The growth of mathematical culture in the Lvov area in the autonomy period (1870–1920)

Introduction

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One looks for things from the past
that are still interesting today.[1]

W przeszłości szuka się tego,
co interesuje człowieka dziś.

Wer sich mit einer Wissenschaft bekannt machen will,
darf nicht nur nach den reifen Früchten greifen,
er muss sich darum bekümmern wie
und wo sie gewachsen sind.[2]

Kto chce zgłębiać jakąś wiedzę,
ten winien nie tylko zbierać dojrzałe owoce,
ale też zwracać uwagę na to jak
i gdzie one rosły.

INTRODUCTION

The culture of mathematics

Mathematics is now present everywhere. Hundreds of thousands of people do it professionally today. Mathematical methods are used in many fields of modern science, in natural science, engineering, economics, political science, sociology, literary studies, management, linguistics and others. Mathematicians, as A.L. Hammond[3] noticed, stay away from public view, they are busy people. It was not always so. There were cultures without mathematics, for example, Roman or Indian, in which mathematics was only a part of the religious sphere. In ancient Egypt mathematics was a part of the occult. In ancient Greece it was a part of philosophy, in the Middle Ages it was preserved within the walls of the monasteries, serving mainly to set the dates of movable feasts. Unlike, for example, in China where the math was on the edge of the culture, in classical Greece, strongly influenced by the Pythagoreans, it has grown to the status of a tool to explore the world.

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[1] H. Samsonowicz, *Przestrzeń historii* [The space of history], Matematyka Społeczeństwo Nauczanie 30–I(2003), pp. 4–8 .

[2] Johann Christian Poggendorff (1796–1877).

[3] A.L. Hammond, *Matematyka – nasza niedostrzegalna kultura* [Mathematics – our invisible coulture], in: *Matematyka współczesna. Dwanaście esejów* [Mathematics today. Twelve informal essays], L.A. Steen (ed.), WN–T, Warszawa, 1983, pp. 26–48.

Its rank has increased enormously since the days of Galileo, Kepler and Newton, as it became a key tool for exploring the world. People look at the world mathematically and in some ways it has been a subject of mathematics. But the mathematics was not just a tool; its creation by mathematicians had an autonomous character, satisfying their own goals and ambitions.

Since the seventeenth century mathematics was developed as a science with a very high degree of abstraction, one of the features of which is the distance between the discoveries and applications. For example, Boolean functions in the nineteenth century could be regarded as a kind of curiosity, and in the twentieth century they became necessary in computer programming; or Riemann geometry, which also turned out to be essential in the theory of relativity. Such examples can be found in the history of mathematics in great numbers.

Developing science, including mathematics, requires adequate social base. The aim of the book is to present formation of such a background in the years 1870–1920 in the area of impact of the Lvov University. We will try to present the activity, in particular, of Lvov mathematicians and their great commitment, and to demonstrate the importance of their work to raise the culture of mathematics in Poland in the second half of XIX and early XX century. After 1920, in Lvov there was one of the major schools of mathematics in the world – the Lvov School of Mathematics, the ground for which has been prepared during the preceding fifty years. In this book, the Lvov School of Mathematics will not be discussed (see Duda, 2007).

Mathematical culture at an elementary level means appreciation for mathematics as a certain intellectual activity, in particular, mastering of certain techniques of calculation, understanding the idea of leading, having a clear definition of terms and even the perception of the beauty of mathematics.

In its social dimension, the mathematical culture of society consists of mathematical culture of individuals. Its expression is widespread in using intellectual techniques such as abstraction, pattern recognition and formation, generalizing, comparing, noticing analogies, sorting, classifying, defining, arguing, making algorithms, or optimizing.

For M. Kordos[4], the mathematical culture consists of skills allowing one to see in a problem under consideration non-existing mathematical objects, which however, amazingly efficiently, lead to solving this problem.

As R. Duda[5] notices: Mathematics is an element of culture, and therefore when looking for its sources it seems reasonable to begin from the history of the culture where it is possible to try to uncover original sources of mathematical thinking.[6]

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[4] M. Kordos, *Zobaczyć to czego nie widać, czyli kultura matematyczna w praktyce* [To see the unseen, or mathematical culture in practice], Publising House Aksjomat, Toruń, 2009.

[5] *Kultura matematyczna a kultura matematyków* [Mathematical coulture and the culture of mathematicians], Matematyka Społeczeństwo Nauczanie 21(VII 1998), pp. 27–31.

[6] R. Duda, *Co każdy o matematyce wiedzieć powinien* [What everynody should know about mathematics], Matematyka Społeczeństwo Nauczanie 31(VII 2003), pp. 2–7.

Why can we be interested in the history of the mathematical thought and its way of forming? In the European culture the role of mathematics was shaped by the ideas of Plato. Plato believed that there are only eternal, unchanging, perfect, pre-existing (eable existed before the foundation of the world) ideas not available to the senses. Things (or the material world) are only an imperfect reflection, a copy of the ideas. The essence of Plato's epistemology was contained in the question of how we can reach true knowledge (of ideas). Plato saw the agent between sensory perception and cognition of ideas (or true knowledge) in mathematics – as an ideological bridge between reality and the visible world. Indeed, in mathematics he saw another form of being, standing between the unchanging world of ideas, which exists, and the material reality, which continually changes, and so only becomes, but does not truly exist.

In Book VII of the Republic he writes about levels of learning for the rulers of his ideal state. As the basic (and most important) he considers the arithmetic ("calculations") and geometry. He notices: Indeed, this subject of science seems to us essential, since it apparently leads the soul to use the intellect to achieve the truth itself. ... People are able to do the accounts manifesting the quickness just in any subject of science[7]. Plato believed that mathematics is the first among all the sciences, because it does not require being concrete, is not dependent on space and time and so it is constant. Thought experiment is therefore much more reliable and more accurate than empirical research, which is dependent on the external world. People do not "discover" mathematics, as mathematical laws dwell independently of us. Mathematics – for Plato, and through him for the whole European culture- grew from his philosophical system, providing the greatest value, difficult to overestimate. Probably the strongest evidence of this is the inscription in the building of so called Plato's Academy: Medeis ageometretos eisito (Do not let anyone unfamiliar with the geometry enter here).

There is a term *nature rationality*[8] in literature, and it serves as a highly un-obvious feature of the reality, which makes mathematical beings – non-material and out-of-time – good in describing the physical reality. Mathematicality of nature was hinted at, as K. Maślanka notices, by Aristotle (*The whole sky is a harmony and a number*), Galileo (*The book of nature is written in mathematical language*), Albert Einstein (*How it is possible, that mathematics, as a fruit of human thinking, independent from experience, may be applied to real objects*

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[7] Platon, *Państwo, księga VII* [The Republic, Book VII], Wydawnictwo Naukowe PWN, Warsaw, 2010.

[8] M. Heller, *Filozofia i Wszechświat* [Philosophy and Universe], Universitas, Cracow, 2006; E. Wigner, *The Unreasonable Effectiveness of Mathematics in the Natural Sciences*, „Communications in Pure and Applied Mathematics", 13(1960), no. 1; K. Maślanka, *Liczba i kwant. Ukryte ślady racjonalności przyrody* [Number and quanum. Hidden traces of rationality of nature], in: M. Słomka (ed.): *Nauka – wiara – rola filozofii* [Science – faith – the role of philosophy], vol.1. pp. 1–17.

with such an admirable way?) and Paul Dirac (*As the time goes by it has become more apparent that the rules interesting for mathematicians are identical with those chosen by Nature*).

Since the times of Greeks, mathematics influenced certain disciplines, becoming a model and support for them. This was reflected in the degree programmes and the attitudes of teachers of mathematical subjects in engineering, physical, chemical, geological, and other studies in Lvov, at the time described in the present book. During that period, in the school and university instruction of mathematics in Lvov and Eastern Galicia one can find the following: attention paid to continuous development, regularity of school and research work, efforts to maintain continuous exchange of ideas with the world scientific centers, the concern about the level of mathematical knowledge of teachers and increasing their motivation, the importance of mathematics in school education and engineering. Mathematics became an important school subject. Demand for mathematical knowledge was growing, especially for engineers and scientists. The works in *School Reports* indicate that the math teachers were interested in their subject, and university professors felt responsible for the teachers and for popularization of mathematics among members of various scientific societies. It is not risky to say that in times of autonomy in the case of mathematics, when the Polish language was introduced for lectures, the school changed its face, ceased to be Austrian. Mathematicians were able to give a new quality to teaching, give a new interpretation of teaching in secondary school, polytechnic and university education.

The book consists of five chapters, Appendices and Bibliography.

Grammar school final exams in the Austro-Hungarian gave so-called census giving access to university studies, or to certain positions in state administration. Individuals with such a diploma were a part of social elite. Grammar schools were therefore of high social status and were treated as "scientific establishments", which is demonstrated by independent scientific studies of teachers (see Chapter I) and sometimes their appointments at university departments. In the first chapter we present the mathematical content in the grammar schools of classical and real type, and in trade school in Lvov. Also, we describe qualified teachers and their status, on the basis of annual reports of various grammar schools and memories of a few prominent mathematicians.

Only a university graduate could be a professor of grammar school. Thus special importance of the university and its professorship, which educated not only future teachers, but also published books and manuals, and performed scientific research. It was a prominent factor in the level of mathematical culture and hence, Chapter II, which deals with the university, is the central chapter of this book. We present in it the role of university in promoting mathematical sciences, education and support for teachers. We represent biographies of professors, their involvement in the education of students and young staff, influence on the choice of research problems. One could reach

the university chair not through assistantships, but by teaching at school. Chapter III deals with the Polytechnic School, the only institution of such a type in Galicia. We represent topics of lectures, their mathematical content and lecturers.

In the second half of the 19th century scientific societies and congresses of scientists of various specialties, including a particularly important Congresses of Polish Physicians and Naturalists, were providing the support for the formation of scientific environment. They are discussed in Chapter IV. The establishment of the first Polish Mathematical Society in 1917 was the mathematical expression of the energy of the environment in Lvov. The subject of this chapter is also publishing activity in Lvov, including journals and books published there. In Chapter V the special cases were presented. We will recall the most important work of J. Puzyna *Teorya funkcyj analitycznych* [Theory of analytic functions], its importance and influence on Polish mathematics. There will be discussed mathematical works, which appeared in the journal Kosmos of the Copernicus Society of Naturalists in Lvov, and papers at meetings of the Lvov Mathematical Society. Then we present the figure of L. Böttcher, an unjustly forgotten mathematician of Polytechnic School, who tried unsuccessfully three times to get venia legendi (licence to lecture) at the University.

In the Appendices we present a bibliography of works on teaching mathematics in the journal Muzeum of the Society of Teachers of Higher Education. The list of works related to the mathematics contained in the publication of the Society of Teachers of Higher Education is completed the information about activities of mathematics professors of universities, secondary schools, members of scientific, technical and natural sciences societies. Final exam topics in mathematics of the period are also included. In order to make the structure of university more familiar, some data on the educational institutions functioning in the Department of Philosophy are also included.

Brief history of Galicia in the era of autonomy

Galicia is the colloquial name imposed by the invaders, setting out the Polish and Ukrainian annexed by Austria in the first partition Poland (1772). Full official name is the Kingdom of Galicia and Lodomeria with the Grand Duchy of Cracow and Oświęcim-Zatorsk Duchy. The genesis of the main core of the name (Galicia) is difficult to decrypt. Some historians seek in it an attempt to return to the old Habsburg possessions in Spain, "original" Galicia is a term for the north-western lands of the Iberian Peninsula (Habsburgs lost Spain irretrievably on November 1, 1700 when king Charles II died.[9])

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[9] Charles II Habsburg (1661–1700) – the last of the Spanish Line of Habsburg line. He did not have offspring.

In 1861, Emperor Francis Joseph I issued the February patent. On its basis Galicia got autonomy with the National Seym (Parliament) and the local government in the capital city Lvov. However, full development of the framework, range and functioning of the autonomy lasted until the early seventies. In 1864, after the fall of the January Uprising in the Polish lands annexed by Russia, Polish population suffered repressions. In Galicia, a state of siege lasted from February 1864 to April 1865. After its abolition, there were some attempts to obtain freedom within the Austrian annexation. Also worth noting is the fact that the events in Galicia fully fit into what was happening in Europe at that time. In 1867, Austrian Empire was transformed into a dualistic monarchy (the imperial-royal) Austro-Hungarian Empire (consisting of Austria – Cislitawia and so-called Lands of Crown of St. Stephen-Translitawia). The reasons of this event should be discerned in the war defeated by Austria, with Prussia in 1866. The attitude and character of the ruler Francis Joseph I was important as well. He was the nephew of his predecessor, Ferdinand I, the Good, and came to power in a very difficult moment for the monarchy (Spring of Nations), so in order to maintain the unity of his powers he had to use force (the bloody suppression of the Hungarian uprising). After ten years of strong central authority (the era of Alexander von Bach) in the monarchy, the slow (though successive) time of liberalization of the political system and social life began. The emperor, who was held in high esteem (even exalted honour), was the epitome of power, tradition and hierarchy, but also progress and development. Note that despite the fact that he grew up in a typically conservative family, he could enter a new, liberal democratic thought of the 19th century (despite aging he had not lost his strength and vigour in action – on the contrary, he continued with his reforms that modernized the monarchy). In 1867 the so-called December constitution, one of the most important documents in the history of Polish lands under partitions, was proclaimed. Administratively, Galicia found itself in Cislitawia. The Constitution of 1867 approved the activities of the National Parliament of Galicia. It convened once a year for six weeks, the meetings covered education, economy and transport. Seym had the right to enact laws concerning the national economy, communications, education and health. The Galician Seym also had an executive body – the National Department (it held the representative position as well as supervised the work of county departments). Also, a governor officiated in Galicia, who resided in Lvov and who impersonated the imperial majesty. The Austrian Government ensured that the governors appointed would be local Poles.

Since 1871, also the minister of Galicia officiated in Vienna (only a Pole could hold this position). Apart from the national authorities of Galicia citizens could also choose their representative to the Council of State in Vienna. The Polish Circle of politicians uniting the various factions appeared there. They were obliged by the principle of solidarity and consensus in the vote. It often was a part of the ruling majority (therefore it had a real impact on the policy

of the monarchy). In 1895, Kazimierz count Badeni, the former governor of Galicia (his governing is regarded as the top influence of the Polish nobility in monarchy), became the Prime Minister of the Austrian Government. Until 1907 (when the universal and fully democratic electoral rights were enacted) the so-called curial system was obligatory in the monarchy. Voters were divided into 4 curias: landowners, industrialists and merchants, urban and rural. This system was not proportional, because it gave a much greater advantage to the higher strata, and therefore an advantage (e.g. in national parliament) was generally for the middle class or conservatives.

With all these liberties, Polish cultural, artistic and scientific life, and thus the national consciousness, could develop in Galicia. Galicia became the guardian of the Polish culture, tradition and history. Here prominent Polish writers, artists and scientists acted, among others Jan Matejko, Stanisław Wyspiański, Władysław Bełza, Kazimierz Przerwa-Tetmajer, Stanisław Tarnowski etc. It was Cracow that became a particularly important centre of Polish culture at the turn of the 19th century (during the historical and literary time, called modernism). It was called the capital of Young Poland. Both literary and theatrical life (St. Przybyszewski, T. Boy-Żeleński), as well as scientific and philosophical (Rev. Pawlicki) flourished in that city.

Galicia was also called a Polish Piemonte. It was believed that just as in Piemonte the realization of the idea of unification of Italy began (completed successfully), the process of unification and rebirth of the Polish lands of the state began in Galicia. In Galicia, paramilitary organizations were created – Sokół [Falcon], Strzelec [The Rifleman], Bartosz's Teams – which constituted the basis for the Polish Legions, formed during the Great War.

In Galicia, Polish political parties arose. I would like to focus especially on two of them in this brief historical outline. In 1892, a social democratic party came into being, which was called the Polish Social Democratic Party of Galicia and Cieszyn Silesia since 1897. The politicians of the party entered the Austrian parliament. Its main activists were Ignacy Daszyński – later Deputy Prime Minister of the Government of National Defence from 1920 and Speaker of Parliament, as well as Jędrzej Moraczewski, the prime minister appointed in November 1918 by Józef Piłsudski's government. The party was a co-organizer of the Provisional Government of the People's Republic of Poland in Lublin in November 1918, when Prime Minister was I. Daszyński. The second party, founded in Galicia, was the Peasant Party formed in 1895 in Rzeszów. In 1903 it adopted the name of the Polish Peasant Party. The party issued a subsequent three-time Prime Minister of Polish Government – Wincenty Witos.

Considering the autonomy and the existence of mild behavior of the Austrian authorities to the Poles in Galicia, the conciliatory concept was also created, which united loyalty to the Monarchy with patriotism and the desire to increase the rights of the Polish population (but only in an official way). The conciliators

called themselves "stanchykers"– the name comes from the so-called Stańczyk portfolio – a collection of letters condemning any rebel outbursts. Their motto and essence was a return to the Emperor Francis Joseph I from 1866: "With you, Your Majesty, we stand and want to stand". The main leaders of this group were Paweł Popiel and Stanislaw Tarnowski. On the eve of World War I, when all political parties had to decide about the orientation in relation to the future international conflict, conciliators sided with the so-called concept of building triple Monarchy (Austro-Hungarian-Polish).

Draft of the parliamentary electoral constituencies in 1900[10]

Galicia was traditionally multi-ethnic and multi-religious. Besides the Poles and Ukrainians there lived Jews, Germans, Armenians, Vlachs, Russians and other nationalities. There were three Christian churches: Catholic (rites: Roman, Byzantine and Armenian), Evangelical and Orthodox, also Judaists and Muslims lived there. Lvov was the seat of three Catholic metropolies: Roman, Greek and Armenian.

Cohabitation of Poles and Ukrainians was a cause of numerous conflicts. After 1867 administrative posts were gradually taken over by Poles, and the

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[10] Source http://dziedzictwo.polska.pl/katalog/skarb,Sejmowe,gid,246660,cid,2048.htm. (Districts marked in white – only Polish, districts marked in red – mixed Polish-Ukrainian, districts marked in blue – only Ukrainian).
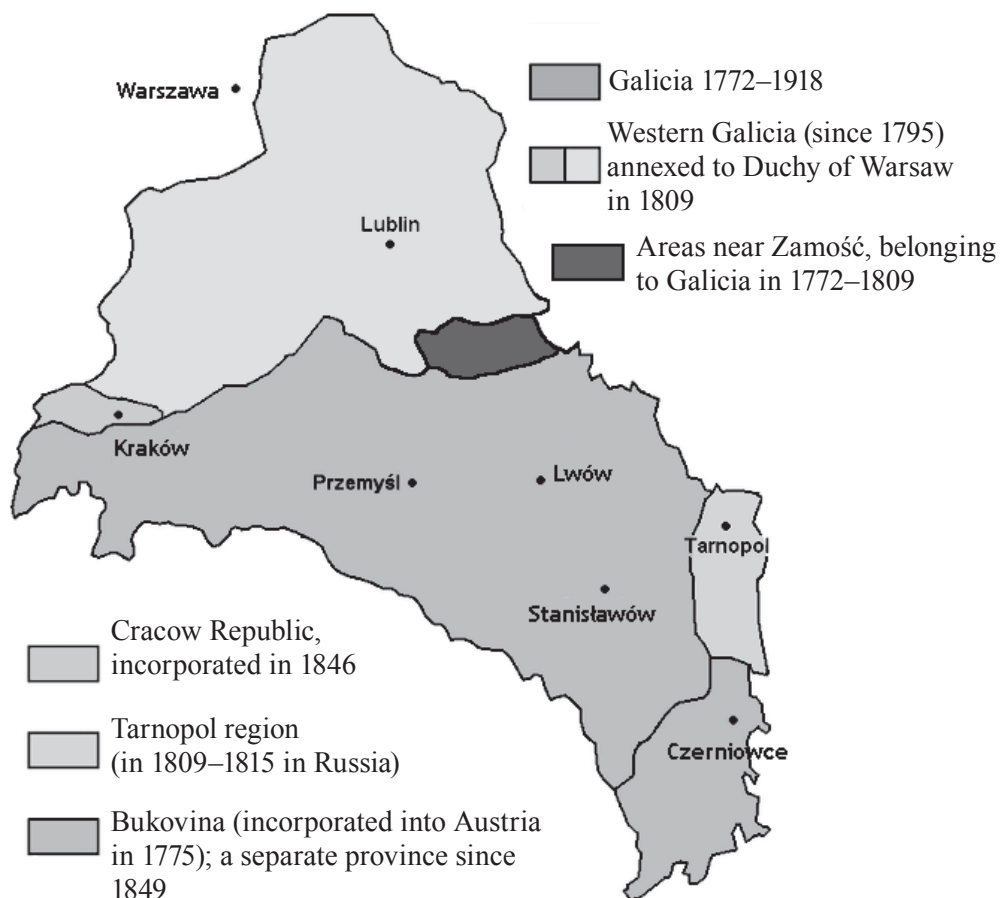
Ukrainians did not like that. In 1890 Polish and Ukrainian parties signed the so-called first compromise in the National Parliament, which provided, among other things, extension of primary and secondary education in the Ukrainian language. Cooperation, however, collapsed after a few years, when the Poles brought about complete polonization of the Lvov University. At the beginning of the 20th century, Galicia was an area of political assassinations, including that of the governor of Galicia count Andrzej Potocki and a Ukrainian student Adam Kocko. A further test of the agreement took place on the eve of World War I – the so-called second compromise provided for a change of the electoral law for the National Parliament in favor of the Ukrainians and the creation of the Ukrainian state university in Lvov. These provisions, however, could not be made real.

The end of the war also created a difficult situation for these two nations – Poles, who occupied Lvov, were still fighting for the Western Galicia and Ukrainians proclaimed the West Ukrainian People's Republic. Józef Piłsudski was a great advocate of the creation of the Ukrainian state, but after the Polish-Bolshevik War of 1920 federalist concepts have falied. Thus ethnic tensions did not disappear during the Second Republic, which was associated with the activities of OUN (Organization of Ukrainian Nationalists) and UIA (Ukrainian Insurgent Army – the armed factions OUN), which were active till the end of World War II.

National conflicts took place not only between Poles and Ukrainians. Regardless of whether it was true, in Galicia it was believed that the Germans, who constituted less than 3% of the population, oppressed Poles because of their origin, and Jews (about 10% of inhabitants) held by the throat all other nationalities (this was probably related to the belief that Jews have an extraordinary talent for trade and economic advantage). The biggest and most dangerous conflict plaguing Galicia was, however, that of the peasants with the manor. The memory of the Galician Slaughter (the massacre of the nobility by peasants) in 1846 was still very vivid in later years. This conflict was fueled not only by the Austrian authorities, but mainly by widening material gap between the peasants and the lords (the proverbial "Galician misery"). The peasants, paraphrasing the official name of the Kingdom, said that they live in the country of "głodomeria golicja" – that means hungry, naked and penniless country.

In Galicia there was also an unofficial conflict between major cities – the capital city Lvov, and – playing a unique role in the Polish mentality – Cracow (this conflict was visible even between the philosophical faculties of both universities). In a broader context, we observe it in the historical dispute over the cause of the fall of the Republic. In the debate we distinguish two schools – Warsaw school of history, which searched for the causes of fall in external factors, and Cracow historical school, which emphasized internal factors. Lvov historians stood on the side of the Warsaw school.

The following map serves to illustrate the place and tomes mentioned:[11]

Galicia 1772–1918

Western Galicia (since 1795) annexed to Duchy of Warsaw in 1809

Areas near Zamość, belonging to Galicia in 1772–1809

Cracow Republic, incorporated in 1846

Tarnopol region (in 1809–1815 in Russia)

Bukovina (incorporated into Austria in 1775); a separate province since 1849

[11] http://www.wikipedia.pl.