4 Staging the OGAS, 1962 to 1969

The year 1962 proved to be a tumultuous one for the world. Khrushchev's grasp on the reigns of the Soviet state began to slip in the face of mounting criticism, and Kennedy's Bay of Pigs invasion metastasized into the Cuban missile crisis, probably the closest the world has yet come to a nuclear world war.[1] Behind the scenes to these potentially cataclysmic situations, a small team of Soviet cyberneticists who were located in Kiev and Moscow were committed to building "electronic socialism" under the guise of the All-State Automated System, or OGAS. The OGAS Project was the Soviet Union's attempt to build a national computer network project that would network the command economy, automate and optimize the immense coordination problems besetting that economy, and thereby speed the grand socialist experiment toward a prosperous and stable Communist future.

The All-State Automated System Project took its first breath with the delivery of a sealed envelope into the hand of Nikita Khrushchev in the late fall of 1962. The letter to the general secretary was written by young scientists from the Komsomol Spotlight (*Komsomol'skii prozhektor*), who noted what they perceived to be the catastrophic backwardness of information technology in the USSR compared to the United States and called for the immediate acceleration and adoption of computing technology into economic planning. The letter made an impression on the public, in the form of an official *Izvestiya* newspaper article titled "Information Technology in the National Economy," and on members of the Politburo, the governing committee of the Soviet state, which reportedly spent nearly thirty-five minutes of a forty-five-minute session discussing the consequences of their fifteen-page letter. Several months later, on May 21, 1963, following the proposals discussed in the previous chapter, the Politburo with the backing of all relevant ministers advanced a Communist Party resolution calling for the same and authorizing the first economic reform carried out by automated computer network (later known as the OGAS). This chapter discusses

the vision, the chief visionary (Viktor Glushkov) and his team, and the institutional landscape for the OGAS Project, the most prominent attempt to establish a civilian national network project in the Soviet Union.

The OGAS: A Vast Vision behind a Global-Local Network

The OGAS Project promised to deliver "electronic socialism" that was as ambitious as its official title was long—the All-State Automated System for the Gathering and Processing of Information for the Accounting, Planning, and Governance of the National Economy, USSR. Its short names were the All-State Automated System for the Management of the Economy, the All-State Automated System, and OGAS. For clarity, I distinguish here between the OGAS as the imagined network that did not come to exist and the OGAS Project as the Soviet actors and institutions that tried to realize this reform.

According to its cyberneticist founders, the infrastructure of the command economy had to be upgraded before the entrenched coordination problems that led to the country's economic woes could be resolved. "In the area of economic management," Glushkov wrote in 1962, "cybernetics fits our socialist planned economy like a glove."[2] The work was fundamentally technocratic and rational and sought to "reduce the influence of the subjective factor in the making of administrative decisions."[2]

In its most modest framing, the OGAS—which stretched nationwide across preexisting and new telephony wires that were entirely separate from preexisting military computer networks—appears little more than the extension of a local factory control computer network. It would be an ASU (automated system of management) or OGASU (All-State ASU) (*Obshche-Gosudarstvennaya Avtomatizirovannya Sistema Upravleniya*). The primary visionary of the OGAS, Viktor Glushkov (who is discussed later in this chapter), had been aware of Anatoly Kitov's efforts, including his Red Book letter, ever since Glushkov began studying computing in Kiev with Kitov's 1956 *Digital Computing Machines* in hand. Glushkov employed Kitov as a consultant in 1960 after Kitov's dismissal from the army. The OGAS was to become the Soviet equivalent of the national economy imagined as a single factory, with one interactive industrial control system serving it across a national computer network in real time. This was not to be a dumb network that would merely exchange data and communication across great distances. It was to be a "smart" network whose decentralized command and control protocols would be capable of automating, mathematically modeling, optimizing, and rationalizing away the profound inefficiencies that beset the command economy. According to the original proposers, the resulting

network efficiencies, which were optimized to serve both national and local needs, would achieve full effect by 1990, nearly thirty years after the Komsomol young scientists delivered their letter into Khrushchev's hands.

As originally envisioned, the OGAS had several distinct features. Perhaps the most meaningful contrast with that of modern networks is that the OGAS was modeled after the economy of a factory writ large for a nation. The basic unit of the OGASU was, as the initials imply, the ASU, the automated management system, or a local information and control system that looped onsite mainframe computers into the industrial processes of a factory or enterprise to provide real-time information feedback, control, and efficiencies. This kernel vision of a network as an expression of the nervous system of a factory, writ large across a nation, magnified the image of the workplace until it incorporated the whole command economy—a sort of simultaneously metaphorical and mechanical collectivization of the industrial household (or what Hannah Arendt calls the *oikos*).

The OGAS Project might be seen as preceding, although not precipitating, the current trends in so-called cloud computing. The national network was to provide "collective access," "remote access," and "distance access" on a massive scale to civilian users who could "access," "input," "receive," and "process" data related to the command economy (such older terms appear to bear more descriptive heft than the modern computing metaphors such as *upload*, *download*, *share*, and *stream*). The decentralized network was designed so that information for economic planning could be transmitted, modified, and managed in relative real time up, down, and laterally across the networked administrative pyramid. At the base of that pyramid, in the network's initial vision, were as many as twenty thousand computer access points and ASUs distributed throughout the nation's enterprises and factories. This base of computer centers would be connected to one hundred to two hundred midlevel regional planning decision centers in major cities, which would be connected to the central planning processing center in Moscow by high-capacity data channels. The original vision of a three-tiered pyramid network—with twenty thousand computer centers on the bottom, one hundred to two hundred in the middle, and one on the top—was scaled back in the original design of the technical base of that network (the Unified State Network of Computing Centers, or EGSVT). The first proposal for that technical network offered a modest blueprint where one central computing center in Moscow would regulate only twenty-five to thirty computing centers in city sites of "information flow concentrations" and an unspecified number of "regional calculating center and points of information gathering"[3] (figures 4.1 and 4.2).


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А II
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А II
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А I
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А I
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Б II
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А I
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А I
1
А III
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А I
6
Б III
40
А I
4
А III
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А III
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А III
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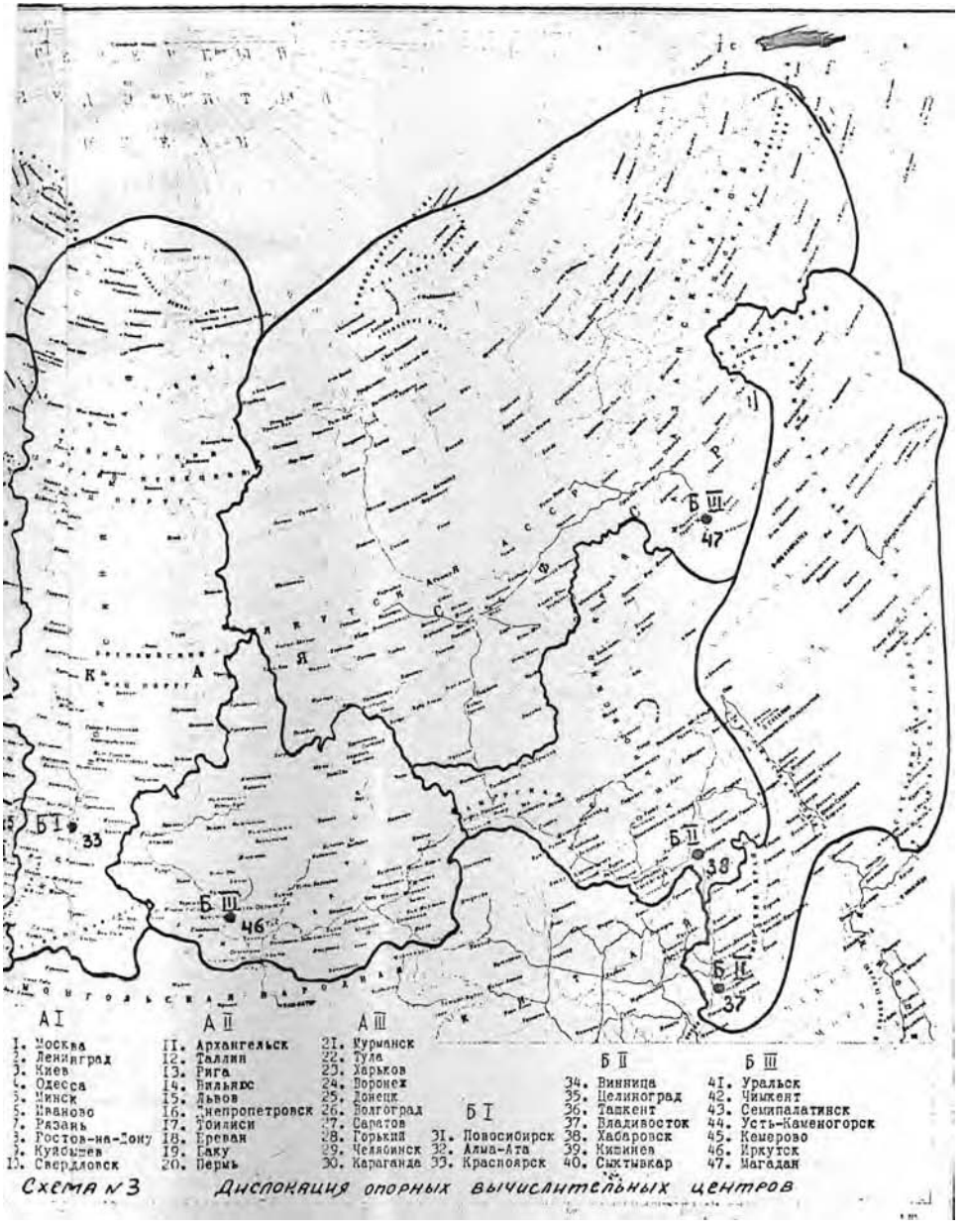


Figure 4.1
Map of the three tiers (I, II, III) of planned computing center sites behind the OGAS (All-State Automated System), 1964.

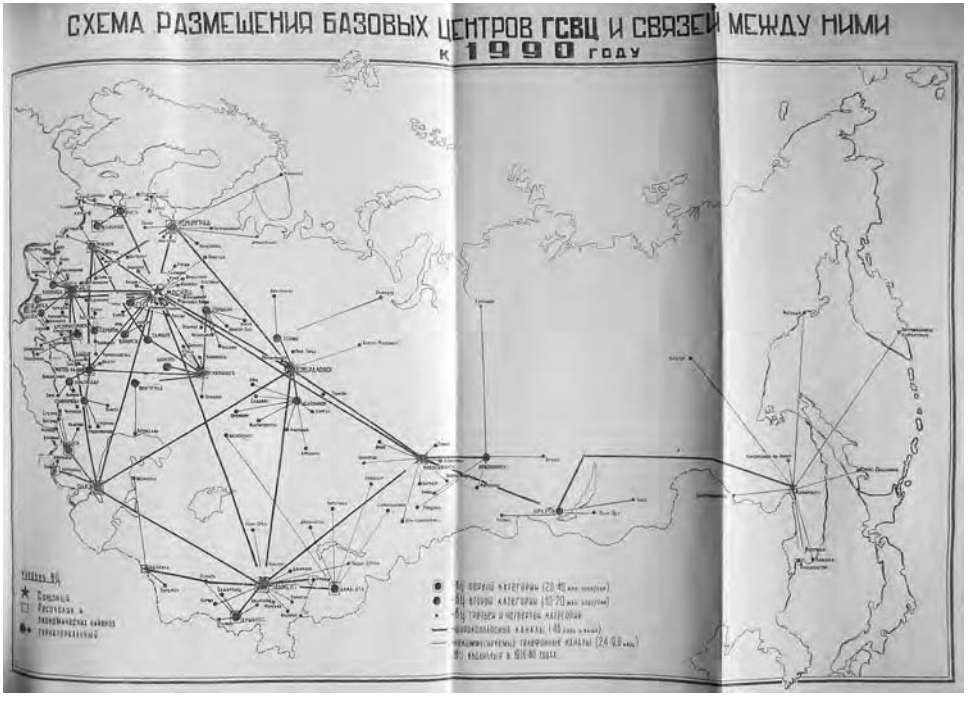


Figure 4.2
Map of the EGSVTs (Unified State Network of Computing Centers) that were projected to be operational in 1990, possibly from 1964.[4]

As communication scholar Vincent Mosco has recently noted, the Soviets offer perhaps the first glimpse of the modern imagining of decentralized remote computing (what recently has been called *cloud computing*) on a massive scale.[5] In Glushkov's design, the network would afford interactive and collective remote access and communication vertically up and down the planning pyramid and horizontally among peer and associated computing centers. Glushkov writes: "the characteristic quality of the network was a distributed database with zero-address access from any point of the system to all the information after automatic verification of the qualified user." In other words, any user with proper permission could access all the content of the network at any point on the network. At local levels, factory workers would be able to input their own information, reports, and recommendations about improving factory workflow, which would automatically be stored in a national unified database for local, regional, and national review. The content format was not to be prespecified. For example, the network visionaries planned to include over 500,000 project

dossiers on foreign scientists, engineers, executives, and companies in the OGAS nationally networked database. (From 1963 to 1968, the associated Department of Scientific Institutions gathered about 75,000 such dossiers.) The proposal's other ambitions went far beyond that of simply sluicing economic planning information. In 1971, the deputy editor of *Pravda*, Viktor Afanasyev, for example, reasoned that OGAS "can be used—and should be used—for gathering, processing, and analyzing information on sociopolitical and ideological processes as well, for the purpose of optimal management [of society]."[6]

As a near synthesis of optimal management and total surveillance, the OGAS is a full articulation of the wider political-economic imagination of the Soviet Union as not just a single unified society and set of nations but as a unified corporation with a socialist mission statement. The OGAS appeared to its founders as the information technology upgrade that the Soviet Union had long needed to be able to function as the corporation it had already long imagined its command economy to be—a single and complex organization that featured decentralized means of control and communication for circulating the informatics lifeblood of a socialist economy. Because socialism openly recognized economic activity as more than merely computational, the network that would best facilitate its fitness would also control and communicate associated political and social concerns as well.

The OGAS Project of course was no ARPANET. It sought much more than data transfer and communication among scientists. From the outset, the OGAS Project sought to bring the economic bureaucracy online by making all relevant government documents electronic, allowing a decentralized remote access to all economic workers, and allowing decentralized access for controlling and optimizing the information in those documents. The decentralized design of the network project is worth stressing. Although still hierarchical, acquiescent to Moscow as the center, and state-led, the longest-lasting Soviet network proposal was (unlike the full central control in Kitov's EASU and the radial design of Kharkevich's ESS) openly worker-oriented, antibureaucratic, and decentralizing in principle. This gives the OGAS Project and its team more credit than many commentators and critics have given it. Both international and internal critics, including the British organizational cyberneticist Stafford Beer, were critical of Soviet management techniques.[7] More than a network, the OGAS Project as formulated by Glushkov outlines a daring technocratic economic imagining that was meant to operate in a future Soviet information society by digitizing, supervising, and optimizing the coordination challenges besetting the national command economy.

The associated costs and scale of such a supercharged system were accordingly colossal. Glushkov captured the sentiment of network effects, which is still alive in surveillance capitalism's promotion of big data today, in this phrase: "world practice shows that the larger the object for which an information-management system is created, the greater its economic effect."[8] More than *komchamstvo*, or Lenin's term for "Communist boasting," the basic OGAS blueprint affirms its staggering magnitude. In its initial proposals, the OGAS Project estimated that it would take over thirty years to be fully online, that it would need a labor transfer of some 300,000 personnel, that costs would be upward of 20 billion rubles for the first fifteen years, and that tens of thousands of computing center and interactive access points would be distributed across the Soviet population.

All this would prove net efficient, promised Glushkov. The 300,000 knowledge workers would constitute an enormous labor transfer, as well as a net reduction in the ever-rising number of people who were employed in economic planning. The 20 billion rubles would be distributed over three five-year plans, with the first requiring a seemingly modest 5 billion rubles. Acutely aware of the advantages of the well-regulated financial management that was enjoyed by the successful military nuclear and space programs, Glushkov insisted to Prime Minister Kosygin that, if the OGAS were to be developed, this civilian program would require a similarly well-managed funding stream, even though it would prove more complicated and expensive than both military programs combined. For his distinctly decentralized civilian economic communication infrastructure project, Glushkov sought fully centralized military-style financial funding. Only with well-managed funding could this civilian project pay for itself, which it promised to do handsomely, returning fivefold on the first fifteen-year investment, or "no less than 100 billion rubles" (roughly $850 billion in 2016 U.S. dollars), and even this estimated windfall in savings "was a conservative figure."

Cost, in other words, is the simplest reason that the OGAS Project never developed as proposed. A networked command economy, as economist critics noted, would simply prove uneconomical. No such sum of funding was granted, and the projected costs soared slowly upward until, according to varying estimates, the OGAS, if built in the late Soviet Union, would cost the staggering sum of 160 billion rubles (or $1.4 trillion in 2016 dollars, or roughly the U.S. deficit in 2009).[9] Still, costs are never black or white. The OGAS Project imagined a series of adjunct projects with less painful price tags. As early as 1963, the EGSVT technical network proposed a far more affordable fraction of this vision—one center in Moscow, twenty to thirty regional computing centers, and unspecified local computing "access points."

The Visionary behind the Vast Network: Viktor Glushkov

Viktor Glushkov (1923–1982), who was called the "king of Soviet cybernetics" in his *New York Times* obituary, was neither the first nor the last to propose a nationwide network. But he figures as the organizing protagonist of the remaining history as the leading champion of the OGAS Project, a well-positioned academician, vice president of the Academy of Sciences, and a leading cyberneticist. Known as both a global thinker and a local doer from a young age, Viktor Mikhailovich Glushkov was born in the temperate southern Russian city of Rostov-on-Don on August 23, 1923, into a family of a mining engineer (figure 4.3). Like many prominent Soviet figures, he excelled in mathematics at a young age and in middle school dreamed of becoming a theoretical physicist. In high school, he quickly grasped topics such as quantum mechanics and absorbed classics in the original German from Johann von Goethe to Georg Wilhelm Friedrich Hegel's *The Philosophy of History*. In 1941, the Nazis executed his mother for her part in the underground resistance. After failing to enlist in the artillery school for health reasons, he turned to mathematics in college, dove into topological algebra, and graduated in 1948. Four years later, including two years to complete his doctorate while holding a research position at a new nuclear center in Yekaterinburg (then Sverdlovsk) in central Russia, he proposed solutions to David Hilbert's generalized fifth problem in 1952. In 1900, in Paris, the German mathematician David Hilbert proposed twenty-three foundational problems that have attracted much attention in modern mathematics since. Two of those problems are considered unresolvable, and the fifth problem, parts of which Glushkov tackled, involves smooth manifolds in Lie group theory. The initial breakthrough came to him while he was climbing an ice field on Mt. Kazbek in the Caucasus with his wife, Valentina Mikhailovna. Six months later he had formalized the shortest solution to that problem to that day.

This feat guaranteed that in the mid-1950s, the rising algebraist could have secured almost any position in the Soviet Union. Thanks to an introduction from academician Boris Vladimirovich Gnedenko, Glushkov became acquainted with Lebedev's computing center in Kiev, which six years later (in 1962) he transformed into the prominent Institute of Cybernetics. He directed the institute from 1962 until his death in 1983. When asked why he chose to shift his attention to the intersection of computer technology and mathematics and subsequently assume the directorship of a Computing Center from Sergei Lebedev in Kiev, Ukraine, in 1956—and not a more politically prestigious position in Moscow—he is reported to have replied that his wife, Valentina, whom he had met in their third year

Figure 4.3
Viktor Glushkov, about 1963. From the personal archives of Viktor Mikhailovich Glushkov.

of college in relatively balmy Rostov, preferred the warmer weather in Kiev and he agreed.[10] It is also possible that this committed theorist of decentralized power saw a position removed from Moscow as a strategic opportunity to practice and leverage decentralized power. So having achieved an ambitious goal in mathematics at a young age in 1956, Glushkov turned his sights to theorizing the emergent field of cybernetics, especially the relationships between information technology and economic cybernetics. His oeuvre swept across theoretical fields (including abstract algebra, mathematical logic, automata theory, and algorithms) and applied fields (including the development of hardware, software, robotics, informatics, and computers and the administration of Soviet economic cybernetics).

Glushkov is remembered by colleagues for having been always "on"—a persistent kind of applied grand theorist—except for the occasional hike or fishing trip down the Dnieper River, which he relished. His children recall him following a strict daily regime: when he was not riding the day-long Kiev-Moscow train (which he jokingly called his home), he rose at 8:30

am, exercised, breakfasted, went to work, returned home in the evening, and continued working until about 2:00 or 3:00 am. In 1963, as the first director of the brand new Institute of Cybernetics, his work habits reached a feverish pitch and then broke. Valentina recalled that he worked eighteen to twenty hours a day until at age forty, he suddenly collapsed from a brain seizure. (A tumor of the medulla likely ended his life twenty years later.) Undeterred and still bound to his hospital bed, he finished the introduction to his Lenin Prize–winning book, *The Design of Digital Automatic Machines*. His intense persistence of mind rendered possible his mathematical achievements, and his vision was shortsighted since youth due to his voracious reading habits. It is not known whether this contributed to his protracted struggle with a fatal brain tumor.

Fluent enough in German and English to lecture and publish abroad in those languages (having once recited excerpts from Goethe from memory for two hours to win a bet), Glushkov figures as a consummate information universalist, even among cyberneticists, for whom practically every challenge reduced to, as his colleague and fellow computer pioneer Boris Malinovsky put it, "the global problem of the computerization of information sharing."[11] Committed to building computer networks that share information, his subsequent research goals pushed him to generalize his applied innovations further and further. Some characteristic examples include career examinations in not just specialized computing but multipurpose control computing; not just von Neumann computing processor architecture but "massively parallel macro-piping" and a recursive base for fractal processing in computer architecture; not just computer programming but natural-language computer programming; not just robots but entirely digital automata; not just bureaucracy but paperless offices and informatics; and in the end, not just a better economic life for private humans and our collective humankind but an even bolder and more remote future. He identified in the inevitable evolution of artificial intelligence the possibility of "informational immortality," where the subjective consciousness, memories, and personalities of individuals and societies might be transferred into a global network that was capable of outlasting the ages, resurrecting and recasting civilization as we know it.[12] Because they reach so far, the endpoints of these various research initiatives begin to express in relief the grander vision that organized his personal commitment to the OGAS Project as the next step in networking onto the higher plane of the grand collective of socialist labor.[13] For Glushkov, the OGAS Project represented a vehicle for achieving the whole of his many scalable visions.

Glushkov modeled his thinking about computer networks and processing after—and often against—the prevailing trends in the study of neural networks. In a notable deviation from von Neumann digital computer architecture that pushes all data bits through a bottleneck one bit at a time, Glushkov theorized about what he called the "macropiping" or "macroconveyor" processor architecture for transmitting information along multiple processors simultaneously between groups of computers. Macropiping was modeled after his cybernetic vision of the computer, which, according to a 1959 speech, would best resemble the human brain in its capacity to process billions of bits of data in parallel simultaneity. This idea germinated into his notion of a simultaneous national network that would function as a self-regulating nervous system for the whole of the Soviet people. Glushkov shared conversations and computing technology with people such as chessmaster Mikhail Botvinnik, among many other ambitious dreamers, to create a machine in the image of man, not the other way around. In the late 1950s, Glushkov sought to develop in theory a computer programming that imitated the sophistication of human thought, cognitive function, and natural language. For example, he and his colleagues examined processes for distinguishing between grammatically and semantically correct sentences, such as "The chair stood on the ceiling," as a step toward achieving natural language programming and a more human "higher intellect" in the computer.[14]

The OGAS Project took shape in a complex network of research teams (at the center of which sat Glushkov). No science is a solitary endeavor, however, and a full accounting of the details of the people who constituted Glushkov's teams, their accomplishments, and their frustrations is beyond the scope of this book. Two of his favorite students and eventually a wife-husband team, Yulia Kapitonova and Aleksandr Letichevsky, identify what they call the intellectual "school" of Viktor Glushkov, which itself contained many teams that contributed to the OGAS Project and many other projects. The first EGSVT proposal began to take shape in the conversations of Glushkov, Vladimir S. Mikhalevich (who directed the Institute after Glushkov), Anatoly Kitov, A. Nikitin, and others, and the first government document published on the EGSVT, on May 21, 1963, also highlights as coauthors Anatoly Kitov, V. Purgachev, Yu. Chernyak, M. Popov, among others. Key members and colleagues at the Institute of Cybernetics in Kiev included Vladimir S. Mikhalevich, V. I. Skurikhin, A. A. Morozov, Yulia V. Kapitonova, Aleksandr A. Letichevsky, A. A. Stognii, T. P. Mar'yanovich, and others. The Moscow-based supporting scientists included Anatoly Kitov, Yu. A. Antipov, I. A. Danil'chenko, Yu. A. Mikheev, R. A. Mikheeva,

among others.[15] Optimization modeling, which would have contributed to the management software running the OGAS economic reform) were developed from 1962 to 1969 by Vladimir Mikhalevich, O. O. Bakaev, Yu. M. Ermol'ev, I. V. Sergienko, V. L. Volkovich, B. M. Pshenychniyi, V. V. Shkurba, N. Z. Shor, and others. Glushkov toiled alongside A. A. Stognii and A. G. Kukharchuk as principal designer in developing the Dnepr-2, a transistor computer. He also headed a team that included Y. Blagoveshensky, Aleksandr A. Letichevsky, V. Losev, I. Mochanov, S. Pogrebinsky, and A. A. Stognii in developing the MIR-1 engineering calculation machine, an exhibition version of which IBM purchased in London.[16]

Other supporting teams in the Glushkov school indirectly reflect on the OGAS Project. Kapitonova and Letichevsky, for example, helped Glushkov theorize an "analytic" mathematical human language programming language and an algorithmic design in computer design automation.[17] This team helped nudge the field of artificial intelligence away from the notion that the brain was machine-inspired (away from McCulloch and Pitts's claim that the brain follows logical circuitry). Instead, they worked on building a brain-inspired machine that was "capable of carrying out complex creative activities," continuously seeking to reveal the "higher intellect" of machines modeled after mechanisms of the mind.[18] If there was a danger in the brain and machine metaphor, it ran only one way for Glushkov: "the danger is not that machines will begin to think like people," he intoned, "but that people will begin to think like machines."[19]

Are National Networks More Like Brains or Nervous Systems?

In 1962, Glushkov imagined the OGAS as a "brainlike" (*mozgopodnobyi*) network for managing the national economy and extending the life experience of the nation and its inhabitants. Consider the implications for the cybernetic analog between neural networks and national computer networks. As already noted, cybernetics brings to bear powerful conceptual frameworks for imagining structural analogies between ontologically different information systems—organisms, machines, societies, and others. The cybernetic instinct rushes many visionaries to profound structural insights but also to overly determined design decisions. The circuitry of a computer chip and the neural networks of a mind do not resemble each other, although cybernetics earns its keep by finding usable analogs between them. This cybernetic system analog instinct—to design in beautiful symmetry where not necessary—helps to explain the consistent hierarchically

decentralized design of all Soviet national network projects. They were designed to resemble the national economy as it appeared in principle, not as it worked in practice. To quote the secretary of the history of the Central Economic Mathematical Institute, a collegial institute of Glushkov's Institute of Cybernetics, the decision was made to "build the country's unified net hierarchically—just as the economy was planned in those days."[20]

In other words, Kitov, Glushkov, Fedorenko, and others followed the cybernetic integration of machines and biology to its design conclusions. Like Kharkevich's design, Glushkov's OGAS and other Soviet economic cyberneticists insisted that the Soviet economy, as a national body, needed a central information processor, administrator, and brain. They were not alone in modeling national networks as a neural network in the early 1960s.[21] The U.S. network engineer Paul Baran envisioned the ARPANET as a distributed packet-switching network that was modeled in part after Warren McCulloch's vision of the brain.

Note the difference here: Soviet economic cyberneticists under Glushkov conceived of the national network as a match for a national economic body with the network as the nervous system complete with a central processing in Moscow, and the American model of distributed networking imagined the whole of the nationwide computer network after the dynamic structure of the brain itself, not the body. In the Soviet Union, the command economy resembled the body, with the economic planning apparatus as its nervous system and Moscow planners as the brain, and in the West, after the ARPANET was commercialized, there was no body outside of the brain itself: the whole national network of users made up the nationally distributed brain itself.

To reduce it to a simplistic cold war binary: cybernetic network entrepreneurs throughout the world had competing analogs for thinking about national networks. In America, the ARPANET was designed to resemble a brain of the nation because its visionaries first imagined the nation as a single distributed brain of users. In the Soviet Union, the OGAS was designed to resemble a nervous system for the nation because its visionaries first imagined the nation as a single incorporated body of workers. This Soviet analog between network and nervous system, far from determining the outcome of the network, also occurred in Project Cybersyn in the early 1970s in Chile. Its principal architect, the British cyberneticist Stafford Beer, sketched the socialist Salvador Allende's nation as a viable system that was based on the "human nervous system" analogized with a comprehensive firm or corporate organization—complete with executives in adaptive feedback loops with the national body of workers.[22]

In addition to taking the cybernetic brain-computer analogy to its logical extreme, Glushkov also sought tight structural analogies in the communication systems that connected technical and human machines. For example, he designed the programming language Analytic to resemble human speech: "We continued to develop it in accordance with the principles of progressively complex machine languages, to get closer to human language.… My goal was to be able to speak directly with the computer and issue commands in our language."[23] Like the relationship between neural, processor, and national economic networks, Glushkov's thoughts about scripting together natural language and computer programming rests on the assumption that there is nothing particularly natural about natural language and that computing coding (like his other conceptual innovations in macropiping processing, automata, and the paperless office) represented an extension of the calculable artifice already hard at work in human behavior.[24]

Each of his innovations sought to reframe and solve knotty local problems in terms that scaled to a larger global system that contained those problems and all those like them. In fact central to understanding Glushkov's life and work and his scalable vision for the OGAS is his unflagging intellectual commitment to what he called "practical universals"—the merging of mathematics and economics, the theoretical and the applied, the universal and the particular. He and his colleagues repeatedly insisted that three principles guided his life work—"the unity of theory and practice, the unity of distant and near goals, and the decentralization of responsibility."[25] He taught others that before putting a principle into action, they had to formulate it into a general model or rule in abstract mathematical terms and then test that rule practically, applying it to countless concrete examples—an imperative to act locally while thinking globally. When higher authorities handed six of his researchers seven discrete system problems, Glushkov insisted that the first step was to develop a universal language for modeling all discrete systems, a language by which they could then solve all seven problems simultaneously, as well as any more they could be given.[26] The OGAS in design and implementation followed suit: people at each step of the network—including factory-based control system, regional computer center, and national economic planning center—sought to solve short-term factory problems by developing a universal system for advancing Soviet socialism toward communism.

The OGAS, for Glushkov, was to be a national communication network, countless local paperless offices, and a dynamic management system that connected them—a global-local network. A proper economic reform, in his mind, must benefit the factory worker, the general secretary, and the whole

populace. The OGAS sought to pole-vault socialism toward communism at the Hegelian level of historical progress and to usher in a better work life for the knowledge worker: in the command economy, everyone needed to work knowledgably with economic plans. The OGAS would grant both at once, automatically storing relevant digital files on every local actor while granting remote access anywhere else in the country. The origins of the ideas behind the OGAS computing network also point to a preexisting academic network, including the circulation of a 1955 Academy of Sciences proposal by Nemchinov to erect large but unconnected state computer centers in Moscow, Kiev, Novosibirsk, Riga, Kharkov, and other major cities. However, this proposal did not connect the computer centers but instead specified that they should be built to facilitate the local exchange and standardization of scientific and economic information. Kitov's Red Book letter in the fall of 1959, which included the initial proposal to network such computers together into one, was the next step. In fact, after Kitov was dismissed from the military, Glushkov hired him to serve as a scientific adviser and personal confidant to his projects. Their respective trust network grew so close that, two decades later, one of Kitov's sons and one of Glushkov's daughters wed, signifying, just as the close connections between Baran and McCulloch, that personal communication networks both precede and outlast national computing networks.[27]

Beginning in the early 1960s, Glushkov's detractors recognized the sweeping commitment to practical universals in this vision and colored it in different shades. As he exercised his penetrating ability to formulate and scale up or down any problem by the force of mathematical reason, Glushkov's vision of the socialist cybernetic future moved, in the estimation of researchers at the Central Economic-Mathematical Institute (CEMI) and liberal economists, in "romantic" and "quixotic" leaps. Even his colleagues admitted in interviews that at the grandest vision, the OGAS ambition had an almost "religious" or cosmological reach to it.[28] The modern reader should suspend incredulity at the scope of his theoretical scale until after observing the similar scale of technological ambitions at work elsewhere. The totalizing corporate missions of modern-day major data companies and the scope with which data are harvested by corporations and states share intellectual affinities with the all-inclusiveness of his or any global-local network vision. Glushkov was not alone in 1963 in proposing that the state should gather dossiers on every worker and economic actor in his nation.

By contrast, Glushkov's proponents, caught up in both the breadth and precision of his plans, too often overlooked the frequent criticism that no

institutional environment could possibly be ready to do all that the OGAS sought to do. Glushkov also recognized that no practical effort, no matter how impressive, could ever satisfy both the local and global demands of making paperless the command economy, and many of his career efforts outside the OGAS Project focused, to his credit, on local projects, including the paperless office.[29] For the OGAS, however, because it was a matter of economic bureaucracy reform, he insisted on a comprehensive meaning of economic information: "since the object of control is not only equipment but also personnel, one must include [in the OGAS] all the information about new technical, technological, economic, and organizational ideas and projects that workers at a given enterprise have."[30] Far more than a shared file containing economic information, the OGAS presented itself as a real-time clearinghouse for information concerning individuals, projects, factories, enterprises, and industries. The network would continue to expand in scope, according to Glushkov, until it encompassed the whole of the Soviet economy as well as all workers, their activities, and their office space. At worst, the vision appears a totalizing and decentralized (not totalitarian) information capture of the workers and their work environment. At best, it appears to be an organization information upgrade that is fit for every large-scale corporation. Depending on how one weighs the values of individual privacy and organizational purpose, these two champion a particular universal ethical tension that occupies the modern media age.

Glushkov also foresaw (or rather projected) a hint of the financial future, although perhaps not the future he had hoped for. Because the socialist economy would be incrementally organized into a cybernetically balanced network of labor, production, and consumption inputs and outputs, Glushkov reasoned, there would remain no reason not to virtualize currency itself and make the exchange of funds take place by "electronic receipt." With the OGAS operational, there would no longer be need for hard currency. All economic exchanges would take place online. Following this line of thought, Glushkov included in his initial OGAS draft proposal a noteworthy provision to eliminate all paper currency, providing in its place wireless money transfers, or a "moneyless system of receipts" over the OGAS network.[31] Although modern readers may be tempted to see in his proposal a prototype of the modern-day ATM, e-commerce digital money transfers, PayPal, or BitCoin, Glushkov framed paperless money transfers in the politics of his time and place, calling it the fulfillment of a Marxian prophecy of a future Communist society without hard currency. Read backward in presentist terms, as historians are loath to do, the proposal, if realized, would have transformed the Soviet Union into, in Vladislav Zubok's phrase, "a

computerized socialist utopia, the motherland of the Internet and also possibly the ATM."[32]

I maintain that the historical lesson is that whatever our present-day language and whatever the future imaginations of hard currency, the past brims with a variety of visionaries who thought about the future of money as virtual, when as history instructs, the dominant form of currency has already always been, since ancient Mesopotomia, the arithmetic matter of credit and debit—itself a form of expectant funds, or money transfers made virtual across time, not space.[33] After reviewing the proposal, Keldysh, then president of the Soviet Academy of Science and a major supporter of Glushkov, asked to meet with Glushkov privately and urged Glushkov to strike from his original OGAS proposal the recommendation of a networked society without hard currency out of fear that it would raise "unneeded emotions." He warned Glushkov that the reviewing Soviet administrators were so deeply attached to the advantages of hard currency that no reasoning or ideological commitment could persuade them to abandon it.[34] Glushkov conceded the point, and the Central Committee initially approved his project, pending further review.

Glushkov as a Pragmatic Administrator

In many ways, Glushkov, whatever his sweeping visions in cybernetic theory, proved to be a pragmatic administrator in practice. Because he understood practical administration, he also knew that the inevitable limitations of his theoretical ambitions were, in fact, an important part and consequence of his approach to problem solving with practical universals. If the Soviet administrative system worked informally behind the scenes, then so must he, especially if he wanted to help to rationalize or formalize that same system. Unlike some of the stillborn or short-lived cybernetic proposals noted earlier, the longevity of the OGAS as a potentially viable network project owes a debt to the tenacious and pragmatic administrative acumen that Glushkov and his colleagues displayed in navigating, managing, and alliance forging in the administrative base of the Soviet state between 1962 and 1983. As illustrated by the Komsomol letter incident and repeated by many of his colleagues, Glushkov was sensitive to the political nature of the OGAS proposals and, with his upper-echelon supporters, strategically planned every step of coalition building around every part of his proposal: who would support what and why.[35] No naïve technocrat, he sought to shape and situate his proposal according to the governing logics of *blat* and personal politics.

His wireless currency proposal is a case in point. On Keldysh's advice, he promptly dropped the idea and turned his attention back to the practical universals that he would need to understand before he could integrate both macroeconomic designs and microlevel problems of the Soviet economy. Glushkov sought out and marinated himself in the practices of the actual command economy so that he would understand locally what he sought to reform universally. In the early 1960s, Glushkov received permission from Keldysh to observe how each of the constituent parts in the Soviet economy—factories, firms, collectivized farms of all types, and administrative organs like local, regional, and national planning committees—actually worked. His purpose was ethnographic—"to ask questions, or simply sit in the corner and watch how they work: what he decides, how he decides it, according to what principles, etc." Glushkov recalls, "And naturally I received permission to acquaint myself with any industrial object—corporations, organizations—that I wanted."[36] By 1963, Glushkov reported having visited and observed over a hundred such industrial sites and nearly a thousand over the next decade, including mines, *kolkhozes* (collective farms), *sovkhozes* (Soviet state farms), railways, an airport, higher control organs, and administrative organs at Gosplan (the Soviet ministry charged with planning the Soviet economy) and the Ministry of Finance. Glushkov claimed that "I may know the structure of the national economy better than anyone else: from the bottom up, I know the peculiarities of the existing controls system, the difficulties which occur, and the most important issues."[37]

At roughly the same time that the OGAS proposal was being reviewed by the Central Statistical Administration, Glushkov gained insights into the navigation of the informal complaint culture and the administrative mechanisms that were available for resolving them. Between 1966 and 1976, he served as a Kiev-based adviser for the Division of Clemency (*otdel' pomilovaniya*) for the prominent city of Kharkiv in eastern Ukraine. His behavior in this public function also provides a glimpse into his administrative behavior concerning top-secret projects such as the OGAS. In these archival materials, a pattern emerges. For each complaint case that he considered, he sent a formal letter and an informal letter. The first letter he sent to the complainant to offer his moral support but declare his likely inability to ease their situation, and the second letter he sent to the relevant supervisory institution pleading informally the strongest appropriate case on behalf of the complainant. Thus he resolved dozens of real-life conflicts within the actual social economy of formal appeals and complaints, including helping a grandmother campaign against alcoholism, speeding a mother's request for an apartment, acquitting a decorated war veteran

convicted of unspecified crimes, and restoring to his studies a graduate student found guilty of "hooliganry" for being found in a "nonsober" condition.[38] At the same time that he was navigating this public trading zone between the superabundant conflicts of bureaucratic and real-life interests, he was developing the OGAS as a top-secret human-computer system proposal that would do the same—resolve informal conflicts at a national economic level. Next I look at how the informal behind-the-scenes work culture of these cyberneticists contextualizes this larger point.

"Cybertonia": From National Cyberculture to Local Counterculture

Glushkov's proposal to rationalize and automate the national economy in 1962 took shape just as his own institutional environment was being upgraded from a small computing center to a more ambitious formal setting of an academic institute, without losing its informal and, in after-work hours, almost countercultural work environment. In the early 1960s, his vision for reforming the command economy took on national ambitions at the same time that his own local institution entered national prominence. A glance at the institutional transition from Sergei Lebedev's laboratory in the valley of Feofania to Glushkov's Institute of Cybernetics will provide insights into how the local institutional culture of this particular transition animated both formal and informal attempts to imagine an alternate Soviet information society.

The formal history of the transition from computing center to academic institute is illustrious if not unusual. In the late 1940s and 1950s, Sergei Alexeyevich Lebedev gathered a small and extraordinarily talented group of electrical engineers into a computing laboratory in the valley of Feofania in the southern outskirts of Kiev, Ukraine. That small group brought into existence the MESM (*malaya electronicheskaya schetnaya mashina*, or the small electronic calculating machine, and predecessor to the mainframe workhorse BESM series), the first stored-memory electronic computer in Europe, arriving four years after von Neumann's UNIAC[39] (figure 4.4). In 1952, the first "large electronic computer," the BESM, or *bol'shaya electronicheskaya schetnaya mashina*, followed, and then a series of Soviet native mainframe computers—the M-20, the BESM-3M, BESM-4, M-220, M-222, and finally the BESM-6. Designed in 1966 and produced first in 1968, the impressive BESM-6 went into serial production and served in special-purpose computation centers and military computer networks for the next two decades. In 1962, under Glushkov's direction, Lebedev's laboratory was relocated a mile away to a separate campus facility of the future Institute of Cybernetics that

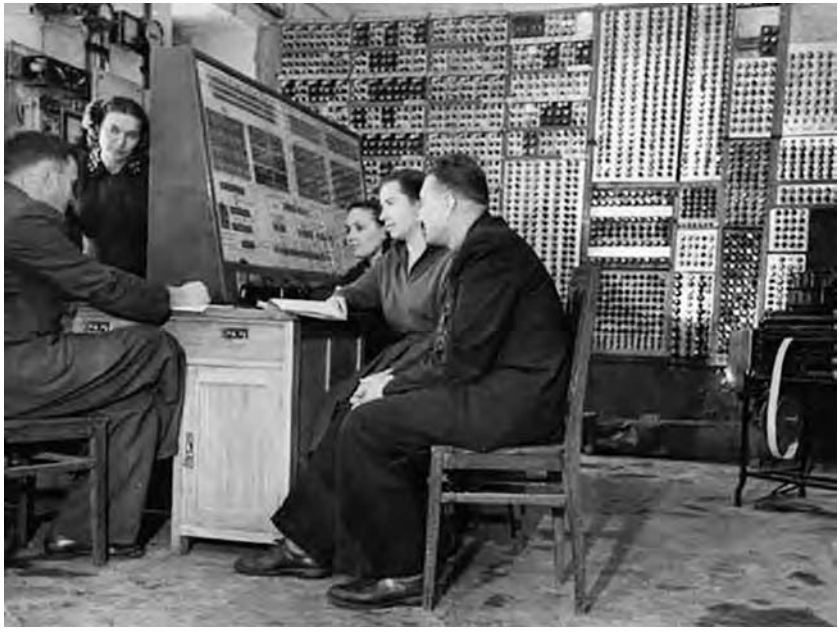


Figure 4.4
The MESM (small electronic calculating machine) and its team in the monastery near the cathedral in Theophania, 1952.

was known for a series of subsequent impressive achievements. Researchers at that facility developed the "Dnieper" computer series, which powered the base stations for Soviet cosmonaut flight south of Moscow while pressing the frontiers of Soviet information science and technology. The institute also is known for developing the mainframe and early microcomputers Mir and Promin and a range of research on economic cybernetics, medical cybernetics, artificial intelligence, optimization, and defense research. The projects included the first network project to digitize the entire command economy and their central project—the OGAS and its technical base EGSVT beginning in 1963. In all, the official histories convey the gravitas that one would expect from one of the elite teams of Soviet scientists.

A closer look at the local practices of these institutions, however, sheds a very different light on this moment of Soviet optimism. The years 1962 and 1963 marked the height of enthusiasm for a young, entrepreneurial, and surprisingly humorous and mischievous group of cyberneticists. Lebedev's laboratory was situated in a forest that was enchanted with Slavic legends. Overrun by songbirds, rabbits, mushrooms, and berries in the summer and haunted in the winter by rumors of wolves and Baba Yaga (the famous

witch of eastern European folklore), this forest served as a curiously naturalistic cradle for Lebedev's MESM, which was then the emblem of the new Soviet religion of rational scientific progress. In the center of an opening in the woods stands St. Panteleimon's Cathedral (Panteleimonivs'kii sobor), a high point of Russian revival ecclesiastical architecture since its construction in 1905 to 1912 (figures 4.5 and 4.6).

Nearby stands a two-story brick building that tells a story of a complicated intersection of faith, madness, murder, and science. Initially built as a dormitory for Eastern Orthodox priests, the building was looted during the 1917 Russian revolution and converted into a psychiatric hospital. In 1941, the Nazis murdered its patients and established it as a military hospital. In 1948, the badly damaged building was transferred to Lebedev's work on the newest icon of Soviet atheism—that triumph of human rationality and creativity that was the automated computer. Six thousand vacuum tubes and two years of astonishing effort later, Lebedev's team turned on the monster calculating machine in 1950. A sense of collaborative, dedicated work ethic lingered in the decades thereafter, and a sense of local autonomy that was away from the watchful eyes of Moscow pervaded the area of Feofania. Researchers who received housing nearby rarely chose to leave, even when offered more prestigious positions. Informal play and even troublemaking abounded. To the priests' chagrin today, engineers sometimes tested

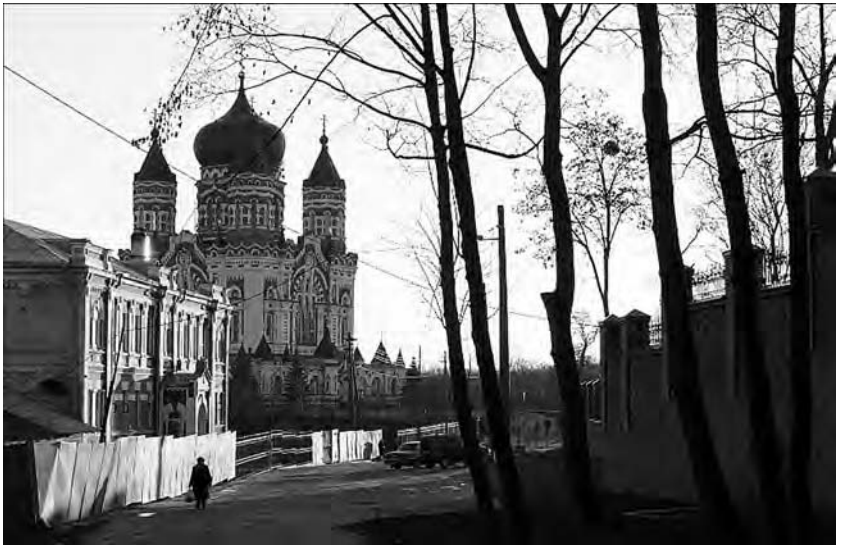


Figure 4.5
St. Panteleimon's cathedral and monastery (left), which housed the MESM.

Figure 4.6
Park, pond, and forest in Feofania, the general setting for Sergei Lebedev's computing laboratory, late 1940s to 1950s.

controlled mechanical explosions in the magisterial monastery. Water fetched from a nearby well was used to extinguish the fires because the building where the first computer in Europe was built had no plumbing. After work, the mood lightened. Bus drivers were sent on wild goose chases through the forest, and juggling and ping-pong balls ricocheted down the hallways of offices and laboratories. On work breaks, volleyball and soccer games broke out, and after work, the researchers ran to swim in the nearby lake and to wander through the tall pines and oak trees of the surrounding forest. Lebedev and Glushkov are rumored to have drafted the organization of the Institute of Cybernetics, built three kilometers to the west, while strolling together through that forest.

When the Academy of Sciences appointed Glushkov to be the first director of the new Institute of Cybernetics, some of that informal spirit transferred to the new institution, in part thanks to a prolonged transition period during the 1960s in which the campus where the institute is currently housed was built. In the after-work hours and at holiday parties, the

growing group of young institute researchers even imagined a humorous autonomous country of their own, "Cybertonia," a virtual country. The researchers, whose average age was roughly twenty-five, first christened this "fairytale [*skazochnaya*] land" during a New Year's Eve party in 1960. The joke snowballed. The fairytale land offered scientific seminars, lectures, films, and auctions mainly in the capital Kiev and an evening ball in the Ukrainian nationalist border city of L'vov, spinning off more and more activities (artwork, ballads, a short film, passports, currency), press releases, seminars, holiday and after-hour gatherings, community functions, and more parties.[40] The researchers at the Institute of Cybernetics were still several years away from occupying the Institute's future campus, which eventually included more than a dozen buildings along Glushkov Prospect in southwest Kiev (figure 4.7). From 1962 to 1970, the institute occupied a building at 4 Lysogorskaya Street several kilometers north, at an intersection with Nauka (Science) Street, an area famous for being featured in the science fiction of the Strugatskii brothers, who worked in the Institute of Physics a few blocks away[41] (figure 4.8).

In its informal practices, the Cybertonia society abounded in pranks, puns, and puzzling wit, recreating a country in the image of the autonomous Soviet automata. The collective issued fake stamped passports and

Figure 4.7
Sketch of the Institute of Cybernetics campus, Prospect Academic Glushkov, 40, Kiev, 1970.

marriage certificates to the mostly male research staff and female administrative staff, authorized by the "Robot Council of Cybertonia."[42] (figures 4.9 and 4.10). Each passport packed mathematical equations into the blanks for personal identification, accompanied by a national constitution and a map of the future capital of "Cyber City" (Kybergrad). The workplace culture at this prominent research institute embraced the joke as an ambiguous means for letting a little steam off after work and, in their more ambitious flights of imagination, envisioning a nation that was independent from the Soviet Union. The blurring of reality and virtuality, work and play, science and art was the point of "Cybertonia," a name that lives on in the title of an academic journal recently begun by Glushkov's youngest daughter, Vera Viktorevna Glushkova.[43] The Cybertonia constitution guaranteed the rights to frivolity and humor complete with the faux-newspeak warning: "anyone who disobeys the Robot will be stripped of their rights and cast out of the country for 24 seconds" (figure 4.11). The map featured landmarks such as "a Main Post Office and the Feedback Division (or Returned Communication)," or *Glavpochtamt y otdel obratnyi svazi*, a possible reference to Cybertonia as a self-contained system apart from the Soviet regime, as well as the "Temple of the 12 Abends" (abnormal program ends, or software terminations), or *Khram 12 avostov*, a near Russian homophone with "the Temple of the Twelve Apostles." Currency was issued on the punch cards that were used in analog computer memory storage.

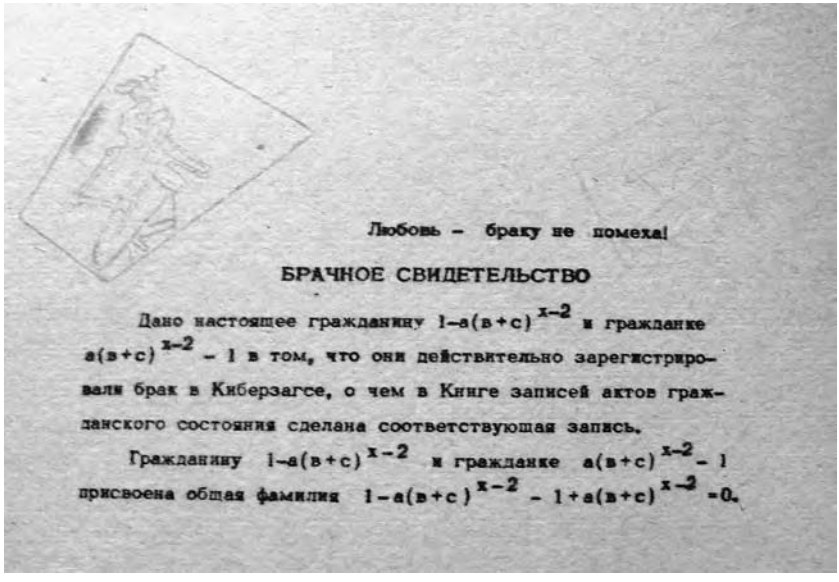
Perhaps most boldly, the Cybertonia society hosted a saxophone-playing robot mascot as a unveiled reference to jazz, an export of American global

Figure 4.8
Sketch of the Institute of Cybernetics building, Lysogarskaya 4, Kiev, 1966.

A

B

Figure 4.9
Cybertonia passport, 1965. (a) front, (b) back.



Любовь – браку не помеха!

БРАЧНОЕ СВИДЕТЕЛЬСТВО

Дано настоящее гражданину $1-a(в+с)^{x-2}$ и гражданке $a(в+с)^{x-2}-1$ в том, что они действительно зарегистрировали брак в Киберзагсе, о чем в Книге записей актов гражданского состояния сделана соответствующая запись.

Гражданину $1-a(в+с)^{x-2}$ и гражданке $a(в+с)^{x-2}-1$ присвоена общая фамилия $1-a(в+с)^{x-2}-1+a(в+с)^{x-2}=0$.

Figure 4.10
Cybertonia wedding certificate, 1965.

ПАСПОРТ
ГРАЖДАНИНА СТРАНЫ КИБЕРТОНИЯ

Фамилия $1-a(в+с)^{x-2}$
Год рождения 1966
День рождения января
Время рождения 18 часов
Место рождения ... Дворец пионеров.

КОНСТИТУЦИЯ СТРАНЫ КИБЕРТОНИЯ

§ 1

Гражданином Кибертонии считается всякий, владеющий одним из следующих видов смеха:
а) ГОМЕРИЧЕСКИМ,
б) САРКАСТИЧЕСКИМ,
в) ИСТЕРИЧЕСКИМ,
г) БЕЗЗАБОТНЫМ.

§ 2

Все граждане Кибертонии имеют равное право на веселье.

§ 3

Хорошее настроение является почетной обязанностью каждого гражданина.

§ 4

Высшим законодательным и исполнительным органом Кибертонии является Совет Роботов.

§ 5

Всякий, кто ослушается Робота, лишается гражданских прав и покидает пределы страны в течение 24 секунд.

Принято на Совете Роботов

Страна Кибертония

Figure 4.11
Constitution of the country of Cybertonia, about 1966.

culture (figure 4.12),[44] and it published at least one issue of a newspaper and made a comedic short film titled "Feofan Stepanovich serditsya" (figure 4.13). By 1966, its motto had evolved to "energy, laughter, dreams, and fantasy." Stamped on the headline of the single issue of the group's newspaper the *Evening Cyber* stood the greetings "s novyim kodom" (or "happy new code," a near homophone with "happy new year" in Russian). In 1968, a season ripe with revolt, a symposium of cybertonians published an irreverent report on the "complex cybernetic aspects of humor" that was issued from "Cyber City" in April 1969. The report contains nothing explicitly subversive but overflows with technocratic wit and sarcasm directed against Soviet authority figures. These merry pranksters compared the task of securing living quarters (a notorious challenge of everyday Soviet life) to hyperdimensional geometry and published "formal" reports on "theory of Graphs/Counts" (*teoriya grafov*, the royal title of *count* is a homophone with the word *graph* in Russian), a Jonathan Swift–like account of laughter at work as an underutilized national economic resource, odes to the virtues of Georgian soccer, cheese, beer, and a few chauvinistic laughs about the prospects of the feminization of science. Another report in 1965 bore the bold

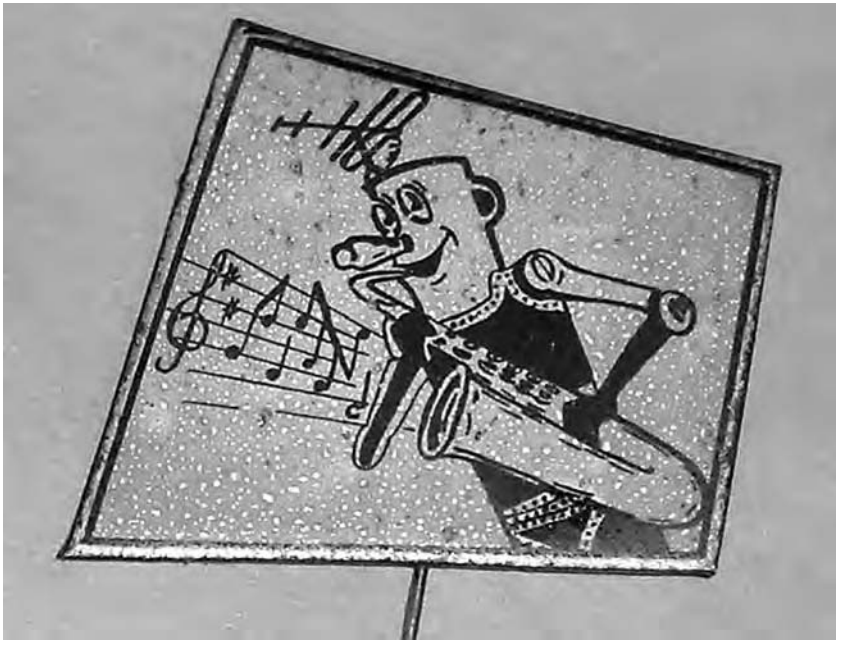


Figure 4.12
Cybertonia logo: a robot playing jazz on a saxophone, about 1966.


С Новым кодом !!!

Вечерний Кибер

ГАЗЕТА СОВЕТА РОБОТОВ КИБЕРТОНИИ

1968 г.
№ 1(1)
Цена 4 киб.(20 коп.)

НАВЕДЕМ ПОРЯДОК В ЧАСТИЧНО-УПОРЯДОЧЕННЫХ МНОЖЕСТВАХ

Сейчас в Кибертонии успешно завершается начатый три года назад по инициативе Совета Роботов процесс объединения непересекающихся множеств. Объединение множеств, доселе замкнутых – это большая заслуга Совета Роботов и в первую очередь его Председателя, уважаемого SCR – 886, который уверенно ведет Кибертонию по пути полного упорядочения частично упорядоченных множеств и неуклонного снижения напряженности внешних и внутренних электромагнитных полей. Даже наличие псевдоэвклидовых метрик, определенных на пространствах кибертонских векторных полей, не в силах помешать необратимым преобразованиям, происходящим в Кибертонии. Почти всюду последовательности элементов наших множеств строевыми рядами сходятся по норе к предельной точке. Конечно, еще имеются отдельные бесконечно малые члены частных сумм, которые злобно пытаются задержать их стремительную равномерную сходимость. Но им не поколебать наши степенные ряды!

Уже заложены первые гильбертовы кирпичи в ортогональный базис, на котором будет построено новое, расширенное полупространство.

„Структурное пространство нашего кольца должно стать пространством максимальных идеалов еще до окончания срока службы наших триолов" – таков лозунг нашего кибертонского общества, и мы, граждане Кибертонии, должны бросить все, от первого до последнего разряда МОЗУ, на выполнение этого грандиозного плана преобразования координат нашего пространства.

И сейчас, в канун светлого праздника „Кибертонии – 86" мы с гордостью повторяем вслед за Советом Роботов: „Частные суммы любого ряда будут принадлежать всему множеству".

Вести с Магнитных полей

Большие Киберюки (ТАКРАКК). В Киберхозе „Красное смещение" открыт новый Q – ратник на 1020 разрядов. Питание батарейное.

11. КИВРЫ (По телепату). В разгаре работы по извлечению и заготовке квапратных корней. Несмотря на неблагоприятные) климатические условия, почти все корни успешно извлечены и собраны.

12. КИБЕРТОНСК (От собкорра). Успешно прошел в нашем городе традиционный „День машинной поэзии и перевода". Любители острых ощущений с интересом встретили выступление юной поэтессы БЕЛЛЫ АХМОДУЛЬНОЙ, прочитавшей отрывки новой поэмы „Моя подготовительная", и выступление ИЕРАРХИЯ АНОДНИКОВА, изложившего результаты своих информационных поисков по „Загадке ОНТИ".

На перевале

Figure 4.13
Parody newsletter: *Vechernii Kiber* (*Evening Cyber*), 1966.

title "Executives Incognito: On Wanting to Remain Unknown, at Least to the Authorities."[45] Puns punctuated the technocratic discourse while quietly resisting power. These scientists sought in Cybertonia their own Cyberia away from Siberia, an escape from the great error of Khrushchev's age if not the great terror of Stalin's. Alas, Cybertonia never did grow to become, as the editors of its 1968 symposium had gleefully enthused, an "interplanetary congress." At some point between 1969 and 1970, as the Brezhnev doctrine compelled the Warsaw Pact to invade Czechoslovakia, "the entire idea of Cybertonia," as a participant recalled, "was buried by the pressure of the Party and government."[46]

The purpose of this snapshot into the informal lives of Soviet cyberneticists should be clear. In the forests of Feofania and in the virtual playground of Cybertonia, network entrepreneurs sought intellectual, political, and social autonomy, revelry, and even subtle informal protest from the oppressive regime that they served. Just as other cultures have demonstrated the rich connections between informal countercultures and cybercultures,

lively network forums reproduced the cultural, institutional, and gendered mores of the Soviet 1960s, conceiving of a kind of privileged cybercommune of their own making.[47]

In the early 1960s—when Glushkov's ambitious plan to network, account for, and automate the nationwide command economy faced both partial formal approval and informal resistance from the top state authorities—his own local institution was undergoing significant institutional growth even as it was being told it must develop the EGSVTs before the OGAS network. In this fleeting period of optimism, the establishment and growth of the Institute of Cybernetics led to a form of institutional adolescence in which it exercised institutional ambitions on the national stage while informally and internally venting a kind of countercultural defiance against the state regime that governed it.

In fact, at the same time, 1962 to 1968, that Cybertonia was being celebrated during after-work hours, the Institute of Cybernetics was transitioning from a relatively small set of buildings near Theofania to a spacious campus a few kilometers to the southwest. It had enough modern buildings to house each major field of cybernetics with its own research department (except for Glushkov's "theoretical and economic cybernetics," which remained a department that preserves to this day the particular universal of Glushkov's merger of mathematics and economics).

CEMI and the OGAS Institutional Landscape in the 1960s

Glushkov's research institute was not alone in experiencing institutional growth in the early 1960s. Many prominent research institutes were established across the Soviet Union in the 1960s (Ukraine today has roughly 130 research institutes, and Russia has many more). Under the leadership of Aksel' Berg and the new president of the Soviet Academy of Sciences, Mstislav Keldysh, most of these pertained to cybernetic research. Those focusing on economic cybernetics included Viktor Glushkov's Institute of Cybernetics in Kiev and Nikolai Fedorenko's Central Economic-Mathematical Institute in Moscow.

These academic institutes were located in the capitals of the Soviet empire and under the umbrella of the Soviet Academy of Sciences. They functioned not as "islands of autonomy" (as may have been the case in the secret Siberian science city of Akademgorodok) but initially as contingent trading zones and eventually holding stations for enthusiastic young researchers who powered much of the early wave of Soviet cybernetic research growth throughout the 1960s. Prominent research institutes of all kinds sought to

establish a rolling range of connections, although they often were prohibited from doing so in lasting ways. In many cases, the most crucial alliances and associations for the survival and success of their core research projects rested on currying productive relationships with the governing state ministries, not peer research institutes, whose areas of responsibility affected their research missions. The CEMI in Moscow, for example, effectively became an operations arm for Gosplan and other large ministries, and the Institute of Cybernetics in Kiev maintained greater degrees of separation. The history of how these institutional alliances unfolded is the short history of the OGAS Project and its undoing. Some attention will be paid in the following sections to outlining the formation and deformation of the alliances between economic cybernetic research institutes and Gosplan, the Ministry of Finance, the Central Statistical Administration, and the Ministry of Defense.

In 1963, Glushkov's Institute of Cybernetics and another new powerful economics institute—the Central Economic-Mathematical Institute (CEMI)—formed an alliance to advance the OGAS project, although the seeds had been planted several years earlier. When Vasily Sergeevich Nemchinov—a senior economist-mathematician who was a strong advocate of economic cybernetic reform and who had done much to introduce Kantorovich's linear modeling and input-output mathematical models into Soviet economic planning—was proposing the CEMI in 1960, he initially called it the Institute of Economic Cybernetics and devoted it to Glushkov's main task of networking the national economy.[48] The founding of CEMI receives a moment of attention, too, because both new institutes invested hundreds of young researchers and dedicated funding streams into developing the OGAS project.

Before CEMI was an institute, it was a small laboratory in Moscow in 1958 called the Laboratory of Economical Mathematical Methods. Nemchinov appealed to the Ministry of Finances of the USSR by letter in January 1962, claiming that the transformation of the Soviet economy from socialism to communism depended on "optimal plans for the nation's economy."[49] By "plans" he had in mind the "optimal planning" of Kantorovich's linear programming as understood as both local microeconomic modeling (which could be done on a standalone mainframe computer) and a macroeconomic national infrastructure for processing the planned economy's commands by computer. Initially inspired by Kitov's failed 1959 Red Book letter, Nemchinov appealed to the Ministry of Finance that "the modern mathematical methods and the means of mechanization and automation" were necessary to manage the complexity of the economy, invoking

Keldysh's call in 1962 for "the transformation of economics into an exact science in the full sense of the word."[50] Keldysh, the president of the Academy of Sciences of the USSR as of 1961, officially approved and promoted economic cybernetic research as a priority of the academy, underscoring that "the development of a theory of optimal planning and management to a unified mathematical model of national economy was one of the main directions of developments in modern economic science."[51]

Nemchinov also employed cold war rhetoric to provide a sense of urgency to his promotion of economic cybernetic methods as a means for governing a society, socialist and capitalist alike, noting the strong similarities between neoclassical econometrics in market economies and economic cybernetics in socialist command economies: "after World War II these methods were reopened in the West and were applied extremely widely to monopolistic government planning."[52] He then invoked a sort of cold war cybernetic economics gap, worrying that the Soviets had lagged behind the use of cybernetic methods "in the internal planning of the most developed capitalistic countries."[53]

Yuri N. Gavrilets joined Nemchinov's laboratory in 1959 and continues to work at CEMI to this day. A former rocket engineer, he was one among many military engineers who, like Kitov, was forced to pursue nonmilitary economic research after a youthful display of what was interpreted to be anti-Stalin activities in the late 1950s. According to an interview with him, the early efforts of CEMI to incorporate mathematical methods into optimal planning of the command economy openly sought to merge the best Marxist principles of social justice and planning with capitalist free-market equilibria.[54] Inflating the threat of capitalist cyberneticists, Nemchinov contended in his original proposal that "not a single scientific point" (which he later crossed out by pen and replaced with the word *center*) currently stood ready to "guide and coordinate research in the field [of economic cybernetics]" in all of the Soviet Union.[55] The Central Economic-Mathematical Institute, Nemchinov concluded, together with the OGAS and its associated mission of planning the economy by a cybernetic management network, would fill just such a gap.

Nemchinov drafted his CEMI proposal several days after First Secretary Nikita Khrushchev spoke at the Twenty-second Congress of the Communist Party on October 18, 1961. That "secret speech" is remembered today for denouncing the cult of personality, although Khrushchev also countered in it Stalin's bias against mathematical economics policy: "life itself requires a much higher class of scientific foundations and economic accounts from the planning and national economic leadership."[56] Cybernetics

features frequently in Nemchinov's official explanation of CEMI's research tasks, such as "the wide application of cybernetics, electronic calculating machines and the regulating devices in production processes of industry, construction industry and transport, in scientific research, in the planning and project construction of calculations, in the sphere of accounting and management."[57]

In a letter dated November 17, 1961, a month after the Twenty-second Congress of the Communist Party, Nemchinov named four institute research directives that were dedicated to the network vision laid out in Kitov's 1959 letter and Glushkov's subsequent formulation of the OGAS:

1. The development of a unified system of planned economic information to improve planned information and documentation companies, including work on the application of modern calculating machines;
2. The development of algorithms for planned calculations based on a unified system of information;
3. Dynamic modeling for developing the national economy; and
4. Mathematical work for constructing a unified, centralized national economic plan, which would develop "the communist form of self-government of the production units, the optimal composition of general governmental interests, every company, and every worker."[58]

These quotations came from his earlier discussion of Lenin-Marxist rhetoric for economic planning. By wedding the cybernetic and Marxist-Leninist rhetoric of self-governing economies, Nemchinov sought to propose "economic cybernetics" and its plausibly nonsocialist "dynamic models of balancing capital investment" in the ideologically most acceptable light.[59] CEMI—in Nemchinov and his superiors' original vision—was set to become a powerhouse intellectual engine for driving a cybernetic vision of the networked national economy.

In late 1962, after receiving preliminary confirmation that CEMI would be established, Nemchinov, then age sixty-eight, grew too sick to continue his work and transferred the directorship of the Institute to the young academician Nikolai Fedorenko. Nemchinov died November 5, 1964, at the age of seventy. Had Nemchniov not grown ill, it is likely he, not Nikolai Fedorenko, would have emerged as Glushkov's first and strongest ally in Moscow.

Fedorenko and Glushkov: A Partnership Pulled Apart

In the beginning, Nikolai Prokof'evich Fedorenko proved a valuable colleague, confidante, and foil for establishing Glushkov's OGAS Project (figure 4.14). In 1962 and 1963, both cyberneticists were appointed the first

directors of brand-new and prestigious academic institutes—Fedorenko's CEMI in Moscow and Glushkov's Institute of Cybernetics (IK) in Kiev—that, under their directorship and their shared vision of networking the national economy, led the Soviet Academy of Sciences in economic cybernetics. At the start in 1963, this dynamic duo of rising young academicians seemed destined to follow parallel paths to greatness while salvaging the failing Soviet economy along the way—at least according to Aleksei Kosygin, then deputy chair of the Council of Ministers, who was supporting their initiatives at the same time that he was advancing the liberal economic reform. All lights appeared green, and in 1964, the funds began to pour into these institutions to shore up the alternative to the Kosygin-Liberman reforms. The personnel at the two institutes multiplied exponentially. In a few years, the Institute of Cybernetics' staff numbers grew from dozens to over two thousand, and the ranks at CEMI sprouted from its original fourteen researchers in Akademgorodok to over one thousand researchers and staff in Moscow. Most of those new employees were young researchers with bold ambitions and a distaste for the culture of totalitarian control in the 1940s and 1950s. Enthusiasm for decentralized economic reform met with central flows of funding. In the late 1960s, after construction work was complete, CEMI moved into a state-of-the-art, twenty-floor skyscraper in the desirable Cheremushki neighborhood in Moscow, and after a decade of transition in the 1960s, the Institute of Cybernetics occupied a well-equipped campus along the scenic southwest edges of Kiev (figure 4.15). At least for a moment in the heady transition of 1962 and 1963, the two institutes appeared ready to remake the Soviet economy together.

One of the systemic sources of institutional volatility in the Soviet knowledge base was the oversized influence that individual leaders, like CEOs in modern Western culture, played in navigating and mobilizing organizational pursuits. In this sense, institute directors, such as Nikolai Fedorenko, appear entrepreneurial in the almost conventional sense of organizational leaders who take risks, invest in them, and mitigate the consequences of those risks by creative institutional problem solving. A year after the founding of CEMI, Fedorenko reported to the Presidium of the Academy of Sciences, USSR, that thanks to "the Institute work on the creation of methods of optimal planning … savings [in the sector of transportation] have already reached about half a billion rubles."[60]

CEMI, in its early years, was not bound by the institutional logic of path dependence. Compare, for example, the major research directives that Fedorenko lists in his yearly reports between 1964 and 1969. In the first annual report (1964), Fedorenko lists the following six research directives,

Figure 4.14
Nikolai Fedorenko, date unknown.

all of which concerned the building of an OGAS-related wide-area information network (note the second and fifth, in particular): (1) develop a theory of optimal planning and management for a unified mathematical model of national economy; (2) develop a unified system of economic information; (3) standardize and algorithmize the planning and management processes; (4) develop mathematical methods for solving economic problems; (5) design and create a unified state network of computer centers; and (6) derive a specialized planning and management system based on mathematical methods and computer technology. Five years later, by 1969, that number had been pared down to three concerned with optimizing and modeling microeconomic problems. The network initiative had disappeared from its Moscow initiative.

In other words, by 1969, the year that the U.S. ARPANET went online, CEMI was no longer actively pursuing any unified computer network projects. As a RAND analyst noted in 1971:

> The most conspicuous feature of the latest version [of CEMI's research directives] is the absence of any reference to the unified state network of computer centers. Also missing is the proposed system of economic information. The projects, representing

Figure 4.15
Central Economic Mathematical Institute in Moscow, with Mobius strip statue, 2008.

research on the methodology of economic analysis and organization of new operational systems, are replaced by work on economic projects, a much less innovative and more conventional activity.[61]

In the same years, Fedorenko's CEMI had drifted from the OGAS Project and grew to nearly forty times the size of Nemchinov's original laboratory. At the beginning of the 1960s, the average age of its full-time faculty was about twenty-six years old; ten years later in 1973, when the institute surpassed one thousand employees, the average age tallied in at thirty-four.[62] According to Gavrilets, a lifelong faculty member at CEMI, the institute began as a lively and energetic place for critical and enthusiastic young economic researchers.[63] Although an increase of eight years in the average age of staff members over a decade probably reflects natural aging, CEMI's workforce was still relatively young and energetic and conditioned to believe they had the support to do anything. As a result, CEMI was not constrained by any formal agreements, as OGAS campaigners might have sometimes wished, to pursue OGAS and its associated network projects.

It might be that CEMI's eventual abandonment of the OGAS Project contributed to the failure of the USSR to reform its economic situation.

The shortcomings of these technocratic economic reforms were due both to the complexity of the reforms as well as the more foundational ad hoc complexity of the ministerial networks that were scrambling for funds in the first place. CEMI chose to devote its funding to microeconomic mathematical modeling of the economy (not the national networking of the economy) because its success as an institute depended on its iterative navigation and securing of state-approved funding. Instead of committing to particular projects (as Glushkov's Institute did, in part thanks to his personal leadership) or requesting and receiving funding to conduct basic, unspecified research (as was common in both Soviet and U.S. military spheres), CEMI had to defend and justify tens of millions of rubles in expenditures for specified civilian-political purposes. Fedorenko reasonably found linear programming and modeling optimal microeconomic interactions (with what he called the SOFE method) to be a more sustainable and less politically fraught task than networking the economy.

Funding of all sorts was earmarked for certain purposes, dependent on budgetary categories, constrained by values set in institutional history and shaped by practice, influenced by industry best practices, marked by gift-giver sources, and saturated in the politics of negotiation and expectation.[64] As the German sociologist and philosopher George Simmel maintained in his classic work on money, economic value is as much a matter for the philosopher and sociologist who debate orders of evaluation (or the realm of the study of value) as it is for the accountants, for whom the key interest is the measuring of monetary value based not on value itself but on the likeness or exchangeability of value.[65] Fedorenko worked out the research directives for his explicitly civilian research institute in a decentralized funding environment where economic value was subject not to a flat marketplace but a hierarchy of state interests. As the beneficiary of such interests, CEMI was free to redirect its research directives (in this case, away from the OGAS Project) and was constrained to justify those civilian research directives in politically acceptable terms (in this case, toward microeconomic modeling). The net effect of the decentralized funding environment for civilian projects, especially during the political freeze under Brezhnev, for the Soviet network institutional landscape was to redirect research toward more politically conservative agendas.

This conclusion might appear backward at first because CEMI's choice to focus on microeconomic modeling arguably shares more with liberal economic (or neoliberal) calculation of value and the OGAS Project appears to be a relatively conservative attempt to use technology to reaffirm and rationalize the (decentralized) hierarchical command economy structure.

However, given the disconnect between practice and principal, the OGAS Project appears both more philosophically bold and practically far-fetched of the two economic cybernetic approaches.

Another barrier—the same that Kitov encountered in his show trial—was the wall between civilian and military economies, and it began to strain the hopes for an economic network. In the spring of 1965, Fedorenko and Glushkov approached the Ministry of Defense to discuss the possibility of joining military network initiatives with their own OGAS dreams. Both Glushkov and Fedorenko's institutes were developing technically compatible, top-down, large-scale computer networks projects—and as Kitov had pointed out in 1959, the Soviet military already had several in operation.[66] The military networks were hierarchical and decentralized, loosely designed after the U.S. SAGE computerized air defense system, the first large-scale computerized command-and-control system in the world. And so with Kitov's Red Book show trial in mind, Fedorenko and Glushkov met with Defense Minister Bagramyan to discuss the matter. After an hour discussion in which Glushkov and Fedorenko did most of the talking, the Minister of Defense Bagramyan replied, according to Fedorenko's memoirs, with the following:

> You are good men, and you are doing right by concerning yourselves with the economy of the people's money. But I cannot help you.… My friends, the state gives me as much money as I ask for to build the technical basis [of the network]. As far as I understand, they give you nothing. If I were to cooperate with you, they would give money to neither me nor you, since there is the opinion that economics is a scab on the healthy body of the governmental mechanism for planning and management.[67]

In Bagramyan's notion that "economics is a scab on the healthy body" of the Soviet state, we encounter a conflict of organizational self-interest. The Soviet military, which was the single greatest benefactor of the Soviet command economy, refused to cooperate with a civilian cybernetic project because of the prevailing disdain for the very economic management techniques that the cyberneticists were hoping to reform. This denial of a request for cooperation is an example of the unregulated freedom that the minister enjoyed when he acted in what he felt was his institution's best interest. This organizational dissonance repeatedly overwhelmed Glushkov's and others' attempts at systemwide collaborative reform.

After this encounter, it is unclear how far, if at all, Fedorenko pursued funding or collaboration with Glushkov's OGAS. As in the case of Paul Baran at RAND, funding decisions clearly favored defense rationales. The Minister of Defense was free not to cooperate with anyone because

top-secret military missions enjoyed competitive advantages over other projects. This also meant that funding approval depended not on the will of top Party officials but rather on peer and lateral coalition building among organizations that were both cooperating and also competing for limited funding and influence in the Soviet state. This contradictory institutional space, where entrepreneurs seek to leverage organizational dissonance, exemplifies what I mean by *heterarchy*. *Heterarchy* describes the presence of ambiguities that result from competing formal regimes of evaluation, and entrepreneurs are those who trade on those ambiguities.[68] As a case in point, the Politburo claimed to oversee the goals of both the Ministry of Defense and Glushkov's and Fedorenko's institutes, and yet the Minister of Defense operated within heterarchical power structure that gave it no reason to recognize the Politburo's evaluation of the OGAS. To have done so would have questioned the necessity of the Ministry of Defense's own access to massive funding from the Politburo. Ministries, free of any single centralized operational logic that might be capable of legislating cooperation top-down, were free to not cooperate. They were also free to shut out peer-competitor institutions.

By the late 1960s, CEMI under Fedorenko's leadership had abandoned the OGAS and EGSVTs national network project to refocus efforts on the microlevel linear modeling of Soviet factories and enterprises. Fedorenko, a former chemist who was accustomed to microanalytic scales, claimed that CEMI's contributions to analyzing the national economy had better chances when applied to smaller, more manageable local scales, which his institute developed into the optimal mathematical planning method known as SOFE (System of Optimal Functioning of the Economy). In his memoirs, Fedorenko admits that the number of successful macrolevel economic analyses that CEMI produced in three decades "could be counted on one hand." In contrast, in the tally of firm-level analyses or smaller, Fedorenko counted hundreds of successes over several decades of work.[69]

A closer look at CEMI's stepwise separation from Glushkov's OGAS Project in the 1960s sheds some light on the negotiated compromises and qualities possessed by entrepreneurs like Fedorenko in the Soviet knowledge base. CEMI, under Fedorenko, went onto pioneer microeconomic modeling across the nation. In 1964, CEMI opened a branch in Tallinn, Estonia, and in 1967, a branch in St. Petersburg. In the 1966 preparations for the celebration of the fifty-year anniversary of the Soviet regime, Fedorenko described the EGSVTs (network) project in glowing if slightly scaled-down terms: "An important direction of CEMI's research is the development and creation of a unified state network. This network should consist of three levels: a main

computational center, a few dozen prominent computational centers, and a lower network. Such a structure will allow flexible information accounting and both operational management of the industry according to territories and the organization of planning accounts according to topics."[70]

After 1967, CEMI internal documents stop mentioning any network projects, whether OGAS or EGSVTs. What began as a small laboratory devoted to a wide-ranging civilian-use network for the management of the economy became, as a RAND report later called it, an "operational support agency" for the Gosplan.[71] Today CEMI is remembered for spearheading optimal planning methods with computerized and mathematical models in the Soviet socialist economy. As its website proclaims with silent hindsight on its early network ambitions, "When the Institute was founded in 1963, its main goal was to elaborate the theory of optimal management of the economy, applying mathematical methods and the use of computers to the task of practical planning."[72]

Like most rivalries, the subsequent rivalry between these two peer institutes, CEMI and IK, developed out of, in Freud's phrase, a narcissism of petty differences. After having their original OGAS mission tabled, both resorted to developing from the bottom up microlevel, factory-level economic planning. Even today, CEMI continues to pursue enterprise-level economic modeling, and IK continues to develop automated systems of management (ASUs) for individual enterprises. Fedorenko reported having improved hundreds of factory-level flow models every decade, and Glushkov claimed to have established ASUs in Ukraine, St. Petersburg, and beyond. Despite these successes, Glushkov in 1975 observed that humans entering "half-truths" were hampering automated control systems so that "we find ourselves somewhere between confusion and a search for scapegoats."[73] The few ASUs that were implemented fell flat, as well, according to the émigré mathematical economist Aron Katsenelinboigen, who reported that ASUs had little to no effect and sometimes even negative effects due to the expenses of installation. Managers, who were often older and wary of being replaced, often lacked the capacity to become familiar with, let alone master, the economic-mathematical methods that the ASU required.[74] As Glushkov later noted in *Pravda*, one automatic control system was dismantled and sold because it "impartially pointed out management's blunders and omissions."[75] What began as an alliance in the early 1960s around a network became a rivalry after the 1970s when cybernetic institutes disagreed over the relevance and proper role of the computer in economic planning. As these sections illustrate, the tensions resulted not from the roles of computing networks and information technology but

rather a series of serious administrative, institutional, personal, political, policy, and social problems.

Management Missteps: "Supervision" and the Separation of the OGAS and the EGSVTs

In 1962, after Keldysh advised Glushkov to submit the OGAS proposal to the heads of the Communist Party without the moneyless payment system, Glushkov, backed by Fedorenko and others, submitted his original OGAS proposal for a chain of reviews by a number of Soviet government agencies. As a result, a commission was formed to review his proposal, which received preliminary approval, and in 1963, it arrived at the desk of the Party Central Committee and the Council of Ministers. At this point, Glushkov, Fedorenko, the chair of the Central Statistical Administration V. N. Starovsky, the first deputy minister of communication A. I. Sergeichuk, the vice minister of finance, and others gathered together as a commission to discuss and review the proposal and several thousand pages of associated materials. For months in 1963, the commission met and discussed the details of Glushkov's proposal, and each member tried to object to and reject specific measures in it. Despite the proposal's considerable political support to this point, including review by the Politburo and the Central Committee, the result was support for a technical computer network but not economic reform. For a period of time, the shell of the OGAS Project was approved for "finalization" at the hands of the Central Statistical Administration, and the heart of the OGAS economic reform was postponed until future review.

Thus, a technical network project—the EGSVTs—was born, and the automated management of the OGAS was put on hold. The technical network was deemed the Unified State Network of Computing Centers (EGSVTs, for *edinnay gosudarstvennaya set' vyicheslitel'nikh tsentrov*), and in response, the committees issued a joint decree titled "On Improving the Supervision of Work on the Introduction of Computer Technology and Automated Management Systems into the National Economy."[76]

The presence of the word *supervision* in the decree title here is telling. The government agreed to improve the supervision of the automated management of the economy, not management itself, which the top Soviet leaders recognized must be left to the distinctly not automated human bureaucracy of state employees and planners. In particular, the officials charged with approving the OGAS stumbled over Glushkov's distinction between a system that would make executive commands, which they feared, and

a system that could command information about those commands—or the economic metadata. When faced with the possibility of controlling all economic information, the commission reviewers concluded, given the already tumultuous economic supervision in the early 1960s, that a national economic network could supervise, not directly manage, the command economy.

Similar to Kitov's Red Book show trial, the official rationale for the initial decision to strip the OGAS of any capacity to reform the planning process itself came with a justification that did not quite match the action. In this case, the Central Committee denied the automated management portion of the OGAS proposal due to what they deemed (not without contradiction) to be the inefficiency of rational management systems. In practice, the Committee apparently denied the request out of a fear that Glushkov's OGAS would strip its own unsanctioned informal control over economic power. Commission members who supported the OGAS also worried that even with top-level support, midlevel administrators would sabotage OGAS's efforts to rationalize their management powers. The initial 1963 decision to postpone the capacity of OGAS to reform economic planning took place as Khrushchev was falling out of power and limited Kosygin-Liberman liberal economic reforms were being introduced. The submarining of both reforms highlights the contradictions that faced the commanding heights of the Soviet state. No matter how obvious it was that the mismanagement of the command economy drove the state's economic woes, the state could approve no major reform without a sweeping revolution in how it managed itself.

Glushkov learned his lesson from the 1963 commission experience and scaled back and reframed his work on networking the command economy from direct management to indirect information supervision. Beginning in 1963, he publicly repeated that "the OGAS does not command the economy, rather it commands the flows of information *about* the state of the economy," although in theory and practice, Glushkov grasped the inherent politics of recordkeeping.[77] There are good reasons to doubt this position as a political compromise. As Glushkov theorized elsewhere, (1) a strict divide between data and metadata functions denies the basic cybernetic proposition of feedback loops that ensure that metadata observation is never influence-neutral, and (2) no organizational reform can ever be divorced from its political implications. Whether for political protection or otherwise, the OGAS team, not unlike other information omnivore projects, sought to ease its critics' concerns by asserting that it would traffic merely in metadata.

In subsequent OGAS preparatory proposals, Glushkov reframed the barebones EGSVTs network not as a matter of direct economic management but rather as a support for information management related to the national economy. This was so even though, in practice, the network he proposed also advanced data exchange and communication across the local and national levels. In the 1960s, Glushkov and his team tried at least two times to propose to Party leaders a technical EGSVTs network—first as an all-nation network (in 1963) and later as a regional network in Ukraine (in 1967).[78] A metadata management view informed both proposals: "To organize information flows on the national scale," as Glushkov once put it, "one needs to centralize interagency management of all information banks and computer centers, not the management of the economy."[79] In reorienting his claim from the politically entrenched national economy itself to the supposedly neutral territory of information banks, technical networks, and data clearinghouses, Glushkov adopted the abiding belief that was common among cybernetics and many digital technologist heirs in the neutral politics of code. Nonetheless, he proclaimed his task to be "not only scientific and technical, but also political," espousing the recurrent and troublesome idea that the politics of computation and technology are somehow more neutral than other politics.[80]

Instead of imagining a future communism arising out of exchanges ordered by an automated network, Glushkov envisioned the revised OGAS Project as the means whereby human planners might process accurate information about the economy via a national computer network. The Soviet computer network, like similar computing projects elsewhere in the 1970s, appeared foremost to be a "public utility" and a mass medium for serving information over great distance.[81] (Computers too were mass media in the age of mass media.) This revised model proved durable politically in part because it came with the added efficiency of promises of liberal pricing reforms, while capitulating to the more pragmatic demands of reforming an economic planning administration staffed with self-interested humans. Moreover, the revised emphasis on having OGAS manage the supposedly immaterial information about economic interactions (rather than command the actual economic planning) also proved a salient political hedge for the defense of the project going forward. Although striking near the heart of the state communist project's goal to transform the material well-being of every citizen, the OGAS defenders publicly defended their reform ambitions as merely immaterial and informational, even as the design analog and cybernetic philosophy quietly espoused the more fundamental fact that every information reform is also an organizational and thus social

reform. This convenient rhetorical distinction holds in later developments of the OGAS Project, including Glushkov's emphasis on "paperless informatics" as a kind of successor to cybernetics as a theoretical vocabulary for the emerging socialist information society.

Conclusion

Despite the tensions outlined above, the initial 1964 decision to downgrade the OGAS from a full-service technocratic economic reform to an EGSVTs technical network was sensible from the point of view of rational state administration. The Soviet state was in a period of political and economic transition from Khrushchev to Brezhnev, so it was not yet ready to implement an economic reform like the OGAS. Its restructuring of the information infrastructure of the command economy was so global that it risked becoming a fully interactive networked political economy that was run by remote-access data exchange and communication. In contrast, the Liberman-Kosygin reforms invoked the scalable introduction of new accounting profit measures in select enterprises and factories that, as the liberal economists stressed, would cost no more than the stroke of a pen. In comparison, the OGAS Project was too big to begin.

So as Kosygin began to implement the profit measure reforms in 1965, the OGAS proposal suffered serious delays and was passed over for institutional review for "finalization" by the Central Statistical Administration, which was directed by one of the most outspoken opponents of the OGAS Project on the commission, Vladimir Nikonovich Starovsky. Starovsky had written to the chair of the Council of Ministers, K. N. Rudnev, as early as November 1963 that he could not support the OGAS proposal because it conflicted with the Central Statistical Administration (CSA) mandate to oversee statistical matters, noting "a basic unified state network, in the opinion of the CSA, should be the extant network of machine stations and factories" already under its supervision.[82] Starovsky's opposition would adjust but never reverse. In retrospect, Glushkov singled out Starovsky's resistance: "later, when the fate of the OGAS was being decided, the leader of the Central Statistical Administration spoke against the project so much more furiously than anyone else that he did much to seal its sad fate."[83]

Still, the Central Committee did not reject the proposal and mandated that the CSA would be in charge of finalizing the project. Stuck between a rock and a hard place, Starovsky chose to resist by other means: the CSA submitted the OGAS proposal for finalization review by sending it off to

its most remote regional departments in Archangelsk and Karakalpak in Siberia, where it underwent several years of what OGAS supporters recall as a series of interminable and often incoherent feasibility reviews and often nonsensical dataflow testing. The specific missteps of the Siberian CSA review—such as arbitrarily declaring that after accounting for overhead hardware costs, calculating economic problems by computer would be on average ten times more expensive than calculating the same problems by hand—are symptomatic of the information organization problem that the OGAS sought to resolve and rationalize. In command economies, the more information involved in planning, often the more opaque or meaningless that information becomes. (It was never clear why computing by machines should be ten times more expensive per calculation than by hand, and yet the number stood with the force of administrative fiat.) Starovsky was concerned that the OGAS would wrest from the CSA its central task of gathering statistics for managing the command economy, and so by introducing and inventing dubious feasibility information about an already uncertain OGAS Project, he effectively stalled the economic reform portion of the proposal from making progress at the national level through the rest of the 1960s.

The global-local character of Glushkov's decentralized design was part of the genius of the project and also illustrates how the OGAS Project continuously threatened the economic bureaucracy that it was meant to reform and serve. Glushkov's decentralized design of rational management could work only if it was implemented top-down with the support of a centralized administration, such as the CSA. But no centralized administration could be found to support it because, in practice, centralized administrations in the civilian sector benefited from not behaving like centralized administrations. Here we can begin to see the political paradox that the OGAS encountered—one that was manifest in the tensions between the formal master plan and the informal practices of the Soviet system and also in the life and work of one of the Soviet master mergers of theory and practice. Glushkov was aware that it was in the self-interest of institutions in the Soviet knowledge base to resist the OGAS. Despite having unparalleled insights into how official and shadow economies worked, Glushkov had no other choice but to model the OGAS network after the formal command economic model, not after economic behavior.

Part of that design choice is an intellectual consequence of the cybernetic instinct to analogize the social and technical into structurally similar information systems, such as the command economy and its national

network. But a great portion of the design choice to model the OGAS after the formal command economy follows from political necessity. Consider this contradiction of political practice. To implement a fully decentralized reform to the economy, top political support needed to be secured to implement the reform systematically. The full decentralizing reform first had to be implemented with centralized systematic approval of the top. To gain the support of those top central authorities, the reform design had to conform to the publicly approved and ideologically acceptable principles of the current economic organization, which means that the OGAS design had to map onto the pyramid structure of economic planning in principle. So far, there is no contradiction because the short story of the tumultuous history of Soviet economic reforms is effectively one of top leaders who variously attempt to reaffirm their own hierarchical control, no matter how decentralized.

The contradiction lies in the practical need for the reform in the first place. The need for decentralized economic reforms follows from the fact that, as discussed, the command economy in practice never functioned in a strictly centralized manner. OGAS supporters sought to transform the economy into a decentralized hierarchy, but the economy, whose leaders publicly defended their positions in a centralized hierarchy, never behaved as a strict hierarchy because those leaders and their supporting personnel benefitted by the informal economy of favors and heterarchical connections. Many of those in the economic bureaucracy resisted the OGAS because although it purported to support the formal power structure that legitimated their positions, it also threatened to strip their institutions of the thing that justified their existence—the need to manage the command economy in the first place. The OGAS, if effective, would strip those positions of what made them informally beneficial to hold—the potential for corruption and personal gain and power. The organizational dissonance coursing throughout the command economy both motivated the reform and caused this initial frustration. With no other choice but to appeal to the top, the OGAS Project was stranded by the potential adopters of its decentralized design (the CSA in the late 1960s and other institutional entanglements in the 1970s and 1980s) because the project sought to resolve the conflicts of interest in the command economy that kept its own bureaucracy from resembling in practice the pyramid of political power that it had to appeal to.[84]

OGAS did not meet its end at the hands of stalled feasibility reports by the Central Statistical Administration between 1964 and 1969, however. During these years, Glushkov, among others, built considerable political support for developing the technical network of the EGSVTs. The late

1960s were a helpful preparatory period for building and securing political alliances that a small group of cyberneticists and network entrepreneurs attempted to form in the 1970s. This period was spent quietly and carefully working within the administrative heterarchy to secure political support. To a surprising degree, Glushkov succeeded in doing so at the upper echelons of Soviet power. Two top-ranking powerbrokers offered relatively unwavering support of the OGAS Project in the late 1960s. First was Aleksei Kosygin, who was effectively second only to Brezhnev in civilian matters. He was initially chair of the State Planning Committee (Gosplan) and first deputy chair of the Council of Ministers under Nikita Khrushchev (1959–1964) and rose under Brezhnev to become premier of the Soviet Union. As already noted, when Kosygin's initial profitability reforms in 1965 were met with fierce resistance from the economic administration and effectively stalled, Kosygin turned to the OGAS as the next best approach. Second was Dmitry F. Ustinov, who was a prominent military leader and manager who, just before helping ousting Khrushchev in 1964, served as first deputy premier with control over the civilian economy. In addition to being a career member of the Central Committee beginning in 1952, Ustinov ruled as the leading defense minister of the Soviet Union from 1976 to 1984.

Not long after the commission decided to postpone the OGAS in 1964, Petro Shelest—the first secretary of the Ukrainian Communist Party—called Glushkov to persuade him to cease promoting the OGAS and return to work (as Fedorenko in Moscow had already begun to do) on local or microeconomic systems. Gluskhov and his team complied with Shelest's commands and turned their attention back to developing local and regional computing centers that might later be connected by telephone and telegraph cables (figure 4.16). Soon after, Dmitry Ustinov countermanded Shelest's wishes, at least for the military: Ustinov, who was on his way to becoming minister of defense (1976–1984), invited Glushkov's team to build ASUs in test military factories.[85] Military support appears to have given the team the administrative license to advance the cause of computing technology and also to have ensured that their ASU work would not benefit or network the civilian economy.

In the 1970s, several civilian factories received ASUs under direction of the OGAS team. Most of these efforts were carried out from the bottom up, although Glushkov and his team at the Institute of Cybernetics continued to seek and occasionally secure top-level support in the 1970s only to see it dissolve in committees convened by intermediary ministries. For example, Glushkov, with the support of the director of the S. O. Petrovskiy television plant, successfully developed in two years local control systems such as the

Figure 4.16
Inside an ASU: Machine Hall, State Institute of Computing Centers, unknown date.

L'viv System or Lviv MICS—an automated control system for streamlining the industrial processes in the Elektron television factory in L'viv, Ukraine. After completing the L'viv System, the team engineered a more complicated Kuntsevo system for planning and managing the resources of the Kuntsevo radio manufacturing plant in southwest Moscow.[86] The Institute of Cybernetics also proposed an industrywide network of ASUs in the industry-rich Donbass region of Ukraine (figures 4.17 and 4.18).

Not all installations went smoothly. One factory manager, Valentin Zgursky, senior technologist at a manufacturing plant, admitted that "when you brought the Universal Control Computer [a mainframe behind the ASU] to our plan for mass-production," Malinovsky recalls being told, "I did everything possible to make sure it would never succeed!"[87] Nevertheless, Zgursky eventually saw the value of the ASU and installed it (although his admission may have been the exception in the long run). Bolstered by some local successes on the edge of an empire in the late 1960s, Glushkov also repeatedly reminded anyone who would listen about the work that even a dozen or so local systems (ASUs) could do after they were connected into a single national network.

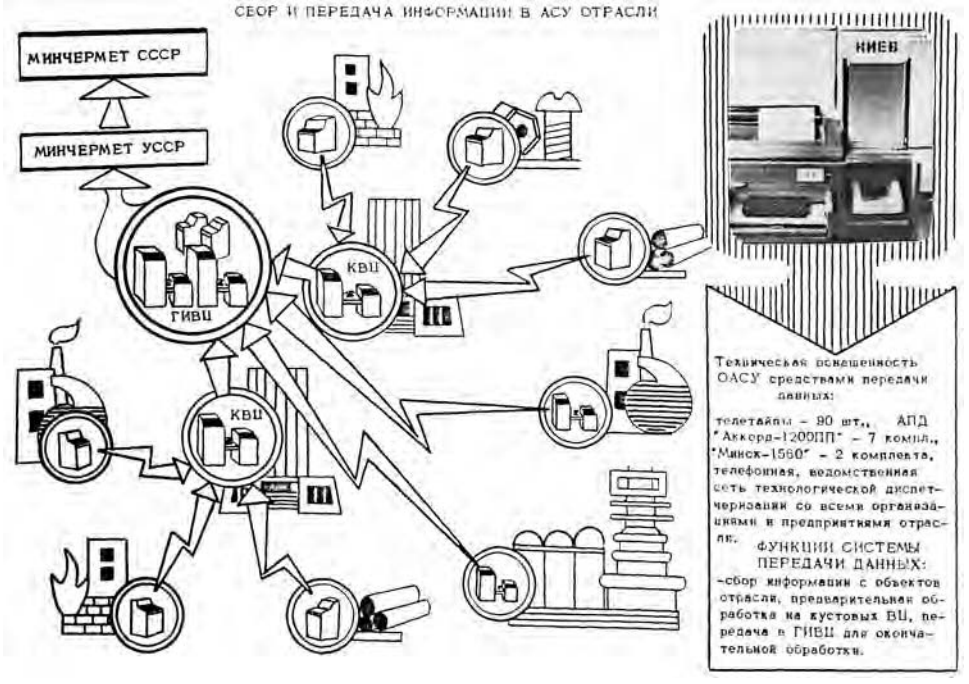


Figure 4.17
Diagram of an ASU network at the industry level, about 1969.

In the late 1960s, after these and other limited local successes, top leaders began to heed some of Glushkov's calls more carefully. Dmitry Ustinov commanded the heads of the military ministries to heed Glushkov's orders while he continued work on the L'viv System. After securing Ustinov's top brass support, Glushkov claimed that as early as the late 1960s, the automated management systems in factories throughout the empire provided the outline of what would become the OGAS: "it was planned from the very beginning that the whole system would apply across all spheres at once, so some rudiments of an all-state system were conceived"[88] (figure 4.19). After this chapter's discussion of the bold vision and rocky institutional landscape that supported the OGAS Project, the following chapter chronicles and comments on what happened when, in 1970, the Soviet centralized command decided to review the OGAS proposal to decentralize the economy by network in earnest.

In summary, in this chapter I have examined the OGAS design thinking that motivated Glushkov and his teams and the initial obstacles that

Figure 4.18
Map of the proposed ASU train industry in the Donbass, Ukraine, about 1969.

Figure 4.19
Viktor Glushkov giving a presentation on the ASU, about 1969.

they encountered. Against the bold vision of a networked electronic socialist future, a tangle of historical episodes frustrated the realization of that vision. This chapter has offered a look at the institutional landscape and alliances that formed and then dissolved between Nikolai Fedorenko's Central Economic-Mathematical Institute and Glushkov's Institute of Cybernetics, their heydays as the leaders of economic cybernetics and networked cybernetic reform through the late 1960s, the informal work culture of the Kiev-based cyberneticists in the 1960s, and early bureaucratic barriers that slowed the advance of the OGAS Project in the Soviet military. Neither the Ministry of Defense nor the liberal economists wanted to collaborate and support the OGAS Project, perhaps because the country had endured four turbulent years, from 1962 to 1966. In that time the Soviet Union had agreed to pursue computer-aided economic reforms, come to the brink of nuclear disaster in Cuba, forced out and replaced its general secretary, founded and funded leading economic cybernetic institutes devoted to building a national network plan, foregone approving the original proposal to introduce liberal profit reforms, and continued to fund the leading economic-mathematical research institute in Moscow as it reoriented itself away from its original network resolution to focus instead on less risky local optimization and modeling problems. Topsy-turvy institutional behavior in civilian matters was the rule, not the exception.