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A House with the Window to the West: The Akademgorodok Computer Center (1958-1993).

Subject

Where does science live? There are many places where science could happen: in laboratories and on couches, at conferences and during conversations, in scientific academies and in private homes. A historical list could be extended to include medieval monasteries, enlightened salons or imperial ships. Then, the legitimate question is: where does science thrive best? Famously, according to Francis Bacon, science gains in productivity when properly housed; such is Bensalem's legendary Salomon House, producing knowledge for the betterment of society. The quest for the proper place of scientific production has animated the history of twentieth century science from the German Kaiser Wilhelm Society to the American National Laboratories to the Soviet Union's infamous closed cities.

This dissertation is about a scientific house that was built as a part of an open Soviet city of science, Akademgorodok, which opened its doors in 1964 to become home of scientific computing in Siberia. I argue that the history of this institute offers a unique perspective on three major issues of twentieth century science and technology and of Soviet history:

1) What was the Soviet post-Stalinist "Big Science" and how did it function? In the West, Big Science often refers to the symbiosis of scientific research with state resources and state priorities on a massive scale with research budgets reaching to the billions. In the Soviet Union, all science was a state sponsored affair by definition. If Soviet Big Science is understood as a form of interaction between science and politics, then the landscapes of techno-scientific micro-regions could be shown as at first shaped by these interactions and, in turn, becoming powerful elements in the interplay. What did it mean for an institution or a person to be part of a Soviet techno-scientific micro-region such as Akademgorodok? How were Soviet scientists' loyalties divided between political and scientific agendas? What were the chains of interaction and power in scientific and political realms?
2) How did transnational scientific networks function in the context of the Cold War? How did scientific knowledge and technology permeate the Iron Curtain? What were the personal, institutional and disciplinary stakes of international science in a divided world? What were its political rationales, and how could they be realized?

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3) How bad was Soviet computing? Usually considered as the great losers of the "information revolution," Soviets were in fact among the pioneers of the computer age. In the West and East alike, scientists were among the first users of the computer, the new powerful instrument that quickly proved crucial to their work. How did scientific computing and the new discipline of computer science develop in the Soviet Union? What does this reveal about more general patterns of the Soviet and global computing?

The topic of this dissertation is the history of the Akademgorodok Computer Center (CC) from 1958-1990 and covers its early days up to the moment of restructuring, when the center was divided into several independent institutions. Although the dissertation's backbone could be characterized as an institutional history, I am interested in the CC not as a separate entity but as a part of Soviet and international computing. In consequence, I plan to focus on international collaborations carried out by the members of the CC at all-Soviet and international events that took place under its roof. Accordingly to this logic, I do not treat all the departments of the CC with the same attention, but closely follow the personal trajectories, scientific interests and networks of Andrei Ershov, the head of computer science department, and Guriy Marchuk, the director of the CC, who later became the last president of the Soviet Academy of Sciences.

The choice of Akademgorodok is motivated by the fact that this science city was to embody Khrushchev's pact with the scientists, an emblem of the open circulation of knowledge possible under the new leadership. I believe that concentrating on the history of one institute will reveal the mode of internal working of the City of Science and the Soviet science structure more generally. The CC was conceived as an all-science-city meeting place and computing service center for the whole region, thus it works as an excellent historical window for the issues important for my project. Furthermore, computing is one of the most problematic and least explored areas on the border between science and technology, which came to symbolize modernity. The history of computing should be crucial to the Soviet political project articulated as an alternative modernity in the recent historiography.[1] In addition, the lenses of scientific computing adapted in this dissertation project radically change the dominant vision of computers as the "Cold War machines"

[1] See for example Stephen Kotkin "Modern Times: The Soviet Union and the Interwar Conjuncture," *Kritika* 2, 1 (2001): 111–64.

reproducing "closed spaces."[2] Finally, close attention to the scientific biographies of two scientists with very different careers will allow the evaluation of developments of two different fields of scientific computing, numerical analysis and computer science, both providing the evidence of the east-west contacts and thus strengthen the dissertation arguments.

Besides representing two different but interdependent disciplines, Marchuk and Ershov's careers demonstrate very different ways of finding one's path through the system of Soviet Science: Marchuk, a party member, became an apparatchik participating in high level decision making related to science, computing, and international affairs while keeping in touch with research in computational mathematics; Ershov only became Academician and a member of state commissions very late in his career, yet his scientific contributions and strong international connections make him a pivotal actor for understanding the history of Soviet computing from an international perspective.

These choices for the dissertation's main topic and methodologies will allow me to bridge, and to contribute to, several understudied areas of historiography, namely: international and Soviet computing, post-Stalinist techno-science, and international science in the Cold War.

Historiography

Three questions haunt historians of the twentieth century Russia: Revolution, Stalinism and Collapse. The chronological framework of this dissertation situates it within the literature contributing to the understanding of the Post-Stalinist period and the end of the Soviet system.[3] In this dissertation I approach the problem of the fall by bringing together three separate branches of historiography: the history of computing, Soviet science studies, and the history of the Cold War.

The history of computing is a young discipline still in the process of institutionalization. The main difficulty facing the field is the protean nature of its main subject, the computer. Initially oriented toward studies of hardware, priority disputes and business history, the field is now drifting toward the history of communications. An indicator of this tendency is in the name of the recently established society for computing history, the ITHS, which stands for the Information Technology History Society: the vagueness of

[2] Paul Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (The MIT Press, 1996).

[3] The reference volume on the fall is Stethen Kotkin, *Armageddon Averted: The Soviet Collapse, 1970-2000*, (Oxford: Oxford University Press, 2008).

"IT" brings both benefits and problems.[4] Historians of computing generally tend to resolve the problem of the nature of the computer by focusing on one of its incarnations. For Martin Campbell-Kelly and William Aspray in the most-read popular history of computing, it is a "data processing machine," for David Mindell and Paul Edwards, computers are ultimately "war machines," for John Agar - "government machine," for Jennifer Light and Alan Grier, computers are most worthy of interest when they were human.[5] The main achievement of this historiography is the displacement of the notion of the "computer revolution," a dominant trope in the popular media.

My approach to the history of computing is in line with Michael Mahoney's, who argued that computer should be in the first place understood as a triple-natured device: it is science, technology, and the relationship between them.[6] This combination is responsible for the many faces of the computer. Thus, accordingly to Mahoney, promising areas of inquiry into the history of computing are in the histories of software or how the different communities of professionals "put their part of the world into computer."[7] The professionals that I am after are Soviet scientists.

Focusing on the institution housing both computer science departments and departments heavily engaged in the usages of computer as a scientific instrument will bring a new perspective to the scarce literature on the scientific usages of computers, whose main interest lies in the epistemological status of numerical simulations. Curiously, being isolated from the history of computing as a branch of history of technology, the existing scholarship on computers as scientific instruments tends to advance a thesis stressing the revolutionary nature of computer for the production of knowledge: from early modern *camera obscura* to computer as the twenty-first century *epistemology engine* of Don Ihde or from the "truth-to-nature" to the new computer-based epistemological virtue of "seeing-as-making" according to Lorraine Daston and Peter Galison.[8] In this dissertation, I plan to focus less on the epistemological status of computers for the Soviet

4 http://www.ithistory.org/

5 Martin Campbell-Kelly and William Aspray, *The Computer: A History of the Information Machine* (Basic Books, 1996); David Mindell, *Between Human and Machine: Feedback, Control, and Computing before Cybernetics* (Baltimore, Md.; London: The Johns Hopkins University Press 2002); Edwards, *The Closed World*; Jon Agar, *The Government Machine: A Revolutionary History of the Computer* (The MIT Press, 2003); Jennifer Light, "When computers were women," *Technology and Culture* 40 (1999), pp. 455-483; and David Alan Grier *When Computers Were Human* (Princeton University Press, 2005).

6 Michael S. Mahoney, "The History of Computing in the History of Technology" *IEEE Annals of the History of Computing*, vol. 10, no. 2, 1988, pp. 116-117.

7 Michael Mahoney, "What Makes the History of Software Hard," *IEEE Annals of the History of Computing*, vol. 30, no. 3, 2008, pp. 8-18.

8 Don Ihde, "Models, Models Everywhere" in Gunter Kuppers, Johannes Lenhard and Terry Shin, *Simulation: Pragmatic Construction of Realty* (Springer, 2006) pp. 79-88; Daston and Galison, *Objectivity* (New York: Zone

scientists per se, and more on the Soviet science organization, disciplinary hierarchies, and practices accompanying usages of computers as scientific instruments.

The importance of social practices and international collaborations within the framework of the Cold War in my project in computing history follows in line with the most recent American and European scholarship. On one hand, the new generation of American historians of computing is interested in investigating the Cold War context and social practices surrounding the emergence of new computer-related professions.[9] And on the other hand, the efforts to destabilize the "American center vs. global periphery" model currently dominating the field are best represented in the research of the European collaborative network Soft-EU under auspices of the Tensions of Europe/Inventing Europe project.[10]

The Russian language literature on the history of Soviet computing is rich in material but, due to its apologist tone and memoir-like features, should be discussed under the rubric of sources. The English language literature could be divided in two categories: a narrow specialist literature oriented toward the evaluation of the Soviet computer industry[11] and one fundamental historical work on the early history of the Soviet computing, the relatively recent *From Newspeak to Cyberspeak* by Slava Gerovitch.[12] This dissertation project could be considered as a companion volume to Gerivitch's book. Opening where he ends, in the late 1950s early 1960s, my project involves some of the same protagonists such as mathematicians

Books, 2007).

[9] Atsushi Akera, *Calcuating a Natural World: Scientists, Engineers, and computers during the Rise of the US Cold War Research* (The MIT Press, 2007) Nathan Ensmenger *"The Computer Boys" Take Over: Computers, Programmers, and the Politics of Technical Expertise* (The MIT Press, Forthcoming) and Thomas Haigh, *Technology, Information and Power: Managerial technicians in Corporate America, 1917-2000*. Unpublished PhD, History and Sociology of Science, University of Pennsylvania, Philadelphia (2003).

[10] On Soft-Eu see: http://www.science.uva.nl/history-of-computing/research/object.cfm/9B32BEE5-1321-B0BE-68D5DB731A41800C/5FDBC9A1-1321-B0BE-68D4E3C595339885. See also: Eden Medina, Cybernetic Socialism, (The MIT Press, forthcoming); Corinna Schlombs, *Productivity Machines: Transatlantic Transfer of Computing Technology and Culture*. Unpublished PhD, History and Sociology of Science, University of Pennsylvania, Philadelphia (2009).

[11] Seymor E.Goodman was the major specialist on the Soviet computing and the author of numerous articles, see for example: N. C. Davis and S. E. Goodman, "The Soviet Bloc's Unified System Computers," *ACM Computing Surveys*, vol. 10, no. 2, (1978), pp. 93-122; Seymour Goodman, "Information Technologies and the Citizen: Toward a 'Soviet –Style information society'? " in Loren Graham, ed., *Science and the Soviet Social Order* (Harvard University Press, 1990), pp. 51-67; S.E. Goodmann, "Software in the Soviet Union: Progress and Problems" *Advance in Computers*, vol., 18, 1978, pp. 238-287; idem, "Technology Transfer and the Development of the Soviet Computer Industry" in B. Parrott, ed., *Trade, Technology and Soviet-American Relations* (Indiana University Press, 1985), pp. 117-140; and G.D. Crowe and S. E. Goodman "S.A. Lebedev and the Birth of Soviet computing" *IEEE Annals*, vol. 16, no. 1, 1994, pp. 4-24. Among other relevant titles are: Daniel L. Burghart, *Red Microchip: Technology Transfer, Export Control and Economic Restructuring in the Soviet Union* (Aldershot, England : Dartmouth ; Brookfield, Vt.: Distributed by Ashgate, c1992.); idem., "Technology transfer and the early development of Soviet computers" (Maxwell Air Force Base, Ala.: Air Command and Staff College, 1988); and David A. Wellman, *A Chip in the Curtain: Computer Technology in the Soviet Union*, (National Defense University Press Publication, 1989)

[12] Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (The MIT Press, 2002).

Sergey Sobolev and Alexei Lyapounov, both of whom moved to Akademgorodok. While Gerovitch concludes by depicting the transformation of cybernetics into "a real pseudo science" and a politicized meta-discourse followed by disengagement of many of its early supporters, I plan to trace the careers of those not so much involved into production of cybernetic discourses but rather in computing stripped of cybernetic rhetoric. Whereas Gerovitch successfully deconstructed the tales of the tragic destiny of cybernetics, I plan to study not the discourses but the practices of scientific computing and the emergence of computer science. Hypothetically, in this domain the Soviets were closer to international trends then the unique history of the Soviet cybernetics "at the service of communism." Most importantly, I would like to use the Gerovitch's book as model productively analyzing cybernetics as part of the Soviet post-war scientific and political context.

The American school of the Soviet Science studies grew out of the Cold War interest in evaluating the scientific system of the chief enemy. The main question underling the scholarship was about the relationship between science and ideology. In his classic history of the Soviet Academy of Sciences, Vucinich tells a story of progressive captivation of the independent scientific community into nets of the party-state with its ideology and pragmatic interests.[13] Loren Graham offers a revision of this view in his *Science, Philosophy and Human Behavior in Soviet Union*.[14] With its rich chapters devoted to many major scientific disciplines, Graham demonstrates the genuine interest and importance of Marxist materialism for knowledge production in the Soviet system. The more recent developments in Russian Science studies are oriented toward uncovering the inner social working of the system in its political context and often employ anthropological and discourse's analysis methods.[15]

In contrast with changing methodologies, the main topical core at the heart of older and more recent scholarship alike is physics and Lysenkoism. The explanations for successes of both the hardest of sciences and the ill-famed pseudo-science could be grouped into two main schemas: a natural product of the Soviet

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[13] Alexander Vucinich, *Empire of Knowledge: the Academy of Sciences of the USSR (1917-1970)* (Berkeley: University of California Press, 1984).

[14] Loren Graham, *Science, Philosophy, and Human Behavior in the Soviet* (New York: Columbia University Press, 1987).

[15] Alexei Kojevnikov, *Stalin's Great Science: The Times and Adventures of Soviet Physicists* (London: Imperial College Press; Singapore; River Edge, NJ : Distributed by World Scientific, c2004); N. L. Krementsov, *Stalinist Science* (Princeton, NJ: Princeton Univesity Press, 1997).

science system or an exception.[16] Furthermore, the bulk of the Soviet science studies in accordance with the centrality of the ideology question is devoted to the period before 1960s.[17] The 1960s and later decades are the main interest of scholars of the space exploration, whose work is less involved in the issues of scientific organization, disciplinary formation or epistemology.[18] Therefore, my choice of the area of study and the chronological framework will contribute to filling historiographic gaps and to discovering broader dynamics of the Soviet techno-science structure up to its destruction.

In addition, this project is also conceived as a counter-narrative to the only English language study of the Siberian science city, Akademgorodok, – *The New Atlantis Revisited* by Paul Josephson.[19] Josephson's manuscript offers a broad picture involving all the major research institutes of Akademgorodok. His interpretive framework however appears not entirely adequate. Akademgorodok is depicted as a unique Soviet phenomenon, a beautiful utopia conceived by scientists but brought to the absurdities of the Soviet reality after the loss of Khrushchev's personal protection. I suggest that several corrections to this plot are necessary: although Akademgorodok was indeed an atypical place, it was the atypical combination of the many typical elements that made it such. First, we need to integrate Akademgorodok into a broader picture of twentieth century Big Science and accompanying proliferation of micro-regional concentrations of techno-science.[20] Unlike Bacon's Bensalem, Akademgorodok was not an island. Nominally a district of Novosibirsk, it was not only dependent on the Novosibirsk party bosses but functioned as part of the city's military-industrial complex. Second, thanks to the close focus on one research center, the scientific and personal biographies of its employees, and the international networks adopted in my project, Akademgorodok history could be moved away from being a history of corrupted utopia, a place without a place, toward being a place

[16] On Lysenkoism see: Zhores Medvedev, *Rise and Fall of T.D.Lysenko* (New York: Columbia University Press, 1969.); David Joravsky, *The Lysenko Affair* (Cambridge, Mass., Harvard University Press, 1970); Graham, ibid.; Krementsov, ibid.; Kojevnikov, ibid. On physics see: Kojevnikov ibid., David Holloway, *Stalin and the Bomb: the Soviet Union and Atomic Energy, 1939-1956* (New Haven: Yale University Press, 1994), Paul Josephson, *Red Atom: Russia's Nuclear Power Program from Stalin to Today* (New York: W.H. Freeman, 2000); Gennady Gorelik with Antonina W. Bouis. *The world of Andrei Sakharov: A Russian Physicist's Path to Freedom* (New York: Oxford University Press, 2005).

[17] See: Michael D. Gordin, Karl Hall, and Alexei Kojevnikov, eds., Intelligentsia Science: The Russian Century, 1860-1960, Osiris vol. 23 (Chicago: University of Chicago Press, 2008).

[18] The most comprehensive history of the Soviet space program is Asif A. Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race, 1945-1974* (Wahshington, D.C., 2000), for further references see its extensive bibliographic essay.

[19] Paul Josephson, *New Atlantis Revisited: Akademgorodok, the Siberian City of Science* (Princeton, N.J.: Princeton University Press, 1997).

[20] Stuart W. Leslie, *The Cold War and American Science* (New York: Columbia University Press, 1994); Rebecca S. Lowen, *Creating the Cold War University: The Transformation of Stanford* (Berkeley, CA: University of California Press, 1997); Peter Westwick, *The National Labs: Science in an American System, 1947-1974* (Cambridge, MA: Harvard University Press, 2003). Need more citations on sc. cities and techno-science regions.

where the everyday science of the post-Stalinist Soviet Union happened.

The last branch of the historiography I intend to engage in this project deals with the interaction of science and politics. On the domestic level, Soviet scientists formed a numerous subgroup of Soviet elites, whereby the Soviet Academy was a powerful state structure not only producing scientific knowledge but political power. In the context of the Cold War, scientists also acted as cultural diplomats.[21] According to some interpretations of the larger role of scientists, they are "policy entrepreneurs," active agents influencing geopolitics. Such is the position of Mathew Evangelista in the *Unarmed Forces*.[22] In contrast to this vision, John Krige depicts American scientific elites as conductors of the American political hegemony, subordinating scientific interests to those of politics.[23] This project aims to go beyond the "who uses whom" question. Like Jacob Hamblin, who analyzes different strategies of the American oceanographers in the changing Cold War context, I am interested in both the political outcomes of the international scientific interaction and the lower level disciplinary, institutional and personal stakes.[24]

Chapter outline

CHAPTER 1. Applied Mathematics as a Cold War Science in the perfect City of Science to be (1940s-1963).

This chapter will set up all the main themes of the dissertation except for computing, namely: spaces of knowledge production, openness vs. closeness in the Cold War context, science and politics, and scientists as cultural diplomats. In this chapter, I plan to provide the context necessary for a further exploration in the history of the Siberian computing school and offer a revision to the typical "exceptionalist" narrative of Akademgorodok origins in three steps.

First, I will inscribe the plans for the Siberian city of science in a larger international context of mid-twentieth century science cities. Second, I plan to compare the close connections between the government and the experts in physico-mathematical sciences in the Soviet Union and the West in order to understand the

[21] See Michael David-Fox, forthcoming. Need more citations on science and cultural diplomacy

[22] Matthew Evangelista, *Unarmed Forces: The Transnational Movement to End the Cold War* (Ithaca and London: Cornell University Press). See also Kai-Henrik Barth, "Catalysts of Change: Scientists as Transnational Arms Control Advocates in the 1980s" in John Krige and Kai-Henrik Barth eds., *Global Power Knowledge: Science and Technology in International Affaires*, *Osiris* vol. 21 (Chicago: University of Chicago Press, 2006).

[23] John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe* (Cambridge, Mass.: MIT Press, 2006).

[24] Jacob D. Hamblin, *Oceanographers and the Cold War: Disciples of Marine Science* (Seattle: University of Washington Press, 2005).

political leverage used by the three Soviet Academicians, M. A. Lavrentiev, S. L. Sobolev, S. A. Khristianovich for the promotion of the concept of the Siberian scientific city and its material realization. The developments of Russian and Soviet mathematics can be traced from the famous Moscow school, the so-called Lusitania, to wartime research and closed cities, to Akademgorodok. Finally, in the last section of the chapter, I plan to analyze the Soviet-American symposium on partial differential equations held at the Akademgorodok Institute of Mathematics. This institute was the first home of the computer department, which later grew into an independent Computer Center (CC.) The 1963 symposium was the first Cold War bilateral encounter between Soviet and American mathematicians, the latter led by Richard Courant. I believe that it served for Guriy Marchuk, the newly appointed director of the CC, as a crucial milestone for Soviet-American networking and information exchange in numerical methods and as a model for how international science should work.

CHAPTER 2. De-centering Soviet Computing: Early years of the Akademgorodok Computing Center (1964-).

The second chapter operates at the national level of the history of Soviet computing. The aim of this chapter is to disentangle the confusing histories of rivalries among the early computing groups by inscribing the newly founded CC into the different landscapes of Soviet computing: what were the tensions and interactions of the CC members with the communities of hardware producers, military computing, and cybernetics? How did Siberian computing reflect the larger situation of Soviet computing, and what were the unique particularities of the Akademgorodok CC due to the location, affiliation and later entrance in the field?

The CC's evolution from a department into an independent institution was accompanied by the acquisition of a building, machines and, of course, people. The main human engine behind these changes was the first director of the CC, Guriy Marchuk. Thus, the central piece of the chapter is the early biography of Guriy Marchuk, which should allow to trace the porous boundaries of civil and military science and to demonstrate Soviet scientists' standing as elites. Here the attention to the material and social life (from "living space" or housing to abstract art to access to things foreign) of a scientist is not a mere excursion in social history but the search for the evidence of his political capital, a must for an ambitious administrator operating in the new field of computing. Next, I plan to follow the trajectories of some of the early staff

members in order to investigate how they envisioned the development of Soviet computing. One of the chapter's sections will discuss several proposals authored by the CC scientists for a network of computer centers covering the Soviet Union. This chapter should also provide one section bringing in a comparative perspective (tentatively with the Moscow Computer Center belonging to the Soviet Academy of Sciences, the Courant Institute in NYC and the Institute Blaise Pascal in Paris) regarding the departmental setup of the CC consisting of computing services, theoretical computing and programming, numerical methods and ocean-atmosphere studies.

CHAPTER 3. "Double Loyalties" in Counterpoint: Computer Science from Silicon Valley to Silicon Taiga (1964-1968).

Dependent on their governmental patrons for funding and social recognition and on their international peers for international authority and circulation of knowledge, The Soviet scientists worked in conditions marked by "double loyalties.[25] First of the two parallel chapters focusing on the networks between the Siberian and western scientists, this chapter highlights the tensions between local, national and universal aspects of knowledge production. Both chapter 3 and 4 provide the evidence demonstrating the inadequacy of the typical isolationist description of Soviet computing from two different perspectives. Based on the materials of the Ershov Archive, Chapter 3 closely follows several episodes in the relations between Andrei Ershov, the head of the CC computer Science department and the famous American computer scientist, John McCarthy. This relationship was chiefly complicated by, but also benefited from Cold War tensions.

The frequent visits of John McCarthy to the Akademgorodok CC and Ershov's 1965 trip to the USA were motivated by scientific reasons and also part of the Cold War drama. During his American visit, Ershov became a victim of an American press campaign using his public lectures to mock the state of the Soviet computing. The 1968 Soviet intervention in Czechoslovakia prevented John McCarthy from realizing his plan to spend his entire sabbatical year in Novosibirsk. August 1968 was primarily a drama of Eastern Bloc party-state governance, yet it became a personal and professional dilemma for Ershov and McCarthy. In contrast to some apocryphal accounts, the August 1968 telegraphic exchanges between the American computer scientist and the CC scientists reveal the deeply emotional responses of the protagonists and very

[25] I use the notion of "double loyalties" as introduced by Nikolai Krementsov in *International Science between the World Wars: The Case of Genetics* (Routledge: 2004).

clear efforts to distance science from politics on both sides. Yet, the discourses provoked by the crisis situation differ from the practices of information exchange: an inevitable part of contact across the Iron Curtain was information collection. The exchange between McCarthy and Ershov provides an unusual lens on the late 1960s Soviet decision to clone the IBM 360 series in the ill-famed RIAD computers co-produced by the East-bloc countries. This section of the chapter is intended to serve in contra-position to the utopian vision of a Soviet-wide network of computer center discussed in the previous chapter and a contribution to the analysis of the controversial issue of technology transfer. In the hardware-centered histories of computing, the Soviet decision to copy the IBM 360 series is considered to be the crucial watershed and the beginning of the end for the Soviet computing. In my version, the focus will be on the scientists' roles and attitudes in the debate.

CHAPTER 4. **Unison of "Double Loyalties": "We need to think more" or Lions-Marchuk Cooperation**. (1966-1970s)

The second of two chapters dealing with the Soviet-West contacts in computing, this chapter aims at deconstructing the usual Soviet –American dichotomy by introducing a third element: French computing. This third European element brings in several additional dimensions to Soviet –West interactions. It opens up the picture involving the traditions of scientific internationalism, varieties of practices and attitudes toward computers as scientific instruments, and a common suspicion toward the American dominance of the field in the swinging context of the Soviet-French Detente.

A very different geopolitical situation of France vis-à-vis the Soviet Union had a positive repercussion for Soviet –French scientific cooperation following Charles de Gaulle's 1966 visit to the Soviet Union. Computer science was among the disciplines included in the bilateral French-Soviet agreement on cooperation in science and technology. The opening section of the chapter will explore the framework of the bilateral agreement and the national interests behind. On the one hand, Europe could serve as an easier access passage to the American machines and know-how for Soviets cut off from the latest American developments by the embargo. On the other hand, French mathematicians had strong ties with Soviet mathematics and passed it on to the emerging computer science. Next, the French were also affected by the shortages of computer power and were eager to learn Soviet numerical techniques for optimizing computer time. The second section of this chapter will explore the content of cooperation with particular attention paid

to the similarities and differences in practices of scientific computing in France, the USSR and the US. What was the status of the computer produced knowledge and where was the border between human and automated proof?[26] I also plan one section on the theme of personal networks introduced in the previous chapter. The human aspects of the professional relations are very strong in the case of the Soviet-French cooperation in computing, nicknamed Lions-Marchuk cooperation by the participants. Both applied mathematicians, Guriy Marchuk and Jaques-Louis Lions, the leader of the French team based in INRIA (National Institute for Informatics and Automation), shared similar visions of sciences at the service of the state and easily circulated in the realms of science, politics and industry. The post-1970s developments in Lions and Marchuk's careers will be discussed in the final chapter.

CHAPTER 5. "Software – the second literacy" or how to learn computing without computers (1968-1988).

Chapter 5 is devoted to the history of software and its disciplinary development in the Soviet context. It takes over from chapter 3 and follows the interests and work of Andrei Ershov, considered the father of the Siberian school of programming. I adapt the prism of pedagogy in order to explore the wider repercussions of software education on the alleged failure of the Soviet Union to become an "information society."Although nationally focused the material of this chapter brings in evidence of the connections between the Soviet and western developments.

This chapter explores the disciplinary development of programming in the Soviet Union by contrasting Ershov's difficulties in establishing an independent chair for programming in the Novosibirsk University and his ultimate success in developing and imposing Union-wide programming classes in the Soviet schools. Blessed with numerous international connections, Ershov was the major Soviet promoter of the "software engineering" concept first articulated in 1968 at the NATO sponsored conference, a famous case of the so-called "software crisis."[27] He was also the author of widely cited essays on the nature of

[26] In order to aboard these epistemological issues I plan to draw on the existing history, sociology and philosophy of science literature such as MacKenzie, Turckle, Galison, Ihde.

[27] By the end of the 1960s, following a series of events the international computing community came to the striking realization that the major costs and reliability problems of computers came not from hardware but software. For a historical discussion of the so-called "software crisis" see: M. Mahoney, "Software: The Self Programming machine," in *From 0 to 1: An Authoritative History of Modern Computing*, ed. Atsishi Akera and Frederik Nebeker (New York: Oxford University Press, 2002); Maria Eloina Pelaez Valdez, "A Gift from Pandora Box: The Software Crisis" (Ph.D. thesis, University of Edinburgh, 1988); Nathan Ensmenger, "From Black Art to Industrial Discipline: The Software

programming activities, "Aesthetics and the human factor in programming" and "Programming, the second literacy."[28] By devoting the core of this chapter to "Shkol'nitsa" (Ershov's educational project), I follow both the recent interest in pedagogy in the field of the history of science and the last major commitment of Ershov, who died of cancer in 1988. One of the difficulties facing Ershov's vision of making Soviet schoolchildren into citizens of an information society was the lack of computers in the majority of Soviet schools. Yet, Ershov believed it was possible to learn programming even without computers. While Ershov's all-Union school programming project was doomed to fail, the Siberian school of programming that considers him as its father figure has survived.

CHAPTER 6. From computing to governing to disintegrating - all while cooperating (1970s-1993).

The last chapter of the dissertation is devoted to the period of the apotheosis in the career of Guriy Marchuk, the last president of the Soviet Academy of Sciences, and the two last decades in the existence of the CC. The organization and places of knowledge production, scientists crossing borders between science, industry and politics, and the many faces of scientific internationalism, all the themes introduced in the first chapter will be echoed here but amplified by the catastrophe of the Soviet project. This chapter has the complicated task of narrating how the Soviet science system ended and how it continued to carry on as a part of the new Russian state.

Since the 1970s, Marchuk's career in the Soviet scientific hierarchies knew no obstructions: first, Marchuk served as the successor to M. A. Lavrentiev as the head of the Siberian branch of the Soviet Academy of Science, next as the chief of the State Committee for Science and Technology, and as the vice-prime minister from 1980 to 1986, Marchuk finally took his place at the pinnacle of the Soviet scientific structure, the presidency of the Soviet Academy of Sciences. In this chapter, I am going to follow the changing nature of Marchuk's involvement with Soviet computing and scientific international cooperation, especially his visits to France in his role as state dignitary. Despite his physical absence from

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Crisis and the Management of Programmers"(Ph.D. Thesis, University of Pennsylvania, 2001); Donald MacKenzie, *Mechanizing Proof* (Cambridge, MA: MIT Press, 2001); a recent reinterpretation is by Thomas High, "Dijkstra,s Crisis: The End of Algol and Beginning of Software Engineering, 1968-1972" in *Computing in Many Languages*, SOFT-EU book project.

[28] A.P. Ershov, "Aesthetics and the human factor in programming" in *Communications of ACM*, vol.15, no. 7 (1972), pp. 501–505;.and idem., "Programming, the second literacy" in *Multiprocessors and Multiprogramming*, vol. 8, no. 1 (1981), pp 1-9.

Akdemgorodok since 1980, Marchuk kept strong ties with Siberian computing, through his numerous pupils and one of his sons, Aleksandr Marchuk who became a computer scientist at the CC. The repercussions of the Soviet collapse on the Soviet-French cooperation in computing, based on the bilateral agreement between the states, is a possible path for unfolding the complex relations between rupture and continuities after 1991. The French-Russian Lyapounov Institute opened its doors in the Moscow State University in 1993. Thus, the post-1991 story of Russian computing is one in which the Akademgorodok CC was eclipsed by new rivals. In 1990, the institute was separated into several institutions sharing the same building. With science budgets practically non-existent, each of new institutes, Institute of Information System, Institute of Computational Mathematics and Geophysical Sciences and the Institute of Computational Technologies, found different strategies for survival during the post-1991 crisis.

Postscript.

I plan a postscript sketching personal trajectories of the main protagonists, their students and collaborators, some of whom stayed in Akademgorodok to open private companies, others moved to Moscow, but many have crossed the Atlantic. Guriy Marchuk is no longer among the leaders of the country but still an active scientist of importance recognized by the government. On June 8th 2010, Russian President Dmitrii Medvedev congratulated the Academician on his 85th birthday. The president's telegram reads: "In Russia and abroad, you are known as an outstanding scientist and a major scientific leader. Your fundamental works span a broad range of problems in numerical and applied mathematics. The research methods you have developed are widely employed in various areas of natural science. You are fruitfully engaged in educating young scientists, and many of Russia's mathematicians are proud to call you their mentor."[29]

Methods and Sources

Three major considerations have guided my approach to the history of the Akademgorodok CC, namely: the coproduction of techno-science and political life or the politics of knowledge, practices of computing, and transnational scientific networks. This dissertation project will engage with the methodologies of institutional history, scientific biography, social construction of knowledge and technology, and international and

[29] http://eng.pda.kremlin.ru/news/395

transnational histories.

Considering the chronological framework and the fact that Guriy Marchuk, John MacCarthy and many of my protagonists' colleagues and pupils are still alive, the project will be based on memoir literature, 1950s-1990s press archives, traditional archival research, and oral history. Among archives containing relevant documents, some are already accessible, such as:

Richard Courant Papers at the NYU Archives (New York City, US);

Charles Babbage Institute archives (Minneapolis, US);

Andrei Ershov personal archive holding Ershov's correspondence, personal documents and documents produced by the Akademgorodok CC (Novosibirsk, Russia; the entire archive of 600 boxes is also accessible online);

The archive of the Siberian branch of the Russian Academy of Sciences including the collection from the CC, the collection from the Institute of Mathematics and the collections covering the work of administration of the Siberian Branch under Marchuk's leadership during 1976-1980 (Novosibirsk, Russia);

The documents covering the scientific collaboration and some aspects of personal relations between Marchuk and Jacques-Louis Lions from mid-1960 to the early 1990s in the archives of the Institut National de l'Informatique et l'Automatique (Roquencourt, France).

Research plan

Fall 2010: research at the NYU Archives for chapter 1; work with Ershov Archive.

Spring 2011: research at the Charles Babbage institute for chapter 3; work with Ershov Archive; 1st draft of chapter 3.

Summer 2011: research at the SORAN Archives and the CC archives, collecting oral history in Novosibirsk, Russia.

Fall 2011 and Spring 2012: drafts of chapters 1, 2, 5.

Summer 2012: Research at the INRIA Archives, France.

Fall 2012: Drafts of chapters 4, 6.

Spring-Summer 2013: revision of chapters' drafts, completion of the project.

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Ksenia Tatarchenko

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