Normalizing Soviet Cybernetics

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Not many word pairs sound as exotic to the Western ear as "Soviet" and "cybernetics." Yet this article argues that what may be most significant about the history of Soviet cybernetics—however full of fascinating figures and tales of an alternative imagination for a midcentury information society—is precisely how normal or representative the Soviet experience with cybernetics appears in the larger context of Soviet history. The article explores how the twists and turns in the Soviet experience with cybernetics follow preexisting political dynamics, debate patterns, rituals of discourse, strategies for intellectual defense, alliance forging, institution building, and other variables. By demystifying the seemingly exotic, this article aims to help spark insight into some of the historical contingencies and conditions behind the contemporary information age.

> [Bletchey Park's Colossus] may even explain why Stalin, more or less blinded by the atomic lightning over Hiroshima and the autoguided missiles over Peenemuende, excommunicated cybernetics as one of the worst bourgeois deviations.
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> —Friedrich Kittler, *Media Wars*

With the first Soviet test of the atomic bomb in 1949, the Cold War conflict between capitalist and socialist slipped into the totalizing nuclear age. Soviet scientists, philosopher-critics, and journalists redoubled their search for real threats, as well as exciting possibilities, in the sphere of science and technology. One such development was cybernetics, whose history deserves brief review. Between 1947 (the year Norbert Wiener coined the term "cybernetics" at a Macy conference in New York) and 1954 (the year after Joseph Stalin died), cybernetics in the Soviet Union was routinely subjected to public ridicule, although Friedrich Kittler's epigraph to this article probably exaggerates that Stalin considered cybernetics one of the "worst" bourgeois deviations. In the decade that followed Stalin's death and his general attack on "bourgeois pseudosciences," Soviet scientists, philosophers, and bureaucrats alike rallied around cybernetics as the science best fit to build the future Communist society; subsequently, the public attitude toward cybernetics

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underwent a radical transformation, accepting it as a technical science and the means by which to reach toward Marxist-Leninist goals while simultaneously overcoming the mistakes of the Stalinist past. By 1964, the year Wiener died, cybernetics was flourishing in the Soviet Union, although it had by then fallen out of fashion in the Western academy. A short decade later, between the late 1960s and early 1970s, the metascience, once a bastion for reformist-oriented Soviets, had undergone yet another transformation, becoming normalized into the Soviet state discourse of social control and communication.[1]

The following history and analysis will describe the significant but neglected historical arc of Soviet cybernetics by documenting a few of the activities of a complex ensemble of well-positioned idea entrepreneurs, critics, and their discursive connections. The story of Soviet cybernetics sheds light onto and expands our contemporary imagination for a sample set of modern information societies. As I argue in conclusion, even though cybernetics seemed poised to help radically remake the Soviet Union as an information society, the history of Soviet cybernetics slouches in significant ways toward the normal patterns of Soviet history; the ordinariness of Soviet cybernetic history is both a part and a product of the exceptional promise associated with early cybernetics in the Soviet Union. This transformation from reforming to reaffirming Soviet structural power deserves description for the chance it presents to sketch an alternative information society as well as to locate the sources of this change in historical conditions still pressingly relevant today.

To date, few English-speaking scholars have taken serious account of the strange case of Soviet cybernetics, although that tendency is beginning to change with the seminal work of Slava Gerovitch, an MIT historian of science. Part of a larger project, this article builds on the historical base of his work.[2] In *From Newspeak to Cyberspeak: A History of Soviet Cybernetics*, Gerovitch periodized three shifts in official Soviet attitudes toward cybernetics: the first is the categorical rejection of cybernetics under Joseph Stalin (1948–53), the second is the enthusiastic embrace of cybernetics as a reformist-oriented science under Nikita Khrushchev (1955–64), and the third is the retooling and diffusion of cybernetics into the service of the status quo and state power under Leonid Brezhnev (1964–80).[3] Of these, I place particular emphasis in this work on the second period of rehabilitation and adoption, 1955–64, dividing this second stage under Khrushchev into two subparts: first, a brief span of public rehabilitation (1955–59) and, second, the subsequent period of open adoption and promotion of cybernetics as a reformist-oriented science (1959–64). In four overlapping steps, Soviet scientific discourse

rejected, rehabilitated, adopted, and adapted cybernetics for historically expedient and changing purposes.

There are, of course, other ways of describing the general shape of the Soviet experience with cybernetics. In step with Gerovitch's three stages and the four stages noted above, recent commentators have periodized the career of Viktor Glushkov, a preeminent Soviet cyberneticist, into five stages. Ranging from 1956 to 1982, his career includes, according to Yu V. Kapitonova and A. A. Letichevskii, the "unexplored territory" stage (1955–61); the "development in depth" stage (1962–67); the "development in breadth" stage (1968–72); the "technological" stage, with special reference to the rise of parallel processing (1973–78); and the "final stage" of his life, marked by a transition to informatics, a direct heir of cybernetics (1979–82).[4] Given that Glushkov's career largely corresponds with the rise and fall of Soviet cybernetics, this periodization may suggest another measure for tracing the changing relationship of Soviet society to early information sciences.

For Glushkov and many others, cybernetics proffered exciting theories for optimizing mechanisms for a cybernetic dialectic of control and communication in society and technology, a dialectic with which the Soviet Union, already a superpower by the 1950s, was long familiar. As the singular governing body, the Communist Party had long felt itself responsible for, among other cybernetic-friendly tasks, the comprehensive regulation of information circulation through surveillance, control over social systems through censorship and single-party rule, and controlling and communicating the party message through policy, the press, and propaganda.[5] The technical vocabulary for modeling control and communication served the comprehensive information management goals of the Soviet state: much of Soviet power had been gained through the well-funded development of specific technological advances—most notably, the atomic bomb—so that a general theory for technological control seemed a natural next step.

Furthermore, in the resonant harmonies between social cybernetics and the Soviet state, the cybernetic goal of controlling and regulating information systems in abstract and supposedly neutral mathematical terms appealed to scientists fed up with political oppression. It simultaneously struck Moscow-based bureaucrats and party officials as a politically feasible way forward in the wake of Stalinism.[6] The idea was attractive: total information control, which the cybernetic dream seems to promise, might still be reachable without all the violence and repression associated with Stalin's personal management techniques. Once it took root, cybernetics gripped a national audience with glimmers of a

brighter technological future—a socialist information society liberated by the neutralizing politics of computer-compatible computation from a stained past.

There were other happy overlaps as well. That hardy keyword of cybernetics, "feedback," already occupied a formal position in the Soviet political imagination of itself as a "socialist democracy," a kind of complex social entity sustained by seemingly Pavlovian mechanisms of stimulus and response, control and cooperation between rulers and masses. (Of course, Western observers have also found the political corollary of feedback mechanisms in the core of the liberal democracy; one need only look to find something cybernetic.)[7] The term "noise reduction" could also stand in as a technocratic synonym for continuing political censorship in the Soviet Union. Moreover, Wiener's twinning of the modern laborer with an automaton also appeared to have natural resonance with Stalin's attempts to make Soviet labor and industry efficient with the scientific management techniques of Taylorism. In summary, Wiener's ideas about systematic information control and communication, once translated into Russian, appeared a recuperation of ideas already well understood.[8] In this light, it may not be a reach too far to assert that, once cybernetics had taken hold and travel restrictions were lessened, Soviet actors would be able to welcome the visit of the American founder of cybernetics, Norbert Wiener, the son of an émigré from Byelostock, to the Soviet Union in June 1960 as though a prophet abroad were finally returning home.[9]

Given the enthusiasm felt in the early 1960s, however, the subsequent inability of Soviet cybernetics to enact meaningful reforms—or to develop the long-awaited Communist society—deserves further attention. Soviet cybernetics, whose promise for structural reform initially flowered in a post-Stalinist "thaw," eventually came to reaffirm and to rearticulate the Communist Party's centralized managerial vision of Soviet information society. Against this backdrop, we draw back the curtains on the minor tragedy of Soviet cybernetics played out on a major midcentury geopolitical stage.

The Stalinist Campaign against Cybernetics: A Normal Pseudoscience

Not all was rosy at the start. Amid abundant American accolades following the publication of Wiener's *Cybernetics, or Control and Communication in the Animal and the Machine* in 1948, the Soviet press poured insults on the volume. In 1950 the American *Saturday Review of Literature* was triumphantly proclaiming that it was "impossible for

anyone seriously interested in our civilization to ignore [Wiener's *Cybernetics*]. This is a 'must' book for those in every branch of science." At the same time, the leading literary Soviet journal *Literaturnaya gazeta* was calling Wiener one of those "charlatans and obscurantists, whom capitalists substitute for genuine scientists."[10] In a 1950 article titled "Mark III, a Calculator," Soviet journalist Boris Agapov ridiculed the sensationalist American press for its exultations about the coming era of "thinking machines," styling Norbert Wiener as an unknown figure "except for the fact that he is already old (although still brisk), very fleshy, and smokes cigars." Commenting on the famous *Time* cover of a computer dressed in a military uniform, Agapov continued: "It becomes immediately clear in whose service is employed this 'hero of the week,' this sensational machine, as well as all of science and technology in America!"[11] After Agapov's 1950 article, Wiener's *Cybernetics* was officially removed from regular circulation in Soviet research libraries; apparently only secret military libraries would retain copies into the early 1950s.[12]

In 1951 a public campaign in the Soviet Union called the computer hype in the United States a "giant-scale campaign of mass delusion of ordinary people." The volume *Protiv filosofiia oruzhenostsev amerikano-angliiskogo imperializma* (Against the philosophical henchmen of American-English imperialism), whose less-than-subtle title appeared in 1951, categorized cybernetics as part of a worrying fashion around "semantic idealism" and dubbed cyberneticists "semanticists-cannibals" for their recursive logics, especially self-informing feedback loops. In addition to American cyberneticist Norbert Wiener, the volume identified those belonging to the group of "semantic obscurantists" as including logician-pacifist Bertrand Russell, his Cambridge colleague Alfred North Whitehead, and Vienna Circle logical positivist Rudolf Carnap. Positivism, semiotics, and mathematical logic all appeared guilty of the cardinal cognitivist belief that "thinking was nothing else than operations with signs."[13] In 1952 *Literaturnaya gazeta* ran an article titled "Cybernetics—a 'Science' of Obscurantists," which cleared the way for a deluge of popular titles: "Cybernetics—an American Pseudoscience," "The Science of Modern Slaveholders," "Cybernetics—a Pseudoscience of Machines, Animals, Men and Society," and so on.[14]

In 1953 an author who wrote under the pseudonym "Materialist" published the infamous article "Whom Does Cybernetics Serve?" in a leading journal for ideological and intellectual battles, *Voprosy filosofii* (Questions of philosophy). Materialist waxed poetic in his rebuke: "The theory of cybernetics, trying to extend the principles of modern computing machines to a broad variety of natural and social phenomena without due regard for their qualitative peculiarities, is mechanicism

turning into idealism. It is a sterile flower of the tree of knowledge arriving as a result of a one-sided and exaggerated blowing up of a particular trait of epistemology."[15] Later in the article, Materialist contended that "in the depth of their despair, [the capitalist world] resort[s] to the help of pseudo-sciences giving them some shadow of expectation to lengthen their survival."[16] With somewhat less vitriol, in 1954 the fourth edition of the *Kratkiĭ filosofskiĭ slovar'* (Concise dictionary of philosophy) cast cybernetics as a slightly ridiculous, although still harmful, anti-Marxist "reactionary pseudoscience." The entry reads:

> Cybernetics: a reactionary pseudoscience that appeared in the U.S.A. after World War II and also spread through other capitalist countries. Cybernetics clearly reflects one of the basic features of the bourgeois worldview—its inhumanity, striving to transform workers into an extension of the machine, into a tool of production, and an instrument of war. At the same time, for cybernetics an imperialistic utopia is characteristic—replacing living, thinking man, fighting for his interests, by a machine, both in industry and in war. The instigators of a new world war use cybernetics in their dirty, practical affairs.[17]

The campaign would continue in the popular and scholarly press more or less unabated through the 1950s, although the first public rehabilitation efforts, noted below, began in earnest as early as 1955.

The list of epithets reserved for cybernetics by the Soviet press should be put into perspective. The campaign against cybernetics, however mean-spirited and aggressive, appears far from the most vicious of campaigns organized by Soviet journalists and public commentators against American thought. Stalin, who was known to read widely across the scientific fields, seems to have known little to nothing about cybernetics; his fury against it appeared independent of "any essential features of cybernetics itself," according to Gerovitch.[18] Without any direct evidence of Stalin's involvement in the campaign against cybernetics, we can speculate that Stalin likely hated cybernetics for the same reasons—most of them ideological and essential to sustaining the Cold War opposition that powered his state building—that he hated all imperialist "pseudosciences." The campaign against cybernetics, which came in the wake of Stalin's personal affront against classical genetics, appeared more or less a "farce" to some philosopher-critics. These same philosopher-critics, according to information theorist Ilia Novik, "berated cybernetics with certain . . . indifference and even fatigue."

In the late 1940s and early 1950s, as cybernetics was sweeping America, England, and France with the enthralling possibilities of self-organizing human-machine ensembles and predictive negative feedback loops, "cybernetics" in the Soviet Union had, to crib Novik's phrase, "emerged as a normal pseudo-science."[19]

The anti-American Soviet campaign against cybernetics was only one among a range of means for repressing the Soviet intellectual base. A few other examples include the rise of Lysenkoism in Soviet biology, which ousted the study of Mendel and classical genetics; the condemnation of Linus Pauling's structural resonance theory by Soviet chemists in 1951; the banning of Soviet Lev Vygotsky's work, now recognized as a foundation of cultural-historical psychology; the forestalling of structural linguistics pioneered by Ferdinand de Saussure, Nikolai Trubetzkoi, and Roman Jakobson; and the excoriation of Einstein's theories of general and special relativity, quantum mechanics, and Heisenberg's principle of indeterminacy as distortions and corruptions of the true (i.e., Marxist), objective and material nature of the universe.[20] In light of these and other examples, the public campaigns against cybernetics strike the contemporary observer as far from masterfully orchestrated or even normal in their regularity. The ground warfare of ideological critique was messy, full of ritual elements, political posturing, and routine debates. Not only did the enterprise of Soviet cybernetics prove to be diverse, the anticybernetic campaigns that preceded it varied richly.[21] In short, there was nothing particularly anticybernetic about the anticybernetic campaigns; rather, the early opposition to the science appears overwhelmingly anti-American in motivation. In the decade that followed, Soviet cybernetics would transform into an apparent harbinger of social reform and then, later, into a normal Soviet science. But in fact, the Soviet experience with cybernetics was normal from the beginning: even the Soviet resistance to cybernetics was mostly to be expected.

Post-Stalinist Rehabilitation of Cybernetics, 1955–1959

> Natural Science will in time incorporate into itself the science of man, just as the science of man will incorporate into itself natural science: there will be *one* science.
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> —Karl Marx, *Economic and Philosophic Manuscripts of 1844*

Stalin's death in March 1953 made possible a watershed shift in public discourse in favor of Soviet cybernetics and gave root to the promise of cybernetic-led structural reform of the Soviet Union. Nikita

Khrushchev, once he had decidedly seized power from his rivals in 1955, titled himself first secretary in an effort to signal a clean break from the past and the launching of a new, post-Stalinist era. Typically, the only thing remembered about the Twentieth Congress of the Communist Party of the Soviet Union in 1956 is Khrushchev's "secret speech," which he delivered to a carefully selected crowd and in which he became the first Soviet authority figure to denounce Stalin's crimes and the now infamous "cult of personality." The speech had no less an effect than to inaugurate the Khrushchev Thaw, a period known for the easing of censorship and political repression as well as the partial de-Stalinization of Soviet policy, international relations, and society. These public revelations, combined with a sagging Soviet economy, compelled even those most shielded from the terrible reality of Stalin's terror to admit that, in Khrushchev's terms, "serious excesses" and "abuses" had been committed.[22]

As part of this sweeping technical reform, the new first secretary also called for an ideological reappraisal of Marxism-Leninism:

> In this connection we will be forced to do much work in order to examine critically from the Marxist-Leninist viewpoint and to correct the widespread erroneous views connected with the cult of personality in the sphere of history, philosophy, economy, and of other sciences, as well as in literature and the fine arts. It is especially necessary that in the immediate future we compile a serious textbook of the history of our Party, which will be edited with scientific Marxist objectivity.[23]

By 1959 Stalin's *Short History of the Communist Party of the Soviet Union*, once characterized as "the catechism of Communism," had been officially deemed full of errors and withdrawn under Khrushchev; it was replaced in 1961 by *Fundamentals of Marxism-Leninism*, a nine-hundred-page tome, scientific editing notwithstanding.[24]

The distance between Stalin's death and cybernetics entering the favor of public discourse was not great. In fact, at the same 1956 Congress at which he gave his "secret speech," Khrushchev also promoted cybernetic-friendly principles for automating the Soviet economy: "The automation of machines and operations," he declared, "must be extended to the automation of factory departments and technological processes and to the construction of fully automatic plans."[25] With the passing of Stalin, cybernetics entered Soviet technical, scientific, and political discourse at a time particularly primed for reform.

Although Soviet science enjoyed reform and looser ideological constraints under Khrushchev, it is worth noting that, strictly speaking, Soviet science may have accomplished more under Stalin than it did under the mantle of cybernetics. Under Stalin, Soviet physicists and chemists pioneered work for which chemist Nikolai Semyonov, physicist Igor Tamm, economist Leonid Kantorovich, and physicist Pyotr Kapitsa received Nobel Prizes decades later. Other Soviet scientists—including Igor Kurchatov, Lev Landau, Yakov Frenkel, Andrei Sakharov, and other world-renowned figures—also developed atomic and thermonuclear bombs, a lynchpin in Stalin's rapid and forceful industrialization of the remnants of the Russian Empire from a backwater country into a global superpower in only a few decades.

Far from every gain in Soviet science under Stalin was forced. Many Soviet scientists successfully employed dialectical materialism as a genuine source of inspiration, not a forced ideology, in their scientific work. It is thus not necessarily the case that Stalin's defense laboratories functioned as "islands of intellectual autonomy," as David Holloway once claimed; rather, after looking at the funding patterns for the two periods, as Loren Graham has shown, the health of the Soviet sciences follows the ample funding sustained by Stalin more than it does the incremental increases in intellectual freedom allowed by Khrushchev.[26] The reality that science, in this case, depended more on funding than it did on freedom also offers a chance for sobering reflection on the contemporary state of science.

Soviet cybernetics arrived at a time in which it could take advantage of the post-Stalinist enthusiasm for a technologically informed revision of scientific Marxist objectivity. It introduced its mind-machine analogies in a light friendly to Ivan Pavlov's celebrated notion in psychology of "conditioned reflexes," which were based on the reflex-response analogy of a telephone electrical switchboard, the reactions of which depended on the programmable configuration of wires. Both Pavlov and, two generations later, cyberneticists worldwide imagined the mind as neural networks and electronic processors, a seminal metaphor for what philosopher Pierre Dupuy dubbed the "mechanization of mind" powering the recent rise of cognitive science.[27]

Soviet cybernetics also found the support of several world-famous mathematicians, a field in which the Soviets were internationally recognized. Figures including Andrei Kolmogorov, Sergei Sobolev, Aleksei Lyapunov, and Andrei Markov Jr. came together, despite significant differences, to form an early core of Soviet cybernetic-mathematicians committed to advancing this new metamathematical science as a single

science for Soviet thought. And just as cybernetics was mobilizing its intellectual defenses, it also found institutional fortification in the creation of Akademgorodok, a new "scientific township at Novosibirsk" in Siberia. Created in the spring of 1957, this city of science (formally part of the city of Novosibirsk) proved a refuge of privilege and relative intellectual freedom for over sixty-five thousand Soviet scientists, including Aleksei Lyapunov, a pioneering cybernetician, among others.[28]

Before the Soviet scientific mainstream could adopt cybernetics, the attendant scholarly communities had to be prepared for an about-face in the official Soviet attitude toward an American-born metascience. The first sign of this turnaround came not from Moscow but from a neighbor in the near abroad: in 1954 Warsaw six "Dialogues on Cybernetics" surfaced that approached cybernetics in a critical and dialectical tone serious enough to suggest that the topic deserved real discussion.[29] In the meantime, three mathematicians and an unlikely philosopher-critic closer to Moscow set off on a mission to remake Soviet cybernetics from the inside out.

The First Soviet Cyberneticists: Kitov, Lyapunov, Sobolev

In 1955 two Russian-language articles appeared in the Soviet journal *Voprosy filosofii* that signaled a transformation in the official attitude toward cybernetics. A closer look at these two articles sheds light on this reversal. Sergei Sobolev, Aleksei Lyapunov, and Anatoliy Kitov, coauthors of the article titled "The Main Features of Cybernetics," began the process of rehabilitating cybernetics from a position of relative authority in the Moscow military-academy complex. Although then the youngest and the least influential of the three mathematician coauthors, Kitov appears to have been the first Soviet cyberneticist. In the fall of 1959, as recent scholarship has begun to suggest, Kitov also became the first person anywhere to propose a nationwide computer network for civilian use.[30] A Soviet colonel engineer, Kitov discovered in 1952 the single copy of Wiener's *Cybernetics* in a secret library of the Special Construction Bureau—SKB-245—at the Ministry of Machine and Instrument Building, where Kitov had been sent to research possible military applications for computers after graduating in 1950 from the military academy where Lyapunov taught with a gold medal, the highest award in the Soviet education system. After he read Wiener's *Cybernetics*, it occurred to Kitov that cybernetics was, in his words, "not a bourgeois pseudo-science, as official publications considered it at the time, but the opposite—a serious, important science."[31]

After digesting *Cybernetics*, Kitov turned to share his newfound enthusiasm for the science with his former instructor, Aleksei Lyapunov. Lyapunov, who later was known as "the father of Soviet cybernetics," was a wide-ranging and luminous mathematician who taught at the Military Artillery Engineering Academy and in the Department of Computational Mathematics at Moscow University. Recognized by biologists, geophysicists, and philosophers alike, Lyapunov took, according to Soviet historian of science M. G. Haase-Rapoport, an "integrating, non-dividing approach in natural science," which "became the rich soil [for] the sprout of cybernetic ideas."[32] Having heard Kitov's case, Lyapunov in turn encouraged Kitov to write an article explaining the essence of cybernetics, promising to coauthor it. Holed up in the secret military research library, Kitov wrote up the draft for the article, after which Lyapunov suggested inviting as another coauthor Sergei Sobolev, then chairman of the Department of Computational Mathematics at Moscow University. Moreover, Sobolev played an important legitimizing role as deputy director of the Institute of Atomic Energy—in effect, the mathematician with a hand on the atomic bomb. In 1933, at the age of twenty-five, Sobolev had become the youngest corresponding member of the Soviet Academy of Sciences and in 1939 the youngest full member (academician) of the academy. After joining the Bolshevik Party in 1940, Sobolev was appointed as the deputy director of the Institute of Atomic Energy in 1943 and contributed to the construction of the first Soviet atomic and hydrogen bombs. With this in mind, Lyapunov and Kitov arranged to visit Sobolev at his dacha in Zvenigorod, an hour west of Moscow, where, after discussing the draft, Sobolev offered his name as coauthor. While it is not known exactly how much he contributed to the article, Sobolev repeatedly and publicly defended cybernetics in the late 1950s.[33]

Sometime in 1952 Kitov and Lyapunov visited the editorial staff of *Voprosy filosofii*, a premier scholarly journal in the Soviet Union as well as a leading forum for scholarly campaigners against cybernetics. For unknown reasons, the editors agreed to publish the article, asking only that the authors receive permission from the Communist Party first. *Voprosy filosofii* continued to publish anticybernetic material for several years, so one might speculate that the editors thought permission would not be granted, thus shifting the blame for the rejection onto higher authorities. It is equally possible that the editors agreed to publish the article out of a genuine desire to encourage intellectual debate. Regardless, the editors sent Lyapunov and Kitov to meet with representatives in the Science Division of Staraya Square, an administrative wing of the

Communist Party in downtown Moscow. The administrators heard their case, asked some questions, and then concluded: "We understand: it is necessary to change the relationship to cybernetics, but an instantaneous split is not possible: before the article can be published, it would make sense to do several public reports."[34] Lyapunov and Kitov spent 1953 and 1954 carrying out tacitly approved public lectures and private workshops; Lyapunov, for example, began hosting a circle of colleagues to discuss cybernetics in his home that lasted over a decade.[35]

At once an introduction, a reclamation, and a translation of Wiener's *Cybernetics*, Kitov, Lyapunov, and Sobolev's final article, "The Main Features of Cybernetics," danced a deliberate two-step. First, it attempted to upgrade cybernetics to equality with other natural sciences by basing an ambitiously comprehensive theory of control and communication almost exclusively on Wiener's 1948 book (although these early Soviet cybernetics made notably less of the field as an applied science and more of it as a universalizing theory than did Wiener). Second, it retooled the conceptual vocabulary into a Soviet language of science. On this Gerovitch observes, "What Wiener called 'the feedback mechanism' they called 'the theory of feedback.' . . . '[B]asic principles of digital computing' became 'the theory of automatic high-speed electronic calculating machines'; 'cybernetic models of human thinking' became the 'theory of self-organizing logical processes.'"[36] The coauthors used the word "theory" six times in their definition of cybernetics to emphasize the theoretical nature of the new science, perhaps since theory was then seen to be antithetical to American pragmatism.

The coauthors also integrated and expanded the stochastic analysis of Claude Shannon's information theory while simultaneously stripping Wiener's organism-machine analogy of its political potency.[37] Wiener's core analogies between animal and machine, machine and mind were retooled into problems of how "self-organizing logical processes [appeared] *similar* to the processes of human thought" as well as control, feedback, and automated systems in the machine and organism; all of this was scripted in the common language of Shannon's mathematical theory of information. For Kitov, this "doctrine of information" took on wholesale the task of universalizing statistical control in machines and minds. It did so by preferring the "automatic high-speed electronic calculating machine" (i.e., the computer) to Wiener's servomechanism as the base analogy for cybernetic comparisons.[38] Computer algorithms added a further layer of technical complication to Wiener's feedback mechanisms, although—despite the coauthors' efforts to silence the social implications of the theory—their analogy of neurons with electronic

switches quietly implied research possibilities in human-computer interaction, robotic prosthetics, and cyborgs. By formulating the science in terms of computers, not servomechanisms, the coauthors propelled the Soviet cyberneticist into the front lines of the escalating space and technology race. Thus, conceiving of the computer as a general regulating machine for any control systems, the Soviet formulation of cybernetics focused on computational systems from the start—a generalized step away from Wiener's interests in communication and control in individual entities, namely, "the animal and the machine."[39] Although computers were not common in the Soviet Union until decades later, to this day the Russian word for cybernetics, *kibernetika*—together with its heir of informatics, *informatika*—remains a near synonym for the study of computing.

A "new medium" (understood as a technology no one knew how to talk about), the computer was known in the Soviet Union as the "automatic high-speed electronic calculating machine."[40] A few years later, frequent use mercifully abbreviated the term to EVM (short for *electronnaya vyichislitel'naya mashchina*, or "electronic calculating machine"). Only well after the cloning of Western machines, namely, the architecture of the IBM-360, in the 1970s and with the skyrocketing of Western personal computers under Gorbachev's *perestroika* in the 1980s did the now nearly ubiquitous English calque *komp'yuter* replace the term EVM.[41] The unwieldiness of the original Soviet term underscores the perennially renewable nature of the discursive contest that makes computers more or less "new": the term "computer," which flaunted creation of Western high technology, came loaded with international competitiveness. To counterbalance the philosophical implications of placing this technology of the enemy at the center of their theory, the coauthors attempted to keep their language very technical and abstract, occasionally reminding the reader to view the cybernetic mind-machine analogy or some other explosive element "from a functional point of view," not a philosophical one.[42]

The technical and abstract mathematical language of Wiener's cybernetics thus served as a political defense against Soviet philosopher-critics and as ballast for generalizing the coauthors' ambitions for scientists in other fields. They employed a full toolbox of cybernetic terminology, including signal keywords such as "homeostasis," "feedback," "entropy," "reflex," and "the binary digit." They also repeated Wiener's emphasis on probabilistic, stochastic processes as the preferred mathematical medium for scripting behavioral patterns onto abstract logical systems, including a whole section elaborating the cybernetic mind-machine

analogy with special emphasis on the central processor as capable of memory, responsiveness, and learning. They also tempered Wiener's call for cyberneticists with "Leibnizian catholicity" of scientific interest into its negative form: a warning against disciplinary isolationism.[43]

On the last page of the article, the coauthors smoothed over the adoption of Wiener, an American, as foreign founder of Soviet cybernetics by summarizing and stylizing Wiener's "sharp critique of capitalist society," his pseudo-Marxist prediction of a "new industrial revolution" arising out of the "chaotic conditions of the capitalist market," and his widely publicized postwar fear of "the replacement of common workers with mechanical robots."[44] A wordplay in Russian animates this last phrase: the Russian word for worker, or *rabotnik*, differs only by a vowel transformation from *robot*, the nearly universal term coined in 1927 by the playwright Karel Čapek from the Czech word for "forced labor."[45] If the first industrial revolution replaced the hand with the machine, or the *rabotnik* with the *robot*, then Wiener's science would help usher in a "second industrial revolution" in which the labor of the human mind could be carried out by intelligent machines, thus freeing the mind to higher pursuits. "Automation in the socialist society," the coauthors wrote in anticipation of Khrushchev's declaration at the 1956 Congress, "will help facilitate and increase the productivity of human labor."[46] While Stalin had found no use for Wiener's sounding of a "new industrial revolution," these mathematicians had found and refashioned in Wiener an American critic of capitalism, a founder of a science fit to sound the Soviet call for "increased productivity of labor."[47]

Given this explicit adoption of Wiener into the Soviet scientific canon, it is surprising to note that the coauthors only quoted one line from any of his work. That line reads: "Information is information, not matter and not energy. Any materialism that cannot allow for this cannot exist in the present."[48] By distinguishing between information, energy, and matter, Wiener asserted two Kuhnian paradigm shifts: first from Newtonian physics of matter to an era of Bergson and thermodynamics, and second from the thermodynamics of energy to a new paradigm of information science and Wiener's cybernetics. For many in the West, this quote meant that information is nothing but information, a value-neutral foundation upon which to rest objective science and the search for computable truth. The meaning was the same for their Soviet counterparts, but it also meant something more. By singling out Wiener's alliance of materialism and cybernetics, the coauthors implied that Wiener had in mind the official philosophy of Soviet science: the dialectical materialism of Marxism-Leninism. The quote thus renders

Wiener as a sort of foreign prophet founding a dialectical materialist science of information, a science that could only be fully Soviet. With these ritual words, the coauthors wed cybernetics to Soviet ideology: the success of this "important new field" of Marxist-Leninist information science, they contended, hung on the call to action voiced by its American originator.

The coauthors also buttressed Wiener's ideas of neural processing with reference to the great Soviet scientist Pavlov, whose original theory of conditioned reflexes in human psychology had been derived from a telephone electrical switchboard, a communication machine with ideal cybernetic resonance. Finally, the coauthors concluded the article in a ritual flourish of Orwellian newspeak common to academic writing at the time, calling for a battle against the capitalists who "strive to humiliate the activity of the working masses that fight against capitalist exploitation. We must decisively unmask this hostile ideology."[49] In short, after years of anti-American, anticybernetic positions, they were first to voice an anti-American, procybernetic position in the Soviet press. In the mid-1950s the tone of subsequent arguments would begin distinguishing between the capitalist use of cybernetics, which was flatly condemned, and cybernetics in general, thus creating space for the argument that the socialist use of cybernetics might be not only possible but even preferable.

The Dark Angel: Ernest Kolman's "What Is Cybernetics?"

Whatever rhetorical flourishes Kitov, Lyapunov, and Sobolev mustered, the strongest witness to the political defensibility of their newfound procybernetic position lay in the article that immediately followed their publication in the same journal, Ernest Kolman's piece "Chto takoe kibernetika?" (What is cybernetics?). A loyal Bolshevik, an active ideologue-philosopher, and a failed mathematician with a long and bloody personal history of attacking nonorthodox mathematicians, Kolman made for a somewhat surprising candidate as the first ideological defender of Soviet cybernetics.[50] Among other ideological offenses he appears, for example, to have done the most of all critics to damage the founders of the Moscow School of Mathematics, a powerful school in imperial Russia and the Soviet Union; in particular, he excoriated them for their nonatheistic commitment to a fascinating intellectual alliance between French set theory and Russian Orthodox name-worshiping mysticism. (The scandalously religious observation began by noting that both infinity and God could be named but not counted.)[51] Kolman

was once dubbed "one of the most savage Stalinists on the front of science and technology" for his tireless defense of Lysenkoism (what is now remembered as the Soviet pseudoscientific alternative to classical genetics).[52] Some feel it was Kolman's diatribes that kept the mathematician Andrei Kolmogorov in the 1940s from beating Wiener—in many ways his intellectual equivalent—to formalizing the link between biology and mathematics. Kolman had a track record of ideological devotion to Marxism, a well-honed sensitivity for political attack, genuine intellectual interests in the history of science, and knowledge of four or five languages. A formidable opponent, he was sometimes known among his detractors and victims as the "dark angel."[53]

Kolman's support of cybernetics was curiously not the first time he had deviated from the most ideologically orthodox line of philosophy. He had spent time in a Stalinist labor camp after World War II for straying from the party line in his interpretation of Marxism. Much later, just before he died in 1982, he published the book *My ne dolzhny byli tak zhit'* (We should not have lived that way), in which he partially confessed to his earlier transgressions, admitting without any details, "in my time I evaluated many things, including the most important facts, extremely incorrectly. Sincerely deluded, I was nourished by illusions which later deceived me, but at that time I struggled for their realization, sacrificing everyone."[54] This context makes Kolman's defense of cybernetics that much more surprising: the embittered ex-mathematician with a track record of decimating allegedly pseudoscientific mathematical theories was also the first ideologue to come to the defense of a nascent Soviet program in cybernetics.

Kolman began his eleven-page promotional history by outlining over a century of international cybernetics, beginning with the French mathematician, physicist, and philosopher Ampère in 1843 and moving to "Russian and Soviet scientists, [such as] Chernishwev, Shorin, Andropov, Kulebakin, and others."[55] Continuing on page 2, Kolman called Wiener "one of the most visible American mathematicians and professor of mathematics at Columbia University" and the one who "definitively" formalized cybernetics "as a scientific sphere" in a veritable shout of praise for the time.[56] In fact, Wiener had been appointed at MIT, not Columbia, since 1919, but there is some reason to think the mistake was deliberate: Columbia University was known at the time by the Soviets for its Russian studies center, the Harriman Institute, which had been a favorite target of McCarthy; thus, connecting the center to Wiener perhaps softened the image of the university in the eyes of Kolman's peer philosopher-critics.[57] In any case, the fact that Wiener occupies the sixth

through the ninth paragraphs of Kolman's ideological support piece signals a second witness of Wiener's adoption into the vanguard of Soviet cybernetic historiography.

Having set Wiener up as the foreign founder of Soviet cybernetics in the article, Kolman promptly invented a Soviet prehistory to the science that broadened and colored the ambition of cybernetics to match Marxism-Leninism. Kolman's narrative integrates cybernetics into a longer history of computational machines ranging from Ramon Llull in 1235, to Pascal in the mid-1600s, to the engineer Wilgott "Odhner of Saint Petersburg" (conspicuously not identifying Stockholm, Wilgott's native city), and the late-nineteenth-century mathematicians A. N. Krilov and P. L. Chebishev. He then discussed how the Soviet mathematicians A. A. Markov (a constructivist mathematician who later became a leading cyberneticist), N. C. Novikov, N. A. Shanin, and others had been advancing the last hundred years' worth of precybernetic work.[58] Kolman's internationalism allowed exactly two people west of Berlin to creep into his history: Norbert Wiener and Nikolai Rashevsky, the first Pavlov-inspired biomathematician and a Russian émigré at the University of Chicago.

While Kolman's revision of cybernetic historiography borders on outlandish, he was not necessarily incorrect to emphasize the Eastern European origins of the American-born cybernetic tradition, although he overlooked the following: Aleksandr Bogdanov, an old Bolshevik revolutionary, right-hand man to Vladimir Lenin, and philosopher who developed a theory of broad analogies between society and political economy that he published in 1913 as *Tektologia: Vsyeobshcheiye organizatsionnaya nauka* (Tectology: a universal organizational science), a sort of protocybernetics minus the mathematics (Wiener may have seen Bogdanov's work in translation in the 1920s or 1930s); Stefan Odobleja, the largely ignored Romanian whose pre–World War II work prefaced cybernetic thought; John von Neumann, the architect of the modern computer and founding game theorist, famously a Hungarian émigré; Roman Jakobson, aforementioned structural linguist, collaborator in the Macy conferences, and Russian émigré; Szolem Mandelbrojt, a Jewish-Polish scientist and uncle of fractal founder Benoit Mandelbrot, who in turn organized Wiener's collaboration on harmonic analysis and Brownian motion in 1950 in Nancy, France; and Wiener's own domineering and brilliant father, Leo Wiener, a self-made polymath, preeminent twentieth-century translator of Tolstoy, founder of Slavic studies in America, and émigré from a Belarusian shtetl. No doubt there are other stories to tell as well.[59]

Anticipating the Enemy Within: Action and Reaction in Soviet Cybernetics

The battle to legitimize Soviet cybernetics began internally, fought against and among Soviet philosopher-critics, the vanguard and police of ideological debate in Soviet discourse. Both procybernetic articles, and especially Kolman's, were loaded with discursive tactics meant to protect cybernetics from counterattacks, so much so that the first pronouncements of cybernetics became participants in Cold War tactics. The following excerpt from Kolman's first public defense of cybernetics, given at a lecture at Moscow State University in 1954, makes this clear:

> Cybernetics are [*sic*] indeed used by reactionaries to "freshen" bourgeois sociology and idealistic philosophy and to give them a scientific coating. . . . They looked at cybernetics as a novel field of sciences only under this narrow viewpoint of the regeneration of bourgeois thinking and neglected all positive aspects of it. Around cybernetics a large and far-reaching movement has developed in the West. It is, of course, very easy and simple to defame cybernetics as mystifying and unscientific. In my opinion, however, it would be a mistake to assume that our enemies are busy with nonsensical things, that they waste enormous means, create institutes, arrange national conferences and international congresses, publish magazines—and all this only for the purpose of discrediting the teachings of Pavlov and dragging idealism and metaphysics into psychology and sociology. There are more effective and less expensive means than the occupation with cybernetics if one intends to pursue idealistic and military propaganda.[60]

Kolman here turned the logic of what Peter Galison called the "enemy Other"—or the rational enemy implicit in all cybernetic strategy—upon Soviet discourse itself in order to save the fledgling movement from future Soviet critics. For example, Kolman invited his Soviet listeners to consider cybernetics from the perspective of an economically rational American scientist. We should imitate the enemy, Kolman reasoned, because we can infer that the enemy knows something we do not, for he is occupied with something we do not understand. In David Holloway's phrase, "the hostile image of capitalist society, which had played an important part in the early attacks on cybernetics, was now turned to its defense."[61]

Coauthors Sobolev, Lyapunov, and Kitov also struck preemptively against the Soviet philosophers, rebuffing them for "misinterpreting

cybernetics, suppressing cybernetic works, and ignoring the practical achievements in this field." The coauthors flipped the argument sure to follow, that Soviet cybernetic defenders were "'kowtowing' before the West," by insisting that "some of our philosophers have made a serious mistake: without understanding the issue, they began by denying the validity of a new scientific trend largely because of the sensational noise made about it abroad."[62] In a concluding flourish, the coauthors contended: "One cannot exclude the possibility that the hardened reactionary and idealistic interpretation of cybernetics in the popular reactionary literature was especially organized to disorient Soviet scientists and engineers in order to slow down the development of this new important scientific trend in our country."[63] Thus, the coauthors held, it was the critics of cybernetics, not its proponents, who should be suspected of having fallen under the spell of the Cold War enemy. In order to recognize the contributions of the enemy without themselves resorting to attack, they heaped suspicion upon suspicion, suggesting that instigators abroad had somehow organized the ideological critique of cybernetics within the Soviet Union. While it is unlikely the coauthors genuinely believed that their discovery of cybernetics came about due to a lapse in the efforts of American spies and agents, this kind of argument nonetheless won internal wars.

Soviet cyberneticists were not alone in employing this strained logic. If Wiener was right in arguing that information arms all its possessors equally, it may too be the case that double heaps of suspicion support exactly the kind of ultrarational strategy straining toward irrationality found in cybernetics itself, alongside military strategist Herman Kahn and US Secretary of State Robert McNamara's policy of mutually assured destruction—a game theoretic scenario in which both parties settle for peace in order to avoid mutual nuclear annihilation. As Peter Galison argues, the fundamental logic of cybernetics is to adopt the logic of the enemy and to preempt and predict the behavior of the intelligent and rational foe.[64] Thus cybernetics, like its sister disciplines of game theory and operational science, appears as a method for rationalizing the enemy, distributing structural strategy evenly across opponents, and flattening the chances an enemy will have to take strategic or logical advantage over an ally. Perhaps nowhere is this as clear as in the Soviet defense of cybernetics itself, except that in Kolman's case the enemy to defend cybernetics against was his own kind. At first rejected for its American sources, Soviet cybernetics took shape less as a Soviet reaction against the American enemy than as a circular defense of Soviet mathematicians against their own philosopher-critics.

A "Complete Cybernetics": The Totalizing Plurality of Soviet Cybernetics

The efforts of Sobolev, Lyapunov, Kitov, and Kolman, combined with the intellectual weight of supporter and preeminent mathematician Andrei Kolmogorov and high-ranking administrator and engineer Aksel Berg, led to the establishment of the statewide Council for Cybernetics in 1959, which in turn promised cybernetics a base for significant growth as an institutional field in the early 1960s. By 1965, not long after an international team of organizational management specialists had toured select facilities in the Soviet Union, an American observed the clear enthusiasm for cybernetics among young Soviet scientists:

> An even more sweeping change may be introduced into the flow of communications by the introduction of modern electronic data processing and computing machinery. In recent years the regime has admitted the relevance of cybernetic theory, which had been banned during Stalin's lifetime. . . . One [informant] remarked that the administrators who were concerned with installing the new equipment were all young, recent graduates of technical higher schools who generally formed a group apart from the older bureaucrats. It is possible, therefore, that the introduction of new methods of communicating information will proceed hand in hand with a turnover in generations in the Soviet administration. Such a "computer revolution" may enormously increase the effectiveness of formal communication channels. This in turn may permit a considerable increase in centralized control. It is quite possible therefore that modernization of communication may have the paradoxical effects of forcing the abandonment of the Leninist ideological exaltation of production at the expense of clerical work at the same time that it actually enhances totalitarian control by making a fully centralized network of administrative communications channels really feasible.[65]

In 1961 the Central Committee began promoting cybernetics at the Twenty-Second Party Congress as "one of the major tools of the creation of a communist society."[66] First Secretary Nikita Khrushchev in particular promoted a far-reaching application of cybernetics. "It is imperative," he declared to the congress, "to organize wider application of cybernetics, electronic computing, and control installations in production, research work, drafting and designing, planning, accounting, statistics, and

management."[67] Central Intelligence Agency (CIA) informants noted similar enthusiasm at an All-Union Conference on the Philosophical Problems of Cybernetics held during June 1962 in Moscow, which included "approximately 1000 specialists, mathematicians, philosophers, physicists, economists, psychologists, biologists, engineers, linguists, physicians." The conference even adopted an official, if troubling, vague definition of cybernetics as the science that "deals with the purposeful control of complex dynamic systems."[68]

Between 1960 and 1961 the popular press began heralding computers as "machines of Communism," and Engineer Adm. Aksel Berg, then director of the Council of Cybernetics, launched the first of a series of volumes entitled *Cybernetics—in the Service of Communism.*[69] This series stirred emotions among Western observers: one American reviewer noted with concern in 1963 that "if any country were to achieve a completely integrated and controlled economy in which 'cybernetic' principles were applied to achieve various goals, the Soviet Union would be ahead of the United States in reaching such a state." The reviewer also picked up on the burgeoning interest in economic cybernetics, stating, "a significantly more efficient and productive Soviet economy would pose a major threat to the economic and political objectives of the Western World. . . . Cybernetics, in the broad meaning given it in the Soviet Union," he concluded with a flare, "may be one of the weapons Khrushchev had in mind when he threatened to 'bury' the West."[70]

Just as Soviet institutional investments began to expand and standardize the field, Soviet cybernetics became a looming menace to certain American observers. During the Kennedy administration, members of the intelligence community agitated against the perceived looming peril of Soviet cybernetics. John J. Ford, then a Russian specialist in the CIA and a future president of the American Society for Cybernetics, was responsible for several alarm-generating reports on Soviet cybernetics that had already grabbed Attorney General Robert F. Kennedy's attention. One fateful evening, Ford gathered with President John F. Kennedy's top men to discuss the impending peril of Soviet cybernetics, only to be interrupted by the announcement that surveillance satellites had just uncovered photos of Soviet missiles in Cuba.[71] By the time the dust settled after the Cuban Missile Crisis, Soviet cybernetics could no longer agitate the administration, which reviewed the science and deemed it not an urgent threat. It is a strange twist of history that the international crisis usually considered the zenith of Cold War hostility may have unexpectedly defused and derailed the mounting American agitation about the "Soviet cybernetic menace."[72]

Berg's volume series produced heated debate and fierce divisions among prominent mathematicians in the Soviet Union.[73] In contrast to the CIA's fear of a mounting, unified platform of Soviet cybernetics—replete with the tales of Soviet "unified information networks" investigated elsewhere by the agency—the internal discord among mathematical cyberneticists swelled, suggesting anything but a unified front. Leading Soviet cyberneticists defined the field in dramatically different terms: Kolmogorov fought to claim information as the base of cybernetics, whereas Markov preferred probabilistic causal networks, Lyapunov set theory, and Iablonskii algebraic logic. In 1958, only three years after their initial article, Kitov, Lyapunov, and Sobolev published an article outlining four more definitions of cybernetics in the Soviet Union, emphasizing the dominant study of "control systems," Wiener's interest in "governance and control in machines, living organisms, and human society," Kolmogorov's "processes of transmission, processing, and storing information," and Lyapunov's methods for manipulating the "structure of algorithms."[74]

Not everyone felt cybernetics should contain multitudes, however. Igor Poletaev, a leading Soviet information theorist and author of the 1958 book *Signal*, argued in 1964 against the then-plastic understanding of cybernetics. He legitimated his call for disciplinary coherence by invoking the iconic and mythically clear foreign founder, Norbert Wiener, claiming that "'terminological inaccuracy' is unacceptable, for it leads (and has already led) to a departure from Wiener's original vision of cybernetics toward an inappropriate and irrational expansion of its subject."[75] "As a result," Poletaev continued, "the specificity of the cybernetic subject matter completely disappears, and cybernetics turns into an 'all-encompassing science of sciences,' which is against its true nature."[76] The mathematician Nikolai Timofeef-Ressovsky, a practicing cyberneticist, once put the same sentiment in lighter terms: in correspondence with Lyapunov, he replaced the Russian word for "confusion" or "mess" with the term "cybernetics," referring to his having once placed a letter in the wrong envelope as a "complete cybernetics."[77] In this we uncover a fitting rejoinder and perhaps a fair description of the early Soviet approach to adopting complete cybernetics as the means for developing a unified information science and society.

After 1965: The Decentralized Decline of Cybernetics

Whatever the messy division among its intellectual pioneers, Soviet cybernetics at its peak appears comprehensive in reach from the

perspective of its subfields and decentralized governance. In the later 1960s the Academy of Sciences of the USSR vaunted cybernetics as an entire division of Soviet science, one of only four divisions.[78] Others waxed extravagant in arguing that even the remaining three divisions—"the physico-technical and mathematical sciences, chemico-technical and biological sciences, and social sciences"—could be read, without much conceptual violence, as subfields of the overarching expanse of Soviet cybernetics, given its ecumenical commitment to stitching together the mechanical, the organic, and the social: a totalizing mission begun with Wiener's attempt to analogize (in his subtitle to his 1948 *Cybernetics*) "the animal and the machine" and later (in his subtitle to 1950's *The Human Use of Human Beings*) "cybernetics and society."[79] Adopting this broad view institutionally, the Academy of Sciences originally categorized cybernetics into eight sections, including mathematics, engineering, economics, mathematical machines, biology, linguistics, reliability theory, and a "special" military section.[80] With Berg's influence on the Council on Cybernetics, the number of recognized subfields grew to envelop "geological cybernetics," "agricultural cybernetics," "geographical cybernetics," "theoretical cybernetics" (mathematics), "biocybernetics" (sometimes "bionics" or biological sciences), and, the most prominent of the Soviet cybernetic social sciences, "economic cybernetics."[81]

This was not all, however. By 1967 the range of sections had expanded to include information theory, information systems, bionics, chemistry, psychology, energy systems, transportation, and justice, with semiotics joining the linguistic section and medicine uniting with biology. Sheltering a huddling crowd of unorthodox sciences, including "non-Pavlovian physiology ('psychological cybernetics'), structural linguistics ('cybernetic linguistics'), and new approaches in experiment planning ('chemical cybernetics') and legal studies ('legal cybernetics')," cybernetics had grown to a nearly all-encompassing size. Whatever its intellectual incoherence, institutionally speaking, by the time Brezhnev came to power in 1964, Soviet cybernetics could not help but droop toward the intellectual mainstream.[82] It could not help doing so because it already encompassed most of the mainstream. Sloughing reformist ambitions to the side, the tremendous institutional growth of cybernetics outran the intellectual legs supporting it. By the 1970s seemingly little more than a name (*kibernetika*) and a common interest in computer modeling held together this loose patchwork of institutions, disciplines, fields, and topics. By the 1980s the term "cybernetics," which, although no longer new, had failed to mobilize consensus, diffused in relevance to the point that it gave way to the rise of its replacement, "informatics."[83]

Conclusion

The introduction to this article suggested that cybernetics, despite tremendous initial promise, failed to provide a comprehensive approach to Soviet information society and science. However, after reviewing the evidence, it may be somewhat wrong-headed to level the accusation that Soviet cybernetics failed on its own terms, however uncontroversial this statement appears in retrospect. The accusation may not stand because it raises that hardy ambiguity involved with writing about historical failure: no historical observer can pass judgment on this (or any other) failure without knowing counterfactually what the Soviet experience would have been like without cybernetics, nor can we project or imagine a successful Soviet cybernetic order with any sense of evidence, nor can we even meaningfully deem Soviet cybernetics a long-term success in information society building, given that both the widespread application of the field and the state it was meant to serve have been thoroughly dismantled in the last twenty years. As a result, we cannot in fairness pronounce the Soviet experiment with cybernetics either a success or a failure. In fact, such a pronouncement, one way or the other, actually cuts against the argument advanced here: to deem an event (e.g., Soviet cybernetics) a success or failure is to color the event in question as an exception and to cast its status as somehow normatively better or worse than competing events. Rather, the Soviet experience with cybernetics serves a different purpose here: understood as a sort of synecdochic reflection of the larger struggles, the story of Soviet cybernetics is helpful for exactly how normal it appears relative to the conditions necessary to sustain the tremendous institutional, technological, and societal growth in the Soviet Union at the time. The arc of Soviet cybernetics—rising in the 1950s, cresting in the 1960s, declining in the 1970s, and unraveling in the 1980s—parallels the parabola the Soviet Union followed in the latter half of the twentieth century. Riding out the wake of the tremendous growth of the first half of the twentieth century, both of these far-reaching Soviet societal and scientific systems were pushed farther and faster than could be sustained; the institutional demands of the command economy overwhelmed the economic base of Soviet society, just as the institutional growth of cybernetics eventually outgrew the intellectual base that could support the metadiscipline.

The Ukrainian computer pioneer Boris Malinovsky once lamented that "cybernetics was met with resentment" in the Soviet Union because "cybernetics . . . claimed to have a scientific validation of the control processes not only in life forms and machines, but in society as well.

Unfortunately, [this claim was made] not on the basis of Marxism-Leninism, but on the basis of exact sciences such as mathematics, automatic control, and statistics. Thus, it contradicted long-cherished Soviet management methods."[84] Malinovsky's quote is instructive because it points to institutional obstacles specific to the country, not to cybernetics, a subject that deserves further treatment elsewhere. Just as the early campaigns against American cybernetics had much to do with anti-Americanism and little to do with cybernetics, the long plateau of Soviet cybernetics appears to implicate the Soviet system more than cybernetics.

As a final note, consider the Soviet experience with cybernetics as a representative example in a much longer history of Russian and Soviet science and technology laid out by historian of Soviet science Loren Graham. Russian and Soviet science and technology, according to Graham, brim with examples of early innovations that were followed, after an initial spike of innovation and a period of normalization, by a steady decline and decay. A few other examples of this peak-and-decline trend include the early dominance in metallurgy and ironworks casting technology in the sixteenth-century Moscow cannon yard; early steam engines, arms modernization, and the advent of gunsmiths under Peter the Great; Russia's role as the largest exporter of iron in the late eighteenth century and largest producer of oil in the early twentieth century; the "Russian lights" that arched streets and public gardens in Paris (but never Moscow) in the 1880s; and the early successes of the Soviet Union in employing nuclear power plants. In these and other cases, the empire centralized in Moscow excelled for a period in the field of science and technology; however, in each of these cases, sustained economic development of these technologies proved elusive, and early innovation gave way to stagnation.[85]

The bright periods of growth and innovation in the sphere of Soviet computer research during the 1940s and 1950s, too, failed to be followed by a sustained development of associated industries. In 1941, for example, Ukrainian physicist Vadim Lashkarev invented the heart of the transistor, the semiconductor p-n junction, using crystals in his laboratory, but did not successfully produce transistors until the early 1950s, three years after engineers in the West had done so.[86] The early advances in Soviet computing took place in large part under the computer pioneer Sergei Lebedev in his Computing Center in Kiev, which was reorganized under his successor, Viktor Glushkov, into the aforementioned Institute of Cybernetics. In 1950, independent of Western research, Lebedev developed the "small electronic computer" (MESM,

Malaya electronicheskaya schetnaya mashina), the first computer in Europe to use stored memory and digital architecture. In 1954 the first "large electronic computer" (BESM, *bol'shaya electronicheskaya schetnaya mashina*) emerged, although it remained on par with Western computers for no more than two years. In 1958 the impressive BESM-6 went into serial production and drove extant military and state computation centers for years to come. After the BESM-6, however, significant developments in Soviet computer technology were slow in coming, even while American equivalents continued to surge forward. Similarly, the sudden rise and steady decline of Soviet cybernetics—understood as a scientific platform for the imagination and regulation of a computer-compatible Soviet information society—appear primarily to have been a symptom in a larger trend of national struggle to sustain sociotechnical innovations due to, according to Graham, "social and economic barriers, rather than technical ineptitude."[87] Perhaps the most noted exception to this general trend of peak-and-decline remains the Soviet space industry, which developed early and remains a powerful, if transformed, figure in the international arena of space exploration today.[88]

In summary, the Soviet experience with cybernetics may be most meaningful for how normal it appears: probably no other science can claim such a wide and representative reach into the latter half of Soviet society. Subsequently replete with fascinating twists, turns, and figures, the story of Soviet cybernetics reflects longer arcs of Soviet information science, technology, and society. The story of Soviet cybernetics recapitulates certain larger social structural trends in the Soviet Union: it echoes a larger tradition ripe with anticapitalistic public campaigns, the ritual aspects of intellectual debates and duels, political machinations and strategies, the broad-reaching institutional diffusion of its subject matter, and a longer history of peaks in innovation followed by downward-sloping plateaus in development. In this confirmation of the null historical hypothesis lies an instructive model for those interested in understanding how modern-day information practice, science, and technologies influence the shape of today's modern societies as well as a considerable challenge for historians, among other agent-observers of change: in periods of perceived social reform, perhaps it is not the most visibly exceptional and extraordinary but rather the ordinary and overlooked actors who best describe the course of history.

Notes

1. The key work in English on the topic of Soviet cybernetics is Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, MA: MIT Press, 2004).

2. This article is a revised form of a chapter of my dissertation—Ben Peters, "From Cybernetics to Cyber Networks: Norbert Wiener, the Soviet Internet, and the Cold War Dawn of Information Universalism" (PhD diss., Columbia University, 2010)—and includes revised selections and figures I first developed in my "Betrothal and Betrayal: The Soviet Translation of Norbert Wiener's Early Cybernetics," *International Journal of Communications* 2, no. 1 (2008): 66–80. The article has benefited from comments and criticism from Slava Gerovitch, Todd Gitlin, Richard John, Catharine Nepomnyashchy, Michael Schudson, Siva Vaidhyanathan, and an anonymous reviewer; Heather A. Graham and Kourtney Lambert Peters provided helpful editorial comments.

3. Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, MA: MIT Press, 2004), 4–5.

4. Yu V. Kapitonova and A. A. Letichevskii, "A Scientist of the XXIst Century," *Cybernetics and Systems Analysis* 39, no. 4 (2003): 471–76.

5. Scott Shane, *Dismantling Utopia: How Information Ended the Soviet Union* (Chicago: Ivan R. Dee, 1994). While in many ways not satisfying, this book nonetheless lays out with a journalist's eye for detail how the Soviet Union and Communist Party relied on a monopoly of information. For a more thoroughgoing media theory on empire's reliance on monopolies of knowledge, see Harold Innis, *Empire and Communication* (Toronto: University of Toronto Press, 1950).

6. Gerovitch, *From Newspeak to Cyberspeak*, 154–55, 301, passim.

7. Otto Mayr, *Authority, Liberty, & Automatic Machinery in Early Modern Europe* (Baltimore, MD: Johns Hopkins University Press, 1989), 144.

8. Gerovitch, *From Newspeak to Cyberspeak*, 122.

9. Flo Conway and Jim Siegelman, *Dark Hero of the Information Age: In Search of Norbert Wiener, the Father of Cybernetics* (New York: Basic Books, 2006), 316.

10. Gerovitch, *From Newspeak to Cyberspeak*, 547–48.

11. Ibid., 120.

12. Ibid., 126.

13. Mikhail G. Iaroshevskii, "Semanticheskii idealism—filosofiia imperialisticheskoi reaktsii," in *Protiv filosofiia oruzhenostsev amerikano-angliiskogo imperializma*, ed. T. Oizerman and P. Trofimov (Moscow: Nauka Publishers, 1951), 100, quoted in Gerovitch, *From Newspeak to Cyberspeak*, 119–21.

14. Gerovitch, *From Newspeak to Cyberspeak*, 119–21.

15. Published under the pseudonym "Materialist," *Voprosy filosofii* 5 (1953): 210–19.

16. Gerovitch, *From Newspeak to Cyberspeak*, 124–26. See also *Ocherki istorii informatiki v Russii*, ed. D. Pospelov and Ya. Fet (Novosibirsk: Nauchnyi Tsentr Publikatsii RAS, 1998).

17. Mark M. Rosenthal and Pavel F. Iudin, eds., *Kratkiĭ filosofskiĭ slovar'*, 4th ed. (Moscow: Gospolitizdat, 1954), 236–37. Also quoted in Pesi R. Masani, *Norbert Wiener, 1894–1964* (Boston: Birkhäuser, 1990), 261.

18. Gerovitch, *From Newspeak to Cyberspeak*, 119.

19. Ilia B. Novik, "Normal'naia Lzhnauka" (A normal pseudoscience), *Voprosy istorii estestvoznaniia i tekhniki* (Questions of history of natural science and technology) 4, no. 4 (1990), quoted in Gerovitch, *From Newspeak to Cyberspeak*, 103.

20. For further reading, see Loren Graham, *Science in Russia and the Soviet Union: A Short History* (Cambridge: Cambridge University Press, 1993). See also Graham, *What Have We Learned about Science and Technology from the Russian*

Experience? (Stanford, CA: Stanford University Press, 1998). On Lysenkoism, see David Joravsky, *The Lysenko Affair* (Chicago: University of Chicago Press, 1970); and Valery N. Soyfer, *Lysenko and the Tragedy of Soviet Science* (New Brunswick, NJ: Rutgers University Press, 1994). On Vygotsky, see Alex Kozulin, *Vygotsky's Psychology: A Biography of Ideas* (Cambridge, MA: Harvard University Press, 1990).

21. Gerovitch, *From Newspeak to Cyberspeak*, 115–19. On Vygotsky, see Alex Kozulin, *Vygotsky's Psychology: A Biography of Ideas* (Cambridge, MA: Harvard University Press, 1990).

22. Sergei N. Khrushchev, *Nikita Khrushchev and the Creation of a Superpower* (University Park: Pennsylvania State University Press, 2000), 94–96, 163–73.

23. George Paloczi-Horvath, *Khrushchev: The Making of a Dictator* (New York: Little, Brown and Company, 1960), 202.

24. Ibid.

25. Ibid., 80.

26. See David Holloway, "Physics, the State, and Civil Society in the Soviet Union," *Historical Studies in Physical and Biological Sciences* 100, no. 1 (1999), quoted in Gerovitch, *From Newspeak to Cyberspeak*, 15. See also Loren R. Graham, "How Robust Is Science under Stress," in *What Have We Learned*, 52–73.

27. Ivan Pavlov, *Conditioned Reflexes: An Investigation of the Physiological Activity of the Cerebral Cortex*, trans. and ed. G. V. Anrep (London: Oxford University Press, 1927). See also Pierre Dupuy, *On the Origins of Cognitive Science: The Mechanization of the Mind*, trans. M. B. DeBevoise (Cambridge, MA: MIT Press, 2009).

28. See Paul R. Josephson, *New Atlantis Revisited: Akademgorodok, the Siberian City of Science* (Princeton, NJ: Princeton University Press, 1997).

29. Gotthard Günther, "Cybernetics and Dialectical Materialism of Marx and Lenin," in *Computing in Russia* (Wiesbaden: Springer, 2001), 317–32; Stanislav Boguslavski, Henryk Grenievski, and Jerzy Szapiro, "Dialogi o cybernetyce," *Mysl filozoficzna* 4, no. 14 (1954): 158–212.

30. Peters, "From Cybernetics to Cyber Networks," 214–21.

31. Anatoliy Kitov, "Chelovek, kotoryi vynes kibernetiku iz sekretnoi biblioteki" (The man who brought cybernetics out of a secret library) (interview), *Komp'iuterra* 18, no. 43 (1996): 44–45.

32. Gerovitch, *From Newspeak to Cyberspeak*, 173–75.

33. Ibid., 176–80.

34. Kitov, "Chelovek," 44–45, quoted in Gerovitch, *From Newspeak to Cyberspeak*, 264.

35. Gerovitch, *From Newspeak to Cyberspeak*, 183.

36. Ibid., 173; see also Sergei L. Sobolev, Anatolii I. Kitov, and Aleksei A. Lyapunov, "Osnovnye cherty kibernetiki" (Basic features of cybernetics), *Voprosy filosofii* 141, no. 4 (1955): 136.

37. See also Paul N. Edwards, "The Machine in the Middle: Cybernetic Psychology and World War II" and "Computers and Politics in Cold War II," in *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: MIT Press, 1996), 175–208, 275–302.

38. Gerovitch, *From Newspeak to Cyberspeak*, 178.

39. Norbert Wiener, *Cybernetics, or Communication and Control in the Animal and the Machine* (Cambridge, MA: MIT Press, 1948).

40. For more on the idea of discursive renewability of new media, see Benjamin Peters and Deborah Lubken, "New Media in Crises: Discursive

Instability and Emergency Communication," in *The Long History of New Media*, ed. David W. Park et al. (New York: Peter Lang, 2011), 193–209.

41. My thanks to Andriy Ishchenko and an anonymous reviewer for this distinction.

42. Sobolev, Kitov, and Lyapunov, "Osnovnye cherty kibernetiki."

43. Ibid., 141–46.

44. Ibid., 147.

45. See Karel Čapek's excellent play *Rossum's Universal Robots*, trans. David Willie (Fairford, UK: Echo Library, 2010).

46. Sobolev, Kitov, and Lyapunov, "Osnovnye cherty kibernetiki," 148.

47. Ibid., 147.

48. Ibid.

49. Ibid.

50. More on Kolman's battles can be found in Loren Graham and Jean-Michael Kantor, *Naming Infinity: A True Story of Religious Mysticism and Mathematical Creativity* (Cambridge, MA: Belknap Press of Harvard University Press, 2009).

51. The basic insight to come to an intersection of important set theorists and religious mystics in Russia around the 1920s (Dmitri Egorov, Pavel Florensky, and Nikolai Luzhin) was the realization that neither infinity nor God could be defined, but both could be named. Graham and Kantor tell the full story in their fascinating account *Naming Infinity*.

52. David Joravsky, *The Lysenko Affair* (Chicago: University of Chicago Press, 1986), 361.

53. Graham and Kantor, *Naming Infinity*, 129.

54. Arnosht (Ernest) Kol'man, *My ne dolzhny byli tak zhit'* (We should not have lived that way) (New York: Chalidze Publications, 1982), 7, quoted in Graham and Kantor, *Naming Infinity*, 130.

55. Ernest Kolman, "Shto takoe kibernetika?" (What is cybernetics?), *Voprosy filosofii* 4 (1955): 148–59, quote at 148–49.

56. Ibid., 149.

57. Wiener had also studied briefly at Columbia under John Dewey in 1915 as well as worked as a consultant for the Statistical Research Group, supported by the National Defense Research Committee, based there in 1940.

58. Kolman, "Shto takoe kibernetika?," 150–57.

59. For more references on Aleksandr Bogdanov, see his *Tektologia: Vsyeobshcheiye organizatsionnaya nauka* (Tectology: a universal organizational science) (Moscow: Akademia Nauk, 1913–22). See also J. Biggart, P. Dudley, and F. King, eds., *Alexander Bogdanov and the Origins of Systems Thinking in Russia* (Brookfield, VT: Ashgate Publishing, 1998). On Stefan Odobleja, see Mihai Draganescu, *Odobleja between Ampere and Wiener* (Bucharest: Academia Republicii Socialiste Romania, 1981). See also Nicolae Jurcau, "Two Specialists in Cybernetics: Stefan Odobleja and Norbert Wiener, Common and Different Features," in *Twentieth World Congress of Philosophy* (1998), http://www.bu.edu/wcp/Papers/Comp/CompJurc.htm.

60. Helmut Dahm, "Zur Konzeption der Kybernetik im dialektischen Materialismus" (manuscript), 25, quoted in Günther, "Cybernetics," 317–32.

61. David Holloway, "Innovation in Science—the Case of Cybernetics in the Soviet Union," *Science Studies*, no. 4 (1974): 316.

62. Gerovitch, *From Newspeak to Cyberspeak*, 180.

63. Sobolev, Kitov, and Lyapunov, "Osnovnye cherty kibernetiki." Gerovitch's translation is quoted in Gerovitch, *From Newspeak to Cyberspeak*, 180.

64. Peter Galison, "The Ontology of the Enemy: Norbert Wiener and the Cybernetic Vision," *Critical Inquiry* 21, no. 1 (1994): 228–66.

65. John A. Armstrong, "Sources of Administrative Behavior: Some Soviet and Western European Comparisons," *American Political Science Review* 59, no. 3 (1965): 643–55.

66. Quoted in Flo Conway and Jim Siegelman, *Dark Hero of the Information Age: In Search of Norbert Wiener, the Father of Cybernetics* (New York: Basic Books, 2006), 316.

67. CIA Intelligence Memorandum No. 0757/64, "The Meaning of Cybernetics in the USSR," February 26, 1964, 2. Also partially quoted in Conway and Siegelman, *Dark Hero*, 316.

68. CIA Intelligence Memorandum No. 0757/64, 3. Like All-Union conferences, this one was sponsored by a vertical line of authority, including, in this case, the Cybernetics Council, the Scientific Council on Philosophical Questions of Natural Science, and the Party Committee, all of the Presidium, Academy of Sciences, USSR.

69. Slava Gerovitch, "The Cybernetics Scare and the Origins of the Internet," *Baltic Worlds* 2, no. 1 (2009): 32–38, http://balticworlds.com/the-cybernetics-scare-and-the-origins-of-the-internet/.

70. D. G. Malcolm, "Review of Cybernetics at [*sic*] Service of Communism, vol. 1," *Operations Research* 11 (1963): 1012.

71. CIA Intelligence Memorandum No. 0757/64; see also Gerovitch, "The Cybernetics Scare," 32–38.

72. Gerovitch, "The Cybernetics Scare."

73. See Slava Gerovitch, "Soviet InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network," *History and Technology* 24, no. 4 (2008): 335–50, 340.

74. Gerovitch, *From Newspeak to Cyberspeak*, 249–51.

75. Igor A. Poletaev, "O matematicheskom modelirovnanii," *Problemy kibernetiki* 27 (1973): 147.

76. Igor A. Poletaev, "Kopredeleniiu poniatiia 'informatsiia,'" in *Issledovanniia po kibernetike*, ed. A. Lyapunov (Moscow: Sovetskoe radio, 1970), 212.

77. Gerovitch, *From Newspeak to Cyberspeak*, 216.

78. Simon Kassel, *Soviet Cybernetics Research: A Preliminary Study of Organizations and Personalities* (Santa Monica, CA: RAND, 1971), v.

79. See Wiener's *Cybernetics* and his *The Human Use of Human Beings: Cybernetics and Society* (Cambridge, MA: MIT Press, 1950).

80. Gerovitch, *From Newspeak to Cyberspeak*, 208.

81. Ibid., 209–10, 8.

82. Ibid., 210.

83. D. A. Pospelov and Ya. I. Fet, eds., *Ocherki istorii informatiki v Rossii* (Essays on the history of computer science in Russia) (Novosibirsk: Nauka RAS, 1998), http://ssd.sscc.ru/PaCT/history/early.html.

84. Boris Malinovskii, *Istoriia vychislitel'noi tekhniki* (The history of computational technology) (Kiev: Kit, 1995), 43. Translated into English as *Pioneers of Soviet Computing*, trans. and ed. Anne Fitzpatrick, http://sovietcomputing.com.

85. After rising to become the second-largest economy and the largest producer of oil, steel, cement, and machine tools in the world, the Soviet Union experienced significant drops in industrial growth rates in the 1970s, eventually leading Gorbachev to initiate *perestroika* and *glasnost* reforms in the mid-1980s. In the auto manufacturing capital of Gorky, the same equipment that was state of the art upon installation in the 1930s was still being used in the 1970s; the mammoth steel mill of Magnitogorsk, modeled after the River Rouge plant in Detroit, stagnated into a rust belt; and the nuclear power plants degraded to the point that Chernobyl in 1986 proved the worst nuclear power plant disaster in history. These and other examples are taken from Graham, *Science in Russia*, 251.

86. Mike Hally, *Electronic Brains: Stories from the Dawn of the Computer Age* (New York: Joseph Henry Press, 2005), 140.

87. Graham, *Science in Russia*, 259.

88. For further reading, see Asaf Assidiqi, *The Red Rockets' Glare: Spaceflight and the Soviet Imagination, 1857–1957* (Cambridge: Cambridge University Press, 2010).