questions about human life which separated them from other classes, from theologians, from artists, from writers" (p. 154). While, as already stated, many of us in the Third World would tend to think similarly, *Buck* states that he does not "think about science inthose terms" (p. 155).

Coming back to the first essay, *Elkana* agrees in it – in passing – that "science is the most important dimension of Western culture" (p. 8); that, for example "viewing the common-sense explanation as a special case of the theoretical, is more typical of Western science than of traditional thought" (p. 30); that "the most typical feature of Western thought is that, at least since the seventeenth century, the theoretical entities have been segregated into two classes which are respectively employed in theology and by science" (p. 30); and, finally, that "Western science is distinctive... in creating deliberately new experiences by inventing theoretical entities in advance of common-sense observations". (p. 30) – all of which is a round about and rather grudging way of singling out Science as being unique and of speaking of a hypotheticodeductive method.

The book is tightly written and well edited but its authors belong exclusively to developed nations and, from an underdeveloped perspective, which is mine, its vantage point seems *blasé* and, to some extent, decadent. It is part of the present anti-science movement, in its most refined and subtle guise. Its chief objective, however, which is "to be suggestive, to stimulate further research and investigation" (*Mendelsohn*'s introduction p. XI) has been achieved and the suggestion that science be located "in cultural space" and the actors, their actions, and their knowledge be understood "within the broader contexts of cultural explanation and anthropological study" (Preface p. VIII) is certainly acceptable and timely.

I know, however, that it is no longer fashionable to speak of the bounties of science and to be "celebratory of the sciences and scientists" (Preface p. VII), after Hiroshima, the population explosion and pollution. But here in the Third World we are pining for the results of an efficacious Western Science, since we are only too well aware of the alternative to it: poverty and dependence. Either we adopt Science, at the same time trying to avoid its "perverse effects" as the French Sociologist Raymond *Boudon* terms them, or we remain subject to Western scientific and technological imperialism as subject people.

All the same, *Sciences and Cultures* will have the healthy effect of combating the arrogance of most practicing scientists, in all Worlds, who, however, are not likely to read the book, destined to a relatively small elite of social and anthropological scholars who are interested in the scientific phenomenon as an object of study.

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Marc de MEY: *The Cognitive Paradigm,* D. Reidel, Dordrecht, Holland and Hingham, Mass, USA, 1982 $ 43.50

Scientific thinking has been a subject of inquiry since at least 1830 with the work of A. *Comte.* An explanation of scientific thinking that is comparable to Darwin's explanation of the origin of species, for example, does not yet exist. This book indicates the great variety of approaches toward an explanation of scientific activity and critically evaluates them. It concludes with the assertion that the time has come for "new alliances between the various disciplines that study scientific knowledge, new alliances between the natural and the social sciences which will reveal the intricate complementarity between knowledge of external worlds and models of ourselves." Whether such alliances will lead to a satisfying explanation and whether the cognitive approach to these alliances will bear fruit is left open.

De Mey does lead the reader masterfully through the various disciplines that study scientific knowledge. He reveals even to those familiar with that literature new patterns of looking at how they interrelate. He does this by weaving together examples from artificial intelligence, cognitive science, genetic epistemology, philosophy, and other traditional and modern areas of scholarship.

The book is organized around what D. *Michie* had regarded to be four stages in the development of artificial intelligence since 1950. These four stages are held to have parallels in the studies of science. The stages are labeled as:

(1) a monadic stage, in which a pattern is recognized by means of template-matching. This corresponds to positivism;

(2) a structural stage, in which a pattern is recognized by virtue of its being constructed from more elementary features according to rules of formation, production and transformation. This corresponds to logical positivism,

(3) a contextual stage, in which a pattern such as A is disambiguated depending on whether it is in the context of TAE or CAT. This corresponds to the sciences of science; and

(4) the present, cognitive stage, in which a pattern can be recognized and disambiguated only by bringing world and/or specialized knowledge to bear upon the task. This corresponds to to paradigm theory.

Having introduced this structure in Chapters 1 and 2, the author presents in Chapter 3 the germinal ideas of positivism as a monadic view. He does this in a way that recaptures some of the enthusiasm that must have accompanied the insights at the time they were originated. With the simple idea that information is data that *fills in forms*, *De Mey* identifies Kant's reason with form and experience with the data that is filled in. The cognitive view is already noticed in British empiricism: object perception is not solely seeing the object; it involves seeing what one knows as well. The attempt to integrate and unify the rapidly expanding scientific specialties led to critical positivism. This, as articulated by *Mach* in 1886, held that "the world consists only of our sensations." *Mach* meant that for a human observer, sensations were primary – his experiments on how moving black and white pictures can give rise to the experience of color typified his position. The function of science, according to *Mach* and *Pearson*, is not to explain, but to group or classify or associate sense-impressions into appropriate clusters of monads. Some of the most ambitious contemporary models of the "mindful brain" (*Edelman*, 1978) appear to subscribe to this monadic view in their stress on natural (Darwinian) selection of neuronal groups as recognizers of external signals from a pre-existing diversity of such groups that suffices to recognize all possible signals of value, even with enough redundancy to accommodate imprecision.

The concern with language marks the transition from positivism to logical positivism. Language is not merely the result of associated sense data, but, rather, a source of the forms for collecting and processing data. Science is thus a well-structured system of sentences linked to facts. Syntactic considerations predominate over semantic ones. But their application to empirical sciences has resulted in confusion, notably one between principles of logical reconstruction and rules for production of science. De *Mey*'s assertion that philosophy of science is preeminently logical positivism and shows a preference for debate over understanding would not be generally accepted by contemporary philosophers of science. The current movement is historical realism, with stress on case histories by scholars such as *Shapere* and *Holton*.

The search for contexts of science led to concern with the history, sociology, psychology, economics and many other sciences of science alongside the philosophy of science. B. *Hessen*'s seminal 1932 paper that gave rise to externalism – a reference that was omitted in *DeMey*'s otherwise very scholarly treatment – analyzed the social and economic conditions that contributed to Newtonian science and stimulated the work of *Merton* and, subsequently, separate disciplinary studies of science.

The cognitive view of science integrated all these specialized approaches. Like the Copernican revolution, *Kuhn*'s analysis of scientific revolutions has as its first stage "the combination of

various cultural influences into a well-defined technical problem. Far-reaching implications for society become manifest only after the technical problem and its solution have been accepted, first by the community of specialists directly concerned and secondly by the specialist communities of other affected disciplines." (p. 83) *Kuhn* postulates an alteration between normal science, characterized by rigid tradition, and revolutionary science. Because a paradigm does not evolve but is replaced, cumulative growth occurs only with respect to a given paradigm. A paradigm is a model, a cognitive structure, that shapes expectations of "normal" scientists.

"Despite the diffuse nature and the many deficiencies of the concept of paradigm, some groups of researchers have been willing to accept it as a challenge to their ingenuity and see it as their task to make it sharper and more substantial." (p. 107) De *Mey* calls these researchers paradigm detectors and paradigm dissectors. He devotes the three chapters of Part II to the former and three to the latter in Part III.

Part II, entitled "The Social Structure of Science," begins with a chapter on bibliometrics and the structure of science. To many specialists in this area, this will be a fresh and well-structured approach to their field. It is reasonably up-to-date and critical, bringing together in a coherent way many well-known methods and results about the growth of science, citation networks and various kinds of bibliographic links. In Chapter 8, de *Mey* offers a lucid exposition of the *Ben-David-Collins* account of the origin of specialities, using the example of Wundt's migration from physiology to found psychology. In Chapter 9, he demonstrates his ability to synthesize by combining features from models for the life cycle of specialties due to *Goffman, Crane, Mulkay, Mullins, Radnitzky* into four stages: the pioneering stage, characterized by a philosophic attitude, creativity, originality, richness of ideas and limited sloppiness; the building stage, one of normal science, solid knowledge, exponential growth in formal publications; internal criticism, with rigorous, precise, transparent standard texts but also with first signs of disintegration; external criticism, in which the specialty becomes defensive by dogmatization, immunization and trivialization.

The three chapters of Part III, "Cognitive Structure and Dynamics of Science," are: Paradigms in the Psychology of Attention and Perception"; "Puzzle-Solving and Reorganization of World Views"; "Conservation and the Dynamics of Conceptual Systems." Analogies between the rabbit/duck, wife/mother-in-law, rat/man, pelican/antelope figures on the one hand and the Galen/Harvey view of blood circulation are artfully exhibited. Drawing of parallels, such as between *Piaget*'s schemes and *Minsky*'s frames, abound throughout the book and come to a climax in the last chapter. *De Mey*'s grasp of the literature that he brings together, organizes and synthesizes is truly comprehensive. Yet there are significant omissions, for example: the works of *Lotka, Nalimov,* D. *MacKay,* S. *Amarel,* M. *Moravcsik* and this reviewer. But the book is a valuable contribution to the literatures of cognitive science, computer science, information science, sciences of science, philosophy and the social sciences generally.

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G.M. *Edelman,* V.B. *Mountcastle, The Mindful Brain,* MIT Press, Cambridge 1978.