Perestroika of the History of Technology and Science in the USSR: Changes in the Discourse

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A great social reconstruction of Soviet society (*perestroika*) ended with the disappearance of the reconstructed object—the Soviet Union—in December 1991. Something else, however, was reconstructed: people's thinking—their attitude to socialism, to their history, and to themselves. Remarkable changes also emerged in Soviet research on the history of technology and science, both reshaping the thematic discourse and altering the methodological profile.

Soviet scholarship in the history of technology and science evolved along the lines of the political and social evolution of Soviet society: from sincere and enthusiastic belief in Marxism to degeneration of the Marxist theoretical framework into an instrument of rhetoric. By the mid-1980s, the time of perestroika, this evolution had resulted in an internalist methodology of research, ideological servility, limitations imposed on the sphere of discussion, and a scarcity of imaginative analysis.

The policy of openness (*glasnost'*) led to the weakening of ideological censorship and opened the doors of some previously inaccessible archives. New opportunities caused a drastic shift in the interests of Soviet scholars toward the recent history of Soviet technology and science. At the same time, the role of Marxist rhetoric began to decrease. Changes in research methodology developed more slowly, for they were touching deeper layers of the discourse. The process of

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revising dogmas and reevaluating historical attainments provoked a sharp methodological debate over fundamental issues concerning relations of technology and science to a sociopolitical context. For some Soviet historians, mostly of the older generation, perestroika consisted of merely changing heroes to villains and vice versa, while preserving the traditional image of technology and science as a largely autonomous enterprise. For others, mostly young historians, technology and science were seen as social activities deeply woven into the fabric of politics and culture. This difference stirred up traditional methodological presuppositions and caused an ongoing debate among proponents of internalist, externalist, and contextual styles.

In this article, I will examine methodological, thematic, temporal, geographic, and disciplinary changes in the discourse of Soviet historians of technology and science, basing my study on a quantitative analysis of the content of the journal *Voprosy Istorii Estestvoznaniia i Tekhniki* (Problems in the History of Science and Technology, hereafter *VIET*) during the perestroika period, 1986–91. *VIET* is the major (and the only academic) Russian journal in this area.[1] It is published in Moscow by the Institut Istorii Estestvoznaniia i Tekhniki (Institute for the History of Science and Technology, hereafter IIET), the leading Soviet (now Russian) institution in this field. A number of popular magazines publish articles on the history of technology and science as well, but they largely reflect the interests of the audience rather than the preferences of academics.[2]

The methodology and criteria of my study are similar to those used by John Staudenmaier in his analysis of the discourse of American historians of technology based on the content of *Technology and Culture* (hereafter *T&C*) from 1959 to 1980.[3] For each article published in *VIET* for the period 1986–91, I have recorded the same characteristics Staudenmaier did for *T&C*: time and place references; methodological style (internalist, externalist, contextual); and function of hypotheses in argumentation (a priori, a posteriori). The *T&C* sample is larger (272 articles in *T&C* vs. 178 articles in *VIET*) and covers a longer period (22 years for *T&C* vs. 6 years for *VIET*), whereas the *VIET* sample is thematically more diverse (it includes articles on the history of science as well as the history of technology). Despite these

[1] For a brief but informative review of *VIET* in English, see Paul R. Josephson, review of *Voprosy Istorii Estestvoznaniia i Tekhniki*, *Isis* 82 (1991): 298–300.

[2] See, for example, *Nauka i zhizn'*, *Znanie—sila*, *Priroda*, *Khimiia i zhizn'*, *Novyi Mir*, *Neva*.

[3] John Staudenmaier, *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge, Mass., 1985).

differences, a comparison of American and Soviet developments is indispensable for situating the changes brought about by perestroika in a larger international milieu. By choosing the methodology introduced by Staudenmaier, I will attempt not only to analyze Soviet developments per se, but also to draw parallels with Staudenmaier's account, and so construct a stereoscopic view of how perestroika changed discourse in comparison both with the pre-perestroika situation and with American discourse.

Pre-Perestroika Developments: From Marxism to "Marxyism"

The Soviet Union was the first country in the world to establish a specialized institution for the study of the history of technology and science. In 1921, the Russian Academy of Sciences organized the Commission on the History of Knowledge, which in 1932 was transformed into the Institute for the History of Science and Technology under the direction of the prominent Bolshevik Nikolai Bukharin. The institute published in 1933–36 several volumes of the *Archive of the History of Science and Technology,* devoted largely to the elaboration of a Marxist approach, with strong emphasis on the history of technology and on socioeconomic analysis.[4] After serious institutional turmoil caused by the arrest and execution of Bukharin, this field of scholarship was reestablished only on Stalin's personal intervention in 1944.[5]

One of the earliest and most famous expressions of the methodology of Soviet historians of technology and science is Boris Hessen's paper "The Social and Economic Roots of Newton's *Principia,*" which created a furor at the Second International Congress of the History of Science in London in 1931. Hessen announced that Newton's scientific activity was nothing more than a response to the social and economic needs of contemporary England—building new machines and weapons, as well as the creation of a new worldview that could reconcile religious dogmas with a new social and economic order. "Newton," Hessen maintained, "was a typical representative of the rising bourgeoisie, and in his philosophy he embodied the characteristic features of his class."[6]

[4] *Arkhiv istorii nauki i tekhniki,* 9 vols. (Leningrad, 1933–36).

[5] "This is an extremely important thing," said comrade Stalin. "Especially the youth must know the history of science" (V. L. Komarov, "Volnuiushchaia beseda," *Vestnik AN SSSR* 1–2 [1945]: 9). For the early institutional history of the field, see Loren Graham, *Science in Russia and the Soviet Union: A Short History* (Cambridge, 1993), pp. 137–55; S. S. Ilizarov, "Sud'by i uchast' istorii nauki v Rossii i SSSR (XVIII–XX vv.)," *VIET* 2 (1989): 32–40.

[6] Boris Hessen, "The Social and Economic Roots of Newton's *Principia,*" in *Science at the Crossroads,* 2d ed., ed. N. I. Bukharin et al. (London, 1971), p. 182.

According to the *Dictionary of the History of Science,* Hessen's paper was instrumental in establishing the "externalist" methodological approach.[7] Without endorsing the extremes of Hessen's externalism, Western historians applied the same logic to explain the origins of his views. When unveiling the "socio-political roots of Boris Hessen," Loren Graham characterized Hessen's paper as primarily a response to the contemporary situation in the USSR, and in particular to the hostility of Soviet Marxists to Einstein's relativity theory. Hessen, a physicist himself, tried to defend Einstein's theory. "Hessen," Graham maintained, "wished to differentiate between the social origins of science and its cognitive value. . . . He knew that he would have an easier time convincing militant Soviet Marxists that Newtonian physics had enduring value despite its bourgeois social origins than he would demonstrating that the still little understood relativity theory also must be valued despite its social origins in capitalistic central Europe."[8] To complete the parallel, Graham characterized Hessen as a "typical member of the old-fashioned Russian intelligentsia."[9]

The methodological profile of early Soviet historians of science was drawn in a general way in 1955 by David Joravsky. He portrayed them as Marxists by necessity: "Under the impress of Marxist-Leninist theory and the specific demands of 'partyness' (*partiinost'*) Soviet historians of science have tended to stress social and economic factors, interpreted in a Marxist-Leninist way, as the determinant of scientific development, but with qualifications, such as 'in the last analysis,' which allow for some suppleness and diversity of interpretation in limited works."[10]

Alexander Vucinich, in contrast, did not see much real Marxism in the works of Soviet historians of science. In characterizing two voluminous surveys of the history of Russian science published in the USSR in the 1950s, he wrote: "Both surveys were monumental compilations of data and both lacked analytical depth. Neither study presented a serious effort to cast the history of Russian science and scientific institutions within a Marxist theoretical framework."[11]

Joravsky's account seems to be more applicable to the period before World War II, while Vucinich's description fits the postwar period.

[7] W. F. Bynum, E. J. Browne, and Roy Porter, eds., *Dictionary of the History of Science* (Princeton, N.J., 1981), pp. 145–46.

[8] Loren Graham, "The Socio-Political Roots of Boris Hessen: Soviet Marxism and the History of Science," *Social Studies of Science* 15 (1985): 718.

[9] Ibid., p. 711.

[10] David Joravsky, "Soviet Views on the History of Science," *Isis* 46 (1955): 12.

[11] Alexander Vucinich, "Soviet Marxism and the History of Science," *Russian Review* 41 (1982): 135.

The Stalinist purges led to the total disappearance of the Old Bolsheviks who had studied Marx's works themselves. Stalin relied on a younger generation of Communists who had learned Stalin's own interpretation of Marxism. The new doctrine retained a Marxist vocabulary, but downplayed critical socioeconomic analysis—a double-edged weapon, which could be dangerous if applied to the Soviet regime itself. The new scholarship was not Marxist, but rather "Marxy," that is, imitating Marxist language without any substantial correlation with the teaching of Marx. "Marxyism" had unlimited malleability, which allowed it to be shaped to the political requirements of any given moment.

With the rise of Russian nationalism in the 1940s, Soviet ideologues demanded that historians of technology and science "repulse all those who infringe on Russian primogeniture in all great deeds."[12] As demonstrating the priority of Russians in discoveries and inventions became a hot topic, internalist-style collections of evidence "proving" such priority soon emerged.[13] An externalist methodology would not provide a satisfying explanation of these (arti)facts, as tsarist Russia was in no way more advanced socially, economically, or technologically than the Western nations. As a result, externalist methodology was pitilessly abandoned and replaced by internalism.

One of the important traits of the new Soviet internalism was its concern for "objectivity." Objectivity meant grounding narrative in solid facts rather than speculative interpretations. For this reason, Soviet historians of technology and science often filled up their papers with "factological" material, without attempting to analyze and interpret it. This satisfied the criterion of objectivity and had the added benefit of being politically safe. An ideological censor could not point out the bias in a paper in which there was no explicit analysis and facts "spoke for themselves." An attentive reader, however, could find the author's "subjectivity" transferred from the analytical to the factological level, revealed in the selection of evidence and construction of (arti)facts. A senior Soviet historian confessed in 1987 that "the deeply rooted tradition of work aimed solely at quantitative output led to the promotion of publications based on volume and filled with sets of assembled 'facts' which, at best, were linked together in a chain by their time coordinates. It was even sometimes the case that

[12] V. V. Danilevskii, *Russkaia tekhnika* (Leningrad, 1948), p. 468. All quotations from Russian-language sources cited in this article are author's translation.

[13] See N. A. Figurovskii, ed., *Istoriia estestvoznaniia v Rossii*, 3 vols. (Moscow, 1957–62); K. V. Ostrovitianov, ed., *Istoriia Akademii nauk SSSR*, 2 vols. (Leningrad, 1958).

these historical 'facts' detailed in our history of science literature never actually took place."[14] Among such imaginary facts were a balloon flight in 1731 and the invention of a submarine in 1829.[15] The most famous and thoroughly elaborated legend was of a bicycle allegedly invented by Artamonov, a craftsman from the Urals in 1801. Let us consider this case in more detail, since it represents the typical Soviet approach to the history of technology.

"Artamonov's bicycle" appeared at the Nizhniy Tagil Mining Museum in the Urals in 1923; its replica was put on display at the Moscow Polytechnical Museum in 1949 and served for a long time as visual proof of the Russian priority in bicycle-making. The story was first mentioned in 1896 by the economist and amateur historian V. D. Belov, who referred to oral information. Thereafter it acquired more, and more vivid, details. The mythical Artamonov received a first name (some authors named him Efim, others Vasilii), a date of birth, and an interesting biography. He was said to have traveled by bicycle from the Urals to Moscow and St. Petersburg, and later even to have arranged the mass production of bicycles. Having no documents in hand, authors of such stories cited Belov's integrity instead, which was "proved" by the fact that Lenin himself had used some of Belov's economic data in his works.[16]

Historians of technology expressed their first doubts about the authenticity of this story only in the mid-1970s, when they realized that this bicycle was in principle unfit for riding. They found no documents or other evidence confirming that this invention had actually taken place.[17] A 1987 laboratory analysis of the metal in Artamonov's bicycle showed that the bicycle could not have been constructed earlier than 1876, after the invention of the bicycle in the West. The origin of the legend, it appeared, was in 1801, when craftsman E. G. Kuznetsov-Zhepinskii and his nephew Artamon exhibited in Moscow an improved horse-driven dray. Later oral tradition transformed the first name Artamon into the last name Artamonov and the dray into a bicycle. The last and decisive argument of the opponents of the legend was that Belov was not really trustworthy: while using some

[14] V. I. Kuznetsov, "Ob osnovnykh napravleniiakh issledovanii v oblasti istorii estestvoznaniia i tekhniki i naukovedeniia," *VIET* 1 (1987): 12.

[15] See I. A. Bykhovskii, "Proekt, rozhdennyi v krepostnom kazemate," *VIET* 3 (1991): 72–81; D. Guzevich and I. Guzevich, "Legenda o podvodnoi lodke," *VIET* 3 (1991): 82–89.

[16] See V. I. Dovgopol, "O velosipede Artamonova," *VIET* 1 (1989): 149–50.

[17] L. E. Maistrov and N. L. Vilinova, "O velosipede Artamonova," *VIET* 1 (1983): 90–96.

of his data, Lenin in fact disagreed with Belov's conservative views on the development of Russian industry.[18]

The bicycle story was shaped by the sociopolitical context of the 1940s. The political demand for establishing Russian priority in technological innovations set up a ready-made agenda for Soviet historians of technology. No analysis was required; the conclusion had already been drawn, and what remained to be done was to find its proof. Accordingly, everything that looked like a fact confirming the pre-established truth was pulled into the account. The question of the social construction of "facts" themselves could never arise in such a context. Interestingly, both supporters and even recent critics of the legend of Artamonov's bicycle considered ideological arguments (Lenin's authority) as crucial for the debate.

As new political demands arose in the 1960s, the methodology of Soviet historians of technology and science changed again. Soviet authorities began to favor broader contacts and collaboration between Soviet scientists and their Western colleagues. Accordingly, the Institute for the History of Science and Technology announced that Russian national contributions to technology and science were no longer the top priority and the time to study the universal history of science had come.[19] Joining the global scientific community meant the rehabilitation of entire scientific disciplines—cybernetics, genetics, resonance theory in structural chemistry, social psychology—and of numerous prominent Soviet scientists who had been victims of the Stalinist purges and the ideological campaigns in science. As Vucinich notes, "The historians of science did not play a decisive role in the process of rehabilitation; their job was merely to record the results of rehabilitation and to rewrite the history of science accordingly."[20]

In the 1970s and early 1980s, when party ideologists intensively developed a concept frequently described as "realization of the achievements of scientific-technological progress under the conditions of advanced socialism," Soviet historians were called on to illustrate the great contribution of technology and science to the development of productive forces and the solutions to social and economic problems. The complexities and sudden shifts in the development of knowledge did not serve as the best illustration; the internalist, cumulative scheme of the gradual development of science in parallel

[18] See V. S. Virginskii et al., "Kak tvoriatsia mify v istorii tekhniki," *VIET* 1 (1989): 150–57.

[19] S. Ia. Plotkin, "Organizatsiia v SSSR issledovanii po istorii estestvoznaniia i tekhniki," *VIET* 23 (1967): 8.

[20] Vucinich (n. 11 above), p. 139.

with the steady perfection of socialist society was better suited to this purpose.

Close party control, which narrowly defined the task of the historian and enforced ideological censorship, prevented historians from examining the social and cultural milieu of technology and science. As a result, internalism dominated this period. A historian of physics, for example, wrote in 1986: "Inevitably the questions arise: Why did Bohr conceive of the role of condition (15) in his theory so late? Why did it remain out of his sight for so long? Any answers to these questions are merely speculative."[21] By dismissing any reference to a larger context as speculation, Soviet historians limited their explanations to the internal workings of technology and science. Within such a methodological framework, many historical problems, like the Niels Bohr case just mentioned, seemed unsolvable. With the field of study so narrow, criticism degenerated into a list of misprints: for instance, a historian of mathematics pointed out in a 1987 book review "the incorrect position of letters in the first table on p. 76 and the loss of a bracket on p. 163, in the second paragraph from the top."[22]

Vivid discussion of priority in discoveries and inventions continued to stir controversy, but many perceived such debates as a waste of time. G. M. Salakhutdinov, for example, proposed a "complex approach based on the accounting of all possible aspects of priority analysis" to stop unnecessary disputes.[23] He concluded: "The study of priority issues requires a creative approach, so an application of the proposed complex method does not guarantee the right answer; this method, however, seems to reduce disagreement, curtail fruitless discussions, etc.—ones which arise from time to time among historians of science and technology."[24] Who could judge whether a particular discussion was fruitless or not? It was much safer not to have any discussions at all.

Thus, among the most remarkable characteristics of the Soviet discourse on the history of technology and science of the pre-perestroika period, one could name: ideological engagement, internalist methodology, a scarcity of creative discussion, and an "objective," factological, noninterpretative approach. Occasional brilliant works like B. G.

[21] A. N. Vial'tsev, "Alogicheskoe reshenie logicheski razreshimykh zadach," *VIET* 3 (1986): 123.

[22] F. A. Medvedev, review of *Metodologicheskie problemy intuitsionistskoi matematiki,* by M. I. Panov, *VIET* 1 (1987): 151.

[23] G. M. Salakhutdinov, "Osobennosti resheniia prioritetnykh voprosov v istoriko-tekhnicheskikh issledovaniiakh," *VIET* 1 (1987): 108.

[24] Ibid., p. 112.

Kuznetsov's on Einstein,[25] B. M. Kedrov's on Mendeleev,[26] and some others were exceptions that proved the rule.

Soviet "Marxyism"—a child of ideological pressure and conformity—should not be confused with Western Marxist scholarship in the history of technology and science. In the works of John Bernal, Benjamin Farrington, David Noble, Dirk Struik, Edgar Zilsel, and many others, the strengths of Marxist analysis—close attention to the socioeconomic facets of the development of technology and science, and examination of technology and science as material factors of social change—were developed in a creative and fruitful way. Paradoxically, Hessen's original elaboration of a Marxist approach proliferated later in the West in the form of externalist history, while it fell into complete oblivion in the Soviet Union. Now historians in Russia can learn about Hessen's work only from Loren Graham's essay, recently translated into Russian.[27]

Opening Pandora's Box: The Russian Archives

In 1985, Mikhail Gorbachev, the new general secretary of the Central Committee of the Communist Party, launched perestroika and announced the policy of glasnost in many areas of public concern previously closed to discussion. For historians, this shift meant the weakening of ideological censorship and access to newly opened archives. Soviet censorship from the 1930s through the 1970s had two major consequences—one direct, the other indirect. The direct consequence was an unwritten prohibition on exploring certain topics, such as the role of Stalinist purges in the development of Soviet science. The indirect effect was a particular Soviet style of historical narrative—internalist, factological, and discussion-avoiding. When censorship was to a large degree eliminated, the direct consequences, naturally, were the first to share the same fate. The indirect effects, however, appeared much more difficult to overcome.

Among the first, most obvious, signs of perestroika in the history of technology and science were publications of previously censored or forbidden works. For example, all the passages from Vladimir Vernadskii's *Scientific Thought as a Global Phenomenon* (1938) that had been cut out earlier by censors were published for the first time.[28] It

[25] B. G. Kuznetsov, *Einshtein*, 3d ed. (Moscow, 1967).

[26] B. M. Kedrov, *Den'odnogo velikogo otkrytiia* (Moscow, 1958).

[27] Loren Grehem [Graham], "Sotsial'no-politicheskii kontekst doklada B. M. Gessena o N'iutone," *VIET* 2 (1993): 20–31.

[28] See V. I. Vernadskii, "Nauchnaia mysl' kak planetnoe iavlenie (1938 g.). (Neopublikovannye fragmenty)," *VIET* 1 (1988): 71–79.

also became possible to study the nature and impact of Stalinist purges and ideological campaigns in physics,[29] genetics,[30] and physiology.[31] Before perestroika, A. A. Berzin could not publish his study of the northern railroads, built in 1947–53 by GULAG prisoners; now it came out under the title "A Road to Nowhere."[32] Berzin even managed to get access to KGB archives and publish materials concerning engineer prisoners of the GULAG, who built a new engine for passenger trains, later named *JS* after Joseph Stalin.[33]

Another conspicuous sign of change was a sharp reduction in the number of ritual references to Marx and Lenin in *VIET* articles. At the outset of perestroika, about one-third of *VIET* publications appealed at least once to the authority of the "classics." The case could be even worse, when a whole paper degenerated into ritual bowing in the spirit of Marxyism. Thus, in Iu. I. Krivonosov's article on the recent history of technology one cannot find a single mention of an engineer or an artifact. The only names mentioned are those of Marx, Engels, and Lenin, and the only event discussed is the twentieth congress of the Communist Party.[34] Ritual references to Marx and Lenin in the works of historians, however, are hardly proof of Marxist methodology, for in most cases they were nothing more than tributes to some ongoing ideological campaign. Rather, they indicate political interference with scholarship—interference that forced historians to put signs of their loyalty into their papers. In 1991, however, only one out of twenty-five *VIET* articles contained a reference to Marxism. A strong wave of criticism of Marxist political theory at that time rendered Marxist methodology very awkward to mention in a positive mode. If the ideological climate of pre-perestroika years had often forced historians to declare themselves Marxists when they were not, perestroika had the opposite effect, wiping any surface signs of Marxism from historical discourse.

[29] G. E. Gorelik, "Obsuzhdenie 'naturfilosofskikh ustanovok sovremennoi fiziki' v Akademii nauk SSSR v 1937–1938 godakh," *VIET* 4 (1990): 17–31; Vl. P. Vizgin, "Martovskaia (1936 g.) sessiia AN SSSR: sovetskaia fizika v fokuse," *VIET* 1 (1990): 63–84, and 3 (1991): 36–55.

[30] "Stranitsy istorii sovetskoi genetiki v literature poslednikh let," *VIET* 4 (1987): 113–24, 1 (1988): 121–31, and 2 (1988): 91–112.

[31] " 'Pavlovskaia sessia' 1950 g. i sud'by sovetskoi fiziologii," *VIET* 3 (1988): 129–41, 4 (1988): 147–56, and 1 (1989): 94–108.

[32] A. A. Berzin, "Doroga v nikuda. Materialy o stroitel'stve zheleznoi dorogi Salekhard-Igarka. 1947–1953," *VIET* 1 (1990): 38–49.

[33] A. A. Berzin, "Parovozy za koliuchei provolokoi: Novye materialy o sovetskom parovozostroenii iz arkhivov KGB," *VIET* 4 (1991): 35–38.

[34] Iu. I. Krivonosov, "Nekotorye problemy noveishei istorii tekhniki i mezhotraslevykh issledovanii," *VIET* 1 (1988): 27–35.

FIG. 1.—Percentage of *VIET* articles referring to the 20th century and to Russia and the USSR.

Perestroika is the focus of my quantitative analysis of *VIET* articles. I will now turn to the discussion of the results of this study, making comparisons wherever possible with the data obtained by Staudenmaier from his analysis of *T&C*.

As perestroika opened formerly forbidden areas to exploration and discussion, a remarkable thematic shift toward the social history of Soviet science, particularly of the Stalinist era, followed. That shift has been accompanied by corresponding changes in the geographic and temporal patterns of research, with the general trend in the direction of "closer in time, nearer in space." That is, historical discourse tends to gravitate toward 20th-century Russia. The solid line in figure 1 shows how the share of *VIET* articles on 20th-century history steadily grew from 44 percent in 1986 to 56 percent in 1991 (compare the corresponding share among *T&C* articles—28 per-

TABLE 1
TIME REFERENCES IN *VIET* (1986–91) AND *T&C* (1959–80)
ARTICLES (in %)

	VIET (Science)	*VIET* (Technology)	*T&C* (Technology)
Ancient (5000 B.C.–600 B.C.)	1	8	2
Classical (600 B.C.–A.D. 400)	2	3	4
Medieval-Renaissance (400–1600)	8	...	10
1600–1800	13	8	8
19th century	6	19	26
20th century	53	48	28
Several periods	17	14	14
No time reference	...	...	10

cent).[35] The distribution of *VIET* articles in the history of science by time period (see tables 1 and 2) confirms, by and large, Staudenmaier's finding for *T&C*: "the more remote the period, the fewer articles in it."[36] Articles in the history of technology distribute less symmetrically across the time frame. Most striking is the absence of works on the history of medieval and Renaissance technology. Historians of technology and science both tend to overemphasize 20th-century events.

The distribution of *VIET* articles by place reference also shows a strong tendency toward concentration in a single region, namely Russia and the Soviet Union. In 1986, the share of *VIET* articles focused on the USSR (47 percent) was approximately the same as the share of *T&C* articles focused on the United States (46 percent). After 1986, Soviet research concentrated more and more on the history of Russian technology and science, until its share reached 80 percent in 1991. As a result, Soviet scholars demonstrate an even stronger Soviet

[35] Staudenmaier (n. 3 above), p. 28, table 3.

[36] Ibid., p. 29. The relatively small number of *VIET* articles related to the 19th century is explained by the fact that many articles cover the 19th century along with the beginning of the 20th, and for this reason fit into the category "Several periods." Table 2 shows how disciplines correlate with time periods. Only the research on the history of mathematics and physics looks well-balanced. The history of chemistry lacks medieval alchemy, and the life sciences look like they were born in the 20th century (the only article dealing with the 18th century was written by authors working outside IIET).

TABLE 2
CORRELATION OF DISCIPLINES AND TIME PERIODS (*VIET*, 1986–91)

	Mathematics	Physics	Chemistry	Life Sciences	Earth Sciences	Multidisciplinary	Technology	Total
Ancient (5000 B.C.–600 B.C.)	...	1	...	...	...	...	3	4
Classical (600 B.C.–A.D. 400)	1	1	...	...	...	1	1	4
Medieval-Renaissance (400–1600)	4	3	...	...	...	4	...	11
1600–1800	3	5	2	1	1	7	3	22
19th century	1	2	3	...	1	2	7	16
20th century	3	18	11	21	6	16	18	93
Several periods	2	4	7	4	5	1	5	28

(Russian) bias[37] than "the Western bias in geography" that Staudenmaier found in *T&C* articles.[38] (See tables 3 and 4.) Soviet historians of science show almost the same interest in European research (36 percent) as American historians of technology (38 percent), while in the works of Soviet historians of technology the study of European developments is but 16 percent.

The most striking element in the geographic pattern of the Soviet discourse is a scarcity of studies on American developments. The very modest interest of Soviet historians in American technology and science (2–5 percent) can only be compared to approximately the

TABLE 3
PLACE REFERENCES IN *VIET* (1986–91) AND *T&C* (1959–80) ARTICLES (IN %)

	VIET (Science)	*VIET* (Technology)	*T&C* (Technology)
United States	2	5	47
USSR	59	68	3
Europe	36	16	38
Greece and Rome	2	3	4
Others	1	8	8

[37] The correlation of disciplines and place references (see table 4) shows that a strong "Soviet-centrism" is characteristic for historians of the life and earth sciences. In the case of the history of biology, this is obviously the result of focusing research on Lysenkoism—both its roots and its consequences for the community of Soviet geneticists.

[38] Staudenmaier, p. 28, table 2.

TABLE 4
CORRELATION OF DISCIPLINES AND PLACE REFERENCES (*VIET*, 1986–91)

Discipline	United States	USSR	Europe	Greece/Rome	Other
Mathematics	...	5	8	1	...
Physics	1	13	18	1	1
Chemistry	1	10	12	...	...
Life sciences	...	24	2	...	...
Earth sciences	...	9	4	...	...
Multidisciplinary	1	23	6	1	...
Technology	2	25	6	1	3
Total	5	109	56	4	4

same low interest of American historians in Soviet developments (3 percent). If one believes that the historian of technology must examine only state-of-the-art technologies, then indeed, American historians may not find very much to study in the USSR. But if the historian is interested in what Staudenmaier calls "questions seldom asked," like cultural conflicts in technology transfer, roads not taken, and technological failures, he or she will find rich material in Soviet (Russian) history. The lack of interest shown by Soviet scholars in the history of American technology and science is even more surprising since it coincides with a great admiration for modern American achievements in technology and science in contemporary Russia. Without understanding clearly how American science is organized, science administrators in Russia are eager to imitate the American model.[39]

The share of articles devoted to the history of technology and science in Russia and the Soviet Union rose in close correlation with an increase in the number of 20th-century studies (note the similarity in form between the solid and dashed curves in fig. 1), which strongly suggests that the Russian bias in geography and the 20th-century bias in temporal dimension are tightly connected. New opportunities for study in previously inaccessible archives and, possibly, fear that this chance might soon be lost because of one more shift in party policy, made researchers work intensely with new historical sources on 20th-century Soviet history and also encouraged them to publish old material that could not appear earlier because of censorship. Historians of technology and science began to explore extensively the Communist Party archives, the KGB files, the archives of Russian scientific-

[39]Loren Graham, "Big Science in the Last Years of the Big Soviet Union," *Osiris*, 2d ser., 7 (1992): 71.

technical societies,[40] machine-tool factories,[41] and other organizations.[42] New materials strongly suggested that the development of technology and science in the Soviet Union had not been a self-determined or "natural" process but, rather, was shaped by the socio-political and ideological context of the time; the role played by the party apparatus and by various governmental agencies began to seem more salient.

New archival findings, however, were often regarded simply as a source for new facts, rather than the catalyst of new interpretations. Some historians went to archives not because they had particular questions in mind, but merely because these archives were now open and available. The flow of publications of "interesting findings" carried on the tradition of historical narratives in which facts "speak for themselves." The focus of the historian's interest became the historical document itself, instead of issues the document might help to resolve. The main reason for some publications was to resurrect "forgotten" facts or documents (typical article titles were "The Forgotten Publication," "The Half-forgotten Phenomenon").[43] Those who understood the recovery from enforced amnesia as merely adding new facts effectively perpetuated the factological approach that had been serving Soviet historians for so long. This approach presumed a model of history in which most facts were already known, but there were still some "dark spots" left. As historians discovered forgotten facts, the dark spots would disappear, and the picture would finally become clear and complete. This view of history required recollection, not reinterpretation.

[40] See N. G. Filippov, "Dokumenty nauchno-tekhnicheskikh obshchestv Rossii kak istochnik izucheniia istorii promyshlennosti i tekhniki," *VIET* 1 (1986): 125–31.

[41] See L. I. Uvarova, "Dokumenty obshchestv mashinostroitel'nykh zavodov kak istoricheskii istochnik," *VIET* 2 (1987): 112–17.

[42] On the All-Union Association of Science and Technology Specialists for Assistance to the Socialist Construction (VARNITSO), see I. A. Tugarinov, "VARNITSO i Akademiia nauk SSSR (1927–1937 gg.)," *VIET* 4 (1989): 46–55. For updated information on newly opened Russian archives, see Vitaly Chernetsky, "On the Russian Archives: An Interview with Sergei V. Mironenko," *Slavic Review* 52 (Winter 1993): 839–46; J. Arch Getty and Oleg V. Naumov, eds., *Research Guide to the Russian Center for the Preservation and Study of Documents of Contemporary History* (Moscow, 1993); Gordon M. Hahn, "Researching Perestroika in the Archive of the TsK KPSS (Soviet Communist Party Central Committee Archive; Center for the Preservation of Contemporary Documents)," *Russian Review* 53 (July 1994): 419–23; David L. Hoffman, "A First Glimpse into the Moscow Party Archive," *Russian Review* 50 (October 1991): 484–86.

[43] See G. D. Arkad'eva and N. I. Chistiakov, "Zabytaia publikatsiia. (K istorii izobreteniia besprovodnoi sviazi)," *VIET* 2 (1991): 93–95; V. P. Mel'nikov, "Poluzabytyi fenomen," *VIET* 1 (1991): 81–83.

The question of new interpretations, however, is not merely a methodological one. In the period of hot public debates over the nature of and the ways of reforming the Soviet system, historical knowledge has become an efficient weapon in political struggle. Pointing to the sensationalization and commercialization of archival studies in the former Soviet Union, Western scholars often fail to recognize the political aspect of the archival gold rush.[44] In the intense process of restructuring the field of power/knowledge relationships, any new interpretation of the role of engineers and scientists in decisive moments of Soviet history is laden with political values.

In the summer of 1992, when *VIET* published a number of historical documents concerning the history of the Soviet atomic project,[45] few expected that this would cause a major controversy in which the historical question of the role of Soviet intelligence in advancing the project acquired contemporary political significance. The publication was based on documents from the KGB archives, uncovered by Lt. Col. Anatolii Iatskov, a former Soviet spy in the United States. Among them were two memoranda revealing that Soviet nuclear physicists in the 1940s had access to Soviet intelligence information on certain details of the Manhattan Project as well as to the design of the first American plutonium bomb. The documents published in *VIET* contained a description of some of the stolen secrets; that was important in order to evaluate the degree to which the Soviet atomic project actually depended on the intelligence information about its American counterpart.

After an issue of *VIET* containing this article was already in print, academician Iulii Khariton—former director of Arzamas-16, the Russian equivalent to Los Alamos National Laboratory—learned about it and made every possible effort to stop publication. He warned that some data contained in these 1940s documents might be useful to those who were trying to build a bomb now, in the 1990s. Moreover,

[44] For discussion of these issues, see J. Arch Getty, "Commercialization of Scholarship: Do We Need a Code of Behavior?" *Slavic Review* 52 (Spring 1993): 101–4; Mark von Hagen, "The Archival Gold Rush and Historical Agendas in the Post-Soviet Era," *Slavic Review* 52 (Spring 1993): 96–100; Amy Knight, "The Fate of the KGB Archives," *Slavic Review* 52 (Fall 1993): 582–86; Ellen Mickiewicz, "The Commercialization of Scholarship in the Former Soviet Union," *Slavic Review* 52 (Spring 1993): 90–95; Boris N. Mironov, "Much Ado about Nothing?" *Slavic Review* 52 (Fall 1993): 579–81; Elliott Mossman, "The Case of the Russian Archives: An Interview with Iurii N. Afanas'ev," *Slavic Review* 52 (Summer 1993): 338–52, and "Research, Ethics and the Marketplace: The Case of the Russian Archives," *Slavic Review* 52 (Spring 1993): 87–89.

[45] "U istokov sovetskogo iadernogo proekta: rol' razvedki, 1941–1945 gg.," *VIET* 3 (1992): 103–34.

it appeared that the materials in question had not even been declassified. Although many copies of the journal had already been sent to subscribers, all remaining copies were immediately confiscated.[46]

In the dispute that followed, it became obvious that the valuable archival records had been disclosed by the KGB in order to prevail in competition with Russian physicists for major credit in creating the Soviet atomic bomb. The well-known Russian scientist Roald Sagdeev argued that "according to those involved in the drama, the driving motive for KGB officials to reveal the history of nuclear espionage was their desire to 'restore' their rightful place in history as the true 'heroes of the Soviet nuclear miracle.' "[47] On the other hand, the true reason behind Khariton's nonproliferation argument against the publication was said to be the physicists' desire to prevent the devaluing of their own contribution. Journalist Sergei Leskov suggested that "the reason for the ban on publishing the intelligence record on the bomb program [in *VIET*] is part of the struggle for a place on the Mount Olympus of history rather than a concern with nuclear nonproliferation. Experts who saw the banned text told me that even Edward Teller and Andrei Sakharov would not have been able to build a bomb based on the information it contained."[48]

The controversy over the credit for the Soviet A-bomb was not just a matter of the reputation of two professional groups, the physicists and the intelligence officers; it became part of a larger political dispute between the Russian liberal democratic movement and a communist-nationalist alliance. For the nationalist-communists, it was particularly important to give the credit for all major scientific and technological accomplishments of the former Soviet Union not to the liberal, pro-Western scientists and engineers, but to "patriots" and "dedicated communists," who in this case were supposed to be the Soviet intelligence officers. Responding to a series of publications in the nationalist-communist press, Sagdeev argued that "the political message of these articles was obvious. They were an attack on the liberal scientific intelligentsia, the engine of the democratic revolution in the Soviet Union."[49]

Recently the ban on the issue of *VIET* in question was lifted, and the journal is now available. However, the political commitments driv-

[46] See G. E. Gorelik, "Iadernaia istoriia i zloba dnia," *VIET* 2 (1993): 159–61.

[47] Roald Sagdeev, "Russian Scientists Save American Secrets," *Bulletin of the Atomic Scientists* 49 (1993): 32.

[48] Sergei Leskov, "Dividing the Glory of the Fathers," *Bulletin of the Atomic Scientists* 49 (1993): 38.

[49] Sagdeev, p. 33.

ing archival research in Russia and the dependence of availability of archival materials on the position of organizations that control their own archives (like the KGB) remain open questions. When moving from "objective" factology toward interpretative social study, historians confront the political meaning of their research. Where internalism could pretend to be apolitical, the analysis of technology and science in a social context cannot.

From Black-and-White to White-and-Black History

In 1963, Joseph Agassi warned that the "approach of the up-to-date textbook worshipper paints all events in the history of science as either black or white, correct or incorrect."[50] When internalism applies this approach, it evaluates scientists according to what scientific theory they support. In the Soviet version of externalism, this approach evaluates scientists in terms of their political views, judged by the most up-to-date party line. Not surprisingly, internalist and externalist histories of Soviet science always coincided in the black-and-white division of scientists.

Before perestroika, Soviet historiography traditionally ascribed major scientific contributions to "progressive" scientists, while portraying those who were politically imperfect as scientists in error (at least with regard to the history of Russian and, especially, Soviet science). This was an integral part of the general ideological framework in which good science could only be done by scientists with dialectical materialist views on both nature and society. Any change in the assessment of the scientific merits of a given scholar could be made only if a corresponding political reconsideration took place. In such a case, the consequences for the history of technology and science followed the political decision immediately.

After his posthumous rehabilitation in 1988, Bukharin—a prominent Bolshevik, one of the organizers of the study of the history of technology and science in the USSR, and long labeled a "black"—suddenly became a "white." *VIET* published a highly laudatory article about him and reprinted the text of one of his 1936 speeches.[51] There were even suggestions to rename IIET in his honor. N. I. Vavilov, a famous Russian geneticist who perished in a Stalinist prison, became almost an icon for Soviet historians of science. His scientific merits were generously complemented by the image of good citizenship. V. M. Surinov portrayed him as a pristinely "white"

[50] Joseph Agassi, *Toward an Historiography of Science* (The Hague, 1963), p. 2.

[51] M. Ia. Gefter, "V preddverii gibeli," *VIET* 4 (1988): 4–10; N. I. Bukharin, "Osnovnye problemy sovremennoi kul'tury," *VIET* 4 (1988): 10–31.

character: "In every situation he displayed himself as a statesmanly leader, as a scientist citizen."[52] Theoretical physicist L. I. Mandel'stam was severely criticized on ideological grounds in the 1940s and 1950s. The exposure of those notorious accusations is now accompanied by his idealization as a perfect scientist: he is said to have been "almost absolutely unable to make mistakes on questions of physics."[53]

Historians of technology took the same route. If the evaluation of a certain engineer by political authorities changed, historians reevaluated his or her contribution to technological developments accordingly. In the 1920s, oil geologist Ivan Strizhov argued with Bolshevik Ivan Gubkin about appropriate methods of oil deposit elaboration. Gubkin labeled him a "class enemy" and "wrecker"; Strizhov was arrested, his proposals rejected. Today Gubkin is no longer in favor, while Strizhov and his technological system have been completely rehabilitated. A. I. Galkin writes: "The time has come to put together and reprint his [Strizhov's] papers written almost a century ago, to publish materials from his archive so that new generations of oil engineers could grow and learn from them."[54]

The old heroic history was thus followed by a new—today's "true" heroes are still giants, not living people with complex lives. We have been given an updated textbook of political history which results in the black-and-white history of technology and science becoming white-and-black.

From Science in a Vacuum to Science in Context

The internalist approach to historical research developed as an indirect consequence of ideological pressure. With the beginning of perestroika, this methodology was questioned and even challenged by proponents of externalism and contextual history.

In my examination of the methodology of *VIET* articles, I follow the distinctions made by Staudenmaier, who classified articles on the history of technology in the following way: "Those focused on the data of technical design alone ('internalist history'), those focused on contextual evidence alone ('externalist history'), and those attempting to integrate both types of evidence ('contextual history')."[55] In the

[52] V. M. Surinov, "N. I. Vavilov kak organizator nauchnykh issledovanii," *VIET* 1 (1988): 45.

[53] S. M. Rytov, "Ideinoe nasledie L. I. Mandel'shtama i ego dal'neishee razvitie," *VIET* 3 (1988): 45.

[54] A. I. Galkin, "Vklad I. N. Strizhova v delo okhrany i ratsional'nogo ispol'zovaniia neftianykh nedr," *VIET* 4 (1991): 43.

[55] Staudenmaier (n. 3 above), p. 25.

history of science, Thomas Kuhn offered similar definitions: "The still dominant form, often called the 'internalist approach,' is concerned with the substance of science as knowledge. Its newer rival, often called the 'externalist approach,' is concerned with the activity of scientists as a social group within a larger culture." Kuhn sees "putting the two together" as "the greatest challenge" for the historian of science.[56] This, in turn, is exactly what Staudenmaier means by "contextual history."

When perestroika removed ideological barriers and opened the social context of technology and science for study, that certainly implied changes in the thematic discourse of Soviet historians. It took some additional time, however, for historians to realize that not only themes, but also research methodologies, ought to change. At first, the editorial board of *VIET* showed little interest in methodological novelties. In an editorial in the first issue of 1987 one can find a promise "to extend the publication of materials which relate to the social history of science—such an intensively growing and problematic field and one that has provoked sharp discussions."[57] It is remarkable, however, that social history was still considered problematic, standing apart from the main path of development of the history of science.

That editorial proposed supporting innovations in method by publishing papers wherein the author's contribution was original (a move against noninterpretative, "objective" history) and works which "analyze the interrelations among different scientific disciplines and fields of knowledge."[58] Still, the development of technology and science was considered a self-contained enterprise. The examination of sociocultural context was relegated to problematic social history, while nonproblematic traditional history was allowed to develop within the tried-and-true internalist paradigm.

This division of labor between sociologists and historians of science and technology was brilliantly expressed in a speech by one of the participants in an October 1986 conference devoted to the problems of the "basic directions of perestroika within IIET": "One department will study a certain field of science from the history of science viewpoint, while another will examine it from the sociocultural context, a third from the context of the structure of science and of the interac-

[56] Thomas Kuhn, "The History of Science," *International Encyclopedia of the Social Sciences* (New York, 1968), p. 76.

[57] "Zadachi zhurnala v usloviiakh perestroiki," *VIET* 1 (1987): 6.

[58] Ibid.

tion of different sciences, a fourth through the methods of measuring the parameters of science."[59] Thus, the historian of science may ignore the social context of science—it is the business of people in another department! In an article on the history of computing in the USSR, for example, the section on the background of the topic is entitled "On some technical and mathematical problems of the 1930s," and includes nothing about the social context.[60] The article leaves the reader with the impression that under Stalin's regime in the 1930s, the only problems relevant to the history of computing were technical and mathematical ones.

Here we touch the very core of the question of why Russian historians of technology and science were so committed to narrow disciplinary history and conceived of the sociocultural approach as alien. The institutional structure of research in the history of technology and science in Russia reinforces this bias: the disciplinary departments of IIET (history of physics, mathematics, chemistry, aerospace technology, shipbuilding technology, etc.) are separated from the "science and technology studies" departments (sociology of science, social psychology of science, complex problems of the scientific-technological revolution, etc.). This institutional structure itself suggests that the social context is to be studied by sociologists and the psychological subtext by psychologists, while historians of technology and science are to do nothing more than collect "facts." At the same conference on the directions of perestroika, L. A. Markova pointed out that the administrative structure of IIET reflects a particular stage and type of historical research, namely disciplinary history. Markova and A. P. Ogurtsov proposed creating flexible research groups instead of rigidly organized departments.[61] To alter old methodology fundamentally would mean to change the structure of IIET, but this went far beyond what the initiators of reform intended.

The structure of IIET has remained the same as it was before perestroika, and, accordingly, methodological changes have been evolutionary, not revolutionary. The share of internalist articles in *VIET* has continuously declined from 57 percent in 1986 to 16 percent in 1991 (see fig. 2), which is even less than the corresponding figure in *T&C* (21 percent).[62] At the same time, the percentage of contextual

[59] "Ob osnovnykh napravleniiakh perestroiki raboty IIET AN SSSR (Materialy nauchno-prakticheskoi konferentsii)," *VIET* 1 (1987): 25.

[60] A. N. Tikhonov et al., "Integrator Luk'ianova v istorii vychislitel'noi tekhniki," *VIET* 1 (1990): 49–57.

[61] "Ob osnovnykh napravleniiakh perestroiki raboty IIET AN SSSR," pp. 21–24.

[62] Staudenmaier (n. 3 above), p. 13, table 1.

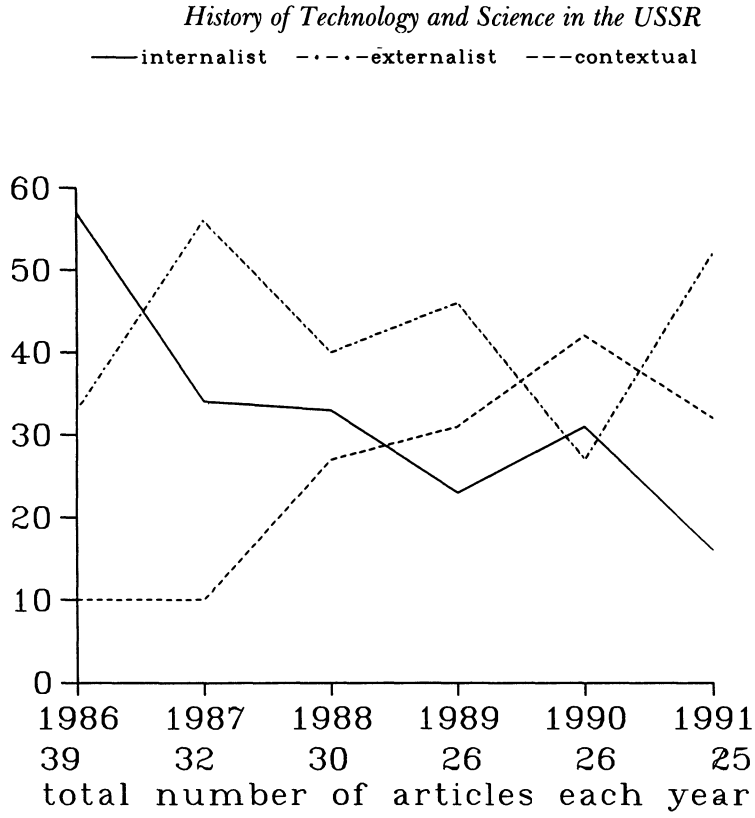

FIG. 2.—Percentage of internalist, externalist, and contextual articles in *VIET*

articles has risen from 10 percent in 1986 to 32 percent in 1991 (see fig. 2).[63] The *T&C* level was 62 percent. A good example of the contextual approach is the article by I. E. Sirotkina, "The History of the Central Institute of Labor: An Embodiment of Utopia?"[64] Sirotkina shows how the sociocultural atmosphere of the 1930s led to the formation of "biomechanics" as a study of the "human machine" in the process of labor, and its transformation into a general theory of professional activities. G. E. Gorelik's paper, "Physics at Universities and at the Academy," represents an externalist approach: it does not speak about physics per se, but rather about rival groups of physicists and their attitudes toward the ideological climate and toward each

[63] These data confirm Paul Josephson's observation that "Soviet scholars have now turned more to the social, political, and cultural history of science and technology," (Josephson [n. 1 above], p. 299).

[64] I. E. Sirotkina, "Istoriia Tsentral'nogo instituta truda: voploshchenie utopii?" *VIET* 2 (1991): 67–72.

TABLE 5
METHODOLOGICAL STYLES IN *VIET* (1986–91) AND *T&C* (1959–80) ARTICLES (in %)

	Internalist	Contextual	Externalist
VIET, total	34	24	42
VIET, history of science	31	24	45
Mathematics	29	42	29
Physics	41	32	27
Chemistry	52	26	22
Life sciences	31	11	58
Earth sciences	46	15	39
Multidisciplinary research	...	19	81
VIET, history of technology	46	22	32
T&C, history of technology	21	62	17

other.[65] The share of externalist papers in *VIET* demonstrates no clear pattern (see fig. 2); this indicates that methodology is still in flux.

An analysis of the distribution of methodological preferences among Soviet historians of different disciplines gives a more detailed picture (see table 5). The share of contextual articles among historians of technology and historians of science is nearly the same, but historians of technology apply the internalist scheme one-and-a-half times more often than do historians of science.[66] The contrast between the methodology of articles on the history of technology in *VIET* and *T&C* is noteworthy. The share of contextual articles in *T&C* is almost three times as large as that in *VIET*. On the other hand, *VIET* publishes significantly more internalist and externalist papers than does *T&C*. Obviously, Soviet historians of technology either describe the particularities of technological design or study the social context, but have difficulties putting the two together.

To explain the dynamics of methodological changes, consider the correlation of methodological styles and time periods in *VIET* articles

[65] G. E. Gorelik, "Fizika universitetskaia i akademicheskaia," *VIET* 2 (1991): 31–46.

[66] There is also methodological diversity among historians of different scientific disciplines. The most internalist research is conducted by historians of chemistry, the most externalist by historians of the life sciences (the Lysenko affair!), probably at the cost of the loss of contextualism. The extra-high share of externalist articles in multidisciplinary scholarship is explained by the fact that these articles consider the organizational structure of science, science policy, and science studies [*naukovedenie*] (see Yakov Rabkin, "Naukovedenie: The Study of Scientific Research in the Soviet Union," *Minerva* 14 [1976]: 61–78), and do not examine the development of scientific knowledge itself.

TABLE 6
CORRELATION OF METHODOLOGICAL STYLES AND TIME PERIODS IN *VIET* (1986–91) AND *T&C* (1959–80) ARTICLES

	VIET			*T&C*			
	Internalist	Contextual	Externalist	Internalist	Contextual	Externalist	Other
Ancient (5000 B.C.–600 B.C.)	...	3	1	5	...	...	1
Classical (600 B.C.–A.D. 400)	1	1	2	6	4	...	...
Medieval-Renaissance (400–1600)	1	7	3	16	7	2	1
1600–1800	9	5	8	3	14	4	...
19th century	7	5	4	3	52	13	2
20th century	27	14	51	6	43	13	13
Several periods	16	7	6	8	15	5	10
No time reference	...	...	...	...	1	...	25
Subtotal	61	42	75	47	136	37	52
Total		178			272		

(see table 6). The contextual approach predominates in articles covering the period from antiquity to the Renaissance, internalism predominates for the period from the 17th through the 19th century, and externalism takes the lion's share for the 20th century. The methodological profile of *T&C* is quite different: most articles covering the period from antiquity to the Renaissance are internalist, while among the rest of the papers the contextual approach dominates.[67] This is a place where American historians of technology and Soviet historians (of both technology and science) demonstrate strikingly different methodological preferences.

This difference does not seem paradoxical if we take into account that the founders of *T&C* focused their attention on contextual history from the very beginning. At the same time, Soviet historians of technology and science developed a tradition of internalism. This internalist tradition has lately been challenged from opposite ends of the time line. Historians of classical and medieval culture have adopted a contextual approach. Externalist studies, on the other hand, have developed along the lines of the new political attitude

[67] Staudenmaier (n. 3 above), p. 33, table 6.

toward Soviet history, and have resulted in a reconsideration of the social history of Soviet science. Consequently, internalism has had to retreat: contextualism has become more common as an interpretation of earlier periods, while externalism has taken over the 20th century.

These changes did not happen easily or peacefully. Hot disputes split the community of Soviet historians of technology and science. For a long time, historians had tried to escape sharp discussions. They could not, however, escape history. And history in the guise of perestroika launched debates about the most fundamental problems of the field.

The Discovery of an Unknown Land

In March 1989, in Leningrad (now St. Petersburg), a conference was held entitled "Science in Antiquity," where the following question was discussed in a roundtable session: Why did science in ancient Greece decline from the third century B.C. on? Opinions differed according to attitudes toward the role of social factors in the development of science. One group of participants maintained that "science develops linearly and cumulatively," and that if its development slows, this must be explained by internal causes.[68] Another group argued that "we attach too much importance to internal impulses in the development of science. . . . External factors are of great importance indeed," and affirmed that the "causes of slowing down and decline are external to cognitive activity."[69] Historians of classical science who belonged to the latter group began to undermine the positions of internalism, insisting on the necessity of the contextual approach.

Internalism was attacked from the other side by historians of 20th-century science who developed an externalist approach. In May 1989, again in Leningrad, young scholars organized a conference called "Sociocultural Aspects of the Development of Soviet Science." When the science-state relationship was discussed, the sharpest debates focused on the question: Which external factor influenced the formation of the cognitive agenda of the scientific community more—the dominant ideology or the direct administration of political power? So-called "*Etat*-ists" insisted on preserving the image of science as a system of knowledge with its cognitive traditions largely isolated from society. All external influences are thereby reduced to administrative state measures—either support and funding, or interference and oppression. Another group, the "ideologists," envisioned science as an integral part of the sociocultural continuum and maintained that al-

[68] "O prichinakh upadka antichnoi nauki (Kruglyi stol)," *VIET* 1 (1990): 144.
[69] Ibid., pp. 141, 144.

though the "virus of ideology" does not always infect the scientific community from above, ideology nonetheless inevitably penetrates scientists' consciousness.[70]

Interestingly enough, this argument became possible only after historians of science had begun to examine the *negative* aspects of the state's influence on science (in particular, during the period of Stalinist purges). Thus, the transition to "white-and-black" history did not merely lead to the inversion of the old picture. In addition, it became possible to consider scientists as independent-thinking individuals whose views could differ from the official ideology. There emerged a tension between science and the state. Soviet historians of science could then conceive of a "new externalism," which would describe the science-state relationship in complex, dynamic terms.

Externalism in the old Soviet fashion, which used the "good Soviet state, good ideology, good science" model, did not permit any distance between the "good state" and "good science." The relationship between the two was not conceived of in terms of influence, acceptance, or resistance. Good Soviet scientists developed the only possible good Soviet science. Their internal motives were not distinguished from external ones. When the new political line of perestroika led to the reevaluation of the former Soviet regime as "bad," a significant gap suddenly appeared between science and the "bad state." The *Etat*-ists chose the model "good science, bad state." The ideologists conceived of a more sophisticated picture, according to which harmful political and ideological controversies can be generated within a scientific community itself and are not necessarily imposed on science by the "bad state."

Two young historians of science, Daniil Aleksandrov and Nikolai Krementsov, developed the views of the ideologists further in "An Experimental Guide to an Unknown Land: A Preliminary Outline of a Social History of Soviet Science from 1917 to the 1950s."[71] They maintained that the Soviet scientific community was not separated from the rest of society; the established totalitarian model of power in science was to a large extent supported by scientists themselves. Aleksandrov and Krementsov described Soviet scientists' striving for the monopolization of power in science and the use of political arguments in scientific discussions as examples of scientists' internalization

[70] D. A. Aleksandrov and N. L. Krementsov, "Sotsiokul'turnye aspekty razvitiia sovetskoi nauki v 1920–1930 gg.," *VIET* 1 (1990): 166–68.

[71] D. A. Aleksandrov and N. L. Krementsov, "Opyt putevoditelia po neizvedannoi zemle. Predvaritel'nyi ocherk sotsial'noi istorii sovetskoi nauki (1917–1950-e gody)," *VIET* 4 (1989): 67–80.

of state ideology. The portraits of scientists who were formerly considered black, then white, now became a bit gray. Aleksandrov and Krementsov emphasized, for example, that Nikolai Vavilov, an icon for Soviet historians, had concentrated in his hands enormous power, being simultaneously president or director of several scientific institutions.

Some historians of technology also took a new methodological route. The role of foreign engineers in building the Russian industrial and transportation system had been ignored or distorted in Soviet historiography for a long time. Only in the late 1980s could D. Guzevich and I. Guzevich publish their numerous archival findings concerning the role of French specialists in establishing formal engineering in Russia in the 18th and 19th centuries.[72] Having taken into account relevant sociopolitical, economic, and cultural factors, these historians addressed some sophisticated questions that did not even arise within the internalist paradigm. They examined the reasons for and the process of adoption of a French model by the Russian system of higher engineering education; they also explored complicated relationships among architects and engineers of different generations and national origins—relationships which caused serious controversies within Russian engineering institutions.[73]

The elder generation of historians of technology, however, did not participate in this movement. While historians of science were exploring the unknown land of social history, historians of technology organized a separate methodological discussion. One senior researcher, G. N. Alekseev, presented a manifesto entitled "The Subject, Method, and Foundations of the Concept of the Development of History of Technology (and Natural Sciences) as an Independent, Complex Scientific Discipline." In his theoretical framework, technology was depicted as a direct derivative of science: "The activity of technical specialists is as follows: 1) scientists transform natural sciences' knowledge into scientific-technological knowledge; 2) design-

[72] D. Guzevich et al., "Gospodin Rokur, kotorogo ia liubliu . . . ," *VIET* 3 (1989): 76–88.

[73] D. Guzevich, "Razvitie mostostroeniia v Rossii v XVIII—pervoi polovine XIX veka i problemy sokhraneniia i ispol'zovaniia tekhnicheskogo naslediia otechestvennykh mostostroitelei" (Ph.D. diss., Institute for the History of Science and Technology, St. Petersburg, 1993); Irina and Dmitri Gouzevitch [Guzevich], "Les contacts franco-russes dans le monde de l'enseignement supérieur technique et de l'art de l'ingénieur," *Cahiers du monde russe et sovietique* 34, no. 3 (July–September 1993): 345–68; Irina Gouzevitch [Guzevich], "La mise en place de l'enseignement technique en Russie et les problèmes du transfert des connaissances au XVIII–XIX siècle" (Ph.D. diss., Institut français d'urbanisme, Paris, 1993).

ers, engineers, inventors, etc., materialize scientific-technological knowledge into various technical objects. The subject of the history of technology as a scientific discipline . . . ought to be exposing causal links and qualitative-quantitative complex regularities of the development of technical objects and creating on this basis a picture of their [the objects'] historical development along with the assessment of prospects and prognostic orientation."[74]

Alekseev viewed technology as a discrete domain whose external influences could be easily summarized: "The external factors [of the development of technology] are as follows: social, economic, political (especially wars), geologico-geographic, . . . personal. . . . The external factors are not directly included into the set of parameters describing the current state of the development of technology . . . but influence quality (type) and value of each parameter."[75] Alekseev's manifesto culminated in a proposal for a mathematical formula which "fully expresses" a general state of the development of the natural sciences and technology at any given moment. The most surprising aspect of the methodological debate around Alekseev's article was not that he presented the old internalist doctrine as a revelation, but that it was not seriously questioned. His colleagues confined their criticism to the discussion of the limits of formalization and the role of prognosis in a historical study.[76] Alekseev's "independent" history of technology portrayed engineering activity as semiautonomous, driven only by internal scientific dynamics. Technology found itself in a vacuum vessel, with social context shaping this vessel's form.

Generations Come and Methodologies Go

New approaches brought about a radical reconsideration of many issues in the history of Soviet technology and science and caused significant disputes among *VIET* authors. These methodological debates were not just about abstract matters; they also touched concrete historical questions. The temperature of the debates in the pages of *VIET* can be seen in figure 3. The diagram shows the percentage of articles containing a priori hypotheses in the history of technology and science. Staudenmaier introduced this parameter in the following way: "A scholar interacts with his or her peers most explicitly in two

[74] G. N. Alekseev, "Predmet, metod i osnovy kontseptsii razvitiia istorii tekhniki (i estestvoznaniia) kak samostoiatel'noi kompleksnoi nauchnoi distsipliny," *VIET* 3 (1989): 111.

[75] Ibid., p. 112.

[76] See I. A. Apokin, "O razumnykh predelakh formalizatsii v issledovaniiakh po istorii nauki i tekhniki," *VIET* 3 (1989): 116–21; I. S. Timofeev, "Iavliaetsia li prognoz edinstvennoi tsel'iu istoricheskogo issledovaniia?" *VIET* 3 (1989): 121–24.

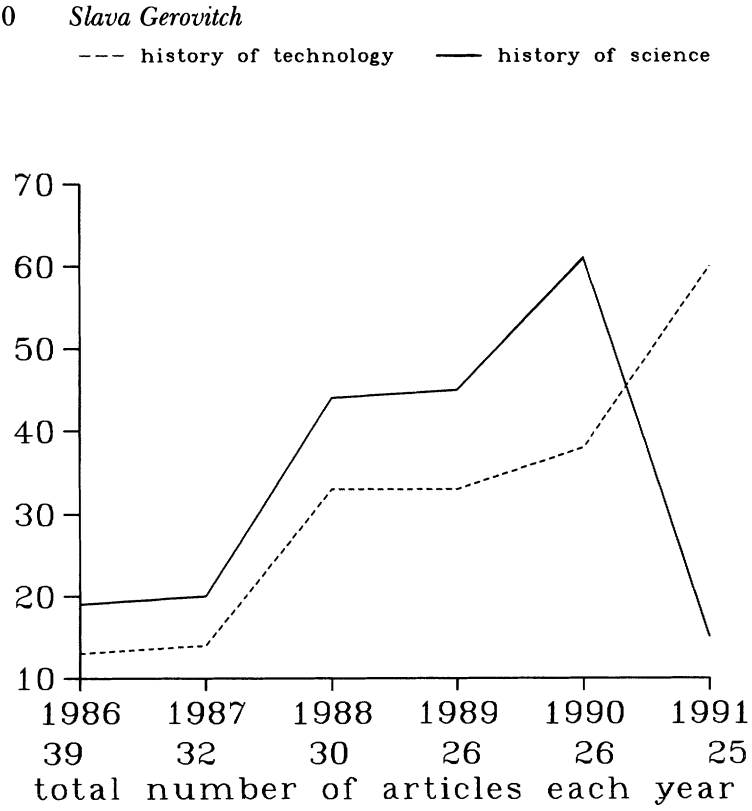

FIG. 3.—Percentage of a priori hypotheses in *VIET* articles

ways: by generating new hypotheses to interpret historical evidence and by critiquing or modifying existing hypotheses. In our taxonomy the category titled '*A Posteriori*' refers to articles whose authors are primarily interested in establishing one or more new hypotheses. The category named '*A Priori*' refers to articles whose authors explicitly respond to already-articulated hypotheses."[77] The predominance of a posteriori hypotheses indicates the division of the scholarship into nearly independent, individual endeavors. The rise in the number of a priori hypotheses points to a more advanced, mature state of the field, characterized by the active interaction of scholars.

I confess that my search for hypotheses was not an easy task. In some *VIET* articles I found nothing more than a collection of facts and a complete absence of hypotheses, either a priori or a posteriori. On reflection, I decided that in these papers a certain kind of "zero-

[77] Staudenmaier (n. 3 above), p. 14.

hypothesis" a posteriori does exist: "No conclusion can be drawn from this evidence." Such papers evidently carry on the tradition of "objective," noninterpretative history. Before perestroika, such a lack of hypotheses could be justified on the ground that the author was not permitted to draw an ideologically wrong conclusion and had to let facts speak for themselves. It is hard to change style overnight, and many historians continue writing factological history, delegating analysis to the reader.

At the conference on the directions of perestroika in October 1986, one of the participants noted that research at IIET had no continuity: each work started from square one and did not rely on previous studies.[78] This meant that very few articles contained a priori hypotheses. As perestroika developed, however, it became harder and harder to avoid disputes. Figure 3 illustrates how the percentage of *VIET* articles on the history of technology with a priori hypotheses grew continuously from 13 percent in 1986 to 60 percent in 1991 (compared to 56 percent in *T&C*).[79] The history of science articles show another pattern: after a four-year period of growth from 19 percent in 1986 to 61 percent in 1990, the share of a priori hypotheses suddenly dropped to 15 percent in 1991. Unlike the previous perestroika years, no materials of roundtable panels were published in 1991—an alarming sign that Russian historians of science were turning away from their disputes and returning to independent elaborations of their subject. For the first time during perestroika, the temperature of debates in the history of technology has risen higher than that in the history of science. However, most of these debates are still about nuts and bolts, and about priority. For historians of technology, altering methodology and shifting debates toward the discussion of new interpretations has proven a particularly difficult task. Most of them belong to the elder generation of historians, for whom standards of scholarship are associated more with the exactness of factual description than with boldness of interpretation.

In May 1990, a second conference on the social history of Soviet science was held in Moscow. Here, the division between the proponents and the critics of new methodological approaches increasingly resembled a generational conflict. The elder generation, long compelled to keep silent about the state's negative impact on science, had a chance to tell the truth as perestroika developed. Such truth-telling

[78] "Ob osnovnykh napravleniiakh perestroiki raboty IIET AN SSSR" (n. 59 above), p. 20.

[79] Staudenmaier, p. 13, table 1.

was the aim of most contributors to the collection *Science Repressed,* which exemplified the new "white-and-black" history.[80]

The younger generation, on the other hand, had developed an approach they called "social history." Historian Aleksei Kozhevnikov wrote,

> This term [social history] implies a certain disagreement with an approach which dominates in publications during perestroika and may be conventionally characterized by the term "science repressed." Instead of considering the science-power relationship solely in a passive voice, in terms of violence, with a stress on its most notable forms—repression and ideological interference—we would like to make a more sober and integrated representation of the highly specific mode of the existence of science in our society, a mode which determines its successes and failures. We would like to attach great significance to sociological, institutional, and cultural factors. The scientific community in this process is believed to play a highly active and ambiguous role.[81]

As Loren Graham comments, "the coming generation of historians of science in the former Soviet Union go beyond the mere identification of heroes and villains and instead look for institutional and social reasons for the emergence of such individuals."[82]

However, the manifesto of the younger generation, Aleksandrov and Krementsov's "Experimental Guide to an Unknown Land," was met by senior scholars with distrust and skepticism.[83] In its first issue of 1990, *VIET* published an article by American scholar Paul Forman in which he argued for a radically externalist methodology in the history of science and pointed out that this approach was underdeveloped by Soviet scholars.[84] The retired former director of IIET, S. R. Mikulinskii, retorted that the very idea of the impact of the socioeconomic and cultural-historical context on science had first been put forward in the USSR and the externalist approach to the history

[80] M. G. Iaroshevskii, ed., *Repressirovannaia nauka* (Leningrad, 1991).

[81] A. B. Kozhevnikov, "Vtoraia konferentsiia po sotsial'noi istorii sovetskoi nauki," *VIET* 1 (1991): 154.

[82] Graham (n. 5 above), pp. 154–55.

[83] See G. E. Gorelik, "Putevye zametki pered puteshestviem v neizvedannuiu stranu, ili vzgliad istorika fiziki na vzgliad istorikov biologii," *VIET* 4 (1989): 80–83; Vl. P. Vizgin, "Neskol'ko zamechanii k stat'e D. A. Aleksandrova i N. L. Krementsova 'Opyt putevoditelia po neizvedannoi zemle,' " *VIET* 4 (1989): 84–87.

[84] Pol Forman [Paul Forman], "K chemu dolzhna stremit'sia istoriia nauki," *VIET* 1 (1990): 3–9.

of science has been developed by Soviet scholars since the 1920s. Mikulinskii called Forman's approach an "extreme externalism" and continued: "We must say that a crude externalist interpretation of social influences on science is not a harmless thing. It leads to the slurring over and even erasing the boundary between science and ideology, and this predetermines the end of science and makes it possible to conceive of scientists as proponents of alien ideology, resulting in grave consequences."[85] Mikulinskii tried to preserve an image of scientists as disinterested seekers of truth, aloof from ideology. This old trick had sometimes helped scientists escape political troubles in the past. Mikulinskii remembered those days quite well and probably thought that exposing this as a myth might subject scientists to new political accusations. The elder generation of Soviet historians of technology and science thus rejected the sophisticated externalist methodology on moral rather than cognitive grounds: science, they maintained, had suffered so much because of the Soviet state, why must it suffer more because of externalist history?

The elder generation acknowledges sociopolitical controversies in the science-state relationship, but still has not taken notice of them within science itself. As Evelynn Hammonds, an American participant at the September 1992 Moscow international conference "Science and Social Justice" has noted: "Among the Russian scholars at the conference it seemed to me that social justice was being defined in terms of the relationship of science to the state. Dr. Simakova noted that the root of discrimination against women scientists in Russia has to do, in part, with the introduction of party politics into appointments to the Russian Academy of Science. . . . [The American speakers] focus[ed] on justice *within* science."[86] For many Russian historians, science remains to a large degree an activity *affected* by the social context, not a social activity in its *essence.*

Conclusion

Perestroika in the USSR has fostered both thematic and methodological changes in the discourse of the history of technology and science. Historians got rid of ideological blinders, took full advantage of newly opened archives, extended their research on the "dark spots" in recent Soviet history, and thus reoriented their interests both geographically and temporally. With regard to methodology of research, the Russian community of historians showed remarkable

[85] S. R. Mikulinskii, "Po povodu stat'i Pola Formana," *VIET* 2 (1990): 85.

[86] Evelynn Hammonds, "Science and Social Justice: Reflections on Moscow Conference," *STS News* (Massachusetts Institute of Technology) (October 1992).

diversity. The elder generation critically revisited traditional ideological dogmas and heroic myths (sometimes reversing their valences). They had reservations about new social studies of technology and science, fearing the reideologization of their field. The younger generation, in contrary fashion, radically changed its understanding of the very subject of study. These historians did not perceive their task as the investigation of what happened to technology and science due to some outside factors, but as the study of the technological and scientific facets of social developments. Paradoxically, having discarded "Marxyist" rhetoric and Marxist terminology altogether, Russian historians of technology and science began to implement in their discourse the methodology of sociopolitical analysis originated in the 1930s by Soviet historians of the Marxist school.

Russian scholarship now stands much closer to its American counterpart, which implies that it shares not only advantages but also unsolved problems. Both concentrate attention on domestic rather than foreign topics, both pay little attention to cultural conflicts in the transfer of technologies and scientific ideas, and both study mostly successes rather than failures (although the boundary between the two is often contingent—especially in the Soviet case).

Russian historians of technology and science, however, have failed to acknowledge the importance of several areas of research actively growing in the West. The Russian discourse is always univocal; it tells the story from one side, usually that of scientists and engineers. The role of sociocultural context is at best reduced to a formative one; the various consequences of different technologies and scientific studies for society are virtually never explored. A gender approach is never mentioned, let alone applied. The same fate is shared by analysis of rhetoric and visual representations. Social constructivist and postmodernist critique is bravely ignored.

As Russian scholarship becomes more sophisticated, it encounters more profound and difficult issues. This can be regarded as a positive trend: where before crude ideological pressure and limited access to historical sources were the main problem, now the major problems stem from the complexity of the subject of study itself—the history of technology and science.

[Footnotes]

[1] **Review: [Untitled]**

Reviewed Work(s):

Voprosy Istorii Estestvoznaniia i Tekhniki by B. I. Kozlov

Paul R. Josephson

Isis, Vol. 82, No. 2. (Jun., 1991), pp. 298-300.

Stable URL:

http://links.jstor.org/sici?sici=0021-1753%28199106%2982%3A2%3C298%3AVIEIT%3E2.0.CO%3B2-Q

[8] **The Socio-Political Roots of Boris Hessen: Soviet Marxism and the History of Science**

Loren R. Graham

Social Studies of Science, Vol. 15, No. 4. (Nov., 1985), pp. 705-722.

Stable URL:

http://links.jstor.org/sici?sici=0306-3127%28198511%2915%3A4%3C705%3ATSROBH%3E2.0.CO%3B2-X

[10] **Soviet Views on the History of Science**

David Joravsky

Isis, Vol. 46, No. 1. (Mar., 1955), pp. 3-13.

Stable URL:

http://links.jstor.org/sici?sici=0021-1753%28195503%2946%3A1%3C3%3ASVOTHO%3E2.0.CO%3B2-3

LINKED CITATIONS

[11] **Soviet Marxism and the History of Science**
Alexander Vucinich
Russian Review, Vol. 41, No. 2. (Apr., 1982), pp. 123-143.
Stable URL:
http://links.jstor.org/sici?sici=0036-0341%28198204%2941%3A2%3C123%3ASMATHO%3E2.0.CO%3B2-3

[39] **Big Science in the Last Years of the Big Soviet Union**
Loren R. Graham
Osiris, 2nd Series, Vol. 7, Science after '40. (1992), pp. 49-71.
Stable URL:
http://links.jstor.org/sici?sici=0369-7827%281992%292%3A7%3C49%3ABSITLY%3E2.0.CO%3B2-8

[42] **On the Russian Archives: An Interview with Sergei V. Mironenko**
Vitaly Chernetsky
Slavic Review, Vol. 52, No. 4. (Winter, 1993), pp. 839-846.
Stable URL:
http://links.jstor.org/sici?sici=0037-6779%28199324%2952%3A4%3C839%3AOTRAAI%3E2.0.CO%3B2-I

[42] **Researching Perestroika in the Archive of the TsK KPSS**
Gordon M. Hahn
Russian Review, Vol. 53, No. 3. (Jul., 1994), pp. 419-423.
Stable URL:
http://links.jstor.org/sici?sici=0036-0341%28199407%2953%3A3%3C419%3ARPITAO%3E2.0.CO%3B2-3

[42] **A First Glimpse into the Moscow Party Archive**
David L. Hoffmann
Russian Review, Vol. 50, No. 4. (Oct., 1991), pp. 484-486.
Stable URL:
http://links.jstor.org/sici?sici=0036-0341%28199110%2950%3A4%3C484%3AAFGITM%3E2.0.CO%3B2-D

[44] **Commercialization of Scholarship: Do We Need a Code of Behavior?**
J. Arch Getty
Slavic Review, Vol. 52, No. 1. (Spring, 1993), pp. 101-104.
Stable URL:
http://links.jstor.org/sici?sici=0037-6779%28199321%2952%3A1%3C101%3ACOSDWN%3E2.0.CO%3B2-Y

LINKED CITATIONS

[44] **The Archival Gold Rush and Historical Agendas in the Post-Soviet Era**
Mark von Hagen
Slavic Review, Vol. 52, No. 1. (Spring, 1993), pp. 96-100.
Stable URL:
http://links.jstor.org/sici?sici=0037-6779%28199321%2952%3A1%3C96%3ATAGRAH%3E2.0.CO%3B2-7

[44] **The Fate of the KGB Archives**
Amy Knight
Slavic Review, Vol. 52, No. 3. (Autumn, 1993), pp. 582-586.
Stable URL:
http://links.jstor.org/sici?sici=0037-6779%28199323%2952%3A3%3C582%3ATFOTKA%3E2.0.CO%3B2-E

[44] **The Commercialization of Scholarship in the Former Soviet Union**
Ellen Mickiewicz
Slavic Review, Vol. 52, No. 1. (Spring, 1993), pp. 90-95.
Stable URL:
http://links.jstor.org/sici?sici=0037-6779%28199321%2952%3A1%3C90%3ATCOSIT%3E2.0.CO%3B2-Q

[44] **Much Ado About Nothing?**
Boris N. Mironov
Slavic Review, Vol. 52, No. 3. (Autumn, 1993), pp. 579-581.
Stable URL:
http://links.jstor.org/sici?sici=0037-6779%28199323%2952%3A3%3C579%3AMAAN%3E2.0.CO%3B2-3

[44] **Research, Ethics and the Marketplace: The Case of the Russian Archives**
E. D. M.
Slavic Review, Vol. 52, No. 1. (Spring, 1993), pp. 87-89.
Stable URL:
http://links.jstor.org/sici?sici=0037-6779%28199321%2952%3A1%3C87%3AREATMT%3E2.0.CO%3B2-P