Book Review

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Edward A. Feigenbaum and Pamela McCorduck, *The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World*, Reading, Mass.: Addison-Wesley, 1983.

This is an engaging and provocative book, with many things to interest a database audience. Feigenbaum and McCorduck see the Japanese Fifth Generation project as something that will have momentous impact on the future development of computers. They seem to think that the project will involve primarily artificial-intelligence techniques, and feel this validates their view of artificial intelligence as the most important part of computer science and the solution to many of the world's problems.

These are audacious claims. They are supported in the book by a wide array of evidence. Feigenbaum and McCorduck are at their best when they are discussing social and political issues as in parts 1, 5 and 6. One can have qualms about the technical discussion, however:

1. It is not clear why the authors think the Fifth Generation has anything to do with artificial intelligence. The Japanese have mentioned it in their plans but the overall goal sounds more like a sophisticated database system than a (usually) narrow-domain artificial-intelligence system.

2. Feigenbaum and McCorduck exaggerate the success of existing expert systems, misleading the reader as to the ease of getting results on practical problems. Despite much work on medical expert systems, there is very little routine use of them because performance has been so unsatisfactory; many difficult problems remain to be solved in clinical implementation. Similar problems are inhibiting progress in other areas, as attested to by chapters 5 and 6 of *Building Expert Systems*, edited by Hayes-Roth, Lenat, and Waterman (Addison-Wesley, 1983).

3. The authors give short shrift to alternatives to artificial intelligence methods for solving problems.

a. The authors seem to be highly ignorant of the progress made in the database field in the past ten years. For instance: "A relational database is one in which the relationship between various objects and events are stored explicitly for flexibility in storage and retrieval." No comment.

b. The authors seem to be highly naive regarding numbers. Thousands of years of scientific progress clearly indicates that sciences only make major strides when they become quantitative, but the authors think otherwise: "Even though a lot of professional work seems to be expressed in mathematical formulas, in fact, except in the mathematically based sciences, the difficult choices, the matters that set experts apart from beginners, are symbolic inferential and rooted in experiential knowledge." There is not much evidence for this assertion beyond a few superficial artificial-intelligence experiments that seemed to work without numbers, which may only be because mathematics has tended to get lost in arid theoretical speculation in the last century. And "experiential knowledge" could be numeric as well as symbolic; the analog encoding of the human nervous system is one justification. It does not seem to have occurred to the authors that there are many difficult aspects of the world that are very hard not to treat as quantitative, like magnitudes of physical objects and processes, degrees of uncertainty about hypotheses and conclusions, evaluative judgements in heuristic search, and conflict resolution in production systems. Nor has it occurred to them that if expert systems are to apply to practical problems, they must be evaluated and tuned by quantitative performance and cost-benefit metrics.

c. It is not clear why most of the advantages of expert systems cannot accrue from just getting so-called experts about a domain together and having them write down everything they know. It may be just laziness that prevents expertise from being written down, and a precise logical encoding of knowledge in a program would not offer much more benefit.

4. **Finally, a moral qualm. Identifying knowledge or expertise as a physical thing that resides in people's heads and can be copied, manipulated, and sold is the fallacy of "reification" brilliantly attacked by Stephen Jay Gould in** *The Mismeasure of Man* **(New York: Norton, 1981). It can be highly dangerous to take an abstract psychological phenomenon like "expertise" and blithely postulate physical things like computer code that it corresponds to. This tends to justify elitism in a society, and has often historically been used as an antidemocratic political ploy. For instance, in our society doctors are of high status, but their so-called "expertise" may be more a result of their monopolistic practices and not reflect any intrinsically complex knowledge on their part. Medical expert systems could thus further undermine accountability for medical decisions.**