

IMRE LAKATOS AND THE INEXHAUSTIBLE ATOM: THE HIDDEN MARXIST ROOTS OF HISTORY AND PHILOSOPHY OF SCIENCE

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Recent work on Imre Lakatos's missing Hungarian dissertation on the historical sociology of science sheds new light on his mature philosophy of science. Remembered primarily as an "internalist" defender of the autonomy of science, and a Cold Warrior in politics, commentators have mistaken his contribution as primarily a rearguard action against the followers of Thomas Kuhn and the "externalists" influenced by Boris Hessen. It comes as a surprise, then, to find that he developed and retained a fully general sociology of scientific knowledge, with Marxist roots that articulated Lenin's "inexhaustible atom." He carried forward this emphasis on the fallible, changing, and incomplete nature of our engagement with the natural world by a dialectical account of how research programs advance and recede historically. In his effort to develop a synthesis of Popper and Kuhn, and via his engagement with Paul Feyerabend, he continued to develop a distinctly dialectical approach to science.

Keywords: Lakatos, Marxism, externalism, Lenin, Hessen, research programs, dialectics

ИМРЕ ЛАКАТОС И «НЕИЩЕРПАЕМЫЙ АТОМ»: СКРЫТЫЕ МАРКСИСТСКИЕ КОРНИ ИСТОРИИ И ФИЛОСОФИИ НАУКИ

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Исследование венгерской диссертации Имре Лакатоса по исторической социологии науки открывает в новом свете его зрелые идеи по философии науки. Лакатоса чаще всего вспоминают как сторонника интернализма и автономии науки. Однако комментаторы ошибаются, рассматривая его вклад исключительно как реакцию на Томаса Куна и «экстерналистов», испытавших влияние Бориса Гессена. В этой связи особенно любопытно обнаружить, что Лакатос разрабатывал и поддерживал общую социологию научного знания с марксистскими основаниями и ленинской идеей о «неисчерпаемом атоме». Он диалектически трансформировал идею об изменчивости и неполноте нашего взаимодействия с миром природы в тезис о развитии и исторической сменяемости исследовательских программ. В своем стремлении объединить Поппера и Куна он также развивал отчетливо диалектический подход к науке.

Ключевые слова: Лакатос, марксизм, экстернализм, Ленин, Гессен, исследовательские программы, диалектика



Lakatos is remembered today primarily as a rearguard defender of “internalism” in the history and philosophy of science against Kuhnian relativism and the relativist and constructivist sociology of scientific knowledge only then emerging in his adopted home in the United Kingdom at the time of his death in 1974. “Internalism” in the history of science had arisen primarily as a counter to the influence of Soviet physicist Boris Hessen on a generation of British Marxist scientists, following his paper, “The Socio-Economic Roots of Newton’s Principia,” delivered on the Second International Congress of the History of Science in London in 1931 [Shapin, 1992; Werskey, 2007, p. 418; Werskey, 1988; Schaffer, 1984]. While Hessen’s “externalism” came to be stereotyped as undercutting the rationality of science by exposing its social roots, Hessen, in fact, had sought in writing the piece to defend Einstein’s relativity from attacks in the Soviet Union very much like those that Mendelian geneticists experienced [Graham 1985; Schaffer, 1984, p. 26]. Hessen ultimately paid the same price, executed for counterrevolutionary crimes in 1936.

Drawing on recent work on the early Hungarian career of Lakatos, I argue that Lakatos’ mature philosophy of science reflected its Marxist roots most evident in papers published from his missing 1947 Hungarian dissertation, “On the Sociology of Concept Building in the Natural Sciences,” that similarly conjoined a thoroughly sociological account of scientific knowledge and a dialectical account of rationality rooted in a Lukácsian-inflected Marxism [Kadvany, 2001; Motterlini, 2002; Kampis; Kvasz; Stöltzner, 2002; Kutrovátz, 2008; Dusek, 2015]. While engaging the classic sociologists of knowledge, Max Scheler and Karl Mannheim, Lakatos went beyond Mannheim’s famous strictures by applying the approach to the exact sciences much as Ludwik Fleck did in his 1935 *The Genesis and Development of a Scientific Fact* [Fleck, 1981].

Lakatos sought to maneuver a similarly charged political context as Hessen’s, shifting from a defender of orthodoxy to a reformer defending free expression, following a stint in prison for his own counterrevolutionary crimes. While he morphed into a neoconservative Cold Warrior following his second PhD with Karl Popper at the London School of Economics, after fleeing Hungary following the Soviet crackdown on the Hungarian revolution, his mature philosophy of mathematics and science continued similar themes in Popperian clothing [Kavadny, 2001; Dusek, 2015].

Lakatos’ friendship and dialogue with Paul Feyerabend illuminate this covert continuity in Lakatos’ thought, particularly in light of their ongoing correspondence and their cooperation in setting up their work as a synthesis of Kuhn’s and Popper’s philosophy in *Criticism and the Growth of Knowledge*, the outcome of the International Colloquium in the Philosophy of Science Lakatos organized in London in 1965 [Lakatos; Musgrave, 1970]. While they had planned to write a book together that would highlight their



differences, entitled *For and Against Method*, it is their similarities that testify to a shared interest in a dialectical philosophy of science influenced by Marxist ideas.

While they shared with Popper a rejection of the idea that a single paradigm can or should control scientific thought, they differed with Popper's emphasis on the logic of falsification. Instead, they both thought multiple perspectives in the history of science generated fruitful scientific work until exhausted and new approaches came to the fore. For his part, Feyerabend appealed to Trotsky's concept of uneven and combined development to underwrite his own dialectical alternative to Kuhn in *Criticism and the Growth of Knowledge*, while Lakatos carried forward themes he first discussed in the Hungarian dissertation that have their roots in an examination of Lenin's concept of the "inexhaustible atom" in his *Materialism and Empirio-Criticism* [Feyerabend, 1970; Lakatos, 1970].

Despite Lakatos' turn to the right politically after emigrating from Hungary, Lakatos continued to see reason as emerging from social determination in a dialectical process emphasizing science's changing engagement with its object. Drawing on Lenin's metaphor of the "inexhaustible atom," he emphasized the fallible, changing, and incomplete nature of our engagement with the natural world [Kutrovátz, 2002]. Lenin had argued that our best scientific representations of the natural world at any moment were indefinitely susceptible to change, as the dialectic process of science confounded any attempt to hold still nature's ontology. The indivisible atom gave way to the electron, which was equally inexhaustible as its own fixed structure could be expected to give way as scientific investigation proceeds [Lenin, 1948].

The result implied that a close look at the sociology of science was necessary to understand how science developed historically, with programs pursued while fruitful in generating new scientific work and abandoned when exhausted. This represents a quite different interpretation than the standard interpretation of Lenin's "reflection theory," arguably closer to Marx's own view of the historical roots of scientific work as they came to light with the publication in 1932 of *Economic and Philosophical Manuscripts* [Lynch; Fuhrman, 1991]¹.

When I am active *scientifically*, etc. – an activity which I can seldom perform in direct community with others – then my activity is *social*, because I perform it as a *man*. Not only is the material of my activity given to me as a social product (as is even the language in which the thinker is active); my *own* existence *is* social activity and therefore that which I make of myself, I make of myself for society being [Marx, 1975, p. 298].

¹ Contrast Putnam's [1975] interpretation of Lenin's theory, which Lakatos rejected for its tendency to politically repress competing theories via a realist semantics [Lakatos; Feyerabend, 1999, p. 25].



Echoing his countryman György Lukács' dialectical reading of Marx, Lakatos developed a fully sociological account of science that emphasized both the material determination of thought and the dialectic between social causes and scientific representations [Lukács, 1971; Kadwany, 2001].

As Hacking [1981, p. 129] put it in an article that anticipated the recent interest in his “thoroughly Hegelian and somewhat Hungarian conception of the events of modern philosophy,” Lakatos sought “to provide a theory of objectivity without a representational theory of truth.” What makes Lakatos' theory “internal” is that he identifies the mechanisms behind the *growth* of knowledge that are internal to a research program rather than identifying a theory's correspondence to an *external* reality [Hacking, 1981, p. 130].

The sociology of knowledge was compatible with progress because progress was defined not by correspondence with natural kinds or a logical structure of scientific explanation, but by success in *generating* new scientific predictions and richer scientific concepts. Above all else, progressive scientific and mathematical programs ensured their own demise by giving rise to perspectives that reframed the value of past discoveries. Only after a research program ceased to sustain the momentum of its positive heuristic did it give way to a rival approach. Before that time, alleged falsifications were ignored and only later does a new research program redefine anomalies as part of a “crucial experiment,” “an honorific title” applied “*long after the event*” [Lakatos, 1970b, p. 100].

In his philosophy of mathematics, Lakatos spoke of the value of lemma-incorporation, whereby concepts were stretched in ways that changed the meaning of mathematical concepts retrospectively. Kadwany [2001, p. 48] calls lemma-incorporation “the motor force of the method of proofs and refutations” because it generated more – and more fruitful – work than the “monster-barring” approach that narrows the content of the mathematical theorem to preserve the logical truth of the theorem to a more restricted class when an exception is noted. Monster-barring tried to maintain continuity of logical structure by banishing exceptions at the cost of sterility, just as degenerating programs in science ultimately did.

This is why Lakatos focused on research programs rather than theories, since it was necessary to examine a series of successively produced theories to have any idea at all if progress was being made. In his correspondence with Lakatos, Feyerabend distinguished between “justificationists” and “conjecturalists,” with Lakatos and Feyerabend sharing with Popper the status of being conjecturalists unconcerned with “proof.” In contrast to Popper, however, they both were “historical” rather than “abstract” conjecturalists, a classification they shared with Vico and Lenin [Lakatos; Feyerabend, 1999, p. 216]. Feyerabend argued that few historians of science were “as well acquainted with contemporary science as was Lenin with the science of his time, and no one can match the philosophical intuition of



that astounding author” [Feyerabend, 1966, p. 414]. Feyerabend developed a defense of Bohr’s Copenhagen interpretation of quantum physics, targeting physicist James Jeans for an insufficiently dialectical approach that failed to take into account the relation between observer and observed. Feyerabend’s argument echoed similar criticisms of Jeans in Lakatos’ Hungarian dissertation [Kutrovátz, 2002, p. 361–362, 354–355].

Feyerabend, for his part, argued that Lakatos’ research programs were misleading because they ignored their permeability to outside influence, as successive theories did not always have pure, non-hybridized lineages. Indeed, for Feyerabend, incommensurability was not the obstacle to outside criticism that it was for Kuhn, but the means for bringing about qualitative change in scientific concepts by use of a new observation language as an external framework that would also change the meaning of established scientific concepts [Feyerabend, 1970]. Both shared a rejection of Kuhn’s “elitist authoritarianism,” whereby scientific communities had authoritative understandings of the natural world that could not be challenged by outsiders [Lakatos; Feyerabend, 1999, p. 27–31, 95–97]. The true significance of scientific ideas in the long run of reason was not a possession of scientists working within a paradigm, but something that could only be seen when the owl of Minerva had spread its wings.

Since we must await its refiguring in the future movement of reason to understand its true significance, Lakatos’ “internal” history is not a snapshot of scientific theories or beliefs, but a retrospective reconstruction of knowledge. The theories and facts are conventional in that they are shaped historically by the state of society and the research programs that make it possible. In contrast to dominant elements in contemporary sociology of scientific knowledge [Collins, 1985], Lakatos does not see knowledge as shared beliefs, the standard sociological alternative to beliefs corresponding to the world. Instead, knowledge is treated as an alienated product of scientific labor [Kutrovátz, 2002, p. 125–29; compare Feyerabend, 1970; Bartley, 1987].

When Lakatos argued that a properly reconstructed history should banish “real” history to the footnotes, this reflected his view that scientists’ psychological attitudes to their theories may be irrelevant to its place in a dialectical succession of theories driven by a positive heuristic. Lakatos’ *Methodology of Scientific Research Programs* (MSRP) represents not an internalism opposed to the sociological determination of thought, but a sociology of knowledge that is dialectical in being driven by the contradictions between existing scientific concepts and the current state of knowledge.

It is no surprise that Lakatos was well-positioned to synthesize the approaches of Kuhn and Popper, given that his intellectual background in Marxist philosophy and bourgeois sociology of knowledge was strong, where Kuhn’s was shallow and dependent upon the fortuitous discovery



of Fleck's book [Fuller, 2000]. Such a synthesis was prefigured already in Lakatos' 1947 Hungarian dissertation, as testified to by the surviving report of one of his readers, Sándor Karácsony. Lakatos, he reported, argued

that scientific concept-building is not objective, not the alphabet of nature, but it is a relation and a function of the prevailing social structure. Therefore, natural science, during the course of its progress, occasionally outgrows its proper system of concepts, as long as socialist society has not yet reached its static rest state, at which it will force scientific concept-building into a form more independent of time and facts [quoted in Kutrovátz, 2008, p. 125].

Only the arrival of socialism played the politically correct role of Pierce's end of inquiry².

Key concepts in Lakatos' mature philosophies of mathematics and science, lemma incorporation and progressive problem-shifts, merely carry over Lakatos's earlier emphasis on the importance of confronting "contradictions," rather than evading them. The other reader of his dissertation, Ottó Varga, attributed to Lakatos the claim "that the dissolution of contradictions is made possible only when we view any scientific statement as a creation of the society which created that science –that is, truth is always a function of history" [Kutrovátz, 2008, p. 126; Kutrovátz 2002, p. 373].

On Lakatos' reading, the history of Euler's formula shows an oscillation between deductive reasoning and quasi-empirical observation of counterexamples. This undercuts the idea of strict deductive necessity. Lakatos rejected the certainty of scientific knowledge, extending Popper's fallibilist approach to mathematics [Lakatos, 1976]. Koetsier [1991, p. 19] argues that for Lakatos, "nothing in mathematics is self-evident. Self-evidence in mathematics is an illusion." Feyerabend observed that Lakatos' argument "remove[d] the last Aristotelian element, the element of necessitation, from modern science" [quoted in Bağçe; Başkent, 2009, p. 19]. Lakatos' philosophy of science likewise argued for the productive role of positive heuristics in promoting theoretical dynamism in science despite the neglect of anomalies by most scientists.

In *Ludwig Feuerbach and the End of Classical German Philosophy*, Engels pointed out that Hegel's claim that the real is rational meant not that anything that exists is rational, but that anything that remains *necessary* within a process of historical change is rational. The real that is "rational" is not whatever exists in the present, but a part that will end up having played a necessary role in the whole of history. **Our own static concep-**

² Lakatos cites Lukács' *History and Class Consciousness* in "Modern Physics, Modern Society," a surviving article incorporated into Lakatos' missing dissertation. The dissertation reader, Sándor Karácsony, tacitly invoked Lukácsian influence in noting that the dissertation was "based on dialectic Marxism, but in its modern and not its orthodox form" [Kutrovátz, 2002, p. 369, n. 13, 372, 374, n. 21].



tion of what we know at a moment in time can be expected to change as the future unfolding of our knowledge reorders the relationships of these incomplete, static parts [Engels, 1941, p. 10].

Engels took this to be suitably paraphrased by the slogan that “all that exists deserves to perish,” a view that when applied to scientific epistemology implies a thoroughgoing fallibilism, denying that the scientific realist’s vision of a complete and final classification of the natural world could be obtained in finite time:

Truth lay now in the process of cognition itself, in the long historical development of science, which mounts from lower to ever higher levels of knowledge without ever reaching, by discovering so-called absolute truth, a point at which it can proceed no further, where it would have nothing more to do than to fold its hands and gaze with wonder at the absolute truth to which it had attained [Engels, 1941, p. 11].

Lenin echoed this criticism of a dream of a final theory in distinguishing dialectical materialism from metaphysical materialism:

The “essence” of things, or “substance,” is *also* relative; it expresses only the degree of profundity of man’s knowledge of objects; and while yesterday the profundity of this knowledge did not go beyond the atom, and today does not go beyond the electron and ether, dialectical materialism insists on the temporary, relative, approximate character of all these *milestones* in the knowledge of nature gained by the progressing science of man. The electron is as *inexhaustible* as the atom, nature is infinite, but it infinitely *exists*. And it is this sole categorical, this sole unconditional recognition of nature’s *existence* outside the mind and perception of man that distinguishes dialectical materialism from relativist agnosticism and idealism [Lenin, 1948, p. 269; see Bunge, 1950].

Lakatos echoed this view in 1947, when he published a critique of (what would later be called) intelligent design by a biologist, Vilmos Csiszár, who had argued that cell division could not be explained in purely materialistic terms. Drawing on Lukács’ view of Marxism as a method not wedded to any particular content, Lakatos defended materialism, but rejected “vulgar materialism” which equated matter with our current scientific conception of it. Since “[e]ach new discovery modifies our concept of matter,” Lenin’s concept of real, but “inexhaustible” atoms should be preferred over Csiszár’s belief in a “well-arranged and comforting *final* explanation, which makes our existence meaningful and purposeful” [cited in Kutrovátz, 2008, p. 359; emphasis added by Lakatos]. In the article excerpted from the dissertation, “Modern Physics, Modern Society,” Lakatos describes “the only thesis of materialism” capable of surviving the historical transformation of scientific concepts to be the “infinitely broad Leninian axiom postulating an existence *independent of our mind*, of which our mind reflects constantly more and more, without ever exhausting it” [Kutrovátz, 2002, p. 359].



Key to Lakatos' 1947 dissertation is the idea that dialectics do not just describe a relationship between concepts abstractly considered, but that it shows the inherently historical dialectic within science that gives rise to those concepts in the first place and eventually exhaust themselves as science develops further. This Luckacsian extension of the sociology of knowledge to science, referred to by Lakatos as "planting historicism into natural science," itself is directly opposed to classic internalism [Kutrovátz, 2002, p. 359, 368], leading Lakatos to interrogate Lenin's metaphor of reflection:

But what should we mean by "more and more" exact reflection? Conceptual development is not a quantitative development that renders ever larger concentric circles of exactness. Nor is it "logical," for conceptual development changes logic as well. So what guarantees the "more and more" exact system of concepts? Does the sociological sphere not penetrate into scientific concept-building itself? [Kutrovátz, 2002, p. 368].

Based on this piece, Lakatos has to be seen as one of the forerunners of a fully general sociology of scientific knowledge, like Ludwik Fleck, who did not exempt the exact sciences from social determination as had Mannheim [Bloor, 1976; but see Kaiser, 1998]. At the same time, Lakatos focused on the contradictions unleashed as the sociological generation of scientific ideas encountered resistance from idealist philosophies endemic to capitalism. His example was the same as Feyerabend's two decades later: the transformation of our conception of matter by quantum mechanics, an exemplification of Lenin's inexhaustible atom, resisted by idealist and subjective philosophies put forward by scientists working in a capitalist society. Similarly, Lakatos argued that the drive towards international scientific cooperation, the concentration of instrumentation into ever more centralized laboratories, and the introduction of greater planning within scientific work, was resisted as the specific, "hermetically isolated" national research schools reflected the same contradictions driving conflict between nations under capitalism [Kutrovátz, 2002, pp. 367–68]. Lakatos' notion of a dialectically-based fallibilism in science and mathematics remained central to Lakatos' thinking throughout his career. Lakatos' mature philosophy abandoned Marxism but continued this early belief that the dialectical method "unmasks the seemingly unchanging and eternal things as historical categories revealing their birth, flourishing, and demise" [Kutrovátz, 2008, p. 117].



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