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The Copenhagen Interpretation

and the fall of physics in the 20th century


by Miles Mathis

We come to our own, and make friends with matter,
which the ambitious chatter
of the schools would persuade us to despise.
—*Emerson*

Bertrand Russell said in 1930 that the desire to foist order upon chaos was born of fear:

The desire to make an intelligible system out of it [the world] is an outcome of fear, in fact a kind of agoraphobia or fear of open places.*

That was one of the themes of the 20th century, so fundamental and so central that it is now a kind of truism. But like everything else in that century, it was inverted. Not only is it not a truism, it is false. In fact, it is the *denial* of the world as intelligible that is born of fear: the fear that you cannot make sense of it no matter what you do. It is this fear, combined with the desire to deny the past, that defined all the great movements of the 20th century—Dada, Futurism, Existentialism, Postmodernism, quantum uncertainty, Relativity.

I will argue that more than anything else, the manifestoes of the 20th century intellectuals, artists, and scientists were a refusal to compete, born of this fear of action. Contrary to what we are told, this refusal to compete was not based on the horrors of the past. Nor was it based on the horrors of the first world war, since both the idea and the attitude predated the war. It was based on the incredible achievements of those that had come before, and especially of those artists, scientists and intellectuals

of the last generations of the 19th century, whom the youth of the 20th century had (what they perceived as) the misfortune to follow on the historical stage. They told us that the easel painting, the novel, the poem, and deterministic science (mechanics) were all dead. Why? Mainly so that they wouldn't be expected to deliver a painting, novel, poem, or science better than or as good as the ones that had come before. Instead of simply admit this, as any weak but honest person might, they did what the weak and dishonest commonly do: they created a tortured logic to make achievement look like selfishness, courage look like fear, and reason look irrational. They then tried to pass off their own achievements —which can be seen to be inferior by any person with eyes—as somehow superior.

This has been true across all the arts and sciences for more than a century—and it is now perhaps recognized to some extent regarding the arts—but in this paper I will focus on the way it has affected physics.

Nietzsche is often called the father of Existentialism, and he is presented in textbooks and university classes as a precursor to many 20th century doubts and novelties. But even this is inverted. If you bother to read Nietzsche without a preset interpretation, you see that he was warning against just this sort of smallness and resentment. He was warning against the refusal to compete. He was warning against those who would invert logic, trying to redefine clarity and creativity as "inauthentic" and their own wafflings as authentic. Far from encouraging or romanticizing this new attitude, Nietzsche was villifying it in the clearest possible terms. Modern intellectuals have re-interpreted Nietzsches's "God is Dead" pronouncement as an excuse for all their various disabilities and inabilities—whether it their inability to do real science or their inability to do real art. But Nietzsche never presented his thesis as an excuse for any sort of nihilism. Nietzsche was the fiercest anti-nihilist in history, and to misread him as a nihilist betrays the worst sort of lazy miscomprehension.

Nietzsche saw the twilight of the idols—the death of the old religions—as an opportunity for both the overman and the lastman, the man of strength and the man of weakness. He foresaw the rise of both, and he wrote to encourage the former and warn of the latter. As with everything else, both his overman and lastman have been misinterpreted. The lastman is usually seen as representing the weak-minded masses, easily led. That is not false, but it is incomplete. The lastman also represents the weak intellectual, and the weak intellectual was more dangerous than any number of herd people, since he would lead them. He was the spider that would invert the old truths and hierarchies.

He [this spider] knows only one great danger: that is science—the sound conception of cause and effect.†

The people have ye served and the people's superstition—*not* the truth—all ye famous wise ones. And just on that account did they pay you reverence. ‡

You see, by the modern and current interpretation, Nietzsche's proclaimed that God is Dead in order to subvert all the old hierarchies. He is seen as a sort of pre-Futurist or pre-Dadaist, rejoicing in all revolutions for their own sake, no matter their form or outcome. But this is to misread Nietzsche. Nietzsche was not sad to see Christianity fall, it is true, but Nietzsche believed strongly in the "natural" hierarchies of strength, health, intelligence, and so on. He had no desire to see a classless society or to promote any sort of egalitarianism. He would have had no interest in a "democratized" art or science or philosophy. He believed in the brutal honesty of nature, where inequality, not equality, is the rule. And like Nature herself, Nietzsche had no pity for weakness.

But all this was turned on its head at the turn of the century, as various nouveau-intellectuals used

Nietzsche to promote their manifestoes. They saw this time of great change as their chance to subvert *all* the old hierarchies, not just the hierarchies of the Church or the State. It wasn't just the gods or the kings they wished to dethrone, it was anyone and everyone who had done anything in the past, good or bad—and especially good. It was the desire to erase history, so that they didn't have to compete with it any longer. They weren't mainly progressives who wanted to get rid of corrupt governments or popes or institutions. What turned out to be a majority of them were more interested in getting rid of the Newtons and Michelangelos and Leonardos of history. As it turned out, these intellectuals were *more* oppressed by Newton and Michelangelo than they were by fake kings or popes. That should tell you who you were dealing with right there.

This thesis is very easy to sell regarding the arts in the 20th century, since the nouveau-intellectuals were quite transparent in their attacks. They admitted it. The critics and artists said in clear sentences that they wished to destroy the past, regardless of quality. They admitted that they didn't wish to destroy Leonardo because he was bad, but because he was good. He oppressed their small spirits. They still admit it, in print, to this day. You only have to read the academic press to see that Nietzsches's *ressentiment* is not only alive in contemporary America, it defines the bulk of current art theory up to this very moment.

But regarding physics, the thesis is somewhat less clear. The critical and theorizing literature in physics is much less voluminous and much less transparent. The literature certainly exists, in huge piles, but beyond the idea of Relativity and a few of the largest ideas of quantum mechanics, the underlying theory never entered the mainstream. The main lines of new science theory have enveloped and disseminated throughout culture like a fetid mist, but they have done so in a more clandestine manner. Physics had to do without a long line of high profile critics. It never had a Clement Greenberg or a Robert Hughes. Classes in science history exist in places in various forms, but the science history "department" is in no way analogous to the huge art history departments that dwarf their own art departments in all universities.

It can be argued that this very lack of physics criticism and physics history has benefitted physics, allowing it to exist in the shadows, untouched by outside forces. For decades it has had to answer only to itself—to its own top theorists, who were shielded by the complexity of their field. And, of course, this complexity was manufactured and extended precisely for that purpose.

But what has benefitted physics from a protectionist standpoint has failed physics from a scientific standpoint. A protected physics has become a corrupt and inbred physics.

To show how this has happened, we need to go back to the 1920's, when all that now exists was formulated and sold. Of course the revolution in physics predates the 1920's, as we saw in my previous paper on Mach. And the attitude that nurtured the physicists of that generation had already been prominent for a generation before them. Various revolutions based on overthrowing the past in all ways had been brewing in the universities for at least two decades, which is why World War One cannot be the cause. The Great War was not cause, but another effect. And, as I have said before, the new physics didn't come to full fruition until Bohr and Heisenberg enshrined it in the 1920's.

Although top physicists have enjoyed belittling philosophers (think of Richard Feynman's constant jabs at the philosophy department in the 1970's), it turns out upon closer inspection that the new physics evolved directly out of the philosophies that were current in the 1920's and just before. In this way, Feynman's attacks were mainly misdirection They were the effort to prevent you from recognizing just how polluted by bad philosophy his field had been since the beginning.

Bohr and Heisenberg tend to now be sold as the hardest of hard physicists, but they were both what any real scientist would call extremely soft—often getting their philosophies before their physics, and letting the former lead the latter. At university, Bohr long sat on the fence between physics and philosophy, finally choosing physics only because it seemed more in vogue. I don't mean to attack philosophy—one of my majors was philosophy. I am not belittling philosophy here but bad philosophy, the sort of 20th century philosophy which, like the science it supports, is based on upside-down definitions, flawed reasoning, and a complete lack of rigor and clarity.

One of the greatest early influences of Bohr was Harald Hoffding, a prominent professor of philosophy at the University of Copenhagen who lectured on Kierkegaard. There is even some speculation that Bohr got the idea for his quantum leap from Kierkegaard's leap of faith. However that may be, it is certain that no one ever got the idea of a quantum leap from data. The data only showed quantum *levels*: it had nothing to say about what was between those levels. To theorize that *nothing* was between those levels was a leap of faith if ever there was one, a leap even more irrational than any leap of Kierkegaard. No evidence in history had ever indicated that objects move from point A to point B without going through points in between, and all evidence had indicated that they did, so the proposition that electrons moved in a discontinuous manner was grossly unscientific and unphysical. So why did Bohr make it anyway?

As it turns out, the proposition wasn't necessary to quantum theory. Planck and Schrodinger and many others did quite well without it. It had no effect on the math or physics and couldn't be proven. It is now played down as mostly unimportant. And yet the idea led all early pitches for quantum mechanics. In the popular press it remained the most famous bullet point for many decades. Again, why? We must assume it comes down to one of two possible reasons, or to both of them. Either Bohr preferred an irrational physics for some reason of his own, or he recognized the sales potential of dressing new physics in paradoxes.** I would guess it must be both, because despite his limitations, Bohr does not seem like a salesman and nothing more. Unlike even newer physicists, he doesn't seem the sort to manufacture a physics from nothing but propaganda. Bohr's physics looks to me like a strange mixture of unconscious propaganda and unconscious cathexis. Remember, Bohr created a personal coat of arms for himself that prominently included the Taoist yin/yang circle. This was to symbolize his principle of complementarity. Complementarity was for him not just a stop-gap or a fudge factor, as it would have been for any true physicist (and as the wave/particle was for Schrodinger, for instance). It was an article of faith, a religious belief. It was thing he believed and vigorously defended against invaders, and he believed it with no proof and no possibility of proof. Which is why I do not say his devotion to it was "like a religion" or a "pseudo-religion." No, it was religious faith, pure and very simple. *Credo quia absurdum*: I believe it **because** it is absurd. No idea was ever a better example of that Latin phrase than complementarity—except maybe the quantum leap.

Nor was this unscientific pathology limited to Bohr. Through him it infected the entire field for many decades. Feynman was still promoting it famously in the 1980's, with his book *QED: the Strange Theory of Light and Matter.* Like Bohr before him, Feynman was still in love with paradox and strangeness for its own sake. He gleefully tells us that Nature does not make sense. He brings scientific Dada into the last two decades of the century.

And the pathology remains ascendant to the present hour, as we see from any issue of *Scientific American* or *Physics Today.* Top theorists still prefer to remain irrational, for reasons of their own. Actually, the reasons are no longer personal, or only personal. It has become clear that irrationality and nescience sell more magazines and research projects than science. Bohr and Heisenberg were

prescient. Their subconscious refusals to compete have been mirrored by generations of scientists and science readers, and multiplied and magnified. By throwing out rigor and embracing mysticism, they have enabled the largest growth in physics ever seen. As Nietzsche said, they have given the people what they want: *not* truth; **superstition**.

We can see the philosophic bent of Bohr in this passage from his book *Atomic Theory and the Description of Nature* [p.99]:

> We are thinking here of the well-known characteristics of emotion and volition which are quite incapable of being represented by visualized pictures. In particular, the apparent contrast between the continuous onward flow of associative thinking and the preservation of the unity of personality exhibits a suggestive analogy with the relation between the wave desciption of the motions of material particles ...and their indestructible individuality. The unavoidable influence on atomic phenomena caused by observing them here corresponds to the well-known change of the tinge of psychological experiences which accompanies any direction of attention to one of their various elements.

Not only is that terrible physics, it is terrible philosophy. What do the characteristics of emotion and volition have to do with the motion of an electron or photon? The analogy is not just tenuous, it is non-existent. Bohr is trying desperately to say something deep here, but comes up only with glaring falsehoods and flights of pointless fancy. Not only does the inability to visualize emotions have nothing to do with visualizing electrons, it turns out that emotions and volitions *are* capable of being represented by "visualized pictures". Bohr must be forgetting Freud here, who taught us that dreams are exactly that; he must be forgetting abstract art, which has been sold as the visualization of emotion. Beyond that, the unity of personality has nothing to do with the discreteness of quanta, and the continuous flow of thinking has nothing to do with wave mechanics. Nor has the influence of the observer in quantum mechanics got anything to do with self-reflection in thinking. How could it, since in thinking we are observing our own thoughts; but the electron is not observing itself. Bohr is refusing to make any critical distinctions here, which is typical of both his philosophy and his physics.

This paragraph, which *is* representive of Bohr's thought processes, betrays a characteristic lack of discipline in argumentation and ideation. As more proof, here's another famous quote:

> There is no quantum world. There is only an abstract quantum physical description. It is wrong to think that the task of physics is to find out how nature *is*. Physics concerns what we can *say* about Nature.

What real physicist would say such a thing? If Bohr really believed that, he should have called himself a Conversationalist and left Physics to others. For we can *say* whatever we like about Nature: it is up to Nature herself to tell us what is wrong and what is right. If what we say about Nature is right, then that indicates how Nature *is*. Bohr is just spreading confusion. He appears to be separating what we *say* from what *is*, in order to make it easier to say things that *aren't*. Certainly that has been his legacy. It has been far easier to pass off airy pronouncements as physics since the time of Bohr, since that is precisely what he did. The Copenhagen Interpretation is not physics, and it is not how Nature is. It is just empty speech. We can see this by looking at the opening paragraph at Wikipedia, which is typical in its gloss of the Copenhagen Interpretation:

> It holds that quantum mechanics does not yield a description of an objective reality but deals only with probabilities of observing, or measuring, various aspects of energy quanta, entities which fit neither the classical idea of particles nor the classical idea of waves. According to the interpretation, the act of measurement causes the set of probabilities to immediately and randomly assume only one of the possible values.

That is a predominantly negative definition, with almost no content, and absolutely no verifiable

content. According to it, QM is *not* objective, *not* classical, *not* really particle *nor* wave. And, it is worth noting, *not* mechanical. Quantum *mechanics* is explicitly non-mechanical, which is false advertising if nothing else. The only positive content of this statement is in the last sentence, but even that is a wild assertion, based on no physics and no data. We have *no* indication from data that the act of measurement randomly causes the values we find. All we have as data are the values. We have no indication how the values fell into place—whether it was random or not, or whether our act of measurement caused the values. We do know that our measurement may affect the values, but affecting them and causing them are two different things. Again, a complete lack of rigor in both ideation and argument.

This is important because according to a poll done in 1997, the Copenhagen Interpretation is still the most widely held interpretation of quantum mechanics. The second most widely held is the many-worlds interpretation of Hugh Everett, which is even worse.

That the Copenhagen Interpretation is nothing but propaganda can be seen from the state of its reported criticisms. Einstein was its most famous critic, and he is reported to have objected to it because it is "not complete." You have to be kidding me! The Copenhagen Interpretation "not complete"? It isn't even embryonic. As it exists now, it begins with

A system is completely described by a wave function.

Talk about leading with a bold contradiction. How can probabilities "completely describe" anything? Look up the definition of probability and get back to me. What they should say is that a quantum system is described *as best we can* by a wave function. That is how Schrodinger would have put it, and he is the one who invented the wave function. That sentence also contradicts other parts of the CI, which tell us that Nature *is not described at all* by quantum physics. If that is so, what "system" are they talking about here? If not Nature, then what? How can quantum mechanics at the same time "completely describe" a system, and "not describe it at all"? And if the wave function "completely describes" some system, then how does that system later randomly assume one value of many? Clearly, according to the sentences quoted above, the wave function by itself can only describe a set of possible values, which an observation then collapses into one value. So this makes the quote more like, "A system is described *as best we can* by a wave function *and* an observation."

To see more contradictions, we can go to the "meaning of the wave function" section at Wikipedia.

The Copenhagen Interpretation denies that the wave function is anything more than a theoretical concept, or is at least non-committal about its being a discrete entity or a discernible component of some discrete entity.

But wait, I thought the wave function "completely described" a system. How can a squishy theoretical concept with no discernible physical status completely describe anything? You can see that Bohr wants his quantum mechanics to be both physically indeterminate and theoretically final and complete. No greater contradiction has ever been pushed in the mainstream (except perhaps modern art). You cannot put up a theory that lacks all mechanical, mathematical, and polemical rigor, and then demand that it is unassailable. You might as well claim that a matchstick hut is impregnable to all onslaught.

Principle 4 of the CI at Wiki is the wave-particle duality. But of course that part of the CI is squishy in the extreme. It is more Bohr speechifying posing as physics. In truth it is neither a principle nor an interpretation. It is just a description of data. The *result* of experiment is sometimes explained best by a wave and sometimes best by a particle, but that tells us absolutely nothing about the physics or

mechanics involved. How does the particle create the wave? Or, how does the particle interacting with the experimental setup create the wave? It is not that some possible quantum theory could not tell us anything about Nature or the system: it is that Bohr and Heisenberg's quantum theory do not tell us anything about Nature or the system. They tell us nothing because they attempt nothing.

Then, as a matter of theory protection, they warn off anyone else from attempting anything. A large part of the CI is spent assuring all future physicists that any attempt at a better theory must fail. What sort of real physicists would say that? What sort of real physicists would *believe* that? What good scientific theory of the past ever tried to pre-empt future theory? Why would a scientist try to prevent science? But a large part of Bohr's response to Einstein is in this form. He led with that argument and his summation is that argument: the quantum mechanics of the 1920's is the best we can do and *the best we can ever do*. That is how the CI is considered complete: it is all that can be done.

That is what I meant by refusing to compete. Bohr and Heisenberg were not only refusing to compete with past physicists on a even footing, they were trying to pre-empt competition with future physicists by forbidding future theory. By making physics indeterminate, Bohr and Heisenberg immediately lowered the bar. If physics no longer describes Nature, is no longer causal, is no longer mechanical, and is no longer required to make sense, then most of the rules have been flushed. *Of course* you can "explain" more if you can say whatever you like. If you can contradict yourself every second sentence and still put up a "successful" theory, of course more successful theorizing is going to get done. Anyone with a pair of lips can do it. The same goes for future theory. If you can just close theory by fiat, of course your theory is more likely to stand. You have bypassed competing with the past by changing all the rules and dumbing down the field, and you have bypassed competing with the future by forbidding the future.

Why would anyone ever give that argument a second look? Einstein disagreed with it, but he claimed to respect Bohr's stature nonetheless. Why? Why would anyone respect a scientist or philosopher who argued that way? There is no clearer sign of anti-science than trying to close theory. Einstein never did that. His theory was always open-ended. Despite the fact that Relativity has since been closed by the gatekeepers of physics, Einstein always considered his theory incomplete and unfinished. That is the true sign of a scientist.

The entire argument about the CI, pro and con, is simply proof of my thesis about the 20th century. Ask yourself how so much time could be wasted debating such things. In centuries previous to the 20th, any physicist proposing such asinine theories would have been immediately drummed out of the field as an imposter. But in the 20th century, Bohr flourished. As we have seen, the CI is still ascendent, after almost 90 years! No progress on duality has been made in that time, and we must assume it is either because physicists bowed to Bohr's false authority, or because they really didn't give a damn, either of which is unscientific on the face of it.

Which brings us back to Nietzsche's twilight of the idols. At the same time that the new intellectuals were smashing the old idols, they were setting up new idols in their place. Top physicists became the new gods, and the rank-and-file physicists and science readers were idolators *par excellence*, never questioning the dogma from above. The more superstition and paradox and idolatry it contained, the more they liked it. The less rigor it contained the more they liked it. But whereas the old pre-20th century dogma was at least rich and poetic, the new dogma was bare and prosaic. Whereas the old dogma at least told a good story, the new dogma told no story or a poor story. Whereas the old dogma was a clever and complex myth, giving meaning, the new dogma was a tattered and transparent lie, denying meaning. The small and pinched thinkers of the 20th century replaced large and beautiful idols

with small ugly idols, to no real purpose. If all is but a conversation, as Bohr maintained, why not have a bright and varied conversation, full of meaning and content and bold creativity, rather than a dreary and one-dimensional conversation, empty and warning off future creativity?

This was the knot Bertrand Russell was never able to unwind. As a sometimes Marxist, he seemed to believe in the historical necessity of the new science, if nothing else. He repeated its false mantras, as above, that seeking meaning and truth were the result of fear. He would have been better off reading Keats than Marx, from whom he would have learned that seeking meaning and truth come from a love for Nature, not a fear of her. But Nietzsche explained Russell's reaction long before Russell arrived: it was the reaction of someone damaged by life. Russell had been damaged simultaneously by the fall of science and by the First World War. Nietzsche explained a healthy constitution as one that was naturally drawn to what was good for it and naturally avoided what was bad for it. A damaged constitution could do neither, and Russell was never adept at resisting his own damage. He was too inclusive and broadminded for that. He was also too much an insider, from birth and from early choices, to ever separate himself to the extent necessary from contemporary ideas. To have done so would have jeopardized his fame and influence, as well as his publishing contracts. He could disagree with popular or current ideas to a certain extent, but no further, and this certain extent was not enough to protect him personally from their influence, or to keep them from absorbing into his own psyche.

I have analyzed the Bohr side of the Copenhagen Interpretation, but what of Heisenberg? Recently, it was finally admitted by scholars that Heisenberg was a Nazi, and had been working on a bomb for them during the war. That isn't a fact of quantum physics, admittedly, but it is indication of the man's character. It is also indication of the scruples of 20th century and current physicists, who found it expedient to cover up Heisenberg's allegiances while exposing everyone else it could. Once more we see the results of selective enforcement. If mainstream physics rests on your name, you get a pass. It is also incredible that Bohr covered for Heisenberg, considering Bohr's mother was Jewish. Bohr didn't just stay silent on the subject, which is bad enough; he actively suppressed information. Would the Heisenberg Uncertainty Principle and the Copenhagen Interpretation be as famous or as influential if we knew in 1950 what we know now? I think not. Bohr was protecting his own fame as well as that of Heisenberg.

Even more incredible is that Wikipedia and other mainstream sources are whitewashing Heisenberg to this day. The Wiki page mentions in passing the documents released by the Niels Bohr archive in 2002, but doesn't bother to mention they prove Heisenberg was an active Nazi. Instead, they continue to stick to the old cover-story: that Heisenberg may have been leading the Nazis off the track. This despite the fact that the footnoted documents *prove* that wasn't the case.

Even the talk page behind the Wiki front page looks whitewashed, since no one asks what I am asking: why is Heisenberg being given a pass? Compare his treatment to the treatment Leni Riefenstahl suffered. She was vilified for decades, and never benefitted from a either a whitewash or a rehabilitation. All she did was take some pictures and make a film. She never worked on a bomb.

I encourage you to read the talk page. The rationalizing reaches astonishing levels. There is this, for example:

About him working for the wrong side: you can't blame a person for being a patriot. I don't believe that he

actually agreed with the Nazi agenda. However him being a German could have caused him to work for his country's side in the war, even if he didn't have any particular love for it's ruling milieu. I don't think he should be condemned for that.

It is that sort of "argument" that has caused much pertinent and factual information, now documented, to be scrubbed from the Heisenberg page. If you think Wikipedia is not an arm of propaganda, think again. From the talk page you can see that the page editors are just deleting anything they don't like, whether it is documented or not. That is business as usual at Wikipedia. When they are asked about now documented facts, they slide sideways by claiming that no one knows. So let me quote the first sentence from the 2002 New Scientist article I linked above.

DOCUMENTS just released show unequivocally that the renowned German physicist Werner Heisenberg was building an atomic bomb for his country during the Second World War.

Doesn't sound too ambiguous to me, so why is Wikipedia deleting that information? *New Scientist* is one of the mainstream's own mouthpieces, so how can Wikipedia be deleting sentences taken straight from it? If you don't believe me, go to Wikipedia and add that bolded sentence to the page on Heisenberg, footnoted to *New Scientist*. See how long it stays up.

Just to be clear, I am not attacking Heisenberg from the standpoint of some patriotic yankee. After the last decade, patriotism is not running high in the US, and I was never much for patriotism to start with. I just find it curious that Americans seem to have such an interest in Nazi hunting in general, but no interest in hearing the truth about Heisenberg. I find it curious that Oppenheimer and Teller have taken more heat for building bombs than Heisenberg, and they were not working for the Nazis. I am not a fan of Oppenheimer or Teller, and I think bombing Japan was the worst thing we ever did. But I also think the truth about Heisenberg is important, should be told, and should not be whitewashed.

But putting the Nazi connection aside, the Bohr/Heisenberg theories never merited the press they have gotten. I dismissed them as non-physical long ago, before I ever knew of Heisenberg's Nazi affiliations. And Heisenberg may have been even worse for 20th century physics than Bohr, since he was so instrumental in importing the math that would blinker it for many decades (up to now). Schrodinger's equations were already bad enough, since even they were completely unmechanical. But Heisenberg's matrix mechanics was ten times worse, since it hid the mechanics ten times deeper than Schrodinger's equations. We also see some strange goings-on in the whole history of matrix mechanics, since Heisenberg got a Nobel Prize for it despite not knowing anything about matrices. Even Wiki admits that. How does a man who doesn't know how to do matrix math invent matrix mechanics and then win a Nobel Prize for it? We are told that Born and/or Jordan added the matrix math before publication, but that of course means Heisenberg is most famous for something he didn't do. Matrix mechanics isn't famous for its mechanics or theory. It has no mechanics and almost no theory. Matrix mechanics is famous for the matrix math, and it looks like Heisenberg didn't do the math.

It doesn't matter to me, since it just shifts my blame for the whole mess to Born and Jordan, but it certainly affects the load of propaganda we have been sold. If "one of the most famous physicists of the 20th century" was a whitewashed Nazi who didn't even do what we are told he did, then this should be of some concern in the schools. Imagine if we found out that Newton was a closet Satanist who sharpened knives for babykillers and didn't actually write *The Principia*. He only thought up the title and hired someone else to do the math. I suppose the editors at Wikipedia wouldn't care: they would brush it off as matter of loyalty: "You can't blame Newton for being loyal to his master."

You may find my view of matrix mechanics astonishing, since we are now expected to bow before everything famous, but my view is no different than the view of Max Planck. Although Heisenberg wrote an article in 1954 praising Planck for his work in quantum physics, Planck did not return the praise. Planck called matrix mechanics "disgusting." He suspected it of being composed of major fudges, and knew for a fact that it was hiding mechanics on purpose. My view is that matrix mechanics was created mainly to hide quantum theory from the criticisms of Einstein, who was a poor mathematician. Einstein hated more than anything being required to jump into long pages of dense new math; and you know what, he never did. He never got around to tearing matrix mechanics down from the ground up. This suspicion is given more weight if Born was behind the math. If you read the Born-Einstein Letters, you will see that Born always considered Einstein a great danger to the future of quantum mechanics. He was the one man that could have brought it down. He very nearly did anyway, with his EPR paper, but in my view he would have been better off attacking the math than the theory. Matrix mechanics was always theory-light and math-heavy. Those who loved matrix mechanics cared little for theory. They were mathematicians, and you hit mathematicians in their math.

Einstein left matrix math alone for another reason. Although Einstein attacked quantum *theory* in 1936, he probably left the math alone because he is the one who nominated Heisenberg, Born, and Jordan for the Nobel Prize in 1928. It would have looked foolish to nominate physicists for a prize based mainly on math, and then to turn around and destroy that math eight years later. It seems to me that by 1936, Einstein was more interested in convincing Bohr and Born to reconsider some of the larger theoretical issues. He wasn't interested in critiquing the math or in going for blood. Again, I think this was a mistake, since they had no compunction about going for his. Feeling threatened by the EPR paper and then by Schrodinger's cat, the central characters of quantum theory circled the wagons and turned up the volume on the propaganda machine. In chorus, they told the magazines that Bohr had won the Einstein/Bohr debate, even though he hadn't. It didn't matter: the power of the press determined the matter, and has determined it ever since. It was a matter of numbers, and Einstein and Schrodinger and Planck were outnumbered.

Planck wasn't the only one who found the new math and theory disgusting. Leon Rosenfeld—who worked with Bohr and coined the term "lepton"—had a very low opinion of the low levels of philosophy invading physics. He said, "The idealism of Heisenberg arises from sociology, not theory of knowledge," and called the new physics "a shibboleth of a class." It turns out that Rosenfeld, like Planck, was right. Heisenberg and the other top physicists of the time weren't bringing interdeterminacy and other ideas into physics based on observation or data. They were bringing them in for social and psychological reasons. Like Feynman after them, they enjoyed being revolutionaries. Even worse, it is now clear that interdeterminacy was used as a marketing tool, as I said above. It was a new idea, in vogue, and as such was a guarantee of attention. The physicists learned this from the artists.

And even worse, it was a tool to purposely remove the rules from physics. In all the arguments of determinacy versus indeterminacy, almost no one has pointed out the operational nut of the whole question: an indeterminate physics is *automatically* less rigorous. It has fewer rules, and all the remaining rules take on a fuzziness. How this new physics might benefit the new physicist is obvious.

We have seen how this has played out over the past nine decades: physics has continued to get fuzzier and fuzzier, jettisoning more rules every year. Almost everything in physics is now virtual or spontaneous or is in some state of violation. Indeterminacy has led to an equally enshrined *inconsistency*, and physicists now feel free to boldly post contradictions, without having to even nod to

the contradictions, much less resolve them. Instead, they now seek out contradictions, since these can be dressed as paradoxes. Nothing sells like a paradox, as we saw with the Bohr footnote below.**

Just as art in the 20th century was no longer about art, physics was no longer primarily about physics. It was about getting noticed. It was about getting prizes and promotions. It was about getting written up in the papers for making shocking statements. Determinacy was old science, and it didn't generate the feelings of euphoria that indeterminacy did. The physicists after the First War couldn't be expected to be invited to party with Picasso and the Ballet Russes, but they could join in the new spirit by thumbing their noses at the old world in their own ways. Although Heisenberg was a Nazi, he was a peculiar sort of Nazi in that he had an innate aversion to clarity and logic. And like Bohr, he also had an innate aversion to diagrams and pictures. The Nazis are famous for their love of art, but Heisenberg had no such love. He was apparently somewhat of a musician, but he was not visual in the least. Visualizations physically revolted him, and he never shared Einstein's predilection for thought problems, especially ones that included pictures or visualizations. He stated early on that he wished to clear physics of all such "hook and eye" illustrations.

Both he and Bohr had what can only be called an irrational aversion to visualizations. I say irrational because, after all, physics *is* physical. An innate aversion to the visual could almost be called an innate aversion to the physical. They both insisted that the quantum realm should not be visualized, that it should be probed with mathematics only. But that was clearly a prejudice. Neither man ever gave a good reason why the quantum realm should not be visualized, or why it could not yield to diagrams. As I have said before, I suspect it is simply because they couldn't draw well or visualize well themselves. They were covering their own disabilities. If you can't do it, outlaw it.

They redefined physics as that which they could do. In this, they were like the artists of the 1920's and 30's, who were doing precisely the same thing. Most of these artists were terrible draftsmen, couldn't visualize, and had very little creativity, but they were ambitious and wanted to be artists anyway. So they didn't let any of the old rules stop them. They simply redefined art as as that thing that they *could* do. They could talk theory and politics, they could find things, they could glue and weld things together, they could spout nonsense for hours on end. So that is what art became. In the same way, physics in the 20th century became what the most ambitious physicists could do. They could fudge big equations, they could hide behind pronouncements and interpretations, they could browbeat weaker colleagues, they could spout nonsense for hours on end. So that is what physics became.

*_Conquest of Happiness_, p. 104.
†_The Antichrist_, 49.
‡_Thus Spake Zarathustra_, the tarantulas.
**One of his famous quotes is, "How wonderful that we have met this paradox, now we have some hope of making progress." The paradox was always a great sales tool for the new intellectuals.