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The Modicum of Hearing of Deaf Mutes; How to
Use It and How to Improve It.



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The Modicum of Hearing of Deaf Mutes; How to Use It and How to Improve It.

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The adjective "deaf," as commonly used, is one of the most flexible terms. Its rhetorical differentiation is nil; its power of scientific definition is valueless; and its promiscuous and general use is misleading. Yet we know of no single terms that will intelligently express the various degrees of deafness, and we are therefore compelled to bring into requisition the awkward and unscientific phrases "hard of hearing," "semi-deaf," "partially deaf," etc., when any attempt toward classification is made. I yet hope that our scientific instruments for measuring hearing may develop in excellency beyond the "tick" of a watch, the variable tuning fork or the human voice, so that we shall quickly and easily be able to say of one whose audition is impaired, "Your hearing is 20 per cent; yours is 35 per cent," etc., and have that gradation recognized as infallible throughout the profession, and even understood in a general way by all. Until some such method is adopted, we shall still be compelled to employ circumlocution when any extended classification of the deaf is entered into.

The physical act of experiencing sensation caused by excitation of the auditory nerve is commonly termed "hearing," and it is this definition that applies to the word as first used in the title of this paper. I recognize, however, that this physical stimulation is but a component part of hearing; that "to hear" in the fullest and broadest sense comprehends cerebral activity, perception, association, and the reflex motions arising from normal excitation of the auditory nerves. It is this latter and fuller meaning that is referred to in the balance of the title. The ability, then, to experience the physical effect of excitation of the auditory apparatus is one thing, and the further power to utilize the effect is another.

In the first classification, it has been found by experimentation, belong a respectable proportion of children who are pupils in institutions for the education of the deaf. In the second classification belong a much smaller proportion of those pupils, yet it is large enough to have recently commanded the attention of educators and scientific men, and ways and means are being devised adaptable to their educational needs. A conviction has long lain in the minds of some who have had charge of institutions for the deaf that a duty in this direction has too long remained unfulfilled.

Gradually, however, the most progressive investigators are forcing upon the authorities the imperative necessity of provision for the instruction of this percentage of pupils, whatever it may be found to be, by means which I will recite further along in this paper.

How much actual hearing, through the ear, by the use of tubes and other bone-conduction, exists among pupils refused by public schools and sent to institutions for the deaf? How many have enough hearing to be of benefit in conversation and recitation? These are questions which have been brought most forcibly and interestingly to my attention. Early in the winter of 1893-4 I resolved to make a recorded test of these questions, with the view of having it as a basis for future operation in the line of educable audition. Through the kind offices of Mr. R. S. Rhodes, of Chicago, the inventor of the "Audiphone," I obtained one of Prof. D. E. Hughes' instruments, called a sonometer, or audiometer, for measuring the hearing power. This simple instrument may be described for the benefit of those not familiar with it, as one arranged to conduce sound produced by the opening and breaking of an electrical circuit through a receiver



to the ear. The sound is a clicking noise, and its intensity is increased or diminished by moving a magnetic disc on a sliding graduated bar towards or away from an electro-magnet, operating by induction. Normal hearing is able by the induction to detect the noise when the disc is at the extreme end of the graduated bar, while one with defective hearing must, in order to hear the noise, have the disc near the coil, the point farthest away from the coil at which the noise is heard determining the relative degree of hearing or deafness.

Out of 523 pupils comprising the enrollment of the Illinois Institution for the Deaf (at Jacksonville), I found it practicable to secure what appeared to be intelligent answers from 381. Frequent false tests were made in cases where it was suspected that the child was ignorant of what was desired to

be known, or where, being deaf absolutely, wrong answers were given unintentionally, and such cases were thrown out of the count. Great care was taken to have the test as nearly perfect as the instrument used and the intelligence of the child would admit, and I feel confidence in the result.

The scale on the audiometer was reduced to 100; R. signifies the right ear; L. signifies the left ear; 100 equals normal hearing; 0 equals total deafness; the percentage in all cases indicates the degree of hearing. In the first table I will give the ten pupils who possessed the greatest percentage of hearing, and for the sake of future reference I will give records of both ears, age at date of test, supposed cause of deafness, and age at which deafness occurred:

	Percentage of Hearing.	AGE.	Supposed Cause of Deafness.
T. H.....	R. 70—L. 80	18 years	Whooping Cough, 4 years
J. W.....	R. 80—L. 0	23 "	Spinal Meningitis 1 year
R. F.....	R. 0—L. 78	19 "	Spotted Fever, 3 years
L. V.....	R. 75—L. 20	12 "	Diphtheria 2 years
A. T.....	R. 0—L. 75	14 "	Congestion of Brain, 5 years
J. W.....	R. 65—L. 70	19 "	Unknown
N. M.....	R. 70—L. 50	9 "	Unknown
H. J.....	R. 35—L. 65	19 "	Unknown
W. S.....	R. 65—L. 20	12 "	Congenital
N. M.....	R. 50—L. 60	17 "	Congenital

Out of 381 I found results indicated in the table below. This classification gives the "best" ear, without reference

to the percentage of hearing in the other. It also gives the average of each group:

PERCENTAGE GROUPS	Per cent of Hearing.	Per cent of whole Number Tested.	Average Present Age.
60 had record of various degrees to.....	10	15.7	15 years
35 had record of various degrees between.....	10 and 20	9.2	17 "
47 had record of various degrees between.....	20 and 30	12.0	19 "
18 had record of various degrees between.....	30 and 40	4.7	16 "
7 had record of various degrees between.....	40 and 50	2.0	17 "
16 had record of various degrees between.....	50 and over	4.2	17 "
40 had record of zero in right ear.....	10.0	17 "
46 had record of zero in left ear.....	12.0	16 "
198 had record of zero in both ears.....	52.0	15 "

There seems to have been quite a variation between the degree of hearing in right and left ears of individual

cases, as out of the total number examined only twenty-six had an equal degree of hearing in both ears. The

average in the aggregate of the percentage of the right, however, and that of the left ear is very nearly the same, a very interesting fact, going to prove, though not by any means fully establishing the fact, that one ear is not more susceptible to influences causing deafness than the other. The average percentage of hearing of all those who heard in any degree is 19 per cent in the right ear and 20 per cent plus in the left ear—practically the same.

By reference to the percentage columns of the last table it will be seen that nearly 11 per cent of all examined recorded an audiometric hearing power of 30 per cent and over of normal hearing. At that rate, there should be in the Illinois Institution for the Deaf nearly sixty pupils who have 30 per cent and over of hearing. The importance of this disclosure would seem to be augmented, taken with the statement of Mr. Rhodes that he himself has only about 7 per cent in one ear and nothing in the other, and that of the late Prof. George Wing, who claimed it as his belief (though not verified by tests) that fully 20 per cent of all pupils in institutions for the deaf were more sensitive to sound than he himself was. Mr. Rhodes, it may be said, carries on a large business and transacts his affairs by speech and hearing, using the audiphone and experiencing little or no trouble. Mr. Wing used a trumpet or flexible hearing tube with as little inconvenience.

Were I to let this statement stand without further comment, the natural conclusion would be: If the gentlemen referred to, having each less hearing than each of sixty pupils in one institution for the deaf, can successfully use that modicum of hearing, the duty is plain and neglect is culpable. But there is a very important fact to note, and that is, children partially deaf do not, and, I may say, will not, excepting in rare instances, put forth the exertion needful to utilize and educate the modicum of hearing they possess. On the other hand, adults, who sensibly appreciate the annoyance arising from deafness, will put forth the utmost exertion, wholly or partially, to retrieve the lost sense. This explanation of the reason why greater success

in this direction may not be attained is, without doubt, the valid one, and the fact is a most serious block in the way of carrying out a most pleasing theory. Only one ray of hope for the removal of the difficulty appears, and that is in more persistent and individual instruction in much smaller classes than it has yet been found practicable to form.

Audiometric tests of hearing power were made also in the New York Institution for the Deaf by Prof. F. D. Clarke, 341 pupils being tested. The result of this test was as shown in the following table:

Number Cases	Audiometer.	Percentage of Cases Tested.
70	0.....	20.52
9	0 and under 5.....	2.63
30	5 and under 10.....	8.79
112	10 and under 15.....	32.96
63	15 and under 20.....	18.47
25	20 and under 25.....	7.33
10	25 and under 30.....	2.93
5	30 and under 35.....	1.46
4	35 and under 40.....	1.17
2	40 and under 45.....	0.58
4	45 and under 50.....	1.17
2	50 and under 55.....	0.58
8	55 and upwards.....	2.34

From the experiments made, the authorities in the New York Institution concluded that about sixty of the whole number tested (341) possibly heard enough to eventually be instructed through the ear, but finally decided to begin with but thirty-two. This was eleven years ago. The latest report is that nineteen only receive instruction through the medium of the ear.

In the Nebraska Institution fifty-four, or about 34 per cent of the whole number receive instruction through the ear. That institution is the pioneer in the classification and instruction of the semi-deaf, and I am sorry that no data are at hand with reference to the recorded degrees of deafness which the number who receive instruction through the ear possessed when such instruction was commenced, for much of the value of such experimentation results from comparisons made from time to time.

The first permanently organized class of semi-deaf pupils in the Illinois Institution was formed in October, 1894. The members of the class were taken from the other classes, where they had been receiving instruction such as is given to deaf mutes who do not hear or speak. From that time to the present these pupils, who have various degrees of hearing, have been compelled to depend upon the ear for their instruction and required to communicate by vocal speech during the five hours each day they are reciting. The experiment has been most gratifying. While the work is exceedingly taxing to the teacher, who must materially increase the volume of vocal speech so as to meet the requirements of the deafest member of the class, yet this great strain will, I trust be lessened by means of assistance from the graphophone. Experiments to that end are now being prosecuted.

The aim, it must be understood, in classifying the semi-deaf together is to secure for them such instruction as they would receive in the ordinary schools, were they able to receive it in public school classes. In addition to this, their defective articulation and breathing, which almost invariably accompanies defective hearing, are corrected and much improved by exercises designed by the teacher to fit such cases. Not only is the practical utility of their remnant of hearing thus made a prominent feature of instruction by its continued exercise toward practical ends, but the esthetic cultivation and use of the semi-dormant sense is undertaken also by a short daily musical program sometimes given by the teacher rendering piano and vocal selections, or by the graphophone. Considered psychologically, this exercise is of no small importance. It is conceded by students of psychology that sound affects the psycho-acoustic and the emotional centers of the brain very perceptibly, and to an extent that may soothe and palliate nervous disorders or excite to serious nervous affections. The effect upon the totally deaf of the absence of sound in the formation of character, as well as the therapeutic value of harmony, is a subject that is well worth investigation.

As a means of laryngeal exercise, the class is also made to go through with a daily drill, very much the same as singers, usually accompanied by the piano, but limited, of course, to rudimentary exercises designed for especial purposes, such as "opening the throat," "abdominal breathing," and the "placing" of abnormal voice.

Aids to hearing are resorted to where it is difficult to secure comprehension normally, and the various tubes and trumpets, as well as the audiphone, are kept at hand. The principle governing the class is "the greatest amount of audition that is possible, together with activity of the vocal and articulatory organs." It will readily be understood that the attendant labor is great, owing to the amount of individual attention required. The graphophone is, I think, going to prove a valuable assistant to the teacher in this respect. The principal way in which it can be used is by the teacher recording upon a blank cylinder such lessons, exercises or recitations as she may desire most frequently to fall upon the ears of her pupils. These cylinders then can at her pleasure be placed in the machine and as many as eleven pupils can, by using the multiple hearing attachment, hear over and over the record of the cylinder. Thus much time as well as lung power can be saved and a vastly greater quantity of vocal utterance into the ears of the pupils can be secured. To what limit the use of the graphophone can be beneficially serviceable is yet to be discovered. Tests are now being made with other pupils whose hearing is much less in degree than those we term the semi-deaf, ranging down to zero. One hundred and ninety have already been tested. The graphophone, it must be understood, has much greater volume than the phonograph, and the person making the record can secure a reproduction that may be heard by normal hearing in any part of quite a large room. The cylinders used in the test were: First, a musical selection by an orchestra (a march), in which was introduced the ringing of a bell; second, a cylinder the record of which was made here, representing, first, loud speech, then the imitation of a bird,

followed by an imitation of the squealing of a pig.

The graphophone was taken to the various class-rooms and the pupils told to listen (using the ordinary tubes usually connected to the phonograph) and write down as good a description of the sound or sensation produced as they could. It is safe to presume that the answers which I reproduce below are for the most part "honest" ones, though doubtless the imagination was drawn upon in some instances. It must be remembered, too, that the greatest majority of those tested probably never very distinctly heard many sounds of any kind, and that, therefore, any sound-impression might be defined, not as relating to any special similarity in quality to another, but as causing a sensation similar to that caused by most any accidental sound-impression which had at some previous time been experienced. Others seem very closely to have recognized some of the sounds produced.

As a matter of comparison, I have reverted to my former audiometric tests and have followed the definition of the sound-impression as given by the deaf pupil with the percentage of hearing found to exist in each case at that time. The columns on the right indicate the right and left ear percentage of hearing as shown by audiometer:

Graphophone Test—190 Deaf Children.

	R.	L.
A., C.—Birds singing. Cats mewling.....	0	0
A., N.—Like Music. Whistle.....	16	16
B., J.—Little like a band.....	0	0
B., S.—Music.....	10	0
B., H.—Whistle. Baby crying. Man said words.....	20	22
C., E.—Heard words and noise of locomotive.....	27	20
C., M.—Like the blowing of a horn. Laugh and whistle.....	25	10
C., W.—Birds singing. Dog bark....	4	4
C., R.—Piano and singing. Train coming.....	10	25
D., G.—Dog bark.....	0	0
D., G.—Whistle. Cow.....	0	0
D., A.—Little sound like a horn and band.....	0	0
E., L.—Music.....	0	0
F., G.—Bird's voice. Music.....	0	0
F., J.—Dog bark. Birds singing....	0	0
G., B.—Like an organ. Dog barking.....	0	0
G., P.—Croaking of window in wind-storm. Voice like screaming.....		
G., E.—Bird.....	3	0
H., J.—Whistle. Bark. Music.....	20	22

H., L.—Singing of animals.....	0	0
H., C.—Noise like a lamb and a cat.	0	0
H., G.—Whistle.....	0	0
H., H.—Whistle. Bark.....		
H., M.—Dog barking.....	0	0
K., P.—Band. Music. Man holding hog that squealed.....	0	22
K., E.—Bird.....	0	0
L., K.—Dog bark. Birds singing....	0	0
M., A.—Bands and songs.....	35	32
McC., T.—Music like in opera house.	5	0
M., N.—Negroes singing. Birds singing.....	50	60
McF., B.—Music. Noise like some animal. Loud talking. Sensibly affected and auditory nerves causing shock.....	10	0
M., O.—Very sensibly and acutely affected auditory nerves and caused shock.....		
McD., M.—Bird.....	0	0
M., J.—Like a boy going up steps...	10	6
M., C.—Ungreased wheels. Dog barking.....	0	0
M., N.—Whistling. Rumbling of wheels.....		
M., K.—Baby crying. Band. Carriage.....	50	0
N., A.—Cow and dog.....	0	0
O., E.—Cat mewling. Dog bark. Hen singing.....	12	0
O., W.—Band.....	3	0
P., B.—Whistle.....	0	0
P., D.—Birds singing. Dog bark. Baby crying.....	8	8
P., E.—Cow. Dog. Whistle.....		
R., F.—Dog bark. Noise of machine. Shout of man.....		
R., V.—Dog bark. Cat mewling. Cow.	0	0
R., C.—Cow.....	0	0
R., M.—Piano. Hand organ. Dog...	20	32
R., D.—Like a cat.....	0	0
R., H.—Band.....	0	0
R., M.—Music.....	2	0
R., S.—Music.....	0	0
R., M.—Singing.....	0	30
S., G.—Preaching. Pig squealing...	30	20
S., J.—Train.....	0	0
S., F.—Music. Whistle.....	0	0
S., L.—Music. Whistle.....	0	0
S., M.—Whistle. Birds singing.....	10	0
S., H.—Birds singing.....	15	20
T., A.—Piano. Dog bark.....	0	0
T., F.—Noise like a cat. Boys playing	0	0
U., T.—Preaching. Pig squealing...	30	20
V., F.—Rooster crowing.....	6	5
V., J.—Whistle.....	0	5
V., L.—Cat. Church bell. Train....	15	15
W., M.—Street car. Whistle. Train	0	0
W., O.—Bell.....	0	0
W., M.—Whistle. Boy's scream. Birds singing.....		
Z., R.—Birds singing. Dog bark....	0	0
C., A.—Dog bark.....	22	20

To utilize and improve the hearing and to educate sound-perception in those whose hearing has never differentiated sounds to an extent that would render their physical hearing a practical agent for conversational uses, requires still more complex and patient treatment. Should a person born deaf miraculously and suddenly receive

hearing, he would be utterly unable to successfully associate the sounds he would hear uttered as vocal speech. He would be as a foreigner in a strange land, and the words of his own mother would be meaningless. His hearing power, so far as its utility in conversation is concerned, would be nil. His auditory cerebral center would have to be educated with as much detail as that of a babe. Frequent repetition of the verbal sound of common objects would be necessary, together with association of the sound with the visual object. A regular course would have to be pursued with him, beginning with the very simplest elements of language, and this, too, in the face of the fact that his previous education may have been carried to a high degree of perfection and he may be able to comprehend by visual means the most abstruse statements.

In this hypothetical case we have the exact condition of one whose hearing, always dormant or never having been utilized, is sought to be improved by any means that may be employed. The degree of physical sound-sensation reaching the auditory nerve, whether greater or less, does not enter into the problem so much as does the past history of the practical use of that degree. In other words, a person born with as high as 60 per cent of hearing, be he of phlegmatic temperament, slow of perception, indolent, and mentally dull, may, if no interference supervenes, live a long life without ever uttering a word or comprehending a word spoken to him. On the other hand, one born with a much less degree of hearing, but of active temperament and an inquiring mind, is open to impressions, faint though they may be, through the auditory nerve. His very keenness to know of cause and effect will frequently lead him to a knowledge and perception of the genius of speech. To what extent these phlegmatics with a comparatively large percentage of hearing power, and these others with active and inquiring minds, though possessing relatively a less degree of hearing power, may be brought to a practical hearing perception, is a question that the future only can answer. Some experiments are now being made in that direction. Sugges-

tions have been made towards massage of the sound-conducting apparatus by means of vibratory impressions graduated so as to meet the requirements of various cases, and to give variety of pitch and quality. This is done by an instrument termed a vibrometer used by Dr. Henry F. Garey of Baltimore. Dr. Garey claims that in the loss of elasticity of the membrana tympani, and adhesions caused by secretions of a gluey nature in the tympanic cavity, curtailing the movements of the ossicula auditus, a systematic massage of the vibrometer will restore these parts to activity. Some eminent members of the profession do not agree with this view, though Dr. Garey cites cases where the treatment has been successful.

Whether the theory is practical or not, there certainly is reason enough in it to induce experiment along that line, though I am constrained to believe that more may be accomplished by professional surgical interference in case of diseases such as Dr. Garey describes.

In the foregoing I have shown, I think, in what manner the modicum of hearing possessed by some of the deaf is, and how in others, it may be utilized in their education and later, in affairs of life. How far we may be able to go in the future depends first upon the success or failure of further experiments, and upon the funds at our command for the employment of assistants. Another difficulty that stands in the way, to which I have before alluded, is the proneness of deaf children to be satisfied with their condition and being loth to put forth the exertion necessary on their part to raise themselves from deafness.

The possibilities are almost illimitable where all conditions are favorable and where individual cases are considered, but any attempt to generalize from isolated cases of success, or to fit theories that under the most favorable conditions might become facts, to conditions unfavorable to success, is liable to failure. Another very necessary adjunct to success is persistency. Ephemeral effort will not avail in these experiments any more than it does with other scientific investigation. Time and intelligence are indispensable.

PATHOLOGICAL.

I now come to the last division of my subject, and that is the study of the etiology of diseases of the ear as presented in the pupils congregated at institutions for the deaf. With only now and then an exception these institutions have confined their energies toward educating and training the deaf with little or no care for the diseased ears. It is presupposed that children who have become so deaf as to require specialists to educate them have either gone so far as to hold out little hope for alleviation or cure, or else have already received medical attention to the limit of medical science. Both of these views are, in my opinion, subject to grave criticism, if not condemnation.

I think I am safe in saying that not seventy per cent of the children present in the Illinois Institution have had any intelligent inspection of their ears, with a view to correct diagnosis. If that is the case, we may have with us quite a number who, through treatment comparatively simple, might either be restored completely, or at any rate to a degree that would admit of the successful use of mechanical aids to hearing. Medical science is constantly progressing, and yet our schools for the deaf do not decrease in proportionate ratio. I am very strongly of the opinion that the reason for this is not traceable to lack of skilled aurists, but to neglect in childhood to have corrected some simple irregularity or to have removed some foreign mucoid or adenoid obstruction from the meatus, the eustachian tube or the naso-pharynx. The time to treat disease is in its incipency, or, if that is not possible, as soon after as it can be done. Certainly little hope can be entertained for successful treatment of deafness after an atrophied state of the organs has become permanent. Another very forcible argument for a department of this kind connected with the state school

for the deaf is that pupils attend school here for nine months in the year, and are boarded and housed and cared for day and night by the same officers. Whatever treatment might be given could be thus given daily and hourly if necessary, while their education would be progressing at the same time. Frequently I have requests from parents to send their child home or to be granted permission to keep him at home for a year, so that some "Indian doctor" of other class of charlatan who may chance to be pitching his tent in the neighborhood, may operate on his ears. It is needless to say that when this has been done no good whatever has resulted, the parents have been fleeced out of as much money as possible, and the child has been set back a year or so in his education. This could all be avoided. If treatment seemed advisable, we could discover the fact here and could proceed with it with little interruption of school work.

No greater field exists for the study and treatment of diseases of the ear. With five hundred and twenty deaf youth gathered together (the largest number in any one institution in the world), all under one control, with all the comforts of a home, and yet sufficient hospital appliances for the most thorough research, what grander chance for doing good to humanity.

I am pleased to state that in compliance with these suggestions, which were embodied in my last Report, the legislature of Illinois and the Trustees of the Illinois Institution for the Deaf have taken the first step toward the desired end—a step, only, it is true, but one which I have reason to hope will result in an otological department to the Illinois Institution for the Deaf which will not only become famous for its scholarly research as to the cause and cure of deafness, but may be the cause of much alleviation and possibly of restoring hearing to some that would otherwise remain perpetually deaf.

