

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 post-doctoral 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

*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.*

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."

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."

\* \* \* \*

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

experimentally conducted day-care program from 8:30 a.m. until about 4 p.m., five days a week. These children were matched on ethnicity, social class and sex with a control group reared totally at home.

About 100 children took part in the study. They were examined every other month for the first 10 months and then again at 20 and 29 months. The researchers were especially interested in those factors that are supposed to lead to competency in adulthood. "In our society," says Kagan, "verbal competence, problem-solving skill, burgeoning independence, sociability and control of anxiety at age 10 seem to predict the adult criteria. We selected criteria in the light of these considerations."

The researchers found little difference between the day-care and home-reared children with respect to cognitive functioning, language, attachment, separation protest and tempo of play. The only effect day-care rearing seemed to have involved behavior with unfamiliar peers. The day-care children were less vigilant and less inhibited in the presence of unfamiliar children than were those reared at home.

While results of this study seem to give day care a clean bill of health with respect to psychological development, it is necessary to point out that the children were

studied under special, experimental circumstances. "It is important to emphasize," says Kagan, "that the sample of children came from predominantly intact families, few experienced extreme forms of psychological deprivation at home, and the day-care experience was closely monitored by the principal investigators and implemented by mature, conscientious and nurturant caretakers."

Considering the fact that the day-care children spent almost as much time in the center as they did at home, how is it possible that there were so few differences between the two groups? Kagan suggests that psychological experiences at home have the priority. The emotional involvement of a mother, for instance, probably has a much stronger and more long-lasting effect on a child than does the more detached behavior of a caretaker. It appears that the effects of the home are not easily altered by the group care experience.

"The entire corpus of data," says Kagan, "supports the view that day care, when responsibly and conscientiously implemented, does not seem to have hidden psychological dangers. Since this conclusion flies in the face of much popular belief—including a prior prejudice of one of the principal investigators—it is both useful and natural to maintain a skeptical attitude toward this generalization." □

observational searches for extraterrestrial intelligence (p. 132), frontiers of the natural sciences, 50 years of anthropology (honoring Margaret Mead), the early history of life on earth, and 50 years of quantum mechanics. The subjects—dealing with the content of science—were seldom part of the program during the almost exclusively issues-oriented AAAS meetings of the early 1970's. Most persons SCIENCE NEWS talked to considered the change an improvement. □

---

## The quiet sun: Omen of drought?

---

The dry weather afflicting the high plains of the American West in recent months may be the beginning of a sustained drought, according to solar physicist Walter Orr Roberts. The recent dry spell over the western plains from South Dakota to New Mexico seems to mark the beginning of the ninth recurrence of a series of droughts that have hit the plains at 22-year intervals, Roberts told reporters at the AAAS meeting. He believes the drought cycles are associated with periods of minimum solar activity. The sun is this year reaching the low point of its 11-year cycle of sunspot and geomagnetic activity and won't begin a significant rise in activity for two to three years.

The sun goes through a complete rise-and-fall cycle of activity every 11 years. During each cycle its magnetic field flips. So there are 22 years between returns to the same magnetic polarity. This is the so-called double sunspot cycle.

There is no certainty that a drought is coming or that it will last a certain time, Roberts says, but during the eight previous recurrences of the low point of the 22-year cycle there has been a drought. The droughts have typically lasted three to six years. The last one was from 1953 to 1955. The one before that was responsible for the dust bowl years of the 1930's.

The subject is controversial because no one has shown any mechanical tie between solar cycles and drought cycles. Nevertheless, the correlation of drought cycles with the 22-year solar cycle is evident, Roberts says.

"I have a very serious fear that the drought of the 1970's has begun. All the signs point to it. If so, the price repercussions and hunger repercussions will be felt by people throughout the world." He says a drought over the high plains could be expected to cause 8 to 10 percent of the total grain production to be lost. He urges farmers and agricultural policy makers to prepare for the worst.

Roberts, formerly director of the National Center for Atmospheric Research and now director of the program in science, technology and humanism at the Aspen Institute for Humanistic Studies in Boulder, Colo., later added this final note: "I hope I'm wrong." □

---

## AAAS: Science out of the shadows

---

This year's AAAS meeting took place in a scientific climate that differs in important ways from past meetings in the early 1970's. For one thing, if AAAS officers are right in their assessment, public and governmental appreciation of science and technology is on an upswing, after reaching a low ebb a few years ago. New AAAS President William D. McElroy has sensed what he terms "a healthy turnaround" in people's attitudes toward the importance of science and technology. He sees the attitude reflected in the mood of students on campuses and in the President's new budget, which proposes major increases for basic research (SN: 1/24/75, p. 52). "Overall, we're seeing people beginning to recognize the importance of new information" in solving problems, McElroy says. "The people are beginning to realize you have to invest in knowledge."

AAAS Executive Officer William D. Carey—himself a former federal R&D budget official—calls the science budget "strong" and "strikingly good." "It has really been a remarkable year" marked by "an unexpected budget of this magnitude." Space scientists, however, have not been similarly cheered, fiscally. Many were heard lamenting a squeeze put on NASA's space science research.

The AAAS meeting itself is in part a reflection of attitudes toward science and in part a shaper of those attitudes. It is the only large scientific meeting devoted

to all the sciences. It is one of the few meetings each year which has as a major part of its purpose the communication of matters of science to the public. The AAAS goes to considerable lengths to facilitate news coverage (hourly news conferences, printed manuscripts of papers, plus Telex, telephones and typewriters). Scores of reporters from across the United States and throughout the world attend and write and broadcast stories.

Last year many scientists and reporters complained that the meetings had become too overwhelmingly laden with general discussions of already well-aired political and social problems at the expense of reports on new progress in scientific research. The AAAS consciously decided to try to strike a better balance in this year's meeting (SN: 2/8/75, p. 86). The goal, as Retiring President Margaret Mead said last week at its outset, was to "reestablish a balance between reports of where science itself is—where pure science is going—and discussions of the misapplications of science and technology."

That effort seems to have succeeded. There were, as in the past, many symposiums on such problems as nuclear power, the ecology of famine and communication on foreign policy. But there was also, for the first time, a new meeting category called "Frontiers of Science" that had fascinating and well-attended sessions on such topics as the Viking mission to Mars,