

Book Review Column

Mirowski's Screed: A Review of Philip Mirowski's *More Heat than Light: Economics as Social Physics, Physics as Nature's Economics*. Cambridge: Cambridge University Press, 1990, Pp. xii + 450. \$59.50 ISBN 0-521-35042-5.

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More Heat Than Light! - that sums it up quite accurately. Alas, it will take more than four words to convince the reader of the soundness of such a stark judgement.

Mirowski's book is a sustained attack on the foundations of modern neoclassical economics. He gives a succinct statement of his thesis:

The only way to fully comprehend value theory in economics is to situate it within the metaphorical simplex of energy, motion, body and value, and to regard it as part and parcel of the same structures that undergird Western physics. [pp. 141-2]

If true, this thesis has severe consequences for our understanding of the history of economic thought and for the methodology of economics. Beyond economics, Mirowski aims to undermine the nexus between social theory and the natural sciences. A key slogan runs: "Physical metaphors used to describe social processes are spuriously grounded in the natural phenomena" (p. 318).

I hold no special brief for neoclassical economics. Throughout his book, Mirowski scatters many telling criticisms of the details of neoclassicism and of the inappropriate imitation of the physical sciences by economists. He offers some attractive ideas for the development of the discipline. Yet, reading this book gave me a slowly rising feeling of outrage. Taken as a whole, it is an outrageous book: neither the history nor the methodology are persuasive; the scholarship is often slapdash; the tone is intemperate; and the style is often obnoxious. Mirowski's hatred of neoclassical economics borders on the pathological: one sometimes wonders if his mother didn't run off with a neoclassical economist, leaving little Phil bereft in the cradle. Mirowski strikes a flashy, bullying tone throughout the book, patronizing the reader, economists and physicists. He offers

consistently uncharitable readings of almost everyone - Veblen, Georgescu-Roegen and a few obscure figures in the history of economic thought excepted.

I

Mirowski's argument is about metaphor and the role of metaphorical exchanges in the development of physics and economics. In the development of energy physics, which is central to this book, accounting notions and notions of economy of action are borrowed from economics. Mirowski cites the suggestive example of Joule, who may have gotten his inspiration for his research into the mechanical equivalent of heat from the carefully maintained accounts of his family's brewery: energy was like money - the diligent bookkeeper had to account for every last tuppence. Mirowski maintains that economics readily borrowed from physics as well, and, by the time of the rise of neoclassicism, the exchange was pretty much one way from energy physics to economics.

Mirowski visualizes the metaphorical complex involved in these exchanges as a triangular pyramid, with "energy" at its apex and "motion," "body," and "value," at the vertices of its base. In chapter 2 he reviews the development of energy physics from the late 18th century through the early 20th century as elaborations of one or other of the metaphorical relations of the three faces of this pyramid. Despite its stylistic infelicities, this is the most fascinating part of the book, even for someone who has heard the story before.

Mirowski argues that the notion of energy and its associated conservation law were not simultaneously discovered as standard histories report. First, each of the putative discoverers, Mayer, Joule, Helmholtz and Colding, were elaborating the metaphorical complex rather than finding an "energy" that was out there independently of their own understandings - i.e., energy was not discovered. Second, the "discoverers" were working on different faces of the energy pyramid. This explains why, in Mirowski's view, it did not occur to them that



they were all doing the same thing
- in fact they were not.

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Mirowski then goes on to trace the development of the law of the conservation of energy and thermodynamics. By the end of the 19th century, it appeared that physics was achieving a grand unification with energy as *the* central concept. The energetics movement associated with Ostwald began to view energy as the key to everything. But then, around the turn of the century, it all began to unravel. Planck and others attacked Ostwald as misunderstanding the basis of the existing energy physics; and that physics itself began to disintegrate. Quantum mechanics and the theory of relativity fractured the hard-won unity of physics, and the law of the conservation of energy was transmuted into symmetry principles that were specifically tailored to different physical theories which no longer formed a unified whole. Not only had the conservation of energy lost its overarching status, $E=mc^2$ suggested that energy might not be conserved, but could be converted into matter and vice versa. Further elaborations of relativity theory suggested that the homely thought behind the law of the conservation of energy - nothing comes from nothing - might be wrong: "It now appears possible that the universe is a free lunch" (Mirowski, p. 392, quoting Guth 1983, p. 215).

All economics, at least from the advent of mercantilism, was, in Mirowski's view, involved in the elaboration of the same metaphorical complex of energy/motion/body/value. But the two-way street of metaphorical exchange between physics and economics became essentially a one-way street with the marginal revolution of the 1870s, and a divided highway once physics itself lost its unity in the 20th century.

According to Mirowski (p.3), "..... the progenitors of neoclassical economic theory boldly copied the reigning physical theories of the 1870s." He dubs this physics "protoenergetics." It is the energy physics that developed out of rational mechanics before the second law of thermodynamics introduced the notion of the irreversibility of thermodynamic processes. Mirowski's claim is extremely strong: "..... those neoclassicals did not imitate physics in a desultory or superficial manner; no, they copied their models mostly term for term and symbol for symbol, and said so" (p.3). Of this claim, more anon.

The central problem for neoclassical economics is that it failed to see that copying physics leads to absurdity. After the protoenergetics stage, physics developed away from substance accounts of energy toward field accounts. Conservation of energy can be expressed technically as the requirement that energy be represented by an irrotational conservative vector field. The characterization of an economy as the simultaneous maximization of utility functions subject to budget constraints is analogous to the field formalisms of physics. Had economics developed its metaphorical borrowing from physics along the same lines as physics itself developed, it would have been forced to impose the conservation law in the form of an irrotational vector field. But then the analogue of the law of conservation of energy would state that the sum of utility (analogous to potential energy) and expenditure (analogous to kinetic energy) would have to be conserved quantity. But that is an economic absurdity; utility and expenditure do not have the same dimensions. Mirowski faults neoclassical economics for not exploring the complete implications of the energy metaphor; and, because those implications are unsavory in the extreme, for adopting the energy metaphor at all.

Mirowski notes various physicists and mathematicians who raised questions about the appropriateness of the energy metaphor for economics, and, particularly, about the counterpart to the law of the conservation of energy. These took the form: are utility fields integrable? He maintains that, after the turn of the century, when these questions were not satisfactorily answered, economists - in large measure because of their mathematical incompetence - simply ignored the question of integrability for nearly thirty years. The sores of an inappropriate metaphor continued to fester. In the 1930s, an influx of engineers and mathematicians raised mathematical competence among economists to a new height. Integrability was rediscovered. Now, however, it was seen as an economically insignificant technical point. Mirowski believes that this attitude was part of an elaborate shell game in which the physics of protoenergetics continued to drive the development of neoclassical economic theory, while economists denied the centrality of the physics metaphor for their own discipline. For this charade - for Mirowski repeatedly questions the motives of the



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economists involved - Paul Samuelson is held chiefly to blame.

II

No one can doubt that economists in the 19th century, as well as before and after, looked to physics as an inspiration for scientific economics, they borrowed its mathematics and found economic analogies for some of its concepts, such as energy. Physics was a resplendent jewel in the crown of the modern intellect. Other disciplines, not just economics, sought to stand in the reflected glory of its scintillating light. Mirowski maintains, however, that physics and economics were bound together more tightly than this suggests: both were elaborations of the single metaphorical complex represented in the energy pyramid. While it is clear in retrospect that the energy pyramid has considerable taxonomic purchase in the history of physics, Mirowski provides no evidence that it had any heuristic power, that it in any way *guided* the development of either physics or economics. Emulation of physics was part of the *Zeitgeist* of the 19th century: it was simply in the air; people talked about energy the way they now talk about quantum mechanics or relativity, usually without rigor and often (as Mirowski himself notes) without understanding or perspicacity. Mirowski denies that the linkage was this loose:

..... the research program at each vertex [of his energy pyramid] is *essentially the same metaphor*. Here is the sense in which we are no longer dealing with prosaic notions of intellectual cross-disciplinary influences, *Zeitgeist*, or epistemes. *The research program situated at each vertex derives legitimacy for its radically unjustifiable principles from the homeomorphisms with the structures of explanation at the other vertexes.* [p. 116]

Significantly, Mirowski does not provide a single instance of the "word-for-word, symbol-for-symbol" borrowing of physics that he promises. There is much equivocation. Apparently, any time any economist uses the words "energy" or "conservation" Mirowski reports them as buying into the fine details of the protoenergetics program. Similarly, any time a physicist uses a word like "value" or a phrase like "nothing comes from nothing" Mirowski sees an appeal to economics. But all these words have now, and had then, meanings that were not closely rooted in any economic or physical

theory. "*Ex nihilo fit nihil fit*" was already known to metaphysics when "economics" referred to housekeeping and was beneath a philosopher's contempt.

The direct and conscious parallels drawn between physics and neoclassical economics that Mirowski cites are invariably surrounded with caveats noting that no analogy with physics will be exact in every detail. Jevons's clearest direct borrowing from physics in his *Theory of Political Economy* is the discussion of the law of the lever. In context, however, it is evident that his point has to do with what sorts of mathematics can be used in certain classes of problems, and not with *precise* analogies between levers and economical systems. Similarly, Fisher is clear that his use of hydrostatic analogies in *The Purchasing Power of Money* (p. 108) and elsewhere are merely suggestive, and not exact. Mirowski reproduces a table from Fisher's doctoral dissertation in which he draws explicit analogies between economics and physics. But Mirowski finds it necessary to construct his own supplement to this table drawing his own further analogies in order to convict Fisher of a complete and precise borrowing of the physics metaphor. Nor is this harmless filling in of obvious lacunae: Mirowski (p. 230) must refer to his own additions to convict Fisher's system of involving absurdities. At the same time, Mirowski is not at all happy that Fisher attempts to insert economic considerations into his table that are not one-for-one with the elements of physics.

It is a good thing that modern physics supports the notion that something may come from nothing, for Mirowski repeatedly draws substantive conclusions from what is not there. His treatment of Fisher's table is a typical example of this rhetorical tactic, which we might name the "evidential free lunch." A few further examples follow.

In Mirowski's view, Fisher's thesis stands convicted of contravening the logic of metaphorical reasoning and failing to perceive the fundamental conflict between the physics of the conservative vector field and neoclassical economics. It happens that J. Willard Gibbs, the imminent thermodynamicist, was one of Fisher's advisers. Unable to produce evidence of Gibbs criticizing Fisher, Mirowski "conjectures" (to use his own word, p. 242) Gibbs's objection:

Gibbs undoubtedly asked Fisher why Fisher's indifference lines should



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be able to be integrated into utility surfaces. Far from being a minor technical complaint, Gibbs probably tried to make Fisher aware that the absence of integrability would necessarily mean that there could exist no such quantity as total utility, and path independence of equilibrium would be compromised. What he apparently never understood was that Gibbs wanted to know why Fisher did not explore integrability as the next logical step towards a dynamic theory of optimization..... Fisher, uncomprehending, instead went on to say that he did not need integrability for his theory, and indeed, he did not need utility, period. This statement only served to demonstrate that he was out of his depth. We can date the collective neoclassical neurosis with regard to the physics metaphor from this point. [p. 243]

Fisher is convicted for wrongly responding to objections for which there is no tangible evidence that Gibbs made. And this is *the* critical juncture in the history of neoclassical economics! I submit that there is a very good reason to believe that Mirowski's conjectured exchange never took palce: Gibbs was Fisher's conjectured exchange never took palce: Gibbs was Fisher's adviser, and he signed off on his thesis, which he surely would not have done had he imagined it to be fundamentally flawed. Or does Mirowski have further conjectural "evidence" that Gibbs was unusually negligent in fulfilling his academic obligations?

A second example comes from Mirowski's recounting of the inquiries of the mathematician, Hermann Laurent. Laurent, at different times, wrote letters full of searching questions about the mathematics, particularly about integrability, of Walras's and of Pareto's systems. Mirowski presents the economists as, by turns, dunder-headed and evasive. He concludes that they failed to communicate because "Laurent understood the physics, and Pareto [and, by a well-supported inference from Mirowski's explicit comments, Walras] did not" (p. 247). Mirowski then wonders at Laurent's *Petit traite d'economie politique mathématique* for supporting the Lausanne school. "His questions 'about integrability'..... were never adequately answered by the protagonists, and so it appears he just passed them by in his own

treatise" (p. 247). The fact that Laurent supports the Laussane school and does not recapitulate his questions suggests to me either that he regarded his questions as having been adequately answered in the end or that he regarded the issue as being of secondary importance or that he doubted his own standing in the debate. In any case, absent Mirowski's own interpretations of which Laurent was no doubt innocent, the evidence of Laurent against neoclassical economics is weak.

III

A central problem in Mirowski's view of history and method is that metaphors are all important, yet there is no explanation of their mode of influence. Indeed, it is not at all clear what a metaphor is for Mirowski: almost every term in every context is described as metaphorical, so one wonders if Mirowski recognizes words as ever having a primary non-metaphorical usage at all. He may not; for he frequently expresses radical skepticism about the "thereness" of energy, of value, of motion, of body, of just about everything. The mildest forms of "realism" are suspect. He speaks of metaphorical resonances. On the one hand, he accuses economists of detailed copying; on the other hand, he asserts that they (consciously or unconsciously) strive to cover up their tracks. Fisher again provides a good example:

His chosen tactic was to *avoid discussion of the conservation of energy* at all costs, even if it meant some misrepresentation of the model appropriated from physics. [p. 230]

Here Mirowski takes Fisher's primary task to be the appropriation and elaboration of the physics metaphor. An alternative and more reasonable interpretation was that Fisher's primary task was to make sense of economic problems. If the physics metaphor implied the absurdity that money and utility were directly commensurably (not that there is any evidence that Fisher understood this implication), then so much worse for the metaphor.

Mirowski subscribes to the *metaphorical imperative*: to use a metaphor is to commit oneself to the complete mapping of that metaphor onto the subject at hand. But surely, if my love is like a summer's breeze, I still have no reason to think that an anemometer would help to gauge the intensity of her devotion.

Mirowski recognizes this but asserts that scientific metaphors are different from poetic metaphors and "have different criteria of



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efficacy and success" (p. 278). But why? Mirowski's only halfway persuasive reason is that "..... one of the most attractive aspects of analogical reasoning is the prefabricated nature of an interlocked set of explanatory structures and constructs, allowing quickened evaluation of logical coherence" (p. 272). But if the choice comes down either to adapting to the requirements of the economic problem or to further prosecuting a metaphor beyond the point at which it is apt, what advantages does such prefabrication provide? Aside from the advantages of prefabrication there simply is no *argument* in favor of the metaphorical imperative. There is only bald assertion. Poetic metaphors, in Mirowski's view, need not be (indeed, should not be) fully prosecuted; but to deny that scientific metaphors must "..... is to deny the possibility of scientific metaphor" (p. 279). This from an avowed enemy of scientism in economics.

Recall that Mirowski is suspicious of all forms of realism, so the imperative of the metaphor replaces the imperative of the economic problem. Explorations of lexicographic preferences are condemned, for example, because they reflect ignorance of the root metaphor of neoclassical economics, no matter how much they may suit the economic behavior of people (p. 366). "Contrary to the ideology of neoclassicism, we are not so indifferently free to choose [the aspects of the physics metaphor we like or dislike]" (p. 272). The metaphorical imperative helps to structure inquiry" which might otherwise be even more rife with rampant individualism than is already the case" (p. 279). The intellectual connection between nominalistic metaphysics and intolerance and totalitarian impulses could not be more neatly illustrated.

The most frequently employed rhetorical paradigm in Mirowski's accounts of economists is, "When did you stop beating your wife?" Walras, for example, is, on the one hand, savaged for his mathematical incapacities and his inability to complete the analogy between physics and his economics. On the other hand, when Mirowski completes the analogy on his behalf, Walras is convicted of economic absurdity. Interestingly, Mirowski admits that whatever the problems of the first three editions of Walras's *Elements*, the fourth edition is free of taint because it restricts itself to virtual trades (i.e., the auctioneer coordinates everything

without allowing false trading) (p. 252). The Arrow-Debreu model is similarly free of taint. What an admission! Walras saw the necessity of altering his model, not because of the energy metaphor (Mirowski assures us that he was too incompetent to pursue that very far) but because of internally generated problems with his earlier account.

Mirowski's view of neoclassical economics is narrow and blinkered: it appears to be coextensive with utility-based general equilibrium price theory. But few self-described neoclassicals worry much about general equilibrium. Marshall, Friedman, and most practitioners of applied microeconomics, including those who invoke general equilibrium most heavily (estimators of demand systems and computable general equilibrium modelers) do not expect a perfect match between neoclassical price theory and the economy. Instead, they find the model suggestive of important aspects of the economy; they are aware of many of the humbler criticisms that Mirowski, along with many others, have made (e.g., absence of an auctioneer, unstable preferences, failure to characterize process); and they are not slaves to the metaphor.

In this, they are hardly different from the physicists. As Mirowski tells it 19th-century physicists dreamed the Laplacian dream of a complete dynamic, deterministic model of everything: a giant Hamiltonian equation in which one need only specify the initial conditions and the future and past of the universe would unfold before one's eyes. But Poincaré demonstrated that Hamiltonian dynamics had severely limited applicability. Nonetheless, Hamiltonian dynamics are still central to many areas of physics. Mirowski observes: "Thus, if the Poincaré theorem was the rude awakening from the Laplacian Dream, most of the dreamers merely rolled over and went back to sleep" (p. 73). Physics has seen no reason to abandon Hamiltonian dynamics or energy or its conservation laws (pp. 90-91).

The physicists have very good reasons for maintaining 19th century mechanics in spite of its failure as a model of everything. Similarly, neoclassical economics has its uses as well as its flaws. Marshall saw this clearly. Mirowski, however, is no friend of Marshall: "There was no solution, so Marshall papered the whole thing over with a florid pattern of Victorian common sense" (p. 302). Mirowski is hardly the Poincaré of economics; and economists would do well to stick to Marshallian common sense



(florid or plain).

IV

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Mirowski's tone is uniformly patronizing. The reader (presumed to be an economist) is patronized: the physics in chapter 2 may be too hard or the reader may not be patient enough or perhaps not civilized enough to have interests beyond economics. The neoclassical economists discussed in the book are patronized: they are all "coy," "disingenuous," "incompetent," and "uncomprehending" with respect to physics and its metaphorical imperatives. Even the physicists are patronized: it is truly amazing that the benighted founders of energy physics advanced their subject at all. And there can be no doubt that Mirowski understands conservation laws better than modern physicists (cf. p. 90). But Mirowski is inconsistent about physics: on the one hand, the scientists do not always get it right; on the other hand, we are repeatedly told that if we, or economists of the past, had only known physics, we or they would have seen through neoclassical economics.

If physicists are sometimes benighted, neoclassical economists are damned; and Lucifer himself is called Paul Samuelson. Or, perhaps, he is only a malevolent wizard: "... the conjuration of scientific legitimacy by means of vague innuendo abounds in Samuelson's oeuvre" (p. 384). There is more than a little of the pot calling the kettle black here. Samuelson says that his forays into thermodynamics, which he does not think bear a close relation to his economics, are part of a search for a civilizing intellectual breadth; and they are "fun." Mirowski comments: "I think almost everyone would agree this is ingenuous in the extreme: People generally are not given Nobel prizes for 'fun'" (p. 385). (Perhaps Mirowski's own work is a sore burden. Still, if he would consider the biographies of Nobel prize winners in physics (Feynman, for instance) he might find that fun plays a bigger part than this suggests.) He then goes on to accuse Samuelson of promoting mathematical economics as a smokescreen to cloak the true nature of neoclassical economics from those who might expose the incoherence of the physics metaphor with philosophical or other evaluative discussion.

Earlier Mirowski suggests that Pareto, Walras and Fisher wished to browbeat and hoodwink other economists with their mathematics (pp. 249-50). Browbeating with mathematics and physics is something Mirowski knows something about. No school of thought is

spared. For example, of the Cambridge (England) post-Keynesians, he writes (p. 342):

If they had been acquainted with a little of the history of physics, they would have seen that their mandate was to explore all of the ways in which a substance theory of value was inconsistent with a field theory of value.

In general, if economists are not presented as too stupid to understand the physics, they are presented as sleepwalkers in the thrall of the energy metaphor, not quite understanding how it disfigures their theories.

There is a glaring omission in Mirowski's discussion of the relationship between economics and physics: John von Neumann. Von Neumann has no entry in Mirowski's index. Indeed, he is mentioned only in the process of asserting that his growth model is genuinely neoclassical in comparison with Sraffa's formally similar model. This is a stunning omission; for von Neumann was an economist and a physicist - and worthy of a Nobel prize in both fields. If competence in physics was the central stumbling block, it is queer that von Neumann did not immediately grasp the difficulties of the energy metaphor.

V

Mirowski's intemperate tone is reinforced by his epideictic (I learned this from him) style. Length and repetition replace argument and evidence. Two-bit words abound. One needs a good dictionary to read Mirowski. My *Concise Oxford English Dictionary* was insufficient. Many times I had to repair to the big *OED*, and once I came up short even there. This may have improved my vocabulary, still "quotidian," "tyro," "tergiversations," "ukase" and "farrago" are not words that improve with frequent use. It was also annoying to find a fair number of Cooperisms (so named in honor of Mark Twain's rule in "Fenimore Cooper's Literary Offenses," "12. Say what he is proposing to say, not merely come near it. 13. Use the right word, not its second cousin"): "frisson of excitement," "self-reflexive" and "from whence" are redundant; "Hobson's choice" is not a hard choice, but no choice at all; a power series expansion is not a "Taylor expansion"; meteors fall, they do not rise; while there may be some difficulty in homogenizing them, there should be no problem in "pasteurizing chalk and cheese"; many, not few, heard the "siren song," it is just that, since hearing it resulting in their being smashed on the



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rocks, they did not live to tell of it - we must presume that Joan Robinson, like Odysseus, was tied to the mast.

An author generally only bears a small part of the blame for proofreading; still, there were many typos. It was a great relief the three times I actually found "accommodate" spelled correctly. It is ironic that a book published by Cambridge University Press should have "Cantabrigian" misspelled.

VI

Some may believe that my taking such great exception to Mirowski's style is part of an overly refined sense of academic decorum. I do not think so. Some styles of argument are calculated to shut off reasonable discussion. At that I feel bound to protest. Once we get past the stylistic barriers, we find that Mirowski's historical claims are unbuttressed by persuasive evidence, and that his methodological rule, the metaphorical imperative, is pure assertion. Standard histories of economics and physics, which Mirowski appears to hold in great contempt, need not be rewritten. Neoclassical economics is open to severe criticisms (Mirowski himself makes a number of telling criticisms in passing), but these are not integrally connected to the energy metaphor. Elaborating the energy metaphor to its fullest extent is of no importance whatsoever.

No doubt Mirowski would believe that I am a mumpsimus.' This lovely, rare and ancient word, which Mirowski learned from Joan Robinson, was first used to describe a semi-literate priest who insisted on reading it where the correct Latin called for "sumpsiums." It now means one who persists in an error that has already been exposed. But if those of us who do not find Mirowski's attack on neoclassical economics to be persuasive are mumpsimuses, perhaps we can do no better than to stand defiantly with the poor priest: "I will not change my old mumpsiums for your old sumpsiums."

Note

I am grateful to my colleague, Julie Nelson, for useful comments on the first draft of this essay.

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