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The Merchant of Venice, or Marxism in the Mathematical Mode

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> Schemes alone cannot prove anything: they can only *illustrate* a process, *if its separate elements have been theoretically explained.*
>
> Lenin (1899, 62)

> A mesmerizing style, like a Medusa's head, will turn us to stone if we stare at it too long; we need a talisman to draw us away from it. But the talisman itself becomes Medusa when we turn to it, and the other then must pull us back.
>
> Staten (1984, 27)

It is characteristic of the modern social sciences to insist on the importance of elaborating general, abstract models and making knowledge claims of the kind and authority usually associated with the natural sciences. Mathematics is often given a special role in fulfilling these requirements. In this sense, modern scientific methods are mathematical methods.

Contemporary Marxian theory is also being recast along the lines of modern science. Marxists are under some pressure to use the box of modern scientific tools (Amariglio 1987), especially mathematical models. This pressure is both "external" and "internal." It is external, insofar as so-called professional standards and job requirements are less-than-subtle inducements to use the prevailing rhetoric of the discipline in question. However, the urge

to introduce mathematics into Marxian theory is also internal in the sense that the use of mathematics is bound up with modern notions of science, and such understandings of science are shared by many contemporary Marxists.

Marxists, to be sure, have not unanimously adopted mathematics and the other so-called modern social scientific methods. Still, one can detect an increasing acceptance of the need to modernize Marxian theory and to use mathematics in developing and presenting Marxian theory. This is especially true in Marxian economic theory. There, econometrics, axiomatic logic, general equilibrium, linear algebra, and so on—by and large the arsenal of mathematical concepts and models originally borrowed and developed by neoclassical economists—are used to rethink traditional concerns and to pose new sets of questions. The "mathematizers" of Marxian theory include writers as diverse as Nobuo Okishio (1963, 1977), Meghnad Desai (1979), Shinzaburo Koshimura (1975), András Bródy (1970), Michio Morishima (1973), Donald Harris (1972, 1978), John Roemer (1986b), Duncan Foley (1982, 1986), Alain Lipietz (1982), Ian Steedman (1975), and Anwar Shaikh (1978). The topics of their mathematical contributions range from the logical status of the Marxian theory of value and the problem of price-value transformation to the law of the tendential fall in the rate of profit, economic crisis, and long-run capital accumulation. In some instances, traditional Marxian concepts and propositions are upheld; in many others, mathematical models are used to demonstrate the incorrectness of and to argue against ideas long associated with Marx and the Marxian tradition. In both cases, mathematics is considered central to the task of investigating and presenting Marxian theory.

At the same time that Marxian theory is being rewritten in mathematics, the modernism of social scientific inquiry is being rethought and, in many cases, called into question. There is, for example, increasing attention to the critique of social scientific philosophy and methodology (Hindess 1977), to the problems of traditional epistemology (Rorty 1979), and to the role of rhetoric in economics (McCloskey 1986 and Klamer 1984) and the other human sciences (Nelson et al. 1987).

There is also an important current within the Marxian tradition which has argued that Marxian theory constitutes a fundamental break with other social theories. This notion of break or rupture, long associated with the work of Althusser (1977; and Balibar 1977), is related not only to the kinds of statements Marxists make about the nature of capitalism and other societies; it also involves the methodology and epistemology which condition the manner in which those statements are produced.

These general concerns lead to a questioning of the status and effects of the use of mathematics in Marxian theory. The problem is that the path to be followed in such an inquiry is virtually nonexistent. There is little, if any, discussion of the use of mathematics in the social sciences—and still less in Marxism. What does it mean to formalize, quantify, or mathematize social theory? General endorsements are common; mathematical models are presented as part of normal science, the handmaiden of modern scientific methods. Mathematics is presented as a set of neutral, rigorous, logical tools to develop theories and to test them against reality.

My own experience in teaching mathematics to first-year graduate students in economics is probably typical: since they all believe in science—in the singular—then those who are adept at mathematics tend to accept it and use it with enthusiasm. Those with less background or interest in mathematical methods either force themselves to learn them, or they avoid them but still feel that the others—the mathematizers—are pursuing true science.

In general, little history is studied. What role did mathematics play in the emergence and later development of neoclassical economic theory? Whence did the first neoclassical economists borrow their mathematical models? What are the effects of having chosen those mathematical analogies rather than others? Nor have these questions ever been proposed with respect to Marxian theory. Even if one is interested in these questions—again from my experience, the mathematically adept students uniformly were not, and fewer of the nonmathematizers than I would have thought were interested—there is little literature to form a basis for inquiry.

The only debate of any significance among neoclassical economists concerning the role of mathematics in economics took place between 1948 and 1958. Economists will recognize that, not coincidentally, that decade was opened by the publication of Paul Samuelson's *Foundations* and closed by Gerard Debreu's *Theory of Value*.[1] There was no official judge or jury, but the debate between opposing positions on the necessity of using mathematical models in economic theory was, de facto, won by the mathematizers. This is part of the external pressure alluded to above; it is in large part the reason why economists use the amount and type of mathematics that characterize their work today. And this is true not just of the neoclassicals, but also of institutional economists and, the subject of this essay, of many Marxists. Basically, the decision handed down by the tribunal at the end of the debate was that mathematics is the only true method of science—because it is logical,

1. Debreu (1984) related his account of the use of mathematical methods in neoclassical economics in his acceptance speech for the Nobel Prize in Economics.

concise, precise, and mathematical models are capable of capturing the essence of reality. At the same time, it was decided that mathematical statements should be translated into prose so that others, presumably less scientific (wasting their time engaged in, to use Samuelson's [1948, 6] words, "the laborious literary working over of essentially simple mathematical concepts" that is "not only unrewarding from the standpoint of advancing the science, but involves as well mental gymnastics of a peculiarly depraved type"), could understand them.

From time to time, there have been a few admonishments from among economists themselves. Oskar Morgenstern (1963) and, more forcefully, Nicholas Georgescu-Roegen (1966, 1971, 1979) have indicated some of the limits imposed by the wholesale mathematization of neoclassical economics. However, even their limited criticisms have been ignored for the most part by the majority of neoclassical economists.

There now seems to be somewhat more interest in the question of the role of mathematics in neoclassical economics, part of the revival of concern with questions of economic methodology. Claude Ménard (1980), for example, has argued that the early neoclassical "social physicists" (Walras, Cournot, etc.) chose to borrow their mathematics (infinitesimal calculus and analytic geometry) from rational mechanics rather than, as in the other emerging social sciences of the late nineteenth century, base their work on the biological analogies associated with statistics. Philip Mirowski (1984, 1987) has pursued a similar line of research in which, he argues, neoclassical economics is fundamentally limited by the energetics metaphor appropriated from nineteenth-century physics.

Mirowski (1986), in fact, suggests that if neoclassical economists borrowed a different set of mathematical metaphors—group theory rather than the calculus of constrained maxima—they would revise their theory of profit and, more generally, their notion of value. Another example of the effects of mathematics on economic theorizing is currently taking place: one of the latest mathematical fashions in neoclassical economic circles is chaos theory.[2] Often associated with the "butterfly effect" (the idea that in a deterministic model in which all parameters are well known, a small change in initial conditions may alter the long-term prediction by a large proportion), chaos theory has the potential of fundamentally disrupting economic forecasting and other features of the neoclassical economic research program. Besides

2. The main properties and results of chaos theory are discussed by May (1976); some of the implications of chaos theory for economic forecasting are analyzed by Baumol and Quandt (1985).

the sensitivity to small changes in the initial conditions, the dynamic behavior of relatively simple nonlinear difference equations described by chaos theory is also characterized by sudden breaks in the qualitative behavior of the system and the kind of nonrepeating cycles often associated with randomness. Although the equations themselves are fully deterministic, their use has the potential of forcing neoclassical economists to relinquish long-held notions of stable and predictable behavior of an economic system.

Still, the discussion of the use, and the effects of the use, of mathematics in economics and, in general, social theory remains at the margins. Not surprisingly, issues relevant to this theme are the subject of more widespread debate elsewhere—in mathematics itself, in philosophy, and in literary criticism. Practicing mathematicians, for example, argue that traditional philosophies of mathematics are not appropriate. Morris Kline (1980) and Philip Davis and Reuben Hersh (1981) make the case that mathematicians, and philosophers of mathematics, need to give up Platonist, intuitionist, and all other "foundationalist" philosophies of mathematics in favor of a radically different understanding of the history of mathematics and the activity of practicing mathematicians. In philosophy, the debate about the contours and limits of modernity and positivism raises important questions about the modernist—and, by extension, mathematical—scientificity of social theory. Jacques Derrida, Michel Foucault, and the "new" Nietzsche are three of the "classical" contributors to this debate. I return to these issues below—in particular, to the related contributions of Martin Heidegger, Edmund Husserl, Ludwig Wittgenstein, and Gaston Bachelard. Finally, the defense of the use of mathematics as a neutral language means that the debates within literary criticism about the non-neutrality of language have an important contribution to make in reconsidering the use of mathematics. Rethinking the role of mathematics in Marxian theory starting with these contributions, far from succumbing to "the temptation to take refuge in literary criticism, epistemology," and so on, as some would argue (e.g., Gintis 1987, 983), may actually lead to a strengthening of Marxian economic and social theory.

Mathematics and Marxian Theory

It is generally accepted that neoclassical economists develop and refine their theory using the language of mathematics (although, as stated above, there are a few dissenting voices). It is somewhat surprising, however, to observe the widespread use of mathematics in Marxian theory—not just mathematics, but many of the particular kinds of mathematics and mathematical models that mark the landscape of neoclassical theory. Surprising, at

least given one reading of the Marxian tradition whereby Marxian theory is distinguished from other, non-Marxian theories by its different mode of analysis.

What, then, are the implications of mathematizing Marxian theory? One way of answering this question is to look at the history of the relationship between Marxism and mathematics, for example, by considering Marx's own views on the subject. This is Leon Smolinski's (1973) approach: there is not a great deal of mathematics in *Capital* and Marx was not a very good mathematician, but he did take mathematics seriously; he even tried to formulate an alternative proof of the derivative to avoid the use of the infinitesimal (see also Gerdes 1985). Why, then, is there so little mathematics used in *Capital*? According to Smolinski, Marx had already worked out his "creed" before becoming interested in mathematics and he did not want to rework it in mathematical terms;[3] also, the "appropriate" mathematics (linear algebra instead of the calculus) did not yet exist.[4] Therefore, Smolinski concludes, Marxists should move ahead and mathematize their work.

Actually, I am not interested in making an argument on the basis of what Marx himself did or did not say about the use of mathematics in economics. Rather, there is a more general, and ultimately more pressing, question about the conception of Marxism in which mathematics is accorded a special status in the elaboration of the theory. This is a concern about the role of mathematics in contemporary Marxian theory, about the increasing acceptance of the idea that Marxism has to be modernized. One example is from the summary of "Studies in Marxism and Social Theory," edited by G. A. Cohen, Jon Elster, and John Roemer for Cambridge University Press. Their series

> will examine and develop the theory pioneered by Marx, in the light of the intervening history, and with the tools of non-Marxist social science and philosophy. It is hoped that Marxist thought will thereby be freed from the increasingly discredited methods and presuppositions which are still widely regarded as essential to it, and that what is true and important in Marxism will be more firmly established (Roemer 1986a, ii).

3. Here, Smolinski is grasping at straws to prove his point. He understands Marx's "creed" as the theory of communism, not the critique of political economy published in *Capital*. As Gerdes (1985, 3-8) has shown, Marx began to study mathematics *at the same time* that he began to work on the preparatory manuscripts of his critique; see also Struik (1948).

4. Needless to say, Smolinski's choice of the most appropriate form of mathematics for Marxian theory is heavily influenced by various contemporary attempts to mathematize Marxian theory using linear programming (e.g., Morishima 1974) and the linear algebra of the Sraffian price system (e.g., Steedman 1981).

I want to use this group—in particular, Roemer's work—to consider in a concrete, specific case the role of mathematics in Marxian theory. Why Roemer? First, his use of mathematical models is creative and sophisticated; it is clearly not just an attempt to get his work published in the professional journals. He uses mathematical models to prove new propositions and to disprove many others; he also defends their use in no less creative and sophisticated ways. Second, he is an excellent communicator. He does not generally obscure theoretical statements, as do so many mathematical economists, by just using mathematical models. There is extensive prose both to motivate his use of the models and to consider their theoretical consequences. One can read the texts (almost) without working through the equations and models. Third, much of Roemer's work is concerned with concepts that are central to the Marxian tradition, especially the notion of class. Finally, and most important, Roemer's conception of the use of mathematics is exemplary. In this sense, Roemer is a particular case of a more general understanding of the role of mathematics and mathematical models in current attempts by a wide variety of Marxists to rewrite Marxian theory in a mathematical mode.

There are many questions concerning the work of Roemer and of the other "analytical Marxists" which cannot be dealt with in any detail here: their concept of value, their traditional interpretation of historical materialism in terms of forces and relations of production, their discussion of forms of explanation, and so on.[5] While perforce touching on these themes, this essay is devoted to the question of the use of *mathematics* in Marxian theory.

Nor is it possible, in this limited space, to analyze with the required attention and detail the many other contemporary uses of mathematics in Marxian theory. Instead, the treatment of the single case of Roemer's work makes it possible both to raise a series of general issues concerning the role of mathematics in Marxian theory and to indicate, in a specific context, the kinds of problems generated by recent attempts to invoke the authority of mathematics in Marxism.

The main theses of the present critique of the use of mathematics in Marxian theory are four:

1. Mathematics is elevated to the status of a special code or language by many Marxists, including Roemer. It is considered both as a neutral, modern language and, at the same time, a language uniquely capable of capturing the essence of reality. Thus, mathematics is accorded both an underprivileged and overprivileged status vis-à-vis other languages.

2. This special status is related, in turn, to both forms of traditional epistemology: empiricism and rationalism. This is a problem for Marxism in the sense that—at least in one interpretation—Marxian theory involves the rejection of all such "essentialist" epistemologies.

3. An alternative approach to mathematics does not necessarily involve a simple rejection of its use in Marxian theory; rather, mathematical concepts and models can be given a redefined status as a set of metaphors, based on the distinction between "representation" and "illustration."

4. The use of mathematical models in Roemer's approach to Marxian theory raises not just epistemological problems. It also displaces class from the center of analysis by creating an anthropology of human beings, what others have called a "theoretical humanism."

This specific analysis of the status and effects of mathematics in Roemer's work will, if successful, open a more general theoretical space within which Marxists can rethink the other uses of mathematics (and still other methods and languages) in Marxian social theory.

Mathematics as a Special Code

The Role of Mathematical Models

Roemer's work, along with that of the other analytical Marxists, is best known for having introduced rational choice models into Marxian theory. Roemer, in particular, on the basis of those rational choice models, has proved a wide variety of propositions, including what he calls the Class-Wealth Correspondence and Class-Exploitation Correspondence theorems, and disproved other ideas, such as the notion that surplus value is the key to exploitation in Marxian theory. His work is also known as "microfoundations Marxism": in an extended argument against teleological and functional forms of explanation, he has argued in favor of a microfoundations approach which consists in "deriving the aggregate behavior of an economy as a consequence of the actions of individuals, who are postulated to behave in some specified way" (1981, 7).

5. The critical literature on analytical Marxism is too vast to summarize here. Van Parijs (1986-87) attempts to extend the analytical Marxist theory of class; Lebowitz (1988) and Anderson and Thompson (1988) are much more critical in their treatment; see also Carling (1986) and Levine et al. (1987).

The problems of teleological and functional forms of explanation are complex and controversial, and they are receiving a great deal of attention in recent literature in the philosophy of the social sciences. I cannot attempt to summarize, let alone develop, here the myriad issues involved.[6] However, there is general agreement that at least most familiar forms of functional explanation fail to meet the requirement of specifying the causal mechanisms for the phenomenon under investigation to occur. In this sense, the microfoundations approach offered by Roemer (and others) has an important therapeutic value in challenging Marxists to question some of their more traditional, and probably faulty, forms of explanation.

Roemer's efforts to provide a microfoundation for Marxism in the form of rational choice theory have, in general, led to the extensive use of mathematics. It is necessary to be specific however. He has not just used mathematics; he has borrowed a particular set of mathematical models: simultaneous equations and general equilibrium theory, mathematical programming, and game theory—in his own words, "the arsenal of modelling techniques developed by neo-classical economics" (1986a, 192).

It is neither possible nor necessary to review all of the mathematical techniques used by Roemer to develop and extend his interpretation of Marxian theory. One example, from his latest book (1988), will suffice at this point:

a. Define a class position by an array of *0*s and +s in the optimal solution (x, y, z) to a program P at a reproducible solution, where x = producing a good (e.g., corn), y = hiring labor, and z = selling labor.

b. Give each agent an endowment of corn. Assume a corn and a labor market. Allow each agent to decide on a best strategy to earn income necessary to purchase a subsistence bundle of corn without running down the existing corn stock.

c. Assume an equilibrium position as a price of corn, relative to the wage, having the property that, if each agent pursues his or her self-interest, then markets clear, every individual plan can be realized, and society can reproduce its capital (corn) stock.

d. The result is that society is characterized by six classes of agents, six positions defined by optimal solutions of the sort (x, y, z).

6. See the more extended discussion by Simon and Ruccio (1986, 199-202). Roemer's analytical colleagues—Elster (1979, 1983), Cohen (1978), and van Parijs (1981)—have been at the center of this debate.

"The important idea to keep in mind," according to Roemer, "is that a person's class position is not exogenously given. Rather, it emerges as a consequence of his optimizing procedure, which is to maximize utility...given his initial endowment" (1988, 77). Thus, "agents choose their own class position—not willingly, but under constraint, as a consequence of optimizing, given their initial endowments" (1988, 80).[7]

The Conception of the Use of Mathematical Models

The preceding example is typical of the kind of mathematical model used by Roemer and other rational choice theorists. These and other game-theoretic/general equilibrium models are used to prove all of his major propositions. But Roemer is not a naive user of mathematical models. He is self-conscious about his extensive use of mathematics, and a strong defender of the use of mathematics to elaborate and extend Marxian theory. He also notes some of what he considers to be the limits of these models.

What, then, is the proper role of mathematics according to Roemer? Mathematical models are formulated within a theory of society; they are a projection, or translation into more formal terms, of that theory. Each model can be said to capture a dimension of the theory. Together, all of the models which, individually, capture one or another dimension of the theory give a more and more accurate representation of the theory—until they exhaust the interesting content of the theory.

However, if they just represent the theory, the models would appear to be superfluous, mere mathematical window dressing. The models themselves are important because they have an absolute truth value, compared to the intuitions, vague arguments, and less-than-logical content of (nonmathematical) theoretical statements. They assure the consistency of the theory. For example, Roemer argues, the use of mathematical models proves that value cannot be theorized in a coherent fashion in terms of embodied labor, but only as an equilibrium between supply and demand. In fact, Roemer writes,

> we have claimed a forceful philosophical position, that value cannot be conceived of independently of the market, as a consequence of rather intricate

7. Roemer's approach also includes another group of mathematical models that lead to a second, quite different approach to class, defined by exploitation. Exploitation, in Roemer's sense (e.g., 1982, 194-237; 1988, 125-47), is based on the difference between a subgroup's welfare under existing property relations versus what it would be under a hypothetical alternative. If the subgroup would be better off under the alternative set of property relations, its members are considered to be exploited. Van Parijs (1986-87) helps to clarify the differences between Roemer's two definitions of class.

> mathematical reasoning. I would assert that one could not possibly arrive at this theorem without mathematical apparatus (1981, 204).

Mathematical models serve to illuminate the "gray areas" of theory. They make the overall theory more "precise" and "clear." The problem, for the Roemerian modernists, is that Marxian theory has not yet been formalized sufficiently to have the precision and clarity of neoclassical economic theory.

Mathematical models also allow one to compare the counterfactuals of different—for example, neoclassical and Marxian—theories. The claims of those different theories can be translated into and thus compared on the same mathematical terrain. In this way, one can compare them and choose between them. This is also true of different statements made within the same theory, as in the case of value as embodied labor and supply-demand equilibrium. Two sets of "intuitions" may contradict one another, but when individuals are forced to state their beliefs in the same language, "there is an objective standard for deciding which is correct" (1981, 2).

The language here is crucial. Other phrases that appear and reappear in Roemer's texts are "analytically sophisticated Marxism"; the necessity of "abstraction"; the "search for foundations," leading to "schematizing, simplifying, and modelling" theory; and the idea that Marxism is nineteenth-century theory, "bound to be primitive by modern standards, wrong in detail, and perhaps even in basic claims" (1986a, 2). In fact, Roemer denies any specific form of Marxian methodology. This is true, for example, of dialectics, which he considers to be a "teleological" and "lazy" form of reasoning. He expresses "no commitment to any specific method of analysis, beyond those that characterize good social science generally" (1986a, 191).

Mathematical models are considered to be an integral part of "good social science." Since all mathematical models are considered to be schematic simplifications of reality, the theorists should choose the ones that have had the most success. In Roemer's case, this means general equilibrium theory, "one of the great contributions to social scientific method of the past century" (1988, 151).

Any Exceptions?

Roemer presents a strong case for the mathematization of Marxian theory. He argues both that mathematical models are crucial for the purpose of guaranteeing the modern scientificity of Marxian theory and that the mathematics originally borrowed and developed by neoclassical economists—those particular models of general equilibrium, game theory, and mathematical programming—are uniquely appropriate for developing and extending Marxian class analysis.

Roemer does note exceptions to the wholesale mathematization of Marxian theory along neoclassical lines. As early as 1978, he criticized the neoclassical optimization model, not because the utility functions and constraints were misspecified, but because it was, in his words, a "nonclass" model. Obviously, this criticism *could* have led him in a number of directions, for example, to the abandonment of optimization models and the search for other (mathematical or nonmathematical) methods. However, he meant something very particular about the nonclass nature of neoclassical theory: it did not capture the coercive nature of the production process nor could it explain sustained collective action on the part of economic agents.[8] This criticism of neoclassical theory announced, then, not the rejection of optimization procedures of individual agents, but the project of attempting to build a "class" model by using the *existing* methods of neoclassical economics.

The twin problems of equilibrium and exogenous preference orderings also arise within Roemer's work; he mentions them at the end of most of his articles and books. In the case of equilibrium, he deserves to be quoted at length:

> There seems to be a deep contradiction between using models whose main analytical trick is to postulate a position that is precisely at variance with the most interesting and important aspects of capitalist economy as described in Marxian theory—its incessant contradictory motion. There is, therefore, the danger that if this intuition is correct, the equilibrium method will prevent one from seeing the most important aspects of the Marxian theory of capital (1981, 10).

However, all of his analyses—of class formation, the theory of value, unequal exchange, and so on—are based on the concept of equilibrium. It is exactly the widespread use of equilibrium models in Roemer's work and elsewhere that allows Adam Przeworski to conclude that "Marxist economic theory shares with neoclassical economics the reliance on equilibrium analysis as the main methodological device" (1985, 398).

In the case of preference orderings, Roemer often acknowledges the need for a theory of "how capitalism (or any economic structure) shapes preferences" (1988, 177). Again, however, all his analyses are carried out by assuming that individuals optimize on the basis of given, exogenous preference orderings.[9]

8. Coercion within production no longer plays a role in Roemer's conception of class, as the preceding example and the discussion below show.
9. In one instance, Roemer contends that he avoids the "myriad problems of endogenous preferences" by assuming a "non-utility-based criterion for welfare improvement" in which

Given these concerns about some of the key concepts of his mathematization of Marxian theory, it is somewhat curious that Roemer fails to raise the question of the exogenous specification of the rules of the social interaction among agents. There is no defense either way. He never argues either that the rules emerge endogenously, that is, that the agents create them as they optimize, or that the agents perceive the rules in a particular way; nor does he specify some other formation of the rules. Presumably, they are relegated to an exogenous, pre-model environment.

Notwithstanding this oversight, it is important that Roemer recognizes some of the well-known limitations of optimization/equilibrium/exogenous preference models which have long characterized neoclassical economics and with which Roemer hopes to rewrite Marxian theory. However, the fact that he continues to elaborate, change, and extend his interpretation of Marxism on the basis of these same models only reinforces their *special* status: this method is so important that, notwithstanding his *own* (and others') criticisms, these models must be maintained.

The Special Code

Mathematics is thought to be a language, one among many others. The existence of the *other* languages is indicated by the very act of choosing to write the theory in one of them, the language of mathematical terms.[10] However, mathematics is set apart from the other languages for its key role in developing Marxian theory. Without it—that is, if the theory were written in prose, or poetry, or some other language—the theory would be old-fashioned, lazy, and all the other antonyms of the terms (analytically sophisticated, objective, etc.) which Roemer uses to characterize his own approach to Marxian theory. Mathematics is special because it is both less privileged and more privileged than other languages—under- and overprivileged, and therefore special.

Underprivileged. Mathematics is understood as a neutral medium into which all statements of each theory, and the statements of all theories, can be translated without modifying them. Mathematics, in this view, is devoid of content. It is neutral with respect to the various theories where it is applied. General equilibrium, game theory, and mathematical programming are

an individual is considered better off if he or she receives more income and at least as much leisure (1982, 266). However, these preferences for income and leisure still describe a utility function given to the analysis; they are exogenous.

10. That the choice of mathematical language always signals the existence of the other languages is similar to the effect of the mark that attests to the economic character of Alfred Marshall's text which, of necessity, trangresses the economic itself; see Visker (1988).

concepts which serve to communicate the content of a theory without changing that content. Similarly, mathematical operations on the mathematized objects of analysis are considered to be purely formal. Thus, as a result of the conceptual neutrality of the methods and procedures of mathematical formalization, the objects of analysis are unaffected by their mathematical manipulation.

Overprivileged. Mathematics is considered to be uniquely capable of interpreting theory in its ability to separate the rational kernel from the intuitional (vague, imprecise) husk, the essential from the inessential. It becomes the unique standard of logic, consistency, and proof. Once intuitions are formed, mathematical models can be constructed which prove (or not) the logical consistency of the theory. Other languages are considered incapable of doing this because the operations of mathematics have an essential truth value that other languages do not possess. Mathematical statements, for example, are considered to be based on the necessity of arriving at conclusions as a result of following mathematical rules.

It is in these two senses that mathematics is considered to be a special language or code. It is more important than other languages in that it is uniquely capable of generating truth statements. It is also less important in that it is conceived to have no impact on what is being thought and communicated.

It is necessary to analyze both the apparent inconsistency between these two senses of the special status of mathematics and the theoretical effects of this conception of mathematics as a special code. It is also necessary to account for why mathematics can operate in this way.

Following Jean-François Lyotard (1984), the power of mathematics (like modern art) can be seen to depend on its maintaining itself as a separate language game, a purely technical exercise, separate from all other discourses in the world (including the discourses of violence and power). To the extent that mathematics is taken to be the science of discovering the "objects of quantity and space" (Davis and Hersh 1981, 6) that exist "out there," tracing the outlines and studying the properties of objects that may have applications beyond mathematics (in applied mathematics, in physics, economics, etc.) but an activity which is essentially untouched by anything other than the mathematical objects themselves, to that extent mathematics occupies a special status vis-à-vis the other spheres of social life.

Another reason for the special nature of mathematics is suggested by Michel Serres: "What is mathematics if not the language that assures a perfect communication free of noise?"[11] Mathematicians eliminate the "noise" which is embedded in the graphic inscriptions that comprise mathematics by agreeing on the meaning of symbols that otherwise would vary from one use to another; they all agree to recognize the "same" symbol. In this sense, the community of mathematicians has triumphed over noise for so long that they become impatient when the problem of mathematics is raised again (Serres 1982a, 69). The mathematizers of Marxian theory would appear to be similarly impatient.[12]

This elimination of noise is as important to the merchants of goods and services as it is to the merchants of a mathematized Marxian science. Where there is no noise, there is no room for cheating—or for misunderstanding. Therefore it was necessary for Venetian merchants to learn the basics of arithmetic, for counting and for converting different currencies and measures, for commodity exchange to take place on an expanded scale.[13]

The status of mathematics as a separate language game, and a game free of noise, can account for its power as special code for Roemer, and for the mathematizers of Marxism in general. The problem is that the order imposed by mathematics may bring with it its own disorder—like the parasite who has the last word, and produces disorder, who generates a different order (Serres 1982b). Letting some noise in, listening to other voices, may, in the end, have the effect of dismantling the traditional authority of mathematics.

Mathematics and Epistemology

The notion of mathematics as a special code is linked, in turn, to the twin pillars of traditional epistemology, empiricism and rationalism.

Empiricism. The oversight of mathematics implied by its underprivileged status is informed by an empiricist conception of knowledge: mathematics is considered to be a universal instrument of representation. It is used as a tool to express the statements of a discourse which already, always has an essential grasp on the real. It is the universal language in and through which the objects (and the statements about those objects) of different economic and social theories can all be expressed.

11. Quoted by Josué V. Harari and David F. Bell in their introduction to Serres (1982a, xxiii-xxiv). Stephen Watson first suggested that I look at Serres's work.

12. For example: "a fundamentalist quarter continues to maintain that mathematics and models can only reify the essential social insights with which Marxism is concerned" (Roemer 1986a, 111).

13. The *Treviso Arithmetic* (Swetz 1987), written by an anonymous author in 1478 in Treviso, a commercial town annexed to the Venetian Republic in 1339, was the first book on mathematics ever published in the West.

In Roemer's terms, theory is compared to the "facts," and declared valid or not (e.g., 1981, 2; 1986a, 200). The role of mathematics is to express the various "intuitive" statements of the theorist in a neutral language such that they can be measured against reality. The mathematical concepts themselves (e.g., the core of a game or the saddlepoint characterization of a mathematical program) are conceived to be neutral with respect to the various theories in which they are used. Similarly, the mathematical manipulation of the mathematized objects of analysis is considered to be a purely formal (technical, mechanical) procedure. The result of the conceptual neutrality of the methods and procedures of mathematical formalization is that the objects of analysis are considered to be unaffected by their mathematical manipulation. In this sense, mathematics is denied any effectivity with respect to its domain of application.

Dominique Lecourt, in his commentary on the work of Gaston Bachelard, has recognized the philosophical alliance between this mathematical formalism and an epistemological essentialism wherein mathematics is the translator of a knowledge inscribed in the real (1975, 58-59). Roemer's empiricist understanding of the neutrality of mathematical concepts is linked to a notion of mathematics as a mere language, a "universal instrument of representation" (Lecourt 1975, 59). In particular, he understands his use of mathematics to be a neutral translation of the pre-mathematical text in which Marxism is written.

What is at stake here is the traditional subject-object dichotomy of empiricist epistemologies: the passive subject and the active object impressing itself on the knowing subject. The theorist, according to Roemer, knows how the world works by gazing at it—by seeing class struggles, or whatever; he or she then translates the description into a model to check its consistency, its logical thoroughness, and so on. Mathematics merely represents, in a different language, that which was already present in the pre-mathematical intuition. In this sense, those (like Serres 1982a, 70) who argue that empiricism would always be correct if mathematics did not exist fail to see this empiricist conception of mathematics as a neutral language.

The conception of mathematics as a mere language contains, however, the seeds of its own destruction. The notion of language as a simple medium through which ideas are communicated has been challenged from diverse perspectives; it has been reinterpreted as both constitutive of, and constituted by, the process of theorizing (e.g., by Williams 1977, 32). The use of mathematics in social theory, too, may be reconceptualized as a discursive condition of theories, which constrains and limits, and is partly determined by, those theories. Mathematical concepts, such as the equilibrium position associated with the solution to a set of simultaneous equations or the exogenous status of the rules of a game, partly determine the notions of relation and causality among the theoretical objects designated by the theories in which the means of mathematical formalization are utilized. They are not the neutral conceptual tools to which the propositions of different interpretations of Marxian theory (or of neoclassical and Marxian theories) can be reduced.

Rationalism. The underprivileged position of mathematics which is linked to Roemer's empiricist epistemology contrasts sharply with the overprivileged status of mathematics. This overprivileged conception of mathematics is associated with a rationalist theory of knowledge wherein the subject-object dichotomy is reversed. This is the role of "abstraction" in Roemer's conception of the use of mathematics. The "standards of logic which are expected of contemporary social science...require the use of mathematics and models" (1986b, 3). Thus, the use of formal, mathematical methods is considered to be a necessary (although presumably not sufficient) condition for arriving at scientific propositions. For example, Roemer rejects the Marxian theory of labor value because, as we saw above, he "proves" it to be incorrect by the use of "rather intricate mathematical reasoning."

Here the subject becomes the active participant in discovering knowledge by operating on the theoretical model of reality. In this sense, the logical structure of theory—not the purported correspondence of theory to the facts—becomes the privileged or absolute standard of the process of theorizing. Reality, in turn, is said to correspond to the rational order of thought. The laws that govern reality are deduced from the singular set of mathematical models in and through which the essence of reality—individual behavior, in Roemer's case—can be grasped.

The process of theorizing, in this view, is identified with the initial elaboration of, and deductive operations on, a set of mathematical models. Mathematical models are conceived as abstract images or ideal representations of a complex reality. Roemer's reminders that his models are mere "fictions"—that reality is infinitely more varied and complex—merely serve to reinforce the idea that what is really real—the causal laws whereby reality can be explained—corresponds to the rational mathematical models of the theorist.

However, the rationalist idea of abstraction, of simplification, also leads to a fundamental problem. It implies that there is a noise which ultimately escapes the "fictional" mathematical model. It implies an empirical distance between the model and its domain of interpretation, the empirical concrete. And that distance is conceived to be part of the empirical concrete itself. There is a part of reality that escapes the model. Thus, rationalist deductions

from the model cannot produce the truth of the real because something is always "missing."

Both empiricist and rationalist epistemologies, conceptions of mathematics as a neutral language and as the language singularly privileged over all others, are part of Roemer's modernization of Marxian theory. He can move back and forth between the two otherwise diametrically opposed conceptions of mathematics because they represent two sides of the same epistemological coin: although each reverses the order of proof of the other, both empiricism and rationalism presume the same fundamental terms and some form of correspondence between them. In this sense, they are variant forms of an "essentialist" conception of the process of theorizing.[14] Both of them invoke an absolute epistemological standard to guarantee the (singular, unique) scientificity of the production of knowledge.

As a result, both forms of traditional epistemology negate the analysis of the conceptual differences among different contending theories and of their differential social consequences in favor of a unique standard of truth against which all theories are compared and declared valid or not. Empiricist and rationalist epistemologies do not lead to an investigation of the differences among theories in terms of their respective discursive entry points, concepts, and conceptual strategies. Nor do they allow for an analysis of the contrasting implications of different theories for changing a particular society. Instead, they invoke an epistemological authority to which the claims of all of the various theories, or interpretations of theories, are submitted. The result of these procedures is the de facto attempt to gain, or maintain, theoretical hegemony based on some set of universal standards of science. Mathematics often plays a key role in such struggles for hegemony.

An Alternative Approach

It is possible—and, I would argue, necessary for Marxian theory—to elaborate an alternative epistemology, one which does away with the traditional subject-object dichotomy and, with it, the conception of knowledge as correspondence. This alternative theory of knowledge leads, in turn, to an alternative conception of the role of mathematical models in Marxian theory.

The general problematic and specific arguments of classical epistemology have not gone unchallenged, especially in recent times.

> The real dichotomy here is no longer between (classical) empiricism and rationalism, but between both of these doctrines and the new post-Hegelian

14. Ruccio (1986) provides a definition and critique of both essentialist theories of knowledge and essentialist approaches to social analysis.

> views which would challenge the basic assumption of *all* classical theories, Aristotelian, Cartesian, Humean, positivist, that the objectivity of science lies in a neutral methodology, capable of being made explicit in a set of logic rules (McMullin 1974, 30).

Attempts to rethink Marxian theory—to recapture its own postmodern moment, its break from classical theories of knowledge—have taken up this challenge; they have begun to elaborate an alternative epistemology.[15] This alternative theory of knowledge begins with the "overdetermination" of the theoretical process and displaces the central question of traditional epistemology. Instead of asking how the absolute truth of science is guaranteed, its aim is to investigate how different knowledges are produced and what their different social effects are.

The question of scientific language, especially mathematical language, is at the center of this controversy over theories of knowledge. It is necessary, therefore, to rethink the status of mathematics as the special scientific code.

Mathematics as Metaphor

The reconsideration of the role of mathematics begins with an examination of the history and foundational debates concerning mathematics. Two recent books, by Davis and Hersh (1981) and by Kline (1980),[16] serve to advance this project: in both cases, the authors contrast the tremendous outpouring of mathematical thought with the diversity of opinion concerning the philosophical underpinnings of mathematics. A diversity exists, but it is no longer the subject of open discussion; there has been an uneasy retreat from the foundational debates of the late nineteenth and early twentieth centuries. These authors then reconstruct the history of mathematics: instead of the common conception of the history of mathematical truths, established long ago and progressively elaborated by successive eminent mathematicians, what emerges from their work is a history of turmoil, of the appearance of many contending mathematics, paradoxes, inconsistencies, and "unprovable" propositions. Finally, they reject the task set forth by the various (constructivist, Platonist, and formalist) foundational schools and call for a new—historical, fully social—understanding of mathematics. In this sense, they succeed in deconstructing the activity of mathematicians much like what Bruno Latour and Steven Woolgar (1979) accomplished with respect to biology.

15. Although Roemer seems not to have taken notice, the elaboration of an alternative—nonrationalist, nonempiricist—Marxian epistemology is by now quite widespread. The path was first cleared by Althusser, and then followed by Hindess and Hirst (1975, 1977). More recently, their contributions have been extended and reformulated by Resnick and Wolff (1987) and Amariglio (1987).

16. This paragraph is a summary of a more extensive discussion of the contributions of these two books; see Ruccio (1984).

If mathematics fails to measure up to its ideal image in the realm of metamathematics, if the emperor is truly *deshabillé*, an opening is generated through which the role of mathematics in social theory can be reconsidered.

A second moment, then, in the deconstruction of mathematical language can be traced back to, among others, Ludwig Wittgenstein: "words are not a translation of something else that was there before they were."[17] Language is connected to the world by social convention and training, not as a form of representation. Wittgenstein shifts the focus from epistemological foundations to the social nature of cognition and knowledge. He then extends this conception of language to mathematics and mathematical proofs: mathematics is treated as a social invention, not a form of discovery of an independent reality. Mathematical proofs—even the new computer-generated proofs—have been reconsidered along similar lines: they are only one part of a larger social process whereby mathematicians come to feel confident about a theorem (de Millo, Lipton, and Perlis 1979).

In a similar vein, Edmund Husserl (Derrida 1978) also argued that mathematics does not correspond to some external configuration; it is not discovered "out there," but invented. Mathematics is historically produced from nonmathematical knowledge, and continues to be elaborated and developed through methods and procedures "handed down"—through a series of "sedimentations"—in a mathematical tradition. The "ideal objectivity" of mathematics is Husserl's term for the idea that mathematical concepts are both ideal (produced in and through human consciousness) and shared by other individuals as a cultural form which escapes the subjectivity of a single individual.

If one looks through these (admittedly small) openings, it is possible to see a different mathematical language. Mathematics will no longer be guaranteed by its correspondence to some pre-mathematical reality. The meaning of mathematics will become tied to a set of intralinguistic rules rather than to the belief that "the universe is mathematical in structure and behavior, and nature acts in accordance with inexorable and immutable laws" (Kline 1979, 128).

17. Quoted by Bloor (1983, 28). Staten (1984, 1) argues convincingly that Wittgenstein "is unique among Derrida's predecessors in having achieved, in the period beginning with the *Blue Book*, a consistently deconstructive standpoint."

The next step, then, is to reconsider the status of the mathematical language outside of mathematics. The role of mathematics as language has received its most thorough treatment in the natural sciences, especially physics. Bachelard, in rejecting the positivist conception of science, in fact argues that mathematics cannot be conceived as a language:

> It has been endlessly repeated that mathematics is a language, a mere means of expression. It has become customary to think of it as a tool at the disposal of Reason conscious of itself, the master of pure ideas endowed with a pre-mathematical clarity (1949, 53).
>
> It is essential to break with that stereotype dear to skeptical philosophers who will see nothing in mathematics but a *language*. On the contrary, mathematics is a *thought*, a thought certain of its language. The physicist thinks the experiment with this mathematical thought (1951, 29).

At first glance, Bachelard's rejection of the notion of mathematics as language appears to conflict with my own argument that mathematics is one form of language alongside many others. However, as Tiles (1984) makes clear, Bachelard's critique is tied to the idea that mathematics introduces both new concepts into the physicist's vocabulary and new forms of reasoning. Thus, Bachelard rejects the traditional philosopher's notion of language as a neutral medium of communication, not the notion of language as such, constitutive of thought. In the case of physics, the shift from being the science of magnitudes to the science of abstract structures—a shift not just in language but in the very notions of objectivity associated with the study of physical reality—was tied to a change in the mathematical concepts with which physical reality was thought.

Bachelard's insistence that mathematics is not just a language—or, in the terms developed here, not merely a type of language considered neutral with respect to the theories within which it is used—involves a rejection of the idea that mathematics only affects the way theories are expressed, not their actual content. According to Bachelard, the empirical content of physics cannot be separated from its mathematical form.

This double movement—the rejection of mathematics as the discovery of an extramathematical reality and the critique of the notion that mathematics merely expresses the form in which otherwise nonmathematical theories are communicated—has various effects. It means that there are no grounds for considering mathematics to be a privileged language with respect to other, nonmathematical languages. There is, for example, no logical necessity inherent in the use of the mathematical language. The theorist makes choices about the kind of mathematics that is used, about the steps from one mathematical argument to another, and whether or not any mathematics will be

used at all. Different uses (or not) of mathematics and different kinds of mathematics will have determinate effects on the discourse in question. Discourses change as they are mathematized—they are changed, not in the direction of becoming more (or less) scientific, but by changing the way the objects of the discourse are constructed, and the way statements are made about those objects.

Ultimately, this deconstruction of mathematics as a special code leads to a rejection of the conception of mathematics as a language of representation. The status of mathematics is both more representational and less representational than allowed by the discourse of representation. More, in the sense that mathematics has effects on the very structure of the mathematized theory; mathematics is not neutral. Less, to the extent that the use of mathematics does not guarantee the scientificity of the theory in question; it is merely one discursive strategy among others.

One alternative approach to the use of mathematics in social, including Marxian, theory is to consider mathematics, not in terms of representation, but as a form of "illustration." For Marxists, mathematical concepts and models can be understood as metaphors or heuristic devices that illustrate part of the contradictory movement of social processes. These concepts and models can be used, where appropriate, to consider in artificial isolation one or another moment in the course of the constant movement and change in society.

The illustration of concepts and conceptual relations by virtue of mathematical models stands in sharp contrast to Roemer's notion of the representation of an object by a model, from which a knowledge of the object may be adduced. In particular, the notion of representation hinges on a purported isomorphism of an object and its model—within social theory, on a relation of correspondence between society (or the theory thereof) and its modeled image. Illustration, as it is used here, requires no such conformity between the two separate domains. To elucidate the continuous movement of social processes by artificially constructing an isolated moment through a hypothetical equilibrium is not an attempt to create a more or less faithful reproduction of the movement as a whole. That would be the mathematics of representation. Rather, the mathematics of illustration is one, more or less dispensable, step in clarifying the conception of the movement of social processes by reference to a distinct concept (or set of concepts). In this sense, mathematical models can provide a "visual" image for the purpose of teaching an instance in the uneven movement of a social totality.[18]

Mathematics may be used, then, to illustrate the nonmathematical statements of Marxian social theory but, like all metaphors, it outlives its usefulness and then has to be dismantled. Bachelard, in his commentary on the positive, scientific use of images and metaphors, developed a similar conception:

> Images, like the tongues cooked by Aesop, are good and bad, indispensable and harmful by turns. One has to know how to use them moderately when they are good and get rid of them as soon as they become useless (1951, 68).

The careful use of mathematical models, subject to a prior theoretical explanation and allowing for their deconstruction in the process of theorizing the object of analysis, can be a positive contribution to Marxian social theory.

This conception of mathematical models does not, then, constitute a flat rejection of their use in Marxian theory. Rather, it accords to mathematical concepts and models a discursive status different from that which is attributed to them in the work of Roemer and of many other mathematical Marxists. It accepts the possibility of using mathematical propositions as metaphors which are borrowed from outside of Marxian theory and transformed to teach and develop some of the concepts and statements of that theory.

The effects of Roemer's considerable rewriting of Marxian theory in the language of mathematics can now be reconsidered in light of this alternative understanding of mathematics. To be clear, the problem is *not* that the problematic nature of Roemer's epistemology of mathematical models *necessarily* invalidates the specific propositions of his interpretation of Marxism. There is no one-to-one correspondence between the theory of knowledge implicit in his efforts and the statements and propositions that emerge from his analysis. Problems in one area of theorizing do not, by themselves, invalidate contributions in the other. At the same time, his use of mathematical models, and the epistemological conditions under which they are invoked, cannot be neglected. They are bound to have particular theoretical effects.

From the standpoint of this critique, Roemer's use of mathematical models does, in fact, raise serious questions concerning his interpretation of

18. In the final stage of revising this essay, I discovered an excellent, similarly inclined but more extensive, discussion of the "rule of metaphor" and its implications for social thought by Dallmayr (1984).

the substantive propositions of Marxian theory. However, the problem is not the one often cited in criticisms of the use of "objective" mathematical models in, for example, neoclassical economic theory—that such models leave out the "subjective" element. In Roemer's case, mathematical models accomplish exactly the opposite: they make human beings the center of the world. This mathematical approach to Marxian theory, in turn, has the effect of displacing class from the center of analysis.

Mathematics and Class

The analytical reconstruction of Marxian theory à la Roemer is based on an epistemology of mathematical models in which mathematics is accorded a special, representational status in the elaboration of that theory. The alternative Marxian epistemology briefly elaborated above opens up a different discussion concerning the use of mathematical models: it is considered one language among others—a Medusa's head, "indispensable and harmful by turns"—with which the concepts and statements of Marxian theory can be illustrated.

This alternative approach to mathematics also allows for a different analysis of the concrete effects of the use of mathematical models in a Marxian discourse. In the case of Roemer, I have already noted that he carefully specifies, in mathematical terms, the conditions under which individuals will choose different class positions. He also shows how those economic agents are, according to his definition, exploited. Having a notion of class and exploitation does not, however, mean that he has captured, let alone developed, a Marxian notion of class.

Roemer produces the "logical necessity" of exploitation in the existence of private property and the inequality of initial endowments. What he forgets is that the exploitation of the majority of human beings by a minority has been "seen" by many others. It is not a Marxist invention. Rather, the contribution of Marxian theory is a set of concepts with which to think the various social forms of that exploitation, including the nonclass "material" (economic, but also political and cultural) conditions of existence of the processes of extracting and distributing surplus labor, and the relationship among and between class processes and their social conditions of existence.

In Roemer's case, he succeeds in producing the "logical necessity" of exploitation from the decisions of individuals to maximize utility (or, equivalently, minimize labor time) given some initial endowment. Against many radical critics of bourgeois economists, he proves that the latter are quite capable of producing a concept of class. In this sense, he has shown that bourgeois economists *have chosen not to elaborate such a concept*. Admittedly, it would be a particular concept of class, different from the Marxian one, and it would play a different role in neoclassical economics. The point is that Roemer has succeeded, where the neoclassicals failed, in responding on neoclassical terms to the class problem posed by Marxists. He has also shown that there are choices at every step in the development of a discourse—it is not simply a matter of logical necessity—and that bourgeois economists have chosen not to take this particular step.

The problem is that Roemer's theory of class is as essentialist as his theory of knowledge. Class need not be conceived of as the essential determinant of society, nor does class itself have to be reduced to some origin. The Marxian notion of class can be, in this sense, fully social: it can be analyzed as the determinate result of the entire constellation of social processes that can be said to make up a society or social formation at any point in time; in turn, it will be only one of the myriad determinants of those nonclass social processes. Roemer's mathematics is, on the contrary, an attempt to find such an origin or essence. And he does find the apparently irrefutable essence—in the form of individual rational choice.

Theory and Human Nature

Methodological individualism pervades what Roemer considers to be both his "positive" and his "normative" theory.[19] In his positive conception of society, given individual agents, with the same preference orderings but different initial endowments, choose different class positions—different positions with respect to the labor process, different amounts of wealth, and so on. Collective action—what he calls class struggle and revolution—is conceived to be a problem defined with respect to individuals acting as members of a class, rather than as pure individuals. This is the project announced in 1978:

> Modern individualist economics has not satisfactorily explained the importance of groups and coalitions in economic behavior or, more generally, the role of collective action in history (147).

Roemer has responded to this challenge by attempting to build such an explanation in terms of the values, beliefs, reasoning patterns, and actions of individual agents. Class, in this view, is not considered to be one aspect of

19. It should be noted, at least in passing, that the positive/normative distinction is itself a reminder of the epistemological problems raised before. It presupposes a fundamental dichotomy between facts and values, between reason and morality, that is intrinsic to the modern, positivist conception of science.

society affecting, producing, or overdetermining individuals and individual behavior. It is set apart from individuals, something distinct from their nature, which itself is given prior to and therefore independent of class.

In the end, Roemer relegates the problem of collective class action to sociology. "Economics" gives the theory of class formation based on individual preferences, while sociology should offer an account of why individual members of the same class overcome the collective action problem in the way they sometimes do. Thus, Roemer passes off the problem of class as collective action to the sociologists much in the way that neoclassical economics has relegated the problem of individual preferences to the poets and psychologists.

The normative purpose of Marxian theory, according to Roemer, is "to challenge the defensibility, from a moral standpoint, of an economic system based on private ownership of the means of production" (1988, vii). How is this challenge mounted? Roemer offers what he considers to be the universal principle that it is good to eliminate forms of property that hinder the development of the productive forces (1982, 271). Thus, it is necessary to eliminate "socially unnecessary forms of exploitation" because of a moral imperative, an "unquestionable good." This moral imperative is, in turn, grounded in human nature, what he calls the "self-actualization of men and of man" (1982, 272). The individual human subject thus serves as the basis for Roemer's attempt to specify a "more absolute" concept of morality.

Both the positive and normative dimensions of Roemer's theory are based on a concept of an originating subject, given to the analysis. An alternative Marxian approach would be to elaborate "decentered" concepts of society and individual human beings in which the class process occupies a central role but in which there is no causal essence or origin—not to derive class and all other social phenomena from human nature, but to analyze their complex, contradictory connections.

I return to this theme below. It is necessary before that, however, to analyze how Roemer's methodological individualism is conditioned by his use of mathematics.

Mathematics and Human Nature

In the most general sense, Roemer conceives of mathematics as an absolute method of science (in the singular). His use of mathematics, as we have seen, is related to an absolutist epistemology in which reality is given to theory—either as a set of facts or as a rational order corresponding to thought. The givenness of mathematization, of Roemer's ability to invoke the rational choice model of the subject as the only alternative to functionalist and teleological forms of explanation, is governed by a conception of mechanical research techniques and a moral imperative. This is what, to take one example, Martin Heidegger (1976) has argued is one of the defining characteristics of the modern world view: a particular combination of objectivism and subjectivism. Objective knowledge is claimed on the basis of the knowing subject's ability to discern the truth of reality. This is, to use our previous terminology, the conception of knowledge as representation. The origin of representation is the (passive or active, in turn) knowing subject.

Roemer's use of the mathematical rational choice models is also, in a second sense, grounded in the human subject on the basis of given human needs. The rational choice model only "works" to the extent that Roemer and other analytical Marxists can take as given a homogeneous space of economic phenomena defined by human needs. These needs are, in turn, related to a naive anthropology, to understanding these needs as the essence of society. This is the role of scarcity in Roemer's (as in neoclassical economic) theory: scarcity privileges human needs. It constrains their fulfillment and therefore makes the satisfaction of those needs—and thus the needs themselves—the originating center of society and history. Social phenomena are explained as the result of individuals making choices in order to optimize their ability to satisfy their needs. History is thus conceived to be the struggle of human beings against scarcity.

Class struggle becomes the *mechanism* for the elimination of particular property entitlements; the *reason* for this elimination is to remove all fetters on the development of the productive forces. Revolutions are understood as the result of human beings' preferences, given their respective endowments of resources, for an alternative system of property rights. Finally, the "moral imperative" to eliminate "socially unnecessary forms of exploitation" is grounded in the need to develop the production of wealth as the necessary condition for the "dynamic self-actualization of man."

"Microfoundations," then, is a code word for an anthropology of human needs.[20] Microsocial mechanisms are worked out on the basis of human

20. The microfoundations approach also involves a second form of essentialism, viz., structuralism. Briefly, solutions to constrained maximization problems are only possible if the constraints are specified. In Roemer's case, included in the constraints are the structures of unequal endowments of resources and property ownership, both taken as given. Roemer's humanism is thus combined with a structuralism.

Still, this kind of structuralism is probably more pronounced in other mathematical approaches to Marxism (e.g., many of those mentioned in the beginning of this essay) in which, in place of individual decision making, the "deep" structure of reproduction schema, embodied labor value, or so-called technical production data is the essential determinant of the problem.

beings attempting to realize their needs. This is the meaning of what Althusser (1977, 219-47) has called a "theoretical humanism" and what Luke (1987) refers to as the combination of ontological, epistemological, psychological, and axiological individualism often associated with rational choice modeling. Roemer is not just concerned about human beings; he assumes that the "ultimate constituents" of the social world are individual people—which he captures in his models.

Roemer produces the "logical necessity" of exploitation from the needs of these human beings. Instead of "relativizing" class, exploitation, and inequality—with respect to one another and as they relate to the other aspects of society—he makes them absolute by tying them to human needs. Instead of leading to an understanding of the contingent, conjunctural—cultural, political, and economic—conditions in which individuals will come together and struggle over one or another dimension of society, including the class dimensions, he sets up a virtually insurmountable obstacle by privileging individual rational action wherein it is all but irrational to engage in such (class and nonclass) struggles.

The result is that the mathematics of rational choice Marxism is related to the anthropology of "man" in a double sense: via the origin of knowledge in the subject, and the origin of society in the human subject.

Human Nature and Class

One further example serves to indicate Roemer's insistence on the givenness of human nature, external to and independent of society and history, and his displacing of class from the center of analysis. Roemer insists that exploitation is a concept that can be thought of as prior to class. He attempts to prove this through a model of a "primitive" economy in which exploitation exists (as defined by Roemer: some agents work more and some less than socially necessary labor), but there are no classes (again, as defined by him: groups of people as they relate to the labor process). Human beings work and have needs before they relate to the labor process. "Man," therefore, comes before class.

This logical priority of human nature with respect to class presumes that there is a set of individual interests prior to social, including class, interests. In this sense, Roemer takes as given, as a self-evident truth, exactly that which should be the result of a process of theoretical production in Marxism.

A different view of this problem begins with the impossibility of separating individuals from classes. In order for there to be individuals who occupy class positions in a society, there have to be social processes whereby surplus labor is performed, appropriated, distributed, and received. These processes do not come later in the story. And in order for there to be individuals (and individual needs), there has to be an infinity of other social processes that constitute their "species-being."

It is possible, on this basis, to go beyond the idea that classes are made up of individuals, and of the related idea that there are two (or three, or more) independent classes of individuals. This alternative approach would mean relinquishing the fetishism of "man" and focusing on the social—including class—constitution of individuals. It would also mean giving up the "economic" theory of class grounded in human needs.

An important precondition for this revolution in theory is to abandon the fetishism of mathematics.

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