

Talking of Entanglement (3/26/16)

Origins, Language, Synchronicity, Scale, Occam's Razor and Schrodinger's Cat

LANGUAGE IS A VIRUS—Laurie Anderson

ASSERTING THAT SCHRODINGER'S CAT IS TRULY BOTH ALIVE AND DEAD (AS A QUANTUM VIEW BASED UPON STANDARD FREQUENTIST/ WAVE FUNCTION-BASED PROBABILITIES WOULD DO--ED)...IS AN ABSURDITY, A MEGALOMANIAC'S DELUSION THAT ONE PERSON'S STATE OF MIND MAKES THE WORLD COME INTO BEING. --(Hans Christian von Baeyer, Quantum Weirdness? Scientific American, Winter 2015, p95)

For almost 100 years theoretical physicists have been tossing and turning in their sleep trying to figure out how to reconcile Einstein's great theory of general relativity with Quantum theory. Though each theory accommodates better to natural and experimental observations than the cruder Newtonian laws, no one has been able to conquer the daunting problem that the two theories of reality seem to contradict each other. The unifying theory of everything has escaped detection. The way that physics tried to work around that was by believing that quantum theory only described the subatomic world and its forces, while Relativity theory described large scale events, objects, phenomena and forces. The theoreticians searched for the magic bullet, formula or idea that would bridge the gap and bring the micro and the macro together in a single theory. String theory with its hidden dimensions and vibrating strings was an attempt to achieve that link. One problem was that neither Classical theory (Einstein) nor Quantum physics were able to define gravity and how it operates in actuality with any exactitude. Beyond Newton, Einstein showed that gravity apparently bends space, time and light, even though none of them are charged. But how? And what are the implications?

I've just finished reading (more than once—this stuff gets confusing for a layperson with a codger's old stiff mind like mine) Scientific American's special collector's edition ***Physics at the Limits-Winter 2015***, where I learned that most physicists now agree that Quantum theory describes everything, making General Relativity Theory all but obsolete though, as we know, a better fit than Newton. I suppose that may sound like a good thing if one wants a single holistic theory to hang one's hat on, but actually it's probably not quite so good as that. Why? Because in the quantum world things--from subatomic particles all the way up to massive stars--don't actually exist categorically in neat time and spatial coordinates as we--or our telescopes and other instruments--perceive them. (I mean what good is a red shift if you're not sure of the probability that the light came from where it appears to come from. At any rate, that's how I see it).

I don't quite understand yet why physicists and mathematicians didn't realize that when Quantum Theory dismissed unexpected observations in purely "ideal" frequency probabilistic terms that that approach might undermine the creation of a practical theory attempting to describe reality. It makes the formulas fit, but perhaps not much more than that. I think that physicists acknowledge this now, and yet they didn't seem to mind still believing that Quantum Theory would lead us to that simple principle of a unified theory with one mathematical formula that could explain the Universe because: if it fits any and every experimental observation, that validates the Theory. Doesn't that sound

tautologic? More recently, “a growing number of people (i.e. physicists-ed) think that what really matters are not things but the relations in which those things stand (which leads to the concept of entanglement-ed). Such a view breaks with the traditional atomistic or pointillist conceptions of the material world in a more radical way that even the severest modifications of particle and field ontologies could do.” (Meinard Kuhlmann, Scientific American Winter 2015, *What is Real*, p.89).

To digress for a minute, when you get down to the bones of it, language (if I may rephrase Laurie Anderson’s song title) is a form of magic. It has a metaphysical quality, because it is metaphorical. The most unique thing that language provided hominids was not categorization and systematization, not grammatical and mental structure (as important as these were and are), but the unlimited capacity for abstract thought. We can connect any idea, thought or object to any other in our minds, through imagination; and the potential links and relationships are all but infinite. This isn’t a vague unproven idea. Neuroscientists have shown how our miraculous ability to interpret the actual intent/meaning of another speaker’s words is based upon a mental/neurologic competition between alternative possibilities filtered through context and other cues. Language is operationalized by probabilistic neural networking at incredible speed. The never ending process of meaning discrimination takes place so rapidly as to defy explanation. (I’ll touch on this later in a discussion of entanglement). That some extreme abstract connections by some minds cause us to call some affected thinkers “mentally ill” in no way diminishes the power of this unlimited capacity for abstract thought, for free associations, and for rapid embodiment of meaning.

I imagine that my cat, Jack, also has an imagination and thinks that his play with toys or living things reflects a daydream in which he is a superlative hunter or a daydream in which he is perfecting his skills as such. I believe Jack’s imagination, though that powerful, is limited by his rather attenuated cat language. Surely, his brain reacts as fast as mine, yet Jack’s thinking and behaviors are probably unified in terms of very particular goals that describe his “catness.” We humans are different. Our imaginations are unbounded. We imagine the beginnings of time and ask what came before that; we imagine the origins of the Universe, and of life, and a life after death and so forth. From small bits of evidence we (eg Charles Darwin) recognized evolutionary theory, noting the evidence that ontology recapitulates phylogeny, or that representatives of species isolated from their kin evolve different features and capacities.

And humans set about creating experiments in physics that would hopefully shine a light upon, and create evidence, from which scientists might validate our cosmological imaginings into verifiable theories. On the other hand like other mammals our thoughts are linked to cultural and biological norms and likewise to individual instinctive needs, desires, fears in ways that are less abstract and not always quite so apparent to us.

Mathematics, unlike typically evolved human languages, was post hoc (after the fact of human language becoming innate in the brain’s structure) abstractly structured by humans as a pure “idealized” language. Math was created as a structured rock solid scaffolding that could never violate its own rules. Math was created as a way to

measure and describe observable phenomena reproducibly in order to best explain them in an undeniable fashion. Probability is a mathematical tool, yet probability incorporates into the Platonic idealization of pure forms, a newer (relativistic) flexibility like normal languages in its rule making. Probability is at heart about variability as a given. Probability allows us to work backward from an ideal form (in many cases the standard bell shaped normal distribution curve) upon which a set of measurable data is overlaid to see how well the data fit expectations of the math (the hypothesis). However, even though the expectations are derived from past data the comparison becomes less useful to us when the comparison is to a randomly varying past experience rather than to the idealized normalized mean (known as μ) of an infinite data set. Some physicists are presently aware that using standardized ideal probabilities in Quantum physics may be at odds with the heart of Quantum theory itself. Interest has been spurred in applying less rigid, less ideal (i.e. more conditional, observationally based) though still probabilistic analyses upon which to predict and compare expected outcomes. This other type of probabilistic approach has been dubbed QBism after Thomas Bayes, the 18th century clergyman who developed the key formula for conditional probability.

Apparently an important new concept that has evolved in parallel with this re-evaluation of how to understand and apply Quantum theory is the quantum mechanics-based principle of entanglement. More and more experimental data is exposing problems in the European idealized notion of experimentation based upon “isolating the system” (i.e. fixing all variables to constants—or to zero-- except for the variable of interest and then carrying out a highly restricted intervention). Almost a hundred years ago Heisenberg described the fallacy in this approach to studying physics. He pointed out that the simplest acts of measuring, observing, photographing, describing, import unknowable impacts upon whatever is being measured, observed, photographed etc. His principle formed an important foundational principle of Quantum physics but its applicability was thought to only apply to sub-atomic particle physics. In recent decades it has now been repeatedly shown that from the tiniest sub-atomic scale up to the very largest scale that measurements and experiments cannot be separated from the larger environment in the way that experimenters have thought they could be. For reasons, apparently not yet well understood, phenomena anywhere and everywhere in the Universe seem to have potential impacts on every local phenomenon (or experiment, test or observation). Surely, in a sense this is nothing more than an extension of the Heisenberg uncertainty principle which underpins Quantum theory—that measuring things is a form of entanglement that has some impact on those things, processes, whatever; yet it surprisingly extends that principle into realms that used to seem logically inconceivable. How can events and forces at a great distance, or a small distance—whether in time or space-- impact each other as much as they apparently do? Why do particles in a field tend to align in unison much more rapidly and more powerfully than can be explained by their charges, the field—or anything else? As if they were linked somehow. On top of all this, how can it be possible that 70% of everything in the Universe is dark energy which we can neither see, nor measure except in our failure to balance certain equations. And of course the 25% of the Universe that is dubbed dark matter—which

we likewise have no way to describe, though it represents something, adds another complication.

We tend to call tribes and human social groups that existed before the modern era “primitive” and think of the age of reason and then the science that created technology in the past 300-500 years or so as representing a surging period of human enlightenment. In contradiction to that idea, each so-called primitive society evolved through its social-cultural discourse a common Origin story to explain how life and the Universe came into being and to locate their group’s place in the cosmos. We, in our modern minds, may think of those cosmologies as “simplistic,” yet they served to unify their respective cultures which adhered to their particular Origin story. And now we find ourselves in a globalized epoch based upon the marketing of technology, but actually lacking any coherent unifying cosmology or physical theory. Maybe black holes, the big bang and singularities, black energy and black matter are moving toward that cosmology. Or maybe they are but a symbol (or symbols) of our contemporary social de-coherence as a species? Perhaps that is what Carl Sagan, the late cosmologist, was trying to say with his novel, Contact.

Of the world’s major religions Judaism, Christianity, and Islam take the Bible--with various embellishments--as their Origin myth. The Bible simply (and I think in a sense successfully) addresses theoretical debates of physics by creating an all powerful singular god who just puts everything in its “proper” place and governs (behind the scenes) over the whole shebang. Other than the important fact that one must love and believe in this God and worry about his nemesis (the devil) or his wrath or being in his good stead, the God formula presents another problem. “His” actual intentions and purposes remain a mystery-- except to those who are planning for Armageddon, or those who believe that “he” is always on their “side” in every conflict, so long as they are faithful. Religions tend to argue that unknowability is a necessary property of the Almighty’s power. Indigenous cosmologies were actually more advanced in foreseeing a redeeming future (on earth) without having to rely upon heaven or hell or the wrath of God. But they shared the same principle of Power.

Religion is a cultural phenomenon that does not lack for imagination and creativity and its function as a socially unifying force (sometimes for better but too often for worse with its divisiveness and self-appointed righteous) are undeniable. What religion particularly does lack, when contrasted to science, is inquisitiveness and the willingness to be challenged on the tautological quality of its beliefs. Religion is more about accepting what is than in seeking to understand the full dimensionality of reality.

Although both religion and science require a high degree of faith (not always deserved) in their utility to serve all mankind, the difference in their relationship to language’s function as an evolved instrument of mental abstraction, are significant. By creating tools (like analytical math and statistics) to help develop and critique its own narratives, science requires the process of abstract and metaphorical thinking. Nevertheless, scientists can be as rigid, sectarian and close-minded as any religionist. So, although Quantum physics reflects a major advance in the way that theoreticians looked at the

problems of physics, many Quantum theorists seemed to have constrained themselves with that now threatened belief that the principles did not apply beyond the sub-atomic level. That thinking, which became a restraint on the application of the theory, is now being loosened. Now Quantum physics has changed with the realization that “entanglement” (the interconnectedness of things and forces) is an irresistible concept based upon both Quantum theory and measurable observations.

Synchronicity, Neurology and Culture—a different kind of entanglement?

Despite the inherent rigidity in the structure of religious ideas, both Religious and Scientific investigation share a particular property derived from the social and linguistic nature of late hominids: synchronicity. Synchronicity (in the way I will use the term) refers to the ability of culture to create from within the neuro-biology of a species or group a unified common (and commonly felt) response field to certain stimuli—a harmonious reactivity or reaction in which the individual is subsumed by the group’s field. Synchronicity is all around us in daily life, but I first became aware of its power when my wife and I participated in a peace encampment to help the Frei Bartolomei Center of San Cristobal de las Casas monitor for and hopefully prevent government military attacks at the Zapatista run community of Oventic in Chiapas. One night we were invited to attend an outdoor community event that included a band and dancing. The weather was warm and the large crowd of several hundred were enthusiastic. But to our surprise the dancing consisted only of the audience moving up and down synchronously as if the audience were one single organism. There were no pairings or divisions, just the whole. This experience also caused us a degree of exhilaration. I don’t know why I had never noticed synchronicity as a trait of human culture and biology before that, but I ran into the phenomenon again in the writing and experience of Oliver Sacks, in his book *Musicophilia*. Oliver related going to a Rock Concert. He was an avid devotee of classical music and he disdained Rock, but a friend convinced him to go. As the pulsing music intensified and the crowd began to synchronously activate as if a single organism, Oliver found himself absorbed by the process, physically and emotionally. He recognized this as a distinct phenomenon he had not appreciated.

The sectarian impact of sycophancy results in squalid leaders like Jim Jones, Donald Trump or even an Adolph Hitler. However, that phenomenon shouldn’t be dismissed as just an aberration or the role of evil within human biologic identity. Sectarianism in human thought is most likely a manifestation--in an as yet to be understood way—of the entanglement phenomenon and cultural synchronicity. Synchronicity in biology appears to be a neural form of social group “harmony” deriving from our implicit and explicit within-species connectedness (by language, culture and sexuality). And yet, species entanglement is not just a socio-cultural function--just an element of animate/living organisms. Because entanglement now seems fundamental to the laws of the physical universe, our synchronicity can be understood as having some biologic function. What might that be?

The belief in humanity as an atavistic, individualist, warring, go it alone, survivalist, dominate by force and wit or “disentangled” species could well become a species ending philosophy if it consistently interferes with our biologically evolved synchronicity needs. A successful and realistic response to that challenge includes the struggle for a pedagogy that exposes how that philosophical legerdemain (which can exist within Religion, Science and other elements of culture) trods a path to human extinction. Meanwhile we should appreciate (both intellectually and emotionally) that synchronicity and entanglement may explain why music is so fundamental and enjoyable an element in human culture going back to the earliest moments and origins of language.