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## The role of Leibnitz in the establishment of scientific schools in Russia

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The speech of K Weierstrass translated for this Journal and introductory notes by A N Krylov provide a clear and conclusive demonstration that the organisation and promotion of scientific activity are the sole means by which to preserve the country's culture, enhance its internal and external potential, and breath new life into it after the period of crisis which we are now suffering. This publication recalled to my mind that the importance of science for the well-being and culture of nations was not emphasised by anyone with more vigour and enthusiasm than by G W Leibnitz. This remarkable man of universal genius, an eminent philosopher, scientist, jurist, philologist, historian, and diplomat, consciously adhered to the idea for fifty years of his life. Leibnitz greatly influenced the spreading of science and propagation of general culture in Russia in which he showed a keen interest during the last 20 years of his life, from 1696 to 1716. He had five meetings with the Russian Tsar Peter the Great (including two occasions on which they were in contact for a few consecutive weeks each time) and maintained correspondence with leading Russian statesmen of his time. Leibnitz was the author of the project to establish the Academy of Sciences in St.-Petersburg and a network of universities in Moscow, Kiev, and Astrakhan; he suggested measures for developing secondary and higher education in the country and posed a number of general problems of immediate relevance to the welfare of its population. Many important projects of Leibnitz were implemented by orders of Peter the Great. Suffice it to mention a plan that envisaged the institution of what was intended to be the country's supreme college of sciences and directly ensued from the propositions of Leibnitz concerning the development of education in Russia. The plan was submitted to Peter the Great by Henrich Fick on June 11, 1718 (that is, exactly 200 years ago), and the tsar authorized it by writing a characteristically brief instruction on the application: "Make the Academy". Leibnitz repeatedly drew the ruler's attention to the necessity to determine whether Asia and North America are connected by land or separated by a navigable passage of water because he believed that Russia needed a sea route around Siberia towards its large rivers. Leibnitz insisted on sending an expedition towards those quarters for surveying areas north of Kamchatka. In 1725, such an expedition was undertaken by V Bering who sailed into the Arctic Ocean through what is presently known as the Bering Strait.

However, many proposals meant by Leibnitz for the benefit of Russia remain as yet unaccomplished. His thoughts and ideas concerning science and its importance

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Uspekhi Fizicheskikh Nauk **169** (12) 1329–1231 (1999) Translated by Yu V Morozov; edited by S D Danilov for the development of nations are so clear and up-to-date that they appear to have a direct bearing on the current situation and, as such, deserve to be cited here.

Two fields of Leibnitz' activity are worth mentioning in the context of the present paper. To begin with, his chief concern was with the worldwide promotion of the development of sciences and arts which he considered to be the principal values of mankind. For him, the accomplishment of this task was a paramount purpose to which he gave priority in preference to the interests of his own nation.

Here is a quotation from his letter to Count Golovkin<sup>1</sup> dated January 16, 1712:

"I make no difference between my motherland and other nations. I prefer seeing an upsurge in the development of sciences in Russia than their slow progress in Germany. A country where sciences sustain continuous growth will be dearest to me because this country is most likely to promote and thus to contribute to the general good of mankind. Sciences and arts are the only genuine wealth of people which distinguishes them from animals and discriminates between civilised nations and barbarians."

An extract from another letter of Leibnitz reads as follows:

"I am not one of those who love only their motherland or any single nation. All my thoughts are turned to the benefit of mankind because I consider the Heavens to be my mother country and all sensible persons its fellow citizens. It is more pleasing for me to do a great deal of good to the Russians than little to the Germans or other Europeans. I could have enjoyed the greatest honour, wealth, and fame among them, but I could not render service to others, and my ultimate goal is to increase general prosperity."

(from a letter to Peter the Great, 1712).

Leibnitz attached equally great importance to international scientific cooperation. According to him, each European capital was to have either a Scientific Society or an Academy working in close contact with one another in order that 'the republic of scientists were no longer a mere phrase but became a well-organised and prosperous great power, a federation of learned Societies doing their best to civilise mankind through the expansion of sciences.'

In 1668, being a very young man (he was born in 1646), Leibnitz undertook to institute a Scientific Society in Mainz. After his stay in Paris between 1672 and 1676 (where he attended sessions of the Academy of Sciences founded by J -B Colbert in 1666), Leibnitz drew up a plan for the German Academy of Sciences in Berlin which was to ponder questions pertaining to all fields of knowledge and fine arts. It took him 25 years of painstaking efforts to eventually have this project implemented by the decision of

<sup>&</sup>lt;sup>1</sup> G I Golovkin, Russian statesman and diplomat who was a close associate of Peter the Great and became Russia's first state chancellor (translator's note).

Frederick III taken on 11 July 1700. Leibnitz became the first president of the new Academy.<sup>2</sup> Beginning in 1696, he proceeded to work on the project for the creation of the Academy of Sciences in Russia which was founded only 22 years later. In 1704, Leibnitz put forward his first plan to establish the Academy in Vienna, but he was not fated to see it realised during his lifetime, despite a decree of 1713 authorising the project. The Academy was erected only 130 years after the death of Leibnitz, in close agreement with his ideas.

Yet, notwithstanding the numerous obstacles encountered by Leibnitz and almost as many setbacks that he suffered during his life, he never lost an optimistic view of things, was rare to err in his judgement of circumstances and foretelling them, had a confident belief in the future of humankind, and always remained a staunch adherent to his basic principle which received the following formulation from the philosopher:

"True faith and sincere hope are not mere words or even thoughts; they consist in practical thinking (practisch denken) and ought to be treated as if they were perceivable objective entities."

(Leibnitz. Werke, published by Klopp, I, p.112, 1864).

"I am convinced", says Leibnitz, "that we must work for posterity. People frequently erect houses where they will not live and plant trees the fruits of which they will never enjoy".

Leibnitz' interest in the development of cultural education in Russia led him to drawing up an ambitious plan for the rational organisation of the entire area of sciences and arts. He regarded Russia as a 'tabula rasa' providing a unique opportunity to build up with greater success than anywhere else by learning lessons from the past, selecting from the experience of other countries and thus avoiding their mistakes. Another important advantage was the peculiar geographic location of Russia between Europe and China which enabled the country to draw knowledge from either side and utilise it for the benefit of its people. And last but not least, the enormous territory between the Baltic Sea and the Kamchatka Peninsula governed from one centre gave ample opportunity to design and carry out a series of important studies in astronomy, magnetism, and meteorology, promising results of considerable practical value in the first place for navigation and thus for the common good.

According to Leibnitz, the cultural development of a country is based on three central activities:

(1) Comprehensive accumulation of knowledge concerning sciences, trades, and arts;

(2) Diffusion of sciences, arts, and trades;

(3) Promotion of sciences, arts, and trades, i.e. furthering their growth and development along new routes.

By the comprehensive accumulation of knowledge, Leibnitz meant the creation of libraries, collections of minerals, botanical and zoological specimens, historical monuments, coins, manuscripts, works of arts, all kinds of instruments, machines, and models, etc. along with the management of zoological and botanical gardens, caves hosting mineral deposits, and other scenic features.

Leibnitz thought of the spread of sciences, trades, and arts as comprising the establishment of printing business and opening printing shops, on the one hand, and the development of universities, general and specialised vocational schools, on the other hand. Leibnitz emphasised that the Russians needed three categories of books to be published for them in the first place. One was a great encyclopaedia incorporating the comprehensive treatment of all branches of knowledge by a roster of experienced specialists from different countries. Another included manuals covering particular subjects to be used as textbooks at schools and universities. The third category comprised concise reference books containing information of either theoretical or practical value on a particular branch of knowledge, viz. for mechanics, ship-builders, travellers, ploughmen, etc. Also, it included a complete atlas of the Russian Empire.

Leibnitz classified schools into lower, vocational, and higher ones. As regards lower schools, special emphasis was placed on physical training and teaching languages (Latin and German for all pupils, French and Ancient Greek for those seeking university entrance, and, in addition, Hebrew for students planning to pursue theological study or missionary activity). Schools were expected to give practical knowledge in agriculture and other applied activities. Leibnitz suggested that universities were opened in a few vital centres of Russia such as Moscow, the main city in the northern part of the country, Kiev (the capital of its southern part), and Astrakhan lying on the route connecting Central Russia with Persia, Caucasus, and the entire Transcaspian region. The university curriculum for first-year students included a number of general courses equally valuable for all of them, regardless of faculty and intended career (in mathematics, agriculture, economy, etc.). Last-year students were to learn and execute practical skills appropriate to their future occupation. Leibnitz thought that Russia needed welltrained specialists ready to go wherever they were needed in different regions of the country to collect geographic, botanical, zoological, and ethnographic data, conduct astronomical and magnetic observations, and survey mineral resources. According to Leibnitz, even for a clergyman it was useful to have knowledge of natural sciences and practical skills in medicine, including surgery, to earn greater authority in the parish committed to him as a pastor and better succeed with his flock. Leibnitz laid much stress on the development of a network of specialised vocational institutions of higher technical education.

Leibnitz' project for the promotion of sciences, trades, and arts in Russia envisaged the institution of a learned society with an affiliated central observatory designed and built according to the plan of the Paris Observatory. In addition, a countrywide network of minor astronomical observatories was to be organised comprising observation stations in Mitava, Riga, Revel, Moscow, Arkhangelsk, Kiev, Voronezh, Kazan, Astrakhan, Tobolsk, Yakutsk, Bukhara, and further eastward as far as India and China. Studies to be conducted by these observatories were diverse and included, besides recording various celestial phenomena and vertical or horizontal deflections of a magnetic needle, collection of botanical, zoological, and mineralogical specimens as well as ethnographic materials, with special reference to the investigation of the dialects of a large number of places. Also, the above Scientific Society was supposed to have laboratories equipped to carry out research in mechanics, physics, and chemistry. The primary objective of chemical studies was, on the one hand, to meet the requirements created by the developing practical pharmacy and medicine and, on the other hand, to promote such industrial processes as metal extraction from ore by smelting, glass making, manufacture of gunpowder and other items of artillery ammunition. The

<sup>&</sup>lt;sup>2</sup> Harnak A *Geschichte der Konigl. preussisch* (Akademie der Wissenschaften zu Berlin, 1901).

Society was to maintain collections of minerals, plants and stuffed animals enlarged on a regular basis with specimens delivered by special expeditions from different areas of Russia. Among the basic goals that Leibnitz had for the Society were the building of glass and mineral-processing plants, the introduction and acclimatization of new plants and animals, the development of agricultural innovations, the improvement of routes of communication especially inland waterway systems (by straightening and deepening river channels through dredging operations, to make navigation possible), making fast-flowing rivers useful as navigable waterways (Leibnitz drew up a special project to this effect), the building of ship canals including one to link the lower Volga River with the Don River and thus connect the Caspian and Black Seas, the development of ship-building, the construction of new mills, the utilisation of the power generated by waterfalls, and many others.

The tree of central activities proposed by Leibnitz for the cultural development of Russia needed administration and coordination by the Supreme College chaired by an authoritative figure and constituted by experts in different disciplines living chiefly at St.-Petersburg, together with a few associate members representing other cities of the country and even from abroad.

Such is the general outline of the large project which Leibnitz first put forward in 1696 and thereafter presented in rapid succession (till 1712) to Peter the Great himself and his ministers. [See, for example, his reports offered to the tsar in December 1708, in 1711, and 1712 and the 1712 report to baron Shleinitz; moreover, Leibnitz wrote several memoranda addressed to Peter the Great containing advisory matter on studying national languages of the Russian Empire, magnetic needle deflections, the problem of an Arctic sea passage between Asia and North America (1712) and also on developing sciences and fine arts in Russia (1716)].

The value of these recommendations is known to have been highly appreciated by Peter the Great. Not infrequently, Leibnitz supplemented them with treatises on various technical problems and specimens of instruments and devices, such as the first calculating machine. In 1712, Peter the Great made him 'Geheimjustizrat' (German: 'privy councillor of justice').

The decree read<sup>3</sup>:

"We, Peter the First, Tsar and Autocrat of all Russia, deigned graciously to promote to the post of our privy councillor of justice Gottfried von Leibnitz, Geheimjustizrat of the duchy of Braunschweig-Luneburg, for his high merits and praised achievements in sciences and arts of which we have heard much. Knowing that he is a capable mathematician, historian and expert in many other branches of knowledge, we have the intention to offer him, in the capacity of our privy councillor of justice, to use these abilities of his to assist in the rapid and successful development of sciences and arts in our country. Also, we take upon ourselves to regularly pay him for his services the annual salary of one thousand efimoks<sup>4</sup> as suits his high rank of

<sup>3</sup> The original text of this decree is in that peculiar variant of the Russian language which entered official documents with the early 18th century Westernizing policies of Tsar Peter the Great. It is a very unusual combination of the Old Church Slavonic style and many loan-words from different Western languages, with some of the synthetic structures formed on German and Latin patterns and European semantic characteristics grafted onto the Russian tradition. In this translation, I have taken the liberty of accommodating the language of the decree to the way we speak now, to make it more readable (translator's note).

our privy councillor of justice, on condition that he takes up his duties on the date of the signing of this document. Another decree to this effect will be issued in a proper manner. Signed and sealed with our own hand in Karlsbad, 1 November 1712. Peter.

Count Golovkin."

The Academy of Sciences in St.-Petersburg was founded in 1724 even though its actual structure failed to completely match the ambitious project of Leibnitz. This fact notwithstanding, the major current activities of the Academy are developing along the lines established by Leibnitz for the promotion of sciences and arts in Russia, rational exploitation of its natural resources, improvement of agriculture, and all-round use of the available productive forces for the benefit of the country. In a word, the extensive programme of basic and applied research adopted by the Academy of Sciences conforms to the general trend outlined by Leibnitz 200 years ago. We owe a debt of honour to Leibnitz's memory for a convincing example of governing force set by an optimistic view of the world and belief in its good future that permeate the entire philosophy of Leibnitz and mark his practical activity.

"Existere nihil aliud esse, quam Harmonium esse."5 (Leibnitz, 1675).

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<sup>4</sup> Singular: 'efimok', Russian name for the basic German monetary unit Joachymstaler (or thaler), a silver coin first minted in the town of Joachymsthal (now Joachymov, Czech Republic) which used to be imported to Russia in the 17th and the early 18th centuries as a raw material for issuing Russian silver coins (note by the translator).

<sup>5</sup> "To exist is to be in harmony." (Leibnitz, 1675)