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The Unlikely Revolutionaries: Decision Sciences in the Soviet Government

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When a glorious moment arrives

Do trust yourself no more.

A changing world, a complex world,

Yet simple is the model of yours.

Oleg Larichev, 1980 [1]

Introduction

In this chapter I propose that we need to reassess the development of the Soviet decision sciences after World War II as an important intellectual field where innovative and influential forms of conceptualizing the governance were created. By decision sciences I refer to different scientific, often quantitative techniques developed in the fields of the operations research, game theory and systems analysis which offer a cognitive procedure for arriving at a better judgment. Decision sciences are part of a wider field that is often described as "policy sciences" and "management sciences" in Western literature. In the Soviet context these terms are captured by a Russian notion *nauchnoe upravlenie* (best translated as scientific governance, which includes but is not limited to scientific management), an approach that emerged in the early twentieth century, was capitalized on during the communist revolution, cracked down by Stalin in the 1930s-1940s to be rehabilitated from the mid-1950s.[2]

Somewhat counterintuitively, the development of Soviet decision sciences was not limited to aiding the Communist Party government to find the most preferable course of

action. To the contrary, I show in this chapter that the history of Soviet decision-sciences of the 1960s-1980s contains important moments that can be interpreted as reflecting the incremental liberalization of an authoritarian political regime. From the 1960s onward, several influential Soviet decision scientists used decision science to develop a kind of alternative social science, seeking to explain social order and social change and offering a much more complex representation of social processes than could, for instance, Soviet sociologists, restricted by Marxist-Leninist ideological dogmas.[3] Soviet decision scientists used insights from the operations research and systems analysis to conceptualize government as a de-personalized process of continuous adaptation to an ever-changing environment. In so doing, Soviet decision scientists addressed many of the Western concerns discussed elsewhere in this volume, including human irrationality and mass participation in government.

Although this story of Soviet decision science is fascinating in itself, there is an important intellectual rationale to extend our inquiry into modern intellectual technologies of government beyond Western case studies.[4] In order to understand a full range of political implications of decision sciences, it is important to address the transnational dimension of their history. On the one hand, while there is an important intellectual history emerging about the ways in which scientific models of complex order and control spilled over into political imagination, these works tend to focus mainly on the West. The developments in the state socialist bloc are analyzed as either a deviation from or a peculiar adaptation of "Western ideas".[5] On the other hand, many historians traced the conceptual and institutional origins of decision sciences in the West, primarily in the US, Britain and France, seeking to deconstruct what is understood as a neoliberal governmentality, a governmental regime that relies on the notions of instrumental rationality, responsibilization of the individual, as well as extension of practices of calculation and market regulation to wide areas of social and political life.[6] In

this context, decision sciences become a suspect form of scientific expertise, a form which seeks to limit popular participation in politics. However, as I show in my Soviet case, there is also another side of decision science, one that bridges scientific governance and the liberal idea of self-regulation in a way that is not limited to the genealogy of the late twentieth century's neoliberalism.

Thus I propose that decision sciences, a quantitative technique of governance that tend to be attributed to neoliberal governmentality, have a political a history of its own, which should not be reduced to either to Cold War technocracy or neoliberal political economy. First, decision sciences are a large, internally heterogeneous field, where different methodologies put different emphasis on predictability, measurability and uncertainty. Their implications to what is rational, to the notions of individual agency and structure and the character of social order can therefore differ quite significantly. Moreover and second, as I show in this chapter, in different contexts decision sciences can have different political effects. For instance, some Soviet decision scientists developed a rather liberal model of limited government, a model which in the context of personalist, authoritarian government of the Communist Party should not necessarily be interpreted as a precursor solely to neoliberal regime, but rather a moment in the development of late modern governmentality.

I draw on the Foucaultian governmentality approach to situate the history of Soviet decision sciences in the long evolution what is described by Foucaultians as the art of government. According to Mitchell Dean, art of governing refers to "an activity which requires craft, imagination, shrewd fashioning, the use of tacit skills and practical know how, the employment of intuition and so on".[7] By using the governmentality perspective, we can begin to understand decision sciences as not only a formal exercise in designing quantitative applications, but a multifaceted activity that is best approached as an assemblage of conceptual principles, institutions and reflexive practices. In his series of lectures at the

Collège de France, Michel Foucault links the emergence of the art of government with the advent of the modern liberal state, which developed intellectual and disciplinary techniques that enabled governance at a distance, which was made possible by acknowledging the power of self-regulation to the governed subjects and objects.[8] As I show, in the Soviet context it was the field of decision sciences which was conducive to a more liberal governmental imagination that underscored the principles of self-regulation, limited central control and governance at a distance.

This contention needs some clarification though. It is remarkable though just how different the liberal effect of decision sciences could be in different political contexts. In order to appreciate this I propose going beyond the generic criticisms of scientific technocracy. Many histories of the decision scientists' communities emphasize their fascination with and even fetishism of numbers, precision, determinism and computer technology. However, there were other decision scientists who were less concerned with deterministic, technical solutions, instead focusing on problem making than solving. But this latter strand of decision sciences so far has received much less attention from historians. This becomes particularly clear when we consider the emerging concern with governing global biosphere both in East and West from the late 1960s. This concern drew on the ideas emerging across different disciplines, such as the traditional liberal idea of self-regulation in the political thought but also its siblings in the theories of biological systems and ecology, the emerging organization theory of bounded rationality in human decision-making developed by Herbert Simon, and the mathematical models of non-linear dynamics, developed in the complex systems sciences. Recent studies began disentangle the genealogy of self-regulation under uncertainty: examples can be found in the recent work by Stephen Collier and Andrew Lakoff on the history of government of vital systems, Helga Nowotny's and Louise Amoore's work on reflexive, prediction-based governance and uncertainty, my own study on the global

application of the systems approach while others outlined genealogies of resilience.[9] In a similar vein, in this chapter I show that according to Soviet decision scientists, to govern a complex system—and Soviet society was increasingly understood as a complex system that included human and non-human actors—meant to rely on qualitative methods and postpositivist epistemology abandoning the utopia of linear planning. Furthermore, there were strands of Soviet decision science that transcended the laboratory approach, according to which scientists delivered their ready-made models to policy makers. Instead, some Soviet scientists cultivated a study of decision as a reflexive social science, an art of participatory government, hoping that this would enable to break the Party's and bureaucratic monopoly on decision-making. It is precisely this thrust of Soviet decision science that I want to draw attention to as it constitutes an important correction in the existing debates on scientific technocracy as trajectory that leads to a non-democratic regime of governance.[10]

This chapter is organized as following. First, I map the transnational development of decision sciences s during the postwar period in order to demonstrate the parallels of the origins, spread and institutionalization of decision sciences in both the East and West. In the 1940s, decision sciences were developed in both the Soviet and U.S. military-industrial complexes, formed an important part of Cold War competition, and later spilled over into the civilian realm. In the Soviet Union, this spill-over coincided with de-Stalinization, the abolishment of the personality cult of the leader, which led to a period characterized by the softening of internal ideological control and the re-establishment of connections with the West. I trace this shift by describing the institutionalization of Soviet operations research (OR) and systems analysis during the post-Stalinist period of the 1950s-1970s. The Soviet decision sciences were practiced not only by academics: decision sciences were introduced into the policy process after 1964, as part and parcel of the attempt to increase the scientific level of national planning, an initiative that was led by the Prime Minister Aleksei Kosygin.[11]

Finally, I close the chapter with a discussion of an important contribution to the Soviet decision sciences: the writings and institutional entrepreneurship of the prominent Russian mathematician Nikita N. Moiseev, who promoted the fields of OR research and computer-based modelling of the geophysical system, most famously in the case of the simulation of environmental effects of nuclear war in 1983-1985. The case of Moiseev speaks volumes about both the institutional structure of Soviet science, which harbored islands of permissibility for maverick ideas, but also the internationalization of Soviet governmental thought where new notions of government and control were pursued in cooperation with Western counterparts.

Revisiting the history of Soviet governance

Before we proceed, several important implications of my argument for Soviet history must be addressed. Studies of Soviet governance have been traditionally divided into two approaches. One approach concentrated on the role of dictatorial, personalized decision-making in the social system, focusing on the leaders of the Communist Party of the Soviet Union (CPSU) and the nomenclature, as they were regarded by scholars as the key governmental actors. Known originally as "Kremlinology", this approach was enriched by institutionalists in the 1990s, who remained interested in the role of personalities, power struggles among individual Soviet actors and their coalitions.[12] Other scholars who emerged as early as in 1970s, collectively comprising the so-called "modernization school", focused on lower level actors, such as regional leaders, managers, and scientific experts, and dedicated themselves to investigating whether a new Soviet technocratic class capable of challenging the hegemony of the Party was emerging.[13] Both of these approaches emphasized the importance of personalities in political and organizational contexts, seeking to identify the "real" decision-makers in a given situation and assess their significance and impact in the future. This

epistemological orientation left policy sciences, which I call the arts of governance, outside the scope of Soviet historiography. The history of Soviet science and technology, albeit well developed, never made it into the mainstream political history of the Soviet regime. While historians and political scientists examined the strategic uses of Marxist-Leninist ideology in the framing of governmental programs and decisions, the complex role played by decision sciences s in Soviet governance was completely left out. Even with the rising interest in Cold War technocracies in East and West but also the global South,[14] the internal intellectual, institutional, and political diversity of the field of Soviet decision science has been hardly ever seriously considered as a defining feature of late Soviet governmentality.

Therefore, to admit that the Soviet policy sciences were not hostage to communist ideology, but in fact represented relatively autonomous intellectual resource for heterogeneous notions of order and control, as I do here, is to question some of the central established narratives in Soviet history. My approach is close to those scholars, such as Stephen Collier, who have emphasized the complexity of Soviet governmentality, where power and control did not flow in a top-down, linear way, but was rather diffused, where expert knowledge and material infrastructure could shape and constrain the scope of the activity of the Party elites.[15] Indeed, a growing body of recent literature on Soviet governance has documented persistent discrepancies between the supposed prevalence of centralized planning and the actual use, or lack thereof, of scientific expertise and local management practices. We now know, for example, that the annual and five-year plans were not "decided" by the CPSU leadership, but rather settled through an informal bargaining process between the All-Union State Planning Committee (Gosplan) and representatives of branch ministries and industry enterprises.[16] Accordingly, while some prominent computer scientists, such as Viktor Glushkov, who initiated a technoutopian attempt to centralize and computerize information processing in this defunct Soviet system through OGAS, an All-Union

Automation System, failed to formalize the Soviet institutions,[17] other Soviet experts of decision making commanded an increasing authority from the 1980s. While I described such cases in the fields of regional and global modelling and strategic management in Soviet Russia,[18] here I develop further my argument by demonstrating the way in which Soviet decision sciences were constructed as a critical social thought.

Furthermore, to focus on political implications of decision sciences means to use a particular notion of power. There is a tendency among Soviet historians to study the relation between scientists, experts and governing communist political elites as an unfolding conflict, a zero-sum power game. Consider, for example, the many studies of scientific autonomy in such fields as physics or mathematical economics, which posit that this autonomy was only achieved at the cost of a "real", demonstrable influence on actual governmental decisions.[19] In turn, increasing authority and power over decision making of scientists was interpreted as the loss of power of the Party's governing elites. Consider the fate of Soviet cybernetics. From the 1960s, according to Slava Gerovitch, the principles of cybernetic theory of predictive control were used to re-conceptualize Soviet policy frameworks as an informational process of goal-setting and control through feedback loops. Cybernetics was officially acclaimed as *the* Soviet science of governance. However, cybernetics failed to structurally reform Soviet policy: a severe shortage of computer technology prevented automation.[20] Furthermore, the widespread practice of informal bargaining and economy of favors that thrived in Soviet ministries and enterprises was not conducive to any form of increased transparency and accountability.[21] Managers resisted cybernetic automation of systems of communication and accounting, because it was perceived as a risk of revealing their illicit activities.[22] If we were to apply this assumption on decision scientists, we would arrive at a similar conclusion: that decision sciences failed to undermine the personalist decision-making practice in the Soviet Union.

Nonetheless, it would be a mistake to interpret the incomplete cybernetization of the Soviet economy as a zero-sum game, thus as a failure. As I have argued elsewhere, Soviet cybernetics enabled the formation of a new normative understanding of what entails good, modern government. From the mid-1970s to conceptualize governance in the Soviet Union meant referring to cybernetic principles of an adaptive self-regulation through feedback loops through administration of enterprise, national and global policy systems, and emerging new practices of personnel management as an interactive social process.[23] In this cybernetic governmental imagination, there was an intellectual and institutional place for decision sciences, which co-existed with the personalist world of decision making, scrutinized by Kremlinologists.

We need to rediscover the intellectual history of the interdisciplinary field of Soviet decision science and understand the role of decision scientists as they have been a rather neglected type of the Soviet governmental actor. In doing this, I propose, that we can reconstruct the history of internal liberalization of Soviet governmental system, where decision science was used as a resource to limit the personalist but also institutional power of the Communist Party governing elites. It was through Soviet decision science that social, environmental and system-cybernetic control systems were brought together to form a new constellation of power and rationality beyond ideology, patronage and economy of favors; importantly, this process took place through an intense East-West circulation of people, technologies and ideas. Conceived in this way, the Soviet case should be approached as an integral part of the transnational development of modern scientific governance.

Transnational development of postwar decision sciences: East-West

Existing literature outlines the history of decision sciences as a principally Western phenomenon, with its roots in the major military conflict: it is widely documented that

operations research and systems analysis emerged from the military engineering, economic, and operations planning during World War II, while during the Cold War, American and European scientists applied their newly acquired expertise to aid decisions beyond military planning and strategy, turning to civil sectors of social and economic governance.[24] Historians, such as Philip Mirowski, David Jardini and S. M. Amadae, have argued that decision sciences s can be understood as an intellectual technology, instrumental in the struggle for world domination. As such, they assert, decision sciences s were part of modern governmentality in the sense that they underscored the use of science in areas that previously relied on political and bureaucratic authority.[25] The political context for the rise of decision expertise, as suggested in the introduction to this volume, was crucial, because scientists and policy makers expected that decision sciences would serve as an antidote to a volatile, personalist decision-making, a structure of judgment associated with authoritarian dictatorships such as Nazi Germany and the Soviet Union.[26] It is important to note that the distinction between what was understood as an uninformed and personalist decision-making and scientific, disembodied decision-making was considered on both sides of the Iron Curtain. Indeed, the rise of Soviet decision sciences could also be understood as a response to informal, personalist decision making and an attempt to limit this practice by ensuring participation of scientific experts in policy process.

The histories of the US cybernetics traced its particular career from the construction of automated weapon systems during the 1940s, such as anti-aircraft missile systems that relied on computational power to identify and attack targets, to the source of inspiration for attempts to fully automate decision-making in business, economic and social planning. If automated servomechanisms could track and shoot a plane, perhaps a computer system could steer a factory, an industry, or even a national economy? Although the pioneers of cybernetics, particularly Norbert Wiener, were strictly against the use of cybernetic theory in

the social forecasting,[27] the idea of information loops enabling surveillance and feedback-based control nonetheless spread throughout the disciplines, was reflected in the theories of political and social systems developed by Marshall McLuhan, Karl Deutsch, and David Easton, among others.[28] In comparison with the US, the extension of the Soviet cybernetics to automation of decisions in the wide societal sectors was also a complex techno-political project, where multiple rationales intertwined.

The postwar development of East-West relations in the area of decision sciences s can be divided into the following two stages: the height of the Cold War during the last seven years of Stalin's rule (1946-1953) and the subsequent incremental re-establishment of contacts with the West and East-West technology transfers that were incrementally resumed after 1956.[29] Under Stalin, research on the military and technical applications of decision sciences was strictly limited to defense and technical applications and was conducted in complete secrecy.[30] Geopolitical tensions between the Soviet Union and United States pushed even the home-grown Soviet decision sciences into isolation: in 1946 Chairman of the Supreme Council Andrei Zhdanov banned any contacts with Western technoscience as part of the campaign against kowtowing to the West. Over the next five years, several major fields of scientific innovation, such as genetics, cybernetics, and relativity theory, were designated as pseudosciences and purged from Soviet academia. Nonetheless, as Gerovitch demonstrated, even under Stalin the Soviet government realized that computer science was vital for defense: the engineering of large technical systems in defense and aviation just could not do without cybernetic automation. Accordingly, computer science was insulated from these ideological attacks; but then, computer technology was strictly classified in the Soviet Union until the mid-1950s.[31] Similarly, the early Soviet version of OR was developed in secret experimental construction bureaus within the military-industrial complex.

The late 1950s and early 1960s were defined by intense Soviet efforts to establish international cooperation in the field of decision sciences s. It was only after the death of Stalin in 1953 and Khrushchev's rejection of Stalin's personality cult in 1956 that the Soviet decision sciences would emerge into the daylight. The process of de-Stalinization resulted in manifold decision scientists returning from the secret science towns in which they had been sequestered to Moscow and other major cities in order to found new laboratories and institutes. The key turning point occurred in 1955, when the leading defense scientists and mathematicians Anatolii Kitov, Sergei Korolev and Aleksei Liapunov published an article defending cybernetics as a genuine science, which, they proclaimed, had nothing to do with capitalist ideology.[32] The following decade saw the rapid development of Soviet research into computer technology and cybernetics, which were now praised in the press and policy programs as effective ways to modernize economic and social planning, management, and industrial production. Decision sciences became an integral part of an envisioned cybernetic future of communism.

With the exception of the ideological disputes that occurred between the end of World War II and Stalin's death, the trajectory of the Soviet decision sciences resembled the Western one. Mathematical methods, including OR and systems analysis, linear and nonlinear planning, and theories of optimal control and dynamic programming, were first transferred from the military-industrial complex to the realm of economic planning and management and, concomitantly, to the social sciences, which in the 1960s were still new disciplines in the Soviet Union.[33] The spread of decision sciences s tapped into the modern belief, shared in both the East and West, in scientific rationalization and was assisted by international organizations, like the Organization for Economic Cooperation and Development, which disseminated the approach internationally from the early 1960s onward.[34] By that time, however, Soviet research policy elites had been learning from and

interacting with leading Western institutions promoting the development of decision sciences s.

As they were in the West, in the Soviet Union decision sciences s were expected to draw boundaries for personalist, dictatorial decisionism by creating a particular informational context and institutional legitimacy, defining what is a good decision. The institutional foundation for the Soviet decision sciences was established during the era of Nikita Khrushchev's leadership (1953-1964), which was defined by a style of governance popularly—and ironically—known as "voluntarism," in which Khrushchev overrode expert suggestions ruthlessly imposing what was described as his own "hare-brain schemes", such as corn planting campaigns across all climate zones in the Soviet Union.[35] However, as I have argued elsewhere, there were other actors in addition to Khrushchev, who were centrally important to the development of late Soviet governmentality. One such key person was Khrushchev's minister and, later, prime minister, Aleksei Kosygin, a capable administrator, who was crucially important for re-introducing scientific experts into economic planning and re-establishing East-West cooperation in the late 1950s.[36] When Khrushchev was ousted in 1964 to be replaced with Brezhnev, Kosygin acquired the central role in the Soviet policymaking. Decision sciences in particular were promoted by Kosygin's son-in-law, Dzhermen Gvishiani, who served as a vice-chairman of the State Committee for Science and Technology (GKNT), the principal body in charge of the all-union policy of technoscientific development and East-West transfer. Gvishiani personally promoted management science and the emerging systems approach, having authored some of the first books on the subject in the Soviet Union.[37] It was under the leadership of Kosygin and Gvishiani in the 1960s-1970s that Soviet decision science emerged as an academic field of applied and fundamental research, was institutionalized, and was used for East-West transfers of knowledge.

The institutionalization of Soviet decision sciences

In the late 1950s and early 1960s a wide array of different scientific approaches, developed to aid management and policy making, came to be publicly promoted and institutionalized in the Soviet Union. These approaches included cybernetics, linear and non-linear planning, input-output modelling, OR, scientific forecasting, and what would become known as the systems approach. Sometimes these techniques were gathered under the umbrella of cybernetics, and sometimes they were promoted as "mathematical methods" of governance. Starting in 1957, the Soviet press presented computers as a new technology able to speed up decisions and, from 1960, widely promoted the automation of management, describing the national economy as an informational system.[38] Although in reality Soviet firms were severely underequipped with computer technology, a strong expectation of a computerized future was widely shared throughout the Soviet Union by the mid-1960s.[39]

The first Soviet research unit dedicated to OR and game theory was founded in 1961 at the Leningrad branch of the Soviet Academy of Sciences.[40] The laboratory had a high profile and was visited by prominent Western scientists, including Oscar Morgenstern, one of the fathers of game theory, who visited the unit in 1963.[41] East-West scientific exchanges had resumed in the late 1950s: in 1960, Norbert Wiener visited Moscow and gave a talk to an overcrowded auditorium; meanwhile, Soviet mathematicians, including the influential Vadim Trapeznikov, the director of the prestigious Institute of Automatics and Telemechanics, travelled to the U.S., returning deeply convinced of the need to apply OR and management science techniques to problems of governance.[42] In the same year, Vassily Nemchinov, Leonid Kantorovich and Andrei Kolmogorov pushed for introduction of mathematical modelling into economics and planning.[43] A fully-fledged network of Soviet OR institutes was initiated in 1964, when defense intellectuals E. Popov and Germogen S. Pospelov facilitated the establishment of OR as a research area in three major institutions: the

Computer Centre in Moscow, the Mathematical Institute at Novosibirsk branch of the Academy of Sciences, and the Institute of Cybernetics in Kiyv, Ukraine.

Within the next few years OR was institutionalized in the republic branches of the Soviet Academy of Sciences, where OR was usually placed in computer science departments. Soviet universities also introduced OR into their curricula, while brochures, such as Georgii Smolian's *Operations Research: An Instrument of Effective Governance* (1967) were published and disseminated widely by the main agency for the popularization of science, *Znanie* (knowledge). As Smolian's text shows, the Soviet scientific leadership identified OR with the optimization of decisions through quantitative methods—such as game theory—ideally using computer technology.[44] By the late 1960s, OR was entrenched in the Soviet academic system, and during the next decade, systems analysis would follow suit.

The institutionalization of OR and systems analysis was part of a larger governmental reform to launch national planning of infrastructure and research and development on a large scale. In 1966, the same scientists who institutionalized OR, Glushkov and Pospelov, proposed to introduce a complex forecasting of the Soviet economy and technoscientific progress for a 5 to 10 years period into the state planning process. According to Dmitrii Efremenko, this proposal would have substantially increased the political role of scientific experts in the strategic decision making. However, although the proposal was supported by Kosygin and Dmitrii Ustinov, who was in charge of the military industrial complex and who later became the minister of Defense, it was turned down by the Politburo.[45] Yet, OR and systems analysis, and in particular the work on optimization, following Wassily Leontief, Leonid Kantorovich and Vasily Nemchinov, would be later used for the development of the complex planning program of techno-scientific progress for 1980-2000, a giant document specifying national goals for the medium and long term with regards the entire Soviet economy, including science, which was drafted over the 1970s.[46]

The use of decision sciences s in economic planning had ambivalent consequences. As we will see, some pioneering scientists, such as Moiseev, became deeply disillusioned about the prospects of using these techniques to rationalize economic and social planning. Instead, they saw environmental governance as a more promising area of application for decision sciences s. This environmental turn in Soviet system-cybernetic governmentality has so far escaped the attention of historians of Soviet economics, for these new developments took place not so much in the economics institutes, but in the institutes involved in computer modelling of large, complex systems, which were home to the scientists who employed home OR and systems analysis.[47]

While the 1950s-1960s saw the rise of OR and game theory, the period beginning with the late 1960s and the 1970s was characterized by the advance of what was called "the systems approach" (in Russian, *sistemnyi podkhod*).[48] Like their Western counterparts, Soviet scientists developed a systemic approach to economic, industrial, environmental, and social analysis as an antidote to bureaucratic fragmentation and narrow-minded "technocratic" decision-making. The epistemology of the systems approach had both institutional and intellectual implications. First, the data and models of different industry branches, such as electric energy, mining, machine building and soon, had to be integrated, because no single industry branch could be planned optimally in isolation from other branches: the expansion of electric grid depended on the future factory siting, the construction of which had to take into consideration consumption and international trade forecasts. Second, system-based decision-making required a historical and long-term view. Fast changes in technoscientific and social development required an ever greater capacity of prediction, but reliable prediction could only be made on the basis of extensive data sets about the past.[49] In practice, systems epistemology underpinned Soviet decision scientists' quest for increasing data transparency: scholars demanded wider access to different types of data, arguing that the sharing of data

across disciplines, institutes, and governmental agencies was the only way to produce reliable scientific expertise. Thus predictive epistemology forcefully introduced a new normative understanding of what constituted good governance, positing a need for new institutions capable of gathering and disseminating data not only within the Soviet Union, but also globally, exchanging the data with the West and developing countries.[50]

Both the Soviet and US cases of introducing decision science into policy process point to a symbiotic relation between OR and the systems approach, though the intertwining of these fields in the Soviet Union has a history of its own. It is important to consider this pre-history of the Soviet decision science, in order to fully appreciate the political legitimacy of this field in the Soviet context (which remained wary of kowtowing before the West) but because it explains the Soviet decision scientists' fervor and the strength of the feeling of a mission which went beyond purely scientific inquiry. In the Soviet Union, the systems approach was rooted in local philosophical traditions, serving as a social glue for scientific communities. Soviet systems scholars were able to draw on the local legacy of systems-thinking, which extended beyond Anglo-American OR to include interwar thought on geophysical, biological, and organizational systems.[51] It is remarkable that in some cases Soviet systems thinkers saw the roots of their approach even in the nineteenth-century mystical tradition of Russian cosmism, a philosophical approach that sought to unite spiritual, human culture and geophysical planetary system into one eschatological worldview.[52] However, in the context of policy sciences, the most influential thinker was Vladimir Vernadskii, whose ideas about the integration and even systemic unity of geophysical systems of space, Earth, and human society would become extremely influential in Soviet debates about the global biosphere in the 1970s and beyond. Another key thinker was Aleksandr Bogdanov (Malinovskii), whose grand, albeit cumbersome, theory of *tektology*,

was invoked by postwar Russian scientists as a genuinely home-grown, Russian theory of organization.[53]

It is important to notice that the key difference between inter- and postwar systems thinking was that, beginning in the 1960s, Soviet systems thinking fed directly into the policy sciences: a new normativity was coming into being, according to which one could not possibly make good decisions without considering complex systemic effects. While the Soviet OR field legitimized the introduction of mathematical methods into economic and social science, previously dominated by Marxism-Leninism, the systems approach posited a more complex view of governmental spheres, where mathematical methods could be applied. The systems approach, in general, was a balancing act between philosophical theorizing and applied science. As a result, there was no single, homogenous Soviet school in systems thinking; rather, divergent attitudes to systems research prevailed. First, prominent systems philosophers such as Igor' Blauberg, Erik Iudin and Vadim Sadovskii were predominantly interested in the development of General Systems Theory and what they called a more descriptive, empirical theory of systems. Others, such as Stanislav Emel'ianov, Iurii Popkov, and Viktor Gelovani, shared a background in OR and electronic engineering and were concerned with concrete applications of systems theory to scientific research, governmental problems, and computer-based modelling. Finally, some scholars, such as Boris Mil'ner, pursued the economic application of the systems approach.[54]

Systems analysis was institutionalized in the Soviet Union in response to what was perceived by scientists and policy makers as an emerging complex system: large scale infrastructure for oil and gas, industrial complexes such as nuclear power and chemical plants, but also large urban systems, as well as environmental projects, such as forestry, fisheries and agriculture.[55] Now, the issues that emerged in all these very different sectors were understood as largely a-political and as such suitable for international cooperation over

the search for efficient solutions. It was to address all these complexities that new institutional frameworks for the production, processing and analysis of data and particularly its use for forecasting the future were developed. Participation in international cooperation was of paramount importance in all areas of Soviet science and technology, and decision science was no exception. Convinced that the planning of Soviet systems had to benefit from computer-assisted decision-making, the Soviet government continuously sought to import both technology and know-how from large Western, mainly US, corporations.[56] The central actor in this process was the State Committee for Science and Technology (GKNT), whose directors regularly met with Western CEOs to learn about their experiences with decision-enhancement technologies. The first Soviet institutions dedicated to the systems approach appeared in the early 1970s, when the Committee for Systems Analysis was established at the Council of the Academy of Sciences, though the activities of this committee were limited to the circulation of information.[57] It was not until 1976 that the main center for systems analysis, the All-Union Institute for Systems Research (VNIISI), was established in Moscow. The VNIISI attracted scientists from some of the leading research organizations in the Soviet Union, such as the GKNT's institute and the Institute of Control Sciences.

Decision sciences also served as a channel for Cold War diplomacy. Beginning in the 1960s, the GKNT regarded the OR-based, quantitative systems approach as a strategically important field in East-West transfer. One of the key principles of nuclear, or indeed, any military strategy, is to ensure that one's opponent used the same forms of thought so that one is able to communicate with and respond predictably to an adversary.[58] This was made clear when in 1966 Lyndon B. Johnson suggested to Kosygin that the United States and Soviet Union establish an East-West think tank. It was American and Soviet decision scientists who were charged with realizing this diplomatic initiative. As a result, the International Institute of Applied Systems Analysis (IIASA) was established in Laxenburg, Austria, in 1972. Over

the course of the 1970s, the IIASA became an important transnational space that brought together American and Soviet scholars in management science. In addition, Soviet scientists had regular contacts with the Cowles Foundation, MIT's Sloane School of Management, Stanford's Graduate School of Business, and Harvard Business School.[59] However, the internationalization of the Soviet decision sciences did not only proceed through Russian-directed organizations: East-West contacts were also actively sought by scientists at the level of the satellite republics. For instance, in Lithuania an OR laboratory, directed by Eduardas Vilkas, who specialized in game theory, econometrics, and decision science, was founded in 1967. Trained in Leningrad under Nikolai Vorob'ev, Vilkas spent four months as a visiting scientist at American universities, including the Cowles Foundation at Yale in 1976.[60] Such lengthy stays were common in fields associated with decision sciences s, systems approach, and computing, and were crucial nodes for establishing informal ties that contributed to the transfer of knowledge. In this way, as I argue at length elsewhere, policy sciences were conducive to the emerging sociality and ethos of responsibility for global problems among the leading scholars from East and West.[61]

Here the application of decision sciences to planning problems, including the regional and global environmental systems, which turned out to be the most conducive area for East-West collaboration. A particularly important channel for East-West exchanges was UNESCO's program, *Man and Biosphere*, which was launched in 1971 to gather the scientific data about the multiple impacts on the environment. Soviet membership in this program was encouraged by environmental scientists, such as soil expert Viktor Kovda, who was a close friend of the research director of the Computer Centre, Nikita Moiseev. Now, Moiseev quickly realized that by participating in *Man and Biosphere*, Soviet scientists could lobby for an integration of environmental science with computer modelling. From the mid-1960s Moiseev developed OR applications for participatory decision making, intended to

combat the de facto existing fragmentation in the centralized planning.[62] But later Moiseev became convinced about the need to change the entire conceptual apparatus of control. It is on this emerging thinking that I focus in the last section of this chapter.

Self-regulation and pluralistic decisions in Soviet systems thinking

Perhaps the most prominent example of Soviet OR and systems thinking is found in the writings and institutional entrepreneurship of Nikita Moiseev, a distinguished scientist who has left a deep legacy in the Russian science and intellectual culture, but has been overlooked in Western histories of science and technology. A mathematician by training, Moiseev was the long-standing vice-director for research of the Computer Centre at the All-Union Academy of Science and a patron of the Soviet OR community (a role reflected in his appointment as the honorary president of the first Russian OR Society, established in Moscow in 1996). Furthermore, Moiseev was a public figure, a prolific writer who extended the systems approach to what can be described as a philosophy of governance.

Moiseev's career was defined by a sustained effort to, first, foster the development of decision sciences s in the Soviet academia and, second, encourage their internationalization. In 1966, Moiseev established an OR laboratory at the Computer Centre and appointed a young and distinguished military scientist, and his former university roommate, Iurii Germeier as the director. Starting in the 1970s, Moiseev initiated and developed one of the foremost computer laboratories at the Computer Centre, where the first three dimensional computer model of the Earth system was created in the Soviet Union (this model contained subsystems reflexing land, atmosphere, and the ocean). However, due to space limitations, this section can only discuss Moiseev's writings about the role of decision sciences s in what he described as a changing, increasingly complex world that posed unprecedented challenges, such as the exhaustion of natural resources, world population growth and pollution, to the

government. In contrast to narrow-minded Soviet technocrats, who resorted to ill-conceived scientific schemes of rationalization that often resulted in human and environmental casualties, Moiseev represented a rare, but influential, voice who championed uncertainty and complexity in the landscape of Soviet scientific expertise.

In his 1970 book *Mathematics, Government and Economics*, which was translated into German in 1973, Moiseev argued that decision sciences could not offer simple solutions to governmental problems. This was because decision sciences—which addressed real world concerns—could not be shut off in a sterile laboratory environment, but must instead engage with social practices and institutional design. Decision sciences, he continued, were just as much about problem making as problem solving. Here Moiseev clearly posited decision sciences as a formative, productive governmental activity and not a mere aid, a devise for calculation and rationalization of political decision of the Party leaders. According to Moiseev, the first issue for decision sciences to consider was goal-setting, as defining what constitutes a desirable outcome was difficult to do in a policy and management context. Marrying theory and practice was another challenge, as finding an optimal solution to a problem did not mean solving it. The implementation of optimal planning required a well-functioning system of coordination, involving the effective feedback of information and clearly established decision procedures.[63] Optimal decision making could not merely be imposed on chaotic, unregulated practices, such as, for instance, competing enterprises or inefficient management, but required wider institutional and management reform. Decision sciences were but one functional component in the government of large systems, at the national and world level.

From the 1960s the mainstream Soviet decision sciences were legitimized by the strong hope that their economic applications would save the stalling economic growth. Soviet decision theorists argued that the Soviet government could uniquely benefit from computer-

assisted decision systems, as these were most appropriate in large organizations: only in large-scale economies could the automation of decisions enable the economization of resources.[64] However, Moiseev recognized that even these economic planning-centred decisions could not be built "from simple blocks onto a complex whole", but instead required grasping complex reality, something which could only be achieved through interdisciplinary cooperation among economists, management theorists, mathematicians, and sociologists.[65] In this way, decision sciences at least theoretically were far from a detached intellectual technology, but an integral component, if not a driving force, of social and organizational change.

An important part of decision sciences, particularly computer-based modelling, posited an epistemological connection between theoretical political economy and the practice of planning, in which the latter could challenge theoretical dogmas even in the Soviet Union. Hardly any Soviet scholar could get away with positing the superiority of computer-assisted decision sciences without making obligatory references to Marxism: even Moiseev wrote that Marx's model of production and consumption was "the first macroeconomic model" ever (although they hardly ever attributed much intellectual significance to these references considering them a mere rhetoric convention).[66] Nonetheless, Moiseev went so far as to dismiss Marx's model as outdated and irrelevant to decision sciences: "Karl Marx's model was created to study a specific process under specific conditions (…) Accordingly, it can not be used to study those processes, which are defined by different conditions. For example, Karl Marx's model cannot answer a question how to distribute investment in order to achieve a certain level of consumption. As we have pointed out earlier, Karl Marx's model does not include governance: [for Marx] the initial state singularly determines all outcomes".[67] Meanwhile, wrote Moiseev, "contemporary macroeconomic models seek to study precisely the impact of 'governing' factors on the flow of economic processes".[68] Moiseev is very clear

here stating that "Highly aggregated models, such as Karl Marx's, cannot be used directly in planning" (he does add then highly aggregated models can still be of practical use for a very long-term planning).[69] Now, what is left after Marxist political economy is deemed insufficient? Moiseev proposes to bridge the gap between Marxist political economy and everyday decisions that are made by the Gosplan by the policy sciences: sophisticated modelling, offering aggregate models to enable long-term forecasting as they reveal general trends, while multi-branch models helped to shape the plan indicators of the economic development.[70]

Furthermore, because computer modelling was conceptually anchored in systems theory, it became possible for Moiseev to legitimately introduce the ideas of autonomy and heterogeneous purposive behavior in the models of Soviet society. For Moiseev, Soviet society was a system comprised of many different and autonomous decision makers, which social planning theories had to take into consideration. For instance, Moiseev wrote that "the economic organism of any state consists of a whole [set] of smaller economic organisms, which are to lesser or greater extent autonomous and are interlinked with each other into a complex hierarchical system of relations. Every element in this whole has both a certain will (ability to make decisions) and certain individual interests (goals)".[71] It is therefore only logical, Moiseev continued, that

> "Society seeks to achieve multiple goals. These goals are not only incomparable, but they are also changing, because our society does not live in a thermostat, but on the Earth, where the conditions for life are not stable. The situations which emerge and influence life activities very often are not only out of [humans'] control, but also unpredictable".[72]

Although Moiseev himself does not specify the political implications of his epistemological argument, this quote hints at his opinion that the existing practice of the Party ideological

leadership in the setting of goals for long-term future and centralized planning are inconsistent with the basic organization of human society. Perhaps unwilling to push the boundaries too far, Moiseev restricted his argument to the criticism of the complete automation of decision making. According to Moiseev, to delegate all decisions to a computer was impossible, partially because real time information processing could never be achieved: thus even a decision-making computer would never be able to "run with the system". But more importantly, Moiseev claimed that a viable system required what he called "a degree of freedom". A complex social system was not the sum of its parts, but rather a complex interaction, the complexity of which could never be known because it was changing continuously and, ultimately, chaotically. The only reasonable way for a decision-maker to deal with complexity, posited Moiseev, was to recognize that subsystems required autonomy for their activities, autonomy being a necessary condition for the emergence of "collective wisdom and collective energy" of the system as a whole.[73]

Moiseev's work suggests that, by the year 1970, Soviet decision scientists fundamentally transformed the Stalinist model of personalized governance. Governance was no longer understood as a personalized system, where the leader or the Party gave direct orders to society. According to decision sciences point of view, the Soviet leadership could only function if it made use of proxies of scientific expertise. Economic planners required highly complex representations of the economy, multi-level models produced by scientific experts. Social planners had to consider society's view on the developmental goals set by the CPSU, but the social sciences and the humanities were needed to make sense of these views.[74] Did this scientific epistemology threaten the Party's monopoly over power? Moiseev made certain to avoid creating this impression: he cautioned that the scientific formulation of alternative decisions and their evaluation were merely "advisory", while the "final decisions" could only be taken by those "responsible for the country".[75] Nevertheless, in spite of the

subordinate role Moissev posited for scientific expertise, being both conceptual and institutional, this proxy of modelling became an increasingly significant field, nurturing ideas, practices and actors that transformed Soviet governance.

While we need further studies of the impact of OR and systems analysis on Soviet economic and social planning, Moiseev's work suggests that the Soviet landscape of economic governance was highly polarized. Some some scientists promoted mathematical applications as technical fixes for economic problems, while others doubted simple mathematical models could address such issues. Moiseev was one of the sceptics. He called into question the very idea that there could be an optimal planning of the national economy as early as in 1970, writing that it was not possible to discern the optimal course of the Soviet economy because economies were relational and models of the world economy were not yet available.[76] Moiseev asserted that Soviet econometricians disregarded the fact that the notion of optimum is a fundamentally relational notion. It is only possible to establish an optimal value in one sector, such as machine production, while systematically considering the other values that emerge as a result of processes in related sectors, such as markets, energy, and natural resources. It is impossible to establish an optimal value in a subsystem of the economy without having a model of the whole national economy and, moreover, a model of the world economy. Pointing out to this complexity, Moiseev did not argue against the idea of optimal planning as such, but rather called for conceptual consistency. An important implication of striving for such a conceptual consistency was a step toward a more integrated, relational, but at the same time more open vision of a firm, a region, and, finally, the entire Soviet Union.

However, when the first econometric models of the world economy were introduced in the 1970s, Moiseev continued to doubt if the Soviet government could benefit from this type of decision aid. In 1980, in his confidential letter to Dzhermen Gvishiani, the vice-

chairman of GKNT, Moiseev could not be more blunt: "I think that the use of econometric methods for the evaluation of more or less long term evolution of economic situation is not particularly promising. Indeed, econometrics offers only a snapshot of a given situation. Accordingly, any extrapolation that is based on them, can only be more or less reliable in relatively short term, a quarter or one year".[77] To sum up, Soviet decision science posited the reality of multiple decision makers and impossibility of decision-making in an institutionally fragmented context where data was not shared across sectors, countries and time periods.

Conclusion

The Soviet decision sciences were much more than a Party instrument, being developed and promoted by as an alternative social theory of order and change. Their development had important political and governmental implications. The very purpose of OR was to replace the everyday, ideological language used in government decision-making with a mathematical language and models that could be used to describe governmental problems and formulate solutions.[78] Whereas in the West scientificization of governmental discourses was criticized as a problematic limitation of the possibility for non-specialists to participate in decision-making, in the Soviet Union the same process had an important, and potentially democratizing, side effect. Mathematical language of governance implicitly constrained the CPSU's capacity to make decisions single-handedly. Intermediaries – policy scientists – were required to step in. Accordingly, these intermediaries became increasingly aware about the importance of reflexive forms of scientific rationalization of governmental practices. Soviet decision sciences required social organization, enlightenment and cooperation among different disciplinary actors, scientific and political elites. In the authoritarian context, this was a liberalizing revolution, albeit a quiet one, one that spoke in formulas and not

ideological slogans and that developed in informal circles of scientific elites and not in public squares.

Similarly to the United States, the governmental revolution of Soviet decision sciences produced its avant-garde and rear-garde. Not all systems scientists were inclined to view the world as a reflexive, adaptive system; they sought instead safety in the authority of technoutopia: computers, mathematical models, and formal theorizing that took place in safe laboratory spaces. At the beginning of my chapter, I quoted a poem written by Oleg Larichev, who would become an academician and leading Russian scientist in the Artificial Intelligence, which was published in a special issue of the principal systems research yearbook in the Soviet Union, published by VNIISI in the 1970s-1980s. Larichev warns a systems engineer not to rely too heavily on results generated by computer modelling. These lines capture well the spirit of at least some Soviet scientists who adopted the systems approach and modelling as an open inquiry into the organization of society and nature, at the same time warning against a temptation to seek for quick fixes in decision sciences. This warning, albeit issued 36 years ago, today is still valid for policy makers both in East and West. It is also a reminder for historians of scientific governance to take into account reflexive and social construction of science, as abstract models may harbor quiet revolutions.

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[1] "No v mig chudesnyi torzhestva/ty sam sebe ne ver'./Izmenchiv mir i slozhen mir,/prosta tvoia model'." Oleg Larichev, "Nekotorye problem metodologii priniatiia unikal'nykh reshenii", in Gvishiani, D. ed. *Filosofskie aspekty sistemnykh issledovanii. VNII Sistemnykh issledovanii* (Moscow 1980), 24-32.

[2] N. V. Ovchinnikova, ed., *Istoriia upravlencheskoi mysli* [The history of the management thought] (Moscow, 2013), 287-288. It is important to note that the Russian word *upravlenie* is similar to the English word governance, whereas the English term control is translated into Russian as the term *regulirovanie* (which means regulating). V. G. Gorokhov, *Istoriia razvitiia avtomatizirovannykh sistem upravleniia v Sovetskom Soiuze, v 60-ee-70-ee gody* [The history of the development of automated management systems in the Soviet Union in the 1960s-70s] Paper presented at the 12th All-Russian Meeting on the Problems of Control, Moscow, 16-19 July 2014. For an important discussion of the Russian use of the terms control and governance, see Gerovitch, *From Newspeak*, 253.

[3] Elizabeth A. Weinberg, *Sociology in the Soviet Union and Beyond: Social Enquiry and Social Change* (Aldershot, 2004); B. M. Firsov, *Istoriia sovetskoi sotsiologii 1950–1980 gg.: Kurs lektsii* (St. Petersburg, 2001).

[4] Daniel Bessner, "Organizing Complexity: The Hopeful Dreams and Harsh Realities of Interdisciplinary Collaboration at the RAND Corporation in the Early Cold War," *Journal of the History of the Behavioral Sciences*, 51, no.1 (2015), 31-53; Nicolas Guilhot, "Cybernetic Pantocrator: International Relations Theory From Decisionism to Rational Choice," *Journal of the History of the Behavioral Sciences*, 47, no. 3 (2011), 279-301.

[5] I criticized this approach proposing a co-productionist perspective on scientific governance, understood as an assemblage of ideas, institutions and social networks all of which were shaped across the Iron Curtain. Egle Rindzevičiūtė, *The Power of Systems: How Policy Sciences Opened Up the Cold War World* (Ithaca, IL: Cornell University Press, 2016).

[6] S. M. Amadae, *Rationalizing Capitalist Democracy: The Cold War Origins of Rational Choice Liberalism* (Chicago, 2003); Philip Mirowski, *Machine Dreams: Economics Becomes a Cyborg Science* (Cambridge, 2002); Will Davies, *The Limits of Neoliberalism: Authority, Sovereignty and the Logic of Competition* (London, 2014).

[7] Mitchell Dean, *Governmentality: Power and Rule in Modern Society* (London, 1999), 18.

[8] Michel Foucault, *Security, Territory, Population: Lectures at the Collège de France, 1977–1978*, trans. Graham Burchell, ed. Michael Senallart (Basingstoke, UK, 2009).

[9] Rindzevičiūtė, *The Power of Systems: How Policy Sciences Opened Up the Cold War World* (Ithaca, 2016); Stephen Collier and Andrew Lakoff, "Vital Systems Security: Reflexive Biopolitics and the Government of Emergency," *Theory, Culture and Society* 32, no. 2 (2015): 19– 51; Helga Nowotny, *The Cunning of Uncertainty* (Cambridge, 2015); Louise Amoore, *The Politics of Possibility: Risk and Security Beyond Probability* (Durham, 2013). On the history of the concept of resilience, see Isabell Schrickel, "On Butterflies and Nuclear Reactors: Media and Politics of Resilience at the IIASA," *Behemoth: A Journal on Civilisation* 7, 2 (2014): 5-25.

[10] I have developed a similar argument on the basis of economic forecasting in Egle Rindzevičiūtė, "A Struggle for the Soviet Future: The Birth of Scientific Forecasting in the Soviet Union", *Slavic Review* 75, no.1 (2016): 52-76. See also Paul Erickson, "Mathematical Models, Rational Choice and the Search for Cold War Culture," *Isis*, 101/2 (2010):386-392.

[11] Rindzevičiūtė, "A Struggle for the Soviet Future," 62.

[12] Such is one of early studies on Soviet decision makers edited by H. Gordon Skilling and Franklyn Griffiths, eds., *Interest Groups in Soviet Politics* (Ann Arbor, 1971), John Löwenhardt, *Decision Making in Soviet Politics* (London and Basingstoke, 1981). For an oversight of Kremlinology, see David C. Engerman, *Know Your Enemy: The Rise*

and Fall of America's Soviet Experts (Oxford, 2009). For a recent personalist take on Soviet governance, see Oleg Khlevniuk and Nora Seligman, *Master of the House: Stalin and His Inner Circle* (Stanford, CA, 2014). For an example of a recent institutionalist approach, see Stephen Fortescue, ed., *Russian Politics from Lenin to Putin* (Basingstoke, 2010).

[13] William Conyngham, *The Modernization of Soviet Industrial Management: Socioeconomic Development and the Search for Viability* (Cambridge, 1982); Erik Hoffmann, Robbin F. Laird, *Technocratic Socialism: The Soviet Union in the Advanced Industrial Era* (Durham, 1985); Mark Beissinger, *Scientific Management, Socialist Discipline and Soviet Power* (London, 1988); Pekka Sutela, *Economic Thought and Economic Reform in the Soviet Union* (Cambridge, UK, 1991).

[14] Michal Kopeček and Piotr Wciślik, eds., *Thinking Through Transition: Liberal Democracy, Authoritarian Pasts, and Intellectual History in East Central Europe After 1989* (Budapest, New York, 2015); Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA, 2011).

[15] Stephen Collier, *Post-Soviet Social: Neoliberalism, Social Modernity, Biopolitics* (Princeton, 2011). For a relevant discussion of different types, Radical and Modernist, Communist approach to governance see also David Priestland, *The Red Flag: Communism and the Making of Modern World* (London, 2009).

[16] Peter Rutland, *The Myth of the Plan* (Harper Collins, 1985); Paul Gregory, *The Political Economy of Stalinism: Evidence from the Soviet Secret Archives* (Cambridge, 2004); Yoram Gorlizki, "Scandal in Riazan: Networks of Trust and the Social Dynamics of Deception," *Kritika*, 14/2 (2013): 243-278.

[17] Benjamin Peters, *How Not to Network a Nation: The Uneasy History of the Soviet Internet* (Cambridge, MA, 2016).

[18] Rindzevičiūtė, *The Power of Systems*; Eglė Rindzevičiūtė, "The Future as an Intellectual Technology in the Soviet Union: From Centralised Planning to Reflexive Management," *Cahiers du monde Russe* 56, no. 1 (2015): 111–134.

[19] Philip Hanson, *The Rise and Fall of the Soviet Economy* (Harlow, 2003); Loren Graham, *The Ghost of the Executed Engineer: Technology and the Fall of the Soviet Union* (1993); David Holloway, "The Political Uses of Scientific Models: The Cybernetic Model of Government in Soviet Social Science", in *The Use of Models in the Social Science*, ed. Lyndhurst Collins (Tavistock, 1976), 110-129.

[20] Gerovitch, 278-279. See also Manuel Castells and Emma Kiselyova, *The Collapse of Soviet Communism: A View from the Information Society* (Berkeley, 1995).

[21] Alena Ledeneva, *Russia's Economy of Favours: Blat, Networking and Informal Exchange* (Cambridge, UK, 1998).

[22] Eglė Rindzevičiūtė, *Constructing Soviet Cultural Policy: Cybernetics and Governance in Lithuania After World War II* (Linköping, 2008), 143-147.

[23] Eglė Rindzevičiūtė, "The Future as an Intellectual Technology in the Soviet Union: From Centralised Planning to Reflexive Management," *Cahiers du monde Russe* 56, no. 1 (2015): 111–134.

[24] Maurice W. Kirby, *Operations Research in War and Peace: The British Experience from the 1930s to 1970* (London, 2003); William Thomas, *Rational Action: The Sciences of Policy in Britain and America, 1940-1960* (Cambridge, MA, 2015).

[25] David R. Jardini, "Out of the Blue Yonder: The Transfer of Systems Thinking from the Pentagon to the Great Society, 1961–1965," in *Systems, Experts, and Computers: The Systems Approach in Management and Engineering, World War II and After*, ed. Agatha C. Hughes and Thomas P. Hughes, 385–412 (Cambridge, MA, 2000); S. M. Amadae, *Prisoners of Reason: Game Theory and Neoliberal Political Economy* (Oxford, 2016); Paul Erickson,

Judy L. Klein, Lorraine Daston, Rebecca Lemov, Thomas Sturm, and Michael D. Gordin, *How Reason Almost Lost Its Mind: The Strange Career of Cold War Rationality* (Chicago, 2013).

[26] Nicolas Guilhot, this volume.

[27] Wiener was explicit on this, see also Robert Kline, *The Cybernetic Moment*, 127.

[28] The political and cultural history of cybernetics is a growing field: Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21, 1 (1994): 228-266; Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* (Chicago, 1999); Philip Mirowski, *Machine Dreams: Economics Becomes a Cyborg Science* (Cambridge, 2002); Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, MA, 2002); Fred Turner, *From Counterculture to Cyberculture: Stuart Brand, the Whole Earth Network and the Rise of Digital Utopianism* (Cambridge, MA, 2006); Eglė Rindzevičiūtė, *Constructing Soviet Cultural Policy: Cybernetics and Governance in Lithuania After World War II* (Linköping, 2008); Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA, 2011); Ronald Kline, *The Cybernetics Moment: Or Why We Call Our Age the Information Age* (Baltimore, 2015); Orit Halpern, *The Beautiful Data: A History of Vision and Reason Since 1945* (Cambridge, MA, 2015); Benjamin Peters, *How Not to Network a Nation: The Uneasy History of the Soviet Internet* (Cambridge, MA, 2016); Eglė Rindzevičiūtė, *The Power of Systems: How Policy Sciences Opened Up the Cold War World* (Ithaca, 2016).

[29] Sari Autio-Sarasmo and Katalin Miklóssy, eds. *Reassessing Cold War Europe* (New York, 2011).

[30] David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939–1956* (New Haven, CT, 1996).

[31] Slava Gerovitch, *From Newspeak to Cyberspeak,* 159.

[32] Gerovitch, 179.

[33] For the impact of cybernetics on Soviet mathematical economics see Adam Leeds, "Dreams in Cybernetic Fugue: Cold War Technoscience, the Intelligentsia, and the Birth of Soviet Mathematical Economics," *Historical Studies in the Natural Sciences*, 46, no.5 (2016):633-668.

[34] Heyck Hunter, *Age of System: Understanding Development of Modern Social Science* (Baltimore, 2015); Benoît Godin, "National Innovation System: The System Approach in Historical Perspective," *Sciences, Technology and Human Values*, 34/4 (2009): 476-501.

[35] Melanie Ilic and Jeremy Smith, eds., *Soviet State and Society Under Nikita Khrushchev* (London & New York, 2009).

[36] Rindzevičiūtė, *The Power of Systems*.

[37] Dzhermen Gvishiani; Richard Vidmer, "Management Science in the USSR: The Role of Americanizers," *International Studies Quarterly*, 24/3 (1980): 392-414.

[38] Gerovitch, *From Newspeak to Cyberspeak*, 267.

[39] See my argument in Rindzevičiūtė, "A Struggle for the Soviet Future."

[40] This section draws on a chapter in my recent monograph. For more on the Soviet OR and systems analysis, see Rindzevičiūtė, *The Power of Systems*.

[41] In 1970 the Russian translation of von Neumann's and Morgernstern's *Game Theory and Economic Behavior* was translated into Russian and published by the Nauka press.

[42] Gerovitch, *From Newspeak to Cyberspeak*, 272.

[43] Ivan Boldyrev, "The Strategy of Getting Together, or How Mathematics Found its Way into Soviet Economic Discourse", paper presented at the workshop *From Technocratic Socialism to Neoliberal Rule: Expert Cultures, Technocracy and Governance in East Central Europe 1960s-1990s*, Prague, 3-5 November 2016.

[44] Although Soviet OR scientists did not identify themselves with the cybernetics movement, finding it too philosophical. An interview with an ex-Soviet OR scientist.

[45] Dmitrii Efremov, *Ekologo-politicheskie diskursy: vozniknovenie i evoliutsiia* [Ecological and political discourses: Emergence and evolution] (Moscow, 2006), 43.

[46] Major histories of Soviet planning skip forward from Kosygin's reforms of 1965 to Gorbachev's perestroika of 1986. However, the 1970s was an important period in Soviet planning, as it was at that time that scientific expertise was integrated in the planning process. For an example, see Michael Ellman, *Socialist Planning* (Cambridge, 2014).

[47] Pekka Sutela, *Economic Thought and Economic Reform in the Soviet Union* (Cambridge, 1991).

[48] Here the rise of the systems approach and modelling in the Soviet Union largely follows the trajectory of these sciences in the US, as detailed in Hunter Heyck, *Age of System*.

[49] Jenny Andersson and Eglė Rindzevičiūtė, "Introduction", in *The Struggle for the Long- Term in Transnational Science and Politics: Forging the Future*, eds. Jenny Andersson and Eglė Rindzevičiūtė (New York, 2015).

[50] Rindzevičiūtė, *The Power of Systems*.

[51] Nikolai Krementsov, *A Martian Stranded on Earth: Alexander Bogdanov, Blood Transfusions, and Proletarian Science* (Chicago, 2011).

[52] George M. Young, *The Russian Cosmists: The Esoteric Futurism of Nikolai Fedorov and His Followers* (Oxford, 2012).

[53] For Vernadskii, see Jonathan Oldfield and Denis Shaw, "V. I. Vernadskii and the Development of Biogeochemical Understandings of the Biosphere, c. 1880s–1968," *British Journal for the History of Science* 46, no. 2 (2013): 287–310. For Bogdanov, also see John Biggart, Peter Dudley, and Francis King, eds., *Alexander Bogdanov and the Origins of Systems Thinking in Russia* (Aldershot, UK, 1998).

[54] B. G. Iudin, "Iz istorii sistemnykh issledovanii: mezhdu metodologiei i ideologiei" [From the history of systems research: between methodology and ideology], *Vestnik TGPU* 1/75 (2008): 28-33.

[55] Paul Josephson et al, *An Environmental History of Russia* (Cambridge, 2013); Stephen J. Collier, Post-Soviet Social: Neoliberalism, Social Modernity, Biopolitics (Princeton, 2011).

[56] Sari Autio-Sarasmo and Katalin Miklóssy, eds. *Reassessing Cold War Europe* (New York, 2011); Oscar Sanchez- Sibony, *Red Globalization: The Political Economy of the Soviet Cold War from Stalin to Khrushchev* (Cambridge, 2014).

[57] Interview with a systems scientist, November 2014.

[58] See Karl E. Weick, *The Social Psychology of Organizing*. 2nd ed. (New York, 1979); Fred M. Kaplan, *The Wizards of Armageddon* (Stanford, CA, 1991).

[59] Boris Milner, "Application of Scientific Methods of Management in the Soviet Union," *Academy of Management Review*, 2/4 (1977): 560. For more on East-West relations in econometrics, see Johanna Bockman and Michael Bernstein, "Scientific Community in a Divided World: Economists, Planning and Research Priority during the Cold War," *Comparative Studies in the Society and History*, 50/3 (2008): 581-613.

[60] Mifodijus Sapagovas et al., *Matematikos ir informatikos institutas* (Vilnius, 2006). See also Eduardas Vilkas, "On a General Approach to Optimality in Game Theory," Cowles Foundation Discussion Paper No. 419 (January 20, 1976). Available on http://cowles.yale.edu/publications.

[61] Rindzevičiūtė, *The Power of Systems*. See also Johanna Bockman and Michael A. Bernstein, "Scientific Community in a Divided World: Economists, Planning, and Research Priority during the Cold War," *Comparative Studies in Society and History* (2008), 50(3): 581-613.

[62] N. N. Moiseev and A. G. Schmidt, "Some Problems of Centralized Economy," *Cowles Foundation Discussion Paper* No. 358 (April 5, 1973), 28.

[63] Nikita Moiseev, *Matematika, upravlenie, ekonomika* [Mathematics, governance, economics] (Moscow, 1970), 4.

[64] Moiseev, *Matematika*, 4-5.

[65] Moiseev, *Matematika*, 7.

[66] Moiseev, *Matematika*, 11.

[67] Moiseev, *Matematika*, 15.

[68] Moiseev, *Matematika*, 15.

[69] Moiseev, *Matematika*, 15.

[70] Moiseev, *Matematika*, 23.

[71] Moiseev, *Matematika*, 25,

[72] Moiseev, *Matematika*, 29.

[73] Moiseev, *Matematika*, 59.

[74] Moiseev, *Matematika*, 31.

[75] Moiseev, *Matematika*, 31.

[76] Moiseev, *Matematika*, 28.

[77] Moiseev to Gvishiani (31 July 1980), The Archives of the Russian Academy of Sciences (ARAN), f. 1918, op.1, d. 463, l.1.

[78] Ovchinnikova, 295.