

THE CIRCLE OF EXPLANATION IN THE SCIENCES

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ABSTRACT: Ontological discontinuities have logical and computational consequences. Physics with constraints begets chemistry; naïve nanotechnology chose to ignore the effects of numerical constraints in orbitals on the type of molecules that can be created. On entering the biological realm, these numerical constraints begin to transform into syntax and semantics. Such projects as the HGP and GWAS have plateaued after ignoring these constraints, best handled in new subjects like biosemiotics.

In this paper, a new way of parsing nature, one that starts from the fact of ontological distinctions, is proposed. Two foci are later identified; the bridge subject of biosemiotics, which this author dealt with in a previous *Cosmos & History* paper, and the quantum mind hypothesis. The latter is seen as another bridge, this time from the academy to the real world in which we are objects as much as subjects

KEYWORDS: Ontology; Computation; Information; Communication; Activism

1. INTRODUCTION

Descartes famously distinguished “*res extensa*” as matter from Mind. While oceans of ink have spilt from the 17th century onward about how this distinction cannot be maintained, the fact remains that “*res extensa*” (literally, stuff extended in space) is an egregious over-simplification of what matter is. On the one hand, matter - while subject to Newton’s laws – also shows chaotic and other dynamics that we have begun to understand only since Poincaré, in a moment of genius, considered the motion of three celestial bodies. Chemistry constrains what matter can do still further, in a manner that will be recapitulated later in syntactic processes in gene-expression, themselves part of biosemiotics. With biology, we get further complexity; the failing of data-driven approaches has been above all their refusal to consider ontological distinctions

Likewise, the biological is a different set of emerging categories to the “merely” physical, although it inherits prosaic qualities like inertia and more interesting ones like chaotic dynamics from the physical. To say that one is in a sea of bliss, a statement we will investigate below now that the New age is focused on non-dualism, is to assert that Bell entanglement is somehow being mediated through the biological. The discontinuity that the biological comprises involves hierarchy (cells are part of organs are part of organisms), codes, and much else that the entanglement must traverse.

Intentionality is inexplicable in terms of anything previously seen in nature, and represents a uniquely human capacity to gain contact with a world of Ideas – or at least concepts. As such, it is distinguishable from more prosaic covariation of sensory receptor and stimulus on the one hand, and non-intentional psychological states depending on brain function on the other. These states may in turn be conscious; to be conscious does not presuppose “authentic existence”, intentionality directed at real objects. Conversely, intentionality may comprise as its target “Platonic” realities. A major argument of this paper is that the human capacity for voluntary control of attention coupled with intentionality toward Platonic objects are together the main breakthrough in human existence.

While most neuroscience undoubtedly can be treated with concepts from classical physics, the recent example of quantum effects in photosynthesis has proved that quantum coherence can persist in biological systems. Can the remarkable effectiveness of our visual and auditory systems be explained under this rubric, particularly if viewed in conjunction with modern research on attention? This will be investigated at length below in the context of the challenge presented by the recent burgeoning successes of AI (Markoff, 2015).

Of course, our ontology may be event-based rather than object-based. Our metaphysics might elide subject and object or –wisely, a la Piaget – argue that they are co-constructed. Indeed, we might radically assert that only attention and the fact that mathematics refers to nature are mysterious. All of these points are topics for other papers.

INTERLUDE: ONE MAGISTERIUM REDUX

My provocatively-titled 2014 monograph has been between covers long enough to warrant unpacking of its main themes. In particular, the notion that there is “One magisterium”; one source of teaching authority cutting across the areas our contemporary society divides into the arts, the sciences, morality and power politics, is deeply controversial and has famously led to incidents like the Inquisition.

However, society has often broken down sufficiently that religious authority, a notion of epistemological as well as moral truth rooted in the divine/sacred, has been the only resort for the preservation of civilization. It can be argued that Europe during the “Dark” ages became a Christian theocracy because the only administrative apparatus that preserved literacy – and indeed order- in the face of barbarism and Islam was that strange congeries of Judaism and Greek thought (the latter preserved largely by Irish monks) we later termed “Christianity”. Indeed it can be argued that so overwhelming was the re-ordering of society involved in this theocratic takeover that it reverberates even in contemporary American politics.

We live in times that are generally gentler and so allow a more plural and nuanced version of authority. If we did not do so, we could easily cobble together a single magisterium from the convergence of science and religion on a cosmos emanating from a singularity, dismissed in the Fred Hoyle phrase “Big bang”. We could argue that, following similar system-builders like Gautama, we can consider our very subjectivity as reflecting cosmic dynamics in matter, We could proceed to argue for a selflessness in our dealings with ourselves and others to manifest pure consciousness in as veridical a way as possible. Aesthetics could be handled with notions of recursive depth, and teachable moments in how primitive musical understanding (to take one example) has gotten since the audiences existed who could understand the stack created in the opening statement of Beethoven's fifth.

The person who did more than anyone to produce such a system in the chaos of the first half of the 20th century was Gurdjieff (1973). The myriad patent absurdities in his system can be looked on partly as provocation; in the midst of mass killing, his statement that the masses are governed by the moon was less absurd than the military tactics forcing such masses into charges against machine gun posts.

We are heirs and debtors of Gurdjieff. Right now, we do not need a single magisterium. We can allot different processes and structures in society for the arts, sciences, politics, and religion while keeping the single magisterium cached in case we need it. In this section I will outline how these different movements of the collective psyche can thrive in this “mal de siècle”, a start as confused to the 21st century as that which marred the 20th.

A first point is that, unlike Gurdjieff, we do not need to contradict our contemporary science. Ours is not just more accurate; it is more aesthetically pleasing and more conducive to human freedom than his contemporaries’ stuffy Victorian worldview. Moreover, as I have repeatedly pointed out in this journal and elsewhere, there is no way of refuting either a Platonic approach to math nor a dualist explanation of the free will that we all accept is our normal modality of understanding

ourselves and others. Much of the rest of this paper will unpack what a reparse of nature results in. Right now, I am going to take a more radical step.

What I argue is that our current status quo allows us indeed to allot “knowledge” to something called science, to allot assertion of life and moral value to some process in society called religion which claims charter from a fundamental cosmic reality, to separate a realm for the ordering of society to politics which must now be constrained by the near-perfect information that each citizen has due to the internet, and to argue that the arts plays on the fact we are indeed primates that can be simultaneously entertained and edified.

This final argument will focus on science. It can be argued that science at its highest level of abstraction plays above all with these entities; order, communication, computation, and observation (the latter including causal explanation). At the quantum level, indeed, observation is itself causal; it adds both to the wave-function of the universe and the observer's knowledge. It resolves superpositions hitherto billions of years old. At this level, computation in the quantum Fourier transform, the holy grail of 21st century computing. The unit of order with which it works is the elusive Qubit.

Communication is instantaneous at this, the quantum level, and thus arguably nonexistent. Finally, there is no causal explanation here; things happen in a way not cognitively penetrable.

All this is in contrast to the classical level, where Aristotle's “efficient causality” is in play. Order and communication converge on information, as Shannon has demonstrated. Moreover, computation is also a bit process, one described by Turing and Church in diverse yet allegedly formally equivalent ways.

This intimacy ends with biology, where “information” gets transmuted into a protean concept involving energy and work, as Terry Deacon and others have argued. Order requires hierarchy; computation requires hierarchy and syntax and semantics, the “small world” effects pervasive in biology, and much else.

When we get to the intentional level, all these constraints from biology are recapitulated in a cognitive system capable of indefinite levels of hierarchy. Moreover, we who can change the world with observation (arguably only with cognition that transcends standard arithmetic that Gödel focused on) can also exhibit “reflexivity” and so the social sciences come into being as the object becomes a subject. The job of edifying us, of allowing us dwell in the delightful transcendence of our subjective state while remaining rooted in the world, would be the job of a 21st century religion, if such existed, and of the arts.

Therefore, we can argue that measurement is always causal for what it measures; the quantum case famously involves aleatory choice of one of an infinite number of superposed states. Yet that is just the beginning; “a bit gives it” and in the classical world information is related to the volume of a black hole, is constrained in its cardinality by physical space, and in the now experimentally attested Landauer work requires energetic transfer. The reason that these effects do not permeate our “daily” experience is that we are working with decohered physical systems.

What can be measured is what can be computed and communicated. There is a “sweet spot” in the classical world when all three of these items converge on a bit metric. That disappears in the biological world with hierarchy, syntax and semantics and much else are required along with an enriched notion of causality/explanation. To that is added intersubjectivity in the intentional domain, quite as messy as we can conceive of.

Of course, there are unexpected consequences of this. It is very difficult to concur with the conventional wisdom that Turing's and Church's formalisms are equivalent if only the former requires energy transfer while the latter is disincarnate. We can assume that, to have observer status for a QM experiment, a very austere brain state must be present, and so on.

In this paper, we are going to focus on completing the circle of explanation in the sciences that is clearly necessary. We then look at the Quantum mind hypothesis .

2 CRITICAL THEORY AND THE SEARCH FOR MIND

The heretofore various methods of state/establishment control have recently become myriad. “Manufacturing consent”, the preferred late 20th century method, has been superseded no less than twice. The first new method was a terrifying combination of “preventative” war, torture, spying by the state, subversion of the electoral process, plutocracy, and trumping of the legislative and representative aspects of the state by the executive. The second one, necessary because of the clear military and economic defeats visited on the first, is altogether more subtle.

Like the first, it involves a “deep state”; an entrenched bureaucracy that can allow criminal behaviour persist for as long as is necessary to acquire power. And so, for example, the US illegally foreclosed on and effectively evicted millions of homeowners post-2008 in order to create a housing “market”. Obama did deals with Wall St of such criminality that, unlike the aftermath of the relatively minor S+L debacle where scores were jailed, nobody has gone to prison. Ireland allowed a private bank destroy its economy by lying to the country’s financial official about what scale of finance would save it. (It can be said in Ireland’s favour that the CEO of that bank is in jail).

This post-neocon dispensation has some entirely new tricks. The first has been referred to by the Poles as “genderism”, an enemy as reviled as communism to them. While the adult population undoubtedly has a right to whatever non-coercive sex it chooses, the extension by the state of marriage to homosexuals is unprecedented in human history. Given the subtlety of the power exchanges between men and women in marriage, it created a furore behind which more of our money could be given to Wall St, the good news, such as it is, resides in the failure to recruit the minute trans population.

In fiction, writers such as Eggers (2013) point to praxis that emerges in Google's/Facebook's world of total disclosure. In an ideal world, we would not need any personal space to reflect on the benevolent social forces that exist. In actual fact, we need personal time and space to consider – a la Jefferson - whether it would not be a good thing to overthrow our rulers every generation

Critical theory shares with more conventional spirituality an attempt to intuit the real nature of our existence. Where it differs from the religious search is in its laser-like focus on the social conditions, including class relations, which shape the contents of our consciousness.

It would seem natural, then, that the boomer generation, having elected a series of neoliberal wolves in sheep's clothing as presidents – Bubba and then Obama - should reflect this impulse in their sciences of mind. Therefore, the work of George Lakoff indeed arrived precisely on cue for the 2004 democratic campaign; if everything is a “metaphor” and there is no access to reality, why not let a second presidential election be stolen? For the record, Lakoff's laughable work on the reduction of math to cognitive linguistics needs antidotes from real mathematicians like Valiani, whose 2015 work takes us through the tortuous route to a new math physics breakthrough

In recent years, the non-dual perspective is in many ways playing the same role. If we but knew it, we are this endless bliss; and the surest way of not learning it is to grab a picket and walk up and down a protest line. Non-dualism has a distinguished intellectual pedigree; it also cannot dialogue with science outside certain QM interpretations.

Hallmarks of political surrender in academia include;

1. Psychologism or the use of formally inadequate methods a la Lakoff; linear models of the neuron are a neural equivalent;
2. Solipsism, the assertion that every thought has validity, versus being suggested by narrative omnipresent in the media, planted there by corporations;

3. Importation of French “thinkers” like Foucault, Derrida and Fancis Lucille to impart a *je ne sais quoi* to the debate already being conducted in a cloud of unknowing. (By the way they are ALL from the elite ENS; Lucille from the weapons end)

So what is wrong with the world today, as the Conchords sang? We are destroying the interplay of forces in the Biosphere we can term “Gaia”; we are making animals extinct; we are not even taking care of ourselves physically. Obama opened the Arctic to drilling by Shell, with its dreadful safety record there, and even they demurred in a fit of blushing virginhood. Fracking is causing earthquakes in hitherto seismically quiet areas like Oklahoma. There are 80k untested artificial chemicals around. The EPA is hopelessly corrupt. We could go on, but this story is well-known.

What is of less obvious immediacy is the incursions by the state. Spying we know about thanks to Snowden; once caught spying on the whole world, including his allies, Obama promised a debate that is yet to materialize. Financialization has involved Robin Hood in reverse; check your task rabbit listings for your future. Private property is history; bankers are bailed out with our money at every downturn, and ownership laws changed to suit them. In fact, the legal process now results in less, rather than more justice.

“Preventative” wars and torture have exacerbated Islamic terrorism. Debt, both private and public is now the norm to the point that it is now a revolutionary act to buy a house with your own cash. Our artists and other creatives are reeling from the trivialization of their work implicit in the non-fee-paying structure of the web, and the autistic Googles that “Crawl”, blind and dumb, the symbolic output of humanity.

What can be done? We can use some of their tools against them; after Assange and Snowden, we know most of their tricks. First of all, be informed; while you may not want to carry a smartphone, they are handy in areas where police misbehave. At home, watch the bastards as they legislate. Secondly, to find someone of the opposite sex, preferably not through a dating site, buy a home, and start a family has become a revolutionary act. Thirdly, participate in as many civil society and community activities as you can; more revolution.

3. BIOSEMIOTICS

Please note that amplification of the following discussion about biosemiotics can be found in my 2008 paper in this journal and Barbieri’s contribution to the same volume.

We are going briefly to look at the following points;

- 1. What is biosemiotics?
- 2. Why introduce it to biology?
- 3. What makes biology different?
- 4. Can the argument be extended to cognitive science?
- 5. What are the consequences for the academy and life outside it?

3.1 What is biosemiotics?

For Peirce, the founder of American semiotics, ; there is a trio of sign, object (meaning), and interpretant. Signs must signify something; conversely, meanings require signs for their completion. A semiotic system connects meanings and signs through a code; all three elements are necessary. This contradicts Saussure, for whom a semiotic system was “sign and meaning”

The biosemiotics credo a la Barbieri is that organic coding requires signs, meaning, and an adaptor. This is a variation on Peirce The physicalist notion is that “biological information” is a metaphor. This is denied by most biosemioticians; they say, for example, that genes and proteins are artefacts, made by molecular machines, and this artifactual property is the essence of life. Moreover, it refutes this physicalist idea

Some definitions of biosemiotics have been attempted. Uexkuell even before Piaget (Ó Nualláin, 2003), wrote about organisms as interpreters of their environment. Sebeok pointed out that signs used by animals are processed in the same way as humans' signs; his term, zoosemiotics, was later extended to plants as well and thus “biosemiotics”, coined by Rothschild in 1962, became common currency

3.2 Why introduce it to biology? ; Life and semiosis

There were two major breakthroughs in genetics; that information is contained in DNA, and that amino acids are specified by it. Shannon's concept of information, based on Boltzmann's equation about the relationship between entropy, microstate, and macrostate, does not specify sequence subunits. However, biological information does, and is thus a nominable entity. Organic meaning mediates between molecules

Early in the history of the biosphere, chemical “bondmakers” got created; some of them acquired the ability to join nucleotides together wrt a template, and are “copymakers” As proteins require mrna, trna, and the ribosome, they are more complex than copymakers. There is no necessity in the relationships between dna and amino acids, or between proteins and their eventual destination in the cell; we therefore can speak of codes

A code is a set of rules that establishes correspondence between elements of two independent worlds. Organic information, according to biosemioticians, is objective and irreducible.

There are a plethora of codes in nature eg the genetic code - the mapping from dna nucleotide sequences to amino acids - and signal transduction codes in cells. Cells continually respond to their environment; yet, the hundreds of possible “first” messages are transformed into combinations of only 4 “second” messages within the cell.

The spliceosome features recognition of either end of scores of introns for each “gene”. So we can talk about “splicing” codes. The cytoskeleton is anchored to the cellular structure in an arbitrary fashion There also are sugar codes, apoptosis codes, and so on.

3.3 What makes biology different?; An ontology of nature

My 2014 monograph outlines an ontology of nature starting with the physical; Newtonian and later mechanics, dissipative systems can be used to model it. QM, “negentropy” are all also techniques that work The biological inherits these techniques and adds syntax and semantics (Monod/Jacob –see my 2008 and 2014 papers in this journal). The cognitive inherits all the above but must also explain how an intentional system can implement the math techniques that we know we can use as we see below

Of course, biology (and we!) is far more than computation. Open questions in biology include types of causal explanation (including Aristotle’s final and material cause as well as efficient cause), the symbolic and the field of biosemiotics as we have noted, metabolism and its interaction with the symbolic, manifest in gene expression, evolution; hox genes and thermodynamics

In my previous work (2008) I have focussed on Epigenetics; where is the program? Let us end with an analysis of constraints on the cognitive

3.4 Can the argument be extended to cognitive science? ; Cognition

Cognitive Science completes the circle of explanation in the sciences. It can also hint at solutions to moral and aesthetic dilemmas, often explained away through postmodernism/subjectivism. It must obey laws of inheritance of facts and constraints; just as biology inherits facts and constraints from physics, so must Cognitive Science inherit facts and constraints from biology. These include conservation laws (physics), chaotic dynamics (both biology and physics); it is likely therefore that concepts like harmonic oscillators and bifurcations should be pervasive in Cognitive Science.

Yet the situation is more complex. For example, we have seen that the concept “information” in physics has an energetic dimension (Landauer stresses deletion of information requires energy), a spatial dimension (Susskind) and, as quantum theory teaches us, it determines to some extent what we consider objective reality. In fact, this paper is sympathetic to the position that attention has effects on the physical precisely because they are indeed part of the same entangled reality at a fundamental level. In that vein, this paper is an attempt to explicate exactly what that level is, and its relation to biological and cognitive reality.

Likewise, it is arguably impossible to continue discourse about biology without granting that codes/syntax are intrinsic to the subject. Cognitive Science also inherits these constraints.

We must go deeper still. We find that mathematics, the most elliptical and precise language with which we describe reality, constrains us in certain ways. Tensors of various orders, from scalars through vectors to the Riemann and Ricci tensors, are distinct with the latter two not describable in terms of the former. Our explanation patterns in Cognitive Science must honour this. So fmri, which specifies a scalar, cannot be an explanation of mind, nor can vectors; it is a category error to suggest they can.

Our explanation patterns in Cognitive Science must also honour what we learned in the 20th century from Gödel, Church et al about the limits of formal systems. This can paradoxically leave us open to non-deterministic thought. So we can indeed, following Gödel, Schrodinger and other greats, assert the existence of the spiritual while remaining completely scientifically responsible. However, we are not going to get a “solution” to the so-called “hard problem”, an algorithm mapping all neural data to experience; that is also a category error. We are going to be able to argue for a substratum of subjectivity and indeed free will in conscious experience while remaining scientific. The job of eliciting subjective states belongs to great artists and spiritual leaders, of whom we have a decreasing number.

4. RELATION TO THE QUANTUM MIND HYPOTHESIS

4.1 Introduction

Our “normal” experience is not of an endless sea of bliss, a cosmic consciousness that we manifest. It is mainly the result of our cognitive system lining up hypotheses for the next challenge we are about to encounter. Much of this processing is unconscious, and much is related to the social environment in which we live. In the early 21st century, that social environment includes an ever more intrusive industrial/financial/military

complex that will be delighted, if plunging into premature ecstasy in a sea of being that exists only in our imagination, we ignore what is happening to us in real life. This paper follows critical theory in philosophy in attempting to rescue those truly spiritual moments from fantasy.

It should be pointed out that statements like “you are one with an encompassing field of knowledge and bliss”, while arguable and very comforting, presume a massive number of assertions from a variety of fields. Ontology deals with what there is, in a way that can make radical assumptions about “levels of being” subject to different orders of laws. For example, the statement just cited cuts across physical, biological, psychological and intentional categories, where the last is defined as the mind's reaching out to “intend”, point at, objects in the world. This paper also traverses those fields, pausing en route at biosemiotics, the bridge between biology and cognition.

The many recent anniversary celebrations for Swami Vivekananda and the advent of Vedanta as a religious force in the West have not obscured the fact that, on the face of things, Advaita Vedanta, the notion that there is a non-dual reality underpinning our derived experience, is a controversial thesis. Yet the classical interpretation of quantum mechanics affords it some purchase on science; the fact that our consciousness is indeed our primary reality gives it existential traction. In a world in which it is clear that successful new spiritual movements will indeed give pride of place to meditation, to the assertion of a real personal identity even in the absence of cognitive content, we might be advised to give this view a second look.

As is the religious context;

1. Does the Von Neumann interpretation of quantum mechanics echo the identity of Atman and Brahman in its suggestion of an undifferentiated state before observation in both what becomes subject and what becomes object?
2. As a religious system, Advaita Vedanta claims not to be a sectarian viewpoint, but rather analogous to an algebraic formalism in which the insights of other religions can be expressed. In its essential claim – that our true nature is divine, and that our goal in life should be to realize this divinity – does it offer any resources to other belief systems?

4.2 Non-computable or simply data-impooverished?

The classic Penrose arguments for the necessity of consciousness in processing are now apparently being falsified by progress in computing. Computers can now “read” emotions, convert sound waves to text, and interpret scenes. at levels close to humans. Remarkably, this has largely been done by “big data” methods rather than the AI

methods used in the 20th century. It would seem to be a natural conclusion that the brain is a deterministic system, and that there is no need to posit quantum effects.

It is, however, a fact that the brain works by allocating resources preferentially to processes deemed important. The techniques assumed germane to this project are dynamic load balancing for allocation of processing resources, with adaptive resonance theory being used to model the neural network structure. In short, this too could be a deterministic process, and is termed “Exogenous attention”.

What this section explores is that the contrastive “endogenous” type of attention may be non-deterministic and invite a quantum explanation. In the 1990's there was consensus that the neurons in the nuclei reticularis thalami (nrt) “gated” information in the corticothalamic loop. We have since found out that the nrt are a gap junction, capable of working at speeds far above that of chemical synapses and consequently prone to quantum effects.

The scenario proposed here therefore, is one in which a superposition of processes is maintained until the nrt select one to be the focus of attention. The process so selected is allowed “broadcast” its content to the whole cortex in a manner facilitated by gamma synchrony, and this is what we call “consciousness” Following Pribram, we are willing to concede that consciousness is describable in classical physics terms, and has as its “intentional” aspect a synchrony between dendritic processes and real world objects.

What is non-classical in our schema is the action of the nrt in choosing which question to ask of nature. It is further argued that the flip side of big data's recent successes is its abject failure in areas like machine translation. It is argued that the recent computational successes pertain to what Fodor called “vertical” cognitive modules, fast and mandatory mental computations not subject to voluntary action. What requires the action of will in “endogenous attention” of “horizontal modules” produces a set of artifacts, like humans' real use of language, which permeates our society. While we indeed are classical machines a great deal of the time, the society we have constructed requires us to engage in quantum computation.

3.3 Precedents

What this writer (2013) finds really interesting about Mitchell's work (2009) is that attention DECORRELATES information so it is irreversible - pretty much what we want for state-vector reduction. In fact, it's beginning to look as plausible that our stream of consciousness is serial, not parallel, as a result of exploitation of quantum effects.

The critical issue then is that attention decorrelates information fluctuations. If this looks more like state-vector reduction than anything classical, the QM approach to mind goes a step toward vindication.

Therefore, the classic Libet et al (1983) work actually supports the Quantum mind hypothesis as only one course of action was being "prepared". There exists also the possibility that Libet's instruments were not sensitive enough to detect alternative actions. Where such measurements have taken place (Bressler et al, 2010, 2013) it is clear that streams not being attended to, while retaining their physiological integrity, have their activity suppressed in the service of keeping one stream, the focus of attention, enriched.

So what we defend is a notion that, as William James put it, the mind seizes on one of many streams of activity in the brain which then becomes the focus of attention. This stream is then characterized by differential informational statistics, as Mitchell et al (2009) have demonstrated, and this confirms a refutable hypothesis. In particular, we now have a "deus ex machina" - attention- preparing an observation in a way that shows purely "mental" effects on the "physical" world of the brain. It is indeed possible that this process may become assimilated to neural activity afterward; nevertheless the capacity is there for voluntary action.

The immediately above goes for bistable perception in general. There is also compelling evidence that the statistics of attended –to streams are different from those not so attended (Mitchell et al, 2009), and that response variability is less in attended-to stream (Ó Nualláin (2013)).

4. REPARSING NATURE

My "One magisterium" (CSP, 2014) monograph proposes a radical reparse of nature. Radical in that it argues for a complete reconstrual of what scientists are doing in various fields, but traditional in that it reasserts the notion of a "Great chain of being". Likewise, the idea that there is but "one Magisterium", one locus of teaching authority encompassing both science and religion, was initially proposed in the context of his contemporary 19th century evolutionary theory by Henry Drummond.

We're concerned here with the former point, the notion of levels of being, and the consequences for scientific methodology. It is argued, for example, that as of 2015 genomics has reached an asymptote, and that the study of "genes" encoding "diseases" has found all the low-hanging fruit. Much more sophistication will be required from now. Likewise, for the same reasons and other, even more fundamental ones, the incessant trawling of corpora on the web by google and others is still yielding laughable results for natural language translation.

“One magisterium” thus insists that ontology, levels of being, need to be re-introduced to science for the most urgent practical reasons. It also asserts that proper attention has to be paid to technologies appropriate to each level, particularly when the level is showing a drive to transcend itself in an evolutionary process. To take an example, Schrödinger famously posited that negentropy was the basis of life. That turns out to be simplistic; in physics, dissipative systems show this capacity without coming alive, and we need to develop a new dynamical systems vocabulary to deal with them. We need also to resurrect Aristotle's “material” causation, effects caused by organization in the matter.

In fact, the biological realm – that of life – seems also to differ from the inorganic in that hierarchy is paramount; in that codes, with syntax and semantics, are used; and finally, in that we seem to need teleological reasoning when we attempt a third-person “objective” description. Moreover, biology inherits from the inorganic realm all the panoply of physical description, from harmonic oscillators to Hopf bifurcations, all of which seem to be useful. Finally, while Sheldrake's insistence on the “memory” of nature and “morphic fields” may be excessive, there does seem to be remarkable convergence between the morphology of – say – the fossa in Madagascar and other top predators from a completely different species like the fox.

Even John Searle admits that the intentional realm is another “gap”, discontinuity, in nature. Co-variance of signal and organism is ancient; however, the existence of a representational system decoupled from the environment – however imperfect that representational system is at the edges – is indeed something new under the sun. “One magisterium” hypothesizes that a standard account like Piaget's can perhaps take us to the point at which a representational system equivalent to standard arithmetic is created; however, at this point, a new set of categories kick in and the mind becomes the host for the kind of Platonic ideas like infinite sets that have proven otherwise both inexplicable and indispensable for math.

This intentional realm, studied by cognitive science, inherits from the inorganic and biological realms as before. Cognitive Science completes the circle of explanation in the sciences. It can also hint at solutions to moral and aesthetic dilemmas, often explained away through postmodernism/subjectivism. It must obey laws of inheritance of facts and constraints; as we have seen, just as biology inherits facts and constraints from physics, so must Cognitive Science inherit facts and constraints from biology. These include conservation laws (physics), chaotic dynamics (both biology and physics); and it is likely therefore that concepts like harmonic oscillators and bifurcations should be pervasive in Cognitive Science. It is also useful to think of the human mind as capable of arbitrary levels of hierarchy.

With the notion of the aesthetic/spiritual dimensions in mind, the notion that the cosmos is a “giant thought” rather than matter needs to be nuanced. While there undoubtedly exist participator effects as envisaged by Wheeler, they are more the exception than the rule. Bell's theorems were initially produced in response to what was intended to be a “reductio” argument in the EPR paper by Einstein et al. The fact, which Einstein found spooky, that there indeed are superluminal connections between entangled particles is no longer in doubt. Yet, absent some principled way of distinguishing between coupled and decoupled cognitive systems, we are stuck with cats' observations collapsing wave-functions unless we privilege representational systems of a power \geq standard arithmetic. It is my view that everything then fits together.

It is illustrative also to see how the complex of concepts around information, work, and the epistemic cut between mental and physical (roughly speaking) change as one traverses the ontological divide. At the quantum level, there is arguably no distinction between the mental and physical and “things” are interlinked by a type of information capable of superluminal speed but useless for signaling. After decoherence/observation, we have “things” and an observer in whom the mental is embedded. Moreover, signals can be sent between distinct things. Yet “information” clearly is incarnated, not just projected as we have seen Landauer and Susskind argue.

The biological realm opens up the door to codes – if you prefer the Barbieri account (Ó Nualláin, 2008) of this paper – or simply relations, if you prefer the Peircean one (Ó Nualláin, 2003). We now have relatively slow-changing symbols governing processes, rather like train tracks guide a train (an analogy I owe to Howard Pattee). When we transition to intentionality, there is a further wrinkle in that the observer wielding a representational system of a power \geq standard arithmetic can collapse a wave function; and that, neurally, attention leads to decorrelation of information fluctuations (Ó Nualláin, 2013)

We seem close to acknowledgement of “information” as protean and of attention as an independent force in nature. While the former is measured in bits, it is fugitive at the quantum level where there is no concept on one “thing” informing another; it is incarnated in matter in classical physics; it has relations to work in biological systems; and it measures the effects of attention, which seems itself a new player in the cosmic landscape. So, while Vedanta tell us we are a sea of bliss without differentiation from the physical world, the ontological approach argues that differentiations exist between realms of nature like the biological and others, and that attention is physically causal, turning quantum into classical reality, reducing state-vectors and perhaps creating

entities in intentional space that we should learn how to characterize. A coda on this theme completes this paper.

A final speculation; as entanglement is to the physical, so morphic fields are to the biological, and so attested telepathy (the “psi effect”) is to the cognitive, There are frankly too many attested incidents in scientific discovery, in particular involving math concepts using completely different formalisms, for this to be ignored. In short, then;

- Biosemiotics is a start to a new parsing of nature
- It must be augmented by a revised look at what the process of explanation is
- By re-introducing the notion of “ontology” we get a radically new view both of how scientific research should proceed and what our potential is as human beings.

CODA; ON DEATH, TAXES, AND SCIENCE

Of course, the foregoing account works only if we are looking for abstract knowledge. We may alternatively seek to know reality through acting on it, in particular through good works; or we may attempt to find out something about the essence of consciousness by attention to physical movements. Jnana, karma, hatha yoga respectively and all valid paths; yet there is an even finer level of analysis. Let us attempt to look, Cartesian-style, at the flow of ideas in our psyche as they present themselves to consciousness. I have not found a better description than this, from 1918 as Russia was in civil war;

“You are no doubt aware of the way we think by chance associations...when everything that falls within the field of our consciousness...calls up these chance associations in our thought. The string of thoughts seems to go on uninterruptedly, weaving together fragments of representations of former perceptions, taken from different recordings in or memories....our thinking apparatus weaves its threads of thought continuously from this material. The records of our feelings evolve in the same way” (Gurdjieff,, 1973, P 45)

In short, we confabulate instant to instant, creating a narrative that may bear little or no relation with reality. Yet the massive social forces in our society, those that declare war and steal from us on an epic scale, are mediated through this chaos. It is easy to trawl though the media and find inconsistencies in politicians' stances; it is only slightly harder to detect the bias in media outlets themselves, both left and right.

The 21st century path has become more difficult, and resembles more the 1960's path in that something unprecedented was set loose with the post 9/11 doctrines of

preventative war, economic neoliberalism, and massive spying. That of course is not the theme of this paper; it is appropriate, however, to suggest that a dark expertise in our manipulation has again been attempted as we explore below. Naomi Klein's argument (2008) is that our status quo emerged from experiments run in countries like Chile in the 1970's, Ireland in the 2000's, and reflects the imposition of "shocks" on societies, shocks meant to destabilize ancient civil society structures, turn citizens into subjects, all the while proclaiming "resistance is futile" and "There is no alternative".

We must be careful, then, in asserting that we are one with a sea of bliss. We do so, at times, because the American universities are producing no articulate response to the political power grab. Instead of a careful interpretation of the forces involved and how they affect social and economic life, the response has been in general to obsess about how these forces present themselves to a psyche interpreted through the lens of subjectivist thought like French postmodernism or American psychologism. For these schools, exemplified by Derrida and Lakoff respectively, there is no reality, either mathematical or social, transcending consciousness.

The point that is being made in this paper is that there indeed is such a reality, sometimes a clearly objective such reality, and sometimes one that has the hallmarks of an unavoidable exigent, transcending reality. In short, both death and taxes transcend the subject, whatever we say about them in our classrooms. The subject of this paper has been science, rather than death or taxes; I leave it to the reader to decide which of the three is the most real to her, right now, Then let the search begin!

Of course, we will never know precisely what reality is. This section is a foray that is expanded on considerably in my 2014 book. Essentially, there are two irrefutable yet logically mutually antagonistic positions; realism and idealism. In the case of the latter, we find Berkeley's absolute idealism kicking in as a set of replies to Hume. If we remove the concept of "substance" from Humean metaphysics, as Berkeley argues we must, cognition becomes identified with apprehension of ideal essences. Similar moves can be found in strands of Buddhist thought. Likewise, it is impossible to refute a determined solipsist.

Realism is, in this writer's view, altogether more interesting. The conclusion we are about to come to is that, while we can never be absolutely sure of our immediate contact with a world we approach through symbolic activity, which is the essence of the realist position, we can absolutely be sure of the falsity of certain counter-arguments to realism.

In the first place, the attempt to describe our access to reality in terms of a set of formally inadequate psychological operations has been termed "psychologism" and we find a less nuanced version of this critique in Gottlieb Frege. Conversely, the attempt

by current writers like Tegmark to argue for worlds in which all possible mathematical dispositions are incarnated is similarly misguided, as we shall see; it is a cosmic manifestation of the opposite fallacy of “logicism”, originally the statement that the laws of logic ARE the laws of thought.

A problem underlying all this is that we have independent accounts from psychology (particularly Piagetian genetic epistemology) that really need to be respected. So if we say “It is Heisenberg's considered view that QM is about our knowledge..” we are forced into an explanatory cycle that will equate knowledge gained from sensorimotor interaction with the kind of application of math we see in QM. There is no way that Hilbert space can be handled in genetic epistemology and there was a very serious row at UC Berkeley when George Lakoff decided to educate the mathematicians about the origins of their discipline in metaphor.

It is I believe much better to consider QM observations as a very refined, austere act of the human mind. We do not know how we do it, and possibly never will. What we do know is that human cognition shows quantum signatures – see my 2013 paper.

Let us return to the issue of realism. What this writer believes that we can establish is that there are realities transcendent to us, and that we humans occasionally develop languages in which a purely SYNTACTIC operation begets new access to external realities. And so, for example, Dirac proposed the positron existed as the symmetric twin to the electron on the basis of symmetry; Emily Noerther was able to rephrase nature's conservation laws as symmetric truths. In the next section, we will investigate the extent to which skepticism about realities transcendent to us has led to some uniquely 21st century evils.

There is no language more elliptical and veridical in our apprehension of reality than math. We may never know why math works; what we do know is that it is couched in terms redolent of Platonic forms like pi, Cosine, and i. We humans can use this language to some extent, and the joins show (rather like anomalies in the movie “The matrix”) when we find ourselves forced to distinguish between converging and otherwise series adding up to infinity or a random integer, when we discuss the infinitesimal, or when we consider that Cantor with justification posited a hierarchy of infinities. In any case, the attempt to reduce math to psychology under some aegis, under some auspices or other, will not work. Math is the language of noesis, direct access to reality, insofar as we as humans can achieve this.

Of course, math famously leads us up blind alleys even in physics; it has proved incompetent for much of biology. Its leading practitioners are often abnormal; there is evidence that Princeton dentists loved patients from Advanced Studies as they were too preoccupied by events in their minds to notice the pain! It tells us little or nothing

about noesis in the arts, in the rest of social life, and for many of these areas we need alternative discourses.

It could be argued that that the noetic language for emotion is music; yet some people are, like the great Michael Polanyi, as insensitive to music as many are to math. For them, there are other languages for these apprehensions of reality, both intersubjective and objective.

Let us summarize. This paper proposes a modified realism. We will never, a la TS Eliot, cease exploring reality; we will continue to develop new and ever more elliptical and veridical tools to investigate it. The math we now use to describe physical reality is well beyond the ken of Isaac Newton, who may have co-invented the calculus but seemed ignorant enough of its application not to use it in the Principia. Where there is an attested craft, like musical instrument-making, there is likely to be a transcendent reality. It is reported, for example, that Stradivarius violins benefited from a cold snap in Europe, leading to tries with their rings compacted closer together being used for the violins!

It is nothing less than obscene to reduce music to psychological operations couched under the current trendy sets of concepts and technologies; it is, as we have seen, absurd to reduce math to metaphor, and (again!) it is reported that the dialogue at the Lakoff incident mentioned above was beyond salty!

However, for many of us, the noetic language is political action. As these often heroic figures frequently live and die in tragic circumstances, we owe them a visit. RFK Jr (Oppenheimer, 2015) is the exception that proves the rule; his family wealth and prestige could buttress his work, but could not rescue a political career from the drug use occasioned by his father's slaying.

It is argued here that, confronted with political power transcendent to us, we tend to narrate to ourselves at a higher gain, in order to foster false notions of agency. Our political and economic masters have recently become brilliant in convincing us, that, yes, we have bought into their narratives..... then they hire educators to convince us that they're right. Unlike Carey (2015), I believe that teaching and research fit will together; I also believe they are being done really badly. The "solutions" like Minerva and Uncollege lack curricula, or (Udacity) a clear market advantage

Barnett (2014) has published 21 books about the university, with this collection a synopsis. Given his refusal to acknowledge the violence of the attack on tenure in Britain, we can safely ignore him

Instead of writing this, this author has the option of watching a reality show in which an erstwhile exemplar of American masculinity explores life as an old woman learning to use make-up for the first time; or he can switch on the wife on his

computer, fully knowing that the NSA can do this without him. He can listen to a black US president on TV debauch the progressivism that begat the New deal, all the while killing American citizens without warrant, showing a “brutal” side (Cockburn, 2015), celebrating his new-found skill in killing people (ibid), and promoting his evisceration of the promises he made in 2008 to enthusiastic, useful young idiots to stop spying and summary execution as being about “love”

How did we get here? Obama's main supporters are pro-abortion liberals who have seen him pump their 401 (k) accounts back up. His is a near-totalitarian version of neoliberalism; the state is to redefine gender, the constitution becomes about abstract rights that famously did not include property rights when the banks needed illegally to evict people. I mention all this as it is my belief that that the psychologism criticized above, when moved to the political sphere, gives us Obama as surely as Lakoff; it results in Foucault, not Jefferson, being taught at elite US schools; it imposes foul-mouthed thugs (or, a la “Puff Daddy” bourgeois kids pretending) in lieu of the higher achievements of black culture like jazz

Whether the argument in this section will eventually qualify as science I do not know; we do know that attempts have been made to automate war so that drones make “kill” decisions, partially on the basis that even mistakes will infuriate the Taliban sufficiently to alienate their supporters (ibid). We do know also that the privatization of war proceeds apace (Hagedorn, 2014). Put the two together.....we also know (Cheyes, 2015) that burgeoning corruption has destabilized states in critical areas of the third world. Ironically, as of 2015 it has freed up civil society structures in some ex-colonies like Ireland, where the retreat of the state has actually been a good thing

Taibbi (2014, xxi), chronicler of the Obama devastation, has written brilliantly about the economic descent into criminality, particularly in the financial sector;

“When an employee in....HSBC ,,,, started looking into how people on terrorist or criminal watch lists opened accounts in his company, he found something odd. In many cases, commas or periods were being surreptitiously added to names, so they would elude the bank's computer screening systems”

However, Eric Holder declared - as far back as 1999 – that there would be no prosecution on the grounds of “too big to fail”;

“Essentially , HSBC....has enthusiastically opened its vaults....allowing embezzlers, human traffickers and mass murderers unfettered access” (ibid, 59)

“So a foreign bank steals billions of dollars from dozens of American towns....but....American law enforcementkicks the problem to the civil courts” (176)

Please excuse the word used in the Lakoff incident above;

“it’s just not about money. It’s about fucking with people. It’s the logic of our new shadow government” (323)

How did the US economy (as distinct from the people) “recover”? It's simple;

“as a commercial bank holding company, Chase gets to borrow virtually unlimited sums of money from the Fed for free”

So these sums could be used to buy bonds from another branch of government, which then paid interest. In the meantime, millions were illegally evicted to create a new housing bubble. Resistance was futile; apart from his bloodlust, the most surprising aspect for his supporters was Obama's relentless pursuit of journalists. The fatwas against Snowden and Assange (Coleman, 2014) were accompanied by stings in which kids were encouraged by FBI agents provocateurs to rampage through the databases or private security companies like Stratfor (ibid.).

In the past, 70's radicals seem to have helped to keep the US state honest with bombing campaigns. As described by Burrough (2015), the bombings constituted a backdrop to a decade in which the Church hearings eviscerated the CIA's state within a state. (Of course, the middle class “terrorists” of the period went off scot free, or got a slap on the wrist a la Patti Hearst while the working class such served decades in jail) Ignatius (2014) argues that the CIA is actually a British plant in the US body politic, an accountable spook service like those that proliferate in Britain. The sheer weirdness of US life is wonderfully captured in Brower's (2011) “Mormon versus Mormon” screed. Read it and you will doubt that Humpty can be reassembled.

50 years ago, Mario Savio stood on a police car and declaimed the kind of education now accepted as routine. Let us take a closer look at his motivation:

'As a high school student on a summer programme at the NSF summer institute
 “One day I made an observationwhich convinced me – and still does - that this essential connection between macrophysics and microphysics also precludes strict determinism... we have once again coupled a a sub microscopic event with macroscopic human behavior. The physical indeterminism of human behavior constitutes a necessary condition for human freedom” (Savio from Cohen, 2009, Pp 17-18)

So we're back to the circle of the sciences. Human freedom starts with QM. More recently, America has responded with its slew of heroes like Snowden. The response

has included hijacking Bolivia's presidential plane in 2013 to see if Edward was aboard. In the meantime, the reader is invited to read an account like Carlson's (2015) and remain convinced that the web should have been colonized by US companies, clearly hand in glove with their state.

There was a time when the US genuinely innovated, as distinct from turning a new technology into a channeling device for Wall Street desiderata (Isaacson, 2014). There is ample evidence, as of 2015, to suggest that the impulse for change may come from middle-class Americans. Joe Stiglitz has pointed out that the 2008 needed a Keynesian solution; but the money could have gone into repairing infrastructure, instead of rewarding the miscreants who created the disaster.

As academics, we can teach a reparse of nature; we can refuse to be bought off; we can assert new crossover subjects like Biosemiotics; and, most importantly, we can insist that what we do, whether we like it or not, is profoundly political!

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