

Book review

The Scientific Methodology in the Light of Cybernetics by P. R. Masani. *Kybernetes*. The International Journal of Systems and Cybernetics. Vol. 23. No. 4. 1994

Masani writes in his Preface; 'This monograph presents the methodology [of science], as it appears today, from the perspective that fuses together the theoretical tradition of seeing problems *sub specie aeternitatis* through mathematical eyes and the pragmatist one that gauges truthfulness in terms of practical efficiency.... Today we call this perspective *cybernetical*, for an analysis of how the mind perceives and how action occurs shows that underlying both are the teleological notions *communication & control* which are central to cybernetics....' (p. 8).

The monograph, however, concerns itself with scientific methodology, *per se*, only in a peripheral way. Although more than half the book is devoted to discussing 'fundamentals', the focus is not on foundational issues such as, for example: what science is about? What is the logical structure of science? What are the distinguishing characteristics, if any, of the activities that create science? What is the difference, if any, between scientific knowledge and commonsense knowledge? Are the structures of these two kinds of knowledge similar? Do these two kinds of knowledge relate to the same world? What is the relationship between the language of commonsense and the language of science?

It is customary to discuss the social relevance of science in terms of the technological applications that stem from it. However, historically, technological accomplishments (for example, in agriculture, animal husbandry, mining and metallurgy, and a variety of other useful arts) have long preceded the growth of science as an organized and systematized activity. So, what are the differences between these earlier technologies and science-based technologies of the last 200 years? Although Masani acknowledges that scientific activity leads to engineering and useful arts, he does not analyse their relationships in any systematic manner.

Masani's monograph is really an extended essay on some philosophical and social issues (which have a tangential bearing on scientific activity and scientific methodology) on which

Masani has very strong and very personal views. In articulating his views he is intellectually and emotionally indebted to three sources: (1) Wiener and his writings on cybernetics; (2) C. S. Peirce and his observations on scientific methodology; (3) early Greek philosophers (especially Plato and Aristotle) and the views on nature and society articulated by Christian fathers and medieval scholastics.

For close to 40 years Masani has immersed himself in Wiener's writings and his personality. He has co-authored papers with him, has been an official editor of Wiener's collected works published in four volumes, and has recently published an extended biography of Wiener. Wiener, inevitably, tends to loom large in his thinking horizon. Wiener seems to have held strong views on most aspects of life and living. Yet, one wonders whether Masani is being fair to Wiener by trying to project him as a man for all time.

Equally problematical is Masani's attitude to cybernetics as a framework for analysing 'purposive' behaviour in animals and humans. Whatever its adequacy in dealing with animal behaviour, I have discussed elsewhere in this issue of *Current Science* the inadequacies of the cybernetic framework to come to grips with symbolic and cognitive behaviour in humans¹. By overstressing the scope of cybernetics, one tends either to trivialize its technical terminology (e.g. '... moral evil should be construed as human teleological noise', p. 121), or gratuitously make exaggerated claims for its analytical potential (e.g. '... such seminal areas as the decipherment of the genetic code in living beings, molecular biology, and genetic engineering – all cybernetical territory, par excellence...', p. 83).

It is a pity that, because of the self-imposed narrowness of his viewing window, Masani has let slip a valuable opportunity to point out the richness and breadth of modern scientific activities, especially those concerned with multidisciplinary areas, and the new questions that are being addressed. He claims that 'in regard to the classification of sciences and the demarcation of their provinces, the scientific tradition is close to Aristotle...' (p. 95). This clearly is not true of modern science whose fertility is rooted in multidisciplinary investigations. I shall illustrate this by considering three

problem-areas discussed by Masani highlighting some of the questions that he does not ask.

Science is based on faith

In Part I, while discussing the 'fundamentals' of scientific methodology, Masani states his central thesis as follows. 'There is thus simply no escape from admitting that the belief in the existence of an orderly world is: (a) logically unjustifiable, (b) necessary in order to survive as human beings and scientists, and (c) has to be based on extralogical faith – a faith or commonsense which allows us to do what animals do instinctively' (p. 14). He goes on: 'when Whitehead and Wiener spoke of an 'act of faith' they meant the voluntary acceptance of a proposition that no amount of reasoning could justify.... Their conception of faith tallies with the scholastic definition: an 'act of faith' is 'an act of intellect brought to assent by the will' (p. 17).

Masani argues for an essential continuity in the development of science. He does not believe in scientific revolutions or even in paradigm shifts. According to him, 'the bonds binding together Heisenberg, Galileo, Kepler, and Plato are impervious to changes in paradigm' (p. 23). This is the main reason for his constant invoking of Greek philosophers, church fathers, and medieval scholastics to provide continuity of background to modern science. Given this ideological stand, one might be pardoned if one were to infer that Masani is claiming that the 'extralogical faith' of modern scientists in the existence and intelligibility of an objective world is of the same kind as the 'religious faith' of medieval schoolmen.

Masani does not actually make this claim in so many words; but the implication is uncomfortably present as a backdrop to his arguments. It is not necessary to point out that there is a world of difference between the 'faiths' in these two cases. The 'extralogical faith' of a scientist – if in fact it *is* a faith – is not circumscribed by any dogma, or revealed truths of god-men. Masani, himself, quotes Peirce's contention: 'That which constitutes science is not so much correct conclusions as it is a correct method.... That which is essential is the scientific spirit which is determined not to rest satisfied

with existing opinions but to press on to the real truth of nature.' (p. 23).

A crucial and significant question that is not even being raised in all this talk about 'faith' is the origin of it. How does this belief in the existence of an independent objective world arise? Are children born with this belief or do they acquire it slowly through their daily interaction with the world in which they are immersed? In developmental psychology this question is posed as follows: How does a child acquire the concept of an object as a real, objective, volume-occupying spatial entity existing independently of the child's own perceptual and motor interaction with it?

Piaget made three rather startling claims about the development of this object concept. To quote Flavell: 'First, he claimed that this utterly basic, "obvious" conception of object is not inborn but needs to be acquired through experience. Second, this acquisition is a protracted one, spanning the entire sensori-motor period of infancy. Third, this process consists of a universal, fixed sequence of developmental stages or sub-acquisitions.'² Piaget's claims have been substantially verified by a wide variety of more recent research.

We acquire our commonsense knowledge of the world (including our knowledge of the behaviour of other people in it) through interaction with it and also through exposure to 'folk psychology'. Recent research shows that even here developmental issues play a determining role. Finally, it can be coherently argued that, both in commonsense and in formal science, the notion 'existence' is a theory-based notion³. These are a few of the extremely interesting and basic cross-disciplinary issues that science is currently grappling with which do not figure at all in Masani's treatment of science and scientific methodology.

Science is natural theology

It is generally accepted now that there is an irreducible non-logical aspect to scientific theory construction. 'Discovering' the so-called laws of nature is an essentially creative activity. Data accumulated through exploratory experiments do not automatically lead to the formulation of general laws. Peirce termed this process of theory construction *abduction*. Masani points out that

'a scientist's concern in abduction is not to accommodate every observed fact, but give an intellectually and aesthetically compelling explanation of data' (p. 46).

A question that immediately arises is this. In Peirce's words: 'How is the scientist able to hit upon a good abduction given the enormous multitude of alternative hypotheses that fit the facts under consideration?' (p. 60). Since, at present, we know very little about the mechanisms that underpin the creative process in humans, questions such as the above rapidly lead to mysticisms of various sorts. In Masani's words: 'Peirce speaks of the innate ability of the human mind to seek positive truths as an *intunement with nature* and attributes it to human evolution. Elsewhere he calls this human "faculty of divining the ways of nature" an *insight*' (p. 61). Many eminent scientists have further argued that a great scientist's abductive ability is 'guided by his perception of mathematical beauty, which in turn comes from a strong faith in the mathematical harmony of the cosmos' (p. 61).

Galileo described 'nature' as God's second book written with mathematical characters. While endorsing this viewpoint Masani goes on: 'The starry heavens are now the second scripture.... The sciences are, thus, the products of the application of scientific methodology to God's second book, i.e. they are just branches of natural theology, much as the application of the scientific methodology to the first book is divine theology' (p. 63).

Earlier, characterizing the abductive capability to be of the general nature of instinct, resembling the instinct of animals, Masani claims: 'It is clear that this Insight or Instinct varies from the low, which belongs to most humans and provides us with linguistic and abductive skills adequate for purposes of daily living, to the very high, which belongs to a small number of individuals and provides them with the power "to divine the ways of nature"' (p. 61).

What is being glossed over in all this discussion is the fact that terms like 'instinct', 'insight', 'linguistic skill', 'abductive skill', themselves, need theoretical underpinning to make scientific sense. In the last several decades a vast amount of literature has grown up based on controlled observations in an attempt to explicate these terms. It is a pity that Masani has missed a valuable

opportunity to add depth to his discussions by taking note of at least the more relevant of these on-going scientific investigations.

Cybernetics, teleology, and morality

In Part III of his monograph, Masani widens the scope of his discussions significantly by confronting issues that are conventionally addressed by humanists and social scientists. Within the framework of cybernetics, which is centrally concerned with purposive behaviour, Masani tries to grapple with concepts like *cooperation*, *conflict*, *exploitation* (in economics), *morality*, and so on.

Masani's main conclusions may be summed up as follows. 'The survival of any biological organism A brings about the destruction of some other biological organism B' (p. 102). This is necessitated by the second law of thermodynamics. For according to Schrödinger, 'the device by which an organism maintains itself at a high level of orderliness (i.e. low level of entropy) really consists in continually sucking orderliness from its environment' (p. 102). Masani maintains that except for humans, conflict in nature necessitated by the above considerations is almost never willfully destructive. He refers to this as the *principle of least violence*. Only humans indulge in willfully destructive intraspecies conflict. He thinks that this is a consequence of the exercise by humans of their freedom of action.

Masani's other major thesis is that there is an *ontogenetic-phylogenetic imbalance* in human beings. Excess labour done by animals – beyond what is needed for self-preservation – such as building nests, taking care of young ones, etc., contributes to species' well being. But this does not hold true in the case of humans. Masani terms this *human alienation* and claims that its social manifestation is the *phenomenon of exploitation* of humans by humans.

Such considerations lead Masani to argue for the need to enunciate a code of conduct (ethical or moral norms) and to urge humans to order their lives and actions to conform to such a code. Specifically he would like scientists to take up scientific activity as a vocation (in the religious sense) and consider that their ultimate aim is 'to design a social

organism in which the ontogenetic and phylogenetic interests are balanced. The prosthesis consists in action designed to reduce the prevailing ontogenetic-phylogenetic imbalance' (pp. 118-119).

It is not for want of religious teaching or exemplary religious teachers that humanity finds itself in the mess it is in now. It is somewhat simplistic to expect that what the moral teachings of these religious teachers have not been able to accomplish during the last several thousand years, scientists will be able to achieve now or in the future. On the other hand, what the scientists, *qua* scientists, can do is to pose why-questions of the following sort and try to find answers to them using the scientific methodology. Why is the socio-biology of humans so complex and so qualitatively different compared to the socio-biologies of other animals? Why are the individual behaviours and group behaviours of humans so qualitatively discrepant?

In trying to find answers to these questions, it is significant to note that language behaviour and culture are two features that differentiate human societies from all other animal societies. Culture determines not only what a human being knows but also how one behaves as a social being. Culture also determines a good deal of the physical details of the world a human being inhabits. Increasingly most human societies tend to live in environments that are culturally manufactured rather than naturally given⁴.

In view of the above aspects, the socio-biology of humans – in contrast to other animals – would seem to be heavily culturally determined rather than be exclusively genetically determined. Language behaviour clearly plays a critical role here in acting as a bridge linking culture and biology. An important, but little understood, feature of language behaviour is its link with affect (emotions and the non-rational substrate of human behaviour). Till we

manage to get a better grasp of some of these issues, all discussions about morality and religion, good and evil, saintly and sinful behaviour, and so on, are likely to remain mere words.

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1. See also, Narasimhan, R., *Curr. Sci.*, 1993, 64, 361-365.
 2. John H Flavell, *Cognitive Development*, Prentice-Hall International Inc., 1985, 2nd edition, pp. 33-34
 3. See for example, Narasimhan, R., 'On the Nature of Scientific Activity Relationship between the Physical and Behavioural Sciences', Tata Institute of Fundamental Research, Bombay, 1971.
 - 4 D'Andrade, R. G., *Cogn Sci.*, 1981, 5, 179-195
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