BOOK REVIEWS

Thoughts of tomorrow

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Man-Made Minds: The Promise of Artificial Intelligence. By M. Mitchell Waldrop.
Walker, New York: 1987. Pp.280. Hbk $22.95; pbk $14.95.
Thinking Machines: The Search for Artificial Intelligence. By Igor Aleksander and Piers
Burnett. *Knopf/Oxford University Press: 1987. Pp.208. Pbk $17.95, £15.*

AMONG other grandiose forecasts, made in the infancy of artificial intelligence (AI), was that we would have to make computers sentimental about the past so they would retain us as interesting pets. Since then, the subject has quite suddenly come of age. Ten years ago, there was only a handful of universities where the subject was taught; the first textbook of AI did not appear until 1975. Today there are dozens of texts and new departments incorporating the subject are opening every week. In their historical reviews of AI Waldrop, and Aleksander and Burnett, provide two main reasons for this sudden access of enthusiasm.

The first is the construction of AI programs that actually do something useful. The earliest example, DENDRAL, was developed in the late 1960s to help in the identification of chemical compounds from their profiles in a mass spectrometer. It departed from most previous work by incorporating knowledge of a particular domain, whereas many earlier programs had concentrated on abstract rules of inference.

The new breed of programs, which multiplied throughout the 1970s and 1980s, came to be known as 'expert systems' or 'knowledge-based systems'. The knowledge base incorporates the knowledge of human experts stored in a standard form (often that of the predicate calculus). When the program is presented with a problem, it applies to it the general rules in its knowledge base, many of which are usually probabilistic, and cranks out an answer. The reasoning involved is performed by a separate part of the program, the inference engine, which can draw deductions by, for example, using the rules of the predicate calculus. Most such systems can also request more information from the user if it is needed and can be interrogated to discover how a particular conclusion was reached. The latter facility is important because mistakes can occur for two overlapping reasons. First the program is limited to the information supplied by the programmer, and second the program has no common sense because the domain within which it operates is so restricted.

Perhaps the best known such program is MYCIN, which diagnoses and prescribes treatments for bacterial infections from analyses of bodily humours such as blood or urine; although, according to one study, it performs better overall than almost every doctor, its lack of common sense can produce disastrous mistakes. The expert systems now in use include other medical systems, a geological system to advise on whether a given site may contain commercially exploitable deposits of ore and — perhaps the most successful of all — a system devised by a computer firm to advise on the most compatible configurations or optional components of its machines.

The second reason for the sudden expansion of AI in the West is not unconnected with the first. Impressed by the potential commercial use of expert systems, the Japanese Ministry of International Trade and Industry announced in 1981 the launching of a ten-year coordinated project costing a billion dollars to create the 'Fifth Generation' computer. The four previous generations had consisted of hardware advances, which were successively the vacuum tube, the transistor, integrated circuits on silicon chips, and very large scale integrated circuits on a single chip, one of which could form a complete microprocessor. These devices brought vast increases in speed and storage space and an equally vast decrease in costs, all of which made possible the advances in AI. Although in their Fifth Generation machine the Japanese were intent on carrying these hardware developments further, they also put forward some staggeringly grandiose software objectives which included machine translation, the creation of knowledge bases on the scale of the *Encyclopaedia Britannica*, and the ability to read, converse in a natural language and understand pictures.

Although many of the more ambitious objectives were abandoned only a few years later, it was felt at the time that if the practically minded Japanese thought they could achieve such lofty targets, there must surely be more to AI than had previously met the eye. The British launched the Alvey program and the EEC reacted with ESPRIT: these programs were to coordinate and fund research at respective costs of one-third of a million and nearly a billion pounds. The United States also responded with increasing funding of AI under both defence and civil budgets. With such riches available it is small wonder that there has been a sudden stampede into the subject.

Two questions can be asked. First, is it a rush of Gadarene swine? So often in the past, the advocates of AI have made promises that were not fulfilled. As far as expert systems are concerned, the technology is well developed and they are

Soft shoe shuffle — a woodcut from Jakob Kobel's Geometrie *of 1531, showing how the measure of one rod was determined by lining up 16 men, heel to toe, in soft leather shoes, as they emerged from church. The illustration is taken from* The Weights and Measures of England *by R. D. Connor, just published by HMSO, London, price £30.*