

## Post-Normal Science: Our Future

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With its defining slogan, 'Facts Uncertain, Values in Dispute...', Post-Normal Science challenges our comfortable beliefs. So many universally acknowledged truths about science must now be unlearned, and quickly. At the time of the first announcement of PNS, only a few could appreciate its radical message. But with the Covid pandemic, traditional certainties about 'Science Experts Speaking Truth to Power' are gone. This is the age of the Posts. PNS announces the problem, and opens the way to a solution. The stakes are truly high; without Trust, both within and about science, its future would be very different from anything that we have hitherto wished to imagine.

Can PNS provide an understanding of science which is appropriate to these perilous times? So far, the signs are encouraging. There has been a steady growth in interest among people concerned with science, and of scholars who are deepening our understanding of science and indeed of PNS itself. The maturing of PNS can be traced through the collections of essays over the last ten years. Now, with this present volume, we can say that there is really a School of PNS. Senior scholars are joined by newcomers, all addressing problems in the spirit of PNS without needing doctrines or factions. And those in the field doing Citizen Science in the PNS way, creating new understandings of the Extended Peer Community, are providing an inspiring example of how science itself can be transformed.

With this secure foundation I can consider some very basic questions that, as one of the founders of this movement, I should sooner or later confront. The first is, **have we really made a difference?** Then, **what can we do to ensure the continued survival of the PNS insight through the next phase of science's evolution?**

The first question is easy. By now, **PNS and its slogan are a meme**. We frequently see the name, and the slogan in whole or part, quoted without a citation. Sometimes it actually appears correctly! We also see arguments that depend on PNS, but where it is not mentioned. So PNS is still '**uncomfortable knowledge**', which under present conditions is not such a bad thing. We know, from contacts over the decades, that PNS has been a source of illumination, and of liberation, for scientists who privately wondered whether there was something wrong with them in their recognition of uncertainty and quality. Now, publicly at the community and society levels, PNS serves to nudge consciousness along, towards acceptance of the new social realities of science.

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An understanding the new realities is crucial for ensuring that PNS will last. The problem that Silvio and I faced 30 years ago is no longer the most salient. Then we saw an implicit dogmatism in policy related science, the assumption that numerical solutions, applied by certified experts, would banish scientific uncertainties and value disputes. It was most clearly exemplified in the ‘probabilistic risk assessment’ studies of the American civil nuclear power installations. These uniformly produced a result of a one in a million chance of a disaster. Although the meaning of such a quantitative statement was never made precise, it was widely accepted to have been refuted by the meltdown at Three Mile Island. The triumph of ‘atoms for peace’ which was hoped to sanitise The Bomb, was mocked as being just another Mickey Mouse gadget. Nuclear power instantly became a zombie technology, where it remains in spite of the never-ending attempts at resuscitation. In the light of that epochal experience, Silvio and I decided then, in the early 1980s, to explore a new scientific-philosophical problem: how could the mathematical experts possibly get it so wrong? Rejecting the prevailing faith in numbers as nuggets of truth, we first created NUSAP<sup>i</sup>, and then its generalisation to PNS.

Now the social reality of policy-related science is very different. Although we still have a superabundance of mathematical simulations, they are being openly challenged on many fronts. The inherited universal assumption of the infallibility and beneficence of mathematical methods is now a relic of past faiths. Furthermore, we now have a situation where significant sections of the world’s populations openly, even militantly, reject the scientific consensus on crucial policy issues. To express this new situation, I am tempted to modify the basic PNS mantra in a way suggested by Steve Rayner. He wanted to replace “facts uncertain“ by “facts contested“. For on issues like Covid-19, we now have two competing universes of fact, which are sometimes closely correlated with related conflicting universes of value. Accusations of low-quality science, even of malpractice, are routinely exchanged. Those who are reading this text might very well say that Our universe is obviously good and true, while the Other is notoriously malign and false. But as a statement of a political situation, we must acknowledge that there are two such hostile universes in play. This total polarisation is already producing grave consequences in the United States. There may be other, less publicised situations, where the polarisation of the polity is equally threatening. **Can PNS make a contribution to resolving this dangerous situation?** If not, it will soon have outlived its usefulness, and with the ageing of its proponents it will decline into irrelevance. This is, after all, the fate of most popular insights about the world.

The question for me is whether the core insight of PNS is sufficiently deep and coherent, for the heuristic to survive the inevitable additions, modifications, and re-interpretations that come with adapting to a new reality. I should say that this happens to be the way it works out in science. I discussed this at length in my first book<sup>ii</sup>. My work as a historian had shown me that scientific concepts are heavily modified, indeed transformed, as they work their way back from the research front to application and teaching. For an example, just search for ‘F=ma’ in Newton’s *Principia*. Those scientific ideas that survive this evolutionary process, and they are of course a minority, will be smoothed over in various ways, so as to be useful in their new contexts. The same sorts of processes apply to conceptual advances, as in the humanities and social sciences. PNS will be no exception.

The process of enrichment of PNS actually began very early. From our contact with colleagues in Ecological Economics, we became aware of the importance of complexity. Of course, we did not join the effort to reduce complexity to a standard simplistic methodology. For a time, I even wondered whether in the rainbow quadrant diagram, we should replace “systems uncertainties“ by “systems complexity”<sup>iii</sup>. I discussed it with Silvio, and we agreed that we should wait until the theory was more socially robust, before starting to tinker with it. But now it is safe to do so; and we imagine complexity in the sense of H. Atlan<sup>iv</sup>, as a situation where there is no privileged perspective. Awareness of this concept opens the way to a much enriched heuristic, of the sort that I have developed with Ariane Koenig in ‘Transformative Sustainability Science’<sup>v</sup>. There we start with ‘contingency’ (the particularity of any real situation that is encountered in action), then ‘uncertainty’ and ‘complexity’, then ‘contradiction’ (in the sense of problems, or challenges, that cannot be solved within the existing paradigm), and finally ‘compassion’. This last might seem to be a very odd element to include in a vision for science, and paradoxically I find it the most promising way forward for PNS. By ‘compassion’ I do not mean becoming personally emotional about suffering wherever it is discovered; rather it is an awareness that Others, however repellent their views, are sentient, striving beings like myself, who also have their Story.

For me the new challenge for PNS is summed up in a single word, that was used by the eminent American liberal economist Paul Krugman. It is the key element of his analysis of the Climate Change issue. This is organised around his review of an account of the Climate Change disputes that was written by a controversial participant, both in the science and in the disputes, Michael Mann. Accepting as simply true all of Mann’s descriptions of the misdeeds of his adversaries, Krugman reflects on how it can possibly be that people reject the plain scientific truths of Carbon-based anthropogenic catastrophic climate change. Reviewing the possibilities, he concludes that such people are simply ‘depraved’<sup>vi</sup>. Thus, something like half of Krugman’s fellow Americans are consigned to a status where citizenship is inappropriate, because of a scientific dispute. This way lies anarchy or worse, all in the name of Science.

For averting this outcome, it seems to me that Post-Normal Science offers the only coherent perspective that we have just now. We must recognise the presence of systemic, indeed official suppression of dissent, which employs the labels of ‘denial’ and ‘misinformation’. There is one notorious case, where Facebook secretly censored items about the ‘leaky lab’ of Wuhan; it became public when that particular conspiracy-theory turned out to be quite credible<sup>2</sup>. A crucial source for this intolerance is the inherited infallibilistic philosophy of science, descended from Galileo and Descartes. We see it in traditional science education: how many years of dogmatic instruction must a student endure, before being entrusted with the knowledge that scientists can sometimes disagree or err? Where is there a science exam with questions like, ‘Critically evaluate...’

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<sup>2</sup> <https://www.wsj.com › articles › facebook-lab-leak-about-face-11622154198>

or ‘Compare and contrast...’? In spite of all the propaganda about science being exploratory and open to debate, with citations from Popper and Feynman, the lived reality of students and researchers is totally different. Only if we start with “Facts uncertain...” and proceed through complexity to compassion, can we rescue science from being enlisted as a tool for enforced conformity.

Is there now an existing theme, **or meme**, around which we can shape and express this enriched, matured understanding of Post-Normal Science? I would suggest ‘**Nonviolence**’. Although it has been extant for some time, and actually motivates some of the most important progressive and idealistic campaigns of our age, it has not yet connected with science except on the far margins<sup>3</sup>. By default, Science, as a symbol or institution, presents no alternative to violence at the institutional or personal level. Interestingly, workers in hi-tech industries now routinely employ activism to protest at unethical practices by their employers. By contrast, campaigns within science have so far focused on practical issues like costs of publication. If nonviolence were to be taken seriously as guidance for behaviour as well as strategy in science, much positive change could be accomplished. The Quakers have a basic principle, “Think it possible that you may be mistaken”<sup>4</sup>. This is the regular, constant experience of anyone engaged in real science as opposed to production-line puzzle-solving; it is only in the official ideology that scientific error is suppressed. There is a corollary to this principle of error: “Inconceivable as it seems at the moment, your adversary might well be right!” Such considerations can lead to the restoration, in science as in the broader society, of civility and tolerance in discourse and debate. Expressed in that way, “Facts uncertain...” is not only a challenge to a dysfunctional inherited faith in a simplistic scientific truth, but is also a guide to a healthy, sane future for science.

Our collection of essays also does full justice to the core of PNS in action, the Extended Peer Community. There is a fruitful ambiguity here; are we referring to a ‘peer community’ that has somehow been extended, or to a new sort of community, that of ‘extended peers’? The concept is based on a recognition of the contingency and complexity of the real world, and the presence of contrasting, even conflicting perspectives of fact and value among participants. As the examples in this volume have shown, the Extended Peer Community can indeed be effective, when it is based on mutual respect and appreciation of one’s own limitations – in a word, compassion. This practical realisation of nonviolence may yet be the most important contribution of PNS to the future world of science.

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<sup>3</sup> Ravetz, J. Towards a non-violent discourse in science. In B.Klein Goldewijk and G.Frerks, *New Challenges to Human Security: Empowering Alternative Discourses*. Wageningen 2006. [core.ac.uk/display/104029784](http://core.ac.uk/display/104029784).

<sup>4</sup> <https://qfp.quaker.org.uk> › passage › 1-02.