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The Scholar and the "Wolfhound Era": The Fate of Ivan E. Orlov's Ideas in Logic, Philosophy, and Science

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Argument

The life and work of the Russian scholar Ivan E. Orlov (September 1, 1886 – October 13, 1936) is described here in detail for the first time. Orlov is well known as one of the pioneers of relevant logic, but he was also interested in a wide variety of other topics including philosophy, chemistry, and music theory. This article shows that the sociopolitical climate of the1920s and 1930s exerted a significant influence on the style and content of Orlov's work. It theorizes that this climate determined to a considerable degree the evolution of Orlov's interests and also his fate.

The Wolfhound Era hurls itself against my shoulders,
But I am not by nature a wolf.
Osip Mandel'shtam (1931)

Introduction

The generation of Russian scholars born in the 1880s and 1890s had a difficult lot. They were educated in the imperial universities and their emergence as researchers occurred during a great upsurge of Russian science and the Russian economy. The period was known as the Silver Age of Russian poetry. Scholars were extremely conventional and study abroad was an essential element of their career. By the time of the February Revolution of 1917 and the October coup, this generation of young, broadly educated scholars had already achieved reputations in science and had become comfortable with foreign colleagues. A brilliant future might have awaited them, especially those in the humanities who had access to the riches of both European culture and the Russian culture of the Silver Era. However, everything changed abruptly, almost in an instant, marked by the date of the October coup that was later officially proclaimed the Great October Revolution. Civil war, hunger, dislocation, the consolidation of *Bolshevik* power, which from the very beginning tolerated no dissent, presented this generation of scholars in the humanities with a choice: either follow the "constructive" path into the dogmas of Marxist ideology and assimilate that

ideology as a prism through which the world is to be viewed, or emigrate and attempt to continue a career outside Russia. This was the alternative that Soviet power presented to many of the leading Russian scholars, especially in the humanities. Some left of their own accord. In 1922 the "philosophical steamships" enriched the soil of Western Europe with the best Russian brains (Khoruzhiy 1994, 189–208). Others were forced to retire at the height of their creative power. Nikolay A. Vasil'yev, for example, very likely escaped the Stalinist repression only because mental illness struck him at the age of 42 (Bazhanov 1988).

All scholars in Soviet Russia had a difficult lot. It was tragic for those who remained and tried to serve the new regime selflessly, or attempted to hide from its all-seeing eye in intellectual fields neutral to the prevailing ideology. Pavel A. Florenskiy and Gustav G. Shpet perished in the *GULAG*. Aleksei F. Losev, who went blind working on the White Sea Canal, wrote his works for nearly a quarter century afterwards only "on the table." As early as 1921, Viktor I. Nesmelov was forbidden to publish. In 1931 a "case" was brought against him in connection with the "detection" of the All-union and administrative centers of counterrevolution of the clerico-monarchical organization "The True Orthodox Church" and its branch in Tataria (Bazhanov 1995, 75). Fate was somewhat kinder to some, especially those who chose a path that involved borrowing Marxist terminology, Marxist principles, and a Marxist approach. Such a choice, while it by no means guaranteed a happy life, did make it possible to continue one's scholarly activity for a time. Sometimes it merely postponed the fateful denouement. Nevertheless, the "Age of the Wolfhound" made no exceptions even for devotees of Marxism.

In some rather rare cases plants of exceptional beauty managed to break through the intellectual soil desiccated by the dry ideological winds of the period from the 1920s through the 1940s. Two such cases in psychology were Lev S. Vygotskiy and Aleksandr R. Luriya. However, the revolutionary enthusiasm nourished by Marxist ideas was capable of drawing with it even the scholars of the ancient cast. Frequently, "the historical cataclysms and ideological disruption altered the nature of scholarly research, and these alterations could be fruitful," as Boris V. Biryukov correctly remarks. "However, when the social upheaval reaches the stage of conservative stagnation (in our country, the stage of stable totalitarianism), even scholarly thought becomes ossified. In every case this applies to subjects that do not immediately promote the military-economic strengthening of the dominant power structures" (Biryukov 1998, 12).

Occasionally some concepts and ideas that were important and promising for the future were hidden under a dense ideological cover during the 1920s. From such a viewpoint, one can appreciate Orlov's *single* paper "The calculus of propositional consistency" (Orlov 1928a), a paper of modest size, but one that played a prominent role in the development of logic. Orlov had already published his first major scholarly papers on the eve of the general upheaval, in 1916 (Orlov 1916a, 1916b); however, in this

article he proposed the first axiomatization of relevant logic, an important logic involving the class of nonclassical logics that developed intensively beginning approximately in the second half of the twentieth century (in the 1960s and 1970s). For his 1928 paper, Orlov can be regarded as the author of the first axiomatization of relevant logic (Došen 1992, Da Costa, Beziau, and Bueno 1995), and even, in the opinion of some scholars (erroneously, in my view), as one of the pioneers of the paraconsistency area in logic (Alves 1992).[1] This single paper brought Orlov worldwide renown. Against the background of his work this paper shines like a sudden *epiphany*, never to be repeated. Was it a fluke, or was it the natural outcome of his earlier thought?

If we cast a glance at Orlov's scholarly legacy, certain traits immediately stand out, traits such as his striking breadth of interest (papers devoted to the philosophical analysis of mathematics and its foundations, philosophical questions of logic, relativistic physics, probability theory, and the inductive method, experiment, musical acoustics,[2] chemistry and chemical engineering—potentiometry, titration, and others) and ideologizing (expressed in a striving to connect scientific and social problems, to approach scientific problems from an exclusively Marxist point of view that does not recognize any other approach). Orlov's thought noticeably drifted away from a philosophical to a specifically scientific set of problems, and in his later years he completely turned away from philosophy and studied only problems of chemical engineering.

Orlov's 1928 paper on logic is quite well known among logicians who specialize in nonclassical logics. His name has been mentioned in papers on the history of Russian logic that discuss the interrelation of formal and dialectical logic (Cavaliere 1990, 13–15). However, his nonlogical interests and papers, the evolution of his interests, and also the motives that caused him to abandon his study of philosophy and concentrate on chemistry, are not generally known.

Do Orlov's philosophical papers contain any significant aspects that prefigure or anticipate the creation of a new type of logic? Here was a seemingly successful philosopher, an active member of the Society of Militant Materialists, whose papers had been published in the leading journals of Soviet Russia such as *Under the Banner of Marxism*, *Red Virgin Soil*, *The Militant Materialist*, and so on, where his name appeared alongside those of the leading Soviet philosophers and ideologues (Vladimir A. Nevskiy, Abram M. Deborin, Vagarshak Vaganyan, Grigoriy Bammel, Arkadiy K. Timiryazev, Aleksandr Varjas, and others). What could have motivated this philosopher to abandon philosophy and study an important economic topic: chemical methods of obtaining iodine and bromine? Our task is to give definite, partly preliminary answers to this question, to gather together all his published papers, and to fill, to some degree, an existing gap in the history of the Russian logico-philosophical tradition.

Some Meager Pages of Biography

Ivan Efimovich Orlov was born 1 September 1886 in Galich, in Kostromskiy Province. He was educated as a hydraulic engineer. In the 1920s he worked in the Section of Natural and Exact Sciences of the Department of Methodology in the Communist Academy. He also worked in a chemical/pharmaceutical institute (biographical data are borrowed from Alekseyev 1995, 435; Povarov and Biryukov 2001, 165).[3]

In the preface to Orlov's posthumous book (Orlov 1939) devoted to the analysis of turbulent waters and methods of extracting iodine and bromine, Aleksandr P. Slesarev (1939, 5) remarks that the author did not have time to finish the manuscript. The preface was written in August 1938. Orlov's last publication appeared in 1935, and he died of natural causes on 13 October 1936 in Moscow.

Orlov's first publications appeared in 1916 (Orlov 1916a, 1916b). They are philosophical in nature and devoted to the analysis of the inductive method in general and inductive proof in particular. Then followed a comparatively long hiatus due to completely understandable causes resulting from the sociopolitical cataclysms. He published again in 1923. To all appearances Orlov was nevertheless writing, and writing a great deal, during those seven years. Nine articles by him, of considerable size, appeared in 1924, along with eight reviews. While his 1916 papers meet the rather rigorous standards of the journal *Problems of Philosophy and Psychology* and are "scholarly" in the strict sense of the word, by the Soviet period his papers are sprinkled liberally with ideological considerations and phraseology, of a sort of nonpersonal nature, to be sure. It is curious that in all of its nearly 200 pages, Orlov's 1925 book *The Logic of Natural Science*, which unified his research in the area of philosophy of natural science, neither Marx nor Lenin is mentioned at all, and there is only one mention of the Marxist classic, Engels (Orlov 1925a*,* 193). As it happens, all the philosophical journals of that period, including, of course, those that Orlov contributed to, abound in articles celebrating the Marxist classics, most of all Lenin. The first 1924 issue of *Under the Banner of Marxism*, which was delayed due to the death of the leader of the worldwide proletariat, contained an exemplary sampling of articles on Lenin (Nevskiy 1924, Deborin 1924, Vaganyan 1924). No periodical that published articles of a philosophical nature could have gotten away with omitting materials on Lenin and other Marxist classics.

It is also noteworthy that Orlov's first publications after the hiatus, during the years 1923 and 1924, encompass almost the entire broad spectrum of his interests. Here there are papers on the philosophical problems of the foundations of mathematics, philosophy of logic, dialectical logic, the problem of probability, and chemical engineering. Nevertheless, Orlov's main focus was on problems of philosophy.

Logic

Orlov divided thought as a logical subject into rational-technical and emotional types (Orlov 1924c, 79). He believed that a thought suffused with emotion was a class ideology, since "some things cannot be thought of without hatred and emotional upset and others cannot be thought of without respect and enthusiasm." In the works of Marx and Lenin, Orlov wrote in his paper "Materialism and the Evolution of Morality," one finds "the supreme examples of emotional thought" (Orlov 1924q, 80).

The main function of logic, in Orlov's opinion, was to provide us with an exact criterion for deciding whether we are reasoning correctly. The laws of thought should be regarded as merely formal rules. The effect of these laws essentially reduces down to the systematic use of the laws of identity and contradiction (Orlov 1925a, 65, 51), although one cannot in any way agree with the formal character of thought, which is the theoretical obstacle to its mechanisms (Orlov 1926d, 72). Orlov criticizes Prof. Aleksandr N. Shchukarev's principles for constructing the logical machine (an improved version of Jevons' machine) precisely because not assuming the absence of contradictions in true grounds and consequents was not enough. The most important thing was that in the operations of the machine one must take account of the possibility of establishing a connection of meaning between them. Orlov thereby approached the idea of substantive logical sequence, relevantness (see Shuranov and Biryukov 1998, 36–37).

The current stage of development of logic in the form of mathematical logic had not produced any really new principles that were not present in the syllogistics of the "usual" type. For that reason the disparaging attitude that writers on mathematical logic expressed toward Aristotelian logic was not justified (Orlov 1925a, 69).

In general, logical laws lie at the foundations of mathematics. In the final analysis, Orlov claimed, the method of mathematics reduces to the use of the law of contradiction and the so-called co-existence relation (Orlov 1923b, 218). The latter relation is none other than a certain interpretation of the relation of logical sequence and its symbolic expression as implication (Orlov 1925c, 70). As it happens, the laws of contradiction and excluded middle cannot be applied to the study of substantive propositions, and the doctrine of the concept is the weakest point of logic (Orlov 1925a, 35).

The main contradiction of logic, whose resolution requires a nontraditional logic, is the relation of logical grounds and consequent. The point, Orlov reasoned, is that the truth of the assumptions is by no means a necessary condition for the truth of the inference, but at the same time, the truth of the consequence is necessary for the truth of the assumptions. The logical relation between assumptions and inference is in reality inverse to that of traditional logic, which is based on this "discrepancy" of contradiction (Orlov 1924k, 70). If one insists that the consequence is a necessary condition for its

assumptions, one is led to construct a non-Aristotelian logic, which will have a dialectical character. It is none other, Orlov continues, than the logical system that has been accepted in science for decades, namely the logic of natural science (Orlov 1924k, 71). This logic is distinguished first of all because conclusions are always more reliable than at least one of the hypotheses and second because the reliability of derived propositions is independent of the reliability of the unconditionally general hypotheses, and finally, because every unconditionally general proposition is a postulate in which the truth of all its consequences is admitted (Orlov 1924k, 72–75). Although all propositions of natural-scientific logic coincide with the deductions of dialectics, this logic is not in any way dialectics. The subject matter of natural-scientific logic is the method of discovery of scientific truths, and the method of proving them, while dialectics requires in addition a discussion of "the most general truth about a specific material" (Orlov 1924k, 90). Orlov emphasized that all information about the external world is obtained by induction, that is, by inferences from consequents to grounds.

Between dialectics and formal logic, Orlov was convinced, there is no mutually exclusive opposition, such as exists between dialectics and metaphysics. However, formal logic is not content with an auxiliary role in scientific research; it claims an absolute value and rejects any reasoning that is not formal/logical. For that reason formal logic itself becomes metaphysics. A critique of formal logic must be dialectical, that is, it must be shown how this logic refutes itself. This occurs because of the contradiction between ground and consequent. The resolution of the contradiction moves formal logic to a higher level, where it assumes the form of the logic of natural science (Orlov 1924k, 89).

Logic and Proof

One of the most important tasks of logic, Orlov remarked, is to provide a satisfactory theory of proof. To prove an assertion means to remove any possibility of doubt as to its truth. The proof is required to collide with established facts and "proceed inductively from them to generalizations." For example, a syllogism should be constructed from the end (Orlov 1925a, 13).

Every proof, Orlov was convinced, is a proof "by contradiction." Even direct (to say nothing of indirect) proofs are based on the law of contradiction.

The Logic of Natural Science

The logic of natural science should pose broader problems for itself than traditional logic. In the nature of the problems to be solved, Orlov believed, the logic of natural science merges with the theory of knowledge. First of all, this logic is obliged to pose the problem of the nature and limits of intuition; it

must estimate the reliability of the initial assumptions and methods by which science arrives at its discoveries. But the task of the logic of natural science can be considered completed only when it becomes an *ars inveniendi*, that is, when it serves as a means of discovering new methods of experimentation and the formation of hypotheses (Orlov 1925a, 65). Here its inferences, as already mentioned, must coincide with those of dialectics.

The Logic of Propositional Consistency and Relevant Logic

The logic of propositional consistency, the only paper Orlov wrote fully in the spirit of his papers on mathematical logic (containing no philosophical admixtures, much less ideological ones), published in 1928 in *Matematicheskiy Sbornik* (Orlov 1928a), where the leading Russian mathematicians published, was the first axiomatic system of relevant logic. In this system, which was to some degree inspired by the attempt to construct a special logic of natural science that would coincide with the theory of knowledge and dialectics, Orlov attempted to overcome the paradox of material implication and connect antecedent and consequent in a dependence of meaning. This would have signified a passage from the "logic of extent" to the "logic of content." Orlov wrote:

> At the basis of the classical mathematical logic lies the concept of material inference, which can combine in a single formula two propositions that have no internal connection in meaning. As it happens, the system we have in mind can treat in symbolic form the connections of meaning between propositions. … It considers first of all not the question of truth or falsity of given propositions, but the question of their mutual consistency or inconsistency. … The requirement of consistency of propositions is sufficient; the requirement that they be simultaneously true is excessive. (Orlov 1928a, 263–264)

Orlov was essentially operating with intensional conjunction and intensional disjunction, although the direct references in his paper were to implication and negation.

Orlov regarded his paper as a certain development of some methods and devices introduced by the proponents of intuitionism. It is no accident, remarks K. Došen, that

> the axiomatization of relevant logic arose at the same time that an axiomatization of intuitionistic logic was proposed. … But this is not Orlov's only achievement. He also anticipates the modal imbedding of systems with intuitionistic negation into systems of type S4 with classical negation (a modal imbedding is an imbedding that places the necessity operator before subformulas of

> nonmodal formulas). …Orlov went as far as the construction of S4 systems, but added the corresponding postulates to relevant logic rather than classical logic. (Došen 1992, 339–340)

In this way Orlov anticipated Gödel's 1933 paper and, most importantly, O. Becker's 1930 paper, which in particular is credited with the construction of an S4 system (Došen 1992, 349).

Quite natural comprehension of Orlov's ideas and their origin is provided within the scope of substructural logics for they reject or restrict some of Gentzen's structural rules. The so called Thinning rule, rejected in relevant logic, stands apart from other structural rules (like Expansion, Cut, or Permutation), and that is the reason, perhaps, why relevant logic appeared earlier than substructural logics (Došen 1993, 9–10).

Philosophy of Mathematics

Orlov defined mathematics as the science of the most general and constant properties of real objects, when these properties are expressed in the maximally abstract form (Orlov 1925a, 86). It is easy to see that such an interpretation of the nature of mathematics is very close to a Marxist one, in which mathematics approaches physics in its epistemological status (Heijenoort 1986).

After Kant, Orlov believed, it was necessary to recognize the synthetic nature of arithmetical operations and geometric reasoning, while theorems are deduced from axioms using only the rules of logic (Orlov 1924n, 88). In addition, the postulates are also synthetic propositions and hence the definitions must be regarded likewise. All mathematical operations reduce to the application of two formal rules, expressed in the laws of identity and contradiction (Orlov 1924a, 93).

Mathematicians fall into the deepest confusion when they attempt to apply mathematical methods of proof to the external world. This world is accessible only to dialectical thought. Any generalization in mathematics is only an "apparent" generalization; in reality the less general is always derived from the more general (postulates, axioms, theorems, and so forth).

Orlov was especially vigorous in his critique of Cantor's set theory, refusing to recognize the legitimacy of an abstract actual infinity. He tried to defend the position that Cantor's theory, being a "free creation of reason," is built on paralogisms, and the inconsistency of its fundamental postulates leads to its self-refutation. While admitting the existence of sets that are "infinite in their entirety" (that is, actually infinite), at the same time Cantor applies reasoning inconsistent with this assumption (Orlov 1924a, 136). Thus, Orlov believed, $2^{\aleph}$ is a countable set if one uses the method of mathematical induction. But if one applies complete induction, the opposite conclusion results (Orlov 1924a, 142). And this is completely

natural, since, Orlov claimed, the theory of transfinite numbers is entirely based on the application of induction to sets that are infinite in their entirety; without using it, one cannot distinguish infinite sets of different cardinalities. Thus there is no ground to support the theory of transfinite numbers (Orlov 1925b).

Another of Cantor's mistakes, according to Orlov, was that he ignored the relative nature of numbers. A definitely infinite number is a collection of units; consequently it is infinite relative to unity. Although the concept of a number infinite in its entirety can be conceived in thought, the concept of a potential infinity is also conceivable, and only the real infinitude of the Universe can reconcile the contradiction between these concepts. Nevertheless, the Cantorian notion of an actual infinity must be considered radically "wrong." "There is no dialectic in Cantor's theory. Its contradictions are flat and formal, based on a simple misunderstanding," Orlov wrote (1924a, 147).

Orlov explained the popularity of Cantor's set theory by the attraction of mathematicians to abstractions that go beyond experience. Mathematicians are prone to relativism and mathematical fetishism, since they do not deal directly with nature (Orlov 1924b, 49); but when science abandons experience and becomes pure intuition, it creates more or less the equivalent of "soap bubbles of thought." Mathematics, as the doctrine of an actual infinity shows, is no exception in this regard (Orlov 1924a, 147).

The concept of randomness was the subject of continual attention for Orlov. He wrote reviews of papers on probability theory in which he proposed his own understanding of randomness and evaluated the papers of some mathematicians pejoratively. Thus in one of his reviews he stated that "Borel's thought suffers from too much diffusion, and a specifically bourgeois limitation…We cannot find any good qualities in his book. … There is not a trace of dialectic in Borel. He does not know that truth is always specific; he seeks an abstract metaphysical solution of practical problems" (Orlov 1923a, 260–261).

Casting a glance at the history of the rise of the concept of randomness, Orlov remarked that it first arose as the result of the evolution of animism, and with the rise of capitalism the bourgeois science of the concept of randomness came into opposition with the causal explanation of events. The meaning of such an opposition is obvious: historical laws have the nature of trends leading inevitably to an intensification of class struggle, to revolutions and the seizure of power by the oppressed classes. But in the concept of randomness, the bourgeoisie sees the means of "suppressing the dialectic of history and creating the impression of an absence of historical laws … however, the same bourgeois science … was glad to make peace with complete determinism in the area of natural science" (Orlov 1924i, 94).

Poincaré refers to the unknown as random. The true problem of probability theory, which studies randomness, according to Orlov, is to study the conditions under which a probability tends to 1, that is

becomes certainty. Laplace and Mill proposed a treatment of probability that is applicable only to individual events, not to masses of them.

Statistical mechanics "applies probability *a priori*, while statistics applies it *a posteriori*. The connection between phenomena established by statistical mechanics is of a rational, rather than empirical, character. For just that reason, it is a powerful tool for explaining nature, Orlov stated. "The statistical explanation is the best *mechanical* [emphasis added] explanation because it excludes any attempt on the part of the devout bourgeoisie to perceive … a 'rational origin,' and suchlike in the system of laws of nature" (Orlov 1924i, 111).

Philosophy of Physics

Physics, Orlov believed, could be divided into classical and relativistic. According to Orlov, the former was developed primarily by experimenters, the latter by mathematicians. Classical physics includes those branches of this science that provide a "harmonious combination" of experiment and theory, among them quantum mechanics and "even the Bohr theory" (Orlov 1924b, 49; 1925a, 106). Thus, classical physics as Orlov understood it was considerably broader than Newtonian physics.

Physical relativism turns mathematical devices into absolute laws of nature and asserts, following Einstein, that all reality is relative. The generalizations of relativity theory proposed by Hermann Weyl demonstrate the "total degeneracy" of this trend, the more so as it was, Orlov thought, hopeless to attempt an experimental verification of the conclusions of Einstein's theory that really do contradict classical physics.

Orlov advanced the following arguments against relativity: 1. In relativity the observable motion of the stars must be regarded as only apparent, fictitious; 2. the existence of centrifugal forces is completely explained by the rotation of the Earth; 3. one should not apply considerations involving remote cosmic masses to explain rotational phenomena.

In modern physical theories, wrote Orlov, a special fluid is involved, the ether, which pervades all space. This gives an "elasticity" to the matter studied by modern physics, a purely "experimental" quality, which is in essence dialectical in the sense that "matter is compressible and incompressible, penetrable and impenetrable at the same time" (Orlov 1924p, 221). The majority of materialists, Orlov asserted in a polemic with Zakhar Zeitlin on the principles of scientific explanation, recognize the existence of the ether, but materialists do not allow metaphysical proofs of that fact, since "this is primarily an experimental question." One also should not identify space and matter, since the latter is elastic and may

undergo a deformation in volume, which would be "absurd" for space (Orlov 1925e, 292). The concept of substance in general is "nondialectic," since it is abstract and has no mechanical basis.

Orlov was a convinced mechanician. He claimed that Engels demanded that all laws of nature be reduced to laws of mechanical motion, and that in general only a mechanical view of nature was tenable. The limits of mechanical understanding define the limits of our knowledge of things. Electrodynamics, and even chemistry are mechanical theories (merely more complicated in the case of chemistry). For describing "higher-order" phenomena (again, take chemical phenomena as an example) there may be an infinitude of mechanical versions.

The mechanical understanding of nature, reasoned Orlov, taken as a universal method, leads to admitting the existence of an infinitely complicated world formula, from which one could deduce the past, present and future mathematically. Such a formula should contain, according to Orlov, all the historical laws together with their negations. Such an understanding is erroneous, since mechanics cannot claim the status of a universal way of knowing; but in the area of physical phenomena the method of mechanical models is the leading one. In particular, "in the struggle with relativism dialectical materialism must emphasize the mechanical moment" (Orlov 1926a, 125).

Only on the basis of the dialectic is it possible to apply mechanical concepts correctly to the study of reality. The dialectic protects them from "degenerating" to the level of simple ancillary representations. As it happens, "the majority of scientific researchers up to now have approached the dialectical method in general and its application to the study of nature in particular with a certain mistrust." As an example of a scholar who did not recognize the dialectic Orlov mentioned A. Samoilov, the well-known philologist, who had also published in *Under the Banner of Marxism* (Orlov 1928b, 149).

In the late 1920s the debate between the "mechanicians" and the "dialecticians" became rather acrimonious. Orlov seems to have tried to avoid taking sides in this polemic. Nevertheless his basic scholarly orientation was close to mechanicism, while in philosophy he regarded himself as a systematic dialectician. For that reason, in his paper "On dialectical tactics in natural science," which dates to 1928, he proclaimed that "the dialectical critique of the 'mechanicians' should not be excessive; while noting the one-sidedness of the mechanical concepts, one must preserve the method of studying the space-time structure of matter" (Orlov 1928b, 159–160).

However, Orlov's call for restraint was not heard. The mechanicians were soon crushed; the dialecticians did not have long to celebrate their victory and triumph: literally a year later they were

proclaimed Menshivistic idealists, and they too fell afoul of the ideological press. The elements of an ideologized science can be found in the work of Orlov even in his early work (Orlov 1923b).

"In our time," wrote Orlov, "we have the same two trends in physics that Vladimir Il'ich [Lenin – V. B.] spoke of, both exhibiting the same vacillation," while the "causal blindness of the school of physics to which Einstein, Eddington, and others belong depends on the a priori prejudices of philosophical idealism" (Orlov 1925d, 297).

Nevertheless, Orlov was right when he asserted in 1924 that physics remains in a state of "ferment" and that the doctrine of matter could not be considered complete (Orlov 1924p, 231). Physics was standing on the very threshold of the formulation of quantum theory and the uncertainty principle, but its "ferment" was of a different nature from the one Orlov chiefly had in mind.

The Phenomenon of Ideologized Science

The syndrome of an ideologized science, which is characteristic of totalitarian regimes, has been studied by Russian scholars only over the past decade, especially the case of the USSR (Akhundov and Bazhenov 1989; Bogolyubov and Rozhenko 1991; Philosophical Research 1993, Nos. 3, 4). Orlov, like many other philosophers and scientists, was caught up in the pathos of the revolutionary surge, and this was reflected in his scholarly work. The dictatorship of the proletariat in Russia meant also the dictatorship of Marxist-Leninist ideology. Even when this ideology did not cast aside traditional scientific values and principles, it was often an indispensable element of scientific discourse and it deeply permeated academic publications (especially in the social sciences and humanities). This method presumed a "preparation" of the objects to be studied using concepts and approaches determined by the ideologue, but later using the ordinary scientific concepts and approaches. The main coordinates in which ideas were interpreted were those prescribed by the struggle between materialism and idealism.

Thus, in regard to Stepan Bogomolov's book *Foundations of Geometry* (Moscow 1923), Orlov wrote that "what unfolds before us is the picture of 'pure' science, whose basic postulates are 'freely chosen by reason.' They are absolutely independent of experience, that is, Bogomolov is expounding ideas favored by mathematicians, ideas that make modern mathematics the citadel of idealistic thought," and the mathematicians themselves were in essence promoting an idealistic metaphysics (Orlov, 1923b, 214, 219). It is in mathematics that "we have yet another front on which the struggle with idealism and with the prevailing 'truths' of the official science of the bourgeois universities must be waged" (Orlov 1924n, 86).

It was noted above in the discussion of the interpretation of random phenomena that, according to Orlov, bourgeois science was striving to suppress the dialectic of the historical process by denying its regularities and treating it in the spirit of indeterminacy.

In evaluating the book *Physical Factors of the Historical Process* by Aleksandr Chizhevskiy (Kaluga 1924), a book that, as is known, expounds the concept of heliobiology, which came to be recognized only in the mid-twentieth century, Orlov wrote that the fact that the curve describing the number of sunspots coincides with the curve describing mass migrations of peoples, demonstrates only the extreme naiveté of the author. Chizhevskiy's concept is "an attempt to take natural science by the hair and find a transcendental factor in the historical process that is independent of the production relations in the class struggle," which shows the "futility" of such "scholarly refinements" (Orlov 1924k, 315).

In his reviews and polemics Orlov resorted to accusations of idealism (the rational dialectical materialism proposed by Zakhar Zeitlin "leads to idealism"), agnosticism (the physics of G. Mie, whose article was published in *Under the Banner of Marxism* in 1927) and appealed to the incontrovertible value of the Marxist classics (Ernst Kol'man, using Marxism as cover, actually promulgated an understanding of randomness that had been opposed by Engels). He used pejorative expressions from the lexicon of politics (Wilhelm Ostwald has founded a sect of "energetics"; idealistic metaphysics weaves a net around the Helmholtz theory of harmony; relativistic physicists are "causal Daltonians," and so forth). He fully shared the opinion that "anything that helps the proletariat in its heroic struggle is moral" and he interpreted morality as a form of adaptation of the human race to reality (Orlov 1924a, 55).

For the sake of justice we should note that, in contrast to other authors who published in *Under the Banner of Marxism*, *The Militant Materialist*, and other such journals, Orlov resorted to ideological labeling and terminology much more rarely than others. He did not provoke others into a polemic by hurling accusations of apostasy from Marxism and the like, but only responded to attacks on himself (Zeitlin, Kol'man). Orlov's appeal to avoid excessive zeal in the critique of mechanicism also shows his lack of aggressiveness, at least a degree of aggressiveness that is insignificant compared to other authors in these journals. However, events took a turn in the direction of increased acrimony and extended to the political level. The scale of repression expanded, and the machinery of repression along with it. Perhaps Orlov had a presentiment that this repression might be directed against himself, a scholar who had published in the pre-Revolutionary journal *Problems of Philosophy and Psychology*, where the ideological enemies of the Bolsheviks worked. It seems very probable such a presentiment would have caused Orlov to seek out an ideologically neutral sphere, especially one that was urgently needed for the development of industry—chemical research and the production of iodine and bromine.

He seems to have spent the years 1928 and 1929 becoming familiar with this new field. He ceased publishing in journals of sociopolitical type and tried to immerse himself in the problems of chemical engineering, publishing his papers in specialized journals and translating the works of foreign chemists: E. Müller, F. Hahn, O. Tomiček (Orlov 1931, 1933, 1934, 1935, 1939). It is unlikely that Orlov was subject to any repression; if he had been, his book would not have been published posthumously in 1939, and Professor Slesarev would not have dared to mention his name in the preface.

Conclusion

Ivan Orlov was a scholar with wide-ranging interests, extending from logic to chemistry and music. His career coincided with the dialectical period in Russian history, during the rise and expansion of the phenomenon of ideologized science, the "Wolfhound Era." The social atmosphere of revolutionary pathos and the machinery of ideologized science were reflected in his work, although perhaps to a lesser degree than in the work of his contemporaries. His ideas were developed in the quest for a special substantive logic of natural science that would correspond to the spirit of the dialectic. In the final analysis, this led him to the formulation of the logic of propositional consistency, which was an important milestone on the path of development of modern relevant logic. The logic of propositional consistency can nowadays be appreciated as an outstanding achievement that had emerged as a revelation in the mind of a multi-faceted scholar whose attempts to reach a properly mathematical logic at least once rose to a level that merited the claim of near-genius.

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[1] In 1930, the system of relevant logic was proposed by E. Nelson. R. Routley stressed that he considered naming Orlov as the forerunner of relevant logic. Perhaps Aleksandr A. Zinov'yev was the first in the USSR who paid attention to the logical ideas of Orlov (1962), and Vladimir M. Popov the first who linked these ideas to relevant logic (1978).

[2] We must say a few words about Orlov's hobby, music theory. He asked himself the question, "Why do our auditory organs recognize … simple numerical ratios [such as 8:11, 8:13, 10:13 and the like] and perceive them as harmony?" (Orlov 1926b, 193). He invoked Helmholtz' theory to show that the intermittent sensation of beats characterizes the phenomenon of dissonance, while consonance results from the absence of beats. Orlov attempted to experiment in music and carried out an experiment with Rzhevkin's cathode harmonium. He analyzed the musical works of Prokof'yev, Skryabin, and Schönberg from the point of view of the presence and status of the "beats" they contained.

[3] It is doubtful that Orlov was really educated as a hydraulic engineer. In his papers he comes across as a scholar striving to investigate fundamental problems. If he was nevertheless educated as an engineer, one can only marvel at his talent for self-teaching. He did, after all, work seriously not only in the philosophy of natural science and logic, but also in chemical and chemical engineering and even wrote on musical theory.