

"Jack must have found the sandwich in the story tasty, but I cannot answer the question in general as I do not eat bacon sandwiches".

The book contains a progression of convincing examples that point the way towards such interactions, while continuously reminding the reader of the enormous programming difficulties that this implies. For Schank the massive memories of the future will be used to make helpful, interactive systems from which people could learn world knowledge in fields that are new to them. He does not believe in the super world-saver but sees systems as developing into patient and understanding teachers. The latter parts of *The Cognitive Computer* return to the positive benefits of this sort of AI: better health services, better banking systems and even better democracies.

There are two economic and social reasons which suggest that Schank's view is right. The first, agreed by both authors, is the falling costs of knowledge storage. The second is the powerful market edge of a machine which is well-tuned to human use over one that isn't. In other words, no industrial concern could bear the costs of Michie's megalomaniac machine and hope to recoup the outlay from a free-economy market. Schank's helpful cooperator, on the other hand, sounds far more marketable than even the most successful micro in the High-street shops today.

On a critical note, it is a sad fact that neither of these books says much about the unprecedented opportunities which lie ahead for new computer structures and designs encouraged by the silicon chip revolution. Both sets of authors pin their hopes on machines whose general structure has hardly altered since 1947. For example, several laboratories in the world are exploiting low chip costs by researching parallelism (a trick that the human brain uses to advantage). This may not only be the precise vehicle that brings down computing times to fulfil some of the predictions, but also opens new opportunities for a flexible and rapid acquisition of knowledge which on conventional machines would just take too long.

If readers can stand up to the continuous barrage of suggestions by Michie and Johnston that future survival depends on machines which may never be built, they may well find the historical approach and the lively style of *The Creative Computer* acceptable. In contrast, Schank and Childers's *The Cognitive Computer* is written in an appealing, absorbing and highly informative style throughout. With its clear philosophy and lucid examples of some difficult programming concepts, it ranks as one of the best general books on AI written to date. □

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Variable climates

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The Global Climate.

Edited by John T. Houghton.
Cambridge University Press: 1984.
Pp.233. £27.50, \$49.50.

ON THE tails of the surge of interest in climate has come a number of books dealing with various aspects of the subject. *The Global Climate* is one of the most recent, and tries to encapsulate current knowledge by drawing on the talents of a number of scientists working in constituent areas of climatic research. The preface states that it is designed "to explain to a wider scientific community the background, aims and main lines of research being pursued". It is to be hoped that this is not the only justification for the book, because, apart from the general summary in the first chapter, it will probably appeal only to those already active in the subject.

The 12 contributions are somewhat specialized in nature and range over climatic observation, modelling, clouds and radiation, ice, the oceans and atmospheric composition. There is no index – a severe drawback – and the standard and content of the chapters are highly variable, some being overly detailed and others quite short and specific. For example the observational study is essentially confined to discussing variations in temperature, which hardly illustrates the real complexity of the observed climate. By contrast the elaborate description of model experiments concerned with soil moisture and surface albedo variations includes virtually every such experiment performed; this detail is hardly justified when no real ap-

preciation is given of the very poor representation of soil moisture used in models at present. There is a similar problem with the account of clouds and radiation which is mainly about results from one-dimensional models, far too little space being devoted to the real problems of modelling the three-dimensional world.

The three chapters on oceanography highlight the important role that the oceans play in climate, and emphasize the complexities of the interactions between the oceans and the atmosphere. Wood's contribution on the upper oceans is particularly comprehensive, but is marred by his excessive use of references; at times the article reads like a telephone directory. The following chapter by Wunsch, on the ocean circulation, is the most stimulating in the book. He emphasizes the problems which have to be resolved, and the book as a whole would have been all the better had more of the authors taken this tack.

The Global Climate portrays, warts and all, the very great complexity of the climatic system and the tremendous problems involved in trying to predict the future. It would have been improved by chapters on palaeoclimatology, and particularly on theory, where the underlying dynamical principles of the climatic system could have been illustrated. But what, above all, is generally lacking is any sense of the excitement offered by climatic research. Communication of this point to a wider audience is necessary if more first-class brains are to be attracted into the field. The intellectual challenges are certainly there – prospective high-energy physicists please note. □

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All about polymers

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Macromolecules, 2nd Edn. Vol. 1 Structure and Properties; Vol. 2 Synthesis, Materials, and Technology.
By Hans-Georg Elias.

Plenum: 1984. Vol. 1 pp.521, \$65, £50.25; Vol. 2 pp.821, \$95, £80.75.

MACROMOLECULES are the building blocks of life, and study of them unites the three prime natural sciences – chemistry, physics and biology. On the other hand, macromolecules in the form of polymers clothe not only people but the wheels of cars and planes, and are used as substitutes for metals and glasses in industry. The writing of a comprehensive, up-to-date account of macromolecular science and technology is thus a complicated and difficult job, but that goal has been achieved by Dr Elias. The original edition of *Macromolecules* acquired a well-

deserved reputation for thoroughness and reliability; this second edition, written practically *de novo*, is much more complete and should be even better received.

The two volumes are encyclopaedic in scope and contain an enormous amount of information, beginning with the chemical structure of macromolecules, their configurations and conformations, and ending with the description of specific materials such as fibres and adhesives. The reader will find here information on nearly everything to do with polymers, from a simplified derivation of the formula for the dimensions of the polymer coil (p.119) to data on the annual production of oil in different countries (p.857). (Oil is one of the best sources of raw materials for polymer production; Mendeleev wrote that the burning of oil was the same as the burning of currency bills!) The whole is written in a clear and straightforward style. And while the approach reflects Dr Elias's viewpoint, the reference lists include all the most important papers, reviews and monographs on the subject.