intention; here the American philosopher Dan Dennett has interesting things to say, also using the chess-playing computer example. He points out that even the designer cannot predict the next move of the machine from its design. He can only do so by considering rational and good moves of the game, which implies that the machine "chooses" rational and good moves. So, one is viewing machines such as these in intentional terms. Dennett, however, is careful to say that we may be right to attribute a lot more to human beings than this rather limited kind of intention, though he is not sure what this extra is.

Hubert Dreyfus is the respected devil's advocate of AI, whose book *What Computers Can't Do* (Harper & Row, 1972) provided, to the credit of all, reasoned criticisms that have been discussed with reason and not merely dismissed by the high priests of AI. Here Dreyfus adapts to the new developments of computer systems, starting with the universally acknowledged achievement of Winograd's natural language understanding program SHRDLU of 1972, which worked in a simplified micro-world, which was not much like our reality. Dreyfus objects to a common AI assumption, that such manageable micro-worlds can be generalized to the real world of physics and people. He suggests that proponents of AI are misled by the success of test-tube procedures in the natural sciences into thinking that these micro-worlds are even relevant; because although the test-tube worlds of physics obey physical laws, the computer micro-worlds may obey only their own laws. I suppose the answer is that "mental" laws are not physical laws anyway, so the whole exercise is outside physics; but it may still be science. Perhaps only physicists will strongly object to this conclusion.

Marvin Minsky invokes the notion of structures of knowledge — "frames" — to match common situations and to be adapted to the special features of situations. He attributes human intelligence to the individual's ability to select frames appropriately and rapidly. Selected knowledge frames are adapted to match the details of particular situations as they are encountered. This bears a resemblance to Bartlett's "Schemas" for locking together and giving significance to perceptions and memories. It is also related to David Marr's "Primal Sketch", his initial descriptive stage of visual processing.

Several of the authors here express doubts on the scientific status of AI and its claims and results. For Marr,

> a *result* in AI consists of the isolation of a particular information-processing problem, the formulation of a computational theory for it, the construction of an algorithm that implements it, and a practical demonstration that the algorithm is successful.

He points out, though, that there may be nice and neat successful solutions (which may not be found) and also messy solutions which may be as successful. Given the aesthetics of science, one may guess that AI will be accepted as properly scientific only if its solutions are both successful and elegant, whatever be the case for our own brain's functions — even when we are thinking about the challenging intellectual issues presented in these illuminating essays on artificial intelligence.

Margaret Boden's *Minds and Mechanisms* is a collection of her own papers on the philosophy of AI. Her concern with the concept of intention goes back to her first book, *Purposive Explanation in Psychology* (Harvard University Press, 1972), and is also a theme of her widely acknowledged text, *Artificial Intelligence and Natural Man* (Harvester, 1977). Intention appears to be basic to any language system, and Professor Boden was largely responsible for pointing this out. Her strength lies in combining a deep knowledge of cognitive psychology, and what AI programs can and cannot at present do, with a background in both natural science and philosophy. The result is an authoritative book, though inevitably there is unevenness and some redundancy as the papers were written separately and for somewhat different audiences. Some of them take us more deeply into the issues of her previous books, and the technical detail presented here justifies careful reading for appreciating the fascination of mind struggling to be transmigrated into man-made machines that surprise and puzzle us. □

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AI at MIT

At the end of April, MIT Press will publish a two-volume paperback edition of *Artificial Intelligence: An MIT Perspective* edited by Patrick Henry Winston and Richard Henry Brown. The original hardback edition was reviewed in *Nature* **282**, 540; 1979. Price of the paperback version is $12.50, £8.75 per volume; hardback is available at $25, £17.50 per volume.

Polymer dynamics revealed

F.A. Bovey

Molecular Motion in High Polymers. By R.T. Bailey, Alastair M. North and Richard A. Pethrick. Pp.415. ISBN 0-19-851333-X. (Clarendon/Oxford University Press: 1981.) £42.50, $69.

AS THEY state in their preface, in *Molecular Motion in High Polymers* the authors have essentially produced two books under one cover. Part A is primarily theoretical in nature and, after a general introduction, deals with normal vibrations and inelastic light scattering, various "hydrodynamic" models of chain motion and statistical theories of polymer molecular motion. The level of mathematical treatment is moderately high, and readers not comfortable with vector and tensor notation and matrix algebra will find themselves somewhat at sea.

Part B is described as a phenomenological treatment. It is more descriptive and the mathematical background is less prominent, although not at an elementary level. Most readers should be able to absorb this section with profit without necessarily resorting to Part A. Dielectric properties, photoluminescence, viscoelastic relaxation, ultrasonic relaxation, nuclear magnetic and electron spin resonance, spectroscopic and scattering phenomena, neutron scattering and diffusion are all well described.

My reservations about the book mainly concern the completeness of the treatment. More specifically, the literature citations have a dated appearance. It should be possible to reference work within at most two years of the publication date, and in fact there is a reference to a 1980 paper by one of the authors. However, in general there are few references to papers later than 1975. This may be acceptable in an introductory textbook, but not in a scholarly treatise such as this. I was especially sensitive to this point in the chapter on nuclear magnetic and electron spin relaxation, my own field. Carbon-13 NMR, the area of greatest recent interest, is given rather short shrift. Although high-resolution carbon-13 NMR of solids is described, the treatment is very compressed. Carbon-13 relaxation in solution, a major area, occupies less than a page, and most of the relevant literature is omitted. It should also be pointed out that the section on the inversion–recovery method for measuring T_1 has been mislabelled "Carr–Purcell Experiments", a quite different technique used for measuring T_2.

This selective treatment means that readers cannot count on being brought to the forefront of the topics described. Despite this reservation, I found the discussion informative and valuable. The book is well written and can be read with pleasure. □

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