LOGIC, DIALECTICS, POLITICS:
SOME RECENT CONTROVERSIES*

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The present paper discusses some inter-relations of logic, dialectics, and politics.[1]   It is largely limited to American and West European literatures on these topics, because I do not pretend to have mastered other relevant literatures and languages. More specifically, it reviews and synthesizes two recently interrelated scholarly controversies, the "paradigms" debate occasioned by Thomas Kuhn's The Structure of Scientific Revolutions (Kuhn, 1962 and 1970)[2] and the somewhat misnamed Positivism Controversy in [West] German sociology (Adey and Frisby (eds.), 1976).[3] The currency of such discussions (centered on the issue of scientific knowledge cumulation) is evident in several other works, perhaps most notably by Radnitzky, Bernstein and Giddens.[4]

My review will pay special concern to the role of formal logic in various social scientific philosophies, as well as the intermediate philosophical positions now visible somehow between classical "logical positivism" and Marxist-Leninist "dialectics," namely Popper-Lakatos' critical rationalism, the "revolutionary hermeneutics" and "methodological anarchism" implied by Kuhn and Feyerabend, and the "dialectical hermeneutics" of Habermas, Apel and other contemporaries of the Frankfurt school. My hypothesis is that the issues raised are sufficiently fundamental to be visible among scholars of other persuasions as well, including Marxist-Leninism. They thus may provide an area of potentially useful scholarly exchange across international political alignments.

Because Bernstein, after Adorno and Habermas, criticizes "mainstream" empirical social scientists like Merton and Smelser for mistakenly viewing "the history of their own disciplines through the spectacles of positivism," (1976, p5), we shall begin with a brief review of the main concerns of 19th century positivistic epistemological philosophy and its 20th century descendants, logical positivism and logical empiricism.

I. From Positivistic Philosophy to Logical Empiricism

Giddens (1976, p. 130) argues that "positivism" in nineteenth century social theory and philosophy meant:

1) (the principle of positive, nonmetaphysical knowledge) "a conviction that all is to count as 'knowledge' ... is capable of being expressed in terms which refer in an immediate way to some reality, or aspects of reality, that can be apprehended through the senses";

2) (social science naturalism) "a faith that the methods and logical structure of science, as epitomized in classical physics, can be applied to the study of social phenomena."

The broad outlines of an optimistic program of rational social transformation were clear. "Compte and Marx wrote in the shadow of the triumphs of natural science, and both regarded the extension of science to the study of human conduct

in society as a direct outcome of the progressive march of human understanding towards man himself." (Ciddens, p12) Reactionary mystifications, idealistic (Hegelian) metaphysics and religious mysteries could be overcome as enlightened man moved from the science of nature toward scientific self-understanding and subsequent technical mastery over the conditions of his own social existence. Hence,

   3) <u>"Scientific cognition must be technically utilizable,"</u> i.e. in unified, rational form so as to be useful for controlling nature and society. At least the Comptean version argued as well that

   4) as a result of its scientific origins, <u>"our knowledge is</u>, in principle, <u>unfinished</u> and <u>relative</u>." (Habermas, 1971, pp74-77, italics added).

   Twentieth century logical positivism or logical empiricism revised and elaborated upon these themes. According to Radnitzky, whom I now quote repeatedly, key programmatic ideals within logical empiricism were:

   1') <u>(the unified science principle)</u> "All scientific disciplines should form part of one basic discipline." Principle 2 above suggests including here the notion that the basic methodology of these disciplines should be the same. Also, it suggests:

   2') <u>(physicalism)</u> "Among the scientific disciplines now in existence physics approximates the ideal best".

   3') <u>(reductionism to an ideal logical language)</u> "Other disciplines may be reduced to physics by making a language that has been designed for an idealized physical science the common language of all "science-like" disciplines, and by making physical concepts the fundamental concepts of the ideal unified science". Post-Russellian mathematical logic or meta-mathematics is thus seen as the ideal of "metascience" or scientific self-understanding, hence 4')-6'):

   4') <u>(The ideal of hypothetical-deductive knowledge systems)</u> "an ideal physics is conceived as a mathematical theory fitted out with semantic rules, which give it empirical content." (Radnitzky, 1970, pxvi).
The universally valid laws of such systems have been usually, but not always interpreted causally.

   5') <u>(The principle of empiricism)</u> For its empirical content, "[E]very primitive term [of a basic vocabulary] must refer to something in 'experience' and every non-primitive term must be introduced in terms of primitive terms by definitional chains [of logical equivalence]." "Experience" here is understood to be either a) of the direct, "positive," <u>phenomenal</u>, observable variety or
b) perceptual, i.e. intersubjectively "verifiable" in a scientific way. (Radnitzky, 1970, I, p28)

   6') <u>(The principle of extensionality)</u> Formally, i.e. grammatically, the ideal logical language should be extensional, i.e. involving truth-functional relationships logically built up from ultimately nonextensional primitive propositions. [5]

Whitehead and Russell's extensionalist logical system in <u>Principia Mathematica</u>, with its aversion to substantial assumptions or descriptions, and its theory of types for avoiding paradoxes inhering in self-referential statements was the exemplary achievement in "nonmetaphysical"linguistics or metamathematics. (Radnitzky; I, p30f) [6]

   It will be useful to add a final element in the program of most 20th century logical positivism or logical empiricism (terms with nearly overlapping meanings) [7] that appears in much of that literature as a descendant of principles 4' and 5' above.

7')(the desirability of insulating science from society and the state) Although the critique of metaphysics inherently distances positivistic inquiry from religiously inhospitable or politically intrusive governments bent on destroying scientific autonomy, science's main objective is theoretical knowledge cumulation, not social emancipation. Social values, norms or prescriptive strategies are not scientifically derivable; but their empirical presuppositions may nonetheless be scientifically confirmed or rejected.

What do positivism, logical positivism or logical empiricism, so characterized, have to say about science qua science? The first point to be made is that the worship of physics and Darwinian biology in early "positivist" views strongly suggests the corollary that all knowledge, if it is to be considered valid or secure knowledge, must be scientific. Secondly, there is the argument of the early positivists, including Wittgenstein, that propositions are either synthetic,

(empirical, sense-data, factual, as above), analytical (logical, of a deductive character or an inductive cast), or meaningless ("poetry", "prescription", metaphysics"). The security of scientific knowledge is then to be derived from its basis entirely in synthetic and analytical propositions. As in 4' and 5' above, scientific statements must be valid in the restrictive sense of being logically true or directly or indirectly empirically verifiable, and perhaps also verified. Thus secure, "scientific" knowledge resides in logically and empirically proven knowledge, a position Popper traces back to Aristotle and Lakatos calls "justificationism."

In recent times, there has been considerable refinement in these views, as when the Kantian category of "synthetic-apriori" knowledge, knowledge that is logically certain yet empirical in nature, was struck down first by the existence of logically consistent non-Euclidean geometries, second by Einstein's successful use of such new geometries in his celestial mechanics.

The Humean argument that one cannot prove general propositions, slowly led to a concern for developing probabilistic standards of induction and proof. (Russell, Keynes, Carnap, Nagel) Clear reflections of this concern for demonstrable truth are also seen in the Whitehead-Russell attempt logically to derive all true propositions "by logical methods" from the knowledge of all true, including factual and other atomic propositions, (see note 5). Whereas Leibniz believed that language was logical and Frege envisioned all propositions as but alternate names of "truth" and "falsehood," Russell or Carnap could extend this view to think that both mathematics and the real world of science were truth-functional.

II. The Response of Popperian Critical Rationalism

We will give special attention here to the views of Karl Popper, an important early critic of both positivism, logical empiricism and dialectical philosophy, as well as a central figure in the formation of Kuhn's views on paradigms, and the bête noir of Adorno and Habermas in The Positivist Dispute in German Sociology. But we will do so with the special purpose of placing his views on the rough, multidimensional ordering between positivism and dialectics mentioned above.

During World War II, Popper wrote his The Open Society and its Enemies (Plato, Hegel and Marx) to attack "the revolt against reason" apparent to him in the ideologically split world of the 1930s, in Freudian accounts of human nature, and in the historicist and relativistic views of Hegel, Marx, Toynbee and others (Popper, 1946 through 1962). By "historicism" he meant the view that "the method of a science of society" should be "the study of history, and especially of the tendencies inherent in the historical development of mankind," e.g. towards progress. Popper considers philosophical, moral or historical views "relativistic" if they argue for the arbitrariness or nonrationality of moral or scientific choice, including the view that laws true of one historical period need not be true of the next one. (Popper, 1962, Vol. II, pp. 8-9, 319, 369)

His own "falsificationist" view of appropriate scientific method replaces "scientific certainty by scientific progress" in the search for truth; it also serves to demarcate science from nonscience.

> "For science does not develop by a gradual encyclopedic
> accumulation of essential information, as Aristotle thought,
> but by a much more revolutionary method; it progresses by
> bold ideas, by the advancement of new and very strange theories
> (such as the theory that the earth is not flat...) and by the
> overthrow [or 'refutation' or 'falsification'] of the old ones."

(Popper, The Open Society,
II, 1962, p. 12f)

In what surely presages Kuhn's thinking, Popper sees theoretical revolutions as real; but properly understood, science embodies a revolution in methods, the reliance on a dialectic of bold conjectures and empirical refutations.

Let me summarize here his views on logic, criticism and scientific explanation; they will also be relevant for our subsequent discussion of Popper's relation to logical empiricism. For Popper, formal (or deductive) logic is the "organon of criticism"; [D]eductive logic is not only the theory of the transmission of truth from the premise to the conclusion, but it is also...the theory of the retransmission of falsity from the [false] conclusion to at least one of the premises." It becomes the theory of all "rational criticism" as well, which "takes the form of an attempt to show that unacceptable conclusions can be derived from the assertion we are trying to criticize." Modern logic has rehabilitated the absolutist concept of truth (a proposition's correspondence with the facts or things as they are). In natural and social science we criticize the truth claims of theories -- deductive systems -- by falsifying conclusions logically derived from, and thus tentatively explained by, theory and some initial conditions. (Popper, in Adorno et al., 1976, pp. 98-101). One is tempted to characterize such views as anti-inductivist and anti-verificationistic yet clearly positivistic. Finally, Popper can be said to differ from positivism rather significantly concerning its claimed wholesale anti-metaphysical character. Principally this may due to his much greater awareness that both his deductive falsificationism and his methodological individualism (an aversion toward treating collective agencies as real) are tenants just as metaphysical and unprovable as realistic logical atomism. Popper clearly objects as well to the repressed metaphysics in the historicist subspecies of positivism and dialectical materialism which impute "meanings" or "progress" as "immanent" in history.

In terms of our pre-articulated standards of comparison, Popper agrees in the main with somewhat more than half of the core positivist program -- its antidogmatic emulation of mathematical physics -- but he objects rather fundamentally to its inductive and verificationist observational theories, its inconsistent antimetaphysical self-understanding, and its historical progessivism, at least in certain of their variants.

How then does Popper fare as a "logical empiricist" in terms of the seven discriminating criteria laid out above? If Popper's differences with positivism entitle him to at least legal grounds for separation, if not divorce, his differences with logical empiricism might better be described as a lover's quarrel, combined with a methodological shift in interest. The points of disagreement are most clearly the inductive and verificationist doctrines of logical empiricism deriving from objectionable positivistic roots.

As for the unified science principle, Popper heavily endorses a methodological, not a disciplinary variant of this view. Progress is not "immanent" in history. "In science (and only in science) can we say that we have made genuine progress: that we know more than we did before." (Popper, in Lakatos and Musgrave (eds), 1970, p. 57). The root discipline for "enlightenment concerning the aims of science, and its possible progress" is the philosophical logic of discovery, not the "spurious sciences" of history, psychology or sociology, (ibid., p. 57f). This discipline is more concerned with logically clarifying and improving knowledge cumulation than with 3"s idea of physical reductionism. Popper's criterion for progress, enhanced truth content residing in nonfalsified theories, admits of some complicating qualifications, however, Thus theories are never unambiguously falsified in a probabilistic world; moreover, as Duhem and others have argued, theories can be temporarily saved by the introduction of appropriate ad hoc hypotheses. These

might concern, for example, new meanings for key terms, stiffer ceteris paribus assumptions, or different ways of measuring derivative concepts and testing various predictions. Popper would prefer such adjustments to have more possible empirical truth content, and thus to be even more falsifiable than their predecessor.

As a label for the presumably expanding content area of true science, "nonfalsified theory" also requires further discussion. Clearly it is a matter of degree, for which a positive concept other than "verified theory" needs to be found. "By the degree of corroboration of a theory I mean a concise report evaluating the state (at a certain time t) of the critical discussion of a theory, with respect to the way it solves its problems; its degree of testability; the severity of the tests it has undergone; and the way it has stood up to these tests." (Popper, 1972, p. 18)

Points 2', 3' and 4' elaborate the ideal-typical logical empiricist's views on physics, reductionism to an ideal logical language and the ideal of explanation via hypothetical-deductive knowledge systems. Although he quotes Carnap and Tarski more than Whitehead and Russell, Popper's methodological views, as summarized above, fit these principles easily. Einstein, for example, may well be Popper's ideal scientist. Presumably, distinguishing among the different deductive mathematical theories different scientists use, Popper appears to assume what Whitehead and Russell had started to show -- the equivalence of deductions using such formalisms to the deductions of standard formal logic. In these views, Popper also does not differ much from Nagel, Merton, Smelser, Easton and other "mainstream" social theorists and philosophers to be discussed further below.

Relating Popper's views, as we have summarized them, to point 5' of the logical empiricist program, the principle of empiricism, is also not difficult. Although Popper certainly would claim that science was grounded in experience, he has consistently rejected any claims that such experience was unmediated by theory or problem definitions. The basic or primitive terms of the scientific theory are not directly given observations, as in 5'a; the meaning of these terms must be decided upon by the scientific community. Can one accept the interpretation of point 5'b in terms of "perceptual experience" as Popperian? If we recall that the replication of individual measurements is a key element in Popperian science but remember also that general laws can never be "verified" in his view, then this version of the principle of empiricism despite its quasi-tautological character may be considered part of the Popperian perspective.

As for extensionality, Popper's views point strongly in this direction, even though they are again more nuanced and sophisticated. First of all, his passionate rejection of Aristotelian essentialism is very Russellian: "The Aristotelian notion of essence was the forerunner, no doubt, of the modern notion of intension or meaning.' [10] Secondly, Popper's extremely strong (one might say overstrong) equation of rational criticism with the use of standard deductive logic seems decisive on this point: standard deductive logic is extensional in very much the sense that Whitehead and Russell meant it.

Nonetheless, if one is to believe the previously quoted views of Whitehead and Russell, there is a certain tension between philosophical logic and mathematical logic, which does not appear to be entirely resolved in Popper's views when he equates critical rationality with standard deductive logic. His criticisms of "scientism" in the "spurious" social sciences is not only, or not mainly that they avoid deductive logic or use it improperly; rather it is that their methodology is too inductivist and not sufficiently falsificationist. Both such views of the "logic of discovery" would traditionally be considered "logical" (in either Hegel's or John Stuart Mill's senses of the term); neither argument is strictly formal or mathematical. Popper's consideration of such principles as requiring the "decision" of the investigator or as "metaphysical" appears to remove their defense from rational discussion, unless we allow the existence of some kind of "discursive" logic appropriate to rational debate in some broader senses of "rationality." [11]

Concerning 7', the desirability of insulating science from society and the state, Popper's strong concerns for the regulative ideal of truth represents a clear restatement of this older concern of logical empiricism. His realism concerning both the obvious influences that the state or church can have and the need for a minimally supportive social environment of science certainly tempers his absolutism or purism concerning the ideal of truth. But, in what is surely more controversial, in a very anti-dialectical, and anti-psychoanalytic passage, Popper has said that "self-analysis is no substitute for those practical actions which are necessary for establishing the democratic institutions which alone can guarantee the freedom of critical thought, and the progress of science." (The Open Society, 1962, II, p. 223, italics added).

In sum, and preparatory to our discussion of the "paradigms" debate proper, we find Popper substantially in agreement with some version of all of the key principles of logical empiricism as Radnitzky and others have defined them. His differences with other variants of this view are certainly not trivial, however,

since they again concern his "logical", anti-dialectical, "falsificationist" and "anti-inductionist" stance, a methodological orientation which has had considerable influence in the development of modern, non-Marxist philosophy of science. And, were we to have given definitional status to the root of the "ideal logical language" component of logical empiricism, which Popper, more than most logical empiricists, could admit to be metaphysical, other serious differences would have been found.

III. From Popper to Kuhn to Lakatos to Feyerabend

In his "Second Thoughts on Paradigms," Kuhn gives an especially clear account of the connections between logical empiricism and the origin of his use of the term "paradigm".

> The analogy between a scientific theory and a pure mathematical system has been widely exploited in twentieth-century philosphy of science and has been responsible for some extremely interesting results. But it is only an analogy and can therefore be misleading. [In addition to the "well-known difficulties" associated with identifying "an empirically meaningful basic vocabulary"...] Empirical content must enter formalized theories from the top as well as the bottom. ...Any account of the cognitive apparatus of a scientific community may reasonably be asked to tell us something about the way in which the group's members, in advance of directly relevant empirical evidence, identify the special formalism [e.g., a variant of "f = ma"] appropriate to a particular problem, especially to a new problem [e.g., the motion of a pedulum]. ...the term "paradigm" ...entered The Structure of Scientific Revolutions because I... could not, when examining the membership of a scientific community, retrieve enough shared rules to account for the group's unproblematic conduct of research. Shared examples of successful practice could...provide what the group lacked in rules.... Unfortunately...I allowed the term's applications to expand, embracing all shared group commitments, all components of what I now wish to call the disciplinary matrix. (Kuhn, 1977, pp. 299-301, 318-319.)

Although Kuhn's views thus have roots in a much larger literature than Popper's previous writings, he starts his contribution to the debate summarized in Lakatos and Musgrave (eds), Criticism and the Growth of Knowledge by noting fundamental views that they share. Both have shifted away from preoccupation with the logical form of ideal scientific sentences ("the logical form of the products") of scientific enquiry, to concern themselves with the "historical", "dynamic process by which scientific knowledge is acquired" (p. 1). This newer concern amounts to a version of 1', the unified science principle, that is methodological rather than disciplinary, and indicates a rather significant retreat from active pursuit of the reductionist program, principle 3' of logical empiricism, on the part of both Popper and Kuhn. Given Popper's clear revulsion toward most social science in general and historicism's search for historical lessons in particular, however, Popper's preference for philosophical -- logical and rational -- reconstructions of scientific discoveries belies fundamental agreement with Kuhn on the adequacy of historical accounts.

Kuhn indicates several theses of "classical positivism" that both he and Popper object to. "We both emphasize...the intimate and inevitable entanglement of scientific observation with scientific theory; we are correspondingly skeptical of efforts to produce any neutral observation language; and we both insist that scientists may properly aim to invent theories that explain [rather than merely subsume or name] observed phenomena and that do so in terms of [metaphysically] real objects...." (p. 2). (Russell wanted to assume as little as possible about existence and to reduce "causality" to predictive lawfulness). Both authors are anti-inductivists and against an accretionist model of knowledge accumulation in that they admit to revolutions in scientific knowledge.

Similarly Lakatos attributes the vast success of Kuhn's book to his popularization of Koyré's persuasive, anti-positivistic, historical view that scientific changes are connected with "vast cataclysmic metaphysical revolutions" in "metaphysical research programmes", like the Einstein-Planck revolution studied by Popper; he sees Popper as principally concerned, however, with defeating the probabilistic justificationism or verificationism which I have above mentioned as a variant of Russell's, Carnap's or Nagel's logical empiricism (ibid. pp. 92-95 and notes). In a review that both criticizes and defends Kuhn's views, Feyerabend begins by acknowledging that the beneficial effects of discussions with him have included various "criticisms of some features of contemporary methodology" made in articles on "Problems of Empiricism" and the first version of his later book (debating, and dedicated to, Lakatos): Against Method. (Feyerabend, in Lakatos and Musgrave, (eds.), p. 197) In this later volume Feyerabend describes Popperian "critical rationalism" as "the most liberal positivistic methodology in existence today," (p. 171); he argues as well that Habermas and Adorno "seem to be justified in calling Popper a positivist" because "Critical rationalism arose from the attempt to solve Hume's problem [of induction from particular experiences to universal causal laws] and to understand the Einsteinian revolution, and it was then extended to politics and even to the conduct of one's private life" (p. 175). And he assumes that critical rationalism a fortiori includes the "principles of logical empiricism" (p. 179). Feyerabend's comment certainly argues for both the reinterpretation of the "paradigms" debate in terms of the correction of positivistic and logical empiricist views, and it makes easier the transitional link to The Positivist Dispute in German Sociology.

Where do these authors disagree? In very heated language, Kuhn's critics, Popperians and others, have accused him of making the matter of theory choice a matter for "mob psychology" (Lakatos) involving "Mere persuasive displays without deliberative substance," omitting appeals to "good reasons of any kind, factual or otherwise." (Sources in Kuhn, 1977, p. 321). Ambiguities are legion.

In "The Nature of a Paradigm" Masterman collates Kuhn's twenty-one meanings into three primary kinds: cosmological or metaphysical paradigms of a philosophical sort; exemplary concrete achievements judicially applied within a scientific community, i.e., sociological paradigms; and, even more concretely, classic texts or actual instrumentation which serve like grammatical tense forms for a foreign language or crude analogies or a specified gestalt-figure as artifact or construct paradigms. Paradigm change in the first sense corresponds to major revolutions in world view such as the transition from the paratactic universe of the archaic Greeks to the substance-appearance essentialism of their classical followers, and the transition from Copernican cosmology to Einstein-Planck quantum theoretic relativity, as much discussed by Koyré, Popper, Kuhn, Lakatos and Feyerabend.

Paradigm content in the sociological sense comes close to what Kuhn now refers to more comprehensively as a disciplinary matrix, which includes both cosmological, exemplary and artifactual elements. These elements are interrelated, "form a whole and function together" (Kuhn, 1970, p. 182), but not always in a mutually reinforcing way (see the example of behavioristic learning theory below and Lakatos' account of Bohr's progress on inconsistent foundations, op. cit. p. 140ff).

One of the important agreements among second generation Popperians (such as Lakatos) and even more dialectical thinkers like Kuhn and Feyerabend is that scientific choice involves more than hypotheses or even separate theories. Historically and social psychologicall Kuhn is concerned with paradigm choice, in the most comprehensive sociological sense of a disciplinary matrix. These matrices include

a) <u>metaphysical paradigms</u> (cosmological, ontological, and heuristic models and beliefs);

b) scientific and other <u>values</u>;

c) <u>symbolic generalizations</u> (readily formalizeable statements or explicit formalisms that allow logical and mathematical manipulations and serve partly as laws, definitions or theories); also

d) <u>exemplars</u> (shared ways of seeing how to apply formalisms and solve homework exercises in classic texts, community-wide laboratory instruction in the use of technical instrumentation, and other shared construct paradigms in Masterman's sense.

Rather similar to Kuhn's sociological disciplinary matrices are Lakatos' "research programs, which generate comparable sequences of theoretical respecifications. Within his research programs are irrefutable <u>cores</u> (containing purely metaphsycial beliefs, <u>negative heuristics</u> indicating beliefs that program adherents refuse to try and falsify, and <u>positive heuristics</u> that hint how to develop refutable variants of the research program) which are combined with auxiliary

assumptions in a "<u>protective belt</u>" with "construction" of <u>sequences of testible theories</u>. 12

Masterman, like Kuhn, focuses retrospectively on the exemplary new way of seeing that a construct paradigm generates either as a concrete picture or model used analogically, or as "an analogy-drawing sequence of word-uses in natural language." (pp. 76-88). She suggests that a crude analogy has the following logical characteristics:

> "(a) a crude analogy is finite in extensibility
> (b) it is incomparable with any other crude analogy
> (c) it is extensible only by an inferential process of 'replication', which can be examined by using the computer-programming technique of 'inexact matching', but not by the normal methods of examining inference."
> (p. 79).

Recall that PM's propositional functions were similarly ambiguous as to referant, and dependent on intensional meanings for their use. Because extensibility in truth-functional thinking refers to well defined sets of objects for which a proposition is true, several of Kuhn's more controversial points can become clearer in terms of this explication as well as the rationale for his attempt("Second Thoughts") to computer model the precise but not wholly abstract, rule-governed, conscious process of sensation.

Like Popper, Kuhn agrees that "progress" is "a perquisite reserved almost exclusively for the activities we call science"; like Popper, Kuhn argues there is no <u>proof</u> of a theory's truthfulness. But going beyond an anti-positivism shared with Popper, Kuhn generalizes the objection to inductionism and neutral basic observation sentences: "There is no neutral algorithm for theory [or paradigm] -choice [defined in terms of scope, accuracy, fruitfulness, etc., considerations], no systematic decision procedure which, properly applied, must lead each individual [in the scientific group logically] to the same decision." (Kuhn, 1970, p. 160 and p. 200). No "semantically neutral techniques exist for theory choice; no logical or merely syntactical rules exist for comparatively measuring the truth content of observational or experimental consequences of two theories stated in a shared basic vocabulary (ibid., p. 158 and p. 234).

For Kuhn revolutionary discoveries are those from which new phenomena emerge. Disciplined, but partly tacit, gestalt changes or "conversions" to "new ways" of "sensing" or "seeing" stimuli occur. The set of things to which basic terms refer mutates, and the terms themselves take on new, vivid -- but peripherally vague -- intensional meanings and more than syntactically unclear extensional references, which do not nicely subsume earlier set boundaries. Extensibility will doubtless be contextually sensitive to "old" ways of seeing. Logical reductionism in the sense of principle 3' may not be possible.

For example: after the discovery of Uranus "comets" became possible "planets"; after Copernicus the moon could have "mountains" and Westerners could "see" sunspots the Chinese had noted for centuries; experimental error in measuring electric attraction became -- in part -- electrostatic repulsion; Leyden jars designed to hold an electrical "fluid" suddenly didn't have to be "jars" at all; after Einstein matter became energy, velocity became "relative" and space became "curved". For such discoveries a "topdown" gestalt-like flip corresponding to the difficulty of recognizing "bottom up" a red six of spades is required, and when it comes, previous extensible taxonomies usually get superceded in nonadditive, nonaccretionary not obviously cumulative ways. Parly new and incommensurable universes of potentially "understandable" and "anomalous" experiences became possible. Many previous anomalies get reinterpreted in terms of the "gradual and simultaneous emergence of both observational and conceptual recognition" with a consequent "change of paradigm categories and [laboratory] procedures" and resultant new anomalies, changes that are frequently resisted. (Kuhn, 1970, p. 70)   /3

Now to Kuhn's attempts to redefine or supercede Popper's falsificationist demarcation principle for distinguishing science from non-science. Kuhn's most important empirical thesis deriving from his concept of exemplars is perhaps that of the pervasiveness within (sub)disciplinary scientific groups of "normal science," a stronger, puzzle-solving oriented, more collective form of what Popper had earlier called the principle of (personal) tenacity.

If the investigator fails to solve such puzzles, e.g. by manipulating auxiliary hypothesis or formalisms, his ingenuity is normally impugned, rather than the validity of the disciplinary matrix's most basic heuristics or symbolic generalizations.

Kuhn's view makes the ideal, "normal" scientific society sound like a dogmatic, "closed society," surely a view he was aware Popper would object to! To turn [Popper's] view on its head, it is precisely the abandonment of critical discourse [characteristic of normal science] that makes the transition to a ["mature" or "normal"] science. Once a field has made that transition, critical discourse recurs only at moments of crisis when the bases of the field are again in jeopardy," (Kuhn, in Lakatos and Musgrave, eds., pp. 4-6), which can happen when many investigators fail to resolve a growing number of puzzling anomalies, or an allied group of specialists produces results fundamentally contradicting basic elements of a disciplinary matrix (Kuhn, Scientific Revolutions, p. 181, etc.). It must be noted that this recursive demarcation of science in terms of its normal self is at least partially tautological and not wholly satisfactory, a point Kuhn realizes.

Kuhn's image of scientific progress gives a definitely verificationist cast to normal scientific activity. For Kuhn, "anomalies" rarely become falsifications. Kuhn, like Lakatos, argues more decisively than Popper that one theory is not falsified unless there is a better one to replace it (one, Lakatos would say, with "higher corroborated content," op. cit., p. 180). Normal science allows considerable incremental knowledge growth, and (dialectically) also makes rather infrequent revolutions possible and fruitful. It generates a lot of very ingenious effort directed toward puzzle solving, which amounts on rare occasions of snowballing failure to the severe, revolutionary falsification efforts that Popper calls for, but for a different reason. The triumph of a new theory in such a situation amounts, says Kuhn, to a kind of comparative verification.

How and why do such triumphs or revolutions occur? Because there is no instant rationality or singly decisive "cricial experiments", Lakatos revises Popper's and Kuhn's views by saying that competition is really between rival research programs, generating series of theories that better fit reality, rather than isolated theories. He and Toulmin object historically to the Kuhnian idea of the tendency for mature scientific communities monopolistically to suspend rival research programs ("paradigms"). An "objective", rather than a "social-psychological", reason for rejecting one program for constructing protective belts is the success of a rival program which explains the previous success of its rival and supersedes it by a further display of heuristic power e.g. the ability to anticipate theoretically novel facts and even novel auxiliary (measurement) theories in its growth. (op. cit. p. 155, p. 175). Lakatos argues that Popper can be read as a "sophisticated (pragmatic) methodological falsificationist" who sees that research programs are never definitively falsified, entering rather into "degenerating problem shifts", i.e. "crises" associated with theory sequences that use heuristically unmotivated and uncorroborated ad hoc adjustments in the search for new or better fits. The loss of heuristic power should be recognized as a bad state to be in, but one in which dogmatic tenacity may be of some scientific value. Normal science includes both degenerating and progressive phases. Unlike nonscientific naive trial and error thinking, both scientific phases involve "deductive guessing" guided by a rational research program, combined with the "determination to eliminate, under certain objectively defined conditions [the arrival of a superior alternative] some research programmes." (ibid., p. 177, including note 4). His demarcation of science from nonscience thus integrates Popper's attack on scientistic inductionism and Kuhn's very similar treatment of "deductive guessing"-- paradigm-guided puzzle solving!

One of Lakatos' most provocative claims vis a vis the Kuhn-Masterman emphasis on partial "incommensurability" is the claim that most history of science is, and should be "internal" history. By this phrase, which surely recalls the language of philosophical logic ("intensionality," and Hegelian-Marxian "internal relations," if not Aristotelian essentialism or historicism) he means activity following the protective self methodology of scientific research programs. /4It represents as well a claim that rationally reconstructable replacement of old research programs by their betters means a reductionistic, extensible, rational, unified account of knowledge cumulation is possible (recall unified reductionist, principles 1' and 3' of logical empiricism). This rational reconstruction takes place neither in the material world nor in the second world of consciousness, but in Popper and Platos third "world of ideas" (truth, standards, propositions, objective, articulated knowledge), which is independent of knowing subjects" (Lakatos, 1970, p179F plus notes).

Kuhn's views on the how and why of revolutionary scientific succession are parallel in certain respects to the Popper-Lakatos view, but in other ways very different. He stresses that the partial incommensurability of partly tacit ways of seeing and puzzle solving gives cross-paradigm conflicts a political or even religious character. With breakdown or disagreement over fundamentals, conflicts over the relative importance of different scientific values, over the institutions of training and research promotion occur; typically, cosmological views reinforcing or undermining different ways of seeing or generating data and its interpretations are involved. Scientific revolutions thus have the quality of dialetical "supercessions" in both their cosmological-metaphysical aspects, their exemplary ways of seeing, and in the rest of their disciplinary matrix as well. The extent of "revolution", however, may be limited to 25 or 50 specialists within a particular research community. The significance of such "conversions" to a new way of seeing and different research heuristics vary with the extent to which fundamental restructuring of their own and overlapping disciplinary commitments takes place.

As for hope that a rational logic can decide such matters or Lakatos' appeal to objective criteria for the supercession of a particular research program, he answers that no guaranteed rules, but the discursive reason of group discussion and debate is necessary for the choice among the competing values involved in such issues; the process involved is social-psychological and historical, even though various good arguments (none of them logically decisive) can be made, such as appeals to greater precision and scope, or simplicity or sensational new factual discoveries. (On these points, Feyerabend takes an even more extreme, "anarchistic" position arguing that no rules can guarantee progress, even rules inveighing against political interference or propagandistic arguments. In fact, Galileo broke such rules in promoting his at the time empirically doubtful views.) In what must have been most provocative, given the whole thrust of The Open Society and Its Enemies, Kuhn even argues that Popper's methdological appeals for more bold conjectures and serious refutation attempts are procedural maxims, not logical criteria. As such they are ideological (dared he to have said "historicist"?) appeals, part of a psycho-social influence process directed toward the scientific societal and philosophical communities.

Kuhn (in <u>Scientific Revolutions</u>, Chapter XI) and Feyerabend at great length
go on to make an argument that most modern historians of science tend, at least
in part, to agree with: that linearized scientific textbooks conceal the contro-
versial nature of most revolutionary scientific periods. This may be justified
in the interests of efficient inculcation of the exemplary skills necessary to
do normal science, but it downplays the incommensurabilities of cross-paradigm
choice, tends to give only the evidence supporting the winning side, and incorporate
the winning paradigm's rationalist reinterpretation of the succeeded program's
previous successes without noting the actual contradictions between the originally
stated positions. For example, Kepler's actual laws contradicted Newton's famous
formulas, even though the version of Kepler's laws we see in textbooks do not,
and Galileo's treatment of motion made for certain improvements in the prediction
of physical motion, but it lost the heuristic power of Aristotle's attempt to
conceive of causal relations characterizing both motions and emotions, physics,
biology and social reality.

IV. Dialectical Hermeneutics

There is a central reason for connecting the paradigms debate to the positivist
debate in German sociology. Both debates are explicitly about social science
methodology, i.e. historiography. All participants in that debate care deeply
about the appropriate way to write <u>principled histories (or interpretations) of
an important social activity</u>: <u>science</u>. I conclude this paper with a summary of
anti-positivist dialectical hermenuetics, as described in that debate.

But as an aside, I recall Kuhn's own story of his own discovery of interpretive
historical methodology, meaning for him . modern hermeneutics. When asked to
give some lectures on the origins of seventeenth-century mechanics, he decided to
find what Galileo and Newton had started from. One memorable, hot summer day, Kuhn
"all at once perceived the connected rudiments of an alternative way of reading the
texts" before him. For the first time he was duly hit by the fact that Aristotle's
subject was "change-of-quality in general, including both the fall of a stone and
the growth of a child to adulthood. In a universe where qualities were the

'ontologically primary and indestructible elements,' imposed on omnipresent neutral
matter, qualities constituted individual bodies or substances. In modern physics
bodies don't have identities; they are the subject of parsimonious, predictively
essential state variable characterization, like spatio-temporal location, mass,
velocity (momentum) and acceleration. But for Aristotle, since position was a
quality, motion was a change-of-state corresponding to child development; identity
was real, but preserved only in the "problematical sense that the child is the
individual it becomes'." (Kuhn, 1977, pxif) With this cognitive gestalt flip,
this new way of understanding, "strained metaphors often became naturalistic reports,
and much apparent absurdity vanished." What Galileo and others did was fundamen-
tally to revise the way of reading Aristotelian texts in order to say something
new. Thus Kuhn rediscovered "hermeneutics" at the same time he conceived his
dialectical idea of a scientific revolution.

A very early point made by Habermas in the positivism debate is that dialectics
"retains from myth an insight forfeited by positivism ... that the research process
instigated by human subjects belongs, through the act of cognition itself, to the
objective context which should be apprehended." In Radnitzky's book this becomes:15

1") (_Habermas' philosophical anthropology of science_). Distinctive research-guiding interests have always guided the sciences. In addition to naturalistic or technical interests in prediction and control, recognizable alternatives include the hermeneutic interest "in intersubjective mediation [roughly, "transmission"] of participatory understanding ... with respect to possible meaning of actions or of texts that connect contemporaries and past generations" (Radnitzky, II, p7) and the emancipatory interest, achieved through enlightenment, in freeing mankind "from the quasi-natural forces of history and society" (_ibid_.) Such knowledge interests are reflectively uncoverable not so much at the individual motivational level, but at the level of "_preconditions_ of the possibility of certain types of" knowledge-constituting activities (Radnitzky, I, pxxxix). Habermas links his three knowledge-constitutive interests to different media operating in the creation and maintenance of societies (work, language, plus steering and control); he further distinguishes clusters of science corresponding to the first three interests above: the natural sciences, the cultural sciences derived from philology, and the critically oriented moral and social sciences, (_ibid_, p6f). Hence the sciences are not "naturalistically" unified, as positivists or analytical-empiricists would have us believe.

To this list Radnitzky adds an anti-positivist, Kuhnian "interest in improving a [scientific cosmology of] worldpictures which contributes to knowledge growth and an "interest in improving reflection upon [ethically relevant] existential themes" (ibid., II, p12f) which influence the practice of life and are not buried in insignificance by universal or historical laws. "[A]nalytical philosophy cannot within its own frame reflect upon its underlying research-guiding interests, and cannot attain an adequate self-understanding." (ibid, II, p11)

Doesn't this view seem a much generalized version of Kuhn's emphasis on cosmological/ontological change in scientific revolutions and his insistence that hermeneutic consistency is an important scientific value, in some cases pointing in different directions than deductive falsification efforts? Doesn't such a broader conception of criticism fit Feyerabend's strictures against science governed wholly by the unitary methodological rules of critical rationalism of falsificationism?

2") (_emancipatory hermenutics_) Among the sciences now in existence, psychoanalysis, _non-uniquely_, best approximates the ideal for social inquiry. In the positivist dispute Adorno and Habermas are defending the "critical theory" orientation of the Frankfurt school, which has its roots in dialectical social theory (from Plato to Hegel to Marx), in Marxian historiography and in Freudian psychoanalysis -- traditions that Popper (and Hitler, for different reasons) severely attacked. In a series of remarks introducing the debate, Adorno uses the Freudian model of analysis repeatedly, also appealing to the dialectical ideal of seeking truth as totality. "Since the individual phenomenon conceals in itself the whole society," (Adorno _et al_, p. 39) we miss the reality that the "overwhelming majority of human beings tolerate relations of domination, identify themselves with them and are motivated toward irrational attitudes by them -- attitudes whose contradiction with the simplest interest of their self-preservation is obvious." The "core of the critique of positivism" by dialecticians "is that it shuts itself off from both the experience of the blindly dominating totality and the [weakly?] driving desire that it should ultimately become something else."

Following Apel and Habermas among others, Raditzsky distinguishes the cultural
sciences from the natural ones in terms of "entities with which the inquirer can
establish communication and may at least in principle enter into a dialogue and
those with which this is not possible," (Radnitzsky, II, p. 20f) thus updating
ontologically the older distinction between the understanding of meanings and the
explanations of objective things as knowledge-constituting interests or purposes.
He then characterizes psychoanalysis as a dialectical, yet complimentary combin-
ation of hermeneutic and emancipatory interests in self-understanding, achieved
in part by tacking between a hermeneutic inquiry and a technical search for causes.
[A]s soon as the causes [of compulsions] are recognized by [the individual] as
his hidden reasons, become intelligible as such, they cease to work casually.
...Thus psychoanalysis -- especially in the form of the criticism of ideologies
patterned on it -- provides the model for the process of the successive reduction
of the irrational elements of the historical dialogue in which humanity has been
engaged and which is an infinite process."

Ironically, Popper's bête noires have become ideal models for a political program
in some ways similar to his own but one paying far more attention to unconscious
forces, to social domination and to psychological repression.   Radnitsky argues
that such a psychoanalytic perspective synthesizes two variants of the hermeneutic
tradition, and objective interpreter's approach (Verstehen) and an engaged,
existential, dialectical or judicial approach emphasizing emancipatory understand-
ing. Popper's situational analysis approach is .   an individualistic rather
than a holistic version of only the former, however.

Both strands of the hermeneutic approach presuppose, and creatively take
advantage of: (5") (the hermeneutic circle) There is "No development of
knowledge without foreknowledge"   (Radnitzsky, II, p. 23). Here Popper's "No
knowledge without problems; but also, no problems without knowledge," fits
the objective interpretation (Verstehen) emphasis, while Habermas comes down
again on the existential: [T]he meaning of the research process as a whole must
be understood before I can know to what the empirical validity of basic state-
ments is related, just as the judge must always have grasped the meaning of
judicature as such." Habermas sounds positively Kuhnian (or should we say
vice versa?!) "The so-called [observational] basis-problem simply does not appear
if we regard the research process as part of a comprehensive process of socially
institutionalized actions [a disciplinary matrix?] through which social groups
sustain their naturally precarious life."

Habermas begins his "Postscript" to the Popper-Adorno controversy with a very
hegelian quotation from Adorno: "Societal totality does not lead a life of its
own over and above that which it unites and of which it, in its turn, is composed.
It produces and reproduces itself through its individual moments." (Adorno et al.
p. 107).

3") (The dialectical approach to totality) "Nevertheless," Habermas continues,
"[the reciprocal] relation of a system to its elements, which is hypothetically
represented in the deductive connections of mathematical functions, [but can only
be apprehended in their reciprocity] has to be strictly distinguished from the
relationship of the totality and its moments which can be revealed only in a dia-
lectical manner." *(Habermas, in Adorno et al., p. 131f).

Unpacking this way of thinking and speaking is difficult. The previous pages in this paper point to just how fundamentally different such dialectic thought is from the model of logical reductionism and hypothetical-deductive knowledge at the core not only of logical empiricism (principles 3' and 4' and 6'), but also the Popper-Lakatos program of objective, internally defined, rationally reconstructable knowledge.

A preliminary reading of such texts immediately suggests that both the ontological "logical atomism" of so much rational choice theory and the holism of various mathematically formulated systems theories are seen as inferior to the relational essentialism of Hegel and Marx. (Recall from Marx's sixth thesis on Feuerbach the claim that "But the human essence is no abstraction inherent in each single individual. In its reality it is the ensemble of the social relations.") Reflective social investigators, as well as the objects of their investigations, are subjective agencies seeking autonomy within the "objective" natural world of which they are internally related parts.

Habermas elaborates upon the psychoanalytic ideal, both its emancipatory use of naturalistic generalizations (critically treated as reifications or social objectifications, not inexorable natural laws) and its refusal to be totally satisfied with the self-understanding contained in merely subjective ideas and intrepretations. These depend in part on an "objective configuration of societal reproduction". Dialectics confronts the object with what it "seeks to be" when left to itself as compared to what it is; criticism is made in terms of the "tension of the possible and the real...." "By linking the method of [engaged] <u>Verstehen</u>

in this manner with the objectivating procedures of casual-analytic science and by permitting the realization of both through a mutually transcending critique, the dialectical approach overcomes the separation of theory and history." And it denies as well Popper's ideal of timeless, objective knowledge in a non-dialectical third world "independent of knowing subjects."

Naturalistic mathematics remains "external," in the dialectical perspective, to the "natural hermeneutics of the social life-world" even when objective, reified social regulaties are discovered. The intentional constitution of meaning and action is also necessary. Concepts "capable of expressing substance and function in one", not content-free "relational forms" of the Russellian variety are required. "Moments" of social totalities might be thought of as aspects of societal life-worlds that are unified or "reciprocally" and "internally" related in historical life-contexts by their essential (capitalistic?) generative modes of work, speech and control. These are not the "repetitive" or non-reflecting, lifeless systems for which cogent empirical science is possible. (Habermas in Adorno et al., p. 141)

(6") (dia-logical intensionality) "<u>Nor is totality a class which might be determined in its logical extension by a collection of all the elements which it comprises</u>;" (Habermas, ibid., p. 131, and Adorno, ibid., p. 3f); it must be dia-logically rather than monologically pursued.) Hasn't the repressed world of philosophical or dialectical logic returned? Bernstein and Giddens, <u>op</u>. <u>cit</u>., not remarkably similar anti-logical empiricist themes in much recent literature. Even Lakatos' "inner" history of science uses essentialist, dialectical language. As either a philosophy of social science or a kind of philosophical attempt to formalize the laws of correct thought,[11] dialectical logic cannot be considered rejected by contemporary philosopher-logicians, because too many scholars are working on it. Progressive increases in falsifiable empirical content and <u>corroborated</u>, theoretical claims are, <u>perhaps</u>, another matter for such traditions of analysis.

References to discursive reason or "dia-logic" are neither obscurantist scholastics no cute neo-logisms, but brief cues to much larger debates concerning the nature of truth, the democratic governability of advanced industrial societies and the scope of human rationality. For both Adorno, Habermas, Kuhn and Lakatos, social and scientific activities are "internally related" when metaphysical cores or essential human potentialities are involved. Habermas' opting for a "consensual" theory of truth treats Kuhn's argument in favor of autonomous scientific consensus as reflective of a much broader political standard, most fully realized when all participants are equally capable participants in very long dialogues or debates. Habermas (Legitimation Crisis, 1975) argues that a key issue is "whether the reproduction of social life is still bound to [practical] reason and, especially, whether generation of motives is still bound to internalization of norms that have need of justification." Since Kant practical reasoning has meant the critical hermeneutic search for the ultimate grounds of, or the universal laws appropriate to, particular practical arguments.

"[I]t must be possible to decide whether dialectics, as positivism asserts, oversteps the boundaries of verifiable reflection and merely usurps the name of reason for an obscurantism which is all the more dangerous; or whether, on the contrary, the codex of strict empirical sciences arbitrarily silences a more comprehensive rationalization, and coverts the strenght of reflection, in the name of precise distinction and sturdy empiricism, into sanctions against thought itself."   --J. Habermas, (Adorno et al, 1976, p. 143)

In the positivist dispute, Adorno agrees with Popper that critical rationality should be the organon of social theory, even though a somewhat broader conception of logic and reason (Hegel's "determinate negation") may be involved. (p. 113) Habermas openly admits the value of empiricists' concern with experience -- "[E]ven a dialectical theory cannot clash with an experience, however restructed it may be" (p. 135). But the cosmological/ontological concept of totality in Marx, Hegel and critical theory (all differently defined) and the vision of capitalism's structural "determinations" affecting almost everything in art, science and society have implications even for the logical empirical method of explanatory causal theorizing, with its appeal to naturalistic experimental testing procedures. As suggested by 3" above, "[P]robably no experiment could convincingly demonstrate the dependence of each social phenomenon on the totality" because 4") "the whole which preforms the tangible phenomena can never itself be reduced to particular experimental arrangements.... The critical path is not merely formal but also material. If its concepts are to be true, critical sociology is, according to its own idea, necessarily also a critique of society..." (Adorno, in Adorno et al., p. 113f).

Without arguing the many controversial issues such a principle raises, let me repeat one of Adorno's most suggestive illustrations of his dialectical treatment of material contradictions. "If social science...takes the concept of a liberal society as implying freedom and equality" and then "disputes the truth-content of these categories under liberalism" because "of the inequality of the social power which determines the relations between people," "then these are not logical contradictions which could be eliminated by means of more sophisticated definitions, nor are they subsequently emergent empirical restrictions of a provisional definition, but rather, they are the structural situation of society itself" (ibid., p. 115). This extremely provocative, but difficult example of self-contradicting constitutive definition builds from core assumptions about both a society's contradictory "essential" or "internal" organizing principles and its "inherent" possibilities for emancipatory transformation. Partly in the spirit of Popper's methodological

"nominalism" discussed above, I call this a "theory-laden definitions approach," and have tried elsewhere to suggest non-trivial, meaningful ways in which such definitions, as well as assertions using them, allow empirical testing and revision. (B. Ollman's Alienation and Elster's Logic in Society are most relevant here.)

7") (The Unity of Social Theory and Social Practice). Despite the disunity of knowledge interests and motives underlying and constituting social science knowledge:

a) social theory and practice achieve unity through the image of man's striving for emancipatory understanding inherent both in these knowledge constituting motives or interests of scientific discourse and in the practical reflections of the objects of investigation themselves. According to the consensual theory of truth, scientific discourse presupposes and hence should consciously reflect both the deductive and the practical rationality of all of society's members, each equally unconstrained. Hence, hermeneutic, emancipatory and existential interests directly connect parochial human practices with the general social theories such practices require, use or help generate. Technical interests in prediction and control -- even the concept of quasi-experimental "causality" used in the physical sciences -- also indirectly but instrumentally connect social practice and social theory. Clearly world-picture building activities -- to cite the last knowledge constituting interest Radnitzky adds to Habermas' list -- play a role in both the development of social ethics and the disciplinary "ways of seeing" characteristic of particular research programs or paradigms.

Nonetheless the reconciliation of the actual and the emancipatory possible envisioned by hermeneutic dialectics is not without serious alternative possibilities:

b) such unities of theory and practice, as actually achieved, will in varying degrees be flawed, distorted, or onesided. To say that theory and practice are internally related through mankind's search for emancipatory self-understanding is not to deny the failings involved in actual practice. Psychologically repressed, market-steered, power distorted, or parochially self-serving misrepresentations of totality may frequently be found. Critically detaching oneself from at least part of one's context is often scientifically required. But the haloed value-neutrality of Weberian objectivistic hermeneutics (descriptive Verstehen) needs critically to be superceded through realizations that a) the scholar is always engaged with the society or text he or she is trying to understand, b) his or her individual knowledge-seeking reflects, often unconsciously, mixes of social domination and emancipation interests; c) "values" themselves, however, one tries to realize, exchange or neutralize them, are as scientific concepts partially distorted, occluded conceptions of full human dignity.

TABLE 1: SOME CONTRASTING VIEWS ON VARIOUS ISSUES OF PARTICULAR SOCIAL SCIENCE RELEVANCE IN THE PARADIGMS AND POSITIVISM DEBATES.

Issue	Positivistic Logical Empiricism (Russell, Vienna Circle, Carnap, Nagel?)	Critical Rationalism or Methodological Falsificationism (Popper, Lakatos, Albert, Donald Campbell?)	"Revolutionary" Hermeneutics (Kuhn) or Methodological Anarchism (Feyerabend)	Dialectics (Adorno, Habermas, Zuñiga) or Dialectical Hermeneutics (Apel, Radnitzky? Giddens?)
Attitude toward Metaphysics	Antimetaphysical, favoring ontological reductionism toward analytical (logical) and synthetic (sensebased) truth (principles 1, 5')	Critical of historicist, and essentialist metaphysics yet cognizant of positive methodological role of atomistic and other ontologies, nonfalsifiable core assumptions, rational standards and positive research heuristics. Truth exists forever in an objective 3rd world of subjectless knowledge.	Emphatic on cosmological component in scientific revolutions, analogies and associated exemplary new ways of seeing associated with disciplinary communities.	Insistent on 3'', the primacy of social totalities acting through individuals; these exhibit contextual historicity, embodied transindividual subjects, the partial identity of subject and object, and the material unity of thought and action. Constructive linguistic reflexivity is an essential human characteristic.
On the Unity of the Sciences and Scientific Progress	Strongly favors such unity (1') and typically employs probabilistic verificationism (5'); knowledge cumulation is typically incremental.	Emphasize methodological principles of falsificationism and the rationally reconstructible internal history of science, including its revolutions when they occur.	Share with Popper et al. the values of truth, simplicity, consistency, fruitfulness, which are however of varying importance; emphasize the discontinuous nature of progress and consider rational reconstructions inadequate accounts thereof.	See a basic disunity (1'') of technical, hermeneutic and emancipatory knowledge-constituting interests; progress is dialectical--ultimately the increase of man's autonomy vis a vis nature and other (groups of) men.
On Naturalism and Physical Reductionism	Strongly favor (2', 3'), i.e. physicalism and the reduction of science to statements in an ideal logical language	Against inductive scientism, also nonfalsifiable psychoanalysis and falsified Marxist historiography. Popper sees sociology as governed by a weakly hermeneutic logic -- a situational approach not used in physics.	Kuhn sees hermeneutics as distinct from natural science; Like Adorno, Feyerabend refuses to identify the boundaries of valid knowledge with contemporary western science (citing Voodoo, acupuncture, etc.). Both oppose reductionism	(2'') Oppose historiography or psychoanalysis to physics, and humanism to naturalism; existentialist rather than historicist hermeneutics is preferred. The constructive appreciation of social-natural totality contrasts with "atomistic" social science in the service of administrative or technocratic interests.

On Logic, Deduction, Extensionality	Approves of Russellian logic or extensionalist metamathematics as the ideal language of hypothetical-deductive scientific theorizing (3', 4', 6').	Deductive logic is the truth-or error preserving organon of rational criticism, but there is no necessary fit of mathematics to nature.	Deny the logical nature of criteria for theory choice. Make problematical both the top down and the bottom up application of mathematical formalisms.	Against absolutizing, extensional deductive logic, (6''); favor dialectical tacking between part and whole, subject and object, theory and practice using discursive logic or "dialogic"
On Empiricism and Truth	Approves either a positivistic version in terms of observational primitives (5'a) or scientifically verifiable perceptions (5'b). Typically a correspondence theory of objective truth is offered.	Denounces the purely observational character of facts (basic propositions), opposes inductivism and objects to the verifiability conception of scientific perception; Popper accepts Tarski on the logical nature of truth, but grounds basic observations in "conventional" decisions by scientists.	Emphasize the tacit, nonlogical, consensually accepted knowledge embedded in basic observational statements (5''); Kuhn's exemplary ways of seeing which prefigure puzzle solutions are closer to the hermeneutic circle than Popper's or Lakatos' similar views.	Dialectical treatments of observations seek societal explanations and critique (4'') beneath hermeneutic meanings and empiricist pseudo-objectifications. Truth is the totality. A consensual theory of truth is given both scientific and political applications.
On Scientific Autonomy, Insulation and Value Neutrality	The logical systems ideal of science seeks autonomy by minimizing value relevance and insulating all stages of theory development.	Falsificationism doesn't deny societal inputs, but tries to correct for them through rational social criticism.	Kuhn usually defends insulation of science, but recognizes cosmological overlaps with social philosophies; Feyerabend defends some violations of autonomy	Science is seen as subordinate to organized practical interests; autonomy/neutrality claims are criticized in the light of social structures preventing genuine consensus and making autonomy less than it could be. (7'') Theory and practice are internally related.
On Social Reform	Commitment to a restricted form of enlightenment makes bureaucratic utilization easier; but this is not always consciously advocated.	Prefer "piecemeal social engineering" or experimentally corroborated reforms in open societies to violent social revolutions, i.e. "reason" over "revolution" (Popper)	Feyerabend, but not Kuhn, argues that anarchistic violence can be helpful in changing social epistemology.	On some occasions violent revolutions are appropriate; but a preference for democracy over totalitarianism is expressed.

1. Metascientific beliefs and values

   a) ultimately revisable ontologies, cosmologies or analogies; images of man and nature; nonfalsifiable core beliefs protected by (modifiable) negative research heuristics

   b) research-related policy concerns, value commitments and critical epistemological standards

   c) schematic answer forms, problem definitions, question sets

2. Originating exemplars and positive heuristics

   a) early applications of analogies or preoperational models in concrete problematic contexts

   b) technical exemplars, including experimental devices, mathematical manipulations and statistical procedures, seen as consistent with epistemological standards

   c) metascientifically appropriate positive heuristics, indicating research priorities and desirable stages in model development

   d) original evidence of exemplar success

3. Symbolic generalizations facilitative of exemplar application, including some empirically revisable theories

   a) metascientifically appropriate specialized logics/languages/formalisms useful for representational and inferential purposes

   b) ideal types, constructs or preoperational formal symbolic models that abstractly realize certain metascientific beliefs and values

   c) quasi-tautological symbolic laws, appropriately expressed

   d) auxiliary measurement theories that help concretize b) and c) above vis a vis 6a) below

   e) theoretical (re)specifications suggested by or consistent with the above, yet revisable in the light of experience (the "protective belt")

4. A cumulative literature, based on exemplars, also mediated through symbolic generalizations, containing some increases in corroborated content

   a) new evidence, from new contexts, of predictive, interpretive, explanatory or emancipatory success using possibly updated exemplars and empirically applied positive heuristics

   b) new data discoveries; corroborated auxiliary measurement theories

   c) other adaptive/transformative adjustments in 1), 2) and 3) vis a vis 6), such as
      i) a renewed list of puzzling phenomena or anomalies taken to be worth trying to account for by those trained in an exemplary way of seeing,
      ii) revised validity/testability standards, better meshed with metascientific and symbolic elements, or
      iii) constructed social realities tending to confirm the "worth" of the research paradigm

5. A scholarly community (re)producing and sharing most of 1-4 above, tending also to be heuristically or theoretically monopolistic within itself, but possibly multiadic and substructured

6. Its external research situation

   a) forgotten or unapprehended, research-relevant experience

   b) knowledge interests immanent in the research context: prediction and control, interpretation (including cosmology development), emancipation (including related existential engagements) interests as they affect motives and practices

   c) research paradigms either subsuming the present activities, overlapping with or externally competitive to them

   d) associated sponsorship/application contexts, at least tolerant of metascientific elements, willing to insulate day to day scientific activity, and supportive towards both research and literature cumulation

*Revised from H. R. Alker, Jr., "From Information Processing to the Sciences of Human Communication," forthcoming.

V. Summary and Conclusions

One can summarize the above debates either by highlighting essential differences in viewpoints, or by trying to synthesize in a compatible fashion the best arguments of both sides, the hidden unities of these debates. Tables 1 and 2, respectively, take each approach. In conclusion I hazard one further comment about the relation between social science epistemologies and political legitimation.

c

---   TABLE 1 ABOUT HERE   ---

Table 1 shows a remarkable comparability of views, once the effort has been made to track down corresponding views. The categories on which contrasts are drawn range from metaphysical views through conceptions of social science, the role of mathematics and logic, the quality of cumulative knowledge advance, and the relationship between scholars and their desciplinary and sociopolitical environments. One should note the extent to which Popper and Lakatos falsificationism, the Kuhn and Feyeraband positions are intermediate between the extreme positions in the Table.

---   TABLE 2 ABOUT HERE   ---

Relying heavily upon Lakatos, Kuhn and Masterman, supplemented by Habermas' important contributions on the role of the context of social research, Table 2 attempts a schematic synthesis of the research program, paradigm exemplar and disciplinary matrix ideas. The categories in the table elaborate upon those in Table 1. The contents correspond to incompletely articulated standards for judging the progressivity of scientific research. Philosophical issues are emphasized, but placed in the socio-historical context of the research in question. I hope this schema which requires and invites additional discussion, will be a contribution to further discussions of social scientific progress.

I have paid particular attention to the kinds of logics most appropriate to scientific political inquiry. In doing so, I have noted a number of formal revisions or extensions of the positivistic PM system that are at least partly relevant for "practical," "reflective" or dialogical purposes. But the issues are deeper. Scientific debate and knowledge cumulation is an ideal form of social practice for all modern/modernizing states. Whether such progress is best governed by positivistic logical "puritanism" the incremental development of internally or externally imposed dogmas, a liberal, open society full of contenders seeking discovery priority rights (Nobel prizes), revolutionary anarchism, dialectical hermeneutics or the liberal communism of scientific knowledge production (Bernal) makes a political difference. Does not the legitimacy of modern states depend in part on how successfully they accommodate their decision-making practice to some "scientific" ideal?

1. Although the footnotes of this paper are a beginning, I cannot pretend to give all relevant citations on this subject generally or the more specialized discussion of dialectical logic. The articles in the Poznan Studies in the Philosophy of the Sciences and the Humanities special issue on the categorical Interpretation of Dialectics are, collectively, one specially relevant source; they tend to reformulate dialectical ideas in standard logic, as does Jon Elster (using modal operations) in Logic and Society: Contradiction and Possible Worlds, Wiley and Sons, New York, 1978. Nicholas Rescher, Dialectics, State University of New York at Albany Press, Albany, 1978, introduces a new set of open-ended logical formalizers derived from Greco-Roman traditions of classical debate. His bibliography too is of help. And one should consult English sources like William Kneale and Martin Kneale, The Development of Logic, Clarendon Press, Oxford, 1978 (a standard account of the transformation of logic in the Anglo-Saxon world from Greek dialectics to post-Fregian extensional formalism) or Susan Haack's partly relevant Deviant Logic, Cambridge University Press, London, 1974.

   Three additional Marxist sources deserving attention are Henri Lefebvre, Logique Formelle Logique Dialectique, Editions Anthropos, Paris, 1969; P.V. Kopnin, Logica Dialectica, Editorial Grijalbo, S.A., Mexico, D.F., 1966; and E. V. Ilyenkov, Dialectical Logic, Progress Publishers, Moscow, 1977.

2. A face to face debate on the International Encyclopedia of Unified Science, Vol. 2, No. 2, Thomas S. Kuhn, The Structure of Scientific Revolutions, University of Chicago Press, Chicago, 1962 and 1970, took place at the International Colloquium in the Philosophy of Science held at Bedford College, Regent's Park, London 11-17 July 1965. Papers derived from this discussion appear in I. Lakatos and A. Musgrave (eds.), Criticism and the Growth of Knowledge, Cambridge University Press, London and New York, 1970. Due to Lakatos' death, the latest major contributions to the original debate are Paul Feyerabend, Against Method: outline of an anarchistic theory of knowledge, New Left Books, London, 1975; Karl Popper, Objective Knowledge: an Evolutionary Approach, Oxford University Press, 1972; S. Toulmin, Human Understanding (Princeton University Press, Princeton, 1972). See also T.S. Kuhn, The Essential Tension: Selected Studies in Scientific Traditon and Change, University of Chicago Press, Chicago, 1977.

3. The degree of misunderstanding characterizing the debates between Popper and Kuhn, their critics and defenders is perhaps even exceeded in the Popper-Adorno controversy reflected in T. Adorno et al, Der Positivismusstreit in der deutschen Soziologie, Neuwied, Luchterhand, 1969, reprinted in revised form as The Positivism Dispute in German Sociology, translated by G. Adey and D. Frisby, Harper Torch books, New York, 1976.

4. G. Radnitzky, Contemporary Schools of Metascience, University Books, Goteborg, 1968 and 1970 (available in the United States in an augmented and revised third edition, 3 vols. in one, Henry Regnery, Chicago, 1973). The author does a better job in clarifying and integrating the continental

"hermeneutic-dialectic" tradition with Anglo-Saxon "logical empiricism," using a rather Popperian "systems-theoretically oriented approach to meta-science with practical intent." (p. xii)

R. Bernstein's The Restructuring of Political and Social Theory, Harcourt, Brace, Jovanovich, New York and London, 1976, is remarkably similar in thematic coverage to Anthony Giddens, New Rules of Sociological Method: A Positive Critique of Interpretative Sociology, Hutchinson of London and Basic Books of New York, 1976.

5. I am departing from Radnitzky's text here not because of the importance of extensionality, which he rightly emphasizes, but because of his definition of it in terms of the Whitehead-Russell logical calculus (called PM), rather than in terms of the ideals that Whitehead-Russell and other mathematical logicians have sought, and more or less realized, in their formal linguistic constructions. My references are to: A.N. Whitehead and B. Russell, Principia Mathematica to *56 Cambridge University Press, N.Y., 1973, p8ff, xvff, 20ff, 72ff, p187, p201 and Appendix C, generalizing somewhat the notion of a "truth-function" (whose truth or falseness depends only on the truth or falseness of its arguments), Whitehead and Russell said that "A function of a [propositional] function is called extensional when its truth-value with any argument is the same as with any formally equivalent argument" (p72); otherwise it is considered intensional.

Atomic propositions in PM are monadic predicates like $R_1(x)$, or intensional relations of a multiadic sort (xR_2y, etc). "Logic is helpless with atomic propositions, because their truth or falsehood can only be known empirically." (pxviif). "[E]very other true proposition can theoretically be deduced by logical "methods" from the knowledge of all true propositions. (pxv). While mathematical logic "requires" extensions, "philosophic logic" supplies only intensions. PM's theory of calsses "reconciles these two apparently opposite facts, by showing that an extension (which is the same as a class) is an incomplete symbol, whose use always acquires its meaning through a reference to intension." (p72)

6. Radnitzky then goes on to suggest that this extremely crucial principle of extensionality leads to preoccupations in the logical empiricist program with problems of formally representing causal relations in some augmented version of PM (causal modelling?) The intensionalist character of ordinary discourse also required reformulation. It should be noted that the logical opaqueness to content and context of ordinary language is a crucial logical argument against abstract formal modelling made by ethnomethodologists and "dia-logic" critics of positivistic formalisms. N. Rescher, Dialectics, helps overcome these objections in his new formalization of the logics of debate.

7. Those readers who would like to check the validity of the above summary characterizations will have to go back to the sources I cite (and their sources). A good partial check would be to see how many of the variants of logical positivism described by A. J. Ayer (ed.) Logical Positivism, New York, 1969, differ from or fit into the "logical empiricist" position whose summary characterization, slightly modified, I have taken from Radnitzky. "Analytical philosophy" up until about 1945 would also fit fairly well here. Radnitzky is correct, I think, in separating "logical empiricism" and its "reconstructionists" from ordinary-language philisophy, pragmatic philosophy, and Popperian "critical rationalism" or Lakatos' "sophisticated methodological falsificationism" as recipes for scientific progress.

8. K. R. Popper, <u>The Open Society and its Enemies</u>, Vol. I (Plato) and
Vol. II (Hegel and Marx), Routledge and Kegan Paul, London, 1945 through 1962.

9. Some will recognize Milton Friedman's "Essay on the Methodology of Positive
Economics," (in his <u>Essays in Positive Economics</u>, Chicago, 1953) to be "Popper-
with-a-twist applied to economics...The idea that unrealistic 'assumptions' are
nothing to worry about, provided that the theory deduced from them culminates in
falsifiable predictions, carried conviction to economists long inclined by habit
and tradition to take a purely instrumentalist view of their subject." Mark Blaug,
"Kuhn versus Lakatos, or paradigms versus research programs in the history of
economics," <u>History of Political Economy</u>, Vol. 7, No. 4 (1975), pp. 399-433, at p.
399. Blaug's paper is a very clear and helpful (but incomplete) discussion of the
Popper-Kuhn-Lakatos debate, and it makes most suggestive applications of Lakatos'
position to economics. Among political scientists Gabriel Almond has particularly
emphasized Popperian views.

10. W.V.O. Quine, "Two Dogmas of Empiricism," <u>From a Logical Point of View</u>, 2nd
edition, Harvard University Press, Cambridge, 1961, pp. 20-46 at p. 22. It is
worth noting that Quine, a logician deeply sympathetic with the Russellian pro-
gram, had before 1960 rejected as dogmatic two of the core principles of logical
empiricism given above: "One is a belief in some fundamental cleavage between
truths which are <u>analytic</u>, or grounded in meanings independently of matters of
fact, and truths which are <u>synthetic</u>, or grounded in fact. The other dogma is
<u>reductionism</u>: the belief that each meaningful statement is equivalent to some
logical construct upon terms which refer to immediate experience." Although Popper
resoundingly rejects the second belief, he apparently still adheres to the "ana-
lytical" half of the first; nonetheless there is a certain conflicted tendency in
his thought to move in the same direction as Quine: "One effect of abandoning
[these two dogmas] is...a blurring of the supposed boundary between speculative
metaphysics and natural science. Another effect is a shift toward pragmatism."
(Quine, <u>Ibid.</u>, p. 20.) Lakatos, <u>op</u>. <u>cit</u>., p. 119, note 5 and p. 184, infers the
same tendencies in some of Popper's more sophisticated distinctions.

11. The issue of the appropriate meaning of "rationality" will come up below in
contrast between naturalistic and hermeneutic or dialectical conceptions of
social science.
   It might also be noted that any contemporary appeal to standard "deductive
logic" needs further specification concerning the extent to which it is entirely
"extensional" or "truth-functional" in the Whitehead-Russell sense. G.E. Moore
long ago showed that allowing a logical connective "is entailed by", or "follows
from the meaning of" (not the "if...then" horseshoe of PM) enables
one formally to represent intensionalist internal relations of the sort Hegelians
are typically concerned with. (Moore, 1921). Elster (1977) gives a related treat-
ment. A supreme logical positivist, Carnap, supplements PM with a special <u>modal</u>
predicate "N" ("it is necessary that") in order to characterize derivations appro-
priate to "analytical" or "intensionalist" inferences from the "meanings" of terms.
G.H. vonWright in <u>Explanation and Understanding</u> (Routledge and Kegan Paul, London,
1971, pp. 40ff) makes a strong case that "causality" is a modal concept requiring
intensionalist interpretation, perhaps one reason why Russell, according 4', does
not treat physical laws as causal. Modern philosophical psychologists have, more-
over, greatly expanded the intensionalist examples of PM (e.g. <u>A</u> believes <u>p</u>),
referring to the "opacity" of such contexts.

[12]Blaugh gives several nice examples of Lakatosian research programs, one of which we include for concreteness at this point, his (incomplete) description of the "neoclassical research programme in business behavior" derived from Latsis. The hard core is made up of "(1) profit-maximization, (2) perfect knowledge, (3) independence of decisions, and (4) perfect markets". Positive heuristics include "the analysis of equilibrium conditions as well as comparative statics." The protective belt includes several auxiliary assumptions: "(1) product homogeneity, (2) large numbers, and (3) free entry and exit." (Blaug, op. cit., p. 419, citing S. J. Latsis, "Situational Determinism in Economics," British Journal of the Philosophy of Science, 23 (1972): 209, 212.

[13]A superb discussion of the role of construct paradigms or partly tacit exemplars that account for the relatively "unproblematic conduct" of disciplined social science research is Sheldon White's unpublished "The Dialectic of Method and Theory in the Work of Psychology."

Briefly White's argument is this. Knowledge grows out of the applications of procedures. Paradigm communities can be identified in terms of "social proof structures," subdisciplinary "games" that are collections of procedures and associated partially tacit knowledge which standardize interactions with the world and allow agreements on reproducible patterns of experience noteworthy as "events". Some methodologically self-conscious procedures also exist within the social proof structure for distentangling replicable "factual" patterns from "artifactual" patterns seen as reflecting properties of such games. And there are procedures for mapping the "out there" patterns to constitute theories.

Comparing learning theory and psychoanalysis, there has been a clear tradeoff between parsimony replicable procedures and reproducible facts on the one hand and plausible consistency in the mapping of a much richer universe of phenomena on the other. Learning theory was slowed down in its progress because of the implausibility of its partial results, findings which nonetheless virtually forced it to abandon its behavioristic pre-theory; a dialectical consequence of behavioristic empiricism, however, was the gradual development of instrumental capabilities permitting the growth of empirically controlled cognitive learning research. Psychoanalysis has seen less empirical development since Freud, White argues, but it has benefitted from a "between-paradigm dialectic" that allows significant, if partial cross-mappings from information-processing, ethnological, genetic epistemological, mental testing and neuro-psychological traditions.

[14] My account follows Blaug, op. cit. p408, who cites I. Lakatos, "History of Science and Its Rational Reconstruction" in R. S. Cohen and C. R. Buck (eds.), Boston Studies in the Philosophy of Science, VIII (1971) at p91f.

[15] Jürgen Habermas, "The Analytical Theory of Science and Dialectics," pp131-162 in Adorno et al, op. cit. at p132. Habermas, like Adorno uses "positivism," as an epithet, but is more careful at most points to clarify what he means. The affinities of Popper with early Wittgenstein, Weber and Nagel appear to be what he has in mind as "analytical" or "analytical-empirical" philosophy.

In addition to previous cited sources the most impressive review of "Dialectical Logic Today" I have found is by Paul Piccone, _Telos_ 1 (no. 2, 1968): 38-83. It connects Hegelian and Marxian roots of the subject to recent philosophical thinking in the United States, plus Eastern and Western Europe.

Clark Butler, in "The Reducibility of Hegelian to Standard Logic," _The Personalist_, 1975, reviews three schools of thought regarding the formalization of dialectics: anti-formalist, presumably like Adorno and Habermas opposed to formalization; hyper-formalists arguing that a whole new kind of logic (typically 3-valued and self-referential) is needed; Butler advocates an extended standard approach allowing intensional meanings (as did Leibniz) and quantification over a universe of pre-dicate relationships, not just sets of objects to which propositions might truth-fully refer.

The text above, by making specific reference to linguistic reflexivity also raises the issue of self-referential logics, overzealously forbidden by Whitehead and Russell's theory of types in PM in order to avoid a whole class of self-referential paradoxes such as the Cretan Parmenidies' ambiguous assertion that "all Cretans are liars." As with other areas of logical development considerable technical progress has been made with the problem of non-contradictory self-referring predicates (see Varela's "A Calculus for Self-Reference," _International Journal of General Systems_, 2 (1975, pp. 5-24), V. Lefevbre, _The Structure of Awareness_, Sage, 1977, and B.L. Alperson's "Calculus of Interpersonal Phenomenology," _Behavioral Science_, 1975.