Speaking Minds: Interviews with Twenty Eminent Cognitive Scientists. P. Baumgartner & Sabin Payr, eds. Princeton University Press, Princeton. 1995.

The realization that living organisms are really information-processing systems and, therefore, the proper framework for the study of their behaviour is the information processing (i.e. computational) framework, has brought about a major revolution in the West in traditional academic disciplines such as psychology, linguistics, education, anthropology, and even sociology. The information-processing framework as a conceptual and theorizing framework, and computer simulation studies as laboratory techniques for evaluating partially articulated theories, have been playing essential roles in drawing several of these traditional disciplines together and giving rise to interdisciplinary programmes of far-reaching consequence. Two such programmes that are beginning to have major impacts on behavioural studies are: Cognitive Sciences Programme and Neurosciences Programme.

Gardner[1] presents a very readable and a detailed historical account of the development of cognitive science which he refers to as 'the mind's new science'. According to his account, the core disciplines constituting cognitive science are: psychology, philosophy, artificial intelligence/computer science, linguistics, neurosciences, and anthropology. Gardner's definition of cognitive science is used as a guideline by the editors of *Speaking Minds*, a book of interviews with 20 academic research scientists identified as 'eminent cognitive scientists'. All the interviewees are from the United States. Their names, disciplines and institutional affiliations are as follows.

Philosophy: Patricia & Paul Churchland (UCSD); D. Dennett (Tufts); H. Dreyfus (UCB); J. Fodor (Rutgers); J. Haughland (Pittsburgh); J. Searle (UCB).
Computer Science: A. Newell (CMU: deceased); H. Simon (CMU); S. Weizenbaum (MIT: retired); R. Wilenski (UCB); T. Winograd (Stanford); L. Zadeh (UCB).
Psychology/Biology: J. McClelland (CMU); S. Palmer (UCB); D. Rumelhart (Stanford); T.Sejnowski (UCSD).
Linguistics: G. Lakoff (UCB).
Math Logic: H. Putnam (Harvard).
Sociology: A. Cicourel (UCSD).
(Note: UC, University of California; B, Berkeley; SD, San Diego; CMU, Carnegie Mellon University)

The choice of persons to be interviewed seems to have been based as much on logistic factors such as time, travel budget, availability of interviewees at the time fixed for the visits, and so on, as on the work in cognitive science these persons are engaged in and the centrality of the role they are playing in the development of this interdisciplinary field.

'Why a book of interviews?' The editors claim 'This dynamic personal discussion seemed to us – at least in some respects – much more powerful and concrete than the more general, and often more moderate and balanced, considerations in the written publications of the same scientists'. However, there are major difficulties with an interview format of the kind the editors have chosen, especially when, as in this case, the person conducting the interview is not himself/herself a practising scientist in the field being discussed critically. The most that can be done is to opt for a somewhat gossipy approach to the issues: 'So-and-So says such-and-such, what is your view on that?' or, alternatively, 'What is your view on such-and-such a controversy?', and so on.

Issues like 'Turing test', 'the chinese-room argument', 'connectionism versus physical symbol system approach', 'whether AI has made (is making) progress or is becoming irrelevant', and so on, lend themselves readily to a format of this kind – especially where the interviewees are academic philosophers with interest in AI and cognitive science. 'Listening' to arguments (gossip?) at a personal level on such issues is illuminating (or even fun) only to the extent the persons involved in the dialogue are interesting personalities in themselves. Unfortunately, this is not always the case and the dialogue pretty soon becomes rather repetitive and tiresome (especially if the personal views being thrown around are already well known to the practioners in the field). To outsiders, quite often, the discussions are likely to be of no value unless they are already 'literate' about the issues being argued about. The editors have tried to help by appending a reasonably detailed glossary of terminology. Another helpful gesture is a reading list of his/her own publications suggested by each interviewee.

In my opinion the participants in the discussions have thrown away a good opportunity to 'educate' aspiring entrants to the field of cognitive science, as well as outsiders, about the really *deep* problems that need to be addressed if cognitive science is to make any substantive contribution to our understanding of the agentive aspects of agents and how the brain/mind plays its central integrating role to enable agents to behave the way they do. What are the deep technical (i.e. computational) and theoretical (*not* philosophical) issues that need to be addressed in understanding vision, language behaviour, perception, motor behaviour (e.g. object manipulation, navigation, controlling body movements. maintaining balance, etc)? What new issues arise when behaviour involving two or more of these modalities has to be deployed to achieve some given end? Babies, only a few months old, have been shown to be capable of imitating facial expressions they are exposed to. How do they achieve this (especially since they cannot watch their own faces)? We still do not know how to construct a robot that can watch somebody else (or another robot) going through an assembly operation and imitate it. Young children are capable of accomplishing this. What are the computational issues involved here?

There are some discussions in the book about how to build up interdisciplinary programmes and why such programmes are generally more successful in the United States than elsewhere – Europe, for example. These discussions are of some relevance in the Indian context, in that in our universities (and elsewhere too) the disciplinary walls continue to remain as thick and impenetrable as ever. It may be useful to close this review with the following remarks by Patricia Churchland on why she chose to go to UCSD:

'The cognitive science community here . . . is large, diverse and lively. At some point or other, everybody passes through, so there is lots of contact, and that means there is opportunity to learn

a lot and keep abstract of new developments. There is also considerable interest and activity in computational neuroscience, so I feel much at home. I am an adjunct at the Salk Institute, and I currently work in . . . Sejnowski's laboratory. The lab has tea every afternoon, and various people drop by – often Francis Crick, and some of the visual psychologists, such as Ramachandran – and we discuss everything from consciousness and free will to apparent motion to NMDA receptor.'

1 Gardner, H., *The Mind's New Science: A History of the Cognitive Revolution*, Basic Book, New York, 1985.

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Development of Ideas in Physics. Nils Ryde. Almqvist & Wiksell International, P. O. Box 4627, Alsnogatan 7, S-116, 91, Stockholm, Sweden. 196 pp. Price: Not known.

The rapid strides made during the first half of this century and a little earlier, have been the subject of numerous books in physics. Indeed, for several decades now, an introductory description of this area commonly known as 'Modern Physics' is an integral part of undergraduate physics curriculum in every university. It includes topics such as the discovery of electron and atomic nucleus, optical and X-ray spectroscopy, discovery of electron spin, neutron, nuclear fission and fusion and introductory quantum mechanics. The well-known textbook by Richtmyer, Kennard (and Cooper in later editions) gives an excellent exposition of these topics. Recent textbooks on modern physics like the one by Kenneth Krane also include more contemporary topics such as nucleosynthesis in stars, quark model of elementary particles and so on.

This book is a collection of a dozen partly didactic and partly historical essays on topics in modern physics. The author has been a participant in the events that unfolded in the 'golden age of physics', and his familiarity with them comes through clearly in his writing. His prose is direct and unostentatious. Most of the essays are well written, especially the ones on 'optical spectroscopy' and 'origin of the elements'. Some, however, are sketchy and need additional material for completeness (for example, the essay on matter and antimatter). The narration could have been made much more interesting with some illustrations and biographical sidelights on the main characters of the story. The quality of production is good, though a few errors remain. (For example, eq. (12) on p. 37 and eq. (21) on p. 44 contain printing errors.)

The main limitation of the book is that the essays are too 'dense' in the subject matter to be comprehensible to a beginning student. For example, in the space of some 15 pages, the author describes the rise of quantum mechanics from Heisenberg's 'arrays', deBroglie's matter waves to the successful QED explanation of the Lamb Shift in hydrogen. Such a compact description is obviously suitable only for those who are already broadly familiar with the theme. Despite this, the book does fill a certain need, since the more authoritative and complete historical accounts of modern physics (such as *The Conceptual Development of Quantum Mechanics* by Max Jammer and *Inward Bound* by Abraham Pais) are too expansive to be read with ease. The book provides short and useful historical summaries of several interesting topics, which teachers and physicists can profitably use for enrichment and recapitulation of what they already know.

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A Modern Introduction to Ancient Indian Mathematics. T. S. Bhanu Murthy. Wiley Eastern Ltd., New Delhi, 1992, 214 pp. Price: Not mentioned.
Indian Mathematics and Astronomy. S. Balachandra Rao, Jnana Deep Publications, 2388, 13th Main, A-Block, Rajajinagar, II Stage, Bangalore 560 012, India. 1994. 234 pp. Price: Rs 75, $17.00.

A man is known by the company he keeps. I suppose a similar statement holds for books as well. One of the books under review (*A Modern Introduction to Ancient Indian Mathematics*) suffers because of its unqualified association with Swami Bharati Krishna Tirtha's *Vedic Mathematics*. The author mentions in the preface that the initial purpose of the book was to present proofs of certain propositions stated in *Vedic Mathematics*, thus subtly authenticating it. (It is more an error of omission than of commission as he fails to warn the readers about the doubts expressed by scholars in respect of many of Swamiji's claims.) First, a few words about *Vedic Mathematics*. It is more or less established that its contents are not of vedic origin (the Swamiji has failed to produce a reliable reference) and its mathematical contents do not, by a long chalk, justify the tall claims made in the book. Take the example of the algorithm to write down the decimal expansion of reciprocals of certain integers. As has been pointed out by S. G. Dani in his excellent two-part article ('Myths and Reality – On Vedic Mathematics', *Frontline*, 22 October 1993 and 5 November 1993), there is no evidence in the available vedic works or even in the works of other Indian mathematicians for over 2000 years later, of any knowledge of writing a fraction in decimal form. Unfortunately, this is one of the propositions Bhanu Murthy chooses to prove in his book.

Apart from these proofs (of Swamiji's propositions), Bhanu Murthy's book contains a well-written account of the *Pell's* equation (which he prefers to refer to as Brahmagupta–Bhaskara equation). There is also a chapter entitled 'Selected Topics in Geometry' and the reviewer fails to understand why some of the topics which are featured are there at all; for instance, Morley's theorem [which would have had some meaning at least if he had given the elegant proof due to M. T. Naraniengar in 1909 (see *Geometry Revisited*, Coxeter and Greitzer)].

On the other hand S. Balachandra Rao's book, *Indian Mathematics and Astronomy*, provides a good introduction to the development of mathematics and astronomy in India since vedic times. Each mathematician's contribution is preceded by a discussion on his place and times according to available records. In fact, one of the praiseworthy features is that statements made are justified with references and different viewpoints are sincerely reproduced. There is an excellent bibliography at the end.