

Background Information on Technology for the Hearing-Impaired Population

It is ironic that although the telephone was invented by Alexander Graham Bell, who as a teacher of deaf students was constantly searching for ways to overcome barriers to human communication, as telephone lines were extended throughout the country, and commerce became more and more dependent on them, deaf individuals were closed out of the telephone network. Deaf people, able to communicate only during face-to-face encounters or by written correspondence, began to be unable to reach help in emergencies, were isolated from significant information about community and educational services, and were severely limited in seeking new employment. Bell's invention, opening channels of communication for the population at large to an unprecedented degree, effectively isolated a substantial portion of the population—those whom Bell most wanted to help.

Over the past 20 years, however, the range of technological aids available to deaf and hearing-impaired individuals has increased greatly. Significant advances in the microminiaturization of electronic circuits and concurrent developments in digital signal processing have improved the quality and diversity of sensory aids.

Conventional hearing aids, which are now lightweight and unobtrusive, are the most widely used sensory aids. Related to personal hearing aids are various types of *auditory trainers* for classroom use, *h&h-gain telephone handsets*, and *special extension headphones for TV and radio*. The problems with hearing aids, especially in fitting children and elderly persons, are not so much in the technology as in determining the correct prescription, assessing the aid's performance, and educating the user. Hearing aids are still very expensive when compared to the cost of advanced pocket calculators and other mass-produced electronic devices in general use.

Auditory speech-processing aids (devices that raise or lower the frequency of the speech signal)

and *tactile and visual aids* are in use in schools and clinics as speech-training aids. Such aids are generally not portable devices (although miniaturized versions are being developed). They are often effective in structured training settings, although there are problems in generalizing their use to that in everyday situations.

Auditory loops had been used for a number of years in special schools for the hearing impaired and in some regular school classes where there were hearing-impaired students. Loops became more widespread and convenient when Desmond Carron, a Maryland engineer, designed and built the first portable loop for his deaf daughter in the late 1960's. The portable audio loop, a wire loop connected to an amplifier and to the speaker's microphone, is easily transported and set up in any meeting room. Persons with hearing aids set their aids on the "T" or telephone switch and receive a much clearer and more direct signal, free of background noise. With the support of William Paschell and others in the Washington, D. C., Area Group for the Hard of Hearing, loops are now used in houses of worship, classrooms, theaters, recreation centers, senior citizen centers, and some places of employment in the Washington area and elsewhere.

More recently, *infrared amplification systems* have been successful in theaters (including the Eisenhower Theater in the Kennedy Center in Washington, D. C.) and in large houses of worship. A hearing aid is not necessary to use an infrared amplification system; hearing-impaired members of the audience borrow or rent a receiver headset that brings them clear, strong sound directly from the stage. The system is particularly helpful to individuals with a mild hearing loss who often miss some words from the stage.

A variety of *warning and alert systems* that convert noises into visual or tactile signals are available to deaf individuals for use at home every day. These systems include flashing-light doorbell

signals, vibrating alarm clocks, baby cry signals, smoke detectors, and burglar alarms.

The most recent technological development for deaf individuals is *captioned television*. Although captioned films for use by schools and social groups for the deaf and open captioning on late evening TV news from WGBH in Boston had been available for some time, closed captions on television (which appear on the screen when the viewer uses a special adapter, but do not appear to other viewers) were first offered in early 1980. Research and development of the closed-captioning concept was financed by the Bureau of Education for the Handicapped, with the support of the Public Broadcasting System and two national networks. In addition to early evening news, 20 to 36 hours per week of prime-time television programs are currently captioned. Deaf viewers who can afford to can buy either a captioning adapter to attach to a television set or a set that has the adapter built into it, both sold by Sears.

Video telephones have been tried on a limited scale. They would be of value to the hearing-impaired as a communication aid for lip reading, signing, or reading the printed word, but the costs of a videotelephone network are prohibitively high. Computerization of typed information into nearly instantaneous yet remote readout is now beginning to appear and is in use by a deaf member of the British Parliament. It has also been used in the U.S. Supreme Court (April 1982).

Research continues on *cochlear prostheses*, which electrically stimulate the ear by means of an implant. A few initial efforts have been made, but practical results are not widespread.

Electric mail systems have been adopted for use by deaf users of telecommunications devices for the deaf (TDDs) through two demonstration projects funded by the U.S. Department of Health,

Education, and Welfare. * These systems have been actively used by a small group of deaf people but have not reached the general deaf population.

Research on *machine recognition of speech* has gone on for many years, although still with only limited success. It may be possible to develop a system that will automatically recognize all essential features of running speech and display them in an easily understandable form.** An ideal system would generate a typewritten message directly from the acoustic wave form. Limited speech recognition devices for single-word spoken commands have been developed and may prove useful to telephone users. It is highly unlikely that an accurate system operating on running speech from any speaker will be developed in the near future, but systems with limited message sets are being developed now (27).

The development and diffusion of *TDDs that allow deaf persons to use the telephone* have been different from all the other technological advances mentioned above. The new network was developed on the basis of existing technology, including the phone system, teletypewriters, and modems.*** It has allowed deaf persons to use the telephone, which has become a necessity of American life. The imagination and persistence of a few individuals got the movement started; the "enthusiasm on the part of the deaf participants was the propelling force behind the concept of telecommunications for the deaf" (45).

● Now the Department of Health and Human Services.

● 'Real-time graphic display, a system of video captioning based on stenography, is a recent development. A real-time graphic display device, consisting of a stenotype machine and video display screen, was used Mar. 25, 1982, at the U.S. Supreme Court to allow a deaf attorney to read the questions raised by the justices. The device, developed by Translation Systems, Inc., of Rockville, Md., costs approximately \$73,000. It requires the services of a skilled stenographer, who enters phonetic symbols into a computer that translates them into conventional English and displays the results in print on a television screen. A similar translating system is currently being used by the National Captioning Institute to provide live, closed captions for the ABC Evening News.

* **A modem (modulator/demodulator) converts TDD electrical impulses into telephone transmittable form.