Controversy

A TALE OF TWO CONTROVERSIES: DISSONANCE IN THE THEORY AND PRACTICE OF RATIONALITY

by Martin Eger

Abstract. The relation between rationality in science and rationality in moral discourse is of interest to philosophers and sociologists of science, to educators and moral philosophers. Apparently conflicting conceptions of rationality can be detected at the core of two current socio-educational controversies: the creation/evolution controversy and that concerning "moral education." This paper takes as its starting point the recorded views of participants in these controversies; exhibits the contradictions and their effect on the public; relates these contradictions to developments in the philosophy and history of science; and suggests, in a preliminary way, one approach for dealing with the problem.

Keywords: creation/evolution controversy; moral philosophy; philosophy of education; philosophy of science; rationality; science education.

> Education is the laboratory in which philosophic distinctions become concrete and are tested.
>
> John Dewey

In the United States during the past two decades two educational controversies have become national issues: the creation/evolution controversy and the clashes concerning formal teaching of morals, values,

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and certain kinds of decision-making. The connection between these two problem areas has not been overlooked, but invariably it is the sociopolitical links that receive attention. First, there is simply the fact that conservatism in our culture includes people who favor creationism in the classroom *and*, at the same time, oppose most values programs now in use. In addition, a larger group of *religious* conservatives believes that the teaching of evolution—by emphasizing man's continuity with nature while depicting an amoral universe—does indeed have something to do with declining morals, as William Jennings Bryan thought. Since the academic world largely attributes the reactions in both realms to educational backwardness or bad reasoning, and since these appear to threaten the integrity of teaching, many scientists and philosophers have been helping schools to ward off the "attacks." However, nothing in the complaints themselves is seen as worthy of serious discussion.

This is unfortunate because a real cognitive question does exist. Although religious and political motives are involved, these should not eclipse the underlying epistemic difficulties in educational philosophy, especially since the same concerns, in one form or another, lie also at the center of debates in philosophy of science and more generally in the theory of knowledge. One consequence of these difficulties is that even in the educational domain the positions of the academic community itself appear dissonant on a basic point—a point, moreover, that the public is now asked to take very seriously. It has to do with *rationality*.

True, the "problem of rationality" has not, as such, captured the popular imagination. But just beneath the surface of these two controversies there lies the following profound question, at once practical and highly theoretical: *What form* of rationality shall be taught to the nation's children, and to their teachers, and to the public through state-supported schools?

The aim of this essay is two-fold: first, to sketch some aspects of a troubling situation, to tell a tale; and then to suggest that while we have been busy with symptoms, rather obvious causes have gone unexamined—causes that reach beyond the symptoms now in the forefront. I wish to show, contrary to prevailing opinion, that certain theories of education and the social disputes to which they give rise are related *not spuriously but logically*. Because this requires concrete examples, references to local conflicts that have actually occurred, I will draw in part on personal observation of one such series of events (Eger [1981] 1984).

The second half of the paper *begins* to show that the problem of dissonance is real in the sense that it cannot be easily disposed of; that it has depth, that aspects of it are manifest on several levels, and that the

most obvious attempts to dismiss it fail. Along the way I indicate why the difficulty at the core is serious enough to exceed the bounds of current controversies. However, it should be understood throughout that the entire presentation is introductory, and no attempt is made to offer solutions or conclusions embracing the problem as a whole.

The stage is set for conflict when certain features of human reason are identified as essential, and curricula embodying these features are developed without regard for side effects or interactions with the total cognitive environment. In North America, in the area of morals, the elements singled out recently for special emphasis have been the "critical attitude" and "choice among alternatives": "The child must be encouraged to develop a critical attitude toward conventional right answers, rules and authority, whether they appear in the form of the Ten Commandments or of parental guidance" (Gow 1985, 77). "Many children at age 8 may be ready and eager to engage in the give-and-take of selecting among alternatives. . . . [There are] six basic steps in the valuing process: 1. Recognition of need for choice. . . . 4. Free choice among alternatives . . . (The University of the State of New York 1976, 62, 89).

The first quotation refers to Clive Beck's "reflective approach" (influential especially in Canada). The second is from a New York State teachers' guide, but the substance of both is found as well in the theory of Lawrence Kohlberg, in "values clarification," "values inquiry," "values criticism," and in other methods described in the literature (Kohlberg 1981; Chazan 1985; Morill 1980; Simon & Howe 1972). They exemplify what are widely regarded as the two necessary components of a rational attitude in ethics and in general: the Socratic, skeptical, questioning stance, and the almost tautological idea that *where choice is absent thought is impotent.*

Why negative reaction to these principles arises in some quarters is not hard to imagine. Again and again, parents of all ages have complained that whatever the motives, the schools are in fact "driving a wedge between the child and his family." Radical skepticism, they charge, is a strong solvent. Where, for one reason or another, families cannot provide the kinds of arguments that satisfy a teenager and make the moral demands placed upon him seem "rational," there, as one mother said, it "most certainly upsets the house" (see Eger [1981] 1984, 213).

It is a mistake to believe that the local conflicts provoked by the application of this philosophy peaked in the 1970s and are now largely behind us. As implementation continues, opposition grows; and the dramas I witnessed years ago are reenacted—with a resemblance that is startling—in many communities today.[1] The question we must con-

sider, therefore, is why, despite abundant criticism both popular and scholarly,[2] the movement as a whole has not substantially changed its direction. Even the proponents of these programs cannot be happy if in fact upset houses and torn families are among the outcomes of their work. Why, then, are such side effects not deemed strong enough to overrule, or at least substantially modify, strategies that (rightly or wrongly) are so often seen as morally and cognitively relativistic, even destructive?

This question is important. Without understanding the motive and claim to legitimacy behind contemporary forms of moral education, the problem which is the target of this essay cannot be fully appreciated. That motive is nothing less than a renewed faith in the power of *rationality*—in its active form—as the only available protection against the kinds of threats that have traumatized our society, from racism to Watergate, from Vietnam to street crime. Because "other methods have failed" so dismally, it is becoming credible again that Socrates, not Kierkegaard, was closer to the truth: Evil is largely error (see Kohlberg 1981, 30). Behind the moral disappointment of our time lies the failure of our *cognitive faculty*. From this it follows that formal education has much to offer, *provided* it takes seriously "its special connection with rational explanation and critical dialogue: with the enterprise of giving honest reasons and welcoming radical questions. . . . Free rational judgment by the student. This is what distinguishes teaching from propaganda or debating . . ." (Scheffler 1965, 11).

Here we reconnect with a major theme in the story of our "coming of age"—an interest in the *manner* of thinking, especially the constraints that may be put upon it. The fear usually expressed is not of error, not of the propagation of falsehood; it is not in the first instance a question of content at all, but of "the structure of our ways of believing" (Green 1971, chap. 3). In basic as well as in higher education, we seem to be attempting to implement certain insights of the previous century, when men like John Stuart Mill expounded this theme with even greater force: ". . . assuming that the true opinion abides in the mind, but abides as a prejudice, a belief independent of, and proof against, argument—this is not the way truth ought to be held by a rational being" (Mill [1859] 1961, 226). Then as now, the perceived dangers were *indoctrination, authoritarianism*, and *narrow prejudice*. As Mill maintained that "Whatever people believe . . . they ought to be able to defend against at least the common objections," so now, leading theorists insist that "this demand for *reasons* . . . is *essential* to the conversation of instruction" (Green 1971, 29).

Of course, couched in such language, it is hard to see how the policy could be opposed by anyone. Yet the critical principle—our first element of rationality— involves us in such a compelling logic that those who accept it very soon make the second move. It escapes few people in our time as in the past that all the "radical questioning" and "honest reasons" are by themselves insufficient if those answers and reasons never have to contend with *alternative explanations*, if genuinely different frameworks for viewing the problem are kept out of sight. Particularly with social and moral issues, whenever "right answers" *only* are provided—*right reasons included*—there, it is widely believed, indoctrination is rearing its ugly head; for then, in effect, we are back to the old-fashioned, blinkered, "right-answer-inculcation-paradigm of knowledge" (Paul 1985, 2).

Michael Scriven has put the case most vividly: ". . . even if one believes that the old values are the best values, the reasons for—and against—them must be rehearsed by each generation or it will rebel against them" (Scriven 1985, 10); and this can be done only through frank encounter with *unorthodox* alternatives: "All the main examples should involve *highly controversial* issues of *considerable personal, social, or intellectual importance* that are *not seriously addressed in the regular curriculum*. Critical thinking is coping with controversy" (Scriven 1985, 12). Scriven is speaking of high schools here. He has in mind such matters as the decriminalization of marijuana, the criminalization of abortion, the effort at "containing communist aggression" in Afghanistan or Central America, the rights of homosexuals and fascists to teach in schools, and the banning of atomic weapons and/or atomic power plants.

It is here, where "reasonableness" demands the *radically* open mind, that educational strategy ignites its own fires. From 1978 through 1981 I observed at close range one such conflagration in a rural community in New York State. At the seventh and eighth grade levels, a school had put into effect programs embodying the approach advocated by Scriven (Eger [1981] 1984). Precisely the idea of "choosing freely," in the idiom of values clarification, or Israel Scheffler's "free rational judgment," caused not just dissent but incredulity—*incredulity that certain kinds of alternatives actually receive consideration inside the classrooms of a modern, civilized state, and thereby acquire a degree of legitimacy.*

In its defense, the board of education of this community invoked what the majority of its members clearly took as the established wisdom of the academic world. "To be a true value, it must be chosen freely," proclaimed an educator at a nearby college: "The one difficulty, he said, is found in the example of a shoplifter who has undergone this

process and still decides to shoplift . . . 'The difficult part is that you have to respect that decision if they have reached it intelligently,' he continued. 'At least in this approach, you are respecting the person as a decisionmaker and you keep the lines of communication open.'"[3]

However, respect is just what many believe ought *not* be granted: "I don't want my son *even to think* of running away to Canada when he receives a draft notice; if his country calls it's his duty to go." That reaction from a father, incensed at some of the school exercises. Answer: To ask a boy to consider this option is not necessarily to recommend it. If upon serious reflection he rejects it, he will understand much better the reason for his behavior. Then, rhetorically, the president of the board of education asked "at what stage in an individual's life should he begin to learn to think for himself?"

Because they were aware of the prevailing academic opinion, because state agencies seemed to concur, local officials repeatedly invoked such arguments to shield themselves from charges of amorality. Richard L. Morill, for example, a college president, requires that students in a values program "be encouraged and enabled to assume the role of someone with a contrasting point of view" (Morill 1980, 245). Kohlberg and his collaborators assure us that "exposure to real or verbal moral conflict situations, not readily resolvable at the child's own stage, and to disagreements with and among significant others about such situations" bring about exactly that "conflict-induced-reorientation" which is needed if we are to ascend to a higher moral stage (Kohlberg 1981, 146).

While there are differences between the proponents of the several values education philosophies, it is important to keep in mind that concerning these two crucial elements—"criticism" and "alternatives"—the consensus is rather close to unanimity. Despite serious opposition, educators have stood just as firm on the second point (the main bone of contention) as on the first; for this too is grounded in the illustrious tradition of western emancipatory thought. Mill's *On Liberty* is widely quoted with devastating effect as he lays bare precisely what is at stake: Even if the alternative "be an error, it may, and very commonly does, contain a portion of the truth; and since the general or prevailing opinion on any subject is rarely or never the whole truth, it is only by a collision of adverse opinions that the remainder of the truth has any chance of being supplied" (Mill [1859] 1961, 245).

In view of what is to follow, we will want to keep in mind every step in the logic of these classic passages. Evidently, "collisions of adverse opinion" are to be promoted not to satisfy some questionable principle of fairness, but in order to attain as much of "the truth" as may be

available on any subject—the argument is cognitive. Moreover, something else is at issue besides that first attainment: "Even if the received opinion be not only true, but the whole truth; unless it is suffered to be, and actually is, rigorously and earnestly contested . . . the *meaning of the doctrine itself will be in danger of being lost, or enfeebled* . . ." (Mill [1859] 1961, 246, italics added). Here one sees, in a nutshell, the theory, the application, the protest, and the defense. One sees the antecedents, elaborately spelled out, of Scriven's need "for each generation to rehearse. . . ." its views.

Little wonder, then, that backed by history and the finest thought of generations, leading educators are not inclined to compromise on this crucial matter. Somehow, the objections, the offenses (real or imagined) must and will be dealt with by the schools themselves; no doubt, the causes of whatever conflicts exist, and whatever complaints really are justified, lie in the local environment—misunderstandings, inadequately trained teachers, fearful administrators, all exacerbated by people whom rapid change has "made insecure."

This tempting response is heard frequently. It does contain a good deal of truth, and the venerable arguments on which it rests are still potent. Nonetheless, my purpose is to show that *because of the context* such a response is too narrowly conceived. Intellectually, it misses the thrust of the objections while underrating the opposition; socially, it fails to comprehend the genuine feelings of injury all this evokes. But to see that, and what I call here *the* problem, we must now continue the tale by turning to the second of our two controversies.

In the wake of the Arkansas "creationism trial"[4] of 1981-82, a large number of books have appeared for teachers, students, and those who "influence public policy," explaining the position of the scientific-educational community.[5] The authors take great pains to show that the objection to discussing creationism in the classroom is based primarily *on scientific and educational grounds*; that it is valid not only against legislative interference and demands for "equal time," but against *creationist arguments in science courses under any circumstances*: They "have no proper place in the science classroom";[6] "Creationism and evolution are mutually antagonistic and cannot survive in the same classroom" (Newell 1985, 14); "Like the belief that the earth is flat, creationism deserves *no* acknowledgment in the science classroom . . ." (Siegel 1981, 101). In fact, the most common state of mind among participants in this effort is (once again) *incredulity*—incredulity that "in this day and age" such elementary principles should have to be explained yet another time, such old battles refought. There is also the fear, openly expressed, that creationism might be given "equal intellectual respectability with evolutionary doctrine" (Asimov [1981] 1984, 191). Thus, speak-

ing as a philosopher of science, a witness for the State of California worries that "the court, by directing evolution to be taught as theory, not fact," awarded creationism an "implied legitimacy" (Siegel 1981, 101). The same anxiety was incorporated formally in a resolution of the American Anthropological Association.[7]

It is this standpoint that interests us, the justifications especially. The educational-philosophic reasons for excluding particular views *a priori* are familiar but as if from "the other side of the looking glass." Michael Ruse, philosopher of science, prolific writer on evolution, and major figure at the Arkansas trial, is somewhat more explicit than others, but his sentiments are widely shared. "One must offer children the best-sifted and most firmly grounded ideas that we have, together with the tools to move inquiry forward. . . . Unless we *exercise control over what we present*, the next generation will have no criteria by which to evaluate and advance knowledge. . . . All must agree that there has to come a time when *we have to cry 'finis' to the teaching of certain ideas. . . . It is an act of bad faith even to present such ideas as a possible basis of belief*" (Ruse 1982, 328-29, italics added; see also 1984).

What *would* happen if creationist views were discussed in schools? Analyzing the dispute as a philosopher, Phillip Kitcher describes the prospects:

> One may ask, why not let Creationists submit their case? Surely the truth will [win] out . . . Nor should we worry about a little wasted classroom time, *when a deeper understanding of the merits of evolutionary theory might be secured* by allowing students to think through the issues for themselves. *The argument is insidious. . . .* The previous chapters [of Kitcher's book] show that there is no genuine contest, no true comparison. What is in doubt is the possibility of a fair and complete presentation of the issues discussed above, in the context of the high school classroom. . . . There will be . . . much dredging up of misguided objections to evolutionary theory. The objections are spurious—but how is the teacher to reveal their errors to students who are at the beginning of their scientific studies? . . . What Creationists really propose is a situation in which people without scientific training—fourteen-year-old students, for example—are asked to decide a complex issue on partial evidence (Kitcher 1983, 174-76, italics added).

Yet the educational policy here enunciated is addressed to the same population (including teachers) that reads Scheffler, Scriven, Kohlberg, Richard Paul—on "critical thinking"—and through them also the words of Mill. Kitcher, as did Scriven before, reproduces Mill's argument with extraordinary faithfulness. But in one sphere that argument is gratefully embraced, in the other it is called "insidious"—and this despite the fact that Kitcher too believes the "study of science provides important training in reasoning." To be sure, I have juxtaposed pronouncements that are aimed in one case at *science*, and in

the other at something else. I will address that point, but for the moment let us continue the comparison.

In Kitcher's apologia, representative of a whole class of such arguments, an important question is raised: What age, level of maturity, and degree of relevant experience is required in order that a student profit by grappling with wrong or misleading or difficult arguments outside the domain of established ideas? We see a remarkable contrast when we put side by side the two answers widely accepted within academia—one dealing with human origins, the other with moral decisions. Regarding the former, Ruse supports Kitcher: "Exposing young minds to it, thinking that it passes for reasonable intellectual activity, reveals irresponsible behavior by the teachers. It is not simply mistaken: it is *corrosive*. Teaching scientific creationism will *stunt* abilities in all areas. . . . Thus, I say, 'keep it out of the schools' " (Ruse 1982, 328-29, italics added). On the other hand, speaking of social and moral concerns, Scriven gives quite a different view of "young minds" and the need to protect them from "corrosion":

> It is sometimes said that the problem with critical discussion of sensitive matters in the school is that the students are not mature enough to handle them. The first fallacy with this argument . . . is the idea that the students are not already facing major decisions demanding every resource of the critical mind. . . . The second fallacy is the assumption that the students will mentally mature when they leave school in some mysterious way that will offset ignorance. . . . But still we avoid biting the bullet, we refuse to give time to the opposition, we refuse to meet the entry requirement for a school that wishes to engage in true critical thinking and teaching. . . . The shock of discovering that Karl Marx's *actual words* are being read by our own innocent children. It is the threat to our own beliefs that strikes fear into our hearts when we hear about alternatives to them being seriously considered in our children's schools. This is defensiveness, insecurity. . . (Scriven 1985, 10-11).

A sweeping indictment, although many schools have in fact "bitten the bullet": A grant becomes available, a proposal is written—the program materializes. It *may* be successful, but sometimes it happens like this:

> The following are eighth grade Decision Making questions to the children of our school.
>
> Q. Which would you prefer to give up if you had to? A. economic freedom? B. religious freedom? C. political freedom? . . .
>
> Q. Do you think people should limit the size of their families to two children? . . .
>
> These are my questions to those questions. Who says "one has to" give up any of those freedoms? . . . Does an eighth grader really know if people should limit their families to two children? . . . What are they talking about? (see Eger [1981] 1984, 212).

Let us reflect a moment on this outcry in a local newspaper, so jarring yet familiar. Imbedded in the blunt, excited phrases, one can easily discern the argument of Kitcher—translated only to fit the situation. Translating the other way, we recover the full power of the academic form: What *the school* really proposes is a situation in which people without *political and economic* training, without *exposure to the psychology of parenting*—thirteen-year-old students, for example—are asked to decide a complex issue on partial evidence.

This complaint is widespread, ongoing, and consistent. Recently, a more articulate young women put it this way:

> They have them debate on information that they don't give students the ability to research . . . to have time to reason it with their parents, their peers, someone else who knows more about the subject. . . . The students would learn about socialism; they would divide the class up and would vote on different aspects of it—if it was right or wrong. Well, the teacher, in his eyes, believes he is teaching children all sides of the story, that they have the right to choose their own values. I don't agree. . . . I believe in a high school American Government class, the student should be in a position to see the good points of *our nation*, that they should understand the *background* and *basis* of our nation.[8]

I cannot say whether the ridicule greeting such complaints, and the charges of anti-intellectualism, are due only to the fact that the complaints are seldom put in proper academic language. I do know, however, that the *dissonance* between the conventional justifications in the two realms is not missed. In the community I visited, the conflict centered on decision-making and values; creationism was not a part of the public debate. However, off-stage, protesting parents repeatedly called attention to that second issue—sometimes with confusion, sometimes with irony—confronting the interested listener with the following question: If it is a good thing for children to consider all sorts of alternatives in moral decision-making, no matter how repugnant—stealing, cheating, betraying one's friends—all for the sake of developing critical reason and autonomy, then why, suddenly, when we come to evolution, is it far more important to learn *right answers*[9] than to think critically? Why *just here* are certain alternatives taboo, even for the sake of discussion—despite the fact that being wrong about a scientific theory of remote origins can never have consequences as grievous as being wrong in one's moral outlook?

The most troubling aspect of these disputes is that while some parents see a glaring contradiction in the philosophies of education frequently expounded for their benefit, to the academic community it seems to be no issue at all. Little if any discussion of it can be found in print, and at times it does appear that such discussion is deliberately avoided: Consider the *National Forum*, one recent issue with "critical

thinking" as the featured theme: Scriven's comments above ("critical thinking is coping with controversy"), and those of Richard Paul, are taken from its pages; and there are other contributions by leaders of the movement. However, alongside their exhortations is an article by Ruse, "Creation Science: Enough is Enough is Too Much," in which the dictum again appears that "the teacher must sift and sort, giving the student the best . . ." and that creationism in a science classroom would be as wrong as "to teach philosophy in a math classroom" (Ruse 1985, 37). It is striking that no article, not even a comment, dealing with the apparent contradiction is included. Yet if indeed the misunderstanding is all on the side of the public, then educators at least have a duty to *show why* the contradiction is in fact only apparent. If outsiders are troubled because they see the matter superficially, then they should be shown how a deeper analysis dispels the trouble.

One reason, perhaps, why this is not being done is that within the academic community the two controversies are not handled by the same group of people. Evolution and creationism involve biologists, philosophers of biology, and theologians. Decision-making and values programs attract the attention of psychologists, ethicists, and logicians. Possibly the right hand does not know what the left is doing. If so, the result is serious because while on the academic side there may be two different sets of speakers, on the public side there is often one and the same audience—comparing messages.

Sometimes the issue *seems* to be addressed. It is said that exclusion of creationist ideas from science classes is not a violation of "fair play," or democratic procedures, or the appealing notion of "letting all sides be heard"—because science study must not be confused with debating, politics, or the judicial process; biology lies in a different sphere—it never was intended to be "democratic." However, this kind of answer misses the point. The dissonance does not arise in comparing classroom teaching with civic action outside the school; no one demands that political methods be imported into science. The context in which evolution is taught, and in which that teaching is viewed, is the scholastic environment itself: the various decision-making and critical thinking programs already in full swing and praised every day. The issue, in other words, is not fair play but *rationality*—rationality in the *search* for knowledge and rationality in *transmission* of knowledge.

Conventional Wisdom and His Problems

It is time now to bring into the picture the main objections. However, since many of these have already been heard in the current debates, I will summarize—or rather characterize—certain vital features of that

opposition. Consider, therefore, the most common demurrers *as publicly voiced*—as phrased perhaps by a man I call "Conventional Wisdom." We shall see that the relation to politics has yet another aspect.

"Very clever," says Wisdom, "you have indeed shown us an ingenious juxtaposition, which, on first sight, seems to expose something serious. However, you are comparing oranges with apples. *On Liberty* is an eminently *political* treatise—political, that is, in the problems to which it is addressed. That is why the expressions Mill uses are appropriate: 'adverse opinion,' 'received opinion'—the key word is 'opinion.' There is a difference between *opinion* or *belief* on the one hand, and *scientific knowledge* or *fact* on the other. Mill's views apply very well to the former; for the latter they are almost irrelevant.

"True, Mill champions diversity of opinion as a *cognitive advantage*, not for the sake of some dubious intellectual egalitarianism. Yet it is *politics* to which his thought is directed. Though all fields of inquiry involve cognition, we must distinguish between the different types of questions asked. You might argue with your doctor about the *value* of his services or the *justice* of his fee, but you do not argue about whether your appendix should come out.[10] Medical theories are tested empirically and methodically. Karl Popper made this distinction when he introduced his criterion of falsifiability—and we forget it at our peril.[11] Yet Popper's criterion is only a way of making more precise what is obvious to common sense: We no longer debate whether the earth goes around the sun; we do not doubt that apples fall *down* from trees, rather than *up*, even when the theory of gravitation undergoes a revolution;[12] although we continue to argue about Aristotle and Marx, socialism and the categorical imperative.

"If parents here and there see in this a contradiction, the mistake is theirs. For such people, some appropriate educational literature does seem to be called for. However, to suggest that when schools promote unrestricted debate on *political and moral issues*, they are somehow at fault for not doing the same in *science classes*, is absurd. The implied, basic argument is a *non sequitur*."

Conventional Wisdom may not be a philosopher of science, but neither is he a fool. Immediately, he zeroes in on the main point; he senses the power of the principle of insufficient reason: If there were *no difference* between science and morals as cognitive fields, then surely the burden of proof would fall on those who nevertheless object to using the same approach in both areas: "Why not?"

This point will occupy us in the next two sections. At the root of a socio-educational dispute, we find, strangely enough, a classic issue in the philosophy of science: a version of the problem of demarcation—not between science and pseudoscience, but between natural science

and morals. No doubt science and morals do differ cognitively and in other ways. What is less obvious is whether these differences are relevant to critical thinking. Are the two fields different in the *structure* of their rationality? Einstein thought not: "Ethical directives can be made rational and coherent by logical thinking and empirical knowledge.... Premises play a similar role in ethics to that played by axioms in mathematics.... Ethical axioms are found and tested not very differently from the axioms of science. Truth is what stands the test of experience" (Einstein [1950] 1953, 779).

These words, provocative as educational policy some thirty-five years ago, could well be an epigraph for a current textbook. To the extent that the foundations of moral discourse continue to shift from a religious base to a rational one, to that extent does science, as *the* model of rationality, become *the* model for morals also. Yet with time, the trend becomes increasingly problematic. For if the core of rationality does include the two elements we have picked out—"criticism" and "alternatives"—then why should not *the* model exhibit them in greater measure than all other fields? It is this that many people sense but often cannot express properly. In morality, in politics, in social problems—criticism and alternatives are the hallmark of *active reason*. And in natural science, *the pride of reason*—there not?

One more excerpt from Mill, not often quoted, is worth quoting at length:

> But, someone may say, "let them be *taught* the grounds of their opinions.... Persons who learn geometry do not simply commit the theorems to memory, but understand and learn likewise the demonstrations; and it would be absurd to say that they remain ignorant of the grounds of geometrical truths, because they never hear anyone deny, and attempt to disprove them." Undoubtedly: and such teaching suffices on a subject like mathematics, where there is nothing at all to be said on the wrong side of the question.... But on every subject on which difference of opinion is possible, the truth depends on a balance to be struck between two sets of conflicting reasons. *Even in natural philosophy, there is always some other explanation possible of the same facts; some geocentric theory instead of heliocentric, some phlogiston instead of oxygen; and it has to be shown why that other theory cannot be the true one*: and until this is shown, and until we know how it is shown, we do not understand the grounds of our opinion (Mill [1859] 1961, 226, italics added).

Mill, writing with a judgment whetted by philosophy of science, reached this position more than 300 years after Copernicus, some 250 years after Galileo's discoveries.[13] Today, following his logic, we may well ask whether "keeping creationism out of the schools" is not one reason why biology teachers are often *incompetent* to answer the classic challenges to evolution—never having faced these challenges themselves as did Darwin.[14] In New York City for example, teachers are

advised ahead of time to redirect such questions to the experts, questions that any bright teenager might ask.

On the one hand, Einstein's remarks indicate that normative ethics can, or should, resemble science as a process; on the other, Mill insists that in regard to methodological pluralism, the educative aspect of natural science ought to resemble ethics. By now these hints have been developed substantially, as part of a trend; and that is the first, clearest, reason for the decreasing plausibility of the argument "from unlikeness." Although the story of this "narrowing of the gap" is not new, its consequences for education and for a more general understanding of the role of science in society have yet to be assessed. It should be useful, therefore, to outline briefly the themes within that story directly relevant to the issue before us. Although the argument from unlikeness is broad enough to include several independent thrusts, we will focus on just one of these—however, a basic one. I want to show not only that it fails but that this failure leads to still other revealing questions.

Narrowing the Gap

Conventional wisdom continues to assert the relevance of the fact/value dichotomy, recent arguments to the contrary notwithstanding. Repeatedly, during these controversies, the public is told that science uses objective methods to establish *facts*, provides explanations based on *law*; and because of this all competent persons can agree on the outcome. Moral inquiry on the other hand depends strongly on the connotation of key concepts, which involve *judgment* and therefore *values* on which humans may justifiably differ. Even if the primary values are not in dispute, individuals assign to them their own priorities and weights; and if primary values *are* in dispute, then the very meanings of basic concepts—such as "murder"—may not be understood the same way by everyone. From this difference in the nature of the object of knowledge we are asked to infer a difference in the nature of study.

The implication is that reason enters moral decision on a high level, but as a guiding principle, not as algorithm; while in science, alternative major theories simply do not have the same status as alternative ethical standpoints. Scientific rationality is best exemplified in the testing of low-level hypotheses, where it takes on the form of rule-governed procedure. Yes, science too has its uncertainties and disputes, but not interminable disputes; as data accumulates, a consensus emerges for one or another of the alternatives, and the frontier moves on. We know from experience that students need not retrace all the wrong steps of the past; and if they are to make progress, to reach the frontier, they *cannot* do so. Isaac Newton said it best: We see further because "we

stand on the shoulders of giants." To study science is to climb up on those shoulders.

No one should underestimate the force of this line of thought. Its apparent self-evidence, coupled with the long-standing agreement of scientists and moralists to "restrict" themselves to their own proper fields, accounts to a large extent for the continued strength of this view, although for some time we have known that the picture is much more complex. Recent work has emphasized the opposite idea, with the result that "restrictionism is dead as an intellectual option" (Graham 1981, 381).

It is a basic point of my argument that the simultaneous pressure of both the old insight and the new—respect for demarcation, and its decline—has much to do with some of the current strife. From the past, a deeply rooted, still viable, essentially positivistic concept of science seeks to keep the barriers of restrictionism effective (especially against penetration *into* science). At the same time, a number of developments in the sciences themselves, in their history, sociology, philosophy, *and* in other fields, tend to erode these barriers (see Laudan 1983).

I would like to pick from this latter category two such developments or movements to indicate how the breaching of the barriers from both sides intensifies the pressure on education. The first, associated with the work of Thomas Kuhn, takes as its raw material actual scientific practice, and is called sometimes "the new philosophy of science"[15] or "the new wave" (Laudan 1984, 13); the second, examining in a modern perspective the nature and logical basis of norms, provides a theoretical framework for the present revival of moral education.[16] Both trends are well known, but their combined impact carries an additional message. This message, while not decisive in itself, has to be taken seriously because it shapes indirectly the climate of opinion surrounding the kinds of controversies with which we are dealing.[17]

What Kuhn and other historians, sociologists, and historically based philosophers have put before us is, of course, more than delectable stories about how scientists "fudge," use "intuition" and "propaganda," "break every rule in the book," and follow only in routine "puzzle solving" that hypothetico-deductive recipe taught so solemnly in schools.[18] They find a serious qualitative difference between science as it really is and as it is pictured, especially in regard to the role of *method* and of *values*. Certainly this work has been criticized.[19] What has survived criticism is the recognition "that the appraisal of theory is in important respects closer to value judgement than it is to the rule-governed inference that the classic tradition in philosophy of science took for granted" (McMullin 1982, 8-9).

Whether this appraisal of theories takes place during brief periods of "crisis" and "revolution," as Kuhn believes, or more frequently and evenly as some others insist, the point is that at such times the differences between scientists lie in the weights each attaches to the various desiderata: accuracy of prediction versus economy in assumptions, fruitfulness versus consistency, and so on.[20] Therefore, as one scientist explained recently in words amazingly close to Kuhn's, "science is an intensely personal enterprise. . . . In every real scientific problem I've seen, the evidence by itself never settled anything because two scientists of different outlook could both take the same evidence and reach entirely different conclusions. You eventually settle the differences, but not because of the evidence itself but because you develop a preference for one set of assumptions over the other."[21]

Nor is it just a matter of shared values *internal* to science itself; metaphysical bias, aesthetic preference, world views, even religious leanings all play a role.[22] The reason is not deviation from some ideal process but a feature increasingly recognized in the philosophy of science—that theories are *underdetermined* by empirical evidence. Something else *must* enter. Imre Lakatos, for example, after trying to save as much method as he could in reworking the Popperian philosophy, concluded that "The direction of science is determined primarily by human creative imagination and not by the universe of facts which surrounds us" (Lakatos 1970, 186-88).

Even allowing for a deliberately provocative style in some pronouncements, the meaning of these studies is unmistakable. If "creative imagination" or "sets of assumptions" have *such* weight, then at the very least the rationality of science is not bound to method as closely as hitherto pictured. When *judgment* based on *values* is the mode of decision-making at the highest level, then reasoning in the scientific realm looks much like that in the *politico-moral* realm.[23]

In just this way, discussing the legal status of marijuana as Scriven urges, high school students apply accepted values—health, personal freedom—each according to individual judgement, using individual relative weights. Many educators believe something valuable is to be learned by seeing how others do it, and by practicing this sort of judgment oneself. Thus, in light of the new philosophy of science, especially its indirect effects on language, on forms of thought, on public debate, we must not be surprised if some say "but if *science too* depends on judgement of this sort, why shouldn't one practice it when studying *that*?"—our old question. However, let us now note the trend on the other side.

Concurrent with this development in "science-studies," mainstream academic ethics seems to be flowing in more or less the opposite

direction: away from relativism, decisionism, the extreme subjectivisms of earlier times (fostered by a positivism that made much of the is/ought dichotomy), and toward what might almost be called a *scientific approach*—the one indicated by Einstein. Today we hear frequently that "any science is significant for ethics on account of the ways in which it serves as an embodiment or exemplar of applied rationality" (Toulmin 1980, 59). Or, more boldly: "One can learn to think ethically much as one learns to think scientifically" (see Morill 1980, 46).

This should surprise no one. In the English-speaking world, with philosophical attention on deontological theories and on approaches that are increasingly analytical,[24] some papers have the structure of typical "puzzle-solving" attempts of the mathematical sort. Ethics is losing its "soft science" image. Meanwhile, in the public schools, there is growing pressure to "do something" about the much-discussed moral vacuum, *and*, at the same time, to satisfy our religious and cultural pluralism—a feat that can be performed most easily by teaching morals with the barest of content! What theory promotes, practice invites, leading to a natural consensus—the consensus for *formalism*: ". . . those who object to a formalist definition of morality have no positive alternative to offer except (1) morality is what is in accord with my own system, or (2) morality is relative."[25] However, formalism in metaethics leads naturally to formalism in normative ethics and decision-making. A formalist conception of morality itself suggests formalist models and highly abstract thought experiments (dilemmas) to which, not surprisingly, formalisms such as game theory or decision theory may be applied, as well as insights gleaned from computerized "value driven decision systems."[26] All this, so characteristic of recent work, creates an environment in which any *physicist* can feel at home.

The influence on teaching, at least on its theory, takes place through a kind of two-stage process, the beginning of which is merely the idea that if moral education is to be serious then *rationality* must occupy the central place (see Bok 1976, 28). When we add an understanding of the "moral point of view" as a formal structure of thought, then the first stage is complete. This in itself is a giant stride toward the methods of science even without attempts to emulate specific practice. The noteworthy feature of the second stage, direct emulation, is that the model of science used is wholly positivist and almost untouched by the "new philosophy." As a result, in many moral education programs the premium is on systematic procedure, rules for thinking, tight verbal argument, graphical schema, and technical jargon. If morality is recognized by its form, why not *teach directly the proper form*, the *process* of thought in six steps?[27]

Moreover, the continued existence of programs such as values clarification, widely criticized as too affective, in no way invalidates what has just been said. For in seeking to protect their legitimacy in the face of pressure for cognitive rigor, these programs too insert into their practice "subroutines" that embody the sorts of features listed above (thereby becoming at once "affective" and "scientific"!).[28] The shift, then, is *from morality as synthesis involving judgment in the broad sense, toward morality as procedure, as skill.* Of course, I am speaking only of the direction of the shift; all judgments in moral thinking cannot be streamlined, and all procedure is not algorithm.

Yet the antiparallel nature of the two movements is clear. While natural science is increasingly viewed by scholars as a "human," personal, and social endeavor, moral education is steadily taking on the aspect of a formal discipline. As *faith, metaphysics, conversion, discipleship, trust, dogma, anarchy, judgment* play a greater role in descriptions of physics, so in the teaching of values—even to thirteen-year-olds—the vocabulary now includes such terms as *equilibrium, rank ordering, decision model, decision point, risk strategy, utility function* and *maximin*.[29] The net effect of these two thrusts has been to narrow the gap between the image of the "hard" sciences, long synonymous with method and objectivity, and that of the humanities, whose reputation (in our time) is the opposite. Especially noticeable is the fact that by directing attention to the *un*common—to crises, revolutions, and theory choice—the recent historical philosophies have uncovered the "ought" in science. For at such times, the big questions are: Which theory *ought* we use, accept, support, or believe? In morals, however, since we now focus on the *common*—the universal and nonindoctrinating elements—naturally, the opposite effect occurs, and we find in the foreground *objective procedure*.

Note, however, that it is not just the extraordinary in science that shows a likeness to moral thought. The new philosophy has taught us also to appreciate the conservative side of scientific practice. Balancing Paul Feyerabend, there is Michael Polanyi; and Kuhn, of course, has a hold on both ends. When a paradigm is well in place, its function is to provide the practitioner with "exemplars" of problem solving precisely because scientific knowledge is *not* wholly embedded in theory and rules. Theory often involves entities or processes that are not completely defined, causing problems of denotation. Sometimes this is because exhaustive definition would be too cumbersome; sometimes the concept is not yet clear. Theory also includes terms that can be understood only as part of a language, and thus there are problems of meaning.

Kuhn then sketches a picture of science education that has startled some people. The learner, it seems, is supplied with model solutions *showing* what the theory and rules really mean; then, forming new notions of similarity, he begins to *recognize* his own problem as one or another of the exemplars, and to solve it by *imitation* (see Kuhn 1970, 187). Because imitation is not just for beginners, but is practiced at the highest levels, Kuhn maintains that this reveals something very important: Stability in science, when it occurs, can be understood only on the basis of a practice in which "tacit knowledge" embedded in the paradigm is passed from one generation to the next in a chain of imitations which, viewed as a whole, constitutes what can only be called a scientific *tradition*.

Here is something to ponder. In other sectors of education, students and teachers are accustomed to *oppose* tradition with the scientific method; hardly anyone believes this amounts to replacing one tradition with another, or that imitation counts. Imitation is important in religion, politics, or the raising of children, where fairy tales, folk heroes, histories, and saints' lives all have a well-known role. We can understand that the Ten Commandments—rules—are not enough for the learner because in the absence of exemplars as Kuhn says in another context (see Kuhn 1970, 188), "the laws and theories he has previously learned would have little empirical content." The rule states: "Do not murder,"[30] but how are we to know what "murder" is and how it differs from other kinds of killing until we are shown examples of murder and examples of non-murder, and after that, human models who distinguish murder from non-murder. In Kuhn's perception (see Kuhn 1970, 187), most of the time a law is not really a law but a "law-sketch" or a "law-schema" which must be interpreted "as the student moves from one situation to the next."

If as a description of physics this still seems strange, in the realm of morals it is only too familiar. After Raskolnikov kills the old woman in *Crime and Punishment*, he finds out it is murder, although at first he did not think so. By following his story, the reader too is enlightened about "Thou shalt not murder." One does not learn from Raskolnikov alone, or from King David, or Brutus, or the troubled and heroic figures of our own time, once and for all what is and is not murder; but taken together, thought about, invoked repeatedly, they do in fact fill in the meaning of a law which we also find "schematized" in a few words.

Certainly this is a *traditional* approach to morality, not now at the center of scholarly or educational interest.[31] Yet precisely for that reason Kuhn's theory links science with morals in a particularly impressive way. For despite moderation, his "sober middle ground" between the "left" and "right" wing of the new philosophy actually embraces the

typical "nonrational"[32] elements of both extremes. During rapid change, he points to pluralism in the application of values; in times of acceptance he calls attention to corporate authority. Both features intimate a logic closer in one way or another to the politico-moral than to the conventionally scientific.

Taking note of this unexpected turn toward "subjectivism and relativism" (and shaking his head sadly), Alasdair MacIntyre believes we are witnessing in the philosophy of science a "recapitulation" of the history of ethics and politics. Comparing the two realms man for man, he sees in Feyerabend a revival of Emerson, and in Polanyi a reincarnation of Edmund Burke (Popper, in this mapping, is Mill!).[33] Because Feyerabend (1978) is so thoroughly convinced of the inefficacy of method, and because he views scientific theories as ideologies unbounded even by those minimal constraints imposed by Lakatos, his picture of science resembles the moral situation *in its modern, anarchic mode*. On the other end of the spectrum, we have Polanyi's master-apprentice relation (1958)—calling on trust, enduring by faith, providing the glue that holds the enterprise together. This too shows science and morals to be close cousins, but only if we view the latter in *traditional* terms.

Against this background, spanning both extremes with a two-phase process, Kuhn's scientific world resembles the moral *both* in the modern *and* in the traditional conception of the latter—or one could say that if morals *in the traditional sense* undergo periods of stability and of transition, then Kuhnian history of science reveals the correspondence at *every* phase. It reveals also the thrust of the movement[34] of which it is a part. Explicit, formally teachable, rule-governed method is downgraded all along the spectrum of views in both the static and dynamic aspects of science.

Let us pause here to take stock of the argument thus far. I have shown, first, that controversies over moral education and over the teaching of evolution are viewed by some people as linked in a way not acknowledged by the educational and scientific communities. I then suggested that *prima facie* this is indeed a logically valid linkage, centering on the concept of rationality; and the problem is that two different kinds of rationality are offered to the public and to students at all levels. In moral education, one form emphasizes methodological pluralism based on a philosophy of which Mill is the best exponent; in natural science, another emphatically rejects such pluralism, basing itself on the hypothetico-deductive method *within* the bounds of established paradigms. The problem is to justify this difference or in some other way to respond appropriately.

Because it appears that any successful justification would have to rest on a relevant distinction between the study of science and the study of morals, we considered a first order argument of this type, which calls for discussion because it is *socially and professionally operative*. It is used widely, is directed at the educated public (including teachers), and is made by responsible members of the academic community.[35] The argument rests on a cognitive demarcation in which science is characterized as a *logic*, operating on observation statements, by algorithm and explicit methods that lead to convergence of conclusions; while in morals, judgment is *expected* to result in *divergence* of conclusions. I then pointed out why, today, such an argument cannot convince those who have been made aware of a new philosophy of science and of what amounts to a new approach to moral education. Since these developments effectively erode certain criteria of demarcation, they surely weaken any argument based on those criteria.

Now we can go further. By examining the implicit interests and perspectives of the parties involved, the inadequacy of the conventional argument can be made more specific.

The Context of Education

One obvious question is this: Do any of the principals on the theoretical side—those responsible for narrowing the gap—have anything to say that bears directly on the educational problem? From their point of view, it might well seem that if methodological pluralism is to reign in moral education, then in science too it should be respected. However, on this point the testimony is sobering: Feyerabend does indeed advocate just such a course, but Kuhn, interestingly enough, comes to the opposite conclusion. The reason for this difference is suggestive.

Feyerabend, following unflinchingly the logic of his own analysis, does not shrink from coming out on the "wrong side" of the creation/evolution debate. "A scientist," he writes, "must compare ideas with other ideas. . . . He will retain the theories of man and cosmos that are found in Genesis . . . to measure the success of evolution and other 'modern views.' He may then discover that the theory of evolution is not as good as is generally assumed and that it must be supplemented, or entirely replaced, by an improved version of Genesis."[36] Thus, when "some opponents of evolution in California in the seventies" applied the "counterforce of public action" to hedge and amend the teaching of evolution there,[37] this was a healthy sign, says Feyerabend (1978, 307), and we should "follow their example." In short, views like those expressed by Michael Ruse, quoted earlier in this paper, are but an instance of the "chauvinism of science."

According to Kuhn, however, such "chauvinism" is not only "normal" in his special sense of the word, it is beneficial. Science *requires* conformity in a profound way, as an approach—indeed, the only possible approach—to radical change. This Kuhn tries to show when he traces how, by a single-minded persuit of the dominant paradigm, one reveals the limits of that paradigm, thus making way for the next paradigm (Kuhn 1970, chap. 6). His is a *methodological* dogmatism. Accordingly, a training in the conservative mode of science is just what is needed; and this, speaking normatively, means nothing less than *respect for authority*—the authority of the reigning paradigm. One can only conclude that science education must be *different* in a basic, cognitive sense since today such a prescription for the humanities or social sciences invites only contempt.

Yet, on closer examination, we quickly discover that Kuhn and Feyerabend are not talking about education in the same sense or in the same context. Kuhn describes the *needs of a profession*,[38] freely admitting that in satisfying these needs there are drawbacks: "Of course this is a narrow and rigid education, probably more so than any other except in orthodox theology. But . . . *the loss due to rigidity accrues only to the individual*" (Kuhn 1970, 166, italics added).

Only to the individual! Well, yes. Since the goal of Kuhn's investigations is to understand the success of science as an institution, as an "instrument" for puzzle-solving, the individual is secondary. Feyerabend, however, is interested precisely in that individual. He grants to professional training its prerogatives, but insists that "special standards which define special subjects and special professions must not be allowed to permeate *general* education and they must not be made the defining property of a 'well-educated man'" (Feyerabend 1978, 217).

Unfortunately, the term *general education* masks some important problems. Nevertheless, both Kuhn and Feyerabend point to the special role that science teaching has acquired even at the lowest levels. As a training and recruiting ground for the nation's scientific-technological infrastructure it is *expected* to be governed by interests other than those governing the rest of the curriculum—*but not by everyone*. And this brings us back to the controversies with which this paper began. Let us look at these again now, in light of the distinction made by Feyerabend explicitly, by Kuhn implicitly, and in passing by many others (see Boyer & Levine 1979, 41). However, this distinction itself requires a preliminary clarification.

Most subjects and certainly all sciences can be viewed and taught either in a context of education or in a context of application. Here *education* is intended to capture roughly what many call *general educa-*

tion. Yet the latter term often denotes merely a subset of specialized or disciplinary topics made digestible for the outsider, while I mean by it simply an orientation toward *depicting* what the world is like and understanding its mysteries as far as possible. This can be done with any degree of rigor, detail, and depth. In contrast, *application* is intended to describe activities in which laws and explanations are seen as *tools* for the solution of predefined classes of problems.

Although the two contexts are not mutually exclusive, it is a fact that science courses today—with the exception of those in colleges labeled "general education" and regarded as watered down—present natural science in the context of application. This is the education Kuhn discusses; it should be called *training*. Whether this orientation is inevitable and whether it represents a loss even as professional training has been debated. For our purpose it suffices to note that only in the context of education is there a conscious concern for the effect of subject matter on the learners' *orientation in the world*, on their actions in society.[39] In the other context any such effect is purely a by-product.

Let us see now what light this sheds on a phenomenon that so many have noticed in the creation/evolution debate at all levels: the lack of real communication due to the inability of either side to address the most vital concerns of the other. Anti-creationist writers routinely raise the fear of a scientific dark age if evolution is not taught within the framework of a totally dominant paradigm, if instead it is encumbered by distracting, useless comparisons with a theory long outworn. Often this warning is joined to a more general plea for keeping all our science at the forefront, lest we "inevitably recede into the backwater of civilization." "American science will wither. We will raise a generation of ignoramuses, ill-equipped to run the industry of tomorrow" (Asimov [1981] 1984, 193). "I'm convinced that if we fail to confront this issue squarely and publicly, we will have an American equivalent of the Lysenko affair . . . The affair virtually killed genetics research in Russia until only a few years ago."[40]

In this type of argument (which is not the only one), all interest lies within the *context of application*. For it is *problems* that occupy centerstage, while *students* are seen as potential problem-solvers. Even when industry and competition are not explicitly mentioned, but only the "level" or "quality" of science as an institution, the concern is still with the fate of that institution—the level of its members, the quality of its research.

By contrast, those who take seriously the creationist argument, or merely its critical side in relation to a magnified evolutionary vision, are oriented almost exclusively to issues within the context of education. They worry about what evolution *says*, or implies, or may imply to

young minds, concerning the roots of human life. They think this important because beliefs about origin do contribute to our image of self, which, in turn, affects our human interaction.[41] And they have strong misgivings about a "scientific world view" so pervasive and well articulated that it expels from consciousness all frameworks not based on an imperative of problem-solving. True, this is a hermeneutic of suspicion, but it is one that many conservatives share with certain liberal[42] and Marxist thinkers.[43] The common concern is for a space free of natural science, where action-orienting self-understanding (Habermas) may be built on other foundations.

Granted that to recognize the role of different contexts in these conflicts is hardly to resolve the conflicts; nor, in the context of education, does creationism somehow become a better theory. But it is also clear that *the conventional argument for treating science differently fails*. It fails because the difference in object domains and the kinds of questions asked is *not sufficient reason* for the greatly diminished role of the critical stance in science study as compared with morals (or the enhanced role of criticism in moral discourse if science is the standard)—*provided the comparison is in the context of education*. Once the professional needs are set aside, it is easier to see that the distress voiced by Ruse, for example—the desire to protect young minds from "corrosion" by pseudoscience—refers to particular arguments and particular contemporary authors. But if, in principle, Mill's analysis stands unrefuted, then the range of alternatives is much larger, and the danger cited must be weighed against the cognitive benefits noted along ago.[44]

If, in other words, the controversy is addressed in the context in which it takes place (in application there is no such controversy), any gap that still remains between the two realms is far less relevant. In the context of education, "knowing" the physical world appears more or less on an equal footing with "knowing" the human world—morality included. Disputes notwithstanding, established propositions of great importance exist in both realms. Knowing some of these propositions, knowing how they were established, and knowing the disputes to which they gave rise, is part of knowing the world. However, if Ruse is right that we must carefully "sift" and "control" what we pass on to the next generation or it will have "no criteria by which to evaluate . . ." then it is hard to see why this applies only to science.

In the reverse direction the argument against demarcation is just as powerful. Ruse's impulse is the essence of conservatism: to save the best. Yet only if our moral experience has no accumulated knowledge worth saving, no giant's shoulders to climb up on for a better view, *is there sufficient reason* to reject here what is deemed so vital, there—*while at the same time* importing from "there" the formal, structural elements.

If in science, where criticism is vital, rationality still demands of the beginner exclusive immersion in the prevailing paradigm, then perhaps in morals too we might "sift" carefully what is presented, and "control" what is to be retained. If, even in science, exemplars are indispensable—cases and individuals—then why in morals should they now be out of place?

The objection that today we lack consensus in the moral realm is, perhaps, *not* sufficient reason. True, there is no consensus among *theoretical* experts on rules or principles, nor on frontier issues, from abortion to the "right to die." However, in regard to exemplars—history's moral heroes—the situation is quite different. When it comes to these *practical* experts,[45] a widely acceptable list can indeed be drawn up; and imitating exemplars, as Kuhn has shown, is at once surer and more flexible than acquaintance with rules. The implications are clear enough. It remains only to point out that in neither realm is imitation, rightly understood, the same as blind following. When, in certain respects, Martin Luther King imitated Ghandi, and Ghandi Tolstoy, they did so with as little blindness as when Einstein modeled himself on Max Planck, or Heisenberg on Einstein. But we cannot here develop this argument.[46]

The tacit assumption that in one case the issue is wholly between science and pseudoscience, and in the other wholly between autonomous thought and a no-longer-legitimate authority has obscured some serious questions about the *role of science in the cognitive domain*, its status in relation to other interests, its proper function in the schools; and about grounds for authority in any practice. By ignoring these concerns, the conventional argument appears to suppress them, and that too makes it inadequate. However, I do not suggest on this account that the defenders of some sort of demarcation in teaching are wholly wrong. For one thing, there are other ways of making distinctions than the one here discussed;[47] and, as some of my examples do show, application or general scientific excellence is not the only concern of those working to keep creationism out of the schools.

For these reasons the present treatment calling attention to context can only be preliminary. However, this preliminary overview is necessary because at present the two types of arguments are so intermixed that it is difficult to weigh opposing considerations meaningfully. It is not possible to compare the desire for rapid advance on the part of future researchers with the need for biology teachers capable of handling objections to accepted theory. It is not possible to weigh advanced technology against coherence in the images of rationality projected by schools. It is hard even to discuss seriously the role of authority and of exemplars in moral education if it is not realized that in science—the

premier cognitive activity—these same features serve to enhance the social, institutional mode of problem-solving.

Our discussion also suggests that to the extent a desire for genuine dialogue exists on either side of the controversy, even if only for pragmatic reasons, to that extent the different cognitive contexts must be taken into account explicitly. There is no doubt that in science, as in morals, the interest in application is perfectly valid, and cannot be lightly brushed aside as was the tendency in the 1960s. However, we should remember that serious accommodations (in both colleges and high schools), accompanied by much good will and some success, were made in the 1960s and 1970s, precisely in response to criticisms in the context of education.[48] This alone should be ample warning that the issues are larger than the events described here. The pace of science makes it inevitable that other such conflicts are barely over the horizon.[49]

Some Preliminary Conclusions

Earlier I suggested that a basic problem for the schools is the collision between the older and the newer conceptions of science—the former largely shaped by the idea of demarcation, the latter less so; the older guiding the study of natural science, the newer exerting direct influence on educators, and evident also in periodic demands to include moral concerns or alternative theories within the teaching of science itself.[50] We see that this collision is exacerbated by the fact that at least two different orientations, both important, are possible in viewing natural science. People with a desire to maintain the dominance of the interest of application in the classroom tend to ignore the newer insights, retain a positivistic framework, and emphasize demarcation from all other fields. This is necessary because in the other fields—language, social studies, history, and so on—the context of education is still primary. On the other hand, those oriented toward the sciences in that latter context, for whatever reason, wish science study to be relevant beyond the professional horizon, and thereby more *educative*. Consequently, they soon notice that "restrictionism is dead" and find "the new philosophy of science" more to their liking.

As part of this clash, everyone involved—students, teachers, and public—are offered simultaneously two differing and partly contradictory interpretations of rationality without serious explanation. This raises questions about the coherence, and therefore rationality, of the philosophy behind the entire educational effort in roughly the same way as occurred in the 1960s. At that time, radical students charged that while rationality was pursued *in the small* by individual instructors or subsystems of the institution, contradictions between different parts of

the educational experience made that experience as a whole *incoherent*, made the academy an irrational place.[51] The problem was fragmentation, the desire was for integration. Today quite similar goals are embedded in carefully-thought-out educational philosophies: "A well ordered belief system is one which is internally consistent . . . and integrated rather than fragmented" (Strike 1982, 21).

No doubt, coherence in teaching can be considered a purely operational problem, a curricular matter internal to the profession. But that depends on what is at issue. Dissonance in regard to rationality is serious any time. It is all the more serious because in education, as we see, reason has been thrust into the spotlight lately. Kenneth Strike, for example, puts it in the form of a "motto for schooling": "The central public function of schooling in a liberal state is the democratic distribution of rationality" (Strike 1982, 12). When the issue is so basic, so philosophical, and the dissonance so obtrusive on concerns outside the academy, the conflicts do become public and social. At such times, it may be quite appropriate to suggest a theoretical study of the causes of incoherence.

For those disciplines concerned seriously with the state of education, the problem discussed here is at the same time practical and theoretical. The practical part is: How to go beyond the *micro-rationality* embodied in small units of instruction to offer the student and the community an environment of *macro-rationality* as well. What good are "critical thinking strategies" in one corner of the curriculum if that curriculum as a whole is *dis*orienting? How can the scientific, skeptical, critical attitude be an example for moral education and other studies *if*, for the sake of expediency or professional need, science courses themselves eschew it? And how can we require the next generation to accept on authority our scientific tradition if all other traditions are ignored or cheerfully dismembered? The more theoretical question is whether, despite the *un*likelihood of universal agreement on the meaning of *rationality* any time soon, it may nonetheless be possible to develop a working conception that embraces *both* the teaching of morals and of science.[52].

A related point that also deserves attention is this: Does the label *science* now take on a semi-official, even official, status, entitling it to insert into the channels of communication filters that prevent possibly healthy contact with certain kinds of ideas? Do we really wish to subscribe to the principle that even outside the context of application a scientific idea can be confronted only by another scientific idea, and only one acceptable to *current* science?[53] This is not just a question of the "dilution" of science, which many (rightly) fear; it is a question also of the *constraint of communication*, of *restriction of dialogue*, in cases where the subject partially, but not wholly, does belong in the context of application.[54]

In dealing with these problems, a study of the values-teaching and creationist controversies could be illuminating; that is why I am suggesting they be discussed within a wider horizon, and in an atmosphere of calmness. Perhaps, for the sake of overall coherence, it may be necessary to take seriously *selected aspects* of the critics' arguments[55] in regard to both science and morals: It may be that in present teaching *con*vergence of views and grounding (in experience) are overemphasized for natural science; *di*vergence and the lack of grounding overemphasized for morals. If so, the task would be to correct this imbalance without compromising progress in science or responsibility in morals. I suspect that a good deal can be learned about both problem areas by scrutinizing each *in light of the other, and* in light of recent philosophy of science.

The morals controversies warn us that a reluctance to communicate tradition, reinforced by overdependence on abstract, analytical skills, may reflect serious misunderstanding of what it means to be rational. Complementing this, the evolution/creation disputes raise to consciousness an aspect of science usually considered secondary, its "communicative" (educative) side—the fact that it has a "social function . . . not as pure ontology, but as a mediation of man's views of himself in relation to nature" (Hesse 1980, xxi). Here claims to unconstrained discussion (unbounded by paradigm) confront our strongest conservative instinct. Perhaps in both realms, if reason is to be *one*—a culturally unifying force—it may not be identified with individual rediscovery any more than with accepted patterns of thought.

Both controversies suggest, in parallel with certain contemporary philosophical trends, that tradition and critique are related by interdependence as well as opposition (see MacIntyre 1981); that insofar as science has a communicative interest, to that extent must its teaching be subject to a communicative (not instrumental) rationality—which surely includes the critical mode;[56] and to the extent that morality embodies lived *experience*, to that extent must it be *transmitted*, not thought out anew. In a very general way, this two-fold view of reason has been advocated before. For example, Scheffler's carefully balanced position seems to address every aspect of our dilemma:

> In training our students to reason we train them to be critical. We encourage them to . . . seek and scrutinize alternatives. . . . *Such a direction in schooling is fraught with risk*, for it means entrusting our current conceptions to the judgement of our pupils. . . . Such risk *is central* to *scientific education*. . . . [However,] scientific method can be learned only in and through its corpus of current materials. Reasonableness in science is an aspect or dimension of scientific tradition, and the body of the tradition is indispensable as a base for grasping this dimension. . . . *Analogously for the art of moral choice: the moral point of view is attained, if at all, by acquiring a tradition of practice*, embodied in rules and habits of conduct (Scheffler 1973, 143, italics added).

But to offer this as pure theory, as a general ideal, far removed from specific conflicts, is one thing. It is quite another task to find appropriate ways (and the will) to take those risks Scheffler acknowledges in the face of a challenge such as the creationists have mounted. More difficult and problematic still is to criticize (with children!) ethical traditions at a time when crumbling traditions are sweeping away the most fundamental tradition of all—the family—*and* to do it in a manner that exhibits genuine rationality, not *rationalization* (of views popular in the academic world). All this is surely part of an unsolved problem of the *applied philosophies* of science and of morals.

NOTES

1. See Holden (1987) and Lewin (1987). Some of the recent court cases are: *Mozert et al. v. Hawkins County Public Schools et al.* (United States District Court for the Eastern District of Tennessee); *Douglas T. Smith et al. v. Board of School Commissioners of Mobile County et al.*, in the United States District Court for the Southern District of Alabama (popularly known as the "Alabama Secular Humanism Trial"). For more general testimony on various aspects of these issues, see Department of Education of the United States 1984.

2. Scholarly criticism includes: Lockwood (1978), Oldenquist (1979), Munsey (1980), Chazan (1985), and Baer (1977).

3. Newspaper article quoting Professor John Kaufhold. (Elmira *Star Gazette*, 1 March 1979, 4.)

4. *The United States District Court Eastern District of Arkansas, Western Division: McLean et al. vs The Arkansas Board of Education, et al.* For the *Opinion* of Judge William R. Overton, and excerpts from pretrial briefs, see La Follette (1983).

5. Nelkin (1982) is an overall introduction. For detailed scientific, philosophical and educational arguments, see Kitcher (1983), Godfrey (1983), Montagu (1984), Futuyma (1982), Ruse (1982), Newell (1985), Eldredge (1982), and David B. Wilson (1983).

6. Resolution of the Board of Directors of the Iowa Academy of Sciences, quoted by David B. Wilson (1983, 196).

7. Passed by the Council of the American Anthropological Association at the 79th annual meeting, 3-7 December 1980.

8. WMHR-Syracuse, *Focus on the Family*, 3 September 1985. The form of education desired by this speaker is termed by Kohlberg, "indoctrination of fourth stage values" (1980, 64).

9. This complaint is the more striking in view of the recent academic movement to redirect precollege teaching away from "right answers," toward the *process* of science (see Ravitch 1983, 242-43). Compare with this: "In indoctrination, we are concerned primarily with *what* people believe. . . . In teaching, however, we are concerned primarily with *how* persons believe . . ." (Green 1972, 44).

10. This argument was used by Dorothy Nelkin in a public debate against creationist Kelly Segraves at the Chautauqua Institution (Chautauqua, NY, 10 July 1985).

11. Falsifiability (see Popper, 1965) was a major criterion at the Arkansas trial, used by the judge to disqualify creationism as a science. However, it has also been used to criticize evolution, especially by Popper (1982, 167-72). But see also the exchange of letters concerning this criticism in *Science* 212 (22 May 1981):873 and (26 June 1981):1446. A related discussion appears in *Nature* 290 (12 March 1981):75-76, 82.

12. It is a common claim in these debates that "evolution is a fact" of the same type as that "the Earth is round," or that apples fall rather than rise from trees, or that "I have a heart" (though I have not seen it). See Gould (1983, 254-55), Eldredge (1982, 29), and Ruse (1982, 58).

13. In view of the fact that the Ptolemaic system is routinely "taught" in astronomy, and even caloric and phlogiston have a place in certain physics courses, the total ban on

creationism is less justified than most people think. Creationism, after all, bears the same relation to evolution as does the Ptolemaic system to post-Newtonian astronomy. To what extent it might have *value* in biology study is a question of educational policy; but it is *historical* creationism, not the writings of a small group of contemporaries, that should be the main reference for any academic discussion. That creationism *was* an important paradigm in science is well established. See Neil C. Gillespie (1979), Hull (1973), Rudwick (1985), and C. C. Gillespie (1951), among others.

14. This is true at least of those in-service teachers taking my philosophy of science course.

15. This term has been widely used, but see McMullin (1983, 3) and Shapere (1966, 50).

16. Sociobiology will not be discussed here because I focus first on method, or approach, not on findings. The potential impact is great. Concerning the influence of ethology on morals and moral education, see Nelkin (1982, 47-51), Conlan (1975), and Dow (1975). On the combined influence of biology and computers, see Pugh (1977).

17. Among moral philosophers the response to the "new philosophy of science" is varied: Some still dismiss it with hardly more than a note, maintaining the traditional "autonomy of moral discourse." See, for example, Gewirth (1978, 4). On the other side, MacIntyre (1980 and 1981, chap. 15) has found in the work of Imre Lakatos independent support for his own idea that science *and* morals "can only become intelligible to us" through their history.

18. The key work in the historico-philosophic school is still Kuhn's (1970). But see also Lakatos and Musgrave (1970), Feyerabend (1978), Laudan (1977). For representative statements of the "constructivist" position in the sociology of science, see Barnes (1974) and Barnes and Bloor (1982).

19. Examples of criticism from an objectivist position appear in Scheffler (1967) and Shapere (1966). For more recent appraisal of Kuhn's influence, see Cohen and Feyerabend (1986) and Gutting (1980). Some of Kuhn's revised views are given in his (1977).

20. In Kuhn's (1977), see especially the chapter, "Objectivity, Value Judgement, and Theory Choice." See also his (1970, 199).

21. An Apollo scientist quoted in Mitroff ([1974] 1981, 173).

22. See, among others: Agassi (1965), Lakatos (1970), Laudan (1977), and McMullin (1982).

23. This feature has been noted widely: "Kohnian analysis . . . seems to put science on the same level as ethics, aesthetics, and literary criticism" (Hull 1973, 451).

24. For example, see Rawls (1971) and the subsequent debates.

25. Kohlberg (1981, 173). A formalist definition of morality involves such criteria as impersonality, universalizability, and reversibility. For the relation of Kohlberg's formalism to Rawls and Hare, see Kohlberg (1981, chap. 5) and Boyd (1980).

26. For value-driven decision systems see Pugh (1977). The "basic outline of a decision system" he gives on p. 54 can be found with minor modification in various teachers' guides. See The University of the State of New York (1976, 89). I also found it in the *Teacher's Manual, Vocational Decision Making 7* of the Spencer-Van Etten Central School, New York.

27. See note 25 and The University of the State of New York (1976).

28. See note 26 and Kirschenbaum (1977, 10).

29. The *Teacher's Manual* in note 26 is an example.

30. I am using the Hebrew-English edition of the translation by the Jewish Publication Society of America (Philadelphia, 1955). Some English translations that use the word "kill" also mention in annotation that the meaning is "murder."

31. Modeling oneself on human exemplars (Martin Luther King, Socrates, Jesus) is expressly ruled out by most formalists, e.g., John Wilson (1972, 20-30). However, on the importance of story-telling see MacIntyre (1981).

32. The charge of "irrationality," denied by Kuhn, continues to be made by some, e.g., Alasdair MacIntyre, although others regard subsequent reformulations as moves back toward the "received view." See Musgrave ([1971] 1980).

33. MacIntyre (1978) and (1980). But see note 17. MacIntyre rejects the subjectivism of the "new philosophy of science" although he heartily welcomes its seriousness about history and shares its attitude toward method.

34. Some developments of this direction are today far beyond Kuhn, e.g., Laudan (1977, chap. 3). Laudan includes as possibly legitimate factors moral attitudes and world views of all sorts.

35. See notes 10 through 12. The same criticism of the public argument is made in Laudan (1983a). Among the views offered the public authoritatively, some are far more outdated than the conventional wisdom, e.g., "a scientist is interested neither in proving nor in disproving. What he is interested in is discovering what the facts are" (Gallant [1984, 302] quoting Ashley Montagu).

36. Feyerabend (1978, 30). For a more detailed discussion of Feyerabend's view of radical alternatives, see his ([1965] 1983).

37. To see exactly how creationists wished to amend the California *Science Framework* concerning the teaching of evolution, see Nelkin (1982, Appendix 3).

38. Although this seems obvious, it is not always acknowledged in the literature. Harvey Siegel (1979), for example, arguing that science need not be taught as Kuhn describes, offers "as counter-example to Kuhn's educational directives," the treatment of alternatives (Ptolemaic system) in the Project Physics Course. But Project Physics was aimed at art and humanities students—an unusual effort in which the concern is certainly within the "context of education."

39. The two contexts require more discussion. They partially overlap Habermas's "practical" (or communicative) and "technical" interests. But while Habermas at first used this dichotomy to differentiate natural from human sciences, it is becoming more apparent that these interests do not correspond to different modes of knowledge, that the communicative interest inheres also in natural science. See Hesse (1980, 167-86).

40. Wayne A. Moyer, executive director of the National Association of Biology Teachers, quoted in Gallant (1984, 289).

41. This is evident in nearly all creationist pronouncements, e.g., Morris (1974, 1-2).

42. One recent protest against the *tacit* expansion of "the scientific world view" into the religious realm is given by Baer (1983).

43. An example is Habermas (1980, 310-15). However, Habermas has tried to reintroduce, on nonpositivistic grounds, a radical distinction between the "empirical-analytic" sciences and other disciplines. Discussion of this type of distinction must be postponed.

44. Ruse (1982, 328) does feel the need to respond to Mill's position, but, significantly, he does so only in regard to general tolerance of dissent. Mill's cognitive argument is not dealt with seriously.

45. For calling my attention to the importance, in the moral realm, of distinguishing between theoretical and practical experts, I am indebted to Professor Philip Quinn.

46. See note 31. But recently, Kohlberg too acknowledged the value of exemplars. In addition to Socrates and Martin Luther King, whom he cited for years, he also recommends the life of Janusz Korczak (1981, Epilogue).

47. See note 43.

48. For one example, and further references, see Eger (1972).

49. See notes 16 and 26.

50. That suggestions for a radically alternative science, one in harmony with philosophic and political views, emanate also from the left, can be seen in Marcuse (1968, 166-69).

51. See Mario Savio's introduction to Draper (1965).

52. The present much used idea does not go far enough: "Reason-giving" may be sufficient to tell the difference between enlightened instruction and old-fashioned rote-learning, but it does not succeed in drawing a clear line between rationality and even the cruder forms of rationalization or propaganda—which excel precisely in the art of providing the "right sort" of reasons. To his credit, Thomas Green (1971, 51) is one theorist of education who acknowledges the difficulty of making the distinction externally and objectively.

53. In regard to sociobiology, some scientists are obviously violating this principle. See Ann Arbor Science for the People Editorial Collective (1977). For an in-depth study of the interaction between scientific, philosophical, and moral concerns in the debate between E. O. Wilson and R. Lewontin, see Segerstrale (1986).

54. Despite his emphasis on rationality, Kenneth Strike (1982a) gives detailed arguments in defense of such restriction of dialogue in science education. There, he maintains, the point is to "internalize the standards and procedures of a field" and to advance "the goals of a discipline" (1982a, 139). "Liberty" is rightly restricted to the community of "experts." In political discussion, however, liberty of dialogue should be based not on Mill's consequentialist, cognitive arguments but on Kant's principle of respect for persons as ends. Strike assumes that even on the nonprofessional or preprofessional level, disciplinary goals should dominate. This in itself is problematic; it is more problematic in sciences that affect self-understanding, where the distinction between the student as "person" and the student as "novice" is not so clear-cut.

55. For one of the few papers that, cautiously, suggest some role for creationism in a biology course, see Anderson and Kilbourn (1983).

56. See Hesse (1980, chap. 7) and Arbib and Hesse (1986, chap. 8), although the inference here is my own.

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