

PHYSICS AS THEODICY

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1 Introduction: "Gravity: Our Enemy Number One"

On Saturday, August 26, 1893, thirteen-year-old Edith Low Babson was swimming in her favorite swimming hole on the Annisquam river in her home town of Gloucester, Massachusetts. Though she was a strong swimmer, something went wrong, and she drowned. A tragedy like all such. But this drowning had unusual consequences. Edith's older brother was Roger W. Babson, who grew up to become one of America's most prominent businessmen of the early twentieth century. A statistician, prolific author, philanthropist, founder of Babson College, in Wellesley, Massachusetts, and the Prohibition Party's Presidential candidate in 1940, Roger Babson was deeply affected by his sister's death, as he was again many years later, in 1947, by the death of his grandson, Michael, who drowned while saving the life of a companion who had been knocked off of a sailboat in Lake Sunapee, New Hampshire. But Roger Babson was a man of action, not one quietly to acquiesce when confronted by suffering inflicted by a seemingly impersonal and uncaring nature. One year after his grandson's death, Babson dedicated a significant part of his vast personal wealth to the establishment of the Gravity Research Foundation in New Boston, New Hampshire, which thereafter awarded an annual prize for theoretical research on gravitation, a prize whose winners include the likes of Stephen Hawking. Why? As Babson explained in a pamphlet published by the new foundation, "Gravity: Our Enemy Number One,"¹ the goal was to alleviate the suffering for which gravity was responsible, the gravity that seized his sister "like a dragon and brought her to the bottom," by developing a partial insulator against the force of gravity, and to reap a host of other benefits for health and human welfare by taming gravity.² Needless to say, Babson's obsession was a bit nutty, and the insulator was never found. Nevertheless, the foundation's support for gravitation research in the late 1940s and 1950s, a lean time in the history of theoretical work on general relativity, helped importantly to maintain and grow a community of younger theorists who were responsible for the tremendous flowering of theoretical general relativity that started in the 1960s and continues to this day.³

¹ Babson, "Gravity: Our Enemy."

² The range of expected benefits can be inferred from the following list of other publications from the Gravity Research Foundation, which can be found at the Foundation's home page, <http://www.gravityresearchfoundation.org/>: Roger W. Babson, "Gravity and Sitting"; Roger W. Babson, "Gravity and Ventilation"; Grace K. Babson, "Gravity Aids for Weak Hearts"; W. Stewart Whittemore, MD, "Gravity and Health"; Mary E. Moore, "Gravity and Posture"; Raymond H. Wheeler, "Gravity and Psychology"; Raymond H. Wheeler, "Gravity and the Weather"; Arthur D. Baldwin, MD, "Gravity Effect in Relation to Health"; William Drake, MD, "Gravity and Your Feet"; William R. Esson, "Possibility of Free Heat"; George M. Rideout, "Is Free Power Possible?"

³ For details on the drownings and the history of the Foundation, see Babson,

We all have our ways of coping with grief and guilt. One might think that a professional grief counselor, had such been available, would have done Babson more good than proselytizing against the evils of gravity. But to think thus would be to miss the importance of the model Babson offers us. For while he names gravity as the “dragon,” the natural root of the evil that befell his sister, his doing this is not the end point of his moral reflections, nor does he then just yield to an implacable nomic gravitational necessity. He is not content just to blame gravity. His naming gravity as the cause is not for the purpose of absolving himself and others of responsibility. No, his naming the evil that is gravity is but the first step in taking responsibility. For Babson, it is not gravity that is, ultimately, the problem. The problem, ultimately, is our ignorance of how gravity works and our consequent inability to control it or, at least, to mitigate the sometimes unfortunate consequences of its operation. On Babson’s view, it is, in the end, we who are to blame.

Sadly, we have recently been afforded other demonstrations of the lesson Babson would have us learn. Hurricane Katrina’s devastation of New Orleans and the Gulf coast will be remembered as our Lisbon earthquake, even if scale, alone, should have earned the December 2004 Indian Ocean tsunami that title. In both instances, overwhelming natural forces wrought unprecedented destruction. It was nature’s wrath, nature’s fury. Humanity was humbled before the power of impersonal natural forces. Or was it? Only years from now will we be capable of the critical detachment needed for a sober analysis. Even the quick-witted Voltaire needed four years after the Lisbon earthquake to write *Candide* (1759). Still, some things are clear. Had there been an Indian Ocean tsunami warning system, as there was such a warning system for the Pacific basin, many lives would have been saved. Why was there no warning system for the Indian Ocean? No blaming nature there. In the case of Katrina, why were the New Orleans levees built only to withstand a category 3 hurricane, not a category 4 or 5? Why, in recent years, did the Bush administration and the congress repeatedly make drastic cuts in the funds requested by the Army Corps of Engineers for upgrading the New Orleans levees?⁴ Forces of nature? No.

The big question about Katrina, however, the question we shall be debating for years, the question most relevant to the purposes of this chapter, is whether a global warming trend caused by human action is partly responsible for the storm’s unprecedented size and savagery. That we are to expect global warming to produce an increase in the severity, if not also the frequency, of hurricanes is something that climatologists have been saying for some time.⁵ Precisely how large a role is played by global warming alone is unknown. Katrina is, after all, part of a long recognized decadal hur-

Actions and Reactions, 15–16, and “Gravity: Our Enemy,” as well as Kaiser, “Roger Babson and the Rediscovery of General Relativity.” I thank David Kaiser for first bringing this fascinating story to my attention. Additional details on the drownings and the history of the Babson family are to be found in Finney-McDougal, *Babson Genealogy*. On the rebirth of work on general relativity, see Will, *Was Einstein Right?* 3–18; and Goldberg, “US Air Force Support of General Relativity.”

⁴ See Bunch, “Did New Orleans Catastrophe Have to Happen?”

⁵ See, for example, Knutson and Tuleya, “Impact of CO₂-Induced Warming,” and Trenberth, “Uncertainty in Hurricanes and Global Warming.”

ricane cycle. Much research has been done; much more is needed. For a scientific understanding of this aspect of global climate change is a crucial prerequisite for planned actions to counteract the trend, just as modeling the fluctuations in the Earth's ozone layer was crucial to the success that has just been reported in halting that frightening trend.⁶ Action to prevent or alleviate suffering requires knowledge. Willful ignorance, or a collective failure to promote and fund the relevant research is a moral failing, not a defect in the natural order of things. A big part of the blame lies with those of us who did not ask and seek to answer the question scientifically.⁷

Writing in 1759, Voltaire mocked the simple-minded optimism of Leibniz's *Théodicée* (1710). Could the Lisbon earthquake, the flames of the Inquisition, pestilence, war, greed, and human savagery all be part of God's plan for the "best of all possible worlds"? One shudders to think what the poorer worlds must be like. But *Candide*, Pangloss, Martin, and Cunegonde are also portrayed as more or less helpless victims of a fate that doles out happiness and misery in roughly equal measure, in accord with no discernible plan. There is no mastering of the overwhelming forces that destroyed one of Europe's great cities with, in sequence, an earthquake, a tidal wave, and an all-consuming firestorm. Hope for no more than to be able to cultivate one small corner of the earthly garden. Perceptive students always note with puzzlement the irony. How is it that one of Newton's greatest French champions and one of the leading theorists of the Enlightenment could have been so shaken by the Lisbon earthquake as to be left with so little confidence in our ability to shape our fate by reason-guided human action? However much he mocks Leibniz's road to resignation, Voltaire walks us down a different road to the same end. Nature will have her way with us. Resistance is futile. Resistance, however, is not futile. For all that we are finite beings of limited capacity, we can know more, and we can do better. The Dutch are already sending us their experts to show us how to build a better sea wall. Our not trying to do better is the moral imperfection upon which we should focus.

2 What's Wrong with Blaming Nature? What Are We Blaming When We Blame Nature?

Is this the best of all possible worlds? I don't know. Being a finite being, I humbly admit that I do not know the bounds of the possible and so do not know even the meaning of "possibility" in this cosmic setting. My finitude debars me also from a knowledge of the only metric whereby the "better" and the "best" are to be judged. Even if, therefore, I assume an omnipotent, omniscient, and benevolent God, I am in no position to draw Leibniz's conclusion. Lacking the comfort of that conclusion, I still must think about the problem of evil. Let us start with so called "natural" evil.

⁶ See "Study: Ozone Layer."

⁷ Of course, the example is not a perfect one, for, in the case of global climate change, we already have more than enough science to serve as a basis for some actions, at least. We are now at a point where the call to do more science, especially the call to do more "sound science," is the favorite refuge of procrastination masking greed (see Mooney, "Beware 'Sound Science'").

To speak of “natural” evil is to speak of a genus of evil for which “nature” is mainly responsible. But what is this “nature” on which we thus pin the blame? For the theologian, it is the divinely created natural order. Many philosophers of science use expressions like “order of nature” too, usually meaning thus to highlight a nomic structure, a structure of laws, whether divinely created or not. Both the theologian and the philosopher speak from within a long tradition of regarding nature, whether harsh or benign, not as a realm of randomness but as an arena of events governed by rules. Within this tradition, to blame nature for evil is thus to blame mostly the laws of nature. Does that make sense?

Here is a place where the philosopher must ask many questions. The first is why we so readily model the order of nature as encoded in laws. One might think it more helpful to model the relevant notion of the natural order as an ontic structure, not a nomic structure. Think of the force of gravity, not the law of gravity. A structure of forces is a problematic alternative to a structure of laws, however, because the notion of force is an even more recent invention than that of laws, arguably just an artifact of the way we happened to do physics for about three hundred years. Newton’s physics was a physics of forces. So was the physics of Michael Faraday and James Clerk Maxwell, but already in the 1890s Heinrich Hertz made a famous attempt to rid mechanics of forces altogether. And while we still speak today of seeking a grand unification of the four fundamental forces—gravity, electromagnetism, and the strong and weak nuclear forces—the basic notion of “force” in this setting is a highly abstract one, little more than a quirk of the mathematics that does the explanatory heavy lifting.

The theist likes to model the order of nature as a structure of laws in part because laws are plausible objects of knowledge in a way that forces or other ontologies are not. I can feel the force of gravity pulling me down (at least when something like the surface of the Earth impedes the resulting motion), but I cannot know the force of gravity in the way in which I can know Newton’s law of universal gravitation. So, if one is enjoined to know God through his works, better to think of his created natural order as being encoded in laws. Of course some like to think of nature in the guise of laws of nature because that comports well with the image of the legislator God, but I shall leave as a homework exercise for you to figure out why this is not a good argument.

Still, the view of nature as an order of laws prevails. Let us assume that and ask a second question, this one with theological consequences in other settings. Ask whether, in all domains of nature, there exist exceptionless laws. Noteworthy is the fact that this question grows more acute as one goes from fundamental sciences, like physics and chemistry, to sciences dealing with more complex phenomena at higher levels of structure or organization, like biology. That there should be exceptionless laws in all domains is a view toward which intuition schooled by tradition strongly inclines many of us. Yet even the careful physics student learns to say, “*other things being equal*, $F = mc^2$.” The problem is that other things are never quite equal. There are no frictionless surfaces, no perfect vacua, no perfectly adiabatic processes, no completely isolated systems. The physics student learns to regard this circumstance as but a distraction. With more complex systems, however, one has to add so many *caeteris paribus* clauses

that the operation of law alone might be difficult to discern. Those who want to find an underlying exceptionless nomic order will explain the seeming exceptions to laws as but consequences of the operations of other laws, as when van der Waals forces are invoked in explaining the friction that hides inertial motion. Those drawn to a more anarchic metaphysics will see in this strategy more evasion than explanation, especially, again, in the biological arena. I don't know who is right, and, frankly, I don't have a pony in this race.

Let us make our task easier by assuming, for the sake argument, that exceptionless law lurks everywhere behind nature's heterogeneity. The next question the philosopher might ask is whether laws reflect an ontic order—as with the Scholastic's real universals, the contemporary anti-Humean's causal powers, or the modal logician's nomic necessitation—or are, instead, just a shorthand for constant conjunctions of events, as the Humean would have it, or mere perfect functional correlations, as Ernst Mach said. Here, too, theological questions are implicated. God's creating a nomic order in the form of real universals has long made sense to many, whereas many have seen a threat to theism in the Humean view of laws. Some would also say that it is harder to put the blame for natural evil on mere correlations, however perfect they be, than on, say, causal powers. But however much causal powers might seem like potentially scary things, the last point is lost on me, the point that it is easier to blame laws realistically construed than laws regarded as constant conjunctions. The stone that crushes my big toe hurts just as much whether such stones merely *happen* always to fall when dislodged from an embankment or *must* do so.

We assume, then, that there are exceptionless laws and that, in thinking about natural evil, it makes little difference whether we view laws as did David Hume and Mach or as did Aquinas and Fred Dretske. What is, for our purposes, a more important question concerns the role of laws in producing natural phenomena. Here too a distinction or two helps. Physicists, at least, tend to think about events as explained, perhaps even produced by laws, boundary conditions, and initial conditions acting in collusion with one another. How would Newton explain the motion of a meteoroid? First, he would need his three laws of motion plus his law of universal gravitation. Second, he would need to know how many massive objects are interacting with the meteoroid gravitationally and whether other forces do or do not perturb the system. Lastly, for all of the masses including the meteoroid, he needs to know for some initial time their precise positions and momenta. Suppose, now, that our meteoroid is the one that struck the Yucatan peninsula at the end of the Cretaceous period causing the extinction of the dinosaurs. What do we blame? Is there any good reason for apportioning more of the blame to the laws than to the boundary conditions and the initial conditions? I see none. Yes, gravity played a role, but just as crucial to understanding the deaths of the dinosaurs is the accident, if you will, of exactly where and when the meteoroid was formed millions of years earlier.

Philosophers of science have their own reasons for arguing about the distinction between laws and boundary conditions. Of late, debates about inflationary cosmology have made this an important problem, because a powerful argument for the inflation model has been that it reduces cosmol-

ogy's dependence on otherwise arbitrary seeming boundary conditions by such things as its demonstrating that cosmic flatness (zero global curvature) would be the expected post-inflation state of affairs regardless of how, within limits, we fine tune some otherwise crucial boundary conditions. The idea seems to be that a better theory is one that makes more of the structure in the domain of description nomic. But serious people have questioned the cogency of the laws–boundary conditions distinction in the cosmological setting (and others). One extreme view holds that it makes no sense to talk of laws in cosmology at all, since talk of laws assumes a generality hard to reconcile with the uniqueness of *the* universe. Another criticism of the distinction notes that what are boundary conditions from the point of view of one set of laws might well be straightforward consequences of the operation of other laws—or even those same laws—in other domains. Thus, it is conceivable that heretofore unknown laws of planetary genesis require there to be exactly nine planets orbiting a star like our Sun, just as we now know that there are laws determining the numbers and properties of the elements, whereas these were arbitrary externalities from the point of view of the mid-nineteenth-century chemist.

However interesting the philosophers' worry about the laws–boundary conditions distinction, those debating natural evil might find the question less than compelling. After all, are not both the laws and the boundary conditions part of a created natural order? I am no theologian, and I surely do not pretend to understand all that is written about divine action, but surely there is here an issue of theological importance. We might agree about God's role in laying down the laws of nature. But we might just as well disagree about his role in fixing boundary conditions and initial conditions. Need we here rehearse seventeenth-century debates about occasionalism? Did God once set the cosmic wheel spinning and then just step back for ever after to enjoy the show? Or does God find it necessary to steady the wheel and give it push from time to time? Or is God content to let it wobble, thus allowing in nature a contingency that is not a violation of the laws but a consequence of what are, from the point of view of the laws, externalities? Note that the very formulation of these alternatives, and, hence, theories of divine action generally, make, thus, a strong assumption about the cogency of the physicists' distinction between laws and boundary conditions. That is why it is probably not an historical accident that debates about occasionalism only came sharply into focus after the rise of the mechanical world view.

Consider now the third option mentioned above, the God who lets the cosmic wheel wobble. If God does not bear a full measure of responsibility for the externalities, and if those externalities are deeply implicated in suffering like the Cretaceous extinction, then do we blame the natural nomic order or do we blame just plain bad luck? Is that why some moral theologians add to natural and moral evil a third genus, existential evil? One skier is swept away by an avalanche. One skiing a few yards away escapes harm. Do we blame the first skier's demise on gravity, statics, and the physics of snow melt, or on the fact that a brief stiff breeze happened to push him ahead of his companion, putting him in harm's way? Both laws and boundary conditions play an explanatory and causal role in all such situations. But to the extent that there is something accidental in the setting of the boundary conditions, then blaming the boundary conditions makes no more

sense than would a finding of criminal liability in a case of unforeseeable accidental injury.

What if the boundary conditions are not accidental? How can they fail to be? One way would be if God contrived them or reset them in line with a plan. Another would be if it were we humans who set or reset them. Such is, arguably, the case in many situations where suffering is the issue. What if the unlucky or unfortunate skier had been pushed ahead by his companion rather than a stiff breeze? What if the companion knew of the avalanche risk and failed to advise his friend to avoid the danger area? What if the ski patrol could have prevented this avalanche by triggering a smaller, controlled avalanche with a percussion shell? What if more research on avalanche risk could have identified more reliably the areas of greatest danger? With questions such as these, we enter a new arena.

3 What's Wrong with Blaming Nature? Perhaps It's Not Nature's Fault Alone

No one could have prevented the Lisbon earthquake. Further research on global climate change might prove otherwise in the case of hurricane Katrina. Our best current modeling shows a robust link between the concentration of atmospheric CO₂ and the intensity of Atlantic hurricanes. The exact mechanism is not understood. It is, after all, a very complex system. But the picture is growing clearer with each new study. What does this tell us about the problem of natural evil?

What it illustrates is that, with the progress of science, ever more of the blame for much of the suffering previously deemed a consequence of natural evil will have to be accorded to human action or the lack thereof. The growing human role in and responsibility for such suffering is to be seen in at least three different ways.

3.1 We Control the Boundary Conditions

Human action has changed the global environment since humankind first emerged. Slash and burn agriculture expanded deserts and altered rain patterns over vast areas, as did deforestation. Lebanon was once a forest. Sicily was once a wet island. Carthage was the breadbasket of Rome. As long as we did not know what we were doing to the environment, our actions were, from a moral point of view, but another part of nature, like in kind to buffalo overgrazing their feeding grounds. Now that we are coming to know more, the scales are gradually tipping. By the early 1960s, we knew that burning fossil fuels polluted the air in the Los Angeles basin. We realized that our failure to act on that knowledge made us responsible for the death and disease that ensued. We did something about it, even if we have still not done enough. Fewer people now get sick. Fewer people now die.

The laws governing the Earth's atmosphere are the same today as they were 500,000 years ago. The laws did not change. But by our human actions, we changed the boundary conditions. Photosynthesis still follows the same laws, but phytoplankton populations have crashed in some areas because of toxic chemical waste while algae flourishes in places where it was formerly rare because of agricultural run-off. It is hard to blame

nature when it is our actions that fix so many of the crucial inputs to the system.

3.2 We Know the Laws

Voltaire did not know the real causes of earthquakes. We do, at least in part. But with knowledge comes responsibility. Knowing why things happen and how things happen, we can sometimes prevent their happening, and sometimes, when we cannot, we can at least mitigate the effects. We cannot stop an earthquake anymore than Voltaire could, but we know enough now to inform the public about possible earthquakes, enabling those who will to evacuate and preparing others to seek safe shelter at the first hint of a tremor. When it comes to floods, some of those we can stop, thanks to what we know now about why they happen. We know that the devastation from the 1993 Mississippi River Valley floods would have been vastly less had we more aggressively restored the lost wetlands that once absorbed excess water.

3.3 New Technologies Make Intervention and Mitigation Possible

We cannot stop an earthquake, but now we know how to construct buildings, bridges, and highways that better withstand earthquakes. In the case of meteoroid impact, as even popular cinema makes clear, we now possess technology sufficient to prevent all but the most massive such bodies from striking the Earth. When you think about it, that is pretty amazing. We are almost certainly not yet well enough organized actually to deploy those technologies in a timely and effective fashion. But at least we now routinely scan the skies for evidence of such threats, and there is a system in place for issuing warnings.

4 What's Wrong with Blaming Nature? We've Got to Take the Good with the Bad

Ignorant of the causes of "natural" catastrophes, it is easy to convince oneself that some of nature's ways are mainly malign. What good can come of earthquakes and floods? Would anyone welcome a hurricane or a tornado? Whatever, then, the underlying forces or laws, do they not bring only misery? Should this be another homework exercise? Only a little knowledge or even just a little careful thought is enough to demonstrate that the same laws that give rise to disasters always produce also good. Gravity pulls a meteoroid down upon us. But Gravity also structures the solar system so as to make possible life on Earth. Tectonic shifts cause earthquakes and tsunamis, but they also build up the land masses that we call home.

Nothing in nature produces only ill (except, perhaps, the appendix). If not exactly morally neutral, natural laws operate in such a way as to yield good and ill in roughly equal measure. How then blame a nature of laws for suffering? If we blame nature for the bad, give credit for the good as well. Better still, stop playing this particular blame game altogether. In nature, things happen. That's it. If that nature is God's creation and God foresees all of the consequences of the operation of natural law, then I suppose that he intended both the suffering and the prospering. But what do we gain

with that insight? Not much, really. The important question is not whether nature acting alone produces evil as well as good. Surely it does. The important question is: "What are we going to do about it?" The answer to that question is: "Do more physics."

5 What's Wrong with Blaming Nature? Blaming Nature Is an Evasion

As we survey the shattered Gulf Coast or the shattered coast of the Indian basin, as we count the shattered bodies and shattered dreams, as we see ourselves caught in the grip of forces so much larger than ourselves, it would be so easy to assign all of the blame to nature. We do it unthinkingly every time we utter the phrases "natural catastrophe" and "natural disaster." No anaesthetic for bodily pain, it is an anodyne for an injured conscience. It gets us off the hook. But however much blaming nature soothes the soul, it is really just an evasion of responsibility.

We are not alone responsible. Savage hurricanes lashed the Gulf Coast long before the human habitation of North America, and tidal waves have reshaped the coast of Sri Lanka for millions of years. But Katrina was probably made more intense by the consequences of our petroleum glutony, and a bit of hydrology, a bit of estuarine ecology, and a bit of engineering would have spared many lives. Of the evil done in Alabama, Mississippi, and Louisiana, more of it than we might care to admit is the result of our acts and omissions. This is moral evil.

6 Hubris and Humility

No. We cannot know everything. No. We cannot prevent all or even most natural disasters. Yes. Intellectual arrogance and intellectual ambition have often produced more suffering than good. In our age look no farther than to nuclear weapons for proof of the consequences of unchecked intellectual arrogance. That is a case in which our doing more physics brought upon the world more suffering than Einstein could have imagined when first he wrote $E = mc^2$, and we have surely not yet taken the full measure of the suffering that will ensue. I would never argue that all knowledge is inherently good. One cannot foresee all of the consequences of new discoveries. Perhaps fusion will turn out to be the ultimate solution to the problem of filling our energy needs. Still, prudence dictates that some lines of research are better left unexplored. Would that we had never built the H-bomb. We must be humble. And yet we cannot and should not stop inquiring. For inquiry is the only way to grow the understanding of nature that gives us our only hope for fixing our own mistakes and for lessening the harm that might be done by a nature unopposed by human will.

7 Conclusion

In a different volume I would want to press other questions. For example, I think that I don't buy the basic moral evil/nature evil distinction because I dissent from assumptions about human "nature" that typically underlie the distinction. Without a robust soul-body distinction, the moral evil/natural evil distinction is hard to float. One does not have to be a crude materialist

reductionist to think that we have not yet worked through all of the problems dragged in with such dualisms. But, again, that is a topic for another time.

The main point that I wish to emphasize in this volume is that knowledge brings with it responsibility, and that we should not shirk that responsibility but embrace it, along with the obligation to learn still more. Of course no one really disagrees with this point. Well, perhaps corporate apologists for the hydrocarbon fuels economy disagree. They seem to prefer ignorance to knowledge as once did the corporate apologists for smoking. But no reasonable person disagrees. We will not stop the funding for research on global climate change. We will not stop the quest to unite a theory of gravitation to a theory of the other three fundamental forces. I doubt that we'll find Babson's hoped-for gravity insulator. But we might find another way to the stars.

Do you want a better world? Do physics.⁸

⁸ My sincere thanks to my colleague, Jerry McKenny, in the Department of Theology at Notre Dame, for suggesting the title for this paper and for much other very helpful advice about the issues addressed. I wish to thank also David Burrell, Niels Christian Hvidt, Ernan McMullan, David Oldroyd, and Peter van Inwagen for help of various kinds, including conversations through which I came to realize that I had, in fact, been thinking about the topic of this paper for a long time.