SCIENCE & TECHNOLOGY

Adhering to the 24-hour day, to infrequent shift changes, and to rotations only from earlier to later shifts to ease the body clocks' adjustment, Moore-Ede concludes, would not only improve the quality of workers' lives, but increase safety and efficiency as well.

Computers That Think Better

"Artificial Intelligence: Making Computers Smarter" by Paul Kinnucan, in *High Technology* (Nov.-Dec. 1982), 38 Commercial Wharf, Boston, Mass. 02110.

During the 1960s, "smart" computers that could defeat humans in chess matches caused a short-lived sensation, but failed to meet the higher expectations of their admirers. Today, however, artificial intelligence (AI) is making a comeback.

The first smart computers suffered from exaggerated claims, a high failure rate, and unwieldy size. But all this has changed, thanks to the semiconductor revolution and other technological advances, writes Kinnucan, a *High Technology* senior editor.

The keys to AI technology are "heuristic" computer programs that use knowledge to find short-cut solutions to problems. Conventional programs, by contrast, analyze data by following a rigid series of predetermined steps. The procedure is not only slow, but unworkable when answers are not clear cut.

Most AI systems rely on "expert" programs using "rules" of logic drawn up by human specialists. One 500-rule system developed at Stanford University diagnoses blood diseases; Cognitive Systems, Inc., is working on a program that will prepare income tax returns and interpret IRS regulations. Such systems perform long, complex tasks at which humans often err. Still other AI computers employ "fuzzy thinking," i.e., reasoning on the basis of uncertain or partial information and ranking answers according to the computer's "confidence" in them. One such system has already been used to help locate a several-million-dollar molybdenum lode in Canada. On the drawing boards are artificial vision systems for automated inspection robots and systems that will respond to verbal orders.

So far, home computers lack the speed and memory capacity to handle AI software, but specialists believe that the next computer generation will put expert legal, financial, and medical advice at consumers' fingertips. Prices of AI systems have already dropped from millions of dollars a few years ago to an average of $50,000 today, and the size of the systems has shrunk accordingly.

AI technology is still in its infancy. Although the United States now dominates the field, Japan recently embarked on a $450 million effort to produce a 20,000-rule system. Meanwhile, computer scientists are working to eliminate one of the "expert" systems' chief drawbacks—human error. "Deep knowledge" computers will be programmed not with rules, but with the theories, scientific models, and other information used in making rules.