

chemistry and electron spectrometry is admirable. Otherwise, the text gives a sound account of most of the analytical techniques of spectroscopy, electrochemistry, radiochemistry, chromatography, mass spectrometry (but not, strangely, for mineral samples) and so on, and includes an all-too-brief review of automation in the laboratory. The book is well illustrated with graphs, line diagrams and tabular summaries, and there are problems for the student, together with answers associated with all the chapters except for the introduction and that on automation.

I found the book to be reliable and sound, rather than inspirational, which is perhaps as much as one should expect from a monolithic work of this nature. Certainly, there is little missing from it, though sampling — the first step in any analysis — is unfortunately ignored. □

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A whole mind of information

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Cognitive Science: An Introduction. By N. A. Stillings, M. H. Feinstein, J. L. Garfield, E. L. Rissland, D. A. Rosenbaum, S. E. Weisler and L. Baker Ward. MIT Press: 1987. Pp. 533. \$25, £22.50.

THE enterprise known as cognitive science is constituted out of five contributory disciplines: psychology, linguistics, computer science, philosophy and neuroscience. Given that the last named of these is itself compounded of a variety of established specialisms, the complete cognitive scientist has to encompass a lot of material. Aspirants to that status can, therefore, look warmly upon this, the first book to provide an introduction to all of the relevant disciplines within a single set of covers. ▶

The first chapter offers a statement of certain assumptions which together define the enterprise itself. Cognitive scientists believe that the mind can be usefully conceived of as a system for processing information, and that meaningful behaviour can result from formal operations on symbol structures that are in some way representational of the world. The case for such assumptions is explained in the first instance with reference to the use of algorithms for long multiplication, and also by means of the computer metaphor of mind. However, it is stressed right from the start that current hardware and software should not be expected to provide good models of the cognitive architecture, the form of which, it is believed, will be revealed only by way of empirical methods.

The main body of the book consists of 11 individually authored chapters offering tutorial reviews of particular areas. Cognitive psychology, linguistics and computer science are emphasized, with single chapters allocated to philosophy and neuroscience. Inevitably, given the large tracts each chapter must cover, the density of information is high. *Cognitive Science* is not, and could not be, an easy read; there are just too many complex ideas to be put across. Nevertheless, and despite variations in individual style, the quality of exposition is also high throughout, such consistency surely owing something to the editorial hand of the senior author. His opening chapters on cognitive psychology establish the standard, and his concluding chapter on vision gives an unusually accessible account of the how and why of such complex matters as the Laplacian operator and the computing of convolutions.

A further attractive feature of the book, and one that may help the flagging undergraduate reader to keep going, is the invigorating air of optimism with which it is imbued. The authors write with a conviction that progress in cognitive science in real and cumulative. Coupled with this enthusiasm, however, is a tendency to gloss over problems and limitations. In the chapter on knowledge representation, for instance, the legal advice program HYPO is cited as an exemplar of artificial intelligence. A section of dialogue concludes with HYPO outputting two wholly trivial pieces of advice, but no comment is passed either on this particular case or on the extent to which trivial conclusions are or are not typical of supposedly intelligent programs.

There is a wealth of high-grade material to be extracted from *Cognitive Science*. But readers will sometimes have to exercise their own judgement as to what is genuine ore and what fool's gold. □

Art of the soluble

Russell Moseley

The Scientific Attitude. By Frederick Grinnell. Westview, Boulder, Colorado: 1987. Pp. 141. Hbk \$29.95, £26; pbk \$13.50.

TOWARDS the end of his short book, Frederick Grinnell touches upon the inadequacies of a traditional education in science in conveying a true picture of what actually constitutes scientific practice. The image of science, as he points out, is typically idealized while a Whiggish view of progress is attributed to something called 'the scientific method'. Little emphasis is placed on how past progress was accomplished, and even less on why developments took the direction they did. Professor Grinnell hopes that his book will give undergraduate students a better picture of how science is done while, at the same time, providing a guide through the complexities of a scientific apprenticeship for graduate students, and also encouraging practising scientists to reflect on the conduct and direction of modern science.

He approaches this formidable task by looking at scientific activity at the levels of the individual, the collective and society. His account of the third of these is the least convincing. A token gesture towards the interaction of science and politics (including the obligatory reference to the Lysenko affair), a brief look at science, religion and ethical issues, and a curious section entitled 'The Impact of the World on Science' (confined to a single page), do

not take us very far. This is a pity, since the earlier descriptions of practising science as an individual and as a member of a scientific collective have much to commend them.

Certainly, anyone contemplating a career in science could read with profit the account of how scientific collectives operate, although I suspect that the description of graduate programmes, thesis advisers, the difficulties of publishing and the awarding of grants might be as familiar to professionals in the social sciences and humanities as to their scientific colleagues.

The earlier parts of the book will, therefore, be useful in giving students (especially in the life sciences, from which almost all the examples are drawn) a feeling for what actually doing science might entail. It has the merit of being jargon-free and clearly written by someone who, as a professional scientist, will have a credibility with science students that a philosopher or sociologist might not. That the book pays little attention to the interaction between science and its broader social and cultural context can always be remedied by encouraging readers to turn to additional sources. Indeed, many will already be familiar with C.H. Waddington's book which was published almost fifty years ago under the same title as Professor Grinnell's. After reading both books, students might well be encouraged to reflect on the ways in which the scientific attitude has changed over the past half century. □

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