of the best specialist of the Polish bear followed by his student Pierre Joray. Knowing my interest for Polish logic, Miéville invited me to work with them in Neuchâtel.

In 2003 I went to Karpacz with Pierre Joray and Nadine Gessler, another student of Miéville. I took part to the 8th edition (May 6–10, 2003) of the ALPFM conference in Karpacz, together with Pierre and Nadine, presenting the talk "A New Four-Valued Approach to Modal Logic" (later publisher as [20]). The following year (2004) the event took place April, 26–30, I came again, with Pierre Joray, and presented the talk "Does logic need axioms?" (see my later paper [19]).

With Joray and Miéville we also went to a meeting in Nancy (November 21–22, 2003) organized by Roger Pouivet on Philosophy in Poland 1918–1939. A book was subsequently published including my paper about Tarski's axioms for the consequence operator [16]. I met there for the first time Katarzyna Gan-Krzywoszyńska, who later on was my partner for the organization of congresses on universal logic and the square of opposition.

Sandra Lapointe visited us in Neuchâtel and then invited us to a meeting she organized September 23–26, 2004, in Montréal, Canada: *Logic, Ontology, Aesthetics—The Golden Age of Polish Philosophy* where I presented a lecture entitled "Tarski on Consequence and Consequence" discussing the difference and relation between Tarski's operator of consequence and the notion of consequence he introduced in his famous paper "On the concept of logical consequence" [77].

I had heard about Zakopane, in particular because of Witkiewicz, but never visited the town, so I was glad to receive an invitation by Joanna Grygiel to come to the 10th edition of the workshop *Applications of Algebra to Logic and Informatics* which took place there March 6–12, 2006. I presented a talk entitled "Universal Algebra and Universal Logic". David Makinson also was there. There was an interesting excursion organized at night in the mountain on a sledge driven by horses on the snow (Fig. 17).

Since 2010 I am back to Rio de Janeiro as professor of logic of the department of philosophy of the University of Brazil. And since then I also came three times to Poland:

- February 2012, Poznań
- September 2016, Łódź, 8th International Conference—Non-Classical Logics Theory and Applications
- June 2017, Warsaw, 2nd World Congress on Logic and Religion.

In January 2012 I was part of an exchange program with the University of Munich with Matthias Schirn and I decided to come to visit Katarzyna in Poznań. I gave at Adam Mickiewicz University a talk on the square of opposition and Katarzyna showed me the place where Suszko was living (Figs. 18 and 19). Suszko's father was the rector of the University there after Ajdukiewicz.

In 2016 I was invited to take part to the *8th International Conference—Non-Classical Logics Theory and Applications*, which took place September 5–7, 2016 in Łódź,

Fig. 17 In Zakopane in 2006, night excursion. Applications of Algebra to Logic and Informatics

Poland. This is a series of events which alternatively takes place in Łódź and Toruń, two of the most active centers of logic in Poland since WWII. I presented there the talk "Paraconsistent Logic from A to Z". The pun is as follows: "A" is the first letter of "Angers" the place where I discovered paraconsistent logic (see [18]) and "Z" the last letter of "Łódź" where I was giving the talk and at the same time the name of a paraconsistent logic I developed and that I named like that because it is based on possible worlds and "Z" is the last letter of "Leibniz". The organizer of the event, Andrzej Indrzejczak, organized for us a special visit to Łódź Jewish cemetery which was very impressive, with a guide telling us all about the story of Łódź's ghetto.

During this visit I also did a stop in Warsaw in preparation of the 2nd world congress on logic and religion that we organized there in June 2017. After a first successful edition I organized in Brazil with my colleague Ricardo Silvestre in 2015 (cf. [28]), we received the proposal by Marcin Trepczyński to organize a second edition at the University of Warsaw. In September 2016 Marcin showed me the projected place of the congress and presented me to Stanisław Krajewski who was the main organizer of the meeting together with Marcin and Piotr Balcerowicz. The event was a great success with invited speakers such as Dov Gabbay, Michal Heller (Templeton Prize), Saul Kripke (I succeed to convince him to come for his first visit to Poland), Laurent Lafforgue (Fields medal), and Jan Woleński. There were many participants from all over the world that enjoyed very much Warsaw and the friendly atmosphere of the meeting (Fig. 20).
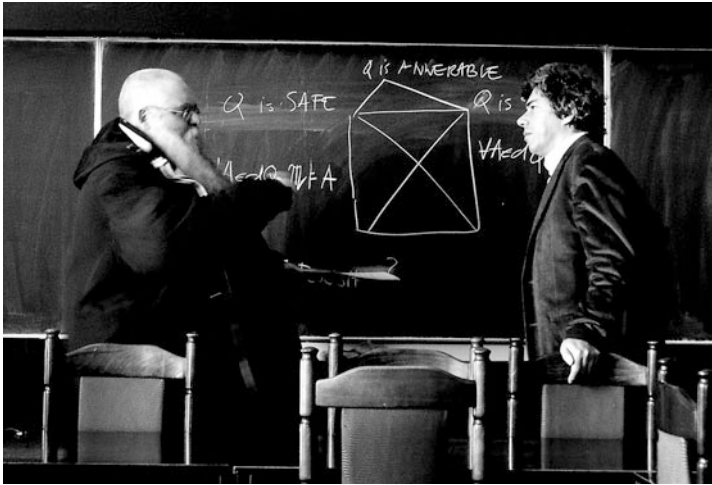
Fig. 18 JYB in front of Suszko's house in Poznań
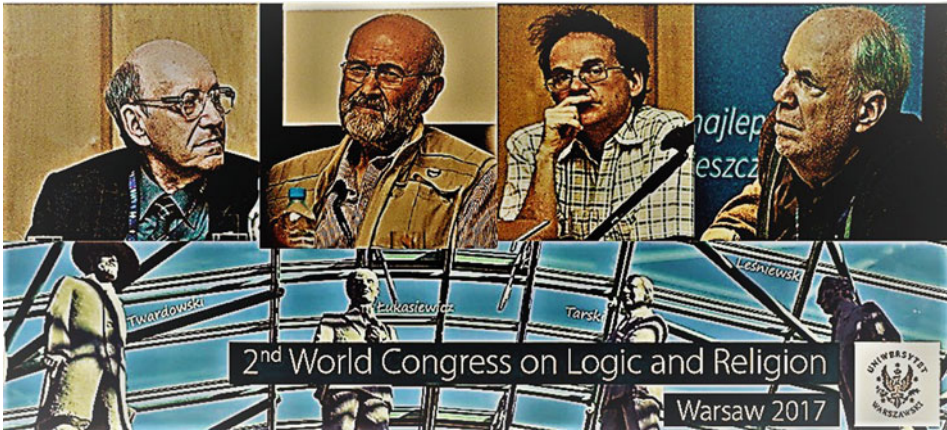
Fig. 19 JYB in Poznań with Piotr Leśniewski

Fig. 20 The 2nd World Congress on Logic and Religion. University of Warsaw, June 2017

## 3.3 The Universal Logic Project

Since now more than 25 years I am developing the Universal Logic project. It is deeply connected with Polish logic and the Lvov-Warsaw School. Here are five basic steps corresponding to the development of the project:

- 1993, Wrocław, choice of the expression "Universal Logic"
- 1995, Paris, PhD *Recherches sur La Logique Universelle*
- 2005, Montreux, *1st World Congress on Universal Logic* (UNILOG)
- 2007, Neuchâtel-Basel, launching of the journal *Logica Universalis* and the book series *Studies in Universal Logic*
- 2018, Vichy, 6th UNILOG, World Logic Prizes, including *Alfred Tarski's Prize*

I chose the expression "Universal Logic" when in Wrocław in 1993. I have explained the choice and meaning of this expression in some other papers (see in particular [14], [15], [23] and [24]), so I will not enter in details here, just focusing on the essential. The expression "Universal Algebra" was promoted (not invented) by Garrett Birkhoff. The central feature of Birkhoff's approach is the abandonment of any axiom. I was much inspired by this to develop a general theory of logics, generalizing Tarski's theory of consequence operator, going one more step into abstraction, throwing out the axioms. I crystallized this into the expression *Axiomatic emptiness* (see [19] and my paper [16] discussing Tarski's axioms).[7]

I presented then a lecture entitled "Universal Logic" at the Logica'94 meeting in Czech Republic and defended in July 1995 a PhD in mathematical logic at the University of Paris 7 bearing this expression in the title [10]. Jan Zygmunt came to Paris and was a member of the Jury. I remember that he stayed at the house of a Polish friend of us, Richard Zuber, Rue Mouffetard. After that I spent time in Rio de Janeiro and California, in particular 2 years at Stanford University with Patrick Suppes.

I was able to systematically start to develop the Universal Logic project when I was in Switzerland during the period 2002–2008. I submitted a research project on universal logic to the Swiss Science Foundation (SNF) which was accepted. After organizing a small workshop at the Universality of Neuchâtel in 2004 I started to work on the preparation of the *1st UNILOG—World Congress and School on Universal Logic* in Montreux in Spring 2005 (Fig. 21, Fig. 22). The SNF was at this time giving special support for people from Eastern Europe in particular students so I decided to invite Katarzyna Gan-Krzywoszyńska from Poznań that I had known in Nancy in 2004 and she accepted to help us in the organization of the event. She was especially dedicated and efficient and she subsequently took part to the organization of the further editions
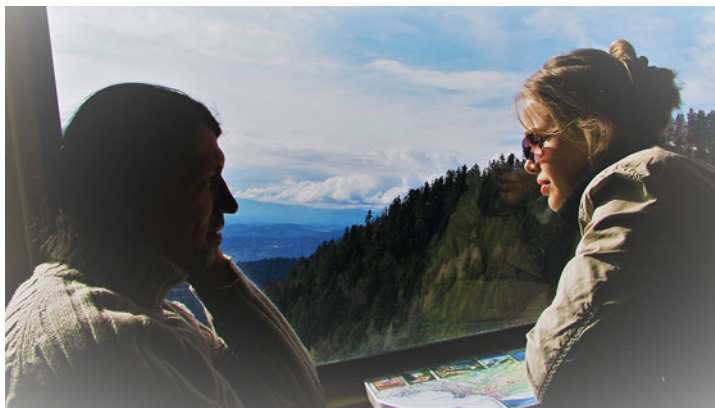
Fig. 21 UNILOG'2005 Montreux—train trip to the Marmot's Paradise, Katarzyna Gan-Krzywoszyńska with Andrei Rodin

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[7]I recently defended the idea that anti-classical logic, the complementary of classical logic, can be considered as a logic in view in particular of the theory of refutation initiated by Łukasiewicz. Anti-classical logic is a concrete example of a logic obeying none of Tarski's axioms; See [27].

Fig. 22 UNILOG'2005, Montreux—excursion on the Lake. Urszula Wybraniec-Skardowska, Janusz Czelakowski, Saul Kripke, Musa Akrami, Joanna Grygiel, João Marcos

of UNILOG: the 2nd UNILOG in Xi'an, China in 2007, the 3rd UNILOG in Lisbon, Portugal in 2010, the 4th UNILOG in Rio de Janeiro, Brazil in 2013 and the 5th UNILOG in Istanbul in 2015. She also helped me to develop other projects such as the congresses on the square of opposition. We jointly organized a congress on analogy in Puebla Mexico in 2015. She invited me to write a paper on a special issue of the journal *Studia Metodologiczne* dedicated to Kazimierz Ajdukiewicz [25] and prepared the paper "Personal recollections about JYB by Newton da Costa and others" published in the second volume of the Festschrift for my 50th birthday [39].

At all UNILOGs we had important participations of Polish logicians: Janusz Czelakowski (invited speaker at UNILOG'2005), Piotr Wojtylak (tutorial on consequence operator at UNILOG'2005) and Joanna Grygiel (tutorial on universal algebra for logics at UNILOG'2005), Stan Surma and Jan Woleński (invited speakers at UNILOG'2007), Andrzej Wiśniewski (tutorial on erotetic logics at UNILOG'2013) and Beata Konikowska (invited speakers at UNILOG'2013), Roman Murawski (invited speaker at UNILOG'2015), Andrzej Indrzejczak (tutorial on cut-elimination at UNILOG'2015).

Urszula Wybraniec-Skardowska, one of the two editors of the present book, took part to the 1st UNILOG in Montreux and to successive editions, organizing in particular a workshop on logic and linguistics at UNILOG'2013 together with Marcos Lopes. As a result they published a special issue of the *Journal of Logic, Language and Information*

(volume 23, issue 3, 2014). Urszula also took part to the SQUARE events, in particular the 2014 edition in the Vatican [100].

The forthcoming edition of UNILOG will happen in Vichy in June 2018. The Polish logician Jerzy Tomasik (who studied logic in Wrocław) was working at the University Blaise Pascal in Clermont-Ferrand. He knew the late Marcel Guillaume, also from this University, a friend of Newton da Costa, who helped him to publish his work on paraconsistent logic in France in the 1960s and was therefore seminal in the world promotion of paraconsistent logic (see [40–42]). Tomasik was at the UNILOG'2013 in Rio and during a visit in Vichy I told him about my project to organize the 6th edition there (He himself organized in Clermont-Ferrand the *Logic Colloquium* in 1994). He then presented me to Christophe Rey working at the Vichy Campus of the now unified new university Clermont Auvergne (UCA), with whom I am now working on the organization of the 6th UNILOG.

At this edition of UNILOG there will be a session entitled *World Logic Prizes*. In 2014 I decided to create in Brazil, the *Newton da Costa Logic Prize*. It is a prize open to any researcher working in logic in Brazil. People have to submit a non published paper. The winner won publication of his paper in *Logica Universalis* and participation to an international logic event. The first edition of the prize was organized in 2015 and the winner, Rodrigo Freire, was invited to take part to UNILOG'2015 in Istanbul. I then decided to work on the promotion of similar prizes in many countries. At UNILOG'2018 (Fig. 23) we will have about 15 countries presenting a winner, in particular the winner of the Polish Prize of Logic that I suggested to name *Alfred Tarski Logic Prize*.

The present book is published in Birkhäuser's book series *Studies in Universal Logic* (SUL). I was particularly glad to develop with Birkhäuser a journal and a book series on

Fig. 23 UNILOG'2018

universal logic, because the collected papers of Tarski were published by Birkhäuser. It is a four volume book which was released in 1986 [79]. Since many years it is out of print. We are now working on the re-edition of this book in the SUL series with an additional fifth volume including letters and unpublished works of Tarski.

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