4 November 2012 | Draft

Knowledge Processes Neglected by Science

Insights from the crisis of science and belief

-- / --

Annex to *Being a Poem in the Making: engendering a multiverse through musing* (2012), where references are listed

Introduction

The main paper (of which this is an annex) is a reflection on engagement with the quantity of information, the challenge of quality and selectivity, and the consequences of ignorance and confusion as time goes by. The situation becomes ever more evident through the increasing accessibility of information, the lack of time to consider most of it, and the need to focus on what appears to be of immediate concern. The situation is aggravated by the range and complexity of the tools by which it is possible to engage with available knowledge and insight -- and diminishing motivation to acquire the skills to use them, or the capacity to do so.

The situation is notably characterized by the multiplicity of purveyors of information and insight -- from the wisdom of the past to the creativity of the present, radically reframed by imaginative speculations on the future. Engagement is further challenged by the claims and disregard with respect to any insight -- and the questionable efforts towards integrative reformulations to facilitate comprehension and memorability, such as

to nourish the quality of life. The potential of global sensemaking has as yet to be realized.

The issues are of significance on the occasion of the publication by the widely-read journal *Scientific American* of a special issue focusing on the *State of the World's Science* (October 2012). In an exercise in comprehensible triumphalism, of particular interest is the range of issues with which it does **not** deal and how these impact on knowledge processes in a global society -- one increasingly defining itself as knowledge-based. It could easily be concluded from that survey that "science" is significantly characterized by the knowledge whose relevance it denies -- or of which it chooses to be unaware. In that sense, science could well be understood as being in a curious form of profound denial which merits attention in its own right -- especially by science.

Dogmas of science: In an accessible summary of the argument of his recent book (*Science Set Free: 10 paths to new discovery*, 2012), Rupert Sheldrake indicates the *The Ten Dogmas of Modern Science* (2012) [see also *10 Dogmas Debunked*, 2012; *10 Dogmas of Modern Science*, 2012]. These are the ten core beliefs he considers that most scientists take for granted, effectively constituting the scientific creed -- which Sheldrake discusses in chapters framed as questions:

- Everything is essentially mechanical (Ch.1: *Is Nature Mechanical?*)
- All matter is unconscious. It has no inner life or subjectivity or point of view (Ch. 3: *Is Matter Unconscious?*)
- The total amount of matter and energy is always the same (Ch. 2: *Is the Total Amount of Matter and Energy Always the Same?*)
- The laws of nature are fixed (Ch. 3: *Are the Laws of Nature Fixed?*)
  13:28 06/10/2016
- Nature is purposeless, and evolution has no goal or direction (Ch. 5: *Is Nature Purposeless?*)
- All biological inheritance is material, carried in the genetic material, DNA, and in other material structures (Ch. 6: *Is All Biological Inheritance Material?*)
- Minds are inside heads and are nothing but the activities of brains (Ch. 8: *Are Minds Confined to Brains?*).
- Memories are stored as material traces in brains and are wiped out at death (Ch. 7: *Are Memories Stored as Material Traces?*)
- Unexplained phenomena like telepathy are illusory (Ch. 9: *Are Psychic Phenomena Illusory?*)
- Mechanistic medicine is the only kind that really works (Ch. 10: *Is Mechanistic Medicine the Only Kind that Really Works?*)

As Sheldrake carefully argues, with many illustrative examples, together these beliefs make up the philosophy or ideology of materialism, whose central assumption is that everything is essentially material or physical, even minds (see Louis Makiello, *The Science Delusion*, *The Epoch Times*, 31 August 2012). It is however appropriate to take his critical argument further to explore processes which inform that mindset and are indicative of modalities which might indeed "set science free" -- thereby increasing its credibility and relevance to people and governance.

There is an appropriate degree of irony and ambiguity between the original title of Sheldrake's book and that required by his publishers for the American market, namely *The Science Delusion: freeing the spirit of enquiry* in contrast with *Science Set Free: 10 paths to new discovery*. Many would consider that "science" is too free with the truths it chooses to cultivate, and quite deluded regarding those it deprecates -- as favoured by other modes of knowing.

Also of relevance to the points discussed below, and presumably an inspiration to those of Sheldrake, are David Bohm's controversial "challenges to some generally prevailing views" as outlined in the *Wikipedia* entry describing his innovative work on *Wholeness and the Implicate Order* (1980). In proposing this new notion of order, he explicitly challenged a number of tenets that he believed are fundamental to much scientific work, namely:

1. Phenomena are reducible to fundamental particles and laws describing the behaviour of particles, or more generally to any static (i.e., unchanging) entities, whether separate events in space-time, quantum states, or static entities of some other nature;
2. Human knowledge is most *fundamentally* concerned with mathematical prediction of statistical aggregates of particles;
3. Analysis or description of any aspect of reality (e.g., quantum theory, the speed of light) can be unlimited in its domain of relevance;
4. The Cartesian coordinate system, or its extension to a curvilinear system, is the deepest conception of underlying order as a basis for analysis and description of the world;
5. There is ultimately a sustainable *distinction* between reality and thought, and that there is a corresponding distinction between the observer and observed in an experiment or any other situation (other than a distinction between relatively separate entities valid in the sense of explicate order); and
6. It is, in principle, possible to formulate a final notion concerning the nature of reality, i.e., a Theory of Everything.

Systemic knowledge processes neglected by science: What are the dimensions of knowledge and information of which science is itself uncritical or unconscious? Although presented as a checklist below (minimally ordered), the following are variously interrelated from a systemic perspective which could merit clarification (cf. *Map of Systemic Interdependencies None Dares Name: 12-fold challenge of global life and death*, 2011). A significant proportion of these additional factors would seem to be partially or completely ignored in Sheldrake's remarkable critique:

- Unquestioning preoccupation with explanation
- Undue preoccupation with validation
- Selective appreciation of creative imagination
- Unexamined preoccupation with professional reputation and recognition
- Deprecation of alternatives and anomalies challenging conventional models
- Methodological dependence on questionable engagement with society
- Uncritical belief of science in the appropriateness of its own process
- Institutionalized incoherence and disagreement
- Ill-considered recognition of constraints and opportunities of an information-based society
- Self-referential inadequacy of "metascience"

Questionable ability of science to communicate meaning: The issues highlighted above (and explored below) raise the question as to whether the very language of science is capable of providing meaning to the lives of many -- given the constraints of an exploding information society. Can science deliver meaning throughout the knowledge universe? If not, why not? What space does it offer to those without access to the latest insights -- and therefore necessarily condemned to being "wrong" and to live in disagreement with those who are "right" and know the truth?

Ironically astrophysics is now faced with the recognition of "dark matter" and "dark energy" about whose nature it is itself fundamentally ignorant. With "dark matter" now estimated to constitute 84% of the matter in the universe, this might be considered remarkably comparable to the level of ignorance in the knowledge universe. That "dark energy" currently accounts for 73% of the total mass-energy of the universe could be considered reminiscent of the shadowy (poorly acknowledged) complicities within the knowledge universe (cf. John Ralston Saul, *The Unconscious Civilization*, 1995).

In this light, and as the peak of current scientific endeavour, is the preoccupation with multiverse (now so fundamental physics) to be seen as a form of **epistemological escapism -- a hiding place for methodological inadequacy**? Is this a way of abandoning the **epistemological dilemmas of life on the planet**? (cf. Clara Moskowitz, *Stephen Hawking Says Humanity Won't Survive Without Leaving Earth*, *SPACE.com*, 10 August 2010; John M. Smart, *The Transcension Hypothesis: sufficiently advanced civilizations invariably leave our universe, and implications for METI and SETI*. *Acta Astronautica*, 78,

September-October 2012).

The successive emergence of software updating computer operating systems offers a remarkable metaphor of the process whereby science ensures the emergence of ever-improved theories of the universe -- versions offering additional "features", upheld as ever more desirable. Each new software version is declared to be necessarily better than the last, and may well not be "backwards compatible". Any "legacy systems" are then to be condemned as obsolete -- even "prehistoric", as with their users.

The process is an integral feature of the business models of those releasing such upgrades -- as with the career advancement models associated with theory production in the academic world. In failing to take account of the economic and learning situations of the users of purportedly outdated "languages" -- costs are incurred in both cases, and are dismissed in both cases.

‚Science fails to address the condition and viability of the "left behind" -- of which biological evolution offers many useful examples, as epitomized by the coelacanth (now alive in the depths of the Indian Ocean, having failed to comprehend the evolutionary imperative). In so doing **science replicates the pattern of religion** with respect to the "left behind".

Of relevance to the further consideration of multiverse, the software metaphor may be usefully explored in the light of unconventional software applications which provide a virtual environment within which older ("obsolete") operating systems, of disparate form and origin, may successfully operate. Known as x86 virtualization, examples include *VirtualBox* (see platform virtual machines, application virtual machines). Appropriate to their metaphorical relevance here, many are free, and even "open source" -- rather than being behind the kind of paywall likely to characterize the emergence and dissemination of a Theory of Everything and representations of the multiverse.

As a self-acclaimed exemplar of appropriate behaviour, science therefore reinforces similar patterns in social processes, especially those of governance. The failure to give adequate consideration to communication of more appropriate insights, if more complex and subtle, undermining any ability to transcend the primitive dynamics of democracy (*Transcending Simplistic Binary Contractual Relationships*, 2012; *Ungovernability of Sustainable Global Democracy?* 2011).

This communication failure ignores and disparages the forms of communication that the wider population finds meaningful, as in the case of social networking. In so doing it fails to explore ways of enabling the emergence of greater insight and more appropriate forms of organization through those processes. Most curiously, the tendency of science to promote its own merits unreservedly as a mode of knowing (as a form of "positive" propaganda) obscures the more scientific approach to "negative" feedback. This complementary perspective is valued as fundamental to the cybernetic insights appreciated by science as appropriate to viable organization. This reinforces similar negligence with respect to remedial strategic responses to crises.

The following factors endeavour to highlight the manner in which "science" is not-scientific". In that respect science is very much its own metaphor -- in the spirit indicated by Gregory Bateson.

Unquestioning preoccupation with explanation

Science positions itself as the primary supplier of "explanations" regarding the phenomena of experience, with little consideration of the nature of "explanation" itself and its relative importance to those to whom it is offered -- often arrogantly. Framed otherwise, this raises the question whether individuals and society have a need for "explanation" commensurate with the importance science attaches to providing it and in the form in which it chooses to do so. The efforts deployed might be construed as having a "frenetic" quality, implying a curiously undignified fear of the lack of adequate explanation -- with little effort to examine what recipients might consider "adequate", most notably in the light of its comprehensibility.

The implications are evident in the preoccupation of science with use of much-strained public resources to detect life on Mars (through deployment there of *Curiosity*), or the "God particle" (through construction of

massive accelerators), or the condition of distant galaxies (through construction of massive telescope arrays). Curiously, in its choice of problems meriting explanation, science avoids the so-called "wicked problems" by which governance of society is bedevilled -- in preference for processes and phenomena amenable to its mode of tidy explanation.

In providing explanations, science is extremely insensitive to the arrogance of its declarations as to what the truth "is" at any moment of time. These lack any humility informed by history or by the potential discoveries of the many scientists of the future. They notably neglect the problematic explanations arrogantly offered by scientists of the past -- as in the case of phrenology, or the possibility of flight, for example. The challenge for science is usefully made in a book review included in the the special issue of the *Scientific American* focusing on the *State of the World's Science* (October 2012). The review of *The Half-Life of Facts: why everything we know has an expiration date* (2012) by Samuel Arbesman is introduced with the phrase:

> Many medical schools tell their students that half of what they've been taught will be wrong within five years -- the teachers just don't know which half.

In cultivating its role as primary provider of explanation, science is notably preoccupied with "explaining" the nature of science itself -- in partial response to a degree of supposedly ill-informed disaffection for what it offers. This process is consistent with efforts to persuade others (to the faith) -- including other scientists and disciplines -- of the merits of particular explanations and models. The process is reminiscent of the proselytizing preoccupations of the religions which science so deprecates -- in their quest for conviction and conversion. Why does science need so desperately to persuade and how does science reflect on its need to do so -- especially when it does not have coherent, comprehensible, integrated explanations to offer?

As a self-acclaimed exemplar of appropriate behaviour, these challenges for science as a mode of knowing can then be generalized to question the nature of the need for "explanation" at this time. Clearly there is no lack of explanations and the capacity to produce them according to standards of credibility variously considered acceptable. It is clear that there is little probability of producing explanations of a quality beyond question. Some may prefer explanations deprecated by science -- as illustrated by astrology. It is also clear that people have a variety of preferences for explanation and their authoritative presentation -- with some preferring those of their own imaginings.

Explanations do not leave space for future creativity -- or for the multiple "rediscoveries of the wheel" which may be of fundamental value to personal and collective learning. Explanations cannot be "future proofed", as is so readily assumed by science.

Undue preoccupation with validation

Closely associated with the preoccupation of science with explanation, is that with validation. Whilst this is inherent in the manner in which science frames the advancement of knowledge, it is rendered problematic by how validation is framed and what is considered acceptable proof -- and for whom. This is most evident in the case of "proof" dependent primarily on "statistical significance" -- and the exclusion of other factors which some may (later) claim to be of greater significance. Again, some caution is appropriate in the light of historical claims of validation of "truths" now considered questionable -- if not laughably obsolete.

Especially interesting is the degree of "connectivity" appropriate to validation of an explanation, as illustrated by the case of the "correspondences" considered acceptable by so-called moonshine mathematics (cf. *Monstrous Moonshine: a collective knowledge creation quest*, 2007; *Theories of Correspondences -- and potential equivalences between them in correlative thinking*, 2007). Of related interest is the degree to which science is associated with what might be caricatured as "downstream thinking", namely a blinkered focus on proximate causes and their (disastrous) effects rather than exploring originating factors -- as is evident in the

case of many social issues aggravated by increasing population pressure (*Scientific Gerrymandering of Boundaries of Overpopulation Debate*, 2012).

A number of controversial issues highlight the challenge of validation at this time: climate change, genetic engineering, smoking, drug use, and the like. The quest for "truth" is dramatized by the case of the Iranian nuclear programme (cf. *10 Demands for Concrete Proof by We the Peoples of the World*, 2012; *Warping the Judgement of Dissenting Opinion towards a general framework for comparing distortion in rules of evidence*, 2002; *Politicization of Evidence in the Plastic Turkey Era: al-Qaida, Saddam, Assassination and the Hijab*, 2003). Most striking is the fatally misleading, scientifically-endorsed, "validation" (now framed as "remarks") presented to the UN Security Council by Colin L. Powell regarding the existence of weapons of mass destruction in Iraq (*Remarks to the United Nations Security Council*, 5 February 2003). Especially problematic is the validation of the legitimacy and precision of drone strikes, given the counter-claims made for the level of associated civilian casualties.

Whilst science, like any social initiative, necessarily arrogates to itself the right to determine appropriate standards of proof, the question is the degree of empowerment of other initiatives and individuals in determining the standards of proof (if any) acceptable to their needs. People and groups will anyway believe as true "what works" for them -- to some degree at least -- understanding that to be a form of validation. Most personally this is evident in the process of falling in love, spiritual revelation, or in any inspiration to creativity. Science has yet to offer credible explanation and validation of falling in love -- and out of it. The latter, as a form of "scientific revolution" in personal knowing, offers an understandable contrast to the final closure characteristic of impersonal scientific validation

The fact is that facts will be ignored or dismissed -- no matter how significant or how authoritatively presented. This is a fact that merits consideration by science in any reoccupation with determining the facts. It follows however that this fact will be ignored.

Selective appreciation of creative imagination

Science typically extolls use of "imagination" -- provided it is applied within a currently fashionable paradigm sanctioned by scientific authorities. Use of imagination to reframe paradigms is typically deprecated -- to be praised, if ever, only after a new paradigm has become fashionable. As noted below, science is much challenged to manage the process.

The challenge in a society in which imagination is widely appreciated is who is to subscribe to whose imagination -- and whose imagination is to be deprecated by whom? For Mario Bunge (*Parallel Universes? Digital Physics?* In: Evaluating Philosophies, *Boston Studies in the Philosophy and History of Science*, 295, 2012, Part 3, pp. 151-157):

> Every original idea is imaginative, because only imagination can trigger creativity. This is why imagination is just as essential in science and technology as in the arts and humanities. The difference between these two pairs of fields is that in science and technology imagination is disciplined rather than free. What motivates such discipline is the objective truth requirement.

As above, this highlights the issue of "objectivity" for whom -- and whether "subjectivity" may be much preferred by others. This is a theme of a penultimate chapter of Sheldrake's critique: *The Illusions of Objectivity*). The challenge to conventional thinking is discussed separately (*¡¿ Defining the objective ∞ Refining the subjective ?! -- Explaining reality ∞ Embodying realization*, 2011; *Conditions of Objective, Subjective and Embodied Cognition*, 2007).

The above quotation is complemented by that of Arjun Appadurai (*Disjuncture and Difference in the Global Cultural Economy*, *Public Culture*, Spring 1990):

> An important fact of the world we live in today is that many persons on the globe live in such imagined 'worlds' and not just in imagined communities, and thus are able to contest and sometimes even subvert the 'imagined worlds' of the official mind and of the entrepreneurial mentality that surround them.

Of emerging significance is the recognition of the placebo effect in the provision of remedies. This is becoming increasingly credible in the field of health, despite its challenge to explanation. It might be asked whether there is appropriate

dependence on such an effect in the strategies of governance where the population may be persuaded that some remedial strategy has been deployed -- in such a manner that belief in its deployment triggers a remedial process. Public relations programmes may well be conceived in such terms -- inviting both imaginative engagement and legitimate suspicion. Again, for the individual, imagination may be elicited in support of any sort of therapeutic process, especially where science is unable to deliver.

Science notably fails to address the extent to which wider society is unable to make use of the explanations so provided -- to whatever degree they are authoritatively "validated". The condition is dramatized at the time of writing regarding whether Hurricane Sandy is further confirmation of explanations regarding climate change (as variously noted in *The Huffington Post*, November 2012; George Monbiot, *Obama and Romney remain silent on climate change, the biggest issue of all*, *The Guardian*, 5 November 2012)..The situation is exemplified by the less well-known case of evidence regarding the potential disaster arising from the probability of geomagnetic reversal -- a switch in the Earth's magnetic poles. Whilst deploring the lack of respect for its conclusions (as with religion before it), science does not consider the dynamic context of such disregard to be of relevance to the manner in which it conceives the methodology of its operations. It focuses on "performance indicators" (cf. *Remedial Capacity Indicators Versus Performance Indicators*, 1981; *Recognizing the Psychosocial Boundaries of Remedial Action: constraints on ensuring a safe operating space for humanity*, 2009).

As a self-acclaimed exemplar of appropriate behaviour, science has been unable to take a more scientific approach to the emergence of new thinking -- especially that of an unusual nature, readily deprecated as "rubbish", irrespective of the meaning it may have for those imagining its relevance, who may be poorly nourished by the meanings offered by science. This approach is not consistent with the appreciation science accords to the widely incomprehensible complexities of the imaginings of physicists -- as with respect to "parallel universes". The proposed existence of the latter can be fruitfully compared to the array of "heavens" proposed by some religions.

It is in this sense that the processes of science reinforce more general tendencies by authority to inhibit imaginative thinking.

Unexamined preoccupation with professional reputation and recognition

Individual "reputation" and institutional "reputability" are fundamental to the processes associated with scientific explanation, validation and imagination. Although well-recognized, notably in various "rankings", they are not factored into any critical analysis of the scientific process. Reputation governs the selection and funding of research topics and the acceptance of the results of research. It is central to the process whereby professional careers are made or broken -- as with the themes with which the professionals are associated.

Of relevance to this argument is the striking emphasis by the above-mentioned *Scientific American* survey of the *State of the World's Science* (October 2012) on the ranking of countries by the number of patents issued, or by the number of research papers in a "selected group of journals", or by research expenditure. This would appear to ignore the qualitative value of insights, especially inn the longer term, in contrast with various quantitative measures of significance to short-term considerations. The preoccupation with patents is

also indicative of a questionable sense in which "science" -- or the reputation of scientists -- is about achieving possession of territory of intellectual property in the knowledge universe, much as miners stake claims. The highly problematic consequence has been remarked with respect to the subsequent market in franchises, especially the withholding of rights to use knowledge where this may block initiatives to achieve financial advantage (cf. *Future Coping Strategies: beyond the constraints of proprietary metaphors*, 1992). Ironically the consideration of the relative value of frames of reference appropriated exclusively in this way merits some consideration in the light of Einstein's major contribution (*Einstein's Implicit Theory of Relativity -- of Cognitive Property? Unexamined influence of patent office procedures*, 2007).

A striking example of preoccupation with reputation is offered by any systematic research relating to population pressure -- a topic deprecated by political and religious authorities (cf. *Overpopulation Debate as a Psychosocial Hazard: development of safety guidelines from handling other hazardous materials*, 2009). Again there is little ability to recognize such influences in systemic analysis of the processes of science.

The issues have been remarked in relation to the pressures of research in quest of ultimate professional recognition through prizes and awards, as with Nobel Prizes, the Fields Medal, etc, as described by David L Labaree (*Gold among the Dross: higher education in the US is driven by a lust for glory*, *Aeon*, December 2018). More generally they have been noted in relation to the "publish or perish" dynamic and the associated issues and abuses of "peer review". any authoritative responses by science to alleged abuse typically takes the form of denial or dismissal as an isolated incident.

Dependence on reputation is indicative of a lack of scientific capacity to investigate information on its own merits. It is a means of avoiding thought and responsibility. It raises the question of how unforeseen indications (of dangers) are to be interpreted in the absence of reputable interpreters (appropriately qualified). It suggests that response to any such indication -- as with warning of a fire -- would be delayed until a qualified "fire expert" could be found to confirm the danger. This says much of the institutional capacity to respond to surprise, as explored by Nassim Nicholas Taleb (*The Black Swan: The Impact of the Highly Improbable*, 2007).

The previously assumed role of reputation has been dramatically eroded in recent decades in many sectors of society, including science (cf. *Abuse of Faith in Governance*, 2009). In the case of science it is charmingly illustrated by the unexamined institutional provisions for the emergence of new variants of the mathematical genius Srinivasa Ramanujan. To what extent is science now organized to ensure that it is minimally troubled by the insights of a Ramanujan -- whilst fully equipped to deny (credibly) that this is the case? Of Ramanujan, according to Hans Eysenck:

> He tried to interest the leading professional mathematicians in his work, but failed for the most part. What he had to show them was too novel, too unfamiliar, and additionally presented in unusual ways; they could not be bothered (*Genius*, Cambridge University Press, 1995, p. 197)

The reframing of the situation with respect to reputation can be recognized in the radical loss of prominence of the United Nations and its Specialized Agencies -- now obliged to have their own Facebook page in order to attract a trickle of "followers". Strangely it is social networking which is now the primary vehicle for social recognition and reputation -- with science itself being increasingly marginalized and confined to self-selected mutual-appreciation clubs ("academies"), characterized by mutual citation pacts.

Deprecation of alternatives and anomalies challenging conventional models

Whilst the tendency of science to deprecate and condemn alternative worldviews is widely recognized (as noted above), there is little capacity of science to reflect on these processes and to discover healthier ways of relating to challenging perspectives. This incapacity reinforces that in other sectors of society (cf. *Guidelines*

for Critical Dialogue between Worldviews, 2006).

There is a degree of irony to the lead contribution to the above-mentioned *Scientific American* survey of the *State of the World's Science* (October 2012) by John Sexton (*A measure of the creativity of a nation is how well it works with those beyond its borders*, pp. 28-32). Understood as a "nation", the question might be asked as to how well "science" does indeed work with those beyond its conventionally well-guarded borders -- and therefore how creative it should be considered to be despite its own claims in that regard. Does science as a "nation" have any sense of what lies beyond those borders that may fruitfully merit consideration? Sexton argues with respect to the past quarter-century:

> Researchers, to the extent that their work required them to collaborate with colleagues beyond national borders had to scale high boundaries to do so. Today things are quite different. Globalization (which I sometimes call "planetization" to signal a phenomenon more comprehensive than "globalization" denotes) is a defining characteristic of this era in human history... It is no longer possible to keep out the economic, political, cultural or intellectual effects of actions taken in distant lands.

Unfortunately for "science", the inhibitory effect of "high borders" continues to operate (as noted by Sheldrake). Science has the greatest of difficulty in engaging with those in "distant lands" -- even those of the social "sciences". An illustration at the time of writing is offered by James Fadiman in an interview relating an exchange with an academic colleague:

> Let me give you just one wonderful example. There was a person who was head of alcohol research for the National Institute of Mental Health. Results were coming out of Canada that said if you take long-term treatment-resistant alcoholics - I mean people who are really pretty wasted, have liver disease and so forth -- and you give them one session with LSD, there's a 50 percent abstinence rate. This person was shown the data, and he said, "I don't believe it." The person who showed it to him said, "So which data would you believe?" His answer was: "None." (*Jim Fadiman: Researcher in the Sky with Diamonds*, *Yale Daily News*, 9 November 2012)

Sexton's comment on "globalization" also usefully clarifies the sense in which the focus of science is on the physical "planet" and avoids the challenge of knowledge integration, as potentially and fruitfully implied by the sense of "global" fundamental to mathematics (cf. *Future Generation through Global Conversation: in quest of collective well-being through conversation in the present moment*, 1997). It is indeed "global solutions" which are lacking at this time -- rather than the fragmented diversity of local solutions around the planet undertaken in ignorance of their unforeseen global implications.

The matter has been usefully summarized by Bernard Barber (*Resistance by Scientists to Scientific Discovery*, *Science* 134, September 1961) who argues that this source of resistance has yet to be given the scruting accorded religious and ideological sources. The distress for the individual scientists has been dramatically highlighted by Max Planck: ***A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die....*** (*Scientific Autobiography*, Philosophical Library, 1949, pp. 33-34).

Missing is any analysis of the variety of processes deployed in response to such challenges -- and their systemic consequences. These range from "authoritative denial", questioning reputation, character assassination, tampering with the evidence, investment in invalidation research, bribery of witnesses, stacking committees of inquiry, suppression of reports, "dirty tricks" of various kinds, etc (cf. *Wrecking an International Project: Notes from a saboteur's vade mecum*, 1972) . A (marginal) exception to this conclusion may be seen in systematic efforts at anomaly detection and anomalistics -- as through the Society for Scientific Exploration.

Especially curious is the need of science to establish univocal explanations and models -- maximizing "agreement" and marginalizing "disagreement". Any indications of the latter are simply declared to be "wrong" or "obsolete", with no ability to situation such perspectives systemically. Science has been unable to articulate a more fruitful approach to creationism, for example (cf. *End of Science: the death knell as sounded by the Royal Society*, 2008).

The semblance of order with which science associates its methods is vulnerable to arguments such as the following articulated by Norman Campbell:

> ... we accomplish the apparently miraculous feat of reducing a chaotic world to order because we carefully confine our attention and our efforts only to those portions which we find can be ordered (*The Foundations of Science*, 1920)

Unfortunately for science, and for authorities in general, there is now considerable public recognition of the questionable value of such processes. Disseminated information is now examined with an increasingly critical eye -- perhaps to be understood as science at its best. People are now empowered to select insights across the spectrum of science and alternatives -- of which "authoritative" science may now be recognized as an increasingly narrow portion. The situation is aggravated by systems to solicit "feedback" from wider publics -- designed as public relations exercises with the intention of ignoring the input elicited.

Methodological dependence on questionable engagement with society

As implied above, science is now complicit to a high degree in dubious processes whereby its methodological turf is defended and continuing research resources are ensured. This is characterized by the presentation of unsubstantiated claims and dubious arguments. It is evident in the questionably predictable claims made for high budget research ("ensuring health", "advancement of knowledge", "increasing food resources", "creating jobs", etc). It is most evident in relation to the complicity of science in military research ("ensuring security"). The complicity engenders questionable endorsement of dangerous and polluting technologies, such as nuclear reactors ("vital energy supplies"), as dramatized by Fukushima (cf. *Anticipating Future Strategic Triple Whammies: in the light of earthquake-tsunami-nuclear misconceptions*, 2011).

A related issue arises from the use by government agencies of scientific advisers whose objectvity as scientists then becomes questionable as in the cases presented by George Monbiot (*Beware the rise of the government scientists turned lobbyists*, *The Guardian*, 30 April 2013). He notes that government science advisers are routinely misleading the public to support the agendas of politicians:

> What happens to people when they become government science advisers? Are their children taken hostage? Is a dossier of compromising photographs kept, ready to send to the *Sun* if they step out of line? I ask because, in too many cases, they soon begin to sound less like scientists than industrial lobbyists....
>
> Among the official duties of the chief scientist is "to ensure that the scientific method, risk and uncertainty are understood by the public". Less than a month into the job, Sir Mark Walport has misinformed the public about the scientific method, risk and uncertainty. He has made groundless, unscientific and emotionally manipulative claims. He has indulged in scaremongering and wild exaggeration in support of the government's position.

In a remarkable follow-up to this analysis, he notes his further discoveries with respect to government understanding of the Precautionary Principle according to the insights of scientific advisers (George

Monbiot, *The Providential Principle*, 1 May 2013):

> Among the many problems with the article he [Walport] wrote was the way he defined the precautionary principle. Interpreting and upholding this principle is fundamental to the chief scientist's role. Yet he doesn't seem to understand what it means. Here's what he said about it:
>
> > This simple idea just means working out and balancing in advance all the risks and benefits of action or inaction, and to make a proportionate response.
>
> Oh yes? Here's how the Rio Declaration, which the UK, with 171 other states, signed in 1992, defines it:
>
> > Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
>
> The difference is critical to an understanding of the government's environmental responsibilities. As if to underline the fact that he hasn't grasped it, Sir Mark used his article to do the opposite: **he used a lack of full scientific certainty as a reason for postponing cost-effective measures to prevent environmental degradation.** [emphasis added]

Of relevance is the fact that Walport is an eminent Fellow of the Royal Society. Since that body is itself one of the most eminent collective representatives of "science", this raises the question of the complicity of "science" with the views cultivated by Walport. Given the recent project launched by Martin Rees, as past-president of the Royal Society, to explore "existential risks" and their denial (*Denial of Catastrophic Risks*, *Science*, 339, 8 March 2013), the implications of the problematic reframing of the Precautionary Principle by Walport merit careful consideration -- especially in the light of a degree of complicity of the Society of which both are Fellows.

How does denial of such complicity relate to the preoccupation, as environmental scientists, of the authors of the latest report of the Club of Rome (Anders Wijkman and Johan Rockström, *Bankrupting Nature: denying our planetary boundaries*, 2012)? Is it science itself which is "in denial" -- as might be inferred from the tardily recognized scandal of undisposed waste around the Antarctic research stations, purportedly concerned with certain "planetary boundaries"? (*Waste Management a Concern in Antarctica*, 2009).

The dynamics of the situation (and the boundaries defined) are such that "science" can always claim that it is not responsible for any problematic consequences -- readily attributed to the misjudgment of individuals, human error, political pressure, and the like, which are of no scientific relevance. This is to be compared with governments in power typically blaming their inadequacies on the legacy of the "previous government".

There is no systematic analysis of the process, as might otherwise be expected of responsible science. The "scientific explanation", as with sexual abuse by clergy, then relies on exceptionalism and the "bad apple" argument -- denying and ignoring systemic ills (Naomi Oreskes and Erik M. M. Conway, *Merchants of Doubt: how a handful of scientists obscured the truth on issues from tobacco smoke to global warming*, 2010; Steve Connor, *Hair-splitting, brazen denials and six decades of dirty tricks*, *The Independent*, 1 September 2011)

The difficulty for science in this situation, as for any powerful group, is that it is now unable to prove that it is not in some way complicit with dubious processes incompatible with its values and methodology. When effectively challenged, recourse is always possible to stacked committees reporting after the necessarily lengthy delays of an authoritative investigation -- and preferably reporting to bodies unable to act on the

matter.

As a self-acclaimed exemplar of appropriate behaviour, the inability of science to engage with these processes systemically -- its own processes -- inhibits the emergence of insights of relevance to their analogues in wider society from which science draws its resources.

Uncritical belief of science in the appropriateness of its own process

As with religion, science is readily able to highlight its core values and achievements whilst neglecting reference to inconvenient counter-indications. Rather than being "scientific", this is an understandable process of public relations and self-promotion -- "positive" propaganda neglecting "negative" feedback (as noted above). The discourse of official science becomes predictable and is welcomed as believable by its practitioners -- as by the adherents of any religion. The questionable behaviour of individual scientists, as with the clergy before them, is reframed by dubious promotional processes which science has collectively engendered, or in which it is complicit. Aspects of the matter have recently been highlighted in a face-saving commentary with respect to the unreplicability of a proportion of reported results (*Science isn't as solid as it should be -- but science can fix it*, *New Scientist*, 13 April 2016)

The matter is most evident in relation to scientific misconduct, bullying in academia and academic dishonesty (cf. William Broad and Nicholas Wade, *Betrayers of the Truth: fraud and deceit in the Halls of Science*, 1982). Curiously the problematic dynamics tend to be made evident in carefully cultivated myths regarding the history of science in which the focus is on isolated (epic) cases -- the "ancient history" of science. This contrasts with well-publicized preoccupation with attacks by quacks, by religion, and the "dirty tricks" undermining research funding -- framed as irresponsible and misguided.

It is difficult to locate systematic studies of such dynamics beyond those characteristic of the necessarily personalized studies of the biographies of scientists -- a focus of the history of science. *Wikipedia* provides an indicative *List of scientific priority disputes* and a *List of topics characterized as pseudoscience*. This is dissociated from any systemic insight into who is "hostile to whom" -- the stuff of non-factual anecdote an corridor gossip -- which might be usefully recognized as a complement to the extensive investment in (mutual) "citation analysis". Ironically missing is any scientific approach to "who does not cite whom" -- as a contribution to systemic insight and an understanding of systemic inadequacies.

Typically published anecdotal accounts focus on "personal animosity" or "scientific feuds", possibly referring to "scientific bias". The accounts conflate:

- dysfunctional scientific processes (highly conditioned by animosity and jealousy),
- preoccupation with recognition of priority,
- contrasting disciplinary and theoretical perspectives,
- controversial and politicized issues (climate change, cold fusion, creationism, pseudoscience)

with the (eventual) emergence of a preferred (depersonalized) scientific view -- to which any prior "human" behaviour is considered incidental. Essentially personal animosity is inextricably confused with substantive concerns -- the former being ignored as irrelevant to progress with respect to the latter. This confusion inhibits systemic insight into the process -- a pattern only to be partially highlighted by the work of Thomas Kuhn (discussed below).

Accounts of feuds are provided in the popularized works of Hal Hellman (*Great Feuds in Science: ten of the liveliest disputes ever*, 1998; *Great Feuds in Technology: ten of the liveliest disputes ever, 2004; Great Feuds in Mathematics: ten of the liveliest disputes ever*, 2006) and of Joel Levy (*Scientific Feuds: from Galileo to the Human Genome Project*, 2010). Examples of biographical commentary on specific feuds include: David Rains Wallace (*The Bonehunters' Revenge: dinosaurs, greed, and the greatest scientific feud of the Gilded Age*, 1999); Joshua Gilder and Anne-Lee Gilder (*Heavenly Intrigue: Johannes Kepler, Tycho Brahe, and the*

murder behind one of history's greatest scientific discoveries, 2004). Again, "feud" may well be framed primarily with respect to substantive issues -- obscuring perspective readily framed as non-scientific and therefore to be ignored as irrelevant.

The epic cases typically cited tend to obscure the nature, incidence and consequences of such processes (cf. *Epistemological Challenge of Cognitive Body Odour: exploring the underside of dialogue*, 2006). Such cases include: Eddington vs. Chandrasekhar, Raman vs. Born, Galileo vs. Pope Urban VIII, Newton vs. Leibniz, Cope vs. Marsh, Wallis vs. Hobbes, Voltaire vs. Needham, Hawking vs. Susskind, Johanson vs. Leakey, Einstein vs. Heisenberg, Freeman vs. Mead, Guglielmo Libri vs. François Arago, Edison vs. Tesla, Koch vs. von Pettenkofer, Diebner vs. Heisenberg, Shapley vs. Curtis. Especially dubious are the individual or collective dynamics of character assassination and "dirty tricks" in response to innovative proposals (exemplified, if documented, by those resulting in Nobel Prizes), as with respect to heliobacter (Marshall and Warren) or quasicrystals (Shechtman). These suggest the extent to which scientific discovery is achieved through heroic battles against conventional conceptual frameworks -- most notably those of resistant peers -- as described in the Schectman case (Alok Jha, *Dan Shechtman: 'Linus Pauling said I was talking nonsense'*, *The Guardian*, 6 January 2013)..

Some indication of the extent of the problem is provided by:

- Clemens J. Heilmann (*Personal opinion and bias in science*, 10 November 2010): *The history of science is full of stories of personal animosity, spite and (now) hilariously wrong explanations.*
- Ya G. Sinai (*Mathematicians and Physicists = Cats and Dogs? Bulletin (New Series) of the American Mathematical Society*, 43, 2006, 4, pp. 563)
- Sonia vn Gilder Cooke (*The Unscientific Method*, *New Scientist*, 16 April 2016; online as *Why so much science research is flawed - and what to do about it*)

Highlighting the issue with respect to psychological lresearch, the latter notes:

> In fact, the problem extends far beyond psychology - dubious results are alarmingly common in many fields of science. Worryingly, they seem to be especially shaky in areas that have a direct bearing on human well-being - the science underpinning everyday political, economic and healthcare decisions. No wonder the whistle-blowers are urgently trying to investigate why it's happening, how big the problem is and what can be done to fix it. In doing so, they are highlighting flaws in the way we all think, and exposing cracks in the culture of science.
>
> Science is often thought of as a dispassionate search for the truth. But, of course, we are only human. And most people want to climb the professional ladder. The way to do that if you're a scientist is to get grants and publish lots of papers. The problem is that journals have a clear preference for research showing strng positive relationships -- between a particular medical treatment and improved health, for example... a few go as far as making things up. But a huge number tinker with their research in ways they think are harmless, but which can bias the outcome.

The editor of *The Lancet*, Richard Horton, has written that something has gone fundamentally wrong with one of our greatest human creations, indicating that:

> Much of the scientific literature, perhaps half, may simply be untrue. Afflicted by studies with small sample sizes, tiny effects, invalid exploratory analyses, and flagrant conflicts of interest, together with an obsession for pursuing fashionable trends of dubious importance, science has taken a turn towards darkness... The apparent endemicity of bad research behaviour is alarming, (*Offline: What is medicine's 5 sigma? The Lancet*, 11 April 2015)

A comparable remark had been previously made by Marcia Angell:

> It is simply no longer possible to believe much of the clinical research that is published, or to rely on the judgment of trusted physicians or authoritative medical guidelines. I take no pleasure in that conclusion, which I reached slowly and reluctantly over my two decades as an editor of *The New England Journal of Medicine*. (*Drug Companies and Doctors: a story of corruption*, *The New York Review of Books*, 15 January 2009).

For Karl Popper, as one of the most influential philosophers of science, framed historicism as the principal theoretical presupposition underpinning most forms of authoritarianism and totalitarianism (*The Open Society and Its Enemies*, 1945), later arguing that:

> Authoritarianism in science [is] linked with [...] proving or verifying theories. [While] the critical approach is [...] trying to refute, or to falsify its conjectures (*The Myth of the Framework: in defence of science and rationality*, 1994)

The issue has been proposed as an object of research in its own right (Dmitry Nikolaenko, *Authoritarianism in science as an object of scientific research*, *Environmental Epidemiology*, 14, 2020, 3). It features in criticism from a religions perspective (Bill Nugent, *How Authoritarianism in Science Slows Down Scientific Progress*, *Defending the Faith*, 1 April 2021).

A quite exceptional articulation of the issue is provided by Stephen D. Ricks:

> The widely held notion that science has delivered us an absolutely authoritative source of knowledge simply cannot withstand close scrutiny. Nowhere is this more apparent than in the history of novel theories and experiments in science. Scientists with radically new ideas have difficulty getting an audience among their more orthodox brethren. Sometimes they are ignored or rejected because of personal animosities or simple inertia. In other cases, the rejection seems to violate the canons of open-minded scientific inquiry. Through the whole spectrum of the sciences, one can document an astonishing disregard for facts which contradict fashionable theories, stereotyping of acceptable approaches to problems and theories, and the waving of academic credentials and ritual invocation of the specialist's mystique to discourage criticism from "outsiders". In these instances, the intellectual conservatism of the scientific community appears to be *authoritarian* rather than *authoritative* in character. (*Is There a Cure for Authoritarianism in Science?* In: *By Study and Also by Faith*, Neal A. Maxwell Institute, Brigham Young University, 1990)
>
> The occurrence of authoritarian behavior patterns appears at first glance to be completely pathological in view of our idealization of science as an objective inquiry after "stubborn irreducible facts". But the personal vanities and insecurities of individual scientists cannot reasonably be invoked to explain widespread authoritarianism in science. Moreover, since the stigmata of rigidity and dogmatism are observable in physics as well as archaeology, the problem cannot arise simply from the peculiarities of individual disciplines, but must be connected with general features of science.

Tom Feilden notes reports that *Most scientists 'can't replicate studies by their peers'* (*BBC News*, 22 February 2017).

Arguably the issues are addressed by ethical committees of individual disciplines. The difficulty is that "ethics" is not a scientific concept (cf. *Honour-related Challenges of the Disciplines: an unexplored aspect of methodology and integrity*, 2005). As with a number of other factors highlighted above, ethical factors are thus readily ignored -- as is only too evident in the involvement of science in development of weapons of mass destruction, environmental degradation, "scientific whaling", methods of enhanced interrogation, eugenics, and moulding of public opinion. Ironically, as with sexual abuse by the clergy, scientists cannot

"prove" that are not implicated.

As a self-acclaimed exemplar of appropriate behaviour, the approach of science to ignoring dysfunctional process, in preference to celebrating its legitimate triumphs is unfortunate. The pattern can be recognized as characteristic of politics, where the extent of such dysfunctionality is also subject to cover-up in celebration of democratic processes. It can be concluded that science fails to provide the kind of insight and leadership in finding ways of highlighting and transcending such inadequacies at a time when there is great need for healthier collective process to enable the emergence of new possibilities.

In the light of the wider implications of the election pof Donald Trump, a thorough framing of the various dimensions of the issue is offered by Andrea Saltelli and Silvio Oscar Funtowicz (*To tackle the post-truth world, science must reform itself*, *The Conversation*, 27 January 2017). This is framed by the recognition that *the scientific community seems set to avoid a much-needed soul-searching about its responsibility in the twin crises of science and democracy, escaping introspection by using denial, dismissal, diversion and displacement*.

A valuable approach to analysis of the controversies which science may engender is provided with respect to other sectors by Jonathan Haidt (*The Righteous Mind: why good people are divided by politics and religion*. 2012). It might be asked why such thinking is not applied -- scientifically -- to science.

Provocatively and ironically, it could be suggested that it is probable that astrophysics will reach a meaningful understanding of **gravity** when science in general is able to understand the **arrogance** inherent in its processes -- gravity and arrogance being equally mysterious. Curiously science recognizes by an ill-defined process that reputation adds "weight" to an argument -- especially when the argument is articulated with the *gravitas* of those esteemed most reputable. This might even be recognized as "bending light" within a "well of arrogance" in psychosocial spacetime, much as does mass within a "gravity well". Is scientific arrogance -- so systemically denied within the psychosocial universe -- to be considered in some mysterious way as analogous to the dark matter/energy of the universe?

Institutionalized incoherence and disagreement

The fragmentation of the sciences is well-recognized and accepted fatalistically. Hopes for any form of unified science have been unfulfilled -- and related proposals abandoned. The more recent consideration of interdisciplinarity and transdisciplinarity has yet to prove meaningful in practice -- beyond token solicitation of expertise across disciplinary boundaries.

The integration to which religions aspire has been deprecated by such as Richard Dawkins (*The God Delusion*, 2006) -- despite the beliefs of many and the only too evident differences between them (cf. *Stephen Prothero*, *God Is Not One: the eight rival religions that run the world -- and why their differences matter*, 2011). Presumably Dawkins is relying on the revelations of a Theory of Everything to provide a coherent foundation for science-- but without considering the capacity of the disparate disciplines (and their proponents) to relate integratively to it. Sheldrake focuses on the delusion arising from ten interconnected dogmas constituting the scientific creed.

In this context there is therefore a case for exploring the possibility that it is "consensus" as currently framed which is itself a delusion (cf. *The Consensus Delusion*, 2011).

As a self-acclaimed exemplar of appropriate behaviour, it might be expected that science would offer imaginative insights into integration of the modes of knowing exemplified by the disciplines -- whether included as "science" or dismissed as "non-scientific". In its failure to do so it reinforces the failure of other sectors of society, most notably religion, with all the bloody conflicts inspired by their disagreements.

Of related concern is the extent to which, within disciplines, the promotion of particular methodologies by particular clusters may be perceived as developing the quality of an uncritical cult. One description of the process is offered by Andrew Zimmerman Jones and Daniel Robbins (*String Theory For Dummies*, 2009):

> One of the major criticisms of string theory has to do not with the theory so much as with theorists. The argument is that they are forming something of a "cult" of string theorists, who have bonded together to promote string theory above all alternatives. This criticism, which is at the heart of Smolin's *The Trouble with Physics* [2007], is not so much a criticism of string theory as a fundamental criticism of the way academic resources are allocated. One criticism of Smolin's book has been that he is in part demanding more funding for the research projects that he and his friends are working on, which he feels are undersupported. (*String Theory: Hundreds of Physicists Can't Be Wrong*)...
>
> This is an exaggeration of the criticism, but in some cases, not by much. String theorists have spent more than two decades building a community of physicists who firmly believe that they are performing the most important science on the planet, even while achieving not a single bit of evidence to definitively support their version of science as the right one.

Ill-considered recognition of constraints and opportunities of an information-based society

It is extraordinary that it can be argued that science has failed to recognize the implications of the information revolution -- which it helped to enable and from which it variously benefits to a high degree.

This is most evident in enabling the emergence of new insights and their dissemination (as noted above). The constrained process of science is remarkably exemplified by the minimally changing conference format (speaker, panel, audience, questions), dissemination of results (peer-reviewed journals), paywall barriers to publicly funded research, avoidance of enabling visualizations interlinking complementary and mutually challenging arguments, and the like.

There is seemingly little interest in analysis of the process whereby insights are communicated, become a focus of attention, are retained in long-term memory (or framed immediately as forgettable), rejected out of hand, or otherwise forgotten. Despite claiming profound insights into time, meeting processes are typically characterized by claims of "shortage of time".

Missing is any recognition of the manner in which key arguments and conceptual links are effectively "buried" inaccessibly in lengthy text -- despite the development of hypertext links (cf. *Knowledge-Representation in a Computer-Supported Environment*, 1977). The question as yet to be examined is the nature of the product of science -- beyond production of "papers". How are hypotheses, theories, and data best to be presented in the future?

Whilst recognizing the ever increasing challenge of "information overload", science has proved to be unable to consider its implications for the dissemination and use of knowledge -- as well as indifferent to the implications for a global knowledge-based civilization. Given that disciplines are increasingly fragmented, and that capacity to comprehend their insights may require years of study (at a "recognized" institution, at whatever cost), what use is who to make of the product of science and how? How is this factor integrated into the nature of explanations and their potentially incomprehensible complexity -- as in the case of the reflections of physicists on the multidimensional nature of "multiverse" (cf. *Dynamics of Symmetry Group Theorizing: comprehension of psycho-social implication*, 2008).

Whilst emphasis is placed on the emergence of a knowledge-based global civilization, how is the capacity to engender knowledge at an ever-increasing rate then to be understood as engendering ignorance at a similar rate -- through the relative incapacity to engage meaningfully with that knowledge? With respect to fundamental physics alone, the matter has been summarized to some degree by Frank Wilczek (*Enlightenment, Knowledge, Ignorance, Temptation*. 2005). Some strategic implications have been notoriously highlighted by Donald Rumsfeld in his role of US Secretary of Defense (*There are known*

knowns, 2002), as discussed separately (*Unknown Undoing: challenge of incomprehensibility of systemic neglect*, 2008).

It would seem that science assumes that the Theory of Everything -- as the Holy Grail of its explorations -- would be readily communicable throughout a global civilization. Ironically there is even a sense that its transformative insight would constitute the cognitive equivalent of the Big Bang of cosmologists (echoing that of religions). However, even as a "supernova" in the knowledge universe, that enlightenment would take years to reach most sectors of that universe -- which would therefore continue to live in a relatively unenlightened past. There is a further irony to the possibility, as noted above, that ignorance within the knowledge universe corresponds in systemic terms to that of dark matter/energy of the universe of astrophysics (*Global Strategic Implications of the Unsaid: from myth-making towards a wisdom society*, 2003).

As a self-acclaimed exemplar of appropriate behaviour, it might be considered appropriate that science engage with ignorance more appropriately (and respectfully), as it is obliged to engage with dark matter/energy.

Self-referential inadequacy of "metascience"

The rethinking of the process of science of a half-century ago is now being celebrated in the light of the revolutionary insights of Thomas Kuhn (*The Structure of Scientific Revolutions*, 1962). This work, and the debate it instigated, could be understood as a basis of "metascience" -- the theme of a journal of that name, more commonly explored through the disparate fields of science and technology studies, science of science policy, history of science, or philosophy of science. The state of progress of "metascience" is implied by the journal's recent review of the compilation by Seymour Mauskopf and Tad Schmaltz (*Integrating History and Philosophy of Science: problems and prospects*, 2012) by Samuel Schindler (*History and Philosophy of Science: coherent programme at last?*, *Metascience*, 2012).

Where is the organization of the sciences and mathematics, appropriate both to their complexity and their connectivity, as suggested by the periodic table of elements, the many approaches to its representation, and to its implications for cognition (*Towards a Periodic Table of Ways of Knowing -- in the light of metaphors of mathematics*, 2009)? Could the elements so organized be indicative of doors to an array of universes -- within a multiverse (as indicated in the main paper)?

In the absence of such considerations, "science" could indeed be seen as fundamentally "non-scientific". It does not have an understanding of the scientific revolutions, through which it evolves, in terms of relevant tools such as system dynamics and complexity theory. With respect to its inadequacies, it is indeed its own metaphor. Given Sheldrake's recent critique (*The Science Delusion: freeing the spirit of enquiry*, 2012), and the additional factors offered above, it is appropriate to ask whether the ongoing debate offers a systemic perspective on the processes of science in its framing of the knowledge universe.

Applying its own processes to itself, to what extent is science adequately self-referential in the light of current insights into the second order cybernetics of human knowing (cf. *Cybernetics and Human Knowing: a journal of second order cybernetics, autopoiesis and cyber-semiotics*; European Society for the Study of Cognitive Systems)? To what extent is the approach of "science" adequate to comprehension of its role with respect to the challenge of the times (cf. *Mapping Paralysis and Tokenism in the Face of Potential Global Disaster: why nobody is about to do anything effective and what one might do about it*, 2011; *Mind Map of Global Civilizational Collapse: why nothing is happening in response to global challenges*, 2011)? **If science is unable to understand how it is part of the problem, is it capable of understanding the nature of the solution required?**

As an example, what insights does "metascience" offer into the process of science whereby the famed editor of *Nature*, John Maddox (Fellow of the Royal Society), described an earlier work of Sheldrake (*A New Science of Life: the hypothesis of morphic resonance*, 1982) under the title "*A book for burning?*".

Consistently Maddox elaborated his position a decade later: *Sheldrake is putting forward magic instead of science, and that can be condemned, in exactly the language that the popes used to condemn Galileo, and for the same reasons: it is heresy*. (BBC Documentary, 1994).

Is this not remarkably suggestive of a corruption of science corresponding to that of official religion, which affirmed that death by burning at the stake be the official punishment for heresy -- a practice it meted out on another pioneer of astrophysics, Giordano Bruno? What proportion of "scientists" would unquestioningly support the (metaphorical) burning of Sheldrake at the stake they uphold -- as stakeholders of the scientific "flavour of the month"? What proportion of would welcome any institutional obligation on Sheldrake to "recant", or to ensure the banning of the dissemination of his views -- as occurred with Galileo? To what extent does "metascience" take the form of "inquisition" in its blinkered selectivity (cf. *End of Science: the death knell as sounded by the Royal Society*, 1998) ?

As a self-acclaimed exemplar of appropriate behaviour, is it useful to see authoritative science as engaged in game-playing to be fruitfully compared with the traditional fair-ground confidence trickery of "find the lady" -- in this case the "lady" being science itself. With highly principled religions and political ideologies, a form of definitional game-playing is used to ensure that outsiders are confused in their efforts to define science (and attribute irresponsibility and blame to it appropriately). Every detected inadequacy is held to be "not-science" -- science necessarily always wins that game, as with religions and political ideologies.

NB: Additional references are listed in the main paper (*Being a Poem in the Making: engendering a multiverse through musing*, 2012)

x

What of the science of today will be deprecated and mocked with laughter in the world of tomorrow?

References

Samuel Arbesman. The Half-Life of Facts: why everything we know has an expiration date. Current, 2012 [summary]

Jeremy J. Baumberg. The Secret Life of Science. Princeton, 2018

Julien Benda:

- La Trahison des Clercs. 1927
- The Betrayal of the Intellectuals. 1955
- The Treason of the Intellectuals. 2006

David Bohm. Wholeness and the Implicate Order. Routledge, 1980

William Broad and Nicholas Wade. Betrayers of the Truth: fraud and deceit in the Halls of Science. Simon and Schuster, 1982

Mario Bunge. Kinds and Criteria of Scientific Laws. *Philosophy of Science*, 28, 1961, 3, pp. 260-281 [text]

Norman Campbell. The Foundations of Science. 1920

Richard Dawkins. The God Delusion. Mariner Books, 2006

Terrence W. Deacon:

- Incomplete Nature: how mind emerged from matter. W. W. Norton, 2012
- The Symbolic Species: the co-evolution of language and the brain. W. W. Norton, 1997

Paul Feyerabend:

- Against Method: outline of an anarchistic theory of knowledge. Verso, 1975
- Farewell to Reason. Verso, 1987
- Conquest of Abundance: a tale of abstraction versus the richness of being. University of Chicago Press, 1999

Joshua Gilder and Anne-Lee Gilder. Heavenly Intrigue: Johannes Kepler, Tycho Brahe, and the murder behind one of history's greatest scientific discoveries. Doubleday, 2004

Marcelo Gleiser. The Island of Knowledge: the limits of science and the search for meaning. Basic Books, 2014

Susantha Goonatilake. Toward a Global Science: mining civilizational knowledge. Indiana University Press, 1999

Richard F. Haglund, Jr. Is There a Cure for Authoritarianism in Science? Maxwell Institute, Brigham Young University [text]

Jonathan Haidt. The Righteous Mind: why good people are divided by politics and religion. Allen Lane, 2012

Hal Hellman:

- Great Feuds in Science: ten of the liveliest disputes ever. Wiley, 1998
- Great Feuds in Mathematics: ten of the liveliest disputes ever. Wiley, 2006
- Great Feuds in Technology: ten of the liveliest disputes ever. Wiley, 2004

Tony Hey and Patrick Walters. Einstein's Mirror. Cambridge University Press, 1997

Adam Huttner-Koros. The Hidden Bias of Science's Universal Language. *The Atlantic*, 21 August 2015 [text]

Erich Jantsch. Towards interdisciplinarity and transdisciplinarity in education and innovation. In: Centre for Educational Research and Innovation. Interdisciplinarity; problems of teaching and research in universities. Paris, OECD, 1972.

Andrew Zimmerman Jones and Daniel Robbins. String Theory For Dummies. For Dummies, 2009

Thomas Kuhn. The Structure of Scientific Revolutions. University of Chicago Press, 1962

George Lakoff and Rafael Núñez. Where Mathematics Comes From: how the embodied mind brings mathematics into being. Basic Books, 2000

Joel Levy. Scientific Feuds: from Galileo to the Human Genome Project. New Holland, 2010

Gerald Markowitz and David Rosner. Deceit and Denial: the deadly politics of industrial pollution. University of California Press, 2003

Seymour Mauskopf and Tad Schmaltz (Eds.). Integrating History and Philosophy of Science: problems and prospects. Springer, 2012

Thomas O. McGarity and Wendy E. Wagne. Bending Science: how special interests corrupt public health research. Harvard University Press, 2012

David Michaels. Doubt is Their Product: how industry's assault on science threatens your health. Oxford University Press, 2008

Chris Mooney. The Science of Why We Don't Believe Science. Mother Jones, May/June 2011 [text]

Gareth Morgan. The Art of Science: pure and applied genius. Matador, 2014

Naomi Oreskes and Erik M. Conway. Merchants of Doubt: how a handful of scientists obscured the truth on

issues from tobacco smoke to global warming. Bloomsbury Press, 2010

Stephen Prothero. God Is Not One: the eight rival religions that run the world -- and why their differences matter. HarperOne, 2011

Nicholas Rescher:

- The Limits of Science. University of Pittsburgh Press, 1999
- The Strife of Systems: an essay on the grounds and implications of philosophical diversity. University of Pittsburgh Press, 1985
- Finitude: a study of cognitive limits and limitations. Ontos, 2010
- Unknowability. Lexington Books, 2009.

John Ralston Saul. The Unconscious Civilization. Free Press, 1995

Samuel Schindler. History and Philosophy of Science: coherent programme at last? *Metascience*, 2012

Erwin Schrödinger. Nature and the Greeks. Cambridge University Press, 1954

Rupert Sheldrake:

- Science Set Free: 10 paths to new discovery. Random House, 2012
- The Science Delusion: freeing the spirit of enquiry. Coronet, 2012
- A New Science of Life: the hypothesis of formative causation. J P Tarcher, 1981
- A New Science of Life: the hypothesis of morphic resonance. Park Street Press, 1995
- Morphic Resonance: the nature of formative causation. Park Street Press, 2009

John M. Smart. The Transcension Hypothesis: sufficiently advanced civilizations invariably leave our universe, and implications for METI and SETI. *Acta Astronautica*, 78, September-October 2012, pp. 55-68 [text]

Nassim Nicholas Taleb. The Black Swan: The Impact of the Highly Improbable. Random House, 2007

David Rains Wallace. The Bonehunters' Revenge: dinosaurs, greed, and the greatest scientific feud of the Gilded Age. Mariner Books, 1999

Anders Wijkman and Johan Rockström. Bankrupting Nature: denying our planetary boundaries. Routledge, 2012

Frank Wilczek. Enlightenment, Knowledge, Ignorance, Temptation. 2005 [text]

Freda A. Wynn. Alternative Realities / The Multiverse: a metaphysical conundrum. Georgia State University, 2006 [text]

Noson S. Yanofsky. The Outer Limits of Reason: what science, mathematics, and logic cannot tell us. MIT Press, 2013 [summary]

Arthur M. Young:

- The Third Derivative: errors and misconceptions of science. In: Mathematics, Physics and Reality, Anodos Foundation, 1990
- Geometry of Meaning. Delacorte Press, 1976