Revolutions in Human Self-Perceptions by *Dave Pruett* (10/27/13)

[TITLE] I like to speak to you today about revolutions in human self-perceptions, a notion that forms the central thread, but by no means the complete essence, of *Reason & Wonder*. Let's start with a quotation from Freud [FREUD]:

[Darwinism] was the second--the biological--blow to human narcissism.

—Sigmund Freud

In 10 words, Freud encapsulated five *centuries* of Western intellectual history. His terse summary refers obliquely to the sixteenth century's Copernican revolution, credits Darwin for a second "Copernican" revolution, and sets the stage for Freud's claim to a third.

[DE REV] Originating in science, Copernican revolutions profoundly alter human self-perceptions. Copernicus' masterpiece of 1543, *On the Revolutions of the Heavenly Spheres*, launched a revolution in cosmology that dislodged humans from the center of the cosmos and exploded the size of the known universe. [DARWIN] While the Copernican revolution was mid-stride, Darwin's *Origin of Species* rocked Victorian England by challenging "special creation" and the exalted status of the human.

The back-to-back punches thrown by Copernicus and Darwin disfigured the human face in the mirror of self-perception. The message from science runs counter that of religion, which proclaims our divine origins and special status. It is like having two parents, one who underscores our uniqueness and the other our commonness. Whom should we believe?

[BERRY] Confronted with a "tragic choice between an antiscientific philosophy and an alienating science," humans, particularly in the West, have lost their way. As a result, humanity faces unprecedented crises on multiple fronts: ecological, economic, political, and spiritual. "We are in trouble just now because we do not have a good story," observed the late eco-theologian Thomas Berry. "We are between stories."

Today I'd like to tell three stories, tales of successive "Copernican" revolutions. Following the first, science and religion separated. Following the second they divorced, contributing to our current peril. The third has only just begun, and how it plays out could determine our future. The choices are enlightenment or catastrophe.

[12] INTRO + STORY ONE:

[CR1] The First Blow to Human Narcissism: Copernicus & Cosmology

[COPERNICUS] Nicolas Copernicus was born in Torun, Poland in 1473. Following a world-class education that included mathematics, astronomy, medicine, and law, he returned home to become canon of Fraunberg Cathedral [FRAUENBERG]. High in a tower where he lived, he built an observatory and many a night studied the heavens.

Copernicus inherited the cozy cosmos of the 1st-Century astronomer Ptolemy. Ptolemy's universe consisted of the sun, moon, 6 known planets, and about 6000 stars visible to the naked eye. [PTOLEMY] Because we don't directly experience the earth's motion, Ptolemy assumed the earth to be fixed at the center of the cosmos. Successive spherical shells,

nested like Russian dolls, rotated on axes to carry the sun and planets about the earth. A final sphere, the celestial sphere, ferried the stars on their diurnal journey across the sky.

Christianity came of age under the spell of Aristotle and Ptolemy, and the Church assimilated much of their thinking into its dogma. The Ptolemaic model suited the Church, with God residing in the Empyrean Realm, just beyond the celestial sphere, and man, his highest creation, tucked neatly at the center of the cosmos.

[DE REV2] Copernicus admired Ptolemy and set out to mimic, correct, and update Ptolemy's great work, the *Almagest*. Soon, however, he came to a disquieting realization: Ptolemy could not be fixed; he must be overthrown. Observed phenomena make far more sense from a heliocentric perspective. We occupy a *solar* system.

Copernicus beheld a copy of his *opus magnum* while on his deathbed and died the very same day. His death spared him. By 1600, Copernicanism was de facto heresy, enough to consign the Dominican friar Giordano Bruno to the stake. [GALILEO] It took the combined gravitas of Galileo and Johannes Kepler to reset the center of gravity of the cosmos. Both suffered for their efforts. Galileo faced the Inquisition and [KEPLER] Kepler--the "Protestant Galileo"--fared little better under Lutheranism.

[GOETHE] **"**Of all discoveries and opinions,**"** Goethe observed, **"**none may have exerted a greater effect on the human spirit than the doctrine of Copernicus.**"** Why? [EINSTEIN] Einstein appreciated that Copernicanism "… was … the severest shock [our] interpretation of the cosmos ever received [because] it reduced the world to a mere province … instead of it being the capitol and center."

[MILKYWAY] The Copernican paradigm shift exploded the size of the known universe. When Galileo turned the telescope skyward, he saw stars numbering more than 100-fold what the unaided eye could perceive. The heavens had depth too. The stars were not neatly confined to a nearby celestial sphere but sprinkled about like shells on an endless shore.

[NEWTON] Aftershocks of Copernicanism continue to ripple through the centuries. In 1642, the year in which Galileo died, Isaac Newton was born. Standing upon the shoulders of Copernicus, Galileo, and Kepler, Newton was able to provide *explanations* of physical phenomena where his predecessors had offered mere *descriptions*. [APOLLO] Newton was midwife to the Age of Reason and to the notion of a mechanistic, "clockwork" universe that culminated in human footsteps on the moon.

[CARINA NEBULA] In the 1920s, Edwin Hubble resolved a conflict that had raged for two centuries: Were nebulae gaseous clouds within the Milky Way or distant galaxies? Immanuel Kant--the titan of philosophy and an amateur astronomer—had speculated as early as 1750 that nebulae are "island universes" like our Milky Way. [ISLANDS_FEW] Hubble's stunning photographs from Mt. Wilson's 100-inch telescope, revealed the Andromeda Nebula to be a galaxy like our own, vindicating Kant. Moreover, such universes are as numerous as the stars of the Milky Way. Most astonishingly, the galaxies rush away from one another like raisins in a loaf of rising bread.

[ISLANDS_MANY] Hubble's observation corroborated an implication of general relativity that even Einstein did not at first believe. The universe must either expand or contract. It cannot remain static. By playing the motion picture of an expanding universe in reverse, the Belgian

scientist-priest Georges Lemaitre envisioned a moment of creation, now called the Big Bang.

[WMAP] In 1965, Bell Lab physicists Arno Penzias and Robert Wilson accidentally eavesdropped on faint whispers of that Bang, still audible as a wispy blanket of microwave radiation throughout the heavens, earning them a Nobel Prize in physics.

[NIETZSCHE] "What were we doing when we unchained this earth from her sun?" lamented Nietzsche. Copernicanism upended so much. The universe is neither perfected nor static as Aristotle taught. It is dynamic, sometimes violent. Neither is it cozy. An estimated 100 billion galaxies each harbor hundreds of billions of stars. And we earthlings do not reside at the center of the solar system, the galaxy, or the cosmos.

[12] STORY TWO:

[CRII] The Second Blow to Human Narcissism: Darwin & Biology

The Second "Copernican" Revolution began like the first, with the publication of a scientific work. [DARWIN] All 1250 advance copies of Darwin's *Origin of Species* sold out on its publication day in 1859. Since then, *Origin* has never been out of print--or out of controversy.

We associate Darwin with biology, but science historian Timothy Ferris calls *Origin* a "time bomb," for it explodes the confines of time as wildly as Copernicus exploded the confines of space.

Like Copernicus, Darwin was a reluctant revolutionary. [YOUNG CHARLES] When he embarked on a round-the-world scientific voyage of the *H.M.S. Beagle*, Darwin, just 22, was conventionally Christian. A young-earth creationist, he accepted, as did most of his day, a biblical chronology that dated the earth at a mere 6000 years. [HENSLOW] Among the books in his possession were Milton's *Paradise Lost* and Charles Lyell's *Principles of Geology*, the latter a bon-voyage gift from his botany professor, John Stevens Henslow. Devoutly Christian, Henslow cautioned Darwin to ignore the blasphemous parts of Lyell, who espoused *uniformitarianism*, the view that the earth has been shaped primarily by the gradual accretion of small changes over countless eons.

[VOBMAP] Traipsing all over South America at the *Beagle*'s ports of call, Darwin honed formidable skills as a geologist. Soon he began to entertain Lyell's blasphemy: [LYELL] **"**The age of the earth must be reckoned not in thousands but in millions of years.**"** First-hand experience of an earthquake near Concepcion, Chile, may have been the tipping point. Following a tidal wave that leveled 70 villages, beds of putrid mussels were found clinging to rocks fully ten feet above high-water mark. [DEEPTIME] Near Valparaiso Darwin observed similar shells 1,300 feet above sea level. Darwin correctly extrapolated: **"**[I]t is hardly possible to doubt that this great elevation has been effected by successive small uprisings, such as that which … caused the earthquake of this year.**"**

[GALAPAGOS] It was a relatively small step from geological to biological dynamism. In the strata of Patagonia, in the Galapagos and Cocos islands, and in the coral reefs of the Dangerous Archipelago, Darwin found incontrovertible evidence of biological adaptation. Nowhere was that adaptation subtler than in the Galapagos Archipelago, where Darwin observed 26 types of finch, most existing nowhere else. [FINCHES] Astoundingly, each

finch's beak seemed finely tuned to crack the seed of the pre-dominant source of food. Darwin pondered: "[O]ne might really fancy that from an original paucity of birds in this archipelago, one species had been taken and modified for different ends." A short time later he confided to his journal a heresy all his own: [HERESY] **"**[T]he zoology of Archipelagoes will be well worth examining; for such facts would undermine the stability of species [emphasis added]."

The notions that Darwin acquired aboard the Beagle--the antiquity of the earth, the malleability of species, and the continuity of creation—haunted him upon his return to England in 1836. [VOYAGE] After publishing his journals as the *Voyage of the Beagle*--an instant success--and settling down to family life with his first cousin Emma Wedgwood [DOWNE], Darwin set to the task of fleshing out his theories. By 1844, his "draft" had grown to 240 pages, but he had told virtually no one. Needing a father confessor, he wrote Joseph Hooker, curator of the Royal Botanic Gardens at Kew. [MURDER] In the letter he confided: **"**I am almost convinced (quite contrary to opinion I started with) that species are not (it is like confessing a murder) immutable."

[APE] "I shall soon be viewed as the most despicable of men . . . the most arrogant, odious beast that ever lived" Darwin wrote to a friend prior to the publication of *Origin*'s sequel—*The Descent of Man*. Sure enough, his contention that humans and apes share common ancestry horrified Victorian sensibilities.

[HGP] Darwin remained ignorant of the genetic mechanism for evolution's prime ingredient: variation. It's astounding then how much he got right. The theory of evolution is corroborated by evidence he could not have dreamed of, from fields as diverse as genomics and plate

tectonics, to mention just two. Consider genomics. Human beings and mice--our more distant mammalian ancestors--share 85 percent of the same DNA. It's not a guess. Both genomes have been sequenced. Humans and apes share 98 percent.

[EMMA] Darwin was, in the words of his beloved Emma, "The most transparent man I ever met." He had no stomach for controversy, and the anxiety of going public with explosive ideas tormented him. For 20 years Darwin procrastinated, until Alfred Russel Wallace nearly scooped him in 1858. Eighteen feverish months later *Origin* appeared. Every bit as controversial as Darwin feared, *Origin* broke a tacit agreement, provoking the divorce between science and religion.

Until Darwin, science and religion had worked in tandem. What motivated the genius of Galileo, Kepler, and Newton? To know the mind of God. The Book of Nature each believed stood on a par with the Scriptures. Each revealed facets of the Creator.

[CAMBRIDGE] So too with Darwin, initially. As a university student at Cambridge, Darwin attended Christ College, the home of John Milton and the Reverend William Paley. The latter's books—*Evidences of Christianity* and *Natural Theology*, in which faith and science coexist harmoniously—had great effect on Darwin. He found inspiration in their logic, and reading them gave him "as much delight as did Euclid."

But the more deeply Darwin examined Nature, the less plausible Paley's design argument seemed. Particularly devastating to design arguments was the wholesale extinction of species. "Certainly, no fact in the long history of the world," he wrote, "is so startling as the wide and repeated exterminations of its inhabitants." [TOXODON] Among the millions to

have perished from this earth was the Toxodon, a giant ungulate whose skull Darwin collected in Argentina. Having held this very skull in her bare hands, one of my students wrote in *her* journal: "It is hard to deny evolution when it is staring you in the face." It is also hard to deny the gut punch of Darwinism—that our existence seems more the work of random forces than inspired design.

[HUMBLE] At the hands of Copernicus and Darwin, we've been humbled. As Darwin wrote in his notebook, **"**Man in his arrogance thinks himself a great work, worthy the interposition of a deity. More humble and I believe truer to consider him created from animals.**"**

[COSMOGENESIS] As we pick ourselves up from this fall from grace, there is work to do. "Creation is not an act but a process; it did not happen five or six thousand years ago but is going on before our eyes. Man is not compelled to be a mere spectator; he may become an assistant, a collaborator, a partner in the process of creation."--Russian geneticist Theodore Dobzhansky. For this process of *continual* creation, the great paleontologist-priest Teilhard de Chardin coined a fitting term: *cosmogenesis*.

[16] STORY THREE:

[CRIII] The Third Copernican Revolution: Psyche/Spirituality [COMMENT]

[ERIN] "What is consciousness if you cannot poke it with your finger?"

During a moment of classroom epiphany in 2004, Erin, an honors student at James Madison University, put her finger on science's most perplexing question, why it's perplexing, and why science was loath to take the bait.

For all their sophistication, scientists are not unlike the child who stumbles upon a toad in her path and yields to the temptation to poke the creature, to learn something about it in the process. In particular, experimental physics is a formalized way of poking things and observing how they respond. In the abstract, an experiment requires just three ingredients: an energy source, an object to be studied, and a detector. One directs a stream of energy at the object, some energy returns to the detector, and something is learned about the object from the pattern of transmitted or reflected energy.

[RUTHERFORD] Indeed, Ernest Rutherford's iconic atom-probing studies of 1911 were vintage "poke-and-watch" experiments. As the energy source, Rutherford used newly discovered "alpha" particles, a type of natural radioactivity. The target was gold foil. What Rutherford observed was completely unexpected. When hurled at metallic foil--presumed to be "solid"--most alpha particles passed through unimpeded. Rarely, an alpha bounced back. An astonished Rutherford mused, "It was as incredible as if you fired a 15-inch shell at a piece of tissue paper and it came back and hit you!" Rutherford concluded that atoms, the building blocks of matter, are mostly empty space, more than 99.9 percent void it turns out.

[EDDINGTON] Summarizing the revelations of 20th-century physics, British astronomer Arthur Eddington marveled: **"**The frank realization that physical science is concerned with a world of shadows is one of the most significant of recent advances." The more deeply one probes the nature of matter, the more gossamer it becomes.

The material world of Rutherford's study had remained the principal domain of science since philosophy and natural philosophy split. In *Discourse on Method*, the French philosopher-

scientist René Descartes (1596–1650) partitioned the cosmos, creating two distinct magisteria: the *res extensa* (extended thing; i.e., matter) and the *res cogitans* (thinking thing; i.e., mind). Rendered asunder, philosophy diverged. Natural philosophy—modern-day science—claimed matter as its domain. By tacit agreement, mind—the domain of philosophy and religion--was off limits. And so it remained until the 20th century, when science was lured into no-man's land by the Trojan horse of physics: quantum mechanics.

[EINSTEIN] The quantum (or subatomic) world is so bizarre that each of quantum's pioneers felt he had created a Frankenstein. In disgust at the probabilistic behavior of electrons jumping "of their own free will" from one orbital to another, Einstein—ever the strict determinist—grumbled, "I would rather be a cobbler, or even an employee in a gaming house, than a physicist."

To enter the quantum world, one falls through the looking glass. Not only does matter begin to look like Swiss cheese, mostly holes, there its troubling split personality. So-called "double-slit" experiments with electrons reveal those electrons to manifest sometimes as particles, which are localized in space, and sometimes as waves, which are distributed. But never as both. What then is an electron when it behaves as a wave? Physicists posit that such waves express *probabilities*: an object's *tendency to exist* when observed, not its reality.

[HEISENBERG] Dominating the landscape of quantum mechanics is Heisenberg's uncertainty principle, which quantifies that one can never know precisely both position and velocity of a quantum object, an electron or photon, for example. You can know where it is, but not where it's going. Or you can know where it's going, but not where it is. Why?

Because whatever the experimentalist does to determine the one destroys the determination of the other. On this virtually all physicists agree: the uncertainty principle collapses the Cartesian partition. Articulated Heisenberg, "The very act of observing alters the object being observed." [PAULI] Subject and object merge. Mind and matter are not disjoint as Descartes presumed. To be complete, physics must therefore embrace psyche. "It would be most satisfactory of all," envisioned Nobel laureate Wolfgang Pauli, "if physics and psyche could be seen as *complementary aspects* [emphasis added] of the same reality."

[LORENZ] On the shoal of uncertainty, determinism also founders. In the delightfully pithy insight of Edward Lorenz, a pioneer of chaos theory: "The present predicts the future, but the *approximate* present does not predict the *approximate* future [emphases added]." To accurately predict the unfolding of events in our dynamic universe—in which the flapping of a butterfly's wing in Brazil literally affects Peoria's weather days later—we must know precisely both the position and velocity of every molecule of air and butterfly. Heisenberg's uncertainly principle forbids just that. When mind impinges on matter, matter responds. A universe in which psyche and matter interact is *contingent*, not deterministic.

[MINKOWSKI] Einstein's theory of relativity also hides a subtle contingency. Special relativity reveals that space and time--perceived by humans to be independent--are blended. In the words of Einstein's math professor Hermann Minkowski, **"**Henceforth space by itself and time by itself are doomed to fade … into mere shadows, and only a kind of union of the two will preserve an independent reality.**"**

This union we call spacetime. General relativity reveals that spacetime is not at all what Newton and Kant supposed: the Euclidean backdrop to events. Spacetime is participatory.

[WEB] The stage and the players interact just as the spider and its web are partners. The spider's motions jostle and distort the web, even as the web's fabric makes possible the spider's locomotion. General relativity constructs a web-like cosmos. Space, time, and all events that occur in spacetime are integrally interconnected. Elementary particles, planets, and stars all perturb the spacetime fabric, sending ripples throughout the cosmic pond. Who knows what ripples you and I will generate when we leave this room.

[SPOOKY] Einstein never gave up searching for the Achilles heel of quantum theory, and in a fiendishly clever thought experiment of 1935 he thought he'd succeeded by exposing "spooky action at a distance" within the quantum world. The modern term for spooky action is *quantum entanglement*, which refers to the mysterious and instantaneous interconnection between pairs of widely separated quantum objects. Entanglement—now well-established science--suggests that spatial separation may also be an illusion of human perception.

[SHERRINGTON] In 1932, the year in which Heisenberg won the Nobel Prize for physics, the Nobel for medicine went to neurologists Charles Sherrington and Edgar Adrian. Sherrington observed two contrary winds blowing about the cosmos: **"**The universe of energy is, we are told, running down. It tends fatally towards an equilibrium [that] shall be final. An equilibrium in which life cannot exist. Yet life is evolved without pause. Our planet in its surround has evolved it and is evolving it. And with it evolves **mind**."

In the scientific paradigm, matter came first, matter begets life, and life begets mind. Kant turned the paradigm on its ear. His brush with astronomy had quickened him to the problem of perception. [DING_AN_SICH] Kant concluded that *Das Ding An Sich* (ultimate reality,

literally "the thing in itself"), lies beyond the grasp of perception because our senses and mental structures filter and distort what is sensed. In particular, 3D space and time seem to be imposed upon external reality as limitations of the human mind. He went so far as to propose a paradigm reversal every bit as revolutionary as that of Copernicus: [KANT] "It is the representation that makes the object possible rather than the object that makes the representation possible."

This chicken-or-egg question—which came first, mind or matter—lies at the root of much human dysfunction. "A pox on both houses" offers up my poet friend Charlie Finn.

[TEILHARD] The cosmology of Copernicus, Galileo, and Kepler; the physics of Newton and Einstein; the biology of Darwin and the genome; the quantum of Heisenberg and Bohr; and the thermodynamics of Boltzmann and Gibbs: all point toward a revolutionary view of the cosmos that might best be termed the Teilhardian synthesis: The universe is dynamic, it is contingent, it is participatory, and, Teilhard believed, it is conscious at all levels. In his words: "There is neither spirit nor matter in the world. The stuff of the universe is spirit-matter; no other substance but this could have produced the human molecule." [WISDOM] In a collective paraphrase of Teilhard, Barbara Marx Hubbard, and Pir Vilayat Inayat Kahn: "We co-participate in the evolution of the cosmos through the unfolding of our own consciousness."

To return to Erin's question: What then *is* consciousness, and how does it arise in a material universe? We don't know what it is, but most likely it's been here all along, and it is shared. [JAMES] **"**The truth of *things* is after all their *living* fullness," wrote he great 19th-century American philosopher Wm. James, "and some day, from a more commanding point of view

than was possible to anyone in [a previous] generation, our descendants, enriched with the spoils of all analytic investigations, will get round to that higher and simpler way of looking at nature."

James envisaged that analytical science will one day grasp what aboriginals, poets, and mystics have always known. That knowledge—so vital in our present time of confusion--is summed up in three words in the Upanishads: *That art Thou* [UPANISHADS]. There is no separation between self and other. Separation is *maya*: illusion. All creation is one.