

Death by Mathematics

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In the 20th century, physics underwent a transformation. No one would deny that. But normally the transformation is credited to Relativity and Quantum Mechanics. And normally the transformation is seen as a great advance. In this paper I will argue the opposite. The transformation was due more to a transformation in mathematics, and that transformation has been almost wholly deleterious.

This transformation due to mathematics began in the 19th century, but it did not engulf physics until the 20th century. In the 19th century the stage was set: we had several abstract mathematical fields that reached "fruition", including a math based on action variables and principles, a math based on curved space, a math based on matrices, a math based on tensors, a math based on i , and a math based on infinities.

As I have shown, 19th century mathematics inherited many unsolved problems from the past, including problems from Euclid and Newton. It made no progress in solving these problems because it did not recognize them as problems. It had already given up on foundational questions as "metaphysics", and it preferred instead to create more and more abstract systems. The more abstract the mathematical system became, the more successful it could be in avoiding foundational questions.

The clearest example of this is the field of applied mathematics based on action variables. For the last hundred years we have heard an ever-increasing level of praise of action variables, culminating in the propaganda of Feynman. But action variables are just an abstraction of Newtonian variables. By abstraction, I mean that they do not add clarity, they cloak disclarity. Newtonian variables were never very rigorously defined, but action variables are very good at hiding Newtonian variables. Action variables do not replace Newtonian variables, as some appear to think. Action variables *contain* Newtonian variables. Action variables restate Newtonian variables in what is considered to be a more efficient form. But action variables are utterly dependent on Newtonian variables. If it were discovered that Newtonian variables were false, action variables would be, too, by definition. The action concept developed directly out of Newtonian mechanics, and action assumes the absolute validity of Newtonian mechanics. Action does not transcend Newton in any conceivable way, it only compresses his method. Just as velocity is a compression of distance and time, the Lagrangian is a compression of kinetic and potential energy. Each compression is a mathematical abstraction, because the individual variables are no longer expressed singly. They often do not appear in the equations at all. They are included only a parts of greater variables.

From an engineering standpoint, this is a real advance. As long as the greater variables express the changes of the individual variables in the right way, abstract systems like this can save a lot of time. But from a theoretical standpoint, abstract mathematics can be a great danger. Since the individual variables are no longer in the equations, it becomes much more difficult to see when they are being misused. Abstract mathematics must assume that all its original assumptions are applying with each new application, and with many new applications this may not be so. If time and distance are not behaving in normal ways, then the equations have no way of correcting for that, since they don't have any way to express it. The equations rely on original definitions and assignments, and modern mathematicians and physicists do not usually

bother to check to be sure that all these definitions and assignments hold for each new application. They don't do this for two reasons. One, they often don't know what the original definitions and assignments were. The mathematical systems are taught as abstract systems, where foundations are considered to be moveable. In the case of the Lagrangian, for instance, we are taught that the variables are general coordinates that we can apply to almost anything. Well, this is true to only a limited degree, and the limits have been ignored. Two, definitions and variable assignments are considered to be metaphysical, and therefore beneath the notice of mathematicians and scientists. Modern scientists cannot be bothered to look at foundational questions, since math is only the equations themselves. If you have mastered the manipulations, you have mastered the math, they think.

To be very clear, it is not action variables I object to. What I object to is their misuse. They are misused when they are applied to systems that do not match the time and distance assignments they were created for. I also object to the implied superiority of action variables. They are very efficient in some uses. But because they are abstract, they are prone to misuse. In this way they are actually inferior. They are inferior because they are less transparent than Newtonian variables. Newtonian variables are not always transparent either, but action variables are *always* less transparent. Action variables are the first cloaking of physics. And in some cases this cloaking is not an accident. Action variables and the math surrounding action is not always used to generate efficient solutions in familiar situations. It is now often used to blanket over holes in theory or math. Like many other mathematical systems, it is now used to mask purposeful fudges.

The next mathematical system that invaded physics is that of Gauss and Riemann, invading through the door of General Relativity. This was really the first major invasion, and the most important. Up until then, physicists had been wary of allowing mathematicians to define their fields, especially with the new abstract systems. The action principle had not yet invaded physics on a full scale, and would not until the arrival of quantum mechanics. Einstein himself was very wary of abstract math, purposely avoiding it until 1912. Put simply, he "did not trust it." But in that year he discovered Gauss, and called on his friend Grossman to help him with the math. A couple of years later Einstein was hired in Berlin, and there he got even better help, from Hilbert and Klein, no less. Einstein had asked the wolf in at the front door.

I don't think it is an accident or coincidence that the first thing the wolf tried to do is take over the house. Hilbert, after schooling Einstein on all the latest techniques, tried to beat Einstein to the punch by publishing the theory of General Relativity two weeks before him. He didn't succeed in this dastardly trick, but amazingly history has not held it against him. Einstein quickly forgave him, and now Hilbert is treated as the greatest mathematician of the 20th century. But to me, this incident perfectly presaged the way the 20th century would go. The mathematics department, invited to consult, would see its opportunity to steal the show, and it has since stolen the show. Someone like Feynman could throw barbs at the math department, but this was only misdirection. The top mathematicians could look back over their shoulder in feigned opposition, only because they had already taken over the physics department. Feynman was not smirking at mathematics, he was smirking at mathematicians who were too narrow to crossover and become famous, like he had. It was as if to say, "We now own physics, the queen of the sciences and the modern kingmaker, and you guys prefer to argue over trivialities like Fermat. That will never win you a Nobel Prize or a trip to the White House."

Einstein's success with the tensor calculus called all the present demons out of the closet, invited them all into the kitchen, and gave them control of the fire. He showed the road to fame, and the first stop on that road was enlisting a new abstract mathematics. That has been the road ever since, and it defines the current low road of string theory, which had planned to awe all opposition with a math so great and so abstract there was no beginning or end to it (its plan is not moving as planned). Quantum Mechanics was the first to learn this lesson, though, and Heisenberg was the greatest student. Heisenberg understood first and best how to use mathematics to impress and cow the audience. He also understood first and best how to use

mathematics as a tool of propaganda. A math of proper abstraction and complexity could be used to hide all error, to divert all effort, to deflect all criticism. It could be used like a very heavy, very highly decorated quilt, covering the bedbugs beneath. This new abstract math would come not with a foundation, but with a manifesto. It did not have axioms, it had public relations. It was not sold with an explanation, but with an "interpretation", and this interpretation was to be accepted on authority.

The takeover in the 20th century was very quick once it began. The mathematician Minkowski reworked Special Relativity before the presses had even cooled on Einstein's paper, expressing the field in complex and abstract terms. This reworking was completely unnecessary, but it was accepted just as fast as it was offered. The novelty of it was enough to complete the sale, although the price was steep indeed. The problem with Minkowski's math is the same as the math of action: the danger is all in the loss of transparent variables. Again, I have nothing against complex math as long as it is used with discretion and complete honesty. But Minkowski fails miserably on both counts, as I have shown at <http://www.geocities.com/mileswmathis/mink.html>. The symmetry is a manufactured symmetry, and the loss of the time variable has been disastrous. The subtle errors in Einstein's math were immediately cloaked under an abstract math, and that abstract math was in no way more elegant than the simple algebra of Einstein's original paper. Einstein's paper was dense, but that was Einstein's fault, not the algebra. Minkowski's unstated axioms were not only unstated and unnecessary, they were false. The time dimension does not travel orthogonally to the other three, and this is not a metaphysical subtlety. It is a physical and mathematical fact, easily proved. See <http://www.geocities.com/mileswmathis/hyper.html>. Even Einstein called Minkowski's math "superfluous erudition." He was only half right. Minkowski's math was certainly superfluous, but it was false pedantry, not erudition. It was sciolism.

Even this unnecessary abstraction and obstruction was not enough to satisfy. Another level was soon added by the tensor calculus, a blanket ten times as heavy as the blanket of Minkowski. Although I have shown that General Relativity can be expressed with Newtonian variables, a Euclidean field, and high-school algebra, the worthies of the time preferred to express it with an undefined curved field and a hatful of unwieldy tensors. In his previous mood, Einstein had said, "You know, once you start calculating (with abstract mathematics) you shit yourself up before you know it." But suddenly, in 1912, he developed a fondness for this mess. Perhaps he saw darkly what Heisenberg would see very clearly: the 20th century would have a love affair with shit. The century proved this in every field, from art to math to science to war to politics to entertainment to sex. The century loved nothing so much as watching someone foul himself in public, as long as that someone could sell the spectacle as a transcendent event.

Once again, a Gaussian field and tensors and all that has followed can be made to work. In some situations it is actually useful. I am not arguing that these fields or manipulations are necessarily false. What I am arguing is that physics doesn't need them. The physical field is not that complex. We have invented maths that are much more complex than we need, and we have gotten lost in their mazes. The problem with the math of General Relativity is that it cloaks the mechanics involved. It is too abstract by several degrees. This means that although Einstein sometimes found a way to get the right answer with all this math, he just as often got the wrong answer. The math is so difficult that almost no one can sort through it and tell when the answer is right and when it is wrong. Even worse is the fact that the opacity of the math makes it impossible to unify it with any other math. The primary events are buried so deep and are so poorly defined that there is no hope of expressing them with the mathematical tools available, or isolating them so that they can be located in other fields. The mathematical manipulations become the primary events, and the mathematical field becomes reality. The math ends up usurping the mechanics.

This opacity causes another problem. Because the primary variables are buried under so many abstract layers, they cannot be studied when problems arise. Later repairs cannot be done at ground level, they have to be done in end-math that adds complexity. In QED this end-math is called renormalization. In GR it is

called other things, but in either case it leads to an endless scholasticism and an endless and unsightly tinkering. It ends up providing physics with equations that are post-dictive instead of pre-dictive. Every new experiment requires a new fix, and each new fix is pasted over all the others. You then end up with what we have: a physical math that is burdened with so many fields and operators and manipulations and names that it makes Medieval biblical exegesis look like a cakewalk. And it leads to the absurd situation of having physicists who invoke Occam's razor and the beauty of simplicity offer us a proliferation of fields and manipulations that is truly mind-numbing. When I see a string theorist invoke Occam's razor, I can't help feeling queasy. It is like Fox News invoking honesty in reportage.

Next came Quantum Mechanics. Heisenberg saw Einstein's success with the matrices and voila, the matrix moved to QM, making it even more famous than GR. But this time we got a confluence of new abstract maths: the turn of the screw. It was feared the matrix would not be enough to wow the world, and so the matrix was joined by the Hamiltonian and Hilbert Space and Hermitian operators and eigenvalues and so on. It was never explained why quanta could not travel in Euclidean spaces under transparent variables, just as it was never explained why gravity required tensors. It was never explained because no one needed an explanation. All were quite satisfied to have new things to do. The new math was the main draw. It gave the theory a required ballast and made everyone look smart. What was there not to like?

Well, there was the fact that everything was based on probabilities, that the mechanics was contradictory and unfathomable, that many insoluble paradoxes were created, and that the math required an infinite renormalization that was basically "hocus pocus." But I mean, other than that, what was not to like? If we could just learn to accept that Nature no longer made sense, we would be just fine. After all, the math was big enough to make up for everything. What was Nature next to a math that could fill blackboards?

And now that QED is "perfect", we graduate to the even bigger blackboard that is string theory. Since a huge unfathomable math was so successful in QED, string theory naturally developed an even huger and more unfathomable math, one with exponentially more paradoxes and contradictions and ad hoc fixes. If QED requires an infinite renormalization, string theory requires a trans-infinite renormalization. Since QED so successfully ignored mechanics, string theory ignores it even more thoroughly. QED had to state out loud that it was going to ignore mechanics, as a matter of some sort of principle (we are not sure what principle). But string theory goes to the next level of ignorance, which is ignoring that mechanics exists or ever did exist. Like Mephistopheles, the string theorist can call up any entity he likes, just by a simple conjuring. He doesn't need an axiom or a proof or even a definition. All he needs is a need. Science is now defined by desire more than anything else. "I desire a ten-dimensional donut with spikes like a pufferfish, and a gauge theory in the shape of a wombat sitting in the corner smoking a cigar, therefore the universe and this computer model must supply me with one. Oh, and all this exists beneath the Planck limit. Except for the cigar, which disappears in the presence of a scanning microscope."

Yes, modern physics has become a neo-scholasticism. It is the avoidance of real questions in the pursuit of trivial methodology. It is the memorization of an endless list of names and manipulations in lieu of understanding mechanics. It is the knee-jerk invocation of authority and the explicit squelching of dissent. It is the institutionalized acceptance of censorship and the creation of dogma. Grand Masters like Feynman say "shut up and calculate!" and everyone finds this amusing. No one finds it a clear instance of fascism and oppression. An internet search on "against Feynman" or "Feynman was wrong" or "disagree with Feynman" turns up nothing. The field is monolithic. It is completely controlled and one-dimensional. All discussion has been purged from the standard model, and all debate has been marginalized. Any non-standard opinion must be from a "crank" and blacklisting is widespread. Publishing is also controlled, both in academia and in the mainstream. Einstein already found science publishing too controlled for his taste in the 30's, refusing to work with *Physical Review*. What would he think now? Can anyone imagine his early

papers getting published in the current atmosphere?

If you are an insider at a major university, you can publish anything, the more absurd the better. You can say anything without fear of contradiction or analysis, since science most wants right now to be creative, and it thinks (like modern art) that absurdity is the most creative thing possible. The paradox is the highest distinction, the contradiction the surest sign of elevation. The contemporary physics paper has become like Dubuffet's *La Lunette Farcie*, a purposeful mockery of all convention, a nothing packaged as a something. Soon the physicist may be expected to follow Duchamp, publishing a toilet seat as a TOE.

Contrary to what we are told, contemporary physics is not booming. It is not very near to omniscience, it is not the crown jewel of anything. In fact, it is near death. It has been damaged by any number of things, only a few of which I have mentioned by name here. But the prime murderer has been abstract mathematics. Physics has succumbed to a suffocation. It is the victim of a strangulation. It is in a not-so-shallow grave, and piled on top of it like dirt are a thousand fields and operators and variables and names and spaces and terms and eigenvalues and dimensions and criteria and functions and coordinates and conjugates and bases and bijective maps and automorphism groups and abelian gauge fields and Dirac spinors and Feynman diagrams so on *ad nauseum*. The only way the grave could be any deeper and darker, in fact, is if we allowed Deconstruction to dump its transfinite dictionary of onanic terms on top of this one.

The only road out of this grave is to start digging in the upwards direction, clearing away all this schist. The sort of math that physics requires is a math of rigorous definitions and transparent variables, with as little abstraction as possible. We don't need spaces of infinite dimensions, since we don't have infinite physical dimensions. We don't need abstract operators, we need direct representation of motions and entities. Taking the advice of Thoreau, we must "simplify, simplify, simplify." That is our only hope of a Unified Field and a mechanical explanation of the universe.