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How Not to Attack Intelligent Design Creationism: Philosophical Misconceptions About Methodological Naturalism

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Abstract In recent controversies about Intelligent Design Creationism (IDC), the principle of *methodological naturalism (MN)* has played an important role. In this paper, an often neglected distinction is made between two different conceptions of MN, each with its respective rationale and with a different view on the proper role of MN in science. According to one popular conception, MN is a self-imposed or intrinsic limitation of science, which means that science is simply not equipped to deal with claims of the supernatural (Intrinsic MN or IMN). Alternatively, we will defend MN as a provisory and empirically grounded attitude of scientists, which is justified in virtue of the consistent success of naturalistic explanations and the lack of success of supernatural explanations in the history of science (Provisory MN or PMN). Science *does* have a bearing on supernatural hypotheses, and its verdict is uniformly negative. We will discuss five arguments that have been proposed in support of IMN: the argument from the definition of science, the argument from lawful regularity, the science stopper argument, the argument from procedural necessity, and the testability argument. We conclude that IMN, because of its philosophical flaws, proves to be an ill-advised strategy to counter the claims of IDC. Evolutionary scientists are on firmer ground if they discard supernatural explanations on purely evidential grounds, instead of ruling them out by philosophical fiat.

Keywords Intelligent design creationism · Methodological naturalism · Supernatural explanations · Scientific methodology · Science and religion

1 Introduction

In the recent debates between evolutionists and proponents of Intelligent Design Creationism (IDC), the principle of *methodological naturalism* (MN) has been an important battleground. In response to typical creationist accusations about science's alleged metaphysical

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bias towards naturalism and materialism, some philosophers and scientists have pointed out that science is naturalistic only on the level of its methodology (MN), but is neutral with respect to metaphysics. The principle MN has itself become the "focal point of intense criticism" (Miller 2009, p. 118) by antievolutionists, and there has also been some discussion among philosophers of science about the correct understanding of MN in relation to its metaphysical counterpart (Edis 2002; Forrest 2000; Koperski 2008; Miller 2009; Nelson 1996; Pennock 1999; Plantinga 2001; Richter 2002; Ruse 2005; Shanks 2004; Smith 2001).

In fact, there is an important divergence of opinion on the rationale of MN and its proper role in science. We will argue that the most widespread view, which conceives of MN as an intrinsic or self-imposed limitation of science, is philosophically indefensible. On that account, it is also an ill-advised strategy to counter the claims of IDC and other forms of creationism[1]. As we have detailed elsewhere (Boudry 2009)[2], opponents of evolution have exploited the philosophical flaws in this popular presentation of MN to accuse scientists of philosophical prejudice and dogmatism. Alternatively, we will defend MN as a provisory attitude of science based on the successful track record of natural explanations and the miserable track record of supernatural explanations. Supernatural claims do not fall beyond the reach of science; they have simply failed.

2 Naturalism in Science

In the past, creationists have often taken offence at what they saw as the 'dogma' of naturalism and materialism in science. They complained that the hypothesis of special creation is rejected in favour of evolution by natural selection simply because scientists dogmatically cling to metaphysical naturalism, i.e. the claim that nature is all there is. In this worldview, supernatural forces are dismissed out of hand, and there is only place for blind material forces and processes. For instance, already in 1971 Norman Macbeth wrote: "If a Watchmaker is thus carefully excluded at the beginning, we need not be surprised if no Watchmaker appears at the end. The dice have been loaded against him." (Macbeth 1974, p. 126) According to Duane Gish, the universal acceptance of evolutionary theory has nothing to do with scientific evidence but everything with metaphysical prejudice:

> The reason that most scientists accept the theory of evolution is that most scientists are unbelievers, and unbelieving, materialistic men are forced to accept a materialistic, naturalistic explanation for the origin of all living things. (Gish 1973, p. 24)

With the advent of IDC, this philosophical argument rose to prominence, as Phillip Johnson made it the central tenet of his influential *Darwin on trial* (Johnson 1993). In response to this accusation, many evolutionary scientists and philosophers of science have claimed that creationists misconstrue the nature of naturalism in science. They argue that science is committed to **Methodological Naturalism (MN)**, but not to **Ontological/Metaphysical Naturalism (ON)**. For example Robert Pennock:

[1] As the principle of MN has in the past been attacked by advocates and sympathizers of the IDC movement, we would like to state at the outset, and to avoid any possible confusion, that we do *not* in any way defend IDC. We completely agree with the majority opinion among philosophers and scientists that IDC has no scientific merits whatsoever but we differ as to the proper *ground*s for rejecting IDC.

[2] See also our as yet unpublished manuscript (present authors): "Grist to the mill of anti-evolutionism: the failed strategy of ruling the supernatural out of science a priori".

> Ontological Naturalism should be distinguished from the more common contemporary view, which is known as *methodological naturalism.* The methodological naturalist does not make a commitment directly to a picture of what exists in the world, but rather to a set of methods as a reliable way to find out about the world—typically the methods of the natural sciences, and perhaps extensions that are continuous with them—and indirectly to what those methods discover. (Pennock 1999, p. 191)

The principle of MN demands that scientists appeal exclusively to natural causes and mechanisms. We want to distinguish two conceptions of MN, along with their respective rationale and their different perspective on the proper role of MN in science.

3 Two Versions of Methodological Naturalism

In the first version, MN is conceived of as an intrinsic and self-imposed limitation of science, as something that is part and parcel of the scientific enterprise *by definition*. We will term this view **Intrinsic Methodological Naturalism (IMN)**. In the Kitzmiller vs. Dover case on the teaching of IDC in biology lessons, Judge John E. Jones denied the status of science to IDC because it "fails to meet the essential ground rules that limit science to testable, natural explanations." (Jones 2005, p. 70) Based on the testimonies of Kenneth Miller, Robert Pennock and John Haught, Jones stated that "This rigorous attachment to 'natural' explanations is an essential attribute to science by definition and by convention." (Jones 2005, p. 66) Philosopher of science Michael Ruse, among others, agrees that science "by definition deals only with the natural"[3] (Ruse 1982, p. 322; see also Maienschein 2007; Miller 2009; Scott 2004, 1998; Strahler 1992) The position of IMN is also endorsed by the National Academy of Sciences in their official booklet *Teaching about Evolution and the Nature of Science*:

> Because science is limited to explaining the natural world by means of natural processes, it cannot use supernatural causation in its explanations. Similarly, science is precluded from making statements about supernatural forces because these are outside its provenance. (National Academy of Sciences 1998, p. 124)

Defenders of IMN claim that science has no bearing on questions of metaphysics and is not equipped to deal with claims about the supernatural. Therefore, science is *not* committed to metaphysical naturalism. As John Haught explained: "By its very nature, science is obliged to leave out any appeal to the supernatural, and so its explanations will always sound naturalistic and purely physicalist". (Haught 2004, p. 231; Miller 2009). Similarly, science cannot negate the existence of the supernatural either. In the words of Eugenie Scott, executive director of the National Center for Science Education: "Science is a way of knowing that attempts to explain the natural world using natural causes. It is agnostic toward the supernatural—it neither confirms nor rejects it." (Scott 1999, p. 29; see also Scott 1998)

In contrast with this view, which we will criticize in the section below, we defend an alternative view of MN and of its legitimate function in scientific practice. According to what we call **Provisory or Pragmatic Methodological Naturalism (PMN)**, MN is a provisory and empirically grounded commitment to naturalistic causes and explanations, which *in principle* is revocable by extraordinary empirical evidence. According to this conception, MN did not drop from thin air, but is just the best methodological guideline that emerged from the history

[3] In his recent writings, Ruse takes a more pragmatic approach, arguing that scientists adopt MN because it has proven successful in the past. See for example Ruse (2006, pp. 47–51).

of science (Shanks 2004; Coyne 2009; Edis 2006), in particular the pattern of consistent success of naturalistic explanations. Appeals to the supernatural have consistently proven to be premature, and science has never made headway by pursuing them. The rationale for PMN thus excludes IMN: if supernatural explanations are rejected because they have *failed* in the past, this entails that, at least in some sense, they *might* have succeeded. The fact that they didn't is of high interest and shows that science *does* have a bearing on the question of the supernatural.

Although the focus in this paper is on different conceptions of MN, we note that Intrinsic MN should not be confused with a form of ON that is traditionally called philosophical naturalism (PN). According to this position, which has exerted a strong influence on the early scientific revolution, the notion of a supernatural explanation is simply incoherent.[4] The proponent of PN maintains that only physical causes can bring about physical effects (the thesis of 'causal closure'), and hence that the notion of a supernatural or non-physical cause is conceptually confused.

As PN rejects appeals to the supernatural a priori, it seems more akin to IMN than to PMN, which discards supernatural explanations merely on the basis of their miserable track record. However, PN is a much more stronger position than IMN. Whereas IMN claims that science is ill-equipped to deal with supernatural causes, leaving open the possibility that they exist, PN rules out their existence altogether.

4 Five Arguments in Support of IMN

4.1 Argument 1: Argument From the Definition of Science

The most important argument in support of IMN holds that MN is simply part of science *by definition*. Michael Ruse, for example, maintains that science "by definition deals only with the natural, the repeatable, that which is governed by law." (Ruse 1982, p. 322). In his memorandum opinion of the Kitzmiller v. Dover case, Judge John E. Jones concluded that the "rigorous attachment to 'natural' explanations is an essential attribute to science by definition and by convention." (Jones 2005, p. 66) However, there have been many attempts in the past to define the boundaries of science, and none of them has achieved general consensus among scientists and philosophers of science. (Laudan 1996; Edis 2006) It is true that the notion of 'supernatural' is completely absent from the corpus of modern scientific knowledge. But does that mean that supernatural events, if any of these would ever occur in our universe, are necessarily beyond the reach of science?

The definition argument for IMN sits uncomfortable with the fact that reputable scientists and sceptics have investigated allegedly paranormal phenomena which, if corroborated through repeatable and careful experiments, would point to the existence of supernatural forces, or at least so they claim. In a famous study by Benson et al., for instance (Benson et al. 2006), the therapeutic effect of intercessory prayer in cardiac by-pass patients was investigated through a methodologically sound RCT-trial. Although the study failed to demonstrate any effect, prima facie it is an honest attempt to establish supernatural intervention by scientific means. If intercessory prayer really did help patients to recover from illness, one would expect this to become visible through carefully conducted trials like these.

[4] Problems with the definition of 'supernatural' will be considered below.

If defenders of IMN are correct that science cannot deal with the supernatural "by definition", does it mean that these experiments were pointless to begin with, or that scientists are not entitled to be sceptical about the therapeutic effect of intercessory prayer, because such purported phenomena necessarily lie beyond the epistemic reach of science?

The solution depends on one's definition of the term 'supernatural'. At least one philosophical approach vindicates IMN and argues that scientific experiments like the one mentioned are either logically absurd, or what they purport to demonstrate is not 'supernatural' after all. We argue that this approach is philosophically defensible but sterile, and we propose a more fruitful definition.

4.1.1 How Unnatural is the Supernatural?

The philosophical way to vindicate IMN immediately is to define 'supernatural' as any phenomenon that is inaccessible by scientific means *in principle*. Thus, as soon as an allegedly supernatural phenomenon becomes scientifically detectable, it ceases to be supernatural and must from that moment be reconsidered as 'natural'.[5] 'Scientific' evidence for the existence of supernatural forces is immediately precluded by analytic definition. In her discussion of supernaturalism, Barbara Forrest adopts this analytic approach (although her actual position is more complicated, see below).

> To become more than a logical possibility, supernaturalism must be confirmed with unequivocal empirical evidence, and such confirmation would only demonstrate that this newly verified aspect of reality had all along never been supernatural at all, but rather a natural phenomenon which just awaited an appropriate scientific test. (Forrest 2000, p. 25)

Robert Pennock, for his part, wrote that "if we could apply natural knowledge to understand supernatural powers, then, by definition, they would not be supernatural." (Pennock 1999, p. 290) However, if the scope of the term 'naturalistic' is simply extended to whichever new aspect of reality science might discover, it becomes almost trivial to uphold MN in scientific practice. How could the principle of MN possibly have any adversaries if we agreed on this definition of natural and supernatural, or, alternatively, what exactly would it mean to *defend* MN?

Consider the claims of IDC. Although in their public statements defenders of IDC are sometimes reluctant to explicitly identify the alleged Intelligent Designer with God, there is no doubt that their views are religiously motivated and rehearse the ancient 'argument from design' for the existence of God. But if God has left observable traces in our material universe, as IDC proponents claim He did, these are in principle open to scientific investigation, and thus God would be reduced to the realm of the 'natural', by a matter of philosophical definition. Pennock thinks it is ironic that, in the course of introducing God in science, IDC theorists actually *naturalise* God without realizing it. That may well be true according to Pennock's definition of 'supernatural', but by the same token IDC theory does not violate

[5] Another way to uphold this analytic definition is to maintain that science simply ceases to be scientific as soon as supernatural explanations would become successful. Michael Ruse, for example, wrote that "even if Scientific Creationism were totally successful in making its case as science, it would not yield a *scientific* explanation or origins. Rather, at most, it could prove that science shows that there can be *no* scientific explanations of origins." (Ruse 1982, p. 322; see also Haught 2000, p. 201)

the strictures of IMN any longer, and Pennock's argument on the basis of IMN misses the mark.

Imagine that IDC theorists, contrary to the actual state of affairs, had provided us with clear and unmistakeable evidence for intelligent design behind functional biological complexity (in the next section we will consider what could constitute such evidence). Following Pennock's logic, even if the designer were to reside beyond the known material universe, forcing a complete revision of our metaphysics, our reply to the IDC proponents would be something like this: 'You see, now we have a *scientific* proof for Intelligent Design. By definition, that means that we have to do with a *natural* phenomenon. Thus, I was right after all, supernatural causes and forces have no place in science.'

But why would the IDC theorist be bothered that some philosophers regard his hypothesis as 'natural' after all? If he had really succeeded in demonstrating the existence of an intelligent creator residing outside the known material universe, that terminological discussion would probably be the least of his worries. Therefore, when Pennock and Forrest adopt this analytical definition of the 'supernatural', they cannot longer challenge IDC by using IMN as a philosophical shield, because it misses the mark by their own definition. Instead, they will have to convince IDC theorists that the so-called Intelligent Designer would be 'natural' like anything else. This is a different route to the same conclusion we are defending in this article: that claims of IDC have to be confronted head on, and rejected on scientific grounds, instead of being excluded *by fiat* on shaky philosophical grounds.[6]

A being that would be truly 'supernatural' under the analytic definition would have to be completely isolated from our material universe, and not be able (or willing) to interact with it at all. But this being is completely irrelevant for our concerns and is surely not the 'intelligent designer' that the IDC theorist (or any sensible theist, for that matter) believes in. The controversial claim of IDC theory is precisely that an Intelligent Designer meddled very directly in terrestrial affairs during the course of evolution: he constructed the flagellum of the bacterium *E. coli*, for one thing (an act with tangible consequences if there ever was one).[7]

[6] The discussion between Alvin Plantinga and Michael Ruse on this point is interesting. Plantinga objects to Ruse's appeal to the definition argument that "it is hard to see how anything like a reasonably serious dispute about what is and is not science could be settled just by appealing to a *definition*." (Plantinga 2001, p. 345) In his reply, Ruse seems to admit that deciding the matter by means of simple analytic definitions would be unsatisfactory, and he goes on to deny that this was his intention. He agrees that this victory "would altogether be too easy to achieve." (Ruse 2005: 50). In trying to explain what he *did* mean by his definition argument, however, Ruse gets entangled in his own reasoning:

> What I am trying to do is to offer a lexical definition: that is to say, I am trying to characterise the use of the term "science." And my suggestion is simply that what we mean by the word "science" in general usage is something that does not make reference to God and so forth, but that is marked by methodological naturalism. I am not saying anything at all about whether or not God exists, or has any role in the world or anything like that. I am simply saying that science does not allow for this possibility, judged *qua* science. (Ruse 2005, p. 50)

But it is hard to see how a *lexical* definition of science carries any more epistemic weight than an *analytical* definition.

[7] Although the analytic definition of the supernatural misses the mark of IDC and is therefore uninteresting in this context, we have to note that it accords well with the psychological function of the vulgar notion of the 'supernatural', and the very reason for the widespread fascination with the topic. People are attracted to the mysterious, to that which seems to defy ordinary experience and scientific explanation, and call this 'supernatural' or 'paranormal'. Once a phenomenon has been given a proper and scientific explanation, it no longer satisfies the craving of many for the mysterious, and hence they look for something else.

In accordance with our reconstruction of MN as an empirically grounded and provisory methodological guideline of science (PMN), we propose to define 'supernatural' as referring to any phenomenon which has its basis in entities and processes that transcend the spatiotemporal realm of impersonal matter and energy described by modern science (for a similar approach, see Stenger 2008, pp. 14–16). In contrast with the foregoing analytical take on the issue, if any such supernatural force were to *intervene* in our material universe (and of course these are the cases of particular terrestrial interest) we still want to term it 'supernatural' here.[8] As we will see, this definition is closer to the IDC's conception of supernatural agency, and it is more relevant to the discussion of MN.

Thus, if we had compelling empirical evidence for some intelligent entity residing beyond our spatiotemporal universe, but nonetheless capable of interfering with our material world (see below), we would have a demonstration of a 'supernatural' phenomenon. To be sure, as far as we can see there is absolutely no such evidence (but see Swinburne 2004, for an opposing point of view), and therefore scientists are well advised not to waste too much time pursuing supernatural explanations (PMN)[9]. However, that does not mean that such evidence would be intrinsically impossible, or that it falls beyond the reach of science.

4.2 Argument 2: Lawful Regularity and the Supernatural - Anything Goes?

Biologist J. B. S. Haldane once said that, when he designed an experiment, he assumed that "no god, angel, or devil is going to interfere with its course" (Haldane 1934, p. vi). Many defenders of IMN are concerned that, if the idea of supernatural interference were allowed in science, experimental practice would become impossible. Biologist Richard Lewontin sets up a stark contrast between two "irreconcilable world views":

> Either the world of phenomena is a consequence of the regular operation of repeatable causes and their repeatable effects, operating roughly along the lines of known physical law, or else at every instant all physical regularities may be ruptured and a totally unforeseeable set of events may occur. . . . We can not live simultaneously in a world of natural causation and of miracles, for if one miracle can occur, there is no limit. (Lewontin 1983, p. xxvi)

Therefore, science simply *has* to adopt the principle of MN, lest the whole enterprise be compromised. As creationist Phillip Johnson put it bluntly: "[T]here is no way to tell God when he has to stop." (Johnson 2001, p. 65)

Consider Robert Pennock's elaboration of this argument in terms of natural laws. Pennock points out that "science does not have a special rule just to keep out divine interventions, but rather a general rule that it does not handle any supernatural agents or powers since these are taken by definition to be above natural laws." (Pennock 1999, p. 284)[10] For Pennock, this constitutes the most important reason for disallowing them in scientific practice:

[8] If one adopts the position of philosophical naturalism (PN), this causal influence will be ruled out. The problem is the one Descartes encountered when he proposed the pineal gland as the place where the human soul interacts with the body. However, we are willing to grant, for the sake of the argument, the *logical possibility* of the idea of supernatural interventions.

[9] Already in 1748 David Hume warned: "The many instances of forged miracles, and prophecies, and supernatural events, which, in all ages, have either been detected by contrary evidence, or which detect themselves by their absurdity, prove sufficiently the strong propensity of mankind to the extraordinary and the marvellous, and ought reasonably to beget a suspicion against all relations of this kind. (Hume 2000 [1748], p. 89)

[10] He admits that hypotheses involving supernatural causation have uniformly proven unsuccessful in the history of science, but in the end he does not think this is the fundamental rationale for MN (see also Scott

> Lawful regularity is at the very heart of the naturalistic worldview and to say that some power is supernatural is, by definition, to say that it can violate natural laws. […] Controlled, repeatable experimentation […] would not be possible without the methodological assumption that supernatural entities do not intervene to negate lawful natural regularities. (Pennock 1999, p. 321)

In her discussion of metaphysical and methodological naturalism Barbara Forrest presents basically the same argument:

> Introducing supernatural explanations into science would destroy its explanatory force since it would be required to incorporate as an operational principle the premise that literally anything which is logically possible can become an actuality, despite any and all scientific laws; the stability of science would consequently be destroyed. (Forrest 2000, p. 10; for other examples, see Lewontin 1997; Scott 1998, p. 20; Strahler 1992, pp. 13–15)

We think there are two problems with this argument. First, Forrest and Pennock do not explain why *any* occurrence of supernatural intervention in the natural realm would necessarily frustrate *all* experimental work or automatically "destroy the stability of science". That anything logically possible can become an actuality is not as dramatic as it seems—in fact, it just restates the definition of logical possibility. Second, even if mysterious supernatural forces acting in the natural world would make scientific endeavours impossible, by itself this does not amount to a good argument for adopting IMN.

As for the first argument, suppose the RCT in *American Heart Journal* turned out to confirm the hypothesis of therapeutic efficacy of intercessory prayer. Moreover, suppose that further experimental work following this demonstration, which would arguably mark a complete revolution in science, indicated that this form of supernatural causation is predictable because it exhibits certain regularities. For instance, it works only with prayers officially sanctioned by the Catholic Church, only if the ill person is baptised by a Catholic priest, etc. Though it may be ridiculous to speculate that anything of the sort would ever happen, as no alleged case of miraculous healing has even been authenticated scientifically[11], if it would, there is no obvious reason why the scientific enterprise would immediately and entirely collapse[12]. The fact that some prayers actually do help people recover would admittedly cause a complete metaphysical revolution in science (imagine the enthusiasm of theologians), but if the range of action of this supernatural power turned out to be restricted, why would it endanger the rest of our scientific endeavours?

Pennock thinks this is because the idea of supernatural design is a "one-size-fits-all" (Pennock 2007, p. 319) explanation and will therefore leave the door wide open to all sorts of appeals to the supernatural. For example, it would make the practice of law open to "both suits and defences on a range of possible divine and occult interventions" (Pennock 1999, p. 295). But while this suspicion is certainly justified in the case of the contemporary IDC movement

2004). "Clearly, it is not just because such persistence has proven successful in the past that science encouraged this attitude." (Pennock 1999, p. 196)

[11] In order to be beatified by the Roman Catholic Church, a person has to perform a miraculous healing from beyond the grave. At some point in the procedure, the alleged miracle has to be investigated by the Consulta Medica, a board of doctors appointed by the Vatican, to determine whether the recovery was sudden and permanent, and to rule out any scientific explanation for the healing. However, these putative miracles are not accepted by the scientific community at large.

[12] True enough, any such supernatural intervention would force us to revise the fundamental law of energy conservation, or at least allow some exceptions.

and its political agenda (Forrest and Gross 2004), we have to ask whether it is an *intrinsic* problem with supernatural explanations. Let us grant, for the sake of the argument, that defenders of IDC only wish to appeal to the supernatural if their own criteria—irreducible complexity, complex specified information—compel them to do so. Behe for example tries to reassure us that "hypotheses for the involvement of an intelligent agent in the development of life or other historical events have to be evaluated on a case-by-case basis." (Behe 2006, p. 242)

This seems reasonable, and sceptical investigators of the paranormal and supernatural would undoubtedly concur. However, as many scientists and philosophers have amply demonstrated (Miller 2000; Pennock 1999; Shanks 2004), Behe's notion of irreducible complexity and Dembski's criterion of complex specified information are simply very bad filters for detecting design, because they single out biological phenomena that present no problem whatsoever for standard evolutionary explanations. Thus, it is true that if we would allow the appeal to supernatural causation on so flimsy evidential grounds as the IDC movement wants us to do, in practice that would be an invitation for more spurious appeals to the supernatural. But this is a general logical point: if we allow a particular form of sloppy thinking on one occasion, we are left with no grounds for disallowing the same reasoning in other cases. Thus, the claims of IDC are invalidated by *specific* flaws of reasoning and by the simple lack of evidence, not because of some perceived *intrinsic problem* associated with supernatural explanations.

Our second and more fundamental objection deals with the perceived 'danger' of allowing supernatural explanations in science. Pennock and Forrest would probably admit that supernatural interventions in the natural world are at least logically possible, because if they *did* involve logical inconsistencies, that would rule them out ontologically as well, a conclusion Pennock clearly wants to avoid (otherwise he would not insist on the distinction between ontological naturalism and MN). The point is that we cannot exclude the possibility of massive supernatural interference in the universe a priori. For example, if we were stuck in this universe with a whimsical and meddlesome creator, we would simply have no other option than to resign to the possibility of reliable natural knowledge about the world. After all, when Haldane assumed that no God or devil interfered in his experimental practice, he did this not because of the perceived danger for the stability of science, but because of his own professional experience and the empirical success of this methodological guideline: "this assumption has been justified by such success as I have achieved in my professional career." (Haldane 1934, p. vi) Thus, if the devil *were* to thwart Haldane's experiments, that would just be too bad for Haldane, and too bad for science.

In 1775, the Royal Academy of Sciences in Paris issued a statement that it "will no longer accept or deal with proposals concerning perpetual motion". Numerous attempts had been made to construct a *perpetuum mobile*, and many had claimed success, but none of the devices could withstand critical scrutiny. Even in 1775, well before the full theoretical development of thermodynamics, the decision of the Royal Academy of Sciences was quite reasonable. To review all these complicated devices was very time-consuming, and the consistent failure of all proposals in the past suggested that the physical possibility of perpetuum mobiles was very unlikely. Nowadays, we know that they would violate the first law of thermodynamics (the conservation of energy), which is as rock solid as anything in modern science. However, even that fact does not warrant the conclusion that a device for creating energy *ex nihilo* is absolutely impossible. It would simply require extraordinary evidence to convince the scientific community, because its existence would completely overthrow our fundamental laws of physics. The fact that serious scientists no longer deal with proposals for a perpetuum mobile does not mean that science *cannot* deal with them, or that scientists *have* to assume that perpetuum mobiles are impossible because these would "destroy the stability of science".

This attitude of scientists is simply a good rule of thumb for not wasting too much time on highly improbable claims.

4.3 Argument 3: Science Stopper

Apart from the previous objection, Robert Pennock offers an argument for IMN that goes back as far as Francis Bacon[13]. According to Pennock, the argument from design, and the appeal to supernatural explanations in general, are "science stoppers". If we would allow such arguments in science, "the scientist's task would become just too easy." (Pennock 1999, p. 292) With no prospect of a methodology to deal with supernatural phenomena and to proceed with scientific investigation, the supernatural is just a science stopper. By adopting the IDC approach and making the design inference, "any motivation for further research would end" (Miller 2009, p. 130).

> [i]f one were to find some phenomenon that appeared inexplicable according to some current theory one might be tempted to attribute it to the direct intervention of God, but a methodological principle that rules out appeal to supernatural powers prods one to look further for a natural explanations. (Pennock 1999, p. 293)

Pennock is right, of course, that in practice Behe's argument from irreducible complexity and Dembski's argument from complex specified information boils down to a facile science stopper. However, we think Pennock's formulation is unsatisfactory because it circumvents a more sound argument for dismissing these particular science stoppers, which again boils down to PMN. We claim that the appeal to supernatural explanations of IDC proponents is unscientific, not because it is the easy way out per se (although of course it is), but because it is the easy way out in the face of the very reasonable *prospect*—based on our long-standing experience – that a little more effort will yield perfectly reasonable naturalistic explanations (Dennett 2003, p. 395)[14].

Consider Pennock's analogy that "[S]cience is godless in the same way as plumbing is godless" (Pennock 1999, p. 282). However, as far as we can see, plumbers abstain from supernatural explanations for stopped drains not because such an explanation is the easy way out per se (although presumably it is) but because the idea of a supernatural Obstructor did not prove to be a particularly fruitful hypothesis for plumbing work. We tend to overlook this simple pragmatic rationale simply because we live in a world where looking for natural explanations for stopped drains is so *dead obvious*.

Returning to the world of living systems, what reasons do we have, apart from our successful track record and the global materialistic picture emerging from science, to believe that we will eventually come up with naturalistic explanations for all biological phenomena? The more general point lurking here connects with the previous argument about the stability of science as well: what a priori guarantee do we have that nature is structured for the convenience of human scientific inquiry? As Alvin Plantinga writes: "Obviously we have

[13] "For the handling of final causes mixed with the rest in physical inquiries, hath intercepted the severe and diligent inquiry of all real and physical causes, and given men the occasion to stay upon these satisfactory and specious causes, to the great arrest and prejudice of further discovery." Cited in Ruse (2004, p. 16)

[14] Darwin seems to have advocated this sober rationale for the pursuit of naturalistic explanations as well. In *The Expressions of the Emotions in Man and Animals*, he wrote: "No doubt as long as man and all other animals are viewed as independent creations, an effectual stop is put to our natural desire to investigate as far as possible the causes of Expression. By this doctrine, anything and everything can be equally well explained; and *it has proved as pernicious* with respect to Expression as to every other branch of natural history." [our italics] (Darwin 1965 (1872), p. 12) (quoted in Shanks 2004, p. 62)

no guarantee that God has done everything … in such a way as to encourage further scientific inquiry, or for our convenience as scientists, or for the benefit of the National Science Foundation." (Plantinga 2001, p. 357) Although we certainly do not share Plantinga's theistic premises, his point is equally valid for the non-theist. How can we be so sure that the universe is structured in a way that is favourable or rewarding to scientific inquiry, and that is comprehensible to the human mind? As we saw in the previous section, if God or the devil chose to thwart our every attempt at scientific inquiry, we would have no other option than to resign ourselves to that. In a world like that, science is simply useless as a way of obtaining knowledge.

One does not have to be a theist like Plantinga to appreciate this general point. After all, our brains primarily evolved to deal with the adaptive problems our ancestors faced in Pleistocene environments. If one considers the opportunistic and tinkering way by which natural selection typically arrives at adaptive solutions, it would not have been terribly surprising if our brains were "cognitively closed" for the fundamental structures of the universe that surrounds us. For example, the phenomena described by quantum mechanics and general relativity theory are so difficult to grasp because our minds were simply not designed to cope with phenomena on a cosmological or microscopic scale. Only with a lot of mental effort and mathematical equipment have scientists been able to overcome these cognitive limitations.[15] As Einstein once remarked: "The most incomprehensible thing about the world is that it is comprehensible."

Moreover, the *mere* fact that an explanation is easier in terms of intellectual effort does not mean that it is less likely. For example, Freudian dream interpretations, with their intricate associations and multiple levels of unconscious meaning, are certainly more demanding on an intellectual level than 'resorting' to the idea that dreams are just incoherent fragments of nocturnal brain activity. However, the Freudian theory of dreams is wrong beyond any reasonable doubt. Modern psychology discourages the search for hidden meaning in dreams, just like it discourages the search for a *perpetuum mobile*. In these cases, stopping further inquiry has been reasonable. Thus, Plantinga has a point when he writes: "The claim that God has directly created life […] may be a science stopper; it does not follow that God *did not* directly create life." (Plantinga 2001, p. 357) Indeed, the mere fact that it is a "science stopper" is not a fatal objection. However, when we consider that stopping the search for natural explanations in the face of biological complexity has *always been premature*, and that creationists have never grown tired of searching for new candidates of insurmountable 'gaps' when the old ones had worn out, we *do* have very good reasons to dismiss the current spate of challenges to evolutionary theory.

Finally, it is not even obvious that invoking a supernatural force in an explanation would automatically necessitate that one ceases to investigate the phenomenon altogether. (Koperski 2008) One can be confident that, on the contrary, such supernatural phenomena would attract lots of attention from the scientific community at large.

4.4 Argument 4: Procedural Necessity

In her discussion of MN, Barbara Forrest uses another argument in defence of IMN, although her position turns out be somewhat ambiguous. On the one hand, she does refer to the historical failure of supernatural explanations, and she defends a "tentative" denial of the supernatural: "the more science successfully explains, the less justification there is for the supernatural as an explanatory principle." (Forrest 2000, p. 11) This certainly suggests that she is on the PMN

[15] Colin McGinn has claimed that the human mind is cognitively closed for some fundamental problems (see McGinn 1994).

side of the debate. On the other hand, however, Forrest relies on the sterile definition of the supernatural we quoted above, which simply equates it with "that which is beyond the reach of science". Thus, she claims that a proof for the supernatural is *procedurally impossible*, because it is impossible "to prove the existence of something about which nothing can be known *through scientific investigation*." (Forrest 2000, p. 10) MN thus follows naturally:

> Methodological Naturalism does exclude the supernatural as an explanatory principle because it is *unknowable by means of scientific inquiry*. (Forrest 2000, p. 14)[16]

But if the possibility of scientific evidence for the supernatural is already excluded from the very start, why would the unsurprising failure of supernatural explanations be of any interest to Forrest? Why would the metaphysical naturalist appeal to "the lack of explanatory success of supernaturalism" (Forrest 2000, p. 14), as Forrest does, if that success were *procedurally impossible*? Or, to approach the dilemma the other way around: if supernatural explanations are deemed to have *failed* in the past, in a non-trivial sense, it follows that they *might* have succeeded. It seems that Forrest wants to have her cake and eat it too. Her ambivalence leads her to a paradoxical situation, which she acknowledges but never resolves: "Paradoxically, supernatural claims are the kind of propositions for which empirical evidence is required, but impossible to obtain" (Forrest 2000, p. 16).

In Steven Schaferman's defence of naturalism, we find the similar ambivalent position. On the one hand, he writes that naturalism is a "hypothesis that has been tested and repeatedly corroborated, and so has become reliable knowledge itself." (Schafersman 1997) Schafermans takes this to be evidence of metaphysical naturalism as well, which is not exactly the topic of this paper, but his reasoning is certainly in line with our outline of PMN (and we would concur with his tentative metaphysical conclusions). On the other hand, however, Schaferman thinks that evidence for the supernatural is a procedural impossibility in science:

> It is doubtful whether any empirical evidence can possibly exist that would prove, demonstrate, or even suggest the existence of the supernatural. Such evidence posited by philosophical supernaturalists would certainly be labeled incomplete, incoherent, illogical, meaningless, misunderstood, or misinterpreted by philosophical naturalists, and thus rejected as reliable evidence. (Schafersman 1997)

Thus, he writes that naturalism is a "methodological necessity" in the practice of science and even an "ontological necessity for understanding and justifying science by scientists."

We think this paradox can be resolved if Forrest and Schafersman plainly choose the P-horn of the MN-dilemma and abandon the uninteresting and sterile definition of the term 'supernatural', which, as we discussed, is not relevant for the claims of IDC anyway. The whole argument about the "procedural necessity" of MN can then be dropped.

From our perspective, the consistent failure of supernatural explanations is not only the rationale for MN, but also provides the main argument for (provisionally) endorsing metaphysical naturalism. Forrest, however, maintains that MN, grounded by the principle of procedural necessity, "provide[s] an epistemologically stable foundation for a metaphysics" (Forrest 2000, p. 14). We think this is peculiar, because the whole point of IMN, according to its defenders, is to *separate* methodology from metaphysics (Pennock 1999, p. 191). After all, defenders of IMN want to assure religious believers that science is *only* naturalistic as far as its methodology is concerned, and that it has no bearing on questions of metaphysics. Forrest's claim that MN provides a foundation for metaphysical naturalism, combined with

[16] For another example of this argument, see Miller (2009, p. 127).

the contention that MN is an intrinsic part of science, feeds the false charge of creationists that scientists are *dogmatic* metaphysical naturalists.[17]

4.5 Argument 5: Methodological Naturalism and Testability

A last and important concern about supernatural explanations, which for some philosophers constitutes the main reason to dismiss them a priori, is that they are *intrinsically untestable*.

> [Science] rejects the possibility of supernatural explanations not as a matter of principle, but of *methodology*: What kind of research would one do, what kind of methodology would one use, if the premise were that God can do whatever He pleases whenever He wishes to do it? (Pigliucci 2002, p. 29)

> If there is an omnipotent force in the universe, it would by definition be impossible to hold constant (to control) its effects. […] The reason that the ultimate statement of creationism cannot be tested is simple: the actions of an omnipotent creator are compatible with any and all observations of the natural world. (Scott 2004, pp. 19–20)

> A supernatural agent is unconstrained by natural laws or the properties and capabilities of natural entities and forces—it can act in any way and accomplish any conceivable end. (Miller 2009, p. 128)

However, we think that Scott and Pigliucci are attacking specific kinds of supernatural claims to derive unwarranted conclusions about supernatural explanations in general. In fact, their objection based on 'intrinsic unfalsifiability' applies only to an omnipotent God who either deliberately conceals his own existence, or who has chosen to create exactly the world one would expect if there were only blind and material forces at work. Take for example the Omphalos hypothesis of Philip Gosse, according to which God deliberately planted forged evidence for an old earth to test our faith, including dinosaur fossils and far-off stars. As many critics noted, the idea is as gratuitous as the idea that God created the world 5 minutes ago, and there is no conceivable way to refute it. However, we should note that the same holds for any number of supernatural *and* natural conspiracy hypotheses about the world, for example the claim that there are elves in my backyard who disappear whenever someone is watching them or trying to capture them on videotape. If a hypothesis is designed to be immune to falsification, scientists are justified in dismissing it, and in that sense we completely agree with Scott and Pigliucci.

Critics have also pointed out that proponents of supernatural claims, notably IDC theorists, often make use of evasive manoeuvres that render their theories immune to empirical falsification. For example, in response to the argument from imperfection and bad design, Michael Behe has simply replied that we cannot gather any scientific information about the character and intentions of the Designer, that His reasons are unfathomable and that any speculation about them is pure metaphysics. Pennock has rightly dismissed this immunizing strategy:

> it provides the design argument with a virtually impenetrable shield […] Behe has successfully insulated the design argument against the imperfection argument.

[17] Apart from that, we completely agree with Forrest's argumentation for metaphysical naturalism as "founded upon the methods and findings, respectively, of modern science" and "the only reasonable metaphysical conclusion—if by reasonable one means both empirically grounded and logically coherent." (Forrest 2000, pp. 8, 9)

> Equipped with such bumpers it can now withstand any impact." (Pennock 1999, p. 249)

This reminds one of Darwin's observation that many supernatural 'explanations' of the biological and physical world are only "re-stating the fact in dignified language" (Darwin 1998 (1859), p. 151). They do not generate novel predictions, because they were "explicitly designed to yield the already known facts […] *and nothing more*" (Worrall 2004, p. 68).

However, we have to be careful not to misconstrue the immunizing strategies and ad hoc amendments of creationists as *intrinsic problems* with supernatural claims. It is true that IDC proponents are guilty of immunization strategies, but as far as we can see, this unwillingness to take empirical risks is just an indication of the dismal state of their research programme. After all, resorting to immunization strategies is a typical feature of pseudo-science, supernatural or otherwise (Boudry and Braeckman 2010).

Thus, if only they chose to do so, IDC proponents could easily equip an alleged supernatural Designer with specific attributes and intentions in such a way that the design hypothesis would yield unexpected predictions and is *not* "compatible with any and all observations of the natural world", as Scott claims (Scott 2004, p. 20; Richter 2002, p. 21). For example, if one supposes that the Designer is benevolent and has created the universe with good purpose, as almost any theist does, one is confronted with the problem of evil and suffering in the world (Hume 2007 [1779]; Kitcher 2007, p. 130). As Reed Richter pointed out, in response to Scott's defence of IMN, "'[s]upernatural' does not automatically imply arbitrary, capricious action as Scott implies".

Moreover, even if we are talking about an omniscient and omnipotent God, the mere fact that He *can* make his own existence completely undetectable does not mean that He chooses to do so. An omnipotent God could as well prefer to reveal himself to the world and leave unmistakable traces of His creative activity, as the natural theologians from the 19^{th} century thought He did. As an interesting analogy, consider the story *Non Serviam* by Stanislaw Lem, in which computer scientists have managed to create conscious life forms in an artificial mathematical environment whose properties are fundamentally different from the three space dimensions and single time dimension of their creator's world (Lem 1999, pp. 167–196). While the programmer is observing and monitoring the actions and behaviour of these 'personoids', he discovers that the creatures start to speculate about their own origins and the possible existence of a Creator. Throughout the story, the 'supernatural' creator remains completely imperceptible for the personoids themselves, but this is only because the programmer has decided not to reveal his existence to them, and to strictly adhere to the principal of non-intervention (he does this for ethical reasons). If he chose to do so, however, the programmer could easily reveal his own existence to his creatures.

There is no rational reason at all to believe that we are in the predicament of the personoids in *Non Serviam*, but the story makes clear that supernatural intervention could be quite straightforward and scientifically detectable (Richter 2002), even if we would have no full 'access' to this supernatural realm, on account of our limitations as three-dimensional beings composed of matter and energy. Taner Edis has sketched the outline for a metaphysical picture in which a supernatural Designer resides beyond the natural world and yet is able to causally interact with it. Victor Stenger even made up a list of hypothetical observations that would favour the God hypothesis (Stenger 2008, pp. 231–234). We mentioned the alleged therapeutic effect of intercessory prayer as one possible source of scientific evidence for the supernatural. In general, if one wants to demonstrate the supernatural, one has to "seek ways in which the natural order is disrupted, indicating a reality beyond the material world." (Edis 2002, p. 43) Repeated miracles or psychic wonders, established through carefully controlled

experiments, would "put an unbearable strain on a naturalistic view of the world" (Edis 2002, p. 188). And if we could detect specific patterns in the incidence of these miracles, they might provide us with clues about the nature of the supernatural cause behind them, or even the intentions of the supernatural being responsible for them.

We conclude that the argument from 'intrinsic unfalsifiability' misconstrues typical immunization strategies and ad hoc manoeuvres of creationists as *general and intrinsic problems* with supernatural explanations.

5 Discussion and Conclusion

In this paper, we reviewed five arguments in favour of the conception of MN as an intrinsic property of science (IMN), and we found them all wanting: the argument from the definition of science, the argument from lawful regularity, the science stopper argument, the argument from procedural necessity, and the testability argument. Instead, we defended MN as a provisory and empirically grounded commitment of scientists to naturalistic causes and explanations, which is in principle revocable by overwhelming and unmistakable empirical evidence (PMN). Evolutionary scientists are on firmer ground if they discard supernatural explanations on purely evidential grounds, and not by philosophical fiat.

The numerous attempts to establish the existence of supernatural and paranormal phenomena *might* have succeeded (Humphrey 1996, pp. 23–28; Edis 1998). As we argued in the last section, unless the alleged supernatural Creator is involved in a cosmic conspiracy that makes his existence completely undetectable to us, it would not be terribly difficult to look out for scientific evidence for his presence.

In a letter to biologist Asa Gray, Darwin wondered what would convince *him* of design (see also Coyne 2009)[18]:

> If I saw an angel come down to teach us good, and I was convinced from others seeing him that I was not mad, I should believe in design. If I could be convinced thoroughly that life and mind was in an unknown way a function of other imponderable force, I should be convinced. If man was made of brass or iron and no way connected with any other organism which had ever lived, I should perhaps be convinced. But this is childish writing. (Darwin 2000, pp. 169–170)

Although the idea of one unmistakable 'smoking gun' for design is probably misguided, one can easily imagine a collection of observations that would lend plausibility to the hypothesis of a supernatural origin of life (see also Coyne 2009; Richter 2002). Suppose that species just popped into the fossil record without any discernible traces of evolutionary descent and without demonstrable relationship to other species. Suppose that all available dating methods concurred on a 6000 year old earth and universe, and that all attempts to explain living systems by any combination of natural mechanisms consistently failed. To top it all, suppose that the letters of the book of Genesis were discovered to be encoded in human DNA (for a discussion of deliberate signatures from Designers, see Dennett 1996, pp. 316–318). This may seem like a preposterous thing to imagine, but it does not involve any logical contradictions, and it is difficult to deny that it would constitute compelling evidence for the hypothesis of

[18] A similar argument is brought forward by Cleanthes in Hume's *Dialogues concerning natural religion* (Hume 2007 [1779]).

supernatural interference in the universe (but for intrinsic objections to the design argument, see Sober 2008).[19]

Thus, naturalists do not need to resort to the claim that scientific evidence for anything supernatural is logically or conceptually *impossible*, and in any case it is imprudent to do so. As Sahotra Sarkar noted, philosophical modesty teaches us that all scientific knowledge is fallible and that we cannot rule out any metaphysical picture with absolute certainty. Metaphysical transformations, although not quite so radical, have happened before, for example with Newton's theory of gravity (the notion of 'action at a distance') and particularly with the advent of quantum mechanics (the demise of classical determinism). Compelling empirical evidence, however unlikely, would certainly trump methodological scruples (Sarkar 2007 see also Koperski 2008).

Elsewhere (Boudry 2009)[20] we have demonstrated that the principle of IMN is also an ill-advised attempt to reconcile science and religion. By excluding the supernatural from science by philosophical fiat, IMN has been grist to the mill of anti-evolutionists intent on accusing scientists of philosophical prejudice and dogmatism. To this end, they have exploited some of the specific philosophical weaknesses discussed in this paper. In our view, the conception of PMN salvages these philosophical problems and provides a more accurate picture of the proper role and rationale of science's naturalistic methodology.

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[19] Philosopher of science Elliott Sober has recently argued that the design argument is intrinsically defective (Sober 2008, pp. 109–188). In the end we think his a priori objections are unavailing, because his own reconstruction of the argument of design in terms of "likelihood" does not capture the argument satisfactorily. Sober acknowledges that the main problem with his reconstruction is that likelihood values can be artificially raised to unity by just tuning the hypothesis to the observations. For example, if "H = there exists a omnipotent supernatural Creator for whom the creation of the bacterial flagellum is number one priority" and "O = there exists a bacterial flagellum", than the likelihood P (O | H) trivially equals one. Sober's solution is to disallow any assumptions about the dispositions and intentions of the supposed designer, because neither of them can be independently supported. But this move is too restrictive, as it eliminates precisely the 'interesting' hypotheses, i.e. the ones that are minimally consistent with the observations (after all, we are not interested in hypothetical designers who have no interest in, or are not capable of, creating something like our world). Unfortunately, reasons of space prevent us from devoting the attention to this discussion that Sober's forceful arguments certainly deserve.

[20] See also our as yet unpublished manuscript (present authors): "Grist to the mill of anti-evolutionism: the failed strategy of ruling the supernatural out of science a priori".

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