Space-Time, Death-Resurrection, and the Russian Revolution

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> An vero si cessarent coeli lumina, et moveretur rota figuli, non esset tempus, quo metiremur eos gyros?
> —St. Augustine, *Confessiones*[1]

In his pioneering cultural history of space and time in the age of modernity, Stephen Kern argued that

> [f]rom around 1880 to the outbreak of World War I a series of sweeping changes in technology and culture created distinctive new modes of thinking about and experiencing time and space… The assault on a universal, unchanging and irreversible public time was the metaphysical foundation of a broad cultural challenge to traditional notions about the nature of the world and man's place in it. The affirmation of private time radically interiorized the locus of experience. It eroded conventional views about the stability and objectivity of the material world and of the mind's ability to comprehend it…
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> The sense of the present was the most distinctively new, thickened temporally with retentions and protentions of past and future and,

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[1] "And even if the heavens' lights stop moving, and only a potter's wheel rotates, should there be no time by which we would measure those revolutions?" Quoted in A. Fridman, *Mir kak prostranstvo i vremia* (St. Petersburg: Academia, 1923), 63.

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> most important, expanded spatially to create the vast, shared experience of simultaneity… The concept of simultaneity appeared in almost every field—physics, psychology, art, drama, poetry, novels, and cinema. Numerous journalists from that period argued that the new transportation and communication technologies had "annihilated time and space," creating what one later historian characterized as an age of simultaneity.… At the end of my period, World War I was the ultimate drama of simultaneity as millions of men, wearing wristwatches for the first time in history, acted in unison in response to telephone messages sent to their commanders from headquarters.[2]

Kern's analysis, which ends at the moment when Europe plunged mindlessly into the debacle of the Great War to be eventually crippled by it, provides a departure point for the current study. The war and its aftermath engendered a much stronger than before sense of disruption and correspondingly more abrupt and profound changes in the culture of space and time, as one would rightfully expect from the scene of collapsing empires, radical social revolutions, public infatuation with general relativity, nonfigurative art, airborne photography, technological mobile warfare, logistically coordinated, heretofore unprecedented movements of millions-strong armies, and the ensuing slaughter of millions. The acceleration of changes, greater heterogeneity of experiences, and enormity of the source base have not yet allowed for the writing of a similarly thorough, chronological sequel to Kern's investigation. As a partial contribution towards that daunting goal, this chapter can still sketch out the outlines of such a sequel by identifying some important and symptomatic trends of that turbulent era.

My inquiry looks into the space-time sensitivities and reactions of the generation that experienced the shock of the great historical cataclysm of the early 20th century and tried to survive it. The violence of war, although common, isolated participating countries and cultures and produced patterns significantly more diverse and discrete than those in the interconnected, pan-European, prewar manifold studied by Kern. In particular, the Russian cultural space analyzed here experienced the sense of disruption more acutely, not least because the country suffered a whole series of catastrophic developments and revolutions in addition to the First World War. The resulting feeling of turmoil also lasted longer in Russia: many observers anticipated and reacted to the looming "time of troubles" already in 1905, during the Russo-Japanese

[2] Stephen Kern, *The Culture of Time and Space, 1880–1918*, 2nd ed. (Cambridge, MA: Harvard University Press, 2003), xiii, 1, 314. For a study that focuses more specifically on the culture of space-time in physics of that era, see Peter Galison, *Einstein's Clocks, Poincaré's Maps: Empires of Time* (New York: Norton, 2003).

War and the first, defeated revolution, whereas a relative stability and settlement after the end of the Civil War was generally achieved and acknowledged only by 1924. Most of the responses analyzed below were produced during the decade of 1915–25, usually closer to its end, but a few could also be traced to somewhat earlier dates down to 1905. The above limits define a generation with a shared "space of experience" (*Erfahrungsraum*) and "horizon of expectations" (*Erwartungshorizont*), to use Reinhart Koselleck's terminology.[3]

Not as a matter of choice, but of availability, my sources came mainly from originators of various cultural products for educated audiences. Like Kern, I find it crucial for the task of identifying cultural trends to include actors from many remote and heterogeneous fields: poetry, science, visual arts, mysticism, medicine, journalism, and philosophy, among others. Unlike Kern, however, I do not believe in the "phenomenological reduction" of these manifold cultural reactions down to some simpler, basic, supposedly universal categories of human experience with time and space. Instead, I classify the responses heuristically by the scale factor: some sources dealt with time and space at the biological, organismic level; others were concerned with human civilizations and their historical or metahistorical time-space, and yet others extended their analysis to astronomical and cosmological dimensions. Remarkably, whether they were discussing organisms, cultures, or universes, authors of diverse backgrounds often used similar metaphors and tropes of space and time, as if they were addressing the same underlying issues but in different situations. If, according to Kern, thickened "simultaneity" and a richer sense of the present dominated the culture of the *fin de siècle*, the postwar era produced at least two other persistent discourses. People who saw their social habitus scattered around and displaced by violent spasms of history tended to perceive space and time not as separate categories, but as interacting and mutually infringing ones (with or without a reference to Einstein or Salvador Dalí). All the while, many in the generation that suffered heretofore unprecedented numbers of premature and meaningless casualties became obsessed with the theme of death, rejuvenation, and imagined resurrection.

In this chapter I pay special attention to cases when these two discourses—space-time and death-resurrection—intersected and interacted with one another. For it was their combination, as will be argued below, that provided the cultural inspiration for one of the most interesting and significant, in the long run, innovations of that period: a vision that our Universe could have been born explosively out of a singularity a dozen or so billion years ago, have expanded ever since, and may continue to grow forever or possibly collapse back into a singularity after billions more years of existence. This

[3] Reinhart Koselleck, *The Practice of Conceptual History: Timing History, Spacing Concepts* (Stanford, CA: Stanford University Press, 2002), 111.

cosmological model was first proposed in 1922 by the Petrograd mathematician Alexander A. Friedmann (Aleksandr Aleksandrovich Fridman),[4] and 40 years later it, or rather its better flexed successor, became generally accepted under the name the "Big Bang Theory," which still forms the core of scientists' cosmological beliefs. By now, we have become sufficiently accustomed to this concept to no longer feel disturbed by its unusual features and ramifications, but historically this was not the case.

My investigation was initially inspired by the puzzling origin of the Big Bang concept in the 1920s. What began as a historical inquiry into its sources has demanded and evolved into a more general exploration of the perceptions of space and time in revolutionary Russia, as well as responses to Einstein's relativity theory not merely by physicists and mathematicians, but also in popular culture, the general public, medical and natural historical circles, artistic, literary, and poetic *milieux*, and religious and mystical authors. Their discussions were so closely entangled with two other intellectual sensations of the decade—one biomedical and the other historico-philosophical—that the analysis had also to incorporate rejuvenation à la Steinach and Spengler's *Decline of the West* alongside relativity. The resulting chapter consists of two unequal parts: in the first section, I describe Friedmann's cosmological proposal in 1922–24 and how its strange aspects provoked initial rejection or resistance within the small professional community of international experts on relativity. The subsequent sections describe Friedmann's contemporaries in revolutionary Russia and their discourses of space-time and death-resurrection at different levels: organismic, historical, and cosmological. The spectrum of their often much stranger ideas will provide the proper contextual background for understanding and interpreting the cultural meanings of Friedmann's physical choices and mathematical formulae.

1. Three Puzzles of Friedmann's Universe

In a short mathematical paper completed in May 1922 and published later that year in the leading physics journal in Germany, the young Petrograd mathematician Alexander A. Friedmann (1888–1925) demonstrated for the first time that in Einstein's general theory of relativity, the Universe did not have to remain stable, but could expand, contract, possibly collapse violently, and be

[4] The rendition of this name as "Alexander A. Friedmann" in the current chapter reflects the author's request. References to this mathematician elsewhere in this book are rendered with our standard transliteration, thus "Aleksandr Fridman."

born explosively out of a "singularity," a point of infinite density and infinitely small radius.[5]

Friedmann had studied mathematics at St. Petersburg University and upon graduation in 1910 had worked primarily in mathematical physics and its applications to meteorology, aero- and hydrodynamics, while preparing for an academic career. During the First World War he served in the air force at the Austrian front, participated in air reconnaissance, and became an expert and instructor on navigation and flight. After the revolution, he was appointed professor of mechanics and taught (and survived) during the Civil War at the newly founded University of Perm′, an industrial city on the trans-Siberian railroad, near the Ural Mountains. In the summer of 1920, as the Civil War drew to a close, Friedmann returned to his alma mater in the by-then renamed city of Petrograd.[6]

While the Russian economy was recovering from its wartime collapse, academics typically made ends meet by holding multiple jobs and part-time appointments. Friedmann resumed his prewar connection with the country's meteorological headquarters, the Main Geophysical Observatory, which became his primary affiliation and where he rose from the position of mathematical investigator to director by 1925. This post oriented most of his personal research towards the mathematical theory of turbulence and dynamical atmosphere, as well as demanding administrative responsibilities for the creation of the vast meteorological network of the Soviet Union. Additional, part-time academic appointments occasioned Friedmann's parallel inquiries into Niels Bohr's quantum theory of the atom and Albert Einstein's general relativity.[7] (See figure 13 in the gallery of illustrations following page 280.)

The special theory of relativity had already been well received in Russia prior to the war, but Einstein's general relativity of 1915 arrived there only after a five-year delay, due to the wartime breakdown of communications.

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[5] A. Friedmann, "Über die Krümmung des Raumes," *Zeitschrift für Physik* (hereafter *ZP*), no. 10 (1922): 377–86. His first paper considered possible worlds with positive curvatures, the finite ones. In his second paper: A. Friedmann, "Über die Möglichkeit einer Welt mit konstanter negativer Krümmung des Raumes," *ZP* 21 (1924): 326–32, he analyzed infinite worlds with negative curvatures. For the English translation, see Jeremy Bernstein and Gerald Feinberg, eds., *Cosmological Constants: Papers in Modern Cosmology* (New York: Columbia University Press, 1986), 49–58 and 59–65.

[6] The most detailed biography of Friedmann is E. A. Tropp, V. Ya. Frenkel, and A. D. Chernin, *Alexander A. Friedmann: The Man Who Made the Universe Expand* (London: Cambridge University Press, 1993).

[7] A. S. Monin, P. Ia. Polubarinova-Kochina, and V. I. Khlebnikov, *Kosmologiia. Gidrodinamika. Turbulentnost′: A. A. Fridman i razvitie ego nauchnogo naslediia* (Moscow: Nauka, 1989).

Together with the physicist Vsevolod Konstantinovich Frederiks (1885–1944), Friedmann became the top Russian expert on general relativity for professionals. Together, the two of them organized a colloquium to discuss and explain the intricacies of the difficult theory to their physicist colleagues. In 1922/23 Friedmann taught the first advanced course on general relativity at Petrograd University. He published two books on relativity: a short philosophical analysis titled *The World as Space and Time* (*Mir kak prostranstvo i vremia*), and a mathematical introduction (coauthored with Frederiks), as volume 1 of an intended multivolume treatise. Additionally, in 1922 and 1924, he produced two very short (many formulae, not too many words) papers on cosmological models compatible with the general theory of relativity. In September 1925, shortly after contracting typhus, Friedmann died without leaving further comments on or explanations of his pathbreaking ideas. At the time of his death, nobody anticipated their fundamental importance for the future development of cosmology. Recognition would only come much later, and slowly.[8]

The very first cosmological models based on general relativity had been suggested in 1917 by Einstein himself and the Dutch astronomer Willem de Sitter (1872–1934). They both regarded a constant and uniform curvature throughout the space-time manifold as the natural and necessary condition for a satisfactory cosmology. Their models differed in other properties, and during the 1920s a small community of experts continued to debate which of the two main contenders better corresponded to the real, observable Universe.[9]

Friedmann's main hypothesis of 1922 transcended the framework of the existing discourse by suggesting that the curvature radius of the Universe could increase or decrease with time, rather than having a fixed value. Early readers did not welcome this suggestion: for them, just as for us now if we give it a thought, it looked much more natural and attractive to live in a stable, permanent world. In his brief paper, Friedmann did not elaborate what had motivated him to propose his alternative, non-static hypothesis, but he quickly moved to derive mathematical consequences from it. Having inserted uniform but time-dependent curvature as a required condition into the basic equations of general relativity, he used his skills as a professional mathematician to describe and analyze the entire spectrum of possible solutions.

The existing models of Einstein and de Sitter became, in his theory, special limiting cases of a much more general range of cosmological models.

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[8] For the Russian edition of Friedmann's selected works, see A. A. Fridman, *Izbrannye trudy* (Moscow: Nauka, 1966); for the scholarly German edition, see Alexander Friedmann, *Die Welt als Raum und Zeit* (Frankfurt am Main: Harri Deutsch, 2006).

[9] Matteo Readli and Guilio Peruzzi, "Einstein, de Sitter and the Beginning of Relativistic Cosmology in 1917," *General Relativity and Gravitation* (hereafter *GRG*) 41 (2009): 225–47.

Einstein's Universe was a sphere of positive curvature in space coordinates, which did not change in time (in four dimensions, it could thus be described as a cylinder). The model allowed an infinite number of mathematical solutions, one for every positive value of the mean density of matter, which parameter determined the other properties of the universe, such as its radius and total mass. A comparison with astronomical data could then help to choose the most realistic value that better corresponded with features of the observable Universe. Friedmann multiplied the manifold of possible cosmological solutions by another infinity: his mathematical scenarios depended on two, rather than one, independent parameters (for example, the mean density and the curvature radius of the Universe at a given moment). For possible comparisons with reality, one thus had to estimate empirically both parameters, which together would then determine the Universe's past and future. Practically all of Friedmann's solutions were nonstatic; the Universe was either expanding or contracting, except in very special cases, such as Einstein's.

The first (and essentially the only) immediate expert reaction in print to Friedmann's proposal was negative. In two short letters to the same journal, Einstein at first called Friedmann's 1922 result "suspicious" and based on a mathematical mistake, then, a year later, corrected himself by admitting the mathematical validity of Friedmann's solutions, but still stopped short of seeing them as physically meaningful.[10] One common way of not accepting Friedmann's model of the Universe was, indeed, the tendency to present his solutions as a merely mathematical, formal rather than a real astronomical possibility. Later this kind of rhetorical resistance, such as by Vladimir Aleksandrovich Fok (Fock, 1898–1974) who was developing his own interpretation of general relativity, would mutate into a popular historical myth that claimed that Friedmann himself viewed his solutions only as a mathematical formality. This tendency to downplay Friedmann's achievement by ascribing to him the opinions of skeptics and resisters persists to the present day and is often repeated in print, even though it does not find justification in Friedmann's own writings.[11]

[10] A. Einstein, "Bemerkung zu der Arbeit von A. Friedmann 'Über die Krümmung des Raumes,'" *ZP*, no. 11 (1922): 326; "Notiz zu der Bemerkung zu der Arbeit von A. Friedmann 'Über die Krümmung des Raumes," *ZP*, no. 16 (1923): 228. For a detailed discussion, see Georg Singer, "Die Kontroverse zwischen Alexander Friedmann und Albert Einstein um die Möglichkeit einer nichtstatischen Welt," in *Einstein's Kosmos: Untersuchungen zur Geschichte der Kosmologie, Relativitätstheorie und zu Einsteins Wirken und Nachwirken*, ed. Hilmar W. Duerbeck and Wolfgang R. Dick (Frankfurt am Main: H. Deutsch, 2005), 142–61.

[11] This is not the place to delve at length into the complex story of receptions, rejections, eventual acceptance, and continuing misinterpretations of Friedmann's cosmological ideas, which I intend to present in a separate publication. Here I focus only on

Einstein abandoned his own commitment to the static Universe in favor of Friedmann's solution in 1931, after learning about Edwin Hubble's astronomical observations. Hubble had announced in 1929 that faraway galaxies were running away, the faster the further they were removed from us. As an empiricist, Hubble was skeptical about cosmologists' speculative attempts to extrapolate astronomical findings for the limited observable region to a theory of the Universe as a whole. As a theorist, Einstein did not share this reservation; he interpreted Hubble's discovery as the expansion of the entire Universe, a direct empirical confirmation of Friedmann's cosmology and a refutation of his own earlier model of 1917. After 1931, Einstein always acknowledged Friedmann's priority for the new cosmology of expanding Universe, especially appreciating it as a theoretical prediction that preceded experimental proofs: "Several authors have made attempts to connect the new data with a spherical Universe whose radius varies with time. A. Friedmann was the first to embark upon this route, and he had done this even before the observational evidence became available."[12]

A non-static Universe was the primary and most explicitly novel hypothesis in Friedmann's model, but not its strangest aspect. Even more discomforting were the singularities, or the fact that in most of his scenarios, the expanding Universe started out from an infinitely small point with infinitely large density, and in many scenarios, it also ended up collapsing back into a point. Friedmann divided the complete set of all theoretically possible solutions for his equation into three qualitatively different classes. The first class, which he called the "monotone world of the first type," described universes that started from a singularity and expanded forever (in modern terminology, the "accelerating Universe" scenario, currently seen as the likeliest description of the real world). In another class of scenarios, the initial expansion from a singularity slowed down with time, the radius would reach some maximum value and then start decreasing as the Universe reversed into a contracting mode, eventually imploding back into an infinitely small point. And only in the third class of scenarios, which Friedmann called the "monotone world of

some initial reactions to his views, which help me to underscore those aspects that were considered strange at the time of his proposal.

[12] A. Einstein, "Zum kosmologischen Problem der allgemeinen Relativitätstheorie," *Sitzungsberichte Preussischen Akademie der Wissenschaften. Physikalisch-Mathematische Klasse* (1931): 235–37; See also his book written for wider audiences, A. Einstein, *Relativity: The Special and General Theory*, which was originally published in 1916, but its multiple editions after 1931 added a discussion of Friedmann's cosmology.

the second type," did singularities not appear. The Universe started from a finite radius and its ever-accelerating expansion never stopped.[13]

Instinctively and for good reasons, physicists and applied mathematicians treat singularities in equations with suspicion if not outright rejection. In the most frequent cases, infinities in mathematical solutions indicate that the simplifying assumptions made in setting up the model and its equations no longer hold under the specific conditions for which a solution is sought. A different, more complex model is then needed, whose assumptions better correspond to real conditions and can thus provide finite, physically meaningful results. Meaningless infinities appeared especially often in the general theory of relativity, where they could easily arise as mathematical artefacts from a choice of coordinate systems. In some coordinates, calculations yielded infinite results, whereas by choosing a different, more suitable coordinate frame, the same problems could be solved normally and without infinities. In view of this existing and recognized problem, it seemed puzzling that Friedmann accepted singularities in his equations matter-of-factly and without question. Without expressing any doubt or reservation, he wrote about "time since the creation of the world" and the "finite total time of the world's existence."[14] Mathematically he would be proven right in the sense that his main results were invariants, independent of any particular choice of coordinate system. But were those singularities physically meaningful? It would have been more natural for a theorist, pure or applied, to think, "no"—at least such was the initial attitude of relativistic cosmology's other founders, including the chief promoters of the expanding Universe, Arthur Stanley Eddington (1882–1944) and Georges Lemaître (1894–1966).

In 1927, aware of the idea of a nonstatic Universe but lacking direct familiarity with Friedmann's papers, Lemaître rederived his equations and analyzed the scenario of cosmological expansion. His objective and conclusions differed, however. Friedmann had described the most complete set of all theoretically possible scenarios, which included Einstein's and de Sitter's as special cases. Lemaître aimed at what he considered a realistic intermediate model, a hybrid between the Einstein and the de Sitter worlds, which combined selective features of both. Lemaître's resulting solution, correspondingly, was narrower, limited to the class of scenarios that Friedmann had called "the monotone world of the second type," in which expansion started from a finite sphere and singularities did not appear. Starting in 1930, Eddington accepted

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13 For a detailed description of Friedmann's classes of scenarios and their mathematical conditions and properties, see Ari Belenkiy, "Alexander Friedmann and the Origins of Modern Cosmology," *Physics Today* 65 (2012): 38–43.

14 Friedmann, "Über die Krümmung des Raumes," 384–85.

and supported Lemaître's solution and popularized it widely in numerous editions of his *Expanding Universe*. He, too, saw this model as "intermediate" between Einstein's and de Sitter's and avoided solutions with singularities altogether. In his theory, the Universe started from a finite spherical Einsteinian state, whose instability due to fluctuations of the metric resulted in the eventual expansion.[15]

Friedmann's idea of singularities would gain acceptance only gradually and significantly later than his idea of cosmological expansion. In the 1930s, several cosmologists included scenarios with singularities in discussions and reviews, but the major push came during the 1940s from George Gamow (1904–68) and coauthors, who developed the theory of the superdense and superhot, exploding universe that combined general relativity with nuclear reactions and the creation of chemical elements. It was then that the concept of the Universe created explosively out of a singularity was christened, derogatively, the "Big Bang" by the skeptical Fred Hoyle (1915–2001). General recognition came only in the early 1960s, 40 years after Friedmann's initial proposal.[16]

Friedmann's third puzzling idea remains weird even at present; it has never become popular and is promoted only rarely, if repeatedly, in the cosmological literature, usually under the name "oscillating Universe."[17] In his two papers, Friedmann had made sure to describe carefully all theoretically possible solutions for the Universe, but he clearly showed more interest in one out of three classes of possible scenarios: namely the one in which the Universe first expanded out of its initial singularity but would eventually collapse back into a point. Later cosmologists have tended to view this scenario as a finite lifespan, from the creation of the Universe to its end. Friedmann, however, called this solution "periodic" and preferred to interpret it as cycli-

[15] Georges Lemaître, "Un univers homogène de masse constante et de rayon croissant, rendant compte de la vitesse radiale des nébuleuses extra-galactiques," *Annales de la Société Scientifique de Bruxelles* 41A (1927): 49–59. English translation "A Homogeneous Universe of Constant Mass and Increasing Radius Accounting for the Radial Velocity of Extra-Galactic Nebulae," *GRG* 45 (2013): 1635–46; A. S. Eddington, "Instability of the Einstein Spherical Universe," *Monthly Notices of the Royal Astronomical Society* 90 (1930): 668–78; Sir Arthur Eddington, *The Expanding Universe* (Cambridge: Cambridge University Press, 1933), 46.

[16] Fred Hoyle, *The Nature of the Universe* (Oxford: Blackwell, 1950), 102; Helge Kragh, "Naming the Big Bang," *Historical Studies in the Natural Sciences* 44 (2014): 3–36. On Gamow's role in the story, see Alexandre Bagdonas and Alexei Kojevnikov, "Funny Origins of the Big Bang Theory," *Historical Studies in the Natural Sciences* 51 (2021): 87–137.

[17] Helge Kragh, "Continual Fascination: The Oscillating Universe in Modern Cosmology," *Science in Context* 22 (2009): 587–612.

cal, in which the point of death is also the moment of rebirth—the beginning of another cycle of expansion and contraction—and so on *ad infinitum*.

Mathematics, Friedmann explained, permitted both visions equally – just one finite cycle of life, or the infinite repetition of them – but his preference obviously lay with the latter alternative. He treated the periodic scenario as the most realistic of all and the only one for which he made some empirical estimates. At the end of his paper, Friedmann mentioned some possibilities for comparing his theoretical cosmology with the real world, but his main problem at the time of writing was the paucity of available astronomical data (Hubble had yet to publish about runaway galaxies). Still, using some very rough approximations for the mean density of the Universe, Friedmann estimated the length of the cosmological period at ten billion years, which by order of magnitude comes surprisingly close to the age of the Universe according to modern estimates, based on much more precise astronomical data.[18]

As befits mathematical publications, Friedmann's two short papers contained mostly formulae and derivations, with hardly any clues or verbal explanations of what could have inspired or motivated his unusual proposal. His early death in 1925 did not allow him to add substantial subsequent commentaries or explain his special interest in the periodically dying and reviving Universe, except for one cryptic remark that it "unwittingly recalled the Indian mythology of life's periods."[19] Revealing clues can be found, however, if we compare those aspects of Friedmann's cosmology that appeared strange and initially unacceptable to his scientific peers with some of the other views, expressed by Friedmann's neighbors and compatriots who were not necessarily scientists. The readers must be warned, however, that these other contemporaneous reactions to Einstein's relativity could sound occasionally a lot weirder than Friedmann's own.

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[18] Friedmann, "Über die Krümmung des Raumes," 386. Shortly before his death in 1925, Friedmann reportedly found empirical support for his cosmology in Vesto Slipher's preliminary data on galactic movements, which were published in the 1923 edition of A. S. Eddington, *The Mathematical Theory of Relativity* (Cambridge: The University Press, 1923).

[19] Fridman, *Mir kak prostranstvo i vremia*, 122. The most likely source of Friedmann's familiarity with Indian philosophy was the Theosophical movement in Russia, not because Friedmann's biographers know of any connection between him and anyone in that movement but simply because Theosophy was fashionable in St. Petersburg circles in the 1910s and the topic of many conversations among intellectuals.

2. Relativity and Resurrection

In November 1919, newspapers around the world spread the sensational news that the most venerated and reliable of all modern sciences, Isaac Newton's gravity, had been overthrown in favor of the newest, unfamiliar and counter-intuitive theory of relativity by Albert Einstein. Many professional astronomers were still cautious, since the three sets of obtained photographic data provided still questionable and considerably diverging numerical results. Even Frank Dyson, the Astronomer Royal and the top organizer of the two British eclipse expeditions that year to measure the deflection of light rays passing near the sun, still thought that more observations were desirable.[20] The Nobel Committee did not hurry either but waited a few more years until awarding Einstein its prize, and even then deliberately recognized not the theory of relativity, but something much less controversial, if not as significant. But the general public's reaction was unconstrained. Practically overnight, Einstein transformed from an anchorite thinker into a media star, followed by paparazzi who reported his every move and opinions on all kinds of questions. Anyone who read newspapers would know Einstein by name, and practically everyone who aspired to be seen as an intellectual, regardless in what field, had at least to pretend to understand something about the theory of relativity and space-time. The social phenomenon of such an outburst of public enthusiasm is typically assumed, but has not yet been properly analyzed, as having something to do with the recently ended catastrophic World War, depressing fatigue, and desired sublimation.

In revolutionary Russia, a similar fame arrived for Einstein after a roughly one-year delay caused by the still unfinished civil war. But once it had arrived by the end of 1920, it triggered a cultural reaction as explosive as elsewhere, or even multiplied by the great hunger for European news after six years of war and informational isolation. The reading and writing public boiled with excitement and discussed Einstein in all sorts of venues and texts, appropriate and not. Hundreds of publications dealing with relativity included translations of major European authors and as wide and incoherent a spectrum of reactions, interpretations, and misperceptions as that which characterized the popular response to relativity elsewhere.[21] Yet some of the commentaries

[20] Daniel Kennefick, *No Shadow of a Doubt: The 1919 Eclipse that Confirmed Einstein's Theory of Relativity* (Princeton, NJ: Princeton University Press, 2019).

[21] For the enormous range of European interpretations and misinterpretations of the relativity theory from all kinds of philosophical and some political perspectives, see Klaus Hentschel, ed., *Interpretationen und Fehlinterpretationen der speziellen und der allgemeinen Relativitätstheorie durch Zeitgenossen Albert Einsteins* (Basel: Birkhäuser, 1990), with a bibliography of over 3,200 titles.

were more idiosyncratic, reflecting the culturally specific realities and experiences of a society in the whirlwind of revolutionary change. Historians of science have produced thorough studies of the relativity theory's reception in Russia and the USSR by professional physicists and mathematicians.[22] But the enormous and practically insuperable mass of popular, pseudoscientific, literary, artistic, mystical, etc. responses to relativity has scarcely been analyzed, and the present, article-length study can only offer a partial remedy to that oversight.

Among the earliest and most immediate of such reactions was that of Vladimir Vladimirovich Maiakovskii (1893–1930), the futurist poet and icon of the artistic avantgarde. It was reported to us by his friend and acolyte, Roman Osipovich Iakobson (Jakobson, 1896–1982), who would eventually also become famous as a linguist and professor at Harvard, but who was at the time still a young and aspiring literary critic, and a diplomatic interpreter. (See figure 14.)

> In the spring of 1920 I returned [from Berlin] to blockaded Moscow, brought some European books and news about the scientific work in the West. M[aiakovskii] forced me to repeat several times my clumsy report on the general theory of relativity and debates surrounding it. Liberation of energy, the problem of time, the question whether the speed faster than light reverses the direction of time—he was carried away by all this. I rarely saw him so attentive and absorbed.—"And don't you think" asked he suddenly, "that immortality will be gained through this?" I looked at him puzzled and muttered something unconvincingly.—Then, with the hypnotizing gaze familiar to all those who knew him well, he moved his jaw: "And I am totally convinced that there will be no more death. And that the dead will be resurrected. I will find a physicist to explain Einstein to me point by point. It isn't true that I cannot understand! I will pay this physicist a special academic ration." At that moment, I saw a very different M., totally obsessed with the demand for victory over death.
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> He soon told me that he was working on a poem, *The Fourth International* (later changed to *The Fifth International*), devoted to all this. "Einstein will be a member of this International…" M. had a plan to send Einstein a radiogram, a greeting from the art of the future to the science of the future. We did not return to this topic later, and *The Fifth International* remained unfinished. But the epilogue of his poem *About*

22 See, especially, V. P. Vizgin and G. E. Gorelik, "The Reception of the Theory of Relativity in Russia and the USSR," in *The Comparative Reception of Relativity*, ed. Thomas F. Glick (Dordrecht: Springer, 1987): 265–326.

> *This*: "I see clearly, to the tiniest detail I see… Inaccessible to decay and putrefaction—gleaming, rearing through the eras, the workshop of human resurrection…" I have no doubt that for M., this was not just a poetic expression, but sincere and motivated appeal to the quiet highbrow chemist of the 30th century."[23]

Though nonplussed by Maiakovskii's belief in personal immortality and the future resurrection in flesh, Iakobson compared it with the "materialist mysticism of philosopher Fedorov." Some recent authors misinterpreted or transformed that short remark into a widespread speculation that Maiakovskii was a follower of Nikolai Fedorovich Fedorov's (1829–1903) religious philosophy,[24] even without any documentary evidence that Maiakovskii ever read Fedorov or knew about him. The striking contrasts between their views are no less important than similarities: Fedorov understood resurrection in a Christian, if heretical, sense. Motivated personally by his own family background, he hoped for a future resurrection of the earlier ancestors, as a Christian duty to those who gave their descendants life. By contrast, for the godless atheist Maiakovskii resurrection represented a scientific and materialistic, if utopian, hope, linked to Einstein's science rather than religious mysticism. And he certainly cared less about any ancient forebears than about himself and his own generation—friends and loved ones—too many of whom, young and talented, were prematurely taken away by death in recent wars and epidemics.

It is also clear that neither Iakobson nor Maiakovskii understood much about physics; moreover, additional confusion could have arisen through second-hand retelling. Still, it is possible to discern an intriguing logic behind Maiakovskii's immediate misinterpretation of relativity. Space and time figure very differently in our common human experience. With space, we are able to deal with significant liberty and confidence: move around, and to remote locations, look around, in one direction and in the opposite one, return to a previous place, etc. Time, on the contrary, practically imprisons and carries us. We cannot do much with it, other than maybe waste it without purpose, accelerate our own death, see imperfectly and not too far back into the past or, with terrible and costly mistakes, into the near future. But if Einstein was right, and space and time are essentially united into one, four-dimensional

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[23] Roman Jakobson, *Selected Writings* (The Hague: Mouton, 1979), 367. For a less literal English translation of this passage, see Roman Jakobson, "On a Generation that Squandered Its Poets" (1930), in *Language in Literature* (Cambridge, MA: Harvard University Press, 1987), 273–300, here 285–86.

[24] Iurii Karabchievskii, *Voskresenie Maiakovskogo* (Moscow: Sovetskii pisatel′, 1990). On Fedorov, see Svetlana Semenova, *Nikolai Fedorov: Tvorchestvo zhizni* (Moscow: Sovetskii pisatel′, 1990).

manifold, then there may be hope. Hope that in the future, thanks to revolutionary advances in science, humans will learn to master time just about as effectively as they do space and possibly restore the situation when friends and loved ones were still alive. To Maiakovskii as a nonphysicist, such reasoning could have easily appeared as logical. In this immediate local reaction to Einstein's relativity, the unification of space and time became strongly connected with the hope for human resurrection, and it was not as irrational as appears at first glance.

3. Rejuvenation and Immortality

In his 1923 poem *Pro eto* (*About This*) Maiakovskii described a towering and shiny "workshop for human resurrection" and appealed, straight from the printed page, to the future chemist with a personal request not to forget to resurrect him, a not so humble poet who lived in the early 20th century. In the preceding verse, he also entered a line, "Four times I'll age—four times rejuvenated be, before I reach the grave,"[25] that pointed precisely to yet another source of hope, another discovery almost as sensational and widely discussed at the time, as the theory of relativity. The most inspirational medical news of the decade came in 1920 from the famous Viennese professor Eugen Steinach (1861–1944), one of the founding fathers of modern endocrinology. Steinach promised to rejuvenate elderly people by preserving their sexual hormones, claiming that a relatively simple surgical operation, vasectomy, could make a sixty-five-year-old man feel physically like forty-five and be sexually active, although without the capacity to impregnate. A somewhat different, more complicated procedure was also offered to women. The media carried the exciting news around the globe, just as it did with Einstein's relativity, and generated a huge wave of replications, imitations, advertisements, and further variations of the method, an international medical industry of sorts. Later, by the evil irony of history, American eugenicists and Nazi doctors used the very same operations forcibly to sterilize hundreds of thousands of people whom they declared genetically inferior and defective. But in the early 1920s, the method was widely touted as a great gift to humanity in general and especially elderly patients. Many were more than happy to take a voluntary risk and pay for the hope of acquiring a second youth. Contrary to the proverbial historical law, the story played out first as farce, and only later repeated itself as tragedy.[26]

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[25] *Mayakovsky*, trans. and ed. Herbert Marshall (London: Dennis Dobson, 1965), on 210.

[26] C. Sengoopta, "'Dr. Steinach coming to make old young!' Sex Glands, Vasectomy, and the Quest for Rejuvenation in the Roaring Twenties," *Endeavour* 27, 3 (2007): 122–26.

Even the old Sigmund Freud got "Steinached," as the saying went. He did so quietly and without publicity, even though he should have better believed in his own theories of sexuality.[27] Others, like the great Irish poet W. B. Yeats (1865–1939) became open and public enthusiasts. Yeats boasted about his own rejuvenation, enjoyed his "second puberty" in romantic and sexual adventures and, with "revived creative power," produced some of his best poetry. In Russia, as elsewhere, Steinach's rejuvenation method was discussed and reported widely and with enthusiasm in professional biological circles as well as in mass media, although its use in actual medical practice was comparatively rare.[28] Like the rest of the reading public, Maiakovskii was certainly familiar with the news, but in the poem quoted above he also registered an additional, more specific intonation, which can be summarized as follows: "Rejuvenation is, of course, great, but resurrection would be much more important and desirable."

Russian doctors in the 1920s created a few medical sensations of their own, including the famous experiment with the severed head of a dog that, when artificially supplied with blood circulation to the brain, continued showing some signs of life for hours, with physiological responses to simple stimuli, such as tickling. (See figure 15.) While rather trivial from the perspective of today's medicine, at the time of its public demonstration in 1925 the experiment generated hype, enthusiasm, speculation, and science fiction literature about the possibility of brain life after death.[29] No less important internationally and in the long run, if less media-sensational, were medical advances in blood transfusion. Aleksandr Aleksandrovich Bogdanov (1873–1928), a radical revolutionary, renegade Bolshevik, and medical doctor by training, died in a transfusion experiment that he performed on himself soon after establishing the State Institute for Blood Transfusion in Moscow in 1926. The system of blood banks designed in the institute—the logistics of centralized collecting, classifying, preserving, and managing blood resources for future patients—continues to serve us today. Forgotten are the more utopian expectations that motivated its development at the time: hopes to achieve rejuvenation, prolon-

[27] J. Tainmont, "Sigmund Freud's Physicians and 'the Monster,'" *B-ENT* (Leuven) 1, 1 (2007): 49–60.

[28] N. K. Kol´tsov, ed., *Omolozhenie: Sbornik statei* (Moscow–Petrograd: Gosudarstvennoe izdatel´stvo, 1923).

[29] "Experiments in the Revival of Organisms," a later (1940) Soviet documentary in English, with an introduction by J. B. S. Haldane, F.R.S, https://www.youtube.com/watch?v=VtDQc-4wGvM (accessed 24 March 2021); Nikolai Krementsov, "Off with Your Heads: Isolated Organs in Early Soviet Science and Fiction," *Studies in History and Philosophy of Biological and Biomedical Sciences* 40 (2009): 87–100.

gation of life, and the blood brotherhood of people from all races through the collectivized sharing and exchange of the life fluid.[30]

Several other theories proposed at the time can be interpreted as sublimation, as attempts to explain away or rhetorically deny death. The young star of Petrograd physiology Nikolai Iakovlevich Perna (Peerna, 1878–1923) finished writing his major book in full awareness of his impending death from tuberculosis. Eighteen years of research and meticulous daily records of his body's various physiological manifestations convinced him of the fundamental periodicity of all essential life functions and organs. According to Perna, cells and different physiological parts and tissues each had their own, distinctive rhythm. For the human organism as a whole, the most important period comprised seven years, after which the organism underwent such a deep fundamental transformation (as, for example, during puberty), that could be compared to the death of one kind of organism and the birth of a new one, with different psycho- and physiological dominants and functions. In this rendering, physiological death and resurrection were not one-time phenomena but recurrent events that everyone experienced periodically during a lifetime, approximately every seven years, which must have made it easier to bear the thought of one's own approaching death.[31]

A senior geochemist and leading spokesmen for the Russian academic community, Vladimir Ivanovich Vernadskii (1863–1945) tried to cope with the trauma of mass deaths in a different way. In August 1914 he witnessed and was deeply shocked by the magnitude and tempo of war mobilization. The technology of railroads and telegraphy made it possible for millions of recruits to respond within mere hours, gather, and march together in coordinated simultaneous movements of human masses. To Vernadskii, their joint action in time and space on such a grandiose scale resembled the unstoppable power of gigantic geological forces. This thought launched him into a new line of investigation that considered the global planetary consequences of human life and activities and eventually, decades later, earned him international recognition as one of the founders of ecological thought. Vernadskii was certainly aware that he could not prevent the deaths of millions of soldiers, but throughout the seven years of wars and revolutions, he inspired and consoled himself with the hope of proving scientifically a new law of nature, the "conservation of living matter." He intended to demonstrate with empirical geochemical data

[30] V. N. Iagodinskii, *Aleksandr Aleksandrovich Bogdanov (Maliniovskii)* (Moscow: Nauka, 2006).

[31] Nikolai Pärna, *Das Wellenphänomen des Lebens* (Leipzig: Merseburger, 1923); Nikolai Perna, *Ritm zhizni i tvorchestva* (Leningrad–Moscow: "Petrograd," 1925). See also Margareete Otter, "The Founder of Chronobiology: Nikolai Pärna," *Acta Medico-Historica Rigensia* 5 (2000): 163–67.

and estimates that the total mass of all kinds of organic material on our planet remains a geological constant, that the sum of all life on Earth can neither be destroyed nor created, even if individual organisms and species die *en masse*.[32]

The widespread obsession with victory over death in revolutionary Russia has sometimes been ascribed to the Bolshevik Party and its political project as well as reflecting either its leaders' concerns about their own aging and immortality or their supposed intention to preserve Lenin's body intact in the Mausoleum for presumed future resurrection. In this case, however, the attribution is imaginary. Proposals to preserve Lenin's body in hopes of future scientific resurrection did exist, but they did not belong to and were not supported by the Bolshevik Party.

As my first attempt at oral history, in July 1986 I was fortunate to interview the late Lev Sergeevich Termen (Léon Theremin, 1896–1993) (figure 16). A young radio engineer in the 1920s, Theremin became famous for inventing the first ever electronic musical instrument, the Theremin-Vox, and even had a chance to perform for Lenin. Once he heard the news of Lenin's death in 1924, Theremin rushed to the Kremlin hoping to use his connections and convince the government to freeze and preserve Lenin's body intact, for possible resurrection by future science, and he was certainly not the only one to suggest such a course of action. Even in his nineties, Theremin still felt utterly disappointed that the Communist Party Politburo destroyed his hopes and precluded any possibility for Lenin's resurrection by deciding to preserve only the outward likeness of Lenin's body, while excising his internal organs for medical experimentation, including the dissection of his brain. In precisely the case that would have mattered to them the most, the life of their revered leader, Bolshevik leaders formally and resolutely rejected the hopes of visionary biology. They did profess belief in the immortality of Lenin's political legacy and ideas, but unlike many among the Russian academics and the public, the party did not buy into the utopia of future victory over physical death and the organism's possible immortality.[33]

If not the Bolsheviks (occasional individual curiosity notwithstanding), who then were the believers in biological resurrection? For the most part, they can be characterized alternatively as sympathizers, victims, survivors, fellow travelers, or surfers upon the revolutionary wave. Among the Russian educated public, diehard Bolsheviks were few and far between, but there were many more who either supported the revolution, accepted it as a fait accompli or as something that sadly or unavoidably had to happen, or else sympathized

32 V. I. Vernadskii, *Nachalo i vechnost´ zhizni* (St. Petersburg: Vremia, 1922).

33 Alexei Yurchak, "Bodies of Lenin: The Hidden Science of Communist Sovereignty," *Representations* 129, 1 (2015): 116–57.

with broad revolutionary aspirations and goals without being fully inculcated into the strictly Bolshevik worldview. The latter provided party members with definitive explanations and the strong conviction of being on the right side of history, supplying *prêt-à-porter* answers for troubling questions, doubts, and personal and collective traumas. Those who did not fully share such definitive revolutionary (or counterrevolutionary) beliefs lacked the comfort of intellectual certainty and were often left to search for alternative explanations on their own, or for some additional, non-Bolshevik utopian hopes.

Fixation on the problem of death and resurrection certainly reflected the collective trauma of a generation that had witnessed millions of deaths that defied justification or rationalization. Most survivors also had to cope with the personal trauma of premature loss, in wars and epidemics, of close family relatives, friends, children, and lovers, while some authors discussed in this chapter also had to wrestle with the awareness that they themselves were about to die prematurely. The revolutionary era, with its unpredictability, excitement, and high tragedy, encouraged the generation of many diverse and often incompatible utopias.[34] In that situation any hope, no matter how slight, for victory over death attracted a rapt attention. Such hopes could come in different styles and forms: a scientific utopia, as for Maiakovskii, a medical experiment, a metaphor or a rhetorical consolation, as for Perna, or the transpersonal, planetary conservation of life, as for Vernadskii.

4. *Der Untergang* and Justification of Deaths

The relationship between the tropes of death-resurrection and space-time also bothered authors who wrote on historical and metahistorical problems, rather than medico-biological ones. If not exactly at the same level as Einstein or Steinach, Oswald Spengler's *Decline of the West* (*Der Untergang des Abendlandes*, which in the Russian translation bore the more realistic title, *The Decline of Europe*), also created a sensation among the Russian public. Spengler's grandly speculative philosophical scheme of world history, with its prophecy or diagnosis of the extended period of the "decline of the West" analogous to the centuries-long decline of the Roman Empire at the end of antiquity, became a major bestseller in Germany immediately upon the first volume's release in 1918. It struck a chord and pandered to the pessimistic views of German burghers by providing a rationalization, and an apology, for their sense of loss and imperial decline after the catastrophic war. In Russia, Spengler's ideas also touched some sensitive nerves, but the tonality of many reviews

34 Richard Stites, *Revolutionary Dreams: Utopian Vision and Experimental Life in the Russian Revolution* (Oxford: Oxford University Press, 1989).

was typically mixed, in part praise, and in part ironic, on both the political left and right.

A Marxist reviewer would acknowledge the correctness, in principle, of the pessimistic part of Spengler's analysis, only with an added clarification that the "decline" of Europe had to be properly understood, of course, as the "crisis of capitalism." But the main thing that Spengler was incapable or unwilling to see, due to his bourgeois worldview, was that against the background of the old order's final crisis, a new, socialist order was already emerging and present, enabled by the era of proletarian revolutions already underway in some countries. At the other end of the Russian political spectrum, reviews written by conservative religious philosophers or historians also acknowledged that Spengler's diagnosis of the decline of European civilization was obviously correct, but not terribly novel. The essence of Spengler's conceptualization of world cultures and their fates had been formulated decades earlier, circa 1870, by the Russian pan-Slavist thinker Nikolai Iakovlevich Danilevskii (1822–85), who had already perceived the "decline of Europe" back then and who had, indeed, influenced Spengler. Like Spengler, the reviewers also drew analogies between the current historical era and the end of the Roman Empire (whose successor the Russian Empire claimed to be) but criticized him for his failure to identify the correct historical moment for comparison. It was already too late, they thought, to complain about the gradual, prolonged decline of the empire; the imperial order had already crashed, once again, and upon its ruins, a new era had commenced that could be described, for example, as the "New Dark Ages," or the "New Barbarism." One way or the other, both left-wing and right-wing Russian critics shared a strong feeling, based on their local *Erfarungsraum* (space of experience) that separated them from the German author, that the old world was not merely in decline, but had collapsed irreparably, and that a new world order had already been born in its infant form, whose eventual mature characteristics they were still struggling to predict, each according to their respective political prejudices.

The most distinctively Russian answer to Spengler's metahistorical speculation, however, came from another avantgarde poet, Velimir Khlebnikov (1885–1922), who had probably not even read Spengler, and did not necessarily need to read *Der Untergang*, because he already had invented a grandiose metahistorical conception of his own design:

> The pure laws of time were found by me in the year 1920, when I lived in Baku, the land of fire, in the high building of the marine dormitory, together with Dobrakovskii, namely on 17/11.... The first decision to look for the laws of time came on the day after Tsushima, when the news about the Tsushima battle [May 1905, in which the Russian navy

> was destroyed by the Japanese] arrived in the Iaroslavl′ region, where I lived then in the village of Burmakino, at Kuznetsov's. I wanted to find a justification for the deaths [*opravdanie smertiam*].[35]

Khlebnikov, also known as "The Chairman of the Globe," and "The King of Time," was proud of being born among the Kalmyks—a Buddhist nomadic tribe that lived close to Astrakhan′ on the Caspian Sea, where his father worked as an ethnographer. His ideas and beliefs reflected the rising "Eurasian" school of Russian thought that conceptualized Russia not as part of Europe, but as a distinctive civilization that combined European and Asian foundations on an equal footing. Having some background in mathematics from his studies at Kazan′ University, Khlebnikov was familiar with non-Euclidean geometry and also with relativity theory to some extent. He did not graduate as a mathematician or biologist, jumping instead into a Bohemian poetic life in St. Petersburg, where he quickly acquired a reputation as an absolute genius among a very narrow circle of connoisseurs, as a "poet for poets," whose versification in the style of *zaum* (literally "beyond sense") was also beyond almost everyone's comprehension.

In the beginning, like many futurists, Khlebnikov artistically romanticized war and violence, but these naïve illusions lasted only until he himself was conscripted, shaved, and dressed in a uniform at the start of the First World War. Once in a barracks, he quickly understood the idiocy of drill and the planetary stupidity of world affairs. He did not have to fake too much to simulate mental illness and escape from military service, and his strong antiwar stance contributed to his enthusiasm for the subsequent Bolshevik Revolution, which he interpreted, like many futurists, in a messianic key. Khlebnikov took part in some civil war adventures, which brought him to Azerbaijan and Persia. He also believed in personal reincarnation, counting among his earlier avatars the Egyptian religious reformer Amenhotep IV, the Greek mathematician Euclid, and the Indian Vedic philosopher Śaṅkarācārya.[36]

Like several other authors discussed in this chapter, Khlebnikov linked the inspiration for his dearest, if unconventional, theory with revelational personal experience: the moment of realization that a completely new historical era was starting, the era of troubles, distorting the usual flow of time. For him, such moment of understanding came with the shocking news about the

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35 Velimir Khlebnikov, *Doski sud′by*, ed. Vasilii Babkov (Moscow: Rubezh stoletii, 2000), 9.

36 On Khlebnikov's poetry, see Raymond Cooke, *Velimir Khlebnikov: A Critical Study* (Cambridge: Cambridge University Press, 1987). His scientific and quasi-scientific views were discussed in Viacheslav V. Ivanov, "Khlebnikov i nauka," *Puti v neznaemoe: Pisateli rasskazyvaiut o nauke*, vyp. 20 (Moscow: Sovetskii pisatel′, 1986), 382–440.

military disaster at Tsushima in 1905. For others, it could be some other big and catastrophic event of which there was no shortage during that period: the start of the Great War, the tragedy of *Titanic*, the first or second Russian revolutions, etc. His existential perception of time was that of a physical force with great destructive power, rather than simply the regular ticking of a clock, the sound of an approaching tsunami that was not yet seen, but could be felt from afar, was impossible to stop, and did not allow a rational strategy of how to stay safe.

Khlebnikov was composing his *Tablets of Destiny* in 1922, as he lay dying of gangrene poisoning at the age of 36 in a remote village, comforted by a family of friends who subsequently preserved his surviving manuscripts. "Please don't show these notes to any academic, but publish, if possible," he expressed as his last wish regarding the pages filled with mathematical calculations on the laws of historical time, on which he had been working for several years. Khlebnikov's pure laws of time relied on Pythagorean numerological exercises, in modern terminology, mathematical formulae with large numbers that described intervals between meaningful events in world history separated by time and space, usually the beginning and the end of some culture or civilization, the rise and fall of dynasties, decisive battles, wars, and uprisings (figure 17). The examples would be the time interval between the tsar's abdication and the Bolshevik uprising in Petrograd in 1917, or between the ancient Greeks' victory over the Persians in 487 BC and the final fall of Constantinople and the Byzantine Empire at the hands of the Turks in 1453 AD. He counted the number of days (not years, but precisely to the day!) between such historical events and expressed these often very large numbers as arithmetical formulae with typical elements 3^n and 2^m in various combinations, for example: "The government of Miliukov-Kerenskii (10 March 1917) appeared 3^5 days prior to the government of Lenin-Trotskii (10 November 1917)."[37]

Khlebnikov did indicate the existential motivation of his laborious project: "to find the justification of deaths." Ever since he escaped from the army barracks, the war pursued him as an obsessive idea and a mortal threat, from which he could save himself, and humanity, only through the discovery of the true laws of time:

> Wars will stop when people will learn how to make the count of time with ink. The war has turned the Universe into an inkpot filled with blood and tried to drown a pitiful funny writer inside it. But the writer wants to drown the war itself inside his personal inkpot.

[37] Khlebnikov, *Doski sud´by*, 14. Dates as given in the source.

His placed his hopes to fool death in the connection between time and space, not necessarily the precise formulae of the theory of relativity, but the basic idea of transforming time into space:

> When the future becomes transparent thanks to these calculations, the feeling of time disappears, and it seems that you are standing still on the captain's bridge and foreseeing the future. The feeling of time is replaced by a field ahead and a field behind; it turns into a kind of space.[38]

In his desperate attempt to turn history into mathematical formulae, Khlebnikov aspired to master historical time as "a kind of space," a utopian logic that was similar to Maiakovskii's, but a more ambitious version. His "justification of deaths" required fighting against their randomness, calculating the intervals between big and tragic events, understanding the mathematical regularities and predictable connections between them. Insofar as the deaths of millions looked completely meaningless and totally random, the desperate question "why?" had no answer at all and the traumas of wars were unbearable. If the tragedies appeared to obey some predictable, mathematical regularities, they acquired at least some meaning, were easier to cope with, and possibly to avoid.

We can see a similar motivation behind the efforts of Aleksandr Leonidovich Chizhevskii (1897–1964) to discover the natural, physical causes of large historical events. After being wounded at the front in the First World War, Chizhevskii resumed his studies at Moscow University for a degree in mathematics and physics, and simultaneously at the Moscow Archeological Institute, where he subsequently became the (self-defined) professor of "history and archeology of exact sciences," a Foucauldian title. In his 1918 doctoral thesis, "A Study of the Periodicity of Global Historical Process" ("Issledovanie periodichnosti vsemirno-istoricheskogo protsessa"), and in more developed form in his 1924 book *Physical Factors of the Historical Process* (*Fizicheskie faktory istorichskogo protsessa*), he amassed huge amounts of statistical data spanning millennia in order to find periodic regularities in human history (figure 18). In Chizhevskii's hypothesis, large events involving masses of people—such as major wars, uprisings, epidemics, famines, and revolutions—correlated with the periodic activity of the sun: both peaked together with a characteristic cycle of approximately eleven years. He did not discover the eleven-year solar cycle, which astronomers had known for several decades, but projected it back onto the span of world history and claimed to have proved that maxima of

[38] Ibid., 167.

the radiation processes on the Sun physically affected mass psychology and influenced large-scale human behavior on the earth.[39]

While most of Chizhevskii's data concerned earlier historical periods, he was obviously inspired by the catastrophic events that he witnessed and survived personally, in particular during the war in 1915. He also made some contemporary predictions, for example, that after the Russian revolutions of 1905 and 1917, the next major upheaval in the country had to be expected around 1928. And the future, believe it or not, confirmed his prophecies with the start of Stalin's collectivization and the "Great Break."[40] By linking historical time with time at the astronomical level, Chizhevskii's theory makes a transition to cosmological views discussed in the next section.

5. Cosmic Pendulum

The Bolsheviks believed their revolution was not just Russian, but a manifestation and part of the World Revolution as a global phenomenon. Some of their contemporaries projected the historical cataclysm they were all living through onto even larger, cosmic dimensions. The provincial mathematics teacher Konstantin Eduardovich Tsiolkovskii (1857–1935), also known as the founding father of spaceflight, combined in a nonstandard way a peculiar version of Christianity with socialism, revolution with science fiction, and pre-relativistic cosmology with catastrophism. His dream of spaceflight predated the revolution, but the latter contributed an additional strong motivation to the idea. According to Tsiolkovskii, the Universe as a whole was infinite and eternal, but individual stars had only limited lifespans and were destined to die and be reborn periodically. Our solar system, too, would unavoidably collapse in the future, and by the time of this catastrophic event, humanity had to be technologically prepared to pack and leave for its survival, using rocketry for spaceflight to resettle in other planetary systems in the Universe. In this way, Tsiolkovskii extrapolated calamitous revolutionary experiences into cosmic predictions, in a manner that was not only catastrophic, but historically optimistic as well: the end of this world would also be the opening into a new one.[41] The possibility of such a reassuring scenario relied, for Tsiolkovskii, upon a technologically utopian and revolutionary, spatial escapism.

39 V. N. Iagodinskii, *Aleksandr Leonidovich Chizhevskii (1897–1964)* (Moscow: Nauka, 1987, 2005).

40 A. Chizhevskii, *Fizicheskie faktory istoricheskogo protsessa* (Kaluga: 1ia Gospoligrafiia, 1924).

41 K. E. Tsiolkovskii, "Zhizn′ Vselennoi" (1920), in *Shchit nauchnoi very: Sbornik statei* (Moscow: Samoobrazovanie, 2007), 207–48.

A different kind of cosmological escapism—mystical, temporal, and antirevolutionary—was proselytized by Petr Demianovich Uspenskii (Peter D. Ouspensky) (1878–1947) and Georgii Ivanovich Gurdzhiev (George Gurdjieff) (1872?–1949). The two met on a train between Petrograd and Moscow, and collaborated on and off during the turbulent years of the Great War and Civil War. They moved around a lot and parted in emigration, each developing his own rival sect of followers, one in England, the other in France. Their mystical teachings generally belonged to the third generation of theosophy, the movement initially sparked in the 1860s by Helena Blavatsky, who discovered how to market effectively Orient-inspired, ostensibly Indian spirituality to Western audiences disenchanted with official religion. Of the two, Gurdzhiev was the genius manipulator, of ethnically mixed "Asiatic" background and looks, who composed Sufi-style music and made his followers dance, and perform collective physical exercises, and abandon to him their material belongings, all for the promise of escape from this traumatic, somnambulistic, and dangerous world into the other world of free spirit, by awaking a higher state of personal consciousness.[42] By comparison, what Uspenskii lacked in personal charisma and appearance, he made up for in writing: with a background in professional journalism, he could express his powerful mystical imagination so much better than Gurdzhiev in texts, and he produced numerous bestselling books, including *The Fourth Dimension* and *Tertium Organum*.

Uspenskii's personal spiritual journey started with the painful discovery that his own life already looked very familiar to him, that he had lived it before, and would be forced to live it again, after death, in exactly the same way, from the beginning to the end, again and again forever.[43] Such reincarnation made any escape to freedom in this world impossible, which also rendered any attempted revolution a misguided and dangerous illusion. Uspenskii actively worked for the counterrevolutionary Whites (and for British intelligence), before emigrating with other political enemies of the Bolshevik regime after the Civil War was lost. A number of his texts written over a span of 20 years would eventually be combined, by 1930, into a major treatise, *A New Model of the Universe*.[44] As befits a theosophist, Uspenskii attributed the origin of his esoteric knowledge to wise elders in Tibet, but it is also very clear that he was reading Einstein all along, quite attentively, and probably not only

[42] Louis Pauwels, *Monsieur Gurdjieff* (Paris: Ed. Seuil, 1954); Roger Lipsey, *Gurdjieff Reconsidered: The Life, the Teachings, the Legacy* (Boulder, CO: Shambala Publications, 2019).

[43] P. D. Uspenskii, *Kinemadrama* (St. Petersburg, 1915).

[44] P. D. Ouspensky, *A New Model of the Universe: Principles of the Psychological Method in Its Application to Problems of Science, Religion and Art*, trans. R. R. Merton (New York: Knopf; London: Routledge, 1931).

popular books about relativity. He appropriated quite a few modern scientific ideas as they resonated with and could be translated into a different, mystical mode of thought. He ultimately ended up with a Universe of six dimensions: three represented the curved Einsteinian space and the other three were temporal. Of the latter, the first dimension was the periodic time of this world, which forced people into the prison of recurrent deaths and rebirths, repeating exactly the same life cycle over and over again. The second dimension of time allowed for eternity and the eternal return, and only the third, the last, promised the desired ultimate escape into the other spiritual world of true freedom.

Scientists and mystics, philosophers and poets tended to perceive the elemental, fundamental processes of being, space, and time as periodic, whether on the biological, historical, or cosmological plane, with a choice of words: cycle, rhythm, pulse, oscillation, beat, eternal return. A good example out of the many existing ones is again that of Chizhevskii, whose writings stretched over all these levels, delving into biophysics, meta-history, and cosmo-biology. His archival collection contains a large unpublished treatise on the system of the world, dated 1920–21, that promoted as its guiding principle the idea of the fundamental periodicity of all processes in nature, from the microlevel of electrons to the macro-astronomical. At the time of its writing, Chizhevskii claimed to have learned the special theory of relativity and to have started studying the general one. Whether he actually did learn the latter is harder to tell, because he was less taken with mathematical formulae than with grandiloquent *Naturphilosophical* speculations.[45]

At the cosmological level, Chizhevskii described the world as the "cosmic rhythm, the pulses of which signify the birth and the death, and further rebirth after the death of stars and solar systems, or even of the entire world-forming material systems—universes." Strange as it might seem, he was able to perceive these periodic cosmic catastrophes, deaths and resurrections of universes, with a somewhat optimistic twist, as a kind of immortality:

> The Cosmos does not know starvation. Its life is eternal, regulated by the rhythm of the colossal cosmic pendulum.… Just one oscillation of this great pendulum includes the entire depth of calculable time, from the beginning to the end of the world, which begins its new rebirth with the start of the next period, and so on, without an end.

[45] A. L. Chizhevskii, *Vsia zhizn´* (Moscow: Sovetskaia Rossiia, 1974).

Such cosmological immortality, in turn, allowed Chizhevskii to derive a similarly reassuring message on the personal, human level, addressed to his contemporaries:

> Our very existence testifies to the fact that the Cosmos has already rebuilt itself and from itself an infinite number of times.… We are the children of our Mother Nature, who wants us to be rational, to finally understand her laws and how to love her … and to stop fearing death. At this point, the newest advances of science and the ancient tasks of philosophy merge together! [November–December 1920, Kaluga][46]

Chizhevskii brings us back to Friedmann, for despite all of their striking differences in style—unrestrained metaphysical speculation and indulging graphomania for one, versus disciplined mathematical logic and strict laconicism for the other—they both convey essentially the same image of a nonstatic, pulsating Universe, endlessly dying and being reborn. They almost certainly did not know each other and could not influence each other's thinking directly. Both were inspired by Einstein and the theory of relativity; Friedmann definitely in a much more professional and informed way. Both were of approximately the same generation, less than 10 years apart, and both had survived through historical cataclysm in wartime and revolutionary Russia. The concept of a periodic Universe that they shared, and the psychotherapeutic message to "stop fearing death" that Chizhevskii derived from it, responded to the common experiences and traumas of the Russian public at the end of the Civil War.

Conclusions

> Weirdly blessed is he who visited this world
> In moments of its fateful doom:
> He was invited by the immortals
> To converse and feast at their symposium.
> An observer of their sacred spectacles,
> He is admitted to the highest council,
> And as a living-being, like the heavens'
> residents,
> Drinks immortality from their chalice.
> —Fedor Tiutchev, "Cicero" (1830s)

[46] Archive of the Russian Academy of Sciences (Moscow) f. 1703 (Chizhevskii Aleksandr Leonidovich 1897–1964), op. 1, d. 1 (A. L. Chizhevskii, *Osnovnoe nachalo mirozdaniia: Sistema Kosmosa*).

Although Tiutchev's poem "Cicero" (Tsitseron) was by then almost a hundred years old and referenced themes from classical antiquity, its linkage of the world's tragedy and the exaltation of immortality resonated with and was frequently cited by those who experienced the misfortune and thrill of living through interesting times in the early 20th century. This chapter has considered a series of cases that contributed to the discourse on space-time and death-resurrection in revolutionary Russia, skipping many more trivial examples (such as generic and standard comments on relativity) to focus on those that could be seen as unusual, puzzling, original, or strange, in some sense. Starting from the proposal of a periodically dying and resurrecting universe, these discussions traversed various cultural fields, scientific, artistic, philosophical, and addressed problems at different scales, organismic, historical, and cosmological. Some of these ideas, especially those related to cultural figures with cult status, such as Maiakovskii and Khlebnikov, have been generally known to scholars but looked puzzling when considered individually. Others involved characters who, even if important, have largely disappeared from public memory and required digging in obscure sources. The comparative approach adopted here analyzed these cases in juxtaposition, revealing some common trends, similar tropes, shared perceptions, and understandable motivations behind them, presenting them in a more comprehensible and less strange light than they would have appeared otherwise if discussed separately.

Thus, in the example of Friedmann and his Big Bang cosmology that prompted my inquiry in the first place, the extant personal documents provide little in the way of elaborate explanations for his three unusual and key ideas: the non-static Universe, his acceptance of the reality of singularities, and his predisposition for a periodic world. Some earlier commentators declared the first two of Friedmann's innovations a formal "mathematical game" without physical meaning.[47] Although such an interpretation could not be reconciled with the third feature of Friedmann's model, the latter could be quietly omitted from discussion or relegated to the status of idiosyncrasy, since it is not as central for today's cosmology as the first two. The cultural historical approach of this chapter helps to avoid such logical inconsistencies and interpret all three ideas—regardless of whether they have or have not been accepted by science today—as carrying important cultural meanings in Friedmann's local, historical time and space. The utter instability of large-scale events around them was obvious to Friedmann's contemporaries, so that not just he, but many others—philosophers, artists, and scientists—extrapolated this

[47] Helge Kragh and Robert W. Smith, "Who Discovered the Expanding Universe," *History of Science* 41 (2003): 141–62, here 147. See also Harry Nussbaumer and Lydia Bieri, *Discovering the Expanding Universe* (Cambridge: Cambridge University Press, 2009).

nonstatic feature also to cosmological dimensions. The adage about historical singularity, the catastrophic collapse of the old world and the rebirth of a completely new one, was such a fixture in Russian social and political perceptions of the time, on both left and right ideological wings, that it was also frequently transplanted to other cultural discourse, including astronomical. And many authors invoked the theme of periodic deaths and resurrections at various levels, from the organism to the cosmos, often with connotations of coping with the collective trauma of a generation that had lost too many lives. The specific culture of space and time in revolutionary Russia made such tropes appear in a variety of fields outside relativistic cosmology. When included by Friedmann in mathematical calculations of general relativity, they could seem strange to his professional colleagues in other countries, as well as to many a later commentator.

The other major source of common shock and shared cultural resources came with the sensational news and ideas imported from Europe after the end of the war. Starting in 1920, these ideas circulated throughout Russian culture much more widely than local authors' creative responses to them. The latter could thus often remain unaware of each other's views, but it was virtually impossible for them, as for the rest of the reading public, to not know at least something about Einstein, Steinach, and Spengler—most often not from the originals, but as refracted through various Russian-language summaries, translations, and commentaries. Most of the cases discussed in this chapter relied on these European ideas as either a major inspiration, as an invitation to respond with a substantial commentary, or sometimes simply as a fashionable allusion, a pretext for authors to publicize their own cherished ideas. The ongoing discussion between Russian respondents and their typically German-language sources reveals important differences between the two postwar cultures. Even if Chizhevskii and Friedmann did not know of each other's cosmological theories, both were strongly inspired by Einstein, and both also deviated from Einstein in a similar direction. Such characteristically Russian cultural deviations from the German originals could be briefly symbolized by pairs of categories: from rejuvenation towards resurrection, from the perception of imperial decline towards the acute sense of collapse and rebirth, and from the curved but static vision of the universe towards a dynamic one.

Other interpretations in the literature typically generalize from partially selected cases. One currently popular approach groups some of the authors discussed above under the loose label of "Russian Cosmism," supposedly an esoteric sect founded by the prerevolutionary religious philosopher Nikolai Fedorov.[48] Fedorov did have a few disciples, not very original ones, who

[48] George M. Young, *The Russian Cosmists: The Esoteric Futurism of Nikolai Fedorov and His Followers* (Oxford: Oxford University Press, 2012). There was even an attempt to

helped to publish his works posthumously. Without good evidence, recent commentators have started wishfully to count among his followers a number of other early Soviet intellectuals whose views appear vaguely mysterious to our contemporary mindset. However, as discussed in the preceding sections, the interest in immortality and resurrection was neither secretive nor particularly mystical in the early 1920s. Rather, it formed part of a wider cultural discourse that appealed to the utopian fervor of the time. Those who contributed to it came from many segments of the Russian educated public and subscribed to different, often incompatible beliefs: the unorthodox Christian socialist Tsiolkovskii, the orthodox Marxist Bogdanov, the godless futurist and troublemaker Maiakovskii, the liberal, highly respectable academician Vernadskii, the marginal, amateur scientist and inventor Chizhevskii, an actual mystic, but not in the Fedorovian sense, Uspenskii, and so on. Once we take into account the diversity of their views and opinions, it becomes increasingly clear that they cannot fit into Fedorov's or any other single sect. The recently and retrospectively invented school of "Russian Cosmism" says more about the post-Soviet fascination with all things mystical rather than the historical culture of the 1920s.

Another partial group of examples, mostly medico-biological ones, has been interpreted in several recent publications as related to the Bolshevik leaders' interest in immortality, prolongation of life, Lenin's possible resurrection, and to their support for big science projects.[49] Political authorities have always been suspected, almost automatically, of having had a hand in any important development or public trend in Soviet Russia, but such suspicions are not always warranted. To be sure, the Bolshevik government did much to promote the institutions of big science with ambitious research projects.[50] Like many others in revolutionary times, the Bolsheviks were also prone to utopian thinking and visions for the future, but their favorite kinds of utopia were social and political, rather than biomedical or eugenic. So far, no evidence has surfaced to show that the Bolshevik Party and state institutions paid anything more than a cursory attention to the discourse about biological immortality. When it came to allocating resources for research institutions,

associate Fedorov's mysticism with the Bolsheviks: Dmitry Shlapentokh, "Bolshevism as a Fedorovian Regime: Fedorovism in the Context of the Russian Culture. The Problem of Interpretation," *Cahiers du Monde Russe* 37, 4 (1996): 429–65.

49 John Gray, *The Immortalization Commission: Science and the Strange Quest to Cheat Death* (New York: Farrar, Straus and Giroux, 2011); Nikolai Krementsov, *Revolutionary Experiments: The Quest for Immortality in Bolshevik Science and Fiction* (Oxford: Oxford University Press, 2014).

50 Alexei Kojevnikov, "The Great War, the Russian Civil War, and the Invention of Big Science," *Science in Context* 15 (2002): 232–75.

they prioritized projects that were markedly different in style and substance: the scientific improvement of cultivated plants, rather than of human stock; the mass production of insulin and the national system of blood collection rather than rejuvenation and resurrection projects. The Bolsheviks' lack of interest in resurrection is demonstrated definitively by the Politburo's decision to destroy Lenin's internal body and brain, while preserving only his superficial likeliness for display in the Mausoleum.

Indeed, diehard Bolsheviks look conspicuously absent from the story presented in this chapter, as do their diehard opponents, for the most part. The closest ones are Uspenskii, a committed counterrevolutionary, and Bogdanov, who had once been a leading Bolshevik, but did not accept the 1917 Soviet Revolution as truly proletarian and turned renegade. No longer constrained by official ideology once he left the party, he could open up to other available utopian views, such as rejuvenation or proletarian culture. Friedmann's case provides another example of mixed ideology and politics. Brought up in the Russian Orthodox Church, he lost faith as a teenager, but in his last year apparently became once again more open to religion. Circa 1905, Friedmann and his high-school friends supported a Marxist party, presumably the Mensheviks. Later, as a professional academic, he became less overtly political, and generally the polarization and fighting of the Civil War made most intermediate party lines, such as the Mensheviks', untenable in practice. But even those who felt neither resolutely Bolshevik nor resolutely anti-Bolshevik often found themselves in situations, in which it was not possible to avoid choosing a side, Red or White. Friedmann definitely cast his lot with the Reds, and while not a Bolshevik, remained broadly sympathetic with their revolutionary government after the Civil War, enthusiastically collaborating with it as an expert and administrator.[51]

The discourse on space-time and death-resurrection analyzed here may thus offer a new angle from which to look at the Russian Revolution, which has typically been represented through the polarized political worldviews of its most active participants, the Bolsheviks and their stringent enemies. The numerically much larger segments of the public who can be characterized as survivors, fellow travelers, collateral victims, or surfers have been afforded fewer opportunities to have their voices heard. Even those of them who were

[51] "God, in whom I believe again, gave us only a short moment of phantom happiness." Friedmann to Natal´ia E. Malinina, 31 October 1923 (Archive of the Russian Academy of Sciences, St. Petersburg branch f. 1085 (Fridman Aleksandr Aleksandrovich, 1888–1925), op. 1, d. 9, l. 62). Malinina, who would become his second wife, was devoutly religious. In 1925 they married in church, which by that time was already considered unusual for a Soviet professor, at least in the eyes of his young students. On Friedmann's politics, see Tropp, Frenkel, and Chernin, *Alexander A. Friedmann*, chap. 2, n. 5.

in awe of the revolution, its goals and grandiosity, could still feel deeply traumatized by the scale of destruction and death, unconvinced by the ready-made worldviews provided by Marxism or traditional religion, and in need of alternative explanations that could, if not alleviate, then at least understand or rationalize the unjustified sufferings inflicted by the blind force of history. Their discourses and utopian visions look quite different from those preferred by mainstream Bolsheviks or mainstream conservatives.[52]

The culturally specific mentality of space-time, the snapshot of which is presented in this chapter, proved relatively short-lived and restricted primarily to the decade of 1915 to 1925. The situation more or less stabilized after that, giving way to different sensibilities, concerns and conditions of a more settled, regular life. The intensity of the cultural fermentation and the momentum that produced so many idiosyncratic theories also subsided or changed direction, although the ideas that had already been born did not completely disappear, at least from the minds of their authors. Examples discussed in the current chapter represent only a small set, and the list could have easily been extended to include many others, famous and forgotten ones alike. The majority of their proposals remained on the margins and appear weird to us today, but a surprising number of them still managed to survive, at least partially, and were sometimes even transformed into accepted views during later periods, such as Big Bang cosmology. Their updated or mutated versions persist in the present-day intellectual world as relics of a unique, culturally explosive moment in historical time-space a century ago, just like the cosmic background radiation whose presence in the Universe of today represents the relic of the original Big Bang that started a dozen billion years ago.

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52 Richard Stites did not discuss this discourse either. His book *Revolutionary Dreams* surveyed many other utopian proposals by revolutionary enthusiasts of the time that focused mainly on reforming and transforming social life.

Figure 13. Alexander A. Friedmann, Petrograd, early 1920s. (Photo courtesy of Archive of the Russian Academy of Sciences, St. Petersburg.)

Figure 14. Vladimir Maiakovskii, Roman Iakobson, and Osip M. and Lilia Iu. Brik in Bad Flinsberg, Silesia, July 1923. (Photo courtesy of State Museum of V. V. Maiakovskii, Moscow.)

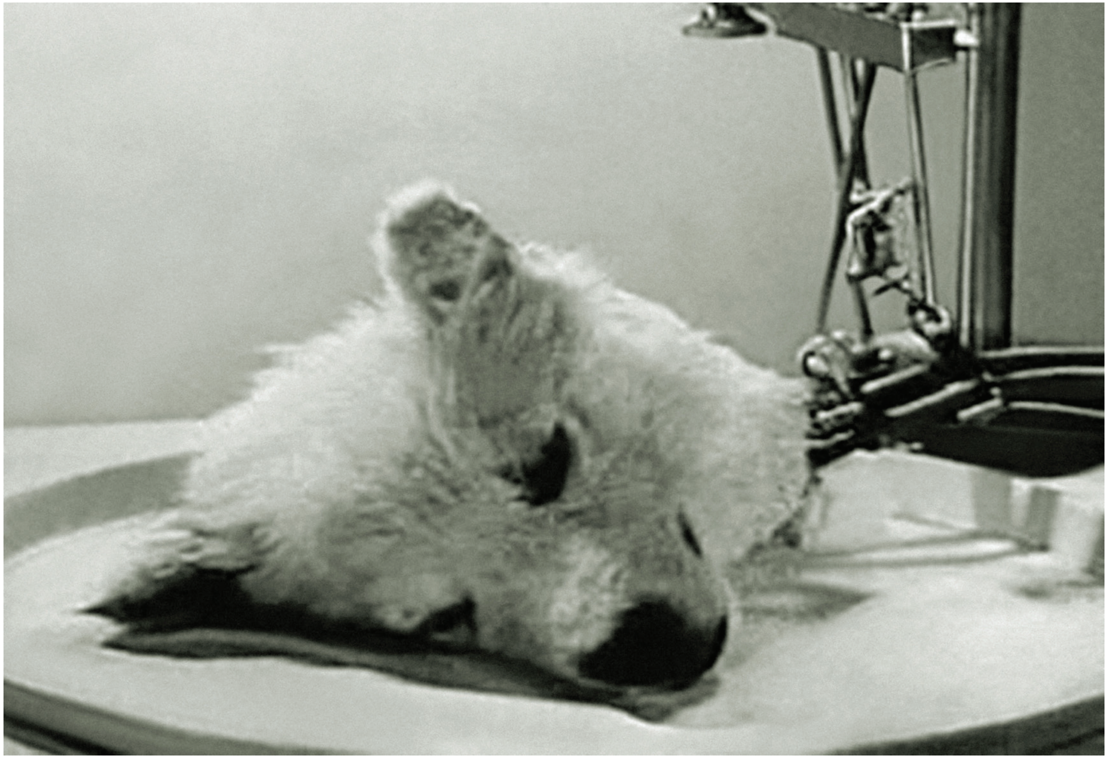

Figure 15. The dog's head experiment, 1925: a still shot from the documentary *Experiments in the Revival of Organisms*, Soviet Film Agency, Moscow, 1940. (Image is in the public domain: https://archive.org/details/Experime1940.)

Figure 16. Léon Theremin at rehearsal with his electro-musical instrument, London, 1927. (Photo courtesy of Peter Theremin and the Theremin family.)

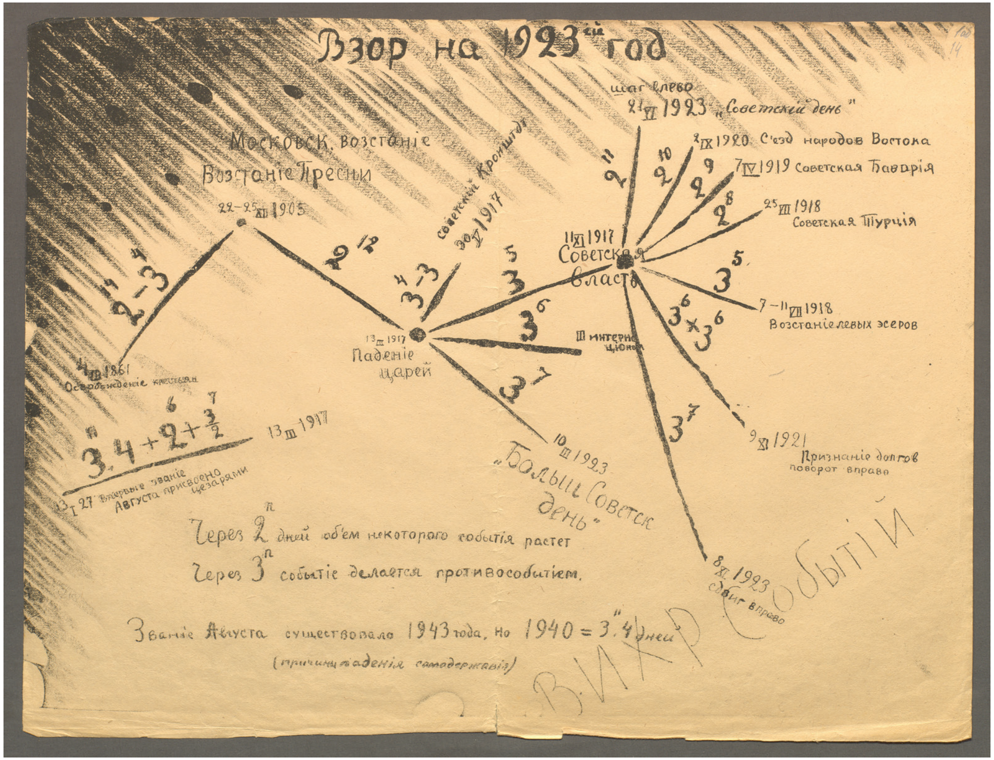

Figure 17. "Swirl of Events. Outlook for 1923." Velimir Khlebnikov's mathematical formulae of the Russian Revolution, 1923. (Image courtesy of Russian State Archive of Literature and Art, Moscow.)

Figure 18. Aleksandr Chizhevskii's doctoral defense, 1918. (Photo courtesy of A. L. Chizhevskii Memorial House and Museum, Kaluga.)

Science, Technology, Environment, and Medicine in Russia's Great War and Revolution, 1914–22

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