CHAPTER

The Dream of Reason brings forth Monsters: Science and Social Progress in an Era of Risk

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"The dream of reason produces monsters" is the title of an etching by Goya. It captures the general sense of disappointment during the early decades of 19th-century Europe at the failure of the liberal Enlightenment to produce a more just and open society. How was it that a cultural, political and social movement based upon the values of liberty and rational enquiry could bequeath the opposite: a return to authoritarian dogma and an atavistic attachment to those fundamentalist urges – "monsters" – which continued to thwart the dreams of reason?

This paradox remains just as resonant today. The novelist, Malcolm Bradbury, in perhaps his best-known work, *The History Man* (1975), demonstrated the fragility of liberal ideals to the onslaught of dedicated dogma, in this case the relentless ratiocination of 1970s Marxism. His final novel, *To The Hermitage* (Bradbury, 2001) ironically contrasted the liberalisation brought to the Russian court of Catherine the Great by the values of the French Enlightenment with the relentless political correctness of 21st-century Scandinavia, itself a potential constraint on the freedom of thought and action which would not be altogether unfamiliar to the inhabitants of Tsarist Russia.

In our recent history, we have come to recognize that these issues are more than a source of comic irony for contemporary novelists. The terrorist attacks of September 11th 2001 on New York and Washington have brought into sharp focus in a very pertinent way how the dream of reason can indeed bring forth monsters. Now more than ever it appears difficult to argue the case for the Enlightenment, namely that the growth of knowledge results in social progress. Instead, in recent years, anti-Enlightenment sentiments appear to

have been on the increase. If anything we have succumbed to a lack of faith in the notion of social progress and a suspicion amounting to an assertion that the growth of knowledge does not guarantee human happiness – rather the reverse. An increasing proportion of the population seems to distrust rational enquiry to establish both the facts and the uncertainties; rather they prefer their instincts, or even to celebrate anti-intellectualism.

In this paper I want to offer some thoughts on how this state of affairs has arisen. But I also want to re-enforce another Enlightenment principle: the unity of knowledge. Indeed, I want to argue that the increasing fragmentation of knowledge is acting as a hindrance to not only the public understanding of science, but also the scientists' understanding of the public. And with this has come the decline in public trust of all kinds of expert knowledge. In doing so I am reminded of the character in the novel *Atomised* by that enfant terrible of modern French fiction, Michel Houellebecq (2001), who, in an unconscious echo of the United Kingdom's 2001 Research Assessment Exercise (HEFCE, 2001), commented: "I am no longer an active researcher... maybe that's why I am starting to think of metaphysical questions late in the day"

ENLIGHTENMENT AND BEYOND

It is important to recall that both natural science, in its modern form, and social science are products of the European Enlightenment and have, from the 18th century onwards, shared both a common purpose and a core set of values – a deep attachment to rational enquiry, a relentless search for law-like generalisations and a strong commitment to the perfectibility of society. Scratch the surface of any researcher, whether in the natural sciences, the social sciences or the arts and humanities, therefore, and you will find a deeply held belief in social progress through the acquisition of knowledge. But, from the middle of the 19th century onwards, the various disciplines have diverged, not only through a necessary division of labour as the sum total of knowledge has expanded, but through the adoption of differing methodologies, divergent forms of organisation and, perhaps most important of all, different kinds of intellectual discourse.

Traditional disciplinary boundaries are not the only cause of the problem, however. There are also underlying conceptual obstacles. For example, it is a commonly held view within the natural scientific community that basic science proceeds through a wholly innate process of scientific discovery. Such discoveries are then translated into various forms of technological change and it is these changes in technology which provide the motor for social and economic progress. This does, of course, contain a simple truth: science does indeed change the world, as the history of the 20th century only too clearly

demonstrates. But science alone does not change society: the history of the 20th century equally demonstrates that society can have a considerable impact on the nature of scientific activity. However, as soon as the natural scientific community has convinced itself that scientific progress is an external force acting on society, then there is the danger that it will regard society itself, in the sense of a wider public, as a mischievous irrelevance, something which hinders the untrammelled pursuit of scientific progress.

This in turn becomes both a cause and a consequence of a particular kind of scientific thinking. For example, the official credo of natural science comprises a "linear-additive" model of knowledge – that is, a positivist world of rational enquiry in which knowledge accumulates in a linear fashion by the progressive discovery of invariant laws of Nature. The whole process is tightly disciplined by rules of evidence. In this process, mathematics and logic are epistemologically privileged – that is, they raise the quality of the knowledge produced by scientific method above that produced by other methods – for example, intuition, religion, magic, witchcraft or metaphysics. In an idealized Newtonian world it was, therefore, possible to conceive of science as eliminating ignorance in this fashion. Eventually, all the laws of Nature would be discovered and we would know all there is to know about the world around us. Even today this model offers an adequate account for most natural scientists about what they do most of the time. This is because, for most natural scientists, science is a matter of practical problem-solving. For this purpose, the linear-additive model is perfectly adequate. As one of Houellebecq's (2001) characters puts it: "Personally, I think that I needed that basic, pragmatic positivism that most researchers have. Facts exist and are linked together by laws; the notion of cause simply isn't scientific. The world is precisely the sum of information we have about it."

However, for scientists with a more theoretical inclination, the linear-additive model was demonstrated throughout the 20th century to be increasingly inadequate. How else, for example, can we explain the paradox that the more we know, the more extensive our ignorance appears to be? And for each problem science solves, many new ones are identified that require solutions. On the one hand our level of reliable knowledge about the world, our ability to make predictions, has never been greater. NASA can now land a probe on an asteroid. A geneticist can tell from the DNA in a strand of hair at birth whether that child will contract Huntington's Disease in middle age. More generally, it has been estimated that the sum total of scientific understanding in the past 50 years has been greater than that in all previous history. Yet for all that we seem to know, the world appears to be an increasingly uncertain place. As a very perceptive article by Thomas Barlow in the *Financial Times* (of all places) put it, "...the knowledge we acquire about the world increasingly allows us to change it, and that in changing it we seem adept at

making it incomprehensible again" (Barlow, 2002). In other words, certainty appears to breed even more uncertainty.

TECHNOLOGICAL ANGST

It is not too difficult to discern why this is the case. The growth of scientific knowledge and the pace of technological change are now such that there is no earthly possibility that the culture of any society can adapt sufficiently quickly to keep pace with it. The potentialities of material change are far outpacing the realities of cultural change, and out of this all kinds of social and cultural dislocations are emerging. As Barlow again puts it: "...we find ourselves suffering from a kind of technological angst, an ambivalence to change, and an escalating feeling that advances in science have begun to outpace human ability for making judgements about their application." (Barlow, 2001)

In the same article in the *Financial Times*, Barlow went on to present a litany of issues which relate to this idea: "Is nuclear power safe? Is overpopulation about to cause a cataclysm of disease and famine? Would pesticides give us all cancer? What caused the hole in the ozone layer? Does biodiversity matter? Is the greenhouse effect real? Is cloning ethically acceptable? Dare we eat genetically-modified foods?" (Barlow, 2001) Unfortunately these kinds of questions are not obviously open to common-sense solutions. Part of the problem is that many of the hazards of the modern world are inaccessible to the senses altogether. In some cases, indeed, the problems we face may be so remote and complex that even the experts have trouble grasping them.

In this context it is not surprising that the world appears a riskier place, even though, on any quantifiable statistical basis there is little doubt that the world is a much less risky place for its inhabitants than it was 50 or even 100 years ago. The sheer pace of technological change has created a generally heightened sense of uncertainty. The past is no longer a guide to the future; just as explanation may not be equivalent to prediction. In a world which has become, according to many, increasingly globalized, the individual may feel less control over his or her daily life. And this world is also a more complex world, one in which, because of the extreme division of labour in modern industrial societies, we must rely on the expertise of others on matters over which we ourselves are relatively ignorant. Risk, uncertainty, vulnerability, trust – this seems like a lexicon of the human condition as we move into the 21st century. In this sense, the discussion of risk is no more than a metaphor for a change in a society struggling to come to terms with itself. Ever since the Enlightenment we have been prepared to believe that human progress can be achieved via the pursuit of knowledge. Now there are many who have

their doubts. The debate over risk is in part a debate over the contemporary state of the human condition.

All of this seems a long way from the linear-additive approach to the accumulation of knowledge. But it also explains a kind of paradox. We all stand in awe of the practical success of modern science. However much one may argue about this or that quantum of scientific knowledge, science demonstrably works. It is for this entirely pragmatic reason, at least in the minds of the general public, that science is elevated above other systematic means of creating knowledge. To say that something has been demonstrated scientifically remains, even despite recent vicissitudes, an ultimate test of the authenticity of knowledge and, therefore, of the authority of the speaker. Conventionally, those emanating from the humanities and the social sciences could only claim such authority when they, too, claim to be arguing "scientifically".

Ironically, the latter half of the 20th century was characterized by scientists asserting the provisional and uncertain nature of their findings rather than the reverse. It was Karl Popper (1959) who, by emphasising the provisional character of scientific knowledge, the rule of theory and the importance of scientific falsification rather than verification, pointed to some intriguing contrasts between scientific rhetoric and scientific reality. It did not take long for those who investigated natural science as it is actually practised to claim that scientists were simply engaged in a systematic deceit upon themselves. They did not spend their days trying to falsify hypotheses, as Popper had taught them they should, but, quite often, interpreted the observable facts to suit their pre-conceived theories.

SCIENCE AS A SOCIAL CONSTRUCT

In this regard, it is difficult to overestimate the influence of the work of Thomas Kuhn (1962), whose notion of scientific paradigms has now passed into everyday scientific discourse, even though, ironically, it is been treated with great scepticism even by those who share Kuhn's view of science as a social construct. Following Kuhn, we now recognize that the natural scientific community has its own culture, which enforces its own norms of what is and is not acceptable evidence, and which, via the subtleties of measurement and instrumentation, overwhelmingly operates in a verificationist fashion, and whose claim to speak with absolute certainty has to be interpreted with the same degree of scepticism with which one would greet similar claims from other brokers of knowledge and ideas.

Kuhn's work unleashed a veritable deluge of studies which sought to demonstrate that scientific knowledge was itself socially constructed. In its more vulgar form this sought also to demonstrate that the knowledge pro-

duced by scientific enquiry should be no more privileged than its predecessors – magic, religion, etc. In seeking to explain how scientific knowledge is created, Kuhn provoked a dangerous non sequitur – that scientific knowledge could be explained away.

Now social science does have a duty to demystify rhetoric and seek the underlying causes of human behaviour which lie behind self-justification. In this respect, the natural science community could be considered as no different to any other whose claims to authority risk being undermined by social scientific investigation. However, natural scientists, not surprisingly, found this approach extremely irritating. To them social science was simply seen as attempting to subvert the authority of natural science and offer little in return. The understandable reaction was to retreat behind the scientific barricades. Who needed this kind of sniping when there were important practical tasks to accomplish? Natural science remained confident in its ability to change the world for the better. Better, too, to ignore these turbulent (and it has to be said, at times, arrogant) critics and get on with the job?

However understandable this reaction, its consequences have been unfortunate. The scientific community has retreated from an engagement with society, just as society at large has been excluded from the real world of scientific method. As the biologist Steve Jones recently pointed out, the scientific community is now completely mystified by the idea that morals should direct its research, while those who seek to make science more publicly accountable are equally baffled by the logic and methods of science. The public now feels it is reduced to the role of a hapless bystander or, at best, the recipient of scientific advance and technological innovation which the scientific community believes it ought to want. If the public decides it does not want it, it is regarded as either ignorant or irrational. The scientific community therefore ends up frustrated by the public's apparent disdain for the fruits of its labours and the public's lack of sympathy for an endeavour which, as far as the scientific community is concerned, is for the public good.

In this situation, as one of Houellebecq's (2001) characters perceptively comments: "It is easy to imagine a fable in which a small group of men – a couple of hundred in the whole world – work intensively on something difficult, abstract, completely incomprehensible to the uninitiated. These men remain completely unknown; they have no apparent power, no money, no honours; nobody can understand the pleasure they get from their work. In fact, they are the most powerful men in the world, for one simple reason: they hold the keys to rational certainty. Everything they declare to be true will be accepted sooner or later by the whole population. There is no power in the world – economic, political, religious or social – that can compete with rational certainty". We are becoming dangerously close to Goya's nightmare of reason creating monsters here. All too often now the natural scien-

tist appears intimidating and remote. And all too often scientific communities treat the public with, at best, condescension and, at worst, as a threat. Once the public trusted scientists, and scientists could speak with authority. Now, both that trust and that authority have been somewhat eroded. Contemporary knowledge is not only unprecedentedly voluminous, but also astonishingly fragmented, and the more we know collectively, the less capable an individual seems to be of interpreting matters outside his or her expertise. As a consequence, while many of the difficult and controversial decisions we must make in modern society are focused around scientific questions, we find ourselves on virtually every topic of importance dependent on advice from small, elite sub-groups of experts. Often we find that the expertise necessary for solving problems is precisely that which created them in the first place.

THE PERCEPTION OF RISK

A good example of this is the study of risk itself. Quantitative risk assessment is now a highly sophisticated and reliable aspect of modern economic and scientific activity. Yet both politicians and scientists continue to be taken by surprise by the public reaction to technological innovations which they assumed were not contentious. Waste disposal, genetically-engineered organisms, food irradiation, food additives – the litany could be extended at length. Many people seem very happy, as has often been pointed out, to take the most enormous risks in their private lives, but react violently against statistically tiny risks in the public domain. One only has to compare the public debate which has recently surrounded accidents on the railways with the daily death toll on our roads in the United Kingdom. It hardly needs to be added that this in turn influences the political and policy framework governing the pace and direction of technological change and, ultimately, therefore, the legally defined conditions surrounding the pursuit of scientific enquiry.

This is not because quantitative risk assessment is somehow inexact. Rather, it misses the point. I am reminded of the famous quotation from the American social psychologist, W. I. Thomas: "If men define situations as real, they are real in their consequences" (Thomas & Thomas, 1928). Thomas was pointing to something which today we would regard almost as a truism, namely that people behave on the basis of their perceptions of reality – including risk – rather than that reality itself. Therefore it is the perception of risk which influences behaviour rather than the statistically objective, quantifiable assessment of that risk. In this sense risk perception cannot be reduced to a single subjective correlate of a particular mathematical model of risk, such as the product of probability and consequences, because this

imposes unduly restrictive assumptions about what is an essentially human and social phenomenon. This is because risk is a social construct (although not only a social construct). And this applies as much to fruits of scientific understanding as anything else. For centuries we have been taught and conditioned to assume that science is certainty. If not today, then tomorrow, scientists would make the discoveries that would remove our worries about disease, hunger and even our social affairs. Yet now we can recognize just how incomplete this view is. The study of risk is just one area where we now find scientists delivering only soft, uncertain facts to decision-makers facing hard decisions. Politicians demand to know what is safe, whilst scientists can only ever state that nothing is risk-free. Typically we find that the facts are uncertain, values in dispute, stakes high and decisions urgent; and the framing of the problem involves politics and values as well as science.

Very many natural scientists find this role uncomfortable, since it disrupts the established taken-for-granted relationship between science and politics. It also presents a problem for politicians in search of scientific legitimacy for their decisions: an appeal to scientific "facts" is a handy device to shut down the much more messy debate necessary to manage uncertainty as well as to reconcile conflicting interests. The scientific study of risk cannot, therefore, be limited solely to "getting the science right". It is simply not the case that once you get the science right, so better decisions are sure to follow. The foot-and mouth-outbreak in England in 2001 surely demonstrated this. Scientists, I know, will feel uneasy about this. Equally, however, natural scientists will need to recognize that the perceptions of risk are shaped by complex social and psychological processes and that scientists' perceptions of the public are equally important as public perceptions of the science. Understanding and managing the distinction between risk assessment and risk perception is difficult, complex, and the outcomes are uncertain. It itself constitutes a risk. But in reality there is no alternative. The things which are perceived as real will be real in their consequences.

This leads me back to where I began. Rather than ignorance being bliss, probably what we all fear most is that which we do not understand. There is a sharp distinction to be made between the practice of science and the logic of scientific enquiry. Being critical of how science is organized and directed is not to be conflated with the criticism of rational enquiry itself. As the President of the British Academy, Viscount Garry Runciman, recently put it: "Both the natural and the human sciences are both objective and subjective, as both are at the same time value-neutral in so far as their results are directly and publicly testable and value-laden in so far as the underlying presuppositions and purposes are not. Both share the same two inescapable requirements: first, reasoned argument as opposed to dogmatic assertion; and second ... docility to the evidence" (Runciman, 2002). Any serious practi-

tioner of either the human or the natural sciences has no need to be told that there are no canonical narratives or definitive series of everything. Or, as Nietzsche put it a century ago: "...without a recognition of logical fictions, without a comparison of reality with the purely imagined world of the absolute and immutable, without a constant counterfeiting of the world by numbers, man could not live..." (Nietzsche, 1923)

RESTORING PUBLIC TRUST

In a less deferential age it will not be easy to restore the public trust in science to levels which pertained in a previously unquestioned authority of other professions and institutions in modern society. The scientific community is beginning to engage more with society at large, albeit hesitantly and tentatively, as it comes to recognize the potential consequences of failing to do so. Equally, the public understanding of what science can – but, more importantly, cannot – deliver has a long way to go. The public stands in awe of the products of recent scientific progress. But science is not magic, and the scientific community does not possess a collective magic wand. Modern science has not removed human moral fallibility.

There is no doubt then that Goya's dream of reason has produced monsters, but part of the Enlightenment tradition is to continue to strive to eliminate such fiends. In the wake of September 11th 2001 we have come to question our faith in social progress and in open human enquiry. But now is the time when we need to re-assert Enlightenment values and to ensure that the growth of knowledge is not impeded by a relapse into the celebration of ignorance.

REFERENCES

Barlow, T. (2001). Article in the London *Financial Times*, 12 May 2001, Financial Times Ltd, London.

Barlow, T (2002). Article in the London *Financial Times*, 5 January 2002, Financial times Ltd, London.

Bradbury, Malcolm (1975). *The History Man*, Secker and Warburg, London.

Bradbury, Malcolm (2001). *To the Hermitage*, Picador, London.

HEFCE (2001). *2001 Research Assessment Exercise: The outcome*, HEFCE, Bristol.

Houellbecq, Michel (2001). *Atomised*, Vintage, London.

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

Nietzsche, F. (1923). *Beyond Good and Evil, The Complete Works of Friedrich Nietzsche*, edited by Dr Oscar Levy, volume 12, George Allen and Unwin Ltd, London.

Popper, Karl (1959). *The logic of scientific discovery*, Hutchinson, London.

Runciman, G. (2002) "Two bodies, One Culture", speech by Viscount Garry Runciman, President of the British Academy, to the Academy's Centenary Dinner, 4 July 2002, British Academy, London.

Thomas, W. I & Thomas, D.S (1928). *The Child in America: Behavior Problems and Programs*, Alfred A. Knopf, New York.