

Proceedings of the British Society of Audiology

DISORDERS OF AUDITORY FUNCTION

edited by W. TAYLOR

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Disorders of Auditory Function

Proceedings of the British Society of Audiology
First Conference—held at the University of
Dundee, from 14 to 16 July, 1971

Edited by

W. TAYLOR

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Foreword

Since its formation, the British Society of Audiology has shown a surprisingly rapid rate of growth, with a membership now standing at over 400. This is but one index of the interest, in Britain, in hearing and its disorders, a subject which concerns people of diverse callings, including those in education, in medicine and in science.

Encouraged by this growing interest in audiology, the Council of the British Society of Audiology decided to inaugurate a series of four-yearly conferences to be held in association with the British Academic Conferences in Otolaryngology, with which subject many aspects of audiology are related. Support for the First Conference, of which this book is a record, vindicated our belief that such a conference was timely and more than justified the efforts of the Congress President, Dr William Taylor, and his Organizing Committee to ensure that the Conference would be a success.

Ronald Hinchcliffe

April 1973

Preface

This volume contains the full text of papers presented at the First British Conference of the British Society of Audiology, held in the University of Dundee from 14th to 16th July, 1971. The University of Dundee has been honoured by being chosen by the Council of the British Society of Audiology as the organizers of the First of four-yearly conferences planned in association with the British Conferences in otolaryngology.

In planning the Conference the organizers took the opportunity of commemorating one of the outstanding pioneers and a key-founder of audiology—Dr Thomas Simm Littler—by initiating “The Thomas Simm Littler Memorial Lecture”.

The Council wish to express their grateful thanks to Sir Alexander Ewing for delivering this inaugural lecture at our British Society's First Conference and this memorial lecture is reproduced in this volume in full. The contribution to audiology made by Dr Littler has also been commemorated by an annual award for the most outstanding research work done in the previous year. The opportunity was taken at the Conference to present this award to Dr John Bench, Reading.

The papers read at the Conference, and collected in this volume, cover a wide field, the deliberate aim of the organizers being to appeal not only to experts and research workers but to all those concerned clinically with the measurement of hearing. Although the academic and clinical departments in Dundee have been mainly concerned with noise-induced hearing loss, this is but one aspect of the growing world-wide interest in noise measurement, in the reduction of noise both in industry and in the community, and in the measurement of hearing loss by subjective and objective methods. Audiology has now been firmly established in such widely diversified areas as industry, hospitals, schools and universities. Thus the papers presented in this volume reflect the interests of many people in many disciplines—in medicine, in science and in education.

The Editor would like to record the help received in organizing the Conference from the President of the Society, Dr R. Hinchcliffe and from Mrs W. M. Massie, the Conference Secretary, the latter serving in

many varied roles before, during and after the Conference. The organizers would like also to express their grateful thanks to Mr R. P. Itter, Secretary to the British Society of Audiology and to the Chairmen of sessions.

W. Taylor
University of Dundee

April 1973



Dr Thomas Simm Littler, Ph.D., F.Inst.P., with H.R.H. The Duchess of Kent at the IX International Congress of Audiology held in London in 1968.

One of the key founders of Audiology, it is very fitting that Dr T. S. Littler was commemorated at the British Society's First Conference. Beginning at Manchester University in 1933, he pioneered electronic hearing aids for the hard of hearing and broad-band amplification for deaf children. After being a Senior Scientific Officer in the Royal Air Force during World War II and Senior Lecturer in Acoustics at Manchester, he was appointed in 1949, by the Medical Research Council, as Director of its newly established Wernher Research Unit on Deafness. He made notable contributions in research on noise-induced hearing loss and presbycusis. Amongst his staff and collaborators were W. Burns, T. E. Cawthorne, R. R. A. Coles, R. Hinchcliffe, J. J. Knight, C. G. Rice and D. W. Robinson. From the Royal Society of Medicine he was awarded in 1951, its Norman Gamble Prize for the most outstanding contributions in Otology in the preceding five years. Notable among his many writings was his book "The Physics of the Ear", published in 1965.

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The Thomas Simm Littler Memorial Lecture

The Place and Functions of Audiology in the Community

SIR ALEXANDER EWING

Alderley Edge, Cheshire, England

This lecture celebrates the memory of Thomas Simm Littler. I am deeply grateful for the honour and privilege of having been invited to give it.

Dr Littler was one of the pioneer founders of audiology. His personal researches, his many contributions to the relevant professional journals, and lectures to most of the appropriate societies and institutions, together with his book *The Physics of the Ear* published in 1965, have assured him an international reputation. Of equally outstanding value to our community was his constant and continuing service to governmental authorities in peace and war. He will always be an outstanding figure, in the history of audiology. Yet he never sought honours. Speaking as a collaborator and a friend, I will say he played an essential part in the development of the Manchester University Department and in the shaping of my own career. Later, I will refer to some aspects of his work and thinking, particularly as regards communication.

Audiology is a convergence of disciplines comparable to a junction at which a number of roads meet. This is well summarized by Hayes Newby in the first edition of his book *Audiology*.

If the mother and father of audiology are speech pathology and otology then . . . among the medical relatives are pediatrics, gerontology, psychiatry and neurology. Pediatricians and gerontologists represent extremes in ages of patients, yet both are concerned with problems of impaired hearing as they affect the health and adjustment of their patients.

He went on to refer to maladjustments, frequently caused by hearing impairments, auditory disorders involving pathology of the nervous

system, clinical psychologists as an important unit in the team approach and of course to acoustics and electronics. He described audiology as related to education, particularly in matters concerning the training of deaf and hard of hearing children.

Under this heading in the field of paedo-audiology, he emphasized the necessity of a specialized knowledge of the principles and practice of training pre-school and school-age children, and close co-operation with teachers. It is no wonder that at the end of this chapter Newby concluded

No one individual can be expected to be the complete audiologist.

We might also state that audiology is a field in which great advances, in many directions, have been made in the last four decades. The subjects included in the index to Volumes 1-9 of the journal *International Audiology*, 1962-70, are classified under 54 headings. As a profession we are concerned with auditory stimulation, auditory sensation and what might be described as auditory de-sensitization, and both with sound wanted and sound unwanted.

Audiology began and developed primarily as a "humane science". These two words describe essential features of the personality of T. S. Littler. When I first knew him, 40 years ago, he had resigned his appointment as Senior Lecturer in Physics at the Egyptian University, Cairo, because he wanted opportunities for research, then lacking there. He had driven back to England in his Fiat car, including a drive up Mount Vesuvius as part of his itinerary! Running repairs to cars were always well within his scope. On one occasion, in the centre of Manchester, he diagnosed a car break-down as due to a fault in the ignition distributor, then repaired it with the graphite core of a "lead" pencil. Another time, halted on a trans-Pennine road journey by fracture of the transmission shaft, the local garage owner could not undertake to repair his car. Within a few hours Littler had himself obtained and fitted the necessary spare part.

When he returned from Egypt Tom Littler's potential value to research on human pathologies was quickly perceived by our then Reader in Human Physiology, F. W. Lamb. It was while he was investigating detection and measurement of heart murmurs by electronic techniques that Dr Lamb brought him to see us. Tom Littler was motivated to begin what became his life-long work because he realized that deafness results in specific human needs. Within three years he pioneered the valve-amplifying group hearing aids for use in special schools that our previous data had shown to be urgently needed. They were constructed to his own design in our University Department.

Confronted with the problems of severe deafness in hard of hearing adults he quickly conceived the idea several years before 1939, that electronic hearing aids should be made available to all who needed them and he arranged with an electrical engineering firm to produce a small portable aid at low cost—the progenitor, of course, of our British National Health Service hearing aids.

To the end of his life Dr Littler saw the prosthetic requirements of hearing-impaired people as a vital function of audiology in its service to the community. In our excellent journal *Sound* (initiated and edited by him) he wrote, within eighteen months of his death (Littler, 1968), a short article “Can alleviation by hearing aids be improved?” I will discuss later what I believe may be the fundamental importance of his discussion in that article. Earlier in the 1960s he had already made an important contribution towards better alleviation by hearing aids for deaf children. His survey for the London County Council Committee on “Improved Hearing Aid Equipment” related to data showing that there is a considerable incidence of better capacity for response to sound of low than of high frequencies among children diagnosed as severely or profoundly deaf. With typical ingenuity Littler adapted the Medresco OL.58 bone conduction hearing aid for use with a modified air conduction receiver. This, as many of you may know, enabled a much smoother low-frequency performance to be obtained as compared with the Medresco OL.57, when fitted with a 575 receiver. In his report Littler stated that severely deaf children, without exception, preferred the modified OL.58 aid to the OL.57. His finding has been followed up by production of a new aid but not yet, I understand, available for the benefit of all deaf children when supplied with hearing aids through our National Health Service.

This finding marks a step forward towards some effective and practical conclusions about the long-controverted problem of selective prescription of hearing aids. In Littler’s own words

... it was felt that more efficient use could be made of the Medresco aid ... by providing a testing service where the response characteristics of each aid could be obtained, and in consequence allocating those aids with higher gain and outputs to the more severely deaf children and the wider frequency responses to those who would benefit most by their use. ... It is again suggested that the Committee should seriously consider that an issuing and testing centre be created with the service of the L.C.C. schools.

Embodied in these last statements, therefore, we have recommendations firstly for audiologists selectively to prescribe a type of hearing aid specifically designed to suit an aural condition that it is for them to take steps to identify—and secondly for the performance of each hearing

aid of a particular design (in Littler's report the Medresco) to be evaluated—say with the Brüel and Kjaer apparatus—in order that an audiologist might know it to be capable of meeting an individual patient's need. Successive investigations of particular types of hearing aid in the Manchester University laboratories in my time as Director and since have confirmed the validity of the second point.

That certain identifiable groups of hearing-aid users do best with hearing aids designed to provide specific performances in terms of frequency bands was also reported by Dr A. M. Boothroyd at the Mexico Congress and in *International Audiology* (Boothroyd, 1967). His tests were given to 25 children aged 8 to 15 years, all of them pupils in a school for the partially hearing, diagnosed as having perceptive hearing losses. In the following year Dr Daniel Ling of McGill University and Mrs Doris Leckie of the Montreal Oral School for the Deaf reported that they had tackled this problem with 12 children who had residual hearing mainly restricted to low frequencies. They stated that, with a standard model hearing aid amplifying from 250 Hz to 3 kHz, the vowel /ee/ was audible only up to about 3 ft, although they could hear the vowel /ah/ at 30 ft. With one of the more recently developed type of body-worn aids (amplifying from 100 Hz to 3 kHz) all vowels and voiced consonants were audible to all the twelve children at 35–40 ft. I myself have obtained somewhat similar results. For every patient, surely, the first function of a hearing aid is that it should make as much as possible of the speech area available to him.

As regards very profoundly deaf children I believe that Dr A. M. Boothroyd's report at last year's Stockholm Congress has great significance. Defining this category of children as those

... who have no response to sound within the standard audiometric range or who respond at low frequencies only and within or close to the range of tactile sensitivity

he stated that in experiments with classroom equipment at the Clarke School, Massachusetts, where he is now Director of Research, he has found that

... the first requirement for such children is a good low frequency response extending at least as far as 100 Hz.

To introduce my next point I should like to quote the final sentence in Dr Littler's editorial article on improvement of alleviation by hearing aids to which I have already referred. After stating that

... for the majority of deaf subjects a form of wide-band frequency response that is smooth in character has been confirmed over and over again as the most satisfactory.

He refers to the finding that binaural hearing, so far, does not seem to have produced anything like the striking results so helpful to normals . . .

Then he asks what I believe to be a key question

—Is it not now appropriate that we should review the whole field to see if we should do some re-thinking of the situation?

He questions whether the partial failure of prosthetic provision of binaural hearing is related to

. . . the need for special training in binaural reception for deaf ears which have not experienced this faculty.

I would strongly urge that this subject of special training is worthy of far more research by audiologists than it has ever yet received. As regards use of binaural amplification through two separate electronic channels, with their separate microphones picking up sound at two separate points in space, our observation is that there may be hard of hearing patients who can achieve directional hearing with two ear-level hearing aids. Is it not possible that, as Littler has asked, some subjects could achieve the same invaluable ability, as a result of training and with adequate amplification, in spite of never having enjoyed it before in their lives? I am thinking of both children and adults with a diagnosis of life-long sensori-neural deafness. Of course, one has worked with the experienced hearing-aid user in this category who reports that

What I hear in this ear sounds quite different from what I hear in the other ear

but this does not apply to all patients.

The problem of achieving directional hearing in particular cases may or may not be insurmountable. It may well be so, for instance, when causation is diagnosed as retrocochlear, with a sub-cortical or cortical pathology seriously affecting the neurological mechanism of hearing. This would be implied, for example, by Jeffress (1971).

The practical issue is surely that even if only a minority of hearing aid wearers could be given ability to use directional cues this would help them to cope with one of the most severe forms of difficulty which they constantly encounter—namely discriminating speech signals against a background of noise and reverberation. Recently, I myself experienced deprivation of binaural hearing for some weeks. This confirmed most conclusively a sentence in my wife's and my book (Ewing and Ewing, 1964), namely that

binaural hearing is also known to affect very significantly capacity to listen discriminately to sound from a particular source in conditions in which reverberation and noise are present.