

That computers can do the speaking for those who cannot speak must seem in the realm of magic, even in an age that gets bored with watching men on the moon. What is going on at Michigan State University under John Eulenberg must have immediate interest to anyone who is physically handicapped or who is working for people trapped in such conditions. The following two pieces offer, first, a glimpse of the human activities there as reported by John Moses, and second, a means of keeping in touch with what will yet be accomplished there and elsewhere, through the special publication edited by Tamara Redburn and devoted to these augmented and alternative forms of communication. There must be many among our readership who feel a strong need for this kind of connection, and this Journal is glad to give descriptive space to a publication that does such stimulating and urgent work in what is clearly a highly enterprising style.

John F. Moses

Artificial speech

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John Eulenberg was showing me a wheelchair portable system, with a TV set propped up for the user to see what he's saying on it, an input device controlled by his foot, and memory storage in a back pack behind the seat. He then deposited me in front of a TV screen in one of the lab rooms with a stack of videotapes.

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"Jim Brooks"

Narrator: "Jim Brooks was born with spastic athetoid cerebral palsy and never spoke a single intelligible word for the first 23 years of his life. Because he couldn't communicate, most people thought he was retarded, and only his parents realized he was a bright, quick learner. His only means of communicating with them was typing on an electric typewriter with his big toe. But today, thanks to a sophisticated communicator mounted on his wheelchair, Jim can speak, and the world has discovered that Jim Brooks possesses a brilliant scientific mind trapped for many years in a body that wouldn't respond. Jim's speaking computer is the only one of its kind in the world, and was developed at the Artificial Language Laboratory at Michigan State University in Lansing by a team of scientists headed by Dr. John Eulenberg, who saw in Jim a man in need of a voice."

Eulenberg: "When you can't communicate people think you're stupid - they think you're mentally impaired, and that was probably the greatest problem and probably the area of greatest liberation since he's had his system."

Narrator: "And Jim confirmed his intelligence by actually helping design his own computer."

Eulenberg: "I mentioned it is a very slow process for him to type out letters on a typewriter, but he did it and every time Jim would come down to the laboratory for the next stage of his system or deeper evaluations he would come with a letter - sometimes 3 or 4 pages long, single-spaced. From the very beginning he directed the design of his system."

Narrator: "Jim's computer actually talks for him. He uses his right foot - the only part of his body he has control over - to operate a lever called a joy stick which types out words or parts of words into his microcomputer. Jim can see what he's typing out on a display screen mounted at eye level. When a sentence is composed, Jim simply tells the computer to speak it. This revolutionary computer has been dubbed the Jim Brooks System. And because it may one day help others with speech problems, Jim has been taken all over the United States demonstrating it to medical groups."

Eulenberg: "Jim is often asked to give the benediction or the invocation for meetings all over the country. There's something very holy - very sacred - about the experience of Jim Brooks speaking."

The lapboard

When John returned he began with his lecture proper. He started with a word board. The word board consists of a grid

of words and commands. John took a magnet and touched "I - want - sleep", touched sentence command, and got "I want to sleep."

"See. The computer adds the prepositions. This board makes the value of each square contingent on where you were before. As far as I know, we were the first to do that." Then John showed me other aspects of the systems. "Punch 'man'. Punch plural, get 'men'. Punch 'I'. Punch "see". Punch future. 'I will see'."

Other ways to get semantic access: Punch "good". Punch similar to and you get "behave". Punch opposite to and you get "misbehave".

Punch "eye". Punch make action with. Get "see". Punch "stomach". Punch make action with. Get "digest".

Just as I was getting excited by the vast array of logical constructions represented in this 2 x 3 foot board, I was reminded of its limitations. I tried an adjective "fast", pushed similar to, and found it didn't produce anything. As I write this, I think of that scene in the movie Sophie's Choice, where Sophie, Nathan and Stingo rush to come up with synonyms for fast: rapid, quick, fleet, hurried, winged it seems they'll never end.

John said, "I don't like lapboards. I think we make the best in the business. If we were in competition on the design of lapboards, we've gone about as far as it can go. I think lapboards with language written on them are a throwback to the pre-computer era. There may always be a lapboard with words in it, but communications is going beyond that because of the intrinsic limitations of lapboards. Better have a window display on language space and have all this language and function be represented on those little EPROMS (Erasable Programmable Read-Only Memory).

"If you do that, then you don't have a real estate problem. The problem with boards is there's just so much you can pack into them. But you can conceptually make a virtual language space and use a display as a window on language space."

The phrase "language space" comes up all the time with John. It appears to be all the logical combinations which are possible for a language. Still, how do you get all those combinations into a memory storage and speaking system? Leaving the word board, John introduced me to a project in the synthesis of speech from electronic sounds and the bubble memory project.

(As to bubble memory - he drops small heavy things notable for their inscrutability into my palm - they will permit a great increase in memory storage power. The price was \$1200 apiece a few years ago, but now it's nearly nothing - and something like the thing I held in my hand had enough power to be a disc drive in an Apple. It represented 128 K - a million bits of information.)

Word synthesis

John showed me how words are synthesized. "There are 64 of these commands - 63+ No." pointing to the interior of half-dismembered Rockwell. "Let's take the word 'method'. It has an 'o' that sounds like an 'uh'." He flipped through the manual and said, "I don't want you to go home with an 'uh'. 'Uh' is 33." He pressed a button and we got a very metallic "uh". "A 'd' is a little different from a vowel because it's a single event..."

Piece by piece a word is synthesized: "Method".

"There are digital techniques and analog techniques in voice synthesis and this is a combination of both of them. More purely digital techniques are coming into favour."

I asked if it would be possible to teach a computer to use accents or other tonal modifications.

"In doing speech synthesizing - access to voice, you might say we're creating a new art form. If we do it well, we're going to go far beyond the need to communicate by voice - like creating new musical instruments, especially if you think of musical instruments themselves as being substitutes or extensions of the human voice. There's been progress. I expect to see female voices in the next two years." It hadn't occurred to me until he said that that all the voices were low-pitched. I hadn't thought about gender at all, but I guess the voices are male, to date.

Jim came in later in his electric wheelchair with Steven Blosser. A number of people gathered around while John and I, and then a number of other people, asked questions. Jim's foot moved about furiously. The messages came out on the red one line display for visual checking as they were put into the synthesizer - John's window into language space.

I found the experience a little confusing. I would ask Jim something. While he prepared an answer I talked to other people, perhaps about entirely different matters. Then Jim's answer would come out. I would have to track back to our point of departure. It seems that to really communicate I would have to juggle two times at once. I didn't think to ask Jim if this is his experience too, the first the rate of hearing, and the second that of response. It seems almost sinful in the face of the miracle of speech where once there was none to be so aware of the distance to equivalent true communication. But time lag and time is central to the quest for true communication.

Generalizing the particular and other futures

John says "The true challenge in engineering communication systems such as we are doing in the laboratory is to make a device that really fits well the needs and abilities of an individual person, and yet is generalized in the engineering

so that, once you develop that device for a specific person, it can also be used with a minimum of specialized or individualized adaptations for other people.

"There are going to be a lot of people who will be speaking who never thought they'd ever be able to speak. There are parents who will hear their children speak to them for the first time. And that's the near future."

In the long range, John hopes to create machines which can monitor the brain and automatically pick up the impulses it sends to the muscles. "So just by thinking about moving a finger, even without moving, it can cause an appropriate signal to be sent into a computer as though you were moving that finger. For people with cerebral palsy or other disabling conditions this is very important, because it means they will be able to control through a computer mechanical operations that their own hands fail them in."

Another aspect of future research which interests John is increasing the accessibility to other computers of people using synthetic voice machines. Since most computers have a keyboard, they are not open to people with severe motoric problems. What is required is a single-switch entry mechanism like Jim Brook's foot pedal. With it he can choose single letters, control characters, words, phrases of any length, and send them into whatever computer he's programming. He does this with word processing on his Apple home computer, writing letters, reports, and homework with it. This is facilitated by a keyboard emulator developed by an engineer at MSU, which is hooked up inside the Apple to keyboard sockets. These applications will be of greater import as people with communication disorders move towards employment. In fact, Jim Brooks presently spends about ten hours a week in the laboratory programming devices for others, an activity which may lead to a viable career.

And there is work going on with a neurological approach to speech input. At the medical center at MSU there is already a prototype for an evoked-response input system. Electrodes on the occipital lobe measure evoked response - that is, the neural reaction to specific stimuli such as a flashing light. You take a display board with letters on it, and under each letter a light flashes in a specific rhythm for that letter. As one looks at each square, a particular response is evoked for each signature rhythm. The response can be used by a computer to translate into speech.

However, at this time, the computer system being used is not portable. Moreover, the real-time problems central to the whole question of synthetic voice input continue, because it takes about four seconds for the eye to focus on a letter with sufficient accuracy. But the direction may be right.

John is open, it seems to me, to everyone's contribution in this field. All advances intrigue him. After all, as he pointed out, the ultimate prostheses may come from some entirely unsuspected place. For instance, it has been frequently noted

that some people without speech or limb movement during waking hours can move and speak when asleep. So perhaps, John reasons, the ultimate speech prosthesis will be a drug - or even chanting.

Tamara L. Redburn

Artificial speech

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Communication Outlook is an international publication which provides a forum for individuals interested in the application of techniques and aids for persons who experience communication handicaps due to neurological or neuromuscular conditions. It is a cross-disciplinary information source and a reference for individuals who wish to contact others working in the field of communication enhancement. Communication Outlook is edited and published by the Artificial Language Laboratory at Michigan State University in partnership with the Trace Center for the Severely Communicatively Handicapped, University of Wisconsin, Madison. It is a publication of the International Society for Augmentative and Alternative Communication (ISAAC).

Communication Outlook is more than a quarterly publication. It provides a regular forum allowing individuals interested in communication enhancement to exchange views and establish contacts, as well as furthering the progress toward an adequate delivery system of state-of-the-art communication aids to those who need them.

ISAAC

ISAAC goes one step further, in enabling Communication Outlook readers to belong to an organization linking people throughout the world, whose common goal is to advance the