



Pergamon

Futures 31 (1999) 641–646

---

---

**FUTURES**

---

---

www.elsevier.com/locate/futures

Editorial

## Post-Normal Science—an insight now maturing

Jerome Ravetz, Silvio Funtowicz\*

The concept of Post-Normal Science has evolved continuously since the first presentation of its characteristic diagram, some sixteen years ago [1], in response to the changing contexts in science and in society. At first it was conceived in relation to a growing awareness of the pathologies of the industrial system. Its tasks were described as cleanup and survival; and its flavour was that of enlarged participation rather than protest. But as scientific research has increasingly been harnessed to industry or government, the emergence of well defined runaway technologies [2] has given a new urgency, and a new focus, to its critical insights. Public participation in decision-making on science-related issues is now fashionable. Post-Normal Science shows why it is necessary, not merely for political justice, but also for the quality of the decisions themselves. The new issues are complex, and the knowledge involved in them is also complex; and common understanding has not yet caught up with this fundamental aspect of Post-Normal Science.

The threats of unknown, irreversible and potentially dangerous developments in the technologies of information, notably biological but also electronic, have finally brought home the message that science must join the polity. The historic mission of European science, the reduction of complex whole systems to their simple atomic elements, is finally becoming understood as the production of the tools of technological power without the means of societal control. Hence the traditional claims to truth and virtue made for science can no longer protect it from the checks and balances that are applied to all other societal institutions. What important area of scientific progress is immune from problems of uncertainty and value-conflict? That is the measure in which all of science has become post-normal.

From the beginning, the message of Post-Normal Science was inescapably radical. By emphasising the uncertainties and value loading of policy-related science, it implicitly contradicted centuries of conventional wisdom for science, in which uncertainty was tamed, ignorance suppressed, and the supposedly value-free character of

---

\*Silvio Funtowicz is at the EC Joint Research Centre: Institute for Systems, Informatics and Safety (ISIS), 1-21020 ISPRA (Va) Italy. E-mail: [silvio.funtowicz@jrc.it](mailto:silvio.funtowicz@jrc.it)

Jerome R. Ravetz is a longstanding contributor to *Futures*, and co-author, with Silvio Funtowicz, of numerous publications on Post-Normal Science. He may be contacted at 196 Clarence Gate Gardens, London NW1 6AU. E-mail: [jrravetz@compuserve.com](mailto:jrravetz@compuserve.com)

science proclaimed as a great value. It subverts the ‘boundary-work’ of scientists in the policy domain, whereby they have established a monopoly of expertise on policy problems with a technical component.

In calling for extended peer communities, with their ‘extended facts’, Post-Normal Science legitimates the introduction of a plurality of knowledge (e.g., ‘housewives’ epidemiology’ and even the injection of ethical and spiritual considerations) into policy debates. Its focus on the quality of the processes instead of the universal truth of the results reconciles science with current societal trends on participation and locality. In this way, Post-Normal Science has become a liberating insight for many. It has given a name to their feeling that the terms of policy debate had been biased by the presumption that anything ‘scientific’ must be free of uncertainty, independent of values, and the exclusive possession of a technocratic elite.

Earlier movements critical of science were hampered by the contradiction that science seemed overwhelmingly and essentially beneficial. Criticisms on any but the narrowest of fronts were easily dismissed as ‘Luddism’ or ‘anti-science’. However broadly based the objections to nuclear weapons, or to civil nuclear power, or to particular forms of pollution, it was politically impossible for them to raise the question of whether science itself has to be reformed. The simple answer was that science ‘worked’, in delivering a consumers’ version of ‘the good life’ in ever increasing measure. Only now can the systematic questions be raised. All work done in the name of science, be it research, development or policy advice, is selected, shaped, applied or inhibited, interpreted, and revealed or concealed; now we can ask, for whose benefit is this done?

Although Post-Normal Science exposes and clarifies the political dimension of specific practice, it is not reducible to politics, any more than the writings of a committed author are merely propaganda. Its foundation lies in an analysis of science in this new age, when the dreams of the prophets of science are becoming true and are in part turning into nightmares. Its political messages are derived as the conclusions of its philosophical critique. Their relation to campaigns about science and its applications, present and future are those of general guidance and legitimation. Post-Normal Science is an insight, enhancing understanding for both research and action. There are sorts of action that we consider contrary to its spirit and intent, for it is not a bland, all-encompassing uplift. But there is no monopoly of true interpretations of Post-Normal Science; that would be contrary to its message.

As Post-Normal Science develops, and its concepts are refined through discussion and experience, it is likely that differing interpretations will emerge. There may arise along traditional lines, as between scholars and activists, or between reformers and radicals. For example, Post-Normal Science as it has developed up to now is an insight rather than a theory. Although the insight has been explained and articulated at reasonable length, its authors recognise that it is only one partial glimpse into a complex reality. It justifies itself by its usefulness in helping people to understand and manage their problems; and in the measure that it is successful it can expect to become absorbed into common sense and to lose its salience. When, eventually, no one expects ‘applied science’ to entail all policy conclusions, then the threefold distinction loses interest.

This conception of Post-Normal Science fits with the social location of its authors, operating as individuals and diffusing their ideas through writing. Others have established academic positions, and they can both diffuse and develop Post-Normal Science through teaching and research. They naturally tend towards establishing PhD programmes and the other apparatus of university work. Is this building a ‘normal’ Post-Normal Science? Is such a term an oxymoron? Such tension between the prophetic conception of the founders of a movement and the priestly conception of the consolidators is universal. Within Post-Normal Science we would hope to make it fruitful, by employing the insights developed in Post-Normal Science itself.

Another possible fault-line relates to the political functions of Post-Normal Science. This can be seen through consideration of the place of ‘applied science’, actually a form of ‘normal science’, within the post-normal scheme. We do not believe that science-related issues can or should be resolved solely through political negotiations; they necessarily have a scientific input to their resolution. Agreement requires a harmonisation of values, and a bounding of uncertainty. Does this mean that in the last resort ‘applied science’ should become the arbiter? In that case, Post-Normal Science could be seen as merely an early phase of a process of normalisation of dissent; and its radical implications could be neutralised without difficulty. (We are grateful to Jeff Howard for this analysis.) Our present response to this possible contradiction is to recall that under post-normal conditions, ‘applied science’ is not ‘normal’ in Kuhn’s sense. That is, it is not conducted within unquestioned and unquestionable frameworks, or paradigms. Rather, the quality of its products, and indeed its processes, will be assessed self-consciously by the scientists themselves, in dialogue with the extended peer community. Whether this enriched conception would be sufficient to prevent future conflicts within the Post-Normal Science community, only time will tell.

Those problems are a sample of what we expect and hope to encounter as Post-Normal Science develops. Without dialogue and debate among friends and critics, it would become a mere curiosity. And since its scope is so broad, it needs the widest possible circle of people for its growth. The essays in this present collection provide a good indication of the breadth of the concerns that are animated by Post-Normal Science. This is the first time that so many authors have been brought together to reflect on how Post-Normal Science has influenced their thinking, and also on how their own experience enriches Post-Normal Science itself. Their themes in these essays range over political theory, governance, systems ecology, philosophy and social theory. We intend that this is just a first instalment in a series that will grow and bear fruit.

The contents of this issue of *Futures* can be seen as marking the completion of a phase of the maturing of Post-Normal Science. For its first seven years, it was known only to a few [1]; then it was effectively launched at an important conference in 1990 [3]. There followed a series of papers, mostly written in response to invitations for conferences or collections. The most significant of these are listed below [4–15]. Being an insight rather than a theory, Post-Normal Science allows different aspects to be emphasised as the occasion suggests, and as our own understanding develops.

The leading essay here provides a brief, in some ways elementary introduction to the insight. It is designed to display to readers of this journal that the idea is both reasonable and practicable. How should we react to the phenomenon that the elements of Post-Normal Science are being realised in all sorts of places by all sorts of people, without any apparent influence from ourselves? Does this mean that our work has already become redundant, and that we are only bobbing on a wave that is rising quite nicely without us? That is one possible interpretation. The other is that all this independent ‘discovery’, or better, realisation, shows that this is an idea for which the time is quite ripe. We believe that our insight has a structure and a conceptual clarity that enables it to explain and unify these various endeavours. To the extent that it is useful in that regard, our work will have been worthwhile.

A most important task in the articulation of Post-Normal Science is locating it in its context in contemporary social theory of industrial society. This is accomplished by Stephen Healy. Focusing on the crucial role of trust, he shows how the extended peer communities are necessary for its cultivation by new means. In this he also relates Post-Normal Science to leading currents in the social theory of risks, as advanced notably by Giddens and Beck. With their concepts of ‘sub-politics’ (Beck) and ‘multilayered democratic participation, (Giddens) they can be seen as moving in the same direction, although they do not fully appreciate the role of extended peer communities and their extended facts.

A complementary perspective is offered by James Kay and his colleagues, who arrived at Post-Normal Science through thermodynamics and systems ecology. Their work can be seen as providing an appropriate coherent vision of the natural and social worlds, for the grounding of Post-Normal Science. Their concept of Self Organizing Holistic Open systems provides sufficient richness in structure and action for uncertainties and value-loadings to be comprehended and managed. They also make it plain why linear causal systems cannot possibly provide a conceptual framework for successful management of complex systems. The way forward lies in the post-normal style of adaptive management, where the scientists provide narratives rather than predictions, and participate as equals with the others.

The Post-Normal Science perspective is applied to contemporary problems by Bruna de Marchi and Ravetz, on the theme of risk and governance. They have a historical progression of issues, starting with the ‘Seveso’ accident involving the release of dioxin, then analysing the BSE disaster, and finally considering an early episode in the battle over Genetically Modified organisms in the food chain. The progression shows how risks have evolved and can now be managed only through the post-normal approach. For in the case of GM foods, the risks are (as yet) purely hypothetical, so systems uncertainties are very high. But the consequences of unwanted effects can be so severe, and public concern in the UK and Europe generally is so acute, that we have here a classic case of high decision stakes. The implications for governance have already been accepted in some important quarters; and the official experts have no choice but to dialogue with an extended peer community.

An original perspective on Post-Normal Science is offered by Fred Luks: rhetoric. Part of the work of dialogue with an extended peer community is expanding the language of the discourse beyond the technicalities of normal science. Developing

his argument from debates in the field of economics, Fred Luks shows how the construction of an ‘external rhetoric’ is an integral part of the enterprise. To do this well requires a reflexive awareness of the rhetorical aspects of scientific language, and an understanding of the real boundaries between scientific analysis and political action.

Another theoretical perspective is offered by Sylvia Tognetti, in her exploration of the relations between the seminal ideas of Gregory Bateson and the insights of Post-Normal Science. When Bateson wrote (from the 1930s onwards), the positivistic conceptions of science and knowledge were so dominant that he had little opportunity for dialogue for the development of his ideas. But he had a vision of a science for which there was ‘as yet no satisfactory name’. For example, he saw how ‘abduction’, constructing knowledge from consistencies in the evidence from multiple sources, is a fundamental process in human thought. He also identified ‘deutero-learning’, that is, being aware of the context of the original topic, as essential for true understanding. And, very close to the insight of complex systems theory about the plurality of legitimate perspectives, he expressed the rule, ‘two perspectives are better than one’. Bateson’s best known concept is that of ‘double bind’ (determination of behaviour by considerations that are no longer relevant); and given the recognition of complexity, of inherent uncertainties and of the involvement of researchers, it could well be said that in the policy process normal science suffers from a multiplicity of double-binds.

Finally, Martin O’Connor reminds us of the absolute necessity for the inclusion of the social, the dialogic and also the poetic elements in any genuine practice of science. He articulates a framework of epistemological/ethical stances, where the “Laplacian reconciliation, Cartesian epistemology, and Domination ethic” are contrasted with, respectively, the “Dialogic, Complexity, and Hospitality”. Basing his analysis on the work of Serge Latouche about being-in-society, he provides a set of entries in the “philosophical dictionary of everyday life”. These include “inter-subjectivity”, “irreducible pluralism”, “an ironical use of axiomatic reasoning”, and “the dialogical nature of social knowledge”. Finally, in developing the “hospitality ethic”, O’Connor describes the Japanese ‘renku’ verse, where each poet adds a line and then invites his friend to do so, producing an interplay of autonomy and creation. All this provides insights for the harmonious reconciliation of diverse points of view, so essential for the processes of Post-Normal Science.

## References

- [1] Three types of risk assessment: a methodological analysis, in: C. Whipple, V.T. Covello (Eds.), *Risk Analysis in the Private Sector*, Plenum, New York, 1985, pp. 217–232.
- [2] *Scientific Knowledge and its Social Problems*. Oxford University Press, 1971; Transaction, New Brunswick NJ, 1995, p. 53.
- [3] A new scientific methodology for global environmental issues, In: R. Costanza (Ed.), *The Ecological Economics*, Columbia University Press, New York, 1991, pp. 137–152.
- [4] Three types of risk assessment and the emergence of post-normal science, In: D. Golding, S. Krimsky (Eds.), *Social Theories of Risk*, Greenwood Press, New York, 1992, pp. 251–273.

- [5] The emergence of post-normal science, in: R. von Schomberg (Ed.), *Science, Politics and Morality*, Kluwer, Dordrecht, 1992, pp. 85–123.
- [6] The worth of a songbird: ecological economics as a post-normal science, *Ecological Economics* 10(3) (1994) 197–207.
- [7] Uncertainty, complexity and post-normal science, *Environmental Toxicology and Chemistry* 13(12) (1994) 1881–1885.
- [8] Emergent complexity and procedural rationality: post-normal science for sustainability, with M. O'Connor, S. Faucheux, G. Froger, G. Munda, in: R. Costanza, O. Segura (Eds.), *Getting Down to Earth*, Island Press, Washington, DC, 1996, pp. 223–248.
- [9] Risk management, post-normal science, and extended-peer communities, in: C. Hood, D.K.C. Jones (Eds.), *Accident and Design*, UCL Press, London, 1996, pp. 172–181.
- [10] Emergent complexity and ecological economics, with M. O'Connor, in: J. van den Bergh, J. van der Straaten (Eds.), *Economy and Ecosystems in Change*, Edward Elgar, Cheltenham, 1997, pp. 75–95.
- [11] The passage from entropy to thermodynamic indeterminacy: long-term principles for sustainability, with Martin O'Connor, in: K. Mayumi, J.M. Gowdy (Eds.), *Bioeconomics and Sustainability: Essays in Honour of Nicholas Georgescu-Roegen*, Edward Elgar, Cheltenham, forthcoming.
- [12] The good, the true and the post-modern, *Futures* 1992;24(10):963–974.
- [13] Science for the post-normal age, *Futures* 1993;25(7):735–755.
- [14] Emergent complex systems, *Futures*, 1994;26(6):568–582.
- [15] The poetry of thermodynamics, *Futures*, 1997;29(9):791–810.