Against Physics

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Summary—Against Physics recounts the two major physical theories developed during the Twentieth century in context of Ockham's principle of economy and Dirac's principle of aesthetic value.

Quotation—It is more important to have beautiful theories and equations than to have them fit the data.
—Paul Dirac

In 2001 I presented a discussion on spatial-temporal or time-series riskmodeling at Cornell University in Ithaca, New York for the Palisade.com Corporation who offers a suite of decisionmaking tools for Microsoft Office. While traditional risk metrics like value-at-risk model risk over a single time-period (eg. one day), spatial-temporal riskmodeling represents uncertainty over multiple time-periods across multiple domains. My approach is to split time-series into signal-wave-noise through the application of mathematical algorithms. Then by understanding the exposure to uncertainty, one is able to deconstruct historical time-series data, and then reconstruct going forward through exposure as to producing forecasts. Spatial-temporal riskmodeling turns uncertainty into opportunity and is destined to be the favorite toy in the CFO's toybox.

Time to a Pig. I awoke early Sunday morning and caught a plane from Calgary to Toronto. From there I rented a car and drove through Buffalo, then east along the interstate highway, and finally south alongside Lake Cayuga towards Ithaca. While exploring some of the spectacular wine country around the lake, I came across a farmer standing under an apple tree with some pigs. I watched the farmer while he held a pig above his head as the pig ate an apple from the tree. He put the pig down and picked up another pig, only to perform the same mesmerizing act once again. I approached the farmer and asked him whether he might be better off taking some of the apples from the tree and putting them on the ground for the pigs to eat there—suggesting that this could save time—for which he responded—What's time to a pig?

Ockham's Razor. The English monk William of Ockham (1285-1349) was one of the greatest thinkers of all time. He was known for his keen sense of logic and his enduring theological ideologies. Going entirely against the philosophy of his time, Ockham put forth his now famous principle of economy—which states that the plurality of reasons should not be postulated without necessity. Or in other words, if all things are equal, the simplest theory tends to be the right one. Ockham employed his principle so frequently and with such purpose that it became known as Ockham's razor. He claimed it is vain to do with more what can be done with less. Even today, Ockham's razor still is the foundation of all truly authentic scientific reasoning.

Against Complexity. In keeping with the principle of economy, the young physicist Albert Einstein (1879-1955) was said to have so totally despised complexity that he refused to buy shaving soap when regular washing soap was sufficient. At the time, Einstein and others were working towards resolving the conflict between the newly-realized invariance of lightspeed and absolute Newtonian space. Einstein unraveled the conundrum in 1905 with his special theory of relativity by combining the separate notions of space and time into absolute spacetime. Specifically, special relativity takes distance in the direction of motion that is orthogonally joined with distance divided by time (or velocity) relative to lightspeed—where lightspeed is the upper speed limit inside the universe. Einstein invoked Ockham's razor again in 1915 with general relativity—based on the revelation that gravity and inertia are the same thing.

Rotating the Hour-Hand from 12 to 3. In characterizing relativity, consider for a moment an astronaut named Elvis traveling through space. Consider a two-dimensional orthogonal continuum with distance on the vertical axis and distance divided by time relative to lightspeed on the horizontal axis. As Elvis accelerates towards lightspeed (186,284 miles per second) his spacevelocity-axes rotates clockwise so that the vertical-axis moves towards the original horizontal-axis. If Elvis were traveling at eighty-seven percent of lightspeed he would shrink to be half his original height, while time for Elvis would elapse at half of its original rate. If Elvis were to somehow achieve lightspeed, his spacevelocity-axes would rotate a full ninety degrees from its original position and he disappears from the spacetime continuum altogether. In other words, upon reaching lightspeed, we could say that Elvis has left the universe.

Spacetime to a Photon. It would of course be impossible for Elvis to actually achieve lightspeed, given that such an endeavor would require all of his mass be converted into energy in accordance with Einstein's famous E = mc^2 equation. However, it is interesting to note that, by definition, particles of light or photons travel at lightspeed—thus implying that photons must exist at the outside boundary of the spacetime continuum. As such, one could imagine a universe populated by a fantastic number of photons existing away from the singularity and holding position at the boundary of the universe. As Lincoln Barnett wrote in: The Universe and Dr Einstein (1948): "The laws governing these contractions are defined by the Lorentz transformation and they are very simple—the greater the speed, the greater the contraction. A yardstick moving with 87 percent the velocity of light would shrink to about half its length; thereafter the rate of contraction becomes more rapid; and if the stick could attain the velocity of light, it would shrink away to nothing at all. Similarly, a clock traveling with the velocity of light would stop completely." And if one were to choose this moment to invoke Ockham's razor, the obvious question would be—Economically speaking, why would the universe need more than one photon if photons exist outside of space and time? The answer to such a question would certainly be that there does not need to be more than one photon—from which we must therefore conclude that there is but one photon.

Authenticity. The British physicist Paul Dirac (1902-1984) was just twenty-six years old when he formulated the relativistic wave equation that led to the discovery of antimatter in the form of the antielectron or positron. Dirac discovered the key when he realized that E = –mc^2 is valid as well. Interestingly, Einstein was also twenty-six when he put forth special relativity and, like Dirac, worked alone for his entire career. The aesthetically-deduced relativistic wave equation became a cornerstone of quantum theory in that it integrated Einstein's relativity into Schrödinger's wave equation, thus accounting for the behavior of electrons and positrons traveling near lightspeed. In putting his own enlightened spin on Ockham's razor, Dirac claimed it is more important to have beautiful theories and equations than to have them fit the data. While lesser philosophical disciplines like empiricism and positivism have attempted to deploy Ockham's razor as the basis for systems aimed at producing totally objective reasoning—Dirac found the missing link, in subjectivity, that enabled scientific reasoning to make the next quantum leap forward. And to be sure, genuine art is always economical, yet its true value is arrived at subjectively. John Wheeler subjectively asserted that positrons are electrons moving backwards in time.

Through the Looking Glass. Dirac shared the Nobel Prize with Erwin Schrödinger (1887–1961) best known for studying the wave mechanics of orbiting electrons and positrons in formulating quantum theory. In attempting to explain the paradoxical nature of quantum mechanics, Schrödinger put forth the classic cat-in-a-box thought problem as follows—A quantum-cat also named Elvis is placed in a box. The box is such that no one can know what is happening inside. A device triggers the release of either food or poison with equal probability, and Elvis meets his fate—or does he? In the strange world of quantum mechanics, subatomic particles exist in several places at once and only become determinate upon observation. Schrödinger argued that Elvis is both alive and dead until the moment the box is opened. Inside the box, unobserved, his state of existence can only be described by a probability wave. Remarkably, quantum theory claims universal indeterminacy beyond the boundary of Planck's constant. In fact, Planck's constant is a threshold of the universe in the same way that lightspeed is a threshold. While in the unobserved state, Elvis rotates out of the spacetime continuum into a metaphysical realm where determinism is replaced by indeterminism—and where we could once again say that Elvis has left the universe. Upon opening the box, the observer's consciousness becomes present and Elvis snaps back into the spacetime continuum whereupon his fate is summarily determined.

Rotating Our Minds. In his 1992 book Dreams of a Final Theory the Nobel Prize winning physicist Steven Weinberg includes a chapter entitled Against Philosophy in which he claims that, historically speaking, philosophy has contributed little to our understanding of physical phenomena. According to Weinberg—Most physicists carry around a working philosophy, a rough-and-ready realism, a belief in the objective reality of the ingredients of our scientific theories. But this has been learned through the experience of scientific research, and rarely from the teachings of philosophers.

Conclusion. One is presently reminded of the ancient story of the three monks that one day happen across a flag blowing in the wind. The first monk claimed the wind was moving (Geocentricity). The second monk claimed the flag was moving (Heliocentricity). The third monk then trumped the first two by claiming that it is only our minds that are moving (Psychocentricity). And strictly as a matter of interest, one wonders what the third monk would have to say about the lone photon moving across the sky at lightspeed? The simplest and most aesthetically appealing theory would of course be that God and Light are the same thing. As the deeply religious Einstein once remarked—I fully expect to spend the remainder of my life pondering the nature of light.