

Materialistic reductionism has got to go! Watch out, evolutionary theory (and physics too)!

A Review of Thomas Nagel's *Mind and Cosmos* (Oxford University Press, 2012)

Elliott Sober
Philosophy Department
University of Wisconsin, Madison

Thomas Nagel, a distinguished philosopher at NYU, is well known for his critique of “materialistic reductionism” as an account of how mind and body are related. In the present book, Nagel widens the attack. It isn't just materialistic reductionism about the mind that has got to go. Nagel argues that evolutionary biology is fundamentally flawed and that physics also needs to be rethought (3).¹ What is needed is a new way of doing science, not more of the same. Nagel thinks that teleology (explanations that invoke goals) is the answer, though he admits that he has no teleological theory of his own to offer. His job, as he sees it, is to point to a need; creative scientists, he hopes, will do the heavy lifting.

Nagel's rejection of materialistic reductionism, which he characterizes as the thesis that physics provides a complete explanation of everything (13-14), does not stem from religious conviction. He says that he doesn't have a religious bone in his body (12). The new science that Nagel wants is naturalistic, not supernaturalistic. This point needs to be remembered, given that the book begins with kind words for proponents of intelligent design (10, 12). Nagel applauds them for identifying problems in evolutionary theory, but he does not endorse the solution they propose.

Nagel says that his goal in this book is not so much to argue against materialistic reductionism as to explore the consequences of its being false (15).² This is unfortunate. Those who know their Nagel will be able to fill in the details, but new readers may be puzzled. Here is the backstory:

In his famous 1974 article “What is it like to be a bat?”³ Nagel argues that current science lacks the concepts that would allow us to understand how a materialistic account of subjective experience could be possible. Present day science can give us information about the bat's brain, but it cannot answer the titular question of Nagel's article – what does it feel like, from the inside, to be a bat? Nagel chooses this organism as his example because it has a sensory system (echolocation) that we lack; this choice is to

¹ All numbers in parentheses refer to pages in Nagel's book.

² Nagel expresses skepticism about Saul Kripke's argument against materialism (40). For Kripke's argument, see his *Naming and Necessity* (Wiley-Blackwell, 1991, new edition).

³ *Philosophical Review*, 1974, 83: 436-450.

make the problem vivid, but Nagel thinks the problem arises at home. Each of us knows what sugar tastes like, but current science lacks the vocabulary to understand and explain what that peculiar subjective experience is like. Nagel is cautious in the bat article; he holds out the hope that a future materialistic science might be able to do better.

In the book under review, Nagel holds that that can't happen. Here he draws on his bolder and more recent paper, "The Psychophysical Nexus."⁴ Nagel's position now is that materialistic reductionism is false, not that we currently don't understand how it could be true. For Nagel, perception and other psychological processes involve irreducibly subjective facts, and for that reason there are important aspects of the mind that are forever beyond the reach of physical explanation. Nagel's present position is compatible with many doctrines that are associated with materialism. For example, he doesn't gainsay the slogan "no difference without a physical difference" – if you and I have different psychological properties, then we must be physically different. Indeed, Nagel's position is even compatible with the idea that every mental property is identical with some physical property – for example, it may be true that being in pain and being in some neurophysiological state X are identical (in the same way that being made of water and being made of H₂O are identical properties). Nagel thinks that this identity claim, if true, is something that physics in principle cannot explain. Mind and Cosmos begins with the thesis that materialistic reductionism hits a roadblock with the mind/body problem. But there are other roadblocks ahead.

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Materialism is a monistic doctrine – it holds that everything that exists is made of matter (and of nothing but). Idealism is also monistic; it holds that everything is made of mental stuff. Dualism isn't monistic, of course; it holds that there are two irreducibly distinct kinds of thing. In the book under review, Nagel rejects all of these. He wants a monism that is neither materialistic nor idealistic. Nagel opts for "neutral monism;" what Nagel means by this that the connection of mental to physical is to be explained by a deeper fact, namely that the universe is populated by a set of "neutral elements" that are to

⁴ "The Psychophysical Nexus," in *Concealment and Exposure and Other Essays*, Oxford University Press, 2002.

be characterized by “some transphysical and transmental concept”⁵; these elements have both mental and physical properties (57).

Nagel sometimes describes neutral monism in a way that makes it unclear how the view differs from materialism. For example, he says that neutral monism “holds that certain physical states of the central nervous system are also necessarily states of consciousness” and that “brain processes are in themselves more than physical, and the incompleteness of the physical description of the world is exemplified by the incompleteness of their purely physical description” (57). I don’t see why materialists need to reject these statements. Materialists can agree that various brain states are necessarily states of consciousness in just the way that certain chemical states of the stomach are necessarily states of a digestive process. And materialists can also agree that some brain processes have psychological properties. As for the “incompleteness” of physical descriptions, materialists have no problem with the idea that there are truths about organisms that can’t be expressed in the language of physics. The words “belief” and “desire” do not occur in theories in physics; yet you and I have beliefs and desires.

Nagel’s monism is intended to give equal status to the mental and the physical in the sense that the basic elements out of which everything is made have both kinds of properties; Nagel’s monism therefore involves a kind of panpsychism (57). This doesn’t mean that rocks have beliefs and desires. Rather, Nagel’s idea is that the neutral elements he postulates have the potential to form complex objects that have truly mentalistic characteristics. Nagel’s neutral elements have mental properties only in a very attenuated sense – it’s like acorns having the properties of oak trees. But here again, it isn’t clear how monism differs from materialism; materialists hold that atoms have the potential that Nagel thinks his neutral elements possess.

I don’t see how Nagel’s neutral monism, insofar as it differs from materialism, can solve the mind/body problem. Materialism’s job is to close the explanatory gap⁶ between the physical and the mental. It attempts to do this by relying on the considerable information that science supplies about material objects and processes and how they give rise to entities that have psychological properties. Nagel’s monism is in a different position. It postulates the existence of neutral elements; if these are different from the physical particles that science describes, then science has nothing to say about their existence and properties. Nagel says that these elements have both physical and mental characteristics (though, as noted, he thinks they have the latter only in an attenuated sense); from this postulate, the

⁵ Nagel is here quoting a passage from Tom Sorrell’s *Descartes Reinvented* (Cambridge University Press, 2005, p. 95).

⁶ The phrase is from Joe Levine’s 1983 paper “Materialism and qualia: the explanatory gap” (*Pacific Philosophical Quarterly* 64: 354-361).

mind/body relationship is supposed to be explained. Nagel's monism reminds me of Bertrand Russell's quip — "the method of 'postulating' what we want has many advantages; they are the same as the advantages of theft over honest toil."⁷ How can postulating the existence of something that has both physical properties and the potential to form composites that have mental properties explain the relationship of body to mind?

If materialists proposed to solve the mind/body problem by saying that atoms have physical properties and also have the potential to form composite entities that have psychological properties, the riposte would be that that doesn't solve the problem. That is the problem – how can material objects form composites that have minds? Nothing changes if we substitute "neutral elements" for "atoms."

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Nagel holds that evolutionary biology is in trouble, but what sort of trouble is it in? There are two possibilities. Evolutionary theory could be in trouble just because it is committed to materialistic reductionism; if so, the theory would be perfectly okay if it dropped that commitment. Indeed, this drop might make sense independent of Nagel's beef with reductionism, since the philosophical doctrine makes claims about lots of things that are not within the purview of evolutionary biology (e.g., why black holes exist). Understood in this way, it's the philosophy that has gone wrong, not the biology. But much of what Nagel says is not in this vein. He thinks that the biology itself is flawed. Even if you dropped the commitment to materialistic reductionism, the theory would still be in trouble. For Nagel, the combination of evolutionary theory and materialistic reductionism is false, while evolutionary theory taken on its own (without the philosophical add-on) is incomplete (30). Incompleteness means that the theory provides explanations of important biological events that are, at best, partial.

Here I want to consider two criticisms that Nagel makes of evolutionary theory. The first concerns probability; the second concerns ethics. Neither criticism depends on the idea that evolutionary theory is committed to materialistic reductionism.

⁷ *Introduction to Mathematical Philosophy* (New York and London, 1919, p 71). I should note, however, that Russell endorsed a form of neutral monism in *The Analysis of Mind* (London: George Allen & Unwin, 1921).

Nagel thinks that adequate explanations of the origins of life, intelligence, and consciousness must show that those events had a “significant likelihood” of occurring (32); these originations must be shown to be “unsurprising if not inevitable” (32) and a complete account of consciousness must show that consciousness was “something to be expected” (53). Nagel thinks that evolutionary theory as we now have it fails to deliver the goods, so it needs to be supplemented.

Nagel doesn't impose this condition of adequacy on all the events that science might address. He is prepared to live with the fact that some events are just “flukes” or “accidents” or “improbable coincidences.” For example, it may just be an improbable coincidence that Evelyn Marie Adams won the New Jersey lottery in 1985 and then did the same thing again four months later. But the existence of life, intelligence, and consciousness are not in the same category (7). Why do Nagel's standards go up when he contemplates facts that he deems “remarkable”? Maybe this falls under what Nagel refers to, in a different context, as his “ungrounded intellectual preference” (26). It isn't theistic conviction that is doing the work here, but Nagel's faith that the basic facts he mentions must be “intelligible,” where intelligibility requires that these facts had a significant probability of being true.

My philosophical feelings diverge from Nagel's. I think it is a remarkable fact that Beethoven existed, but I regard his existence as an improbable fluke. He could easily have failed to exist. Indeed, my jaded complacency about Beethoven scales up. I don't think that the existence of life, intelligence, and consciousness had to be in the cards from the universe's beginning. I am happy to leave this question to the scientists. If they tell me that these events were improbable, I do not shake my head and insist that the scientists must be missing something. There is no such must.

I also reject Nagel's requirement that an event is intelligible only if it has a high probability. Suppose that Mom and Dad have two children. Why are both of them female? A simple Mendelian answer is that all of Mom's eggs had an X chromosome while half of Dad's sperm had an X and half had a Y. The process of fertilization randomly combines an egg from Mom with a sperm from Dad. This means that the chance of a daughter is $\frac{1}{2}$. The chance of two daughters is therefore $\frac{1}{4}$. We explain the two-daughter outcome, not by showing that it was to be expected, but by elucidating the process that produced the outcome with a certain probability.

In thinking about Nagel's probability argument, we need to be careful about which facts we are considering. The fact that life on earth started up some 3.8 billion years ago, and that intelligence and consciousness made their terrestrial appearances more recently – this is a local fact about our planet, and maybe it was very improbable, given how the universe got started. But consider a more global fact – the

fact that the universe contains life and intelligence and consciousness at some time in its total history. What's the probability of that, given the universe's initial state? Science doesn't really have much of a clue (yet), but this gap in our present knowledge does not show that fundamental presuppositions of the sciences need rethinking. After all, conventional science does tell us that the universe is a very big place with lots of planets that are about as close to their stars as our planet is to the sun. Maybe life and intelligence and consciousness had a high probability of arising (someplace and sometime, not necessarily on earth in the last 3.8 billion years). If this global fact is the remarkable fact that Nagel has in mind, it offers no reason to think that biology needs to be supplied with new organizing principles. Do not confuse the proposition that Evelyn Marie Adams won the New Jersey lottery twice in 1985-86 with the proposition that someone won some state lottery or other twice, at some time or other. The first was very improbable, the second much less so.

Before leaving the topic of probability, I want to highlight what is involved in Nagel's requirement that the facts he says are remarkable must be shown to be unsurprising. For the sake of concreteness, let's take this to mean that the probability must be greater than $\frac{1}{2}$. Suppose that to get from the universe's first moment to the origin of consciousness, 200 stages must be traversed. The universe starts at stage S1, then it needs to pass to S2, then to S3, and so on, until it reaches S200, at which time consciousness makes its first appearance. Suppose further that we have a theory that says that the probability of going from each of these stages to the next is 99/100. This means that the probability of going from S1 to S200 is $(99/100)^{199}$. This probability has a value of about $\frac{1}{10}$. The demand that the origin of consciousness must have had a probability greater than $\frac{1}{2}$ entails that the theory I just described must be wrong or seriously incomplete. I agree that it might be wrong or incomplete, but this is not because it violates Nagel's demand.⁸ In addition, I think that a theory of this sort could shed considerable light on why consciousness arose; it doesn't show that the event was to be expected, given the universe's initial state; but, if true, it does elucidate the step-wise process that produced the outcome we observe. When a theory says that X was improbable, this does not mean that the theory says that X is unintelligible.⁹

What makes more sense than Nagel's probability requirement is one about possibility -- that an adequate theory must allow that the origin of life, mind, and consciousness all were possible, given the

⁸ If Nagel's standards were less demanding, so that the requirement were only that an adequate theory must show that remarkable facts have probabilities that are greater than $\frac{1}{10}$, the same sort of argument could be constructed.

⁹ Welsey Salmon, Richard Jeffrey, and James Greeno, *Statistical Explanation and Statistic Relevance* (University of Pittsburgh Press, 1971).

initial state of the universe. If this were all that Nagel meant by saying that “the propensity for the development of organisms with a subjective point of view must have been there from the beginning” (61), I would have no quarrel. But then there would be no objection to the sciences we now have.

Not only does Nagel require that remarkable facts must be fairly probable; he also insists that they can't be byproducts (aka side-effects). He applies this requirement to the appearance of minds (17, 72), consciousness (53), and reasoning (88). Nagel doesn't reject all byproduct explanations. For example, he is comfortable with the standard evolutionary account of why vertebrate blood is red (50). This didn't happen because there was an adaptive advantage in having red blood. Rather, the explanation is that the hemoglobin molecule was selected because it transports oxygen to tissues. The molecule makes our blood red, but that is just a side-effect. And it isn't just useless traits like the color of blood that evolutionary biology says are byproducts. Sea turtles use their forelimbs to dig nests in the sand when they come out of the water to lay their eggs, but the tetrapod arrangement evolved long before turtles evolved this behavior. The ability to build nests in sand is a side-effect. Evolution repeatedly puts old structures to new uses.

Evolutionary biology doesn't insist that the remarkable facts that Nagel considers must be byproducts, but the science doesn't rule this out in advance. Darwin and Wallace disagreed about how the human capacity for abstract theoretical reasoning should be explained.¹⁰ Darwin saw it as a byproduct. There was selection for reasoning well in situations that made a difference for survival and reproduction; the fact that we are capable of reasoning about mathematics and natural science and philosophy is a happy byproduct. Wallace disagreed and thought that a spiritualistic explanation was needed. Nagel finds Darwin's side-effect account “very far-fetched” (78) but he does not say why.

I now turn to Nagel's second reason for thinking that something is seriously amiss with current evolutionary theory. Nagel is what philosophers call a “moral realist.” This doesn't mean that he has the cynicism of a Humphrey Bogart character. It means that he thinks that some statements about right and wrong are true, and that what makes them true isn't anyone's say-so, nor are they made true by the fact that we would come to believe them if we engaged in a certain type of deliberation. For Nagel, the statement that causing suffering is bad¹¹ is like the statement that the Rocky Mountains are more than 10,000 feet tall; both are true independently of whether anyone thinks they are true. Nagel thinks that moral realism “is incompatible with a Darwinian account of the evolutionary influence on our faculties of

¹⁰ Stephen Jay Gould, “Natural Selection and the Human Brain – Darwin vs. Wallace,” in *The Panda's Thumb* (New York: Norton, 1980), pp. 47-58.

¹¹ What I mean by “causing suffering is bad” is that it counts against an action that it causes suffering; there may be countervailing considerations that show that the action is permissible or even obligatory.

moral and evaluative judgment.” He resolves the conflict as follows: “since moral realism is true, a Darwinian account of the motives underlying moral judgment must be false” (105).

Why does Nagel think that evolutionary theory conflicts with moral realism? Although he credits the conflict idea to an argument developed by his colleague Sharon Street, I think Nagel’s argument is different.¹² Nagel’s is based on Ockham’s razor, the principle of parsimony.¹³ For some of the psychological capacities we have, it seems pretty clear that they evolved because they provided our ancestors with reliable information about the world they inhabited. Perceptual beliefs are the clearest example. Our ability to use our sensory systems to form beliefs about our immediate surroundings evolved because the beliefs they generated were largely true. Nagel thinks that no such explanation can be offered for why we have the moral beliefs we have. For example, Darwin argued that moral norms enjoining altruistic behavior are now widespread in human societies because groups that internalized and complied with these norms outcompeted groups that did not.¹⁴ Whether it is true that we ought to act altruistically isn’t something that Darwin or more recent biologists need to take a stand on to explain why people accept such norms.

Okay, you may be thinking, why is the evolutionary explanation of our moral beliefs an argument against moral realism? Here you need to reach for your razor. Nagel’s idea is that if you don’t need to postulate the existence of moral facts to explain why we have the moral beliefs we have, then you should slice those alleged facts away. This doesn’t just mean that you should decline to believe that there are moral facts of the sort that moral realism postulates. It means that you should believe that there are no such things. The razor doesn’t tell you to suspend judgment; it tells you to deny. That, I think, is Nagel’s reason for thinking that there is a conflict between evolutionary theory and moral realism – evolutionary theory underwrites a parsimony argument against moral realism.

I don’t buy this argument. I agree that you don’t need to postulate moral truths to have an evolutionary explanation for why we have the moral beliefs we do. But that doesn’t mean that evolutionary theory justifies denying that there are such truths. Nagel is assuming that if moral realism is

¹² In “A Darwinian Dilemma for Realist Theories of Value” (*Philosophical Studies* 127: 109-166, 2006), Street argues that evolutionary theory shows that if moral realism is true, then we can’t have reliable knowledge of moral truths. Nagel argues that if evolutionary theory is true, then moral realism is false.

¹³ Michael Ruse and Edward O. Wilson use a Darwinian parsimony argument against moral realism in their “Moral Philosophy as Applied Science” (*Philosophy*, 1986, 66: 173-192).

¹⁴ I discuss Darwin’s ideas on group selection in *Did Darwin Write the Origin Backwards?* (Prometheus Books, 2011).

true, then the truth of moral propositions must be part of the explanation of why we believe those propositions. I disagree; the point of ethics is to guide our behavior, not to explain it.¹⁵

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As I've explained, Nagel thinks that an adequate scientific account of the existence of life, mind, and consciousness must show that those events had significant probabilities. Nagel holds that current science does not deliver the goods, and that it therefore needs to be supplemented. But with what? Nagel's answer is that science should go teleological, meaning that concepts of goal and purpose need to be used in new scientific theories. Nagel sees that this suggestion conflicts with the dominant scientific tradition that one finds in the physics of Galileo, Newton, and their successors, which banished teleology (92). Nagel's teleology is the most radical idea in his book.

Nagel says that teleology means that "things happen because they are on a path that leads to certain outcomes" (67). Suppose that A caused B and that B then caused C. A teleological explanation of B will say that it occurred because it was on the path from A to C. This explanation of B cites C, which occurs later than B. The teleological explanation does not say that the later event caused the earlier one. For Nagel, teleological explanations are noncausal (58). In addition, Nagel wants a naturalistic and nonintentional teleology, one that does not involve God or any other intelligent designer directing the universe towards some goal (91).

Nagel also notes that a teleological theory says that things tend to change in the direction of certain types of outcome (66). This is right, but, as Nagel realizes, it isn't sufficient for a theory to be teleological. The second law of thermodynamics says that closed chambers of gas tend to evolve in the direction of increasing entropy, but that doesn't mean that they are goal-directed systems. Nagel also says that conventional (nonteleological) physics describes "how each state of the universe evolved from its

¹⁵ Nagel makes this very point in his earlier book *The View from Nowhere* (New York: Oxford University Press, 1989, p. 144-146) when he says that "it begs the question [against moral realism] to assume that explanatory necessity is the test for the reality of values. The claim that certain reasons exist is a normative claim, not a claim about the best explanation of anything." But then Nagel seems to draw back from this thesis: "it is not clear whether normative realism is compatible with the hypothesis that all our normative beliefs can be accounted for by some kind of naturalistic psychology." And still later he says that "the true explanation of my impression [that my headache is a bad thing] may be the simplest one, namely that headaches are bad, and not just unwelcome, to the people who have them."

immediate predecessor (92),” but teleology is different: “teleology requires that [some] successor states ... have a significantly higher probability than is entailed by the law of physics alone (93).” Whether or not this is a necessary condition for teleology, it too is insufficient. Suppose I buy a lottery ticket on Monday, win the lottery on Tuesday, and splurge on luxury goods and big charitable donations on Wednesday. The probability of my winning on Tuesday, given that I bought the ticket on Monday, is low, but the probability that I win on Tuesday, given that I bought the ticket on Monday and was a big spender on Wednesday, is much higher. This isn’t teleological, however, since it isn’t true that my spending on Wednesday explains why I won the day before.

I do not reject teleology wholesale. I do not reject claims like “flowers have bright petals because they attract pollinators” and “Sally went to the park at 8:30 because there were fireworks at 9.” These statements do not say that a later event caused an earlier one, but they are true because certain causal facts are in place. The statement about flowers is true because there was selection for bright colors among plants that gained from the services of pollinators that used color vision. The statement about fireworks is true because Sally knew there would be fireworks at 9 and she wanted to arrive in time to get a good seat. I have no idea how the origin of life, mind, or consciousness can be explained teleologically. But if there are causal underpinnings for teleological statements about these remarkable facts, as there are for the teleological statements about flowers and fireworks, the materialist need not object.

Nagel’s thesis is not just that there are true teleological statements about the emergence of life, mind, and consciousness, but that these statements cannot be explained by a purely causal/materialistic science. Only then does his teleology go beyond what materialistic reductionism allows. I see no reason to think that there are true teleological statements of this sort. If readers are to take seriously the possibility of teleological statements that are both true and causally inexplicable, it would help if Nagel identified some modest example of this sort. He never does. That raises the worry that the kind of explanation for which Nagel hankers is a pipe dream.

Nagel wants a teleological science partly because he is moved by probability considerations. If conventional science says that remarkable facts had low probabilities, given what came before, the probabilities of these facts can be boosted by adding information about what came after. In this respect, the emergence of life resembles my winning the lottery on Tuesday. Each event is quite probable, given what happened later. The problem is why we should regard that as an explanation.

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Nagel is hardly unique in being an anti-reductionist. Indeed, my bet is that most philosophers nowadays would say that they are “against reductionism.” What sets Nagel apart is his idea that current biological and physical theories need to be fundamentally overhauled. Why is it that other anti-reductionists decline to take this radical step? It is not that they are faint of heart. Mostly they decline because they endorse the following picture: When an organism has a new visual experience, the physical state of the organism has changed. And when an economy goes into recession, the physical state of that social object also has changed. These examples obey the slogan I mentioned before— “no difference without a physical difference.” However, when it comes to understanding visual perception and economic change, the best explanations are not to be found in relativity theory or quantum mechanics. Sciences outside of physics can explain things that physics is not equipped to explain. But this doesn’t mean that physics needs to be revised. The philosophers and scientists I am describing disagree with Nagel’s claim that evolution is more than a physical process (50), though they agree that physics is not the best tool to use in understanding evolution.

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A true and well-confirmed causal statement like “smoking cigarettes causes lung cancer” calls for explanation. We want to know how inhaling the smoke causes the tumor. If someone said that this causal statement is just a brute fact – that it is true but has no explanation – we would raise our eyebrows. When one event causes another, we expect there to be intervening events. We explain why C causes E by showing that C causes I1, that I1 causes I2, and so on, up to some further I that causes E. If causal chains are dense (meaning that if X causes Z, then there exists an event Y such that X causes Y and Y causes Z), then the enumeration of intervening events can go on forever. But materialism should not commit to this. It should be open to the possibility that some causal relationships are brute facts. This is one reason to be suspicious of the view that Nagel calls materialistic reductionism – that physics provides a complete explanation of everything. Scientists already leave room for brute facts in another context. When they say that a law is “fundamental,” they mean that it can’t be explained by anything deeper.

If there can be brute facts about purely physical causation, why can't there be brute facts about physical events having mental effects? Suppose the event C just mentioned is the hammer hitting your thumb and that E is the pain you feel. Science explains why C caused E by interpolating causes. The chain of events that goes from C to E passes (perhaps gradually) from the physical to the mental. The idea that there can't be brute facts about physical-to-mental causation is just as misguided as the idea that there can't be brute facts about physical-to-physical causation.

Nagel says that "all explanations come to an end" (22). This could point to a practical matter; when we run out of time or patience, we settle for what we have. But the limitation may also be forced on us by the world. Maybe there are brute causal facts. Maybe some scientific laws are fundamental. And maybe some crucial facts about the mind/body relation are brute as well. Not that we should be complacent. If smoking causes lung cancer, it makes sense to expect that there is an explanation as to why. But we should not over-generalize, turning a good heuristic into a metaphysical principle that brooks no exceptions. Whereas the materialistic reductionism that Nagel criticizes says that everything has a complete physical explanation, a more circumspect materialism would assert that everything that has an explanation has a complete physical explanation.

Mind and Cosmos is dominated by a set of very strong assumptions about explanation— that the facts that Nagel deems remarkable must have explanations, that those explanations must show that the remarkable facts have fairly high probabilities, and that remarkable facts cannot be byproducts. Nagel does not take seriously the possibility that the world may not be so obliging.

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There may be fundamental flaws in current science, but I don't think that Nagel has made a convincing case that this is so. And even if there are serious explanatory defects in our current world picture, I don't see how teleology can be a plausible remedy. In saying this, I realize that Nagel is trying to point the way to a scientific revolution and that my reactions may be mired in presuppositions that

Nagel is trying to transcend. If Nagel is right, our descendants will look back on him as a prophet – a prophet whom nay-sayers such as myself were unable to recognize.¹⁶

¹⁶ I thank Marty Barrett, John Bengson, Hayley Clatterbuck, Joshua Cohen, Jordan Ellenberg, Stewart Eskew, Martha Gibson, Casey Helgeson, John MacKay, Sarah Paul, Trevor Pearce, Russ Shafer-Landau, Larry Shapiro, Alan Sidelle, Dennis Stampe, and Michael Titelbaum for useful discussion.