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OVERSEAS VISIT, SEPT-OCT. 1979: INTERNATIONAL SYMPOSIUM ON AMPLIFICATION IN EDUCATION AND VISITS TO NASHVILLE, MEMPHIS, CINCINNATI, SAN FRANCISCO, LOS ANGELES

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Introduction

This visit served the following purposes:-

1. To participate in an International Symposium on Amplification in Education, held at Vanderbilt University, Nashville, Tennessee.
2. To collect information about current clinical practices in some prominent audiology clinics.
3. To discuss common research interests with American audiologists and, in some instances, to present talks on NAL methods to audiologists, audiology students and medical students.

The visit arose from an invitation, including all expenses, to participate in the symposium. I also received invitations, with expenses, to lecture at the University of Cincinnati and Memphis State University. In view of the current (in Sept. 1979) review of NAL's clinical procedures it was decided to extend the visit by a few days so that I could visit some American Audiology clinics to collect information about their clinical and administrative procedures. The symposium, the visits mentioned above and others undertaken during a day and half which I was obliged to spend in Los Angeles on my way home, provided excellent opportunities to discuss common research interests with a large proportion of the leading audiologists who are working in the field of amplification.

An outline of the professional activities which were undertaken is given in Appendix 1. These are described in more detail in the following sections.

International Symposium on Amplification in Education - Vanderbilt University, Nashville, 26-28 Sept. 1979.

The program of this symposium is outlined in Appendix 2. In the words of its convenor, Dr. Fred Bess, its basic purpose was "to assemble state-of-the-art information on the use of both personal and group type amplification systems in the schools as well as to provide direction for future research and educational needs". The target audience was (again quoting Dr. Bess) "audiologists, educators of the hearing-impaired, speech-language pathologists, and to a lesser extent allied disciplines in special education". The symposium was intended to be limited to 300 participants but, in fact, slightly more (about 320) were accepted. Educators were well represented but my impression was that the majority of participants were audiologists who worked in an educational setting. It appears that in the USA there are many such "educational audiologists" who work closely with teachers either within the schools or in clinics which provide parent guidance and auditory training services.

The conference was designed to provide a comprehensive coverage of its subject. It consisted entirely of presentations from invited speakers who were requested to deal with specific aspects of the topic. This ensured that no important areas were neglected and that repetition was minimized. The first two days consisted of an introductory lecture on "Auditory training in historical perspective" followed by twenty-two 30 minute presentations arranged in the following sections: Speech as a physical stimulus (1 paper); Sensory capabilities of the hearing-impaired child (4 papers); Classroom amplification systems (6 papers); Desirable characteristics of amplification systems (10 papers); Future directions (1 paper). The final half day of conference consisted of a panel discussion followed by three workshops.

The faculty included nearly all the recognized American experts who are concerned with educational amplification. The majority of speakers were audiologists but also included were educators and engineers. The "international" contingent consisted of: Dr. Eric Wedenberg (Sweden), Dr. Daniel Ling (Canada) and myself. (An invited speaker from England (Dr. A. Markides) was obliged to withdraw at short notice owing to ill health.)

My own contributions to the symposium were the presentation of two papers and serving as a panel member together with Drs Ross, Ling and Matkin. My first paper was on psychoacoustic aspects of selecting amplification. This followed a paper by Dr. Daniel Schwartz on electro-acoustic and clinical considerations. These two papers could be regarded as complimentary in that together they co vered the topic of selecting amplification. In my second paper I described the principles of selecting amplification for individual children with devices other than conventional hearing aids, the selection methods developed in NAL and how the relevant principles are being put into practice in the NAL/CSIRO complete amplification system currently being developed.

As might be expected, such a carefully planned conference proceeded very smoothly and the choice of speakers ensured a consistently high standard. In fact, to single out any particular papers as "highlights" would be rather arbitrary and I suspect that any such choice would vary greatly for different members of the audience, depending on their individual interests.

The conference attracted the kind of participants for which it was designed and it appeared that all the presentations were well received. I received quite a number of compliments on my own papers and enquiries about various aspects of our work. The main areas of interest were:

hearing aid selection techniques; the NAL/CSIRO complete amplification system; and the NAL three stage impression technique, which I mentioned incidentally in one of my papers. A considerable number of people requested reprints and further information about the aid selection and impression techniques.

The only significant criticism which I heard of the conference, was that there was no opportunity for general discussion until the final day. There were, of course, many discussions among speakers and audience members during the breaks for lunch and morning tea and afternoon tea but these breaks were relatively brief. Furthermore, there was a busy social program for the speakers which separated them from the audience members at nearly all times except the conference sessions and the evening of the conference dinner. This meant that my opportunities for talking to other speakers were especially good but that there was less time for talking to audience members than I had expected.

Any summary of a conference of this nature must inevitably reflect some personal bias in the selection and interpretation of material. Nevertheless it seems worth reporting two themes which were very evident. First, there was general agreement that many hearing-impaired children should use some form of "classroom" amplification device in addition to their conventional hearing aids. This follows from recognition that under some common listening conditions hearing aids do not provide a satisfactory signal. Although the effectiveness of the conventional hearing aid could often be improved by giving more attention to such matters as the acoustical treatment of classrooms, there are certain limitations which cannot be readily overcome. The most favoured form of "classroom" amplification was the self-contained, wearable radio frequency system. However some participants mentioned problems relating to acceptance of these units, because they are larger than hearing aids and also problems concerning high cost, servicing difficulties and the

restricted scope for individual selection of amplification characteristics. The other panel members, and members of the audience, appeared to be impressed with the advantages of NAL's proposal to issue a complete amplification system, with respect to efficient servicing and especially the capacity for individual selection. It was accepted without question that this capacity is a very important requirement and it was agreed that most currently available systems are seriously deficient in this respect.

Another major theme was the need to apply scientific principles more consistently at the classroom or clinical level. This point was made concerning the use of amplification but also with reference to other matters such as the teaching of speech. Related to this was the question of how to bridge the gap between what is known and what is used. Indeed the panel discussion was largely devoted to this issue after several members of the audience expressed their frustration that the presentation of so much useful information at conferences was rarely followed by significant improvements in classroom or clinical practices. This problem was attributed to various causes including inadequate or inappropriate training of teachers and educational audiologists, insufficient "master" teachers and clinicians to train others by their example, and excessive, but unavoidable, pre-occupation with such everyday problems as those associated with the purchase and maintenance of amplification equipment and avoiding acoustic feedback. Some of the specific problems which were mentioned are peculiar to American scene, but the general difficulty of translating the latest knowledge into practical benefits is one which frustrates audiologists and teachers everywhere.

The symposium served as an excellent tutorial for the less experienced while, for the more experienced, it was a good opportunity to take stock of what is known. A moderate amount of new material was presented

although this was not a primary purpose of the symposium. Overall, I believe that this conference offered good value to all participants. It would have been particularly valuable to many of NAL's clinical audiologists especially those of moderate experience who are working in the pediatric area.

The conference papers are being expanded into chapters for a book which should prove to be an excellent reference on amplification in education. Copies of the two chapters by myself (one co-authored by R. Christen) are available for reading by NAL staff.

Clinical and Administrative Practices in American Audiology Clinics

As indicated in the introduction, the second purpose of my visit was to collect information about current clinical and administrative practices in some American audiology clinics. I visited three clinics specifically for this purpose namely the hearing and speech clinics at the Veterans' Administration Hospital in San Francisco and at Vanderbilt University, Nashville, and the University of Cincinnati. A little information was also gathered incidentally at Memphis and Los Angeles and from audiologists participating in the symposium, although most of the discussion at these places was concerned with research interests. At the three clinics mentioned above, I asked a series of questions mainly concerned with the management of adult hearing aid cases. The information acquired at the three clinics is summarized in the following sections:-

A. Hearing and Speech Clinic, V.A. Hospital, San Francisco

Clients being fitted with hearing aids for the first time receive three appointments with intervals of about 4 weeks between the first and second and between the second and third. Clients who have

previously worn a hearing aid and are being fitted with a new aid, receive only the first two of these appointments. An outline of each of the appointments follows:

1. Diagnostic Evaluation and Trial Aid Fitting (time allocated: 3 hrs)

The basic evaluation consists of:-

a) Pure tone audiogram (air and bone conduction)

b) Impedance testing

c) Speech Reception Threshold, each ear

d) Discrimination for PB words (W-22 lists). Two lists are presented each ear, one at estimated PB max and one at a higher level to test for "roll over". Recorded lists (mainly reel to reel tape recordings) are always used, this being mandatory for compensation purposes. Testing is discontinued after the presentation of 25 words if no more than one word is incorrect. Otherwise the full list of 50 words is used.

In addition to the above, tone decay testing is often used and various other diagnostic tests are used less frequently when deemed appropriate.

Trial Hearing Aid Fitting

After testing, the client is fitted (assuming that aid fitting is recommended) with a trial hearing aid taken from a stock of used hearing aids. He is instructed in the use of the aid and is required to keep a diary of aid usage and his experience with the aid over a trial of 4 weeks. The object of this exercise, as conceived by the audiologists at the clinic, is to assess the client's response to amplification in general rather than to ascertain the appropriateness or otherwise of the particular aid used for the trial. In keeping with this rationale, there is no attempt to select the electroacoustic characteristics of

the trial aid beyond choosing reasonably suitable levels of gain and maximum power output (MPO). Behind-the-ear aids (BTE) are usually fitted. The client is sent to another section of the hospital to have an ear impression taken for a custom-made earmould. The audiologists are not involved in taking the impression or fitting the earmoulds, which are available a day or two later.

2. Aid Selection and Final Fitting (time allocated: 1½ hrs)

At the end of the trial (i.e. 4 weeks after the first appointment) the client returns and, by this time, has the earmould or earmoulds which will be used for the final fitting. His response to amplification is assessed from his verbal comments and the information recorded in his diary. Provided this response has not been too unfavourable, this appointment is devoted to the selection and fitting of an aid or aids.

Aid selection consists merely of having the client listen to 3 or 4 aids from the clinic stock and to indicate which one sounds best. Usually this is done in the audiologist's office but some audiologists encourage the client to try the aids in other parts of the hospital or outside in the grounds. The audiologists recommend certain aid models in preference to others, on the basis of mechanical features, such as the number, size or location of switches, but apparently they do not usually make any recommendations about electroacoustic characteristics although, of course, the final choice of aid is dependent on which aids were offered to the client to try.

3. Follow-up (time allocated: ½ Hr)

Clients who have not previously worn a hearing aid, are given a follow-up appointment 4 weeks after aid fitting. This is the only follow-up carried out routinely but further appointments are available on request.

Miscellaneous Information

a) Rehabilitation courses (one week full time) are conducted at the clinic. This is not a regular part of the service but rather seemed largely dependent on the strong personal interest of some members of staff. The emphasis in these courses is on group discussion of hearing problems rather than instruction in lipreading or auditory training activities.

b) There is no country visiting service except for clients who are medically unfit to travel.

c) To obtain hearing aid repairs or batteries, clients post their aids or battery requests to a central service depot located at Denver. The San Francisco clinic has no record of these transactions.

d) In certain problem cases, aided thresholds are tested with narrow bands of noise. There is no kind of aided testing which is done routinely and aided speech hearing tests are rarely used.

e) Clients are referred for appointments by medical personnel and certain particulars are recorded on forms. At the beginning of each fortnight a senior audiologist examines these forms and specifies what appointments will be made for each client.

f) Appointments are scheduled on the basis of one case to each audiologist at any particular time.

g) In an average year the clinic handles 650-700 hearing aid cases, 1,200 hearing evaluations and 550 diagnostic audiology cases. The usual staff is 4 full time audiologists (excluding the clinical supervisor) and 3 trainees who have half a caseload each.

h) A limited use is made of the Synthetic Sentence Test and the Staggered Spondees Test. These are the only audiological tests used in this clinic which are not in regular use in NAL.

i) The clinic's most senior audiologist (except for the Chief of Audiology and Speech Pathology) and the next senior audiologist take turns of 2 weeks each at acting as clinical supervisor. Thus, at any given time, one of these senior audiologists handles the more complex cases while the other, who has no caseload, supervises the more junior staff and manages the clinic.

j) Case records are kept on a variety of forms stored in files. The older files are culled periodically. They regarded their record system as less than fully satisfactory and, like ourselves, have problems in trying to keep adequate clinical records without becoming overburdened with papers.

k) Each audiologist is allocated cases for 6½ hours of his 8 hour day.

General Impressions and Comments

From the above information, it will be evident that the audiologists in this clinic have given considerable attention to assessing their clients' response to amplification in general but very little attention to hearing aid selection and only moderate attention to follow-up. Indeed it seemed that in the past the audiologists had scarcely considered the possibility that hearing aids of similar gain and MPO might differ significantly in electroacoustic performance either in terms of general quality or suitability for individual clients. I was told that some brands of aids were fitted much more frequently than others but, on enquiring why, was informed that this was mainly because they were easier to handle. The question of selecting hearing aid performance is, apparently, being reconsidered as the senior audiologist has recently begun collecting articles on the subject and he requested particulars of NAL methods. The general attitude towards follow-up for hearing aid clients was that those who have problems can be relied on to seek help.

However, no evidence was available to justify this belief and the audiologists concerned agreed that they could be mistaken, especially when I informed them that we had contrary evidence regarding NAL clients.

Most of the above information was obtained from the senior audiologist, Dr. Jack Clements, with whom I spent almost a whole day. I also had lengthy discussions with the Chief, Audiology and Speech Pathology, Dr. Lyman Barrett and with Dr. Denis Arnst, another senior audiologist. All these gentlemen were very hospitable and helpful and I believe that I was given full and accurate information in reply to all my enquiries. However, contrary to my previous belief, I was told that clinical practices in relation to hearing aid clients vary considerably from one VA clinic to another. Apparently the standardization which I had believed applied throughout the VA system only holds for certain procedures, such as mandatory use of recorded speech tests. It would, therefore, be valuable for NAL audiologists to visit other VA clinics if the opportunities arise.

Bill Wilkerson Hearing and Speech Center (Vanderbilt University)
Nashville, Tennessee

This centre, which is a department of Vanderbilt University, has audiological training, clinical and research responsibilities. The Director, Professor Fred Bess, explained that the centre has a long-standing, high reputation for its training and clinical functions but that its research, so far, has been limited. However, the research capacity is being considerably expanded by recent and proposed additions to research facilities and staff.

The clinical and administrative procedures used at the Bill Wilkerson clinic are well documented in a manual, a copy of which I was given. This report will, therefore, be brief as the manual is available

for the perusal of interested persons.

Adults requiring hearing aids are seen, initially, for three appointments. These are:-

1. Audiological Evaluation and Aid Recommendation (time allocated: 1½ or 1¼ hrs)

This includes:-

a) Case history taking

b) Pure tone audiogram

c) Speech discrimination testing

d) Impedance testing (some cases)

e) Discussion about hearing aids and hearing aid candidacy.

2. Hearing Aid Selection and Evaluation (time allocated: 1½ or 1¼ hrs)

The client is given speech discrimination tests (PB words - NU 6 lists) with 3 or 4 hearing aids from the clinic stocks.

Tests are presented at 70 dB SPL and, if the client's hearing loss is only mild or moderate, he is also tested unaided. If the client has a high PB max., tests are presented in noise but otherwise in quiet.

After testing, one of the hearing aids is recommended and the client is referred for fitting. Hearing aids are not dispensed at the clinic at present but it is hoped to do so in the future.

3. Follow-up (time allocated: 3/4 hr or 1/2 hr)

The follow-up appointment is 2 weeks after aid fitting. For adults this is organized on a clinic basis. (Follow-up of children is always by the audiologist who has previously seen the case.) Follow-up is regarded as very important and, to avoid discouraging attendance, the first follow-up is provided free of charge. (For other services there is a charge of $34 U.S. an hour.)

Further follow-up appointments are provided on request or when judged to be desirable. Annual re-evaluation of clients and their

hearing aids is recommended and each client receives a reminder card one year after fitting.

Some aural rehabilitation programs have been conducted but it has been difficult to induce clients to attend. The major problem is considered to be the cost, to the client, which is substantial because of the relatively large amount of time involved.

Comment

Although this clinic currently selects hearing aids by using the traditional American "hearing aid evaluation" procedures, this is regarded as unsatisfactory by the Director, Dr. Bess, and is expected to be changed very soon. The centre has just recently appointed an additional research audiologist, who is well known for his work in hearing aid application, and when he takes up this appointment his first duty will be to examine the question of hearing aid selection with a view to recommending more satisfactory procedures. Dr. Bess and one of the present research audiologists at the centre (Dr. L. Humes) both requested further information about NAL procedures. Several people at this clinic expressed an interest in NAL's three stage ear impression technique. It was, therefore, arranged to show them a videotape of the technique and I promised to ask Mr. Doug Fifield to send them further details.

Overall the visit to the Bill Wilkerson Center was very enjoyable and, I believe, mutually profitable from the point of view of exchanging information. Dr. Humes hopes to visit Australia next year to attend the Audiological Society and the Acoustical Society conferences and to visit NAL.

University of Cincinnati Medical Center's Hearing and Speech Clinic

My time in Cincinnati was spent: enquiring about clinical practices; in giving lectures; in discussing matters of mutual interest.

Clinical Practices

Unfortunately I was unable to obtain very much dependable information about clinical practices at this centre. One reason was that the Director, Professor Robert Keith, was away on the first day of my visit which included the time set aside for discussing clinical practices. I was, however, able to discuss this matter with him briefly on the following day, although most of the available time was committed to other matters. My main informants were the Clinical Supervisor and the Associate Director who unfortunately, from my point of view, were both very new to their present positions and were not thoroughly familiar with practices in their clinics. The situation is complicated by the fact that the 15 or so audiologists under their control work at several locations in Cincinnati rather than in a single clinic. The following is an outline of clinical practices, with regard to hearing aid cases, as described by the Clinical Supervisor:-

Hearing Evaluation and Hearing Aid Selection (time allocated: 1 to 1½ hrs)

Audiological evaluation consisting of:-

a) Pure tone audiogram

b) Impedance testing

c) Measurement of MCL and UCL.

This is followed by "hearing aid evaluation" using 3 or 4 aids from clinic stock fitted with stock earmoulds. If an in-the-ear aid is being considered, the evaluation is performed with a master hearing aid (Starkey) instead of individual aids. The evaluation procedure, conducted with each hearing aid (or master aid setting) and binaurally,

consists of SRT, PB max. in quiet and in noise. At the end of this procedure a particular instrument is usually prescribed but sometimes only a general recommendation is made. The client is sent to a dealer for aid fitting and all aids are obtained on a 30 day trial. The clinic does not dispense aids at present but hopes to do so in the future as it is felt that there is a serious problem arising from the variable quality of service obtained from different dealers and sometimes even from the same dealer at different times.

Follow-up (time allocated: 1 hr)

This takes place during the trial period (i.e. within 30 days of fitting). It includes testing the hearing aid as well as evaluating the client's success with it. Further follow-up appointments are available on request. To avoid discouraging clients from attending follow-up appointments, or from seeking appointments when help is needed, all follow-up appointments are provided without charge.

Comment

I am very doubtful about the accuracy of the information received from the Clinical Supervisor as she seemed so intent on impressing me with the "efficiency" of her staff that I suspect that she was not objectively reporting what is actually done, if indeed she knows. In particular it seemed impossible that the audiologists could be doing all that they were reported to be doing in the time allocated for the first appointment. The Associate Director also seemed sceptical about this but he did know what the facts are. When I questioned Dr. Keith on the following day his account of clinical practices differed substantially from that of the Clinical Supervisor. For example, on the question of hearing aid selection, Dr. Keith told me that his audiologists had been instructed to use Berger's selection procedure which,

of course, is similar to the NAL procedure and bears no resemblance to the "hearing aid evaluation" procedure described by the Clinical Supervisor. When I commented on this discrepancy Dr. Keith was surprized but admitted that he was not sure what procedures were actually used in the clinics. I feel that all the above information must be regarded cautiously as it seems clear that none of the three senior people at this clinic were really certain what was being done as distinct from what they thought should be done or had instructed their audiologists to do.

Lectures and Discussions

I gave two lectures at this clinic, one to medical and audiology students on the basic principles of hearing aid selection, and the other to community audiologists and audiology students on NAL procedures for selecting hearing aids. Both lectures were very well received. They provoked considerable discussion and several requests for further information. I also showed the videotape of the three stage ear impression technique to the clinic audiologists and audiology students. This ellicited a lively discussion and requests for details.

During my two days in Cincinnati I discussed a variety of topics with Dr. Keith, his staff and Dr. John Bamford of Reading (UK), who was visiting the clinic for two months. The visit was most enjoyable and it was a pleasure to present information on NAL methods to a very receptive and appreciative audience. There was also a two-way exchange of information on several research matters of mutual interest. The visit was, therefore, very worthwhile despite some disappointment at being unable to obtain very much reliable information on the clinical practices in use at this clinic.

Discussions and Lectures

In the preceding sections I have indicated the lectures given as part of the symposium and at the University of Cincinnati. I have also mentioned the salient points of discussions which occurred during my visits to the hearing centres in San Francisco, Nashville and Cincinnati. This section will summarize other discussions of particular relevance to NAL and I shall indicate the other places at which I gave talks on NAL procedures.

Discussions at Symposium (in particular with Dr. H. Levitt, New York)

During the symposium I had discussions with all the other speakers and many of the other participants. Some which were particularly interesting, for various reasons, were with Mr. Sam Lybarger, Dr. Derek Sanders, Dr. Daniel Ling, Mr. Arthur Neimuller, Dr. Mark Ross and Dr. Anna Nabalek. However, the most extensive discussions, and those of greatest importance to NAL, were with Dr. Harry Levitt of City University of New York and some of his colleagues. Dr. Levitt has recently completed a very extensive study using a wearable "master" hearing aid. The main object of this study was to develop a protocol for using such devices as part of the hearing aid selection process. One aspect of the study was to compare the amplification parameters (in particular, frequency response) indicated as best, for each subject, by tests with the master hearing aid, with those which would be selected by several of the best known aid selection procedures, including the NAL procedure for selecting frequency response. There are three results of this study which are especially relevant to NAL. First, it provides good evidence of the value of individual selection of frequency responses. Such selection, and the range of amplification options needed to apply it, is essential to maximize understanding of speech. This, of course,

is only one of several recent studies providing clear evidence for selective fitting properly carried out in terms of real-ear performance (the work of Pascoe at CID and Lippman at MIT are other examples). Secondly, the NAL procedure agreed fairly well with the master hearing aid measurements (i.e. speech discrimination tests) in indicating the optimal frequency response over a variety of cases. Furthermore, the NAL procedure was clearly superior to any of the other four theoretical selection procedures which were examined. Thirdly, the Levitt study used some novel speech materials and tests strategies which are of particular interest to NAL for research, and possibly clinical, purposes. This study has been reported in a lengthy article, by Levitt and Collius, copies of which have been distributed to NAL hearing centres.

My discussions with Dr. Levitt were partly concerned with the above study but, in particular, with a further, extensive study which he is about to commence. This will focus on determining the extent to which optimal amplification, as indicated speech discrimination measurement, can be predicted by theoretical selection procedures. Dr. Levitt is intending to examine two very new procedures, not available for the previous study, as well as the NAL procedure. The reason for conducting these studies is that the "master" hearing approach is only feasible if it is possible to make a reasonable estimate of the optimal amplification parameters and then proceed to test variations around this estimate. Dr. Levitt is interested in determining which procedure gives the best initial estimate. (Obviously if any procedure consistently gives an extremely accurate estimate it becomes unnecessary to conduct tests with the "master" aid.) Whatever the outcome of this experiment it, like the preceding one, will give valuable information about the validity and possible limitations of the NAL procedure. This type of information is difficult and time consuming to obtain and it is especially valuable when

it is provided by someone like Dr. Levitt whose expertise and independence are beyond question.

Dr. Levitt urged me to attempt to visit New York but this invitation (as well as one from Dr. Nabelek to visit Knoxville) had to be declined because of my other commitments.

Visit to Dr. G. Studebaker and Dr. R. Cox at Memphis

Shortly before leaving for the USA I received an invitation to visit Dr. Gerald Studebaker and Dr. Robyn Cox at Memphis State University. A member of their staff attended the symposium in Nashville and drove me to Memphis on the afternoon of Friday, 28 September. I stayed there on Friday night and most of Saturday, returning to Nashville on Saturday night. On the Saturday morning I gave a talk to audiology students on NAL's hearing aid selection procedures. During the afternoon I discussed common research interests with Drs. Studebaker and Cox.

The talk was very well received and ellicited numerous questions about our procedures and more generally about the delivery of hearing aids in Australia and NAL's role in this matter. I discovered that the NAL procedure is one of several hearing aid selection procedures which are taught to students during their training at this university. Dr. Cox told me that some students have difficulty with the NAL procedure because it is conceptually more complex than some of the others, which, however, are considered to be over-simplified.

The research at this centre is all concerned with hearing aid application and is, consequently, highly relevant to NAL's interests. Dr. Studebaker's current research is in two areas, namely, hearing aid selection and hearing aid measurement. He has conducted several experiments with paired comparisons of speech processed by various hearing

aids and has found that this technique is at least as sensitive for detecting differences in electroacoustic characteristics as is speech discrimination testing. He performs hearing aid measurements using broad band signals and has demonstrated that this gives a quite different, and much truer, indication of hearing aid performance under overload than is shown by the standard pure tone methods. Dr. Cox's current projects include the acoustics of hearing aid systems and the clinical assessment of the advantages of binaural aid fitting.

This was a particularly stimulating and enjoyable visit and I was sorry that I could not spend more time at this centre. I was given several recent (not yet published) papers dealing with the current research of this centre, which are available for interested NAL persons.

Dr. Studebaker also gave me a paper entitled "Fifty years of hearing aid research: an evaluation of progress". His major thesis is that there has been very little progress in hearing aid research. One of the reasons is that American audiologists have clung to their traditional "hearing aid evaluation" procedure, which is demonstrably unsatisfactory, instead of considering alternatives, as we have done in NAL, and as an increasing number of Americans, such as Dr. Studebaker, are now doing.

Another major problem is that the American system provides little opportunity for the audiologists, who are in a position to determine the amplification requirements of individuals, to influence hearing aid design or, conversely, for the engineers, who design hearing aids, to obtain any substantial body of knowledge on user requirements. Dr. Studebaker regards a multidisciplinary approach as essential to making progress in achieving improved hearing aids and improved methods of selection and fitting. He writes "It is not sufficient to have sophisticated technical answers to questions. They must also be the right questions. Thus there is a need for the involvement of persons with

discomfort level (LDL) and the level required for optimal speech discrimination. Their main conclusions are that optimal discrimination is always achieved somewhat below LDL and that increasing the level beyond this point causes a decrease in discrimination which is typically much greater if noise is present that when tested with speech in quiet. In view of this, they stress the need to avoid over amplificaton but do not, as yet, have any definite procedure for selecting hearing aid gain. One of their current projects is concerned with testing the effects of frequency response variations on speech discrimination. I saw a demonstration of the computerized, adaptive speech testing which is being used for this project and was extremely impressed by its speed and efficiency. This type of facility would be ideal for many NAL audiological research projects and perhaps eventually for speech hearing testing in NAL hearing centres. This group is examining some of the newer speech discrimination tests in detail, in particular the nonsense syllable test (which we are using in one NAL research project) and the SPIN test.

Dr. Dirks and Dr. Gilman are deeply involved in measuring hearing aids on the KEMAR manikin and in real ears. They have a number of technical innovations which either improve the accuracy of measurements or make them easier to obtain. For example, Dr. Gilman has developed a system for delivering sound from a point source and has developed methods for transforming sound pressure levels measured with a probe tube microphone embedded in an earmould, into equivalent SPL's at the eardrum.

Altogether the day spend at UCLA was extremely stimulating and enjoyable and provided me with a considerable amount of information of direct relevance to NAL interests.

Overall Conclusions and Value of Visit

It will be evident from my earlier comments that this trip was highly successful. The symposium met the high standard which I had expected and, also as expected, it provided numerous opportunities for valuable discussions. (It also provided most of my total expenses and thereby made the trip possible.) The visits to the clinics provided information which is of interest for comparison with NAL clinical practices. However, with some possible minor exceptions, it is not recommended that NAL adopt any of these overseas practices as, in general, they are less sophisticated, and no more efficient, than existing NAL practices regarding hearing aid application. For example, all three clinics are considering changing their current methods of hearing aid selection and are likely to adopt new methods which are more in line with NAL procedures.

It was gratifying to see the keen interest of many audiologists in NAL procedures and in the research which led to the development of these procedures. The invitations to participate in the symposium and to present lectures or informal talks at various institutions is evidence of this interest. This was confirmed by the good reception accorded to all my talks and is something which I believe would not have been possible a few years ago because in most respects my views are the antithesis of the traditional American approach. It appears that many American audiologists, probably including most of those who are doing significant research in hearing aid application, are rejecting the traditional American approach in favour of something more in line with NAL's philosophy.

In addition to the symposium, the highlights of the visit were the detailed discussions which I was able to have with a number of the best

research workers in the hearing aid field. The groups led by Drs. Levitt, Studebaker and Dirks are undoubtedly three out of only about half a dozen American groups who are doing a substantial amount of significant research in the area of hearing aid application. To my knowledge, the only other comparable groups are the one at the Central Institute for the Deaf, St. Louis (represented at the symposium by Drs. Erber and Neimoller), and probably those at Massachusets Institute of Technology and at the University of Maryland/Veterans Administration, Washington. There is, of course, a limited quantity of worthwhile work on hearing aids, being done at quite a lot of locations and this was well represented at the symposium. It was gratifying to find that people such as Drs. Levitt, Studebaker and Dirks were keen to discuss their current work in detail and to seek my comments and suggestions as well as to learn more about NAL work. The long term value of establishing this kind of information exchange can hardly be overestimated as it means that we are receiving the latest information far ahead of publication, that we are obtaining expert, independent feedback on the value of NAL's approaches, and that we can plan our research efforts to compliment those of other groups and thus avoid needless duplication and avoid pursuing lines which others have demonstrated to be unproductive. There are also some immediate benefits in that these groups have experience with certain new techniques which we are currently using or are considering for use for research and/or clinical purposes.

Finally, this overseas trip demonstrated very convincingly that we, in Australia, enjoy some very important advantages over our American colleagues by virtue of our system for dispensing hearing aids. One advantage is that we can promote effective use of amplification much more successfully because we supply virtually all the hearing aids used by children and a large proportion of those used by adults. The

situation in America is much more difficult because teachers and audiologists have to deal with numerous aid makes and models for which adequate information and service is often difficult, or even impossible, to obtain. Secondly, NAL audiologists are very fortunate in being able to supply hearing aids, and the associated services, to clients, particularly children, at no cost to the client. In America cost is often a major concern and, in some instances, it prevents the audiologist from recommending what he believes to be best for the client. This is seen in the rather widespread reluctance to recommend binaural aid fittings and, less commonly, in a reluctance to recommend adequate follow-up.

Probably the most important advantage of all, is that in NAL there is a system for providing audiological input into hearing aid design which means that hearing aids can be designed to meet the requirements of users, as determined by audiological research and the extensive contact of audiologists with clinical cases. As mentioned earlier, Dr. Studebaker has commented on the lack of this facility in the current American system and considers it to be a major obstacle to progress in the hearing aid field. The problem arising from the lack of audiological input, is also appreciated by the engineers who design hearing aids and components. For example, in a recent publication (1978) the president of Knowles Electronics writes "the technology has gotten considerably ahead of our understanding of what the optimum characteristics of hearing aids should be. The clinical work to tell the engineers what to build, lags behind what the industry is capable of providing technologically". All the audiologists, with whom I talked about hearing aids, and also leading design engineers such as Mr. Sam Lybarger, were particularly impressed with the fact that in NAL the audiologists, who assess user requirements, write the performance specifications for the hearing aids which are then designed specifically to meet the requirements of the hearing-impaired users. In my opinion, it is vital that this principle be preserved if there is any change in NAL's system for obtaining hearing aids.

Appendix 1 - Outline of Professional Activities

1. Mon 24 Sept 1979 - Visited San Francisco Veterans Administration Audiology Clinic to discuss and observe clinical practices.
2. Wed - Fri 26-28 Sept - Participated in International Symposium on Amplification in Education, Nashville.
3. Sat 29 Sept - Visited Memphis State University and
   (a) presented talk to students on NAL methods of hearing aid selection
   (b) discussed research on hearing aid selection and hearing aid measurement techniques.
4. Mon 1 Oct - Visited Bill Wilkerson Hearing and Speech Center, Nashville to discuss and observe clinical practices.
5. Tues - Wed 2-3 Oct - Visited University of Cincinnati Medical Center and
   (a) discussed clinical practices employed in Center's Speech and Hearing Clinic
   (b) presented talk to community audiologists on NAL methods of hearing aid selection
   (c) presented talk to residents in Otolaryngology and audiology students on basic principles of hearing aid selection.
6. Thurs 4 Oct - Visited Hearing Rehabilitation Research Center, Los Angeles.
7. Fri 5 Oct - Visited audiological research facilities and hearing and speech clinic of UCLA School of Medicine - discussed hearing aid selection, evaluation and measurement techniques.

Appendix 2 - Program of International Symposium on Amplification in Education

Wed. 26 Sept. 1979

a.m. Introduction

Auditory training in historical perspective - Eric Wedenberg, M.D. (Stockholm).

I. Speech as a Physical Stimulus

Speech as a physical stimulus - Harry Levitt, Ph.D. (New York).

II. Sensory Capabilities of the Hearing Impaired Child

Perception of speech by the hearing-impaired child - Norman Erber, Ph.D. (St. Louis).

The language development of hearing-impaired children: constructing inferences from depleted contexts - Peter Norlin, Ph.D. (Nashville).

Speech development and sensory processing in hearing-impaired children - Daniel Ling, Ph.D. (Montreal).

p.m. Utilization of audition in the education of the hearing-impaired child - Julia Davis, Ph.D. (Iowa City).

III. Classroom Amplification Systems

Group amplification - Arthur Boothroyd, Ph.D. (Northampton).

Group vs. individual amplification: an analysis of the present and future status of an old controversy - Mark Ross, Ph.D. (Storrs).

The effects of noise and reverberation on speech intelligibility - Wayne Olsen, Ph.D. (Rochester).

Architectural acoustics and the hearing-impaired child - Arthur Niemoeller, D.Sc. (St. Louis).

Classroom Amplification systems in electroacoustic considerations - Vernon Larson, Ph.D. (Oklahoma City).

Appendix 2 (contd.)

Thurs. 27 Sept. 1979

a.m. Amplification for children: current status and future priorities - Noel Matkin, Ph.D. (Tucson).

IV. Desirable Characteristics of Amplification Systems

The Status of Classroom Amplification in American Education - Barry Freeman, Ph.D. (Clarkesville) and Stephen Sinclair, Ph.D. (Nashville).

Defining education objectives - Derek Sanders, Ph.D. (Buffalo).

A public school audiology program: Auditory management, amplification maintenance, and in-service education - Gloria Hoverstein M.A. (Los Angeles).

Selective amplification: electroacoustic and clinical considerations - Daniel Schwartz, Ph.D. (Washington D.C.) and Steffi Resnick, Ph.D. (Baltimore).

Selective amplification: some psychoacoustic considerations - Denis Byrne (Sydney).

Maintaining appropriate real-ear performance with differing amplification systems - Denis Byrne.

p.m. Standard acoustical measurements on auditory trainers - Samuel Lybarger, B.S. (McMurray).

Electroacoustic modifications - William Ely, M.S., E.E. (Minneapolis).

Potential damage to the auditory system from over-amplification - Larry Humes, Ph.D. and Fred Bess, Ph.D. (Nashville).

Appendix 2 (Contd.)

Thurs. 27 Sept. 1979 (Contd.)

V. Future Directions

Future Directions - Fred Bess.

Evening Banquet address - Marion Downes M.A. (Colorado).

Fri. 28 Sept. 1979

a.m. Panel Discussion

Panel - Mark Ross, Daniel Ling, Noel Matkin, Denis Byrne.

VI. Workshops

1. The use of the hearing aid test box to assess the performance of FM auditory training units.
2. The use and care of classroom amplification systems.
3. Applications of different types of classroom systems.

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p.m. Tours of Bill Wilkerson Hearing and Speech Center.