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POSTMODERN SCIENCE: THE DECLINE OR LIBERATION OF SCIENCE?

1. INTRODUCTION

I sometimes think that the appeal of postmodernism to many people, myself included, is that it relieves us of the effort of trying to make sense of a world that no longer seems to make sense. This would have profound implications for science, which is, after all, about understanding the world.

It's not that simple, of course. But postmodernity does pose interesting and important challenges for science – and for science communication and the public understanding of science. Science communication is, and must be, about much more than 'selling' science to the public. Fundamentally, it concerns the relationship between science and society, and it has a powerful role in shaping this relationship, and so what science is done and how it is used, not just economically, but culturally too. This means science communication is also closely associated with science policy issues.

In this paper, I want to look broadly at several different – but, I think, related – aspects of how science could influence and be influenced by cultural developments, especially in modern Western societies. In particular, I want to look at the possible impact on science of the cultural changes associated with postmodernity, the relationship between science and material progress, and, finally, the potential for a reconciliation between scientific and spiritual worldviews. All have far-reaching implications for humanity. And depending on how these matters are played out, we could see, in the next century, either the decline or liberation of science.

2. POSTMODERNITY AND SCIENCE

Postmodernity (or late modernity, as some scholars prefer to call it) describes a world coming to terms with its limitations, including the recognition that the 'modern' dream of creating a perfect social order is ending, and that some of our problems may be insoluble. Postmodernity is marked by ambivalence, ambiguity, relativism, pluralism, fragmentation, contingency and paradox. There are no grand narratives or creeds that define who we are and what we believe, but a multiplicity of them.

Science and technology are among the key instruments of the modernist vision. As Anthony Elliott (1996, 18-19) states: 'Science, bureaucracy and technological expertise serve in the modern era as an orientating framework for the cultural ordering of meaning'. This changes in a postmodern world. Elliott argues that the vision of the Enlightenment has faded. 'The grand narratives that unified and structured Western science and philosophy… no longer appear convincing or even plausible.' From a postmodern perspective, he says, 'knowledge is constructed, not discovered; it is contextual, not foundational'.

Elliott (1996, 66-70) argues that knowledge generated by experts and institutions is no longer equated with increasing mastery and control of the social order. In fact, he says, the advance of modernisation is increasingly equated with the production of risks, hazards and insecurities on an unprecedented global scale. 'Put more accurately, technological knowledge and control of the social world today are as much about managing socially produced risks and dangers which are worldwide in their consequences as about unbounded mastery in the service of political domination.' The profound paradox of our situation is well described by Marshall Berman (cited by Elliott, 1996, 11), who said:

> To be modern is to find ourselves in an environment that promises us adventure, power, joy, growth, transformation of ourselves and the world - and, at the same time, that threatens to destroy everything we have, everything we know, everything we are.

So we can see that there are two aspects to the postmodernist critique of science: epistemic relativism; and science as a two-edged sword.

Scientists are most hostile to the first charge – that scientific knowledge is culturally adulterated. I don't entirely agree with this assertion. Scientific knowledge does transcend its cultural context; science does 'advance' in a way that is, I think, unique. But scientific knowledge is never the whole truth or an absolute, immutable truth. And what science is done, and how its results are applied, are powerfully determined by its cultural context.

So given that we choose into which corner of the dark cavern of the unknown we shine the light of scientific inquiry, and given that we will never light up everything, then we do need to acknowledge the degree to which what we see depends on what influences our choice of where to look and what to look for – that is, on who we are and what we believe. This degree of cultural construction depends on the science: smaller in the case of the physical sciences, larger in the social; lesser in pure science than in applied.

The second charge against science – that it is a mixed blessing - is uncontestable, and doesn't need elaboration. This applies to specific products of science (technologies) such as nuclear energy, pesticides or genetic modification, or more broadly to the whole relationship between science and material progress – a subject to which I'll return later.

There is a second factor which could compound the effect of postmodern thinking on science: the possibility that science may have to confront its own intrinsic limitations.

John Horgan (1996) has argued that we must accept the possibility that the great era of scientific discovery is already over. He is not referring to applied science, which still has an abundance of problems to solve, but what he calls 'science at its purest and grandest, the primordial human quest to understand the universe and our place in it'. Horgan develops an idea propounded by Gunther Stent in *The Coming of the Golden Age: A View of the End of Progress*, published thirty years ago. Stent argued that if there are any limits to science, any barriers to further progress, then science may well be moving at unprecedented speed just before it crashes into them. When science seems most muscular, triumphant, potent, that may be when it is nearest death, Stent said. 'Indeed, the dizzy rate at which progress is now proceeding makes it seem very likely that progress must come to a stop soon, perhaps in our lifetime, perhaps in a generation or two.'

Horgan implies three different reasons for this view. One reason is that all the major discoveries - or should we call them 'constructions'? - may have been already made: 'Now that science has given us its Darwin, its Einstein, its Watson and Crick,' he says, 'the prospect arises that further research will yield no more great revelations or revolutions but only incremental, diminishing returns.' (He discusses, but dismisses, the claim that scientists thought this about physics last century.) Another reason is that even seemingly open-ended sciences like physics inevitably confront physical, financial and even cognitive limits: modern physics, for example, is becoming increasingly difficult for anyone, even physicists, to comprehend. A third factor is the intrinsically indeterministic nature of many natural phenomena – that is, they are unpredictable and apparently random - making them resistant to scientific analysis. The work emerging from chaos and complexity theories demonstrates that science, when pushed too far, culminates in incoherence.

I'm not necessarily endorsing Horgan's arguments, only suggesting they deserve consideration in looking at the future of science.

3. POSTMODERN SCIENCE

So science is being assailed by two forces: the first, postmodernism and its challenge to science's social and intellectual authority; the second, science's own 'limits to growth'. What will be the consequences?

While technological innovation will continue apace, science will cease to be the defining and dominant feature of our society. It will co-exist, often uncomfortably, with irrationalism, superstition and other belief and knowledge systems. In losing its ideological dominance as the source of progress, science is losing its own internal coherence, and the philosophy and culture that have held it together. While good science will remain rigorous and empirical, this will be more a question of professional ethics and sheer pragmatism - this science

delivers the best results - than the sort of ideal represented by sociologist Robert Merton's four norms of science: universalism, communism, disinterestedness and organised scepticism.

Like everything else, science is fragmenting. Much more openly and unequivocally than in the past, science today serves different masters and different purposes. Its culture and norms become those of its users. Thus, it is increasingly meaningless to talk about a single form of scientific progress, or about attitudes to science in any generic sense. Public opinion about science depends on which public and which science. The epigraph on the United States National Academy of Sciences building in Washington - 'To science, pilot of industry, conqueror of disease, multiplier of harvest, explorer of the universe, revealer of nature's laws, eternal guide to truth' – will, with its implied congruence and attainability of all these goals, its unified vision of progress, become a quaint anachronism in the postmodern world.

This is already apparent from surveys of how people perceive science and technology. They are ambivalent and contradictory in their views - and also discerning. Take, for example, a study I initiated several years ago, under the auspices of the Australian Science, Technology and Engineering Council, which explored young people's hopes and fears for Australia in the year 2010: a key finding was the extent to which views on science and technology were embedded in a wider social context (Eckersley, 1999). The role young people saw for science and technology changed markedly between their expected and preferred futures.

Young people are not so much *against* science and technology: they acknowledge their importance in achieving a preferred future. But they are astute enough to realise science and technology are tools, and their impacts depend on who controls them and whose interests they serve. They *expected* to see new technologies used further to entrench and concentrate wealth, power and privilege. They *wanted* to see new technologies used to help create closer-knit communities of people living a sustainable lifestyle.

For example, young Australians (aged 15-24) were asked in one poll question to agree or disagree with nine specific statements about science and technology. The responses showed that:

- Young people believed science and technology offered the best hope for meeting the challenges ahead (69%), but also that they were alienating and isolating people from each other and nature (53%).
- They believed that computers and robots were taking over jobs and increasing unemployment (58%), and a significant minority that they would eventually take over the world (35%).
- They were more likely to think that governments would use new technologies to watch and regulate people more (78%) than they were that new technologies would strengthen democracy and empower people (43%).
- They expected science to conquer new diseases (87%), but not that it would find ways to feed the growing world population (39%), or solve environmental problems without the need to change lifestyles (45%).

In another question, young people were asked to nominate which of two positive scenarios for Australia in 2010 came closer to the type of society they both expected and preferred:

> A fast-paced, internationally competitive society, with the emphasis on the individual, wealth generation and 'enjoying the good life'. Power has shifted to international organisations and business corporations. Technologically advanced, with the focus on economic growth and efficiency and the development of new consumer products.
>
> A 'greener', more stable society, where the emphasis is on cooperation, community and family, more equal distribution of wealth and greater economic self-sufficiency. An international outlook, but strong national and local orientation and control. Technologically advanced, with the focus on building communities living in harmony with the environment, including greater use of alternative and renewable resources.

Almost two thirds (63%) said they expected the first, 'growth' scenario. However eight in ten (81%) said they would prefer the second, 'green' scenario. About a third (35%) expected the 'green' scenario, and 16% preferred the 'growth' scenario.

One possible consequence of postmodernity is that science will become a greatly diminished cultural influence in our lives and in national affairs (even while we continue to embrace its products). For example, Horgan (1996) sees the limitations of science contributing to a growing reluctance by the public to support science, and even to the rise of anti-scientific sentiments. He notes that Oswald Spengler foresaw the disillusionment with science in *The Decline of the West*, published in 1918: Spengler predicted that the demise of science and the resurgence of irrationality would begin at the end of the millennium. As scientists became more arrogant and less tolerant of other belief systems, notably religions, he believed society would rebel against science and embrace religious fundamentalism and other irrational systems of belief.

There are signs that this might be happening, although public sentiment has not so much swung against science and technology as shifted towards superstition and fundamentalism. For example, Americans view science and technology as the engines of the past century's economic prosperity and the main reasons for the improvements in their well-being, and are optimistic about further gains in the next century (Pew, 1999). Yet they also express misgivings about the way their country has changed culturally and spiritually (Pew, 1999). Asked in a recent poll what was more important, encouraging a belief in God or encouraging a modern scientific outlook: 78% of Americans chose 'a belief in God', and only 15% 'a modern scientific outlook' (Washington Post/Kaiser/Harvard, 1998). Over a third (36%) believe the Bible is the actual word of God, to be taken literally word for word, while almost half (48%) believe it is the inspired word of God, but not everything in it should be taken literally. Only 14% regard the Bible as an ancient book of fables, legends, history and moral precepts recorded by man.

But there are also other possibilities. In the early 1990s, I wrote in essays for the Australian Commission for the Future and *The Futurist* that science could play a crucial role in achieving the sort of cultural or values shift necessary to address 21st century challenges (Eckersley 1992, 1993). But in effecting change, science must itself be changed. While remaining rigorous, science must become intellectually less arrogant, culturally better integrated and politically more influential. Science must become more tolerant of other forms of reality, other ways of seeing the world. It must become less remote from public culture, with a steadier and readier flow of influence between the two - in both directions. And it must contribute more to setting political agendas. Science communication has a pivotal role in these changes.

I didn't realise then how postmodern this perspective was. It represents perhaps the best outcome for postmodern science. There are also signs that this is happening! It is from this perspective that postmodernism can liberate science. By forcing us to acknowledge that science is not a dispassionate, value-free search for objective knowledge about nature and society, that it is imbued with the subjective and conditioned by its social and cultural environment, science becomes more pluralistic and flexible.

Science can shed its close association with 'progress' as we currently define it, and openly associate itself with other social goals. Science and scientists have, after all, been the driving force behind the modern environmental movement. We could see the growth of a 'transformational science', a highly interdisciplinary style of research that would draw its inspiration, its coherence, from a shared ideal to use science to achieve a transition from a society defined by economic growth and a rising material standard of living, to one that offers a high, equitable and sustainable quality of life. While the research would continue to be directed towards practical outcomes, it would be defined and guided by this transformational vision of sustainable development.

4. SCIENCE, INNOVATION AND PROGRESS

The concept of sustainable development poses the most formidable challenge so far to that of material progress, the defining characteristic of Western society for the past few centuries. Within the paradigm of material progress, the role of science has increasingly come to be seen as the engine of progress, the source of innovation that drives economic growth and wealth creation.

A few decades ago, innovation was seen as a linear process, a pipeline: research led to invention which was commercialised to become innovation. Since then, this model has been replaced by a succession of more complex models that emphasise the dynamic and social nature of innovation, which involves researchers, producers, marketers and customers in an iterative, interactive process (Bessant and Dodgson, 1996). The contributions of research to this process go beyond being a source of invention and are often indirect and diffuse.

Innovation theories seem to be continuing to evolve in the light of new experience. A recent book, *The Innovator's Dilemma*, focuses on 'disruptive technologies' and argues that it is only by ignoring current customers and disobeying seemingly sound management practices that drastic innovation can be harnessed (Christensen, 1999). Not only are the market applications for disruptive technologies unknown at the time of their development, they are unknowable, and, by and large, they are initially embraced by the least profitable customers in a market.

While innovation theory has come a long way in recent decades, our notions of progress seem still to be based on a model similar to the old linear model of innovation (Eckersley, 1998). Progress is like a pipeline: pump more wealth in one end, and more welfare will flow out the other. Current government policy is underpinned by the belief that wealth creation comes first: economic growth increases our capacity to meet environmental and social

objectives, as well as raising material standards of living. This notion provides the framework of debate, which then centres around how the fruits of growth should be distributed.

The fundamental assumptions about economic growth – that it enhances welfare or well-being and that it is environmentally sustainable - are rarely highlighted or explored. However, the belief in the primacy of wealth creation is wrong: if the processes by which we pursue economic growth do more damage to the social fabric and the state of the environment than we can repair with the extra money, then we are still going backwards (even assuming we can fully identify, cost and repair the impacts). 'Efficiency' in generating wealth may well mean 'inefficiency' in improving overall quality of life.

The rationale for continuing economic growth in rich countries seems flawed in several important respects: (1) it overestimates the extent to which past improvements in well-being are attributable to growth; (2) it reflects too narrow a view of human well-being, and fails to explain why, after 50 years of rapid growth, so many people today appear to believe life is getting worse; and (3) it underestimates the gulf between the magnitude of the environmental challenges we face and the scale of our responses.

The issue of contention in the debate about progress is not simply growth versus no-growth. That growth is better than recession in generating jobs - the main political justification for promoting growth - is insufficient reason for not looking much more closely at *what* is growing, what *other effects* this growth is having, and what *alternatives* might exist. We need to examine more critically the whole basis on which progress is currently defined, measured and achieved. Instead of just 'going for growth', and focusing science on that end, we need to be 'going beyond growth'. To suggest this is not to be 'anti' the economy, business or scientific research and technological development; it is to argue that these activities need to be driven by different values towards different ends.

5. SCIENCE AND RELIGION

I touched earlier on the tension between science and religion. Given religion's importance to values, let me come back to this issue. The relationship between science and religion today hangs in balance between conflict and concurrence. The outcome will depend on our interpretations of what both are.

The religious experience is not easy to articulate. Theologians argue that God is beyond images and beyond thought. Thomas Aquinas said that we know God best when we come to the point of knowing that we don't know him. A Sanskrit text, the Upanishad, says of Brahman (the ultimate reality, or Self, from which the world was created): 'Brahman is unknown to those who know it and is known to those who do not know it at all'. The novelist, Morris West, a devout Catholic, once said: 'I don't know who or what God is but I do know that there is a relationship between me and the Cosmos and its origins - I'm part of it.' Charles Birch, a biologist and theologian, also emphasises the 'relational' nature of God (Birch, 1993). God, he says, 'is internally related to all that is'. 'God is to the world as self is to the body.' As I understand this, he is saying our relationship to God is personal, but it is an internal relationship, not a relationship to something or someone else; there is no 'other'.

I define spirituality as a deeply intuitive sense of relatedness or connectedness to the world and the universe in which we live. Religions are social institutions built up around a particular spiritual metaphor, or set of metaphors, for this relationship. Religions may be socially necessary and desirable to obtain the greatest social and personal benefits from a sense of the spiritual - meaning, fulfilment, virtue. However, they can be made so rigid and sclerotic by institutional inertia, and by layers of bureaucracy, politics and corruption, that their spiritual core withers. When this happens, they become self-serving institutions lacking any higher purpose; worse, they can become potent ideologies of oppression and abuse.

Science also uses metaphors to describe the world. These days, cosmology is full of terms like black holes, worm holes, quantum foam. We are learning that science and religion use different metaphors to describe the same world, or different dimensions of the same world. (Some metaphors, such as Gaia, the notion of the Earth as a single, self- regulating living system or organism, can even be both scientific and religious).

Here are two scientific descriptions of the world. The first comes from biologist Richard Dawkins (1995):

> In a universe of electrons and selfish genes, blind physical forces and genetic replication, some people are going to get hurt, other people are going to get lucky, and you won't find any rhyme or reason in it, nor any justice. The universe that we observe has precisely the properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but pitiless indifference.

The second is from physicist Paul Davies (1995):

> The true miracle of nature is to be found in the ingenious and unswerving lawfulness of the cosmos, a lawfulness that permits complex order to emerge from chaos, life to emerge from inanimate matter, and consciousness to emerge from life....(T)he universe (is) a coherent, rational, elegant and harmonious expression of a deep and purposeful meaning.

The two views represent the extremes of the modern scientific worldview. According to the first, we are doing what all species have ever done: to do as well as possible, to sequester for ourselves as much of the earth's resources as we possibly can. According to the second, we are part of an awesome evolutionary pattern that has seen, in the space of some 12 billion years, the emergence of a universe that can wonder and marvel at itself. I don't think the two perspectives are irreconcilable, and simply reflect different dimensions of the evolution of life – Dawkins focusing on living organisms and their struggle for survival, Davies on a more abstract cosmology.

Western culture has been deeply influenced by the old, Newtonian model of a dead, mechanical, clockwork universe. It has yet to absorb the significance of the new model, one of a dynamic cosmic network of forces and fields, of an 'undivided, flowing wholeness' - to use physicist David Bohm's words - that is far more compatible with a spiritual sense of connectedness to the universe.

The Nobel laureate, Steven Weinberg (1994), has argued that life as we know it would be impossible if any one of several physical quantities had slightly different values. For example, the vacuum energy or cosmological constant appears to need to be fine-tuned to an accuracy of about 120 decimal places for life to exist in the universe. Weinberg acknowledges that opinions differ on the degree of this fine-tuning. He also says this does not necessarily mean that 'life or consciousness plays any special role in the fundamental laws of nature'. Still, it raises an intriguing question: is this the razor's edge of probability, or exquisite precision engineering?

So spirituality is the intuitive sense of what science seeks to explain rationally. For me, the significance of all this is not that there is some Divine Purpose or Supreme Being somewhere 'out there' that gives meaning to life. Rather this understanding, or awareness, of our relationship with the Cosmos fosters a sense of deeper purpose, or meaning, within ourselves.

The anthropologist, Clifford Geertz, said that: 'Whatever else religion does, it relates a view of the ultimate nature of reality to a set of ideas of how man is well-advised…to live' (cited in Novak, 1994, 111). It has often been said that science, while also offering a view of 'the ultimate nature of reality' lacks the moral dimension. Yet research in a wide range of disciplines – from psychology and physiology, epidemiology and sociology, to ecology and cosmology – does provide guidance on how we ought to live, guidance of a kind that is compatible and consistent with religious teaching. But in both realms – science and spirituality – we are operating at the very limits of our capacity to comprehend 'the grand scheme of things'. At this conceptual level, our view is highly subjective, we can only express ourselves in metaphors; the moral lessons can only be human interpretations, not laws of science or of God.

Religion faces a growing tension that will bear mightily on its future: a tension between developing new, or renewed, 'transformational' religions and retreating to old, fundamentalist faiths. The former would use metaphysical metaphors and practices attuned to our times and our modern, scientific understanding of the world; the latter offer rock-solid certainties in a time when these can be enormously destructive. I don't mean, in talking about this tension, to sideline current mainstream faiths, but rather to suggest they will be caught up in it, and could be profoundly shaped by it. The danger with fundamentalism is that it mistakes the religious 'metaphor' for the spiritual 'truth', and so cedes too much power to those who claim to speak on God's behalf. On the other hand, more 'modern' concepts of God, while philosophically compelling, may be too abstract to meet the human yearning for spiritual comfort and moral authority. Still, this path seems to me to offer the best prospects of a better future – harder, undoubtedly, but more likely in the long run to lead to a peaceful, equitable and sustainable world. Science has a role in encouraging us to take this path.

The new religions would transcend, rather than confront, the powerful individualising and fragmenting forces of postmodernity. One of the most exciting ideas to emerge from recent postmodern scholarship is that we have the opportunity, however small, of becoming truly moral beings, perhaps for the first time in history (Bauman, 1995, 10-43, 256-288). That is, we have, each of us, the opportunity to exercise genuine moral choice and to take responsibility for the consequences of those choices, rather than accepting moral edicts based on some grand, universal creed and handed down from on high by its apostles. Bauman (1995, 43) writes:

> The denizens of the postmodern era are, so to speak, forced to stand face-to-face with their moral autonomy, and so also with their moral responsibility. This is the cause of moral agony. This is also the chance the moral selves never confronted before.

This seems close to what theologians call the doctrine of 'primacy of conscience'. This is an immense challenge, and it may well be asking too much of us. But the ideal is there, if often hidden, in both religious teaching and science.

Human well-being is associated with the deep and enduring personal, social and spiritual attachments that give our lives a moral texture and a sense of meaning - of self-worth, belonging, identity, purpose and hope. Psychologists have shown that positive life meaning is related to strong religious beliefs, self-transcendent values, membership of groups, dedication to a cause and clear life goals. Bruce Headey and Alex Wearing (1992, 191) say in their book, *Understanding Happiness*, that: 'A sense of meaning and purpose is the single attitude most strongly associated with life satisfaction'. The psychologist, Martin Seligman (1990), argues that one necessary condition for meaning is the attachment to something larger than the self, and the larger that entity, the more meaning people can derive. 'The self, to put it another way, is a very poor site for meaning.'

Meaning in life need not be religious. Many people today find it in the pursuit of personal goals – in careers, sport or family, for example. But spirituality offers something deeper. It is central to the age-old questions about the meaning of life: Who am I? Where have I come from? Why am I here? It represents the broadest and deepest form of connectedness. It is the most subtle, and so easily corrupted by societies, yet perhaps the most powerful. It is the only form that transcends our personal circumstances, social situation and the material world, and so can sustain us through the trouble and strife of mortal existence.

Morris Berman (1990, 344) concludes his book, *Coming to Our Senses: Body and Spirit in the Hidden History of the West*, with these words:

> Something obvious keeps eluding our civilisation, something that involves a reciprocal relationship between nature and psyche, and that we are going to have to grasp if we are to survive as a species. But it hasn't come together yet, and as a result, to use the traditional labels, it is still unclear whether we are entering a new Dark Age or a new Renaissance.

How we think of science and its relationship with society, the economy and culture, including religion, will have a large bearing on whether we grasp this 'something' and so which way we go. And, as I said in the Introduction, this question is, fundamentally, a challenge for science communication.

6. CONCLUSION

In *Biology and the Riddle of Life*, Charles Birch (1999, 58) says science inevitably leads to mechanical analyses. Is there nothing more to be said, he asks:

> I think there is. It is to propose that there are two points of view – *the inside and the outside, the subjective and the objective, from within and from without*…. There is an enormous gap between what science describes and what we experience…. (T)he solution to the riddle of life is only possible through the proper connection of the outer with the inner experience.

I have argued that postmodernity could see the decline of science, or its liberation. By liberation, I mean abandoning, or at least qualifying, our notions of scientific knowledge as objective and value-free – as discovered, rather than constructed. And I also mean breaking free of a narrow, limited view of science, particularly by governments, that sees the prime objective of science policy as harnessing scientific research and education ever-more closely to the task of growing the economy - to the pursuit, in other words, of material progress.

In taking a broader view of the relationship between science and society – and so of science communication - I also discussed the role of science in achieving a high, equitable and sustainable quality of life, rather than a life that is merely materially richer, and in strengthening a sense of the spiritual.

The current dominant view of science as an economic tool is such an impoverished vision. Science has much, much more to offer humanity than that.

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