

anticipated that in the near future, however, standardized selections of everyday speech will be available. This will greatly enhance the usefulness to industry of the speech audiometer, since by measuring the threshold of hearing for everyday speech, it is possible to make some estimate of the listener's practical ability to hear correctly everyday speech.

M. RELATION BETWEEN THE THRESHOLDS FOR PURE TONES AND SPEECH

Because of the complications introduced by the variety of causes of hearing loss and by the variations in the shape of the audiogram, there is no method that precisely predicts an individual's "hearing for speech" directly from his pure-tone audiogram. In addition, different kinds of speech tests rank hearing impairment differently. Therefore, it is impossible to make this computation with accuracy for each individual. However, a simple rule may be used to obtain the relation that most often holds between the thresholds for pure tones and speech. The lack of ability to hear speech at threshold is highly correlated with the average of the pure-tone hearing losses at 500, 1000, and 2000 c.p.s.¹⁸ Thus, the hearing losses in decibels at these three frequencies are added and the total divided by 3 to get an estimated "hearing loss for speech."

The fact that only the three frequencies 500, 1000, and 2000 c.p.s. are used in this computation does not necessarily mean that sounds above 2000 c.p.s. are unimportant in the understanding of speech. It is the high correlation between the average of the three pure-tone hearing losses and the "hearing loss for speech" that allows us to bypass the details of the very complicated matter of how we understand speech.

N. AUDIOMETRIC PROGRAMS

It is extremely important that industrial audiometric programs be under the supervision of a competent otologist whenever one is available. Many matters may arise that require his medical judgment, and his testimony about the quality of the audiometric program may be extremely valuable in any future litigation.

The training of the personnel who actually carry out the audiometric program should be approved or supervised by the otologist. Such personnel may include a technician, a nurse, an audiologist, or the plant physician. A mutually satisfactory audiometric procedure should be developed and followed rigorously. Procedures should be set up for the proper care of those whose audiograms indicate unusual susceptibility to noise or those who show symptoms of any of the other kinds of hearing impairment. Advice about audiometric programs may be obtained from the Subcommittee on Noise in Industry of the Committee on

¹⁸ R. Carhart, Speech reception in relation to pattern of pure-tone loss, *J. Speech Disorders*, 11, 97 (1946).

Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology.¹⁹

O. HEARING IMPAIRMENT

There are many disorders that can affect the hearing apparatus. Traditionally these disorders are grouped according to whether they occur in the sound-conducting apparatus (outer and middle ear) or in the remainder of the system (cochlea, auditory nerve, and central nervous system). The former group are called conducting disorders and the latter have variously been called perceptive, nerve, or inner-ear disorders. In order to emphasize the different character and the importance of disorders of the central nervous system, this group has been listed separately in Table 7.

TABLE 7
Hearing Impairments and Their Causes

- I. Disorders of the sound-conducting apparatus.
 - A. Obstruction of the ear canal by:
 1. Excess wax or foreign bodies.
 2. Swelling from bacterial or fungus infection, particularly in hot, wet climates.
 - B. Movement of the drum membrane and the ossicular chain hindered by:
 1. Extreme displacement of the drum membrane and the ligaments of the ossicular chain caused by barometric changes that occur when the Eustachian tube is closed (swelling from an adenoid infection or a cold may produce closure).
 2. Fluid or pus in the middle ear.
 3. Bands of scarlike, fibrous tissue called "adhesions" that tend to increase in number and size as a result of repeated middle ear infections.
 4. Otosclerosis, an abnormal bonelike growth on the stapes that begins just after adolescence and becomes progressively worse.
 - C. Damage to drum membrane or ossicular chain as a result of:
 1. Explosion or a blow on the head.
 2. Chronic infection.
 3. Removal by a surgeon to halt the spread of infection.
- II. Disorders of the auditory receiving apparatus.
 - A. Malfunctioning of the cochlea as a result of:
 1. Ménière's disease, a transient disorder that is usually characterized by attacks of dizziness, ringing in the ears, and loss of the ability to understand words even when sounds are heard.
 2. Hereditary causes that produce a permanent and sometimes progressive hearing loss.

(continued)

Inquiries may be sent to the Director of Research, Subcommittee on Noise in Industry, 701 N. Bonnie Brae, Los Angeles, Calif. In addition to providing advice to industry on audiometric programs, the Subcommittee acts as a central agency for the collection and analysis of data relating hearing loss to noise exposure. This work is directed toward increasing knowledge of the effects of noise. Groups interested in contributing audiometric data should write to the Subcommittee for information on recommended procedures and standardized cards for collecting data.