THE CYBERNETICS SCARE AND THE ORIGINS OF THE INTERNET

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In the late 1950s, as Soviet society began to shed the legacy of Stalinism, science and engineering became new cultural icons. The new, post-Stalin generation was fascinated with Sputnik, nuclear power stations, and electronic digital computers. The popular image of an objective, truth-telling computer became a vehicle for a broad movement among scientists and engineers calling for reform in science and in society at large. Under the banner of cybernetics, this movement attacked the dogmatic notions of Stalinist science and the ideology-laden discourse of the Soviet social sciences.

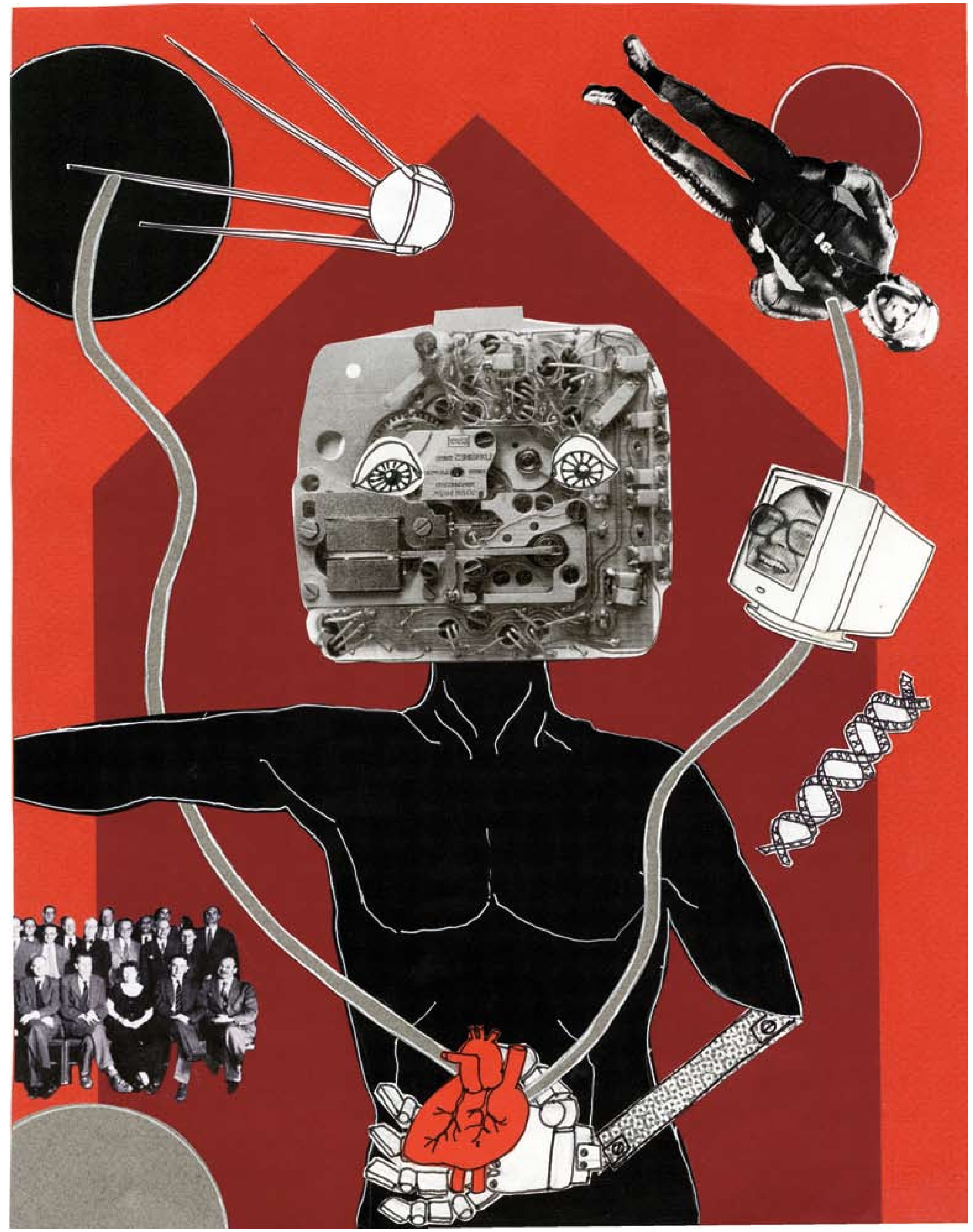
Proposed originally in 1948 by the American mathematician Norbert Wiener as a science of control and communication in the animal and the machine,[1] cybernetics acquired a much wider interpretation in the Soviet context. Soviet cyberneticians aspired to unify diverse cybernetic theories elaborated in the West – control theory, information theory, automata studies and others – in a single overarching conceptual framework, which would serve as the foundation for a general methodology applicable to a wide range of natural and social sciences and engineering.[2]

The more Soviet society departed from Stalinism, the more radical the cybernetic project became. Step by step, Soviet cyberneticians overturned earlier ideological criticism of mathematical methods in various disciplines, and put forward the goal of "cybernetization" of the entire science enterprise. Under the umbrella of cybernetics, scientific trends that had been suppressed under Stalin began to emerge under new, cybernetic names, and began to defy the Stalin-era orthodoxy. "Biological cybernetics" (genetics) challenged the Lysenkoites in biology, "physiological cybernetics" opposed the Pavlovian school in physiology, and "cybernetic linguistics" (structuralism) confronted traditional comparative philology and historical linguistics. Soviet cybernetics enthusiasts set the goal of achieving a comprehensive "cybernetization" of modern science by representing the subject of every discipline in a unified, formalized way and by moving toward a synthesis of the sciences. They aspired to translate all scientific knowledge into computer models and to replace the ideology-laden, "vague" language of the social and life sciences with the "precise" language of cybernetics.

The global aspirations of Soviet cybernetics drew on the rich and seemingly universal cybernetic language, which I call "cyberspeak". It emerged in the "cybernetics circle" of Wiener and his colleagues, as they met regularly over the course of ten meetings sponsored by the Macy Foundation in 1946-1953. The participants of these meetings included mathematicians, engineers, philosophers, neurophysiologists, psychiatrists, psychologists, biologists, linguists, and social scientists, among them Claude Shannon, John von Neumann, Warren McCulloch, William Ross Ashby, Roman Jakobson, and Gregory Bateson.[3]

The cyberneticians put forward a wide range of human-machine analogies: the body as a feedback-operated servomechanism, life as an entropy-reducing device, man as an information source, human communication as transmission of encoded messages, the human brain as a logical network, and the human mind as a computer. This assembly of mathematical models, explanatory frameworks, and appealing metaphors presented a rather chaotic and eclectic picture. What held it together was a set of interdisciplinary connections: the same mathematical theory described feedback in control engineering and noise reduction in communication engineering; information theory was linked to thermodynamics, as information was equated with "negative entropy"; information was interpreted as a measure of order, organization, and certainty, while entropy was associated with chaos, noise, and uncertainty; brain neurons were modeled as logical elements; and thinking was likened to computation.

Norbert Wiener. Wunderkind, who died at the entrance to the Royal Institute of Technology in Stockholm.



During the Cold War, the Soviets lauded the coming capabilities of cybernetics. And people were scared to death of it.

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Cyberneticians combined concepts from physiology (*homeostasis*), psychology (*behavior* and *goal*), control engineering (*control* and *feedback*), thermodynamics (*entropy* and *order*), and communication engineering (*code*, *information*, *signal*, and *noise*), and generalized each of them to be equally applicable to living organisms, self-regulating machines (such as servomechanisms and computers), and human society. In their view, machines, organisms, and human society were all seen as *self-organizing control systems*, which, *operating* in a certain *environment*, pursued their *goals* (hitting a target, increasing *order*, achieving better *organization*, or reaching the state of *equilibrium*) by *communicating* with this environment, that is, sending *signals* and receiving *information* about the results of their actions through *feedback* loops.

machine	human	society
signal	communication	free press
information	meaning	free speech
system	physiology	economy
self-organization	homeostasis	democracy
regulation	thinking	management
computer	brain	government

Upon its publication in 1948, Wiener's *Cybernetics* gained enormous popularity. *The New York Times* called it one of the most influential books of the twentieth century, comparable in significance to the works of Galileo, Malthus, Mill, or Rousseau. Cybernetics promised solutions to a wide range of social, biological, and technological problems through information processing and feedback control. Complex social and biological phenomena looked simpler and more manageable when described in cybernetic terms. Masking the differences in the nature and scale of those phenomena, the common cybernetic language allowed one to use the same mathematical techniques across a wide range of disciplines. When translated into cyberspeak, biological, technological, and social problems all seemed to have similar – cybernetic – solutions. Taking cybernetic metaphors literally, many biologists and social scientists pushed the boundaries of cybernetics even further than Wiener and his colleagues originally envisioned.

With the wide introduction of electronic digital computers, Wiener's original parallels between thinking and analog computing expanded to include digital computers. Speaking of human thought as computation and describing digital computers in anthropomorphic terms as "giant brains"[4] became two sides of the same coin, brought into wide circulation by cybernetics. *Scientific American* published an accessible account of cybernetics under the provocative title "Man Viewed as a Machine"[5]; and philosopher Frank H. George threw a challenge to the readers of the English journal *Philosophy*: "you can't tell me anything that your wife can do that a machine can't (in principle)".[6] Political scientists spoke of the cybernetic "nerves of government",[7] engineers, economists, and journalists described the bright technological future populated with intelligent robots,[8] and business consultants began to sell "management cybernetics".[9]

Ironically, Wiener, who was hailed as a prophet of the new age of automatic machinery, held ambivalent views about the social implications of cybernetics. He regarded automatic machines as both "threat and promise".[10] Wiener proclaimed the advent of the "second industrial revolution", which would bring about fully automated factories running without human agency. This revolution, in his view, carried "great possibilities for good and for evil".[11] Cybernetic techniques and technologies, he argued, "open to us vistas of a period of greater plenty than the human race has ever known", although they create at the same time the possibility of a more devastating level of social ruin and perversion than any we have yet known".[12] Wiener warned that automation was "bound to devalue the human brain".[13] "The skilled scientist and the skilled administrator may survive", he wrote, but "the average human being of mediocre attainments or less has nothing to sell that it is worth anyone's money to buy."[14] Wiener was deeply critical of capitalist America. He did not believe in the ability of the "invisible hand" of free market to establish an economic and social equilibrium, or *homeostasis* in cybernetic terms. His social outlook was overtly pessimistic: "There is no homeostasis whatever. We are involved in the business cycles of boom and failure, in the successions of dictatorship and revolution, in the wars which everyone loses."[15]

Cybernetics, in Wiener's view, provided hope for social change. Two years after *Cybernetics*, he published the book *The Human Use of Human Beings: Cybernetics and Society*, in which he developed a cybernetic critique of the pervasive controls over social communication under McCarthyism in America and under Stalinism in Russia. He believed that describing society in cybernetic terms as a self-regulating device would make it clear that controlling the means of communication was "the most effective and most important" anti-homeostatic factor, which could drive society out of equilibrium.[16] Wiener noted that on both sides of the Atlantic "political leaders may attempt to control their populations" by manipulating information flows, and argued that "it is no accident that Russia has had its Berias and that we have our McCarthys".[17] His views of capitalism and communism were best summarized by his colleague and friend Dirk Struik: "plague on both your houses".[18]

It was profoundly ironic – and illustrated the limited power of the creator over his creation – that both of these "houses" became fascinated with cybernetics. The promise of universality of the cybernetic approach was alluring; the unlimited applicability of cybernetics evoked the image of unlimited power. But even greater than the allure of cybernetics was the fear that cybernetics might become a weapon in the hands of the other side in the Cold War.

In the early 1950s, on the wave of Stalinist ideological campaigns against Western influence in Soviet science, the Soviet academic and popular press attacked cybernetics as "a modish pseudo-science" and "a reactionary imperialist utopia". Soviet critics used all tools in their rhetorical arsenal: philosophical arguments (accusing cybernetics of both idealistic and mechanistic deviations from dialectical materialism), sociological analysis (labeling cybernetics "a technocratic theory" whose goal was to replace striking workers with obedient machines), and moral invectives (alleging that cyberneticians aspired to replace conscience-laden soldiers with "indifferent metallic monsters"). Like any propaganda, the anti-cybernetics discourse was full of contradictions. Critics called cybernetics "not only an ideological weapon of imperialist reaction but also a tool for accomplishing its aggressive military plans", thus portraying it both as a pseudo-science and as an efficient tool in the construction of modern automated weapons.

Khrushchev's political "thaw" after years of Stalin's rule opened the gates for liberalization in the scientific community, and cybernetics was quickly rehabilitated. Soviet cyberneticians radically expanded the boundaries of cybernetics to include all sorts of mathematical models and digital computer simulations. Cybernetics became synonymous with computers, and computers synonymous with progress. In October 1961, just in time for the opening of the Twenty-Second Congress of the Communist Party, the Cybernetics Council of the Soviet Academy of Sciences published a volume appropriately entitled *Cybernetics in the Service of Communism*. This book outlined the great potential benefits of applying computers and cybernetic models to problems in a wide range of fields, from biology and medicine to production control, transportation, and economics.

A large number of previously marginalized research trends found a niche for themselves under the aegis of the Academy Council on Cybernetics, including mathematical economics, which was refashioned into "economic cybernetics". The entire Soviet economy was interpreted as "a complex cybernetic system, which incorporates an enormous number of various interconnected control loops". Conceptualizing the Soviet economy in cybernetic terms, economic cyberneticians regarded economic planning as a giant feedback system of control. Economic cyberneticians aspired to turn the Soviet economy into a fully controllable and optimally functioning system by managing its information flows. Soviet cyberneticians proposed to optimize the functioning of this system by creating a large number of regional computer centers to collect, process, and redistribute economic data for efficient planning and management. Connecting all these centers into a nationwide network would lead to the creation of "a single automated system of control of the national economy".[19]

The new Party Program adopted at the Twenty-Second Congress included cybernetics among the sciences that were called upon to play a crucial role in the construction of the material and technical basis of communism. The new Program vigorously asserted that cybernetics, electronic computers, and control systems "will be widely applied in production processes in industry, building, and transport, in scientific research, planning, designing, accounting, statistics, and management". The popular press began to call computers "machines of communism".

"However unusual this may sound to some conservatives who do not wish to comprehend elementary truths, *we will be building communism on the basis of the most broad use of electronic machines*, capable of processing enormous amounts of technological, economic, and biological information in the shortest time", proclaimed Engineer Admiral Aksel' Berg, Chairman of the Academy Council on Cybernetics in 1962. "These machines, *aptly called 'cybernetic machines', will solve the problem of continuous optimal planning and control*."[20]

Despite the lofty rhetoric of cybernetics enthusiasts, Soviet government officials remained skeptical about the prospects for a radical nationwide reform of economic management. The potential computerization of economic decision-making threatened the established power hierarchy and faced stubborn opposition at all levels of Soviet bureaucracy. Through an endless process of reviews, revisions, and reorganizations, Soviet government agencies were able to slow down the cybernetic reform and eventually brought it to a halt.[21] As the idea of an overall economic reform withered away, so did the plans for a nationwide computer network, which no longer had a definite purpose.[22]

Yet the vociferous media campaign launched by Soviet cybernetics advocates caused serious concern in Washington. "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", wrote an American reviewer of *Cybernetics in the Service of Communism*. He warned that cybernetics "may be one of the weapons Khrushchev had in mind when he threatened to 'bury' the West".[23] The CIA set up a special branch to study the Soviet cybernetics menace.[24]

CIA analysts apparently confused Soviet cyberneticians' unbridled enthusiasm with actual government policy. The CIA task force on Soviet cybernetics reported that "Soviet policy makers took up the cybernetic methodology on an unprecedented scale". The task force warned that "tremendous increments in economic productivity as the result of cybernetization of production may permit disruption of world markets" on an unprecedented scale. In August 1961, senior CIA research staff reported that the Soviets were ready to apply cybernetic control techniques "not only for the natural sciences and the economy but for the shaping of society as a whole".[25] The cybernetic methodology of automated education was aimed at bringing up the "New Communist Man". "The creation of a model society and the socio-economic demoralization of the West will be the added ideological weapon", concluded CIA analysts.[26]

On October 15, 1962, John J. Ford, head of the special CIA task force on Soviet cybernetics, made an informal presentation to Attorney General Robert F. Kennedy and other top government officials at the house of Secretary of Defense Robert S. McNamara. Ford captivated the audience by touting "the serious threat to the United States and Western Society posed by increasing Soviet commitment to a fundamentally cybernetic strategy in the construction of communism". Everything went well until the presentation was interrupted by the news of Soviet missiles discovered in Cuba.

Even as the Cuban Missile Crisis unfolded, top Kennedy administration officials requested more information from Ford on Soviet cybernetics. On October 17, Ford submitted a summary of his unfinished talk to Arthur Schlesinger, Jr., President Kennedy's Special Assistant. Speaking as a private citizen (the CIA did not take an official position on Soviet cybernetics), Ford warned that "the Communists have a Bloc-wide program devoted to research, development and application of cybernetics to insure the outcome of the East-West conflict in their favor, whereas the U.S. has neither a program, nor a philosophy for developing cybernetics toward attainment of national objectives". "Persistent disregard of this aspect of Soviet strategy", concluded Ford, "amounts to arbitrary neglect of the central intentions of the enemy and unwitting compliance with his principal strategy for world communization."[27]

Three days later, with the missile crisis in full swing, the cybernetics scare crept up the ladder of the Kennedy administration. Schlesinger wrote to Robert F. Kennedy that the "all-out Soviet commitment to cybernetics" would give the Soviets "a tremendous advantage". Schlesinger warned that "by 1970 the USSR may have a radically new production technology, involving total enterprises or complexes of industries, managed by closed-loop, feedback control employing self-teaching computers". If the American negligence of cybernetics continues, he concluded, "we are finished".[28]

In November 1962, as soon as the missile crisis abated, Schlesinger raised the Soviet cybernetics issue with the President himself. President Kennedy then asked his Science Advisor Jerome Wiesner to set up a cybernetics panel to "take a look at what we're doing compared to what they're doing, and what this means for the future".[29]

Wiesner had headed the Department of Electrical Engineering at MIT; he was well familiar with cybernetics, and regarded Norbert Wiener as his mentor. Wiesner gathered top experts in the field. The prominent MIT biophysicist Walter Rosenblith chaired the panel, which also included physiologist William Ross Adey, psychologist George Miller, electronics engineer John Pierce, mathematician John Tukey, computer scientists Peter Elias and Willis Ware, and mathematical economists Leonid Hurwicz and Kenneth Arrow. The panel met several times in 1963 until the Kennedy assassination and Wiesner's subsequent resignation put an end to this study.[30]

And in the U.S., Wiener appeared to be a critic of capitalism.

The Cold War qua illness: The Kennedy administration was afflicted with the cybernetics scare.

An apocalyptic vision of a fundamental transformation of the Soviet system along the lines of cybernetics was expressed in a manuscript entitled "The Communist Reformation", which Wiesner received in February 1963. "Cybernetics became *officially* the primary science in the Soviet Union" and "the veritable spearhead of 'Communist Reformation'", claimed the author, the Hungarian émigré George Paloczi-Horvath. "The rise of primacy of cybernetics in all branches of Soviet administration, economy, industry and science started to change the Communist system of governing and control itself." "If a new crash programme is not adopted very soon", warned Paloczi-Horvath, "in the late nineteen sixties and the early nineteen seventies instead of the missile gap, American and Western public opinion will be worried by the 'computer-gap', and the 'programmer-gap'."[31] Although Wiesner believed that the idea of an emerging "cybernetics gap" was "ridiculous in the extreme",[32] he did sponsor Paloczi-Horvath's further research and the publication of his revised manuscript.[33]

In the meantime, the CIA continued to sound the alarm. In February 1964, the CIA issued a secret report on Soviet cybernetics, mentioning, among other strategic threats, the Soviet plans to build a "Unified Information Net". The CIA circulated the report to a hundred people in the Defense Department, the State Department, the Atomic Energy Commission, the National Security Agency, NASA, and other government agencies.[34] In November 1964, at a conference at Georgetown University, Ford publicly presented a paper surveying Soviet cybernetics and predicting that the development of new information techniques in government might become the battlefield for "a new kind of international competition during the next 15 years".[35] His public call seriously alarmed some military officials. The Commander of the Foreign Technology Division of the U.S. Air Force Systems Command concluded: "Unless we Americans as a people, and we in the Air Force in particular, understand these momentous trends, we may not have much choice. The system could be imposed upon us from an authoritarian, centralized, cybernated, world-powerful command and control center in Moscow."[36]

CIA analysts wildly overestimated the Soviet cybernetics threat. A 1964 CIA report suggested that "architects and engineers are now drawing up technical plans for the center of the USSR's 'automated economic information system' to be located in Moscow on a site already selected".[37] Indeed, the Central Economic Mathematical Institute, created in Moscow in 1963 to develop the concept of a computerized nationwide economic management system, had no building of its own, and its staff was crammed in a few rooms with no computer facilities. The construction of a new building took more than 10 years; it was completed only in the mid-1970s. A 1965 report warned that a decentralized network of "satellite" computer centers was being created, in which the output of information processing in one center was cross-fed into other satellite centers and into a central computer. The report alleged that these satellite centers would be interconnected on a regional basis by 1967.[38] A 1966 report claimed that "the Unified Information Network was the most significant planned application of cybernetics discussed during 1965". The CIA identified 350 computer centers that "might become nodes" in the "'nervous system' of the Soviet Government".[39]

In fact, the Soviet Union suffered from acute shortage of computers. In 1968 there were only 9 computers in the entirety of Lithuania.[40] The few lucky organizations that managed to obtain a computer held tight control over its use and had no intention to share it with outsiders. The so-called computer centers rarely had

THE LEGACY OF WIENER DURING AND AFTER THE CONFLICT BETWEEN THE TWO SOCIAL SYSTEMS

Those who have suggested that cybernetics died in connection with the end of the Cold War need to revise their views. Cybernetics is very much alive, although it has evolved under new conditions. The cybernetics phenomenon was elucidated in November of 2008, in Stockholm, when, for two days, some seventy researchers were focused on addressing the cybernetic heritage and its relevance today.

THE FIRST DAY OF THE conference included seven lectures which in various ways illuminated and problematized the history and future of cybernetics, as well as the way in which varying conditions have pushed its development in different directions. Andrew Pickering, from the University of Exeter, critically examined the British experience, and showed that the matter occupied more than simply the key players in the conflict between the two systems. Slava Gerovitch from MIT surveyed cybernetics from an East-West perspective — the essay in this issue of BW is a reworked version of his presentation for the conference. The relationship between bioethics and cybernetics was discussed by Joanna Zylinska from the University of London, while the relationship between cybernetics and systems theory was interrogated by Vessel Misheva from Uppsala University. Jasia Reichardt spoke of how she, in 1960s London, was part of the rebellious art world and how cybernetics was part of the concretist creative universe of artists and poets of that time.

THESE LECTURES TOOK place in the interior of the Nobel Museum. They were monitored from the ceiling by a stream of images of Nobel Prize laureates which slowly moved over the participants in an ingenious technical design

THE SECOND DAY of the conference, at Södertörn University, consisted of short presentations by approximately twenty researchers primarily from Europe, the U.S., and Russia. Mathematician Norbert Wiener (1894–1964) is often claimed to be the father of cybernetics. He died suddenly during a visit in Stockholm in the middle of the Cold War. It is said that this took place on the stairs leading up to the Royal Institute of Technology. The Stockholm conference could be seen as a belated tribute to Wiener, 45 years after his death. ≈

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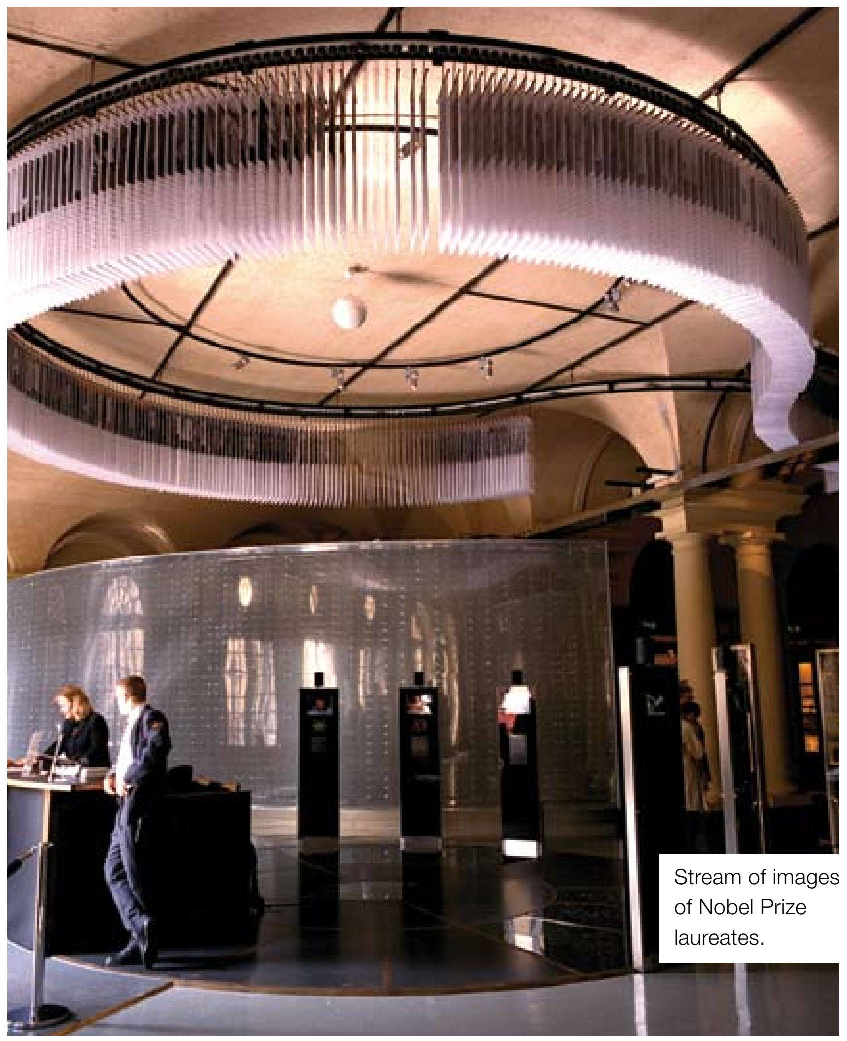

Stream of images of Nobel Prize laureates.

more than one machine and were not linked to any network. In 1967 the Central Economic Mathematical Institute received its very first computer, Ural-14B, a slow, unreliable machine with small memory, totally unsuitable for large-scale information processing. Lacking its own building, the Institute installed the computer in a local high school. The first "network" the Institute developed consisted of two computers. This was a forced measure: since the capabilities of Ural-14B were so limited, the Institute linked it to the more powerful BESM-6 computer, located at the Institute's Leningrad branch, to enable running a few experimental simulations. In the mid-1960s, Soviet cybernetic economists tried to persuade the leadership of the Ministry of Defense, which was building its own network, to convert it to dual use. The reply was curt: "We are getting as much money for technological development as we ask for. You are getting nothing. If we cooperate, neither of us will get any money."[41] With the lack of political and financial support, the Institute soon dropped the automated economic management information system from its research agenda and focused on the development of optimal mathematical models. Practical reform was supplanted by optimization on paper.

Though short-lived, the Wiesner panel made a sober evaluation of Soviet cybernetics. The leading economist on the panel, the future Nobel laureate Kenneth Arrow, dismissed Soviet efforts at mathematical economic planning as "no more that the aggregate of operations research work being done in the United States by industrial corporations". He stressed that even though the Soviets were collecting extensive economic data, "nobody has really been able to figure out how to make good use of this enormous pile of material". Arrow was highly skeptical of the claims of computer-based rationality and argued that even if the United States could "computerize our political decision-making", the economy would not achieve "perfect stability". He concluded that a much more efficient economic policy could be worked out simply by improving intelligence, while computers might serve merely as "a mystical symbol of accuracy".[42] In 1964, soon after leaving his position as President's Science Advisor, Wiesner visited the Soviet Union to see the fruits of what he called the "cybernetics binge"[43] for himself. The only modern automated production facility he could find was a champagne bottling plant.[44]

Herbert Simon, another future Nobel laureate in economics and a leading artificial intelligence expert, was also involved in the work of the cybernetics panel. He later recalled how the CIA had submitted a thick report to President Kennedy about an alleged "great Soviet plot to conquer the world with cybernetics. [...] Alas, our panel was too honest. If we had reported back to Wiesner that the Soviet cybernetics project was genuinely dangerous, American research in artificial intelligence would have had all the funding it could possibly use for years to come. Putting temptation behind us, we reported that the CIA document was a fairy story – as events proved it to be."[45]

Whether the panelists were able to put the temptation behind or not, U.S. research in artificial intelligence did receive a very significant boost at the time. Starting in 1963, the Information Processing Techniques Office (IPTO) at the Defense Department's Advanced Research Projects Agency (ARPA) lavishly funded Project MAC at MIT and other artificial intelligence initiatives. "It was heaven", MIT's Marvin Minsky recalled. "It was your philanthropic institute run by your students with no constraints and no committees. Of course there was no way to spend that much money, so we built some machines and for the next few years I never had to make any hard decisions whether to fund one project or another because we could just do both."[46]

The head of IPTO, MIT psychologist J. C. R. Licklider, had a longtime interest in cybernetics. "There was tremendous intellectual ferment in Cambridge after World War II", he recalled. "Norbert Wiener ran a weekly circle of 40 or 50 people who got together. They would gather together and talk for a couple of hours. I was a faithful adherent to that." Licklider audited Wiener's lectures and became part of a faculty group at MIT that "got together and talked about cybernetics". "I was always hanging onto that", he remembered. Licklider closely collaborated with George Miller and Walter Rosenblith, future members of Wiesner's cybernetics panel. While at MIT, Licklider was also very close to Wiesner, and when the latter became President Kennedy's Science Advisor, Licklider was appointed the head of a panel on scientific and technical communications. Licklider thus divided his time between ARPA and Wiesner's Office of Science and Technology, to some chagrin on the part of his Pentagon bosses.[47]

Licklider's combined interest in psychology, computing, and communications helped him conceptualize the computer as a communication device, rather than merely a big calculator. In his 1960 article, "Man-Computer Symbiosis", he outlined his vision of a network of "thinking centers", multi-user computer timesharing systems, which would "incorporate the functions of present-day libraries together with anticipated advances in information storage and retrieval and [man-computer] symbiotic functions".[48] Licklider's biological metaphor of "symbiosis" echoed the cybernetic blurring of human-machine boundaries. As Licklider's article achieved the status of a "unifying reference point" in computer science and artificial intelligence, it spread the cybernetic vision (without using the term) throughout these disciplines.[49]

The cybernetic concept of communication transcended the boundary between human and machine. In the cybernetic world, people could communicate via and with computers, eventually forming seamless human-computer communication networks. Licklider vigorously promoted human-computer interaction to Pentagon officials. "The problems of command and control were essentially problems of man-computer interaction. I thought it was just ridiculous to be having command control systems based on batch processing", he recalled. "Every time I had the chance to talk, I said the mission is interactive computing."[50] The IPTO funded a plethora of projects around the United States, and each group developed its own time-sharing computing system, incompatible with others. Licklider jokingly named this conglomerate of research groups the Intergalactic Computer Network. In 1963, he sent a memo to members of this informal social network, urging them to standardize their systems so that data could be communicated from one system to another. "Consider the situation in which several different centers are netted together", he wrote, arguing that it was important "to develop a capability for integrated network operation".[51]

Russian abacuses were in use well into the Internet Age.

In 1968, Licklider co-authored the article "The Computer as a Communication Device" with Robert Taylor, the head of IPTO in 1965–69. Under Taylor, the IPTO took practical steps to unite "digitally isolated" research groups into a "supercommunity" by developing the ARPANET, which eventually evolved into the Internet.[52]

Historian Paul Edwards has argued that "cyborg discourse", which blurred the boundary between human and machine, blended with the Cold War "closed world" discourse, which represented the world as amenable to computer simulation, manipulation, and control. "Cyborg discourse functioned as the psychological/subjective counterpart of closed-world politics", he writes. "Where closed-world discourse defined the architectures of a political narrative and a technological system, cyborg discourse molded culture and subjectivity for the information age."[53] Ironically, cyborg discourse achieved its triumph at the cost of erasing its roots in Wiener's cybernetic vision. Wiener's reso-

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Several Nobel Prize laureates were drawn into the attempt to create a defense against the cybernetics threat.

lute pacifist stance after Hiroshima brought him under close FBI watch and cast a shadow of suspicion over his ideas. The subsequent cybernetics scare in the United States further tinged this field with the red of communism, and set hurdles for federal funding of cybernetics research. "They wanted to chase out cybernetics as fast as they could", recalled the leading cybernetician Heinz von Foerster. "It was not suppressed, but they neglected it."[54] Although the ARPANET originated in the context of cybernetic analogies between human and computer communication, its cybernetic genealogy was obliterated.

While in the Soviet Union cyberspeak dominated scientific discussions, cyborg discourse in the United States seeped through culture and became universally accepted to the point of being invisible. American scientists talked in cyberspeak and didn't even realize it, just as Monsieur Jourdain in Molière's play did not realize he was speaking in prose. The initial ARPANET goals were very humble – to share computing resources among research groups – and dissociated from the explicit cybernetic vision of society as a feedback-regulated mechanism. Perhaps precisely for this reason it proved feasible, while the grand designs of Soviet cyberneticians to build a nationwide computer network to regulate the entire national economy ran into insurmountable political obstacles.

The Internet – the ultimate cybernetic machine – has weaved together humans and computers, control and communication, information and free speech. Just as Wiener envisioned, digital communication can be used both to liberate and to control, and authoritarian governments still try to limit free circulation of information. Artificial organs, online avatars, and ubiquitous computing have made cybernetic human-machine metaphors almost literal. Wiener's cybernetic vision of society based on free exchange of information has become (cyber)reality on the World Wide Web.

This story is profoundly ironic: America rejected cybernetics but implemented the cybernetic vision, while the Soviet Union did just the opposite: it paid lip service to cybernetics and stalled practical cybernetic projects. The cybernetics scare both focused the attention of U.S. science administrators on human-machine interaction and made explicit cybernetic references ideologically suspect. As a result, Americans pursued a narrowly defined but viable technical project, while the Soviets aimed at a utopian grand reform. This teaches us something about the power of discourse: it resides not so much in overt declarations but in subtle metaphors that change our mode of thinking and ultimately reshape our world. ≈

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REFERENCES

1 Norbert Wiener, *Cybernetics, or Control and Communication in the Animal and the Machine*, Cambridge, Mass. 1948.
2 See Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics*, Cambridge, Mass. 2002.
3 See Heims, *Constructing a Social Science for Postwar America: The Cybernetics Group*, 1946-1953, Cambridge, Mass. 1993.
4 See Edmund C. Berkeley, *Giant Brains, or Machines that Think*, New York 1949.
5 See John G. Kemeny, "Man Viewed as a Machine", *Scientific American*, vol. 192 (April 1955), pp. 58-67.
6 Frank H. George, "Could Machines Be Made to Think?", *Philosophy*, vol. XXXI, no. 118 (July 1956), p. 252.
7 See Karl W. Deutsch, *The Nerves of Government: Models of Political Communication and Control*, London 1963.
8 See *Automatic Control*, New York 1955.
9 See Stafford Beer, *Cybernetics and Management*, New York 1959, and *Decision and Control: The Meaning of Operational Research and Management Cybernetics*,London 1966.
10 Norbert Wiener, "The Machine as Threat and Promise" (1953), in Wiener, *Collected Works*, vol. IV, pp. 673-78.
11 Wiener, *Cybernetics*, p. 28.
12 Wiener, "The Machine as Threat and Promise", p. 677.
13 Wiener, *Cybernetics*, p. 27.
14 Ibid., p. 28.
15 Ibid., p. 159.
16 Ibid., p. 160.
17 Norbert Wiener, *The Human Use of Human Beings: Cybernetics and Society* [1950, 1954], New York, pp. 181, 192.
18 Quoted in Steve J. Heims, *John von Neumann and Norbert Wiener: From Mathematics to the Technologies of Life and Death*, Cambridge, Mass., p. 311.
19 Anatolii Kitov, "Kibernetika i upravlenie narodnym khoziaistvom", in Aksel' Berg, ed., *Kibernetiku – na sluzhbu kommunizmu*, vol. 1, Moscow and Leningrad: Gosenergoizdat, 1961, pp. 207, 216.
20 Aksel' Berg, "Kibernetika i nauchno-tekhnicheskii progress", in Aleksandr Kuzin, ed., *Biologicheskie aspekty kibernetiki*, Moscow 1962, p. 14 (emphasis in original).
21 Gerovitch, *From Newspeak to Cyberspeak*, chap. 6. – On the frustrated attempts to introduce automated management systems into economic governance in Lithuania, see Egle Rindzevičiute, *Constructing Soviet Cultural Policy: Cybernetics and Governance in Lithuania after World War II*, Ph.D. dissertation, Linköping University, Sweden, 2008, pp. 125-148.
22 Slava Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a Nationwide Computer Network", *History and Technology* 24:4 (December 2008), pp.335-350.
23 D.G. Malcolm, Review of *Cybernetics at Service of Communism*, vol. 1, *Operations Research* 11 (1963), p. 1012.
24 Flo Conway and Jim Siegelman, *Dark Hero of the Information Age: In Search of Norbert Wiener, the Father of Cybernetics*, New York, p. 391.
25 CIA, Senior Research Staff on International Communism, "Soviet Communism in the Sixties: Some Notes on Its New Dimensions", 1 August 1961, p. 8.
26 John J. Ford to Arthur Schlesinger, Jr., 17 October 1962; Schlesinger Personal Papers, John F. Kennedy Library, Boston, Mass., box WH-7, "Cybernetics".
27 Ibid.
28 Arthur Schlesinger, Jr., to Robert F. Kennedy, 20 October 1962; Schlesinger Personal Papers, box WH-7, "Cybernetics".
29 John F. Kennedy, Dictating Memorandum, 28 November 1962; Presidential Recordings, John F. Kennedy Library, Boston, Mass., cassette J, dictabelt XXX.A.
30 1963 reports; Office of Science and Technology Papers, John F. Kennedy Library, Boston, Mass., roll 64.
31 György Pálóczi-Horváth, "The Communist Reformation", unpublished manuscript; Schlesinger Personal Papers, box WH-7, "Cybernetics".
32 Spurgeon Keeny, Jr., "The Search for Soviet Cybernetics", in *Jerry Wiesner: Scientist, Statesman, Humanist: Memories and Memoirs*, ed. Walter Rosenblith, Cambridge, Mass. 2003, p. 84.
33 George Paloczi-Horvath, *The Facts Rebel: The Future of Russia and the West*, London 1964.
34 Conway and Siegelman, *Dark Hero*, pp. 318, 330.
35 John J. Ford, "Soviet Cybernetics and International Development", in *The Social Impact of Cybernetics*, ed. Charles R. Dechert, New York 1966, p. 189.
36 Colonel Raymond S. Sleeper, "Cybernetics in the Service of Communism", *Air University Review* (March-April 1967) (http://www.airpower.maxwell.af.mil/airchronicles/aureview/1967/mar-apr/sleeper.html).
37 CIA Office of Scientific Intelligence, "The Meaning of Cybernetics in the USSR", Intelligence Memorandum No. 0757/64, 26 February 1964, p. 9.
38 CIA Office of Scientific Intelligence, "The Features of the Soviet Cybernetics Program Through 1963", Research Source Book No. OSI-RA/65-2, 5 January 1965, p. 13.
39 CIA Office of Scientific Intelligence, "Major Developments in the SovBloc Cybernetics Programs in 1965", Scientific and Technical Intelligence Report No. OSI-RA/66-29, 3 October 1966, pp. 2, 24.
40 Rindzeviciute, *Constructing Soviet Cultural Policy*, p. 146.
41 Nikolai Fedorenko, *Vspominaia proshloe, zagliadyvaiu v budushchee*, Moscow 1999, pp. 179, 228.
42 Kenneth J. Arrow to Walter W. Heller, 1 November 1962; Schlesinger Personal Papers, box WH-7, "Cybernetics".
43 Jerome Wiesner to Arthur Schlesinger, Jr., 25 February 1963; Schlesinger Personal Papers, box WH-7, "Cybernetics".
44 Keeny, Jr., "Search for Soviet Cybernetics", p. 86.
45 Herbert A. Simon, *Models of My Life*, New York 1991, pp. 295-296.
46 Quoted in Conway and Siegelman, *Dark Hero*, p. 321. – On IPTO funding of AI, see Arthur Norberg and Judy O'Neill, *Transforming Computer Technology: Information Processing for the Pentagon, 1962-1986*, Baltimore, Md. 1996.
47 J.C.R. Licklider, OH 150. Oral history interview by William Aspray and Arthur L. Norberg, 28 October 1988, Cambridge, Massachusetts. Charles Babbage Institute, University of Minnesota, Minneapolis. (http://www.cbi.umn.edu/oh/pdf.phtml?id=180).
48 J.C.R. Licklider, "Man-Computer Symbiosis", *IRE Transactions on Human Factors in Electronics*, vol. HFE-1 (March 1960), p. 7.
49 Paul N. Edwards, *Closed World: Computers and the Politics of Discourse in Cold War America*, Cambridge, Mass. 1996, p. 266.
50 J.C.R. Licklider, OH 150.
51 Quoted in Katie Hafner and Matthew Lyon, *Where Wizards Stay Up Late*. New York 1996, p. 38.
52 Janet Abbate, *Inventing the Internet*. Cambridge, Mass. 1999, p. 44; J.C.R. Licklider and Robert W. Taylor, "The Computer as a Communication Device", *Science and Technology* (April 1968), p. 31 (http://gatekeeper.dec.com/pub/DEC/SRC/publications/taylor/licklider-taylor.pdf).
53 Edwards, *Closed World*, pp. 2-3.
54 Quoted in Conway and Siegelman, *Dark Hero*, p. 321.

THE CYBERNETICS SCARE AND THE ORIGINS OF THE INTERNET

It is said that the Web turns 20 in 2009. Office telephones have become mute.