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A Bell Laboratory scientist working with the talking computer.

Computers at Bell Learning to Speak And Listen Politely

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MURRAY HILL, N.J., Sept. 10 —At the acoustics research department of Bell Telephone Laboratories here, the computers are learning to talk and listen in order to perform services experimentally. And they are polite.

When Dr. James L. Flanagan, head of the laboratory, is communicating with the experimental directory-assistance system and does not know the initials of the colleague whose number he wants, he punches telephone buttons to indicate that he does not know. The computer's voice then lists three alternative names, their laboratory locations and extension numbers.

When Aaron E. Rosenberg, a researcher, whose voice the computer recognizes from prerecorded patterns, tells the experimental airline reservation system that he wants to fly from Newark, the computer confirms this by saying, "Newark," before asking the

Bell's Computers Talk and Listen Politely in Experimental Services

next question: "At what time of day do you wish to fly?"

Both the directory-assistance and reservation experiments call on a limited vocabulary of words, put into digital code from recordings of an actual human voice and stored in the computer.

Cecil H. Coker is working on a more elaborate system designed to handle a far larger vocabulary. This involves encoding an entire dictionary with its rules of word-division and pronunciation.

It also demands an increasingly elaborate mathematical description of the human voice box —vocal chords, mouth, tongue and lips—to produce an artificial-sounding speech on demand (instead of keeping a bored human being reading words into a tape recorder for many months).

But even Mr. Coker's system is polite. While a diagram of the human vocal tract moves on a cathode-ray screen, the computer's synthesized voice says, "What would you like for me to say?"

Giving Bank Balances

Such politeness is considered essential here, and in the other industrial laboratories tackling the problem, for securing human cooperation in a commercial future when many necessary but repetitive and irritating services now performed by people, who get tired and make mistakes, will be turned over to computers that speak and listen.

Among the man-machine voice communication systems that are foreseen are computers giving bank balances, taking sales orders and making reservations for callers whose voices are authenticated by comparison with pre-recorded patterns.

According to the soft-spoken, red-haired Dr. Flanagan, such commercial transactions of "modest gravity" will become commercial realities far earlier than the more science-fictional idea of dictating letters directly to a typewriter.

Experimenting with a system that might be practical, he said, involved "stepping back from the more ambitious problem, biting off a small piece and concentrating on something that is do-able and usable."

Complex Linguistic Studies

Even the relatively simple systems, Dr. Flanagan said, involve pushing much farther with already complex linguistic studies. These had been stimulated earlier because telephone engineers, fearing future communications traffic jams, sought ways to squeeze the most traffic onto the fewest channels.

As soon as several technologies, including laser beams traveling through glass fibers, opened communications highways of almost unlimited width, a new challenge appeared: a wave of unauthorized use of telephone credit cards. This stimulated work on computer recognition of voices.

Meanwhile, Dr. Flanagan noted, quite complex systems began to appear realistic when the semiconductor manufacturers began making tenfold reductions in the cost of electronic operations every few years.

Both he and Dr. Bruce Hannay, Bell Lab's vice president for research and patents, cautioned that the current work did not foreshadow an imminent new "service offering."

Dr. Hannay said the work in Dr. Flanagan's department "shows what is possible and is not a preview of what is to come." He acknowledged that many researchers in the field have "a strong interest in seeing it used," and said that Dr. Flanagan likes the idea of putting together demonstration systems "using fairly standard types of hardware."

Advances in linguistics, Dr. Hannay said, have simplified the rule for achieving satisfactory synthetic speech. He called it "a very substantial increase in cleverness instead of brute force."

'Fantastic Reductions'

"Absolutely fantastic reductions," in the cost of electronics, Dr. Hannay said, now make it possible to dream up new telephone services that would raise the productivity of the service sector of the economy.

Man-made communication by voice has become such a hot subject among engineers that the Institute of Electrical and Electronics Engineers devoted an entire issue of its proceedings to it this year. Dr. Flanagan wrote the introductory article and his colleagues from Bell Labs wrote several others.

In the issue, Dr. Thomas B. Martin of Threshold Technology Inc., formerly of the RCA Corporation, noted several practical systems were already using man-machine voice messages.

Since 1973, Dr. Martin wrote, the Owens-Illinois Corporation has used a computer to record the spoken findings of quality-control inspectors of color-television faceplates. Late in 1974, he reported the S. S. Kresge Company installed a voice-commanded system for routing cartons on a conveyor belt.

Experiments by Installers

Dr. Flanagan said that in the Bell system, Western Electric installers were experimenting with a way to get around using a stack of computer print-outs in making the more than 13,000 wiring connections of a switching system called the Number 1 E.S.F. Using the old way, the installers lost time and ran the risk of error at each step.

In the experiment, they strapped tape recorders to their belts, put a tape-drive switch next to their boots and donned headphones to listen to cassettes bearing instructions recorded by a computer. A prerecorded tone stopped the tape automatically after each instruction.

Dr. Flanagan and his colleagues look forward to mobile telephone systems that would make use of a preset inventory of frequently called numbers, recorded in an ultra-miniature semiconductor memory and computation unit in the car's glove compartment.