cobbled from a variety of sources and running on a shoestring budget, often completely unattended, the hydrogen-line survey is nonetheless free to operate almost 24 hours a day, 365 days a year. The antenna system is the equivalent of a 175-foot-diameter dish, and although results are so far the same as everyone else's, the value of such a broad mapping effort is obvious. Two other wide-ranging experiments are being conducted in the Soviet Union, using arrays of radio telescopes spanning the country under the auspices of the Institute of Cosmological Research in Moscow and of Gorky University. Both, says Sagan, use a "coincidence-count" system, in which a signal must appear on at least two receivers to be registered.

With all this listening going on and more to come, Philip Morrison of Massachusetts Institute of Technology took advantage of the AAAS session to call for order. A journal, he suggested (with a broad hint at Sagan's ICARUS), or some central clearing house ought to keep track of who has looked where, when and at what frequencies. Looking for extraterrestrial civilizations, he says, is not so much science as exploration. Maybe man is alone in the universe, but earth's sun is part of a vast population of similar ones, and in an apparently unextraordinary part of its galaxy. "In spite of that blandness," he asks, "are we somehow singled out?" □

A computer under your hat

"When the question is asked, 'What kind of relationship would you want to have with your computer?' the answer is simple: Whenever you think you want to know something, you will have the information right in your head, instantly." That sounds about three orders of magnitude easier said than done—but not to Adam Reed. Within 50 years, Reed says, scientists will have perfected the ultimate computer technology: the brain-computer hook-up.

Miniaturized computers, implanted under the scalp, will be programmed to "read" and "speak" the electrochemical language of the human brain, Reed says. And, without the cumbersome translation of input and output messages, the computer will function as an automatic brain booster that expands the memory and allows the processing of large amounts of information with the speed and accuracy of . . . well, a computer. Reed, a postdoctoral psychologist at Rockefeller University, presented this prediction to a skeptical but nevertheless fascinated crowd at the AAAS session on future man-computer relations.

Reed is currently working on a rudimentary step in the long-term project; the deciphering of the brain's internal language. Animal studies are beginning to yield neural coding and processing patterns that can be linked to specific physical activities. But the research is relatively new and the recording hardware—thin-wire electrodes inserted into individual neurons—must undergo a "qualitative improvement" if this internal language is to be learned. The total cross sectional area of 100,000 of these electrodes should not exceed one square millimeter, Reed says, but that's a 10-fold decrease from their current size.

And this technological advance, he says, is only one of five leviathan problems. Researchers will also have to learn 1) how to get computer information into the brain, 2) which are the relevant neurons (in other words, where to hook up the electrodes), 3) how to program the computer with the brain's internal language (whatever it may be) and 4) how the brain "stores the meaning of things" with its coding and processing. "I don't know how long this will take," Reed says, "but we can expect it within our lifetimes."

Most of our Science News of the Week section and the research notes on page 139 are devoted to coverage of the annual meeting of the American Association for the Advancement of Science in Boston. Further articles will appear in later issues.

Developmental problems aside, potential abuse of the computer implants in terms of "memory-tapping" or thought control poses a second dimensional problem.

A scientist's participation would have to be conditional on governmental non-abuse of the technology, Reed says. "If there were abuses," he said, "those who work in the field would simply shut off the availability of that technology." The brain computer hook-up would be a "great thing to have," he says, "as long as it was under one's own personal control."

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Computer access of a different sort—command and input by the human voice rather than brain impulses—is another futuristic concern in computer research. William A. Woods, a senior scientist at Bolt Beranek and Newman, Inc., of Cambridge, Mass., described computer speech-recognition systems to the same AAAS session.

"Unlike 'Hal' in the movie '2001,' " Woods says, "current computers are far from being able to understand a wide range of spoken English." Some existing spoken-word computer systems can recognize about 50 words if the voice patterns are put in in advance by the one who will later give voice commands. Such systems are being used successfully for zip code sorting and numerical data input. But recognition of complete, spontaneous sentences can only be done with slow experimental systems—and then somewhat poorly.

The research is slow-moving, Woods says, because at a basic level there is little information in the acoustic signal the voice makes. The best error rate for word recognition by voice prints alone is about 25 to 30 percent. When a syntax program and semantic commands are added though, the accuracy can be as high as 96 percent. But, as the axiom goes, computers are essentially dumb. An experimental voice recognition computer used during analysis of the moon rocks, for example, "heard" this phrase: "Give me all lunar samples with magnetite," and interpreted it as this one: "Ten people are glass samples with magnetite."

Speech recognition is a desirable input mode, Woods explains. "First of all, speech is man's most natural output channel." It's four times faster than high-speed typing and ten times faster than average typing. Besides that, he says, speaking is spontaneous. It doesn't tie up hands, eyes, feet or ears. It can be used while in motion. And the computer's input terminals would be inexpensive—microphones or perhaps telephone receivers.

"The prospect looks good" for perfecting the system within 10 to 15 years, Woods says. "But a great deal more must be done before we can take a person off the street and have a computer understand his speaking voice." □

Day-care children: No ill effects

"But what will happen to the children if you go back to work?" This question is becoming increasingly important as more and more women decide (or are forced by economic pressures) to have a job as well as children. One solution to the problem has been day-care centers, but it has been suggested that such rearing can be psychologically harmful to a child. Separating a child from its mother every day, for instance, is thought to provoke anxiety and promote insecurity. While the long-term effects of day-care rearing are still unknown, one study has been completed which compares patterns of psychological development in day-care and home-reared children. No significant differences were found.

Research was done by Jerome Kagan of Harvard University and Richard B. Kearsley and Philip R. Zelazo of Tufts University Medical School in Boston. The results were presented last week at the AAAS meeting.

Chinese and Caucasian children from working- and middle-class families took part in the study. Beginning at three and one-half months of age they attended an