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Can't philosophers tell the difference between science and religion?: Demarcation revisited

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Abstract In the 2005 *Kitzmiller v Dover Area School Board* case, a federal district court ruled that Intelligent Design creationism was not science, but a disguised religious view and that teaching it in public schools is unconstitutional. But creationists contend that it is illegitimate to distinguish science and religion, citing philosophers Quinn and especially Laudan, who had criticized a similar ruling in the 1981 *McLean v. Arkansas* creation-science case on the grounds that no necessary and sufficient demarcation criterion was possible and that demarcation was a dead pseudo-problem. This article discusses problems with those conclusions and their application to the quite different reasoning between these two cases. Laudan focused too narrowly on the problem of demarcation as Popper defined it. Distinguishing science from religion was and remains an important conceptual issue with significant practical import, and philosophers who say there is no difference have lost touch with reality in a profound and perverse way. The Kitzmiller case did not rely on a strict demarcation criterion, but appealed only to a "ballpark" demarcation that identifies methodological naturalism (MN) as a "ground rule" of science. MN is shown to be a distinguishing feature of science both in explicit statements from scientific organizations and in actual practice. There is good reason to think that MN is shared as a tacit assumption among philosophers who emphasize other demarcation criteria and even by Laudan himself.

Keywords Demarcation · Intelligent Design · Creationism · Creation-science · Methodological naturalism · Science and religion

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> "[W]e have addressed the seminal question of whether ID is science. We have concluded that it is not, and moreover that ID cannot uncouple itself from its creationist, and thus religious, antecedents."—*Kitzmiller v Dover* (2005, p. 136)

1 Introduction

Intelligent Design, the latest version of creationism to try to wedge its way into science classes, suffered a legal death blow in a Federal District Court in the 2005 *Kitzmiller et al. v. Dover Area School District* case. After hearing 21 days of testimony over a 40-day period in which Intelligent Design (ID) proponents and their critics presented their best evidence and arguments regarding the purported scientific and educational merits of "Design Theory", Judge John E. Jones III ruled that ID was not science but disguised sectarian religion and thus that teaching it in the public schools is illegal, a violation of the United States Constitution.

With nary a sentence in the ruling that granted even the least element of their claims, ID proponents howled that the judge "got on his soapbox to offer his own views of science, religion, and evolution" and had overstepped his authority in ruling on the question of whether ID was science, calling him "an activist judge who has delusions of grandeur" (Discovery Institute spokesman John West, quoted in (Anonymous 2006)). Such *ad hominem* denunciations were an about face from some ID pre-trial writings, which had lauded him as a Bush-appointed good ol' boy with impeccable conservative credentials. Discussing in a recent interview the question of whether he should have ruled about whether ID qualified as science, Judge Jones noted that this was not only a legally relevant question in the trial, but that *both* sides in the case had asked him to rule on just this point (Philadelphia Inquirer 2006). The defense's pre-trial memorandum, for instance, stated that "the evidence will show that IDT [ID theory] is a scientific argument, advanced by scientist [sic] relying on evidence and technical knowledge proper to their specialties," and that ID's reliance on supernatural explanations "does not place [it] beyond the bounds of 'science.' Quite the contrary, IDT's refusal to rule out this possibility represents the essence of scientific inquiry." (Thomas More Law Center 2005, pp. 10–11). It is disingenuous, to say the least, for ID proponents to call for a ruling on this issue and then, when the ruling did not go their way, to complain that the judge overstepped.

Indeed, ID leaders had been hoping for a test case that would rule on this from the moment law professor Phillip Johnson brokered a truce between young-earth and old-earth creationists and united them under the banner of ID as a way of wedging their "theistic science", as he called it, through the wall of separation between church and state. To this end, ID leaders produced law review articles and legal guides promoting the legality of teaching ID and planned for direct legal assistance to public schools (DeWolf 1999; DeWolf et al. 1999; Discovery_Institute 1999; DeWolf et al. 2000). *Kitzmiller* gave them the opportunity but not the outcome they had sought, finding that ID was "not science" but rather "creationism relabeled" and "a religious alternative masquerading as a scientific theory". A few ID opponents argued that it should have been sufficient for the plaintiffs to show that ID is religion without asking the court to also rule on whether or not ID is science, but *Kitzmiller* attorney Richard B. Katskee

gives a detailed explanation of why this was a central legal question in this historic test case (Katskee 2006).

The *Kitzmiller* case involved a policy that had been instituted in 2004 in the public schools of Dover, Pennsylvania, by the school district's Board of Directors, which was then dominated by creationists. The policy spoke of purported gaps and problems with what it called "Darwin's Theory" and changed the science curriculum to allow inclusion of Intelligent Design as an alternative theory. Biology teachers were directed to read a statement that warned students that Darwin's theory "is not a fact" and told them about ID as a differing explanation. The ID textbook *Of Pandas and People* was made available for students to gain an understanding of what ID actually involves.

Eleven parents filed a suit against the district, charging that allowing ID in the schools was unconstitutional. The School District and the Board were defended by the Thomas More Law Center (TMLC), which calls itself "The Sword and Shield for People of Faith." TMLC drew primarily from Fellows of the Discovery Institute (DI), the ID think tank, in its initial list of expert witnesses—key players and leaders of the ID movement, including Michael Behe, Scott Minnich, William Dembski, Stephen C. Meyer, and John Angus Campbell. (The last three of these abruptly withdrew from the case at the last minute before their depositions. Two other ID experts, Dick Carpenter and Warren Nord, also withdrew. Steve Fuller was added to the ID roster and did testify.)

The *Kitzmiller* case was widely described as a 21st-century replay of the Scopes Monkey trial, but it was in many more ways a replay of the 1981 *McLean v. Arkansas* trial. The *McLean* case involved a state bill (Act 590) that had mandated that so-called "creation-science" be given "balanced treatment" with evolution in public school science classes. As in the ID case, creation-science proponents had claimed that they were offering a scientific alternative theory devoid of religious commitments. As ID speaks of an unspecified "designer", creation-science spoke generically of a "creator" and did not identify it as God or make explicit reference to the Bible. There were numerous other parallels, including the final judgment: the judge in the *McLean* decision, William Overton, ruled that creation-science was not science but religion, and thus that teaching it in the public schools is unconstitutional.[1]

An important part of Overton's decision relied upon expert testimony of philosopher of science Michael Ruse, who offered five criteria to distinguish science from non-science, namely:

(1) It is guided by natural law;
(2) It has to be explanatory by reference to natural law;
(3) It is testable against the empirical world;

[1] The *McLean* case, which was decided in early 1982, was not appealed. A second case, *Edwards v Aguillard*, that ruled against a parallel Louisiana law was appealed and made its way to the U.S. Supreme Court, which in 1987 reached the same conclusion that teaching creation science was unconstitutional. One of the revelations of the *Kitzmiller* trial was documentary evidence showing how, immediately following the *Edwards* decision, creationists had simply replaced the term "creation" with the term "design" and "creationist" with "design proponent" in the textbook for the public schools (originally titled *Creation Biology*, but eventually published as *Of Pandas and People*) that they were producing without changing the substance of the material (Matzke 2005a,b).

(4) Its conclusions are tentative, i.e., are not necessarily the final word; and
(5) It is falsifiable. (Overton 1982, §IV(C))

Two philosophers, Larry Laudan and Philip Quinn, subsequently took issue in print with Overton's decision and with Ruse's role in it. Ruse reprinted their articles in his original anthology *But Is It Science?* about this philosophical question in the *McLean* trial. He gave brief rebuttals, but then let his critics have the last word (Ruse 1988). Unfortunately, this generous editorial gesture left the impression that the critics could not be answered, and tens of thousands of students have had no further exposure to the issue than this limited and misleading exchange. Creationists have exploited this misleading impression ever since.

ID creationists (IDCs) cite Laudan and to a lesser extent Quinn, who mostly makes the same points, in almost everything they have written that discusses the question of whether ID is science. Lauding Laudan for insight and honesty, they proclaim *McLean* a hollow victory based upon an irresponsible misrepresentation of the nature of scientific demarcation. There is no way to legitimately rule out ID as science, they claim, as Laudan showed that there is no way to distinguish science from non-science. J. P. Moreland, for instance, a philosopher and ID advocate at Biola University (previously known as the Bible Institute of Los Angeles), which houses the ID movement's model teaching program, makes this claim and appeals to Laudan in an article (Moreland 1994) in which he still used creation-science terminology. The Discovery Institute administrator and core ID leader Stephen C. Meyer (who has previously taught philosophy at Whitman College and Christian Apolgetics at Palm Beach Atlantic University) does the same in an article in which he argued that it was legitimate to advance a supernatural "Theory of Creation" as methodologically equivalent to the theory of evolution (Meyer 1994). IDCs have especially relied upon Laudan in articles claiming the legality of teaching ID, such as a legal guidebook they published on how to include ID in public school science curricula (DeWolf 1999).

They continued to do so following the *Kitzmiller* case. Criticizing my own expert testimony on the questions of whether ID is science and whether it is religion, Discovery Institute staffer Casey Luskin quoted Laudan's and Quinn's criticisms of Ruse and went on to claim, bizarrely, that Ruse himself recanted his testimony (Luskin 2005). IDCs trumpeted an on-line preprint by the philosopher Bradley Monton who claimed to have no sympathy for ID, but who echoed their criticisms of the Court's decision, mostly repeating their exact arguments and their appeal to Laudan (Dembski 2006; Monton 2006; Wirth 2006). As Laudan and Quinn had questioned Ruse's professional integrity, so did Luskin and Monton question mine, on the same grounds—we were purportedly misrepresenting philosophy of science not only by appealing to outmoded demarcation criteria, but by not recognizing that the demarcation problem was dead.

In this article I hope to correct some of the common errors these commentators have made and to offer a more reasonable approach to how to think about distinguishing science from pseudoscience in general and religion in particular. Why revisit this? Because Laudan's and Quinn's discussions of demarcation, which can only be described as histrionic and ill-considered, and those of their careless imitators continue to muddy the waters to the detriment of both science and philosophy of science.

2 Rumors of demise

Commenting on the *McLean* case, Laudan chided Judge Overton, and indirectly Ruse, for basing his decision against creation-science on what he called "a false stereotype of what science is and how it works." (Laudan 1982, p. 355) He opined that *McLean* was an "anachronistic effort to revive a variety of discredited criteria for distinguishing between the scientific and the non-scientific" and that for the scientific community to leave it unchallenged would "raise grave doubts about that community's intellectual integrity" (Laudan 1982, p. 355). (It is worth pointing out that Laudan's critique focuses almost entirely on Ruse's criteria, which was only one part of what Overton took into account in ruling that creation-science was not science. Overton also discussed how the activities of so-called creation scientists differed so markedly from that of real scientists. He took into account the dearth of peer-reviewed publications to establish an evidential basis for creation-science and the absence of appropriate educational materials. And he explicitly discussed the nature of religion and the ways that creation-science was religious. None of this should have been ignored.) In another article—"The Demise of Demarcation"—Laudan went further and charged that the problem of demarcation was itself dead. He wrote: "The problem of demarcation between science and non-science is a pseudo-problem (at least as far as philosophy is concerned)." (Laudan 1983a, p. 348).

However, even if Laudan had been correct that philosophers viewed demarcation as a pseudo-problem, that would not mean that it is a pseudo-problem in other settings or for scholars with other interests. The relevant context in *McLean* is the legal arena and deciding Constitutional questions regarding the establishment of religion is hardly a pseudo-problem for plaintiffs, defendants, attorneys and courts.[2] Neither does it mean that philosophy could not set aside its peculiarly abstract and rarified interests and make a useful contribution in these other contexts for their more practical purposes. However, we need not develop this avenue of reply because the premise of the objection is false on its face. Indeed, it is hard to know what to make of the superficial scholarship that leads IDCs and others to cite Laudan as though he provided the last word on the subject and as the official coroner of philosophical interest in the issue of demarcation. Laudan's obituary of the demarcation problem was premature, to say the least.

It would have been one thing had Laudan simply been describing his own view or giving his judgment that philosophers *should* give up the demarcation problem as dead, but he wrote as though he were stating a historical fact. However, even at the time he wrote his article it was false to say that demarcation was no longer a live topic. Moreover, subsequent to Laudan's paper and up to this day, demarcation questions continue

[2] I will not take the time to address those who have claimed that the courts have no business saying anything about what is or is not science. Such complaints are myopic to the point of absurdity. Determining what is and is not science is absolutely critical in legal settings, quite apart from the issue of the status of creationism. The courts have to determine for all sorts of cases what to admit as scientific expert testimony and what to exclude. Crystal-ball readers are not recognized as scientific experts, nor would someone who claimed that God told him that the butler did it. Through various legal precedents, the courts have laid out ways to make such determinations, such as the *Frye* rule and the *Daubert* criteria. As we shall see, courts countenance neither suits nor defenses that appeal to non-scientific, supernatural "alternative theories."

to be regularly discussed in the philosophical literature. Even a cursory search turns up well over a dozen articles and several books that directly address the demarcation question and many more deal with it or assume it indirectly.

Several of these are explicitly critical of Laudan's treatment (Ruse 1982; Gross 1983; Derksen 1993), some highly so. Barry Gross, who served as a philosophy consultant to the ACLU in the *McLean* trial, found Laudan's treatment to be almost willfully naïve and misguided.

> [Laudan] not only missed the context of this inquiry and the essential features of the creationist position, but has also shown lack of comprehension of the constitutional issues and standards of proof involved, of the nature of adversary trial, of the weight of legal decision, of the dynamics of preparation for trial undertaken by a large team of attorneys, and of the nature of state and local text of decisions. (Gross 1983, p. 30)

He wrote, "Larry Laudan presents in his jeremiad on *McLean v. Arkansas* a perfect example of a philosopher richly deserving an exclusion from 'the conversation of mankind"' (Gross 1983, p. 30), concluding with a stinging philosophical rebuke that "Mr. Laudan in proposing himself as the Socrates of the *Gorgias* has, instead, read us the lines of Euthyphro." (Gross 1983, p. 37). Many philosophers quickly reject Laudan's conclusions and proceed to defend various demarcation criteria, while several do so without even bothering to mentioning his pronouncements. If the problem of demarcation is a philosophical pseudo-problem, then there is a long list of first-rank pseudo-philosophy journals (*Philosophy of Science*, *British Journal for the Philosophy of Science*, *Studies in the History and Philosophy of Science*, *Philosophy of Social Sciences*, etc.) and an even longer list of top-notch pseudo-philosophers publishing on the question at the time and since. Among those who have continued to tackle the problem are Deborah Mayo (Mayo 1996), Keith Abney (Abney 1997), George Reisch (Reisch 1998), Michael Ruse (Ruse 2001), and many more.

Naturally, different philosophers continue to disagree about the best way to demarcate science. Joseph Agassi and Nathaniel Laor emphasize the importance of repeatability, arguing that "Scientific method sharply characterizes facts given to scientific inquiry: all and only those facts are scientific that are given to repeatable observation." (Agassi and Laor 2000). Resnik (2000) offers a pragmatic approach for distinguishing what is scientific. Roper (2005) argues that intelligent design creationism is not science by making use of Goodman's notion of projectability. Even those who approach the matter from a constructivist perspective, such as Charles Taylor (1996), agree that there is a difference, though perhaps a historically contingent difference, between what is and what is not science. Gieryn (1983) gives a sociological account of how scientists draw professional boundaries to distinguish science from non-science. Thus, while there are different views about exactly how to draw a line between science and non-science, there is widespread agreement not only that there is a real difference but that it is of philosophical interest.

If ID supporters continue to cite Laudan's pronouncements on the death of the demarcation problem, they should be recalled of Mark Twain's wry comment, slightly paraphrased, that the rumors of its demise are greatly exaggerated.

3 The *Kitzmiller* philosophy

Before going on to look in more detail at the demarcation problem and Laudan's discussion in the contemporary setting, it will be worthwhile to briefly explain our approach to this issue in *Kitzmiller* and highlight ways in which it differed from the *McLean* reasoning. This will help avoid some common misunderstandings found in commentaries about both cases.

(1) First of all, there was no attempt in *Kitzmiller* to follow Ruse's five criteria from the *McLean* case. Indeed, my recommendation to the legal team from the beginning was to avoid the philosophical problems inherent in Overton's listing of these and to revise and simplify the argument. There were indeed problems with some of the *McLean* criteria, but more than that it was overly and unnecessarily ambitious to attempt to lay out criteria that are necessary and sufficient to define science. Thus, for instance, we made no appeal to falsifiability or tentativeness as scientific litmus tests. Even when we discussed some of the same concepts, such as notions of explanation, natural law and testability, we did so in quite different ways that reflected more current thinking in philosophy of science.

IDC critics of the *Kitzmiller* opinion, and even some critics unsympathetic to IDC like Monton, seem not only to presume that Laudan had given the last word on the demarcation problem, but also that nothing else had changed in thinking about explanation, causation, confirmation and other philosophical issues relevant to the demarcation question in the twenty plus years of philosophical discussion since *McLean*. ID leader Stephen Meyer's defense of appeal to supernatural agency rebuttal of Ruse's demarcation criteria at the 1992 Southern Methodist University (SMU) conference that publicly launched the ID movement was already so out of date and confused in its discussion of the relations among law, cause and scientific explanation (Meyer 1992) that it inadvertently undermined its own argument. Meyer's subsequent papers have not corrected the problems (Pennock 2004). By 2005, philosophy of science had progressed well beyond many of the old philosophical debates of the middle part of the century (some of which will be discussed in the penultimate section) that had still lingered in the *McLean* debate. The *Kitzmiller* argument was able to draw upon the lessons of the last three decades and avoid earlier confusions.

(2) Moreover, even the overlapping concepts were not used as demarcation criteria in the sense Laudan criticized the *McLean* ruling for. Neither did we substitute an alternative set. Indeed, we made no attempt to give a list of criteria to strictly define science. It was not necessary to do so. The relevant demarcation problem is far simpler than Laudan would have us believe. The task was not to demarcate science by pinning down its precise borders in the formal sense of giving a set of necessary and sufficient conditions that are shared without exception among all and only sciences, both historical and contemporary. I am as skeptical as Laudan that such a clear bright pinline border could ever be discovered, though more for general reasons about the nature of classification than for anything special about the case of science and pseudoscience. However, contra Laudan, I would argue that this standard of demarcation is not only unrealistic but fundamentally misguided. It is certainly an inappropriate standard in this context. What is needed is not an ahistorical formal definition but something

more pragmatic and down to earth—what might be called a *ballpark* demarcation that simply identifies a position as violating a basic value, or *ground rule*, inherent in the practice. One need not be able to list all the rules that distinguish baseball from softball or stickball to be able to say that someone who wants to use immaterial balls and bats and call in a supernatural pinch hitter is playing a totally different game. Showing that creationism is not science requires no more complicated notion of demarcation than that— it violates a scientific ground rule and is not even in the ballpark.[3] Indeed, for the Constitutional case the problem is simpler still because the contrast classes are not even science and pseudoscience, but rather science and religion. Laudan's entire critique of demarcation, which expects a precise line that can unambigiously rule any possible theory in or out of science, addresses quite a different question than was at issue in *Kitzmiller*, which required as its first part only showing that a particular thing—"ID theory"—was not science. (This essay has space to deal only briefly with the second part of showing that ID is religion.)

(3) *Kitzmiller* articulated a simple ballpark approach in ruling out creationism, identifying methodological naturalism (MN) as a ground rule of science that ID and other forms of creationism violate. MN holds that as a principle of research we should regard the universe as a structured place that is ordered by uniform natural processes, and that scientists may not appeal to miracles or other supernatural interventions that break this presumed order. Science does not hold to MN dogmatically, but because of reasons having to do with the nature of empirical evidence. I initially laid out the arguments for this in (Pennock 1996a) and elaborated upon it in (Pennock 1996b, 1998, 1999) and will not rehearse them here. Neither did we rehearse them in any detail in court, but tried to illustrate points with examples and to put the arguments in terms that were as simple as possible without sacrificing accuracy. As one illustrative example of methodological naturalism, I noted in my testimony that we cite the Hippocratic corpus as at least proto-scientific precisely because it begins to reject supernatural explanations; epilepsy is not to be thought of as a "sacred disease" but one for which we seek an explanation and cure in terms of ordinary natural causes. Hippocrates even begins to offer some good methodological reasons for this: "Men think epilepsy divine, merely because they do not understand it. But if they called everything divine which they do not understand, why, there would be no end of divine things."

It is worth noting that expert witnesses are advised to testify in as simple and succinct a manner as is possible, and are cautioned against going into detailed, technical explanations unless called upon to do so. Usually such questions come during cross-examination as the opposing attorneys attempt to challenge an expert's opinion. These in-court challenges, in turn, are typically based upon detailed questioning that occurred

[3] The notion of ground rules has its origin in baseball as the rules governing play on a particular field but has come to refer to any basic rule(s) of procedure and behavior to be taken for granted. It is the latter, stronger sense that have I have in mind here—scientific ground rules that are tacitly understood as being so fundamental that they usually do not even need to be listed among the official rules—but I will certainly not take issue with a Red Sox fan who insists that the peculiar Fenway Park ground rule that a ball that rolls under the tarp in Canvas Alley counts as two bases should be taken no less seriously. (I have elsewhere spoken metaphorically of creationism as attempting to sneak into the "stadium of science" (Pennock 1999). So the first sense of ground rule could similarly apply metaphorically if one wanted to retain the historical usage.)

previously during the pre-trial deposition. In my case, a Thomas More attorney spent nearly nine hours probing every argument and claim I had made in my written opinion, and on key points also questioned me about my published articles I had based it upon, hoping to find holes or weaknesses to exploit.[4] I mention this aspect of the legal process to highlight the critical fact that a judge's written opinion in a case is a distillation of in-court testimony and documentation which is itself a distillation of prior oral and written testimony and other evidence, which itself is often based upon a previously published body of material. It is thus an embarrassment that many philosophers have felt free to opine on *McLean* (and a few on *Kitzmiller* as well) based on no more than a superficial review of the final opinion and in near-total ignorance of the documentation and justificatory process that stood behind it. Criticisms, for example, that Ruse assumed a naïve Popperian falsificationism without regard to issues of Duhemian holism are plausible only if one stops with a bare reading of Overton's list. ID creationists and a few philosophers have similarly misread *Kitzmiller* by assuming that methodological naturalism was being offered as a replacement *a priori* demarcation criterion in the same sense that Laudan took Ruse to be doing with his five criteria. Even a cursory reading of my publications would have prevented such an impression.[5]

Put simply, the argument was that as a point of method science does not countenance appeals to the supernatural. Again, we did not claim *only* science requires this ground rule. Such appeals are disallowed in court as well, for instance; MN is tacitly assumed in legal reasoning just as it is in science and should be so for the same sorts of reasons (Pennock 1999, pp. 294–300). Suffice to say that no judge would take seriously a plaintiff who sought damages against someone for laying a curse upon their car or a defendant who pleaded innocent on the grounds that the crime had actually been committed by a ghost. A lawyer would be laughed out of court who argued that judges and juries should consider "alternative theories" that a crime was committed by a supernatural intelligence. The IDC's call for a "theistic science" is similarly unworkable (Pennock 1998).

Methodological naturalism is such a basic assumption that it is mostly taken for granted even among those who disagree about criteria of demarcation. Many philosophers do mention a basic prohibition against appeals to the supernatural in discussions of scientific demarcation. Reisch, for instance, emphasizing the unity of science, writes, "In the case of creation-science, statements about immaterial agencies and

[4] Failing to find the hoped-for weaknesses, their cross-examination in court mostly took a different approach, asking me many questions about more or less obscure persons and facts (mostly from the history of science) in what I learned was a standard tactic used to try to make an expert appear ignorant. I thank my professors from graduate seminars many years ago at Pittsburgh for serendipitously preparing me for many of these questions.

[5] Even some philosophers who have written on the right side of the issue have sometimes made similar mistakes. Neil Tennant, for instance, says that what he calls "Pennock's positive account of testability" is satisfactory for a lay reader but "will not pass muster for the logician" (Tennant 2007). But he bases this assessment on a single sentence from my testimony, improperly reading into it a notion of logical consequence where I was careful to avoid just that term and meaning. Indeed, he attributes to me a view of testability that I have explicitly argued against in publications over 15 years, and offers by way of rebuttal a logical counterexample of the very sort I have used against that view myself. I predict that some ID creationist will try to undermine *Kitzmiller* by quoting Tennant against me for a view I have actively rejected.

the creation of things through supernatural processes…would render it 'isolated' from the existing network of science." (Reisch 1998, pp. 345–346). Agassi and Laor focus on repeatability in large part because they say that ignoring it leads to vague metaphysical "magic" whereas "science is the search for natural laws." (Agassi and Laor 2000, p. 556). Many more do not mention the proscription explicitly but nevertheless can be seen to take it for granted in the possibilities they do or do not take seriously, or in the way they tend to misunderstand those who seek to overturn it. Even critics of demarcation often seem to assume it. For instance, just a week after the *Kitzmiller* ruling, George Alexander wrote an op-ed criticizing it along Laudanian lines for trying to draw a line between science and non-science. But in the same breath that he concludes that philosophers should dismiss the demarcation question he gives his own "liberal" definition of science: "Let's abandon this struggle to demarcate and instead let's liberally apply the label 'science' to any collection of assertions about the workings of the natural world." (George 2005). Presumably even such a liberal definition would not apply the label to anything at all, so George has not really abandoned the demarcation struggle. And the limit that he seems to presume is at least very like the ballpark notion of MN in restricting science to claims about the natural world. As we will see later, there is even reason to think that this is true of Laudan.

Equally importantly, especially in the context of the case, *even creationists* grant that naturalism is a ground rule of science (though they typically confuse or conflate methodological and metaphysical naturalism). One of the reasons I advocated focusing on MN in the *Kitzmiller* case rather than other characteristic scientific values was that all of the major ID creationists had explicitly acknowledged it as a ground rule of science—though a ground rule they think should be overturned—often using those very words. In my written and oral testimony in court I gave a sample of representative quotations from ID leaders to show this (Pennock 2005). Indeed, as discussed above, the primary goal of the ID movement from the beginning has been to change the definition of science to allow appeal to the supernatural in a revolutionary new theistic science.

In light of this fact, it is interesting that *Kitzmiller* ID witness Steve Fuller gives an odd explanation of his testimony against methodological naturalism. Fuller argues that MN improperly conflates "the source of hypotheses and the conditions under which they are testable." (Fuller 2006, p. 829). He defends the role of the supernatural as a legitimate *inspirational heuristic* in the context of discovery, and then points out how this role "comes to be erased" once the previously mysterious (he gives two examples, gravity and genes) has been given experimental proof in the context of justification. He writes how the separation of these "explains the studious neutrality that philosophers of the scientific method have tended to adopt toward 'metaphysics', in which both naturalism and its opposite, supernaturalism, are normally included: neither metaphysics offers a royal road to scientific validity but both have had significant heuristic value" (Fuller 2006, p. 829) and argues that MN is a Whiggish reading back of where-science-ended-up into where it emerged. But this defense is of no help to the ID movement, which does not advocate supernatural design as a mere heuristic that may later be discarded in the context of justification, but as a metaphysical truth

that should be substantively incorporated into the scientific picture of the world. It is always their substantive claim, not their inspiration, that is at issue.

Ironically, Fuller uses one of the same examples I have used in print and in my oral testimony to illustrate the point about naturalizing the supernatural (which will be discussed further below); the scientific investigation of gravity is a perfect example of how MN views the world in terms of natural regularities. Again, Fuller's example provides no comfort to creationists, whose view of Newton's thinking about gravity is that he was right to call upon God to keep the planets orbiting regularly when his laws of gravitation seemed to fall short of a full explanation. No scientist today would take seriously such appeal to divine nudges to explain the heavens. Fuller writes that he is "not a known advocate of—or expert in" intelligent design (Fuller 2006), so it is possible that he was unaware of the core philosophical commitments of the ID movement, which may explain why he often said things in his testimony that better supported the claims of the plaintiffs than the defendants. His point above about the studious neutrality towards both supernaturalism and metaphysical naturalism in the context of justification fits quite well with the view that we articulated—and that ID creationists adamantly opposed—in *Kitzmiller*.

Rejecting the naturalism of science is not a peripheral issue but is the central point of the ID movement, which aims to serve as a "wedge" to break apart the naturalism they see as having driven God from the public square.[6] IDCs are often cagey about this core commitment, sometimes even seeming to deny that theirs is a supernaturalist view (occasionally even by attempting to redefine nature), but we were able to provide ample documentation of their view in court. To give just one additional example here, in his paper at the SMU ID symposium William Dembski claims that scientific naturalism (which he links to atheism, materialism, scientism, and secular humanism) is incomplete because it excludes appeal to the supernatural, and he tries to argue "that it is legitimate within scientific discourse to entertain questions about supernatural design." (Dembski 1994).

IDCs will also sometimes say that they could accept "evolution" but by this they have in mind change where every increase in biological complexity necessarily is purposefully directed by a supernatural entity. We will again limit ourselves to just one example from Dembski who once wrote that "The design theorists' beef is not with evolutionary change per se, but with the claim by Darwinists that all such change is driven by purely naturalistic processes which are devoid of purpose." (Dembski 1995). This quotation also illustrates a second, related matter, namely that IDCs illegitimately build atheism into their definitions of evolution (here "Darwinism") and scientific naturalism. In fact, neither of these are inherently atheistic or theistic but are neutral with regard to metaphysical views about possible transcendent purposes. IDCs regularly try to claim that naturalism in science simply defines away what may be a real possibility about the world that it is created supernaturally (e.g.(Plantinga 1991, p. 345)). But it is IDCs who employ idiosyncratic definitions. Nothing in our account of science defines away anything about such metaphysical possibilities. On

[6] For accounts of the ID "Wedge" strategy and the leaked ID Wedge document manifesto that became an important exhibit in the *Kitzmiller* see especially the accounts by *Kitzmiller* expert witness Barbara Forrest (Forrest 2001; Forrest and Gross 2003).

the contrary, it remains scrupulously neutral regarding the existence or non-existence of God or other transcendent beings. Judge Jones made this quite explicit in his ruling; the ID belief in a supernatural designer may indeed be true, but it is just not science.
(4) Consistent with this view, we did not claim, as creationists often charge (e.g. (Witt 2005)), both that ID is unfalsifiable and that it has been tested and found false. I have already mentioned that we did not appeal to a falsifiability demarcation criterion, but there are two other common misunderstandings regarding this issue that are worth mentioning.

The first arises in relation to the conclusion in the *Kitzmiller* opinion that ID fails as science not just for the primary reason that it violates the ground rules of science, but for two additional reasons, namely that "the argument from irreducible complexity, central to ID, employs the same flawed and illogical contrived dualism that doomed creation science in the 1980's" and also that "ID's negative attacks on evolution have been refuted by the scientific community." (2005) Neither of these points contradicts the claim that the central positive thesis of creationism (that the complexity of life is the result of the purposeful action of a transcendent designer) is untestable. As I pointed out in my oral testimony, irreducible complexity (IC) and the other common creationist arguments do not offer evidence for their positive thesis but are simply challenges to evolution. As such *they are not tests of ID but rather of evolution*, a critical point that is regularly overlooked. Moreover, they are tests that evolution passes. For instance, regarding the IC argument, I had presented a counter-example in *Tower of Babel* (Pennock 1999) that Behe later admitted undermined his definition of IC (Behe 1999). He has yet to provide a promised revision to fix the error. I also testified about experiments that colleagues and I had done using evolving computer organisms to test some of Darwin's hypotheses about the evolution of complex features (Lenski et al. 2003). Some of these experiments turned out to also be relevant to the case in that some of traits that we observed were irreducibly complex in Behe's sense and so provided a direct observational refutation of the core ID claim that such systems cannot evolve. Biologist Ken Miller also testified in court about IC and other failed challenges, as did paleontologist Kevin Padian. Moreover, even if science did not have a ready answer to such negative arguments, such explanatory gaps would not have supported the positive ID claim, as poking holes in evolution does not prove creationism. Overton had previously identified this fallacy of the dual model argument of the creation-science arguments and Jones was correctly pointing out that ID made exactly the same mistake.

The second misunderstanding arises in a different way, with ID proponents and even some opponents (typically supporters of metaphysical naturalism), claiming that science can indeed test the supernatural. This confusion often seems to turn on an inadvertent naturalizing of the supernatural, such as treating creationist hypotheses as though they were meant in the ordinary way. For instance, both Laudan and Quinn cite the young-earth creationist view that God created the earth is 6,000 to 10,000 years ago as a hypothesis that is testable and found to be false. But this and other examples that are offered to show the possibility of tests of the supernatural invariably build in naturalistic assumptions that creationists do not share. Confronted with the empirical evidence for an ancient earth, creation scientists dismiss the relevance of any such observations on the ground that God simply made the earth *appear* to be old (or "mature"). Some think of this as a test of faith so that one learns to accept the

authority of the Bible over that of one's (mere) senses. The point here is that we cannot overlook or ignore, as Laudan and company regularly do, the fact that creationists have a fundamentally different notion from science of what constitutes proper evidential grounds for warranted belief. The young earth view is certainly disconfirmed if we are considering matters under MN, but if one takes the supernatural aspect of the claim seriously, then one loses any ground upon which to test the claim.

The "design" hypothesis is another common case in point; IDCs regularly conflate natural notions of design such as are used in archeology and forensics (notions that are unproblematic scientifically) with supernatural notions that science cannot countenance. One must carefully distinguish between the truly supernatural and what is only apparently so (Pennock 1999, Ch 6, esp. 301–308). This distinction is exemplified historically in the difference between supernatural magic, which called upon demons or angels, and "natural magic," which might seem mysterious to the uninitiated but was assumed to rely upon natural, albeit esoteric, cause-effect relationships. Sometimes it is relatively easy to identify a truly supernatural claim and see why it is not testable, such as is the case with the religious explanation of how communion wine can be said to change to blood metaphysically without modification of any of its mundane properties (Ruse 1982; Pennock 2006). There are a host of familiar religious mysteries one could also cite, ranging from view of Jesus as simultaneous God and man to the orthodox claim that God's "being" is a concept beyond being and not being. Nor is this issue limited to such overtly religious theses. That a non-religious term is used does not tell by itself that a thesis can be understood naturalistically; for instance, it would be a mistake to think that spiritual "energy" is testable as the scientific notion of energy is (Pennock 2000). Would it even be intelligible to speak of supernatural "weight" or supernatural "color"? If these were truly meant to be different than the notions of weight and color as we understand these concepts in terms of our ordinary natural experience, then we have no ground upon which to draw any inference about them. Supernatural "design" is of a kind. As Hume pointed out, we have no experience and thus no knowledge of divine attributes. Those who think otherwise, whether in the service of proving or disproving the divine, invariably do so by illegitimately assuming naturalized notions of the key terms or other naturalized background assumptions.

Evan Fales makes this mistake in arguing that *Kitzmiller* reached the right conclusion for the wrong reason, claiming that there is no reason that "suitably precise claims about the supernatural could not have distinctive empirical implications, and hence be testable." He faults ID "not merely because it invokes the supernatural…[but because] it refuses sufficiently to flesh out its supernatural hypotheses." (Fales 2006). Ironically, Fales's way of putting this shows the problem he misses; it is only by adding flesh to ghostly supernatural hypotheses that they become amenable to test. To specify who the designer is, what its purposes are, and how it achieves them helps make design hypotheses testable when we are speaking in natural terms, but the moment we acknowledge the supernatural element as "other-worldly" and as truly different in kind from the natural the terms lose any connection to testable reality.

Elliott Sober occasionally seems to take a similar line to Fales in suggesting that at least some claims about supernatural beings are testable if they are suitably stated, giving by way of example "the claim that an omnipotent supernatural being wanted

above all that everything in nature be purple." (Sober 2007). Presumably he thinks the ordinary observation that not everything in nature is purple shows that the hypothesis is false because an omnipotent being with such a desire would surely have made the world so. If we are thinking of this in terms of a naturalistic understanding of notions such as "a being," "desire," "above all," "nature," "to be," "purple," and so on, that test may be perfectly fine.[7] But what can we say when we treat the hypothesis supernaturally? Might not all of nature now indeed "be purple" in its noumenal substance, irrespective of its accidents, as wine purportedly becomes blood without observable change in the miracle of the Eucharist? Is it even possible for God (to specify the being behind this generic talk of omnipotent supernatural entities), to want such a thing "above all"? Even if one sets aside Leibnizian problems with such a notion it is not clear how we could tell whether this is a coherent thesis. And what can we say follows from a claim of supernatural "wanting", by an omnipotent being or not, unless we treat that desire naturalistically like our own? One could easily continue, but let us not belabor the point—it is only under a tacit naturalistic reading that the testability of hypotheses with containing such concepts could be thought plausible.

Admittedly, interpreting such "hypotheses" is inherently confusing because of the pervasive inconsistency of religious claims in general and creationist claims in particular. Only rarely may we proceed as though they presume MN; more often we are obliged to address these under the standard assumption that they reject it. ID creationists are intentionally vague and prevaricating when speaking of their design hypothesis to obscure the inherent supernaturalism of their views. However, the principle of charity requires that we consider the strongest version of their argument, which requires the truly supernaturalist interpretation. As far as possible, I have tried always to be careful to indicate when I am treating a thesis purely scientifically and assuming MN and when I am stepping back to take a supernatural thesis seriously. For instance, I pointed out in my oral testimony that even our experimental observation of the evolution of an irreducibly complex system refutes Behe's challenge to Darwinian evolution only under the presumption of MN—if some supernatural entity is intervening in the computer core to simply make it appear that evolution happened naturally, we have no way of checking. To put the general point philosophically: it will not do to argue only with Cleanthes and ignore Demea, or to inadvertently treat Demea's mysterious God like Cleanthes' (naturalized) anthropomorphic God.

(5) Finally, we did not assume, as some creationists charged, that something is religion simply by virtue of not being science. Rather we identified a characteristic—namely, appeal to the supernatural—that by itself was sufficient to rule ID as not science and that independently was sufficient to show that it was religion for legal purposes.[8] We provided extensive documentary evidence to support this, showing not only that ID is religious, but that it is sectarian religion.

[7] The example is not elaborated, so I set aside possible complications that could make the test problematic even in the naturalized case. For instance, we are not given the purported observation evidence or the confirmation relation, so it is not clear whether the hypothesized agent is relevantly tested or whether it is illegitimately "confirmed", say, as an irrelevant conjunction.

[8] This should be obvious but, for the record, neither did we assume that the supernatural is the defining characteristic of all religions.

There is more that one could say about the *Kitzmiller* philosophy and ways in which it compared to or differed from *McLean*, but this brief overview is sufficient for our present purposes and puts us in a position to return to discuss of Laudan's objections to demarcation.

4 Laudan contra *McLean* and demarcation

Laudan gave his key arguments against the demarcation problem in a triptych of articles (Laudan 1982, 1983a,b), the upshot of which is this strongly-worded and oft-quoted conclusion.

> If we would stand up and be counted on the side of reason, we ought to drop terms like "pseudo science" and "unscientific" from our vocabulary; they are just hollow phrases which do only emotive work for us. As such, they are more suited to the rhetoric of politicians and Scottish sociologists of knowledge than to that of empirical researchers. (Laudan 1983b, p. 349)

Laudan tries to support this conclusion through two main lines of argument.

His first argument is to appeal to the lack of unity among philosophers regarding proposals for criteria of demarcation.

> From Plato to Popper, philosophers have sought to identify those epistemic features which mark off science from other sorts of beliefs and activity. Nonetheless, it seems pretty clear that philosophy has largely failed to deliver the relevant goods. Whatever the specific strengths and deficiencies of the numerous well-known efforts at demarcation . . . it is probably fair to say that there is no demarcation line between science and non-science, or between science and pseudo-science, which would win assent from a majority of philosophers. (Laudan 1996, p.210)

On this point, we may here again briefly mention Quinn's commentary. ID leader William Dembski, for instance, cites Quinn's conclusion that "One bad precedent, particularly one so extensively publicized and so apt to arouse passionate feelings, is already one too many." (Quinn quoted in (Dembski 1995)) Quoting this out of context, Dembski improperly makes it appear that the purportedly "bad precedent" Quinn speaks of was the *McLean* case itself, though Quinn was actually referring to what he claimed was the bad precedent of a philosopher as expert witness. Quinn wrote that "the major problem in *McLean v. Arkansas* [is that] Ruse's views do not represent a settled consensus of opinion among philosophers of science." (Quinn 1984, p. 384) He also faults the opinion and Ruse's demarcation criteria on the same grounds as Laudan. Before dealing with the more substantive points about purportedly failed, false, and fallacious arguments, the complaint about general acceptance deserve a brief rebuttal.

While it is true that there was no consensus in 1983 among philosophers of science regarding Ruse's five criteria, the lack of a "settled consensus" should hardly be seen as a bar to engagement at the bar. The law does not require unanimity before a professional may be called as an expert witness; there would be no such testimony possible if it did. Philosophy is hardly unique in its internal professional disagreements. It is well

known that economists laid end to end still all point in different directions. Of course there are probably always more devil's advocates on any given question among the ranks of philosophers, but contrarians are to be found on even well-settled issues in any profession, including science. ID advocates continue to cite astronomer Fred Hoyle's contrarian rejection of the Big Bang and evolution on earth. Hoyle's like-minded colleague Chandra Wickramasinghe testified on behalf of creation-science in the *McLean* case. IDCs likewise have a group of "Darwinism dissenters" they regularly trot out. However, unlike the *McLean* criteria, there is good reason to think that MN is accepted by a large majority of philosophers of science and is probably as close to a settled consensus as is possible in our profession. In any case, as will be discussed in detail in the next section, there is excellent evidence that it is all-but-universally accepted as a tacit ground rule of science among scientists, which is the more relevant standard. This last fact is also relevant to the second major criticism.

Laudan's second, more substantive, approach is to ask whether *McLean* accurately captured how science works:

> The victory in the Arkansas case was hollow, for it was achieved only at the expense at perpetuating and canonizing a false stereotype of what science is and how it works. (Laudan 1982, p. 355)

This and the first line from the quotation that headed this section are repeated endlessly by ID creationists and, sad to say, probably are the most influential sentences in Laudan's entire body of work. But what exactly is the false and "anachronistic" stereotype that Ruse supposedly perpetuated in *McLean* that calls into question the scientific community's intellectual integrity? It is what Overton called the five essential characteristics of science distilled from the testimony of Ruse and the scientific witnesses in the case. Laudan's strategy in criticizing Ruse's five criteria and presumably any other demarcation criteria was to find counterexamples from the history of science. For each of the five he offers one or another exception and so concludes that they fail as a list of necessary and sufficient conditions.

These considerations lead Laudan to conclude that there is no sensible distinction between science and pseudo-science. Applying this reasoning to creationism, he says that we should admit that it is science, but just very bad science. Creationism is testable, he opines, writing: "[To claim that] creationism is neither falsifiable nor testable is to assert that creationism makes no empirical assertions whatever. That is surely false." (Laudan 1982, p. 352) Laudan then goes on to give a list of what he says are testable creationist assertions drawn from the *McLean* decision itself, such as that the earth is of very recent origin. Indeed, he chides Judge Overton for mentioning these "apparently without seeing the implications". But Laudan and others who make this sort of statement are wide of the mark.

First of all, Laudan's statement that a claim that is neither falsifiable nor testable implies that it makes no empirical assertions whatever is odd unless he means to define "empirical" in terms of falsifiability and testability. That is a curious move to make given that there are non-scientific empirical matters that do not involve either. And it is certainly a strange statement for someone to make in a discussion of the definition of empirical science who has just rejected both of these criteria for just that purpose. (Of course there is a contrast between the empirical and the mathematical sciences, but no

one took the debate in *McLean* to be about the latter.) If Laudan's counterexamples work against these as demarcation criteria for defining science, then they or ones like them should work equally well against them for defining the empirical. Thus it is Laudan here who apparently fails to see the implications of his arguments, not Overton, who surely would not have quibbled over whether we disqualify creationism because it isn't science or because it isn't empirical science.

Second, Laudan and company fundamentally misunderstand the nature of the creationist claims he cites as having already been disconfirmed. Take again the key example that Laudan mentions, namely that the earth is of very recent origin. In the Arkansas balanced-treatment act the thesis was put forward with just this vague language, but the notion of "recent" creation is a standard term in creationist circles to refer to the young-earth creationist view that the earth is no more than 6,000 to 10,000 years old. Laudan does not say how he thinks scientists know that this is false, but presumably he would cite the usual sorts of scientific evidence. Indeed, if we judge the evidence in the ordinary scientific manner, then this conclusion is inescapable. But as we have seen and must continually emphasize, creationists do not view the evidence in the ordinary scientific manner.

5 Defending demarcation

Laudan and company are wrong to think that scientific demarcation is a pseudo-problem and that there is no point to maintaining a distinction between science and pseudo-science or religion. In this section I will give four reasons for philosophers to reject Laudanian anti-demarcationism and to take the task of demarcation seriously. I begin by briefly defending a weak version of the distinction that would be reasonable even if one were to grant most of Laudan's other points.

5.1 The dustbin of history argument

The conclusion that creation-science does not qualify as science is defensible even it one were to grant Laudan's superficial view about creationist claims, namely that "these claims are testable, they have been tested, and they have failed those tests" (Laudan 1982, p. 352). Take the geocentric view of the world, which is still advanced by some creationists. While one may say that such a claim was historically scientific or even that it remains scientific in the abstract sense that it is testable, it would nevertheless be fair to conclude, because this claim has been decisively disconfirmed (at least under the assumptions of MN), that it is unscientific to continue to hold and teach it today. The scientific picture of the world does not include claims that have been decisively refuted and effectively relegated to the dustbin of scientific history. Creationists want their claims about the age of the earth, the universal flood, the sudden emergence of life forms with all their features intact, or what have you, to be taught as the truth or at least as live alternatives. But this is unscientific in a perfectly straightforward sense.

Confronting a would-be biologist who intentionally or because of incompetence paid no heed to empirical evidence and what it has shown, a responsible academic

advisor would have to say, I'm sorry, but you are not doing science and you have no business being in this program. Similarly, a school administrator would be irresponsible who did not say the equivalent thing and remove a teacher who was teaching creation-science or ID in a science class. Putting this another way, once the two senses of the term are recognized, we may declare that sufficiently bad science is not science at all. In *Kitzmiller* we covered this base as well.

As a supplement to the primary reasons for why ID fails to qualify as science, Judge Jones also notes that "ID has failed to gain acceptance in the scientific community, it has not generated peer-reviewed publications, nor has it been the subject of testing and research." (2005, p. 64). We do not need to say anything beyond what has already been mentioned in passing about the first and last points; not only has ID failed to subject its claims to test, but it has failed even to offer any positive research program and statements from dozens of national and international professional scientific societies are unanimous in rejecting ID as science. Regarding the second point, I have elsewhere remarked upon the dearth of peer-reviewed scientific publications by ID proponents (Pennock 2002), but it is worth briefly looking at a few of the claims IDCs make about their publications before we conclude, if only to highlight some of the possible pitfalls a commentator must learn to watch out for to understand how ID theory tries to masquerade as science.

One case in point is *Darwinism, Design, and Public Education*, an anthology edited by philosopher Stephen C. Meyer and rhetorician John Angus Campbell. (Both were mentioned previously as ID leaders who had originally been listed as expert witnesses for the defense in the Kitzmiller case but who withdrew at the last minute.) When the book appeared the Discovery Institute issued a press release, hailing it as "… a peer-reviewed book from Michigan State University Press that presents a multi-faceted scientific case for the theory of intelligent design" (Discovery_Institute 2004), and in a letter to the *Chronicle of Higher Education* Meyer held it up as "a peer-reviewed … scientific anthology." (Meyer 2004). However, in a letter to the *Chronicle*, the Director of the MSU Press corrected these false characterizations.

> Of concern to us is the fact some individuals now are stating that MSU Press's publication of *Darwinism, Design, And Public Education* proves that the "Intelligent Design" (ID) theories presented in the work have been subjected to a "scientific vetting," which, in turn, proves or supports their credibility. Such comments are inaccurate and wrong.
>
> [T]he vetting was specifically for a work that would appear in our Rhetoric & Public Affairs Series; the procedures and criteria applied to this review were fundamentally different from those applied to manuscripts we would consider "scientific" in nature. In other words, Michigan State University Press's publication of *Darwinism, Design, And Public Education* should not be construed as demonstrating that the book's contents have scientific validity.[9]

[9] (Personal communication. Bohm copied his email to the *Chronicle* to me as well as to the Dean of the College of Natural Sciences and several other campus administrators. Unfortunately, it appears that the *Chronicle* never published his rebuttal.)

This is not an isolated incident of misrepresentation. On the stand in the *Kitzmiller* case, Behe touted his own book as a prime example of peer-reviewed science, claiming that it was actually reviewed even more stringently. His claims were directly impeached during cross-examination and subsequent information further undermined them.[10] The handful of other publications that IDCs cite that are peer-reviewed give no evidence for ID. For instance, articles mentioned of Discovery Institute Fellow Douglas Axe (2000, 2004), who now works for the DI-funded Biologic Institute, provide no positive evidence for ID whatsoever and simply try to show problems that evolution faces in producing functional bio-molecules. As with Behe's and Dembski's publications and those of every other creationist I know of, such "research" completely fails to test their own "alternative theory" but, as previously noted, rather are tests of evolution.

Although one could disqualify creationism with this weaker notion of science, I want to argue now that we should not grant Laudan's analysis in either its specific claims about creationists' views or in its major claims about demarcation as it applies to the case at hand. Again, *Kitzmiller* did not attempt to draw a pinline border between science and anything else, but needed only to show that ID was not science but religion.

5.2 The perversity argument

We may begin by pointing out the *prima facie* absurdity of Laudan's claim that searching for demarcation criteria is a pointless pseudo-problem; philosophers distinguish 57 varieties of realism and antirealism, but they can't tell science from pseudoscience or religion? What ever happened to the adage that you can always sell a philosopher a distinction? As much as philosophers delight in provoking their listeners by problematizing the commonplace, there comes a point at which this pleasure becomes a perversity. To hold that there is no sensible difference between science and pseudoscience is to abandon any claim of insight into the analysis of knowledge or questions about distinguishing the real from the deceptive. And to hold that there is no difference between science and religion is to make philosophy appear absurdly out of touch and irrelevant to scientists.

When philosophers step back from being merely provocative they do acknowledge the real difference. As a case in point one need only mention Paul Feyerabend, whose infamous defense of epistemological anarchism and claim that in science "anything goes" earned him the reputation as perhaps the most extreme philosophical critic of scientific method. Yet even Feyerabend, despite his playful acceptance of all manner of odd views, knew he had to draw a line somewhere. He does so in giving criteria for ruling out cranks. Feyerabend writes that "the distinction between the crank and the respectable thinker lies in the research that is done once a certain point of view is adopted." As he explains this distinction,

[10] For instance, Michael Atchison, who identified himself as the reviewer who the publisher said was the deciding factor to publish Behe's book, revealed that he gave his recommendation based simply on a description of it in a ten-minute phone call, attributing his critical role to divine intervention by which the Lord placed Behe's book in the hands of an editor whose wife just happened to be a student in a class in which Atchison identified himself as a Christian (Atchison 2004).

> The crank usually is content with defending the point of view in its original, undeveloped, metaphysical form, and he is not at all prepared to test its usefulness in all those cases which seem to favor the opponent .... It is this further investigation ... which distinguishes the 'respectable thinker' from the crank. The original content of his theory does not. (Feyerabend 1981, p. 199)

What is Feyerabend doing here if not offering a practice-based criterion of demarcation between science and crank science? Indeed, it is almost as though he meant to apply this criterion to rule out creationism as crank science. Creationists of all stripes are well-known as beginning with beliefs, both metaphysical and empirical, that they hold immune from empirical test. Feyerabend only fails to see that this problem is not just a matter of attitude—metaphysical immunity to test can indeed be built into the original content of the theory. As we have seen, this is exactly what creationism does.

My purpose here is not to defend Feyerabend's or any other particular proposal to demarcate science from pseudoscience in the sense that Laudan had in mind, but rather to point out the absurdity of the view that philosophers view demarcation as a pointless pseudo-problem. Contra Laudan's blithe dismissal, pseudo-science in the ballpark sense is a useful, reasonable concept that even someone like Feyerabend had to acknowledge. To hold that there is no useful conceptual difference between science and pseudoscience is to lose touch with reality in a profound way.

5.3 The pragmatic argument

If philosophers really couldn't tell the difference between science and religion, and if anti-demarcationism were really taken seriously and held consistently in philosophy departments our course listings and hiring practices would be quite different than they are. But one would be hard pressed to find a department that does not list philosophy of science and philosophy of religion as separate courses. We expect that these should cover quite different subject matter. If a philosophy of science course touches on religion at all, it would likely involve how science views religion, and vice versa. The fundamental assumptions and characteristic concepts that are subject to philosophical analysis are essentially different in these courses. No philosophy department would be taken seriously that failed to distinguish between these.

Quinn may contend that there is "no settled consensus of opinion among philosophers of science" (Quinn 1984) about what criteria distinguishes science from religion, but even he (and in the same breath) acknowledges that there are philosophers of science. Presumably he also acknowledges that there are philosophers of religion, since he is one himself. His professional colleagues would surely balk if he proposed that one could not tell the difference between these when conducting a job search. Laudan would not have remained long as department chair if he started hiring philosophers of religion for philosophy of science openings or vice versa. The fact is that philosophy departments have no trouble recognizing the difference between science and religion or making practical decisions based on that difference.

Even if this were not the case, it would be more a mark against philosophy than a sign that there is no real distinction. Indeed, the basic commitment of a philosopher of science is to analyze and explicate the concepts and assumptions of science as it

is practiced, so it behooves us to consider what science actually says and does with regard to this question.

5.4 The empirical argument

When we look empirically at what scientists and science educators themselves say science is, then we see immediately that they all ignore Laudan and clearly operate on the idea that there is a real distinction between science and non-science. Indeed, the evidence for this view is so pervasive that it is hard to see how one can take Laudan's incredible pronouncements as anything but indicating a cavilier disregard for the balance of evidence and a foolhardy disengagement from what should be the subject matter of philosophy of science. I can here only give an outline of some of some of what Laudan had to ignore in his anti-demarcationist screed.

Resolutions from professional scientific associations on this issue are in broad agreement. The National Academy of Sciences, for instance, dismisses both classical creationism and ID as unscientific:

> Creationism, intelligent design, and other claims of supernatural intervention in the origin of life or of species are not science because they are not testable by the methods of science. (National Academy of Sciences 1999, p. 25)

By a recent count, over seventy-five professional scientific organizations have issued public statements opposing ID and other forms of creationism and nearly all say explicitly that these are not science. Moreover, almost all of these statements mention in one way or other science's restriction to natural explanations as a reason for disqualifying creationism.

Professional science education organizations have issued similar statements, rejecting creation-science and ID as not real science. The National Science Teachers Association (NSTA) statement on the nature of science is but one case in point. It reads, in part:

> Although no single universal step-by-step scientific method captures the complexity of doing science, a number of shared values and perspectives characterize a scientific approach to understanding nature. Among these are a demand for naturalistic explanations supported by empirical evidence that are, at least in principle, testable against the natural world. Other shared elements include observations, rational argument, inference, skepticism, peer review and replicability of work.… Science, by definition, is limited to naturalistic methods and explanations and, as such, is precluded from using supernatural elements in the production of scientific knowledge. (National Science Teachers Association 2000)

In another statement on the teaching of evolution, NSTA explicitly rejects creation-science and ID on the grounds that they are not science for just such reasons (National Science Teachers Association 2003). One can find dozens of similar statements from both scientific and science education organizations that in more or less direct ways articulate a presumption of natural regularity and the requirement that science appeal only to naturalistic explanations.

The number and consistency of such statements is good evidence by itself that scientists see a difference between science and non-science and that they count creationism as falling in the latter group. Moreover, the methodological restriction of science to testable, natural hypotheses is a key reason given for ruling creation-science and ID out of bounds. But is this just the propaganda of scientists defending their social authority, as creationists sometimes charge? Again, the evidence does not support such a charge. Indeed, one gets an even stronger sense of the importance of this ground rule by examining scientific practice directly, where it is simply taken for granted. The few cases of what some might superficially take to be exceptions to the ground rule, such as attempts to weigh the soul or to test the efficacy of petitionary prayer, actually turn out to be confirming examples when one examines them more carefully, for these all work by naturalizing the relevant concepts.

To find plausible counter-examples, one usually has to look to the early history of science. By far the most common counter-example cited is the one we noted previously, namely Isaac Newton and his appeal to such a being in the General Scholium of the *Principia*, but one occasionally hears mention of William Whewell, Charles Lyell and even Darwin, all of whom left open the door to some degree for interventions by the Creator. This is not the place to examine in detail such historical examples, which are not always as clear as they are purported to be. Many do not actually make use of supernatural intervention but remain properly agnostic and simply acknowledge it as a possibility (which is consistent with MN); some reserve it for ultimate explanations in a way that is more philosophical than scientific; some seem to hold it by inertia as an inconsistent hold-ever from a prescientific way of thinking; and a few seem to be merely pious lip service.

But we do not need to explain or explain away every purported counter-example; it is no surprise that there are some cases to be found, especially in the early history of science. Again, we are not proposing a conception of science that ignores how conceptions have changed or may continue to change over time. The point is that science as it is currently understood would not countenance their supernatural explanations. Whether we view them with indulgence or embarrassment, Newton's and other's appeal to miracles are mostly simply ignored now and are not taken to be part of what was scientific about these scientists' pioneering work. Contemporary scientists who opine for or against the supernatural mostly confine their speculations to popular "philosophical" writings, for they have no place in the scientific journals.

Nor is there any sign that this requirement of MN as a scientific ground rule is changing. As part of my research for my expert opinion in the *Kitzmiller* case, I did a systematic search of major indices of scientific journals to see whether there was any evidence that appeals to the supernatural were being countenanced in scientific studies (Pennock 2005). In databases that covered tens of thousands of peer-reviewed scientific articles there were only a tiny number that even mentioned the supernatural and these mostly dealt with medical studies about how to deal with patients' *belief* in the supernatural. A single article I found that did seem to take supernatural possibilities seriously was by an advocate of prayer in alternative medicine; yet even that author did not take exception to the ground rule of methodological naturalism but explicitly acknowledged that considering such non-natural possibilities took one outside of science (Levin 1996).

5.5 The philosopher's task

I have emphasized how MN is assumed in statements and resolutions about the nature of science, but it is important to point out that such statements also make reference to other scientific values, including ones in Overton's list. Someone might say that these statements are an incoherent hodgepodge. But even if they are, this is where the job of the philosopher of science begins. To reiterate, the basic task of philosophy of science is to explicate scientific reasoning and practice in the Carnapian sense of giving a rational reconstruction of the relevant concepts and their interrelationships.

My own account has been to explicate scientific naturalism as a methodological commitment, not an *a priori* metaphysical one, and to rationally reconstruct it as arising from a basic value in science, namely to the idea of testability or, more precisely, to science's epistemic value commitment to the authority of empirical evidence. MN is not dogma; it continues to be accepted in part because of its success—it works. Moreover, we do not necessarily rule out modifying the ground rule if someone were to find a workable method of finding evidence for supernatural hypotheses. On my analysis of the relevant concepts I find it hard to even imagine what such an alternative method would look like and I have seen no proposal that comes close to being conceptually coherent (certainly IDCs do not have such a method), but I remain open to being shown wrong. Such an attitude usually goes without saying in philosophy, but in this context one must mention it explicitly because IDCs regularly try to tar defenders of evolution and scientific naturalism as closed-minded ideologues.

Finally, my explication of the ground rule is obviously not the only possibility. A few scientists do appear to take science's naturalism in a metaphysical sense. Biologist Richard Lewontin is probably the clearest example (Lewontin 1997), though in his case this view of science likely stems from his Marxism. (Creationists nevertheless endlessly quote Lewontin on this point as though he represented all of science. They also regularly cite a comment Ruse once made in a talk about the *McLean* case in which he seemed to say that science assumes metaphysical naturalism.[11]) Moreover, whether one holds to a metaphysical or to a methodological form of naturalism, a philosopher of science could explicate its justification and its relationship to other scientific concepts in different ways. What one may not do is ignore or lightly dismiss such a pervasive and fundamental ground rule.

Similarly, while it is certainly a philosophical option to argue that the commonly understood distinction between science and pseudoscience (or science and religion) is a pseudo-problem, it should be acknowledged as an extreme view for a philosopher of science to take because it departs so radically from the actual scientific norms and practices that are the subject matter of our analysis. In light of such evidence, it is hard

[11] Creationists posted a transcript of a talk Ruse gave in February 1993 at an AAAS symposium "The New Antievolutionism" in which he said: "But those of us who are academics, or for other reasons pulling back and trying to think about these things, I think that we should recognize, both historically and perhaps philosophically, certainly that the science side has certain metaphysical assumptions built into doing science, which—it may not be a good thing to admit in a court of law—but I think that in honesty that we should recognize, and that we should be thinking about some of these sorts of things." <www.arn.org/docs/orpages/or151/mr93tran.htm>. More recently, however, Ruse has defended methodological naturalism Ruse (2001).

to think that Laudanians are taking our subject seriously. How could Laudan have gone so wrong?

6 Diagnosing and rehabilitating Laudan

One reason for Laudan's errors seems to have been that he was ignorant of many important aspects of creationists' real claims and of the epistemological assumptions that they do not share with science. Unfortunately, it is a common problem for both many philosophers and scientists that because they do not take creationism seriously—it being merely a public controversy—they fail to do their homework before opining on the subject. Though they may mean well, probably more harm has been done to the defense of science education by such ill-prepared and politically naïve commentators than could have ever been done by creationists unaided by their ill-considered remarks.

A second reason involves the nature of classification; most of the problems with Laudan's analysis arise because of the way he frames the demarcation problem. At the very least, the perverse insistence that demarcation requires finding a set of exceptionless necessary and sufficient conditions is making perfection the enemy of the good. We should not expect a sharp, bright pinline of demarcation. I suspect that Laudan viewed the demarcation problem this way because he was thinking about it primarily in reaction against Karl Popper's treatment of the question. It was Popper who set up demarcation as an issue in philosophy of science in the latter half of the 20th century and who proposed his own deductive notion of falsification as the criterion to mark the border. Laudan's article was written near the end of an era of widespread "Popper bashing" within analytic philosophy, and it should really be seen as an attack on Popper by way of an attack on Overton and Ruse who unfairly seem to be taken as his surrogates.

This would also explain the anti-demarcationists' emphasis on problems with the falsification criterion. Quinn, appealing to the work of Duhem, objects that statements are not testable or falsifiable in isolation. Then, like Laudan, he goes on to cite the young-earth creationist view as something that "has been repeatedly tested and is so highly disconfirmed that, for all practical purposes it has been falsified." (Quinn 1984) Setting Quinn's inconsistencies aside, these points would be unproblematic if directed against a naïve falsificationism and if creationists' claims about the age of the earth were understood under the ground rule of MN. However, one sees that they are wide of the mark once one moves beyond a superficial reading of Overton's opinion and becomes more familiar with what creationists actually hold.

In any case, as discussed above, *Kitzmiller* did not appeal to falsification as a demarcation criterion.[12] However, we might now ask whether Laudan's other arguments would put him at odds with our ballpark demarcation approach that judges creationism as unscientific because it violates methodological naturalism. Interestingly, Laudan gives Overton's criterion about the "natural law" (which is related though

[12] The notion of testability that we did make use of does, of course, involve the possibility of disconfirmation as well as confirmation, but this inductive notion is quite different from Popperian falsifacationism.

not identical to MN) only a very cursory mention (Laudan 1982) compared to the material about falsifiability. Moreover, he criticizes just the limited bit about "law," noting, correctly, that we can study phenomena without having the laws. Again, we need to read Laudan in light of issues of interest to the logical empiricism of the period; he is probably here just making a passing gesture to a well-known problem with Hempel's Deductive-Nomological (D-N) model of scientific explanation. It is likely that he assumed that Ruse's second criterion was referring to the D-N model (specifically to its requirement that the *explanans* of a scientific explanation contain a law) and, of course, he was quite correct to call that requirement into question as it had already been shown that one may have legitimate explanations even without being able to specify the relevant covering law. But, again, this technical issue does not bear on and is no criticism of the more general issue of the rule of MN, which does not depend at all upon a D-N account of the relation between explanation and laws. Quinn also devotes only a brief paragraph to Ruse's condition about natural law and scientific explanation (Quinn 1984), and his counterexamples are of the same sort as Laudan's and similarly do not bear on MN.

Although Laudan's discussion of creationism and demarcation has been a boon to ID proponents and other creationists, we ought to at least briefly consider whether Laudan is being used or misused. Unfortunately, it seems that Laudan's usual good sense did abandon him in this instance; he takes himself too seriously in these pieces and his attack on Ruse is too personal. As noted above, it seems as though Laudan was insufficiently familiar with creationists' real views and was oblivious to much of what was at issue in the *McLean* case. However, although Laudan has only himself to blame for the trouble he caused following *McLean*, it remains possible to interpret him in a manner that would put him in line with the ballpark demarcation argument of *Kitzmiller*. Indeed, I think that a fair case can be made that Laudan actually takes for granted the ground rule of naturalism in something close to the sense I have advocated it.

For instance, even in his response to Ruse's reply to his criticism of the *McLean* decision, Laudan does note that Ruse advanced the thesis of transubstantiation as one example of a non-science that doesn't fit Overton's definition of science and, for what it's worth, he does not take issue with the description of transubstantiation as non-science. Another bit of evidence for this interpretation has already been touched upon indirectly, namely, in the way that Laudan treated creationist claims as if they had already been tested and refuted, and failed to take into account their real supernatural content. Laudan either does not recognize the distinctive religious aspect of views or else simply does not take them seriously. Either way, it appears that he tacitly, perhaps unconsciously, assumes that science should treat them naturalistically.[13] And

[13] This is not enough to tell whether Laudan is presuming just methodological naturalism or the stronger metaphysical notion, but we need not get into that interpretive issue here. In his *Beyond Positivism and Relativism* [1997] Laudan does endorse what he calls Methodological Naturalism. However, in his use of the term there he means naturalism about methodology—the view that methodology is an empirical discipline. He holds that a sound methodology is one that leads to success in achieving our goals and so whether a methodology is sound is an empirical matter. This is not the sense of MN that we have been discussing here, though I suspect that Laudan's notion would not make sense without it, so this may be another reason to think he does presume it.

more explicitly, although he objects to the thesis that a claim is unscientific until we have found the laws upon which the phenomenon depends (as do I), Laudan clearly endorses what he acknowledges is the ultimate goal of explaining phenomena "in a lawlike way." (Laudan 1982, p. 354) Without putting too fine a point on it, that is essentially what the regulative ground rule of MN requires.[14]

7 Conclusion

Barry Gross thought that Laudan's basic mistake was a disastrous application of inappropriate standards. Laudan, he wrote, "has confused the outlines of a Constitutional conflict with a colloquium in philosophy" and in doing so neglected his own wise pragmatic advice about the need to pay attention to the relevant context of inquiry and to the actual course of the evolution of science (Gross 1983, p. 30). Gross was certainly right about this, but as we have seen there is more to the problem, for Laudan and others who have echoed him fail in philosophically more serious ways.

Laudan's broad claim that philosophy regards demarcation as a dead pseudo-problem was and remains inaccurate and it is shoddy scholarship, to say the least, for creationists or others to cite his pronouncement as authoritative. This is not to say that Laudan was wrong on all counts. Many of his criticisms of Ruse's five criteria were correct if the demarcation task is taken to require the identification of an ahistorically exceptionless set of necessary and sufficient criteria to mark a pinline border between science and non-science. But this is an unrealistic and inappropriate standard. In any case, I did not advocate such a list in *Kitzmiller* or elsewhere. Nor did I simply substitute methodological naturalism as an alternative or attempt to draw an *a priori* sharp line to demarcate all and only science; rather I explicated MN as a basic ground rule that one finds as an all-but-universally-accepted assumption of scientific practice and that is well-justified on epistemological grounds as a rational basis for empirical research. Only such a ballpark demarcation judgment is needed to determine that intelligent design or some other form of creationism is not science. Furthermore, I showed that ID creationists themselves recognize naturalism as a scientific ground rule and that their revolutionary aim is to redefine science in the interest of using its authority to support not just a general religious view, but a narrow sectarian one.

As we have seen, Laudan and those who echo his views are completely out of step with the theory and practice of actual scientists. If Laudan's view were indeed the norm in philosophy of science, then it is little wonder that some say philosophy is irrelevant to any matters of practical consequence. Is philosophy going to be so removed from the realities of the world that it has nothing of value to say even on topics that ostensibly are its core concerns? It would be a sad commentary on our profession if philosophers could not recognize the difference between real science and a sectarian religious view masquerading as science. When squinting philosophers like Laudan, Quinn and their imitators such as Monton and George purport that there is no way to distinguish between science and pseudoscience or religion they bring to mind Hume's

[14] Again, this does not mean that scientific explanations must explicitly cite a law as a premise or even that a specific law be known; we are well past discussions of the D-N model (Pennock 1995).

observation that "Generally speaking, the errors in religion are dangerous; those in philosophy only ridiculous." (Hume 1978 (1739), bk. I, pt. iv, sec. Vii.) Unfortunately, in giving succor, inadvertently or not, to creation-science and now to ID, such philosophers compound the error, making the ridiculous dangerous.

Judging creationism in the ballpark sense requires doing one's homework to learn what creationists actually hold and it requires some philosophical care to frame one's critique within a sound epistemological framework and to avoid various pitfalls, but it is not a matter of controversial conceptual hair-splitting. This is not like the umpire calling a player out who attempts a dusty slide to home plate but more like distinguishing a real ball game at Fenway Park from the "baseball movie" *Field of Dreams*. Critics like Laudan first demand a precise line of demarcation for any possible case and then, failing to find one, petulantly declare that there is no difference and try to take away the ball and make everyone go home. But demarcation, properly understood, is not dead and ID does not just miss the line by a hair; the rational judgment here is that creationism does not even belong in the stadium, that it is playing a different game entirely—Sudoku perhaps. We do not need to precisely delimit the boundaries of science any more than we need the precise boundaries of a pin to conclude that it is not science to ask how many angels can dance on its head. Fortunately, a wise judge understood that, even if a few myopic philosophers still do not.

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