Blocking Inquiry in the Name of Science: The Dispute About Nothing

CORNELIS DE WAAL

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Susan Haack has written a great book with great title: *Defending Science—Within Reason*: *Between Scientism and Cynicism*.[1]

At face value, this title may seem a bit odd. Given its track record it seems that science does not need a defense, and that if any defense were needed it would by nature be a reasonable one. It is rather the *un*reasonables as exemplified by the flat-earthers, anti-vaxers, and creationists that science needs to be defended from. Though I agree that science is under attack from such quarters, especially in an age where misinformation reigns supreme, the story does not end there. Science needs to be defended also from some of its most vocal proponents—from scientists who defend their trade in ways that are decidedly unreasonable. Often this takes the shape of people claiming, boldly, that the natural sciences can solve any question about the world that is worth asking, and that philosophy and the religious tradition have nothing to contribute to this at all, but are at best an obstacle to be avoided. As Haack astutely observes, "we need to avoid *both* under-estimating the value of science, *and* over-estimating it."[2] Hence, the final part or the title—*Between Scientism and Cynicism*—between being overly deferential to science and being naively dismissive. The current paper focuses on the first faulty extreme. Though historically successful, science is not perfect, nor is it the only way that inquiry can be conducted. This is true especially given that those who overestimate the value of science also tend to be most restrictive in what they consider science; a certain inquiry, say within sociology, may only be called scientific when it emulates the methods that physicists have so successfully deployed within *their* domain.

Put briefly, in this paper I aim to discuss a case where science becomes unreasonable in its defense of itself, and does so in part by uncritically disparaging the religious tradition from which it ultimately derives.[3] This should not be taken, however, as an attempt at returning to a religious reading of nature. There was a time when references to God, say as the designer of the universe, gave us the best explanation for a great variety of natural phenomena. But those days are clearly over. That does not imply, however, that the inquires of old have nothing left to contribute to today's questions, nor does it leave us with science—especially when conceived narrowly—as our only resource for all questions we can possibly ask about the world. To this we can further add that various religious notions have survived, in a secularized garb, in ways that can be counterproductive. The case I focus on in this paper provides an example of this.

This case concerns recent attempts by physicists to show how the universe could have emerged out of nothing—*ex nihilo*. In my discussion, I focus on one book in particular: *A Universe from Nothing; Why There Is Something Rather than Nothing* by the American physicist Lawrence M. Krauss.[4] Some may object that in focusing on Krauss I am setting up a straw man. This would certainly be justified were my purpose that of criticizing recent attempts within physics to show how the universe could have emerged out of nothing.[5] But that is not my goal. My goal is rather that of providing an example of an unreasonable defense of science, one where science is cordoned off so as to exclude anyone from contributing to it except fellow scientists. To that purpose Krauss's book serves very well. In fact, one of the elements his book shares with books on familiar pseudo-sciences, such as creationism, is that its intended readership is a non-scientific, or non-specialist one.

The nineteenth-century American scientist and philosopher Charles Sanders Peirce (who, incidentally, also argued that the universe spontaneously emerged out of nothing)[6] claimed, emphatically, that we should not block the road of inquiry because doing so violates what he called the first rule of reason: to learn one must desire to learn.[7] True, this is a rather pedestrian rule, as it merely states that when we ask a question we should try to answer it. But it is also an important one, as it is so easily and so often violated. We may be lazy or simply don't care, we may dislike where a question leads us, or we may be driven by ulterior motives, such as a desire to become famous, to appease the financial interests that funded the research, to reaffirm an already firmly held belief, or to make it consistent with some broader worldview. It is, moreover, as Haack aptly observes, not a black-and-white issue that enables us to neatly separate the bad guys from the good guys:

> In real life, of course, people's motives are usually mixed; and what we find is not so much a clean, sharp demarcation between pseudo-inquiry and the real thing as a continuum from less to more commitment to arriving at a predetermined upshot, from less to more openness to all the evidence.[8]

In this paper, I will show that Krauss violates Peirce's first rule of reason in a significant manner, and that he does so to the detriment of the physics that he seems to hold dear. At least in part what lies behind this is that Krauss does have an ulterior motive: he wants to prove that we no longer need to refer to a god to explain the existence of the universe. In an odd way this makes *A Universe from Nothing* a book in theology rather than physics—a negative theology perhaps, as its main focus is proving that the god that theologians talk about cannot exist, but a theology nonetheless.[9] Moreover, it appears that such a negative theology also has its fundamentalists, and *A Universe from Nothing* makes one suspect that Krauss is one of them.

The point where Krauss violates the first rule of reason is where he off-handedly refuses to take seriously competing conceptions of nothing against the backdrop of which his own version of nothing turns out to be not truly nothing. These competing conceptions come mostly from theological and philosophical quarters. Krauss is well aware of his refusal. As he boasts in the preface, philosophers and theologians, following the creationists' playbook, have gone out of their way to "define and redefine 'nothing' as not being any of the versions of nothing that scientists currently describe," replacing it at best with "some vague and ill-defined" concept of "nonbeing" (xiv).[10]

Now it is easy to see that his is obviously a straw man, because Krauss happily compares the best that science has to offer with rather crude views he ascribes to philosophy and religion. However, it does raise the broader question whether philosophy and theology have still something useful to contribute to the physicist, and whether to offhandedly dismiss their contributions truly counts as blocking the road of inquiry. This question is especially interesting because of another normative tenet in Peirce's theory of inquiry, which pertains to the economy of research. Briefly put, should the contemporary cosmologist still pay attention to the arguments of theologians and philosophers, or is that simply a waste of time?[11]

It seems to me that biologists who seriously engage with creationists, or Intelligence Design theorists are indeed wasting their time, and that those who refuse to do this are not in violation of Peirce's first rule

of reason. This because these self-proclaimed alternative approaches have nothing to offer to the questions that biologists are actually asking, given what they already know about nature, and given the tools they developed within their own discipline for answering those questions. Here I side again with Peirce, who called for a *natural* rather than an artificial division of the sciences.[12] On such view, biology is a historically grown organic clustering of questions, combined with attempts to resolve these questions and the methods developed to resolve them. Though biologists may borrow questions and methods from other disciplines (or they may be imposed upon them externally) what comes out of such questions and methods is only relevant to biologists when it has become part of their discipline—in all of this keeping in mind that biology may change in the process, even revolutionary so. Briefly put, until the creationist's views are shown to be relevant to *biology,* the biologist would not be blocking inquiry when refusing to take them on. There remains, of course, the issue of the public acceptance of biology, especially evolutionary biology, in the face of a hostile and politically savvy religious fundamentalism, but that is a socio-political issue, not a scientific one.

There are times when Krauss admits that philosophy still has something of value to offer. Responding to critics he writes that he never meant to issue "a blanket condemnation of philosophy as a discipline."[13] But in making this concession he pulls back the rope as much as he extends it. Insofar as philosophy is not scientistic,[14] it is reduced to issues "that are relevant to making decisions about how to function more effectively and happily as an individual, and as a member of a society."[15] Far from a desire for cross-fertilization, this is a demand for total control: unless you accept our ways, you cannot contribute. Philosophy is of value to physics only to the extent that it has become physics. The problem with this is that Krauss simply takes it for granted that all *philosophical* questions, insofar as they have any bearing upon physics, have already been settled, so that physics is no longer in need of philosophy.

In essence, what we are talking about is the issue of interdisciplinarity. When should people be embraced as capable of making genuine contributions, or voicing serious objections, and when should they not? This is a question that may be very difficult to answer when one is not a specialist in the disciplines that those contributions and objections come from. This can be seen, for instance, from the at times tense relationship between psychology and neuroscience, especially when addressing specific topics, such as depression.[16]

A better way perhaps of looking at the question, and here I am taking my cues from Peirce and Haack, is not in terms of disciplines and the insights acquired by them, but in terms of inquiry, more precisely by drawing a distinction between genuine inquiry and pseudo-inquiry.[17] We can characterize genuine inquiry as any inquiry engaged in with the desire to have one's questions answered, no holds barred and with no axe to grind. That is to say, there are no questions that we are prohibited from asking, nor any answers that are from the outset unacceptable. It can be argued that, at least in principle, questions about what counts as evidence, which methods are appropriate, and what is the best terminology can all be resolved within inquiry itself. Importantly, the methods used in inquiry are not externally imposed upon it, but are generated within inquiry—they are part of the inquiry itself. It is because of this that we can say, as I did earlier, that the biologist can, and even should, ignore the creationist's views as long as they have nothing to offer to the questions that biologists are actually asking given what they already know about nature, and given the tools that they have developed within their discipline for answering those questions. It is against this backdrop of existing questions, answers, and methods that new questions acquire their meaning. It is typical for science that one must possess certain knowledge to be able to adjudicate why a question is worth asking, what it entails, and how to go about answering it. In fact, formulating the right questions is key to scientific progress, whereas asking the wrong questions can be a true hindrance.

Inquiry would *not* be genuine if its aim is different than having one's questions answered, and it would not be genuine *even if* it were to rely on methods, pieces of evidence, and terminology that were derived from genuine inquiry.[18] Someone engages in *pseudo*-inquiry when an activity that is not inquiry is made to look as if it is inquiry. The situation here is not any different than when we feel the need to say that a belt or a purse is made from genuine leather rather than from something that is made to look like leather. Importantly, genuine leather, is not some special kind of leather, or some higher grade of leather, quite the oppo-

site, genuine leather is just leather. The same is true for inquiry. When using the phrase "genuine inquiry," the adjective is only a reminder that there is such a thing as counterfeit inquiry and that we must make sure that what passes for inquiry truly is inquiry. In short, we use the phrase mostly when we feel at risk of being duped. When we are not, we just call it inquiry.

The distinction between inquiry and pseudo-inquiry is broader than the one typically drawn between science and pseudoscience. This is because the word science has acquired a far more narrow usage, especially in English. Its usage is so narrow, in fact, that to our purpose—which concerns the relations between science, theology, and philosophy—it is less useful and may even be counterproductive, as neither philosophy nor theology should be conceived as part of science if science is conceived in this narrow way.[19] That being said, what differentiates science from pseudoscience is precisely that whereas the former is characterized by genuine inquiry, the latter is characterized by pseudo inquiry. Consequently, we can identify a certain scientific-sounding book, or article, as pseudoscientific if it can be shown to be a product of pseudo-inquiry, and we can show the latter by showing that in some significant manner it violates Peirce's first rule of reason by blocking the road of inquiry. It is important to keep in mind that scientific methods, and reasoning more generally, are easily abused. Consequently, we cannot conclude from the fact that someone combines reason with established scientific methods and scientifically confirmed findings that we are dealing with a work of science.

Having pointed out that one should not block the road of inquiry, Peirce lists "four familiar shapes in which this venomous error assails or knowledge," the first of which is "the shape of absolute assertion."[20] (Haack later shows that all four shapes reduce to this one.[21]) In his review of *A Universe from Nothing,* David Albert effectively claims that Krauss's argument takes this first shape,[22] and there are certainly moments where we find Krauss making the kind of absolute assertions that Peirce dreaded so deeply. "My real purpose here," Krauss writes in the introduction,

> is to demonstrate that in fact science *has* changed the playing field, so that these abstract and useless debates about the nature of nothingness have been replaced by useful, operational efforts to describe how our universe might actually have originated. (xv)

In a single claim, boldly made and question begging, the door to philosophy and theology appears firmly and permanently shut.

With all of this in mind, let's "put philosophy to work" (another great phrase of Haack's)[23] and turn to *A Universe from Nothing* to see whether the road of inquiry is indeed being blocked, if so where and with what consequences, and whether this justifies calling it pseudoscience.

NOTHING CONCEIVED AS EMPTINESS

In Krauss's discussion of the claim that the universe emerged from nothing we can discern three steps. In the first, nothing is conceived as empty space, or a vacuum. In the second, Krauss considers what he calls a "more fundamental nothing" that precedes and gives rise to space in accordance with the laws of physics (174). In the third and final step, Krauss entertains the idea that nothing precedes even the laws of physics. Like many physicists, Krauss becomes less and less comfortable the further he moves away from the idea that nothing means empty space. Not only do his chapters become shorter and less assured, but also when introducing his third concept of nothing, he begins by reaffirming that the first two remain perfectly legitimate interpretations, while expressing doubt that there is much to be said about the third (ibid). Perhaps this lack of assurance is because the further Krauss moves away from the idea of nothing as empty space, the more the established theories in physics need to go out on a limb, making the result less scientific and more speculative. This notwithstanding, Krauss insists, without much of an argument, that physics is still adequate to address the issue, whereas philosophy and theology are not (146).

Key to Krauss's dismissal of philosophy and theology is his rejection of any conception of nothing that is conceived a priori. As he puts it in the preface,

> When it comes to understanding how our universe evolves, religion and theology have been at best irrelevant. They often muddy the waters, for example, by focusing on questions of nothingness without providing any definition of the term based on empirical evidence. (xii)

In a subsequent article for *Scientific American*, Krauss further adds: "sticking firm to the classical ontological definition of nothing as 'the absence of anything'—whatever this means … strikes me as essentially sterile, backward, useless and annoying."[24] Instead, he writes: "If 'something' is a physical quantity, to be determined by experiment, then so is 'nothing.'"[25] So, for Kraus, "nothing" must be looked upon as a physical quantity that can be empirically determined. With this in mind let's look more carefully at Krauss's argument.

The first conception of nothing Krauss entertains is that of empty space. "For the moment, I will assume space exists," he writes, "with nothing at all in it, and that the laws of physics also exist" (149). He calls this "the simplest version of nothing" (id.), and he believes, mistakenly, that this was historically the standard view (xiv).[26] The central intuition behind it, however, is indeed simple and straightforward. On this first conception, nothing is what we are left with once we have emptied a region of space of all it contains—"dust, gas, people, and even the radiation passing through" (58). The question that needs to be raised here is whether this emptiness is to be interpreted empirically, as a state that is obtained after performing certain acts of removal, or normatively, as some goal or ideal to be worked toward and of which our specific acts may fall short. If the latter, then we must subsequently ask whether this norm itself is extrapolated from our past attempts, which makes it again empirical, or whether it is derived from some abstract ideal, such as the a-priorily stipulated absence of anything that Krauss dreads so much.

Robert Boyle's experiments with the vacuum pump clearly fall within the empirical camp, as Boyle believed that it gave us empirical proof that space could be empty. The problem of this approach, however, is that removing from a region of space everything that we suspect that is in there, does not by itself prove that nothing remains—that it is truly empty. Consequently, a good case can be made for conceptualizing nothing in terms of an a priori ideal, as in that way it can guide empirical science and prevent it from calling out prematurely that it arrived at nothing. In brief, nothing is not some empirical quantity to be discovered in the way one discovers a new particle, or a new species of termites, but it is rather a regulative ideal that can be used to set the course of inquiry. Sometimes such ideals can be reached, and at other times they cannot.

Now if we interpret nothing in terms of empty space, then we must pay attention to what is meant by "something," because if there is still something left, then the space was obviously not empty. Recall that Krauss said that "something" is an empirical notion, calling it, "a physical quantity, to be determined by experiment."[27] It is not wholly clear what this means. A physical quantity, to the physicist, is any physical property that can be quantified—that is, measured using numbers—such as length, temperature, velocity, mass, etc. For instance, we determine the length of a table by experiment by holding a ruler right next to it and say "37 inches." I'm not sure, however, how *being something* could be a property, let alone a property that can be quantified, as what would it be a property of?[28] So Krauss's concept of something may not be vague, but it is certainly ill defined. It is easier, and I think more appropriate, to conceive of something as anything that has some (physical) quantity—anything that is somehow positively measurable. Thus, the table can be said to be something because it has length and a room can be said to be "not empty" when it has a table in it. It seems though that not everything that can be quantified as such counts. For instance, we can say that the empty room still contains four areas where the table would fit. But that parts of the room can thus be physically quantified does not thereby make the room any less empty. Of course, we could maintain that space itself is something on the ground that *it* can be physically quantified, but that would be to deny that Krauss's first conception of nothing—as "empty space"—even qualifies as a candidate. Conversely, one can think of things that cannot be quantified that still count as something. For instance, my dread about going to the dentist is still something (not nothing), irrespective of whether that dread can be (physically) quantified. In sum, the idea of empty space is much less self-explanatory than may have seemed at the outset. This, however, is by no means a recent insight. In fact, much of what motivated the medieval notion that

nature abhors a vacuum was that the very notion of empty space was considered incoherent. As it turns out, it was modern physics that opened up the possibility of empty space. For instance, in his Scholium to the *Principia* Newton envisioned absolute space in a manner that does enable us to think of it as empty.[29]

Perhaps a better way of conceptualizing "something" is by saying that it applies to whatever we can ascribe a quantity, quality, or relation to, and that if we can ascribe a *physical* quantity, quality, or relation to it, then it will be a *physical* something. Again, this would be an a priori notion of something—it tells you what something must be like for it to count as something—and it is a pretty comprehensive one at that. One will be hard pressed to find anything that isn't something. In fact, as the example of the table showed, even the *absence* of something can be something. On this view, empty space can then be conceived as space that is devoid of anything of which anything whatsoever can be ascribed, and empty *physical* space as space that is devoid of anything of which anything physical can be ascribed.

To sum up the above, in defining nothing as empirically certifiable empty space, Krauss is making various unwarranted assumptions that a more careful analysis of the concepts involved quickly bring to the surface. These assumptions relate not only to what these concepts stand for, but also to what role they play within scientific inquiry. By refusing to take into account conceptual issues like these, Krauss is de facto blocking the road of inquiry. His situation differs from the biologists who are ignoring the creationists, because Krauss's off-handed dismissal of a philosophical analysis of what we (can) mean by nothing does have a direct impact on what physicists are doing, as they are purportedly trying to prove how the universe could have emerged from nothing. It is, furthermore, quite clear why he does this. He wants to exclude *a priori* certain answers to the question of the origin of our universe.

Since the aim of the whole enterprise is to explain how something (more specifically, our universe) could have emerged from nothing, Krauss spends quite a bit of time and energy explaining how things can appear in empty space, apparently out of nothing, and without violating the laws of physics:

> Sometimes conditions are such that real, massive particles can actually pop out of empty space with impunity. In one example, two charged plates are brought close together and, once the electric field gets strong enough between them, it becomes energetically favorable for a real particle-antiparticle pair to "pop" out of the vacuum with the negative charge heading toward the positive plate and the positive part toward the negative one. (154)

However, from the fact that two particles appear to come out of nothing it does not follow that they actually do. It might very well be that the space they emerged from wasn't truly empty, but only seemed that way. In fact, Krauss appears to agree with this. He writes, "empty space is complicated. It is a boiling brew of virtual particles that pop in and out of existence in a time so short we cannot see them directly" (153; see also 97). However, the point that Krauss seems to be driving at here is not that the vacuum isn't truly empty, but that given what we know about quantum mechanics, we cannot conceive physical space to ever be completely empty. Because of Heisenberg's uncertainty principle we cannot cognize zero energy, so that the emptiest physical space that we are able to conceive will always emit some energy. And because of Einstein's famous formula, $E = mc^2$, on which energy and mass are the same thing, such non-zero-energy empty space must continuously be producing particles to carry this mass—particles which, because of their extremely brief existence, are called virtual.[30] Consequently, though we may still be able to conceive of, say, a *mathematical* space that is absolutely empty, we cannot conceive of a *physical* space that is absolutely empty, and it is the latter, not the former, that is relevant when talking about the origin of the universe. A consequence of this is that we either have to forgo on equating nothing with empty physical space or redefine nothing such that it is equivalent to empty physical space with all that is brewing within it. If we opt for the former, the nothing we are speaking of is no longer a physical nothing; it is, so to speak, not of this world. Krauss opts for the second on the ground that he wants to do physics and that this is about as empty as physical space can possibly get. Quantum mechanics further comes with a conceptual infrastructure that allows particles to escape from this virtual brew and become real so to speak, as happened in the example of the two charged plates. In that case we would have something emerge from nothing, where nothing is quite jus-

tifiably defined as physical empty space. The question that remains, though, is whether nothing should indeed be defined as empty space, as it can be plausibly maintained that space, no matter how empty, is never nothing; it is something—namely, empty space. In line with the theme of trying to explain how the universe emerged from nothing, this raises the question where did this physical empty space come from. It is to this question that we turn next.

NOTHING CONCEIVED AS SPACELESS EMPTINESS

The second view concerns recent theories in physics that can account not only for things emerging within space, but also for the emergence of space itself, where the latter is taken to have emerged from what Krauss now calls a "more fundamental nothing" (174).[31] Importantly, space is still conceived as emerging in accordance with the laws of physics. This is crucial, because the aim is still that of showing that physics, or natural science more generally, is adequate to address not only the emergence of things within space, but also the emergence of space itself, as only then is physics capable of proving that the universe emerged from nothing and did so in a purely naturalistic manner.

The big bang theory is typically understood as having the universe emerge in an event that should *not* be conceived as happening within space, whether empty or not, but as an event that itself *originated* both space and time—a view that goes back to St. Augustine.[32] On this view, space is as much a product of the big bang as anything that we may find within that space. Crudely put, the process through which space is now taken to emerge out of nothing is mirrored on how things were conceived to emerge out of empty space. A quantum theory of gravity, which combines the general theory of relativity with quantum mechanics, is taken to allow for the creation of small compact spaces out of nothing as virtual universes that are theoretically on a par with the virtual particles that were taken to emerge within empty space, so that now, as Krauss puts it, "space itself is forced into existence" (161). However, the lifetime of such universes would need to be extremely short, roughly 10^{-44} seconds, as otherwise it would entail a violation of the laws of physics as we know them. Hence, an additional argument is needed to show how our universe could have emerged—that is to say, an explanation for how our universe managed to endure beyond those 10^{-44} seconds and grow out to its current proportions. Here inflationism comes into play, a theory that was developed in reaction to three well-defined problems that had plagued the big bang theory: the flatness problem, the horizon problem, and the monopole problem.[33] On the whole we can say that general relativity, quantum mechanics, and inflationism provide an avenue for contemporary physics that shows that it is at least in principle possible to have the whole universe, not just the things within it, emerge from nothing.

Leaving technicalities aside, there are still conceptual problems that need to be resolved. The idea of nothing that drives these theories still trades on the notion of empty space, which is now conceived as zero-dimensional—a mere point—that subsequently expanded into the universe as we know it. In brief, having first emptied space as much as we could, we are now making it as small as we can. This zero-dimensional space is further considered subject to the same laws of physics that were found to apply to the expanded (physical) space. Now, the same reason why we cannot conceive space to be absolutely empty also precludes us from conceiving space as truly zero-dimensional. Due to Heisenberg's principle, any point will be smeared out, so to speak, in both time and space. Hence, on Krauss's second view, nothing thus becomes a near-zero-dimensional boiling brew of virtual spaces, subject to the laws of physics. In brief, whereas Krauss earlier conceived nothing to be the emptiest physical space possible, now he is making that space as small as it can possibly be. Taken in this way, Krauss's view that the first two views are *both* perfectly legitimate interpretations of nothing becomes clearer (174).

To all of this, however, philosophers or theologians can again plausibly reply that this does not adequately capture what we mean by nothing, most importantly because it still entails that there is something; a recognition that allows us to repeat the question: Where did it come from? Or better, how did it come to be? The same philosophers and theologians can further argue that we do not necessarily need an *empirically* grounded notion of nothing, which continues to be Krauss's major concern, and that there is no need

to restrict what nothing can be to what the current laws of physics allow it to be. What suffices is a notion that is consistent with our established empirical findings, and if we want to stick to Krauss's attempt to prove that the universe emerged out of nothing (and as I will show it is by no means clear that we should), it must enable us to conceptualize how our universe (could have) emerged from it. In any case, Krauss seems to realize that his second conception of nothing does not go far enough, and this brings us to his third view.

NOTHING CONCEIVED AS LAWLESS, SPACELESS EMPTINESS

On the third view, nothing precedes not only things in space, or space itself, but also the laws of physics that were taken to govern this empty space and its emergence. On this third view, the nothing from which the universe emerged is not in any way subject to the laws of physics. This means that if we want to maintain, as does Krauss, that physics, or science more generally, is capable of addressing whether the universe emerged from nothing (146), then physics, or science more generally, must be able to account for the emergence of the laws of physics out of nothing also. The laws of physics, again, are clearly something, even though arguably they don't have any measurable properties.

Regarding the origin of the laws of physics, it appears that Krauss has painfully little to offer, stating that they "may have come into existence … by some yet unknown but possibly purely physical process" (142); a view that does not put him in a substantially better position than those theologians who suggest that the laws of physics could be the product of a divine intelligence, about which they too admit they know very little.

The claim that nothing *precedes* the laws of physics, however, must not be taken to imply that these laws somehow emerged from nothing before being applied to anything, but rather that they emerged together with what they applied to. It means that the laws of physics as we know them evolved from more primitive laws—that in its evolution the universe became more lawful, with the first laws possibly emerging, not from nothing, but from lawless something. Such an evolutionary conception of the laws of physics also goes back to Peirce, who posited it in the early 1890s in conjunction with his claim that the universe emerged from nothing.[34]

In his discussion of the third type of nothing, Krauss relies heavily, if not entirely, on multiverse theory.[35] The emergence of our universe is not some unique and unprecedented event, he writes, rather nothing is continuously spawning universes of various shapes and duration. The multiverse idea allows us to say that the emergence of *our* universe is not some inexplicable singular event, but a logical consequence of a somehow well-behaved random process that is physical, and which sooner or later necessitates the emergence of a universe such as ours. As Krauss puts it, "Under the general principle that anything that is not forbidden is allowed, then *we would be guaranteed,* in such a picture, that some universe would arise with the laws that we have discovered" (176; emphasis added). In this way multiverse theory can explain the origin of *our* universe; it can explain why, seemingly against all odds, *our* universe had to emerge.

There are various problems with multiverse theories, and many physicists find them so unscientific that they prefer to shove them onto the philosopher's plate, which does not bode well for Krauss's insistence that physics is up to the task (146).[36] However, I don't think I want them on my plate either. A crucial point where Krauss and cosmologists like him seem to go wrong is that they believe (tacitly or not) that a true theory of the origin of our universe must explain how a universe like ours was guaranteed to arise, since it is the origin of *our* universe that they are seeking to explain, and since explaining something, at least for the physicist, seems to mean showing it a product of the laws of physics. Taking the view that something like our universe is guaranteed to emerge makes sense for the theist, for whom our universe is the one that God presumably intended, but much less so for the physicist. In fact it can be argued that physicists that take this view simply fail to break loose from the theist's playbook. Nothing may be unstable, as Krauss claims it is, but that doesn't mean it had to generate *our* universe, or even something like it; it only means that something had to come out of it, and that what happened to come out of it, possibly among other things, or instead of other things, is our universe. Now, to admit that our universe may be contingent doesn't make it inexplicable. The Battle of Waterloo was a contingent event. Things could have turned out such that it never

happened, or that it happened very differently. But we can still explain after the fact why it happened the way it did. To acknowledge that the emergence of our universe was not necessary, and take a historical-evolutionary approach, allows us to avoid the conceptual overkill that furnishes multiverse theories.

What I want to focus on, however, is an aspect of multiverse theory that echoes the discussion so far. Krauss describes the multiverse as follows: "In a multiverse of any of the types that have been discussed, there could be an infinite number of regions, potentially infinitely big or infinitesimally small, in which there is simply 'nothing,' and there could be regions where there is 'something'" (177). Hence, for Krauss, a multiverse has regions. Some of them are big, others small; some of them are empty, others not, etc. This shows that he is still trying to conceptualize nothing in terms of empty space. Put briefly, this third view of nothing is conformant with the second view, which had the universe emerge from a point, albeit that this point is now given a location in what Krauss calls "a landscape of universes" (176), and that in the process of this the laws of nature somehow emerged. There is, however, no mechanism put in place to explain how this is supposed to work beyond the observation that our universe is a possible outcome, so that in the end it had to emerge. Crucially, no argument is given for why the laws of statistics would apply to this "landscape of universes." In brief, nothing is reduced to a space where universes are spawned spontaneously and in large numbers. So it seems that in the end Krauss is simply unable to conceptualize nothing in any other way than as an empty space. To this philosophers and theists can again plausibly respond that claiming that our universe emerged within a landscape of universes, even if correct, falls far short of proving that it emerged out of nothing. In fact, by maneuvering ourselves into a position where we now have to prove that the entire multiverse emerged out of nothing, we seem to have made our task quite a bit more complicated. No wonder that more down-to-earth physicists want to excise it from their discipline.

A RETURN TO PURE NOTHING?

Where does this all leave us? Physics has done a great job, and is still doing a great job, exploring the workings of the universe and tracing its origin. It seems, though, that claiming, as Krauss has done, that it has proved, or is close to proving, that the universe emerged from nothing is a gross overstatement and is misleading. It is the product of changing what we mean by the word nothing—a change that is mostly supported by revisionist history, a lack of understanding of how a priori concepts work, and deliberately ignoring how the term is actually used. I hope to have at least indicated that there is still valuable (philosophical) work to be done interpreting what can be meant by nothing, and that Krauss has continuously tried to make something out of nothing. Most significantly, by failing to properly come to terms with the concept, Krauss continued to conceptualize nothing as empty space, to which the natural response is that this is not how the term is used and that empty space does not even qualify as nothing—it is empty space, which is something. The result is that in the end Krauss begs the question: The problem of how something could have emerged from nothing is solved by making nothing mean a particular kind of something; the question is answered by defining it away. Hence, rather than confronting the theologian, as Krauss claims to be doing, he changed the subject while pretending that he did not.

Krauss can retort to this, as he has done, that the conceptions of nothing as theologians and philosophers entertain them are meaningless or nonsensical. To this there are basically two responses. One can say that the term *does* have meaning, or one can admit that it does not. Both spell trouble for Krauss. If it is the first, he should not have ignored it; if it is the second, if nothing spells meaningless gibberish, he should have rejected the very idea of trying to prove that our entire universe emerged from it. Concisely put, in the first case he is blocking the road of inquiry; in the second he is setting it on the wrong path.

With regard to the road that is being blocked, opening it up requires importing into physics a concept that is not derived from its theories. It requires taking seriously the idea, conceived a priori, of nothing as "the absence of anything," and to seriously explore what can be done with it. This is likely to be an a priori philosophical/mathematical project aimed at connecting this notion of nothing with the simplest or emptiest something that physics can come up with. Physicists may balk at this, as it lacks a much-needed cor-

rective influence of hard fact, but all that all that would be needed is one plausible account of how the earliest state of our universe, as described by physics, could have emerged, unconditionally, from a state of pure nothing. All we need is one theory, or model, that is clearly more parsimonious than the current alternatives, whether they are versions of intelligent design theory, or posit an endlessly spawning multiverse. This task is further greatly facilitated when we relinquish the rather haughty hypothesis that once nothing is granted something like our universe is guaranteed to emerge.

With regard to setting physics on the wrong path, one can try to get it back on track by returning to the question that spurred it all—the attempt to explain why there is something rather than nothing—and the physicist's claim that this question can be answered while remaining within the realm of physics.

The question "Why is there something rather than nothing?" famously goes back to Leibniz and was motivated by a feeling that the world we find ourselves in demands some sort of explanation—or, in Leibniz's words, the world by itself does not present a sufficient reason for its existence.[37] The existence of the world is not self-explanatory, because it seems at least possible, and perhaps even more likely, that there would not have been anything at all. In fact, immediately following the question, Leibniz tells us why he is asking the question. He is asking it, he writes, because "nothing is simpler and easier than something."[38] Leibniz's phrasing is interesting because of what it does not imply. It does not imply that nothing requires no explanation at all—suggesting that once we have shown how the universe emerged out of nothing we have somehow fully explained why the universe exists. Far from it, it seems that, for Leibniz at least, nothing needs an explanation too. Consequently, if we could conceptualize pure nothing—the "nonbeing" that is so abhorrent to Krauss (xiv)—and show how the universe could have emerged from it, then our explanation would *still* be incomplete. We must also be able to account for this nothing from which the universe purportedly emerged.

This suggests that perhaps a better way of approaching the entire issue is to start by asking whether this nothing from which the universe is said to have emerged is a possible physical state of being to begin with. If we take this course, then we discover fairly quickly that if there were truly nothing, then there would be absolutely nothing to keep it absolutely nothing, making it, so to speak, the ultimate unstable equilibrium. If there is nothing, then there is nothing to prevent anything from happening, possibly including the creation of virtual universes, though they seem too elaborate as a "first step." If this is correct, if nothing is indeed inherently unstable, then Leibniz had it wrong. As long as we think of something as there "being anything at all," and not as there "being anything in particular," then it is *something* rather than nothing that is simpler and easier, as something can more easily be conceived to remain something. This means that we do not need to prove that the universe came out of nothing to *disprove* the claim that the universe needs a divine creator, which is what Krauss is trying to do. Quite the opposite, one would need a divine creator, and a mighty powerful one at that, for nothing to be sustainable. We'll have to imagine a god who continuously has to work really hard at *preventing* anything from happening. Put differently, that our universe exists, with all its peculiarities, is much more likely than that there is absolutely nothing at all. But if that is the case, then we cannot *explain* our universe by showing how it emerged from nothing. The purpose of such an explanation would be to show that the universe is a likely outcome of something simpler and perhaps self-explanatory. But the exact opposite seems to be true here: we would be trying to explain something by showing how it can be conceived as a natural outcome of a state that is so unlikely as to be virtually inexplicable. Consequently, it appears that the physicist's quest to prove that the universe emerged from nothing (and to claim that this shows that therefore there is no longer any need for a divine designer) is a red herring.

However, to claim, as Krauss has done, that we are better off replacing this utopian notion of nothing with an empirical one, seems neither necessary nor advisable; it is, to adapt a venerable British expression, like flogging a red herring.[39] If we accept that nothing and something are the only two options, and find that nothing is extremely unlikely to ever be, then we are left with the conclusion that there has to be something—and that the question to be answered is not "why is there something rather than nothing?" but rather: wherefrom comes the order that we perceive in the universe—how could this enormous, law-governed and practically empty space have emerged from something that may have been none of that?[40]

Perhaps it is good to recall at this point why theologians found it necessary to argue that God created the universe out of nothing. They did so, not because Scripture decrees it, or nature suggested it, but because they thought that any other account of creation would run counter the belief that God is omnipotent. If God created the world out of something, then there was something out of which he created the world; that is, then there was some medium he had to struggle with and adapt himself to, as if he were a mere carpenter, sculptor, or painter. In contrast, the more modest claim that God, or an intelligent designer, created the world *without* this being a creation out of nothing, can be considered to have long been a scientific claim that was directly inspired by nature, as until only recently it was the best if not the only credible explanation for the order that we perceive within the world.[41] Put differently, the claim that God created the world "out of nothing," or *ex nihilo,* has always been a purely theological claim, as it is grounded not in the perceived order of nature but in the dogma that God is omnipotent. Consequently, the physicist who is trying to prove that the universe emerged from nothing is unwittingly following the theologian's research agenda rather than his own—a research agenda that is inspired not by anything found in the domain of physics (i.e., nature), but by the claim that God exists and is all-powerful. This leads to the interesting situation that physicists who ignore the theologian on this point are not blocking the road of inquiry, whereas physicists, like Krauss, who take up the challenge they perceive the theologian posing are blocking the road of inquiry. They do so by introducing into physics something that does not belong there and let *it*, rather than the findings of physics itself, determine what the debate should be like in physics—what questions to pursue, what counts as an answer to certain questions, etc. It is on a par with biologists letting their discipline be infected by creationist presuppositions, or gerontologists who take their cues from legends about the Holy Grail.

In sum, we can conclude that when Krauss is seeking to make his case that the universe emerged out of nothing, he is truly engaging in pseudoscience. Without giving much of an argument, he dismisses non-physicist approaches to nothing as nonsensical, while at the same time insisting, again without much of an argument, that the concept that these approaches aim to capture is not nothing: there really is such a thing as nothing, it is just that philosophers and theologians are wrong when they are trying to explain what it is. In addition to this, Krauss is arguing, again without much of an argument, that this concept is of value to physicists who are studying the history of the universe. That is, he makes showing how the universe emerged from nothing an explicit part of their mission.

In response to this I argued that the term nothing as envisioned a priori by non-physicists is not nonsensical and that Krauss's attempts to redefine it are unacceptable because they tacitly reduce nothing to a kind of something, and that his blind rejection of all that has been said about nothing by theologians and philosophers is unjustified. I have further shown how the concept as envisioned by philosophers and theologians could be meaningfully deployed in a physical account of the history of the universe, while at the same time showing why such an account fails as an explanation. As I have shown, though it may be logically possible for our universe to have emerged out of nothing, this state of nothing from which it is supposed to have emerged is such an anomaly that it is far harder to make the case for nothing than it is to make the case for something (as long as we are not making the case for any *particular* something). You cannot explain something by showing it the product of something else, something that not only lacks an explanation, but which is also far more difficult to explain than what you are trying to explain.

None of this must be taken to imply that there was always something, as if the universe were infinitely old. The reason for this is that time, like space, requires a certain type of order, and that the concept of something by itself does not necessitate that the conditions for such a type of order are met. In other words, time, like space, is not the kind of thing that can be ascribed to the something that the universe emerged from—at least not without argument. Put concisely, it is far more plausible to say that our universe did not emerge from nothing—this odd state necessitated by the requirement of an omnipotent God—but that it emerged from something, because (and here I disagree with Leibniz) something is simpler and easier than nothing.

Pseudoscience often commits two epistemic evils: refusing to ask certain questions, and making people ask the wrong ones. Both violate Peirce's first rule of reason and risk blocking the road of inquiry. As we

have seen, in *A Universe from Nothing* Krauss commits *both* evils: the theologian Krauss blocks inquiry by refusing to take seriously classical conceptions of nothing; the physicist Krauss blocks inquiry by pushing physics in the wrong direction, by forcing upon it, *ex cathedra* (no argument is given) the theologian's research agenda—that of reconciling the dogma of God's omnipotence with the world we encounter. In doing so, Krauss has left science proper and entered into the shady netherworld of pseudoscience. *A Universe from Nothing* is a work that should be treated with great caution, not so much because its author leads us to the wrong answers, but because he is forcing us to ask the wrong questions, which is far worse. [42]

NOTES

1. Amherst: Prometheus Books, 2003.
2. Susan Haack, "Six Signs of Scientism," *Logos & Episteme* 3.1 (2012): 75–95, p.75. Whereas in *Defending Science,* Haack primarily criticizes those who under-value science, in both "Six Signs" and her 2016 Agnes Cuming Lectures, *Scientism and Its Discontents* (London: Rounded Globe, 2017), her main focus shifts to those who over-value science.
3. Even a cursory acquaintance of the history of science will bear this out. For a more detailed account, see e.g., Peter Harrison, *The Bible, Protestantism, and the Rise of Natural Science* (Cambridge: Cambridge University Press, 1998).
4. Lawrence M. Krauss, *A Universe from Nothing; Why There Is Something Rather than Nothing* (New York, Free Press, 2012). After this paper was substantially completed I learned that several women accused Krauss of sexual harassment, and later that year it came out that Jeffery Epstein, a convicted pedophile who Krauss publicly defended, was a major donor to his Origins Project. (See e.g., Matthew Haag, "Lawrence Krauss to Retire From Arizona State After Sexual Misconduct Accusations," *The New York Times,* 22 October 2018, and Peter Aldhous, "Jeffrey Epstein's Links To Scientists Are Even More Extensive Than We Thought," *BuzzFeed,* 26 August, 2019.) It seems, though, that poor choices regarding his relations to women and financiers, assuming the accusations correct, should not preclude one from revealing his poor intellectual choices.
5. See e.g., Edward P. Tryon, "Is the Universe a Vacuum Fluctuation?" *Nature* 246 (1973) 396f.; Alexander Vilenkin, "Quantum Origin of the Universe," *Nuclear Physics* B252 (1985): 141–52, and "Creation of Universes from Nothing," *Physics Letters* 117B, 1–2 (4 November 1982): 25–28; David Atkatz and Heinz Pagels, "Origin of the Universe as a Quantum Tunneling Event," *Physical Review D* (15 April, 1982): 2065–73; J.B. Hartle and Stephen W. Hawking, "The Wave Function of the Universe," Physical Review D (1982): 2960.
6. See e.g. *The Collected Papers of Charles S. Peirce* 8 vols, edited by Charles Hartshorne, Paul Weiss, and Arthur Burks (Cambridge: Harvard University Press, 1931–58), cited by volume and paragraph number: CP 6.189–209 (1898).
7. CP 1.135 (1898).
8. Susan Haack, *Evidence Matters, Science Proof, and Truth in the Law* (Cambridge: Cambridge University Press, 2014), p. 12. A fascinating case in point is that of the French microbiologist Didier Raoult. See Scott Sayare, "He Was a Science Star, then He Promoted a Questionable Cure for Covid-19," *The New York Times Magazine,* 12 May 2020.
9. I have capitalized "god" where it can be interpreted as the name of a divine being that is referred to in canonical texts within the Judeo-Christian-Islamic tradition on the ground that names are normally capitalized; otherwise it is lowercased.
10. Lawrence M. Krauss, *A Universe from Nothing,* op. cit.; references to this work are given in-line by page number only.
11. For Peirce discussion of the economy of research, see e.g., *The Writings of Charles S. Peirce,* edited by the Peirce Edition Project (Bloomington: Indiana University Press, 1981–) 4:72–8.
12. Charles S. Peirce, "On Science and Natural Classes," in *The Essential Peirce* Vol. 2, edited by the Peirce Edition Project (Bloomington: Indiana University Press, 1998), pp. 115–132.
13. Lawrence Krauss, "The Consolation of Philosophy," *Scientific American*, 2012.

14. See Haack, 2017, passim.
15. Lawrence Krauss, 2012, op. cit.
16. See e.g., Seth J. Schwartz, Scott O. Lilienfeld, Alan Meca, and Katheryn C. Sauvigné, "The role of neuroscience within psychology: A call for inclusiveness over exclusiveness," *American Psychologist* 71.1 (Jan 2016): 52–70.
17. The Catholic theologian Matthew Lamb expresses the same idea quite nicely when he writes: "The roots of dogmatism and nihilism in modernity, as in other epochs, is the fallacy of misplaced normativeness. It is the process of making *the products* of intelligence and reason as normative rather than *the questioning praxis* of intelligence and reason." See Matthew Lamb, *Eternity, Time, and the Life of Wisdom* (Naples, FL: Sapientia, 2007), p. 132; emphasis added. However, given Lamb's position regarding the Magisterial teachings and his insistence on the *mandatum,* he can be rightfully accused of falling victim to the fallacy himself.
18. My conception of pseudo-inquiry is, I think, broader than Haack's, who writes, "The distinguishing feature of pseudo-inquiry is that what the 'inquirer' wants is not to discover the truth of some question but to make a case for some proposition determined in advance," in that my conception includes both sham and fake reasoning. *See Manifesto of a Passionate Moderate* (Chicago: University of Chicago Press, 1998), p. 8.
19. Much of Haack's *Scientism and Its Discontents* (op. cit.) is directed against those who want to make philosophy scientific in the narrow sense, while retaining the idea that philosophy can be conceived as part of science if science is conceived broadly in a Peircean manner.
20. CP 1.136f.
21. Susan Haack, "Do Not Block the Road of Inquiry," *Transactions of the Charles S. Peirce Society* 50.3 (2014): 319–39.
22. David Albert, "On the Origin of Everything," *The New York Times* (25 March 2012): BR20.
23. Susan Haack, *Putting Philosophy to Work,* 2nd expanded edition (Amherst: Prometheus Books, 2013).
24. Lawrence Krauss, 2012, op. cit.
25. Ibid.
26. For a detailed account of the history of the concept of nothing and its relation to that of a vacuum, see Edward Grant, *Much Ado about Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution* (Cambridge: Cambridge University Press, 1981).
27. Krauss, 2012, op. cit. There are various problems with this view. For instance, when I'm thinking of a school bus, I'm thinking of something, I'm clearly not thinking of nothing, even though the school bus I'm thinking of is unlikely to be the kind of thing that can be captured in terms of one or more physical quantities. One would have to subscribe to a pretty radical form of reductive materialism that has yet to be properly argued for, especially if one takes the empirical route.
28. Interestingly, Krauss's view that something is some kind of property removes a key objection of Anselm's ontological argument for the existence of God.
29. "Scholium to the Definitions," *Philosophiae Naturalis Principia Mathematica* 1 (1689); trans. Andrew Motte (1729), rev. Florian Cajori (Berkeley: University of California Press, 1934), pp. 6–12. And, importantly, this was not an empirical discovery.
30. The only way something can escape the time constraint set by the Heisenberg principle is where particles cancel each other out so that the law of the conservation of energy is not violated in the process.
31. Though the aim of this second step seems that of addressing those who deny that nothing is empty space, the choice of words indicates that rather than rejecting that nothing is empty space, Krauss continues to identify it as such, albeit that this nothing is somehow less fundamental. In a sense the difference that is being drawn is the ages-old distinction between the intra-cosmic and the extra-cosmic vacuum (or void). See Grant, op. cit., passim.
32. In *The City of God* (early 5th century AD) and elsewhere Augustine tries to interpret the opening chapters of *Genesis* so that they agree with the idea of God creating the universe *ex nihilo.* In the process Augustine runs into some of the very same issues that Kraus is raising. See e.g. Bk. XI, Ch. 4–6.
33. See e.g., Alan Guth, *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins* (Reading: Addison-Wesley, 1997).
34. *The Writings of Charles S. Peirce,* op. cit., 8:107 (1890).

35. The notion of multiverse has been used to discuss the existence of other universes existing beyond the observable universe, which is now identified as being our universe. Some have conjectured that very different laws of physics can govern such other universes, which is possible because they are in no way connected to our universe given the speed of light. The notion of a multiverse used here, however, is different, in that it has to explain the big bang itself, hence it must simultaneously explain the origin of the observable universe and anything that might exist beyond it.
36. One could even go as far as to say that in all of this the physicist does not fare any better than the theist. True, the theist can be accused of violating Occam's razor by frontloading his account of the origin of the universe with a designer-god, but the multiverse hypothesis, which postulates a large and possibly infinite number of universes, does plenty of frontloading too. Moreover, there is no empirical proof for either, and the prospects of obtaining it are dim.
37. See esp. G.W.F. Leibniz, "The Principles of Nature and Grace, Based on Reason [1714]," in Philip P. Wiener, *Leibniz Selections* (New York: Charles Scribner's Sons, 1951). Leibniz was certainly not the first to ask the question. Already in the 4th century, St. Augustine asked (*De Civitate Dei,* Bk. 11, Ch. 21) why God created the universe (which Augustine considered to be a *creatio ex nihilo*). Since God might as well have not created it, he must have had a reason for doing it. Augustine's answer was that God did create the universe because God thought it was good. Hence, Augustine's answer, inspired by *Genesis* 1:1–5, was that the universe exists because it is *better* than nothing. See *The Works of Aurelius Augustine,* edited by Marcus Dods (Edinburgh: T&T Clark, 1871–83), 1:461.
38. Leibniz, op. cit., p. 527.
39. Note further that if we take an *empirical* approach to nothing, the response to the question "Why is there something rather than nothing?" will not be that Leibniz's presupposition was wrong (i.e., the idea that nothing is easier and simpler than something), but that the question itself is wrong, because with a average density of less than a handful of protons per cubic meter, the conclusion has to be that on all reasonable accounts the universe is empty, so that there is *nothing* rather than something, and that the reason why Leibniz thought otherwise is due to him being biased. It is as if he were to sit on a little speck of dust floating in an empty room pondering why the room isn't empty, rather than realizing that his presence, and that of the speck, are so insignificant that they do not demand any explanation.
40. It is further worth noting that the claim that the universe emerged out of nothing privileges linear over cyclical time, which too has its origin in theology—linear time having been inspired by the idea that cyclical time would require Jesus to die on the cross over and over again, which was considered absurd. The result was that the universe was envisaged to run in a straight line from Creation to Apocalypse. See e.g. Pascal Richet, *A Natural History of Time* (Chicago: Chicago University Press, 1999), p. 29f.
41. In that sense cosmological design arguments for the existence of God are very different from the idea of a creation *ex nihilo*.
42. Though the universe may have emerged out of nothing, this paper certainly did not, and in many ways its Big Bang was caused by a powerful fusion of the views of Charles S. Peirce and those of his sympathetic and insightful critic, Susan Haack. I further want to thank Kelly de Waal, and Mark Migotti for their insightful comments. An earlier version of this paper was read at the *American Philosophical Association, Central Division*. Meeting in Denver, Colorado, 20–23 February 2019.